

Appendix H

**Survey of Coomberdale TEC Regional
Extent (Trudgen et al. 2012)**

**AN EXTENSION OF A
FLORA SURVEY,
FLORISTIC ANALYSIS
AND VEGETATION SURVEY
OF AREAS OF THE
COOMBERDALE CHERT TEC
TO INCLUDE A FURTHER AREA**

prepared for

SIMCOA OPERATIONS Pty Ltd

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1.0 INTRODUCTION

1.1 Background

This report extends the geographical coverage of vegetation and flora surveys of parts of the Coomberdale Chert Threatened Ecological Community documented in two earlier reports (Trudgen *et al.* 2006 & Trudgen *et al.* 2001) prepared for Simcoa Operations Pty. Ltd. ("Simcoa"). Simcoa operates a chert mine approximately fifteen kilometres north of Moora in the Midlands district of the Western Australian wheat belt that mines the chert the threatened ecological community occurs on. Trudgen *et al.* 2001 was prepared for environmental impact assessment processes related to an extension of the mine to a second pit (the Western Ridge or Western Ore Body), and the Trudgen *et al.* 2006 report was an update and extension of that report.

The geological unit (The Noondine Chert, formerly called the Coomberdale Chert, and still often referred to by the latter name) containing the quartzite mined north of Moora by Simcoa and material derived from it is the geological substrate of a group of vegetation types that the Department of Environment and Conservation (DEC) considers to be an "Endangered Ecological Community" (Hamilton-Brown 2000, p. 2). This vegetation is known as the *Coomberdale Chert Threatened Ecological Community* and has high conservation value for vegetation and flora. The definition of this threatened ecological community is currently under review (M. Hunter (DEC) pers. comm. January 2011).

The Coomberdale Chert Threatened Ecological Community is not a *community* in the sense of the word as used by botanists in the definition of *plant communities* in formal schemes of vegetation description. Plant community in formal vegetation description has a quite narrow definition, whereas the use of community in the term *The Coomberdale Chert Threatened Ecological Community* is a very broad sense not related to formal vegetation schemes. Rather, it is a catchall name for all the vegetation on the Coomberdale Chert and on geomorphology associated with it in the Moora area dominated by *Regelia megacephala* (a species restricted to the Coomberdale Chert) and *Allocasuarina campestris* (the common name of which is Tammar) a more widespread species associated with shallow soils. This includes vegetation on actual outcrop, on areas where there is a soil layer over the chert, or where the outcrop is broken up, and on areas of chert gravel on slopes associated with the chert ridges. While the *Regelia megacephala* and *Allocasuarina campestris* are the main dominants in this vegetation (and are the defining ones for the Threatened Ecological Community) there are a number of other species that are dominant or important in vegetation on the Coomberdale Chert and the vegetation they form should also be included in the concept of the Coomberdale Chert Threatened Ecological Community (and has been in this report). Some of the vegetation dominated by these other species is in fact less common than some of the vegetation dominated by *Regelia megacephala*.

1.2 Purpose of this survey

The purpose of the survey is to add further detail and knowledge to the Coomberdale Chert Threatened Ecological Community by incorporating vegetation and flora details of one property east of The Midland Road and north of Kiaka Road that was not visited as part of the survey for the 2006 report (Trudgen *et al.* 2006). Therefore, this report extends detailed knowledge of the Coomberdale Chert Threatened Ecological Community to an area previously not known in detail (although some work rare flora survey work had been done there), but other areas of the Coomberdale Chert are known that still have not been surveyed in detail.

The report covers a group of properties from north of Kiaka Road south to Dalaroo East Road. For the Coomberdale Chert Threatened Ecological Community areas on these properties it provides vegetation and flora surveys, especially surveys of flora of particular conservation significance, including Declared Rare Flora, Priority Flora, and other species of conservation significance.

1.3 Location of the survey area and details of locations or sub-areas

The survey area lies from about twelve to seventeen kilometres north of Moora on the eastern side of the Midlands Road (see Map 1). It extends (see Map 2) from the northern side of the Dalaroo East Road (parts of the Gardiner's and Morgan's properties) to north of Kiaka Road (parts of John Tonkin's and Stan Ridgway's properties and the new area surveyed). Between these properties, it includes parts of the farm "Goonderoo", formerly owned by Lance Doust and parts of several other properties.

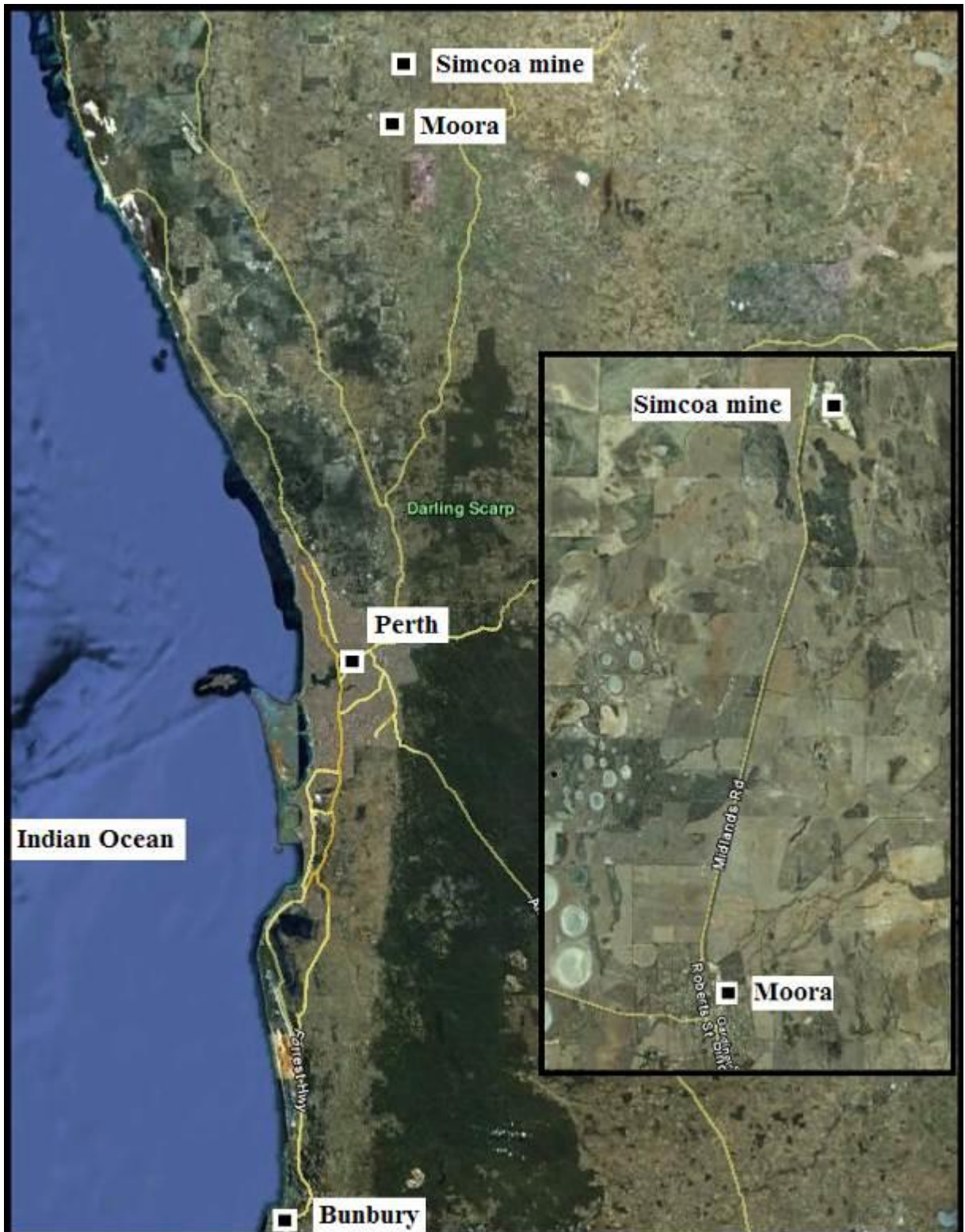
The addition to the previous survey area is the vegetation of the Coomberdale Chert Threatened Ecological Community on Arthur and Rhonda Tonkin's property (see Map 2). This is all the remnant vegetation on this property.

The survey area has several sub-areas (see Map 2), which are discrete (or semi-discrete) blocks of vegetation. Some of the vegetation described (from the Western Ore Body) has now been cleared, but is included in this report so that the variation known for the Coomberdale Chert Threatened Ecological Community is fully described. The sub-areas are:

- Cairn Hill Westrail Reserve. Originally a gravel reserve for the railway system. Has significant areas of disturbance, but is mostly relatively undisturbed native vegetation. Now part of the Conservation estate;
- Cairn Hill North. An area of vegetation on the "Doust" property, contiguous with Cairn Hill, but which has had some grazing through it;

- The Eastern Ore Body. An area of vegetation at the southern end of the original mine pit, on the southern continuation of the ore body. Has now been partly mined;
- The Western Ridge (or Western Ore Body). An area of vegetation which lies to the west of the original mine pit on a low quartz ridge. Has now been partly mined;
- The Eastern Ridge. A large area of vegetation to the east of the original pit and Eastern Ore Body. Has had significant grazing pressure and has some degraded patches but in most parts retains good or better condition vegetation;
- The (formerly) Proposed Waste Dump. An area between the Western Ridge and the original mine pit that has been considered for expansion of the waste dump. Has been grazed, but retains native vegetation (although degraded to variable extent);
- 'Gardiner's Hill', a large remnant of bush on P. and J. Gardiner's property;
- John Tonkin's property north of Kiaka Road;
- Arthur and Rhonda Tonkin's property north of Kiaka Road and east of John Tonkin's property;
- Two areas of remnant vegetation on Stan Ridgway's property (Ridgway's East and Ridgway's West);
- Small areas of remnant vegetation on farm land south and south east of Cairn Hill (on Kim Chester's, Morgan's and Gardiner's properties (Small southern remnants);
- Small areas of remnant vegetation on farmland east of the Eastern Ridge, Cairn Hill North and Cairn Hill Reserve (on Peter and Loretta Doblestein's, Ron Manning's and Phil and Jenny Gardiner's properties).

Vegetation recording quadrats were recorded in the larger areas of remnant bush, which all included chert ridges. However quadrats were not located in the smaller areas of remnant bushland as they were generally in poorer condition.



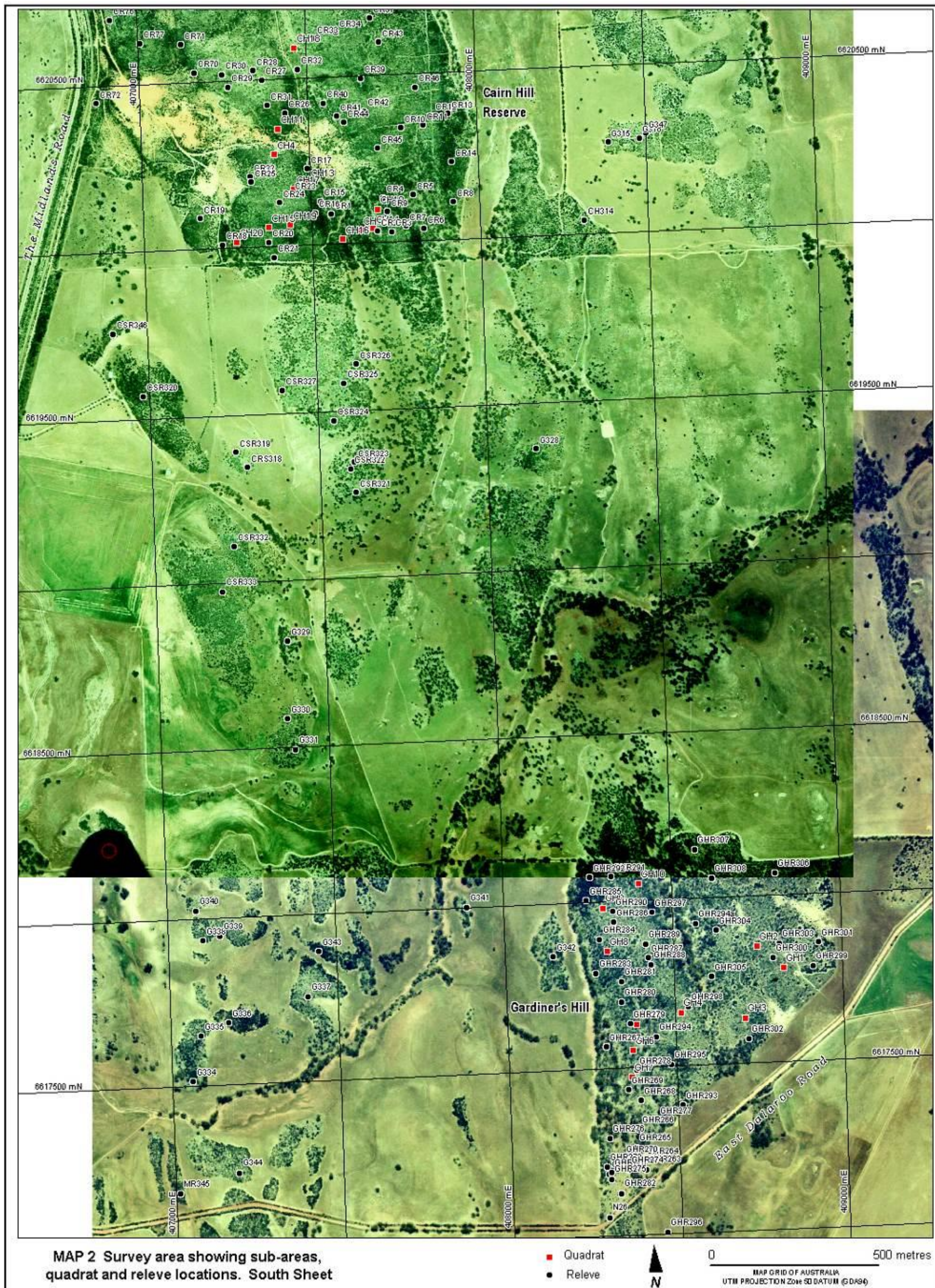
Map 1: Location of the Simcoa quartzite mine Australia

Note: Images from Google Earth.





Note: Large parts of the Western Ridge and "Simcoa Mine Site" have been mined since the image was taken.



MAP 2 Survey area showing sub-areas, quadrat and releve locations. South Sheet

■ Quadrat
● Releve

N

0 500 metres

MAP GRID OF AUSTRALIA
 UTM PROJECTION Zone 50 DATUM (GDA84)

1.4 Previous studies of the vegetation of, or including, the survey area

Several earlier reports or publications provide information on the vegetation considered in this report and are useful background reading.

They include:

- The original vegetation and flora survey for the current mine (Trudgen 1985), which was a survey of a relatively small area based on limited field work, but which identified the *Regelia* and *Kunzea* vegetation as having significant conservation value;
- A survey of the extent of the Priority flora species *Regelia megacephala* (Burgman 1983), which located five populations of this species in the area from Dalaroo to Coomberdale, in which the current survey area is located;
- A detailed study at a subregional level of the remnant vegetation in the Bindoon to Moora area (Griffin 1992) which defined regional vegetation units, one of which is the basis of the threatened ecological unit on the chert hills north of Moora. This study concluded that there were nodes of species richness in the region, and that landscape diversity, contributing to the species richness, was moderate to high in the context of Southwestern Western Australia.
- The draft Interim Recovery Plan (Hamilton-Brown 2000) published by the Department of Conservation and Environment (DEC, formerly Department of Conservation and Land Management CALM) for the Threatened Ecological Community on the Coomberdale (= Noondine) Chert. This plan documented eight occurrences of the Communities and outlines a proposal for recovery and conservation of the remaining areas.

2.0 DEFINITION AND DISCUSSION TERMS USED

This section gives definitions of a number of the terms used in this report and discussion of them as appropriate. However, some of the terms and concepts relating to vegetation and use of the term *conservation value* will be discussed in more detail in later sections.

It should be noted that what is being done here is to present working, practical definitions. It should be understood that it is difficult to present definitions of some concepts, such as species, plant community and conservation value, that are unequivocal or for which exceptions cannot be found. However, as noted below, while the definition of species is notoriously difficult, this does not stop biologists and others from using the concept in a practical way. Thus the approach taken here is to try to impart the general use (or best use) of terms such as species, plant community and conservation value, rather than to present a legalistic definition.

Flora

The term flora has different meanings in different contexts. A flora species is a member of the plant kingdom, which includes the flowering plants, pines, cycads, ferns, mosses, liverworts, algae, lichens and other groups. Flora in this sense is generally taken to include the fungi, which used to be included in the plant kingdom, but which are now considered to form a separate kingdom. The flora of an area or region is all the plant species of that area or region. An example of the latter use is: an area may be said to have a diverse flora or a poor flora, depending on the number of species of flora present, its area, habitat diversity etc.

Declared rare flora

Declared rare flora species are flora species that are protected by the State through the Wildlife Conservation Act.

Without the consent of the Minister, it is illegal to "take" declared rare flora. The Department of Conservation and Environment (DEC) administers the Wildlife Conservation Act and makes recommendations to the Minister on which species should be gazetted.

Priority flora

The Priority flora list maintained by the Department of Environment and Conservation (DEC, previously the Department of Conservation and Land Management) is a list of species that the Department considers are rare, likely to be rare, or which are considered potentially under threat, but which have not yet been recommended for gazettal (usually because their status has not been sufficiently well defined). There are four priority ratings (Atkins 1995, 1998, 1999, etc), the definitions of which are reproduced in Appendix 1. A list of priority flora is maintained by DEC with the declared rare flora list and updated once or twice a year. The priority status of species is also indicated on the DEC website "Florabase" and the priority levels shown in this report were current when it was written.

Priority species are not protected directly by legislation. However, it is usual for them to be considered during assessment of the potential environmental impact of a proposal by the Environmental Protection Authority (EPA). If the EPA considers that the impact on a population of a priority species is environmentally unacceptable it can recommend to Government that the proposal is environmentally unacceptable, effectively protecting the particular population concerned of the priority species if the Government accepts the recommendation. Alternatively, the EPA may recommend amendment of the proposal to protect the population or part of it.

The Priority Flora List is a working document and species are added and removed, or declared as rare flora as better information becomes available. Due to the size of the flora of Western Australia, changes to the list will occur for some time to come.

Species of conservation significance

Declared rare and priority species are species of conservation significance. However, while declared rare flora are legally protected and priority flora have a level of de facto protection there are other categories of flora or specific populations of flora that botanists consider have special conservation value and would recommend they should be given some level of protection. These include:

- Previously unknown taxa (species or subspecies). The fact that a species or subspecies has not been previously found very often indicates that it is not common and may be rare. This is especially the case in the botanically better-known parts of the State, such as the Swan Coastal Plain and nearby areas;
- Disjunct populations. These are populations that are separated from the main area of distribution of the species they belong to by a significant distance. They are of conservation significance because they are likely to be genetically different from the main population, having the potential to evolve into a separate species over time because of this difference and the disjunction. They may also indicate the ability of the species to inhabit a different habitat;
- Populations at the ends of the range of a species. The populations at the ends of the range of a species may have genetic differences that enable the species to inhabit areas that are environmentally different from the main part of the distribution and also demonstrate the ability of the species to inhabit areas less favourable to it than the main part of the range;
- Un-common or rare species that have not been gazetted as rare or recognised as requiring priority species status. Due to the size of the flora of Western Australia and the small number of botanists working on this flora, it is not uncommon for species to

have not been recognised as requiring protection as declared rare flora or as priority species when one of these categories would be appropriate.

The discussion of species of conservation significance above relates to the general treatment of species in environmental assessments and surveys, that is it focuses on species and populations that are considered of particular importance. However, an equally, or arguably more, valid proposition is that all flora populations have conservation significance, but that to simplify the issue for practical considerations we talk of flora of conservation significance when we mean flora (species and populations) of special conservation significance. That is, flora species or populations that natural or human processes have made of more restricted occurrence or placed under threat.

Dominant

The *Oxford Dictionary of Plant Sciences* (Allaby 1998, p. 142) entry for dominant is "In ecology, the species having the most influence on community composition and form. Sometimes the term is also used to refer to the largest and/or most abundant species in the community." As generally used in relation to vegetation, it refers to either the species that contribute most of the mass of the vegetation, or those that are tallest.

Vegetation

Vegetation is the communities that flora species, including flowering plants, gymnosperms, ferns, mosses, fungi etc., form. The *Oxford Dictionary of Plant Sciences* (Allaby 1998, p. 466) definition, "A collection of plants of diverse or the same species", is not very satisfactory. Barbour *et al.* (p. 4) offer a different perspective, giving the following definition "Vegetation consists of all the plant species in a region (the flora) and the way those species are spatially or temporally distributed." The latter definition adds an aspect of variation through time, but is still not satisfactory, as the term is not solely used to describe the plant cover of a region. A definition such as: *The various forms of communities or structures developed by co-existing populations of plant species*; might be more useful.

A range of terms exists to describe various levels of different classifications of vegetation. The different ways that these terms have been used by different schools of plant ecologists has caused significant confusion in the classification and description of vegetation. There is no simple solution to this problem and the definitions of terms such as *plant community* and *vegetation association* are inherently difficult due to the range and types of variation that vegetation exhibits.

To some degree, in the absence of measurable agreed levels of similarity for defining plant communities and vegetation associations, the definition of such units will remain a matter of opinion for any given survey area. This is because significant causes of confusion relating to the practical description of plant communities and their grouping into vegetation associations

(not to mention assessment of their conservation value) are that before this work can be carried out well, sufficient experience with the species making up the vegetation is needed to enable the variation that exists to be actually observed (ie, if you can't recognise the species you can't properly observe the variation in the vegetation they form) and some familiarity with vegetation of the region being worked in is needed to be able to make judgements of the degree of significance of the variation observed. However, too much should not be made of this problem, as in practice experienced workers often produce fairly similar descriptions of the vegetation of the same or similar areas when they are working at the same level of description.

Vegetation structure

Vegetation structure is the arrangement of the different flora species present in a stand of vegetation into the physical form or physiognomy of the vegetation.

The major components of the description of the structure of vegetation are the height and cover (see below) of the different strata (see below) or layers of the vegetation and the life form of the dominant (see above) species. The cover combined with the form giving an indication of the spatial distribution and abundance of the dominant species.

Vegetation can have very simple structure, such as a grassland, consisting of one layer or stratum, or can have a complex structure with several layers. Sometimes the strata are well defined, and at other times they are poorly defined. An example of a complex structure is a stand with an open layer of Tuart (*Eucalyptus gomphocephala*) trees over a high shrub layer of Parrot bush (*Dryandra sessilis*) over scattered tall shrubs of Zamia Palm (*Macrozamia fraseri*) and Grasstree (*Xanthorrhoea preissii*) over an open low shrub layer of *Phyllanthus calycinus* over an annual herb and grass layer.

Vegetation description schemes such as that of Specht (as modified by Aplin 1979, see Appendix 2) often give arbitrary heights as cut-offs for layers (commonly 0.5 metres, 1 metre, 2 metres and 10 metres). In reality, plants of a species often straggle across one or more of these levels. In such cases it is usual in the description of a vegetation stand to notionally put all the individuals of a species into the upper layer that it reaches. This is done on the assumption that when the stand reaches a mature state that at least most of the individuals will reach this layer. However, where experience indicates that it is only exceptional individuals that are reaching a particular height then it is practical to assign the species to a lower layer.

Plant community

The best use of the term plant community is as a fairly narrow unit of vegetation that consists of one type. That is, it is best regarded as a basic unit that has a low level of synthesis and is not readily dividable into more than one distinct type, although it will have a range of variation. In this use of the term, a particular plant community can be characterised and

recognised by a fairly constant structure, species dominance and floristic composition. That is, there is variation but it is not great. We consider this the best use of the term as otherwise there is no basic unit to use as a base for the development of units of higher order of synthesis. We specify structure, species dominance and floristic composition as these are the major variables of vegetation and any unit that does not take account of all three is unlikely to be satisfactory as a basic unit.

However, plant community is a difficult concept to define, partly because it is different things to different people. Unfortunately, the term is used quite loosely. The various concepts that people hold for plant community are partly derived from the vegetation that they have worked with and partly from the methodology they have used or been taught.

Plant community as described above works well over small to medium sized areas. For larger areas it is more difficult to apply, as the influence of regional scale factors starts to alter the floristic composition of stands of vegetation, making the distinction of related communities necessary.

From this discussion it should be apparent that the definition of individual plant communities, particularly in the absence of a very detailed regional study, is a matter of professional opinion. However, in practice it is often possible to identify many of the plant communities present in a survey area quite readily, with the remainder being more problematical.

Vegetation association

There are different approaches to the definition of vegetation association. Most commonly, it is conceived of as a group of plant communities with similar structure and dominance (this is the approach taken in this report). For example, forests dominated by Jarrah might form one or more associations depending on how the concept is interpreted, how large an area is under consideration and how much variation there is in the understorey.

An alternative view (Barbour *et al.* 1987, p. 7) is that: "An association is the collection of all plant populations co-existing in a given habitat." Such a definition then becomes tied to how habitat is defined and does not actually classify variation in vegetation, rather variation in habitat (in essence, this usage is equivalent to "vegetation complex"). However, Barbour *et al.* also note that "As formally defined in an international botanical congress early this century, an association has the following attributes: (a) it has relatively fixed floristic composition, (b) it exhibits a relatively uniform physiognomy, and (c) it occurs in a relatively consistent type of habitat." These attributes are similar to those for a plant community and so an association really differs from plant community in how widely "relatively" is interpreted.

Vegetation associations can be grouped into broader units (vegetation formations) and may be grouped into vegetation 'sub-alliances' and 'vegetation alliances' as an intermediate step.

Vegetation Formation

A vegetation formation is a very broad unit of vegetation description that is defined by structure only, that is the particular species making up the vegetation are not taken into account, only its physiognomy. Examples of vegetation formations are tall forest, open forest, low woodland, heath and grassland.

Sometimes the term vegetation formation is used to denote a particular example (which would vary from other examples in details such as the dominant species) and the general sense as outlined above is referred to as a "formation type" which is then given as similar in meaning to biome (see Allaby 1998, p. 179).

Biome

"A biological subdivision of the Earth's surface that reflects the ecological and physiognomic character of the vegetation. Biomes are the largest geographical biotic communities that it is convenient to recognise. They broadly correspond with climatic regions, although other environmental controls are sometimes important. They are equivalent to the concept of major plant formations in plant ecology, but are defined in terms of all living organisms and of their interaction with the environment (and not only the dominant vegetation type). Typically, distinctive biomes are recognised for all the major climatic regions of the world eg. tropical rain forest biome...." (Allaby 1998, p. 54)

There are varied concepts for biome, but generally there is an accent on a restriction in vegetation structure (physiognomy) and a geographic/climate aspect. Note that the use of formation as an ecological concept (formation type) is different from that of a vegetation structural classification unit (as it used in this report).

Cover

The cover of a plant species is the proportion of the area of a stand that a species occurs over.

There are two different measures of cover that are often used. The first is canopy cover, which uses the total of the areas within the perimeters of the canopies of all the individuals of the species being considered as the cover. The second is projected foliage cover, which defines the sum of the area covered by the individual leaves of the species when viewed vertically as the cover. (See the vegetation methods and limitations section for a discussion of estimation of cover relevant to this report.)

Stand of vegetation

A stand of vegetation is an area of vegetation with reasonably consistent structure and flora composition within one area of one type of habitat. This can include vegetation that grades

from one structural unit (eg open woodland) to another (woodland), but which maintains some overall consistency.

The change from one stand to another can be fairly abrupt or quite gradual, depending on the way that environmental factors, such as slope, aspect, soil and water availability etc. change (also see ecotone).

Stratum (strata)

A stratum in relation to vegetation is one recognisable layer of the structure or physiognomy of a stand or vegetation unit.

Vegetation classification and description schemes usually have several height intervals defined to facilitate description of vegetation structure (e.g. low forest is less than 10 metres tall, forest 10 to 20 m tall and tall forest more than 30 metres tall). Vegetation varies considerably in the arrangement of the plants present into such strata; sometimes there are well-defined strata, while at other times there are not.

Quadrat or plot

A quadrat or plot is a vegetation or flora sampling site of a defined size and shape that is usually recorded in a homogenous area of vegetation.

Quadrats or plots are usually marked out with pegs at the corners with tapes or cord strung between them at the time of recording. Quadrat size and shape is varied to suit the particular requirements of a survey or monitoring exercise. Quadrats or plots are used to give a higher level of consistency than is achievable from a releve (see below). However, use of (properly recorded) releves can have advantages over the use of plots or quadrats.

Releve

A releve is a sampling site that does not have a fixed size or shape that is marked out, although there is generally an approximate size for a given survey, or an intention to record data of a to a certain level (e.g. all the dominant species and most of the more common species in the area sampled, or all species in the area sampled).

Releves are often used rather than quadrats as well recorded releves can give good data, depending on the purpose for which it is required, and establishing quadrats is time consuming as well as requiring pegs. An advantage of the use of releves is that the area can be varied to record what is judged as a consistently good sample (eg., more than 80%) of the flora species of a stand rather than being constrained by a given area.

Floristic Community Type

A floristic community type is a group of flora recording quadrats (or releves, depending on the study) that represent a range of vegetation separated from other such groups of quadrats

on the presence or absence of flora species, so that quadrats with similar assemblages of flora species are grouped together (or have at least a core group or groups of species in common). It is a poor term, because of the confusing similarity to plant community. In this report "group" in relation to Floristic Community Type is used to refer to the group of quadrats shown to be related to each other in the analyses carried out.

The grouping of quadrats into floristic community types is carried out using appropriate computer programs. Floristic Community Types (groups) can be defined at a wide range of levels depending on the purpose of the study and the size of the data set. There is no standardised terminology to rank floristic community types in a similar hierarchy to plant community, vegetation association etc.

Habitat

For the purposes of this report the term habitat is used to refer to a physical position in the landscape when used to describe the place of occurrence of a vegetation type. For example, slope or crest. This is a fairly broad use of the term, and an individual flora species may have a much more restricted occurrence that would require definition of it's habitat in a more detailed manner that included soil type, rock type and possibly other factors such as aspect and rainfall.

While the various positions in the landscape provide habitats (in conjunction with other variables such as water tables) for vegetation types, the vegetation and landscape provide habitat for individual flora and fauna species. The habitat range of individual species of flora varies very widely, with some being very restricted in habitat while others are found in a wide range of habitats.

Conservation value

Conservation value is the value of an aspect or part of nature, such as a flora or animal species, a type of vegetation, the geomorphology of an area or the geology of a particular outcrop, that relates to, or is brought about by, its development or evolution, often over very long periods of time, as a part of natural systems. A simplified definition would be:
Conservation value is the value of some part of nature that is inherent to it.

Conservation status

The conservation status of a species is an assessment of the population status of the species (large, small, rare, how distributed etc.) combined with what processes (eg., clearing of vegetation, dieback disease, grazing) are impacting the populations. That is, an attempt to assess what the outlook for the species is in terms of its longer-term survival. Sometimes conservation assessments are made without taking into account the processes affecting the species or vegetation type being considered.

So a species that is common and widespread with few processes deleteriously affecting its populations would have a good or excellent conservation status while a species that is rare and localised and under pressure could be endangered or under threat of extinction.

In a similar fashion, the conservation status of a vegetation type is an assessment of the future of the vegetation type taking into account the area of the vegetation type remaining, its original extent, how the remaining part of the original extent is distributed and what processes are deleteriously affecting it.

Reservation status

The reservation status of a species or vegetation type is an assessment of how well reserved, that is how well represented in secure conservation reserves, that species or vegetation type is. This will obviously be important for the conservation status of the species or vegetation type as areas or populations in secure reserves will have fewer deleterious processes affecting them.

Ecological community

The term "ecological community" is a catchall jargon of no particular rank or type that is defined as "A naturally occurring biological assemblage that occurs in a particular type of habitat" (English and Blyth 1997, Attachment 1; although I would exonerate them from blame for originating the term, which would appear to literally mean a community that studies its own interactions). Like floristic community type, it is a poor term because of the lack of specificity and the likelihood of confusion with plant community. It also has the deficiency that it defines biological groupings (biota) on the habitat they occur in rather than on their own attributes. Biota would have been a far better term.

Threatened ecological community; endangered ecological communities etc

"A threatened ecological community (TEC) is one which is found to fit into one of the following categories; 'presumed totally destroyed', 'critically endangered', 'endangered' or 'vulnerable'." (English and Blyth 1997, Attachment 1, p. 1.)

English and Blyth (1997, Attachment 1, p. 3) also give definitions for the various categories of threatened ecological communities listed above. For example, they define an endangered ecological community as "An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future".

3.0 CLIMATE OF THE REGION INCLUDING THE SURVEY AREA

The region including the survey area has a Mediterranean climate, with a cool wet winter and summer drought. The summers are warm to hot, with average maxima of approximately 30° Celsius and extremes of over 40° Celsius. The winters are cooler and milder with average maximum temperatures between 15° and 20° Celsius and minimums of around 5° Celsius.

The average annual rainfall is 463 mm, the majority of which falls from May to September.

Figure 1 of Griffin (1992) shows rainfall and temperature graphs for the survey area and compares them with other regional centres.

4.0 GEOLOGY, TOPOGRAPHY AND SOILS

4.1 Geology

The underlying rocks of the survey area belong to the Middle Proterozoic Moora Group. These are sedimentary rocks, which are separated from the Archaean rocks of the Darling Plateau by a series of poorly defined faults (Griffin, 1992).

The Noondine Chert Formation (originally called the Coomberdale Chert), which outcrops frequently in the survey area, is a part of the Coomberdale Subgroup of the Moora Group. "It consists of bedded chert, chert breccia, orthoquartzite, silicified limestone and dolomite and contains significant siliceous siltstone and sandstone beds, and minor claystone." (Carter and Lipple 1982).

The Noondine Chert lies on the western edge of the Darling Plateau, immediately east of and parallel to the Darling Fault. The survey area is located in the largest and most extensive area of outcrops of this formation, between Dalaroo and Coomberdale and includes Cairn Hill, a highpoint approximately fifteen kilometres north of Moora. Cairn Hill is in a nature reserve vested in the Department of Environment and Conservation and was formerly a Westrail reserve for gravel extraction.

The survey area has several faults present, perhaps most notably the Kiaka Fault, which runs NW-NE across the northern end of the Eastern Ridge before disappearing under the sand plain. Partly due to this dissection of the area by faults, acting as drainage channels, the quartzite in this group is relatively free of impurities.

4.2 Topography

The survey area contains part of a narrow and discontinuous series of low hills that are formed from the higher (and presumably more resistant to erosion) parts of the Noondine Chert Formation. These hills run north from Mt. Lamb, approximately ten kilometres south-south-east of Moora, to the Billeranga Hills some thirty kilometres north of Three Springs and occur along the western edge of the Darling Plateau.

Cairn Hill Nature Reserve contains the highest point in the survey area, the hill of the same name. This reserve has some steep, narrow chert ridges in its western part (close to the railway line) and then slopes upwards to the east, moderately and then steeply. Thus a large part of this reserve is westerly facing slopes, although the slopes are complex, so that there are also north-westerly and south-westerly facing areas. The eastern part of the reserve includes the crest above the slope. This has some flattish areas.

The vegetated area referred to in this report as 'Cairn Hill North' (see Map2, central sheet above) is a ridge running north from Cairn Hill Nature Reserve. The crest of this ridge slopes gently to the north, ending in a valley that separates Cairn Hill and Cairn Hill North from the

Western Ridge, the Eastern Ridge and the Eastern Ore Body. Cairn Hill North has a long western slope, while the wooded gullies along the top of the ridge have a variety of slopes, some of which have developed a reasonable soil cover.

The Western Ridge was a small ridge (in fact little more than a shoulder on a larger ridge) to the west of the original mine. Its southern part (about a quarter of its length) had blocky chert outcrop on a steeper southerly facing slope while the northern part had gentler slopes with chert at or just below the surface. The 'ridge' mainly sloped to the west, with a narrow area of gentle eastern facing slope on its eastern side (into a slight dip on the larger ridge the Western Ridge lies on). Since vegetation quadrats were recorded on the Western Ridge, much of it has been mined.

The area referred to as the 'Proposed Waste Dump' is a gently sloping area between the Western Ore Body and the current mine. It slopes to the south and south-west (it is now unlikely that [waste](#) will be dumped on this area).

The 'Eastern Ridge' is a long ridge that lies east of the current mine and stretches from south of the current mine path almost to Kiaka Rd, which runs west to east north of the mine site. The Eastern Ridge has a variety of slopes, mostly easterly or westerly facing, with some south and north sloping areas, generally in gullies. The central area of the Eastern Ridge is fairly flat, and slopes gently to the south, east, west and north-east from various parts of the crest. On part of the western side of the Eastern Ridge there is a breakaway, which is curved to form an amphitheatre with steep rocky sides providing a distinctive section of the western slope.

The original mine is based on the 'Eastern Ore Body', (what was) a ridge between the Western and Eastern Ridges. A small section of this ridge remains unmined, immediately south of the mine pit and in the path of the mine. This area has a steep boulder outcrop area facing south-west, below which are gentle colluvial slopes, while from the crest above the outcrop area moderate slopes with chert at the surface run to the south-east.

The areas north of Kiaka Road that were surveyed have a series of more or less parallel north-south trending ridges of chert, with small valleys between them. East of the easternmost of these there is a larger valley. There is an overall slope from east to west, with the western ridges lower than the eastern ones. The ridges vary considerably in cross section, some having gentle slopes on both sides and others (often narrower) having quite steep sides. There were some steep rocky areas, but the slopes are mainly gentle to moderate, with a few being quite steep.

South and southeast of Cairn Hill Reserve there are small, scattered remnants of vegetation on chert on three properties (Chester's, Gardiner's, Morgan's.). The southern part of this area had ridges with very low relief, while the area adjacent to the Cairn Hill Reserve has hills with

steeper slopes and rocky outcrops. The P. & J. Gardiner property had a series of north - south trending ridges and hills with relatively steep western slopes and flatter areas at the top leading to gentle slopes on the north and eastern sides. An area to the east of the south-east corner of Cairn Hill Reserve has more rounded, stony hills with sandy areas between them.

East of Cairn Hill and Cairn Hill North the ridges are generally oriented north-south and are low and rocky.

4.3 Soils

The soils on the chert ridges vary in depth from skeletal on the blocky outcropping chert, to gravelly, loamy sands lower down the slopes (Griffin, 1992). The surface soil was often pale grey, silty, fine sand.

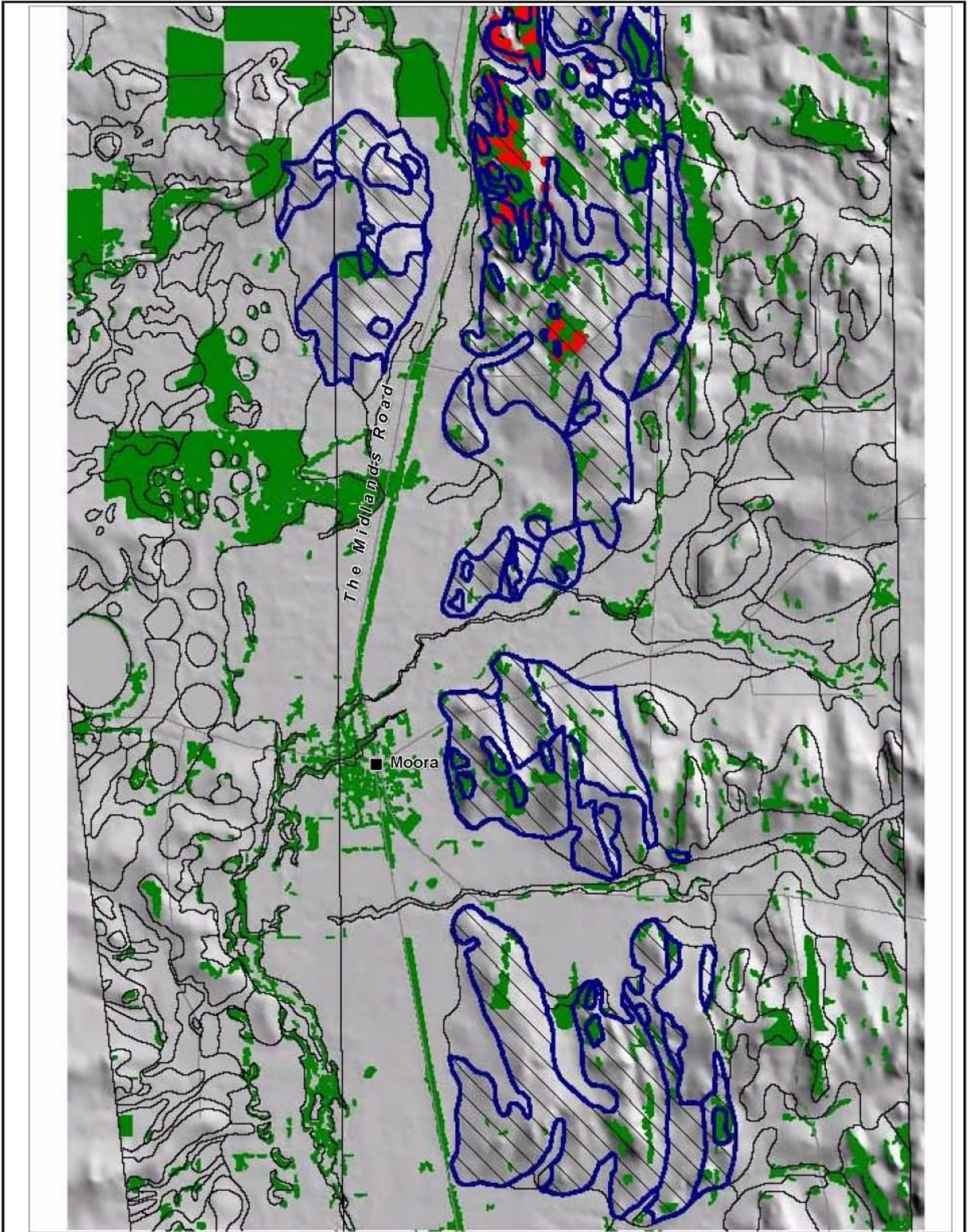
The soils in the valleys between the ridges are deeper over clay and broken rock (A. Tonkin *pers com.* and personal observation).

4.4 Mapping summary of landscape, soils and remnant vegetation

Map 3 (Sheets A-F) is a visual summary of the topography and the distribution of soils-landscape mapping units in an area containing the current survey area and the distribution of the Coomberdale Chert.

Of particular interest is the existence of two soil-landscape mapping units in the region that both occur on the Noondine Chert. These are two divisions of the Moora Group. The first is the Coorow Landscape (Chert subsystem) this has gentle topography with low stripping of the soils by erosion. It occurs to the north of the current survey area and does include some chert outcrop. The second is the Coomberdale Landscape (Chert subsystem). This has gentle to moderate topography with moderate stripping of the soils by erosion. The survey area lies within areas of the Coomberdale Landscape (Chert subsystem). The surface in the Coomberdale Landscape (Chert subsystem) generally has outcropping chert on the higher parts and colluvium with chert gravel on the slopes.

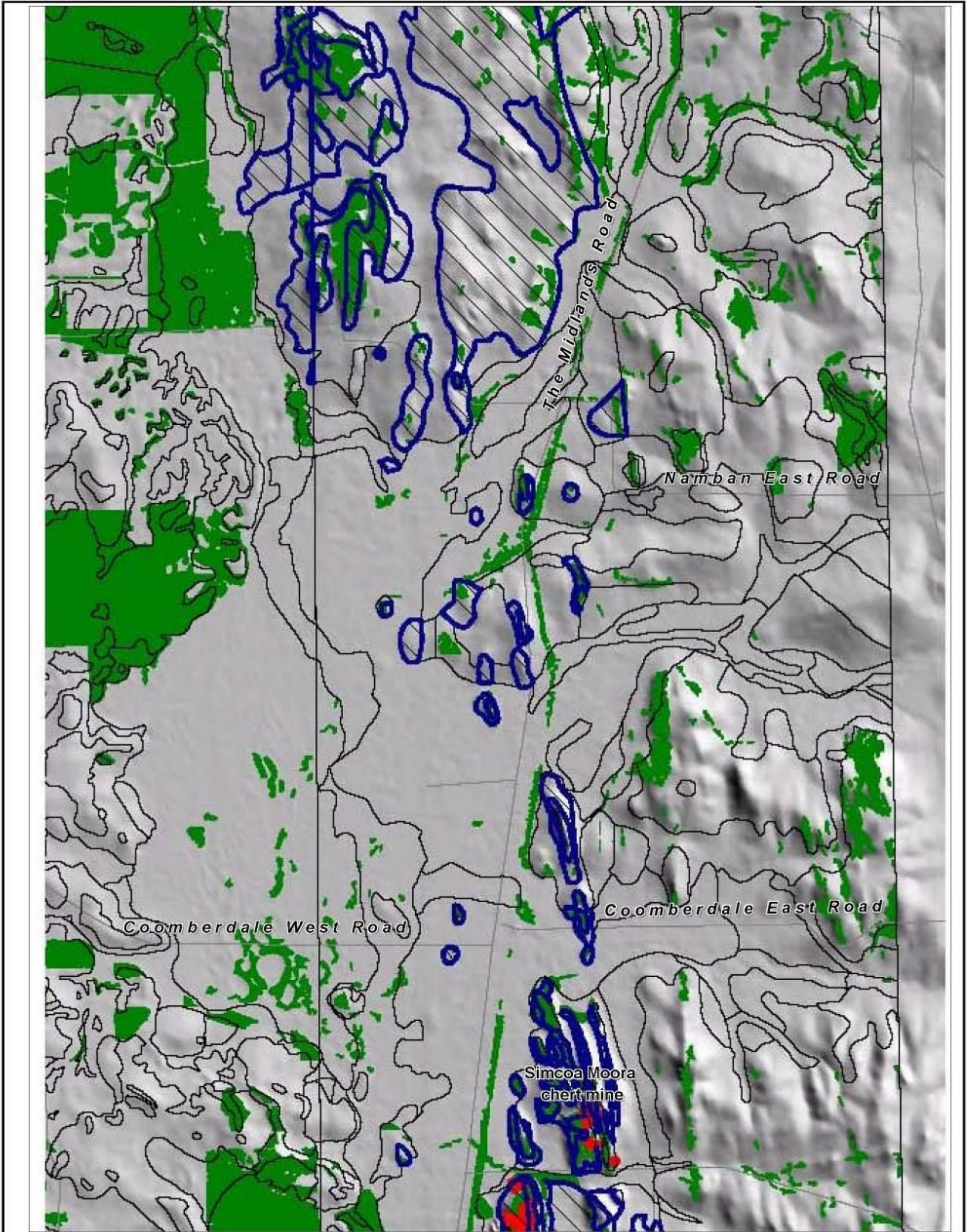
Within individual areas of the Coomberdale Landscape (Chert subsystem) there can be small areas (such as patches of laterite) that are minor occurrences of other subsystems of this soil-landscape unit.



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet A : Just south of Moora to Simcoa Moora chert mine.

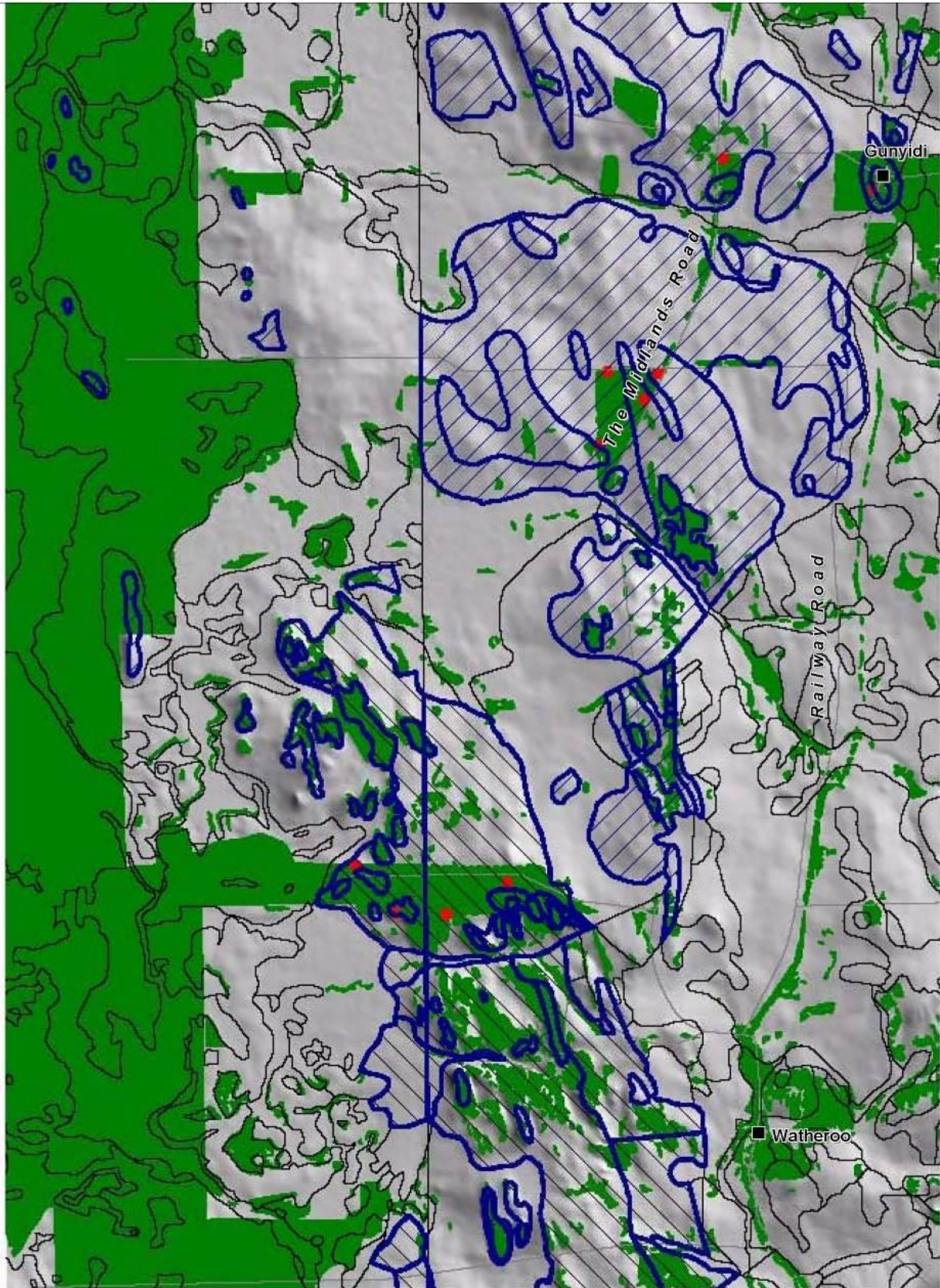
Soil landscape mapping (draft)

- Moora Group
- All other boundaries
- ☐ Sun-shaded topography
- ☐ Remnant vegetation
- ☐ Vegetation recording quadrat
- ▨ Coorow Landscape (chert subsystem) with gentle topography with low stripping
- ▨ Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet B : Simcoa Moora chert mine to south of Watheroo

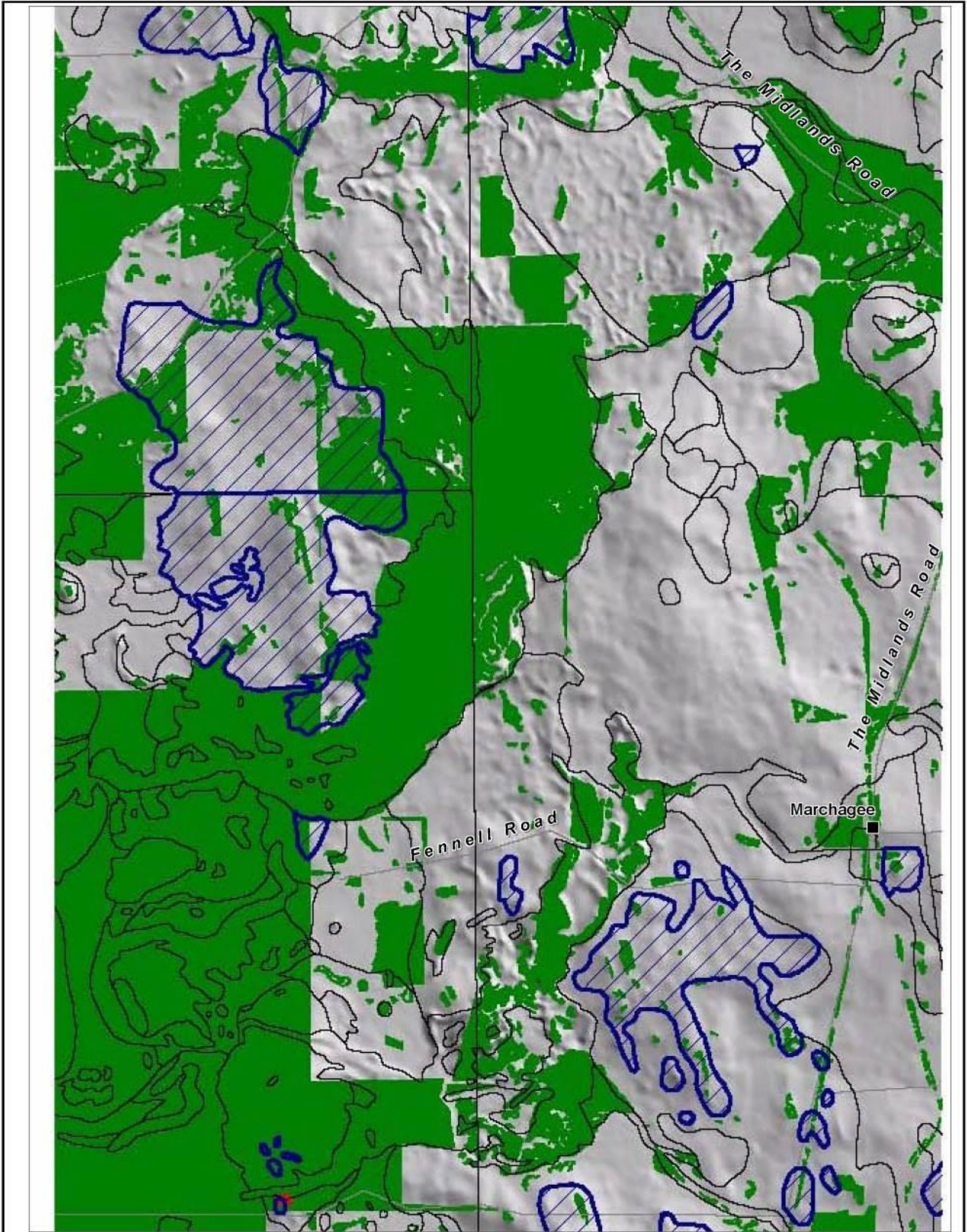
- Soil landscape mapping (draft)**
- Moora Group
 - All other boundaries
 - ☐ Sun-shaded topography
 - ☐ Remnant vegetation
 - ☐ Vegetation recording quadrat
 - ▨ Coorow Landscape (chert subsystem) with gentle topography with low stripping
 - ▨ Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet C : South of Watheroo to south of Marchagee (just north of Gunyidi)

Soil landscape mapping (draft)

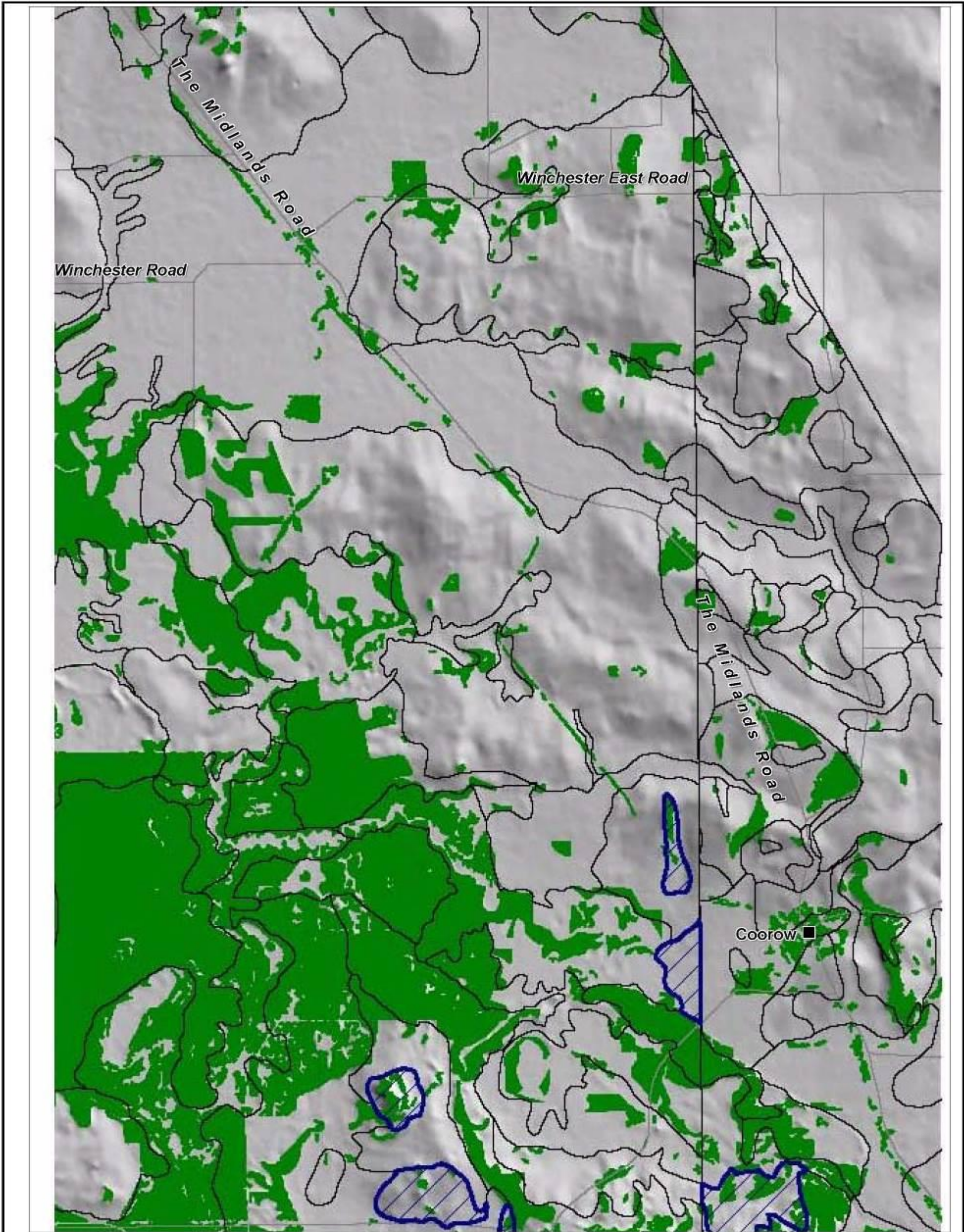
- Moorra Group
- All other boundaries
- Sun-shaded topography
- Remnant vegetation
- Vegetation recording quadrat
- ▨ Coorow Landscape (chert subsystem) with gentle topography with low stripping
- ▩ Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet D : South of Marchagee (just north of Gunyidi) to just southwest of Coorow

Soil landscape mapping (draft)

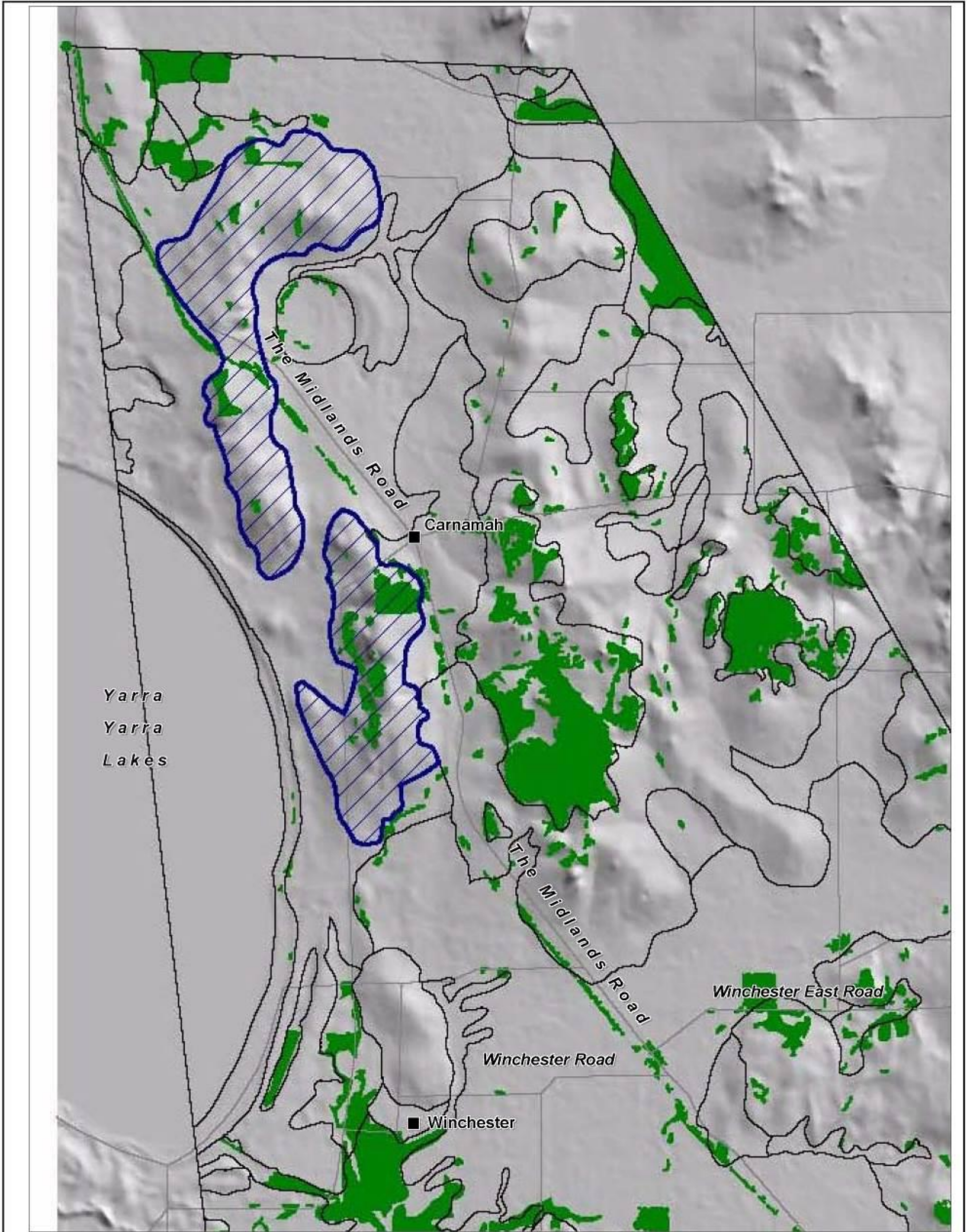
- Moora Group
- All other boundaries
- Sun-shaded topography
- Remnant vegetation
- Vegetation recording quadrat
- ▨ Coorow Landscape (chert subsystem) with gentle topography with low stripping
- ▨ Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet E : Just southwest of Coorow north to Winchester

Soil landscape mapping (draft)

- Moorra Group
- All other boundaries
- Sun-shaded topography
- Remnant vegetation
- Vegetation recording quadrat
- Coorow Landscape (chert subsystem) with gentle topography with low stripping
- Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping



MAP 3 : Soil landscape mapping and remnant vegetation (circa 2000) on sun-shaded topography
Sheet F : Winchester north to Carnamah

- Soil landscape mapping (draft)**
- Moora Group
 - All other boundaries
 - Sun-shaded topography
 - Remnant vegetation
 - Vegetation recording quadrat
 - Coorow Landscape (chert subsystem) with gentle topography with low stripping
 - Coomberdale Landscape (chert subsystem) with gentle to moderate topography and moderate stripping

5.0 SOME SPECIES COMMON IN THE SURVEY AREA

In order to understand the descriptions of the vegetation of the survey area provided in this report and the relationship of this vegetation to other vegetation it is necessary to have some familiarity with the species that form it. It is particularly important to have some familiarity with those species that are relatively important in the vegetation because they are major contributors to the vegetation, ie, are the dominants, providing the structure of the vegetation. Therefore, brief descriptions are provided for some of these species as well as other species of interest.

Two of the species considered in this section, *Regelia megacephala* and *Kunzea praestans*, are quite common in the survey area but are geographically restricted and either uncommon outside the Moora Chert Threatened Ecological Community (the *Kunzea*) or not found out of it (the *Regelia*). The other species discussed below are all quite common outside the Moora Chert Threatened Ecological Community.

***Acacia acuminata* subsp. *acuminata* (Jam)**

Jam is a small tree that usually grows to around five to seven metres tall in the survey area. It has long narrow "leaves" (strictly speaking, phyllodes) of a distinctive dusky green. This species occurs as scattered plants through much of the survey area, usually occurring with *Allocasuarina huegeliana*. Occasionally, it is the dominant in stands.

***Allocasuarina campestris* (Tammar)**

Tammar is a bushy, leafless shrub, usually two to three metres tall with insignificant red (female) or pale brown (male) flowers. The female inflorescence developing into small cone like aggregations of fruit. On the chert ridges in the survey area Tammar generally grows where there is deeper soil (ie. the chert is broken up below the surface). Often this is on mid-slopes, but Tammar also occurs on crests. In summer, Tammar suffers badly from drought stress and turns yellowish as the stems lose their green colouration. Heath dominated by this *Allocasuarina* is one of the main plant communities in the Coomberdale Chert Threatened Ecological Community.

***Allocasuarina huegeliana* (Rock Sheoak)**

The Rock Sheoak is a leafless tree four to ten metres tall that is often associated with granite or other rocky areas. The bark is dark with longitudinal fissures. This tree tends to avoid the exposed chert, preferring to grow on deeper soils on slopes, in gullies or in valleys, although it grows on crests if there is deeper soil. Rock Sheoak is the dominant in some communities.

***Dryandra sessilis* var. *sessilis* (Parrot Bush)**

Parrot bush is a shrub or small tree to five metres tall, with cream or yellow flowers. It is usually a fairly dense plant, and flat sclerophyllous leaves with spines on the margins. This

species is widespread in the survey area, but is not abundant there as it appears to favour the slopes below outcropping chert, and these have been largely cleared.

Hibbertia subvaginata

This species is generally an erect shrub with yellow flowers, although sometimes it is spreading and it is often rather straggly. Most individuals observed were about 0.5 to 1.2 metres tall, except under denser vegetation and in re-growth areas where it was lower. In the survey area, *Hibbertia subvaginata* was often found with *Kunzea praestans* and also often with the Declared Rare Flora species *Acacia aristulata*. While not abundant in most vegetation types in the survey area, it is occasionally dominant in the lower shrub layer.

***Eucalyptus loxophleba* ssp. *loxophleba* (York Gum)**

York Gum is a small to medium sized tree, with most individuals in the survey area being five to twelve metres tall. It has rough bark persisting on the lower part of the trunk, often with strips peeling on the upper parts. While not common on the ridges, York Gum did occur on the ridges where soils were deeper (for example, there were scattered individuals on upper parts of the Eastern Ridge and on the lower slopes of the Proposed Waste Dump). However, York Gum is commoner on lower slopes in the survey area.

***Eucalyptus wandoo* subsp. *wandoo* (Wandoo)**

Wandoo is a medium sized tree with slightly powdery, smooth white bark often with pink and/or grey tones (this varies through the year). There are usually brown patches of dead bark on the trunk and branches, giving a mottled appearance. This tree was found on the eastern side of the Eastern Ridge, in a small community on a fault line or dyke. It was also observed in Cairn Hill Westrail Reserve near the radio tower and on a lower slope on A. & R. Tonkin's property.

***Kunzea praestans* (a relative of the bottlebrushes)**

Kunzea praestans is an erect shrub with pink flowers and small leaves. It is usually one and a half to two metres tall, but was seen to three metres tall. In the survey area, *Kunzea praestans* was usually found with *Hibbertia subvaginata* and was sometimes found mixed with *Regelia megacephala*, although it tended to occur at the edge of *Regelia* stands rather than with the *Regelia*. It was observed at or near ridge crests and on slopes, usually in gravelly soil, but also in broken chert. Stands dominated by *Kunzea* are also from plant communities that belong to the Moora Chert Threatened Ecological Community as strictly defined.

***Regelia megacephala* (a relative of the bottlebrushes)**

Regelia megacephala is an erect shrub from two to five metres tall with purplish-red flowers and small, thick leaves in four rows. It grows mainly where the underlying chert is fairly massive, with relatively little infiltration of gravel and soil from the surface. In such situations, where other species appear to be unable to compete, it forms dense stands.

Vegetation dominated by *Regelia megacephala* forms several plant communities that are part of the Moora Chert Threatened Ecological Community.

***Xanthorrhoea drummondii* (a Grass Tree)**

This species is a Grass Tree or Blackboy; in the survey area it is usually from two to four metres tall, however it often occurs with shorter stems.

(This section from personal observation and from Paczkowska and Chapman, 2000.)

6.0 DISCUSSION OF DIFFERENT METHODOLOGIES FOR STUDYING VEGETATION RELEVANT TO DESCRIPTION AND ASSESSMENT OF THE VEGETATION OF THE SURVEY AREA

6.1 Scope of this section

This section will briefly describe and discuss some of the different methodologies that have been used for studying, describing and mapping the vegetation of the survey area and areas including it. Understanding of the different approaches is necessary to understand the bases of each and how they can properly be used, as well as understanding their relationship to each other and to vegetation, as it exists in the field.

It is also important to understand that the study of the vegetation of an area is an iterative process, refined over time as the theoretical limitations of studies and approaches are recognised or overcome, or different, often more specific, questions are asked that require more detailed study and understanding to be adequately answered.

It also needs to be recognised that studies of regional variation often cannot answer questions requiring answers based on more detailed knowledge, but provide a framework within which more detailed studies can be carried out. So (ideally) there is a progression from broader regional studies to detailed studies of smaller areas although, in practice, small areas often get studied before whole regions. There has also been a technological element involved in the progress of studies of vegetation in recent years. Until fairly recently, computers able to handle significant sized datasets were not readily available, this has changed, and has meant studies using larger data sets have become more practical.

The approaches discussed are the:

- More traditional structure and dominant species approach using the classification of Specht as modified by Aplin (1979) as an example (which has been used to describe the vegetation of the survey area);
- The floristic method, for example the floristic analyses carried out for this survey, and the survey of the Bindoon to Moora region by Griffin (1992);
- The approach of Beard (1980) in his regional mapping

These different methods are based on the use of either the structure and species dominance or the overall floristic composition of the vegetation, or a combination of these attributes. Before discussing them, it is worthwhile to consider why there are a number of different methods and not a single agreed resolution for classification of vegetation. The essence of the problem is that vegetation is very diverse as a result of:

- The number of species available within a region to form a stand;
- The number of species (few to many) that may form a stand of vegetation;
- The differing contribution to biomass that species can make in different stands (ie. one, a few, or more may be dominant or co-dominant);
- The number of different habitats vegetation occurs in, even in one region;
- The fact that habitats are often not discrete, ie. the change from one habitat to another may be gradual or abrupt;
- The range of structural types that vegetation can take, for example from herblands with one low stratum of herbs to forests or woodlands with two tree layers, three shrub layers and herb or sedge layers (although, this is driven by habitat); and
- The range of climate that vegetation occurs in, even within a single region.

Thus, the study of vegetation is difficult and is a particular case of the complexity of biological problems caused by the general problem that nature is extremely diverse.

6.2 Discussion of individual approaches used

6.2.1 The structure and dominant species approach

This approach places emphasis on the species present that are abundant or relatively so, and often largely on the tallest stratum of the vegetation. Therefore it generally emphasises those species that are more structurally important and/or often visually important from a human perspective.

The structure and dominance approach defines plant communities that are then grouped into vegetation associations and further into vegetation formations, with intermediate groupings sometimes used such as sub-formation or society. The left hand column of Table 1 shows this hierarchy. At the upper level of this approach (vegetation formation) only the structure is used. This provides a conceptual break between association and formation, because in the latter unit the identity of the species in the vegetation is ignored. This is a larger conceptual break than between association and community as here the difference is a matter of level. The definition of both the vegetation association and plant community levels is based on a combination of structure, dominant species and overall species composition.

Using the simplest format of the structure and dominant species approach (describing the tallest stratum of vegetation only) can be unsatisfactory in ecological studies or for conservation assessment as it can group together otherwise dissimilar vegetation on the basis

of a similar upper stratum even though the lower strata are different. Also, the upper stratum may not be a good indicator of habitat values for other flora and for fauna.

The modification by Aplin (1979) of Specht's classification uses description of all the different vegetation strata in a stand. At higher levels (eg. formation) it uses only the upper stratum, but at lower levels (eg. plant community) it uses all the strata. This vegetation classification system is used in this report to describe the vegetation stands recorded and the communities and associations defined from them.

6.2.2 The floristic approach, for example Griffin's (1992) survey of the Bindoon to Moora region

The floristic approach is based on defining units in the vegetation of an area on the basis of species presence and absence, ignoring their individual contribution to the biomass or structure of the vegetation. Generally, computer programs such the 'PATN' package (Belbin 1987 and later dates) are used to sort sites, on the basis of detailed flora lists, into groups or clusters of sites having more similar lists and providing a measure of that similarity. The resulting groups are then used to define units often referred to as "floristic community types". A step beyond the usual presence/absence sorting occurs when the site data includes information on the species cover. Then, the approach tends back towards the structure/dominance approach, but with the emphasis on floristics.

In general with the floristic approach it is found that, where it is desired to define regional units, a good result is obtained from the use of presence/absence data only (i.e., without cover). This would appear to be reasonable, as over large areas there is more scope for changes in climate, soil and habitat to cause differences in the presence or absence of species than over small areas. Correspondingly, when defining units of a lower order over smaller areas, abundance data is often found to be useful as the scope for changes in species composition is lower over smaller areas, but changes in habitat can influence abundance greatly. Lower order units will have similar floristics but different abundances.

The study of Griffin (1992) is of particular interest in the context of floristic studies of the region containing the survey area, as it is the only study of the region based on a large number of rigorously recorded sites. Griffin uses his floristic data (which includes cover values) to firstly define "vegetation types" and then secondly to describe seven floristic regions. Referring to Table 1 (see below), Griffin's "vegetation types" are equivalent to a unit at a level of synthesis between a vegetation association and a vegetation formation and his floristic regions are of a similar level of synthesis to the vegetation complex level of Heddle (1980), but are defined differently. Griffin (1992, p. 1) notes that the vegetation types were significantly "correlated with geological substrates". These units, while very useful in describing broad variation at the regional scale, are limited in that middle and lower order

units with conservation significance were not defined (to be fair such units were beyond the scope of the project) and consequently not available for conservation assessment.

6.2.3 The approach of Beard (1979) in his regional mapping

Beard used a variety of information, including soils and geology maps, to define broad map units for which he then described the vegetation using a physiognomic approach. This approach is similar to the vegetation complex approach. However, the amount of detail for each polygon is usually restricted to one generalised vegetation description rather than the description of a range of vegetation likely to occur in a polygon.

6.3 The relationship of the units used in different approaches to studying the vegetation of the survey area.

The relationship of the various units used in the studies commented on, and their appropriate use, may be better understood by tabulating them (see Table1) so that concepts of approximately the same level of synthesis are arranged more or less together, although there may be some overlap. This does not imply that the units are equivalent or interchangeable; they are products of very different concepts. What Table 1 shows, is the level at which the units should be interpreted. It also shows that most of the units in use in the region including the survey area are very broad units, a reflection of the fact that very little detailed description of vegetation has been carried out in this region.

6.4 Method of description of units used in this report

In this report, Aplin's (1979) modification of Specht's vegetation description system is used for describing and mapping the vegetation. While Specht's original scheme did not adequately deal with the variation found in vegetation because of a reliance on the upper stratum, Aplin included lower strata, eg shrub or herb layers, to allow differentiation between what may otherwise seem to be the same vegetation. This then gives a description that addresses two criteria that need to be considered when defining plant communities, the structure of the vegetation and the dominance of the species that make up the bulk of the structure. A third criterion, the overall floristic composition, is considered by comparison of the site species lists.

This approach allows the description of plant communities as basic units of the vegetation of the survey area. These are then grouped into vegetation associations and these again into vegetation alliances (see Table 1).

Table 1: Comparison of some units of vegetation description used for the survey area, or areas including it and some used in well known studies on the Swan Coastal Plain and the adjoining Darling Plateau to the commonly accepted structural/dominance classification of vegetation to indicate the approximate relationship of level of synthesis of these examples of various approaches used to study vegetation and the distribution of flora.

Hierarchy for vegetation divided on structure only at the two upper level(s) and on structure and dominant genera or species at the lower levels	Examples of vegetation divided on structure only at the two upper level(s) and on structure and dominant genera or species at the lower levels	Vegetation divided on geomorphological boundaries with subdivision on structure and dominant species	Vegetation divided only on the basis of the presence or absence of flora species (floristic analysis using pattern analysis).	Vegetation divided on the basis of the presence or absence of flora species and cover of species (floristic analysis using pattern analysis with cover).
<p>Biome A concept that is partly distinguished on structure and partly on being a geographical entity. For example, the tropical rainforests of the Amazon Basin are a biome. Obviously, such as a large entity would not be entirely one formation but would have inclusions of others that would occur in a related fashion. This concept therefore straddles the conceptual boundary between the units in this column and the next.</p>				<p><u>Floristic Regions</u> of Griffin (1992) defined in his Bindoon to Moora study area 👉? [See discussion in 8.0 below]</p>
<p>Vegetation formation A concept that covers vegetation of the same structure of the upper layer without reference to dominant species. While stands referred to a particular formation may have similar structure, they may have different dominant and associated species. For example a Banksia woodland with two shrub layers and a herb layer and a Casuarina woodland with virtually no understorey are both simply woodlands at the formation level. Aplin's (1979) modification of Specht provides a list of 29 formations</p>		<p>Vegetation complex on the Swan Coastal Plain A concept that covers a range of structural types that occur on a major geomorphological unit. (Heddle <i>et al.</i> 1980)</p> <p>Vegetation complex on the Darling Plateau (+/- land unit) A concept that covers a range of vegetation that occurs on one part of the range of geomorphology of the Plateau and the valleys incised into it and with subdivisions based on changes in vegetation related to broad climatic parameters. (Note: this reflects the fact that the Plateau/Scarp complex has a higher range of topography and is older than the coastal plain, meaning that more diverse ecological situations have *developed. The result (with exceptions) is that there is less structural diversity in P/S vegetation complexes(Heddle <i>et al.</i> 1980 gives 30 vegetation complexes for the Northern Jarrah Forest) (? variable, possibly to sub-formation)</p>	<p>Gibson <i>et al.</i> (1994) level floristic community type Uses a concept that divides flora records for sites into a number of groups of sites on the basis of species presence and absence. The number of groups used being selected by the person doing the analysis. That is, varies from study to study. Gives 36 Floristic community types for the southern Swan CP [(? Variable, possibly to alliance)</p>	<p><u>Vegetation types</u> of Griffin (1992) for his Bindoon to Moora study area Used both species composition and cover to define 45 "Vegetation types" [See discussion in 8.0 below] 👉?</p>

Vegetation sub-formation At the sub-formation level, the genus of the dominant of the upper layer is included to group examples of the same formation with related species as the dominant(s). For example, <i>Eucalyptus</i> woodland.		Mapping by McArthur and Matiske (1985) of the Bassendean Dunes of the Gngangara Mound		
Vegetation alliance This groups examples of associations that have the same dominant species. For example, <i>Eucalyptus marginata</i> (Jarrah) forest and may have the same or related species important in the understorey			Floristic "groups" (or "floristic community types") defined in the current study of the Moora chert hills. (Possibly higher than here)	
Vegetation association A concept that covers two or more <u>plant communities</u> with similar structure and dominant species. May vary significantly in associated species but all stands referred to it will have some visual similarity.	Vegetation associations described for the Moora Chert Hills study. Some possibly nearer alliance.			
Society A series of plant communities with the same structure and the same species dominant in the different strata				
Plant community The basic unit of vegetation description (although, sometimes sub-communities are defined). Standing at one place looking at a stand of vegetation one is looking at a physical example of a plant community. Extending this concept to several very similar stands introduces some variation and it becomes a concept.	Plant communities described for the Moora Chert Hills study			
Stand A particular example of a plant community				

Notes: Based on Table 3 of Trudgen (1999) and expanded to include relevant studies. Definitions of *alliance* and *society* follow Aplin (1979), the definition of *association* used is similar in meaning to that of Aplin. The definition of *biome* by various authors varies significantly, the concept used here is somewhat more restricted than used by some authors (see Allaby 1998, p 54 for example) who would equate it to all examples of a particular formation or a climatic type and arguably it could be above or below formation in the left hand column of this table (or in the column to the right at a higher level than land system (bioregion)). Alliance and society are rarely used.

7.0 APPROPRIATE USE OF THE DIFFERENT VEGETATION UNITS IN THE ASSESSMENT OF THE VEGETATION

7.1 General comment on the use of regional units

The use of regional units in the assessment of conservation value for vegetation should take into account the variation within them. This variation may be regional or sub-regional variation in the flora composition or structure and dominance of stands. It may be caused by climatic or edaphic changes over distance or it may be related to the fact that broad units contain a range of finer units at a local or district level that are related to local or district changes in environmental factors; such as aspect, depth to water, or slope. Regional units should not be perceived as uniform, homogenous entities when they are mostly in fact quite variable. Therefore, regional units should be used to identify the need for conservation at a regional level (e.g. there should be reservation of such a unit over its range), or the value of an area at the regional level, understanding that more detailed studies of the vegetation would be needed for a more detailed analysis.

7.2 The use of the floristic regions of Griffin (1992)

The floristic regions of Griffin (1992) are regional scale units that divide the landscape on a very broad scale and therefore it is appropriate to use them for assessing the value of areas at this scale. These floristic regions largely follow large-scale geomorphological/geological features presumably because the floristic variation they are based on is related to such features. It could not be expected that units defined at this scale will take into account significant variation in habitat that would support a wide range of vegetation types. An example of an appropriate use would be to assess the adequacy of reservation in the region at the level of these units.

7.3 The use of the units of Beard (1979) in conservation assessment

The units of Beard (1979) are conceived at quite a broad level and, like the vegetation types of Griffin (1992), divide the landscape at a broad scale. Therefore, these units can be used in a similar way to the floristic regions of Griffin, but are less well developed than those. As noted above, they are essentially broad level "vegetation complex" units (that is largely defined from geology or soils units), but with a low level of detail for what each unit covers.

7.4 The use of the "vegetation types" of Griffin

These units are generally sub-regional units, and as there are no maps of their distribution, it is not possible to use them in conservation assessment based on the area of their original extent and the proportion of that extent remaining. However, the number of occurrences known for each gives some indication of the abundance of them in remnant vegetation, and the number of them in particular floristic regions gives some idea of the diversity of vegetation in those regions. Ideally, these units would be used in conjunction with more detailed analysis and vegetation mapping to assess the part of the variation of them present in

an area and its importance. It might be possible to use them in conjunction with Beard's mapping.

7.5 The use of plant communities and vegetation associations in vegetation conservation assessment

Plant communities (as used in the description of vegetation in this report) are units of vegetation that closely reflect how vegetation occurs in the field. They are low-level units that discriminate the vegetation at a fairly fine level based on structure, dominance by different species and overall floristic composition. Thus, assessment at the plant community level allows either a real measure of the variation and diversity of the vegetation of an area, or a comparison of areas based on their relative values for vegetation at this level.

Two areas could be in the same floristic region (or other broad floristic unit), or have vegetation referable to the same vegetation formation, but have quite different vegetation when assessed at a plant community level. To use the vegetation of the survey area as an example; it all falls within Griffin's (1992) Coomberdale Floristic Region and includes three of his "vegetation types". However the vegetation of the survey area is very rich at the plant community level, due to the significant variation in habitat and soils present. Thus the plant community level can be used to make comparisons between two (or more) areas of vegetation that are located in the same broader unit, such as the same "vegetation type" of Griffin or in one of the areas defined by Beard (1979).

The vegetation association level can be used in the same way, but because these units are somewhat broader, the comparison between areas will be less detailed and therefore the reliability of the comparison less robust.

8.0 BOTANICAL CONTEXT AND DEFINITION OF THE COOMBERDALE CHERT THREATENED ECOLOGICAL COMMUNITY

The survey area lies in the South West Botanical Province of Beard (1980), one of the three botanical provinces defined by Beard for Western Australia. Within this province, it is located in the Avon Botanical District, close to the border of the Darling Botanical District. Apart from Griffin (1992), and some very localised studies, there is relatively little published material dealing with the vegetation of the Avon Botanical District.

Griffin's (1992) Bindoon to Moora study area samples several of Beard's botanical districts, including part of the Avon Botanical District, and uses floristic and cover data to define "floristic regions" for the study area and within these what Griffin called "vegetation types".

Griffin's floristic regions are obviously lower level units than Beard's (1980) botanical districts, but are of a higher level of synthesis than the vegetation complexes defined for the Swan Coastal Plain by Hedde *et al.* (1980), and also therefore a higher level than formation (but of a different type to both). Griffin's floristic regions are part way between the level of vegetation formation and biome, just where depending on which definition of biome is used (biome is generally used in such a broad way that Griffin's units must be well below this category, but somewhat above vegetation formation).

Griffin's "vegetation types" are equivalent to a unit at a level of synthesis between a vegetation association and a vegetation formation (but closer to the latter) and may approximate the level of the vegetation complexes defined for the Swan Coastal Plain by Hedde *et al.* (1980). Griffin (1992, p. 1) noted that his vegetation types were significantly "correlated with geological substrates", which suggests a similar level to the Swan Coastal Plain vegetation complexes (see section 2.2.2 and Table 1 above).

Griffin placed the chert hills of the Noondine (Coomberdale) Chert in his Coomberdale Floristic Region. This floristic region occurs on the Noondine Chert Formation between Moora and Jingemina Hill, which is in the Watheroo National Park northwest of Watheroo. The largest and most extensive area of outcrops of this chert, and hence the largest representation of the vegetation of the Coomberdale Floristic Region occurs between Dalaroo and Coomberdale, where the current survey area is located. Three of Griffin's (1992, see pp. 134, 135, 136) "vegetation types" (numbers 23, 25 and 26) make up much of the vegetation of the survey area.

Hamilton-Brown (2000) has discussed the vegetation on the chert hills of the Coomberdale Floristic Region, recasting Griffin's three "vegetation types" as three "sub-units" of the threatened ecological community on the chert hills of the Coomberdale Floristic Region. She notes that "Three closely related vegetation sub-types occur on the exposed chert ridges and gravelly slopes of the Chert Hills in the Coomberdale Floristic Region that are recognisably

different from other vegetation types within this floristic region and other floristic regions." These sub-types (after Hamilton-Brown, 2000) are:

- Sub-type 1: a dense heath dominated by *Regelia megacephala* or *Allocasuarina campestris* on exposed chert ridges, with the *Regelia* being especially prominent on the ridges with little or no soil cover;
- Sub-type 2: a dense heath or open low woodland over dense to mid-dense heath dominated by *Kunzea praestans* on ridges or slopes; and
- Sub-type 3: *Allocasuarina campestris* on shallow loamy rocky soil on ridges or slopes.

It is presumed in this report that the circumscription of the Coomberdale Chert Threatened Ecological Community was restricted to these three sub-types because that was the level of information available, whereas the intent seems to have been to protect all the vegetation restricted to Noondine Chert outcrop and soils derived from it.

The vegetation described above has been listed as an "endangered" ecological community, under the title "Heath dominated by one or more of *Regelia megacephala*, *Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale Floristic Region" (Hamilton-Brown, 2000). Part of the reason for perceived importance of the vegetation defined as this Threatened Ecological Community is that some stands are dominated by two species that have very restricted occurrence (*Regelia megacephala* and *Kunzea praestans*). Many of the "heath" stands are in fact high shrubland or high open scrub, not heath.

A preferable way to deal with the definition of the Coomberdale Chert Threatened Ecological Community would be to define it on a vegetation complex basis: as that vegetation on the outcrops and surrounding slopes of the Coomberdale Chert. To base the definition on the three sub-types listed above excludes not only much of the variation on the chert and slopes, but much of the less common vegetation. For example, the *Dryandra sessilis* vegetation on the slopes has been preferentially cleared (as the soil is better than upslope, though still gravelly and sometimes with some outcrop) and is a much smaller component of the remaining vegetation of the chert ridges and associated slope than the *Allocasuarina campestris* vegetation units.

9.0 A DISCUSSION OF RARITY IN RELATION TO VEGETATION

Any assessment of the rarity of an area of vegetation depends on the level of description used, the boundary the assessment is related to and a decision regarding what constitutes rarity in the sense of either a relative measure (for example an attribute such as the remaining percentage of the original extent), or an absolute measure (e.g. having an original extent that was small enough to be inherently rare, or being reduced to an area that is inherently rare).

The same area of vegetation may be thought of as common as part of a broadly defined unit or less common as part of a lower level unit. That is, when broader units are used to assess rarity then what is actually assessed is the rarity of that particular unit, not of any of its components.

Thus, if broad units alone are used to assess rarity then the real rarity of an area of vegetation (or of components of it) may not actually be assessed. Broad units often include unusual areas that have not been recognized as different. They may not have been discriminated to minimise the number of units mapped, or because their separation was not relevant to the aim of the mapping. The point here is that the real rarity of vegetation is a function of what exists in the field rather than in abstract units defined at broad levels, and it is important that the units used reflect this real variation as closely as possible (for example, plant communities), or that the limitations of using broader units are understood and taken into consideration. It is also the case that assessment based on different levels or types of information can, when they are combined, give the best overall understanding of the importance of an area of vegetation in the absence of critical mapping of regions at a level that identifies rarity in a meaningful manner. For example, using the detailed mapping of a small area to interpret the value of an area of a broad unit can give critical insight into how the values of the broad unit vary (eg. with topography or soil changes).

Turning to the boundary an assessment is made within, an area may appear to have common vegetation if a small surrounding area (context) is considered, but to have rare vegetation when a wider region is considered. Such a situation is described as locally common but regionally rare, with the latter more accurately describing the status of the vegetation. An extreme example of how the selection of boundaries affects the concept of rarity is that, from a world viewpoint *Banksia attenuata*, *Banksia menziesii* woodland is extremely rare, being found only in a small corner of Western Australia, while from a different viewpoint, perhaps only considering a small area surrounding Gingin, it appears very common. The point here is that a boundary has to be selected to have meaning in relation to the vegetation type being considered and the question being asked. To achieve a full understanding of the significance of an area of vegetation, it may be necessary to look at more than one boundary to reflect the relationship of different contexts to different levels of assessment. That is, if the area under consideration is heterogenous then it may be necessary to consider the rarity of different parts of it in relation to different boundaries or concepts.

To fully assess the rarity of an area of vegetation it makes sense to use boundaries that have been defined on biologically relevant bases rather than arbitrary ones. That is, the types of boundaries that are likely to be most useful are Botanical District or Sub-district boundaries and geomorphological boundaries (which may or may not co-incide).

The question of how much of an area of vegetation qualifies as rare, either in an absolute or relative sense, is a matter of opinion as there is no way of devising a standard from basic principles. Trudgen (1995) considered this question of a definition of rarity in relation to vegetation for the purpose of an assessment for the Australian Heritage Commission and made the following observation and suggestions in the Western Australian context:

“There are no accepted definitions of rare flora communities (vegetation) and ecosystems and no simple definition is practical. For the purposes of this analysis, the following definition is advanced: an ecosystem or vegetation type (whether plant community, association, vegetation complex or floristic community type) should be considered rare when:

- Its original extent was less than 2,000 hectares, irrespective of what proportion of its original extent survives; or
- Its original extent was 2,000 to 20,000 hectares and less than 2,000 hectares or less than 30% of its original extent survives; or
- Its original extent was 20,000 to 100,000 hectares or more and the portion of the original extent remaining is less than 30% for an original extent of 20,000 ha declining to less than 20% for an original extent of 50,000 ha to less than 10% for an original extent of 100,000 ha or more.

The thrust of this definition is to define vegetation as rare when its original extent was very small (2,000 ha or less) and as having become rare compared to an original extent when the original distribution has become reduced by clearing or other activities [to] below the areas suggested above. The end of this sliding scale has been taken as ten percent for areas of 100,000 ha or more, as ten percent is the minimum area recommended for protection of an ecosystem by the International Union for the Conservation of Nature (IUCN). However, this would obviously not be appropriate for vegetation types (or ecosystems) with very small original extents. Therefore, a sliding scale was chosen to link small areas through intermediate sized areas to the general standard. Obviously, this is somewhat arbitrary, but a vegetation type with an original extent of only 2,000 hectares is rare or at least unusual on a national scale and a vegetation type that originally had an extent of more than 100,000 hectares and has been reduced to 10,000 hectares or less is certainly uncommon (or rare) compared to its original extent. The scale attempts to provide a resolution of a problem that is

partly absolute (for small original extents) and partly relative (for large original extents) and should be taken as a guide.” (Trudgen 1995, pp.7-9).

While this approach does not solve the problem (it is one person’s opinion), it at least makes the issues clearer when considering the effect of the absolute and relative aspects of rarity of vegetation on the conservation value of the vegetation of an area of land.

Although there is no generally agreed approach to the assessment of rarity of vegetation in Western Australia, English and Blyth (1997) have developed “categories for assigning conservation status to ecological communities”. The categories they selected “are based on the most recent World Conservation Union (IUCN) categories for threatened species or communities”. Their categories are:

- "a) presumably totally destroyed (PD)
- b) critically endangered (CR)
- c) endangered (EN)
- d) vulnerable (VU)
- e) data deficient (DD)
- f) lower risk (LR)
- g) not evaluated” (English and Blyth 1997, p 3 and Attachment 1)

The definition advanced by English and Blyth for their ‘critically endangered’ category is “an ecological community which has been adequately surveyed and found to have been subject to a major contraction in area and/or which was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.”

Later in their report (English and Blyth 1997, Attachment 6, p.4) they give criteria for the listing of critically endangered ecological communities:

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

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

- i) geographic range, and /or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)
- ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

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

- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)
- ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
- iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years).”

While these criteria recognise the absolute and relative aspects of rarity, and in fact recognise the same level (10% remaining) as an indication of a critical reduction in original area that indicates relative rarity, they are aimed at identifying entities that are under immediate threat. That is, they are provided for use in identifying ecological communities in urgent need of management or protection due to threatening factors rather than simply to identify rarity.

As a result of their work, English and Blyth have identified sixteen critically endangered, seven endangered ten vulnerable and five deficient “ecological communities”, which they list in their Table 1 (English and Blyth 1997, p.4). Examination of this list shows that what is being dealt with is the rarest of the rare, that part of the category that is under threat of loss in the near future. While this is extremely valuable and will result in the protection of areas of conservation and scientific value, it does not deal with the more general question of what constitutes rarity for the question of assessment for conservation value. Note that in the intervening period that the Department of Environment and Conservation have updated such lists and this later material is available on that departments website.

Table 1 of English and Blyth (1997, p. 4) lists communities already assessed at the time of publication of the report. The definition of an ecological community given by English and Blyth (1997, Attachment 1) is “A naturally occurring biological assemblage that occurs in a particular type of habitat”. This applies to the vegetation which is the subject of this study (ie., the vegetation of a series of low chert ridges), although it is not one "assemblage", but rather is an assemblage of assemblages (plant communities).

English and Blyth (1997, Attachment 5) include the Coomberdale Floristic Region of Griffin in their table of ‘Ecological Communities Proposed for Inclusion on the Threatened Ecological Community Database 7/5/97’. This "community" was assessed by the Department of Conservation and Land Management's (the precursor to DEC) Threatened Ecological Communities Scientific Advisory Committee as Endangered in October 1999, and an Interim Recovery Plan has been formulated (Hamilton-Brown, 2000).

10.0 METHODS AND LIMITATIONS OF THE VEGETATION AND FLORA SURVEYS

10.1 Methods of the flora survey

The flora survey of the overall survey area of this report is quite comprehensive, being based on a combination of fieldwork carried out for the precursors to this report (Trudgen *et al.* 2001 and Trudgen *et al.* 2006) and work carried out to complete the vegetation flora surveys on Arthur and Rhonda Tonkin's property in 2010. This included:

- Collection of flora specimens during the recording and re-visiting of the floristic survey/vegetation survey quadrats;
- Collection of flora specimens during recording of relevés for the vegetation mapping;
- Opportunistic collections of flora specimens made between the quadrats and relevés, especially of species not previously recorded;
- Collection of flora specimens during a systematic survey (see section 10.2) of the distribution of Declared Rare Flora for almost all parts of the survey area, especially of species not previously recorded.

During the work for the precursors to this report, three thousand seven hundred and fifteen (3,715) flora collections were made for the identification of species occurring in the quadrats, about another one thousand five hundred (1,500) collections were made during the vegetation mapping, on route between quadrats and relevés and during the rare flora search. A further two hundred and sixty-six (266) collections were made while surveying Arthur and Rhonda Tonkin's property for this report. This gives a total of about five thousand four hundred and sixty collections made for the whole area covered by this report.

Thus, the flora survey was carried out in conjunction with the vegetation survey, the data collection (recording of quadrats) for the floristic analysis of the vegetation and the rare flora survey. The resulting flora list also incorporates data from the original survey of the mine site (Trudgen 1985) and data from Griffin (1992) from within the survey area.

The specimens collected were numbered to tie them to the quadrats, relevés or locations (including a geocode) noted for them. Specimens were numbered and pressed on site, and dried later. Common species known to the authors were collected only a few times to ensure accurate identification, while species not well known (or taxonomically difficult, such as *Austrostipa* species) were collected at each quadrat to ensure identification was consistent. Once dried, specimens were sorted and identified. Identifications were made by keying specimens out in various papers and books, comparison to specimens in the research and reference collections of the Western Australian Herbarium, and by relevant experts on various

taxonomic groups (see acknowledgements section). The specimens collected at different times were comprehensively checked against each other to ensure consistency in naming.

Prior to and during the fieldwork, flora lists from previous studies (Trudgen 1985, Griffin, 1992) and the 1995 and 1998 DEC (formerly Department of Conservation and Land Management) Declared Rare and Priority Flora Lists (Atkins 1995, 1998) were consulted to ensure that species of conservation interest recorded from, or likely to occur in, the survey area were known and could be identified.

The Access database containing the vegetation data is structured so that it can provide a flora list, incidental records are typed into a “dummy” site so that they are included in the list. The list produced also indicates the number of records made for each species in the quadrats.

10.2 Methods for the searches for declared rare flora

There were two distinct methods used in the declared rare flora searches, which depended on the aim of the search.

Firstly, on the Western Ridge, Eastern Ridge, Cairn Hill North, the Proposed Waste Dump and the vegetation remaining on the Eastern Ore Body where the aim was to gain a quite accurate assessment of the populations of DRF present, searches were carried out in transects (note, that some of these areas have now been mined). Areas where the vegetation was relatively dense, restricting visibility, were searched at a 5-10 metre spacing depending on density. This covered all areas except for the southern end and northern half of the Eastern Ridge and the southern part of Cairn Hill North. The southern part of the Eastern Ridge, where the vegetation was not as dense, was searched at a spacing of about 20 metres (areas considered more likely to have declared rare flora, ie. *Kunzea* and *Regelia* stands were targeted for more intensive searching in these areas). When DRF or suspected DRF were found, the location was recorded using a GPS unit and the number of individuals present within a 5 to 10 metre radius noted. Where larger groups of individuals of DRF were encountered, a 20 to 30 metre radius was searched.

In the searches carried out on private property north of Kiaka Road and south of Cairn Hill, time did not allow as detailed a survey. In these areas, straight transects along a compass bearing were replaced with a zigzag pattern within set boundaries that was somewhat dictated by the density of the vegetation. When DRF were found, the location was recorded with a GPS unit and a count of individuals made within 50 metres of the GPS point. Note that when the vegetation of these areas was mapped, further observations were made for DRF.

10.3. Methods of the vegetation survey and floristic analysis

10.3.1 Methods for vegetation quadrat selection and recording

Prior to beginning of the original parts of the survey, aerial photographs of the survey area were studied to gain an impression of the variation of the vegetation in the survey area. It was decided to use quadrats measuring 10x10 m (ie. 100 m²), as this size is commonly used in regional surveys in the south-west of Western Australia (eg., Griffin 1992, Gibson *et al.* 1994) and it would allow comparison of the data collected to previously collected data. However, it was also decided to record a 30x30 m (900 m²) quadrat surrounding the smaller quadrat to provide data appropriate for more detailed study of the floristic analysis of the vegetation. This decision was partly taken on the basis that the vegetation of the survey area tends to be species poor, so that larger plots would provide samples less prone to stochastic variation.

Within the limits of the time available, quadrat sites were selected to represent the range of the vegetation types present in the survey sub-areas sampled. However, because of the high diversity of the vegetation, while the range was sampled, not all variation in that range could be sampled. The 10x10 m quadrats were pegged at all four corners with galvanised fence droppers and the location of the first peg recorded with a hand-held GPS unit. The 30x30 m areas were defined around the smaller area with tape measures but were not pegged or locations recorded with the GPS, as location of the pegs for the 10x10 m quadrat would adequately locate the 30x30 m quadrat. Where it was not possible to fit the 30x30 m quadrat in exactly because of stand size or disturbance, the boundaries were modified to include 900 m² where possible.

At each of the quadrats, the structure and dominance of the vegetation was recorded using Aplin's (1979) modification of Specht's table (Appendix 2). When a stratum was floristically diverse, only the more abundant species were included in the vegetation description. The quadrats were carefully searched to record as many of the species present as possible, all species observed were recorded for the site with an estimate of their height and cover. A "+" sign was used to indicate a cover assessment of significantly less than 1%.

At each site the condition of the native vegetation was assessed using the scale of Trudgen (1988, reproduced in Appendix 3). The scale has six categories as follows:

- Excellent
- Very Good
- Good
- Poor
- Very Poor
- Completely Degraded

Completely degraded was used to cover areas of post mining regrowth, severely disturbed areas and areas with only scattered trees remaining. Also recorded at each site were the levels of weed invasion and brief notes on the surface soil. The condition scale from Trudgen (1988) was modified so that 'Completely Degraded' areas included parkland cleared areas (areas with only scattered native plants in pasture) and areas where the vegetation had been removed when they were mined for gravel. Areas in Cairn Hill reserve, which had been mined for gravel and consequently had some apparently spontaneous regrowth, were also included in the 'Completely Degraded' category.

10.3.2 Data basing of the quadrat records

All data from the recording sheets used was entered into a Microsoft Access database with the interface mimicking the recording sheets. After specimens were identified the names were entered into the database at the appropriate collection number, to correct field identifications. Duplications were removed to avoid errors in analysis. The database has report functions to generate species lists and to export the vegetation data for inclusion in reports (for this report see Appendix 6) and forms suitable for floristic analysis.

10.3.3 Floristic analysis of the quadrat data

The quadrat data was analysed on a floristic basis (species presence and absence) with and without weeds and again including cover (without weeds) using the PATN computer package (Belbin 1987). One of us (E. A. Griffin) carried out the PATN analysis. The methodology used was generally similar to that used by Griffin (1999).

To provide a regional floristic context, a further analysis was carried out using relevant data from Griffin (1992) combined with data from the survey area.

10.3.4 Vegetation mapping methods

The vegetation of the survey area was mostly mapped at the plant community level, although some units may be either equivalent in level to the vegetation association level. The vegetation unit boundaries were drawn onto digitised images of 1:5000 ortho-corrected aerial photographs with a geocode (WGS84 datum) grid and the quadrat locations marked on them. The community boundaries were drawn on the photographs either using boundaries that were self-evident on the photographs, or by plotting boundaries on the aerial photographs by using a GPS unit and the grid marked on the photographs.

Where the vegetation was very similar or effectively the same as that recorded in one of the eighty-eight quadrats recorded in the survey area, the vegetation was considered to be equivalent to the vegetation of the relevant quadrat. Where a vegetation unit had not been previously recorded, the vegetation was described (using Aplin's (1979) modification of Specht's table) and the geocode, soil, habitat, some associated species and usually vegetation condition were recorded. These releve sites were numbered for the survey sub-area they were

located in. Using this methodology, all vegetation areas (polygons) drawn on the aerial photographs were labelled with a quadrat or releve number to indicate vegetation type.

Subsequently, the vegetation stands sampled in the quadrats and at the releves were classified into plant communities and these in turn into vegetation associations, based on a combination of structure, dominance and floristics. Stands were allocated to the same plant community if they had very similar structure, dominants and floristics. Plant communities were allocated to the same vegetation association if they had similar structure and dominant species, even if varying significantly in associated flora species (that is, the associations are sometimes fairly broad for the vegetation association level). The vegetation associations were then grouped into broader groups (called *Vegetation Alliances* in this report) that approximate vegetation alliances (see Table 1 above) in their level of synthesis, but not strictly in terms of their delimitation.

Each Vegetation Alliance contains vegetation associations with the same species forming the dominant cover, but not necessarily the tallest stratum. For example, the vegetation associations *Regelia megacephala* open scrub and *Allocasuarina huegeliana* low open woodland to low open forest over *Regelia megacephala* open scrub over scattered sedges and herbs were both included in Vegetation Alliance 15: *Regelia megacephala* high shrubland to open and closed scrub'.

The vegetation associations were given unique codes based on the first letters of the names of their dominant species, eg. Vegetation Association EsEl is *Eucalyptus salmonophloia* woodland over *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over scattered *Acacia erinacea* and scattered herbs and grasses including *Ptilotus divaricatus* var. *divaricatus*, *Rhodanthe polycephala* and **Bromus diandrus*. Within each vegetation association, the plant communities have been distinguished by adding numbers after the association code, eg EsEl.1.

The hand drawn map was scanned and the polygons digitised using a digital mapping program to produce a final map.

10.3.5 Vegetation condition mapping methods

Vegetation condition was estimated at many of the ninety-nine quadrats (see section 10.3.1 above) and several hundred releves recoded for the vegetation mapping. At these sites vegetation condition was assessed using the vegetation condition scale of Trudgen (1988). As well as this 'point' data, vegetation condition was noted in areas where vegetation condition was poorer, such as the smaller fragmented remnant vegetation blocks to the south and east of Cairn Hill and Cairn Hill North.

To produce a map of the condition of the vegetation of the survey area using this data, it was plotted onto a digital image of the vegetation. Areas of similar vegetation condition were then

defined by the occurrence of the point and other data, supplemented by the overall knowledge of the vegetation of the survey area.

10.4 Limitations of the flora survey

The major limitation of the flora survey reported is that any such survey is a sampling procedure in a variable environment that attempts to locate all species present when there is variation in population size, distribution, flowering time and distinctness (visibility or ease of discrimination in the field, which is related to size and morphology) of species. Some species are only available for collection for part of the year, for example annual species such as many daisies, which survive summer as seed, and cryptophyte species such as orchids, that survive the summer as tubers. If these have the opportunity to begin their growth cycle early, or if the year is a bad one, they may be missed, also, a few species of orchids only flower in some years. These factors mean that to locate all species from a survey area the size of the current one with a relatively small number of visits to each sub-area is an unrealistic expectation. The completeness of a survey is therefore dependent on the time available, when the work is carried out, the size and habitat diversity of the survey area, and the experience of the workers carrying out the search.

However, the flora survey presented in this document now reports quite detailed work for the area surveyed, as it includes records from ninety-nine (99) vegetation recording quadrats; records made during systematic rare flora searches; incidental records; records made at releves; and records made during the vegetation mapping. For much of the survey area this includes records from different times of the year, so that autumn, winter and spring sampling is represented. Most of the quadrats were visited twice, increasing the sampling for the overall flora survey. The exception is that, due to the drought year in 2010, sampling on the property of A. & R. Tonkin is somewhat less than other parts of survey area.

A significant limitation of the flora survey is that it is restricted to flowering plant species and other vascular flora groups (pines, cycads, and ferns). Fungi, mosses, liverworts, lichens and algae are generally not surveyed for environmental impact assessment and associated surveys in Western Australia, as surveying each of these groups is a specialist task, the level of information available to assess them against is poor and they comprise only a small part of the vegetation biomass.

Given the above limitations, it is likely that this work has recorded more than 95% of the flora of the overall survey area. However, a somewhat lower percentage is likely to be recorded for some of the individual sub-areas of the survey area.

While the survey has been as thorough as possible given the time constraints, it is possible that some species of conservation significance (Priority species, Declared Rare Flora, previously unknown species etc) occur in the survey area but have been missed.

10.5 Limitations of the rare flora searches

To locate all individuals of rare flora in areas as big as those surveyed would be a substantial task, however it is estimated that 90 to 95% of the populations on the Western Ridge, Eastern Ridge, Cairn Hill North (excluding an area adjacent to Cairn Hill not searched due to time constraints), the Proposed Waste Dump and the vegetation remaining on the Eastern Ore Body were located. For the areas north of Kiaka Road and south of Cairn Hill it is more difficult to estimate what percentage of populations were found however, it is likely to be more than 85% (with those missed being smaller populations or isolated individuals) as these areas have been re-visited since the rare flora survey for the vegetation mapping and to establish quadrats.

A significant limitation of the rare flora survey was that Cairn Hill was not specifically searched, however, The Department of Conservation and Environment (DEC) has kindly allowed use of data from a partial search of the reserve and a significant amount of data was available for this area from the quadrats recorded and observations made during the vegetation mapping carried out for this report.

10.6 Limitations of the vegetation mapping and classification

The vegetation of the survey area consists of a large number of small stands of a significant diversity of vegetation types, many of which are not discernable on the aerial photography available for the project. This has meant that there are limits to the accuracy of the individual polygons, although such limitations are within those usually accepted for vegetation mapping.

Many of the stands have the same dominants in varying amounts, or variations of combinations of them, and similar permutations in the understorey layers. However, at the same time they are significantly different in terms of vegetation classification. These aspects of the vegetation have made the classification of the vegetation very difficult, with the only way to express this diversity being a large number of units. While this reflects the diversity present, it makes "reading" the map more difficult due to its complexity.

In some places the stands were too small to map or were very variable, such areas have been mapped as mosaics.

10.7 Limitation of the vegetation condition mapping

The condition of the vegetation was not mapped in the field as a separate task, rather when it seemed desirable to include a vegetation condition map in the report, it was deemed practical to use the information collected at the quadrats and relevés to define vegetation condition at those points and then combine this information with aerial photograph interpretation and the knowledge of the areas to produce a map of vegetation condition. Therefore, the vegetation condition map is limited by the amount of information available. However, the number of

points where condition was recorded is quite large and so the map should easily be of sufficient accuracy for environmental impact assessment or reserve planning uses.

10.8 Limitations of the floristic analyses

Any floristic analysis is limited to some degree by the number of sites recorded (or otherwise available) and the thoroughness with which they are recorded and whether or not the recording includes visits in different seasons. Other factors that can influence the results are the size of the quadrats and seasonal factors. In the present case the size of the quadrats is appropriate for the purpose of the analysis. The density of recording (number of quadrats related to the variation being sampled) is good, except it was found that in the update of the report to include A. & R. Tonkin's property that more quadrats in other parts of the northern end of the survey area would have been desirable to better understand the floristics of the vegetation on A. & R. Tonkin's property.

However, it is not clear if the problem was lack of such quadrats, or the effect of the drought on the data recorded from the quadrats on A. & R. Tonkin's property (see below).

11.0 RESULTS OF THE FLORA SURVEY AND RARE FLORA SEARCHES

11.1 Flora recorded

Three hundred and thirty-eight (338) species of native flowering plants, one native pine (*Actinostrobus arenarius*) and four species of native ferns (three *Cheilanthes* species and a *Pleurosorus*) were recorded for the survey area. In addition, fifty-four (54) introduced species of flowering plants (weed species) were also recorded.

Of the native species flowering plant species now recorded, ninety-three (93) are monocotyledons and two hundred and twenty (220) are dicotyledons (of these, four have two varieties in the survey area). For the native monocotyledons recorded, the Orchidaceae (Orchids) with twenty-seven species recorded was the family with the most species in the survey area. Following this were the Poaceae (grasses) with twenty-one (21) species recorded and Anthericaceae (part of the lilies) with fourteen (14) species and then a drop to the Cyperaceae (sedges) with twelve (12) species.

For the dicotyledon the families with the most species present were the Asteraceae (Daisy family) with thirty-two (32) species, the Myrtaceae (Gum tree and Bottlebrush family) with thirty-one (31) species present, the Mimosaceae (*Acacia* family) with seventeen (17) species (one of which had two subspecies in the survey area), Papilionaceae (Pea family) fourteen (14) species and Proteaceae (*Banksia* family) with thirteen (13) species, were also well represented.

A list of the flora recorded in this study is given in Appendix 5, with the flora from the earlier studies (there is some possible difference in naming between the studies, but it is quite small, affecting only about six species). Additional species may be known by DEC for Cairn Hill Westrail Reserve, but it has not been possible to collate these records for this study.

11.2 Declared Rare Flora (DRF) species recorded in the survey area

Five species that have been gazetted as Declared Rare Flora (Atkins 2004, Florabase 2011) under the Wildlife Act were recorded during the survey. They are *Acacia aristulata*, *Synaphea quartzitica*, *Daviesia dielsii*, *Eucalyptus pruiniramis* and *Goodenia arthrotricha*. The distribution of these species in the survey area is shown on Map 4 and maps showing their overall distribution (from the DEC website "Florabase" are also given. Relevant information about them is summarised in Table 2 (see below) and discussed below. Details of the occurrences of the rare flora species (numbers of groups of individuals, numbers of individuals, AMG references of populations) are given in the tables in Appendix 4. One of these species, *Goodenia arthrotricha*, was a priority species at the time of the earlier reports, but has had its status changed to Declared Rare Flora since the last report (Trudgen *et al* 2006).

The lesser number of records of Declared Rare Flora (and Priority Flora) in the northern part of the survey area is due to a combination of factors. Firstly, the very northern part of A. & R

Tonkin's property has woodland of *Allocasuarina huegelii*, which has fewer shrub species and herbs in the understorey than other vegetation types in the survey area (and a different combination of species). Secondly, this area was surveyed in detail in a drought season, which meant that some species (cryptophytes) were not available for collection, as they did not produce above ground parts due to the poor conditions. Thirdly, some parts of the northern part of the survey area (e.g. the easternmost ridge on J. Tonkin's property) are more degraded than other parts of the survey area.

Acacia aristulata

This species is an erect or scrambling small shrub to one metre tall, although it is usually smaller. It has distinctive phyllodes ("leaves"), which have a single mucron (spine) at the apex. It appears to be most common in vegetation dominated by *Kunzea praestans*, but is also often found with *Regelia megacephala*. *Acacia aristulata* was fairly common in the survey area. However, it was less common in the areas on private property south of Cairn Hill Reserve, than in the rest of the survey area. Plants of this species were often grazed.

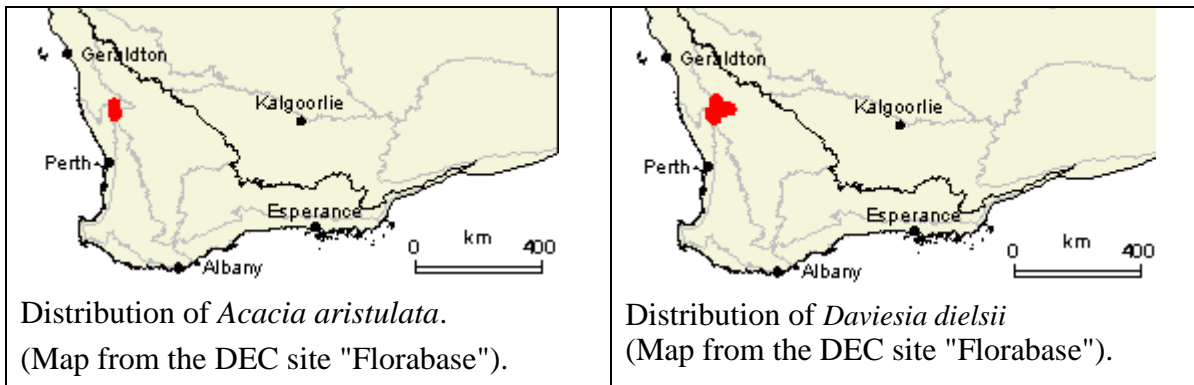
Table 2: Declared Rare Flora species recorded with occurrences in different sections of the survey area.

Notes: Columns 2 and 3 from Atkins (2004). MW = Midwest

Species	DEC region	Distribution	Survey area
<i>Acacia aristulata</i>	MW	Moora, Jingemia Hill (Watheroo NP)	Recorded in plots in: CHN, CAH, EOR, ERG, WDM, WOR. Also observed outside plots for these areas and during surveys of the Ridgway, J. Tonkin, A. & R. Tonkin, Chester and Gardiner properties
<i>Daviesia dielsii</i>	MW	Moora, Marchagee, Watheroo, Dalwallinu	Recorded in plots in: WDM, CAH, ERG, CHN. Also observed outside plots for these areas and during surveys of the Ridgway, both Tonkin, Chester and Gardiner properties
<i>Eucalyptus pruiniramis</i>	MW	Mogumber-Three Springs	Recorded in Cairn Hill Reserve (one small patch) and on Phil & Jenny Gardiner's property (two small patches).
<i>Synaphea quartzitica</i>	MW	Moora	In the survey area only known from Cairn Hill Reserve, where it was recorded once during vegetation (Geocode available on request).
<i>Goodenia arthrotricha</i>	SW	Wannamal	Recorded in plots in: ERG, CHN. Confused at one stage with <i>Scaevola phlebopetala</i> . Possibly also in some other sections of the survey area.

Daviesia dielsii

Daviesia dielsii is a many-branched shrub to one and a half metres tall. Like *Acacia aristulata*, this shrub has a distinctive leaf with a spine at the tip. It is most commonly found at the ecotone between *Kunzea* and *Allocasuarina campestris* communities. It is usually not as common as *Acacia aristulata*, although it was more common in Cairn Hill North than that *Acacia*. It was less common in the areas searched south of Cairn Hill Reserve, than in the reserve or the central parts of the survey area.

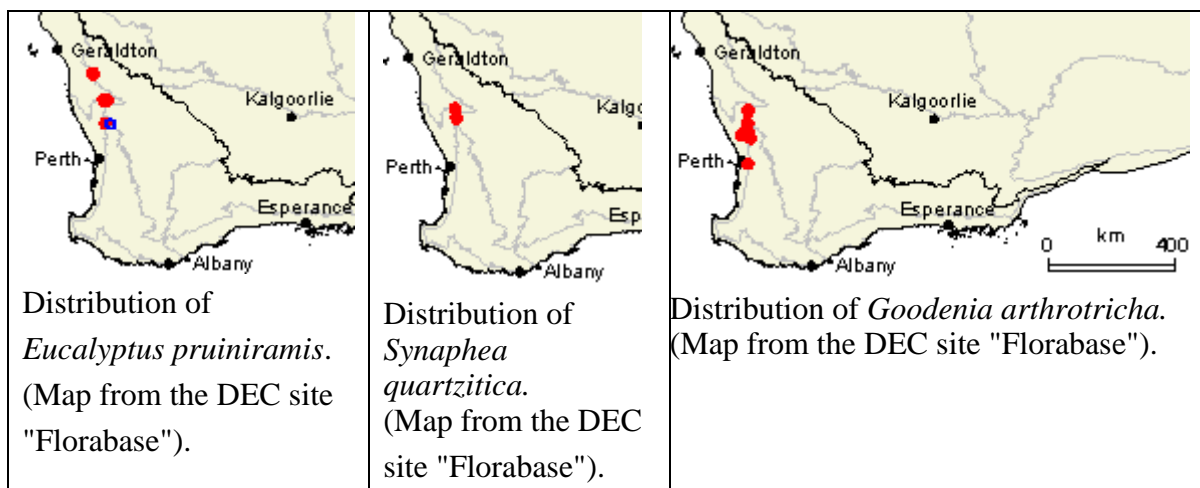


Eucalyptus pruiniramis

This is a small mallee *Eucalyptus* species that grows to five metres tall. The population found in Cairn Hill Reserve was very small and the two populations found on the property of Phil and Jenny Gardiner are both also small (to 25 m across). The species occurs from the Watheroo National Park southwards, with all but one previous collection north of Cairn Hill and the one exception being from the Mogumber area. As each population in the survey area has few individuals in it, the new localities are unlikely to change the conservation status of the species.

Synaphea quartzitica

This species is a small shrub with yellow flowers that is found on rocky quartzite hills and flowers in July and August. It is known in the survey area from Cairn Hill Westrail Reserve, south of the current mine site (Hamilton-Brown *pers com*). It is possible that this species, while not recorded in the plots, may have escaped attention during the rare flora searches.



Goodenia arthrotricha

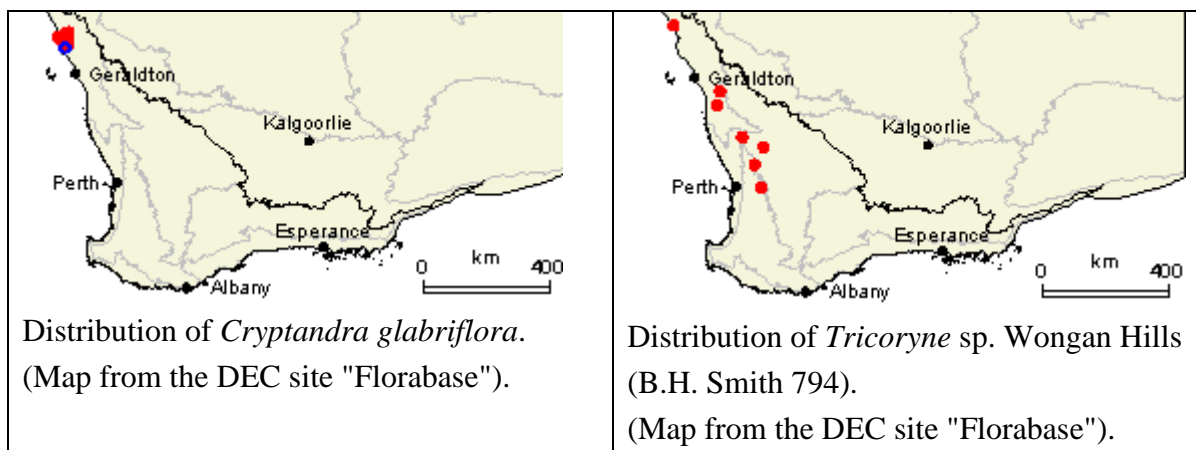
Goodenia arthrotricha is an erect herb to 40 cm tall; it has blue flowers with a white throat. At the time of the previous version of this report (2006) it was a Priority 2 species, but is now

considered be threatened, and therefore to be Declared Rare Flora. This species was possibly confused in the field with *Scaevola phlebopetala* at times and may be more common in the survey area than the records for the survey indicate. It was recorded at six quadrats in the Eastern Ridge and Cairn Hill sub-areas.

11.3 Priority flora species recorded in the survey area

Seven Priority Flora species are currently recorded from the survey area. There have been several changes in the list of priority flora known for the survey area in the time that this series of reports (Trudgen *et al.* 2001, 2006 and the current report) covering it have been prepared. Changes have been partly due to enlargement of the survey area and increased survey intensity (resulting in a higher number in 2006 compared to 2001) and partly due to some species being removed from the Priority Flora List when more information about their occurrence became available (resulting in a lower number in 2011 compared to 2006). Most of the species in the latter category have been found to be more common, but one (*Goodenia arthrotricha*, see section above) has been found to be less common or under more threat and has been placed on the Declared Rare Flora List.

Of the seven priority flora species recorded, three are Priority 2, three are Priority 3 and the remaining one is Priority 4. They are all discussed individually below and their priority level, their known occurrence in DEC regions and their occurrence in the sub-areas of the survey area are given in Table 3. Their distribution in the survey area is shown on Map 4. For definitions of the priority levels, see Appendix 1. In a similar fashion to the occurrence of Declared Rare Flora, less Priority Flora are known or the northern part of the survey area. The same three reasons (see second paragraph of section 11.2 above) are relevant here.



Cryptandra glabriflora

Cryptandra glabriflora is a small to medium sized shrub that grows to between a half and one metre tall. It is a Priority 2 species. This species is uncommon in the survey area (it was only recorded at eight of the quadrats) and has limited distribution in it.

Table 3: Priority flora recorded in the survey area.

Notes: Columns 2 and 3 from Atkins (2004). Survey sub-area Codes: CAH = Cairn Hill, CHN = Cairn Hill North, ERG = Eastern Ridge, WOR = Western Ridge, JT = John Tonkin's Property, WDM = Waste Dump, EOR = Eastern Ore body.

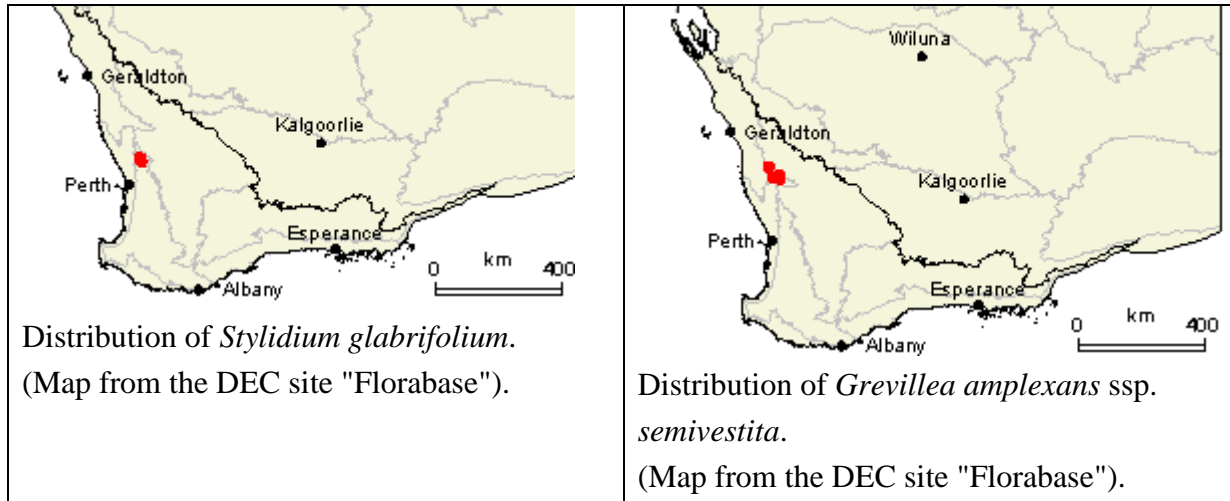
Species	Priority level	DEC Regions	Distribution	Distribution in the survey area
<i>Cryptandra glabriflora</i>	P2	MW	Kalbarri NP	Recorded in plots in: ERG, WOR, and WDM. Not observed in other sections of the survey area.
<i>Tricoryne</i> sp. Wongan Hills	P2	WB, MW	Yandanooka Hill, Wongan Hills, Depot Hill, Mingenew	Recorded in plots in: ERG, CHN.
<i>Styliidium glabrifolium</i>	P2	SW	Bindoon	Recorded from two quadrats on the Eastern Ridge and one from the Eastern Ore Body.
<i>Grevillea amplexans</i> ssp. <i>vestita</i>	P2	MW?	Small area SSE of Geraldton	Recorded from the south-east part of the survey area (see Map 4 south sheet).
<i>Baeckea</i> sp. Moora	P3	MW	North of Moora	Recorded in plots in: CAH, CHN. Also observed in EOR
<i>Guichenotia tuberculata</i>	P3	MW, SW	Mogumber, New Norcia, Gillingarra, Wannamal, Bullsbrook	Recorded on road verge of Dalaroo East Road (Voucher MET 21,790)
<i>Melaleuca sclerophylla</i>	P3	MW, WB, SW	Manmanning, Marchagee, Wongan Hills, New Norcia, Dalwallinu, Moora, Miling, Morawa, Caljie	Recorded in Gardiner's Hill at releve 227.
<i>Austrostipa</i> sp. Cairn Hill	P3		A few scattered but widespread localities.	Recorded from one site in C
<i>Regelia megacephala</i>	P4	GRE	Moora, Coomberdale, Dalaroo	Recorded in plots in: CAH, CHN, EOR, ERG, WDM, WOR. Also observed outside plots for these areas and during surveys of the Ridgway, J. Tonkin, A&R Tonkin, Chester and P. & J. Gardiner properties

***Tricoryne* sp. Wongan Hills (B.H. Smith 794)**

Tricoryne sp. Wongan Hills is a rhizomatous perennial herb to 20 cm high. This Priority 2 species was recorded at three quadrats in the survey area and appears to be uncommon there. However, as it was not known to be in the survey area prior to one of the earlier reports in this series (Trudgen *et al* 2001), it was not searched for during the systematic rare flora surveys carried out for that report. In Trudgen *et al* (2006) this taxon was referred to as *Tricoryne arenicola* MS (the name available at that time).

Styliidium glabrifolium

Stylidium glabrifolium is a small herb and is a Priority 2 species. In the survey area, it was only recorded from three quadrats. Two were located on the Eastern Ridge, and the other in the remnant of native vegetation at the south end of the main mine (the Eastern Ore Body – note that some of this area has been mined since the collection was made).



Grevillea amplexans* ssp. *semivestita

This taxon has been placed on the Priority list since the earlier reports. In the survey area, *Grevillea amplexans* ssp. *semivestita* has only been recorded from two relevés in the south-eastern part of the survey area (see Map 4, South Sheet).

***Baeckea* sp. Moora (R. Bone 1993/1)**

Baeckea sp. Moora is a low, spreading shrub to between 0.4 and 0.8 metres tall with small white flowers. This species was common in Cairn Hill Reserve and also present in the Cairn Hill North and the Eastern Ore Body sub-areas, but was not seen in the remainder of the survey area. It was recorded at thirteen quadrats. Although its distribution is limited in the survey area, *Baeckea* sp. Moora is quite abundant in some localised areas where it contributes significantly to the vegetation (see section 12 below). It is a Priority 3 taxon.

Guichenotia tuberculata

This small perennial shrub is a Priority 3 species. It was only recorded at one place in the survey area, on a road verge adjacent to the Dalaroo East Road.



Distribution of *Baeckea* sp. Moora (R. Bone 1993/1).
(Map from the DEC site "Florabase").



Distribution of *Guichenotia tuberculata*.
(Map from the DEC site "Florabase").

Melaleuca sclerophylla

Melaleuca sclerophylla is a low shrub. This Priority 3 species was only collected once during the survey, at Releve 227 on the property of Phil and Jenny Gardiner.



Distribution of *Melaleuca sclerophylla*.
(Map from the DEC site "Florabase").



Distribution of *Regelia megacephala*.
(Map from the DEC site "Florabase").

Regelia megacephala

Regelia megacephala is one of the defining species of some of the vegetation types of the Coomberdale Chert Threatened Ecological Community and is known to be quite restricted in overall distribution. However, where it does occur it is often the dominant in the vegetation, although sometimes there is a taller (but more open) stratum over it. There are forty-eight records for *Regelia megacephala* from the ninety-nine quadrats recorded in native vegetation, but as vegetation dominated by this species was a focus of the study this overestimates its distribution in the survey area. The proper assessment of this species is that it is very geographically restricted, locally common in vegetation it occurs in within its area of distribution, but not common in an absolute sense although it is usually dominant in the stands in which it occurs. The distribution and abundance of this Priority 4 species in the survey area is shown on Map 4, where stands of vegetation that have it as a significant component are shaded.

11.4 Other species of particular conservation interest

Several other species recorded in the survey area are of particular conservation interest. By this it is meant that while they do not fall into the categories of Declared Rare Flora or Priority Flora, their populations in the survey area have more than the general level of conservation of value those species that are not uncommon (which of course can range from just over the notional – and poorly defined - border from uncommon to common to extremely common). These species are discussed below and the distribution of some of them within the survey area is shown on Map 4. Further research may indicate that some of these species deserve to be Priority or Declared Rare Flora. Others are of interest because the population in the survey area is at the end of the species range or is an outlying (disjunct) population.

Cyrtostylis huegelii

The record of this species is an extension of the known range of the species (pers com. Andrew Brown 2006). The population is therefore of conservation significance as it is at one extreme of the known range.

Pterostylis aff. rufa

The record of this species extends the known range of the species a long way to the west (pers com. Andrew Brown 2006). The population is therefore of conservation significance as it is at one extreme of the known range.

Hemigenia sp.

The two specimens of this species could not be matched at the Western Australian Herbarium. Specialist determination is needed to identify the species. Vouchers: MET 21,789 and Cairn Hill at 50J 0407772 UTM6620677

Leptospermum aff. erubescens (Moora Chert; B. Morgan 133).

Two collections are known of this taxon, both are from the survey area. One was collected during the rare flora survey of the Gardiner Hill bush area (on the property of P & J. Gardiner) in 2001. The site was in a disturbed area on the edge of the vegetation remnant. The other (D.J.E. Whibley 4905) is from the gravel pit in Cairn Hill reserve; it was not collected as part of this survey. The two collections appear to represent a very uncommon undescribed taxon restricted to the Chert Hills at Moora (R. Davis pers comm. 2006). Until this taxon can be adequately surveyed, it should be treated as very rare. Accurate geocodes are not available for these two collections and the sites indicated on Map 4 are approximate.

Calothamnus aff. quadrifidus (Moora - Watheroo)

This taxon was separated out from other variants of *Calothamnus quadrifidus* at the Western Australian Herbarium during preparation of the earlier versions of this report. It was recorded at fourteen quadrats during the survey, with three records from John Tonkin's property, two from P. and J. Gardiner's property one from Cairn Hill North, and the remainder from Cairn

Hill Reserve, but it is not common in the survey area. It is one of a number of variants of *Calothamnus quadrifidus* that are likely to be described as subspecies or separate species. It is probably restricted to the Coomberdale Floristic Region of Griffin (1992) and it should be treated as a geographically restricted taxon. There are about fifteen specimens in the collections at the Western Australian Herbarium, but this may over-estimate the abundance of the taxon as it is a large species (generally two to four metres tall) and thus more likely to be collected than smaller ones. This taxon needs surveying to provide sufficient information to decide if it should be placed on the DEC priority flora list.

Since this taxon was investigated for the 2006 precursor to the current report, material of this taxon has been included in *Calothamnus quadrifidus* ssp. *angustifolius* by George and Gibson (2010). It has not been possible to examine this assignment in detail for this report, and it has been decided to leave the reference to the entity as in the previous report. This has been done as one of us (MET, who has considerable experience in the taxonomy of the Myrtaceae) examined the material in the Western Australian Herbarium and came to the conclusion specimens from the geographic area including the Coomberdale Chert were a distinct entity (possibly a variety). This is not incompatible with the paper by George and Gibson.

***Bossiaea* sp. Cairn Hill (M. Henson CH2-28)**

Bossiaea sp. Cairn Hill is a distinct, geographically restricted species related to *Bossiaea eriocarpa* (which is a complex known to contain several taxa). There was one specimen of *Bossiaea* sp. Cairn Hill (M Henson CH2-28) under *Bossiaea eriocarpa* at the Western Australian Herbarium prior to the earlier survey (Trudgen *et al.* 2001). *Bossiaea* sp. Cairn Hill (M Henson CH2-28) is restricted to the chert hills of the Coomberdale Floristic Region and is only known from the survey area for this report. It was recorded at 23 of the quadrats recorded during the survey and an associated survey of rehabilitation areas. However, it was only recorded from the Cairn Hill Reserve, Cairn Hill North, Eastern Ridge, Western Ridge and Rehabilitation areas. This is a very restricted distribution, part of which (the Western Ridge) has been mined since the quadrats there were recorded. This species is certainly much less abundant than *Regelia megacephala* and *Kunzea praestans*. It should therefore be regarded as a very geographically restricted species that should be placed on the Department of Environment and Conservation (DEC) priority flora list. This species was often grazed (sometimes heavily), but it is not known if this was by domestic stock or kangaroos.

Hypoxis* aff. *glabella

One specimen (CH12-11A from Cairn Hill Reserve) was referred to the name *Hypoxis* aff. *glabella*, like *Hypoxis glabella* it has two bracteoles on the flower stalk. However, they are much larger than those of *Hypoxis glabella* and are alternate rather than opposite. It is not possible to give an authoritative view of the importance of the specimen, as *Hypoxis* is in need of revision, is a 'difficult' genus because of the reduced nature of the species it contains (simple, small herbs with a few leaves and little variation in the flowers) and the specimen is

poor. However, it can be said that it *may* represent a new species, and therefore needs further studies (especially field studies to find out if the form is consistent) to determine its significance.

***Caesia* sp. Moora**

A number of specimens collected during the survey appear to represent a new species of *Caesia*, a genus of the lily group of families. Specimens were collected from thirteen of the ninety nine quadrats recorded for the survey (from four in Cairn Hill, two in Cairn Hill North, one on the Eastern Ridge (area remaining vegetated in 2006 now partly mined), one on the Western Ridge (now mostly mined) and five on John Tonkin's property). While this species appears to be not uncommon in some parts of the survey area, it is probably restricted to the Coomberdale Chert and may be localised to the survey area and nearby. It is much less common than *Regelia megacephala* and should be placed on the DEC Priority Flora List.

Pityrodia dilatata

One sterile specimen collected at releve R168-5 in 2006 on the Eastern Ridge in one of the earlier surveys was identified as *Pityrodia*, but could not be determined as the specimen was sterile. Flowering material has now been collected and identified as *Pityrodia dilatata*, a species with a fairly restricted distribution and which is known from relatively few specimens.

***Trichocline* sp.**

A sterile specimen collected at site GH7-57 on the Gardiner's property is undoubtedly a *Trichocline* (this taxon was referred to *Amblyperma* in Trudgen *et al* 2006; these two genera having been in and out of favour in recently years – that is authorities differ on which is correct). However, it does not match either *Trichocline spathulata* or *Trichocline* sp. Treeton (= *Amblyperma minor*), the two *Trichocline* species known for Western Australia. It is closer to the latter taxon. The site needs to be re-visited to collect flowering material, so that the status of this taxon can be resolved. If the specimen should be found (when flowering material is available) to be *Amblyperma* sp. Treeton, then the locality is a massive range extension for that species.

***Eremaea* sp. Cairn Hill (B. Morgan BMor 531)**

One specimen of this taxon was collected on the property of Phil and Jenny Gardiner. Extensive checking against the research collections held at the Western Australian Herbarium failed to find any matching material. While further collections and study are needed to clarify the status of this collection, it is very likely to represent a new species allied to *Eremaea beaufortoides*, or possibly a new subspecies of that species.

***Petrophile brevifolia* (forma)**

A collection (G316-4) referred to *Petrophile brevifolia* (forma) is atypical for that species (ms Barbara Rye pers. comm. 2006), but flowering material and expert identification are necessary before the status of the collection can be fully assessed.

11.5 Other flora results of the survey

There are some other records of flora collected during the survey that are of interest, either because they have not been recognised as distinct previously (but are not rare), or because they were categorised as priority flora until recently (see Table 4) and while more common than previously believed are still not common species.

Gastrolobium acutum

This species (at one stage placed in *Nemcia*) has recently been removed from the DEC Priority Flora list after more information became available about its distribution and population status. It is an erect, or occasionally straggly shrub to one metre tall. While only recorded in thirteen of the eighty-nine quadrats recorded in native vegetation, this species was observed as scattered individuals, or small groups of individuals, in the survey area and north of Kiaka Road.

Table 4: Species categorised as priority flora at the time of the earlier reports (Trudgen *et al.* 2001, 2006), but subsequently removed from the priority flora list.

Notes: Columns 2 and 3 from Atkins (2004). Survey sub-area Codes: CAH = Cairn Hill, CHN = Cairn Hill North, ERG = Eastern Ridge, WOR = Western Ridge, JT = John Tonkin's Property, WDM = Waste Dump, EOR = Eastern Ore body,

Species	Former priority level	DEC Regions found in	Distribution	Distribution in the survey area
<i>Kunzea praestans</i>	Formerly P3	GRE	Watheroo, Coomberdale, Jam Hill	Recorded in plots in: CAH, CHN, ERG, WDM, WOR. Also observed outside plots for these areas and during surveys of the Ridgway, A&R Tonkin, J Tonkin, Chester and Gardiner properties
<i>Gastrolobium acutum</i>	Formerly P3	MW, SW	Armadale, Darlington, Bindoon, Regan's Ford, Lesmurdie	Recorded in plots in: CAH, CHN, EOR, WDM. Scattered plants observed in other sections of the survey area including North of Kiaka Road.
<i>Stenanthemum tridentatum</i>	Formerly P3	MW, WB, SC	West River, Tutanning, Kukerin, Wagin, Gunyidi, Boddington, Bulyee, S Kuminin, Beverley, Kellerberrin, Pingelly	Only recorded from one quadrat on Gardiner's Hill
<i>Wurmbea drummondii</i>	Formerly P4	MW, SW, WB	Moora, Narrogin, Toodyay	Recorded on John Tonkin's Property (Vouchers JT12-19, JT 6-55)

<i>Austrostipa exilis</i>	Formerly P2	SC	Cocklebidly, Fitzgerald River, Wickepin, etc	Recorded in Cairn Hill (Voucher CR6-4)
<i>Wurmbea drummondii</i>	Formerly P4	MW, SW, WB	Moora, Narrogin, Toodyay	Recorded on John Tonkin's Property (Vouchers JT12-19, JT 6-55)

Kunzea praestans

This species has been removed from the Priority Flora list after more information became available about its distribution and population status. It is a tall shrub that in the survey area occurs mostly near the edges of chert outcrops.

Stenanthemum tridentatum

Stenanthemum tridentatum is a very small shrub and was a Priority 3 species, but has been removed from the Priority Flora List since 2006. In the survey area it was only collected from one quadrat in the Gardiner's Hill survey sub-area

Austrostipa exilis

Since the previous version of this report, *Austrostipa exilis* has been removed from the DEC Priority Flora list due to the collection of specimens that have extended its range to north of the survey area (its northern limit in 2006) and also increased the number of known locations.

Wurmbea drummondii

Wurmbea drummondii is a very small herb (ca. 5 cm tall with one or two leaves and one or two small flowers). It was only recorded at two places on John Tonkin's property during the survey and was a Priority 4 species. It is very uncommon in the survey area, but has also been removed from the DEC Priority Flora list.

Millotia* aff. *tenuifolia

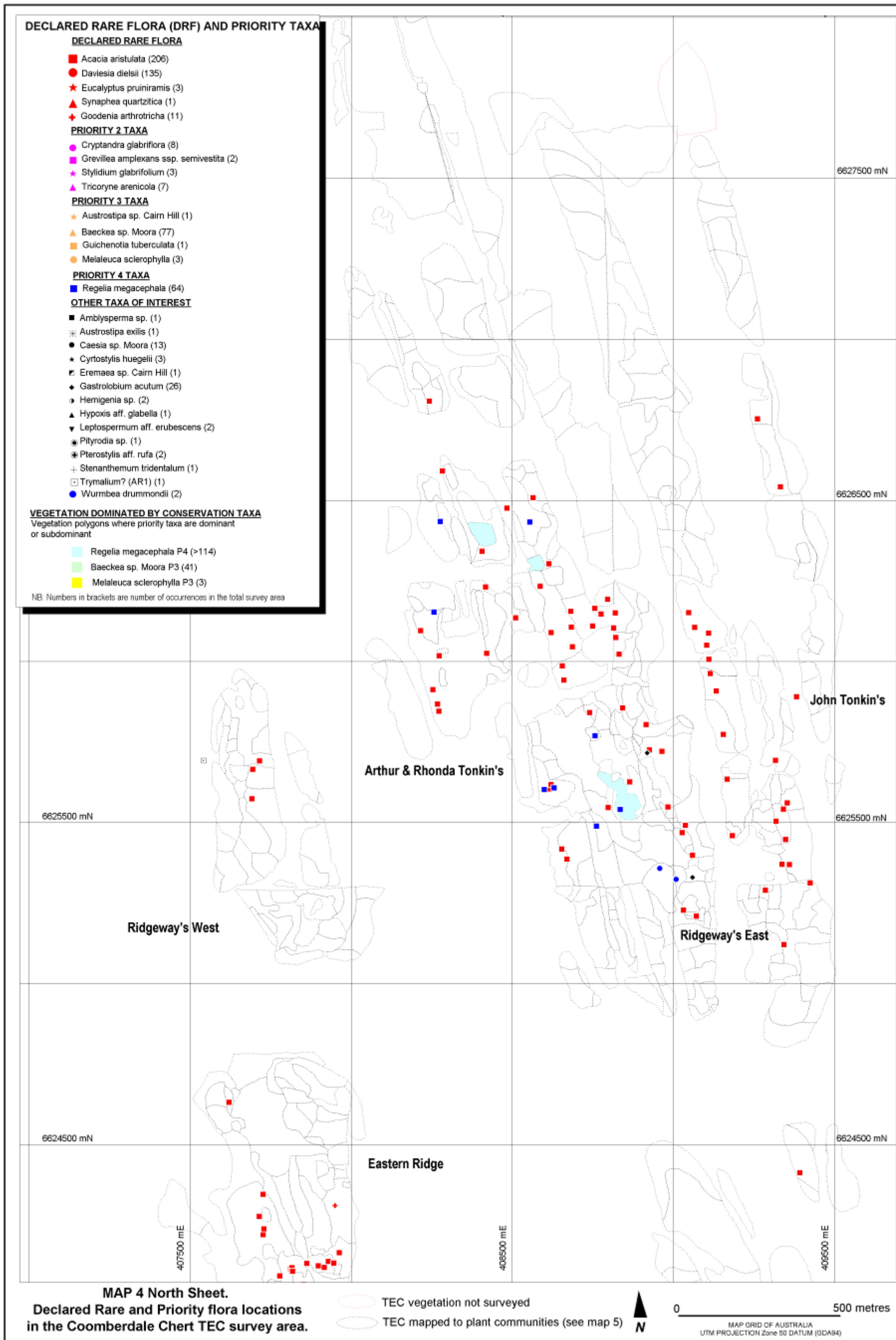
During identification of the *Millotia* specimens collected during the survey it was realised that the material under the name *Millotia tenuifolia* var. *tenuifolia* in the Western Australian Herbarium is mixed. One specimen (CH20-11) was collected that belongs to the (probably) undescribed form. This form can be easily distinguished by the spreading hairs on the leaves, it is not restricted in distribution and it does not appear to be uncommon.

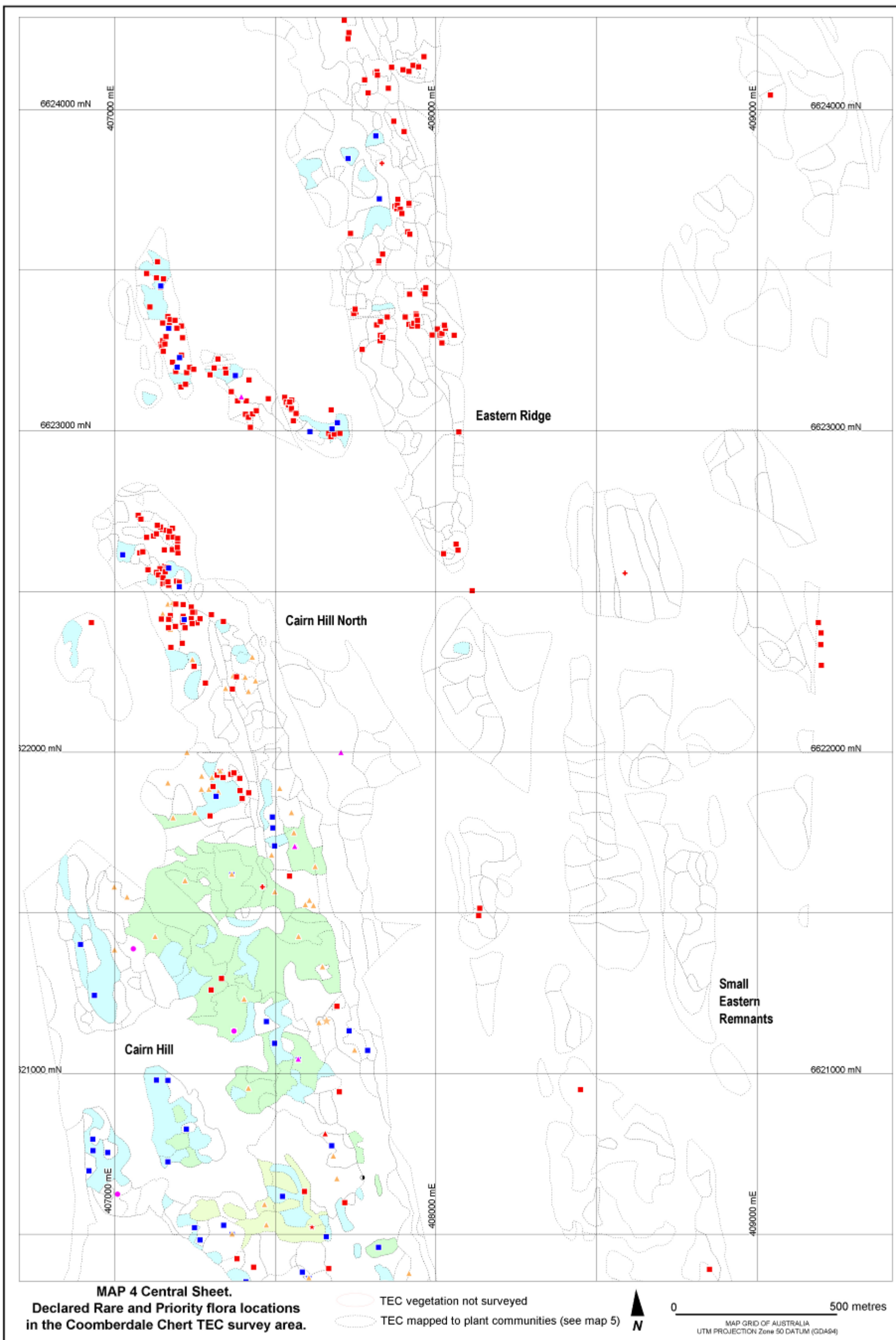
Podotrochea gnaphalioides

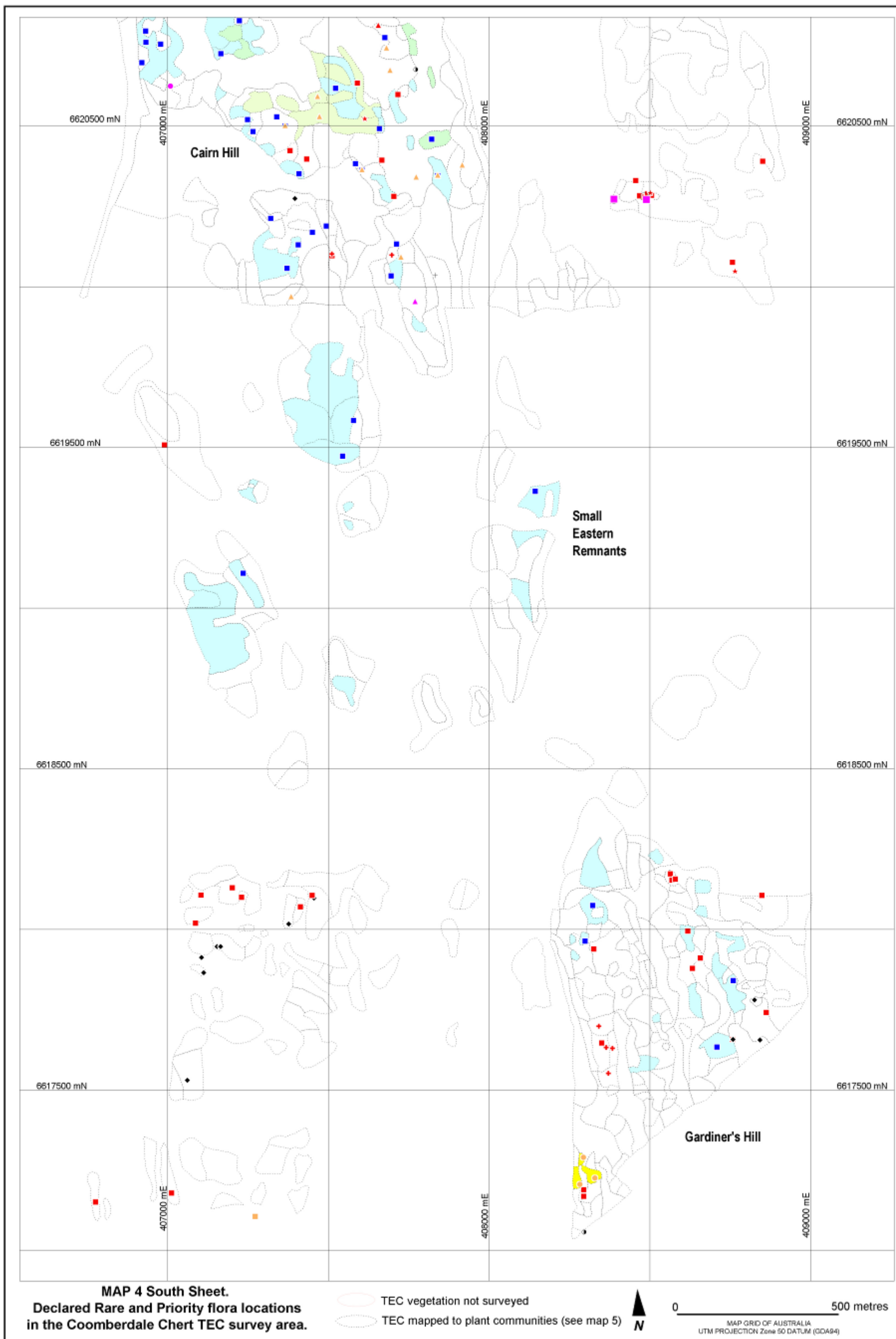
One specimen (WDM1-65) referred to *Podotrochea gnaphalioides* differed from the others in the indumentum and the shape of the bracteoles forming the floral involucre. A (quick) review of the material determined as *Podotrochea gnaphalioides* at the Western Australian Herbarium indicated that the specimen represents one of several "forms" currently referred to *Podotrochea gnaphalioides*, but which probably deserve some level of taxonomic recognition.

***Eucalyptus camaldulensis* var.**

Although *Eucalyptus camaldulensis* has been reviewed fairly recently, the study did not clarify the correct name for the subspecies (several subspecies are accepted) that occurs in the South West of Western Australia, or whether or not there is more than one taxon in that area. The range and conservation status of the form collected during the survey is therefore not known (although the form is probably fairly widespread in west coastal areas of the South West of Western Australia).







12.0 VEGETATION OF THE SURVEY AREA

12.1 Introduction

This section describes and classifies the variation present in the vegetation of the survey area using "traditional" vegetation description and mapping techniques; the analysis of the floristic composition of the same vegetation using pattern analysis is described and discussed in Section 14.0 below. Here, the vegetation is described using the vegetation descriptions recorded at the ninety-nine quadrats recorded and at a further ca. three hundred relevés recorded for the vegetation description and mapping. The full descriptions of the quadrats are given in Appendix 6 and the descriptions of the relevés are incorporated in the vegetation classification in Appendix 7, which includes data from the quadrats as well.

Using these descriptions of the vegetation structure, dominance and the composition of the 506 different individual stands of vegetation recorded (99 quadrats and 407 relevés – the latter in less detail), a series of lower order units were defined. These lower order units are mostly defined near the *plant community* level (see Table 1 and section 6.2.1 above) the sites in a unit having very similar structure, dominance and floristics, and will be referred to as at this level for the rest of this report. However, some of the units are broader and are part way in level of synthesis to the vegetation association level (that is, they include more variation than at the plant community level). To facilitate understanding of the very significant complexity of the vegetation of the survey area, the plant communities were grouped into one hundred and four *vegetation associations* if they had similar structure and dominant species and these then grouped again into thirty-one *vegetation alliances* as a third level of classification. Some of the vegetation alliances consisted of only one vegetation association; for example, vegetation association **Ec** is the only association in the vegetation alliance 'Eucalyptus camaldulensis open forest to low mallee open forests'. Table 1 (see above) gives definitions of these levels of vegetation classification.

The alliance (third) level of the classification is a quite high order of synthesis and as noted above the units are being treated as *vegetation alliances*, however at this level of synthesis in vegetation classification there is necessarily an element of arbitrariness, because it attempts to impose order on a very complex phenomenon. However, the units defined are considered to mostly be fairly close to the *vegetation alliance* level, although in some cases the upper stratum is open and the vegetation has been grouped on the second stratum. That is, the arbitrary rules have been bent to make the result more meaningful.

The vegetation alliances are each vegetation units with one particular dominant species in their upper stratum. For example, Vegetation Alliance 1 is *Eucalyptus salmonophloia* woodland to open forests; Vegetation Alliance 2 is *Eucalyptus wandoo* subsp. *wandoo* woodlands and open forests and Vegetation Alliance 13 is *Allocasuarina campestris* high shrublands to open and closed scrubs. It should be noted that while *Regelia megacephala* scrub units have been included in Vegetation Association 15, *Regelia megacephala* high

shrubland to open and closed scrub, other vegetation units which had *Regelia megacephala* as a sub-dominant rather than the dominant, that is with lower cover may have been included in other vegetation alliances. For example, the vegetation association AhRm, *Allocasuarina huegeliana* low open forest over *Regelia megacephala* high open shrubland, was placed in Vegetation Alliance 9, *Allocasuarina huegeliana* low woodlands to low open forests.

Table 6: Abbreviations used for the species in the vegetation association/plant community codes.

Code for species	Species	Code for species	Species
Aa	<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Ep	<i>Eucalyptus pruiniramis</i>
Ac	<i>Allocasuarina campestris</i>	Es	<i>Eucalyptus salmonophloia</i>
Ah	<i>Allocasuarina huegeliana</i>	Ew	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>
Ahu	<i>Allocasuarina humilis</i>	Ha	<i>Hypocalymma angustifolium</i>
Am	<i>Allocasuarina microstachya</i>	Hr	<i>Hakea recurve</i> subsp. <i>recurva</i>
As	<i>Acacia scirpifolia</i>	Hs	<i>Hibbertia subvaginata</i>
B	<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	Id	<i>Isopogon divergens</i>
Bp	<i>Banksia prionotes</i>	Kp	<i>Kunzea praestans</i>
Cd	<i>Calytrix depressa</i>	Lp	<i>Lepidosperma pubisquamum</i>
Cl	<i>Calytrix leschenaultii</i>	Mc	<i>Melaleuca calyptroides</i>
Cq	<i>Calothamnus</i> aff. <i>quadrifidus</i> (Moora-Watheroo)	Mco	<i>Melaleuca concreta</i>
Co	<i>Casuarina obesa</i>	Mcor	<i>Melaleuca coroncarpa</i>
Df	<i>Dryandra fraseri</i>	Mr	<i>Melaleuca radula</i>
Di	<i>Dodonaea inaequifolia</i>	Ms	<i>Melaleuca sclerophylla</i>
Dp	<i>Dodonaea pinifolia</i>	Pd	<i>Pityrodia dilatata</i>
Ds	<i>Dryandra sessilis</i> var. <i>sessilis</i>	Rv	<i>Ricinocarpus velutinus</i>
Ec	<i>Eucalyptus camaldulensis</i>	Rm	<i>Regelia megacephala</i>
Ee	<i>Eucalyptus eudesmioides</i>	Rmu	<i>Ricinocarpus muricatus</i>
Eh	<i>Eucalyptus horistes</i>	Td	<i>Trymalium daphnifolium</i>
El, Elo	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Tl	<i>Trymalium ledifolium</i> subsp. <i>rosmarinifolium</i>
Eo	<i>Eucalyptus obtusiflora</i>	Xd	<i>Xanthorrhoea drummondii</i>

The vegetation alliances and the vegetation associations that they group together are listed and described in section 12.2 below. For the sake of brevity, the plant communities recorded in the survey area are described under their respective vegetation alliances and vegetation associations in Appendix 7, which is a complete classification of the vegetation.

The vegetation map (see Map 5 at end) shows the distribution of the plant communities, which are the individual polygons mapped. It also shows the distribution of the vegetation alliances, which are indicated on the map by different colours. Each map polygon is labelled

with an alpha-numeric code to indicate the plant community occupying that polygon. The letters at the beginning of the code indicate the vegetation association (see section 12.2 below) and the number at the end of the code identifies the particular plant community within the vegetation association. See Appendix 7 for descriptions of the plant communities.

12.2 The vegetation associations and vegetation alliances of the survey area

The vegetation associations recorded in the survey area are briefly described below, under the vegetation alliances that they have been placed in. The vegetation associations are each given a unique code based on abbreviations of the names of the dominant species. A capital letter indicates the genus and a lower case letter indicates species. Where two or more species of the same genus occur in the same structural layer, the genus is indicated only once in the code. Abbreviations for the species names used in the codes are given in Table 6.

Vegetation Alliance 1: *Eucalyptus salmonophloia* woodlands to open forests

Salmon gum open forest occurred in a few locations in the survey area, in small valleys between low ridges and in a few places in the remnant vegetation at the base of the chert ridges on the edge of broad valley floors now largely cleared for farming.

Vegetation Association Es: *Eucalyptus salmonophloia* (*Eucalyptus wandoo* subsp. *wandoo*) over *Dodonaea inaequifolia* high open shrubland.

This vegetation association included one plant community.

Vegetation Association EsEl: *Eucalyptus salmonophloia* woodland over *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over scattered *Acacia erinacea* shrubs and scattered herbs and grasses including *Ptilotus divaricatus* var. *divaricatus*, *Rhodanthe polycephala* and **Bromus diandrus*.

This vegetation association included two plant communities. One plant community differed by having a number of Chenopod species present.

Vegetation Alliance 2: *Eucalyptus wandoo* subsp. *wandoo* woodlands and open forests

This vegetation alliance was not common among the chert ridges in the survey area. It occurred along some sections of narrow linear 'valleys' between some of the ridges (dykes) and sometimes in the remnant vegetation at the base of the chert ridges on the edge of broad valley floors now largely cleared for farming.

Vegetation Association Ew: *Eucalyptus wandoo* subsp. *wandoo* low woodland or open forest over open herb/grasslands that included *Opercularia vaginata*, *Lomandra effusa*, *Crassula colorata* var. *colorata*, *Trachymene pilosa* and *Waitzia nitida* herbs and *Austrodanthonia setacea* and *Austrostipa exilis* grasses.

Four plant communities were described in this vegetation association, one with wandoo woodland over scattered herbs (Ew1), one with wandoo woodland over *Allocasuarina campestris* high shrubland (Ew2 (probably an intermediate unit)), one with wandoo woodland over *Acacia acuminata* subsp. *acuminata* low woodland over herbland/sedgeland/grassland (Ew3) and one with wandoo woodland over *Olearia dampieri* subsp. *eremicola* and *Hibbertia subvaginata* open (low) shrubland (Ew4).

Vegetation Association EwDi: *Eucalyptus wandoo* subsp. *wandoo* low open forest over *Dodonaea inaequifolia* scattered tall shrubs to high shrubland.

This vegetation association was recorded in one salmon gum and wandoo valley in the south-east corner of Cairn Hill Reserve and included one plant community, EwDi1.

Vegetation Association EwTl: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Trymalium ledifolium* var. *rosmarinifolium* scattered shrubs to low open shrubland.

This vegetation association included two plant communities, which were recorded on rocky ridge slopes, one on Gardiner's Hill and one in Cairn Hill. In plant community EwTl.2 wandoo grew over *Allocasuarina huegeliana* scattered trees and *Allocasuarina campestris* scattered tall shrubs on a low ridge slope. Plant community EwTl.1, wandoo grew over an *Allocasuarina huegeliana* and *Acacia acuminata* subsp. *acuminata* low open woodland and *Xanthorrhoea drummondii* open shrubland and *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland on the rocky upper slope at the end of a low ridge.

Vegetation Association EwAa: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* open scrub.

This vegetation association included only one plant community; EwAa.1. It was recorded on a gentle west-facing slope on A. & R. Tonkin's property. Although the stand is adjacent to cleared areas, it was in quite good condition.

Vegetation Alliance 3: *Eucalyptus loxophleba* subsp. *loxophleba* low woodlands to low open forests

Eucalyptus loxophleba subsp. *loxophleba* was mainly recorded in the survey area from lower slopes of ridges and the adjacent valley floor areas. It was also occasionally found growing on the crest of the low ridges and along some sections of narrow linear features between some of the ridges (dykes).

Vegetation Association El: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over scattered shrubs and very open herbland.

This vegetation association included five plant communities that differed in both the tree species occurring with the York Gum and the scattered shrub species.

Vegetation Association Elo: *Eucalyptus loxophleba* subsp. *loxophleba* low open to closed forest over scattered shrubs and very open herbland.

This vegetation association includes six plant communities that differed in the scattered shrub species present.

Vegetation Association EIEo: *Eucalyptus loxophleba* subsp. *loxophleba*, *Eucalyptus obtusiflora* low open woodland over scattered tall shrubs over *Dodonaea inaequifolia* low woodland over scattered shrubs over scattered sedges and very open herbland.

This unit included one plant community recorded in a deep gully along a shallow drainage line on the boundary of Cairn Hill and Cairn Hill North.

Vegetation Association EIXd: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland to low open forest over *Xanthorrhoea drummondii* scattered shrubs to high open shrubland.

This vegetation association only included one plant community.

Vegetation Alliance 4: *Eucalyptus eudesmioides* low mallee woodlands to low mallee open forests

Vegetation Association Ee: *Eucalyptus eudesmioides* low mallee woodland to low mallee open forest over annual grassland.

This vegetation association included one plant community, recorded at one site where the vegetation was in Poor to Very Poor condition.

Vegetation Association EeDs: *Eucalyptus eudesmioides* low mallee open forest over *Dryandra sessilis* var. *sessilis* high open shrubland and *Hibbertia subvaginata* low open shrubland.

Vegetation Association EeKp: *Eucalyptus eudesmioides* low mallee woodland over *Kunzea praestans* scattered tall shrubs to high shrubland.

This vegetation association included three plant communities, which differed in the shrub species.

Vegetation Association EeId: *Eucalyptus eudesmioides* low mallee woodland over *Xanthorrhoea drummondii* and *Isopogon divergens* scattered shrubs.

Vegetation Association EeRm: *Eucalyptus eudesmioides* low mallee open forest over *Calothamnus* aff. *quadrifidus* (Moora-Watheroo), *Regelia megacephala* high open shrubland.

Vegetation Alliance 5: *Eucalyptus camaldulensis* open forest

Vegetation Association Ec: *Eucalyptus camaldulensis* open forest.

This vegetation association was recorded on the valley flats on the south-east side of the survey area.

Vegetation Alliance 6: *Eucalyptus obtusiflora* low woodlands to low open forests

A small area of this unit occurred on a section of the floor of a linear depression (dyke) that occurred near the Cairn Hill North ridge crest and on a similar feature in the southern part of Cairn Hill.

Vegetation Association Eo: *Eucalyptus obtusiflora*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low mallee open forest over *Acacia erinacea* scattered shrubs over a very open herbland.

Vegetation Association EoTd: *Eucalyptus obtusiflora* low mallee woodland to low open forest over *Trymalium daphnifolium*, *Acacia erinacea* shrubland.

Vegetation Alliance 7: *Eucalyptus horistes* low woodlands to low open forests

A small area of this eucalypt was found in Cairn Hill North, at the base of a low ridge near the southern boundary of Cairn Hill and at the base of the same ridge several hundred meters further south of Cairn Hill.

Vegetation Association EhAh: *Eucalyptus horistes* mallee woodland over *Allocasuarina huegeliana* low open woodland over scattered shrubs.

Vegetation Association EhEe: *Eucalyptus horistes*, (*Eucalyptus eudesmioides*) mallee woodland to low open forest.

This vegetation association included two plant communities. One was a low open forest over little understorey (Very Poor condition due to grazing) and the other was a woodland over a mixed high open shrubland and open shrubland.

Vegetation Alliance 8: *Eucalyptus pruiniramis* low woodland

A group of *Eucalyptus pruiniramis* mallees, described here as a small woodland, was found on the top of a rounded low hill east of Cairn Hill. A small clump of this mallee also occurred a few hundred meters to the south-east of the woodland and one small clump was found on the mid-slopes of a low ridge in Cairn Hill about 800 meters north of west of the small woodland.

Vegetation Association Ep: *Eucalyptus pruiniramis* low mallee woodland.

Vegetation Alliance 9: *Allocasuarina huegeliana* low woodlands to low open forests

Allocasuarina huegeliana grew as low woodland and low open forest on the sections of the ridge crests and slopes in the survey area.

Vegetation Association Ah: *Allocasuarina huegeliana* low woodland to low open forest over scattered shrubs.

Four plant communities were included in this vegetation association, differentiated by the composition of the tree layer and the shrub species.

Vegetation Association AhAc: *Allocasuarina huegeliana* low woodland to low open forest over *Allocasuarina campestris* scattered shrubs to high open shrubland.

Five plant communities were included in this vegetation association, differentiated by the composition of the tree layer and the shrub species growing under or with the *Allocasuarina campestris*.

Vegetation Association AhDf: *Allocasuarina huegeliana* low open forest over *Stylobasium australe* scattered shrubs and *Dryandra fraseri*, *Calytrix depressa* low open shrubland over *Lepidosperma leptostachyum* very open sedgeland.

One plant community was recorded in this vegetation association. It was recorded from the flat valley floor on the western boundary of Cairn Hill.

Vegetation Association AhDp: *Allocasuarina huegeliana* low woodland to low open forest over *Dodonaea pinifolia* scattered shrubs with *Xanthosia fruticulosa* very open herbland.

Two small plant communities were recorded in this vegetation association. Both units occurred along a breakaway on the side of a ridge. They differed in the associated tree and shrub species.

Vegetation Association AhDs: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland.

Four plant communities were included in this vegetation association. They differed in the associated and sub-dominant species in the tree and shrub layers. One of these plant communities was distinguished by a low (open) shrubland of *Hibbertia subvaginata*, while another occurred on rocky ridge slopes in Gardiner's Hill and included *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland.

Vegetation Association AhDsKp: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high shrubland over *Kunzea praestans* scattered tall shrubs to high open shrubland.

This vegetation was recorded from John Tonkin's, Ridgway's, Cairn Hill North, Cairn Hill and Gardiner's Hill. Four plant communities were included in this vegetation association. They differed in the composition of the tree and shrub strata. One plant community was differentiated by having *Hibbertia subvaginata* scattered low shrubs to low open shrubland, while another plant community was a single stand at Gardiner's Hill where the *Dryandra*

sessilis var. *sessilis* formed an open scrub under an *Allocasuarina huegeliana* low open forest. A third plant community was distinguished by having a *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland to shrubland.

Vegetation Association AhHr: *Allocasuarina huegeliana* low open forest over *Hakea recurva* subsp. *recurva* scattered tall shrubs.

This vegetation association included one plant community that was recorded at Gardiner's Hill.

Vegetation Association AhHs: *Allocasuarina huegeliana* low open woodland to low woodland over *Hibbertia subvaginata* low open shrubland to low shrubland.

This vegetation association was only recorded on the Eastern Ridge. It included one plant community.

Vegetation Association AhKp: *Allocasuarina huegeliana* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs to high open shrubland.

This vegetation association included three plant communities. One plant community was differentiated by having *Hibbertia subvaginata* scattered low shrubs to low open shrubland, while another plant community included a *Xanthorrhoea drummondii* high shrubland and a *Calytrix leschenaultia*, (*Hibbertia subvaginata*) low open shrubland. A third plant community included an *Allocasuarina campestris* high open shrubland.

Vegetation Association AhRm: *Allocasuarina huegeliana* low open forest over *Regelia megacephala*, *Allocasuarina campestris* high open shrubland.

This vegetation was recorded on the crest and slopes of two neighbouring ridges in the central western part of the Cairn Hill survey area. The vegetation association included two plant communities, with one occurring on the ridge slopes and including a *Kunzea praestans* high shrubland.

Vegetation Association AhRmAc: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, *Allocasuarina campestris* open scrub over *Ricinocarpos muricatus* scattered shrubs to open shrubland

This vegetation was recorded on the low rocky chert ridges within the area north of Kiaka Road. One vegetation community was recorded with *Ricinocarpos muricatus* as a shrub layer.

Vegetation Association AhTl: *Allocasuarina huegeliana* low woodland to low open forest over *Trymalium ledifolium* ver. *rosmarinifolium*, *Hibbertia subvaginata* scattered shrubs to low open shrubland over scattered sedges and grasses, with *Xanthosia fruticulosa* very open herbland and *Cheilanthes adiantoides* scattered ferns.

This vegetation association consisted of two plant communities, which occurred on three breakaways at Cairn Hill and Eastern Ridge. The plant community at Cairn Hill was an *Allocasuarina huegeliana* low open forest over *Trymalium ledifolium* var. *rosmarinifolium* scattered shrubs.

Vegetation Association AhXd: *Allocasuarina huegeliana* low open woodland to low woodland over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over scattered low shrubs including *Trymalium ledifolium* var. *rosmarinifolium* and *Hibbertia subvaginata* shrubs.

Five plant communities were included in this vegetation association. They varied in the shrub subdominants. One plant community was recorded from rocky slopes and included *Trymalium ledifolium* var. *rosmarinifolium* scattered shrubs to low open shrubland. Another included a *Hibbertia subvaginata* low open shrubland. A third included an *Opercularia vaginata* open herbland.

Vegetation Alliance 10: *Casuarina obesa* open forest

Vegetation Association Co: *Casuarina obesa* open forest.

This vegetation association included one plant community that was described from one stand which occurred on the valley floor flats at the base of a low ridge.

Vegetation Alliance 11: *Acacia acuminata* low woodlands to low open forests

Acacia acuminata subsp. *acuminata* formed stands of low woodlands to low open forests in mainly small areas along the lower slopes of ridges. It commonly occurred with *Allocasuarina huegeliana* throughout the survey area.

Vegetation Association Aa: *Acacia acuminata* subsp. *acuminata* low open forest over scattered grasses sedges and very open herbland.

This vegetation association was made up of three plant communities. One plant community was distinguished by having *Allocasuarina huegeliana* present in the tree layer. Another plant community was distinguished by having a *Xanthorrhoea drummondii* high open shrubland.

Vegetation Association AaAc: *Acacia acuminata* subsp. *acuminata* low woodland over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over very open herbland.

This vegetation association was made up of three plant communities. One plant community differed by having *Allocasuarina huegeliana* present in the tree layer. Another plant community was distinguished by having *Allocasuarina huegeliana* present in the tree layer and a *Xanthorrhoea drummondii* high open shrubland.

Vegetation Association AaDs: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Dryandra sessilis* var. *sessilis* (*Xanthorrhoea drummondii*) scattered tall shrubs over very open herbland.

Two plant communities were included in this vegetation association. One was distinguished by the presence of an *Opercularia vaginata* herbland.

Vegetation Association AaDsKp: *Acacia acuminata* subsp. *acuminata* low woodland over *Dryandra sessilis* var. *sessilis* (*Xanthorrhoea drummondii*) scattered tall shrubs over *Kunzea praestans* scattered tall shrubs to high open shrubland over very open herbland.

There were two plant communities in this vegetation association which differed in the shrub layer species. One plant community had *Hibbertia vaginata* scattered low shrubs while the other plant community had a *Melaleuca calyptroides* open shrubland.

Vegetation Association AaEl: *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* low woodland to low open forest over very open grassland/herbland.

This vegetation association included three plant communities. One plant community was distinguished by the presence of *Allocasuarina campestris* scattered tall shrubs while another plant community had scattered *Xanthorrhoea drummondii* and *Olearia dampieri* subsp. *eremicola* in the shrub layer.

Vegetation Association AaHr: *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees over *Hakea recurva* subsp. *recurva* scattered tall shrubs to high open shrubland over very open herbland.

There were two plant communities in this vegetation association. One plant community differed by having an *Allocasuarina campestris* scattered tall shrubs component and a *Dodonaea pinifolia* low open shrubland over *Stenanthemum tridentatum* scattered low shrubs

Vegetation Association AaHs: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low woodland over *Allocasuarina campestris* scattered tall shrubs over *Hibbertia subvaginata* low open shrubland to low shrubland.

There was one plant community in this vegetation association. It was only recorded on the Eastern Ridge and is similar to the unit AhHs.

Vegetation Association AaKp: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs to high open shrubland over very open herbland.

There were two plant communities in this vegetation association. One plant community was differentiated by having *Allocasuarina campestris* and *Xanthorrhoea drummondii* in the high open shrubland layer.

Vegetation Association AaMcor: (*Eucalyptus wandoo* scattered trees) over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca coronicarpa* low open shrubland over very open herbland.

One plant community, recorded from a small stand at the southern corner of Gardiner's Hill, was included in this vegetation association.

Vegetation Association AaMr: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Melaleuca radula* scattered tall shrubs to high shrubland.

Two plant communities were included in this vegetation association, one distinguished by having an *Allocasuarina campestris* high shrubland.

Vegetation Association AaTl: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Trymalium ledifolium* var. *rosmarinifolium* open shrubland.

One plant community was included in this vegetation association.

Vegetation Alliance 12: *Banksia prionotes* scattered low trees.

Vegetation Association Bp: *Banksia prionotes* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland.

Two plant communities were included in this vegetation association. One plant community was recorded near the head of a gully between low ridges, just east of Cairn Hill. The other plant community was quite different and recorded on the crest of a low rise a few hundred meters to the north-east.

Vegetation Alliance 13: *Allocasuarina campestris* high shrublands to open and closed scrub

Allocasuarina campestris formed high shrublands to open and closed scrubs extensively throughout the survey area. They were most common on lower slopes around and between the low chert ridges and on parts of the ridges where there was deeper soil over the underlying rock and probably where the underlying rock was more fractured and penetrable.

The *Allocasuarina campestris* scrub often grew with no tree layer in the survey area. Stands of *Allocasuarina campestris* scrub varied throughout the survey area with the presence and species composition of low woodlands and with associated plant species that varied in some part with sub-areas of the survey area and with habitat.

Vegetation Association Ac: *Allocasuarina campestris* open to closed scrub over scattered sedges/grasses/herbs.

There were eight plant communities in this vegetation association. They differed mainly in the presence and composition of a tree layer (scattered low trees to low open woodland) and the species of associated scattered low shrubs. One plant community differed by having an *Acacia acuminata* subsp. *acuminata* scattered low trees to low open woodland strata. Another had a *Eucalyptus loxophleba* subsp. *loxophleba*, (*Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*) scattered low trees to low open woodland layer. Another differed by having an *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low open woodland layer. Different shrub and low shrub species that were present (scattered) in different plant communities were *Calytrix depressa*, *Dryandra fraseri*, *Hibbertia subvaginata* and *Melaleuca calyptroides*.

Vegetation Association AcAa: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris* high open shrubland to high shrubland.

There was one plant community in this vegetation association.

Vegetation Association AcAh: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low open forest over *Allocasuarina campestris* high open shrubland to open to closed scrub.

There were two plant communities included in this vegetation association. They differed in the *Allocasuarina huegeliana* cover and *Allocasuarina campestris* cover.

Vegetation Association AcAhu: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris*, *Allocasuarina humilis* open scrub over *Hibbertia subvaginata* shrubland.

One plant community was included in this vegetation association. It occurred on a steep, lower to mid slope of a low chert ridge.

Vegetation Association AcAs: *Acacia scirpifolia*, *Acacia saligna* high open shrubland over *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* (Moora-Watheroo)) closed scrub over *Melaleuca calyptroides*, *Acacia congesta* subsp. *congesta* open shrubland.

There was one plant community included in this vegetation association. It was recorded in Cairn Hill from one stand on a broad valley floor, with no defined drainage line. The likelihood of recording other areas of this vegetation unit would have been much reduced by the clearing of much of that habitat in the survey area for gravel mining (in Cairn Hill Reserve) and for pasture and cropping.

Vegetation Association AcB: *Allocasuarina campestris* open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland to open heath.

Four plant communities were included in this vegetation association. One plant community that was recorded on lower slopes, differed by having *Melaleuca radula*, *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs to open shrubland under an *Allocasuarina campestris* open scrub. Another plant community was recorded at three sites on the broad top of a low ridge in Cairn Hill and Cairn Hill North and was differentiated by having a strata of scattered *Allocasuarina huegeliana* low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs. Another differed by having a *Baeckea* sp. Moora (R. Bone 1993/1), *Melaleuca calyptroides* (open) shrubland to open heath under an *Allocasuarina campestris* closed scrub.

Vegetation Association AcCq: *Allocasuarina campestris*, *Calothamnus* aff. *quadrifidus* (Moora-Watheroo) open to closed scrub.

There were three plant communities assigned to this vegetation association. One was differentiated by having a *Melaleuca calyptroides* scattered shrubs to open shrubland layer. Another plant community differed by having a had scattered *Astroloma serratifolium* and *Hakea lissocarpha* low shrub layer.

Vegetation Association AcDs: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Allocasuarina campestris* open to closed scrub.

Four plant communities were included in this vegetation association. One was distinguished by the presence of *Kunzea praestans* in the open scrub layer. Another plant community differed by having a high open shrubland of *Xanthorrhoea drummondii*. Another plant community differed by having a high open shrubland of *Melaleuca radula* and *Xanthorrhoea drummondii*.

Vegetation Association AcEe: *Eucalyptus eudesmioides* scattered low mallees to low mallee woodland over *Allocasuarina campestris* open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) scattered low shrubs to low shrubland.

This vegetation association included two plant communities. One differed from the generic description above by having *Kunzea praestans*, *Regelia megacephala* high shrubland component and a *Melaleuca calyptroides* open shrubland to shrubland component.

Vegetation Association AcEl: *Eucalyptus loxophleba* subsp. *loxophleba* low open woodland to low open forest over *Allocasuarina campestris* open scrub.

There were two plant communities included in this vegetation association. They differed in their *Eucalyptus loxophleba* subsp. *loxophleba* low tree cover, one having a low open woodland to low woodland of *Eucalyptus loxophleba* subsp. *loxophleba*, while the other had a *Eucalyptus loxophleba* subsp. *loxophleba* low open forest.

Vegetation Association AcEw: *Eucalyptus wandoo* subsp. *wandoo* low open woodland over *Allocasuarina campestris* open to closed scrub.

There were four plant communities included in this vegetation association. They tended to be intermediate vegetation units on the lower slopes of rocky ridges, adjacent to *Eucalyptus wandoo* subsp. *wandoo* woodlands down slope and *Allocasuarina campestris* open to closed scrubs. One of the four plant communities differed by having a *Calothamnus* aff. *quadrifidus* (Moora-Watheroo) high shrubland component. Another plant community differed by having an *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees to low open woodland layer. Another plant community was described from a breakaway rocky slope of a low ridge with scattered *Kunzea praestans* and *Melaleuca calyptroides* present and typical breakaway slope species present (*Xanthosia fruticulosa*, *Stypandra glauca* and *Trymalium ledifolium* subsp. *rosmarinifolium*).

Vegetation Association AcHa: *Allocasuarina campestris* scattered tall shrubs over *Hypocalymma angustifolium* low open shrubland over *Pityrodia dilatata* low open shrubland.

Two plant communities were included in this vegetation association. Each plant community was recorded from one small stand each. The two stands were adjacent to each other and were both on top of a very small, very low rocky rise. One plant community differed by having *Dryandra fraseri* and *Hakea lissocarpha* in the low open shrubland over a low open shrubland of *Acacia aristulata* with only scattered *Pityrodia dilatata*.

The specimen identified as *Hypocalymma angustifolium* is a poor match for most of the material under this name in the Western Australian Herbarium, but matches some material there.

Vegetation Association AcHs: *Allocasuarina campestris* open to closed scrub over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.

Two plant communities were included in this vegetation association. One plant community differed by having a *Eucalyptus loxophleba* subsp. *loxophleba*, *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland layer.

Vegetation Association AcId: *Allocasuarina campestris* open to closed scrub over *Isopogon divergens* open shrubland.

This vegetation association was mainly recorded on ridge tops or upper slopes in Cairn Hill. It included three plant communities. One differed by including a *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1), (*Calothamnus sanguineus*) open shrubland to shrubland and *Calytrix leschenaultii*, *Dryandra fraseri* scattered low shrubs. Another plant community differed by having an *Allocasuarina huegeliana* scattered low tree layer along with a *Kunzea praestans* high open shrubland component and *Melaleuca calyptroides* shrubland over *Calytrix leschenaultii* scattered low shrubs.

Vegetation Association AcMr: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris*, (*Melaleuca radula*) open scrub.

Three plant communities were included in this vegetation association. One differed by having an *Acacia acuminata* subsp. *acuminata* scattered low trees to low open woodland tree layer. Another plant community differed by having no tree layer and an *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* (Moora-Watheroo), *Melaleuca radula*) closed scrub.

Vegetation Association AcMs: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* open to closed scrub over *Melaleuca sclerophylla* open shrubland.

One plant community was included in this vegetation association. It was described from a small stand on the south-west boundary of Gardiner's Hill.

Vegetation Association AcRm: *Regelia megacephala* high open shrubland to shrubland over *Allocasuarina campestris* open to closed scrub.

Four plant communities were included in this vegetation association. They were probably intermediate vegetation to *Regelia megacephala* scrub and *Allocasuarina campestris* scrub units. One plant community, which occurred on a chert breakaway, differed by having *Santalum acuminatum* low open woodland and included a *Calothamnus* aff. *quadrifidus* (Moora-Watheroo) high open shrubland. Another plant community differed by having an *Allocasuarina huegeliana* scattered low trees layer, a *Calothamnus* aff. *quadrifidus* (Moora-Watheroo), *Kunzea praestans* high shrubland component and *Melaleuca calyptroides* scattered shrubs. One vegetation community was recorded with *Ricinocarpos muricatus* as a shrub layer.

Vegetation Alliance 14: *Allocasuarina microstachya* open scrub.

Allocasuarina microstachya was only recorded at Gardiner's Hill. It formed an open scrub in a small area of hill crest.

Vegetation Association Am: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina microstachya*, *Kunzea praestans* open scrub over *Calytrix leschenaultii*, *Calytrix depressa* scattered low shrubs over scattered sedges/grasses and open herbland.

One plant community was included in this vegetation association.

Vegetation Alliance 15: *Regelia megacephala* high shrubland to open and closed scrub

Regelia megacephala high shrubland to open and closed scrub occurred on the exposed chert slopes and sometimes crests of the chert ridges in the survey area. In places *Regelia* scrub stands occurred in low open woodlands and occurred with different associated tree and shrub species which varied depending on the area within the survey area.

Vegetation Association Rm: *Regelia megacephala* open scrub.

One plant community was included in this vegetation association. The condition at the recording site was Very Poor and so this plant community may be a consequence of the vegetation deterioration.

Vegetation Association RmAh: *Allocasuarina huegeliana* low open woodland to low open forest over *Regelia megacephala* open scrub over scattered sedges and herbs.

This vegetation was recorded from sites in Cairn Hill, Cairn Hill North and Gardiner's Hill. Four plant communities were included in this vegetation association. In one plant community, *Allocasuarina huegeliana* formed a low open forest over a *Regelia megacephala* open scrub on the lower slopes of a chert ridge in the north-east corner of Cairn Hill. Another plant community was differentiated by having *Kunzea praestans* high open shrubland and *Hibbertia subvaginata* low open shrubland.

Vegetation Association RmB: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland.

This vegetation association included one plant community.

Vegetation Association RmDs: *Regelia megacephala*, (*Dryandra sessilis* var. *sessilis*) open scrub.

One plant community was included in this vegetation association.

Vegetation Association RmEe: *Eucalyptus eudesmioides* scattered low trees to low woodland over *Regelia megacephala* open to closed scrub.

Two plant communities were included in this vegetation association. One was distinguished by having a *Kunzea praestans* high shrubland and *Melaleuca calyptroides* scattered shrubs to open shrubland.

Vegetation Association RmHs: *Regelia megacephala* open scrub over *Hibbertia subvaginata* low open shrubland to low shrubland.

This vegetation association included three plant communities. One plant community differed by the presence of a low tree layer (scattered *Allocasuarina huegeliana*). Another plant community was differentiated by having a low tree layer (scattered *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*), an *Allocasuarina campestris* high open shrubland and *Hibbertia subvaginata* scattered shrubs.

Vegetation Association RmKp: *Regelia megacephala* high shrubland to open scrub over *Kunzea praestans* high open shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.

This vegetation association included three plant communities. One plant community was a *Regelia megacephala* high shrubland over *Kunzea praestans* open scrub over very open herbland. The second plant community differed by having a lower cover of *Kunzea praestans* (high open shrubland to high shrubland) over *Hibbertia subvaginata* scattered shrubs. The third plant community had a *Regelia megacephala*, *Kunzea praestans* open scrub over *Hibbertia subvaginata* with *Ricinocarpus muricatus* as an associated species.

Vegetation Association RmKpMc: *Regelia megacephala* open to closed scrub and *Kunzea praestans* high open shrubland to open scrub over *Melaleuca calyptroides* open shrubland to shrubland over *Hibbertia subvaginata* low open shrubland.

This vegetation association included three plant communities. One plant communities structure included a *Kunzea praestans* high shrubland to open scrub and a *Melaleuca calyptroides* open shrubland. Another plant community only had a lower *Kunzea praestans* cover (high open shrubland) and a higher cover of *Melaleuca calyptroides* (open shrubland to shrubland). The third plant community differed by having *Allocasuarina campestris* in the scrub layer.

Vegetation Alliance 16: *Kunzea Praestans* high shrubland to open and closed scrub

Kunzea praestans grew as high shrublands and open scrubs on parts of the slopes and crests of the chert ridges. It commonly grew over *Hibbertia subvaginata* (low) open shrublands to (low) open heaths.

Vegetation Association KpAh: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.

This vegetation association includes one plant community. One plant community is differentiated by having an open heath of *Hibbertia subvaginata*.

Vegetation Association KpAhB: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* high shrubland to open scrub over shrubland including *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs to open shrubland.

This vegetation was recorded from numerous locations at Cairn hill and Cairn Hill North where *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) were widespread. Three plant communities were included in the vegetation association. One plant community differed by having a strata of *Dryandra sessilis* var. *sessilis* high open shrubland and no *Melaleuca calyptroides* open shrubland. Another plant community was distinguished by having *Allocasuarina humilis* in the open scrub on a rocky chert slope.

Vegetation Association KpAhDs: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata* low open shrubland.

Three plant communities were included in this vegetation association. While one plant community had a *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland over *Hibbertia subvaginata* low open shrubland, another plant community differed by having a *Kunzea praestans*, (*Xanthorrhoea drummondii*) high open shrubland over *Hibbertia subvaginata* low heath. The third plant community differed by not having *Hibbertia subvaginata* in the low shrub layer.

Vegetation Association KpAhMc: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* open shrubland to shrubland.

This vegetation association included one plant community.

Vegetation Association KpDs: *Dryandra sessilis* var. *sessilis* high open shrubland over *Kunzea praestans* (*Xanthorrhoea drummondii*) open scrub over *Hibbertia subvaginata* scattered low shrubs.

One plant community was included in this vegetation association.

Vegetation Association KpDsMc: *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Kunzea praestans* high shrubland to open scrub over *Melaleuca calyptroides* scattered shrubs to shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.

Three plant communities were recorded in this vegetation association. One plant community differed by having a tree strata (*Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low woodland). Another plant community differed by having a *Xanthorrhoea drummondii* high open shrubland strata.

Vegetation Association KpEe: *Eucalyptus eudesmioides* low woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* and *Baekkea* sp. Moora (R. Bone 1993/1) open shrubland.

This unit was recorded at Cairn Hill.

Vegetation Association KpHs: *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* (low) open shrubland to (low) open heaths over scattered to very open sedgeland/grassland/herbland.

Two plant communities were included in this vegetation association. One of these differed by having *Allocasuarina campestris* in the open scrub.

Vegetation Association KpXd: *Xanthorrhoea drummondii* high open shrubland over *Kunzea praestans* high open shrubland.

One plant community was included in this vegetation association.

Vegetation Alliance 17: *Melaleuca calyptroides* open to closed heath

Most of the units of this vegetation were recorded on John Tonkin's and the Ridgway's properties.

Vegetation Association Mc: *Kunzea praestans* high open shrubland over *Melaleuca calyptroides* open to closed heath over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs to low open shrubland.

Four plant communities were included in this vegetation association. One plant community differed by having a scattered *Dryandra sessilis* var. *sessilis* upper strata. Another differed by having a scattered *Dryandra sessilis* var. *sessilis* upper strata and a *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland. The fourth plant community differed by having a low tree layer (*Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees).

Vegetation Alliance 18: *Hibbertia subvaginata* low shrublands to low open heath

Hibbertia subvaginata commonly grew as scattered shrubs or low shrubland in association with *Regelia megacephala* and *Kunzea praestans* high shrublands and open scrubs. However, at a few site *Hibbertia subvaginata* grew as a low shrubland or open heath with no other dominants or under scattered trees. Most recordings of this unit were on the Eastern Ridge.

Vegetation Association Hs: *Hibbertia subvaginata* open heath.

This vegetation association included one plant community.

Vegetation Association HsAh: *Allocasuarina huegeliana* scattered trees over *Hibbertia subvaginata* (low open shrubland) open heath.

Three plant communities were included in this vegetation association. Two of these were recorded on rocky, south-facing slopes on the Eastern Ridge. One of these plant communities differed by having a *Pityrodia dilatata* low shrubland. The other was distinguished by its *Allocasuarina campestris* high open shrubland. The third plant community had *Kunzea praestans* scattered shrubs to open shrubland over *Hibbertia subvaginata* low open shrubland.

Vegetation Association HsDs: *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Hibbertia subvaginata* low shrubland.

One plant community was included in this vegetation association.

Vegetation Alliance 19: *Xanthorrhoea drummondii* high open shrubland

Vegetation Association Xd: *Xanthorrhoea drummondii* high open shrubland over grassland/herbland/sedgeland

One plant community was recorded in this vegetation association.

Vegetation Alliance 20: Miscellaneous heaths

Vegetation Alliance 20/1: *Dryandra sessilis* high shrubland to open scrub

Vegetation Association Ds: *Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii* high open shrubland over *Allocasuarina campestris* scattered tall shrubs.

There was one plant community in this vegetation association.

Vegetation Association DsHs: *Allocasuarina huegeliana*, (*Acacia acuminata*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* high open shrubland to open scrub over *Hibbertia subvaginata* low shrubland.

There was one plant community in this vegetation association.

Vegetation Association DsKp: *Dryandra sessilis* var. *sessilis* high shrubland to open scrub over *Kunzea praestans*, *Leptospermum erubescens* high shrubland over *Acacia pulchella*, *Baeckea* aff. *preissiana*, *Daviesia dielsii*, *Dryandra nivea* ssp. *nivea* (narrow leaf, mound) *Banksia sphaerocarpa* low open shrubland.

There was one plant community in this vegetation association. This plant community was recorded on the gentle slopes of a broad low rise with some exposed chert.

Vegetation Alliance 20/2: *Melaleuca concreta* open scrub.

Vegetation Association Mco: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca concreta* open scrub over scattered low shrubs over scattered sedges.

Two plant communities were recorded in this vegetation association. One plant community occurred in a small area of a linear depression (?dyke) that occurred near the Cairn Hill North ridge crest. The other plant community occurred in a small area in the south-west corner of Gardiner's Hill and differed in not having a tree layer and having a *Melaleuca sclerophylla*, *Olearia dampieri* subsp. *eremicola* open shrubland.

Vegetation Alliance 20/3: *Melaleuca radula* high shrubland to open scrub

Vegetation Association Mr: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low woodland over *Melaleuca radula*, (*Calothamnus* aff. *quadrifidus* (Moora-Watheroo), *Xanthorrhoea drummondii*) high shrubland to open scrub.

One plant community was included in this vegetation association, with all sites recorded at Gardiner's Hill.

Vegetation Alliance 20/4: *Melaleuca sclerophylla* open heath

Vegetation Association Ms: *Melaleuca sclerophylla*, (*Grevillea* sp. (GHR270-2)) open heath over *Dodonea pinifolia*, *Gastrolobium obovatum* low open shrubland.

One plant community was included in this vegetation association. It was recorded from one small area in the south-west corner of Gardiner's Hill.

Vegetation Alliance 20/5: *Baeckea* sp. Moora (R. Bone 1993/1) low open heath

Vegetation Association B: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Allocasuarina campestris*, (*Xanthorrhoea drummondii*) high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1), (*Calytrix leschenaultii*) low shrubland to low open heath.

One plant community was recorded in this vegetation association. It was recorded on the top of a low ridge in the Cairn Hill North area.

Vegetation Alliance 20/6: *Calytrix leschenaultii* open heath

Vegetation Association Cl: *Allocasuarina campestris*, *Kunzea praestans* scattered tall shrubs over *Calytrix leschenaultii*, (*Hibbertia subvaginata*) open heath.

One plant community was included in this vegetation association. One stand on a lower slope of a low chert ridge varied significantly by having a low open woodland of *Eucalyptus wandoo* subsp. *wandoo*, possibly indicating underlying doleritic soils.

Vegetation Association ClAh: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland over *Calytrix leschenaultii* open heath.

There were two plant communities in this vegetation association. One differed by having a *Dryandra sessilis* var. *sessilis* scattered tall shrub layer and a *Hibbertia subvaginata* low open shrubland component.

Vegetation Alliance 20/7: *Calytrix depressa* low open heath

Vegetation Association Cd: *Allocasuarina campestris* scattered tall shrubs over *Melaleuca radula*, *Grevillea* sp. (JTR270-2) open shrubland over *Calytrix depressa* low shrubland.

One plant community was recorded in this vegetation association. It was recorded on the slopes of a low ridge in Gardiner's Hill.

Vegetation Association CdAh: *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris*, *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs over *Calytrix depressa* low open heath.

One plant community was recorded in this vegetation association. Very small areas of this plant community were recorded on the top of the low ridge at Cairn Hill North.

Vegetation Alliance 20/8: *Calothamnus* aff. *quadrifidus* (Moora-Watheroo) high shrubland

Vegetation Association CqMc (1): *Calothamnus* aff. *quadrifidus* (Moora-Watheroo) high shrubland over *Xanthorrhoea drummondii* scattered shrubs over *Melaleuca calyptroides* shrubland.

One plant community was included in this vegetation association.

Vegetation Association CqAh (1): *Allocasuarina huegeliana* scattered low trees over *Calothamnus* aff. *quadrifidus* (Moora-Watheroo), (*Kunzea praestans*, *Allocasuarina campestris*) high open shrubland to high shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.

One plant community was included in this vegetation association.

Vegetation Alliance 20/9: *Ricinocarpus muricatus* shrubland to open heath

Vegetation Association Rmu: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Ricinocarpus muricatus* shrubland to open heath.

One plant community was included in this vegetation association. It was described from the slopes of two low ridges in Ridgway's property, just north of Kiaka Rd.

Vegetation Alliance 20/10: *Ricinocarpus velutinus* open heath

Vegetation Association Rv: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over *Ricinocarpus velutinus* open heath.

One plant community was included in this vegetation association. One stand of this plant community was recorded in a remnant vegetation block about 500 meters east of the southern end of the Eastern Ridge.

Vegetation Alliance 21: Other miscellaneous

Vegetation Alliance 21/1: *Lepidosperma pubisquameum* sedgeland

Vegetation Association Lp: *Xanthorrhoea drummondii* open shrubland over *Lepidosperma pubisquameum* sedgeland with an annual herbland and open annual grassland.

One plant community was included in this vegetation association. It occurred in one small area on the top of a low rocky ridge near the south end of Eastern Ridge.

Vegetation Alliance 22: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest

Vegetation Association CoAl.1: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest over *Acacia ligustrina* and *Hakea preissii* high open shrubland over **Cynosurus echinatus* and **Vulpia myuros* closed annual grassland.

This alliance differed from the previous *Casuarina obesa* alliance as it contains an additional structural unit. One community was recorded in this vegetation association.

12.3 Most abundant vegetation alliances

The most abundant of the thirty vegetation alliances in the survey area occurred on the upper parts of the ridges in the survey area. They are:

- Vegetation Alliance 9: *Allocasuarina huegeliana* low woodlands to low open forests;
- Vegetation Alliance 11: *Acacia acuminata* low woodlands to low open forests;
- Vegetation Alliance 13: *Allocasuarina campestris* high shrublands to open and closed scrub;
- Vegetation Alliance 15: *Regelia megacephala* high shrubland to open and closed scrub; and
- Vegetation Alliance 16: *Kunzea Praestans* high shrubland to open and closed scrub.

12.4 Less common vegetation alliances

Some vegetation alliances were less common in the survey area mainly because they occurred in habitat that is less common in the survey area. Examples of these are:

- The Wandoo (*Eucalyptus wandoo*) vegetation alliance (which occurred in small areas of the Eastern Ridge, Cairn Hill Reserve, A. & R. Tonkin's property and Gardiner's Hill);

- Many of the York Gum (*Eucalyptus loxophleba*) vegetation associations, which occurred both along dykes intruded into the chert ridges and along the edges of the broad valley floors (which are largely cleared) at the bases of the chert ridges; and
- The Salmon Gum (*Eucalyptus* vegetation association which was recorded along some narrow valley floors between chert ridges in Cairn Hill Reserve and Gardiner's Hill and within some of the adjacent remnants.
- There are a number of other vegetation alliances with limited distribution in the survey area including:
 - Vegetation Alliance 5: *Eucalyptus camaldulensis* open forest, this alliance only occurred on a small area on the flat plains on the west side of remnant chert ridge vegetation on the Chester's property, south of Cairn Hill Reserve;
 - Vegetation Alliance 6: *Eucalyptus obtusiflora* low woodlands to low open forests. This alliance is restricted to two small areas on dykes in Cairn Hill North and Cairn Hill Reserve;
 - Vegetation Alliance 7: *Eucalyptus horistes* low woodlands to low open forests. This alliance is restricted to one location in Cairn Hill North, one location at the base of a low ridge near the southern boundary of Cairn Hill and at the base of the same ridge several hundred meters further south of Cairn Hill, on the Chester's property;
 - Vegetation Alliance 20/2: *Melaleuca concreta* open scrub. This alliance is restricted to one small area in Cairn Hill North and another small area on Gardiner's Hill);
 - Vegetation Alliance 20/4: *Melaleuca sclerophylla* open heath. This alliance is limited to one small area on Gardiner's Hill;
 - Vegetation Alliance 20/9: *Ricinocarpus muricatus* shrubland to open heath. This alliance is restricted to two ridges on the Ridgway's property;
 - Vegetation Alliance 20/10: *Ricinocarpus velutinus* open heath. This alliance is restricted to one small area of remnant vegetation east of the southern end of the Eastern Ridge.
 - Vegetation Alliance 22: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest

While vegetation dominated by the species that dominate these vegetation alliances will mostly be found elsewhere, it is likely to vary very significantly from the alliances described here and be referable to different alliances. That is, with the possible exception of

Vegetation Alliance 5., the vegetation listed above is likely to be extremely rare as it is likely to be restricted to the (see Map 3 above) Coomberdale Landscape (Chert subsystem) where the gentle to moderate stripping of the landscape has exposed chert.

12.5 Vegetation associations dominated by the geographically restricted species *Kunzea praestans*

Kunzea praestans vegetation associations also occurred in all the main bushland areas in the survey area, but were most extensive north of Kiaka Rd. While *Kunzea praestans* was often a fairly minor component of vegetation associations, it was also prominent in a significant number of associations, including:

- Vegetation Association EeKp: *Eucalyptus eudesmioides* low mallee woodland over *Kunzea praestans* scattered tall shrubs to high shrubland.
- Vegetation Association AaDsKp: *Acacia acuminata* subsp. *acuminata* low woodland over *Dryandra sessilis* var. *sessilis* (*Xanthorrhoea drummondii*) scattered tall shrubs over *Kunzea praestans* scattered tall shrubs to high open shrubland over very open herbland.
- Vegetation Association Am: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina microstachya*, *Kunzea praestans* open scrub over *Calytrix leschenaultii*, *Calytrix depressa* scattered low shrubs over scattered sedges/grasses and open herbland.
- Vegetation Association RmB: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland.
- Vegetation Association RmKp: *Regelia megacephala* high shrubland to open scrub over *Kunzea praestans* high open shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.
- Vegetation Association RmKpMc: *Regelia megacephala* open to closed scrub and *Kunzea praestans* high open shrubland to open scrub over *Melaleuca calyptroides* open shrubland to shrubland over *Hibbertia subvaginata* low open shrubland.
- Vegetation Association KpAh: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.

- Vegetation Association KpAhB: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* high shrubland to open scrub over shrubland including *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs to open shrubland.
- Vegetation Association KpAhDs: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata* low open shrubland.
- Vegetation Association KpAhMc: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* open shrubland to shrubland.
- Vegetation Association KpDs: *Dryandra sessilis* var. *sessilis* high open shrubland over *Kunzea praestans* (*Xanthorrhoea drummondii*) open scrub over *Hibbertia subvaginata* scattered low shrubs.
- Vegetation Association KpDsMc: *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.
- Vegetation Association KpEe: *Eucalyptus eudesmioides* low woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland.
- Vegetation Association KpHs: *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* (low) open shrubland to (low) open heaths over scattered to very open sedgeland/grassland/herbland.

12.6 Vegetation associations with the geographically restricted species *Baeckea* sp. Moora common

Vegetation alliances in the survey area with the priority flora species *Baeckea* sp. Moora (R. Bone 1993/1) forming a significant part of the vegetation stands included in them occurred only in Cairn Hill North, the Eastern Ridge and Cairn Hill Reserve. The vegetation associations with *Baeckea* sp. Moora (R. Bone 1993/1) more abundant are:

- Vegetation Association AcB: *Allocasuarina campestris* open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland to open heath.

- Vegetation Association RmB: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland.
- Vegetation Association KpEe: *Eucalyptus eudesmioides* low woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland.
- Vegetation Association B: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Allocasuarina campestris*, (*Xanthorrhoea drummondii*) high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1), (*Calytrix leschenaultii*) low shrubland to low open heath.

12.7 Vegetation associations dominated by the geographically restricted species *Regelia megacephala*

Vegetation alliances dominated by *Regelia megacephala* were recorded in all the main sub-areas of bushland in the survey area, however there are significant structural differences between *Regelia megacephala* units across the survey area, although a proportion of the stands are fairly similar. For example, in the southern part of the survey area, some *Regelia megacephala* open scrub stands occurred under an overstorey of *Allocasuarina huegeliana* low open woodland to low open forest (Cairn Hill, Cairn Hill North and Gardener's Hill) and *Regelia megacephala* open scrub occurred under *Eucalyptus eudesmioides* scattered low trees to low open woodland (Cairn Hill Reserve). This scale of this variation is self-evident from the list of vegetation associations from the survey area with *Regelia megacephala* dominant or sub-dominant given here:

- Vegetation Association AhRm: *Allocasuarina huegeliana* low open forest over *Regelia megacephala* high open shrubland.
- Vegetation Association AcRm: *Regelia megacephala* high open shrubland to shrubland over *Allocasuarina campestris* open to closed scrub.
- Vegetation Association Rm: *Regelia megacephala* open scrub.
- Vegetation Association RmAh: *Allocasuarina huegeliana* low open woodland to low open forest over *Regelia megacephala* open scrub over scattered sedges and herbs.
- Vegetation Association RmB: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland.

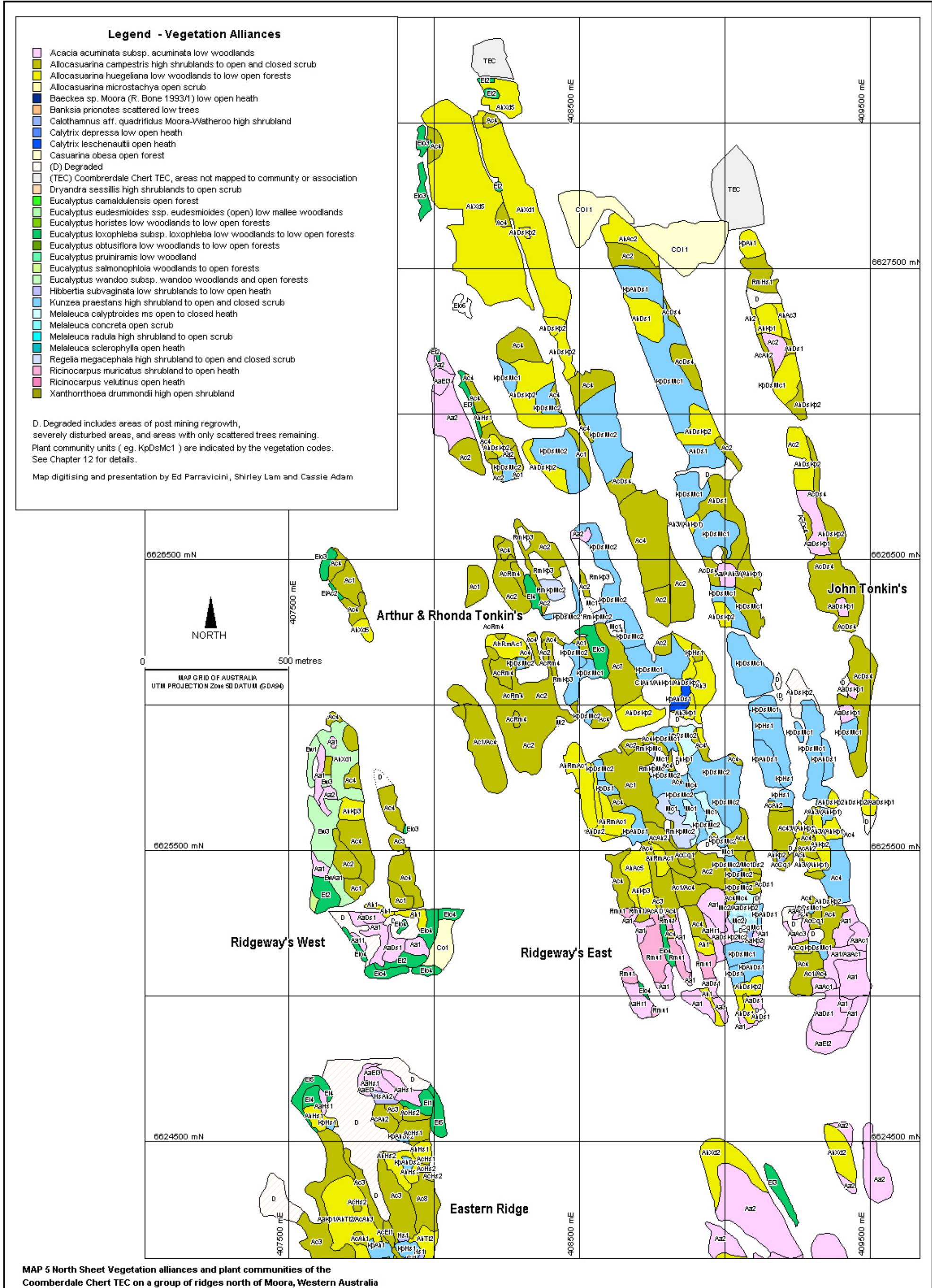
- Vegetation Association RmDs: *Regelia megacephala*, (*Dryandra sessilis* var. *sessilis*) open scrub.
- Vegetation Association RmEe: *Eucalyptus eudesmioides* scattered low trees to low woodland over *Regelia megacephala* open to closed scrub.
- Vegetation Association RmHs: *Regelia megacephala* open scrub over *Hibbertia subvaginata* low open shrubland to low shrubland.
- Vegetation Association RmKp: *Regelia megacephala* high shrubland to open scrub over *Kunzea praestans* high open shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.
- Vegetation Association RmKpMc: *Regelia megacephala* open to closed scrub and *Kunzea praestans* high open shrubland to open scrub over *Melaleuca calyptroides* open shrubland to shrubland over *Hibbertia subvaginata* low open shrubland.

Floristic differences within the *Regelia megacephala* stands recorded are considered in section 14 below. The extent of vegetation dominated by *Regelia megacephala*, or with this species fairly significant in the vegetation, is shown on Map 4. The distribution of the different associations list above is shown by the alphabetic part of the community codes on Map 5.

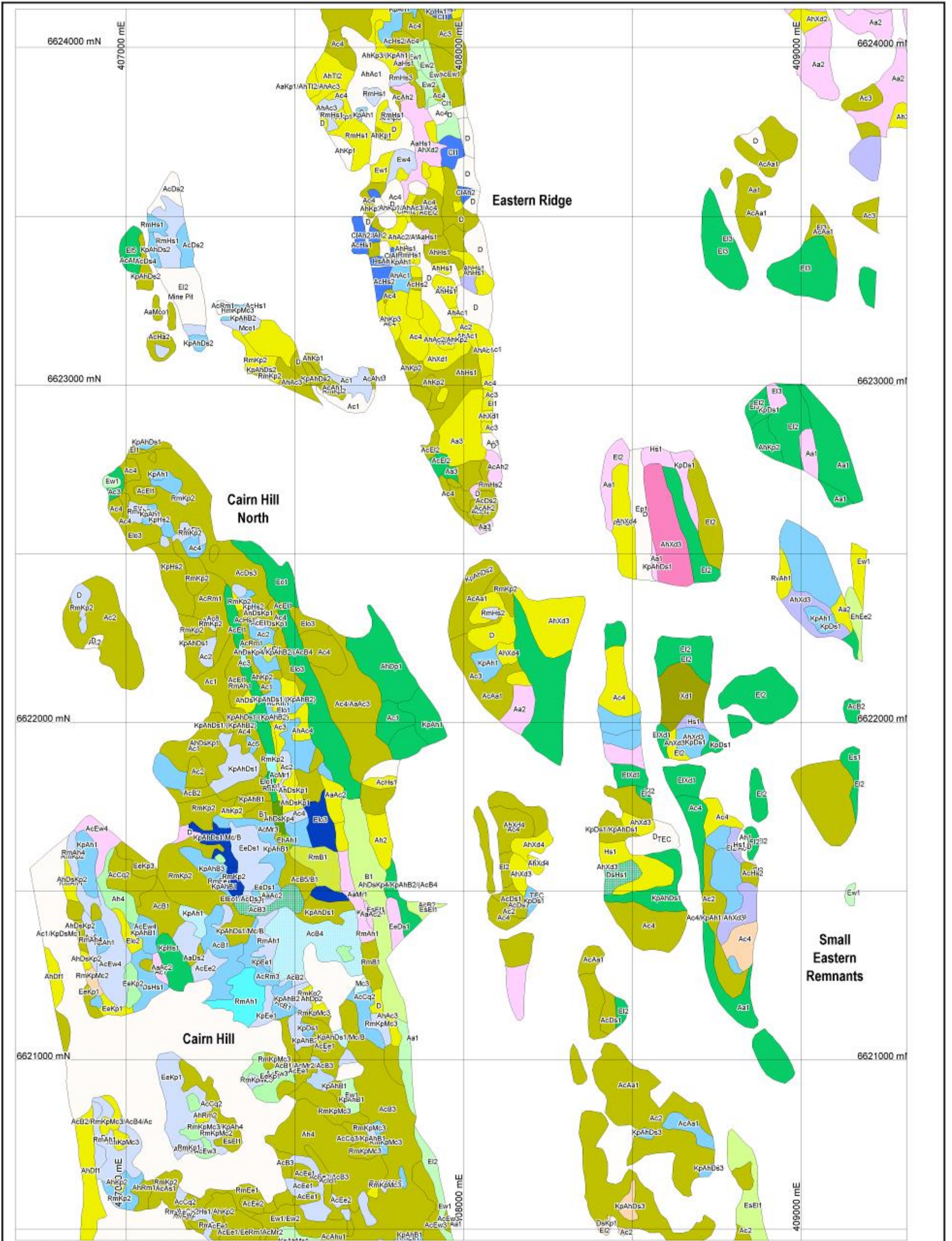
Floristically, the *Regelia megacephala* stands were quite different across the different sub-areas, as indicated by their floristic groupings (groups 1,3,5 and 8 in the 10 group analysis) in the floristic analysis (see below).

The condition of the *Regelia megacephala* stands varied from excellent in the Cairn Hill sub-area to good to very good in Cairn Hill North, the Western Ore Body, the Eastern Ore Body and the Eastern Ridge sub-areas. Some weed invasion and grazing were the cause of degradation of the *Regelia* stands. However, the very rocky chert outcrop habitat typical favoured by the *Regelia* stands generally limited the degradation. The *Regelia* stands in the Gardiner Hill and Kiaka Rd North sub-areas were also in good to very good condition. The Chester Property *Regelia* stands were in the poorest condition (+/-good), with more significant degradation from grazing and more severe weed invasion. The associated flora was also in the poorest condition in this area.

The *Regelia megacephala* stands in the Eastern Ridge sub-area were smaller stands than most other stands. The two quadrats located in these stands were recorded as in very good and good to very good condition respectively.

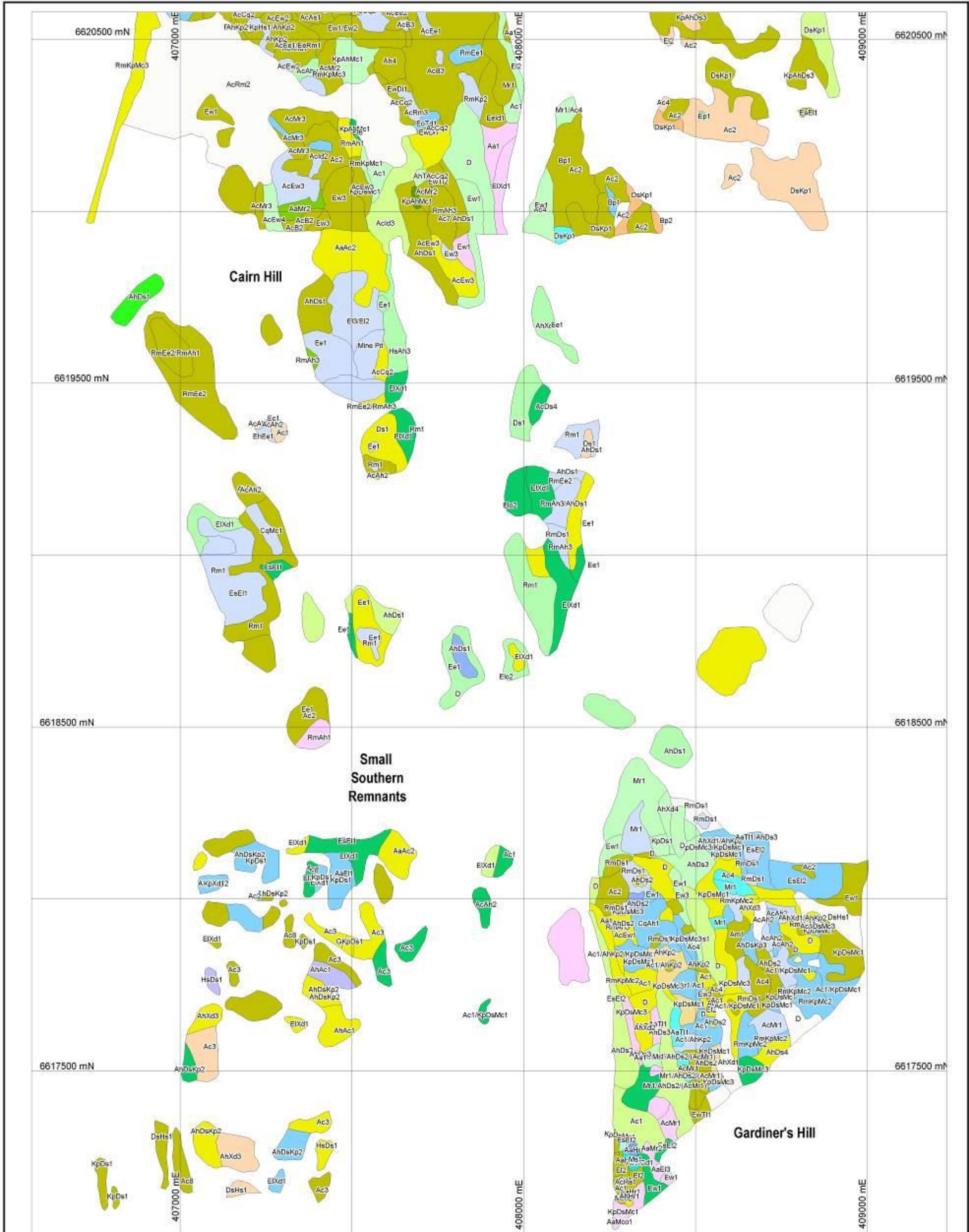


Map 5. Vegetation alliances and plant communities of the Coomberdale Chert TEC

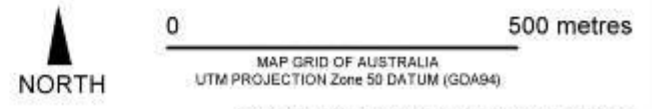


MAP 5 Central Sheet (See North Sheet for legend.)
Vegetation alliances and plant communities of the Coomberdale Chert TEC
on a group of ridges north of Moora, Western Australia

0 500 metres
 MAP GRID OF AUSTRALIA
 UTM PROJECTION Zone 50 DATUM (GDA94)
 Map digitising and presentation by Shirley Lam & Ed Parravicini



MAP 5 South Sheet (See North Sheet for legend.)
Vegetation alliances and plant communities of the Coomberdale Chert TEC
on a group of ridges north of Moora, Western Australia



Map digitising and presentation by Shirley Lam & Ed Parravicini

13.0 THE CONDITION OF THE VEGETATION OF THE SURVEY AREA

13.1 Assessment of the condition of the vegetation

At each of the detailed recording sites (quadrats) and relevés, the condition of the vegetation was assessed using the scale of Trudgen (1988, see Appendix 3). General impressions of the condition of the vegetation were also gained while walking between sites and while conducting rare flora searches. This information was used in conjunction with aerial photograph interpretation to produce a condition map of the remnant vegetation in the survey area (see Map 6). The condition of the vegetation of each location (Western Ridge, Cairn Hill North etc see section 1.3 above) in the survey area is discussed separately.

13.2 Condition of the vegetation in each of the survey sub-areas

13.2.1 Cairn Hill Reserve (CAH)

Until recently, Cairn Hill Reserve was a Westrail reserve used for the extraction of gravel (it is being transferred to the nature conservation reserve system). Significant areas have been heavily impacted (cleared, soil profile changed, and allowed to revegetate) by the gravel extraction (see Map 6). However, the level of disturbance in the areas not directly impacted by the gravel extraction appears to be very low. This is reflected in the condition scores given to the sites recorded in this area, which ranged from Very Good to Excellent (see Map 6). This means there is minimal disturbance and weed invasion at the sites recorded and the overall impression of the area was of vegetation in apparently near undisturbed condition. Noticeably, the vegetation in Cairn Hill Reserve had the best lower stratum (herbs, small shrubs) vegetation in the survey area. This is presumed to be due to no or very little grazing having taken place in the reserve.

13.2.2 Cairn Hill North (CHN)

This block of vegetation extends northwards from Cairn Hill Reserve into a paddock on the farm "Goonderoo" on which the Simcoa Chert Mine is located. This fairly large remnant of native vegetation has not been fenced off from the farm paddock it is located in and, except for its southern edge, where it abuts the Cairn Hill reserve, is surrounded by pasture. Although this remnant has undoubtedly been subject to significant grazing pressure, the condition assessments of the sites recorded in it varied from Good to Very Good, with some Excellent areas (see Map 6). However, weeds were more abundant than in Cairn Hill Westrail Reserve and there was less of a herb or annual layer under the perennials - possibly partly due to grazing. Some areas have been impacted by grid lines, which have been bulldozed to facilitate access for drilling.

13.2.3 Western Ore Body (WOR)

Much of the Western Ore Body (or Western Ridge) has now been mined. The bulldozing of large gridlines has disturbed parts of the remaining area. Despite this, and the fact that this ridge had been part of a paddock before mining began, the remaining vegetation was graded as being Good to Very Good, although with an increasing level of weed invasion closer to the

edge. The relatively good condition was apparently partly due to the density of the stand (reducing grazing) and partly due to the hostility of the soil surface, which was very rocky, inhibiting weed invasion.

13.2.4 Proposed Waste Dump (WDM)

The vegetation was assessed as Good at two of the sites recorded in this sub-area, and to Very Good or to Excellent in the other. The quadrat with the higher assessment was further into the block and therefore was less affected by weed invasion from the surrounding vegetation. Observation of the general area around the plots indicated some degradation, with a heavy weed invasion and little understorey in parts of the sub-area.

13.2.5 Eastern Ore Body (EOR)

This small area at the south end of the main mine area also had some gridlines cleared for drilling, although there was more vegetation left between them than at the Western Ridge. The condition of the three sites was recorded as Good to Very Good, despite the area being part of a paddock at one stage. It seems likely the density of the vegetation, and the rockiness of the slopes, protected the vegetation from grazing to a significant degree.

13.2.6 Eastern Ridge (ERG)

Most of this area was outside the mine boundary fence, and therefore still subject to grazing. Fourteen quadrats were recorded from the south to north ends of this ridge and recorded a variety of values from Poor to Excellent. If the ridge is split into a northern section and a southern section, then the southern end has the poorer condition and the northern the better. Although, one plot on the northern end was recorded as in Poor to Good condition. It appears that grazing pressure may have been heavier at the southern end. Despite plot condition assessments mostly being Good to Very Good, there are large areas on the flatter part of the ridge top that are very degraded (these were avoided when selecting sites for the quadrats) and a lot of deaths of *Regelia megacephala* (possibly due to the dry winter). The northern end shows signs of degradation in the areas of *Allocasuarina campestris* scrub.

13.2.7 North of Kiaka Road

The survey area included parts of three properties north of Kiaka Road; those of: A & R Tonkin; J Tonkin; and G. Ridgway. The vegetation condition of this area was recorded at the quadrats and relevés and during vegetation mapping and priority flora searches. The vegetation condition of the area ranges from Completely Degraded (cleared farm land) to Very Good (see Appendices 6 and 7 for quadrata and releve details).

It is not clear how much some areas, especially on the property of A. & R. Tonkin have been effected by grazing, as they appear to be in good or better condition but have lower species numbers than other areas. It is likely that some of these areas naturally have lower species numbers and that the recording of quadrats on A. & R. Tonkin's during the 2010 drought

accentuated this somewhat. With most in Poor to Good, Good or Good to Very Good condition. Vegetation condition was generally better in the vegetation types on rockier sites, steeper sites and where the *Regelia* or *Allocasuarina campestris* was denser.

13.2.8 South of Cairn Hill

The vegetation on the hill on the Gardiner Pastoral Company's (P. & J. Gardiner's) property on Dalaroo Rd. East that has been fenced to preserve the vegetation was rated as varying from Good to Very Good condition. However, it still shows signs of grazing. On K. & S. Chester's property (immediately south of Cairn Hill), much of the vegetation on the lower ridges in the south of the property was in Poor condition, as were many of the ridges on the east side. The vegetation on the two main ridges in the centre of the property was generally in Good to Very Good condition.

13.2.9 Small eastern remnants

Generally, the chert ridges in this area had very open remnant vegetation, with an overstorey of *Acacia acuminata* subsp. *acuminata* (especially on the south west ridges) and with *Eucalyptus loxophleba* subsp. *loxophleba* or *Allocasuarina huegeliana* low trees. A large part of these low ridges was partially cleared and there were very few understorey species remaining. Overall, the remnant vegetation was in poor to very poor condition due to clearing, intense grazing and weed invasion.

13.3 Processes affecting the condition of the vegetation of the survey area

A number of activities carried out in the areas around the 'islands' of remnant native vegetation that comprise the survey area affect the condition of the vegetation, as do several processes operating in the survey area vegetation due to the location of the vegetation in a 'sea' of (mainly) agricultural activity. These activities and processes are discussed individually below.

13.3.1 Agriculture, including grazing and cropping

Except for the Cairn Hill Westrail Reserve, the mine site (which is fenced off, although stock are let in at times) and an area set aside for conservation on the Gardiner Pastoral Company Property (which has been grazed in the past) the remnant native vegetation of the survey area is not fenced off from paddocks where stock (mainly sheep) graze. Consequently, particularly at the edges, where the surface is not rocky and where the plant communities are more open, livestock graze the lower shrubs and the herb, sedge layer of the vegetation. This has led to a varying degree of impact on the vegetation by grazing that is difficult to assess, making assessment of the condition of some stands difficult.

Given the various factors involved in the impact of grazing, the observation in the field that stands dominated by *Allocasuarina campestris* were more heavily affected by grazing than stands dominated by *Kunzea praestans* and these more heavily than those dominated by

Regelia megacephala would seem to be reasonably likely to be correct. The impact of grazing on the stands dominated by *Allocasuarina campestris* was often difficult to assess because of the variation in these stands, but it seems likely that there has been significant loss of ground flora species (mainly herbs, but also small shrubs) from a number of stands with less impact on others. Stands dominated by *Regelia megacephala* were generally fairly dense and had very rocky soil surfaces. Both these factors would reduce grazing impacts by discouraging stock from entering them and lessening the invasion of weeds. Stands dominated by *Kunzea praestans* are generally more open, and usually had a less rocky soil surface than *Regelia* stands. The apparent extent of grazing impact on *Kunzea* stands varied significantly, with position (at the edge of a remnant or not, steep or gentle slope) and soil surface affecting the degree of degradation. Certainly, stands with smooth surfaces at the edges of remnants were more impacted than stands with rockier surfaces well into remnants.

The impact of stock is not limited to actual grazing, with use of the vegetation for grazing or shelter involving trampling of the soil surface and of smaller plants. Obviously, these uses also interact with weed invasion and with re-establishment of native species after fire or other disturbance.

The impact of agricultural use of land adjoining remnants of native vegetation is not limited to impacts caused by stock, cropping involves the use of herbicides and artificial fertilisers, which impact on native vegetation through drift of these chemicals into the vegetation. The effect of such chemicals can be direct death or weakening of species susceptible to herbicides or changes of relative strength due to fertilisers. Fertilisers or herbicides may also affect native soil fungi and this may lead to death of flowering plants dependant on symbiotic relationships with such fungi.

13.3.2 Weed invasion

Weed invasion impacts native vegetation in a number of ways, weeds directly compete for resources (water, nutrients) and for space and can increase flammability or release toxic chemicals that effect other species. They enter remnants as seeds carried by livestock (on their coats, or in faeces) or through distribution by other agents such as the wind. Weed invasion is to some degree "resisted" or made more difficult by stands that are healthy and dense, as such stands provide more competition. Conversely, stands that are heavily grazed (or recently burnt) will be more open and have the soil surface more disturbed, increasing the ability of weeds to establish. Vegetation on harsh sites, such as the more rocky sites on which *Regelia megacephala* grows, are more resistant to weed invasion, and this appears to be a major factor in the relatively low weed invasion of much of the native vegetation in the survey area.

Fifty-two species of weeds were recorded in the survey area. The cover of some of these species was quite high in some plots and a number of them (ten or eleven of the more

common ones) may occur in one 10 x 10 m quadrat with total cover of 10% or more. Fortunately, most of the weeds recorded are not highly aggressive species with some (eg. *Aira caryophyllea*) being very small species. In most of the areas surveyed small annual native species such as *Trachymene pilosa* and *Trachymene ornata* were still present, so the impact has probably been loss of population size for such species, rather than total loss. However, at the edges of stands and in the stands in Poor or worse condition it is likely that species have been lost due to higher cover of more aggressive species of weeds.

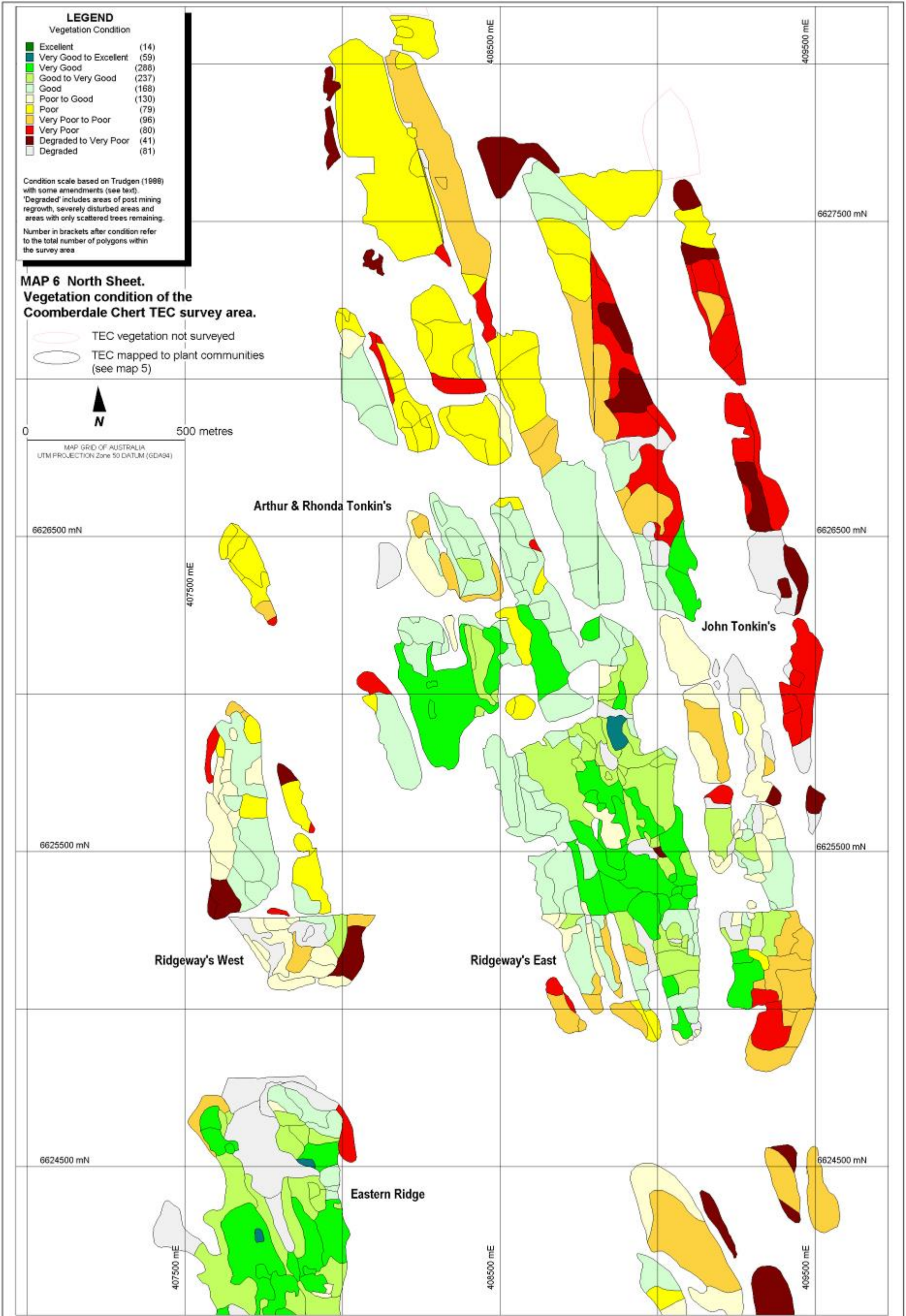
13.3.3 Mining operations

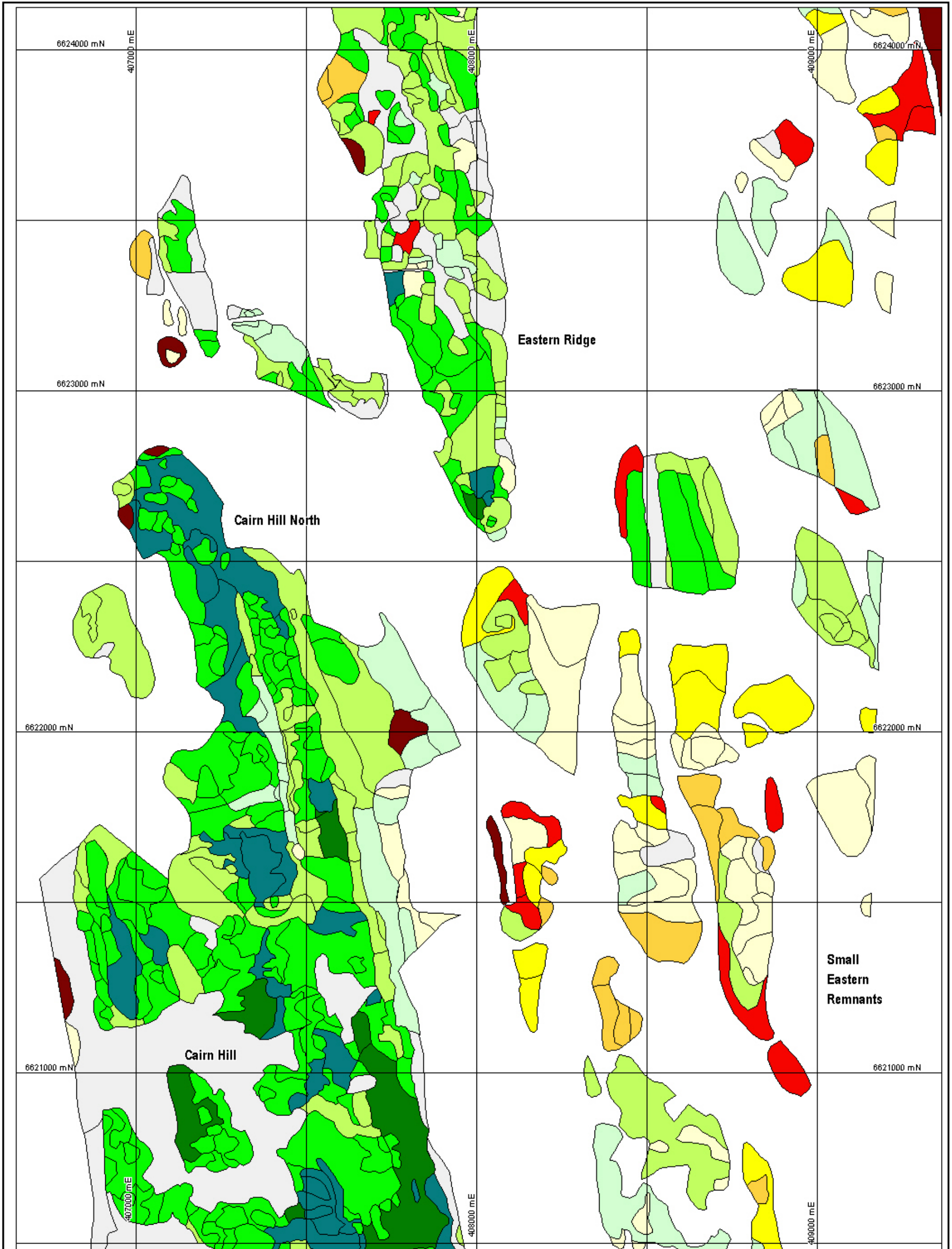
The small scale of the mining of chert by Simcoa means that large areas are not directly impacted by it, however, those areas impacted suffer total loss of the vegetation which cannot be regenerated on the sites mined (or on waste dumps) because of the change to the soil profile (Trudgen *et al.* 2001). However, rehabilitation of waste dump areas appears to be able to develop vegetation of native species local to the area, which should help maintain population sizes of some species locally.

Other impacts (than actual mining) of mining operations include clearing of grid lines for drilling work and vehicle and personnel movements that can affect vegetation by carrying weed seed into vegetation or by physical impact on the vegetation. Due to the small scale of the Simcoa operations, these impacts have been small, except for the original mine, and the mine on the Western Ore Body. A *Regelia* stand in Cairn Hill North has also been impacted, by the bulldozing of grid lines at some time in the past.

13.3.4 Rubbish Dumping

Rubbish dumps are often foci for the introduction of weeds into native vegetation and can also be a localised source of pollutants. A number of small, disused rubbish dumps were found in various parts of the survey area, mostly associated with farming activity. The rubbish included household refuse, motor vehicles, old farm machinery, timber, galvanised iron and an occasional drill rod.

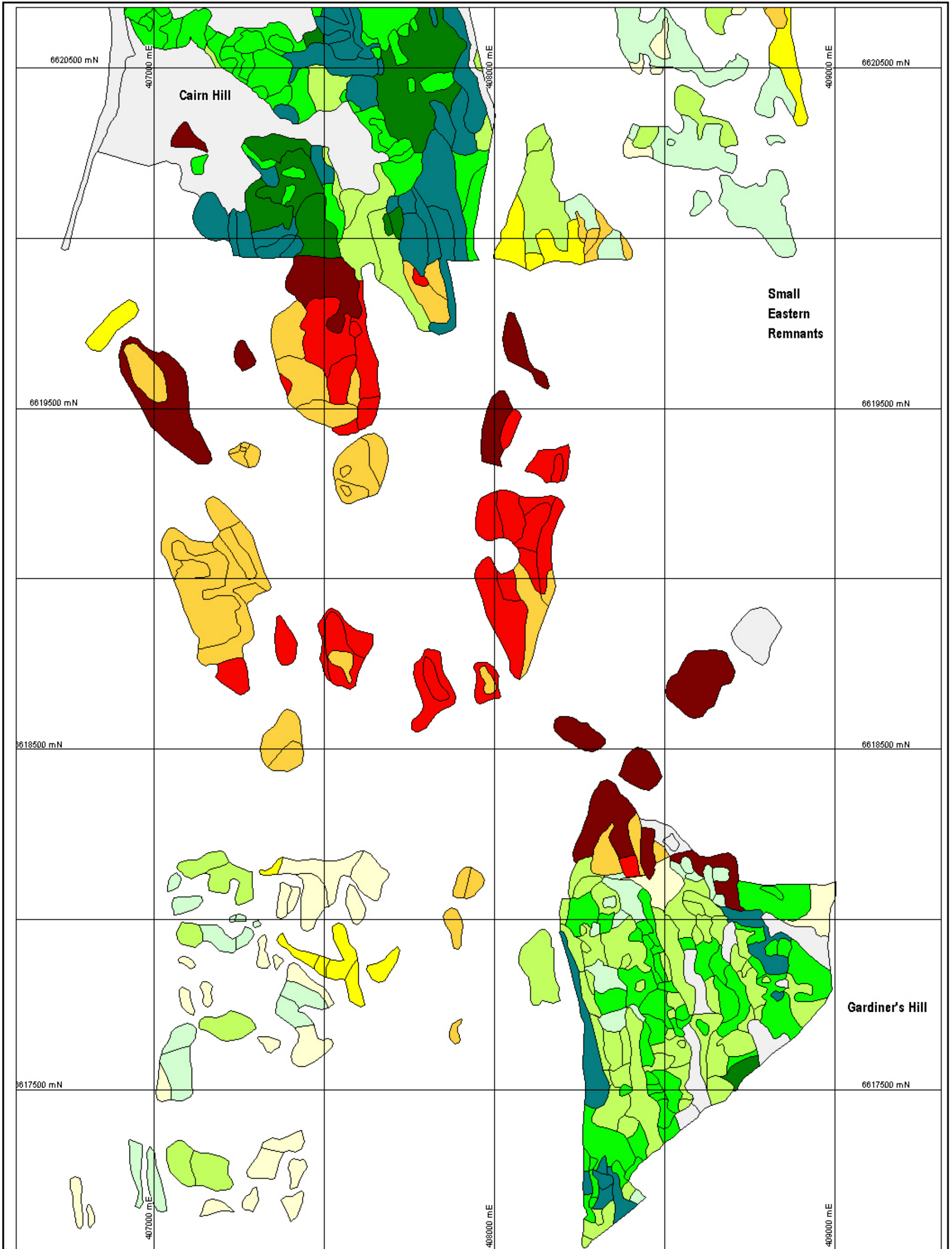





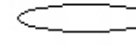
MAP 6 Central Sheet.
Vegetation condition of the
Coomberdale Chert TEC survey area.
 see north sheet for legend

- TEC vegetation not surveyed
- TEC mapped to plant communities (see map 5)

500 metres
 MAP GRID OF AUSTRALIA
 UTM PROJECTION Zone 50 DATUM (GDA96)



MAP 6 Southern Sheet.
Vegetation condition of the
Coomberdale Chert TEC survey area.
see north sheet for legend

-  TEC vegetation not surveyed
-  TEC mapped to plant communities (see map 5)



0 500 metres
MAP GRID OF AUSTRALIA
UTM PROJECTION Zone 53 DATUM (GDA96)

14.0 FLORISTIC ANALYSIS OF THE QUADRAT DATA

14.1 Introduction to the floristic analysis

The use of floristic analysis, that is the comparison of the flora present in quadrats recorded in different stands of vegetation using computer programmes written specifically to identify patterns of variation in such data, is a methodology that can be employed to assist in investigating the nature of variation in vegetation in a comparatively objective way. In the current survey, such techniques have been used to examine several significant issues relating to the floristic composition of the vegetation of the survey area. However, it should be noted, that vegetation is a complex phenomenon and floristic composition is one aspect of its variation - with structural/dominance aspects described in section 12.0 (see above).

The objectives of the analysis were to:

- Determine what floristically based vegetation units are present in the study area;
- Evaluate the geographical extent of the floristic units identified within the study area;
- Evaluate the likely geographical extent of the floristic units identified outside the study area.

To evaluate the floristic variation in the survey area, data from ninety-nine quadrats (10 by 10 metre quadrats nested inside 30 by 30 metre quadrats) recorded in the main areas of remnant native vegetation in the survey area (from the A. & R. Tonkin and J. Tonkin properties north of Kiaka Road south to Dalaroo Road) was analysed. These quadrats (see Map 2 above for their locations) sampled the range of vegetation types based on structure and dominance by different species (ie. the vegetation types that look fairly different because they are dominated by different species and/or have different form) in the different sub-areas (the Western Ore-body, Cairn Hill, Cairn Hill North, the Eastern Ridge, the Proposed Waste Dump, the Eastern Ore-body, John Tonkin's Property, A. & R. Tonkin's property, Gardiner's Hill and Stan Ridgway's property) of the survey area. Sampling occurred over a period of time (2000 to 2010) and the dates are given in Appendix 6 for each quadrat.

To examine the regional floristic variation in the area with similar geology to the current survey area (and including it), data from 29 releves recorded by one of us (E.A. Griffin) from an earlier regional survey was analysed. This data includes examples of the known areas on the Noondine (Coomberdale) chert (exposed or weathered). In a precursor report (Trudgen *et al* 2001) to this report, the data from these sites was analysed together with the quadrat data collected from the then survey area (a portion of the current survey area). This is no longer considered appropriate, because the significant difference in the sampling effort for the two

data sets makes interpretation of the classification difficult. However, the 29 relevés were considered suitable for examining the regional variation in the floristics of the Coomberdale Chert.

Both data sets were analysed using various modules of the PATN computer package (Belbin 1987). These analyses were performed to assist in evaluating the nature of the variation present in the floristic dataset. The principal results were classifications of the sites to identify the nature of the floristic variation at both scales. To assist in this evaluation, the species were also classified. This enabled the presentation of the occurrences of species at sites in a table in which the site order reflected the classification of sites and the species order reflected the classification of species (Figure 9). In addition, the sites were subjected to an ordination analysis. This attempts to represent the variation between the sites in multi-dimension space.

As noted above, this report extends an earlier report (Trudgen et al 2006) by the inclusion of the property of A. & R. Tonkin (which is now the north-western part of the area surveyed). As the quadrats on this property were recorded during 2010, the second driest year on record, it was not considered reliable to run an entirely new analysis. Therefore, this section contains the 2006 floristic analysis and separate analyses to relate the new data to that analysis.

14.2 Floristic analysis of the quadrat data from the 2006 report survey area

This report has two precursor reports that look at smaller parts of the chert hills surveyed. As indicated in the methods, the data from the quadrats recorded in the 2006 survey area were analysed in three ways:

- Presence/absence data, all species;
- Presence/absence data, weeds omitted; and
- Cover data, weeds omitted.

It was hoped that consistency between the results of these sets would increase confidence in the interpretation of the results.

The dendrogram reproduced in Figure 1 represents the classification from presence/absence data using all the species recorded in the quadrats (ie., including weed species). From this classification a somewhat arbitrary number of 20 groups ("floristic community types") was set. That is, the analysis was set to give 20 groups.

Figure 1: Dendrogram from the floristic analysis of the 88 quadrats from the 2006 report survey area

Notes: Based on all species (native and introduced). Gp10 and Gp20 are site classification numbers at the ten and twenty group classification levels respectively. The Gp 20 groups are coloured to allow them to be easily distinguished in the dendrogram.

Site	Gp10	Gp20	Dendrogram									
			0.1920	0.2724	0.3529	0.4333	0.5138	0.5942	0.6747	0.7551	0.8356	0.9160
CAH001	1	1										
CAH006	1	1										
CAH018	1	2										
CAH002	2	3										
CAH005	2	3										
CAH011	2	3										
CHN002	2	3										
CHN003	2	3										
CHN006	2	3										
CHN004	2	3										
CHN008	2	3										
CHN007	2	3										
ERG014	2	3										
WDM001	2	3										
WOR002	2	3										
CAH007	2	4										
CAH015	2	4										
CAH008	2	4										
CAH013	2	4										
CAH004	2	5										
CAH017	2	5										
CAH019	2	5										
EOR002	3	6										
EOR003	3	6										
WOR001	3	6										
WOR004	3	6										
WOR005	3	6										
WOR003	3	6										
WOR006	3	6										
GH001	4	7										
GH003	4	7										
GH002	4	7										

JT001	5	8	_____				
JT008	5	8	_____ _____				
JT003	5	8	_____				
JT007	5	8	_____				
JT011	5	8	_____ _____ _____				
JT010	5	8	_____ _____				
JT002	5	8	_____				
JT005	5	8	_____				
JT009	5	8	_____ _____ _____				
JT004	5	8	_____				
JT006	5	8	_____ _____ _____ _____				
CAH003	6	9	_____				
CAH009	6	9	_____ _____				
CHN010	6	10	_____ _____ _____				
CAH010	7	11	_____				
GH005	7	11	_____				
GH009	7	11	_____ _____ _____				
GH004	7	11	_____				
GH008	7	11	_____ _____				
GH010	7	11	_____ _____ _____				
ERG004	7	11	_____				
ERG016	7	11	_____ _____				
GH007	7	11	_____ _____ _____				
CAH012	7	12	_____				
GH006	7	12	_____ _____ _____				
CHN001	7	13	_____				
WDM002	7	13	_____				
WDM003	7	13	_____ _____ _____ _____				
ERG017	7	14	_____				
ERG019	7	14	_____ _____				
ERG018	7	14	_____				
ERG020	7	14	_____ _____ _____				
ERG022	7	14	_____ _____ _____ _____				
CHN005	7	15	_____				
EOR001	7	15	_____ _____				
ERG002	7	15	_____				
ERG021	7	15	_____				
ERG009	7	15	_____ _____				

ERG011	7	15	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG003	7	15	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG010	7	15	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG012	7	15	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG001	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG005	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG007	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG013	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG008	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG006	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG015	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
ERG023	7	16	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
CAH014	8	17	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
CAH016	8	17	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
CHN009	8	18	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
CAH020	9	19	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
JT012	10	20	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
SW1	10	20	----- ----- ----- ----- ----- ----- ----- ----- ----- -----									
			0.1920	0.2724	0.3529	0.4333	0.5138	0.5942	0.6747	0.7551	0.8356	0.9160

However, this arbitrary number was actually found to be quite reasonable, in that it represented a maximum fusion of a dissimilarity co-efficient of about 0.5, which is roughly equivalent to that separating the Floristic Community Types of Gibson *et al* (1994) for the Swan Coastal Plain. However, the 0.5 dissimilarity level suggests that there is significant variation within these twenty groups. Examination of the dendrogram in Figure 1, clearly show this variation within the groups, with the larger ones having several sub-groups.

The dendrogram in Figure 1 also shows that most of the sites (quadrats) tended to group with sites from the same sub-area (vegetation remnant) from the survey area. Thus, the classification suggests that much of the variation between sub-areas is determined by geographically related factors, probably soil/geology and topographic differences.

As can be seen in the dendrogram (Figure 1), and more graphically in Figures 2 to 5, all three of the site classifications (all species, without weeds, and using cover) showed strong localization of the variation in community composition. The initial impression from the classification with weeds included was that the control of these patterns might have been differential grazing pressure, which would be (partly) consistent with the land use history of the different sub-areas. This is because grazing pressure, to the level observed in the survey area, causes an increase in the abundance of weeds, and in the number of weed species.

To investigate this issue, analysis of the dataset with weeds removed was carried out. However, the reasonable accord of the three classifications suggested other fundamental factors were influencing the composition.

The challenge is defining the controlling factors and, thereby, building a model of the response of species and communities to the Coomberdale chert landscapes. Clearly, there are strong relationships between plant species and vegetation to soil and geology. *Regelia megacephala* vegetation is an obvious example of vegetation from which many species are absent, because of its harsh habitat. However, absences are also a product of differentially applied modifying agents such as man, stock and rabbits and it is difficult to interpret such absences of species from communities in a similar manner.

Are, the geographic variations clearly present in these data a product of habitat variation, or is it differential disturbance? Clearly, there is some of both, with the marked habitat differences between some of the sub-areas suggesting that the role of such variation is fairly strong.

The shaded relief map (Map 3 sheets A-F above) indicates clearly that the landscape of the sub-areas vary considerably. Cairn Hill and to some degree Cairn Hill North have the greatest

relief while Gardiner's Hill for example is mostly gently undulating (although it includes one moderate sized valley). The Eastern Ridge and John Tonkin's property have intermediate relief. These landscape differences are accompanied by soil type differences that would undoubtedly support different plant communities.

Thus, it is inferred that the significant variation in the composition of the floristic community groups defined in the analysis is probably present because of the landscape and geologically controlled soil parent material. Grazing pressures has also fairly obviously been a factor in contributing to the current differences in composition in the floristic community types from different areas. However, what the specific effects of grazing have been are far from clear. It is obvious that some weed species have been introduced. But, just what native species may have been lost from different quadrats (and the vegetation they sample) is more problematical.

Most classification formulae are based on a combination of what species are present and what species are absent in the vegetation being analysed. These methods are thus very sensitive to absences as well as to presences. This needs to be appreciated in the interpretation of the significance of the floristic community types identified using such analyses.

Figure 11 is a representation of the results of the classifications of species and of sites. It shows both species and sites ordered in their respective classification order. The species are shown grouped at the 80, 40 and 20 group levels and the sites grouped at the 10 and 20 group levels. The values shown are the cover-coded values for the species at the particular site, however cover was not used in these classifications.

The most obvious point to be seen from Figure 11 is that some species appear to be largely ubiquitous (ie, frequently present, although not abundant in all the types they occur in – dominant or abundant in some uncommon in others) in the vegetation of the survey area, these include *Hibbertia subvaginata*, *Allocasuarina huegeliana* and *A. campestris* and form species group 80 at the end of the figure. However, many of these more or less ubiquitous species are absent from the quite distinct communities of site groups 17 to 20. Due to their size, life span and ability to cope with disturbance, a number of these species are unlikely to be missing from site groups 17 to 20 as a result of grazing.

Figure 2: Schematic representation of the location of the quadrats in the survey area sub-areas.

Notes: To provide better separation of the quadrats, the E-W scale is about 2x that of the N-S. CAH = Cairn Hill; CHN = Cairn Hill North; EOR = Eastern Ore body; ERG = Eastern Ridge; GH = Gardiner's Hill; JT = John Tonkin's; SW = Stan Ridgway's property; WDM = proposed Waste Dump; WOR = Western Ore body; ART = A. & R. Tonkin's.

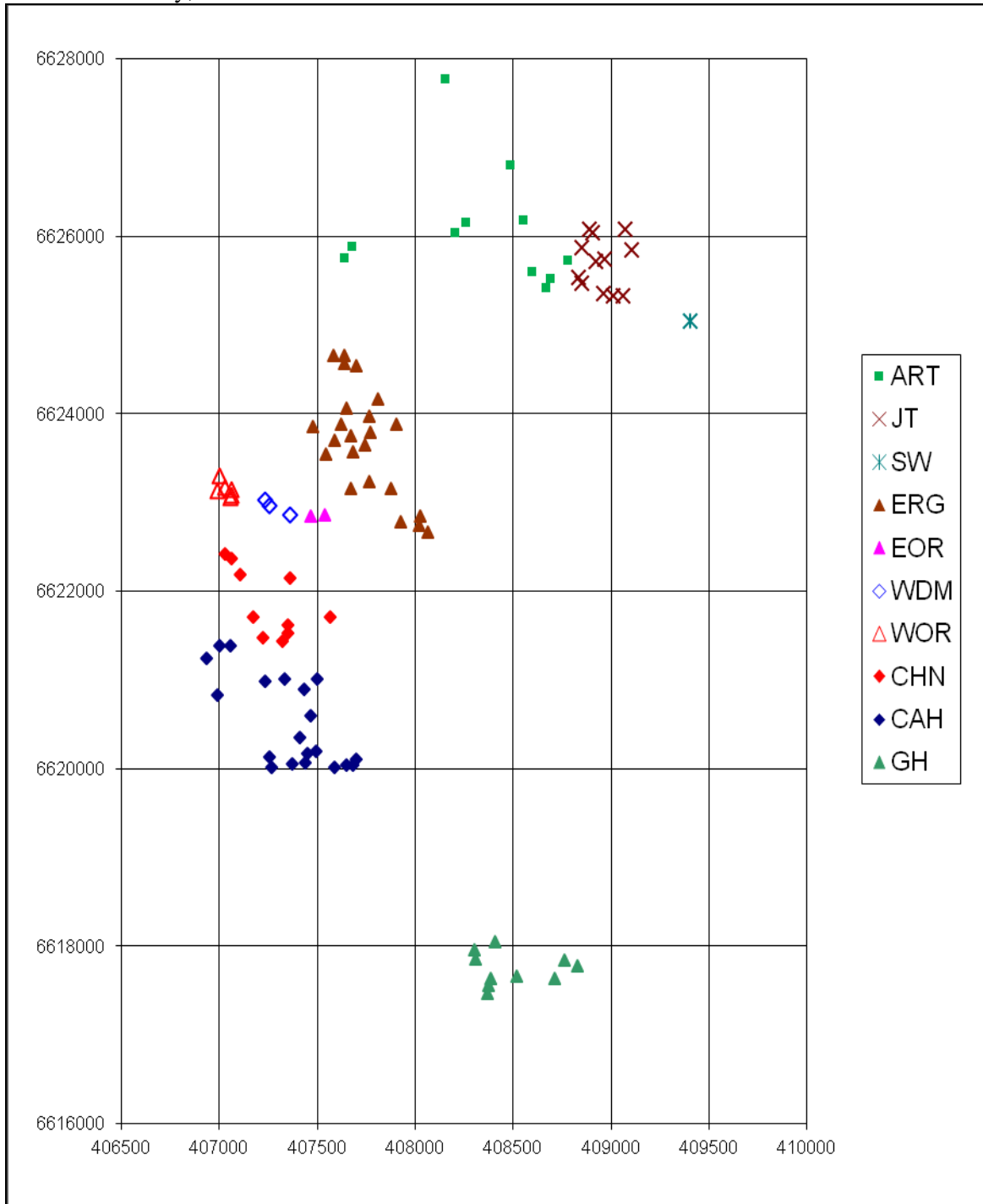


Figure 3: Distribution in the survey area of the groups defined at the 20-group level in the classification using all (native and introduced) species, including A. & R. Tonkin property sites.

Notes: The same symbol shape indicates quadrats in a group at the 10-group level. To provide better separation of the quadrats, the E-W scale is about 2x that of the N-S scale. Especially note that this is the 2006 classification, with the A. & R. Tonkin's property sites (ART) assigned to it by a separate process. Particularly important is that Group 0 (green squares) is those ART sites that do not fit the 2006 analysis; these sites probably represent several units at this level new to the survey area.

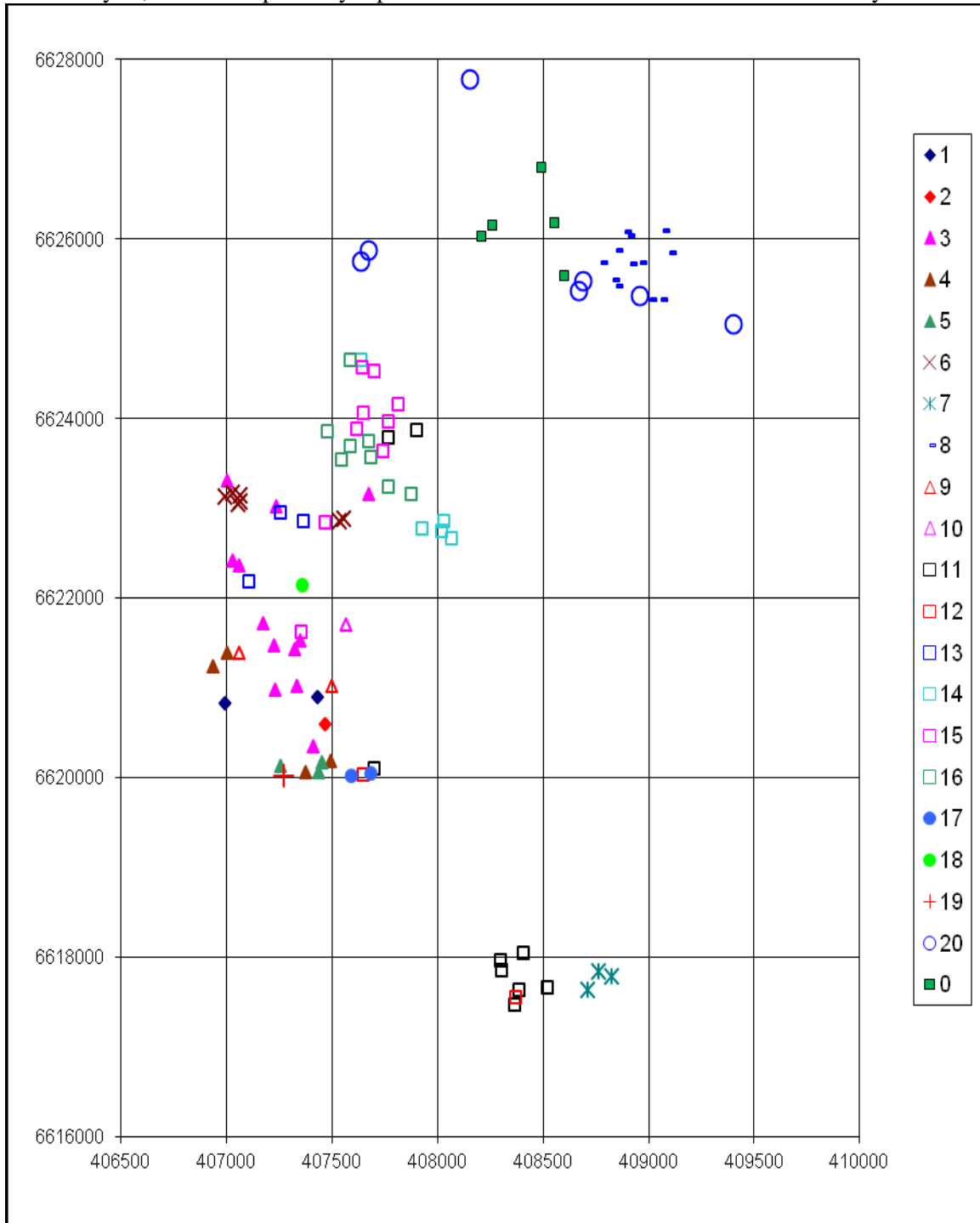


Figure 4: Distribution in the survey area of the groups defined at the 20-group level in the classification using native species only (ie. introduced species excluded), 2006 data only.

Notes: The same symbol shape indicates quadrats in a group at the 10-group level. To provide better separation of the quadrats, the E-W scale is about 2x that of the N-S scale.

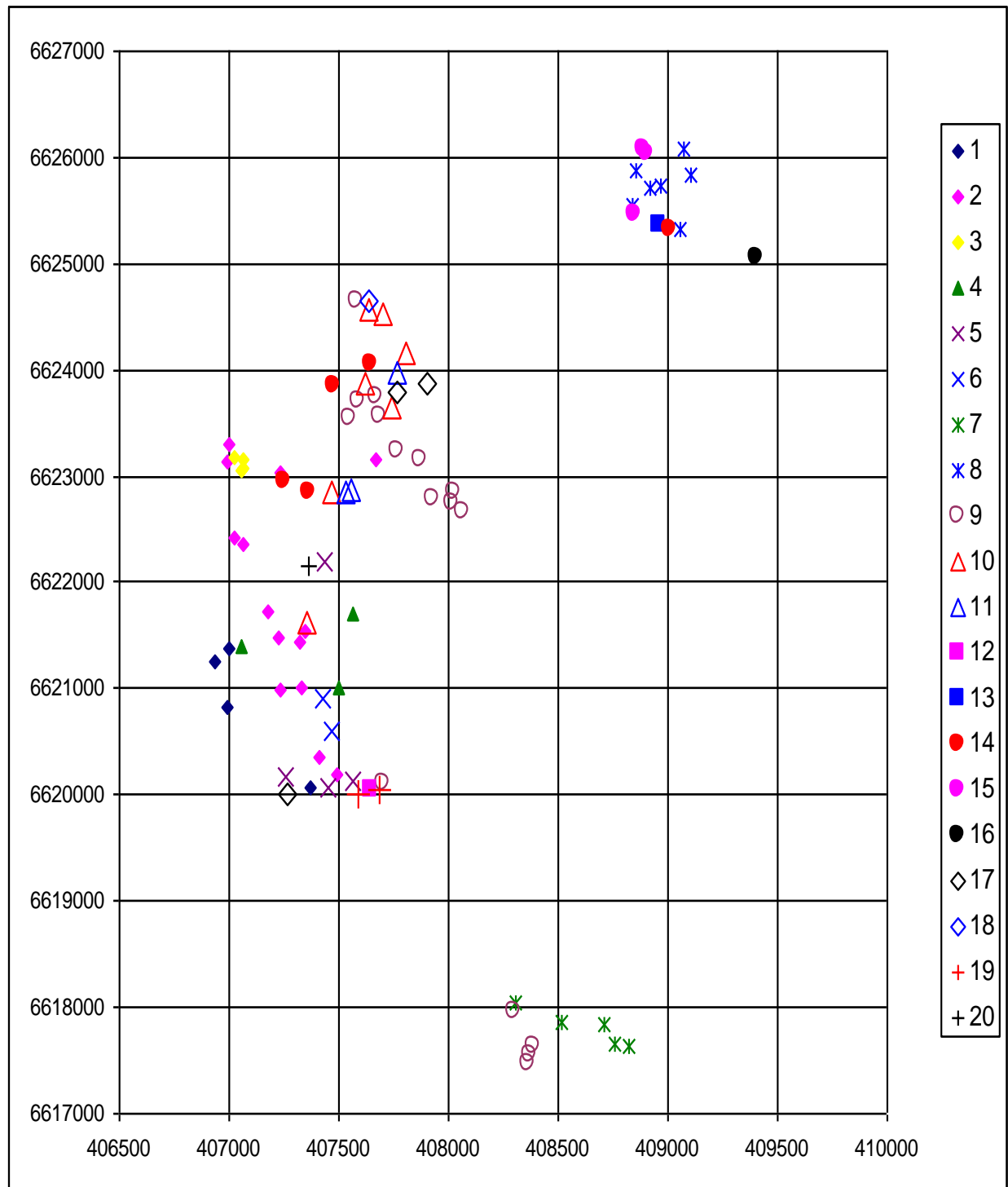
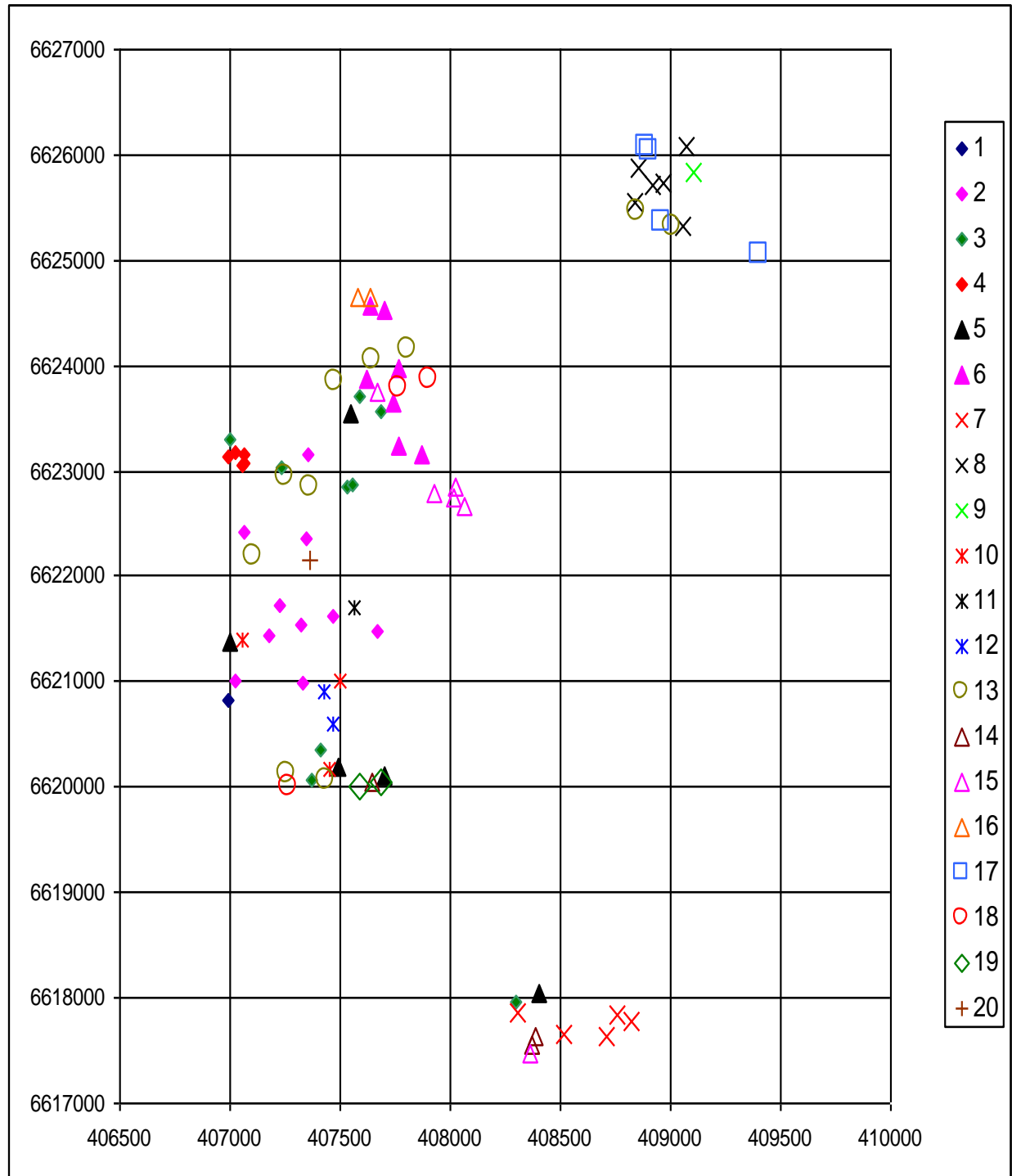


Figure 5: Distribution in the survey area of the groups defined at the 20-group level in the classification using cover of native species only (ie. introduced species excluded), 2006 data only.

Notes: The same symbol shape indicates quadrats at the 10-group level. To provide better separation of the quadrats, the E-W scale is about 2x that of the N-S scale.



While species group 79 has species that are common in many communities, many species in this species group have low frequency in the quadrats located in the vegetation of the Eastern Ridge. This group include the species *Melaleuca calyptroides*, *Dryandra sessilis* and *Drosera erythrorhiza*. Most of the species are, however, infrequently present, either across communities or confined to one or two communities. Of the latter group of species, the presence of such species as *Eucalyptus wandoo* or *Dodonaea inaequifolia* is definitive of communities 12 and 17 respectively.

The overall conclusion then is that, some of the floristic groups on the chert hills form a suite with floristic changes apparently defined as much by “absences” of species as by presence of species. Standing out from these floristic groups there are a number of floristic groups with distinct *presences* of species that are *absent* from the other floristic groups.

For the purpose of discussion and interpretation of floristic patterns, the classification using all native and introduced species was used.

14.3 Addition of 2010 sites to classification.

The number of native species in the 11 quadrats on the A. & R. Tonkin property was relatively low (Table 7), but the number of weeds was similar to other sub-areas. Typically, low species richness of new sites (when adding them to a pre-existing classification) has a major influence on the results of classifications. As the low richness might be because of the 2010 drought, it was possible that the analysis of the combined data might be drought affected. Also, were weeds to be included in the data for analysis, they are likely to have a major influence on the classification of the ART sites. This is because weeds were a much higher proportion of the species in ART than in other areas.

It was concluded that a more reliable inference of the floristic patterns would be obtained from techniques to match to the existing 2006 classification with the weed species omitted.

14.3.1 Matching methods

To match the new data from A. & R. Tonkin's property to the 2006 classification, both classification and nearest neighbour analysis techniques were employed, and each with two data sets: firstly all natives and secondly perennial natives. From the classifications (dendrograms showing relationships), the most likely group for a new site is inferred from the group of the previously classified sites to which it is joined. From the nearest neighbours, the

most likely group for a new site is inferred from the group of the previously classified sites to which it is most similar.

Table 7. Average richness of the survey sub-area per site by species group

Note.: weeds* dark shading indicates weeds are >30% of All. pale 20-30%. else <20% . CAH = Cairn Hill; CHN = Cairn Hill North; EOR = Eastern Ore body; ERG = Eastern Ridge; GH = Gardiner's Hill; JT = John Tonkin's; SW = Stan Ridgway's property; WDM = proposed Waste Dump; WOR = Western Ore body; ART = A. & R. Tonkin's.

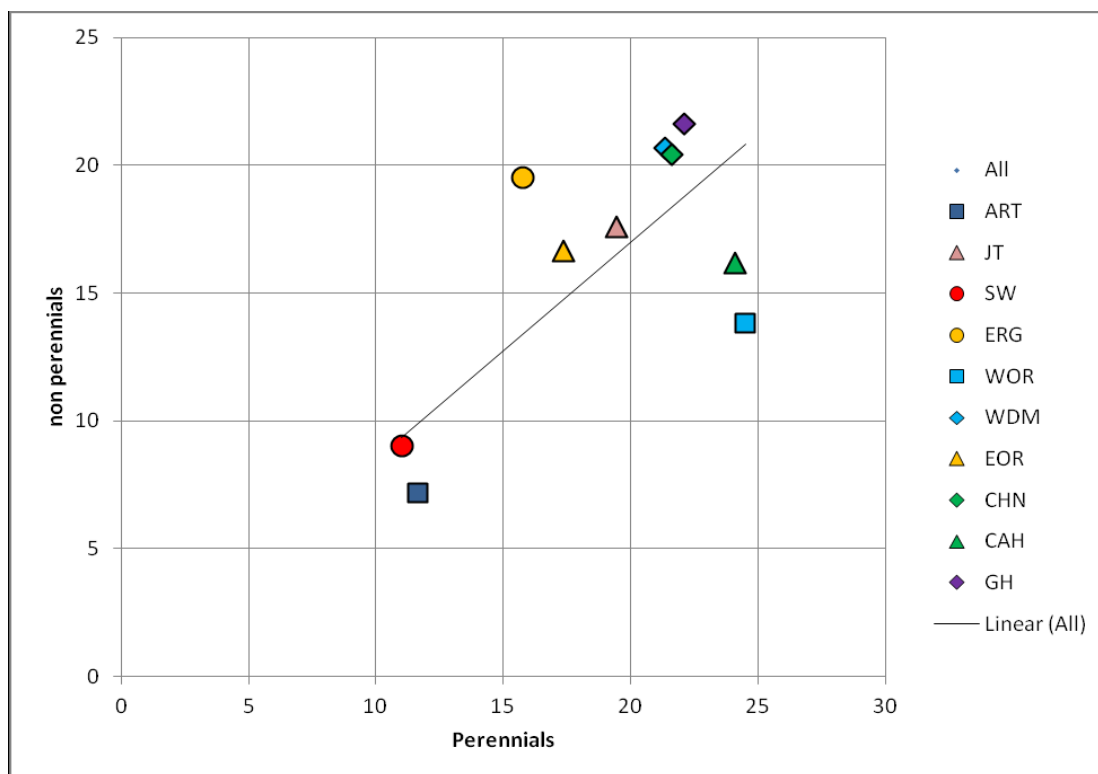
Sub-area	Number of sites	Average number of species per quadrat				
		All	Weeds*	Native	Perennial	Non perennial
ART	11	31	12	19	12	7
CAH	20	46	7	40	24	16
CHN	10	51	9	42	22	20
EOR	3	47	13	34	17	17
ERG	23	48	12	35	16	20
GH	10	53	10	44	22	22
JT	12	50	13	37	19	18
SW	1	32	12	20	11	9
WDM	3	54	12	42	21	21
WOR	6	50	11	38	25	14

The classification using all native species produced a strong clustering of the ART sites to their cohorts rather than those from other areas (Figure 9 – see six pages below). Such results make it difficult to infer a group for new sites as it suggests data inconsistencies. In this case, it suggests that the ART dataset may have a systematic bias (possibly due to the drought period they were recorded in, but possibly due to other factors). This problem was largely overcome through a technique known as single-site-insertion, where one new site is added and classified separately.

The possibility of a systematic difference was evaluated at a gross level by reviewing some aggregate statistics. Clearly the ART sites had fewer native species (Table 7), including perennial and non-perennial lower to a similar degree (Figure 6).

It is conceivable that there are relatively fewer non-perennial natives, consistent with the drought. But the values are not so low to be unequivocal about this inference; it depends on should the number of non-perennial be related to the number of perennial, or should the number of non-perennial be similar to the number in other areas.

Figure 6. Average number of non-perennial natives against average number of perennial natives



14.3.2 Matching results

The floristic group suggested for the sites from A. & R. Tonkin's property (ART sites) varied somewhat between the method (classification or nearest neighbours) or the datasets. The latter was to be expected to some degree and more notice was taken of that from the all natives rather than perennials only. Predominantly, the closest groups for the ART sites (existing floristic groups 20, 8, 16 and 6 at the 20-group level) were from areas nearby, particularly sub-areas JT, SW and to a lesser degree ERG and WOR. The nearest sites come from these nearby areas.

The inferred groups are shown in Figure 9 in which it can be seen that they appear consistent with the classification where all sites were included, but from which it was difficult to make reasonable inferences. Of particular note is that several sites have no group assigned. This is because the evidence is such that these sites appear to be significantly different from the 2006 (Trudgen et al 2006) sites (and therefore groups) and therefore represent new groups at the same level as the 2006 classification. The data suggests there are several new groups but the uncertainty about the impacts of the drought on the data means that it is not possible to be definitive in clarifying this.

Table 8. List of quadrats recorded on A. & R. Tonkin's property with assignment to the groups from the 2006 classification and their vegetation descriptions

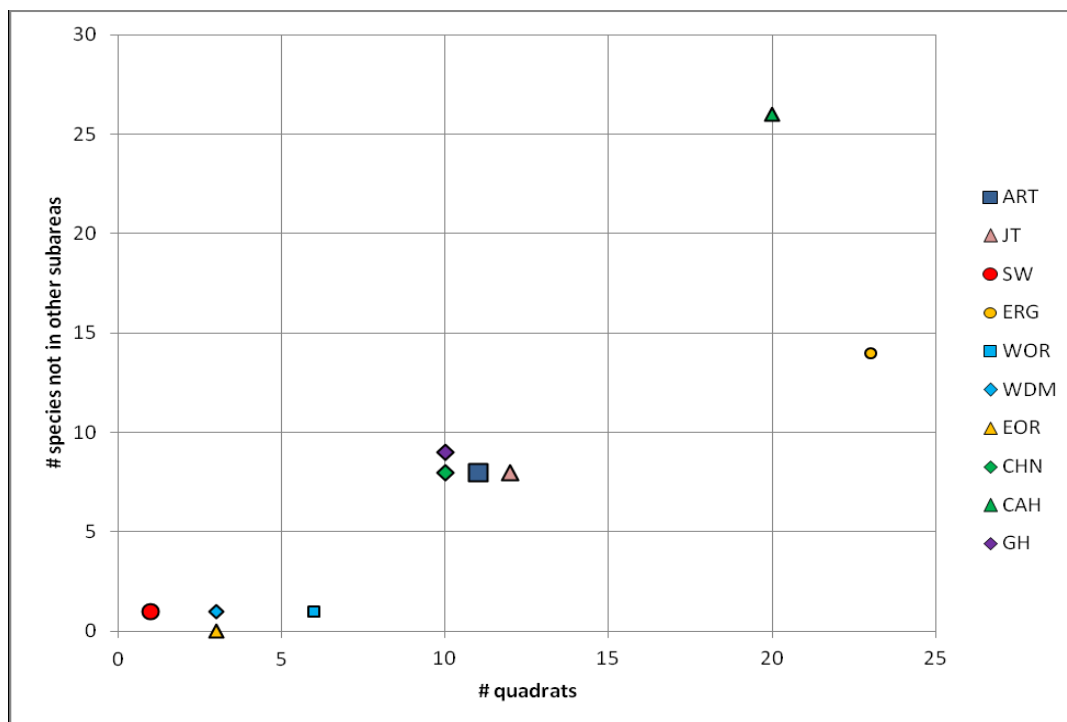
Notes. An "N" in column two indicates a probable new group.

Site	Assigned to group	Vegetation Description
ART01	N	Regelia megacephala open scrub over Ricinocarpos muricatus scattered shrubs over Dichopogon capillipes, Lepidosperma sp. (ART01-07), scattered herbs and sedges and *Ursinia anthemoides, Hypochaeris glabra, Ehrharta longiflora, *Vulpia myuros annual herb/g
ART02	N	Allocasuarina humilis open heath over Stylium septentrionale, Borya laciniata, Cheilanthes adiantoides open herbland/fernland.
ART03	N	York gum low woodland to low open forrest over Melaleuca concreta over Austrostipa sp. (perennial) scattered low tussocks (with scattered introduced herbs and grasses)
ART04	8	Acacia acuminata scattered low trees overs Kunzea praestans (Dryandra sessilis) open scrub over Hibbertia racemosa low shrubland over Desmodium flexuosum low open shrubland and Cheilanthes adiantoides, Cheilanthes distans low open fernland.
ART05	N	Allocasuarina huegeliana scattered low trees over Regelia megacephala high shrubland over Cheilanthes adiantoides Low open herbland.
ART06	20	Allocasuarina huegeliana, Acacia acuminata low open woodland over Allocasuarina campestris high shrubland over Cheilanthes adiantoides open fernland and Asteraceae/Poaceae (native/weedy) annual herb/grassland.
ART07	20	Allocasuarina huegeliana low woodland over Xanthorrhoea preissii scattered shrubs over Hibbertia racemosa, Trymalium sp. low open shrubland over Cheilanthes austrotenuifolia low open fernland with Ursinia anthemoides, Dioscorea hastifolia
ART08	20	Allocasuarina huegeliana, Acacia acuminata low open forest over Xanthorrhoea preissii open shrubland over Lomandra sp. (ART08-02), Neurachne alopecuroidea, Austrostipa sp. (ART08-05) scattered low grasses and *Ehrharta longiflora, *Avena fatua annual grassland
ART09	N	Kunzea praestans, Dryandra sessilis high shrubland to open scrub over Xanthorrhoea preissii open shrubland over Hibbertia racemosa low open shrubland over *Avena, *Bromus diandrus, Hypochaeris glabra annual grass/herbland.
ART10	20	Allocasuarina huegeliana low open forest over Allocasuarina campestris, Xanthorrhoea preissii shrubland/high shrubland over Hibbertia racemosa low open shrubland over Austrostipa sp. (ART10-14?, ART10-06) scattered grasses.
ART11	20	Eucalyptus accedens scattered trees over Acacia acuminata, Allocasuarina huegeliana low woodland over Xanthorrhoea preissii scattered shrubs/tall shrubs over annual grassland and herbland.

The assigned groups are included in Figure 3.

The quadrats on A. & R. Tonkin's property have eight native species not in other areas. However, this degree of difference in flora composition appears consistent with other sub-areas (Figure 7), which also have species not found on A. & R. Tonkin's property or variously in other sub-areas. This supports a conclusion that A. & R. Tonkin's property has genuine differences in its floristics to the other sub-areas of the survey area.

Figure 7. Number of species only in each area related to the number of sites in the area



14.3.3 Discussion of inferences made

The data shows that A. & R. Tonkin's property largely has vegetation floristically related to the adjacent sub-areas. However, it appears likely that the vegetation on this property includes some that appears to be unique to it in the survey area. However, more evidence is needed to confirm that this property contains vegetation of significance, as given the present data it is not possible to differentiate with certainty what is an artefact of the disturbance history from real floristic differences.

14.4 Regional Variation

The Proterozoic Moora Group of rocks extend for over a hundred kilometres from Moora to Three Springs. This group of rocks is highly variable, having occurrences of the Coomberdale chert and a range of other altered sedimentary rocks. Folding, faulting and intrusions have imprinted features on these rocks that have further influenced the range of landscapes developed on the Moora Group. As a result of the combination of these factors and further differences caused by variation in the degree of weathering, and the presence or absence of covering material, a wide range of substrate as habitats for plant communities has been developed.

Outside the current survey area, a limited number of chert areas have been examined and their plant community composition recorded. This is partly due to the limited amount of native

vegetation that remains on chert areas and partly due to the limited botanical survey work that has been carried out in the region. In apparent contradiction to the current survey area, where it is often massive and outcropping, some areas of chert soils are preferred farming land.

Figure 8 is a dendrogram representing the floristic classification of the 29 relevés recorded on chert areas by Griffin (1992). (Note these data were captured less efficiently than the current data and could not readily be incorporated for the regional analysis.) The distribution of these sites is from Cairn Hill to the southern end of Pinjarrega Nature Reserve is shown in Figure 7. This classification suggests that the vegetation of Cairn Hill, as a representative of that of the Coomberdale area, is quite different from even the Jingemina area of Watheroo National Park, which has some moderately dissected landscape with exposed chert.

The data also tend to suggest that these small islands of chert within a sea of sandplain have a mixture of species. There are some typical plants (eg *Kunzea praestans*), but also locally common species that do not occur in the Coomberdale area. Thus the indications from the available data are that the chert between Watheroo and Three Springs appears to have plant communities of significantly different floristic composition from those in the Coomberdale area and that therefore chert areas in Watheroo National Park are not similar to those in the Coomberdale area

Figure 8: Dendrogram showing the classification of the sites recorded by E.A. Griffin from Cairn Hill to the southern end of Pinjarrega Nature Reserve

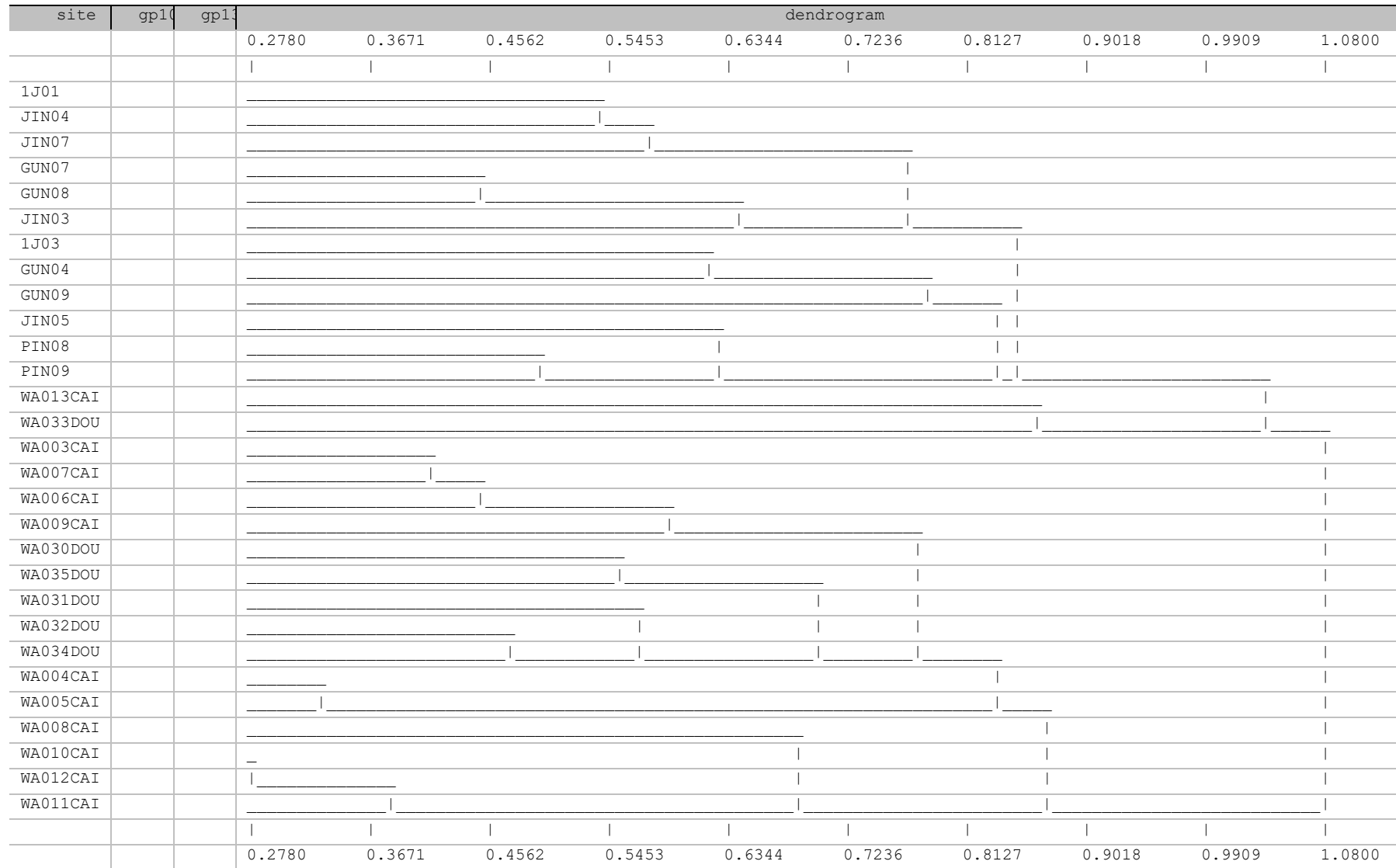


Figure 9. Dendrogram of Classification 2010 and 2006 sites using all native Species.

Notes. A. & R. Tonkin's property (ART) quadrats highlighted. The group-20 classification in the second column is based on the 2006 data (all species), while the group-10, second group-20 and group-40 are from the new classification

site	g20	gp10	gp20	gp40	data							
					0.2380	0.3404	0.4429	0.5453	0.6478	0.7502	0.8527	0.9551
ART001	-	1	1	1	_____							
ART005	-	1	2	2	_____ _____							
ART004	8	2	3	3	_____ _____							
ART009	-	2	3	3	_____ _____							
JT010	8	2	3	4	_____ _____							
ART006	20	3	4	5	_____							
SW1	20	3	4	5	_____ _____							
ART011	20	3	4	6	_____ _____							
ART007	20	3	4	7	_____ _____							
ART010	20	3	4	7	_____ _____							
ART008	20	3	4	8	_____ _____ _____							
CAH001	1	4	5	9	_____ _____							
CAH015	4	4	5	9	_____ _____							
CAH007	4	4	5	9	_____ _____							
CAH002	3	4	5	10	_____ _____							
CAH011	3	4	5	10	_____ _____							
CAH006	1	4	5	10	_____ _____							
CAH005	3	4	5	11	_____ _____							
CHN006	3	4	5	11	_____ _____							
CHN002	3	4	5	11	_____ _____							
CHN003	3	4	5	11	_____ _____							
CHN004	3	4	5	11	_____ _____							
CHN008	3	4	5	11	_____ _____							
CHN007	3	4	5	11	_____ _____							
ERG014	3	4	5	11	_____ _____							
WDM001	3	4	5	12	_____ _____							
WOR002	3	4	5	12	_____ _____							
CAH004	5	4	5	13	_____ _____							
CAH017	5	4	5	13	_____ _____							
CAH019	5	4	5	13	_____ _____							

site	g20	gp10	gp20	gp40	data									
					0.2380	0.3404	0.4429	0.5453	0.6478	0.7502	0.8527	0.9551	1.0576	1.16
CAH008	4	4	6	14										
GH010	11	4	6	14										
WOR001	6	4	7	15										
WOR004	6	4	7	15										
WOR005	6	4	7	15										
WOR003	6	4	7	15										
WOR006	6	4	7	15										
CAH013	4	4	8	16										
EOR002	6	4	8	17										
EOR003	6	4	8	17										
ERG003	15	4	8	17										
CHN005	15	4	8	18										
ERG011	15	4	8	18										
ERG002	15	4	8	18										
ERG009	15	4	8	18										
ERG021	15	4	8	18										
EOR001	15	4	8	18										
ERG010	15	4	8	18										
CAH003	9	4	9	19										
CHN010	10	4	9	19										
CAH009	9	4	9	20										
CHN001	13	4	10	21										
JT002	8	4	10	22										
JT005	8	4	10	22										
JT006	8	4	10	22										
JT009	8	4	10	22										
JT004	8	4	10	23										
GH001	7	4	11	24										
GH003	7	4	11	24										
GH002	7	4	11	24										
GH004	11	4	11	25										
GH008	11	4	11	25										
JT001	8	4	11	25										
JT007	8	4	11	25										
JT008	8	4	11	25										

site	g20	gp10	gp20	gp40	data													
					0.2380	0.3404	0.4429	0.5453	0.6478	0.7502	0.8527	0.9551	1.0576	1.16				
JT003	8	4	11	25	_____													
JT011	8	4	11	25	_____													
CAH018	2	5	12	26	_____													
CAH010	11	6	13	27	_____													
ERG006	16	6	13	27	_____													
GH005	11	6	13	27	_____													
GH009	11	6	13	27	_____													
ERG005	16	6	13	28	_____													
ERG013	16	6	13	28	_____													
ERG008	16	6	13	28	_____													
ERG015	16	6	13	29	_____													
ERG023	16	6	13	29	_____													
ERG001	16	6	14	30	_____													
ERG007	16	6	14	30	_____													
ERG012	15	6	14	30	_____													
ERG018	14	6	14	30	_____													
ERG020	14	6	14	30	_____													
WDM002	13	6	14	30	_____													
WDM003	13	6	14	30	_____													
ERG004	11	6	14	31	_____													
ERG016	11	6	14	31	_____													
ERG022	14	6	14	32	_____													
ERG017	14	6	14	33	_____													
ERG019	14	6	14	33	_____													
GH007	11	6	14	33	_____													
CAH012	12	6	15	34	_____													
GH006	12	6	15	34	_____													
ART002	-	7	16	35	_____													
ART003	-	8	17	36	_____													
CAH014	17	9	18	37	_____													
CAH016	17	9	18	37	_____													
CHN009	18	9	18	38	_____													
CAH020	19	10	19	39	_____													
JT012	20	10	20	40	_____													

Figure 10: Distribution of the floristic groups in the sites recorded by E.A. Griffin.

Notes: The lowest cluster are in the Cairn Hill area (see Figure 8 for an expanded representation). The top left group are in the Pinjarrega Nature Reserve. The centre left group are in the Jingemia Hill area in Watheroo National Park. The others are in or near Gunyidi Nature Reserve.

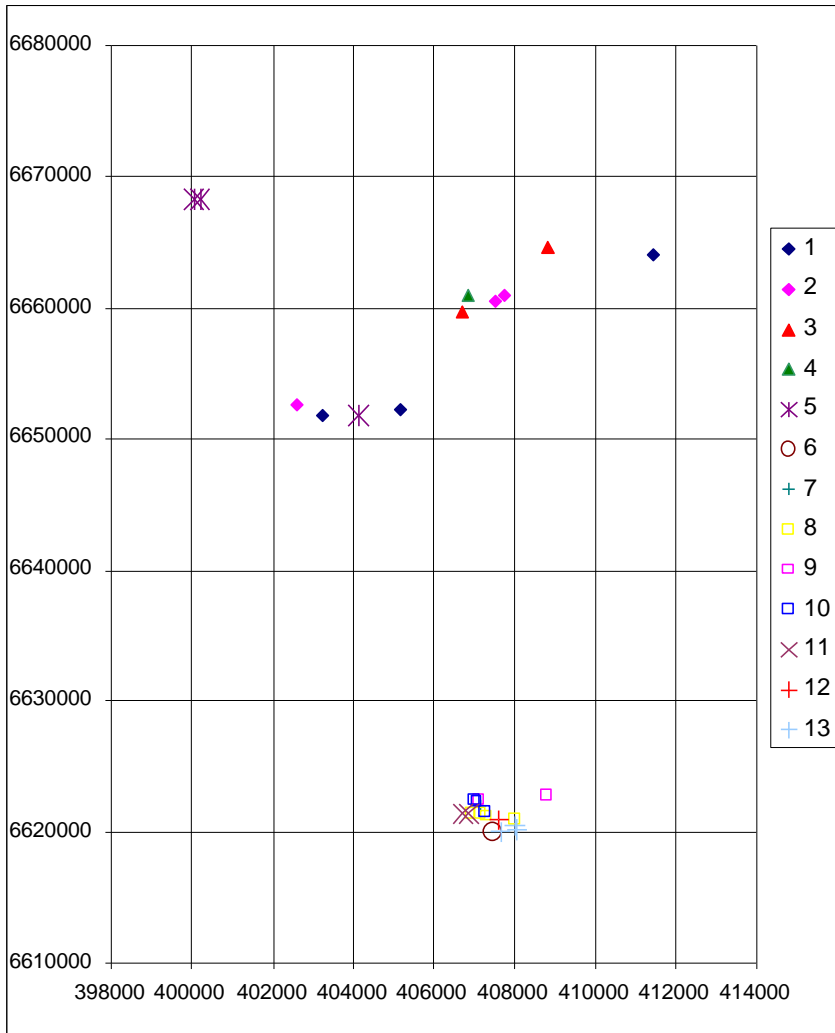
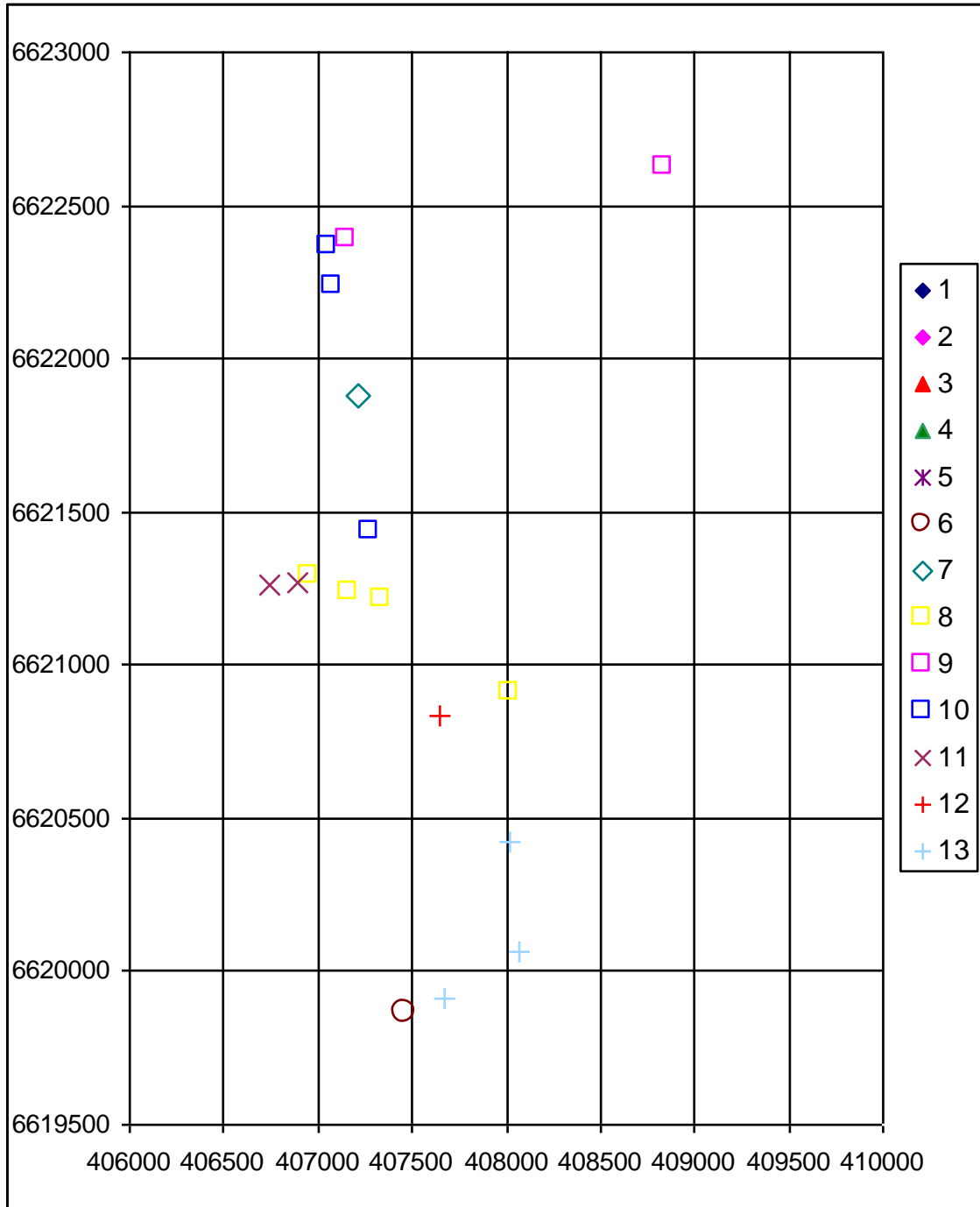


Figure 11: The distribution of the floristic groups in the sites recorded by Griffin in the Cairn Hill and Cairn Hill North survey sub areas and nearby.

Note: This is an expansion of the southern most group from Figure 7.



14.5 Overview of the floristic analyses

The results of the floristic analysis of the data collected in the 2001, 2006 and 2010 surveys indicate that there is significant variation in the composition of the vegetation in the different survey area sub-areas. While some of this difference reflects the effects of differential grazing pressure, the variation in landscape development and hence soil development is considered to be likely to be the major controlling factor.

While some ambiguity must remain around the issue of how much of the variation is a result of grazing, it is clear that the survey area sub-areas are largely not interchangeable in regard to the floristic variation in their vegetation and that this is not due to grazing. There is significant overlap in floristic composition between Cairn Hill and Cairn Hill North at the 10-group level (which is a very broad level). This would be expected, as they are contiguous, however, there is much less overlap between the other sub-areas at this level.

Table 9 is a summary of the distribution of the floristic groups (at the 10- and 20-group levels) in the different sub-areas of the survey. This table shows that a significant proportion of the variation sampled in the survey area is within Cairn Hill, which contains half of the groups defined at the 20-group level. Given that Cairn Hill has the largest topographic variation of the survey sub-areas, this indicates the importance of habitat range and type as an underlying cause of the development of the floristic groups found in the survey area.

Table 9 also shows that Cairn Hill North (CHN) has significant overlap with Cairn Hill, as six of the quadrats recorded in it are from the same floristic group at the 20-group level as three from Cairn Hill. The similarity is greater at the 10-group level, although at this level the groups defined are very broad. At the 20-group level the other four quadrats recorded in Cairn Hill North are from different floristic groups, so while there is overlap, there is also significant difference between these two survey sub-areas.

In contrast, most of the quadrats recorded on the Eastern Ridge (ERG) are from floristic groups (at the 20-group level) that are not present in Cairn Hill. The Eastern Ridge survey sub-area has overlap with both Cairn Hill and Cairn Hill North, but is significantly different from both. Like Cairn Hill North, it has less variation than Cairn Hill.

Table 9: Summary of Site classification (all species) by sub-area

Notes. The cell values are the number of quadrats in each combination. The values in bold indicate floristic groups restricted to one survey sub-area. CAH = Cairn Hill; CHN = Cairn Hill North; EOR = Eastern Orebody; ERG = Eastern Ridge; GH = Gardiner's Hill; JT = John Tonkin's; SW = Stan Ridgway's property; WDM = Proposed Waste Dump; WOR = Western Ridge, ART = A. & R. Tonkin's.

Groups at the 10 & 20 group level		Sub areas									
gp10	gp20	CAH	CHN	ERG	WDM	WOR	EOR	GH	JT	SW	ART
1	1	<u>2</u>									
1	2	<u>1</u>									
2	3	3	6	1	1	1					
2	4	<u>4</u>									
2	5	<u>3</u>									
3	6					5	2				
4	7							3			
5	8								11		1
6	9	2									
6	10		<u>1</u>								
7	11	1		2				6			
7	12	1						1			
7	13		1		2						
7	14			<u>5</u>							
7	15		1	7			1				
7	16			<u>8</u>							
8	17	<u>2</u>									
8	18		<u>1</u>								
9	19	<u>1</u>									
10	20								1	1	5
Other											5

The Western Orebody (WOR) mostly has (or had, it has now largely been mined) communities which it shared only with the Eastern Ore body. However, one quadrat was from a floristic community type that was shared with several other survey sub-areas.

Gardiner's Hill (GH) has a mixture of floristic variation that is restricted to it (at the 20 and 10-group level) and variation shared with Cairn Hill and the Eastern Ridge. The overlap with Cairn Hill is low, as it is in floristic community types that are represented in Cairn Hill by one quadrat each, although one of these types included six of the quadrats from Gardiner's Hill.

The twelve quadrats on John Tonkin's property were referred to only two floristic community types, although the significant structural and dominance variation would have appeared to suggest more would be present. These were shared with A. & R. Tonkin's property (ART sites)

and Ridgway's property (SW site).

Five of the sites on A. & R. Tonkin's property appear to have floristically different vegetation from the other sub-areas. The data suggest these are from two different floristic types.

The colour coding on Figure 11 shows the distribution of the quadrats from the different sub-areas in the floristic groups (the heavier vertical lines group the quadrats into the floristic groups defined at the 10-group level). This figure shows the very wide distribution through the analysis of quadrats from Cairn Hill and Cairn Hill North, reflecting the diversity of habitats and vegetation types sampled in those areas. It also shows the somewhat lesser spread of sites from the Eastern Ridge, which had less diversity of vegetation and the small spread of the sites from the Western Orebody and the other survey sub-areas. The Western Orebody sites were in two floristic groups in this analysis, but only in one in the first analysis.

14.6 Comparison of the floristic analysis to the structural/dominance classification

It was not possible to compare all the different levels of floristic community types defined in the floristic analysis to all of the units of the three layers of the structural dominance classification of the vegetation given in section 12 above. Such a complete comparison would require having at least one quadrat in each of the many plant communities defined (if not most of the polygons mapped) and is outside the scope of this report. However, it was possible to compare the floristic groups the 88 quadrats were placed in with the plant community and vegetation alliance they were placed in (see Table 10)

Bearing in mind that for the diversity of the vegetation sampled the number of quadrats is not very large, some points can be made. Firstly, ten plant communities that had more than one quadrat recorded in them had quadrats placed in two or more floristic groups and of these, for six plant communities, quadrats were placed in different floristic groups at the 20-group level. This shows that these plant communities, while having similar structure and dominance are significantly variable floristically. Secondly, in the nine other cases where more than one quadrat was recorded for a plant community the two quadrats sampled were placed in the same floristic group at the 40-group level. This suggests that these communities are more tightly defined. Together, these points suggest that the ranking of the plant communities defined as mostly at that level, but with some varying to near the vegetation association level is likely to be correct.

One plant community (RmKp1, one of those dominated by *Regelia megacephala*) had three quadrats allocated to group 23 and two to group 25 at the 40-group level (both of which are in

group15 at the 20-group level). Two other *Regelia* plant communities had two and three quadrats respectively placed in the same floristic group at the 40-group level, while another had one quadrat in one group and two in another. This suggests that a more detailed classification of the *Regelia* vegetation would define more plant communities, but that a proportion of those defined are close to the plant community level, while others are broader.

Table 10. Comparison of floristic analysis to structural/dominance classification

Notes: See section 12 for descriptions of vegetation alliances and Appendix 7 for descriptions of the plant communities. The numbers in cells are numbers of quadrats (only from 2006 survey).

	Floristic analysis GP20	8	8	15	15	15	15	15	16	16	17	17	17	17	17	17	18	18	19	19
	Floristic analysis GP40	12	13	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Vegetation Alliance	Plant community code																			
1	Es1																1			
2	EwAc2										1									
2	Ew1										1									1
2	Ew2										1									
2	EwDi1										1									
2	EwT11											1								
3	El(of)1																		1	
3	E11												1							
3	E12												1							
3	E13															1				
3	E14										1									
4	EeRm1			1																
4	EeAc2	1																		
4	EeAc3		1																	
6	EoTd1																		1	
9	AhHs1																		1	
9	AhHs2															1				
9	AhAc1											1		1						
9	AhAc2												1							
9	Ah4							2												
9	AhKp1							1												
9	AhT11		2																	
9	AhT12										1								1	
11	Aa2																			1
11	Aa3																			1
11	AaT11										1									
11	AaT12																		1	
13	Ac3												1	1	1					
13	Ac4								1										1	
13	AcAs1												1							
13	AcAs2														1	1				
13	AcBsM4								1											
13	AcCq1							1												
13	AcId2				1															
13	AcId3				1															

15.0 CONSERVATION VALUE FOR FLORA

15.1 Context for assessing the conservation value for flora of the survey area

The appropriate context for assessing the overall conservation value of the survey area for flora is that it lies in the South West Botanical Province of Beard (1980), that within this Province it is located in the Avon Botanical District, close to the border of the Darling Botanical District. And, that within the Avon Botanical District it lies in the Coomberdale Floristic Region of Griffin (1992).

Within this context it is appropriate to consider various aspects of the flora of the survey area, such as the overall population of plant species, the presence of declared rare species, the presence of priority flora and other species of particular conservation interest species, and species whose populations on the subject land are of biogeographical interest.

15.2 The conservation value of the overall flora population of the subject land

The overall flora population of native vascular species of the various sub-areas of the survey area is consists of the populations of the three hundred and thirty-two (332) native species (four ferns, one gymnosperm and three hundred and twenty-seven angiosperms or flowering plants) recorded for it. This was an increase by one fern and nineteen flowering plants by the addition of the A. & R. Tonkin property to the survey area. There are also significant sized populations of lichens (often abundant on the chert boulders and outcrop), probably of fungi (impossible to estimate without specialist surveys) and smaller populations of mosses and liverworts.

In the context of the highly cleared nature of the Avon Botanical District, these populations persist in a very large area with a rich flora that has comparatively little native vegetation in secure conservation reserves (see section 16.0). For many of the native species recorded in the survey area, this means that their populations have already been greatly reduced compared to their size before European settlement. Thus, the conservation value of these remaining populations is that the flora populations of the survey area persist in a context where the original extent of plant populations has been greatly reduced by clearing of native vegetation, largely for agriculture, and the proportion of the original vegetation (and thus of flora populations) of the botanical district in secure conservation reserves is well below international and national objectives for secure reservation.

At the broad level of the Avon Botanical District, the conservation value for flora of the survey area is therefore very high. The long-term value is to some degree increased by the fact that the vegetation occurs on well-drained low hills, as many of the lower-lying existing conservation reserves in the Avon Botanical District are threatened by rising water tables and increased salination. The fact that the survey area is very close to the border of the Drummond Botanical District would not significantly change this assessment (although that

District has a higher proportion of its original vegetation remaining), as there are significant differences between the floras of the two Botanical Districts.

If the context is reduced from the Avon Botanical District to the Shire of Moora, the outcome is much the same, as some 85% of the Shire has been cleared for agriculture (Hamilton-Brown, 2000) and therefore any substantial areas of native vegetation would have very high conservation value for flora. The figure of 15% is also likely to underestimate the level of clearing, as it probably would not include roads and towns. The Shire of Moora also includes areas of the Drummond Botanical District, which has a much higher proportion of its original vegetation remaining so that the percentage of the Shire remaining vegetated underestimates the clearing of those areas in the Shire that are in the Avon Botanical District.

Similarly, if the context of the assessment is reduced to the Coomberdale Floristic Region of Griffin (1992), the regional floristic unit to which the vegetation of the survey area belongs, the outcome is similar. The Department of Environment and Conservation (DEC) considers the three major variants of the vegetation of the Coomberdale Floristic Region to be an Endangered Ecological Community (Hamilton-Brown 2000, p. 2) and the overall survey area (from north of Kiaka road to Dalaroo East Road) contains the largest remaining occurrence of this vegetation; and therefore of the plant populations it contains. As a large proportion of the Endangered Ecological Community (especially the types that grew on slopes, see section 16 below) has already been cleared and the unit had a fairly small original extent, the conservation value of it for flora is high.

It is suggested here, that the definition of the TEC would be improved if it were based on a vegetation complex concept. This would mean defining the areas mapped as native vegetation on chert or chert derived soils in this report as a Coomberdale Chert Vegetation Complex and basing the TEC (for the areas mapped) on those borders. This would remove the arbitrary nature of basing the definition on a few vegetation types and include the full range of vegetation types that actually occur on the chert. As is demonstrated in this report, many of these other vegetation types actually have much smaller extents than the types the TEC was originally based on and have very high conservation value.

15.3 Distribution of flora conservation values in the sub-areas

The distribution of this overall conservation value for flora in the various sub-areas of the survey area is shown (at the somewhat superficial level of species occurrence rather than populations) in Table 11. Predictably, this table shows that the sub areas with more variation in habitat (geomorphology/topography) and consequently of vegetation, have a larger number of species. Interestingly, Cairn Hill has the most native species recorded (168) in spite of the fact that more quadrats were recorded in the Eastern Ridge. This undoubtedly reflects the wide range of habitat sampled in Cairn Hill. However, it may also partly reflect the exclusion of grazing from Cairn Hill in contrast to the fairly regular grazing of the Eastern Ridge..

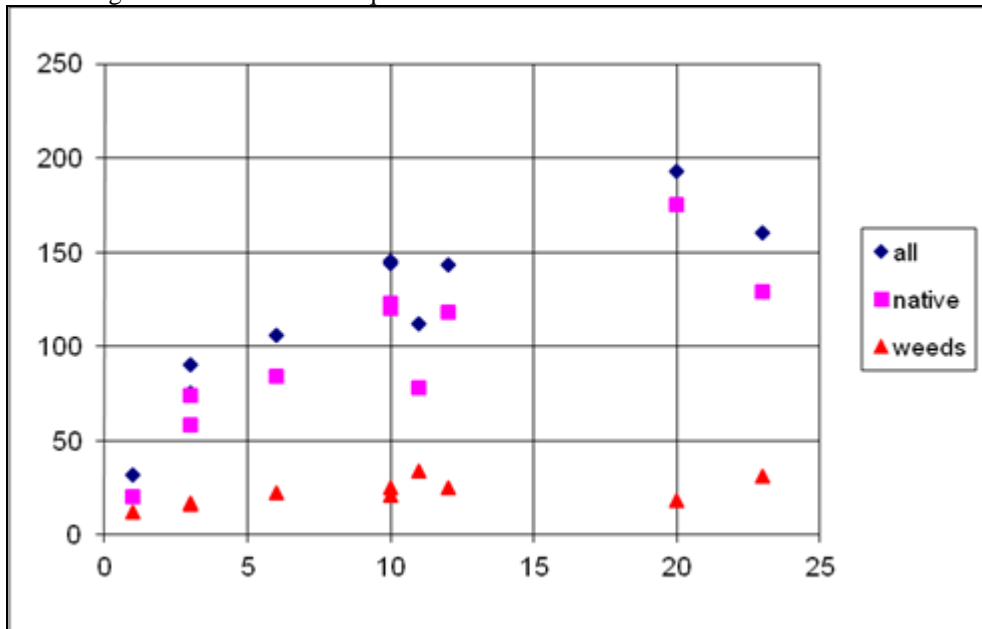
Table 11: Number of native flora species, number of weed flora species, total number of flora species recorded for the different sub-areas of the main survey are, and numbers of quadrats recorded in them.

Project sub-area	Number of quadrats	Total number of species	Number of native species	Number of weed species
Cairn Hill	20	186	168	18
Cairn Hill North	10	135	119	16
Eastern Ore Body	3	74	58	16
Eastern Ridge	23	150	123	27
Gardiner Hill	10	137	114	23
John Tonkin	12	133	111	22
Stan Ridgway	1	26	17	9
“Waste” Dump	3	87	71	16
Western Ridge	6	100	81	19
A. & R. Tonkin	11	155	121	34

The data in Table 11 can be shown diagrammatically (Figure 10), this shows the importance of the size of the individual sub-areas for flora conservation value. Larger sub areas had more quadrats in them and there is a generally steady increase in the number of native species with size in the sub-areas. This greater size also implies larger populations, which are likely to be more sustainable.

Figure 10: A plot of number of species recorded for individual survey sub-areas against the number of quadrats in the sub-area.

Note: Larger sub-areas had more quadrats recorded in them.



The Eastern Ore Body and the Proposed Waste Dump had fifty-eight (58) and seventy-one (71) native species respectively, reflecting their small size and low diversity of vegetation types. The Western Ore Body (now largely cleared) on the other hand compared very well in

terms of species diversity with sixty-nine (69) species recorded, although it also had a small range of habitat and vegetation types and most was cleared before the quadrats there could be re-visited. However, it should be noted that the Western Ore Body had more quadrats recorded in it than the Eastern Ore Body and the Proposed Waste Dump, and this would have increased the flora recorded.

15.4 Conservation value of the survey area for declared rare flora species

Four declared rare flora species have been recorded for the survey area. Two of these species, *Acacia aristulata* and *Daviesia dielsii* are widely distributed in it, occurring in all of the sub-areas. The total populations of these two species in the survey area are of very high conservation value for them. In fact, the population of *Acacia aristulata* in the survey area probably represents the major part of its known population. *Daviesia dielsii* has a larger range than *Acacia aristulata* (see Table 3 in section 11.2), however, the population of this species in the survey area is still probably a significant part of its total population as the vegetation over much of its range has been cleared.

The third and fourth declared rare flora species known for the overall survey area are *Synaphea quartzitica* and *Eucalyptus pruiniramis*. The only known population of *Synaphea quartzitica* in the survey area is in Cairn Hill Westrail Reserve, and it is very much less common locally than the other two declared rare flora species. *Eucalyptus pruiniramis* is also very uncommon in the survey area with one small patch in Cairn Hill and two small patches on Phil and Jenny Gardiner's property.

The value of the population of *Synaphea quartzitica* in Cairn Hill is quite high, as this is a very rare species with few known populations. The value of the populations of *Eucalyptus pruiniramis* in the survey is also high, as this species has a scattered distribution and these populations occur in a large gap in this distribution.

15.5 Conservation value of the survey area for priority flora species

Several species of priority flora are known from the survey area, these are: *Cryptandra glabriflora*, *Goodenia arthrotricha*, *Regelia megacephala*, *Baeckea* sp. Moora; *Guichenotia tuberculata*, *Wurmbea drummondii*, *Austrostipa exilis*, *Tricoryne* sp. Wongan Hills, *Stylidium glabrifolium*, *Stenanthemum tridentatum* and *Melaleuca sclerophylla*. Details of the priority level of these species and their occurrence in the various sub-areas of the survey area are provided in Table 4 (see section 11.3 above).

The overall conservation value of the survey area for these priority flora species is very high, although it varies for the individual species depending on factors such as the sizes of the population of them in the survey area and the proportion of their overall populations that the populations in the survey area represent.

Table 12: Occurrence of priority flora species in survey sub-areas

Sub-area → Species	A.&R. Tonkin	Cairn Hill	Cairn Hill North	Eastern Ridge	John Tonkin	Eastern OB	Waste Dump	Western Ore Body	Other
<i>Austrostipa</i> sp. Cairn Hill		Yes							
<i>Baeckea</i> sp. <i>Moora</i>		Yes	Yes			Yes			
<i>Cryptandra</i> <i>glabriflora</i>		Yes		Yes			Yes	Yes	
<i>Goodenia</i> <i>arthrotricha</i>		Yes	Yes	Yes					Gardiner' s Hill
<i>Grevillea</i> <i>amplexicans</i> ssp. <i>vestita</i>									Gardiner' s Hill
<i>Guichenotia</i> <i>tuberculata</i>									Dalaroo East Rd
<i>Melaleuca</i> <i>sclerophylla</i>									Gardiner' s Hill
<i>Regelia</i> <i>megacephala</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Gardiner' s Hill
<i>Stenanthemum</i> <i>tridentatum</i>									Gardiner' s Hill
<i>Stylidium</i> <i>glabrifolium</i>				Yes		Yes			
<i>Tricoryne</i> sp. <i>Wongan</i> Hills		Yes	Yes				Yes		

For *Regelia megacephala*, the value is extremely high as the populations in the survey area represents a major proportion of the known population and this species is very geographically restricted. The same applies to *Baeckea* sp. *Moora*, which is even more geographically restricted and has a higher proportion of its total population in the survey area. Similarly, the survey area has significant value for *Grevillea amplexicans* ssp. *semivestita*, which is known from relatively few populations.

On the other hand the value for *Cryptandra glabriflora* would be much less, as the species is considerably more widespread and has smaller populations in the survey area. The value for *Goodenia arthrotricha* would be intermediate as this species has a larger range than the *Regelia* or *Baeckea* and a smaller range than the other species and apparently has a small population in the survey area, the population of *Tricoryne* sp. *Wongan Hills* has similar value. The value for *Guichenotia tuberculata* would be low, as the only specimen came from a road verge. The value for *Austrostipa* sp. *Cairn Hill* would also be low as only one collection from

Cairn Hill was definitely this species (another may be). However, the species has a very sporadic distribution and the population is in a reserve and therefore has particular value.

The populations of *Stylidium glabrifolium* is a range extension and this species has very few records, therefore the population is of high value. On the other hand the population of *Stenanthemum tridentatum* is one of a relatively larger number and while it is at the northern limit of the species is not a great range extension, it therefore has lower value.

The value of the different sub-areas of the project area (see Table 12) for the priority flora species known from the survey area vary markedly. For example, Cairn Hill Westrail Reserve had populations of the *Baekkea* and *Regelia* while the Western Ridge had populations of the *Regelia* and the *Cryptandra*. Interestingly, the Eastern Ridge had only one less priority species than Cairn Hill Reserve, even though it has a smaller topographic range and less habitat range. The Gardiner property and the verge of the nearby Dalaroo East Road obviously have a different suite of species than further north. This reflects the significant differences between different parts of the survey area in their topography and minor differences in geology.

The fewer priority species recorded from the A. & R. Tonkin property probably partly reflects the drought year this property was surveyed in.

15.6 Conservation value of the survey area for other species of conservation interest

Several other species (see section 11.4 above) that occur in the survey area are of particular interest for conservation. They include *Calothamnus* aff. *quadrifidus* (Moora - Watheroo), *Bossiaea* sp. Cairn Hill (M. Henson CH2-28) and a *Hemigenia*

The value for the *Bossiaea* is very high as on current knowledge, as it is restricted to the Coomberdale Chert threatened ecological community in the survey area. However, it is likely that this species does extend a short distance outside the survey area.

The *Calothamnus* has a larger range and the conservation value of the survey area for this taxon is lower, although it needs to be noted that the population status of this taxon is only known from herbarium specimens, except for the survey area, where it is not common.

Hemigenia sp. The two specimens of this species could not be matched at the Western Australian Herbarium. The survey area has high value for this species.

Amblyosperma sp. If this is a distinct species, then the population in the survey area is the only known population. If it is *Amblyosperma* sp. Treeton, then the population is an extremely large range extension and has high value for that species.

Caesia sp. Moora, the material referred to this name appears to be a new species only known from the survey area. Obviously, the survey area has very high value for this species.

Leptospermum aff. *erubescens*, the material referred to this name is almost certainly a new species. As this taxon is only known from the two collections from the survey area, the survey area has very high value for this species.

As well as species that are of conservation significance because they are poorly known, the survey area has value for populations that are extensions of the range of the species. Two Orchid species fall into this category. The populations of *Cyrtostylis huegelii* and *Pterostylis* aff. *rufa* in the survey area extend the known ranges of these species (A. Brown pers com) and are of significant conservation value.

Eremaea sp. Cairn Hill (B. Morgan BMor 531)

One specimen of this taxon was collected on the property of Phil and Jenny Gardiner. As this seems to be the only record for this species the survey area has very high value for it.

Other taxa of interest for conservation in the survey area are discussed in section 11 above.

16.0 CONSERVATION VALUE FOR VEGETATION OF THE SURVEY AREA

16.1 Context for assessing the conservation value for vegetation of the survey area

The appropriate context for assessing the overall conservation value of the survey area for vegetation is that it lies in the Avon Botanical District of the South West Botanical Province of Beard (1980), near the border of the Darling Botanical District, and that within the Avon Botanical District it is located in the Coomberdale Landscape (Chert subsystem). Also relevant is that it lies in the Coomberdale Floristic Region of Griffin (1992).

The botanical province and district that the survey area lies in are relevant because these are broad scale areas defined on vegetation that the survey area vegetation lies in. However, they are probably too broad in scale for very meaningful comparisons to be made, except that they are known to have very high proportions of their areas cleared. The Coomberdale Floristic Region of Griffin (1992) is also a fairly large area and is possibly too broad to make meaningful comparisons to, except, again, to say that a large proportion of it is cleared.

The Coomberdale Landscape (Chert subsystem) is the best concept for making more detailed assessments within, as it is the original area that the native vegetation types still extant in the survey area would have been restricted to before clearing for agriculture. This is because the Coomberdale Landscape (Chert subsystem) is a geomorphology/soil unit and geomorphology and soils are a major control on the development of different vegetation types within areas of similar climate.

16.2 Conservation value of the vegetation of the survey area in the context of the Avon Botanical District

The Avon Botanical District is the basis of the IBRA (Interim Biogeographic Regionalisation For Australia) Avon Wheatbelt Bioregion (Thackway *et al.* 1995), that is, they are the same area with somewhat different names in different systems of mapping. Thackway *et al.* (1995, Table 14, p. 43) gives the reservation status of the Avon Wheatbelt Region as < 1%. The same authors (Table 15, p 51) give the "Dominant Condition i.e. context" as category "A", which is defined by them (p. 55) as "Modified ecosystems dominant i.e. very little indigenous ecosystem remains".

It is therefore quite obvious that any remnant of native vegetation in the Avon Botanical District (whether referred to as an IBRA region or a botanical district), except for those of trivial size, have high or very high conservation value for vegetation depending on their size, and to a lesser degree on their condition, the diversity of vegetation types present and the particular vegetation types present.

Leading on from this, the significant size of the vegetation remnants that comprise some of the sub-areas of the survey area must mean that they have very high conservation value for vegetation. The sub-areas that would be large enough to cross this threshold would seem to

be Cairn Hill, Cairn Hill North, the Eastern Ridge, Gardiner's Hill adjacent to the Dalaroo East Road (on the Gardiner property) and the areas north of Kiaka Road (John Tonkin's property and adjoining properties), although the latter might need to be considered as one or two such areas and some smaller areas. The position of the survey area at the border of the Drummond Botanical District (which has more native vegetation remaining) would not have any impact on these assessments, as that botanical district has vegetation quite different to that of the survey area.

This leaves smaller areas such as the Western Ridge, the Proposed Waste Dump, the small remainder of the Eastern Ore Body (the currently mined ridge) and small areas south of Cairn Hill and north of Kiaka Road. Some of these areas would still rate as having high conservation value (at least for their size, see note below), particularly those in better condition. This would include the Proposed Waste Dump, the Eastern Ore Body and any part of the Western Ridge that has not been mined, although the clearing of grid lines has impacted the latter area.

Note: There is an issue in this section concerning the use of "very high" conservation value for areas that are much smaller than some areas that might also be assessed at this level. However, the alternative seems to be to underrate the value of the areas being assessed. A non-linear scale is needed to solve this problem and is not available. Addition of "for its size" might help, but would tend to reduce weighting of the significance being assessed as present.

16.3 Conservation value of the vegetation of the survey area in the context of the Coomberdale Floristic Region

The conservation value of the remnant vegetation in the survey area can also be assessed in the context of the Coomberdale Floristic Region of Griffin (1992).

"The Coomberdale Floristic Region corresponds to the discontinuous, narrow (Å 2-10 km wide) outcrop of Noondine Chert from Jingemia to Moora with the largest most extensive outcrop between Coomberdale and Watheroo" (Hamilton-Brown 2000, citing Griffin 1992 and Carter and Lippelle 1982). However, Griffin (1992, p. 160) actually gives the distribution of his Coomberdale Region as follows "This region was mapped as discontinuous. It was essentially areas where the Moora Group of Proterozoic rocks, especially Noondine Chert, was outcropping. Small areas just east of Moora marked the southern limit. The main portion extended from Dalaroo East Road to Coomberdale, north of the survey area, and discontinuously beyond." That is, he does not give a northern limit at Jingemia Hill (although that may be his most northerly releve site).

Examination of the Moora 1:250,000 Geology map (Carter and Lippelle 1982) shows that the area of outcrop of the Noondine Chert in the current overall survey area is about one quarter of that mapped between Moora and Marchagee. Hamilton-Brown also gives a series of areas for the known occurrences of the threatened community, which total 551 hectares. It seems

from these points and examination of aerial photographs (including limited stereo-coverage) that the vegetation of the Noondine Chert has suffered significant clearing, apparently of greater than 60% in the Marchagee to Moora area, with the types on the lower slopes (mostly dominated by *Allocasuarina campestris*) being preferentially cleared.

Therefore, it seems firstly that the Coomberdale Floristic Region, of which the Moora Chert Threatened Ecological Community is a major component, was never abundant, and possibly was (before partial clearing) intrinsically rare although there may have been more than 2000 hectares, if that is taken as the (arbitrary) cut-off point (see section 9.0 above) for intrinsically rare. Certainly it seems that subsequent to clearing, with the known area of the threatened community totalling 551 hectares that this unit is either intrinsically rare (and has become rare due to clearing) or has become rare due to the amount of it that has been cleared. Whichever applies, it is obvious that all areas of it (except those of trivial size or very degraded) have high or very high conservation value for vegetation. It needs to be noted here that "Threatened Ecological Community" is not a standard term used for vegetation classification, and as used in this case by The Department of Conservation and Land Management includes a range of vegetation alliances, vegetation associations and plant communities (see section 12 above). Obviously, these each have much smaller areas than the overall Threatened Ecological Community, and are therefore individually very rare.

16.4 Conservation value of the vegetation of the survey area in the context of the Coomberdale Landscape (Chert subsystem)

Examination of Map 3, sheets A, Band C show that the Coomberdale Landscape (Chert subsystem) is fairly highly cleared, with about 80 to 85% (by visual estimation) of its original extent cleared. This means that the level of clearing is quite high and that any significant sized remnants have high conservation value for vegetation.

The *very high diversity* of the vegetation of the remnants of the Coomberdale Landscape (Chert subsystem) surveyed suggests that the conservation value for vegetation of these areas is higher than would frequently be the case for similar sized areas in the Avon Botanical District.

16.5 Contribution to conservation value of the remnants from their diversity

In the preceding section, the high diversity of the vegetation of the remnants surveyed was commented on. This deserves some more detailed comment.

Table 13 shows that the areas of remnant vegetation surveyed have high diversity of vegetation at the vegetation alliance (upper level of classification for the survey) and at the plant community level (lower level of classification for the survey). It also shows that the number of individual areas of vegetation (stands; map polygons) is high. This table confirms that the vegetation of the survey area is diverse and supports (because of the small polygon

size) the observation that the high diversity is driven by the development of numerous discrete plant habitats in the rocky landscape.

Table 13: Vegetation diversity attributes of the survey sub-areas

Survey sub-area	Number of vegetation polygons	Number of alliances	Number of communities
Cairn Hill	176	14	79
Cairn Hill North	126	13	49
Doblestein	15	4	5
Eastern Ore Body	2	1	1
Eastern Ridge	172	9	48
Gardiner's Hill	145	14	40
John Tonkin's	127	8	25
Ridgeway's East	68	8	23
Ridgeway's West	17	4	6
Small Eastern Remnants	137	15	32
Small Southern Remnants	116	13	30
Waste Dump	4	2	3
Western Ore Body	9	2	3
A. & R. Tonkin's	142	7	33

16.6 Different values of the sub-areas for conservation of vegetation

Examination of Table 13 and Table 14 (see below) shows that even at the Vegetation Alliance level, the highest level of the classification of the vegetation of the survey area used in this survey, the survey sub-areas have significantly different values. For example, eight out of the thirteen sub-areas in Table 13 have representation of the *Regelia megacephala* vegetation alliance. Further, for these eight, the area of the alliance varies from 0.2 hectares to 21.3 hectares.

Similarly, only three of the survey sub-areas had representation of the *Melaleuca calyptroides* vegetation alliance. For four of the vegetation alliances, only one-survey sub-areas had representation of the alliance.

The number of vegetation alliances in a remnant also varies very significantly, with Cairn Hill having fourteen (14) vegetation alliances recorded, while the Waste Dump site had only two, as did the Western Ore Body while the Eastern Ore Body only had one. Similar information for vegetation associations and plant communities (see Appendices) shows that at lower levels of treatment of the vegetation, that the differences between remnants become more pronounced.

Table 14: Occurrence of the vegetation alliances in the survey sub-areas.

Notes. The numbers in the cells are the areas of the alliances in hectares. Does not include A. & R. Tonkin property.

Veg Alliance no	Vegetation Alliance	Cairn Hill	Cairn Hill North	Dobelstein	Eastern Ore Body	Eastern Ridge	Gardiner's Hill	John Tonkins	Ridge-ways East	Ridge-ways West	Small Eastern Remnants	Small Southern Remnants	Waste dump	Western Ore Body
1	Eucalyptus salmonophloia woodlands to open forests	2.6	4.0				6.9				2.7	1.7		
2	Eucalyptus wandoo subsp. wandoo woodlands and open forests	9.3	0.2			1.8	6.4				1.7			
3	Eucalyptus loxophleba subsp. loxophleba low woodlands to low open forests	1.6	13.2	0.7		3.4	2.0		0.4	2.5	32.0	9.2		
4	Eucalyptus eudesmioides low mallee woodlands to low mallee open forests	3.3	1.0									10.8		
5	Eucalyptus camaldulensis open forest											0.9		
6	Eucalyptus obtusiflora low woodlands to low open forests	0.1	0.3											
7	Eucalyptus horistes low woodlands to low open forests	0.6	0.1									0.1		
8	Eucalyptus pruiniramis low woodland										0.0			
9	Allocasuarina huegeliana low woodlands to low open forests	11.9	5.2	4.4		18.8	9.9	10.5	1.5	0.4	14.0	14.0	0.7	
10	Casuarina obesa open forest									1.1				
11	Acacia acuminata subsp. acuminata low woodlands	2.5	4.7	15.5		5.6	2.7	4.2	12.2	2.2	5.6	2.3		
12	Banksia prionotes scattered low trees										0.8			
13	Allocasuarina campestris high shrublands to open and closed scrub	47.5	38.7	0.6	0.6	27.5	8.6	21.8	3.8		44.9	17.9	0.6	

14	<i>Allocasuarina microstachya</i> open scrub					0.0								
15	<i>Regelia megacephala</i> high shrubland to open and closed scrub	21.3	5.9			2.8	4.7	0.7			0.2	12.7		1.6
16	<i>Kunzea praestans</i> high shrubland to open and closed scrub	9.6	9.0			2.4	12.6	24.3	2.0		9.3	4.0		1.3
17	<i>Melaleuca calyptroides</i> open to closed heath	1.6						2.3	0.6					
18	<i>Hibbertia subvaginata</i> low shrublands to low open heath					0.7					3.5	0.9		
19	<i>Xanthorrhoea drummondii</i> high open shrubland										2.1			
20-1	<i>Dryandra sessilis</i> high shrublands to open scrub	0.2									7.7	2.9		
20-2	<i>Melaleuca concreta</i> open scrub		0.3				0.1							
20-3	<i>Melaleuca radula</i> high shrubland to open scrub						1.0				0.3			
20-4	<i>Melaleuca sclerophylla</i> open heath						0.2							
20-5	<i>Baeckea</i> sp. Moora (R. Bone 1993/1) low open heath	1.4	2.1											
20-6	<i>Calytrix leschenaultii</i> open heath					2.0		0.5						
20-7	<i>Calytrix depressa</i> low open heath						0.2							
20-8	<i>Calothamnus</i> aff. <i>quadrifidus</i> (Moora-Watheroo) high shrubland						0.2	0.1	0.1			0.5		
20-9	<i>Ricinocarpus muricatus</i> shrubland to open heath								2.9					
20-10	<i>Ricinocarpus velutinus</i> open heath										3.1			

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Griffin, E.A (1999). Floristic classification of the vegetation of Lots 46 and 47 Maralla Road and Lexia Avenue Ellenbrook. Appendix 6 of Trudgen (1999) – see above.

**AN EXTENSION OF A
FLORA SURVEY,
FLORISTIC ANALYSIS
AND VEGETATION SURVEY
OF AREAS OF THE
COOMBERDALE CHERT TEC
TO INCLUDE A FURTHER AREA**

prepared for

SIMCOA OPERATIONS Pty Ltd

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APPENDIX 1. The Department of Conservation and Land Management Priority Flora Categories

Definition of CALM Declared Rare and Priority Flora categories (from Atkins 1998).

Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

Declared Rare Flora - Presumed Extinct Flora

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

Priority One - Poorly Known Taxa.

Taxa which are known from one or a few (generally < 5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

Priority Two - Poorly Known Taxa.

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

Priority Three - Poorly Known Taxa.

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

Priority Four - Rare Taxa.

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

APPENDIX 2. Vegetation structural table of Specht as modified by Aplin (1979)

Life form and height of tallest stratum	Projective foliage cover of tallest stratum as %	Description
Trees over 30 metres	70 -100	High closed forest
30 -70	High open forest	
10 - 30	high woodland	
2 -10	high open woodland	
under 2	Scattered tall trees	
Trees 10 - 30 metres	70 -100	Closed forest
30 -70	Open forest	
10 - 30	Woodland	
2 -10	Open woodland	
under 2	Scattered trees	
Trees under 10 metres	70 -100	Low closed forest
30 - 70	Low open forest	
10 - 30	Low woodland	
2 -10	Low open woodland	
under 2	Scattered low trees	
Shrubs over 2 metres	70 - 100	Closed scrub
30 - 70	Open scrub	
10 - 30	High shrubland	
2 -10	High open shrubland	
under 2	Scattered tall shrubs	
Shrubs 1 - 2 metres	70 - 100	Closed heath
30 - 70	Open heath	
10 - 30	Shrubland	
2 -10	Open shrubland	
under 2	Scattered shrubs	
Shrubs under 1 metre	70 - 100	low closed heath
30 - 70	low open heath	
10 - 30	low shrubland	
2 -10	Low open shrubland	
under 2	Low scattered shrubs	
Herbs/Sedges/Grasses	70 - 100	Closed herb, sedge, grassland
30 - 70	Herb, sedge, grassland	
10 - 30	Open herb, sedge, grassland	
2 -10	Very open herb, sedge, g'land	
under 2	Scattered herbs sedges, grasses	
Grasslands then divided into:		
Tussock grasslands (perennial tussock species, e.g. <i>Eragrostis</i> species);		
Hummock grasslands (<i>Triodia</i> and <i>Plectrachne</i> species that form hummocks)		
Curly spinifex grassland (<i>Plectrachne pungens</i> , which does not form hummocks)		
Annual tussock grassland (e.g. annual <i>Sorghum</i> species).		
The "curly spinifex grassland " division follows J.S. Beard.		

APPENDIX 3. Condition scale of Trudgen (1988)

E = Excellent. Pristine or nearly so, no obvious signs of damage caused by the activities of European man.

VG = Very good. Some relatively slight signs of damage caused by the activities of European man. E.g. some signs of damage to tree trunks caused by repeated fire and the presence of some relatively non-aggressive weeds such as Ursinia anthemoides or Briza spp., or occasional vehicle tracks.

G = Good. More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones.

P = Poor. Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man such as grazing or partial clearing (chaining) or very frequent fires. Weeds as above, probably plus some more aggressive ones such as *Ehrharta* spp.

VP = Very poor. Severely impacted by grazing, fire, clearing or a combination of these activities. Scope for some regeneration but, not to a state approaching good condition without intensive management. Usually with a number of weed species including aggressive species.

D = Completely degraded. Areas that are completely or almost completely without native species in the structure of their vegetation. I.e. areas that are cleared or "parkland cleared" with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX 4: Location of declared rare flora, priority flora and flora of special interest in the survey area

This appendix lists the locations recorded Declared Rare Flora (DRF), Priority flora and flora of special interest found in the study area. Recordings from the rare flora searches included plant numbers. In this case the numbers of plants were recorded for discrete groups of plants (within a 10 m radius of the GPS reading). However, in areas where rare plants occurred dispersed over a larger area, plant numbers were recorded within approximately 30 m of the GPS reading (the latter generally indicated by larger numbers of plants at a location).

The rare flora searches in the Eastern Ore Body, Waste Dump and Western Ore Body sub-areas were searches along grid lines about 15 metres apart. The northern two-thirds of Cairn Hill North and the central section of Eastern Ridge (adjacent to the current mine, waste dumps and rehabilitated dump areas) was similarly grid searched. Time did not permit completion of a search in the southern end of Cairn Hill North. Rare flora searches in the remaining parts of the Eastern Ridge and the sub-areas Kiaka Rd North, Gardiner property and Chester property were selectively but less intensively walked, focusing on habitats most likely to contain known DRF taxa.

Table 1 App4 below also includes locations of DRF, Priority flora and species of special interest recorded in quadrats, releves, and general collections or observations while mapping the vegetation.

Table 1 App.4: Locations for DRF, Priority flora and flora of special interest.

Taxon	Area	MGA_EAS T	MGA_NOR TH	Status	Number of Plants	Data source
Acacia aristulata		408134	6621493	DRF	3	Mpg GC
Acacia aristulata		408137	6621516	DRF	4	Mpg GC
Acacia aristulata		406776	6617153	DRF	12	Mpg GC
Acacia aristulata		407013	6617181	DRF	80	Mpg GC
Acacia aristulata	Cairn Hill North	407073.71	6622739.14	DRF	3	RFS
Acacia aristulata	Cairn Hill North	407078.72	6622622.15	DRF	2	RFS
Acacia aristulata	Cairn Hill North	407081.72	6622727.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407087.71	6622625.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407099.72	6623491.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407103.72	6622569.15	DRF	1	RFS
Acacia aristulata	Western Ore Body	407109.71	6623387.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407130.72	6623478.14	DRF	2	RFS
Acacia aristulata	Cairn Hill North	407130.72	6622681.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407130.72	6622561.15	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407132.72	6622707.15	DRF	1	RFS
Acacia aristulata	Western Ore Body	407133.72	6623528.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407136.72	6622553.15	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407141.72	6622573.15	DRF	1	RFS
Acacia aristulata	Western Ore Body	407142.71	6623449.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407142.71	6622702.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407143.72	6623451.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407143.72	6623271.14	DRF	1	RFS

Acacia aristulata	Cairn Hill North	407145.72	6622416.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407147.72	6623264.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407149.72	6623337.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407149.72	6623282.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407150.71	6622545.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407151.72	6623249.14	DRF	4	RFS
Acacia aristulata	Western Ore Body	407152.72	6623474.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407156.72	6623272.14	DRF	3	RFS
Acacia aristulata	Cairn Hill North	407157.71	6622563.15	DRF	1	RFS
Acacia aristulata	Western Ore Body	407159.72	6623295.14	DRF	3	RFS
Acacia aristulata	Cairn Hill North	407163.72	6622578.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407165.72	6623357.15	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407165.72	6622532.13	DRF	2	RFS
Acacia aristulata	Cairn Hill North	407168.71	6622415.14	DRF	2	RFS
Acacia aristulata	Western Ore Body	407170.72	6623339.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407170.72	6622689.14	DRF	3	RFS
Acacia aristulata	Western Ore Body	407172.71	6623348.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407175.71	6622328.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407179.71	6622632.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407180.72	6623215.14	DRF	3	RFS
Acacia aristulata	Western Ore Body	407187.72	6623345.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407190.71	6623186.14	DRF	2	RFS
Acacia aristulata	Cairn Hill North	407190.71	6622462.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407192.72	6622534.13	DRF	2	RFS
Acacia aristulata	Western Ore Body	407193.72	6623321.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407196.72	6622667.15	DRF	3	RFS
Acacia aristulata	Cairn Hill North	407196.72	6622658.15	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407197.71	6622622.15	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407201.71	6622530.13	DRF	1	RFS
Acacia aristulata	Chester's Hills	407201.71	6618131.11	DRF	9	RFS
Acacia aristulata	Western Ore Body	407206.72	6623138.14	DRF	11	RFS
Acacia aristulata	Western Ore Body	407208.71	6623328.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407208.71	6623237.14	DRF	3	RFS
Acacia aristulata	Western Ore Body	407211.72	6623291.14	DRF	1	RFS
Acacia aristulata	Western Ore Body	407220.72	6623146.14	DRF	3	RFS
Acacia aristulata	Western Ore Body	407224.72	6623183.14	DRF	16	RFS
Acacia aristulata	Western Ore Body	407233.72	6623199.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407242.72	6622437.13	DRF	3	RFS
Acacia aristulata	Cairn Hill North	407282.71	6622217.14	DRF	3	RFS
Acacia aristulata	Waste Dump	407297.72	6623176.14	DRF	1	RFS
Acacia aristulata		407301	6621262	DRF		Releves
Acacia aristulata	Waste Dump	407309.72	6623197.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407319.72	6621930.14	DRF	1	RFS
Acacia aristulata	Waste Dump	407321.72	6623225.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407328.72	6621941.13	DRF	1	RFS
Acacia aristulata	Waste Dump	407344.71	6623193.14	DRF	1	RFS
Acacia aristulata	Waste Dump	407363.72	6623123.14	DRF	1	RFS
Acacia aristulata	Waste Dump	407382.72	6623095.14	DRF	1	RFS
Acacia aristulata	Cairn Hill North	407397.72	6621857.14	DRF	4	RFS
Acacia aristulata	Waste Dump	407407.72	6623053.15	DRF	3	RFS
Acacia aristulata	Waste Dump	407416.72	6623044.14	DRF	2	RFS
Acacia aristulata	Waste Dump	407422.72	6623012.15	DRF	10	RFS
Acacia aristulata	Waste Dump	407429.72	6623054.15	DRF	1	RFS
Acacia aristulata	Waste Dump	407441.72	6623064.15	DRF	2	RFS
Acacia aristulata		407450	6618107	DRF	1	Mpg GC
Acacia aristulata		407498	6621096	DRF		Releves
Acacia aristulata		407621	6624633	DRF		Releves
Acacia aristulata	Eastern Ore Body	407666.71	6622994.14	DRF	1	RFS

Acacia aristulata		407667	6620395	DRF		Relevés
Acacia aristulata	Eastern Ore Body	407673.71	6622984.14	DRF	5	RFS
Acacia aristulata	Waste Dump	407674.71	6623067.14	DRF	1	RFS
Acacia aristulata		407676	6620777	DRF		Relevés
Acacia aristulata	Eastern Ore Body	407683.72	6622991.14	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	407691.72	6625575.15	DRF	7	RFS
Acacia aristulata	Kiaka Rd North	407694.72	6625667.16	DRF	6	RFS
Acacia aristulata	Eastern Ore Body	407701.72	6622994.14	DRF	3	RFS
Acacia aristulata		407704	6620283	DRF		Relevés
Acacia aristulata	Kiaka Rd North	407715.73	6625693.15	DRF	1	RFS
Acacia aristulata		407717	6620600	DRF		Relevés
Acacia aristulata	Eastern Ridge	407726.73	6624347.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407734.72	6623616.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407744.72	6623367.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407751.72	6623372.14	DRF	6	RFS
Acacia aristulata	Eastern Ridge	407778.72	6624094.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407789.72	6624053.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407812.72	6624116.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407815.72	6623331.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407816.72	6624119.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407818.73	6624108.15	DRF	1	RFS
Acacia aristulata		407822	6620461	DRF		Relevés
Acacia aristulata	Eastern Ridge	407827.72	6623341.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407834.72	6623551.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407852.72	6624067.15	DRF	3	RFS
Acacia aristulata	Eastern Ridge	407862.73	6624133.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407869.73	6623965.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407872.72	6623700.15	DRF	9	RFS
Acacia aristulata	Eastern Ridge	407878.72	6623693.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407880.73	6623704.16	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407881.72	6623722.15	DRF	6	RFS
Acacia aristulata	Eastern Ridge	407889.72	6623691.15	DRF	7	RFS
Acacia aristulata	Eastern Ridge	407894.72	6623678.15	DRF	8	RFS
Acacia aristulata	Eastern Ridge	407897.72	6624125.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407901.72	6623933.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407904.72	6623356.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407912.72	6623621.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407916.72	6624120.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407916.72	6623705.16	DRF	3	RFS
Acacia aristulata	Eastern Ridge	407916.72	6623333.14	DRF	3	RFS
Acacia aristulata	Eastern Ridge	407918.72	6623427.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407925.72	6623328.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407929.72	6624139.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407931.72	6623336.14	DRF	3	RFS
Acacia aristulata	Eastern Ridge	407938.72	6623365.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407939.72	6623359.15	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407942.72	6623342.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407942.72	6623345.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407942.72	6623328.14	DRF	3	RFS
Acacia aristulata	Eastern Ridge	407946.73	6624134.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	407961.72	6623439.14	DRF	1	RFS
Acacia aristulata		407963	6624166	DRF		Relevés
Acacia aristulata		407967	6623428	DRF		Relevés
Acacia aristulata	Eastern Ridge	407969.72	6623447.14	DRF	2	RFS
Acacia aristulata	Eastern Ridge	407988.72	6623300.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	408004.72	6623318.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	408013.72	6623300.14	DRF	10	RFS
Acacia aristulata	Eastern Ridge	408019.72	6623275.14	DRF	2	RFS

Acacia aristulata	Eastern Ridge	408019.72	6623304.15	DRF	5	RFS
Acacia aristulata	Eastern Ridge	408024.72	6622619.15	DRF	1	RFS
Acacia aristulata	Eastern Ridge	408026.72	6623330.14	DRF	10	RFS
Acacia aristulata	Eastern Ridge	408030.72	6623321.14	DRF	6	RFS
Acacia aristulata	Eastern Ridge	408057.72	6623299.14	DRF	2	RFS
Acacia aristulata	Eastern Ridge	408063.72	6622649.14	DRF	1	RFS
Acacia aristulata	Eastern Ridge	408069.72	6622630.14	DRF	2	RFS
Acacia aristulata	Eastern Ridge	408071.72	6622998.14	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408242.72	6626810.16	DRF	1	RFS
Acacia aristulata		408295	6617191	DRF		Releves
Acacia aristulata		408295	6617171	DRF		Releves
Acacia aristulata	Kiaka Rd North	408406.72	6626344.16	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	408417.72	6626233.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408420.72	6626027.16	DRF	1	RFS
Acacia aristulata	Gardiner's Hills	408564.72	6618174.11	DRF	2	RFS
Acacia aristulata	Gardiner's Hills	408579.72	6618158.11	DRF	6	RFS
Acacia aristulata	Kiaka Rd North	408586.73	6626235.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408613.72	6626305.17	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408614.73	6625606.16	DRF	4	RFS
Acacia aristulata	Gardiner's Hills	408618.72	6617996.11	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408620.72	6626091.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408620.72	6625619.16	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	408660.73	6625944.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408681.73	6626157.17	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408686.72	6626047.16	DRF	10	RFS
Acacia aristulata	Kiaka Rd North	408749.73	6626112.17	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	408756.72	6626167.16	DRF	7	RFS
Acacia aristulata	Kiaka Rd North	408775.73	6626149.16	DRF	4	RFS
Acacia aristulata	Kiaka Rd North	408796.72	6626195.16	DRF	13	RFS
Acacia aristulata		408815	6626106	DRF		Releves
Acacia aristulata	Kiaka Rd North	408819.73	6626152.16	DRF	6	RFS
Acacia aristulata	Kiaka Rd North	408821.73	6626076.16	DRF	32	RFS
Acacia aristulata	Kiaka Rd North	408831.73	6626024.16	DRF	5	RFS
Acacia aristulata	Kiaka Rd North	408842.73	6625857.16	DRF	6	RFS
Acacia aristulata	Kiaka Rd North	408915.73	6625806.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	408925.73	6625727.15	DRF	5	RFS
Acacia aristulata	Kiaka Rd North	408964.72	6625723.15	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	408983.72	6625550.15	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	409027.72	6625470.16	DRF	1	RFS
Acacia aristulata	Kiaka Rd North	409047.73	6626153.17	DRF	>10	RFS
Acacia aristulata	Kiaka Rd North	409066.73	6626107.17	DRF	3	RFS
Acacia aristulata	Kiaka Rd North	409103.72	6626052.16	DRF	16	RFS
Acacia aristulata	Kiaka Rd North	409109.73	6626090.16	DRF	8	RFS
Acacia aristulata	Kiaka Rd North	409110.73	6626008.17	DRF	14	RFS
Acacia aristulata	Kiaka Rd North	409114.72	6625964.17	DRF	6	RFS
Acacia aristulata	Kiaka Rd North	409133.72	6625910.17	DRF	45	RFS
Acacia aristulata	Kiaka Rd North	409155.72	6625775.15	DRF	81	RFS
Acacia aristulata	Kiaka Rd North	409167.73	6625636.15	DRF	34	RFS
Acacia aristulata	Kiaka Rd North	409183.73	6625461.16	DRF	>10	RFS
Acacia aristulata	Kiaka Rd North	409261.72	6626755.16	DRF	2	RFS
Acacia aristulata	Kiaka Rd North	409317.73	6625695.15	DRF	2	RFS
Acacia aristulata		409319	6625506	DRF		Releves
Acacia aristulata	Kiaka Rd North	409332.73	6626544.16	DRF	3	RFS
Acacia aristulata	Kiaka Rd North	409341.72	6625543.15	DRF	8	RFS
Acacia aristulata	Kiaka Rd North	409348.73	6625449.15	DRF	20	RFS
Acacia aristulata		409354	6625563	DRF		Releves
Acacia aristulata		409361	6625371	DRF		Releves
Acacia aristulata	Kiaka Rd North	409382.72	6625892.15	DRF	13	RFS

Acacia aristulata		409393	6624414	DRF	12	Mpg GC
Acacia aristulata	Kiaka Rd North	409424.74	6625314.16	DRF	>50	RFS
Acacia aristulata		406991	6619509	DRF	25	Mpg GC
Acacia aristulata		407730	6621135	DRF		Relevés
Acacia aristulata		408506	6620286	DRF	1	Mpg GC
Acacia aristulata		409191	6622405	DRF	3	Mpg GC
Acacia aristulata		409199	6622336	DRF	6	Mpg GC
Acacia aristulata		409200	6622373	DRF	13	Mpg GC
Acacia aristulata		409201	6622272	DRF	1	Mpg GC
Acacia aristulata		407512	6620098	DRF		Relevés
Austrostipa exilis	Cairn Hill	407832	6620037	P2		Miscellaneous
Baeckea sp. Moora	Cairn Hill North	407150	6622430	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407166	6622461	P1	3	RFS
Baeckea sp. Moora	Cairn Hill North	407166	6621904	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407174	6622382	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407180	6622465	P1	3	RFS
Baeckea sp. Moora	Cairn Hill North	407182	6621796	P1	20+	RFS
Baeckea sp. Moora	Cairn Hill North	407190	6622393	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407220	6622389	P1	32	RFS
Baeckea sp. Moora	Cairn Hill North	407224	6622418	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407225	6621999	P1	2	RFS
Baeckea sp. Moora	Cairn Hill North	407239	6622453	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407242	6622288	P1	5	RFS
Baeckea sp. Moora	Cairn Hill North	407246	6622402	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407250	6621812	P1	30+	RFS
Baeckea sp. Moora	Cairn Hill North	407270	6621885	P1	50+	RFS
Baeckea sp. Moora	Cairn Hill North	407271	6621925	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407294	6621885	P1	>10	RFS
Baeckea sp. Moora	Cairn Hill North	407303	6621921	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407323	6621876	P1	6	RFS
Baeckea sp. Moora	Cairn Hill North	407329	6621941	P1	2	RFS
Baeckea sp. Moora	Cairn Hill North	407369	6622238	P1	2+	RFS
Baeckea sp. Moora	Cairn Hill North	407407	6622233	P1	1+	RFS
Baeckea sp. Moora	Cairn Hill North	407417	6622189	P1	>20	RFS
Baeckea sp. Moora	Cairn Hill North	407429	6622296	P1	1	RFS
Baeckea sp. Moora	Cairn Hill North	407439	6622222	P1	50+	RFS
Baeckea sp. Moora		407607	6621539	P1		Relevés
Baeckea sp. Moora		407730	6621135	P1		Relevés
Baeckea sp. Moora		406999	6621580	P1		Relevés
Baeckea sp. Moora		407039	6621549	P1		Relevés
Baeckea sp. Moora		407126	6621426	P1		Relevés
Baeckea sp. Moora		407219	6621600	P1		Relevés
Baeckea sp. Moora		407249	6620522	P1		Relevés
Baeckea sp. Moora		407266	6620484	P1		Relevés
Baeckea sp. Moora		407301	6621262	P1		Relevés
Baeckea sp. Moora		407346	6622198	P1		Relevés
Baeckea sp. Moora		407366	6620501	P1		Relevés
Baeckea sp. Moora		407417	6620954	P1		Relevés
Baeckea sp. Moora		407473	6620529	P1		Relevés
Baeckea sp. Moora		407499	6621565	P1		Relevés
Baeckea sp. Moora		407514	6621887	P1		Relevés
Baeckea sp. Moora		407551	6621812	P1		Relevés
Baeckea sp. Moora		407558	6621749	P1		Relevés
Baeckea sp. Moora		407591	6620635	P1		Relevés
Baeckea sp. Moora		407594	6621525	P1		Relevés
Baeckea sp. Moora		407605	6620364	P1		Relevés
Baeckea sp. Moora		407619	6621523	P1		Relevés
Baeckea sp. Moora		407624	6621644	P1		Relevés

Baeckea sp. Moora		407647	6621332	P1		Relevés
Baeckea sp. Moora		407667	6620395	P1		Relevés
Baeckea sp. Moora		407676	6620777	P1		Relevés
Baeckea sp. Moora		407681	6620743	P1		Relevés
Baeckea sp. Moora		407692	6620673	P1		Relevés
Baeckea sp. Moora		407692	6621211	P1		Relevés
Baeckea sp. Moora		407700	6620945	P1		Relevés
Baeckea sp. Moora		407705	6621999	P1		Relevés
Baeckea sp. Moora		407747	6621073	P1		Relevés
Baeckea sp. Moora		407822	6620461	P1		Relevés
Baeckea sp. Moora		407841	6620347	P1		Relevés
Baeckea sp. Moora		407917	6620378	P1		Relevés
Baeckea sp. Moora		407385	6619969	P1		Relevés
Baeckea sp. Moora		407403	6621231	P1		Relevés
Baeckea sp. Moora		407573	6621426	P1		Relevés
Baeckea sp. Moora		407726	6620092	P1		Relevés
Baeckea sp. Moora		407774	6620341	P1		Relevés
Baeckea sp. Moora		407638.72	6621163.13	P1		Quadrat
Baeckea sp. Moora		407000	6621385	P1		Quadrat
Baeckea sp. Moora		407058	6621390	P1		Quadrat
Baeckea sp. Moora		407130.72	6620981.13	P1		Quadrat
Baeckea sp. Moora		407315.71	6621864.14	P1		Quadrat
Baeckea sp. Moora		407364.72	6621620.14	P1		Quadrat
Baeckea sp. Moora		407371.72	6621134.13	P1		Quadrat
Baeckea sp. Moora		407460.72	6621582.14	P1		Quadrat
Baeckea sp. Moora		407467	6620592	P1		Quadrat
Baeckea sp. Moora		407472.71	6621163.13	P1		Quadrat
Baeckea sp. Moora		407488.72	6621679.14	P1		Quadrat
Baeckea sp. Moora		407565	6621707	P1		Quadrat
Baeckea sp. Moora		407571.71	6621045.13	P1		Quadrat
Cryptandra glabriflora		407009	6620626	P2		Relevés
Cryptandra glabriflora		407058	6621390	P2		Quadrat
Cryptandra glabriflora		407143.72	6623452.14	P2		Quadrat
Cryptandra glabriflora		407202.72	6623229.14	P2		Quadrat
Cryptandra glabriflora		407371.72	6621134.13	P2		Quadrat
Cryptandra glabriflora		407375.72	6623173.14	P2		Quadrat
Cryptandra glabriflora		407571.71	6621045.13	P2		Quadrat
Cryptandra glabriflora		407824.72	6623723.15	P2		Quadrat
Daviesia dielsii	Cairn Hill North	406927.72	6622405.14	DRF	4	RFS
Daviesia dielsii		407087	6618021	DRF	10 +	Mpg GC
Daviesia dielsii	Cairn Hill North	407099.72	6622670.15	DRF	1	RFS
Daviesia dielsii		407104	6618108	DRF	3	Mpg GC
Daviesia dielsii	Cairn Hill North	407120.71	6622674.14	DRF	4	RFS
Daviesia dielsii	Cairn Hill North	407147.72	6622695.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407150.71	6622545.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407150.71	6622525.14	DRF	9	RFS
Daviesia dielsii	Cairn Hill North	407154.72	6622631.14	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407156.72	6622580.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407159.72	6622692.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407159.72	6622528.13	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407167.72	6622670.15	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407167.72	6622389.13	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407168.71	6622521.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407170.72	6622689.14	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407173.72	6622427.14	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407180.72	6622698.14	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407181.72	6622671.15	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407189.72	6622393.13	DRF	5	RFS

Daviesia dielsii	Cairn Hill North	407195.72	6622639.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407197.71	6622622.15	DRF	1	RFS
Daviesia dielsii	Chester Hills	407201.71	6618131.11	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407210.72	6622340.13	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407211.72	6622407.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407212.71	6622406.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407213.72	6622461.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407213.72	6622424.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407219.71	6622389.13	DRF	20	RFS
Daviesia dielsii	Chester Hills	407230.71	6618101.11	DRF	>20	RFS
Daviesia dielsii	Cairn Hill North	407238.71	6622453.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407238.71	6622417.14	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407241.71	6622401.13	DRF	4	RFS
Daviesia dielsii	Waste Dump	407246.72	6623193.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407247.72	6622268.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407248.71	6622437.13	DRF	20	RFS
Daviesia dielsii	Cairn Hill North	407256.71	6622404.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407265.72	6622417.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407297.72	6621803.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407301.72	6622429.13	DRF	3	RFS
Daviesia dielsii	Cairn Hill North	407306.72	6621895.13	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407332.72	6621297.13	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407337.71	6621923.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407338.72	6622408.14	DRF	1	RFS
Daviesia dielsii	Waste Dump	407346.72	6623182.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407361.72	6621933.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407366.71	6622198.13	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407371.72	6621937.13	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407379.72	6622236.13	DRF	1	RFS
Daviesia dielsii		407381	6620425	DRF		Releves
Daviesia dielsii	Cairn Hill North	407389.72	6621920.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407390.72	6621882.14	DRF	1	RFS
Daviesia dielsii	Waste Dump	407409.71	6623095.14	DRF	1	RFS
Daviesia dielsii	Chester Hills	407413.71	6618072.11	DRF	2	RFS
Daviesia dielsii	Cairn Hill North	407417.71	6621875.14	DRF	1	RFS
Daviesia dielsii	Waste Dump	407418.72	6623160.15	DRF	1	RFS
Daviesia dielsii	Waste Dump	407478.72	6623101.14	DRF	1	RFS
Daviesia dielsii	Eastern Ore Body	407529.72	6623106.15	DRF	2	RFS
Daviesia dielsii	Eastern Ore Body	407534.71	6623090.14	DRF	1	RFS
Daviesia dielsii	Eastern Ore Body	407541.71	6623082.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	407544.72	6621616.14	DRF	1	RFS
Daviesia dielsii	Eastern Ore Body	407545.71	6623091.14	DRF	3	RFS
Daviesia dielsii	Eastern Ore Body	407550.72	6623067.14	DRF	1	RFS
Daviesia dielsii		407551	6623071	DRF		Releves
Daviesia dielsii	Eastern Ore Body	407551.72	6623097.14	DRF	2	RFS
Daviesia dielsii	Eastern Ore Body	407556.71	6623033.14	DRF	1	RFS
Daviesia dielsii	Eastern Ore Body	407564.71	6623056.15	DRF	1	RFS
Daviesia dielsii		407591	6620635	DRF		Releves
Daviesia dielsii		407667	6620395	DRF		Releves
Daviesia dielsii		407692	6621211	DRF		Releves
Daviesia dielsii	Eastern Ridge	407714.72	6624279.15	DRF	3	RFS
Daviesia dielsii	Eastern Ridge	407726.73	6624222.15	DRF	2	RFS
Daviesia dielsii	Eastern Ridge	407729.72	6624240.15	DRF	6	RFS
Daviesia dielsii	Eastern Ridge	407744.72	6623367.14	DRF	4	RFS
Daviesia dielsii	Eastern Ridge	407748.73	6623380.14	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407770.73	6623255.15	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407815.72	6623331.14	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407821.72	6623526.14	DRF	1	RFS

Daviesia dielsii	Eastern Ridge	407822.72	6623530.14	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407826.72	6623282.14	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407827.72	6623299.14	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407827.72	6623341.14	DRF	2	RFS
Daviesia dielsii	Eastern Ridge	407835.72	6623292.14	DRF	2	RFS
Daviesia dielsii	Eastern Ridge	407848.72	6623356.15	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407916.72	6623709.15	DRF	1	RFS
Daviesia dielsii	Eastern Ridge	407919.72	6623613.14	DRF	1	RFS
Daviesia dielsii	Cairn Hill North	408113.72	6622504.14	DRF	1	RFS
Daviesia dielsii	Kiaka Rd North	408215.72	6626097.16	DRF	1	RFS
Daviesia dielsii	Kiaka Rd North	408253.72	6625914.17	DRF	>10	RFS
Daviesia dielsii	Kiaka Rd North	408268.72	6625869.16	DRF	4	RFS
Daviesia dielsii	Kiaka Rd North	408272.72	6625847.15	DRF	>5	RFS
Daviesia dielsii	Kiaka Rd North	408273.72	6626019.16	DRF	9	RFS
Daviesia dielsii	Kiaka Rd North	408283.72	6626593.16	DRF	1	RFS
Daviesia dielsii		408295	6617191	DRF		Releves
Daviesia dielsii		408295	6617171	DRF		Releves
Daviesia dielsii		408326	6617940	DRF		Releves
Daviesia dielsii	Gardiner's Hill	408350.72	6617648.11	DRF	1	RFS
Daviesia dielsii		408451	6620952	DRF	1	Mpg GC
Daviesia dielsii		408457	6620332	DRF	4	Mpg GC
Daviesia dielsii		408469	6620284	DRF	1	Mpg GC
Daviesia dielsii		408483	6620280	DRF		Releves
Daviesia dielsii	Kiaka Rd North	408483.72	6626478.16	DRF	4	RFS
Daviesia dielsii		408493	6620290	DRF		Mpg GC
Daviesia dielsii		408506	6620286	DRF		Mpg GC
Daviesia dielsii	Kiaka Rd North	408510.72	6626137.16	DRF	2	RFS
Daviesia dielsii	Kiaka Rd North	408564.73	6626510.16	DRF	1	RFS
Daviesia dielsii	Gardiner Hills	408569.72	6618155.11	DRF	2	RFS
Daviesia dielsii	Gardiner Hills	408632.72	6617880.11	DRF	1	RFS
Daviesia dielsii	Kiaka Rd North	408653.72	6625419.16	DRF	2	RFS
Daviesia dielsii	Kiaka Rd North	408655.73	6625988.16	DRF	15	RFS
Daviesia dielsii	Gardiner Hills	408657.72	6617912.11	DRF	2	RFS
Daviesia dielsii	Kiaka Rd North	408669.73	6625388.15	DRF	4	RFS
Daviesia dielsii	Kiaka Rd North	408683.73	6626108.17	DRF	8	RFS
Daviesia dielsii	Kiaka Rd North	408686.72	6626047.16	DRF	15	RFS
Daviesia dielsii	Kiaka Rd North	408740.73	6625843.15	DRF	2	RFS
Daviesia dielsii		408758	6620078	DRF		Mpg GC
Daviesia dielsii	Gardiner Hill	408758.73	6617659.12	DRF	14	RFS
Daviesia dielsii	Kiaka Rd North	408796.72	6626195.16	DRF	4	RFS
Daviesia dielsii	Kiaka Rd North	408797.73	6625548.15	DRF	8	RFS
Daviesia dielsii	Gardiner Hill	408848.73	6618107.11	DRF	1	RFS
Daviesia dielsii		408852	6620392	DRF	5	Mpg GC
Daviesia dielsii	Gardiner Hill	408862.72	6617743.11	DRF	3	RFS
Daviesia dielsii		408865	6625628	DRF		Releves
Daviesia dielsii	Kiaka Rd North	408983.72	6625550.15	DRF	4	RFS
Daviesia dielsii		409032	6625230	DRF		Releves
Daviesia dielsii	Kiaka Rd North	409037.73	6625493.15	DRF	1	RFS
Daviesia dielsii		409042	6624046	DRF	>4%	Mpg GC
Daviesia dielsii	Kiaka Rd North	409059.72	6625400.15	DRF	2	RFS
Daviesia dielsii		409072	6625211	DRF		Releves
Daviesia dielsii	Kiaka Rd North	409167.73	6625636.15	DRF	1	RFS
Daviesia dielsii	Kiaka Rd North	409285.73	6625291.15	DRF	1	RFS
Daviesia dielsii	Kiaka Rd North	409337.73	6625372.16	DRF	2	RFS
Daviesia dielsii	Kiaka Rd North	409343.73	6625123.16	DRF	1	RFS
Daviesia dielsii		407700	6620945	DRF		Releves
Daviesia dielsii		407433	6620399	DRF		Releves
Eucalyptus pruiniramis		407614	6620524	DRF	>1	Mpg GC

Eucalyptus pruiniramis		408502	6620294	DRF		Mpg GC
Eucalyptus pruiniramis		408765	6620050	DRF	2	Mpg GC
Goodenia arthrotricha		407460.72	6621582.14	P1		Quadrat
Goodenia arthrotricha		407512	6620103	P1		Mpg GC
Goodenia arthrotricha		407698	6620100	P1		Quadrat
Goodenia arthrotricha		407833	6623834	P1		Mpg GC
Goodenia arthrotricha		407950.72	6624312.15	P1		Quadrat
Goodenia arthrotricha		408299	6617965	P1		Quadrat
Goodenia arthrotricha		408342	6617700	P1		Relevés
Goodenia arthrotricha		408365	6617634	P1		Relevés
Goodenia arthrotricha		408372	6617553	P1		Quadrat
Goodenia arthrotricha		408385	6617631	P1		Quadrat
Goodenia arthrotricha		408590	6622558	P1		Relevés
Guichenotia tuberculata	Gardiner's Hill	407273	6617108	P3		Miscellaneous
Hemigenia sp.	Cairn Hill	407772	6620677	Of Interest		Miscellaneous
Hemigenia sp.	Gardiner's Hill	408296	6617059	Of Interest		Miscellaneous
Melaleuca sclerophylla	Gardiner Hill	408330	6617228	P3		Relevés
Melaleuca sclerophylla	Gardiner Hill	408283	6617208	P3		Relevés
Melaleuca sclerophylla	Gardiner Hill	408294	6617292	P3		Relevés
Gastrolobium acutum		407062	6617532	Of Interest	1	Mpg GC
Gastrolobium acutum		407106	6617914	Of Interest	9	Mpg GC
Gastrolobium acutum		407113	6617867	Of Interest	1	Mpg GC
Gastrolobium acutum		407154	6617948	Of Interest	3	Relevés
Gastrolobium acutum		407165	6617948	Of Interest	3	Mpg GC
Gastrolobium acutum		407364.72	6621620.14	Of Interest		Quadrat
Gastrolobium acutum		407371.72	6621134.13	Of Interest		Quadrat
Gastrolobium acutum		407375.72	6623173.14	Of Interest		Quadrat
Gastrolobium acutum		407396.72	6620276.12	Of Interest		Quadrat
Gastrolobium acutum		407409	6620353	Of Interest		Quadrat
Gastrolobium acutum		407451	6620171	Of Interest		Quadrat
Gastrolobium acutum		407472.71	6621163.13	Of Interest		Quadrat
Gastrolobium acutum		407571.71	6621045.13	Of Interest		Quadrat
Gastrolobium acutum		407693.72	6623027.14	Of Interest		Quadrat
Gastrolobium acutum		407841	6620347	Of Interest		Relevés
Gastrolobium acutum		408299	6617965	Of Interest		Quadrat
Gastrolobium acutum		408760	6617842	Of Interest		Quadrat
Gastrolobium acutum		408815	6626106	Of Interest		Relevés
Gastrolobium acutum		408826	6617782	Of Interest		Quadrat
Gastrolobium acutum	John Tonkin's	408835	6625542	Of Interest		Specimens
Gastrolobium acutum	John Tonkin's	408919	6625718	Of Interest		Specimens
Gastrolobium acutum		409060	6625331	Of Interest		Quadrat
Gastrolobium acutum	Chester's	407377	6618018	Of Interest	2	RFS
Gastrolobium acutum	Chester's	407456	6618099	Of Interest	4	RFS
Gastrolobium acutum	Chester's	408759	6617659	Of Interest	1	RFS
Gastrolobium acutum	Chester's	408843	6617657	Of Interest	2	RFS
Regelia megacephala		406894	6621403	P4		Relevés
Regelia megacephala		406920	6620699	P4		Relevés
Regelia megacephala		406932	6620797	P4		Relevés
Regelia megacephala		406933	6620762	P4		Relevés
Regelia megacephala		406937	6621245	P4		Quadrat
Regelia megacephala		407025	6622616	P4		Relevés
Regelia megacephala		407130.72	6620981.13	P4		Quadrat
Regelia megacephala		407143.72	6623452.14	P4		Quadrat
Regelia megacephala		407166	6620980	P4		Relevés
Regelia megacephala		407166	6620727	P4		Relevés
Regelia megacephala		407168.71	6622574.15	P4		Quadrat
Regelia megacephala		407168.71	6623321.14	P4		Quadrat
Regelia megacephala		407194.71	6623200.14	P4		Quadrat

Regelia megacephala		407201.71	6622517.14	P4	Quadrat
Regelia megacephala		407202.72	6623229.14	P4	Quadrat
Regelia megacephala		407217	6622414	P4	Relevés
Regelia megacephala		407224	6620829	P4	Relevés
Regelia megacephala		407236	6619110	P4	Relevés
Regelia megacephala		407249	6620522	P4	Relevés
Regelia megacephala		407266	6620484	P4	Relevés
Regelia megacephala		407315.71	6621864.14	P4	Quadrat
Regelia megacephala		407340	6620530	P4	Relevés
Regelia megacephala		407364.72	6621620.14	P4	Quadrat
Regelia megacephala		407366	6620501	P4	Relevés
Regelia megacephala		407371.72	6621134.13	P4	Quadrat
Regelia megacephala		407372	6620059	P4	Quadrat
Regelia megacephala		407375.72	6623173.14	P4	Quadrat
Regelia megacephala		407409	6620353	P4	Quadrat
Regelia megacephala		407451	6620171	P4	Quadrat
Regelia megacephala		407472.71	6621163.13	P4	Quadrat
Regelia megacephala		407491	6621800	P4	Relevés
Regelia megacephala		407492.72	6621766.14	P4	Quadrat
Regelia megacephala		407494	6620190	P4	Quadrat
Regelia megacephala		407498	6621096	P4	Relevés
Regelia megacephala		407498	6621710	P4	Relevés
Regelia megacephala		407523	6620619	P4	Relevés
Regelia megacephala		407545	6619474	P4	Relevés
Regelia megacephala		407571.71	6621045.13	P4	Quadrat
Regelia megacephala		407579	6619585	P4	Relevés
Regelia megacephala		407605	6620364	P4	Relevés
Regelia megacephala		407608.71	6622999.14	P4	Quadrat
Regelia megacephala		407676	6620777	P4	Relevés
Regelia megacephala		407676.72	6623007.15	P4	Quadrat
Regelia megacephala		407693.72	6623027.14	P4	Quadrat
Regelia megacephala		407696	6620035	P4	Relevés
Regelia megacephala		407726.73	6623849.15	P4	Quadrat
Regelia megacephala		407730	6621135	P4	Relevés
Regelia megacephala		407788	6621074	P4	Relevés
Regelia megacephala		407813	6623919	P4	Relevés
Regelia megacephala		407822	6620461	P4	Relevés
Regelia megacephala		407824.72	6623723.15	P4	Quadrat
Regelia megacephala		408144	6619365	P4	Relevés
Regelia megacephala		408299	6617965	P4	Quadrat
Regelia megacephala		408323	6618076	P4	Relevés
Regelia megacephala		408709	6617635	P4	Quadrat
Regelia megacephala		408760	6617842	P4	Quadrat
Regelia megacephala		408835	6625542	P4	Quadrat
Regelia megacephala		406979	6620756	P4	Relevés
Regelia megacephala		407321	6620214	P4	Relevés
Regelia megacephala		407407	6620132	P4	Relevés
Regelia megacephala		407585	6620384	P4	Relevés
Regelia megacephala		407659	6620494	P4	Relevés
Regelia megacephala		407713	6620134	P4	Relevés
Regelia megacephala		407841	6620347	P4	Relevés
Synaphea quartzitica	Cairn Hill	407656	6620813	DRF	GC
Tricoryne arenicola		407394.72	6623106.15	P2	Quadrat
Tricoryne arenicola		407565	6621707	P2	Quadrat
Tricoryne arenicola		407571.71	6621045.13	P2	Quadrat
Tricoryne arenicola		407705	6621999	P2	Relevés
Tricoryne arenicola		407551	6621812	P2	Relevés
Tricoryne arenicola		407561	6621707	P2	Relevés

<i>Tricoryne arenicola</i>	Cairn Hill	407770	6619954	P2	Specimens
<i>Wurmbea drummondii</i>	John Tonkin's	408958	6625359	P4	Miscellaneous
<i>Wurmbea drummondii</i>	John Tonkin's	409009	6625325	P4	Miscellaneous
<i>Cyrtostylis huegelii</i>	Eastern Ridge	407822	6623667	Of Interest	Quadrat
<i>Cyrtostylis huegelii</i>	Eastern Orebody	407677	6623008	Of Interest	Quadrat
<i>Cyrtostylis huegelii</i>	Cairn Hill	407409	6620353	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Eastern Ridge	407813	6623304	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill	407646	6620040	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill	407683	6620043	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill	407590	6620015	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill	407275	6620019	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill North	407058	6621390	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Western Orebody	407204	6623297	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	John Tonkin's	408881	6626068	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	John Tonkin's	408852	6625867	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	John Tonkin's	408906	6626039	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	John Tonkin's	408835	6625542	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	John Tonkin's	408958	6625359	Of Interest	Quadrat
<i>Caesia</i> sp. Moora	Cairn Hill North	407316	6621865	Of Interest	Quadrat
<i>Amblysperma</i> sp.	Gardiner's	408366	6617473	Of Interest	Quadrat
<i>Pterostylis</i> aff. <i>rufa</i>	Gardiner's	408372	6617553	Of Interest	Quadrat
<i>Pterostylis</i> aff. <i>rufa</i>	Cairn Hill	407058	6621390	Of Interest	Quadrat
<i>Hypoxis</i> aff. <i>glabella</i>	Cairn Hill	407646	6620000	Of Interest	Quadrat
<i>Pityrodia</i> sp.	Eastern Ridge	408004	6622885	Of Interest	Releve
<i>Leptospermum</i> aff. <i>erubescens</i>	Gardiner's	408800	6617640	Of Interest	RFS
<i>Leptospermum</i> aff. <i>erubescens</i>	Gravel Pit	407140	6621150	Of Interest	Collector
<i>Eremaea</i> sp. Cairn Hill	Cairn Hill	408308	6620008	Of Interest	Specimen
<i>Stylidium glabrifolium</i>	Eastern Ridge	407950	6624313	P2	Quadrat
<i>Stylidium glabrifolium</i>	Eastern Ridge	407820	6624653	P2	Quadrat
<i>Stylidium glabrifolium</i>	Eastern Orebody	407694	6623028	P2	Quadrat
<i>Stenanthemum tridentatum</i>	Gardiner's	408370	6617600	P3	Quadrat

APPENDIX 5: Flora list for the study area

Notes: The abbreviations in the top of the top row are those used in the report, they are followed by the number of quadrats recorded in the relevant sub-area. The right hand column has records from areas of vegetation that were mapped, but did not have quadrats located in them (usually because they are small areas, or are degraded). An asterisk in the third column indicates an introduced or alien (weed) species. Specimens not identifiable due to poor material or recorded as "sp." have been included in the list, but not counted for the number of species recorded, these records are shown in grey text (ie. grey). records at quadrats are indicated by a "q" and at releves by an "r". Specimens collected opportunistically (rather than at a quadrat or releve) are indicated by an "o".

Family	Family number	W e e d *	NAME	ART (11) A&R Tonkin	CAH (20) Cairn Hill Reserve	CHN (10) Cairn Hill North	EOR (3) Eastern Ore Body	ERG (23) Eastern Ridge	GH (10) Gardiner's Hill	JT (12) John Tonkin	WDM (3) Waste Dump Area	WOR (6) Western Ridge	Records from other areas of vegetation surveyed
FERNS													
Adiantaceae	007		Cheilanthes adiantoides	4q	17q, 37r	9q, 21r	3q	23q, 40r	8q, 21r	11q, 15r	3q, 1r	6q, 1r	32r
Adiantaceae	007		Cheilanthes austrotenuifolia	5q, 1o									
Adiantaceae	007		Cheilanthes distans	3q, 3r	1q		1q			1q			
Aspleniaceae	011E		Pleurosorus rutifolius				1q	2q	1q	1q			
PINES													
Cupressaceae	018		Actinostrobus arenarius							1q			
ANGIOSPERMS													
Monocotyledons													
Poaceae	031	*	Aira caryophylllea		10q			5q	1q	5q			
Poaceae	031		Amphipogon caricinus		5q, 2r	1r		4q	1q, 3r			2q	
Poaceae	031		Aristida contorta		1q						1q	1q	
Poaceae	031		Austrodanthonia acerosa	2q	4q, 2r			2q, 4r	4q, 1r	3q	2q	4q	1r
Poaceae	031		Austrodanthonia caespitosa	1q, 1o	5q	1q		8q, 7r	3q, 3r			1q	4r
Poaceae	031		Austrodanthonia setacea		7q, 3r	7q	3q	10q, 4r	3q, 1r	2q, 1r	1q	4q	2r
Poaceae	031		Austrodanthonia sp.	1r,	1q				2q	1q			7r
Poaceae	031		Austrostipa compressa			8q							
Poaceae	031		Austrostipa elegantissima	1q, 1r,	8q, 5r	2q	1q	8q	6q, 5r	2q	2q	2q	2r
Poaceae	031		Austrostipa eremophila		1r								
Poaceae	031		Austrostipa exilis		2r								
Poaceae	031		Austrostipa hemipogon	1q				1q	2q	1q	1q	3q	

Poaceae	031	<i>Austrostipa macalpinei</i>						2q				
Poaceae	031	<i>Austrostipa mollis</i>					1r					1r
Poaceae	031	<i>Austrostipa nitida</i>		2q			4q, 3r	2q	5q			3r
Poaceae	031	<i>Austrostipa scabra</i>		3q				4q	1q			1r
Poaceae	031	<i>Austrostipa</i> sp.		1q	1q		1q		1q, 2r			
Poaceae	031	<i>Austrostipa</i> sp. Cairn Hill (M.E. Trudgen 21176)		1q								
Poaceae	031	<i>Austrostipa tenuifolia</i>				1q	1q			1q		
Poaceae	031	<i>Austrostipa trichophylla</i>	8q, 1r	8q	5q	1q	12q	3q, 2r	1q	2q	5q	
Poaceae	031	<i>Austrostipa variabilis</i>		4q		1q	3q	6q	3q, 2r		1q	
Poaceae	031	* <i>Avena barbata</i>	9q, 7r	8q	5q	3q	23q, 17r	9q, 10r	11q, 20r	2q	6q	67r
Poaceae	031	* <i>Brachypodium distachyon</i>	3q									
Poaceae	031	* <i>Briza maxima</i>	7q	10q	8q	3q	23q, 8r	8q, 35r	12q, 6r	3q	6q	17r
Poaceae	031	* <i>Bromus diandrus</i>	5q, 1o	3q	2q	3q	12q, 5r	4q, 1r	9q, 2r	1q	5q	9r
Poaceae	031	* <i>Cynosurus echinatus</i>	1q, 1r									
Poaceae	031	* <i>Ehrharta brevifolia</i> var. <i>cuspidata</i>	1q									
Poaceae	031	* <i>Ehrharta longiflora</i>	10q, 3r	12q	6q	3q	19q, 6r	7q, 5r	9q, 5r	1q	6q	1q, 25r
Poaceae	031	<i>Eriachne ovata</i>		1q								
Poaceae	031	* <i>Hordeum leporinum</i>	1q									
Poaceae	031	* <i>Lamarckia aurea</i>	1q									
Poaceae	031	* <i>Lolium perenne</i>	2q	1q				1q	1q			1r
Poaceae	031	<i>Neurachne alopecuroidea</i>	7q, 4r	16q, 55r	10q, 34r	2q, 1r	20q, 38r	10q, 33r	12q, 10r	3q, 2r	6q, 1r	1q, 21r
Poaceae	031	* <i>Pentaschistis airoides</i>	8q, 1r	3q	7q	3q	15q			3q	5q	2r
Poaceae	031	* <i>Pentaschistis pallida</i>		1q			3q	7q, 6r	7q, 6r		1q	11r
Poaceae	031	* <i>Pentaschistis</i> sp.	2q				1q	1q				
Poaceae	031	* <i>Pentaschistis</i> sp. Moora (doubtful ID)		1q			2q		3q			
Poaceae	031	* <i>Schismus barbatus</i>	1q 1o									
Poaceae	031	* <i>Vulpia myuros</i>	11q, 3r	17q, 1r	8q	2q	5q	9q, 3r	11q, 7r	3q	5q	
Cyperaceae	032	<i>Gahnia drummondii</i>										1r
Cyperaceae	032	<i>Lepidosperma pubisquameum</i>	1o		1r		1q	1r				
Cyperaceae	032	<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)		5q	1q		4q	5q	1q		1q	
Cyperaceae	032	<i>Lepidosperma costale</i>		4q, 1r			2q	1q, 2r				
Cyperaceae	032	<i>Lepidosperma leptostachyum</i>		4q, 14r	4r	2q	13q, 3r	2q, 1r		1q	4q	5r
Cyperaceae	032	<i>Lepidosperma</i> sp.		1q	1q, 1r		1q	1r	2r	1q		

Cyperaceae	032	Lepidosperma sp. P1 small head (M.D. Tindale 166A)		2r								
Cyperaceae	032	Lepidosperma tenue	1q, 1r	8q, 10r	1q, 4r		5q, 35r	8r	3r	1r	2q, 1r	7r
Cyperaceae	032	Schoenus brevisetis		1q, 4r	1q							
Cyperaceae	032	Schoenus clandestinus	1o	4q, 13r	1q, 9r		3q, 7r	28r	5q, 8r	2q, 1r	1q, 1r	
Cyperaceae	032	Schoenus nanus		1r	1q							
Cyperaceae	032	Schoenus pleiostemoneus		1q							1q	
Restionaceae	039	Desmocladus flexuosus	8q, 2r, 1o	14q, 39r	7q, 15r	1q, 1r	5q, 10r	9q, 19r	11q, 24r	2q, 1r	4q, 1r	17r
Restionaceae	039	Lepidobolus chaetocephalus		4q, 8r	1q, 1r			4r	2r	1q		
Centrolepidaceae	040	Centrolepis drummondiana		2q	1q							
Centrolepidaceae	040	Centrolepis pilosa		1q		1q				1q		
Centrolepidaceae	040	Centrolepis sp.			1q							
Dasypogonaceae	054C	Lomandra (Moorra twisty)	2q	1q			4q	1q	2q			
Dasypogonaceae	054C	Lomandra aff. micrantha subsp. micrantha	1q	3q			3q	1q		1q		
Dasypogonaceae	054C	Lomandra effusa		1q, 5r	1q			3q, 5r				1r
Dasypogonaceae	054C	Lomandra sp.		1q								1r
Xanthorrhoeaceae	054D	Xanthorrhoea drummondii	7q, 4r	16q, 39r	9q, 22r	2q, 1r	10q, 27r	8q, 20r	10q, 15r	3q	6q, 1r	1q
Phormiaceae	054E	Dianella revoluta var. divaricata	1o	6q, 2r	3q, 1r		2r	3q, 2r		2q	3q	
Phormiaceae	054E	Stypandra glauca	5q, 2r	12q, 39r	5q, 15r	3q	17q, 19r	3q, 5r	4q, 2r	2q, 1r	5q	
Anthericaceae	054F	Agrostocrinum scabrum	1q	1q				2q				
Anthericaceae	054F	Caesia (Moorra hairy stem)		4q	1q		1q		5q		1q	
Anthericaceae	054F	Caesia alfordii		1q, 1r			5q	2q	1q			
Anthericaceae	054F	Chamaescilla corymbosa var. corymbosa		15q, 13r	9q, 10r	1q, 1r	22q, 15r	10q, 4r	11q, 4r	3q	6q	7r
Anthericaceae	054F	Dichopogon capillipes	7q, 1r	17q, 42r	7q, 16r	3q	22q, 28r	10q, 10r	9q, 2r	3q, 1r	6q	1q, 22r
Anthericaceae	054F	Laxmannia omnifertilis		1q								
Anthericaceae	054F	Laxmannia ramosa subsp. ramosa	1q						2q			
Anthericaceae	054F	Sowerbaea laxiflora			1q		5q, 1r	5q				
Anthericaceae	054F	Thysanotus dichotomus	1o	1q			2q, 3r	1q, 1r				1o
Anthericaceae	054F	Thysanotus manglesianus	3q, 1r	18q, 5r	9q, 9r	3q	20q, 2r	8q, 1r	11q	3q	4q	
Anthericaceae	054F	Thysanotus multiflorus		1q					1q			
Anthericaceae	054F	Thysanotus patersonii					1q					
Anthericaceae	054F	Thysanotus sp.		1q			1q					
Anthericaceae	054F	Tricoryne arenicola		1q	1q, 3r					1q		

Anthericaceae	054F	<i>Tricoryne elatior</i>	2o		3q, 2r		3q, 2r	1q				
Colchicaceae	054J	<i>Burchardia bairdiae</i>					1q					
Colchicaceae	054J	<i>Burchardia umbellata</i>	2q	15q, 21r	9q, 8r	3q, 1r	18q, 16r	8q, 6r	7q, 1r	1q	6q	3r
Colchicaceae	054J	<i>Wurmbea drummondii</i>						2q				
Boryaceae	054L	<i>Borya laciniata</i>	3q, 1o	1q	1q							
Boryaceae	054L	<i>Borya sphaerocephala</i>	1r,	10q, 29r	5q, 15r	1r	7q, 19r	76q, 35r	7q, 1r	3q, 1r	1q	15r
Haemodoraceae	055	<i>Conostylis androstemma</i>		1q								
Haemodoraceae	055	<i>Haemodorum paniculatum</i>		2q	1q				1q	1q		
Haemodoraceae	055	<i>Haemodorum simulans</i>	1o	4q	2q				2q	1q	1q	1r
Hypoxidaceae	056A	<i>Hypoxis aff. glabella</i>		1q								
Hypoxidaceae	056A	<i>Hypoxis glabella</i> var. <i>leptantha</i>	1q	3q	1q			3q		1q		
Hypoxidaceae	056A	<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>		1q	4q	1q	20q	6q	4q	3q	1q	
Hypoxidaceae	056A	<i>Hypoxis</i> sp.							1q			1q
Dioscoreaceae	059	<i>Dioscorea hastifolia</i>	9q, 4r	15q 19r	7q, 5r	3q	23q, 24r	7q, 4r	4q, 3r	2q	6q	1q, 8r
Iridaceae	060	* <i>Moraea setifolia</i>	1q, 1o									
Iridaceae	060	<i>Orthrosanthus laxus</i> var. <i>gramineus</i>		1r, 1q				4q, 2r			2q	
Iridaceae	060	* <i>Romulea rosea</i>			1q	2q	7q		1q	3q	2q	
Orchidaceae	066	<i>Caladenia denticulata</i>				1q	9q		6q	2q	1q	
Orchidaceae	066	<i>Caladenia flaccida</i> subsp. <i>flaccida</i>		1q						1q		
Orchidaceae	066	<i>Caladenia flava</i> subsp. <i>flava</i>	3q	9q	9q	3q	17q	9q	9q	1q	4q	
Orchidaceae	066	<i>Caladenia</i> sp.			3r							
Orchidaceae	066	<i>Caladenia vulgata</i>	1q				1q	1q				
Orchidaceae	066	<i>Cyanicula deformis</i>		3q	9q	3q	17q	8q	10q	3q	1q	
Orchidaceae	066	<i>Cyanicula gemmata</i>			1q		1q		4q			
Orchidaceae	066	<i>Cyrtostylis huegelii</i>		1q		1q	1q					
Orchidaceae	066	<i>Diuris aff. recurva</i>		5q	6q		6q	5q	3q	1q	1q	
Orchidaceae	066	<i>Elythranthera brunonis</i>			1q				1q		2q	
Orchidaceae	066	<i>Eriochilus dilatatus</i>		1q		1q	2q			3q	1q	
Orchidaceae	066	<i>Eriochilus helonomos</i>		7q	4q		1q	4q				
Orchidaceae	066	<i>Habenaria elongata</i>					1q					
Orchidaceae	066	<i>Leporella fimbriata</i>		1q	1q			2q		1q		
Orchidaceae	066	<i>Paracaleana carinata</i>							1q			
Orchidaceae	066	<i>Prasophyllum gracile</i>					1q	1q				
Orchidaceae	066	<i>Pterostylis aff. nana</i>			2q		1q					

Orchidaceae	066	<i>Pterostylis aff. rufa</i>		1q				1q				
Orchidaceae	066	<i>Pterostylis exserta</i> (ms)							1q			
Orchidaceae	066	<i>Pterostylis recurva</i>		6q	2q	1q			1q		1q	
Orchidaceae	066	<i>Pterostylis sanguinea</i>		12q		2q	9q	8q	4q	2q	1q	
Orchidaceae	066	<i>Pterostylis sargentii</i>						1q				
Orchidaceae	066	<i>Pterostylis scabra</i>		3q		1q	1q					
Orchidaceae	066	<i>Pterostylis setulosa</i>		5q	8q	3q	7q	1q	2q	2q		
Orchidaceae	066	<i>Pterostylis sp.</i>		1q, 2r	1q		1q		2q			
Orchidaceae	066	<i>Pterostylis spathulata</i>	1o	1q								
Orchidaceae	066	<i>Pterostylis vittata</i>			1q						2q	
ANGIOSPERMS												
Dicotyledons												
Casuarinaceae	070	<i>Allocasuarina campestris</i>	3q, 6r	15q, 62r	9q, 33r	2q, 1r	17q, 40r	1q, 22r	8q, 18r	3q, 1r	4q, 1r	40r
Casuarinaceae	070	<i>Allocasuarina huegeliana</i>	6q, 6r	10q, 51r	7q, 29r	3q, 1r	19q, 48r	9q, 26r	8q, 25r	2q, 1r	3q, 1r	59r
Casuarinaceae	070	<i>Allocasuarina humilis</i>	2q	1q, 5r								
Casuarinaceae	070	<i>Allocasuarina microstachya</i>						1r				
Casuarinaceae	070	<i>Casuarina obesa</i>	3r									3r
Urticaceae	088	<i>Parietaria debilis</i>		2q								
Proteaceae	090	<i>Banksia prionotes</i>										2r
Proteaceae	090	<i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i>	1r, 1o									1r
Proteaceae	090	<i>Dryandra fraseri</i>	1o	1q, 5r				1q, 3r	1q			1o
Proteaceae	090	<i>Dryandra nivea</i> ssp. <i>nivea</i>										1r
Proteaceae	090	<i>Dryandra sessilis</i> var. <i>sessilis</i>	2q, 1r	5q, 17r	3q, 14r	1r	4q, 2r	6q, 9r	6q, 19r	1q	5q, 1r	33r
Proteaceae	090	<i>Grevillea amplexans</i> subsp. <i>semivestita</i>										2r
Proteaceae	090	<i>Grevillea biternata</i>					1q					1o
Proteaceae	090	<i>Hakea incrassata</i>		4q, 6r								
Proteaceae	090	<i>Hakea lissocarpha</i>		5r	1r		4r	3r				1r
Proteaceae	090	<i>Hakea preissii</i>	1r									
Proteaceae	090	<i>Hakea recurva</i> subsp. <i>recurva</i>	1o		1r			7r				1r, 1o
Proteaceae	090	<i>Isopogon divergens</i>		7q, 7r	1q			2q, 3r	1r			1o
Proteaceae	090	<i>Petrophile brevifolia</i>										1r
Santalaceae	092	<i>Leptomeria preissiana</i>		1r								
Santalaceae	092	<i>Santalum acuminatum</i>	4o	1q, 2r	1r							1o

Santalaceae	092	<i>Santalum spicatum</i>	1o				1q					
Loranthaceae	097	<i>Amyema miraculosa</i> subsp. <i>miraculosa</i>	1r, 1o				1q					
Loranthaceae	097	<i>Amyema preissii</i>	2q, 1r, 1o				2q, 1o					1o
Loranthaceae	097	<i>Lysiana casuarinae</i>					1q					
Loranthaceae	097	<i>Nuytsia floribunda</i>	2q, 1r	5r	2q			2r	1q, 1r		1q	6r
Polygonaceae	103	* <i>Emex australis</i>	1q									
Polygonaceae	103	<i>Muehlenbeckia adpressa</i>				1q	1q		1q			
Chenopodiaceae	105	<i>Atriplex suberecta</i>	1q, 1r					1r				
Chenopodiaceae	105	<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	1q									
Chenopodiaceae	105	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	2q	1r								
Chenopodiaceae	105	<i>Maireana brevifolia</i>	1r					1r				
Chenopodiaceae	105	<i>Maireana enchylaenoides</i>						2r				
Chenopodiaceae	105	<i>Maireana marginata</i>	1q	2q				2r				
Chenopodiaceae	105	<i>Rhagodia drummondii</i>		3q, 1r								
Chenopodiaceae	105	<i>Rhagodia preissii</i> subsp. <i>preissii</i>		2q, 1r	1q							
Amaranthaceae	106	<i>Ptilotus declinatus</i>	1o	2r								
Amaranthaceae	106	<i>Ptilotus divaricatus</i> var. <i>divaricatus</i>		2q, 1r	2r			2r				1o
Amaranthaceae	106	<i>Ptilotus drummondii</i> var. <i>drummondii</i>	1q, 2o	2r	1r			1r				
Amaranthaceae	106	<i>Ptilotus gaudichaudii</i> var. <i>parviflorus</i>	1q				1q					
Amaranthaceae	106	<i>Ptilotus holosericeus</i>			1q							
Amaranthaceae	106	<i>Ptilotus manglesii</i>		1r								
Amaranthaceae	106	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	1q, 1r	1r			1q, 2r		1q		1q	
Amaranthaceae	106	<i>Ptilotus spathulatus</i> forma <i>spathulatus</i>	1q, 1r		1q			1q				
Nyctaginaceae	107	<i>Boerhavia coccinea</i>	1o									
Gyrostemonaceae	108	<i>Gyrostemon ramulosus</i>										1o
Portulacaceae	111	<i>Calandrinia calyprata</i>	5q, 1o	4q			5q	5q	3q			
Portulacaceae	111	<i>Calandrinia eremaea</i>		1q	1q				1q			
Portulacaceae	111	<i>Calandrinia remota</i>	1q		1q							
Portulacaceae	111	<i>Calandrinia</i> sp. (inadequate material or not collected)		5q, 1r	4q	1q	8q	2q, 3r		1q	1q	1r

Portulacaceae	111	Calandrinia sp. Blackberry (D.M. Porter 171)							1q			
Caryophyllaceae	113	* Petrorhagia dubia	3q, 1r,		1q		10q	1q	8q	1q	1q	
Caryophyllaceae	113	* Petrorhagia prolifera	6q									
Caryophyllaceae	113	* Polycarpon tetraphyllum	1q									
Caryophyllaceae	113	* Silene gallica var. gallica	5q		3q		5q	4q	9q		1q	1q
Caryophyllaceae	113	* Spergula arvensis									1q	
Lauraceae	131	Cassytha pomiformis	1o	3q	1q			1q, 1r				
Brassicaceae	138	* Brassica barrelieri subsp. oxyrrhina					1q		1q			
Brassicaceae	138	Lepidium rotundum		1r								
Droseraceae	143	Drosera aff. macrantha	4q	13q	5q	2q	3q	6q	6q	2q	6q	
Droseraceae	143	Drosera erythrorhiza subsp. erythrorhiza	1q	7q	4q		+	6q	3q	2q		
Droseraceae	143	Drosera macrantha subsp. macrantha		10q	4q	1q	20q	9q	7q	2q	2q	1q
Droseraceae	143	Drosera macrophylla subsp. macrophylla		1q			1q		3q			
Droseraceae	143	Drosera pallida		1q	5q	1q	3q					
Crassulaceae	149	Crassula colorata	1q	1r					2r			6r
Crassulaceae	149	Crassula colorata var. acuminata	3q, 1r									
Crassulaceae	149	Crassula colorata var. colorata	2q	7q, 4r	4q	3q	9q	5q, 3r	11q		1q	2r
Crassulaceae	149	Crassula decumbens var. decumbens		1q					1q			
Crassulaceae	149	Crassula exserta	3q	3q	3q	1q	7q	2q	5q	2q	2q	
Pittosporaceae	152	Sollya heterophylla		2r				1q, 1r				1o
Surianaceae	160	Stylobasium australe		3r								1o
Mimosaceae	163	Acacia acuminata subsp. acuminata	6q, 5r, 3o	5q, 33r	3q, 31r		20q, 40r	7q, 22r	10q, 20r	1q	2q	72r
Mimosaceae	163	Acacia aestivalis			1q							
Mimosaceae	163	Acacia aristulata	1o	9q, 9r	4q	2q	6q, 3r	4q, 2r	5q, 3r	1q	5q	
Mimosaceae	163	Acacia congesta subsp. congesta	1o	5q, 10r	1q, 1r	3q, 1r	5q, 8r		1q	1q	2q	1r
Mimosaceae	163	Acacia ericksoniae						1r				
Mimosaceae	163	Acacia erinacea	1r,	2q, 2r	1q, 1r			1r				2o
Mimosaceae	163	Acacia hemiteles							2q			1o
Mimosaceae	163	Acacia lasiocarpa var. sedifolia		1q	1q, 1r	1q, 1r	2q, 2r	1q, 1r		1q	2q	1r
Mimosaceae	163	Acacia ligustrina	1q, 1r	1q								
Mimosaceae	163	Acacia microbotrya	1o	1q, 2r			1o	1r				1r
Mimosaceae	163	Acacia pulchella		1q, 1r								

Mimosaceae	163	Acacia pulchella var. glaberrima										1r
Mimosaceae	163	Acacia pulchella var. goadbyi		1q, 1r								
Mimosaceae	163	Acacia restiacea	1o	3r				2q, 3r	1q			1r
Mimosaceae	163	Acacia saligna		1r								
Mimosaceae	163	Acacia scirpifolia		1r								1o
Mimosaceae	163	Acacia stenoptera				2q	1q				5q	
Papilionaceae	165	Bossiaea sp. Cairn Hill (M Henson CH2-28)		6q, 13r	4q, 2r		2q				6q	1r
Papilionaceae	165	Cristonia biloba						3q				
Papilionaceae	165	Daviesia benthamii subsp. benthamii		1q								
Papilionaceae	165	Daviesia dielsii	1o	7q, 6r	1q	1r	1q	3r	2q, 1r	1q		5r
Papilionaceae	165	Daviesia hakeoides subsp. subnuda		1r					1q			1o
Papilionaceae	165	Gastrolobium acutum										1r
Papilionaceae	165	Gastrolobium obovatum						4r				
Papilionaceae	165	Gompholobium glutinosum MS		2r								1o
Papilionaceae	165	Isotropis drummondii										1o
Papilionaceae	165	Jacksonia floribunda										1r
Papilionaceae	165	Jacksonia foliosa										1r
Papilionaceae	165	Kennedia prostrata	1q			1q	7q	1q				2r
Papilionaceae	165	* Lupinus angustifolius			3q		2q					
Papilionaceae	165	Nemcia acuta		6q, 1r	1q	1q		3q	2q, 1r	1q		
Papilionaceae	165	Templetonia smithiana						1r				
Papilionaceae	165	* Trifolium arvense var. arvense	2q		2q	2q	3q		1q	3q	3q	
Papilionaceae	165	* Trifolium campestre var. campestre	1q									
Papilionaceae	165	* Trifolium hirtum	1q		1q		1q	1q	8q			
Papilionaceae	165	* Trifolium repens var. repens				1q	6q				1q	
Papilionaceae	165	* Trifolium subterraneum			2q		11q		2q		1q	1q
Geraniaceae	167	* Erodium botrys	4q, 1r				5q	3q	5q			3r
Geraniaceae	167	Erodium cygnorum		4q	2q	1q	4q	1q	1q		1q	1q
Geraniaceae	167	Pelargonium littorale subsp. littorale					1o					
Oxalidaceae	168	* Oxalis corniculata		1q	1q			1q				
Linaceae	170	* Linum trigynum	1q				4q	1q				1r
Rutaceae	175	Boronia coerulescens subsp. spinescens			2r		2q					1o
Rutaceae	175	Boronia ramosa subsp. anethifolia		1q	3q						3q	

Polygalaceae	183	<i>Comesperma integerrimum</i>	1q, 1o	4q, 1q	1q, 1r	2q	8q	2q	3q	3q	6q	1r
Polygalaceae	183	<i>Comesperma virgatum</i>						1q				
Polygalaceae	183	<i>Comesperma volubile</i>		2q					2q			
Euphorbiaceae	185	<i>Beyeria lechenaultii</i>										1o
Euphorbiaceae	185	<i>Euphorbia drummondii</i> subsp. <i>drummondii</i>	1q						1q			
Euphorbiaceae	185	<i>Phyllanthus calycinus</i>					4r					1o
Euphorbiaceae	185	<i>Poranthera microphylla</i>		1q			2q		1q			
Euphorbiaceae	185	<i>Ricinocarpos muricatus</i>	1q, 5r, 1o									
Stackhousiaceae	202	<i>Stackhousia monogyna</i>		2q				3q, 1r	3q			
Stackhousiaceae	202	<i>Tripterococcus brunonis</i>		5q	4q		1q	3q	1q		2q	
Sapindaceae	207	<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	4q, 1r, 1o						4q, 1r			
Sapindaceae	207	<i>Dodonaea inaequifolia</i>	1o	4q, 19r								1o
Sapindaceae	207	<i>Dodonaea pinifolia</i>		1q, 7r	1r			2r				
Rhamnaceae	215	<i>Cryptandra glabriflora</i>		3q, 1r			1q			1q	2q	
Rhamnaceae	215	<i>Stenanthemum tridentatum</i>						1q, 5r				
Rhamnaceae	215	<i>Trymalium daphnifolium</i>		2q	1q, 1r							
Rhamnaceae	215	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	1q, 1r, 1o	3q, 6r			4q, 4r	3q, 6r	2r			
Malvaceae	221	<i>Alyogyne hakeifolia</i>	1o		1o							1o
Malvaceae	221	<i>Alyogyne huegelii</i> var. <i>grossulariifolia</i>		1r								
Sterculiaceae	223	<i>Guichenotia micrantha</i>			1q		1o					
Sterculiaceae	223	<i>Guichenotia sarotes</i>					1q					
Sterculiaceae	223	<i>Guichenotia tuberculata</i>										1o
Sterculiaceae	223	<i>Thomasia grandiflora</i>		2q, 3r		1q	1r				2q	
Dilleniaceae	226	<i>Hibbertia acerosa</i>		1q								
Dilleniaceae	226	<i>Hibbertia subvaginata</i>	6q, 6r	14q, 33r	8q, 13r	3q, 1r	19q, 6r	7q, 8r	8q, 18r	2q, 1r	6q	24r
Thymelaeaceae	263	<i>Pimelea imbricata</i> var. <i>piligera</i>		1q, 1r	3q							
Myrtaceae	273	<i>Baeckea crispiflora</i> (smaller leaf form)		2r								1r
Myrtaceae	273	<i>Baeckea crispiflora</i> var. <i>tenuior</i>		3r			2r	2r				2r
Myrtaceae	273	<i>Baeckea preissiana</i>										1r
Myrtaceae	273	<i>Baeckea</i> sp. <i>Moora</i> (R. Bone 1993/1)		8q, 28r	5q, 12r							
Myrtaceae	273	<i>Calothamnus</i> aff. <i>quadrifidus</i> <i>Moora</i> -	1o	8q, 23r	1q		1r	4q, 7r	3q, 4r			3r

		Watheroo										
Myrtaceae	273	<i>Calothamnus sanguineus</i>	1o	3q, 6r	2q			2q, 2r	1q			
Myrtaceae	273	<i>Calytrix depressa</i>		2r	1q, 2r		1q	3r				
Myrtaceae	273	<i>Calytrix leschenaultii</i>	2q, 2r,	14q, 34r	9q, 22r	1q, 1r	7q, 22r	9q, 23r	10q, 15r	2q, 1r	4q	17r
Myrtaceae	273	<i>Calytrix strigosa</i>										1r
Myrtaceae	273	<i>Eremaea beaufortioides</i> var. <i>lachnosanthe</i>										1r
Myrtaceae	273	<i>Eremaea</i> sp. Cairn Hill (B. Morgan BMor 351)										1o
Myrtaceae	273	<i>Eucalyptus camaldulensis</i> (forma)										1r
Myrtaceae	273	<i>Eucalyptus camaldulensis</i> var. <i>obtusa</i>		1o								
Myrtaceae	273	<i>Eucalyptus eudesmioides</i>		3q, 16r								3r
Myrtaceae	273	<i>Eucalyptus horistes</i>		1r	1r, 2o							1r
Myrtaceae	273	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	1q, 2r,	6r	1q, 12r	1q	7q, 16r	1q, 8r	1r	1q		21r
Myrtaceae	273	<i>Eucalyptus obtusiflora</i>		1q, 1r	1r							1o
Myrtaceae	273	<i>Eucalyptus pruiniramis</i>										1r, 4o
Myrtaceae	273	<i>Eucalyptus salmonophloia</i>	1o	1r				3r				1r
Myrtaceae	273	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	1q, 1r	5q, 12r			2q, 3r	2q, 3r				3r
Myrtaceae	273	<i>Hypocalymma angustifolium</i>						4r				
Myrtaceae	273	<i>Kunzea praestans</i>	4q, 3r	13q, 42r	8q, 16r	1r	7q, 15r	5q, 10r	11q, 21r	1q, 1r	6q	25r
Myrtaceae	273	<i>Leptospermum</i> aff. <i>erubescens</i> (Moora Chert; B. Morgan 133)						1o				1o
Myrtaceae	273	<i>Leptospermum erubescens</i>										3r, 1o
Myrtaceae	273	<i>Melaleuca calyptroides</i>	2q, 3r,	10q, 31r	5q			5q, 7r	9q, 8r	1q		5r
Myrtaceae	273	<i>Melaleuca concreta</i>	1q	1r	1q, 1r			1r				1o
Myrtaceae	273	<i>Melaleuca coronicarpa</i>						1r				1r
Myrtaceae	273	<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>			1o							
Myrtaceae	273	<i>Melaleuca radula</i>	1o	6q, 16r	1q, 7r		1r	1q, 11r				1r
Myrtaceae	273	<i>Melaleuca sclerophylla</i>						3r				
Myrtaceae	273	<i>Melaleuca</i> sp.							1q			
Myrtaceae	273	<i>Regelia megacephala</i>	2q, 5r	9q, 26r	5q, 5r	3q	2q, 1r	3q, 1r	1q	1q	4q	
Myrtaceae	273	<i>Verticordia acerosa</i> var. <i>preissii</i>		1q								
Myrtaceae	273	<i>Verticordia densiflora</i> var. <i>densiflora</i>		1r				1r				1o

Myrtaceae	273	Verticordia huegelii var. stylosa		1r								
Myrtaceae	273	Verticordia pennigera										1o
Haloragaceae	276	Glischrocaryon flavescens		1r				1q				1o
Haloragaceae	276	Gonocarpus nodulosus			1q		1q		1q			
Apiaceae	281	Apium annuum		3q		2q	2q		1q			
Apiaceae	281	Daucus glochidiatus	3q	2q			7q	3q			1q	
Apiaceae	281	Homalosciadium homalocarpum							1q			
Apiaceae	281	Platysace cirrosa		10q	6q	1q	14q	2q	2q	1q	1q	
Apiaceae	281	Trachymene cyanopetala	5q	5q, 14r	7q, 5r		10q, 1r	5q, 1r	9q	2q	2q	
Apiaceae	281	Trachymene ornata	6q	14q, 6r	6q, 2r	3q	19q, 1r		7q, 1r	3q	4q	1q
Apiaceae	281	Trachymene pilosa		12q, 21r	1q, 7r		7q, 4r	7q, 6r	5q, 1r		3q	
Apiaceae	281	Trachymene sp.		2q			1q	1q				
Apiaceae	281	Xanthosia fruticulosa		14q, 33r	7q, 7r							
Epacridaceae	288	Astroloma serratifolium		4q, 8r	1r			3q, 2r	2q, 1r	1q		
Epacridaceae	288	Leucopogon sp. Yanchep (M. Hislop 19,861)						1q				1o
Primulaceae	293	* Anagallis arvensis	1q	5q	4q	3q	4q	5q		1q	3q	
Loganiaceae	302	Phyllangium sulcatum		2q	3q		13q	2q	4q			
Gentianaceae	303	* Centaurium tenuiflorum									1q	
Asclepiadaceae	305	Rhyncharrhena linearis						1q				
Convolvulaceae	307	Convolvulus angustissimus subsp. angustissimus	1q									
Poaceae	31	* Ehrharta calycina										2r
Chloanthaceae	311A	Pityrodia dilatata	2q, 1r	6q, 4r	4q, 1r	1q, 1r	9q, 7r	3r	5q, 2r	1q	5q	
Lamiaceae	313	Hemiandra incana		1q								1o
Lamiaceae	313	Hemigenia sp. (needs further study)	1o									
Solanaceae	315	Lycium australe			1o							
Solanaceae	315	* Solanum nigrum	1q					1q				
Solanaceae	315	Solanum oldfieldii	1o				1q, 2r					
Scrophulariaceae	316	* Dischisma capitatum					1o					
Scrophulariaceae	316	* Parentucellia latifolia	2q	3q	4q	1q	17q	4q	6q	3q	4q	1r
Scrophulariaceae	316	* Zaluzianskya divaricata					1q					
Orobanchaceae	320	* Orobanche minor									1q	
Myoporaceae	326	Eremophila lehmanniana		1q								
Plantaginaceae	329	Plantago debilis		2q	1q					1q		

Rubiaceae	331	* Galium murale					2q	1q	1q			1q
Rubiaceae	331	Opercularia vaginata	1q	5q, 7r	6q, 1r		4q, 1r	5q, 14r	6q, 2r		2q	7r
Campanulaceae	339	* Wahlenbergia capensis		1q			1q		1q			
Campanulaceae	339	Wahlenbergia gracilentia	1r	6q		1q	1q		1q		1q	
Lobeliaceae	340	Isotoma hypocrateriformis		1q								
Lobeliaceae	340	Lobelia sp. small flowers (K.F. Kenneally 7705)		3q			1q	3q				
Goodeniaceae	341	Brunonia australis					4q					1r
Goodeniaceae	341	Dampiera lavandulacea		2q, 3r	1q			1q, 3r				
Goodeniaceae	341	Goodenia arthrotricha		1q	1q		1q	3q, 2r				1r
Goodeniaceae	341	Goodenia berardiana	1q	4q	5q, 1r		13q, 3r	3q	2q	1q	1q	
Goodeniaceae	341	Goodenia glareicola		1r								
Goodeniaceae	341	Goodenia hassallii		1q, 1r	1q, 3r			1q, 3r				
Goodeniaceae	341	Goodenia sp.						2q		1q		
Goodeniaceae	341	Lechenaultia biloba		2q				1q				
Goodeniaceae	341	Scaevola anchusifolia			1q							
Goodeniaceae	341	Scaevola glandulifera		1q			1r					
Goodeniaceae	341	Scaevola phlebopetala		3q	4q				1q		1q	
Goodeniaceae	341	Velleia cynopotamica		1r			1q					
Stylidiaceae	343	Levenhookia stipitata		2q	1q				1q			
Stylidiaceae	343	Stylidium calcaratum		1q	1q					1q		
Stylidiaceae	343	Stylidium caricifolium						1q	1q		3q	
Stylidiaceae	343	Stylidium cordifolium		1q, 1r				1q	2q			
Stylidiaceae	343	Stylidium glabrifolium				1q	2q					
Stylidiaceae	343	Stylidium miniatum		2q				1q				
Stylidiaceae	343	Stylidium repens	1r					3q	6q			
Stylidiaceae	343	Stylidium septentrionale	2q	13q, 28r	9q, 7r		1q, 2r	6r	9q, 1r		1q	
Asteraceae	345	Actinobole uliginosum	1o									
Asteraceae	345	Amblysperma sp. Moora (GH7-57)						1q				
Asteraceae	345	* Arctotheca calendula	6q	6q	8q	1q	15q	3q	11q	3q+	1q	
Asteraceae	345	Blennospora drummondii		7q, 11r	9q, 2r	2q	8q, 2r	2q, 4r	1q, 1r		1q	
Asteraceae	345	Brachyscome perpusilla	1q		1q							
Asteraceae	345	Calotis hispidula			1q		1q					
Asteraceae	345	* Cotula turbinata	1q									

Asteraceae	345		<i>Erymophyllum tenellum</i>			1r						
Asteraceae	345		<i>Gilberta tenuifolia</i>	1q, 1o	2q	1q, 5r		9q, 20r	4q, 3r	1q, 1r	3q	13r
Asteraceae	345	*	<i>Hedypnois rhagadioloides</i>					3q	1q			
Asteraceae	345		<i>Hyalosperma cotula</i>	1o		2q		2q	9q, 2r	1q	2q	1q
Asteraceae	345		<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>			1r		1q		1q		2r
Asteraceae	345	*	<i>Hypochaeris glabra</i>	10q, 1r	17q	9q	3q	22q, 2r	7q, 4r	12q, 13r	3q	4q
Asteraceae	345	*	<i>Hypochaeris radicata</i>		3q							
Asteraceae	345		<i>Lagenophora huegelii</i>		1q				3q			
Asteraceae	345		<i>Lawrencella rosea</i>	1r	8q, 19r	8q, 10r		9q, 5r	1q, 4r		1q	1r
Asteraceae	345		<i>Millotia</i> aff. <i>tenuifolia</i> (Moora: CH20-11)		1q							
Asteraceae	345		<i>Millotia myosotidifolia</i>	2q					1q	2q		
Asteraceae	345		<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	1q, 1r	4q, 5r		1q	4q	1q	2q, 1r	1q	2r
Asteraceae	345		<i>Olearia dampieri</i> subsp. <i>eremicola</i>	1o				9q, 9r	6q, 11r	1q, 1r		4r
Asteraceae	345		<i>Podolepis canescens</i>	1q, 1r, 2o	3q, 5r	2q		2q	5q, 20r	1q		
Asteraceae	345		<i>Podolepis gracilis</i>								1q	
Asteraceae	345		<i>Podolepis lessonii</i>	2q, 1r	5q, 9r	8q, 11r		19q, 31r	8q, 15r	10q, 14r	3q, 2r	6q
Asteraceae	345		<i>Podotheca</i> aff. <i>gnaphalioides</i> (Moora WDM1-65)								3q	
Asteraceae	345		<i>Podotheca angustifolia</i>		3q, 6r	6q, 3r		11q, 1r	7q, 5r	4q, 3r	3q	1q
Asteraceae	345		<i>Podotheca gnaphalioides</i>	1q						2q		
Asteraceae	345		<i>Pterochaeta paniculata</i>		1q							
Asteraceae	345		<i>Quinetia urvillei</i>			2q		4q				
Asteraceae	345		<i>Rhodanthe laevis</i>					3q		4q	1q	
Asteraceae	345		<i>Rhodanthe manglesii</i>			1q				1q		
Asteraceae	345		<i>Rhodanthe polycephala</i>	2q	5q, 3r	1q, 3r		1r	1r			
Asteraceae	345		<i>Rhodanthe pygmaea</i>			1q						
Asteraceae	345		<i>Schoenia cassiniana</i>	4q	3q			3q	3q	1q		1q
Asteraceae	345		<i>Senecio glossanthus</i>	1q								
Asteraceae	345		<i>Siloxerus humifusus</i>					1q				
Asteraceae	345	*	<i>Sonchus asper</i>	1q								
Asteraceae	345	*	<i>Sonchus oleraceus</i>		1		1q	2q	1q	1q, 1r	2q	
Asteraceae	345	*	<i>Tripteris clandestina</i>	1q	5q	2q	2q	7q	2q	8q	1q	1q
Asteraceae	345	*	<i>Urospermum picroides</i>	8q, 1r	2q		2q	5q	4q	3q		2q

Asteraceae	345	*	<i>Ursinia anthemoides</i>	10q, 6r	18q, 1r	9q	3q	23q, 2r	10q, 4r	12q, 2r	3q	6q	1q
Asteraceae	345		<i>Waitzia acuminata</i>						1q				
Asteraceae	345		<i>Waitzia nitida</i>	1q	1q, 7r	1q, 4r		13q, 8r	4q, 9r	5q			

APPENDIX 6: Quadrat site descriptions and species lists for the study area

Notes: All coordinates are given in the WGS 84 datum. The item Type: "QUADRAT 10x10 m, 30x 30" means a ten by ten metre quadrat nested within a thirty by thirty metre quadrat.

CAIRN HILL RESERVE

Moorra **Site** CAH001

Described by BRM **Date** 22/10/00 **Type:** QUADRAT 10x10 m, 30x 30

Location: Cairn Hill Westrail Reserve, approximately 11 km north of Moorra on the Midlands Road. The quadrat is on the south side of the track to the radio tower, approximately 250 m east of the Midlands Road.

MGA Zone 50 407129 **m E** 6620970 **m N** -30.539955 **S lat** 116.031824 **E long**

Habitat: Mid-slope, North facing.

Soil: Grey loamy sand amongst outcropping chert.

Rock Type: Chert outcrop, 80-90% surface cover.

Vegetation: *Regelia megacephala* open to closed scrub over *Kunzea praestans*, *Melaleuca calyptroides*, *Calothamnus* aff. *quadrifidus* Moorra-Watheroo, *Dodonaea pinifolia* scattered shrubs over *Stypandra glauca* very open herbland.

Vegetation condition: Excellent.

Fire age: < 5 years

Notes: 30x30m area restricted on east side (vegetation changes to a n *Allocasuarina campestris* community)

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30 cm	CH1-3	
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	1.8 m	CH1-7	=EO1-1
<i>Allocasuarina campestris</i>	+	<1 %	1 m	CH1-11	
<i>Amphipogon caricinus</i>	+	<1 %		=WO1-4	
<i>Baeckea</i> sp. Moorra (R. Bone 1993/1)	+	<1 %		CH1-10	
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	30 cm		
<i>Burchardia umbellata</i>	+	<1 %	15cm	CH1-23	Revisit ? <i>Thysanotus</i>
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moorra-Watheroo	1-2	1-5%	1 m	CH1-4	No flowers
<i>Calytrix leschenaultii</i>	+	<1 %	1 m	CH1-6	
<i>Cheilanthes adiantoides</i>	+	<1 %	10 cm		
<i>Desmocladius flexuosus</i>	+	<1 %	40 cm	CH1-8	
<i>Dichopogon capillipes</i>	+	<1 %	40 cm		Lilly, purple flower,
			dead base		
<i>Dioscorea hastifolia</i>	+	<1 %		=EO1-11	
<i>Dodonaea pinifolia</i>	2	1-5%	1.2m	CH1-2&18	Revisit
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20, 40 cm	CH1-21,22	=WO1-23, Climbing & #Revisit, <i>Drosera</i> #1
<i>Hibbertia subvaginata</i>	+	<1 %	90cm		Revisit
<i>Hypochoeris radicata</i>	+	<1 %	2cm	CH1-19	Revisit
<i>Kunzea praestans</i>	2	1-5%	1 m	CH1-1	
<i>Melaleuca calyptroides</i>	3	1-5%	1.3m		Revisit
<i>Pterostylis recurva</i>	+	<1 %	15cm	CH1-20	Revisit
<i>Regelia megacephala</i>	4	1-5%	2-3 m		
<i>Stypandra glauca</i>	3-4	1-5%	60 cm	=EO1-13	
<i>Tripterococcus brunonis</i>	+	<1 %		CH1-9	
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Xanthorrhoea drummondii</i>	1	<1 %	1 m		2 only
<i>Xanthosia fruticulosa</i>				CH1-5	
<i>Borya sphaerocephala</i>	+	<1 %		CH1-16	
<i>Lawrencella rosea</i>	+	<1 %		CH1-14	Daisy
<i>Pityrodia dilatata</i>	+	<1 %		CH1-13	
<i>Scaevola phlebopetala</i>	+	<1 %		CH1-15	
<i>Stackhousia monogyna</i>	+	<1 %		CH1-12	
<i>Thysanotus manglesianus</i>	+	<1 %		CH1-17	

Moora Site CAH002**Described by** MJH **Date** 22/10/00 **Type:** QUADRAT 10x10 m, 30x 30**Location:** Cairn Hill Westrail Reserve, approximately 11 km north of Moora on the Midlands Road. The plot is on the slope to the N side of the track from the gravel pits to the radio tower, approx. 500 m east of the Midlands Road.**MGA Zone** 50 **407370 m E** 6621123 **m N** -30.538594 **S lat** 116.03435 **E long****Habitat:** SW-facing moderate mid- slope.**Soil:** Dark grey silty loam amongst outcropping chert. Good litter layer.**Rock Type:** Chert outcrop, 60% cover.**Vegetation:** Eucalyptus eudesmioides subsp. eudesmioides low open woodland to low woodland over Regelia megacephala, Kunzea praestans open scrub over Melaleuca calyptroides open shrubland over Calytrix leschenaultii, Baeckea sp. Moora (R. Bone 1993/1), Hibbertia subvaginata, Bossiaea sp. Cairn Hill (M Henson CH2-28) low open shrubland over Desmodium flexuosus very open sedgeland.**Vegetation condition:** Excellent.**Notes:** First coord is for NE peg; 2nd coordinate is for SW peg.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
Acacia aristulata	+	<1 %	30 cm	CH2-30	
Allocasuarina humilis	+	<1 %	1.2 m	CH2-43	1 of
Austrostipa variabilis	+	<1 %	70 cm		
Baeckea sp. Moora (R. Bone 1993/1)	2-3	1-5%	30-50 cm	CH2-18	
Boronia ramosa subsp. anethifolia	+	<1 %	30 cm	CH2-2	
Briza maxima	+	<1 %	10-15 cm		
Burchardia umbellata	+	<1 %	15 cm		
Caladenia flava subsp. flava	+	<1 %	15 cm	CH2-11a	
Calytrix leschenaultii	1-2	1-5%	60 cm	CH2-12	
Chamaescilla corymbosa var. corymbosa				CH2-11,40	Also 30x30.
Cheilanthes adiantoides	+	<1 %			
Desmodium flexuosus	1-2	1-5%	15-20 cm	CH2-3	
Dichopogon capillipes	+	<1 %	20 cm		
Dioscorea hastifolia	1	<1 %	1m		
Drosera aff. macrantha	+	<1 %	0.2-1.5 m	CH2-13a&	Tall one (2x2-13)
Drosera macrantha subsp. macrantha	+	<1 %	45 cm	CH2-5	
Eucalyptus eudesmioides subsp. eudesmioides	20-30	10-25%	6 m	CH2-16	Mallee
Hibbertia subvaginata	1	<1 %	90cm		
Isopogon divergens	+	<1 %	1.6m		Revisit.
Kunzea praestans	10	5-10%	1-2.5 m		
Lawrencella rosea	+	<1 %	5 cm	CH2-6,2-1	White daisy
Melaleuca calyptroides	1-2	1-5%	1.75 m	CH2-10	
Nemcia acuta	+	<1 %	10cm		Revisit. Elliptic leaves,
Neurachne alopecuroidea	+	<1 %	10 cm	CH2-4	
Pentastichis airoides	+	<1 %	5 cm	CH2-8	Grass
Pterostylis recurva	+	<1 %	2cm	CH2-36	Revisit. Pterostylis #2
Pterostylis sanguinea	+	<1 %	12cm	CH2-35,38	Revisit.
Regelia megacephala	30	25-33.3%	2-3 m		
Stylidium septentrionale	+	<1 %	5 cm	CH2-19	
Thysanotus manglesianus	+	<1 %	2 m	CH2-9	
Trachymene ornata	+	<1 %	5 cm	CH2-7	
Ursinia anthemoides	+	<1 %	10 cm		
Xanthorrhoea drummondii	2-3%	1-5%	2-3 m		
Xanthosia fruticulosa	+	<1 %	20-30 cm	CH2-1	
Agrostocrinum scabrum	+	<1 %	30cm	CH2-44	Lilly (glaucous, tussock)
Allocasuarina huegeliana	+	<1 %	3 m		
Amphipogon caricinus	+	<1 %	35cm	CH2-39	Revisit.
Austrodanthonia setacea	+	<1 %	20 cm		Grass-
Austrostipa elegantissima	+	<1 %	45 cm	CH2-26	
Blennospora drummondii	+	<1 %		CH2-24	Daisy
Bossiaea sp. Cairn Hill (M Henson CH2-28)	+	<1 %	80cm	CH2-28	
Calothamnus aff. quadrifidus Moora-Watheroo	+	<1 %	50 cm	CH2-20	
Centrolepis drummondii	+	<1 %		CH2-22	
Comesperma integerrimum	+	<1 %	2m, 30 cm	CH2-21,42	
Cryptandra glabriflora	+	<1 %		=CH9-46	Rhamnaceae
Dianella revoluta var. divaricata	+	<1 %	80 cm	CH2-13b	(2x2-13)
Hypochaeris glabra	+	<1 %	2cm		Revisit.
Lepidosperma tenue	+	<1 %	40cm	CH2-27	

Levenhookia stipitata	+	<1 %		CH2-23	
Pityrodia dilatata	+	<1 %			
Schoenus pleiostemoneus	+	<1 %	10cm	CH2-41	Revisit.
Stypandra glauca	+	<1 %	60 cm	CH2-14	Blue lilly
Trachymene pilosa	+	<1 %		CH2-15,31	Specimen poor.
Vulpia myuros var. hirsuta	+	<1 %		CH2-25	Grass

Moora Site CAH003

Described by MET **Date:** 22/10/00 **Type:** QUADRAT 10x10 m, 30x 30

Location: Cairn Hill Westrail Reserve, approximately 11 km north of Moora on the Midlands Road. The plot is on the E side of track to the radio tower towards the top of the hill, approximately 700 m along the track from the Midlands Road.

MGA Zone 50 **407637 m E** **6621152 m N** **-30.538353 S lat** **116.037135 E long**

Habitat: Gentle upper slope facing northwest.

Soil: Whitish grey, gravelly siliceous silty fine sand. Litter under Allocasuarina campestris.

Vegetation: Allocasuarina huegeliana scattered low trees over Dryandra sessilis var. sessilis, Xanthorrhoea drummondii scattered tall shrubs over Allocasuarina campestris shrubland to open heath over Melaleuca calyptroides open shrubland over Desmocladius flexuosa, Borya sphaerocephala, Stylidium septentrionale, Neurachne alopecuroidea open herb/grass/sedgeland.

Vegetation condition: Excellent. Weed invasion minimal.

Fire Age: >10 (>15?) years since burnt.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Allocasuarina campestris	20-25%	10-25%	2-2.5m		
Allocasuarina huegeliana	2	1-5%	6 m		
Amhipogon caricinus	+	<1 %	10cm	CH3-12,50	
Austrostipa sp 2 hairy sheath	+	<1 %	50 cm	CH3-20	
Austrostipa tenuifolia	+	<1 %	15 cm	CH3-8	
Baeckea sp. Moora (R. Bone 1993/1)	+	<1 %	50 cm	CH3-15	
Blennospora drummondii	+	<1 %	4-5 cm	CH3-11	
Borya sphaerocephala	+	<1 %	4 cm	CH3-5	
Briza maxima	+	<1 %	20cm		
Burchardia umbellata	+	<1 %	40 cm		
Caladenia flaccida subsp. flaccida	+	<1 %			
Calytrix leschenaultii	+	<1 %	65 cm	CH3-14	
Centrolepis pilosa	+	<1 %	1.5 cm	CH3-21	
Chamaescilla corymbosa var. corymbosa	+	<1 %		CH3-53	
Comesperma integerrimum	+	<1 %	25 cm	CH3-3	
Desmocladius flexuosus	1-2%	1-5%	20cm		
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	2cm	CH3-55	
Drosera macrantha subsp. macrantha	+	<1 %	50 cm	CH3-4,52	
Dryandra sessilis var. sessilis	+	<1 %	2.6(4) m		
Goodenia berardiana	+	<1 %	7-10 cm	CH3-13	
Haemodorum simulans	+	<1 %	15 cm	CH3-18	
Hemiandra incana	+	<1 %	30 cm	CH3-10	
Hypochaeris glabra	+	<1 %	5 cm		
Kunzea praestans	+	<1 %	20-70 cm		juv
Lawrencella rosea	+	<1 %	20 cm	CH3-9	Daisy
Laxmannia omnifertilis	+	<1 %	15 cm	CH3-6	
Lepidobolus chaetocephalus	+	<1 %	25 cm	CH3-7,51	
Melaleuca calyptroides	5	5-10%	1-1.5 m	CH3-1	
Millotia tenuifolia var. tenuifolia	+	<1 %	4 cm		=EO3
Opercularia vaginata	+	<1 %	25 cm		
Parentucellia latifolia	+	<1 %	5 cm		
Podolepis lessonii	+	<1 %	10 cm	CH3-22	
Pterochaeta paniculata	+	<1 %	4cm	CH3-24	Daisy
Schoenus clandestinus	+	<1 %	6 cm	CH3-23	
Stylidium miniatum	+	<1 %	2 cm	CH3-17	Rosette
Stylidium septentrionale	2	1-5%	10 cm	CH3-2	
Thysanotus manglesianus	+	<1 %		CH3-54	Fleshy leaf (Probably juv. T. Mang-MET8/05)
Trachymene cyanopetala	+	<1 %	10 cm	CH3-19	
Trachymene ornata	+	<1 %	6 cm	=WD3-9	
Ursinia anthemoides	+	<1 %	5-12 cm		

<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10-15 cm	CH3-16	
<i>Xanthorrhoea drummondii</i>	5	5-10%	1.5-3.7 m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	6.5 m		
<i>Austrodanthonia caespitosa</i>	+	<1 %	6 cm	CH3-27	
<i>Calytrix depressa</i>	+	<1 %	40-70 cm	CH3-30	
<i>Goodenia hassallii</i>	+	<1 %	70 cm	CH3-26	Near NW corner
<i>Hibbertia subvaginata</i>	+	<1 %	40 cm		
<i>Isopogon divergens</i>	+	<1 %	1.6m		
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	50 cm	CH3-29	
<i>Leporella fimbriata</i>	+	<1 %	4cm	CH3-56	Orchid
<i>Pimelea imbricata</i> var. <i>piligera</i>	+	<1 %	60 cm	CH3-31	
<i>Verticordia acerosa</i> var. <i>preissii</i>	+	<1 %	50 cm	CH3-25	

Moora Site CAH004

Described by BRM **Date** 23/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill Westrail Reserve, approximately 11 km north of Moora on the Midlands Road. The plot is approximately 400 m south and then east along the track from the entry to the Reserve from the Midlands Road

MGA Zone 50 **407395 m E** **6620265 m N** **-30.546337 S lat** **116.034534 E long**

Habitat: East facing mid-slope.

Soil: Quartz gravel grey sand.

Rock Type: Chert, 40-50% cover.

Vegetation: *Allocasuarina campestris* closed scrub over *Xanthorrhoea drummondii* scattered shrubs over *Calytrix leschenaultii*, *Daviesia hakeoides* subsp. *subnuda* scattered low shrubs over *Desmocladius flexuosus*, *Stypandra glauca* scattered sedges and herbs.

Vegetation condition: Excellent, no signs of disturbance.

Notes: Earthworks in 30x30 area about 5m downslope (north side) of 10x10 - only searched to this.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	80	>75%	2-3 m		
<i>Aristida contorta</i>				CH4-27	
<i>Borya sphaerocephala</i>	+	<1 %	2 cm	CH4-1	
<i>Burchardia umbellata</i>	+	<1 %	15cm	CH4-56	fleshy leaf
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		CH4-10	Orchid
<i>Calytrix leschenaultii</i>	+	<1 %	1 m	CH4-2	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	CH4-3,54	
<i>Cheilanthes adiantoides</i>	+	<1 %	10cm		=WO1-19
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	1-2	1-5%		CH4-6	
<i>Desmocladius flexuosus</i>	+	<1 %		CH4-7	
<i>Dichopogon capillipes</i>	+	<1 %	20cm	CH4-51	
<i>Dioscorea hastifolia</i>	+	<1 %			=EO1-11
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		CH4-58	
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	2cm	CH4-53	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %			2=EO1-18
<i>Dryandra fraseri</i>	+	<1 %	60 cm	CH4-9	prostrate
<i>Hypochaeris glabra</i>				CH4-13	
<i>Lepidosperma leptostachyum</i>	+	<1 %	30cm	CH4-19,57	Also 30x30.
<i>Lepidosperma tenue</i>	+	<1 %		CH4-18	Sedge
<i>Melaleuca radula</i>	+	<1 %	1-1.5 m	CH4-11,52	
<i>Nemcia acuta</i>				CH4-14	
<i>Neurachne alopecuroidea</i>	+	<1 %			=WO1-17, grazed
<i>Platysace cirrosa</i>	+	<1 %	40cm	CH4-50	
<i>Schoenus clandestinus</i>	+	<1 %		CH4-15	
<i>Stylidium calcaratum</i>	+	<1 %		CH4-4	leaf at base
<i>Stylidium septentrionale</i>	+	<1 %		CH4-5	
<i>Stypandra glauca</i>	1-2	1-5%		=EO1-13	
<i>Thysanotus manglesianus</i>	+	<1 %	40cm	CH4-55	Climber
<i>Trachymene ornata</i>				CH4-25	
<i>Tripterococcus brunonis</i>	+	<1 %		CH4-8	
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Xanthorrhoea drummondii</i>	+	<1 %	1 m		
<i>Xanthosia fruticulosa</i>				CH4-12	
<i>Austrodanthonia setacea</i>				CH4-20	
<i>Austrostipa tenuifolia</i>	+	<1 %		CH4-23	

Calothamnus aff. quadrifidus Moora-Watheroo	+	<1 %		CH4-16	
Crassula exserta	+	<1 %		CH4-22	
Daviesia dielsii	+	<1 %		CH4-24	
Eriochilus helonomos	+	<1 %	20cm	CH4-59	Orchid
Genus sp.	+	<1 %	2cm	CH4-61	Daisy.
Hakea incrassata	+	<1 %		CH4-17	
Hibbertia subvaginata	+	<1 %			
Kunzea praestans	+	<1 %			
Pentaschistis airoides	+	<1 %			
Pterostylis sanguinea	+	<1 %	2cm	CH4-60	Pterostylis flat
Vulpia myuros var. hirsuta	+	<1 %		CH4-21	

Moora Site CAH005

Described by MJH **Date** 23/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill Westrail Reserve, approximately 11 km north of Moora on the Midlands Road. The plot is on the slope to the N side of the track from the gravel pits to the radio tower, approx. 600 m east of the Midlands Road.

MGA Zone 50 **407471 m E** **6621152 m N** **-30.53834 S lat** **116.035405 E long**

Habitat: Gentle midslope.

Soil: Brown fine sand/silt. Good litter cover.

Rock Type: Chert cobbles-large gravel. Cover 20-70% variable.

Vegetation: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata scattered low trees over Dryandra sessilis var. sessilis high open shrubland over Kunzea praestans closed heath to closed scrub over Melaleuca calyptroides, Calothamnus sanguineus scattered shrubs over Hibbertia subvaginata, Calytrix leschenaultii low open shrubland over Desmocladius flexuosus open sedgeland.

Veg Condition: Excellent

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia aristulata	+	<1 %	(20) 50cm	CH5-29	
Austrodanthonia caespitosa	+	<1 %	5-10 cm	CH5-21	
Austrodanthonia setacea	+	<1 %	25 cm	CH5-7	Grass-Amphipogon/ Austrodanthonia
Austrostipa elegantissima	+	<1 %	80cm	CH9-5B	
Blennospora drummondii	+	<1 %	5 cm	CH5-18,20	
Bossiaea sp. Cairn Hill (M Henson CH2-28)	+	<1 %	25 cm	CH5-23	
Briza maxima	+	<1 %	5 cm		
Burchardia umbellata	+	<1 %	10-40cm	=CH1-23	Fleshy leaf
Calothamnus sanguineus	2	1-5%	1m	CH5-5, 57	
Calytrix leschenaultii	2	1-5%	1 m+	CH5-4	
Cassytha pomiformis	+	<1 %	50 cm	CH5-11	
Chamaescilla corymbosa var. corymbosa	+	<1 %	5cm	CH5-24, 50	
Cheilanthes adiantoides	2	1-5%	2cm		
Desmocladius flexuosus	10-12	10-25%	15-20 cm	CH5-3	
Dichopogon capillipes	+	<1 %	10cm		
Drosera aff. macrantha	+	<1 %	40cm	CH5-52,56	
Drosera macrantha subsp. macrantha	+	<1 %	1 m	CH5-8	Large
Dryandra sessilis var. sessilis	5	5-10%	3-4 m		
Hibbertia subvaginata	3-4	1-5%	90 cm		
Kunzea praestans	80	>75%	1.5-2.5 m		
Lawrencella rosea	+	<1 %	5 cm	CH5-13	
Melaleuca calyptroides	2-4	1-5%	1 m	CH5-6	
Neurachne alopecuroidea	+	<1 %	10 cm	CH5-9A	
Platysace cirrosa	+	<1 %		CH5-54	
Pterostylis recurva	+	<1 %	2cm	=CH2-36	Pterostylis flat base
Pterostylis sanguinea	+	<1 %	15cm	CH5-55	
Stylidium septentrionale	+	<1 %	10 cm	CH5-2	=ch2
Trachymene ornata	+	<1 %	5 cm	CH5-15	
Trachymene pilosa	+	<1 %	5 cm	CH5-17	Grass
Tripteroascus brunonis	+	<1 %	25 cm	CH5-10	Also CH5-12,16
Ursinia anthemoides	+	<1 %	15 cm		
Vulpia myuros var. hirsuta	+	<1 %	5 cm	CH5-19	
Xanthorrhoea drummondii	+	<1 %	2.5 m		
Xanthosia fruticulosa	+	<1 %	20 cm	CH5-1	
Acacia acuminata subsp. acuminata	+	<1 %	8 m		On edge
Acacia pulchella var. goadbyi	+	<1 %	70cm	CH5-53	Det BRM, but atypical.

<i>Allocasuarina huegeliana</i>	+	<1 %	6-7 m		On edge
<i>Allocasuarina</i> sp.	+	<1 %	1.5m		
<i>Austrostipa variabilis</i>	+	<1 %	20 cm	CH5-30	
<i>Avena barbata</i>	+	<1 %	30 cm		
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	+	<1 %	1.5 m	CH5-27	
<i>Dioscorea hastifolia</i>	+	<1 %	30 cm		
<i>Ehrharta longiflora</i>	+	<1 %	15 cm		Open patch upslope
<i>Haemodorum simulans</i>	+	<1 %	30 cm	CH5-28	
<i>Hypochaeris glabra</i>	+	<1 %			
<i>Nemcia acuta</i>	+	<1 %	50 cm	CH5-31	
<i>Pityrodia dilatata</i>	+	<1 %	5-10 cm		Juvenile
<i>Regelia megacephala</i>	+	<1 %	3 m		
<i>Scaevola phlebopetala</i>	+	<1 %	25 cm	CH5-26	
<i>Thysanotus manglesianus</i>	+	<1 %		CH5-51	

Moora Site CAH006

Described by MET **Date** **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill Westrail Reserve, approximately 11 km north of Moora on the Midlands Road. The plot is ~200 m NNW of the radio tower.

MGA Zone 50 **407570 m E** **6621034 m N** **-30.539412 S lat** **116.036426 E long**

Habitat: Gently sloping upper hillslope.

Soil: Gravelly, pebbly siliceous silt/fine sand. Some litter.

Rock Type: Some outcrop.

Vegetation: *Eucalyptus eudesmioides* subsp. *eudesmioides* mallee low open woodland to woodland over *Regelia megacephala*, *Kunzea praestans*, *Xanthorrhoea drummondii* open shrubland over *Allocasuarina campestris* open heath over *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii* shrubland.

Vegetation condition: Very good to excellent. Would be excellent except burnt 5/10 years ago. Low weed invasion.

Fire age: 5-10 years ago.

Notes: Less *Regelia megacephala* outside plot.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	40	33.3-50%	1.2m	CH6-56	
<i>Amhipogon caricinus</i>	+	<1 %	40 cm	CH6-18	
<i>Apium annuum</i>	+	<1 %	2 cm	CH6-13	
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	15-20	10-25%	50-70 cm	CH6-15	
<i>Blennospora drummondii</i>	+	<1 %	2-4 cm	CH6-14	
<i>Borya sphaerocephala</i>	+	<1 %	4 cm		
<i>Briza maxima</i>	+	<1 %	5 cm		
<i>Burchardia umbellata</i>	+	<1 %	20cm	CH6-50	
<i>Calytrix leschenaultii</i>	+/-5	1-5%	60-80 cm	CH6-4	
<i>Centrolepis drummondiana</i>	+	<1 %	2 cm	CH6-11	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	CH6-58	
<i>Cryptandra glabriflora</i>	+	<1 %	40cm	CH6-54	Rhamnaceae
<i>Daviesia dielsii</i>	+	<1 %	50 cm		
<i>Desmocladius flexuosus</i>	+	<1 %	25 cm	CH6-6	
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20 cm	CH6-24	Climber
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1 cm		ssp.??
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	25cm	CH6-52	
<i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i>	<10	5-10%	3-5 m	CH6-1	Smooth grey-light brown bark
<i>Hakea incrassata</i>	+	<1 %	1 m	CH6-22	
<i>Hibbertia subvaginata</i>	+	<1 %	60 cm		
<i>Kunzea praestans</i>	+/-1	<1 %	1-1.4 m		
<i>Lawrencella rosea</i>	+	<1 %	15-25 cm	CH6-16	
<i>Lepidosperma</i> sp.	+	<1 %	35 cm	CH6-8	
<i>Melaleuca calyptroides</i>	5	5-10%	90cm		
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	4 cm	CH6-7	
<i>Neurachne alopecuroidea</i>	+	<1 %	5 cm		
<i>Pentastichis airoides</i>	+	<1 %	10-15 cm		
<i>Pityrodia dilatata</i>	+	<1 %	(2) 55cm	CH6-9,53	
<i>Platysace cirrosa</i>	+	<1 %	15cm	CH6-51	
<i>Pterostylis sanguinea</i>	+	<1 %	2cm	CH6-55, 57	<i>Pterostylis</i> sp.
<i>Regelia megacephala</i>	2-3	1-5%	1.5 m		
<i>Scaevola phlebopetala</i>	+	<1 %	20 cm	CH6-17	

<i>Styloidium septentrionale</i>	+	<1 %	10 cm	CH6-10	
<i>Stypandra glauca</i>	+	<1 %	25-75 cm	CH6-5	
<i>Trachymene ornata</i>	+	<1 %	5 cm		
<i>Trachymene pilosa</i>	+	<1 %	5 cm		
<i>Tricoryne arenicola</i>	+	<1 %	15 cm	CH6-3	PRIORITY 2
<i>Tripterococcus brunonis</i>	+	<1 %	50 cm	CH6-2	
<i>Ursinia anthemoides</i>	+	<1 %	10 cm		
<i>Wahlenbergia gracilentia</i>	+	<1 %	7 cm	CH6-12	
<i>Xanthorrhoea drummondii</i>	<5	1-5%	1.5-2 m		
<i>Xanthosia fruticulosa</i>	+	<1 %	30 cm		
<i>Acacia aristulata</i>	+	<1 %	50 cm	CH6-20	
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	1.8 m	CH6-27	
<i>Astroloma serratifolium</i>	+	<1 %	25 cm	CH6-19	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	+	<1 %	1.9 m	CH6-29	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	70 cm		
<i>Nemcia acuta</i>	+	<1 %	20 cm	CH6-25	juv
<i>Scaevola glandulifera</i>	+	<1 %	50 cm	CH6-21	NW corner
<i>Stackhousia monogyna</i>	+	<1 %	45 cm	CH6-28	
<i>Thysanotus multiflorus</i>	+	<1 %	20 cm	CH6-23	
<i>Vulpia myuros</i> var. <i>hirsuta</i>				CH6-26	

Moora Site CAH007

Described by BRM **Date** 9/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Chert ridge in NW corner of Cairn Hill Reserve (railway 100m to west))

MGA Zone 50 **406937 m E** **6621245 m N** **-30.537462 S lat** **116.029846 E long**

Habitat: Steep mid-slope of chert ridge, west-facing

Soil: Grey sand in matrix of exposed sheet rock with boulders, rocks and cobbles. Surface has 80-90% rock cover.

Rock Type: Chert

Vegetation: *Regelia megacephala*, *Kunzea praestans* high shrubland over *Xanthosia fruticulosa* low open shrubland over *Borya sphaerocephala* open herbland

Vegetation condition: Excellent to very good. Only a few weeds.

Fire age: Fire >10 years since burnt.

Notes: Coordinate datum: WGS'84.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Aira caryophylla</i>	+	<1 %	15cm	CH7-7	Pentastichis
<i>Borya sphaerocephala</i>	10-12	10-25%	10cm	CH7-2,12	
<i>Briza maxima</i>	+	<1 %	40cm	CH7-13	
<i>Burchardia umbellata</i>	+	<1 %	15cm	CH7-3	Burchardia
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	CH7-6,27	
<i>Cheilanthes adiantoides</i>	3-5%	1-5%	15cm	CH7-4	Cheilanthes
<i>Dichopogon capillipes</i>	+	<1 %	40cm	CH7-5,14	
<i>Dioscorea hastifolia</i>	+	<1 %	10cm		
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	15cm	CH7-29	Lilly
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20cm	CH7-8	Also CH7-24,25.
<i>Ehrharta longiflora</i>	+	<1 %	20cm		
<i>Hibbertia subvaginata</i>	+	<1 %	20cm		
<i>Hypochoeris glabra</i>	+	<1 %	20cm	CH7-10	Sonchus
<i>Kunzea praestans</i>	5-10%	5-10%	2.2m		
<i>Platysace cirrosa</i>	+	<1 %	25cm	CH7-11,28	
<i>Pterostylis recurva</i>	+	<1 %	10cm	CH7-26	Greenhood orchid
<i>Regelia megacephala</i>	15-20%	10-25%	2.5-3.0m		
<i>Stypandra glauca</i>	+	<1 %	45cm		
<i>Trachymene ornata</i>	+	<1 %	20cm	CH7-9	Trachymene white top
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Xanthosia fruticulosa</i>	1-2%	1-5%	35cm	CH7-1	Xanthosia
<i>Acacia aristulata</i>	+	<1 %	35cm	CH7-21	Acacia (shrub)
<i>Allocauarina huegeliana</i>	+	<1 %	8m		
<i>Avena barbata</i>	+	<1 %	40cm		
<i>Crassula exserta</i>	+	<1 %	4cm	=ER15-5A	Crassula colorata
<i>Eriachne ovata</i>	+	<1 %	10cm	CH7-22,30	
<i>Lawrencella rosea</i>	+	<1 %	15cm	CH7-19	Asteraceae
<i>Podolepis canescens</i>	+	<1 %	25cm	CH7-17	?Podolepis
<i>Podolepis lessonii</i>	+	<1 %	15cm	CH7-18	Podolepis lessonii

Thysanotus manglesianus	+	<1 %	60cm	CH7-16	Thysanotus
Trachymene pilosa	+	<1 %	10cm	CH7-15	Trachymene
Urospermum picroides	+	<1 %	20cm	CH7-23	Asteraceae
Vulpia myuros var. hirsuta	+	<1 %	15cm	CH7-20	Poaceae (cyl head)

Moora Site CAH008

Described by MET **Date** 9/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: NW corner of the Cairn Hill Reserve on the east side of the first low ridge.

MGA Zone 50 **407000 m E** **6621385 m N** **-30.536204 S lat** **116.030515 E long**

Habitat: East-facing moderately sloping upper slope of a low chert ridge. Below areas of outcrop.

Soil: Gravelly, cobbly (chert) light grey silty sand with scattered boulders and thin litter layer (mostly Allocasuarina needles).

Vegetation: Allocasuarina huegeliana low woodland to low open forest over Kunzea praestans, Xanthorrhoea drummondii scattered tall shrubs over Xanthosia fruticulosa low open shrubland to low shrubland over Opercularia vaginata, Cheilanthes adiantoides, Neurachne alopecuroidea low

Vegetation condition: Area seems to be generally in very good condition. However there are some vehicle tracks (bulldozer?) in places possibly from an old drilling program (there were chips of chert in a pile that could only be from drilling).

Fire age: Not burnt for more than 15 years, possibly 25 year

Notes: Coordinate datum: WGS'84. In places has Hibbertia subvaginata open shrubland understorey.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia congesta subsp. congesta plant)	+	<1 %	70cm	CH8-26	Acacia ?aristulata (1
Allocasuarina huegeliana	25-35%	25-33.3%	(4)6-7m		
Austrodanthonia acerosa	+	<1 %	10cm	CH8-9	Austrodanthonia
Austrostipa variabilis	+	<1 %	10cm	CH8-2	Austrostipa
Baeckea sp. Moora (R. Bone 1993/1)	+	<1 %	60cm		
Briza maxima	+	<1 %	5cm		
Burchardia umbellata	+	<1 %	30cm	CH8-12	Poaceae
Calandrinia sp.	+	<1 %	5cm	CH8-17	Calandrinia
Calytrix leschenaultii	+	<1 %	1.4m	CH8-11	Calytrix
Cheilanthes adiantoides	2-3%	1-5%	5-15cm		Cheilanthes
Desmocladius flexuosus	+	<1 %	10-15cm	CH8-4	"Loxocarya"
Dichopogon capillipes	+	<1 %	25cm	CH8-23	Dichopogon
Dioscorea hastifolia	5-10%	5-10%	10-50cm		
Drosera aff. macrantha	+	<1 %	0.4-1 m	CH8-25	Also CH8-21, 28 (30x30).
Ehrharta longiflora	+	<1 %	10-30cm		
Genus sp.				CH8-10	Lilly
Gilberta tenuifolia	+	<1 %	6cm	CH8-19	"Myriocephalus"
Goodenia berardiana	+	<1 %	15cm	CH8-6	Goodenia
Hypochaeris glabra	+	<1 %	5cm		
Kunzea praestans	2	1-5%	1.5m		
Lobelia sp. small flowers (K.F. Kenneally 7705)	+	<1 %	5-8cm	CH8-14	Lobelia
Neurachne alopecuroidea	+	<1 %	10cm	CH8-3	Neurachne
Opercularia vaginata	3-5%	1-5%	10-15cm	CH8-13, 24	Opercularia
Pentastichis sp. Moora (doubtful ID)	+	<1 %	12cm	CH8-18	Poaceae
Platysace cirrosa	+	<1 %	15cm	=ER16-9	Unknown
Podolepis canescens	1	<1 %	15-45	CH8-5	Podolepis "ray"
Podolepis lessonii	+	<1 %	10cm	CH8-7	Podolepis "button"
Podotheca angustifolia	+	<1 %	5-10cm	CH8-16	Podotheca
Pterostylis sp.	+	<1 %	15cm		Pterostylis sp (dead)
Schoenia cassiniana	+	<1 %	8-15cm	CH8-8	Daisy pink/white
Stypandra glauca	+	<1 %	60cm		
Trachymene pilosa	+	<1 %	5-10cm		
Ursinia anthemoides	+	<1 %	10-25cm		
Wahlenbergia gracilentia	+	<1 %	10-15cm	CH8-15	Wahlenbergia
Xanthorrhoea drummondii	2	1-5%	1.7m		
Xanthosia fruticulosa	8-10	5-10%	30-55cm	CH8-1	Xanthosia
Aira caryophyllea	+	<1 %	5-10cm		*Aira
Hibbertia subvaginata	+	<1 %	0.5-1.4m		
Lepidosperma tenue			fern/herb/grassland.	+	<1 %55cm CH8-22 Lepidosperma
Stylidium septentrionale	+	<1 %	15cm	CH8-20	Stylidium

Thysanotus manglesianus	+	<1 %		CH8-27	Thysanotus Climber
Vulpia myuros var. hirsuta	+	<1 %	10cm		Vulpia

Moora Site CAH009

Described by BRM **Date** 9/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Eastern side of chert ridge in the NW corner of Cairn Hill Reserve.

MGA Zone 50 **407058 m E** **6621390 m N** **-30.536163 S lat** **116.03112 E long**

Habitat: Lower to mid-slope, colluvial gentle east-facing slope.

Soil: Cobbly, pebbly brown sand.

Rock Type: Chert.

Vegetation: Allocasuarina huegeliana scattered low trees over Kunzea praestans, Allocasuarina campestris high shrubland over Melaleuca calyptroides open shrubland to shrubland over Baeckea sp. Moora (R. Bone 1993/1), Calytrix leschenaultii low open shrubland over Neurachne alopecuroidea, sedge (CAH9-5) scattered grassland/sedgeland with Borya sphaerocephala, Stylium septentrionale scattered herbs.

Vegetation condition: Very good to excellent (few weeds).

Fire age: Not burnt for more than 10 years.

Notes: Datum: WGS84. 1st coord is SE peg; 2nd peg is NW peg. Only the SE and NW corners were pegged. There was higher percentage cover of Baeckea sp. Moora (R. Bone 1993/1) outside plot than in it.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Lepidobolus chaetocephalus	+	<1 %	30cm	CH9-41,42	Restionaceae
Acacia microbotrya	+	<1 %	10cm	CH9-18	Acacia (juvenile)
Aira caryophyllea	+	<1 %	10cm	=CH7-7	Pentaschistis
Allocasuarina campestris	3-5%	1-5%	2.5m		
Allocasuarina huegeliana	+	<1 %	4-6m		
Amhipogon caricinus	+	<1 %	25cm	CH9-10A	BIS, Borya removed
Austrodanthonia setacea	+	<1 %	4cm	CH9-38	Grass
Austrostipa elegantissima	+	<1 %	30cm	CH9-9	Austrostipa ?elegantissima
Austrostipa trichophylla	+	<1 %	30cm	CH9-7	Austrostipa
Avena barbata	+	<1 %	30cm		
Baeckea sp. Moora (R. Bone 1993/1)	1	<1 %	60cm	CH9-2	More % cover outside
Borya sphaerocephala	1-2	1-5%	10cm	CH9-10B	
Burchardia umbellata	+	<1 %	30cm	=CH7-3	Burchardia
Calytrix leschenaultii	1-2	1-5%	80cm	CH9-3	Calytrix
Chamaescilla corymbosa var. corymbosa	+	<1 %	15cm	CH9-13,36	Chamaescilla
Cheilanthes adiantoides	+/-1	<1 %	15cm	=CH7-4	Cheilanthes
Daviesia dielsii	+	<1 %	40cm	CH9-19	Daviesia dielsii
Desmocladus flexuosus	+	<1 %	20cm	CH9-8,40	Desmocladus ?flexuosus
Dianella revoluta var. divaricata	+	<1 %	50cm	CH9-26	Also 30x30. Dianella
Drosera aff. macrantha	+	<1 %	35cm	CH9-17,32	Also CH9-32,33. Drosera (lge Yellow cup)
Genus sp.	+/-1	<1 %	30cm	CH9-5	Sedge
Hypochaeris glabra	+	<1 %	20cm	=CH7-10	*Sonchus
Hypochaeris radicata	+	<1 %	2cm	CH9-37	Hypochaeris glabra
Isopogon divergens	+	<1 %	1.1-2.5m	CH9-6	Isopogon ?divergens
Isotoma hypoc crateriformis	+	<1 %	10cm	CH9-20	juvenile
Kunzea praestans	5%	5-10%	2.3m		
Lepidosperma aff. leptostachyum (Moora: ERG18-7)	+	<1 %	20cm	CH9-12	Lepidosperma
Levenhookia stipitata	+	<1 %	2cm	CH9-16	Stylidiaceae
Melaleuca calyptroides	10%	10-25%	1.8m	CH9-1	Melaleuca
Melaleuca radula	+	<1 %	1.5m	CH9-14	Melaleuca
Neurachne alopecuroidea	+	<1 %	4cm	CH9-39	Neurachne
Parentucellia latifolia	+	<1 %	6cm		Parentucellia
Podolepis canescens	+	<1 %	20cm	=CH7-17	Podolepis
Podolepis lessonii	+	<1 %	10cm	=CH7-18	Podolepis
Podotheca angustifolia	+	<1 %	2cm	CH9-15	Entry correct.
Stylium septentrionale	2-3	1-5%	10cm	CH9-4	Stylium
Thysanotus manglesianus	+	<1 %	20cm	CH9-34,35	?Thysanotus upright
Thysanotus sp.	+	<1 %	10cm		Thysanotus
Trachymene ornata	+	<1 %	5cm	=CH7-9	Trachymene (white heads)
Trachymene pilosa	+	<1 %	5cm	CH9-11	Trachymene
Ursinia anthemoides	+	<1 %	15cm		
Vulpia myuros var. hirsuta	+	<1 %	15cm	=CH7-20	Grass 'cyl head'

<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	1m		
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	50cm	CH9-44	Acacia
<i>Astroloma serratifolium</i>	+	<1 %	15cm	CH9-21	Astroloma
<i>Austrostipa nitida</i>	+	<1 %	30cm	CH9-27	Austrostipa
<i>Borya laciniata</i>	+	<1 %	10cm	CH9-43	Laxmannia
<i>Cryptandra glabriflora</i>	+	<1 %	20cm	CH9-45, 46	Rhamnaceae (white flr)
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	+	<1 %	40cm	CH9-47	Pea/Acacia
<i>Dichopogon capillipes</i>	+	<1 %	20cm	CH9-28	Dichopogon
<i>Dioscorea hastifolia</i>	+	<1 %	40cm		
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %		CH9-23	Drosera
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	5m	CH9-25	Dryandra sessilis
<i>Haemodorum paniculatum</i>	+	<1 %	30cm	CH9-30B	Haemodorum ID?
<i>Haemodorum simulans</i>	+		50 cm	CH9-30A	
<i>Lechenaultia biloba</i>	+	<1 %	40cm	CH9-24	Lechenaultia
<i>Opercularia vaginata</i>	+	<1 %	20cm	CH9-31	Opercularia
<i>Schoenus clandestinus</i>	+	<1 %	3cm	CH9-22	Schoenus
<i>Stylidium miniatum</i>	+	<1 %	15cm	CH9-29	Stylidium

Moora Site CAH010

Described by MET **Date** 23/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Southern part of Cairn Hill Reserve near SE corner.

MGA Zone 50 **407698 m E** **6620100 m N** **-30.547852 S lat** **116.037676 E long**

Habitat: Moderate to steep slope with more than 10% outcrop (chert).

Soil: Grey (brownish) silty sand with thin litter layer. Very gravelly (chert) - pebbly amongst boulders and outcrop.

Vegetation: Eucalyptus wandoo subsp. wandoo scattered low trees/trees over *Allocasuarina huegeliana* low woodland over *Dodonaea inaequifolia*, *Santalum acuminatum* scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland over *Desmocladius flexuosus* low open sedgeland.

Vegetation condition: Very good to excellent. Not excellent because a bit too weedy and *Xanthorrhoea* dying out.

Fire age: Not burnt for more than 10 (>20?) years.

Notes: Coordinate datum: WGS'84. 1st coord is for NE peg; 2nd coord is for SW peg. Seedling *Dryandra sessilis* 4cm in plot (south side) and juvenile *Calothamnus* - mature plants of each nearby. Tall shrub layer patchy from <2% to >10% (in 10x10m areas). A large wandoo in the plot but overall cover <5% (ie more in the plot, but stand cover is <5%). Nearby, CALM? plot. Fence droppers with tag 'CH01'. 50J0407613; UTM6620080. 2nd peg 10 to south. Samples a west-facing boulder scree slope, lower; *Eucalyptus* sp. (not wandoo or *loxophleba* - has smooth bark, pale grey to tan, not powdery) woodland over *Acacia* sp. low shrubland (patches) and *Dodonaea* high shrubland. Species poor.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Aira caryophyllea</i>	+	<1 %	5-10cm	CH10-11	
<i>Allocasuarina huegeliana</i>	>10	10-25%	4-5m		
<i>Anagallis arvensis</i>	+	<1 %	5-8cm		
<i>Apium annuum</i>	+	<1 %	5-10cm	CH10-17	Apium ID?
<i>Austrodanthonia acerosa</i>	+	<1 %	5cm	CH10-10	
<i>Austrodanthonia setacea</i>	+	<1 %	10cm	CH10-24	
<i>Austrostipa elegantissima</i>	+	<1 %	30cm	CH10-8	
<i>Austrostipa variabilis</i>	+	<1 %	10cm	CH10-25,2	Also 30x30.
<i>Avena barbata</i>	<=1	<1 %	40cm		<i>Avena fatua</i>
<i>Briza maxima</i>	+	<1 %	10cm		
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12cm	CH10-56	
<i>Calandrinia calyptrata</i>	+	<1 %	5cm	CH10-18	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	+	<1 %	15cm(juv)		<i>Calothamnus quadrifidus</i>
<i>Calytrix leschenaultii</i>	+	<1 %	40cm	CH10-21	<i>Calytrix</i>
<i>Cheilanthes adiantoides</i>	1-2	1-5%	10cm		<i>Cheilanthes austro?</i>
<i>Comesperma integerrimum</i>	+	<1 %	35cm	CH10-54,6	Also 30x30.
<i>Comesperma volubile</i>	+	<1 %	30cm		
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2-3cm		<i>Crassula colorata</i>
<i>Crassula exserta</i>	+	<1 %	5cm		
<i>Desmocladius flexuosus</i>	1-2	1-5%	10-25cm	CH10-5	<i>Desmocladius</i>
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	10cm(juv)		<i>Dianella revoluta</i>
<i>Dichopogon capillipes</i>	+/-1	<1 %	5-30cm	CH10-9	Also CH10-52,53.
<i>Dioscorea hastifolia</i>	1-2	1-5%	10-25cm		
<i>Dodonaea inaequifolia</i>	3-4	1-5%	(0.8)3-4m	CH10-1	Erect to spreading open

						shrubs. 3-4m+ tall.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	50cm	CH10-55,6		Also 30x30. Climber
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	4cm (juv)			<i>Dryandra sessilis</i> var. <i>sessilis</i>
<i>Ehrharta longiflora</i>	2-3	1-5%	15-45cm			
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	<5%	1-5%	8-11m			<i>Eucalyptus wandoo</i>
Genus sp.	1-2	1-5%	10-40cm	CH10-6		Lilly
<i>Goodenia berardiana</i>	+	<1 %	15cm	CH10-14		
<i>Hypochaeris glabra</i>	+	<1 %	5cm			
<i>Lepidosperma costale</i>	+	<1 %	20-50cm	CH10-15		
<i>Lepidosperma leptostachyum</i>	1	<1 %	40cm	CH10-7		
<i>Lepidosperma tenue</i>	+	<1 %		CH10-7 #2		
<i>Lobelia</i> sp. small flowers (K.F. Kenneally 7705)	+	<1 %	15cm	CH10-20		
<i>Lolium perenne</i>	+	<1 %		CH10-23,5		
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm			
<i>Phyllangium sulcatum</i>	+	<1 %	5-10cm	CH10-12		"Mitrasacme"
<i>Podotheca angustifolia</i>	+	<1 %	5cm	CH10-19		Podotheca
<i>Pterostylis sanguinea</i>	+	<1 %	2cm	CH10-51,6		Also 30x30. Orchid flat
<i>Rhodanthe polycephala</i>	+	<1 %	8-15cm	CH10-13		Asteraceae
<i>Santalum acuminatum</i>	2-3	1-5%	2-3m	CH10-2		
<i>Schoenia cassiniana</i>	+	<1 %	10cm	CH10-28		Also 30x30 and CH10-58, 61. Daisy white/pink. Abundant
<i>Stypantra glauca</i>	1	<1 %	20-40cm			
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	CH10-22		Also CH10-50,57. <i>Thysanotus</i>
<i>Trachymene pilosa</i>	+	<1 %	8cm			
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	2-3	1-5%	10-80cm	CH10-3		
<i>Ursinia anthemoides</i>	2	1-5%	8-15cm			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	5-6cm			<i>Vulpia myuros</i>
<i>Wahlenbergia gracilentia</i>	+	<1 %	25cm	CH10-16		
<i>Xanthorrhoea drummondii</i>	+	<1 %	30cm			Dead
<i>Xanthosia fruticulosa</i>	5-6	5-10%	10-35cm	CH10-4		<i>Xanthosia</i>
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	1-5.5m			<i>Acacia acuminata</i>
<i>Allocasuarina campestris</i>	+	<1 %	3m			<i>Allocasuarina campestris</i>
<i>Cyanicula deformis</i>	+	<1 %	12cm	CH10-65		Blue orchid
<i>Goodenia arthrotricha</i>	+	<1 %	40cm	CH10-27		Unknown, dead.
						<i>Goodeniaceae?</i> 3m SW of SW peg. multi stemmed. Stems and leaves slightly glandular/sticky. Perennial with short lived stems.
<i>Hibbertia subvaginata</i>	+	<1 %	1m			
<i>Lawrencella rosea</i>	+	<1 %	12cm	CH10-63		Daisy
<i>Podolepis lessonii</i>	+	<1 %	20cm	CH10-59		Daisy
<i>Thysanotus dichotomus</i>	+	<1 %	30cm	CH10-67		
<i>Trachymene ornata</i>	+	<1 %	10cm			
<i>Tripteris clandestina</i>	+	<1 %	20cm	CH10-62		Daisy
<i>Waitzia nitida</i>	+	<1 %		CH10-29		

Moora Site CAH011

Described by BRM **Date** 23/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill near southern end of reserve.

MGA Zone 50 **407409 m E** **6620353 m N** **-30.545547 S lat** **116.034686 E long**

Habitat: Lower to mid-slope of steep, south-facing slope of medium height ridge.

Soil: Gravelly, pebbly, cobbly brown sandy loam amongst exposed sheet rock and boulders.

Rock Type: Chert. Rock cover of surface about 70%.

Vegetation: *Regelia megacephala* (*Kunzea praestans*) open scrub over *Allocasuarina campestris* scattered shrubs over *Hibbertia subvaginata*, *Xanthosia fruticulosa* low open shrubland over *Stypantra glauca* very open herbland with *Dioscorea hastifolia* very open lianes.

Vegetation condition: Very good to excellent.

Fire age: Not burnt for more than 10 years.

Notes: Datum: WGS84. 1st coord is for SW peg; 2nd coord is for NE coord. 30x30 search area limited on southern side by *Allocasuarina campestris* scrub community.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30cm		
<i>Aira caryophyllea</i>	+	<1 %	10cm	CH11-4	<i>Pentaschistis</i>
<i>Allocasuarina campestris</i>	2	1-5%	1.7m		
<i>Anagallis arvensis</i>	+	<1 %	10cm	CH11-12	

<i>Arctotheca calendula</i>	+	<1 %	10cm	CH11-57	
<i>Austrodanthonia acerosa</i>	+	<1 %	15cm	CH11-18	Native grass
<i>Austrodanthonia caespitosa</i>	+	<1 %	35cm	CH11-23	<i>Austrostipa</i> #2
<i>Austrostipa elegantissima</i>	+	<1 %	1m	CH11-15	
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Blennospora drummondii</i>	+	<1 %	10cm	CH11-14	<i>Blennospora</i>
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Bromus diandrus</i>	+	<1 %	15cm		<i>Bromus</i>
<i>Burchardia umbellata</i>	+	<1 %	40cm	CH11-63	Also 30x30.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	20cm	CH11-24	Orchid
<i>Calandrinia</i> sp.	+	<1 %	2cm	CH11-53	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	+	<1 %	1.2m	CH11-22	<i>Calothamnus</i> ? <i>quadrifidus</i>
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm	CH11-9	<i>Cheilanthes</i>
<i>Cyanicula deformis</i>	+	<1 %	12cm	=CH12-57	Blue orchid
<i>Cyrtostylis huegellii</i>	+	<1 %	1cm	CH11-54	Round base-leaf orchid
<i>Dichopogon capillipes</i>	+	<1 %	35cm	CH11-5	<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	2-4	1-5%	1.5m		<i>Dioscorea</i>
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	CH11-50,5	Yellow stem
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20cm	CH11-6	
<i>Ehrharta longiflora</i>	+	<1 %	30cm		
<i>Eriochilus helonomos</i>	+	<1 %	20cm	=CH14-61	Orchid
<i>Hibbertia subvaginata</i>	5	5-10%	60cm		<i>Hibbertia</i>
<i>Hypochaeris glabra</i>	+	<1 %	2cm		cats tongue leaf
<i>Kunzea praestans</i>	+	<1 %	2-2.5m		
<i>Lepidosperma tenue</i>	+	<1 %	35cm	CH11-7,65	Also 30x30.
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	10cm	CH11-13	<i>Millotia</i>
<i>Parentucellia latifolia</i>	+	<1 %	10cm		<i>Parentucellia</i>
<i>Pityrodia dilatata</i>	+	<1 %	35cm		<i>Pityrodia</i>
<i>Pterostylis sanguinea</i>	+	<1 %	20cm	CH11-21,5	Orchid
<i>Regelia megacephala</i>	50-60%	50-75%	3-4m		
<i>Stypandra glauca</i>	3-5	1-5%	80cm		
<i>Thysanotus manglesianus</i>	+	<1 %	1.2m	CH11-8	<i>Thysanotus</i>
<i>Trachymene ornata</i>	+	<1 %	10cm		<i>Trachymene</i> white heads
<i>Tripteris clandestina</i>	+	<1 %	20cm	CH11-11	Also CH11-17,19,56
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	+	<1 %	40cm	CH11-20	Rhamnaceae
<i>Urospermum picroides</i>	+	<1 %	25cm	CH11-10	<i>Sonchus</i>
<i>Ursinia anthemoides</i>	+	<1 %	30cm		<i>Ursinia</i>
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	20cm	CH11-2,3	Grass (cylinder head)
<i>Wahlenbergia gracilentia</i>	+	<1 %	10cm	CH11-16	
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.5m		
<i>Xanthosia fruticulosa</i>	5	5-10%	40cm	CH11-1	<i>Xanthosia</i>
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	3cm(juv)		
<i>Calytrix leschenaultii</i>	+	<1 %	90cm		<i>Calytrix</i> (purple)
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=CH12-52	Orchid
<i>Dampiera lavandulacea</i>	+	<1 %	25cm	CH11-28,6	
<i>Daviesia dielsii</i>	+	<1 %	1.1m		coordinates collected
<i>Desmocladius flexuosus</i>	+	<1 %	25cm	CH11-62	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	70cm	CH11-26	<i>Dianella</i>
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	15cm	CH11-58	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	2.5m		<i>Dryandra sessilis</i>
<i>Hakea incrassata</i>	+	<1 %	1.2m	CH11-27	<i>Hakea</i> ? <i>incrassata</i>
<i>Isopogon divergens</i>	+	<1 %	1.6m	CH11-29	<i>Isopogon</i>
<i>Melaleuca calyptroides</i>	+	<1 %	1.4m	CH11-32	
<i>Nemcia acuta</i>	+	<1 %	35cm	CH11-31	<i>Nemcia</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	30cm	CH11-25	<i>Neurachne</i>
<i>Stylidium cordifolium</i>	+	<1 %	30cm	CH11-34	
<i>Stylidium septentrionale</i>	+	<1 %	10cm	CH11-60	
<i>Thomasia grandiflora</i>	+	<1 %	80cm	CH11-30	<i>Thomasia</i> ? <i>grandiflora</i>

Moora**Site** CAH012**Described by** MET**Date**23/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** South section of Cairn Hill Reserve, towards SE corner**MGA Zone** 50 407646 **m E** 6620040 **m N** -30.548389 **S lat** 116.037129 **E long**

Habitat: West-facing midslope of a low ridge.

Soil: Slightly pinkish-grey silty gravelly to cobbly sand. No outcrop but some small boulders (of chert).

Vegetation: Eucalyptus wandoo subsp. wandoo scattered low trees to trees over *Allocasuarina campestris* open scrub to scrub over *Lepidosperma tenue* scattered sedges over *Cheilanthes adiantoides*, *Borya sphaerocephala* low open fern/herbland.

Vegetation condition: Very good to Excellent. (Again, *Xanthorrhoea* seems to be dying out).

Fire age: Not burnt for more than 20 years.

Notes: Coordinate datum: WGS'84. 1st coord is for NW peg; 2nd coord is for NE peg; 3rd coord is for SW peg. Wandoo cover given as 5% as for stand - more actually in plot. In 30x30 search, only went 5m downslope of the 10x10 as beyond this it changed. Did not go into the outcrop area upslope from the quadrat (plot 14 type veg; excluded *Trymalium*). Large individual of the blue-green (larger) *Lomandra* about 7m NE of NE peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	>=5%	5-10%	5-6m		<i>Acacia acuminata</i>
<i>Acacia pulchella</i>	+	<1 %	10cm(juv)		<i>Acacia cf pulchella</i>
<i>Aira caryophylla</i>	+	<1 %	5-8cm	CH12-9	
<i>Allocasuarina campestris</i>	>60%	50-75%	3.5m		<i>Allocasuarina campestris</i>
<i>Austrodanthonia caespitosa</i>	+	<1 %	10cm	CH12-3	
<i>Austrostipa elegantissima</i>	+	<1 %	20cm	CH12-16	
<i>Austrostipa scabra</i>	+	<1 %	15cm	CH12-5	
<i>Borya sphaerocephala</i>	2%	1-5%	5cm		<i>Borya</i>
<i>Briza maxima</i>	+	<1 %	15cm		
<i>Caesia</i> (Moorra hairy stem)	+	<1 %		CH12-6,50	
<i>Caesia alfordii</i>	+	<1 %		CH12-8B	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15cm	CH12-52	
<i>Cheilanthes adiantoides</i>	5-8%	5-10%	5-10cm		<i>Cheilanthes austro?</i>
<i>Crassula decumbens</i> var. <i>decumbens</i>	+	<1 %	6cm	CH12-18	long pedicels
<i>Dichopogon capillipes</i>	+	<1 %	25cm	=CH10-52	
<i>Dodonaea inaequifolia</i>	+	<1 %	1m	=CH10-1	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	15cm	CH12-7	Also CH12-53,59.
<i>Eriochilus helonomos</i>	+	<1 %	25cm	=CH14-61	Orchid
<i>Erodium cygnorum</i>	+	<1 %	3cm	=CH14-53	
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	<5%	1-5%	11m		<i>Euc wandoo</i>
<i>Hypochaeris glabra</i>	+	<1 %	2cm		
<i>Hypoxis aff. glabella</i>	+	<1 %		CH12-11A	Det. As aff. <i>glabella</i> 23/8/05
MET. 2 alternate bracts.					
<i>Hypoxis glabella</i> var. <i>leptantha</i>	+	<1 %	20cm	=CH14-59	Lilly
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	10cm	CH12-14	<i>Hypoxis</i> . Spec missing, presumed = other record.
<i>Lagenifera huegelii</i>	+	<1 %	10cm	CH12-51	
<i>Lawrencella rosea</i>	+	<1 %	30cm	=CH10-6	Lilly
<i>Lepidobolus chaetocephalus</i>	+	<1 %	10cm	=CH10	
<i>Lepidosperma aff. leptostachyum</i> (Moorra: ERG18-7)	+	<1 %	20cm	CH12-12	
<i>Lepidosperma tenue</i>	3%	1-5%	40-70cm	CH12-1	<i>Lepidosperma</i>
<i>Lomandra aff. micrantha</i> subsp. <i>micrantha</i>	+	<1 %	10cm	CH12-13,1	
<i>Lomandra effusa</i>	+	<1 %	10-15cm	CH12-15	Blue green
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm		
<i>Orthrosanthus laxus</i> var. <i>gramineus</i>	+	<1 %	30cm	CH12-2	<i>Orthrosanthus</i>
<i>Platysace cirrosa</i>	+	<1 %	20cm	CH12-11B	Also 30x30 and CH12- 26,54. Linear leaves dried black.
<i>Pterostylis sanguinea</i>	+	<1 %	1cm	=CH10-51	<i>Pterostylis</i> flat
<i>Schoenia cassiniana</i>	+	<1 %	10cm	=CH10	Daisy white/pink
<i>Schoenus clandestinus</i>	+	<1 %	4cm	CH12-10	
<i>Stylidium septentrionale</i>	+	<1 %	7cm	CH12-20	common one
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	CH12-4	<i>Thysanotus</i>
<i>Trachymene ornata</i>	+	<1 %	8cm		
<i>Ursinia anthemoides</i>	+	<1 %	10cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	7cm		
<i>Wahlenbergia gracilentia</i>	+	<1 %	10-15cm	CH12-19	
<i>Xanthorrhoea drummondii</i>	+	<1 %			dead
<i>Austrostipa</i> sp.	+	<1 %	15cm	CH12-23	
<i>Calandrinia calyptata</i>	+	<1 %	8-12cm	CH12-21	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3-5cm		
<i>Cyanicula deformis</i>	+	<1 %	12cm	CH12-57	Blue orchid

<i>Daucus glochidiatus</i>	+	<1 %	10cm	CH12-24	
<i>Dioscorea hastifolia</i>	+	<1 %	10cm		
<i>Drosera macrophylla</i> subsp. <i>macrophylla</i>	+	<1 %	3cm	CH12-58	
<i>Ehrharta longiflora</i>	+	<1 %	15-30cm		
<i>Lepidosperma costale</i>	+	<1 %	55cm	CH12-27	
<i>Melaleuca radula</i>	+	<1 %	2m	CH12-22	straggly
<i>Rhodanthe polycephala</i>	+	<1 %	8cm	CH12-25,5	Daisy (juv)
<i>Trachymene pilosa</i>	+	<1 %	10cm	CH12-56	juv
<i>Tripteris clandestina</i>	+	<1 %	12cm	CH12-60	Asteraceae

Moora Site CAH013

Described by BRM **Date** 23/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Ridge at south end of Cairn Hill Reserve.

MGA Zone 50 **407494 m E** **6620190 m N** **-30.547024 S lat** **116.035557 E long**

Habitat: East facing slope of low ridge, mid-slope.

Soil: Pebbly, cobbly grey-brown loamy sand, skeletal amongst boulders and exposed sheet rock.

Rock Type: Chert. Covers 70% of surface.

Vegetation: *Acacia huegeliana* low open forest over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland over *Neurachne alopecuroidea*, *Desmocladius flexuosa* very open grass/sedgeland with *Dioscorea hastifolia* very open lianes.

Vegetation condition: Very good to excellent (very few weeds).

Fire age: More than 10 years since burnt.

Notes: Coordinate datum: WGS'84. 1st coord is for NE peg; 2nd coord is for SW peg. *Allocasuarina campestris* just upslope of plot is different community.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina huegeliana</i>	55-65%	50-75%	6-8m		
<i>Austrodanthonia acerosa</i>	+	<1 %	35cm	CH13-5	
<i>Austrodanthonia caespitosa</i>	+	<1 %	30cm	CH13-4	hairy
<i>Austrostipa scabra</i>	+	<1 %	20cm	CH13-29	
<i>Austrostipa trichophylla</i>	+	<1 %	30cm	CH13-3	
<i>Burchardia umbellata</i>	+	<1 %	35cm	CH13-53	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	6cm	CH13-18,5	Orchid
<i>Calandrinia calyptrata</i>	+	<1 %	4cm	CH13-12	
<i>Calytrix leschenaultii</i>	+	<1 %	40cm	CH13-30	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20cm	CH13-19	Chamaescilla
<i>Cheilanthes adiantoides</i>	1-2	1-5%	15cm	=CH11-9	Cover recorded winter 2003
<i>Comesperma integerrimum</i>	+	<1 %	3m	CH13-8	Climber; woody
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2cm	CH13-20	Crassula
<i>Daviesia dielsii</i>	+	<1 %	20cm	CH13-21	Juvenile
<i>Desmocladius flexuosus</i>	1	<1 %	20cm		
<i>Dichopogon capillipes</i>	+	<1 %	30cm	CH13-22	Dichopogon
<i>Dioscorea hastifolia</i>	3-4	1-5%	30cm		Cover recorded winter 2003
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	CH13-11,5	
<i>Ehrharta longiflora</i>	+	<1 %	20cm		Ehrharta
Genus sp.	+	<1 %	3cm	CH13-23	
<i>Goodenia berardiana</i>	+	<1 %	20cm	CH13-15	open mouths
<i>Hibbertia subvaginata</i>	+	<1 %	80cm		
<i>Hypochaeris glabra</i>	+	<1 %	20cm	CH13-24,5	
<i>Lepidosperma costale</i>	+	<1 %	20cm	CH13-27	
<i>Lobelia</i> sp. small flowers (K.F. Kenneally 7705)	+	<1 %	3cm	CH13-7,28	
<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>	+	<1 %	30cm	CH13-10	
<i>Neurachne alopecuroidea</i>	1	<1 %	15cm	CH13-2	
<i>Pentaschistis pallida</i>	+	<1 %	15cm	CH13-13	
<i>Phyllangium sulcatum</i>	+	<1 %	10cm	CH13-26A	Number split.
<i>Pityrodia dilatata</i>	+	<1 %	20cm		
<i>Poranthera microphylla</i>	+	<1 %	2cm	CH13-22b	
<i>Pterostylis setulosa</i>	+	<1 %	20cm	CH13-9	Orchid
<i>Stylidium septentrionale</i>	+	<1 %	20cm	CH13-14	
<i>Stypandra glauca</i>	+	<1 %	60cm		
<i>Thysanotus manglesianus</i>	+	<1 %	60cm	CH13-50,5	Thysanotus Climber
<i>Trachymene ornata</i>	+	<1 %	10cm		White heads
<i>Trachymene pilosa</i>	+	<1 %	15cm	CH13-6	short hairs

Trachymene sp.	+	<1 %	10cm		hairy
Trymalium ledifolium var. rosmarinifolium	1	<1 %	40cm	CH13-1	Rhamnaceae
Ursinia anthemoides	+	<1 %	30cm		
Vulpia myuros var. hirsuta	+	<1 %	10cm	CH13-17	Vulpia
Wahlenbergia capensis	+	<1 %	15cm	CH13-25	
Xanthorrhoea drummondii	+	<1 %	1.3m		
Xanthosia fruticulosa	+	<1 %	30cm	=CH11-1	Xanthosia
Acacia aristulata	+	<1 %	30cm		
Allocastrum campestris	+	<1 %	3m		
Anagallis arvensis	+	<1 %	4cm	=CH11-12	
Arctotheca calendula	+	<1 %	15cm		
Cheilanthes distans	+	<1 %	4cm	CH13-56	hairy Cheilanthes
Eucalyptus wandoo subsp. wandoo	+	<1 %	12cm		Eucalyptus wandoo
Isopogon divergens	+	<1 %	50cm	=CH17-2	
Kunzea praestans	+	<1 %	2.5m		
Regelia megacephala	+	<1 %	80cm		

Moora Site CAH014

Described by MET **Date** 24/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Southern part of Cairn Hill Reserve.

MGA Zone 50 **407683 m E** **6620043 m N** **-30.548365 S lat** **116.037515 E long**

Habitat: Flat to gently sloping small "bench" near top of west-facing side of ridge.

Soil: Very gravelly, pebbly, cobbly light grey silty sand. Small cobbles strewn on surface. Thin litter layer over most of the quadrat, some areas within lichen crust.

Vegetation: Eucalyptus obtusiflora mallee scrub to closed mallee scrub over Trymalium daphnifolium, Acacia erinacea shrubland over Austrodanthonia setacea, Austrostipa elegantissima scattered low grasses.

Vegetation condition: Excellent.

Fire age: More than 10 years (?15 years) since burnt.

Notes: Coordinate datum: WGS'84. 1st coords is for NE peg; 2nd coords for NW peg; 3rd coords for SE peg; 4th peg is for SW peg. Eucalyptus wandoo overhanging the quadrat but is excluded from the list because it is rooted in a different habitat. Quadrat dimensions were about 8x12m to fit the stand. Only north and south side of quadrat surveyed for 30x30 as different habitats east and west. Stand only about 20x90m. Stand varies to have almost no shrubs in the understorey (Sth of quadrat).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia erinacea	5-10%	5-10%		CH14-3	straggly shrub
Aira caryophyllaea	+	<1 %	10cm	CH14-13	
Apium annuum	+	<1 %	5cm	CH14-8	ID?
Arctotheca calendula	+	<1 %	3cm		Cape weed
Austrodanthonia setacea	+	<1 %	5cm	CH14-10	
Austrostipa elegantissima	+	<1 %	40cm	CH14-12,5	Grass
Blennospora drummondii	+	<1 %	5cm	CH14-14	Daisy
Bromus diandrus	+	<1 %	10cm	CH14-11	
Caesia (Moora hairy stem)	+	<1 %	20cm	CH14-9,58	
Calandrinia sp.	+	<1 %	2cm	CH14-64	
Cheilanthes adiantoides	+	<1 %	5cm		Cheilanthes austro?
Crassula colorata var. colorata	+	<1 %	3cm		
Daucus glochidiatus	+	<1 %	10cm	CH14-62	
Dichopogon capillipes	+	<1 %	25cm	=CH10-52	?Dichopogon
Dioscorea hastifolia	+	<1 %	4cm		
Dodonaea inaequifolia	1-2%	1-5%	2.2m	CH14-4	
Ehrharta longiflora	+	<1 %	10-20cm		
Eriochilus helonomos	+	<1 %	20cm	CH14-61	1 leaf-stem orchid
Erodium cygnorum	+	<1 %	10cm	CH14-53	
Eucalyptus obtusiflora	>75%	>75%	6cm	CH14-1	Mallee, bark smooth, grey or tan.
Hypochaeris glabra	+	<1 %	3cm		
Hypoxis glabella var. leptantha	+	<1 %	15cm	CH14-59	Lilly
Lomandra sp.	+	<1 %	20cm	CH14-50	
Maireana marginata	+	<1 %	2cm	CH14-6	Maireana ?
Oxalis corniculata	+	<1 %	4cm	CH14-54	Yellow flowered Clover-leaf
Plantago debilis	+	<1 %	10cm	CH14-7,56	
Pterostylis sanguinea	+	<1 %	1cm	=CH10-51	flat leaf-base orchid

<i>Pterostylis scabra</i>	+	<1 %	20cm	CH14-57	
<i>Ptilotus divaricatus</i> var. <i>divaricatus</i>	+	<1 %	90cm	CH14-5	tangled perennial shrub
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	+	<1 %	15cm	CH14-51	
<i>Rhodanthe polyccephala</i>	+	<1 %	10cm	CH14-55	?Daisy
<i>Thysanotus manglesianus</i>	+	<1 %	45cm	CH14-15	<i>Thysanotus patersonii</i>
<i>Trachymene cyanopetala</i>	+	<1 %	10cm	CH14-63	
<i>Trachymene ornata</i>	+	<1 %	12cm		
<i>Trymalium daphnifolium</i>	>=10%	10-25%	0.8-1.4m	CH14-2	shrub
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm		
<i>Austrostipa variabilis</i>	+	<1 %	8cm	CH14-16	
<i>Avena barbata</i>	+	<1 %	40cm		<i>Avena fatua</i>
<i>Calotis hispidula</i>	+	<1 %	3cm	CH14-66	herb
<i>Lepidosperma tenue</i>	+	<1 %	35cm	=CH12-1	On sloping edge.
<i>Trachymene</i> sp.	+	<1 %	10cm		not ornata or pilosa

Moora**Site** CAH015**Described by** BRM **Date** 24/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** South end of a ridge on the southern boundary of Cairn Hill Reserve.**MGA Zone** 50 **407372 m E** 6620059 **m N** -30.548196 **S lat** 116.034274 **E long****Habitat:** Steep, south-facing slope on medium sized ridge.**Soil:** Gravelly, pebbly, cobbly brown sand, skeletal amongst exposed sheet rock and boulders.**Rock Type:** Chert. About 70% of surface covered by rock.**Vegetation:** *Allocasuarina huegeliana* low open woodland over *Regelia megacephala* open scrub over *Xanthosia fruticulosa*, *Hibbertia subvaginata* low open shrubland over *Stypandra glauca*, *Dichopogon capillipes* very open herbland.**Vegetation condition:** Excellent. A few weeds.**Fire age:** Not burnt for more than 7-10 years.**Notes:** Coordinate datum: WGS'84. 1st coord is for SW peg; 2nd coord is for NE peg. Four dead, four live *Xanthorrhoea* observed point on southern boundary of plot. Very low recruitment. Note area with *Regelia* also dead.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30cm		
<i>Aira caryophyllea</i>	+	<1 %		CH15-10	
<i>Allocasuarina huegeliana</i>	5%	5-10%	3.5-5.5m		
<i>Anagallis arvensis</i>	+	<1 %	10cm	=CH11-12	
<i>Austrostipa trichophylla</i>	+	<1 %	30cm	CH15-5	
<i>Avena barbata</i>	+	<1 %	30cm		
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Burchardia umbellata</i>	+	<1 %	30cm	CH15-1	<i>Burchardia</i>
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15cm	CH15-4	Orchid
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	+	<1 %	1.8m	=CH11-22	<i>Calothamnus</i> ?quadrifidus
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	30cm	CH15-7	
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm	=CH11-9	<i>Cheilanthes</i>
<i>Desmocladius flexuosus</i>	+	<1 %	20cm		
<i>Dichopogon capillipes</i>	+/-1	<1 %	30cm	=CH13-22	<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	+	<1 %	1.8m		<i>Dioscorea</i>
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	CH15-57	Donkey orchid
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	45cm	CH15-6,54	<i>Drosera</i> Climber
<i>Ehrharta longiflora</i>	+	<1 %	20cm		
<i>Eriochilus dilatatus</i>	+	<1 %	15cm	CH15-52	Orchid (side leaf)
<i>Hibbertia subvaginata</i>	1-2	1-5%	1m		
<i>Hypochaeris glabra</i>	+	<1 %	15cm	=CH13-24	
<i>Lepidosperma leptostachyum</i>	+	<1 %	35cm	CH15-58	
<i>Lepidosperma tenue</i>	+	<1 %	35cm	CH15-3	
<i>Melaleuca calyptroides</i>	+	<1 %	1.6m	=CH11-32	
<i>Pterostylis recurva</i>	+	<1 %	30cm	CH15-2	Orchid
<i>Pterostylis sanguinea</i>	+	<1 %	25cm	CH15-50	Orchid green hood
<i>Pterostylis scabra</i>	+	<1 %	15cm	CH15-59	Orchid green hood
<i>Pterostylis spathulata</i>	+	<1 %	25cm	CH15-9	Orchid
<i>Regelia megacephala</i>	60-70%	50-75%	2.5-5m		
<i>Stypandra glauca</i>	3-5	1-5%	40cm		<i>Stypandra glauca</i>
<i>Thysanotus manglesianus</i>	+	<1 %	35cm	CH15-55,5	<i>Thysanotus</i> Climber

Trachymene pilosa	+	<1 %	5cm	CH15-11	short hairs
Ursinia anthemoides	+	<1 %	15cm		
Vulpia myuros var. hirsuta	+	<1 %	10cm	CH15-8	Grass
Xanthorrhoea drummondii	+	<1 %	60cm		juvenile
Xanthosia fruticulosa	2-3	1-5%	30cm	=CH11-1	Xanthosia
Allocasuarina campestris	+	<1 %	2.5m		
Borya sphaerocephala	+	<1 %	10cm		Borya
Bossiaea sp. Cairn Hill (M Henson CH2-28)	+	<1 %	35cm		
Kunzea praestans	+	<1 %	2.2m		
Neurachne alopecuroidea	+	<1 %	15cm	=CH13-2	Neurachne

Moora Site CAH016

Described by MET **Date** 24/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: South side of Cairn Hill Nature Reserve.

MGA Zone 50 **407590 m E** **6620015 m N** **-30.54861 S lat** **116.036543 E long**

Habitat: Lower slope in valley between two ridges, adjacent to but not including a small poorly defined drainage line and below a stabilized scree slope.

Soil: Gravelly, pebbly light brown silty sand/loam.

Vegetation: Eucalyptus salmonophloia, (Eucalyptus wandoo subsp. wandoo) woodland over Dodonaea inaequifolia high shrubland over Acacia erinacea open shrubland over Austrostipa scabra, Austrostipa elegantissima, Austrostipa trichophylla, Austrodanthonia setacea scattered grasses.

Vegetation condition: Very good to excellent.

Fire age: Not burnet for more than 10 years.

Notes: Coordinate datum: WGS'84. 1st coord is NE peg; 2nd coord is SW peg; very few annuals where the ground is a bit more gravelly/pebbly. 30x30 only to the north and south to fit the vegetation community type. <10% of CAH(16-1) in plot but 10-15% over the stand. Pair of white cockies. Pink and greys roost here and possibly nest in hollow 14m up.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia erinacea	5%	5-10%	1-1.6m	=CH14-3	
Aira caryophylla	+	<1 %	5cm	CH16-5	WRONG specimen #
Allocasuarina campestris	+	<1 %	3.5m		
Austrodanthonia setacea	+	<1 %	8cm	CH16-12	
Austrostipa elegantissima	+	<1 %	45cm	CH16-6	
Austrostipa scabra	+	<1 %	5cm	CH16-8	
Austrostipa trichophylla	+	<1 %	10cm	CH16-13	
Avena barbata	+	<1 %	30cm		
Caesia (Moora hairy stem)	+	<1 %	10cm	CH16-7	
Calandrinia eremaea	+	<1 %		CH16-16	Det provisional
Calandrinia sp.	5%	5-10%	3-7cm	=CH12	
Calotis hispidula	+	<1 %	2cm	CH16-15	
Cheilanthes adiantoides	1	<1 %	10-15cm		Cheilanthes austro?
Comesperma volubile	+	<1 %	1.7m		Overhanging
Crassula colorata var. colorata	+	<1 %	3-8cm		
Daviesia benthamii subsp. benthamii	2	1-5%	80cm	CH16-2	
Dichopogon capillipes	+	<1 %	20cm	=CH10-52	?Dichopogon
Dioscorea hastifolia	1	<1 %	1.6m		
Dodonaea inaequifolia	25-35%	25-33.3%	3-4m	=CH10-1	
Ehrharta longiflora	2-3	1-5%	15-60cm		
Eremophila lehmanniana	+	<1 %	60cm(2.5)	CH16-3,54	?Eremophila
Erodium cygnorum	+	<1 %	3cm	=CH14-53	
Eucalyptus salmonophloia	10-15%	10-25%	12-20m	CH16-1	
Hypochaeris glabra	+	<1 %	2cm		Cats tongue-leaf
Hypoxis glabella var. leptantha	+	<1 %	12cm	=CH14-59	Lilly
Neurachne alopecuroidea	+	<1 %	8cm		Neurachne
Pterostylis setulosa	+	<1 %	1cm	CH16-51	Flat leaf-base Pterostylis
Ptilotus divaricatus var. divaricatus	2	1-5%	1m	=CH14-5	
Rhagodia drummondii	+	<1 %	25cm	CH16-11	
Rhagodia preissii subsp. preissii	1	<1 %	90cm	CH16-4	Also 30x30 and CH16-52, 57.
Rhodanthe polycephala	+	<1 %	5-8cm	CH16-14,5	Asteraceae
Thysanotus manglesianus	+	<1 %		CH16-10	Thysanotus patersonii
Trachymene cyanopetala	+	<1 %	8cm		Trachymene: not pilosa,
Trachymene ornata	+	<1 %	10cm		

<i>Trachymene pilosa</i>	+	<1 %	10cm		
<i>Tripteris clandestina</i>	+	<1 %	15cm	CH16-9,53	Asteraceae
<i>Trymalium daphnifolium</i>	+	<1 %	1.6m	=CH14-2	
<i>Ursinia anthemoides</i>	+	<1 %	10cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	12cm		
<i>Wahlenbergia gracilenta</i>	+	<1 %	15cm		usual
<i>Acacia ligustrina</i>	+	<1 %	2.5m	CH16-56	
<i>Arctotheca calendula</i>	+	<1 %	12cm		
<i>Bromus diandrus</i>	+	<1 %	10cm	=CH14	
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	+	<1 %			
<i>Maireana marginata</i>	+	<1 %	2cm	CH16-55	hairy
<i>Parietaria debilis</i>	+	<1 %	30cm	CH16-58	herb (?Solanum ?Nicotiana)
<i>Plantago debilis</i>	+	<1 %	2cm	=CH14	
<i>Pterostylis scabra</i>	+	<1 %	20cm	=CH14-57	
<i>Sonchus oleraceus</i>	+	<1 %	8cm		

Moora Site CAH017

Described by BRM **Date** 24/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Ridge near southern end of Cairn Hill Reserve (CAH13 on east-facing slope and CAH15 on south-facing slope of this ridge).

MGA Zone 50 **407451 m E** **6620171 m N** **-30.547192 S lat** **116.035107 E long**

Habitat: Flat crest of low ridge.

Soil: Gravelly, pebbly, cobbly brown sandy loam with some exposed sheet rock.

Rock Type: Chert. Rock cover of surface is 40-50%.

Vegetation: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris*, *Kunzea praestans* high shrubland to open scrub over *Melaleuca calyptroides*, *Isopogon divergens* shrubland over *Calytrix leschenaultii* low open shrubland over *Borya sphaerocephala*, *Stylidium septentrionale* very open herbland.

Vegetation condition: Excellent (few weeds).

Fire age: Not burnt for more than 7 to 10 years.

Notes: Coordinate datum: WGS'84. 1st coord is for NW peg; 2nd coord is for SE peg. *Allocasuarina huegeliana* trees at northern end of quadrat.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	2cm		
<i>Allocasuarina campestris</i>	20-25%	10-25%	2.5m		
<i>Allocasuarina huegeliana</i>	2%	1-5%	4m		
<i>Arctotheca calendula</i>	+	<1 %	2cm	CH17-58	Daisy (germinated in kangaroo dung)
<i>Austrostipa nitida</i>	+	<1 %	5cm	CH17-12	no flower spike
<i>Borya sphaerocephala</i>	3-5	1-5%	6cm		Borya
<i>Burchardia umbellata</i>	+	<1 %	20cm	CH17-53	Burchardia
<i>Calandrinia calypttrata</i>	+	<1 %	6cm	CH17-11	
<i>Calytrix leschenaultii</i>	2	1-5%	35cm	CH17-3	Calytrix purple
<i>Cassytha pomiformis</i>	2-3	1-5%	1.5m	CH17-5	Cassytha
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	5cm	CH17-55	1xleaf - underside red
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2cm	CH17-9	Crassula
<i>Daviesia dielsii</i>	+	<1 %	50cm		
<i>Desmocladius flexuosus</i>	+	<1 %	20cm		
<i>Dichopogon capillipes</i>	+	<1 %	10cm	CH17-59	
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	CH17-57	
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	CH17-50,5	red rosette leaf
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	1cm	CH17-7	rosette
<i>Eriochilus helonomos</i>	+	<1 %	15cm	CH17-60	Orchid
<i>Hibbertia subvaginata</i>	+	<1 %	35cm		
<i>Hypochaeris glabra</i>	+	<1 %	10cm	=CH13-24	
<i>Hypochaeris radicata</i>	+	<1 %	1cm	CH17-52	
<i>Isopogon divergens</i>	10-15	10-25%	1.2m	CH17-2	Isopogon
<i>Kunzea praestans</i>	2	<1 %	2m	CH17-64	
<i>Melaleuca calyptroides</i>	10-15	10-25%	1.8m	CH17-1	
<i>Neurachne alopecuroidea</i>	+	<1 %	15cm	CH17-8	
<i>Opercularia vaginata</i>	+	<1 %	25cm	CH17-10	Opercularia
<i>Platysace cirrosa</i>	+	<1 %	15cm	CH17-54	
<i>Pterostylis sanguinea</i>	+	<1 %	15cm	CH17-61,6	green hood orchid

<i>Stylidium septentrionale</i>	1-2	1-5%	10cm	CH17-4	
<i>Stypandra glauca</i>	+	<1 %	35cm		Stypandra
<i>Thysanotus manglesianus</i>	+	<1 %	15cm	CH17-56	Climber
<i>Trachymene cyanopetala</i>	+	<1 %	6cm		Trachymene hairy
<i>Trachymene pilosa</i>	+	<1 %	6cm	CH17-13A	short hairs
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm	CH17-6	Grass
<i>Xanthorrhoea drummondii</i>	2	1-5%	2m		
<i>Xanthosia fruticulosa</i>	+	<1 %	15cm	=CH11-1	Xanthosia
<i>Austrodanthonia</i> sp.	+	<1 %	30cm	CH17-63	WRONG specimen #
<i>Calothamnus sanguineus</i>	+	<1 %	90cm	CH17-18	Calothamnus ? sanguineus
<i>Cheilanthes adiantoides</i>	+	<1 %	10cm		Cheilanthes
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	25cm	CH17-65	?Donkey orchid
<i>Lechenaultia biloba</i>	+	<1 %	35cm	CH17-14	small upright shrub
<i>Melaleuca radula</i>	+	<1 %	1.0m	CH17-13B	Melaleuca radula
<i>Nemcia acuta</i>	+	<1 %	35cm	CH17-15	
<i>Regelia megacephala</i>	+	<1 %	2.5m		
<i>Schoenus brevisetis</i>	+	<1 %	20cm	CH17-16	
<i>Tripterococcus brunonis</i>	+	<1 %	30cm	CH17-17	Tripterococcus

Moorra Site CAH018

Described by BRM **Date** 25/08/03 **Type:** QUADRAT 10x10 m, 30x30

Location: Mid part of Cairn Hill Reserve, just east (upslope) of track across middle of Cairn Hill Reserve between northern and southern gravel pits.

MGA Zone 50 **407467 m E** **6620592 m N** **-30.543395 S lat** **116.035312 E long**

Habitat: Moderate, north-west facing lower to mid-slope of low ridge.

Soil: Gravelly, pebbly pale yellow-brown loamy sand. (NB Uncertain if soil surface is undisturbed - there is a lot of disturbance too.)

Rock Type: ?Chert.

Vegetation: *Eucalyptus eudesmioides* subsp. *eudesmioides* low woodland to low open forest (distribution very patchy) over *Allocasuarina campestris* closed scrub over *Baeckea* sp. Moorra (R. Bone 1993/1), *Calytrix leschenaultii* low open shrubland over *Lomandra* (CH18-3), *Neurachne alopecuroidea* scattered herbs and grasses.

Vegetation condition: Uncertain as to whether very good regeneration following a hot fire or clearing or whether in very good condition with a natural paucity of herbs, grasses and sedges.

Notes: Coordinate datum: WGS84. Datum of coordinates was WGS'84. 1st coordinate is for NW peg; 2nd coord is for SE peg. Appears to be regeneration from a hot fire (even aged young *Allocasuarina campestris* about 80cm to 1.3m tall) or some other disturbance. Old revegetated excavated area (excavated to about 1m depth) to north of plot. Uncertain as to whether some broad clearing many years ago for gravel mining or perhaps a hot fire. Paucity of herbs indicates there may have been soil surface disturbance in past. 30x30 area search limited to 5m to north of 10x10 on north side (old excavations) and also avoided large areas without the *Eucalyptus eudesmioides* subsp. *eudesmioides*.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	50-60%	50-75%	0.80-1.3m		
<i>Baeckea</i> sp. Moorra (R. Bone 1993/1)	5-6%	5-10%	40-70cm	=CHN10-1	
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	10cm		
<i>Burchardia umbellata</i>	+	<1 %	12cm	CH18-4	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moorra-Watheroo	+	<1 %	1.2m	CH18-7	
<i>Calytrix leschenaultii</i>	1-2	1-5%	35cm		
<i>Desmocladius flexuosus</i>	+	<1 %	10cm		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	15cm		
<i>Dichopogon capillipes</i>	+	<1 %	3cm	=CH10-53	Dichopogon flat top
<i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i>	35-45%	33.3-50%	4-5m	CH18-1	
<i>Hibbertia subvaginata</i>	+	<1 %	20cm	CH18-6	
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moorra: ERG18-7)	+	<1 %	30cm	CH18-5	
<i>Lepidosperma costale</i>	+	<1 %	12cm	CH18-3	Sedge, not <i>Lomandra</i> .
<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>	+	<1 %	35cm	CH18-18	
<i>Neurachne alopecuroidea</i>	+	<1 %	4cm	CH18-2	
<i>Pterostylis setulosa</i>	+	<1 %	1cm	=CHN3-56	Flat base
<i>Xanthorrhoea drummondii</i>	+	<1 %	30cm		Leaves chewed of at bases - 28 parrot damage
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	1.1m		
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %	60cm	CH18-16	DET BRM

<i>Astroloma serratifolium</i>	+	<1 %	15cm	CH18-17	
<i>Borya sphaerocephala</i>	+	<1 %	3cm		
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	4cm		
<i>Dampiera lavandulacea</i>	+	<1 %	50 cm	CH1811(B)	Number used twice?
<i>Daviesia dielsii</i>	+	<1 %	35cm	CH18-12	
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	CH18-9	
<i>Drosera pallida</i>	+	<1 %	45cm	CH18-10	
<i>Hakea incrassata</i>	+	<1 %	50cm	CH18-8	WRONG specimen #
<i>Lepidosperma leptostachyum</i>	+	<1 %	30cm	CH18-13	
<i>Melaleuca radula</i>	+	<1 %	30cm	CH18-15	
<i>Platysace cirrosa</i>	+	<1 %	12cm	=ER2-53	
<i>Pterostylis sanguinea</i>	+	<1 %	15cm	=CHN6-55	Pterostylis 'bottom lip'
<i>Rhagodia drummondii</i>	+	<1 %	20cm	CH18-11	Specimen No. wrong.
<i>Stylidium septentrionale</i>	+	<1 %	5cm	=CHN8-59	
<i>Stypandra glauca</i>	+	<1 %	30cm		
<i>Thomasia grandiflora</i>	+	<1 %	30cm	CH18-14	
<i>Xanthosia fruticulosa</i>	+	<1 %	12cm		

Moora Site CAH019

Described by BRM **Date** 24/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: South end of ridge near the southern boundary of Cairn Hill Reserve.

MGA Zone 50 **407436 m E** **6620064 m N** **-30.548156 S lat** **116.034942 E long**

Habitat: South-west-facing, steep mid-slope on southern end of medium height ridge.

Soil: Gravelly brown sand.

Rock Type: Chert. Some outcropping near surface.

Vegetation: *Allocasuarina campestris* closed scrub over *Isopogon divergens* open shrubland over *Daviesia* (19-1) scattered low shrubs over *Neurachne alopecuroidea* scattered grasses.

Vegetation condition: Excellent (very few weeds).

Fire age: Not burnt for 7-10 years.

Notes: Coordinate datum: WGS'84. 1st coord is for NW peg; 2nd coord is for SE peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Aira caryophylla</i>	+	<1 %	6cm	CH19-2	
<i>Allocasuarina campestris</i>	80-90%	>75%	2.5-3m		
<i>Astroloma serratifolium</i>	+	<1 %	20cm	CH19-12,5	
<i>Blennospora drummondii</i>	+	<1 %	4cm		Blennospora
<i>Burchardia umbellata</i>	+	<1 %	20cm	CH19-55	succulent leaf
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15cm	CH19-4	Orchid
<i>Calytrix leschenaultii</i>	+	<1 %	50cm	=CH17-3	Calytrix
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	CH19-52	Orchid 1-leaf red u/nth
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm	=CH11-9	Cheilanthes
<i>Conostylis androstemma</i>	+	<1 %	15cm	CH19-56,6	
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	1-2%	1-5%	50cm	CH19-1	
<i>Desmocladius flexuosus</i>	+	<1 %	20cm		
<i>Dichopogon capillipes</i>	+	<1 %	5cm	=CH13-22	
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	CH19-15,5	Also 30x30. Orchid
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	40cm	CH19-53	Climber
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	2cm	CH19-51	rosette base
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	35cm	CH19-5	
<i>Ehrharta longiflora</i>	+	<1 %	30cm		
<i>Eriochilus helonomos</i>	+	<1 %	20cm	CH19-50	Orchid side leaf
Genus sp.	+	<1 %	3cm	CH19-7	
<i>Hypochaeris glabra</i>	+	<1 %	15cm	=CH13-24	
<i>Isopogon divergens</i>	2-3%	1-5%	1.3m	=CH17-2	Isopogon
<i>Lepidobolus chaetocephalus</i>	+	<1 %	20cm	CH19-16,6	Also 30x30. Restionaceae
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	20cm	CH19-8	
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	5cm	CH19-6	Millotia
<i>Neurachne alopecuroidea</i>	+/-1%	<1 %	15cm	CH19-9	
<i>Platysace cirrosa</i>	+	<1 %	25cm	CH19-11,5	
<i>Pterostylis</i> aff. <i>rufa</i>	+	<1 %	20cm	CH19-13	Orchid
<i>Pterostylis recurva</i>	+	<1 %	15cm	CH19-57	
<i>Pterostylis sanguinea</i>	+	<1 %	25cm	CH19-14,6	Orchid
<i>Pterostylis setulosa</i>	+	<1 %	15cm	CH19-10	Orchid

<i>Stylidium septentrionale</i>	+	<1 %	10cm	=CH17-4	
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	CH19-66	
<i>Trachymene ornata</i>	+	<1 %	4cm		White top
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm	CH19-3	Grass
<i>Xanthosia fruticulosa</i>	+	<1 %	20cm	=CH11-1	Xanthosia
<i>Calothamnus sanguineus</i>	+	<1 %	40cm	CH19-63	
<i>Cassytha pomiformis</i>	+	<1 %	1m	=CH17-5	
<i>Haemodorum paniculatum</i>	+	<1 %	30cm	CH19-64	
<i>Haemodorum simulans</i>	+	<1 %	35cm	CH19-17	Lilly
<i>Melaleuca calyptroides</i>	+	<1 %	1m	=CH17-1	
<i>Melaleuca radula</i>	+	<1 %	70cm	CH19-60	
<i>Rhodanthe polycephala</i>	+	<1 %	3cm	CH19-61	Daisy? Seedling det. provisional.
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Xanthorrhoea drummondii</i>	+	<1 %	2m		

Moora Site CAH020

Described by BRM **Date** 25/04/03 **Type:** QUADRAT 10x10 m, 30x30

Location: About 100m north of the southern boundary of Cairn Hill Reserve and on the west side of of the Reserve. About 100m west of CH15.

MGA Zone 50 **407269 m E** **6620015 m N** **-30.548585 S lat** **116.033196 E long**

Habitat: Lower, west-facing, gentle slope of a low rocky ridge. On a fault (or dyke) trending north-south along the slope.

Soil: Gravelly, pebbly, cobbly bouldery brown sand.

Rock Type: ?Chert

Vegetation: Eucalyptus wandoo ssp. wandoo open forest over *Dichopogon capillipes*, *Cheilanthes adiantoides* scattered herbs and ferns and *Calandrinia* sp. scattered annual herbs.

Vegetation condition: Very good to excellent. Considerable soil disturbance in surrounding areas.

Notes: WGS'84 datum. 1st coord for NW peg; 2nd coord for SE peg. Considerable leaf and stick litter. 30x30 search area only about 1-2m wide on east side (up to *Allocasuarina campestris* scrub).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Caesia</i> (Moora hairy stem)	+	<1 %	10cm	CH20-3	
<i>Calandrinia</i> sp.	+	<1 %	2cm	CH20-4	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i> ?corymbosa	+	<1 %	5cm	=CHN2-57	<i>Chamaescilla</i>
<i>Cheilanthes adiantoides</i>	+	<1 %	10-15cm		
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	CH20-9	
<i>Dioscorea hastifolia</i>	+	<1 %	5cm		
<i>Ehrharta longiflora</i>	+	<1 %	25cm		
<i>Eriochilus helonomos</i>	+	<1 %	4cm	=CH14-61	leaf-stem orchid
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	50-60%	50-75%	8-12m	CH20-1	
Genus sp.	+	<1 %	5cm	CH20-8	Grass
<i>Hypochaeris glabra</i>	+	<1 %	2cm		
<i>Lomandra</i> (Moora twisty)	+	<1 %	20cm	CH20-10	
<i>Platysace cirrosa</i>	+	<1 %	25cm	=ER2-53	Climbing
<i>Pterostylis setulosa</i>	+	<1 %	1cm	=CHN3-56	<i>Pterostylis</i> flat base
<i>Rhagodia drummondii</i>	+	<1 %	15cm	CH20-6	Chenopodiaceae
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	CH20-2,5	Climber
<i>Trachymene cyanopetala</i>	+	<1 %	3cm	CH20-7	
<i>Ursinia anthemoides</i>	+	<1 %	10cm		
<i>Allocasuarina campestris</i>	+	<1 %	3m		
<i>Anagallis arvensis</i>	+	<1 %	4cm	=CHN3-62	
<i>Arctotheca calendula</i>	+	<1 %	4cm		Capeweed
<i>Austrostipa trichophylla</i>	+	<1 %	4cm	CH20-12	hairy ? <i>Austroanthonia</i>
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3cm		
<i>Erodium cygnorum</i>	+	<1 %	4cm	=ER17-52	? <i>Erodium</i>
<i>Gilberta tenuifolia</i>	+	<1 %	3cm	=ER17-59	Daisy
<i>Hypoxis</i> sp.	+	<1 %	15cm		common <i>Hypoxis</i>
<i>Millotia</i> aff. <i>tenuifolia</i> (Moora: CH20-11)	+	<1 %	3cm	CH20-11	Aff. <i>tenuifolia</i> . Hairy grey daisy
<i>Neurachne alopecuroidea</i>	+	<1 %	3cm		
<i>Opercularia vaginata</i>	+	<1 %	12-15cm	=JT12-4	O. ? <i>vaginata</i>
<i>Parietaria debilis</i>	+	<1 %	3-15cm	CH20-13	soft green leaf
<i>Tripteris clandestina</i>	+	<1 %	15cm	=JT3-50	stink daisy

CAIRN HILL NORTH**Moora** Site CHN001**Described by** MJH **Date** 26/10/00 **Type:** QUADRAT 10x10 m, 30x30**Location:** Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is on the west side of the ridge, approximately 1 km SSE of the entry to 'Goonderoo' from the Midlands Road.**MGA Zone** 50 **407243 m E** **6622325 m N** **-30.527739 S lat** **116.033133 E long****Habitat:** Gentle west facing slope.**Soil:** Skeletal, fine grey-brown silty loam.**Rock Type:** Chert gravel and cobbles.**Vegetation:** Allocasuarina campestris open heath to low open heath over Borya sphaerocephala, Hypoxis occidentalis var. occidentalis, Austrodanthonia setacea, *Vulpia myuros var. hirsuta very open herbland/grassland.**Vegetation condition:** Very good to excellent.**Fire age:** Old.**Notes:** Wide clear track about 8m to north of 10x10 (regen on track <2 years old).**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
Allocasuarina campestris	70	50-75%	0.75-2 m		
Austrodanthonia setacea	+	<1 %	15 cm		Grass
Avena barbata	+	<1 %	6cm		
Borya sphaerocephala	10-15	10-25%	5 cm	CHN1-1	
Briza maxima	+	<1 %	20 cm		
Burchardia umbellata	+	<1 %	30cm	CHN1-55	
Chamaescilla corymbosa var. corymbosa	+	<1 %	10-15 cm	CHN1-2	
Cheilanthes adiantoides	1	<1 %	10 cm		Cover re-assessed in winter 2003
Cyanicula deformis	+	<1 %	12cm	CHN1-50	
Diuris aff. recurva	+	<1 %	20cm	CHN1-54	Orchid
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	1 cm	CHN1-7	Rosette. ssp.??
Drosera macrantha subsp. macrantha	+	<1 %	40cm	CHN1-15,51	
Dryandra sessilis var. sessilis	1	<1 %	3 m		1 only
Ehrharta longiflora	+	<1 %	12cm		
Elythranthera brunonis	+	<1 %	15 cm	CHN1-8	
Genus sp.	+	<1 %	20 cm	CHN1-9	Herb
Haemodorum paniculatum	+	<1 %	35cm	CHN1-14, 58	
Hypoxis occidentalis var. occidentalis	1-2%	1-5%	15cm	CHN1-52	Cover assessed in winter 2003
Neurachne alopecuroidea	+	<1 %	10 cm		
Parentucellia latifolia	+	<1 %	10 cm	CHN1-12	herb
Pentaschistis airoides	+	<1 %	5-8 cm	CHN1-3	Grass
Platysace cirrosa	+	<1 %	12cm	=ER2-53	Climber
Pterostylis aff. nana	+	<1 %	12cm	CHN1-59	Flat base
Schoenus clandestinus	10-12%	10-25%	3cm	CHN1-6, 53	
Stylidium calcaratum	+	<1 %	7 cm	CHN1-10	
Stylidium septentrionale	+	<1 %	10 cm	CHN1-13	
Thysanotus manglesianus	+	<1 %	30cm	CHN1-57	Climber
Trachymene ornata	+	<1 %	5 cm	CHN1-5, 56	
Vulpia myuros var. hirsuta	+	<1 %	10 cm	CHN1-4	Grass
Acacia aristulata	+	<1 %	15 cm		juv
Blennospora drummondii	+	<1 %	5 cm	CHN1-206	Also CHN1-62, 63. Grey daisy
Caladenia flava subsp. flava	+	<1 %	6cm		
Calytrix leschenaultii	+	<1 %	20-30 cm		
Eriochilus helonomos	+	<1 %	10cm	=CH14-61	side leaf orchid
Goodenia hassallii	+	<1 %	30 cm	CHN1-21	??
Haemodorum simulans	+	<1 %	15 cm	CHN1-17	
Hibbertia subvaginata	+	<1 %	50 cm		
Hyalosperma cotula	+	<1 %	5 cm	CHN1-22	White daisy
Lupinus angustifolius	+	<1 %	20 cm		Blue lupin
Podolepis lessonii	+	<1 %	10-15 cm	CHN1-18,6	Daisy
Trachymene cyanopetala	+	<1 %	5 cm	CHN1-19	
Trifolium subterraneum	+	<1 %	2cm	CHN1-60	Clover
Xanthorrhoea drummondii	+	<1 %	1 m		

Moora Site CHN002**Described by** BRM **Date** 26/10/00 **Type:** QUADRAT 10x10 m, 30x30**Location:** Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is at the northern end of Cairn Hill North, approximately 1 km SE of the entry to 'Goonderoo' from the Midlands Road.**MGA Zone** 50 **407167 m E** 6622563 **m N** -30.525585 **S lat** 116.032362 **E long****Habitat:** Gentle northwest-facing upper slope, just below crest of low ridge.**Soil:** Pebbly, cobbly, gravelly grey loamy sand.**Rock Type:** Chert outcrop and boulders, 90%+ cover.**Vegetation:** *Regelia megacephala*, (*Kunzea praestans*, *Allocasuarina campestris*) open to closed scrub over *Hibbertia subvaginata* scattered low shrubs over *Xanthosia fruticulosa* scattered low shrubs over *Stypantra glauca*, *Dichopogon capillipes* very open herbland.**Vegetation condition:** Very good to excellent. Not much evidence of grazing. Very few weeds: some non-aggressive weed invasion.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	4-5	1-5%	2 m		
<i>Arctotheca calendula</i>	+	<1 %	6cm		
<i>Austrodanthonia setacea</i>	+	<1 %		CHN2-12	
<i>Avena barbata</i>	+	<1 %	4cm		
<i>Blennospora drummondii</i>	+	<1 %	3cm	=CHN1-62	Daisy
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %	40cm	CHN2-14,5	Boronia
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)				CHN2-19	
<i>Burchardia umbellata</i>				CHN2-21	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		CHN2-9	Orchid
<i>Calytrix leschenaultii</i>	+	<1 %	1 m	CHN2-13	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>				CHN2-20	
<i>Cheilanthes adiantoides</i>	+	<1 %		CHN2-6	
<i>Desmocladus flexuosus</i>				CHN2-22	
<i>Dichopogon capillipes</i>	1	<1 %		CHN2-3,50	Mauve lilly, dead base
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	40cm	=CHN1-54	
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		CHN2-8	=WO1-23
<i>Ehrharta longiflora</i>	+	<1 %	8cm		
<i>Hibbertia subvaginata</i>	1-2%	<1 %	<1m	CHN2-53	
<i>Hypochoeris glabra</i>				CHN2-17	
<i>Kunzea praestans</i>	2	1-5%	2-2.5 m		
<i>Neurachne alopecuroidea</i>	+	<1 %		CHN2-11	
<i>Pentaschistis airoides</i>	+	<1 %		CHN2-5	
<i>Pityrodia dilatata</i>	+	<1 %		CHN2-18	
<i>Platysace cirrosa</i>	+	<1 %	15cm	=ER2-53	Climber
<i>Podotheca angustifolia</i>	+	<1 %	4cm	=CHN3-52	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	25cm	=CHN6-55	<i>Pterostylis</i> 'bottom lip'
<i>Pterostylis setulosa</i>	+	<1 %	10cm	=CHN3-56	flat base
<i>Regelia megacephala</i>	70-75	50-75%	2-3 m		
<i>Scaevola phlebotopetala</i>	+	<1 %		CHN2-10	
<i>Stypantra glauca</i>	2-3	1-5%	60 cm	CHN2-1	
<i>Trachymene cyanopetala</i>	+	<1 %	3cm	CHN2-51B	
<i>Trachymene ornata</i>	+	<1 %		CHN2-51A	Also CHN2-25
<i>Tricoryne elatior</i>	+	<1 %	30 cm	CHN2-15	
<i>Tripterococcus brunonis</i>	+	<1 %	30 cm	CHN2-16,2	Redet 05/05
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		CHN2-4	grass
<i>Xanthosia fruticulosa</i>	1-2	1-5%	30 cm	CHN2-2	
<i>Acacia aristulata</i>	+	<1 %		CHN2-24	
<i>Allocasuarina huegeliana</i>	+	<1 %	3.5-4m		
<i>Briza maxima</i>	+	<1 %	35cm		
<i>Calandrinia</i> sp.	+	<1 %	2cm	CHN2-54	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	1cm	CHN2-55	
<i>Cyanicula deformis</i>	+	<1 %	12cm	=CHN1-50	
<i>Lawrencella rosea</i>				CHN2-30	Daisy
<i>Lepidosperma tenue</i>				CHN2-29	sedge
<i>Pterostylis</i> sp.	+	<1 %	35cm	CHN2-56	
<i>Stylidium septentrionale</i>	+	<1 %		CHN2-27	
<i>Xanthorrhoea drummondii</i>	+	<1 %			

Moora**Site** CHN003**Described by** MJH **Date** 26/10/00 **Type:** QUADRAT 10x10 m, 30x30**Location:** Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is on the crest of the ridge approximately 100 m to the NNE of CHN001.**MGA Zone** 50 **407200 m E** 6622506 **m N** -30.526102 **S lat** 116.032701 **E long****Habitat:** Gentle west-facing upper slope, slightly below crest of low ridge.**Soil:** Pebbly, cobbly, bouldery grey brown silty loam.**Rock Type:** Chert outcrops and cobbles, cover 70-90%.**Vegetation:** Kunzea praestans, (Allocasuarina campestris) open scrub to high shrubland over Hibbertia subvaginata scattered shrubs over Dichopogon capillipes, Chamaescilla corymbosa var. corymbosa scattered herbs.**Vegetation condition:** Generally very good, weed invasion in parts stop it being excellent (very little Avena barbata and Ehrharta longiflora in the 10x10).**Notes:** Daviesia dielsii: group of 7 plants @ 50J 0406999, UTM 6622354, and others downslope. Several dead Hibbertia subvaginata plants. 30x30 search area didn't include Regelia scrub to east.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
Acacia aristulata	+	<1 %	5 cm		juv
Allocasuarina campestris	10-12	10-25%	2 m		
Austrostipa tenuifolia	+	<1 %	20-30 cm	CHN3-17	
Avena barbata	+	<1 %	15 cm		
Blennospora drummondii	+	<1 %	3cm	=CHN1-62	Daisy
Bossiaea sp. Cairn Hill (M Henson CH2-28)	1-2	1-5%	70 cm		juv
Briza maxima	+	<1 %	15 cm		
Burchardia umbellata	+	<1 %	35cm	=CHN1-55	
Caladenia flava subsp. flava	+	<1 %	15 cm	CHN3-16	
Calandrinia sp.	+	<1 %	2cm	CHN3-59	
Calytrix leschenaultii	+	<1 %	20 cm		
Chamaescilla corymbosa var. corymbosa	+	<1 %	15-20 cm	CHN3-7	
Cheilanthes adiantoides	+	<1 %	5-8 cm		
Crassula exserta	+	<1 %	1cm	CHN3-60	
Cyanicula deformis	+	<1 %	15cm	=CHN1-50	Blue Beard orchid
Desmocladius flexuosus	+	<1 %	15 cm	CHN3-3	
Dichopogon capillipes	1-2	1-5%	30 cm		
Dioscorea hastifolia	+	<1 %	1 m		
Diuris aff. recurva	+	<1 %	20cm	=CHN1-54	Donkey orchid
Drosera aff. macrantha	+	<1 %	15-20 cm	CHN3-13	Also CHN3-50,51.
Drosera pallida	+	<1 %	15 cm	CHN3-8	
Ehrharta longiflora	+	<1 %	20-30 cm		
Goodenia berardiana	+	<1 %	20cm	=ER8-52	
Hibbertia subvaginata	2%	1-5%	<1 m		
Hypochaeris glabra	+	<1 %	5 cm		
Kunzea praestans	40-60	33.3-50%	2-3 m		
Melaleuca calyptroides	+	<1 %	1 m		
Neurachne alopecuroidea	+	<1 %	30 cm		
Opecularia vaginata	+	<1 %	5 cm	CHN3-4a	???herb Not sure of
number					
Pentaschistis airoides	+	<1 %	5 cm	CHN3-12	
Phyllangium sulcatum	+	<1 %	5 cm	CHN3-4	
Platysace cirrosa	+	<1 %	6cm	=ER2-53	Climber
Podolepis lessonii	+	<1 %	10-20 cm	CHN3-9	
Podotheca angustifolia	+	<1 %	45cm	CHN3-52,5	Climber 4
Pterostylis setulosa	+	<1 %	30cm	CHN3-56,5	Goodeniaceae 7
Scaevola phlebopetala	+	<1 %	50-90cm	CHN3-14,58	
Schoenus nanus	+	<1 %	5 cm	CHN3-5	
Stylidium septentrionale	+	<1 %	5 cm	CHN3-15	
Stypandra glauca	+	<1 %	20 cm	CHN3-10	
Thysanotus manglesianus	+	<1 %	12cm	CHN3-55	Pterostylis 'bottom lip'
Trachymene ornata	+	<1 %	5 cm		
Tricoryne elatior	+	<1 %	30 cm	CHN3-2	
Trifolium sp.				CHN3-18	Not T. arvense
Tripterococcus brunonis	+	<1 %	30 cm	CHN3-1	
Ursinia anthemoides	+	<1 %	15 cm		
Vulpia myuros var. hirsuta	+	<1 %	5 cm	CHN3-6	Grass

<i>Xanthosia fruticulosa</i>	+	<1 %	15 cm		
<i>Anagallis arvensis</i>	+	<1 %	5cm	CHN3-62	
<i>Arctotheca calendula</i>	+	<1 %	15cm		Around base of <i>Nuytsia</i>
<i>Erodium cygnorum</i>	+	<1 %	4cm	=ER17-52	
<i>Guichenotia micrantha</i>	+	<1 %	35cm	CHN3-61	
<i>Lawrencella rosea</i>	+	<1 %	25cm	=CHN4-60	Pink daisy
<i>Nuytsia floribunda</i>	1	<1 %	5 m		
<i>Pityrodia dilatata</i>	+	<1 %	20cm		
<i>Regelia megacephala</i>	+	<1 %	3 m		
<i>Trifolium hirtum</i>	+	<1 %	10cm	CHN3-64	
<i>Trifolium subterraneum</i>	+	<1 %	10cm	CHN3-63	Clover #2
<i>Triptaris clandestina</i>	+	<1 %	25cm	=JT3-50	Stink daisy
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		

Moora **Site** CHN004

Described by BRM **Date** 26/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is approximately 1.1 km SSE of the entry to 'Goonderoo' from the Midlands Road on a NW facing slope.

MGA Zone 50 407314 **m E** 6621853 **m N** -30.532003 **S lat** 116.033831 **E long**

Habitat: Northwest-facing, moderate sloping mid-slope of low ridge.

Soil: Gravelly, grey sandy loam.

Rock Type: Chert outcrop ~30% cover.

Vegetation: *Regelia megacephala* open scrub over *Allocasuarina campestris* open shrubland over *Melaleuca alyptroides* scattered shrubs over *Hibbertia subvaginata* scattered low shrubs over *Borya sphaerocephala* scattered herbs and *Lawrencella rosea* scattered annual herbs

Vegetation condition: Very good. Evidence of some grazing?

Fire age: Long time unburnt.

Notes: Very rocky. Gridlines to north (2m) and south (4m) of 10x10 plot.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	5-8	5-10%	2 m		
<i>Anagallis arvensis</i>	+	<1 %	1cm	CHN4-50	
<i>Austrodanthonia setacea</i>	+	<1 %		CHN4-13	grass
<i>Austrostipa variabilis</i>				CHN4-12b	
<i>Blennospora drummondii</i>	+	<1 %	20cm	CHN4-57	big leaf daisy
<i>Borya sphaerocephala</i>	1-2	1-5%			=WD2-4
<i>Briza maxima</i>	+	<1 %			
<i>Burchardia umbellata</i>	+	<1 %		CHN4-11	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		CHN4-5	Orchid
<i>Calandrinia eremaea</i>	+	<1 %	1cm	CHN4-54	Det provisional
<i>Calytrix leschenaultii</i>	+	<1 %		CHN4-8	
<i>Cassytha pomiformis</i>	+	<1 %		CHN4-10	Climber
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %		CHN4-29	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2cm	CHN4-55	
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Blue Beard orchid
<i>Desmocladius flexuosus</i>	+	<1 %	3cm	CHN4-56	Daisy
<i>Dioscorea hastifolia</i>	+	<1 %			Climber
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		CHN4-14	Climbing, =WO1-23
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	30cm	CHN4-51	Climber (no fleshy leaves)
<i>Drosera pallida</i>	+	<1 %		=EO1-18	Short fat leaf
<i>Goodenia berardiana</i>	+	<1 %	25cm	=ER8-52	
<i>Hibbertia subvaginata</i>	+	<1 %	1 m		
<i>Hypochaeris glabra</i>	+	<1 %	1cm		
<i>Kunzea praestans</i>	+	<1 %	1-2 m		
<i>Lawrencella rosea</i>	+	<1 %	15cm	CHN4-60,6	Also CHN4-2b; pink daisy, linear leaves
<i>Melaleuca calyptroides</i>	1-2%	1-5%	1.1-1.9m		
<i>Neurachne alopecuroidea</i>	+	<1 %		=WO1-4	
<i>Parentucellia latifolia</i>	+	<1 %		CHN4-12a	
<i>Pentaschistis airoides</i>	+	<1 %		CHN4-3	
<i>Pityrodia dilatata</i>	+	<1 %	10cm		
<i>Podolepis canescens</i>	+	<1 %	35cm	CHN4-58	Pterostylis tall
<i>Podolepis lessonii</i>	+	<1 %	4cm	=ER1-58	Daisy

<i>Pterostylis setulosa</i>	+	<1 %	10cm	=CHN7-58	Flat leaf base
<i>Regelia megacephala</i>	50	50-75%	3 m		
<i>Romulea rosea</i>	+	<1 %	25cm		
<i>Scaevola phlebopetala</i>	+	<1 %		CHN4-4	
<i>Stylidium septentrionale</i>	+	<1 %		CHN4-6	
<i>Stypantra glauca</i>	+	<1 %		=EO1-13	
<i>Thysanotus manglesianus</i>	+	<1 %	12cm	CHN4-52,5	
3					
<i>Trachymene ornata</i>	+	<1 %		CHN4-1	
<i>Trifolium</i> sp.	+	<1 %	2cm	CHN4-59	Clover
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		CHN4-7	
<i>Allocasuarina huegeliana</i>	+	<1 %			
<i>Arctotheca calendula</i>	+	<1 %	10cm		Capeweed
<i>Austrostipa elegantissima</i>	+	<1 %	40cm	CHN4-63	
<i>Baeckea</i> sp. <i>Moora</i> (R. Bone 1993/1)	+	<1 %	15cm	CHN4-62	
<i>Bossiaea</i> sp. <i>Cairn Hill</i> (M Henson CH2-28)	+	<1 %	15cm	CHN4-64	
<i>Bromus diandrus</i>	+	<1 %	25cm	=ER10-58	
<i>Caesia</i> (<i>Moora</i> hairy stem)	+	<1 %	30cm	CHN4-65	
<i>Calothamnus sanguineus</i>	+	<1 %		CHN4-30	
<i>Cheilanthes adiantoides</i>	+	<1 %		=WO1-19	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	60cm		
<i>Dichopogon capillipes</i>	+	<1 %			Mauve lilly, dead base
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %		CHN4-17	
<i>Eriochilus helonomos</i>	+	<1 %	20cm	=CH14-61	Leaf-stem orchid
<i>Hyalosperma cotula</i>	+	<1 %		CHN4-20	Daisy
<i>Opercularia vaginata</i>				CHN4-22	
<i>Pimelea imbricata</i> var. <i>piliger</i>	+	<1 %		CHN4-26	
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %		CHN4-19	
<i>Xanthorrhoea drummondii</i>	+	<1 %			
<i>Xanthosia fruticulosa</i>	+	<1 %		CHN4-24	

Moora Site CHN005

Described by MJH **Date** 23/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is approximately 50 m on the east side of the "York Gum Gully" which runs through the hilltop 150 m east of CHN004.

MGA Zone 50 **407491 m E** **6621755 m N** **-30.532901 S lat** **116.035667 E long**

Habitat: Flat to gently sloping, north-facing slope on crest of low ridge.

Soil: Well mulched grey fine loam, skeletal.

Rock Type: Chert outcrop, cobbles, 80-90% cover.

Vegetation: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, *Kunzea praestans* high open scrub over *Xanthosia fruticulosa* low open shrubland with *Hypoxis occidentalis* var. *occidentalis*, *Cheilanthes adiantoides* scattered herbs and ferns.

Veg Condition

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	12 cm		juv
<i>Acacia congesta</i> subsp. <i>congesta</i>	1	<1 %	1 m	CHN5-10	
<i>Allocasuarina huegeliana</i>	15-20	10-25%	5-7 m		
<i>Arctotheca calendula</i>	+	<1 %	10cm		Capeweed
<i>Austrodanthonia setacea</i>	+	<1 %	25 cm	CHN5-5	Grass
<i>Austrostipa tenuifolia</i>	+	<1 %	20 cm	CHN5-7	
<i>Austrostipa variabilis</i>	+	<1 %	30 cm	CHN5-8	Grass
<i>Briza maxima</i>	+	<1 %	5-10 cm		
<i>Burchardia umbellata</i>	+	<1 %	40cm	=GH9-52	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15 cm	CHN5-4	
<i>Calytrix leschenaultii</i>	+	<1 %	20 cm		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	=ER19-50	
<i>Cheilanthes adiantoides</i>	1-2	1-5%	5 cm		
<i>Cyanicula deformis</i>	+	<1 %	12cm	=ER17-51	Blue Beard orchid
<i>Desmocladius flexuosus</i>	+	<1 %	10 cm		
<i>Dichopogon capillipes</i>	+	<1 %	20cm		
<i>Dioscorea hastifolia</i>	+	<1 %	2 m		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30 cm		

<i>Drosera pallida</i>	+	<1 %	20 cm		
<i>Hibbertia subvaginata</i>	+	<1 %	30-50 cm		
<i>Hypochaeris glabra</i>	+	<1 %	1cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	1	<1 %	15cm	=ER17-58	
<i>Kunzea praestans</i>	5-6%	5-10%	2-2.5 m		
<i>Neurachne alopecuroidea</i>	+	<1 %	30 cm		
<i>Opercularia vaginata</i>	+	<1 %	10-20 cm	CHN5-3,55	Also recorded in 30x30.
<i>Pterostylis sanguinea</i>	+	<1 %	15cm	CHN5-53	?Opercularia
<i>Pterostylis setulosa</i>	+	<1 %	6cm	=CHN7-58	Pterostylis flat base
<i>Regelia megacephala</i>	20-25	10-25%	3 m		
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	35cm	CHN5-50	Climber
<i>Stylidium septentrionale</i>	+	<1 %	5 cm	CHN5-2	
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	CHN5-54	fleshy leaf Thysanotus
<i>Trachymene cyanopetala</i>	+	<1 %	10cm	CHN5-52	
<i>Tripterococcus brunonis</i>	+	<1 %	20 cm	CHN5-9	
<i>Ursinia anthemoides</i>	+	<1 %	5-10 cm		
<i>Xanthorrhoea drummondii</i>	1-2%	1-5%	1.5 m		
<i>Xanthosia fruticulosa</i>	5-10	5-10%	20-30 cm		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	6-7 m		
<i>Allocasuarina campestris</i>	2	1-5%	2 m		
<i>Austrostipa compressa</i>	+	<1 %	30 cm		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	80 cm		
<i>Goodenia berardiana</i>	+	<1 %	8cm	=ER8-52	
<i>Lawrencella rosea</i>	+	<1 %	15cm	=CHN4-60	pink daisy linear leaf
<i>Trachymene ornata</i>	+	<1 %	5 cm		

Moora Site CHN006

Described by BRM **Date** 26/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is on top of the ridge, approximately 100 m south of CHN005.

MGA Zone 50 **407487 m E** **6621668 m N** **-30.533685 S lat** **116.035618 E long**

Habitat: Ridge-top.

Soil: Pebbly, cobbly, bouldery grey loamy sand amongst exposed sheet rock.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans* open heath over *Hibbertia subvaginata* low open shrubland over *Xanthosia fruticulosa* low open shrubland over *Neurachne alopecuroidea*, *Austrostipa variabilis*, *Austrodanthonia setacea*, *Dichopogon capillipes* very open grass/herbland.

Vegetation condition: Good to very good. Considerable weed cover on the north side of the plot.

Notes: Numerous *Kunzea praestans* and *Hibbertia subvaginata* deaths (deaths not included in cover estimates). Old dead *Xanthorrhoea drummondii* in plot. *Regelia* scrub 8-10m north of 10x10 not included in the 30x30 search area - search only included *Kunzea* dominated areas.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	5 m		
<i>Allocasuarina huegeliana</i>	5-8	5-10%	5 m		Tree fallen in plot - estimated cover assuming tree standing.
<i>Arctotheca calendula</i>	+	<1 %	10cm		
<i>Austrodanthonia setacea</i>	+	<1 %		CHN6-11	Grass
<i>Austrostipa variabilis</i>				CHN6-17	
<i>Avena barbata</i>	+	<1 %	10cm		
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	1-2	1-5%		CHN6-10	??
<i>Blennospora drummondii</i>	+	<1 %		CHN6-8	grey Daisy
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %	20cm	CHN6-15,5	Also recorded in 30x30.
6					
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %			=WO1-20
<i>Briza maxima</i>	+	<1 %			
<i>Burchardia umbellata</i>	+	<1 %	20cm	CHN6-52	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		CHN6-3	Orchid
<i>Calandrinia</i> sp.	+	<1 %	2cm	CHN6-53	
<i>Calytrix leschenaultii</i>	+	<1 %	35cm	CHN6-20	Also recorded in 30x30.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %		CHN6-12	
<i>Cheilanthes adiantoides</i>	1-2%	1-5%			
<i>Crassula exserta</i>	+	<1 %		CHN6-5	
<i>Cyanicula deformis</i>	+	<1 %	15cm	=ER17-51	

<i>Desmodium flexuosus</i>	1%	1-5%			= CHN4-15
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %		CHN6-14	
<i>Dichopogon capillipes</i>	2-3	1-5%			Mauve lilly, dead base
<i>Dioscorea hastifolia</i>	1	<1 %			
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	40cm	CHN6-51	Climber
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %			overhanging 10x10 plot
<i>Ehrharta longiflora</i>	+	<1 %	5cm		
<i>Eriochilus helonomos</i>	+	<1 %	20cm	=ER8-56	side leaf orchid
<i>Hibbertia subvaginata</i>	8-10	5-10%	1.4m		
<i>Hypochaeris glabra</i>	3-4%	1-5%	2cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER17-58	
<i>Kunzea praestans</i>	33-40	33.3-50%	1.8-3m		
<i>Lawrencella rosea</i>	+	<1 %	20cm	CHN6-2	pink daisy linear leaves
<i>Levenhookia stipitata</i>	+	<1 %		CHN6-16	not sure of no.
<i>Opercularia vaginata</i>	+	<1 %		CHN6-9	
<i>Parentucellia latifolia</i>	+	<1 %		CHN6-6	
<i>Pentaschistis airoides</i>	+	<1 %		CHN6-1	
<i>Platysace cirrosa</i>	+	<1 %	4cm	=ER2-53	Climber
<i>Podotheca angustifolia</i>	+	<1 %	4cm	=GH10-52	?Daisy
<i>Pterostylis recurva</i>	+	<1 %	15cm	CHN6-50	
<i>Stylidium septentrionale</i>	+	<1 %		CHN6-23	
<i>Thysanotus manglesianus</i>	+	<1 %	1cm	CHN6-54	Pterostylis flat base
<i>Trachymene pilosa</i>	+	<1 %			
<i>Tripterococcus brunonis</i>	+	<1 %		CHN6-13	
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		CHN6-4	Grass
<i>Xanthosia fruticulosa</i>	2-3%	1-5%			
<i>Acacia aestivalis</i>	+	<1 %	3m	CHN6-59	Needs further study.
<i>Allocasuarina campestris</i>	+	<1 %	2.5m		
<i>Calothamnus sanguineus</i>	+	<1 %		CHN6-19	
<i>Lepidosperma</i> sp.	+	<1 %		CHN6-24	Specimen missing 9/2005.
<i>Melaleuca calyptroides</i>	+	<1 %		CHN6-25	
<i>Neurachne alopecuroidea</i>				CHN6-27	
<i>Nuytsia floribunda</i>	+	<1 %	60cm	CHN6-57	juvenile
<i>Podolepis lessonii</i>	+	<1 %	10cm	=ER1-58	Daisy
<i>Pterostylis</i> aff. <i>nana</i>	+	<1 %		CHN6-21	
<i>Pterostylis sanguinea</i>	+	<1 %	30cm	CHN6-55	Pterostylis 'bottom lip'
<i>Pterostylis vittata</i>				CHN6-26	
<i>Scaevola phlebopetala</i>	+	<1 %	15cm	CHN6-22,5	Goodeniaceae
<i>Xanthorrhoea drummondii</i>	+	<1 %			

Moora Site CHN007

Described by BRM **Date** 4/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is on the western side of the ridge, approximately 1.6 km SSE of the entry to 'Goonderoo' from the Midlands Road and only 200m N of the Cairn Hill boundary fence.

MGA Zone 50 **407459 m E** **6621571 m N** **-30.534558 S lat** **116.035317 E long**

Habitat: Western end of chert ridge at the south end of Cairn Hill North. Very gentle southerly slope.

Soil: Grey, silty loamy sand

Rock Type: Quartz cobbles/gravel. Exposed outcrop 5%. Cover 30-40%.

Vegetation: *Allocasuarina huegeliana* and *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Allocasuarina campestris*) open scrub over *Hibbertia subvaginata* open shrubland over *Neurachne alopecuroidea*, *Austrodanthonia setacea*, *Stylidium septentrionale*, *Opercularia vaginata*, *Chamaescilla corymbosa* var. *corymbosa* very open grass/herbland.

Vegetation condition: Very good to excellent (a few weeds).

Notes: 1st coord is for NE peg; 2nd coord is for SW coordinate. Considerable *Kunzea* 'dieback', but most have new shoots.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	3-4%	1-5%	1.8-2.5 m		
<i>Allocasuarina huegeliana</i>	+	<1 %	1.6m		juvenile
<i>Austrodanthonia setacea</i>	+	<1 %	30 cm	CHN7-8	Grass
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	3	1-5%	70 cm		

<i>Blennospora drummondii</i>	+	<1 %	4 cm	CHN7-5	grey daisy
<i>Briza maxima</i>	+	<1 %			
<i>Burchardia umbellata</i>	+	<1 %	25cm	CHN7-51,5	<i>Thysanotus</i> fleshy leaf
7					
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	8 cm	CHN7-3,50	Orchid
<i>Calandrinia</i> sp.	+	<1 %	1m	CHN7-56	
<i>Calytrix leschenaultii</i>	+	<1 %			
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	5cm	=ER19-50	
<i>Cheilanthes adiantoides</i>	+	<1 %			
<i>Daviesia dielsii</i>	+	<1 %	70 cm		3 (+9 in 30x30)
<i>Desmocladus flexuosus</i>	+	<1 %	15cm	CHN7-55	
<i>Dichopogon capillipes</i>	+	<1 %	40 cm		
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	25cm	=ER3-52	common
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	CHN7-60	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %			
<i>Drosera pallida</i>	+	<1 %			
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	10 cm		gully
<i>Goodenia arthrotricha</i>	+	<1 %	30 cm		1 plant
<i>Hibbertia subvaginata</i>	6	5-10%	0.7-1 m		
<i>Hypochaeris glabra</i>	+	<1 %	1cm		
<i>Kunzea praestans</i>	33-40	33.3-50%	1.8-3 m		
<i>Lawrencella rosea</i>	+/-1%	<1 %	10-30 cm	CHN7-1,53	
<i>Melaleuca calyptroides</i>	4	1-5%	1-2 m		
<i>Neurachne alopecuroidea</i>	+	<1 %			
<i>Opercularia vaginata</i>	+	<1 %	20cm	CHN7-9,52	
<i>Pentastichis airoides</i>	+	<1 %			Tall
<i>Phyllangium sulcatum</i>	+	<1 %	4 cm	CHN7-4	Small daisy
<i>Platysace cirrosa</i>	+	<1 %	20cm	=ER2-53	Climber
<i>Podolepis canescens</i>	+	<1 %	12cm	CHN7-62	Daisy
<i>Podolepis lessonii</i>	+	<1 %	10 cm	CHN7-6	
<i>Podotheca angustifolia</i>	+	<1 %	3cm	CHN7-63	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	6cm	CHN7-59	<i>Pterostylis</i> tall
<i>Pterostylis setulosa</i>	+	<1 %	10cm	CHN7-58	<i>Pterostylis</i> flat leaf base
<i>Stylidium septentrionale</i>	+	<1 %			Short, pink
<i>Stypandra glauca</i>	+	<1 %	20cm		
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	CHN7-61	Climber
<i>Trachymene cyanopetala</i>	+	<1 %	3cm	CHN7-54	
<i>Tricoryne elatior</i>	+	<1 %	40 cm	CHN7-2	
<i>Ursinia anthemoides</i>	+	<1 %	15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		CHN7-12	
<i>Xanthorrhoea drummondii</i>	1	<1 %	2-3 m		
<i>Xanthosia fruticulosa</i>	+	<1 %			
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %			
<i>Borya sphaerocephala</i>	+	<1 %			
<i>Crassula exserta</i>	+	<1 %	2cm	CHN7-64	
<i>Gilbertia tenuifolia</i>	+	<1 %	10cm	=ER17-59	Small yellow daisy
<i>Trachymene ornata</i>	+	<1 %		CHN7-10	

Moora Site CHN008

Described by MJH **Date** 4/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North is the ridge of Cairn Hill extending north on to 'Goonderoo'. The plot is at the southern end of the Cairn Hill North area, 90 m N of the Cairn Hill boundary and 100 m west of CHN007.

MGA Zone 50 **407363 m E** 6621609 **m N** -30.534208 **S lat** 116.03432 **E long**

Habitat: Moderate to steep west facing slope, mid-slope on low ridge.

Soil: Gravelly, pebbly, cobby dark grey loamy fine sand, with some exposed sheet rock..

Rock Type: Quartz outcrop and cobbles. 60-70% cover.

Vegetation: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala*, (*Calothamnus* aff. *quadrifidus*, *Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland over *Hibbertia subvaginata* low open shrubland over *Borya sphaerocephala*, *Chamaescilla corymbosa* var. *corymbosa* very open herbland

Vegetation condition: Very good to excellent. Some senescence, but lots of *Regelia* volunteering. Some weed invasion.

Fire age: >10-15 years.

Notes: 1st coord is for north peg; 2nd coord is for south peg. Quadrat placed diagonally across slope. Regelia cover a little patchy - higher cover in surrounding areas.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina huegeliana</i>	1-2%	1-5%	4-4.5m		
<i>Anagallis arvensis</i>	+	<1 %	2-3cm	CHN8-52	
<i>Arctotheca calendula</i>	+	<1 %	4cm		
<i>Austrostipa trichophylla</i>	+	<1 %	15cm	CHN8-54,5	Also recorded in 30x30 and CHN8-9. Grass
<i>Avena barbata</i>	+	<1 %	15 cm		
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	5-7	5-10%	1.4 m		
<i>Blennospora drummondii</i>	+	<1 %	4 cm	CHN8-1	
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %	15cm	CHN8-56	
<i>Borya sphaerocephala</i>	4-5%	1-5%	5 cm		
<i>Briza maxima</i>	+	<1 %	10-15 cm		
<i>Burchardia umbellata</i>	+	<1 %	30cm	=GH9-52	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	4cm	=ER16-54	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	2-3	1-5%	0.2-2.4m		
<i>Calytrix leschenaultii</i>	+	<1 %	50 cm		
<i>Centrolepis drummondiana</i>	+	<1 %	5 cm	CHN8-8	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15-40cm	=ER19-50	
<i>Cheilanthes adiantoides</i>	+	<1 %	10 cm		
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2cm	CHN8-55	
<i>Cyanicula gemmata</i>	+	<1 %	1cm	=JT6-54	hairy spade-leaf orchid
<i>Dioscorea hastifolia</i>	+	<1 %	1 m		
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	CHN8-61	?=ER3-52
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	CHN8-50	Also CHN8-53A,B.
<i>Drosera pallida</i>	+	<1 %		CHN8-5	
<i>Eriochilus helonomos</i>	+	<1 %	20cm	=ER8-56	side-leaf orchid
<i>Hibbertia subvaginata</i>	3-4	1-5%	1m		
<i>Hypochaeris glabra</i>	+	<1 %	1-2cm		
<i>Isopogon divergens</i>	+	<1 %	1.1m	CHN8-10,6,5	
<i>Kunzea praestans</i>	2-4%	1-5%	1.2-2.1m		
<i>Lawrencella rosea</i>	+	<1 %	20cm	=CHN4-60	pink daisy linear leaf
<i>Melaleuca calyptroides</i>	+	<1 %	1.5 m		
<i>Neurachne alopecuroidea</i>	+	<1 %	30 cm		
<i>Pentaschistis airoides</i>	+	<1 %		CHN8-3	Grass
<i>Phyllangium sulcatum</i>	+	<1 %	8 cm		
<i>Pityrodia dilatata</i>	+	<1 %	10 cm		juv
<i>Platysace cirrosa</i>	+	<1 %	20cm	=ER2-53	
<i>Podolepis lessonii</i>	+	<1 %	10 cm	CHN8-6	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	12cm	CHN8-51	<i>Pterostylis</i> 'bottom lip'
<i>Pterostylis setulosa</i>	+	<1 %	1cm	=CHN7-58	flat base
<i>Quinetia urvillei</i>	+	<1 %	2cm	=ER13-61	Daisy
<i>Regelia megacephala</i> 3-4m	40-50	33.3-50%	(0.2-0.5)		
<i>Sowerbaea laxiflora</i>	+	<1 %		CHN8-60	
<i>Stylidium septentrionale</i>	+	<1 %	12cm	CHN8-59	
<i>Stypantra glauca</i>	+	<1 %	50 cm		
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	CHN8-57	Climber
<i>Trachymene cyanopetala</i>	+	<1 %	1-3cm	CHN8-62	
<i>Ursinia anthemoides</i>	+	<1 %	10 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	8 cm	CHN8-4	Grass
<i>Xanthorrhoea drummondii</i>	1-2	1-5%	2 m		
<i>Allocasuarina campestris</i>	+	<1 %	3 m		
<i>Borya laciniata</i>	+	<1 %	2cm	CHN8-68	
<i>Cyanicula deformis</i>	+	<1 %	15cm	CHN8-67	Blue Beard orchid
<i>Dampiera lavandulacea</i>	+	<1 %	40cm	CHN8-66	Goodeniaceae
<i>Desmocladius flexuosus</i>	+	<1 %	20cm	CHN8-63	
<i>Dichopogon capillipes</i>	+	<1 %	30cm	CHN8-69	
<i>Nemcia acuta</i>	+	<1 %	20 cm		
<i>Parentucellia latifolia</i>	+	<1 %	20 cm		
<i>Pimelea imbricata</i> var. <i>piliger</i>	+	<1 %		CHN8-12	
<i>Pterostylis recurva</i>	+	<1 %	30cm	CHN8-64	<i>Pterostylis</i> tall
<i>Scaevola anchusifolia</i>	+	<1 %		CHN8-70	

<i>Pterostylis setulosa</i>	+	<1 %	10cm	=CHN3-56	<i>Pterostylis</i> flat leaf base
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	CHN9-29	<i>Thysanotus</i> fleshy leaves
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15cm	CHN9-31,32	

Moora Site CHN010

Described by BRM **Date** 24/03/03 **Type:** QUADRAT 10x10 m, 30x30

Location: Cairn Hill North, about 100 to 150m from south boundary (with Cairn Hill) and about 80m east of CHN6.

MGA Zone 50 **407565 m E** **6621707 m N** **-30.533342 S lat** **116.036433 E long**

Habitat: Mid-slope of gently sloping, east-facing slope on low ridge.

Soil: Gravelly, pebbly pale brown sand.

Vegetation: *Allocasuarina huegeliana* scattered trees to low open woodland over *Allocasuarina campestris* open high shrubland over *Baeckea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii* low open shrubland to low heath over *Borya sphaerocephala* very open herbland.

Vegetation condition: Excellent

Notes: Coordinate datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg. Note: *Baeckea* sp. Moora (R. Bone 1993/1) and *Calytrix leschenaultii* grow mainly around *Allocasuarina campestris* shrubs (not underneath) and form heath in some very open areas where there are none or very few *A. campestris* shrubs.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	12-15%	10-25%	2.5m		
<i>Allocasuarina huegeliana</i>	7-10%	5-10%	4-8m		
<i>Arctotheca calendula</i>	+	<1 %	4cm		Capeweed
<i>Austrodanthonia caespitosa</i>	+	<1 %	3cm	CHN10-14	very hairy grass
<i>Baeckea</i> sp. Moora (R. Bone 1993/1)	15-20%	10-25%	30-90cm	CHN10-1	
<i>Blennospora drummondii</i>	+	<1 %	2cm	=CHN1-62	Daisy
<i>Borya sphaerocephala</i>	5-6%	5-10%	2cm		
<i>Burchardia umbellata</i>	+	<1 %	20cm	=CHN1-55	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3cm		
<i>Calytrix depressa</i>	+	<1 %	35-70cm	CHN10-7	
<i>Calytrix leschenaultii</i>	5-10%	5-10%	0.3-1.0m		
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm		
<i>Cyanicula deformis</i>	+	<1 %	5cm	=CHN1-50	'Blue Beard' <i>Caladenia</i>
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20cm	CHN10-8,1	Climber
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1m	CHN10-6	
<i>Ehrharta longiflora</i>	+	<1 %	4cm		
<i>Gonocarpus nodulosus</i>	+	<1 %	5cm	CHN10-13	
<i>Goodenia berardiana</i>	+	<1 %	10cm	=ER8-52	
<i>Hypochaeris glabra</i>	+	<1 %	2cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=CHN1-52	
<i>Kunzea praestans</i>	+	<1 %	20cm		juvenile
<i>Lawrencella rosea</i>	+	<1 %	10-20cm	=CHN4-60	pink linear leaf daisy
<i>Lepidobolus chaetocephalus</i>	+	<1 %	20cm	CHN10-5	Restionaceae ? <i>Lepido</i>
<i>Leporella fimbriata</i>	+	<1 %	1cm	CHN10-10	
<i>Melaleuca radula</i>	1	<1 %	(30cm)1.9	CHN10-2	
<i>Neurachne alopecuroidea</i>	+	<1 %	3cm		
<i>Podolepis lessonii</i>	+	<1 %	3cm	=CHN1-61	Daisy
<i>Podotheca angustifolia</i>	+	<1 %	3cm	=CHN3-52	Daisy
<i>Quinetia urvillei</i>	+	<1 %	2cm	=ER13-61	Daisy
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	CHN10-9	Climber
<i>Trachymene cyanopetala</i>	+	<1 %	2cm	CHN10-3	
<i>Tricoryne arenicola</i>	+	<1 %	10cm	CHN10-4	soft leaf
<i>Ursinia anthemoides</i>	+	<1 %	5cm		
<i>Waitzia nitida</i>	+	<1 %	10cm	CHN10-12	
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	=CHN2-57	
<i>Haemodorum simulans</i>	+	<1 %	15cm	CHN10-19	ID ?
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	30cm	CHN10-16	
<i>Lupinus angustifolius</i>	+	<1 %		=CHN9-27	
<i>Pimelea imbricata</i> var. <i>piligera</i>	+	<1 %	30cm	CHN10-17	? <i>Pimelea</i>
<i>Pterostylis sanguinea</i>	+	<1 %	12cm	CHN10-15	Also CHN10-18. <i>Pterostylis</i> 'bottom lip'
<i>Pterostylis setulosa</i>	+	<1 %	10cm	=CHN3-56	<i>Pterostylis</i> flat base

Styliidium septentrionale + <1 % 12cm =CHN8-59 (flowering)

EASTERN ORE BODY

Moora Site EOR001

Described by BRM **Date** 22/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: At the eastern end of the current mine path. The site is on the south side of a slope overlooking the 'Goonderoo' farm road, approximately 750 m east of the entry to 'Goonderoo' from the Midlands Road (13 km north of Moora) and 80 m west of EOR002.

MGA Zone 50 **407607 m E** 6622988 **m N** -30.521785 **S lat** 116.036986 **E long**

Habitat: South facing midslope of a hill.

Soil: Grey sandy loam **Rock Type:** Chert.

Vegetation: Allocasuarina huegeliana low woodland over Allocasuarina campestris, Acacia congesta subsp. congesta open scrub over Dichopogon capillipes very open herbland.

Vegetation condition: Good to very good between gridlines.

Notes: 1st coordinate is for NE peg; 2nd coordinate is for SW peg. 30x30 search area limited by drilling grid lines (cleared) 2m to north and south of plot and 1 to 2m to west.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia congesta</i> subsp. <i>congesta</i> (numerous dead)	5	5-10%	1.5-2.5 m	EO1-1	~20% Only 1 shrub alive
<i>Allocasuarina campestris</i>	35-40	33.3-50%	2-2.5	EO1-2	
<i>Allocasuarina huegeliana</i>	40	33.3-50%	6 m		
<i>Anagallis arvensis</i>	+	<1 %		EO1-22	
<i>Apium annuum</i>	+	<1 %		EO1-59B	ID?
<i>Austrodanthonia setacea</i>	+	<1 %		EO1-10	
<i>Austrostipa elegantissima</i>	+	<1 %		EO1-9	
<i>Austrostipa tenuifolia</i>				EO1-4B	
<i>Austrostipa variabilis</i>	+	<1 %		EO1-4	
<i>Avena barbata</i>	+	<1 %			
<i>Blennospora drummondii</i>	+	<1 %		EO1-21	
<i>Briza maxima</i>	+	<1 %			
<i>Bromus diandrus</i>				EO1-7a	
<i>Burchardia umbellata</i>	+	<1 %		EO1-5	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12cm	EO1-6,54	<i>Caladenia</i> ? <i>flava</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	EO1-16	
<i>Cheilanthes adiantoides</i>	+	<1 %			Fern (=WO1-19)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	EO1-58	
<i>Desmocladius flexuosus</i>	+	<1 %		EO1-3	
<i>Dichopogon capillipes</i>	3-5%	1-5%	30cm	EO1-50	
<i>Dioscorea hastifolia</i>	1	<1 %		EO1-11	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	EO1-18,51	
<i>Ehrharta longiflora</i>	+	<1 %	12cm	EO1-57	Det OK
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	+	<1 %	4-5m	EO1-60	very slender trunk, grey stringy bark; very small crown (<0.5mSQ)
<i>Hibbertia subvaginata</i>	+	<1 %			
<i>Hypochaeris glabra</i>	+	<1 %		EO1-20	
<i>Muehlenbeckia adpressa</i>	+	<1 %		EO1-19	Climber
<i>Pentaschistis airoides</i>	+	<1 %		EO1-7	Grass
<i>Platysace cirrosa</i>	+	<1 %	20cm	=ER2-53	
<i>Pterostylis recurva</i>	+	<1 %	20cm	EO1-52	<i>Pterostylis</i> tall + extensions
<i>Pterostylis sanguinea</i>	+	<1 %	15cm	EO1-53	<i>Pterostylis</i> tall
<i>Pterostylis setulosa</i>	+	<1 %	10cm	EO1-56	<i>Pterostylis</i> flat leaf base
<i>Regelia megacephala</i>	2-3	1-5%	2-3 m		2 shrubs alive plus 1 dead
<i>Romulea rosea</i>	+	<1 %	35cm		
<i>Stypantra glauca</i>	+	<1 %		EO1-13	Lilly, blue flower
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	EO1-14,55	<i>Thysanotus</i> fleshy leaf. (Prob Juv. T. mang. MET 8/05)
<i>Trachymene ornata</i>	+	<1 %	2-4cm	EO1-12,59	White head
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %		EO1-25	
<i>Calytrix leschenaultii</i>	+	<1 %		EO1-26	
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	

Hypoxis occidentalis var. occidentalis + <1 % 15cm =ER17-58
 Neurachne alopecuroidea + <1 % EO1-24

Moora Site EOR002

Described by MJH Date 22/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: At the eastern end of the current mine path. The site is on the south side of a chert hill overlooking the 'Goonderoo' farm road, approximately 800 m east of the entry to 'Goonderoo' from the Midlands Road (13 km north of Moora).

MGA Zone 50 **407675 m E** **6622996 m N** **-30.521718 S lat** **116.037695 E long**

Habitat: South facing, steep rocky slope of ridge, just below crest.

Soil: Skeletal where present, grey brown silty loam.

Rock Type: Chert outcrop and boulders, ~ 95% cover.

Vegetation: Allocasuarina huegeliana scattered low trees over Regelia megacephala high shrubland over Hibbertia subvaginata scattered shrubs over Dichopogon capillipes, Stypantra glauca scattered herbs to very open herbland with *Ehrharta longiflora, *Avena barbata very open annual grassland.

Vegetation condition: Good (high weed cover).

Notes: Revisit: Edge of cleared mine area now 2 to 3m north of 10x10. Little or no effect on 10x10 area to date. Limited 30x30 search area on north side.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia stenoptera	+	<1 %	20-30cm	EO2-8,66	
Allocasuarina huegeliana	3	1-5%	6 m		
Anagallis arvensis	+	<1 %	3cm	=WOR2-67	
Avena barbata	+	<1 %	30-40 cm		
Briza maxima	+	<1 %	20 cm		
Bromus diandrus	+	<1 %	15 cm	EO2-1	
Caladenia flava subsp. flava	+	<1 %		=EO1-54	Caladenia flava
Calandrinia sp.	+	<1 %	3cm	EO2-52	
Cheilanthes adiantoides	+	<1 %	15cm	EO2-56,57	in deep crevices in rocks
Cheilanthes distans	+	<1 %	5cm	EO2-14,51	hairy fern
A					
Crassula colorata var. colorata	+	<1 %	2cm	EO2-64	
Cyanicula deformis	+	<1 %	12cm	EO2-59	Blue Beard orchid
Cyrtostylis huegelii	+	<1 %	1cm	EO2-58	round leaf orchid
Dichopogon capillipes	1-2	1-5%		EO2-9	=WO4
Dioscorea hastifolia	+	<1 %			
Drosera aff. macrantha	+	<1 %	1.0m	EO2-53	Drosera ?pallida
Ehrharta longiflora	5-7%	5-10%	20-25 cm		
Hibbertia subvaginata	1-2	1-5%	1-2 m		
Hypochaeris glabra	+	<1 %	15 cm		
Pentaschistis airoides	+	<1 %	5 cm	EO2-7	
Pleurosorus rutifolius	+	<1 %		EO2-51B	
Pterostylis setulosa	+	<1 %	12cm	EO2-65	?=EO1-56: Pterostylis flat leaf
Regelia megacephala	30	25-33.3%	2-3 m		
Sonchus oleraceus	+	<1 %			=WO3
Stypantra glauca	1-2	1-5%	<1 m	EO2-4	
Thysanotus manglesianus	+	<1 %	30cm	=EO1	Thysanotus Climber
Trachymene ornata	+	<1 %	5-10 cm	EO2-3	
Trifolium repens var. repens	+	<1 %	5-10 cm	EO2-5	
Trifolium sp.	+	<1 %	2cm	EO2-55	Clover
Tripteris clandestina	+	<1 %	40cm	=JT3-50	stink daisy
Urospermum picroides	+	<1 %	15cm	EO2-54	
Ursinia anthemoides	+	<1 %	10 cm		
Vulpia myuros var. hirsuta	+	<1 %	20 cm	EO2-2	Grass
Acacia aristulata	+	<1 %	50 cm	EO2-12	
Acacia congesta subsp. congesta	+	<1 %	2 m	EO2-11	
Austrodanthonia setacea	+	<1 %	45 cm	EO2-10	Grass-Amphipogon\ Austrodanthon
Burchardia umbellata	+	<1 %	30cm	=GH9-52	
Comesperma integerrimum	+	<1 %			
Drosera sp.	+	<1 %	20cm	EO2-60	Climbing drosera
Eriochilus dilatatus	+	<1 %	30cm	EO2-63	leaf stem orchid
Kennedia prostrata	+	<1 %	5cm	EO2-50	
Lepidosperma leptostachyum	+	<1 %	50cm	EO2-62	
Pityrodia dilatata	+	<1 %	30cm		

<i>Pterostylis sanguinea</i>	+	<1 %	12cm	EO2-61	Pterostylis tall
<i>Romulea rosea</i>	+	<1 %	45cm		
<i>Thomasia grandiflora</i>	+	<1 %			
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		

Moora Site EOR003

Described by MET

Date

Type: QUADRAT 10x10 m, 30x30

Location: At the eastern end of the current mine path. Site on the eastern slope of a ridge, looking towards the 'Goonderoo' farmhouse, approximately 900 m east of the entry to 'Goonderoo' from the Midlands Road (13 km north of Moora) and 20 m east of EOR002.

MGA Zone 50 **407692 m E** **6623016 m N** **-30.521539 S lat** **116.037874 E long**

Habitat: Moderate southeast facing slope.

Soil: Gravelly and pebbly, grey silt to fine sand, some clayey material.

Rock Type: Quartz cobbles, boulders and outcrop ~ 50% of surface.

Vegetation: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* open scrub over *Hibbertia subvaginata* scattered shrubs over *Stypantra glauca* scattered perennial herbs and **Ehrharta longiflora*, **Pentaschistis airoides*, **Ursinia anthemoides* very open annual grass/herbland.

Vegetation condition: Good to very good. Some dead (apparently fire killed) *Allocasuarina huegeliana* otherwise would be VG. The condition of the overall stand is also reduced by the gridlines on the north and south side.

Notes: Outcrop just upslope from plot and 30x30 is ~30% outcrop. At the time of the revisit (18/8/03) the edge of the mine was 5m from the west side of the 10x10 quadrat. The quadrat is irregularly shaped to avoid disturbance.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>				EO3-2b	
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	(0.3)1.4 m	EO3-2a	
<i>Allocasuarina campestris</i>	2%	1-5%	2 m	EO3-5	
<i>Anagallis arvensis</i>	+	<1 %	2-7cm	=WOR2-67	
<i>Apium annuum</i>	+	<1 %	3 cm	EO3-12,52	
<i>Arctotheca calendula</i>	+	<1 %	10cm		Capeweed
<i>Austrodanthonia setacea</i>	+	<1 %	20 cm	EO3-7	
<i>Avena barbata</i>	+	<1 %	10-15 cm		
<i>Blennospora drummondii</i>	+	<1 %	2-5cm	EO3-9,55	Daisy
<i>Briza maxima</i>	+	<1 %	10 cm		
<i>Bromus diandrus</i>	+	<1 %	30 cm	EO3-1	poaceae
<i>Burchardia umbellata</i>	+	<1 %	40cm	=GH9-52	
<i>Caladenia denticulata</i>	+	<1 %	12cm	=JT6-56	Spider orchid
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	5cm	=EO1-54	
<i>Centrolepis pilosa</i>	+	<1 %	3 cm	EO3-10	
<i>Cheilanthes adiantoides</i>	+	<1 %	5-15 cm		
<i>Comesperma integerrimum</i>	+	<1 %	2 m		large, =WO3
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2 cm		=WO3
<i>Crassula exserta</i>	+	<1 %			=WD3
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Blue Beard orchid
<i>Dichopogon capillipes</i>	1-2%	1-5%	5 cm		Lilly=WD3-14
<i>Dioscorea hastifolia</i>	1-2%	1-5%	1-1.5 m		
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	(1cm)	EO3-53,54	
<i>Drosera pallida</i>	+	<1 %	25 cm		=WD3
<i>Ehrharta longiflora</i>	+	<1 %	10-15 cm		
<i>Erodium cygnorum</i>	+	<1 %	3cm	=ER17-52	
<i>Hibbertia subvaginata</i>	+	<1 %	25 cm		
<i>Hypochaeris glabra</i>	+	<1 %	4 cm		
<i>Lepidosperma leptostachyum</i>	+	<1 %	75 cm	EO3-6	
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	3 cm	EO3-16	
<i>Nemcia acuta</i>	+	<1 %	40 cm	EO3-3	
<i>Neurachne alopecuroidea</i>	+	<1 %	3cm		
<i>Parentucellia latifolia</i>	+	<1 %	5 cm		
<i>Pentaschistis airoides</i>	+	<1 %	5-10 cm		
<i>Pterostylis setulosa</i>	+	<1 %	15cm	EO3-59	Also recorded in 30x30.
<i>Pterostylis</i> flat base					
<i>Regelia megacephala</i>	50-60%	50-75%	(1.3)2-4		
<i>Stylidium glabrifolium</i>	1-2	1-5%	40-70 cm		
<i>Stypantra glauca</i>	1-2	1-5%			
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	EO3-50	Climber
<i>Trachymene ornata</i>	+	<1 %	10cm	EO3-51	

<i>Urospermum picroides</i>	+	<1 %	5-10 cm	EO3-4	Also EO3-57,58.
<i>Ursinia anthemoides</i>	+	<1 %	15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15 cm	EO3-8	
<i>Wahlenbergia gracilentia</i>	+	<1 %	4 cm	EO3-11	
<i>Acacia stenoptera</i>	+	<1 %	60 cm	EO3-17	
<i>Allocasuarina huegeliana</i>	+	<1 %	2.4-4 m		
<i>Pterostylis scabra</i>	+	<1 %	15cm	EO3-56	Pterostylis tall
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %	4 cm		=WO6
<i>Tripteris clandestina</i>	+	<1 %	30cm	=JT3-50	stink daisy
<i>Xanthorrhoea drummondii</i>	+	<1 %	2 m		

EASTERN RIDGE

Moora Site ERG001

Described by MJH

Date

Type: QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on the western slope of the ridge, approximately 1 km SE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 407614 **m E** 6623996 **m N** -30.51269 **S lat** 116.037149 **E long**

Habitat: Gentle west facing slope.

Soil: Dark grey silt/fine sand.

Rock Type: Chert outcrops and cobbles ~50% cover.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminatus* scattered low trees over *Allocasuarina campestris* open heath to open scrub over *Cheilanthes adiantoides*, *Hypoxis occidentalis* var. *occidentalis*, *Borya sphaerocephala*, *Caesia alfordii* very open fern/herbland.

Vegetation condition: Very good (some grazing evident).

Notes: 30x30 search area limited on west side (about 5m to track). Vegetation description revised during winter 2003 visit.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	70	50-75%	1.5-2.3 m		
<i>Amhipogon caricinus</i>	+	<1 %	20-30 cm		
<i>Apium annuum</i>	+	<1 %	5cm	ER1-59	ID?
<i>Arctotheca calendula</i>	+	<1 %	6cm		Capeweed
<i>Avena barbata</i>	+	<1 %	20 cm		
<i>Borya sphaerocephala</i>	1%	1-5%	5-10 cm		
<i>Briza maxima</i>	+	<1 %	10-20 cm		
<i>Bromus diandrus</i>	+	<1 %	10 cm	ER1-6	Grass
<i>Caesia alfordii</i>	+	<1 %	30cm	ER1-10,54	
<i>Caladenia denticulata</i>	+	<1 %	12cm	=JT6-56	Spider orchid
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15 cm	ER1-1	
<i>Cheilanthes adiantoides</i>	4-5%	<1 %	10-15 cm		
<i>Cyanicula deformis</i>	+	<1 %	15cm	=ER17-51	Blue beard orchid
<i>Cyanicula gemmata</i>	+	<1 %	1cm	=JT6-54	hairy spade-leaf orchid
<i>Dioscorea hastifolia</i>	+	<1 %	25 cm		
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	=ER12-54	flat leaf Drosera
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	1m	ER1-51	Climbing
<i>Eriochilus dilatatus</i>	+	<1 %	15cm	ER1-56	leaf stem orchid
<i>Gilberta tenuifolia</i>	+	<1 %	12cm	=ER17-59	yellow daisy
<i>Goodenia berardiana</i>	+	<1 %	15cm	ER1-3,60	?Daisy
<i>Hypochaeris glabra</i>	+	<1 %	15 cm	ER1-11	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	1-2%	1-5%	15cm	=ER12-50	
<i>Lepidosperma leptostachyum</i>	+	<1 %	30 cm		usual
<i>Neurachne alopecuroidea</i>	+	<1 %	30 cm		
<i>Parentucellia latifolia</i>	+	<1 %	5-10 cm	ER1-7	
<i>Pentaschistis airoides</i>	+	<1 %	10-15 cm	ER1-5	Grass
<i>Phyllangium sulcatum</i>	+	<1 %	10-15 cm	ER1-13	
<i>Platysace cirrosa</i>	+	<1 %	25cm	=GH9-54	Trachymene Climber
<i>Podolepis lessonii</i>	+	<1 %	(3)	ER1-2,58	Daisy
10-20cm					
<i>Pterostylis sanguinea</i>	+	<1 %	10cm	=CH10-51	Pterostylis flat leaf base
<i>Rhodanthe laevis</i>	+	<1 %	3cm	ER1-55	Daisy fine grey leaf
<i>Siloxerus humifusus</i>	+	<1 %	1cm	ER1-57	Redet 05/05
<i>Stypandra glauca</i>	+	<1 %	20cm		
<i>Thysanotus manglesianus</i>	+	<1 %	(30cm)	ER1-50,53	Climbing

1.3m					
Trachymene cyanopetala	+	<1 %	5 cm	ER1-9	
Trachymene ornata	+	<1 %	10 cm		
Trifolium subterraneum	+	<1 %	2cm	ER1-52	
Ursinia anthemoides	+	<1 %	10 cm		
Vulpia myuros var. hirsuta	+	<1 %	20-30 cm	ER1-4	Grass
Waitzia nitida	+	<1 %	10-15 cm	ER1-8	
Acacia acuminata subsp. acuminata	+	<1 %	2.5 m		1 plant.
Allocasuarina huegeliana	+	<1 %	6 m		
Austrostipa trichophylla	+	<1 %	25 cm	ER1-14	
Chamaescilla corymbosa var. corymbosa	+	<1 %	15cm	=ER19-50	
Drosera macrophylla subsp. macrophylla	+	<1 %	4cm	ER1-62	
Ehrharta longiflora	+	<1 %	25-30 cm		
Hibbertia subvaginata	+	<1 %	40 cm		at edge of firebreak
Kennedia prostrata	+	<1 %	50 cm		at edge of firebreak
Lawrencella rosea	+	<1 %	12cm	ER1-61	pink daisy
Trifolium arvense var. arvense	+	<1 %	10 cm	ER1-15	
Urospermum picroides	+	<1 %	25 cm	ER1-16	

Moora Site ERG002

Described by BRM **Date** 5/11/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is towards the top of the ridge, approximately 100 m east of ERG001.

MGA Zone 50 **407758 m E** **6624019 m N** **-30.512494 S lat** **116.038651 E long**

Habitat: East side of broad, flat crest of ridge.

Soil: Gravelly, pebbly cobbly grey sand.

Rock Type: Chert cobbles-pebbles, ~70% cover.

Vegetation: Allocasuarina huegeliana and Acacia acuminata subsp. acuminata low open woodland over Kunzea praestans open scrub over Hibbertia subvaginata shrubland over Lepidosperma leptostachyum, Austrodanthonia setacea, Dichopogon capillipes very open sedge/grass/herbland

Vegetation condition: Very good, but some weed invasion.

Notes: 30x30 search area limited on western and eastern sides of quadrat by change in vegetation community. Areas of significant Hibbertia subvaginata deaths along ridge. Many macropods present.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	1	<1 %	(2)4-5 m		
Allocasuarina huegeliana	8-10%	5-10%	(2)5 m		
Austrodanthonia setacea				ER2-6A	
Austrostipa trichophylla	+		30 cm	ER2-6B	Split from ER2-6A
Avena barbata	+	<1 %	20 cm		
Briza maxima	+	<1 %	5 cm		
Burchardia umbellata	+	<1 %	40 cm	ER2-17	
Caladenia flava subsp. flava	+	<1 %	15 cm	ER2-21	Orchid
Calytrix leschenaultii	+	<1 %	70 cm	ER2-9	
Chamaescilla corymbosa var. corymbosa	+/-1%		30 cm	ER2-16A	
Cheilanthes adiantoides	1-2	1-5%	4 cm	ER2-2	
Crassula colorata var. colorata	+	<1 %	1cm	ER2-55A&	
64					
Crassula exserta	+	<1 %		ER2-55(B)	ER2-55 split.
Cyanicula deformis	+	<1 %	12cm	=ER17-51	Blue Beard orchid
Dichopogon capillipes	1	<1 %	30 cm	ER2-5	
Dioscorea hastifolia	6-8	5-10%		ER2-4	
Drosera macrantha subsp. macrantha	+	<1 %	60 cm	ER2-7,50	
Hibbertia subvaginata	15-20	10-25%	0.8-1.2 m		
Kunzea praestans	40	33.3-50%	2-2.5 m		
Lepidosperma leptostachyum	+	<1 %	4 cm	ER2-3	sedge
Lepidosperma tenue				ER2-27	
Millotia tenuifolia var. tenuifolia	+	<1 %	2 cm	ER2-13	
Neurachne alopecuroidea	+	<1 %	40 cm	ER2-8	
Parentucellia latifolia	+	<1 %	4 cm	ER2-12	
Pentaschistis airoides	+	<1 %	5 cm	ER2-1	
Phyllangium sulcatum	+	<1 %	10 cm	ER2-16B	
Pityrodia dilatata	+	<1 %	20cm		Also recorded in 30x30. Also ER2-23

<i>Platysace cirrosa</i>	+	<1 %	30cm	ER2-53	Trachymene Climbing
<i>Podotheca angustifolia</i>	+	<1 %	3cm	ER2-14,54	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	15cm	ER2-52	Pterostylis tall
<i>Pterostylis setulosa</i>	+	<1 %	1cm	ER2-51	Pterostylis flat leaf
<i>Trachymene ornata</i>	+	<1 %	3 cm	ER2-10	
<i>Trachymene pilosa</i>	+	<1 %	3 cm	ER2-11	
<i>Ursinia anthemoides</i>	+	<1 %	10 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10 cm	ER2-15	Grass
<i>Acacia aristulata</i>	+	<1 %	80 cm	ER2-19	
<i>Allocasuarina campestris</i>					
<i>Comesperma integerrimum</i>				ER2-28	
<i>Ehrharta longiflora</i>	+	<1 %	30 cm	ER2-25	light shade grass
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER12-50	
<i>Opercularia vaginata</i>	+	<1 %	15cm	ER2-56	?Daisy
<i>Tricoryne elatior</i>	+	<1 %	15 cm	ER2-24	Redet 14/3/05 MET
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	+	<1 %	30 cm	ER2-22	

Moora Site ERG003

Described by MJH **Date** **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east. This site is to the eastern side of the ridge on a south facing slope on the northern side of shallow, broad valley approximately 200 m north of the Eucalyptus wandoo stand (ERG004).

MGA Zone 50 **407904 m E** **6624109 m N** **-30.511693 S lat** **116.040181 E long**

Habitat: Moderate to steep midslope, south facing in open valley.

Soil: Skeletal. Dark silt/fine sand.

Rock Type: Chert outcrop, boulders, cobbles, ~90% cover.

Vegetation: *Kunzea praestans* high shrubland over *Hibbertia subvaginata* open heath over *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Cheilanthes adiantoides* very open herb/fernland.

Vegetation condition: Very good. Some evidence of grazing, and minor weed invasion.

Fire age: <10 years?

Notes: Vegetation description revised during winter 2003 visit.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30 cm		1, +1 just outside
<i>Acacia congesta</i> subsp. <i>congesta</i>	1	<1 %	2 m		
<i>Arctotheca calendula</i>	+	<1 %	6cm		
<i>Avena barbata</i>	+	<1 %	10-30 cm		
<i>Briza maxima</i>	+	<1 %	25 cm	ER3-11	
<i>Burchardia umbellata</i>	+	<1 %	20cm	=GH9-52	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	20 cm	ER3-2	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+/-1	<1 %	10-20 cm	ER3-1	
<i>Cheilanthes adiantoides</i>	2-3	1-5%	10 cm		
<i>Dichopogon capillipes</i>	1	<1 %	30 cm		
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	35cm	ER3-52	Diuris orchid
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	ER3-54	Drosera Climber
<i>Drosera pallida</i>	+	<1 %	25 cm	ER3-5	
<i>Ehrharta longiflora</i>			+		
<i>Hibbertia subvaginata</i>	35-40	33.3-50%	1-1.5 m		
<i>Hypochaeris glabra</i>	+	<1 %	10 cm	ER3-9	Daisy
<i>Kunzea praestans</i>	30-40	25-33.3%	2-3 m		
<i>Parentucellia latifolia</i>	+	<1 %	10 cm	ER3-10	Grass
<i>Pentaschistis airoides</i>	+	<1 %	15-0 cm	ER3-3	Grass
<i>Pleurosorus rutifolius</i>	+	<1 %	15cm	ER3-55	hairy fern (growing from crevice in chert rock)
<i>Pterostylis</i> aff. <i>nana</i>	+	<1 %		ER3-6	
<i>Pterostylis sanguinea</i>	+	<1 %	12cm	ER3-50,51	Pterostylis flat base leaf
<i>Pterostylis setulosa</i>	+	<1 %	12cm	ER3-51A	Pterostylis flat base leaf
<i>Stypandra glauca</i>	+	<1 %	15 cm	ER3-7	juv
<i>Trachymene pilosa</i>	+	<1 %	4cm	ER3-53	
<i>Ursinia anthemoides</i>	+	<1 %	10-15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10-15 cm	ER3-8	Grass
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.5 m		
<i>Allocasuarina campestris</i>	+	<1 %	1.5 m		

<i>Allocasuarina huegeliana</i>	+	<1 %	5-8 m		
<i>Amhipogon caricinus</i>	+	<1 %			
<i>Austrostipa elegantissima</i>	+	<1 %	40cm	ER3-59	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	ER3-56	
<i>Cyanicula deformis</i>	+	<1 %	12cm	=ER17-51	Blue Beard orchid
<i>Dioscorea hastifolia</i>	+	<1 %	5cm		
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	7-8 m	ER3	
<i>Lawrencella rosea</i>	+	<1 %	15cm	=ER20-54	pink daisy
<i>Lepidosperma leptostachyum</i>	+	<1 %	45cm	ER3-58	
<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>				ER3-13	
<i>Pityrodia dilatata</i>	+	<1 %	20 cm		
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	=ER17-55	Thysanotus fleshy leaves
<i>Trachymene ornata</i>	+	<1 %	5-10 cm		
<i>Trifolium subterraneum</i>	+	<1 %	3cm	ER3-57	Clover
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	+	<1 %	1 m	ER3-12	shrub

Moora Site ERG004

Described by BRM **Date** 5/11/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on the eastern side of the ridge, approximately 1.1 km SE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **407907 m E** **6623930 m N** **-30.513308 S lat** **116.040196 E long**

Habitat: East facing gentle mid-slope. 15-20 m wide belt of *Eucalyptus wandoo* subsp. *wandoo* running N-S along contour.

Soil: Well mulched, fine gravelly brown sand with scattered quartz rocks.

Vegetation: *Eucalyptus wandoo* subsp. *wandoo* low open forest to open forest over *Austrostipa variabilis*, *Dichopogon capillipes* very open grass/herbland.

Vegetation condition: Good - very good. Some weed invasion.

Notes: Regeneration apparent from burnt trunks, and several dead trunks present. 30X30 search area limited to west (upslope) and east (downslope) by different vegetation units. Search about 30 m to N and S in *Eucalyptus wandoo* vegetation.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Anagallis arvensis</i>	+	<1 %	4 cm	ER4-17	
<i>Arctotheca calendula</i>	+	<1 %	5cm		Capeweed
<i>Austrodanthonia setacea</i>	+	<1 %	20 cm	ER4-16	
<i>Austrostipa elegantissima</i>	+	<1 %	40cm	ER4-56	
<i>Austrostipa tenuifolia</i>	+	<1 %	3 cm	ER4-22	Grass
<i>Austrostipa variabilis</i>	+	<1 %		ER4-7	
<i>Avena barbata</i>					
<i>Blennospora drummondii</i>	+	<1 %	4 cm	ER4-18	
<i>Burchardia umbellata</i>	+	<1 %	20cm	=GH9-52	?Burchardia
<i>Calandrinia</i> sp.	+	<1 %	3 cm	ER4-21	
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm		Cheilanthes (usual)
<i>Desmocladus flexuosus</i>				ER4-10	
<i>Dichopogon capillipes</i>	+	<1 %			
<i>Dioscorea hastifolia</i>	+	<1 %	4cm		
<i>Ehrharta longiflora</i>	+	<1 %	15 cm	ER4-1	
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	60-70	50-75%	3-8 m	ER4-27	
Genus sp.	+	<1 %	6cm	ER4-53	Daisy
<i>Hibbertia subvaginata</i>	+	<1 %	70 cm		
<i>Hypochaeris glabra</i>				ER4-3	star head
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER17-58	Hypoxis
<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>				ER4-11	sedge
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>				ER4-4	umbrella grass
<i>Neurachne alopecuroidea</i>	+	<1 %	5cm		Neurachne
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %		ER4-8	
<i>Parentucellia latifolia</i>	+	<1 %	4 cm	ER4-23	
<i>Pentaschistis airoides</i>				ER4-9	
<i>Petrorhagia prolifera</i>	+	<1 %	2-15cm	ER4-12,55	
<i>Phyllangium sulcatum</i>	+	<1 %		ER4-5	
<i>Platysace cirrosa</i>	+	<1 %	25cm	=ER2-53	Trachymene Climber
<i>Podolepis lessonii</i>	+	<1 %	15 cm	ER4-14	Daisy
<i>Podotrochea angustifolia</i>	+	<1 %	5 cm	ER4-25	

<i>Ptilotus gaudichaudii</i> var. <i>parviflorus</i>	+	<1 %	40 cm	ER4-15	
<i>Rhodanthe laevis</i>	+	<1 %	5cm	=ER1-55	Daisy
<i>Schoenus clandestinus</i>	+	<1 %	3cm	ER4-52	
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	ER4-50	Thysanotus Climber
<i>Trachymene cyanopetala</i>				ER4-2(A)	
<i>Trachymene pilosa</i>	+	<1 %	7 cm	ER4-2(B)	Specimen split.
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %	4 cm	ER4-20	red cylinder head
<i>Trifolium subterraneum</i>	+	<1 %	3cm	ER4-51	Clover
<i>Ursinia anthemoides</i>	+	<1 %	10 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	4 cm	ER4-19	slim cylinder head grass
<i>Zaluzianskya divaricata</i>	+	<1 %	6 cm	ER4-24	
<i>Allocauarina campestris</i>					
<i>Briza maxima</i>					
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>		<1 %	10cm	=ER19-50	about 20m south of plot
<i>Solanum oldfieldii</i>		<1 %	30cm	ER4-57	about 20m N of plot
<i>Waitzia nitida</i>				ER4-26	yellow daisy

Moora Site ERG005

Described by MJH

Date

Type: QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on top of the ridge, approximately 100 m NE of the 'Breakaway' area and 1.2 km SSE of the Kiaka Rd/Midlands Rd. junction.

MGA Zone 50 407725 **m E** 6623838 **m N** -30.514124 **S lat** 116.038291 **E long**

Habitat: Flat-gentle slope on ridge-top just below crest.

Soil: Dark silty loam.

Rock Type: Chert outcrop and cobbles, ~50% cover.

Vegetation: *Regelia megacephala* open scrub over *Hibbertia subvaginata* shrubland over *Neurachne alopecuroidea* very open grassland with scattered annual herbs and grasses including *Podolepis lessonii* and **Avena barbata*,

Vegetation condition: Very good. Some senescence (and lack of understorey through grazing?).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	2%		1.8 m		
<i>Amphipogon caricinus</i>	+	<1 %			
<i>Arctotheca calendula</i>	+	<1 %	10cm		Revisit. Capeweed
<i>Avena barbata</i>	+	<1 %	25 cm		
<i>Blennospora drummondii</i>	+	<1 %	5 cm	ER5-4	Grey daisy
<i>Briza maxima</i>	+	<1 %	10 cm		
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	6 cm	=ER16-?	Revisit. ? Flava; hairy leaf.
<i>Calandrinia</i> sp.	+	<1 %	20cm	ER5-53	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15cm	ER05-10	Also =ER19-50.
<i>Cheilanthes adiantoides</i>	1%	1-5%	+?		
<i>Crassula colorata</i> var. <i>colorata</i>				ER5-51	Revisit.
<i>Crassula exserta</i>	+	<1 %	2 cm	ER5-8	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	30cm		Revisit.
<i>Dichopogon capillipes</i>	+	<1 %	25 cm		
<i>Dioscorea hastifolia</i>	+	<1 %	2 m		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	40cm	ER5-55	Revisit. Climber
<i>Ehrharta longiflora</i>	+	<1 %	10-20 cm		
<i>Goodenia berardiana</i>	1%	1-5%	2 cm	ER5-50	Revisit.
<i>Hibbertia subvaginata</i>	5-10%	10-25%	1-1.5 m	ER8	
<i>Hypochaeris glabra</i>	+	<1 %	5 cm	ER5-6	
<i>Lawrencella rosea</i>	+	<1 %	15cm	=ER8-51	Revisit. Pink daisy
<i>Neurachne alopecuroidea</i>	+	<1 %	30 cm		
<i>Pentastichis airoides</i>	+	<1 %	5-10 cm	ER5-3	Grass
<i>Petrorhagia prolifera</i>	+	<1 %	6cm	ER5-57	Revisit. Daisy
<i>Petrorhagia velutina</i>	+	<1 %	5-10 cm		
<i>Platysace cirrosa</i>	+	<1 %	15 cm	=ER2-53	"Trachymene Climber"
<i>Podolepis lessonii</i>	+	<1 %	15 cm	ER5-7	
<i>Podotheca angustifolia</i>	+	<1 %	3cm	=ER2-54	Daisy
<i>Quinetia urvillei</i>	+	<1 %	5 cm	ER5-5	
<i>Regelia megacephala</i>	60%	50-75%	2-4 m		
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	25cm	ER5-58,60	Also recorded in 30x30. Revisit. ?
<i>Thysanotus manglesianus</i>	+	<1 %	1.3m	ER5-54	Revisit. Climber
<i>Trachymene cyanopetala</i>	+	<1 %	20cm	ER5-52B	Revisit.

Trachymene ornata	+	<1 %	20cm	ER5-52A	Revisit.
Trifolium subterraneum	+	<1 %	5cm	ER5-56	Revisit. Clover
Ursinia anthemoides	+	<1 %	10-15 cm		
Vulpia myuros var. hirsuta	+	<1 %	15 cm	ER5-1	Grass
Burchardia umbellata	+	<1 %	30 cm		
Caladenia denticulata	+	<1 %	15cm	JT6-56	Revisit. Orchid
Calytrix leschenaultii	+	<1 %	30-50 cm		
Hypoxis occidentalis var. occidentalis	+	<1 %	12cm	ER5-59	Revisit.
Lepidosperma leptostachyum	+	<1 %	40CM	ER5-61,62	Revisit.
Olearia dampieri subsp. eremicola	+	<1 %	80cm	=ER8/16	Revisit.
Pityrodia dilatata	+	<1 %	30cm		
Stypandra glauca	+	<1 %	40cm		
Waitzia nitida	+	<1 %	10-15 cm	ER5-11	Yellow Daisy

Moora Site ERG006

Described by BRM **Date** 5/11/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east. This site is in the "Breakaway" area near the current mining area, on the western side of the ridge, approximately 1.3 km SSE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **407685 m E** **6623682 m N** **-30.515529 S lat** **116.037861 E long**

Habitat: West facing slope of ridge, in quartz 'breakaway'.

Vegetation: Allocasuarina huegeliana (Acacia acuminata subsp. acuminata) low open woodland over Hibbertia subvaginata low open shrubland to open shrubland over Podolepis lessonii/*Avena barbata, *Briza maxima very open annual herb/grassland.

Vegetation condition: Good? Very open understorey, a lot of weeds.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	4 cm		
Acacia stenoptera	+	<1 %	80 cm	ER6-12	
Allocasuarina huegeliana	15	10-25%	12-15 m		
Amyema preissii	+	<1 %	1.2m	=ER15	Revisit. On Acacia acum
Apium annuum	+	<1 %	2cm	ER6-60	Revisit. #3 ID?
Austrostipa trichophylla	+	<1 %	40 cm	ER6-9	
Avena barbata	+	<1 %	30 cm		
Briza maxima	+	<1 %	15 cm		
Burchardia umbellata	+	<1 %	30cm	GH9-52	Revisit. ?
Caladenia denticulata	+	<1 %	15cm	ER6-50	Revisit. Spider orchid
Caladenia flava subsp. flava	+	<1 %	10cm	=ER16-54	Revisit.
Calandrinia sp.	+	<1 %	2cm	ER6-62A	Revisit
Cheilanthes adiantoides	+	<1 %	10 cm		
Crassula exserta	+	<1 %	2cm	ER6-56	Revisit.
Cyanicula deformis	+	<1 %	12cm	=ER17-51	Revisit. Blue beard.
Daucus glochidiatus	+	<1 %	10cm	ER6-51,25	Also recorded in 30x30.
Dichopogon capillipes	+	<1 %			
Dioscorea hastifolia	4-5%				Revisit.
Drosera macrantha subsp. macrantha	+	<1 %	40cm	=ER6-54	Revisit. Climber ?pallida
Ehrharta longiflora	+	<1 %			
Goodenia berardiana	+	<1 %		ER6-19,52	
Hibbertia subvaginata	3-4	1-5%	0.7-1.2 m		
Hypochoeris glabra	+	<1 %	10 cm	ER6-15	
Hypoxis occidentalis var. occidentalis	+	<1 %	15cm	=ER17-58	Revisit.
Kennedia prostrata	+	<1 %	10 cm	ER6-14	
Lawrencella rosea	+	<1 %	15cm	=ER20-54	Revisit. Pink daisy
Lepidosperma tenue	+	<1 %	6 cm	ER6-20,65	sedge
Linum trigynum	+	<1 %		ER6-18	
Neurachne alopecuroidea	+	<1 %	30 cm	ER6-6	cylinder head
Parentucellia latifolia	+	<1 %		ER6-10	
Pentaschistis airoides	+	<1 %	10 cm		
Phyllangium sulcatum	+	<1 %		ER6-11	
Podolepis lessonii	+	<1 %	15 cm	ER6-3	Daisy
Podotheca angustifolia	+	<1 %	4cm	GH10-52	Revisit. Daisy
Ptilotus polystachyus var. polystachyus	+	<1 %		ER6-13	
Schoenia cassiniana	+	<1 %	10 cm	ER6-2,62B	
Stypandra glauca	+	<1 %	30 cm	ER6-7	

<i>Thysanotus manglesianus</i>	+	<1 %	30 cm	ER6-5,53	
<i>Trachymene ornata</i>	+	<1 %	5 cm	ER6-17,59	
<i>Tripteris clandestina</i>	+	<1 %	10cm	=JT3-50	Revisit. Stink daisy
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	+	<1 %	1 m	ER6-4	
<i>Urospermum picroides</i>	+	<1 %	30 cm	ER6-8,61	
<i>Ursinia anthemoides</i>	+	<1 %	15 cm		
<i>Waitzia nitida</i>	+	<1 %	10 cm	ER6-1,57	Also recorded in 30x30.
<i>Austrostipa elegantissima</i>	+	<1 %	60cm	ER6-58	Revisit. Tall
<i>Comesperma integerrimum</i>	+	<1 %		ER6-24	creeper (?Comesperma)
<i>Dryandra sessilis</i> var. <i>sessilis</i>					
<i>Lepidosperma leptostachyum</i>	+	<1 %		ER6-66	Revisit. In rock shelves
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %		ER6-21	
<i>Pityrodia dilatata</i>	+	<1 %		ER6-22	
<i>Pleurosorus rutifolius</i>	+	<1 %	15cm	ER6-64	Revisit. Hairy fern
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %		ER6-23	
<i>Xanthorrhoea drummondii</i>	+	<1 %			

Moora Site ERG007

Described by MJH

Date

Type: QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is south and east of the 'Breakaway', on the ridge top, and is approximately 1.4 km SSE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 407904 **m E** 6623376 **m N** -30.518307 **S lat** 116.040116 **E long**

Habitat: Gentle south facing slope just below crest.

Soil: Well mulched, dark and loamy.

Rock Type: Well weathered quartz?-not as hard as chert. Some outcrop, cobbles.

Vegetation: *Allocasuarina huegeliana* and *Acacia acuminata* scattered low trees to open low woodland over *Allocasuarina campestris* open scrub over scattered low shrubs of *Hibbertia subvaginata*.

Vegetation condition: Good

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	40	33.3-50%	(0.5)2-2.5		
<i>Allocasuarina huegeliana</i>	5	5-10%	8 m		
<i>Amphipogon caricinus</i>	+	<1 %	30 cm		
<i>Arctotheca calendula</i>	+	<1 %	12cm		Revisit.
<i>Austrodanthonia caespitosa</i>	+	<1 %	20-30 cm	ER7-3,56	
<i>Austrostipa tenuifolia</i>	+	<1 %	25 cm	ER7-2	
<i>Avena barbata</i>	1	<1 %	20-30 cm		
<i>Briza maxima</i>	+	<1 %	10-15 cm		
<i>Bromus diandrus</i>	+	<1 %	10 cm	ER7-4	Grass
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	10cm	=ER11-53	Revisit.
<i>Calandrinia</i> sp.	+	<1 %	10cm	ER7-60	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20 cm	ER7-8	
<i>Cheilanthes adiantoides</i>	+	<1 %	10 cm		
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Revisit. Blue beard
<i>Dichopogon capillipes</i>	1%	1-5%	30cm	ER7-50	Revisit.
<i>Dioscorea hastifolia</i>	3-4%		50cm		Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	ER7-53	Revisit.
<i>Ehrharta longiflora</i>	+	<1 %	5-10 cm		
<i>Gilberta tenuifolia</i>	+	<1 %	15cm	=ER17-59	Also recorded in 30x30. Also ER7-16 (Revisit). Small yellow
<i>Goodenia berardiana</i>	+	<1 %	12cm	=ER8-52	Revisit.
<i>Hibbertia subvaginata</i>	3-5	1-5%	30-50 cm		
<i>Hyalosperma cotula</i>	+	<1 %	10 cm	ER7-10	White daisy
<i>Hypochaeris glabra</i>	+	<1 %	10 cm	ER7-11	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	1-2%	1-5%	15cm	=ER17-58	Revisit.
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	3cm	ER7-58	Revisit.
<i>Lepidosperma leptostachyum</i>	+	<1 %	45cm	ER7-59	Revisit.
<i>Lomandra</i> (Moora twisty)	+	<1 %	30cm	ER7-51	Revisit.
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm		Revisit. Flowering
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	10 cm	ER7-1	
<i>Parentucellia latifolia</i>	+	<1 %	10 cm	ER7-9	Grass
<i>Pentaschistis airoides</i>	+	<1 %		ER7-7	Grass
<i>Petrorhagia prolifera</i>	+	<1 %	15cm	=ER8-65	Revisit.

Phyllangium sulcatum				ER7-5,63	
Platysace cirrosa	+	<1 %	15cm	=ER2-53	Revisit. Climber
Podolepis lessonii	+	<1 %	10 cm	ER7-6	Daisy
Romulea rosea	+	<1 %	30cm		Revisit.
Stypandra glauca	+	<1 %	20cm		Revisit.
Thysanotus manglesianus	+	<1 %	60 cm	ER7-55,62	
Trachymene sp.	+	<1 %	30cm	ER7-54	Revisit.
Trifolium arvense var. arvense	+	<1 %	5 cm	ER7-12	
Trifolium subterraneum	+	<1 %	2cm	ER7-52	Revisit. Clover
Ursinia anthemoides	+	<1 %	5-10 cm		
Waitzia nitida	+	<1 %	10 cm	ER7-65	Also recorded in 30x30. Yellow Daisy=ER5
Xanthorrhoea drummondii	+	<1 %	1.8m		Revisit.
Acacia acuminata subsp. acuminata	+	<1 %	10 m		
Borya sphaerocephala	+	<1 %	4.5 cm		
Burchardia bairdiae	+	<1 %	30cm	=GH9-52	Revisit.
Caladenia denticulata	+	<1 %	20cm	=JT6-56	Revisit. Spider orchid
Calytrix leschenaultii	+	<1 %	50 cm		
Erodium cygnorum	+	<1 %	5cm	=ER17-52	Revisit. ?
Kennedia prostrata	+	<1 %	5 cm		
Lawrencella rosea	+	<1 %	15cm	=ER20-54	Revisit. Pink daisy
Petrohragia velutina	+	<1 %	15 cm	ER7-15	
Silene gallica var. gallica	+	<1 %	30cm	ER7-64	Revisit. ?
Sowerbaea laxiflora	+	<1 %	30 cm	ER7-13	
Thysanotus dichotomus	+	<1 %		ER7-61	
Trachymene ornata	+	<1 %	5 cm		
Trifolium repens var. repens				ER7-17	
Tripteris clandestina	+	<1 %	30cm	=JT3-50	Revisit. Stink daisy

Moora Site ERG008

Described by BRM **Date** 5/11/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is approximately 300 m north of ERG007.

MGA Zone 50 **407823 m E** **6623712 m N** **-30.515269 S lat** **116.039301 E long**

Habitat: Ridge top.

Soil: Grey sand.

Rock Type: Cobbles, rocks, outcrop, ~90% cover - 50% sheet rock.

Vegetation: Regelia megacephala open scrub over Hibbertia subvaginata low open shrubland over Lepidosperma leptostachyum, Lepidosperma tenue, Austrostipa tenuifolia, Neurachne alopecuroidea very open sedge/grassland with *Pentastichis airoides, Podolepis lessonii, Lawrencella rosea scattered annual grasses and herbs

Vegetation condition: Good-very good. Some grazing.

Notes: There have been many Regelia deaths, but there are lots of volunteers to replace them and many mature plants are sprouting from their bases.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Austrostipa tenuifolia				ER8-30	
Acacia acuminata subsp. acuminata	+	<1 %	30 cm		juv
Allocasuarina huegeliana	+	<1 %		ER8-15	
Anagallis arvensis	+	<1 %	4cm	ER8-60	Revisit.
Austrostipa sp.	+	<1 %	40 cm	ER8-18	
Avena barbata				ER8-14a	
Bossiaea sp. Cairn Hill (M Henson CH2-28)	+	<1 %	25cm	ER8-19	Also recorded in 30x30.
Briza maxima	+	<1 %			
Bromus diandrus	+	<1 %	15cm	ER8-63,28	Also recorded in 30x30.
Burchardia umbellata	+	<1 %			
Caladenia denticulata	+	<1 %	15cm	=JT6-56	Revisit. ?Orchid
Caladenia flava subsp. flava	+	<1 %		ER8-1	Orchid
Chamaescilla corymbosa var. corymbosa	+	<1 %	10cm	ER8-59	Revisit.
Cheilanthes adiantoides	+	<1 %			
Cryptandra glabriflora	+	<1 %	5 cm	ER8-16	
Cyanicula deformis	+	<1 %	12cm	=ER17-51	Revisit. Blue beard
Dichopogon capillipes					
Dioscorea hastifolia	+	<1 %			

<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	35cm	=ER3-52	Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	70cm	ER8-12,53	Climber,
<i>Ehrharta longiflora</i>	+	<1 %			
<i>Eriochilus helonomos</i>	+	<1 %	25cm	ER8-56	Revisit. Orchid
<i>Goodenia berardiana</i>				ER8-8a,52	
<i>Grevillea biternata</i>	+	<1 %	10cm	=ER	Revisit.
<i>Hibbertia subvaginata</i>	4-5	1-5%	0.6-1 m		
<i>Hypochaeris glabra</i>	+	<1 %		ER8-10	
<i>Kennedia prostrata</i>	+	<1 %	3cm	ER8-62	Revisit.
<i>Lawrencella rosea</i>	+	<1 %	15cm	ER8-2,51	Daisy
<i>Lepidosperma leptostachyum</i>	+	<1 %		ER8-14	sedge
<i>Lepidosperma tenue</i>	+	<1 %		ER8-13	sedge
<i>Neurachne alopecuroidea</i>	+	<1 %		ER8-7	
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	10 cm	ER8-17	
<i>Parentucellia latifolia</i>	+	<1 %	4cm	ER8-64	Revisit.
<i>Pentaschistis airoides</i>	+	<1 %		ER8-26	
<i>Petrorhagia velutina</i>	+	<1 %		ER8-2B	
<i>Phyllangium sulcatum</i>	+	<1 %		ER8-9	
<i>Platysace cirrosa</i>	+	<1 %	20cm	=ER2-53	Revisit.
<i>Podolepis lessonii</i>	+	<1 %	6cm	ER8-6	Daisy
<i>Podotheca angustifolia</i>	+	<1 %	4cm	=ER2-54	Revisit. Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	1cm	ER8-58	Revisit. Flat base
<i>Pterostylis scabra</i>	+	<1 %	15cm	ER8-57	Revisit. Tall
<i>Regelia megacephala</i>	30-40	25-33.3%	1-2.5 m		
<i>Sonchus oleraceus</i>	+	<1 %			star head = ER6-15
<i>Stypandra glauca</i>	+	<1 %			=ER6-7
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	ER8-54,55	Also recorded in 30x30. Also ER8-32. Revisit. Fleshy leaf
<i>Trachymene pilosa</i>	+	<1 %		ER8-8	
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %		ER8-3	fluffy head
<i>Urospermum picroides</i>	+	<1 %	15 cm	ER8-25	
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		ER8-11	Grass
<i>Waitzia nitida</i>	+	<1 %		ER8-4	
<i>Austrodanthonia caespitosa</i>	+	<1 %		ER8-21	hairy base grass
<i>Austrodanthonia setacea</i>				ER8-29	
<i>Cyrtostylis huegelii</i>	+	<1 %	1cm	ER8-66	Revisit. Orchid (round leaf) (200m west of NW peg)
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %		ER8-23	
<i>Pentaschistis pallida</i>				ER8-27	Grass
<i>Tripteris clandestina</i>	+	<1 %	30cm	ER8-61	Revisit. Stink daisy
<i>Tripterococcus brunonis</i>	+	<1 %		ER8-33	

Moora Site ERG009

Described by MJH **Date** 3/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is near the north end of the ridge, just S and upslope from some costeans, and approximately 900 m ESE from the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **407881 m E** **6623783 m N** **-30.514633 S lat** **116.039912 E long**

Habitat: Ridge top with gentle slope to north.

Soil: Where present, a shallow fine brown sand/silt.

Rock Type: Chert outcrop -> boulders -> cobbles -> gravel. Cover 85%+ of surface.

Vegetation: *Allocasuarina huegeliana*, *Dryandra sessilis* var. *sessilis* scattered low trees over *Kunzea praestans*, *Acacia congesta* subsp. *congesta* shrubland to high shrubland over *Hibbertia subvaginata* open heath to shrubland over **Pentaschistis airoides*, **Vulpia myuros* var. *hirsuta*, **Ehrarta longiflora* very open annual grassland.

Vegetation condition: Very Good - Excellent. Some weed invasion and senescence but overall high quality.

Fire age: >10 Years.

Notes: Is near cleared area (to S). With the amount of chert on this site it may be expected to find the *Regelia* here, but there is none present.

Species List:

Name	Cover	C Class	Height	Specimen Notes
<i>Acacia congesta</i> subsp. <i>congesta</i>	5	5-10%	1-2 m	dead and dying
<i>Allocasuarina campestris</i>	1	<1 %	1-2 m	
<i>Allocasuarina huegeliana</i>	2	1-5%	4 m	

<i>Austrodanthonia setacea</i>	+	<1 %	40 cm	ER9-4,51	
<i>Avena barbata</i>	+	<1 %	20 cm	ER9-3	
<i>Briza maxima</i>	+	<1 %	10 cm	ER9-6	
<i>Burchardia umbellata</i>	+	<1 %	12-20cm	ER9-54	Revisit. Fleshy leaves
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	10cm	=ER11-53	Revisit.
<i>Calandrinia</i> sp.	+	<1 %	2cm	ER9-53	Revisit.
<i>Calytrix leschenaultii</i>	+	<1 %	1 m		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	+	<1 %	10 cm		
<i>Crassula exserta</i>	+	<1 %	8 cm	ER9-1	
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Revisit. Blue beard
<i>Dichopogon capillipes</i>	+	<1 %	15cm	ER9-50	Revisit.
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	ER9-61	Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	15cm	ER9-55	Revisit. Erect
<i>Drosera pallida</i>	+	<1 %		ER9-5	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	2	1-5%	5 m		
<i>Ehrharta longiflora</i>	+	<1 %	20 cm		
<i>Goodenia berardiana</i>	+	<1 %	30cm	ER9-59	Revisit.
<i>Guichenotia sarotes</i>	+	<1 %	60cm	ER9-58	Revisit.
<i>Hibbertia subvaginata</i>	40	33.3-50%	1 (1.2) m		
<i>Hypochaeris glabra</i>	1-2%	1-5%	(2) 15cm		Revisit.
<i>Kunzea praestans</i>	5	5-10%	(0.5)1.8-3m		
<i>Lepidosperma leptostachyum</i>	+	<1 %	30cm	ER9-57	Revisit.
<i>Neurachne alopecuroidea</i>	+	<1 %	20 cm		
<i>Pentaschistis airoides</i>	+	<1 %	10 cm		
<i>Platysace cirrosa</i>	+	<1 %	15cm	=ER2-53	Revisit.
<i>Podotheca angustifolia</i>	+	<1 %	3cm	GH10-52	Revisit. Daisy
<i>Pterostylis setulosa</i>	+	<1 %	15cm	=ER10-60	Revisit. Flat base
<i>Quinetia urvillei</i>	+	<1 %	10 cm	ER9-7	
<i>Romulea rosea</i>	+	<1 %	35cm	ER9-56	Revisit.
<i>Trachymene ornata</i>	+	<1 %	30cm	ER9-52	Revisit.
<i>Ursinia anthemoides</i>	+	<1 %	10-15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10 cm	ER9-2	
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	1 m		juv
<i>Bromus diandrus</i>	+	<1 %	20cm	=ER10-58	Revisit.
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	=ER17-58	Revisit.
<i>Podolepis lessonii</i>	+	<1 %	25cm	=ER1-58	Revisit. Daisy
<i>Trifolium subterraneum</i>	+	<1 %	1cm	ER9-60	Revisit. Clover
<i>Tripteris clandestina</i>	+	<1 %	40cm	=JT3-50	Revisit. Stink daisy

Moora Site ERG010

Described by BRM **Date** 3/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on the south slope of the northern-most hill of the ridge, approx 850 m ESE of the Kiaka Rd/Midlands Rd junction and 100 m east of Kiaka Road.

MGA Zone 50 **407838 m E** **6624673 m N** **-30.506599 S lat** **116.039543 E long**

Habitat: South facing mid-slope on a fairly low chert hill.

Soil: Gravelly, grey silty sand.

Rock Type: Quartz outcrop/boulders/cobbles. Cover ~80-90% of surface.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* scattered low trees over *Allocasuarina campestris* high open shrubland, over *Hibbertia subvaginata* open heath over *Dichopogon capillipes*, *Lepidosperma tenue*, *Austrodanthonia acerosa* very open herb/sedge/grassland.

Vegetation condition: Good - very good. Evidence of grazing nearby, **Ursinia* and **Briza* present.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	4	1-5%	3-4 m		
<i>Allocasuarina campestris</i>	10	5-10%	1.8-2.5 m		
<i>Austrodanthonia acerosa</i>	+	<1 %		ER10-10	Grass
<i>Austrodanthonia caespitosa</i>	+	<1 %	4cm	ER10-53	Revisit. (hairy)
<i>Austrostipa elegantissima</i>	+	<1 %	35cm	=ER4-56	Revisit. Grass
<i>Avena barbata</i>				ER10-59	Also recorded in 30x30.
<i>Briza maxima</i>	2-3	1-5%	15 cm		
<i>Burchardia umbellata</i>	+	<1 %	30cm	=GH9-52	Revisit.

<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12cm	=ER16-54	Revisit.
<i>Calandrinia</i> sp.	+	<1 %	3cm	ER10-54	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %		ER10-4	
<i>Cheilanthes adiantoides</i>	+	<1 %		ER10-7	
<i>Dichopogon capillipes</i>					
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Drosera macrantha</i> subsp. <i>macrantha</i>					
<i>Drosera</i> sp.	+	<1 %	50cm	ER10-50	Revisit.
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	8	5-10%	5 m		
<i>Hibbertia subvaginata</i>	30-40	25-33.3%	1-1.5 m		
<i>Hypochaeris glabra</i>	+	<1 %	1cm		Revisit.
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	20cm	=ER12-50	Revisit.
<i>Lepidosperma leptostachyum</i>	+	<1 %	60 cm	ER10-2	sedge
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	0.4-1.5 m	ER10-1	
<i>Pentaschistis airoides</i>	+	<1 %		ER10-8	
<i>Pterostylis</i> sp.	+	<1 %	12cm	=ER18-57	Revisit. Tall
<i>Stylidium glabrifolium</i>	+	<1 %			
<i>Stypandra glauca</i>	+	<1 %	30cm		Revisit.
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	=ER17-55	Revisit. Fleshy leaf
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %	20 cm	ER10-6	cylinder head
<i>Trifolium subterraneum</i>	+	<1 %	3cm	ER10-55	Revisit. Clover
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>				ER10-3	
<i>Urospermum picroides</i>	+	<1 %	6cm	ER10-57	Revisit. ?
<i>Ursinia anthemoides</i>	+	<1 %	30 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		ER10-9	
<i>Acacia aristulata</i>	+	<1 %			6 of
<i>Allocasuarina huegeliana</i>	+	<1 %			
<i>Bromus diandrus</i>	+	<1 %	20cm	ER10-58	Revisit.
<i>Pterostylis setulosa</i>	+	<1 %	10cm	ER10-60	Revisit. Flat base leaf
<i>Trachymene ornata</i>	+	<1 %	10cm	ER10-61	Revisit.

Moora Site ERG011

Described by BRM **Date** 3/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on a NE facing slope of a gully that empties to the NNW and is approximately 800m SE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **407949 m E** **6624301 m N** **-30.509964 S lat** **116.040667 E long**

Habitat: East facing upper slope.

Soil: Gravelly grey silty sand.

Rock Type: Quartz gravel/cobbles/boulders.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* open to closed scrub.

Vegetation condition: Very good. Little sign of grazing and weeds.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Habenaria elongata</i>					
<i>Allocasuarina campestris</i>	80--85	>75%	2-2.4 m		
<i>Avena barbata</i>	+	<1 %			
<i>Blennospora drummondii</i>	+	<1 %		ER11-7	Daisy
<i>Briza maxima</i>	+	<1 %			
<i>Bromus diandrus</i>	+	<1 %		ER11-6	Grass
<i>Burchardia umbellata</i>	+	<1 %	20cm	=GH9-52	Revisit.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3cm	ER11-53,5	Revisit. Orchid (hairy spade leaf)
(x3 2-3m from NE peg)					
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+/-1%		4cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	+	<1 %			
<i>Cyanicula deformis</i>	+	<1 %	15cm	=ER17-51	Revisit. Blue beard orchid
<i>Dichopogon capillipes</i>	+	<1 %			
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	45cm	ER11-52	Revisit. Climbing
<i>Drosera pallida</i>	+	<1 %		ER11-1	
<i>Hibbertia subvaginata</i>					At edge of 10x10.
<i>Hypochaeris glabra</i>	+	<1 %	1cm		Revisit.

<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	10cm	=ER17-58	Revisit.
<i>Lepidosperma tenue</i>	+	<1 %			Sedge = ER10-2
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	2cm	ER11-54	Revisit. Daisy #1
<i>Neurachne alopecuroidea</i>	+	<1 %	5cm		Revisit.
<i>Pentaschistis airoides</i>	+	<1 %		ER11-2	
<i>Petrorhagia prolifera</i>	+	<1 %		ER11-9	
<i>Phyllangium sulcatum</i>	+	<1 %		ER11-8	Daisy
<i>Platysace cirrosa</i>	+	<1 %	10cm	=GH9-54	Revisit. Climber
<i>Podolepis lessonii</i>	+	<1 %		ER11-3,55	Daisy, small
<i>Pterostylis sanguinea</i>	+	<1 %	10cm	ER11-58	Revisit. Orchid
<i>Trachymene cyanopetala</i>	+	<1 %	2cm	ER11-50	Revisit.
<i>Trifolium subterraneum</i>	+	<1 %	2cm	ER11-51	Revisit. Clover
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		ER11-5	Grass
<i>Acacia acuminata</i> subsp. <i>acuminata</i>					
<i>Acacia aristulata</i>					4
<i>Acacia congesta</i> subsp. <i>congesta</i>					
<i>Allocasuarina huegeliana</i>					
<i>Austrodanthonia setacea</i>	+	<1 %	10cm	ER11-63	Revisit. (top slope edge of 30x30)
<i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	+	<1 %	10cm	ER11-62	Revisit. Small gallow flr
<i>Calytrix leschenaultii</i>					
<i>Goodenia arthrotricha</i>					
<i>Kunzea praestans</i>					
<i>Lepidosperma leptostachyum</i>	+	<1 %	50cm	ER11-61	Revisit.
<i>Stylidium glabrifolium</i>					
<i>Stypandra glauca</i>	+	<1 %	20cm		Revisit.
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	ER11-60	Revisit. Climber
<i>Xanthorrhoea drummondii</i>					

Moora Site ERG012

Described by MJH **Date** 3/09/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on a SW facing slope (facing ERG011) of a gully that empties to the NNW and is approximately 800m SE of the Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **407788 m E** **6624200 m N** **-30.510863 S lat** **116.03898 E long**

Habitat: Rocky, gentle west facing slope.

Soil: Where present, a shallow black fine sand - well mulched under *Allocasuarina campestris*.

Rock Type: Quartz/laterite outcrop and cobbles. Cover 85%+.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp.

loxophleba scattered low trees over *Allocasuarina campestris* closed scrub over *Austrostipa variabilis*, *Hypoxis occidentalis* var. *occidentalis* scattered grasses and herbs

Vegetation condition: Very good - moderate weed invasion.

Fire age: >10 years?

Notes: High degree of outcrop, but quartz not of same quality as supports *Regelia* - mixed with laterite.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	90%	>75%	2.5 m		
<i>Austrostipa variabilis</i>	+	<1 %	20 cm	ER12-3	Grass
<i>Avena barbata</i>	+	<1 %	15-20 cm		
<i>Borya sphaerocephala</i>	+	<1 %	20cm		Revisit.
<i>Briza maxima</i>	+	<1 %	10-15		
<i>Bromus diandrus</i>	+	<1 %	10 cm	ER12-4	
<i>Burchardia umbellata</i>	+	<1 %	30cm	=GH9-52	Revisit.
<i>Caladenia denticulata</i>	+	<1 %	12cm	=JT6-56	Revisit. ?Orchid
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	5cm	=ER11-53	Revisit. Orchid
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20 cm		
<i>Cheilanthes adiantoides</i>	+	<1 %	10-15		
<i>Cyanicula deformis</i>	+	<1 %	12cm	=ER17-51	Revisit. Blue beard orchid
<i>Dichopogon capillipes</i>	+	<1 %	30 cm		
<i>Dioscorea hastifolia</i>	+	<1 %	10cm-1.3		Revisit.
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	10cm	ER12-54	Revisit. Flat base
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	ER12-59,5	Also recorded in 30x30.

Species	+	<1 %	Height	Specimen	Notes
Hypochaeris glabra	+	<1 %	10 cm		Climber
Hypoxis occidentalis var. occidentalis	<1%	<1 %	15cm	ER12-50	Revisit.
Parentucellia latifolia	+	<1 %	10 cm		
Pentaschistis airoides	+	<1 %	10 cm		
Phyllangium sulcatum	+	<1 %	10 cm		
Podolepis lessonii	+	<1 %	10 cm	ER12-1	Daisy
Podotheca angustifolia	+	<1 %	5 cm	ER12-6,60	
Thysanotus manglesianus	+	<1 %	1.1m	ER12-55	Revisit. Climber
Trachymene ornata	+	<1 %	5cm	ER12-53	Revisit.
Trifolium subterraneum	+	<1 %	3cm	ER12-51	Revisit. Clover
Ursinia anthemoides	+	<1 %	10 cm		
Acacia acuminata subsp. acuminata	+	<1 %	4 m		
Allocasuarina huegeliana	+	<1 %	4-5 m		
Eucalyptus loxophleba subsp. loxophleba	+	<1 %	6 m	ER12-7	
Muehlenbeckia adpressa	+	<1 %	2cm	ER12-56	Revisit.
Olearia dampieri subsp. eremicola	+	<1 %	90cm	ER12-57	Revisit.
Platysace cirrosa	+	<1 %	1.3m	=GH9-54	Revisit. Climbing
Pterostylis sanguinea	+	<1 %	2cm	=ER11-57	Revisit. Flat leaf

Moora Site ERG013

Described by MJH **Date** 3/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is on a south facing slope on the eastern arm of a gully emptying east of the ridge, approx. 2 km SE of Kiaka Rd/Midlands Rd junction.

MGA Zone 50 **408012 m E** 6623294 **m N** -30.519055 **S lat** 116.041234 **E long**

Habitat: Gentle - moderate southerly facing slope.

Soil: Black, gravelly silty sand.

Rock Type: Quartz outcrop, boulders and cobbles. ~70% cover (from memory, no notes)

Vegetation: Allocasuarina huegeliana low open woodland over Hibbertia subvaginata open heath over Pityrodia dilatata low shrubland over Neurachne alopecuroidea scattered grasses and *Ehrharta longiflora scattered annual grasses.

Vegetation condition: Good - very good. Lots of weed invasion from paddock below, and weeds almost only herb layer.

Notes: A lot of Acacia aristulata around here - should be recorded separately, but there were 11 individuals in the 10x10 m plot, and others outside.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia aristulata	1%	<1 %	20 cm		
Allocasuarina huegeliana	5%	5-10%	(3)10 m		
Arctotheca calendula	+	<1 %	12cm		Revisit. Capeweed
Austrodanthonia caespitosa	+	<1 %	15cm	ER13-56	Revisit. Hairy godas
Austrodanthonia setacea	+	<1 %	15 cm	ER13-4	Grass
Avena barbata	+	<1 %	15 cm		
Briza maxima	+	<1 %	10-15 cm		
Bromus diandrus	+	<1 %	15cm	=ER10-58	Revisit.
Burchardia umbellata	+	<1 %	20cm	=GH9-52	Revisit.
Caladenia flava subsp. flava	+	<1 %	15 cm	ER13-1	Orchid
Calandrinia calyptrata	+	<1 %	2cm	ER13-55	Revisit.
Chamaescilla corymbosa var. corymbosa	+	<1 %	15 cm		
Cheilanthes adiantoides	+	<1 %	10 cm		
Comesperma integerrimum	+	<1 %	1m	ER13-59,5	Also recorded in 30x30. Revisit. Daisy ID?
Crassula colorata var. colorata	+	<1 %	2cm	Er13-54	Revisit.
Cyanicula deformis	+	<1 %	12cm	=ER17-51	Revisit. Blue beard
Dichopogon capillipes	+	<1 %	15-30 cm		
Dioscorea hastifolia	+	<1 %	1 m		
Drosera macrantha subsp. macrantha	+	<1 %	30cm	ER13-52	Revisit. Climber
Ehrharta longiflora	+	<1 %	15 cm	ER13-62	
Goodenia berardiana	+	<1 %	25cm	=ER19	Revisit.
Hibbertia subvaginata	65	50-75%	1-2 m		
Hypochaeris glabra	+	<1 %	15-20 cm		
Lepidosperma leptostachyum	+	<1 %	40cm	ER13-50	Revisit.
Neurachne alopecuroidea	+	<1 %	30 cm		

<i>Parentucellia latifolia</i>	+	<1 %	10-15 cm		
<i>Pentaschistis airoides</i>	+	<1 %	10-12 cm		
<i>Petrorhagia velutina</i>	+	<1 %	20 cm		
<i>Phyllangium sulcatum</i>	+	<1 %	10 cm		
<i>Pityrodia dilatata</i>	10%	<1 %	45cm	ER13-51	Revisit.
<i>Podolepis lessonii</i>	+	<1 %	20cm	=ER1-58	Revisit. Daisy
<i>Quinetia urvillei</i>	+	<1 %	2cm	ER13-61	Revisit. ?Daisy
<i>Stypandra glauca</i>	+	<1 %	30 cm		
<i>Thysanotus manglesianus</i>	+	<1 %	8cm	ER13-58	Revisit. Fleshy leaf
<i>Trachymene cyanopetala</i>	+	<1 %	12 cm		
<i>Trifolium subterraneum</i>	+	<1 %	3cm	ER13-57A	Revisit. Clover
<i>Ursinia anthemoides</i>	+	<1 %	15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15 cm	ER13-2	Grass
<i>Xanthorrhoea drummondii</i>	+	<1 %	2 m		
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	1.5 m		
<i>Caladenia denticulata</i>	+	<1 %	25cm	ER13-60	Revisit. Spider orchid
<i>Calytrix leschenaultii</i>	+	<1 %	0.5-1 m		
<i>Kennedia prostrata</i>	+	<1 %	5cm		Revisit.
<i>Petrorhagia prolifera</i>	+	<1 %	20cm	=ER8-65	Revisit.
<i>Pterostylis setulosa</i>	+	<1 %	8cm	=EO2-65	Revisit. Flat base
<i>Waitzia nitida</i>	+	<1 %	10-20 cm	ER13-6	Yellow daisy

Moora Site ERG014

Described by BRM **Date** 3/12/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The Eastern Ridge parallels the current mine path to its east, and extends north to Kiaka Rd. This site is adjacent to the current pit on the western side of the ridge, approx. 200 m west of ERG013.

MGA Zone 50 **407812 m E** **6623292 m N** **-30.519058 S lat** **116.039149 E long**

Habitat: Upper slope, west facing. Chert outcropping.

Soil: Grey, silty/loamy sand.

Rock Type: Quartz outcrop, gravel/cobbles.

Vegetation: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Kunzea praestans*, *Xanthorrhoea drummondii*, *Allocasuarina campestris* open scrub over *Hibbertia subvaginata*, *Acacia lasiocarpa* var. *sedifolia* open shrubland over *Borya sphaerocephala* herbland.

Vegetation condition: Poor to good. Very heavily grazed, some weeds. Would regenerate well.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	4 cm		REGROWTH
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %		ER14-5	
<i>Allocasuarina campestris</i>	+	<1 %	2 m		
<i>Allocasuarina huegeliana</i>	4	1-5%	7 m		
<i>Arctotheca calendula</i>	+	<1 %	15cm		Revisit. Capeweed
<i>Austrostipa tenuifolia</i>	+	<1 %		ER14-10	
<i>Avena barbata</i>	+	<1 %			
<i>Borya sphaerocephala</i>	40	33.3-50%	3 cm	ER14-4	
<i>Briza maxima</i>	+	<1 %			
<i>Caesia</i> (Moora hairy stem)	+	<1 %	20cm	ER14-51,5	Also recorded in 30x30. Revisit.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		ER14-3	Orchid
<i>Calytrix leschenaultii</i>	+	<1 %			
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %			
<i>Cheilanthes adiantoides</i>	+	<1 %			
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	ER14-53	Revisit.
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Revisit. Blue beard orchid
<i>Desmocladus flexuosus</i>	+	<1 %			
<i>Dioscorea hastifolia</i>	+	<1 %	5cm		Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	ER14-50	Revisit.
<i>Erodium cygnorum</i>	+	<1 %	1cm	=ER17-52	Revisit. ?
Genus sp.	+	<1 %	10cm		Revisit.
<i>Gilberta tenuifolia</i>	+	<1 %		ER14-8	Daisy
<i>Hibbertia subvaginata</i>	1	<1 %	0.8-1 m		
<i>Hypochaeris glabra</i>				ER14-14,6	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER17-58	Revisit.
<i>Kunzea praestans</i>	30	25-33.3%	2-2.5 m		

Lawrencella rosea	+	<1 %	15cm	=ER20-54	Revisit. Pink daisy
Lepidosperma tenue				ER14-1	Sedge
Lomandra (Moora twisty)	+	<1 %	30cm	ER14-52	Revisit.
Neurachne alopecuroidea					
Parentucellia latifolia	+	<1 %		ER14-9	
Pentaschistis airoides	+	<1 %			Tall
Phyllangium sulcatum	+	<1 %		ER14-11	
Platysace cirrosa	+	<1 %	12cm	=ER2-53	Revisit. Climber
Podolepis lessonii	+	<1 %		ER14-6	Daisy
Quinetia urvillei	+	<1 %	20cm	=Er13-61	Revisit. ?Daisy
Stylidium septentrionale	+	<1 %			Short Stylidium
Thysanotus manglesianus	+	<1 %	20cm	=ER14-54	Revisit. Climber
Trachymene cyanopetala	+	<1 %		ER14-7	
Trachymene ornata	+	<1 %			
Ursinia anthemoides	+	<1 %			
Vulpia myuros var. hirsuta	+	<1 %		ER14-12	Grass
Waitzia nitida	+	<1 %		ER14-15	Daisy
Xanthorrhoea drummondii	+	<1 %	2 m		
Acacia congesta subsp. congesta					
Austrostipa elegantissima	+	<1 %	40cm	ER14-59	Revisit.
Blennospora drummondii	+	<1 %	3cm	ER14-61	Revisit. ?Daisy
Bossiaea sp. Cairn Hill (M Henson CH2-28)			1 m	ER14-16	grazed shrub
Burchardia umbellata	+	<1 %	20cm	ER14-62	Revisit.
Comesperma integerrimum	+	<1 %	1.2m	ER14-58	Revisit.
Daviesia dielsii	+	<1 %			4 of
Dichopogon capillipes	+	<1 %	40cm	=CH10-52	Revisit. Tall
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	1cm	Er14-56	Revisit. Flat
Dryandra sessilis var. sessilis					
Goodenia berardiana	+	<1 %	12cm	ER14-57	Revisit.
Olearia dampieri subsp. eremicola	+	<1 %			=ER10-1
Opercularia vaginata	+	<1 %	20cm	ER14-60	Revisit.
Pityrodia dilatata	+	<1 %	12cm		Revisit.
Stypandra glauca	+	<1 %			

Moora Site ERG015

Described by BRM **Date** 3/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: West side of Eastern Ridge, adjacent to original mine pit.

MGA Zone 50 **407671 m E** **6623754 m N** **-30.514881 S lat** **116.03772 E long**

Habitat: Chert breakaway on west-facing steep rocky slope

Soil: Brown sandy loam amongst chert rock

Rock Type: Chert

Vegetation: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low woodland to low open forest over Kunzea praestans scattered tall shrubs (at top of breakaway) over Pityrodia dilatata scattered low shrubs over Stypandra glauca, Dichopogon capillipes open herbland with Dioscorea hastifolia open lianes, *Avena barbata, *Briza maxima annual open grassland and Waitzia nitida, Schoenia cassiniana very open annual herbland.

Vegetation condition: Good. ?grazing (certainly of surrounds). Weeds abundant.

Fire age: More than 5-10 years since burnt.

Notes: Datum: WGS84. Lichen abundant (mainly 2 types).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	25-30%	25-33.3%	6-7m		
Allocasuarina huegeliana	10	5-10%	6-7m		
Amyema preissii	+	<1 %	3-4m		
Arctotheca calendula	+	<1 %	15cm		
Austrodanthonia caespitosa	+	<1 %	10cm	ER15-55	Revisit.
Avena barbata	5-10	5-10%	80cm		
Briza maxima	5-10	5-10%	40cm		
Caesia alfordii	+	<1 %	35cm	ER15-56,6	Revisit.
Caladenia flava subsp. flava	+	<1 %	20cm	ER15-29,2	Also recorded in 30x30. Orchid
Calandrinia calyptata	+	<1 %	5cm	ER15-11,2	Also recorded in 30x30.
Chamaescilla corymbosa var. corymbosa	+	<1 %	5cm	=ER19-50	Revisit.
Cheilanthes adiantoides	2	1-5%	10cm	ER15-10	Cheilanthes
Comesperma integerrimum	+	<1 %	40cm	ER15-3	Comesperma

<i>Crassula exserta</i>	+	<1 %	5cm	ER15-5A,B	Was mixed, included 15-5B
<i>Dichopogon capillipes</i>	1-2	1-5%	20-30cm	ER15-14	<i>Dichopogon capillipes</i>
<i>Dioscorea hastifolia</i>	2-3	1-5%	20cm	ER15-1,15	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	5cm	ER15-61,6	Also recorded in 30x30. Revisit.
<i>Ehrharta longiflora</i>	5	5-10%	30-35cm		
<i>Hypochaeris glabra</i>	+	<1 %		ER15-18	Daisy weed
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	=ER17-58	Revisit.
<i>Kunzea praestans</i>	+	<1 %	3m		
<i>Lysiana casuarinae</i>	+	<1 %	1.2m	ER15-53	Revisit.
<i>Pityrodia dilatata</i>	1	<1 %	40-50cm	ER15-7	<i>Pityrodia dilatata</i>
<i>Podolepis canescens</i>	+	<1 %	20cm	ER15-12	<i>Waitzia</i>
<i>Podolepis lessonii</i>	+	<1 %	15cm	ER15-13,6	Daisy
<i>Prasophyllum gracile</i>	+	<1 %	12cm	ER15-54	Revisit. Orchid
<i>Schoenia cassiniana</i>	1-2	1-5%	20-30cm	ER15-9,50	pink & white daisy
<i>Stypantra glauca</i>	1-2	1-5%	25-30cm	ER15-4	<i>Stypantra glauca</i>
<i>Thysanotus manglesianus</i>	+	<1 %	80cm	ER15-2	Also ER15-51,60. <i>Thysanotus</i>
<i>Trachymene ornata</i>	+	<1 %	10-15cm	ER15-6,52	<i>Trachymene</i> white top
<i>Trachymene pilosa</i>	+	<1 %	10cm	ER15-16	<i>Trachymene</i>
<i>Trifolium subterraneum</i>	+	<1 %	3cm	=ER15-59	Revisit. Clover
<i>Urospermum picroides</i>	+	<1 %	20cm	ER15-17, 1	Also ER15-57. Daisy weed
<i>Ursinia anthemoides</i>	1	<1 %	20cm		
<i>Waitzia nitida</i>	1-2	1-5%	20-25cm	ER15-8,66	Also recorded in 30x30. <i>Waitzia</i> (high centre)
<i>Aira caryophylla</i>	+	<1 %	10cm	ER15-20,2	
<i>Allocasuarina campestris</i>	+	<1 %	1.5m		
<i>Austrostipa nitida</i>	+	<1 %	20cm	ER15-27	<i>Austrostipa</i>
<i>Daucus glochidiatus</i>	+	<1 %	15cm	ER15-26	<i>Trachymene</i>
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	35cm	=ER3-52	Revisit. Orchid
<i>Goodenia berardiana</i>	+	<1 %	8cm	=ER8-52	Revisit.
<i>Hibbertia subvaginata</i>	+	<1 %	1.0m		
<i>Kennedia prostrata</i>	+	<1 %	20cm		
<i>Lawrencella rosea</i>	+	<1 %	20cm	=ER20-54	Revisit. Daisy pink, linear leaves
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	40cm	ER15-22	Restionaceae (wiry head)
<i>Lepidosperma costale</i>	+	<1 %		ER15-65	Revisit
<i>Neurachne alopecuroidea</i>	+	<1 %	5cm		Revisit.
<i>Parentucellia latifolia</i>	+	<1 %	15cm	ER15-30	
<i>Petrorhagia prolifera</i>	+	<1 %	30cm	ER15-28,6	
<i>Pterostylis setulosa</i>	+	<1 %	12cm	=ER2-51	Revisit. Orchid
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm	ER15-21	Poaceae
<i>Xanthorrhoea drummondii</i>	+	<1 %	2.5m		

Moora Site ERG016

Described by MET **Date** 3/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: East side of eastern side of ridge, near middle of the ridge length, 15km north of moora.

MGA Zone 50 **407902 m E** 6623878 **m N** -30.51378 **S lat** 116.040138 **E long**

Habitat: East facing, moderately sloping mid to upper slope of a low ridge.

Soil: Gravelly to cobbly (angular chert) grey silty fine sand. 30% of surface is chert.

Rock Type: Chert

Vegetation: Eucalyptus wandoo subsp. wandoo low mallee woodland over *Allocasuarina campestris* high shrubland to open scrub over *Dichopogon capillipes* scattered herbs and **Ehrharta longiflora* open annual grassland.

Vegetation condition: Good, but weedy consistent with fairly heavy grazing, so may have lost species. Rabbits active.

Fire age: More than 5 years since last fire.

Notes: Datum: WGS84. Last fire was hot - burnt wandoo stems. Fire has killed large wandoo and left only burnet stumps (some trees bigger than in plot nearby). Nearby (about 15-20m from SE corner) *Acacia aristulata*. One live at 50J0407925/UTM6623864. Three or four dead ones nearby. Revisit - Search limited to areas of Eucalyptus wandoo low open woodland over *Allocasuarina campestris* scrub.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
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<i>Allocasuarina campestris</i>	25-35%	25-33.3%	(1.6)2-3m		
<i>Anagallis arvensis</i>	+	<1 %	5cm		
<i>Arctotheca calendula</i>	+	<1 %	5cm		Capeweed
<i>Austrodanthonia acerosa</i>	+	<1 %	15(30)cm	ER16-17,2	<i>Austrostipa</i>
<i>Austrostipa trichophylla</i>	+	<1 %	15cm	ER16-22	<i>Austrostipa</i>
<i>Avena barbata</i>	+	<1 %	40cm	ER16-53	Revisit.
<i>Blennospora drummondii</i>	+	<1 %	6cm	ER16-20	Asteraceae
<i>Borya sphaerocephala</i>	+	<1 %	3cm		Borya
<i>Briza maxima</i>	1%	1-5%	10-30cm		
<i>Bromus diandrus</i>	+	<1 %	15cm	ER16-3,2B	<i>Bromus</i>
<i>Burchardia umbellata</i>	+	<1 %	30cm	ER16-1	<i>Burchardia</i> (perennial herb)
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15cm	ER16-19,5	<i>Caladenia</i>
<i>Calandrinia calyptrata</i>	+	<1 %	10cm	ER16-14	<i>Calandrinia</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	+	<1 %	10cm		<i>Cheilanthes</i> (locally common)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2-6cm	ER16-12	<i>Crassula</i> (pale green + pale pink)
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Revisit. Blue beard
<i>Dichopogon capillipes</i>	+	<1 %	5-10cm		<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	1	<1 %	60cm		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	ER16-15,5	Revisit. Climber ?palida
<i>Ehrharta longiflora</i>	+/-10%	5-10%	5-25cm		
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	>15%	10-25%	5-6m		Mallee form, suggests regeneration
<i>Hedypnois rhagadioloides</i>	+	<1 %	10cm	ER16-13	Asteraceae (cf <i>Urospermum</i>)
<i>Hyalosperma cotula</i>	+	<1 %	10cm	ER16-16	<i>Rhodanthe</i>
<i>Hypochaeris glabra</i>	+	<1 %	5cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	=ER12-50	Revisit.
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm	ER16-10	<i>Neurachne</i> (per. grass)
<i>Pentaschistis pallida</i>	+	<1 %	5-15cm	ER16-18	Aira
<i>Petrorhagia prolifera</i>	+	<1 %	5cm	ER16-8	'pink'
<i>Platysace cirrosa</i>	+	<1 %	15cm	ER16-9	(perennial rootstock)
<i>Podolepis lessonii</i>	1	<1 %	15cm	ER16-6	<i>Podolepis</i>
<i>Podotheca angustifolia</i>	+	<1 %	6cm	ER16-51	Revisit.
<i>Romulea rosea</i>	+	<1 %	35cm	ER16-52	Revisit.
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	10cm	ER16-4	? <i>Silene</i>
<i>Trachymene cyanopetala</i>	+	<1 %	5-8cm	ER16-21	Also recorded in 30x30.
<i>Trachymene ornata</i>	+	<1 %	7cm	ER16-7,52	Also recorded in 30x30.
<i>Trachymene ?ornata</i>					(wooly)
<i>Trachymene pilosa</i>	+	<1 %	5-10cm	ER16-24	<i>Trachymene pilosa</i>
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %	5cm	ER16-11	Clover (Yellow head)
<i>Ursinia anthemoides</i>	+/-1%	1-5%	5-15cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	1%	1-5%	5-15cm	ER16-2	<i>Vulpia</i>
<i>Waitzia nitida</i>	+	<1 %	5cm	ER16-5	<i>Waitzia</i>
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	3.5m		Revisit.
<i>Austrostipa elegantissima</i>	+	<1 %	50cm	ER16-55	Revisit. ? <i>elegantissima</i>
<i>Desmocladius flexuosus</i>	+	<1 %	12cm	=ER4	Revisit.
<i>Hibbertia subvaginata</i>	+	<1 %	40cm		
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	20cm	=ER4	Revisit.
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	ER16-53	Also ER16-54b. Revisit. Fleshy

Moora Site ERG017

Described by BM **Date** 3/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near (about 300m) southern end of Eastern Range

MGA Zone 50 **407924 m E** **6622781 m N** **-30.52368 S lat** **116.04027 E long**

Habitat: Lower slopes of west-facing gentle slope.

Soil: Gravelly, cobbly brown sandy loam. Some laterite rocks on surface with some exposed base rock nearby.

Vegetation: *Eucalyptus loxophleba* subsp. *loxophleba*, (*Allocasuarina huegeliana*) low woodland over *Austrostipa trichophylla*, *Neurachne alopecuroidea*, *Caesia alfordii* scattered grasses and herbs with *Gilberta tenuifolia*, *Podolepis* sp. open annual herbland to annual herbland with *Dioscorea hastifolia* scattered lianes.

Vegetation condition: Very good. Only a few weed taxa and weed cover very low.

Notes: Datum: WGS84. Vegetation community did not extend to full 30x30m - *Allocasuarina campestris* heath to

north and south of 10x10, fence line to west and *Allocasuarina huegeliana* and *Eucalyptus loxophleba* subsp. *loxophleba* to east.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	5-10	5-10%	6m		
<i>Aira caryophylla</i>	+	<1 %	10cm	ER17-5	Pentaschistis
<i>Allocasuarina campestris</i>	+	<1 %	1.8m		
<i>Allocasuarina huegeliana</i>	5-10	5-10%	5m		
<i>Arctotheca calendula</i>	+	<1 %	4cm		
<i>Austrodanthonia setacea</i>	+	<1 %	30cm	ER17-9,12	
<i>Austrostipa nitida</i>	+	<1 %	20cm	ER17-15	Austrostipa
<i>Austrostipa trichophylla</i>	+/-1	<1 %		ER17-4	Austrostipa
<i>Avena barbata</i>	+	<1 %	30cm		
<i>Blennospora drummondii</i>	+	<1 %	5cm	ER17-23	Blennospora
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Burchardia umbellata</i>	+	<1 %	30cm	=GH9-52	?Burchardia
<i>Caesia alfordii</i>	+	<1 %		ER17-2	Lilly
<i>Calytrix leschenaultii</i>	+	<1 %	20cm	ER17-7	Calytrix
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	=JT5-55	?Lilly
<i>Cheilanthes adiantoides</i>	1	<1 %	10cm	=ER15-10	Cheilanthes
<i>Comesperma integerrimum</i>	+	<1 %	40cm	=ER15-3	Comesperma
<i>Cyanicula deformis</i>	+	<1 %	12cm	ER17-51	Blue beard orchid
<i>Daucus glochidiatus</i>	+	<1 %	10cm	ER17-10	Trachymene grn/red leaf
<i>Dichopogon capillipes</i>	+	<1 %	35cm	ER17-54	?Dichopogon
<i>Dioscorea hastifolia</i>	1	<1 %	50cm	=ER15-1	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	15cm	ER17-13,5	Also recorded in 30x30. Drosera
<i>macrantha</i>					
<i>Ehrharta longiflora</i>	+	<1 %	25cm		
<i>Erodium cygnorum</i>	+	<1 %	10cm	ER17-26,5	Blue flower
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	15-20%	10-25%	6m		
<i>Galium murale</i>	+	<1 %	3cm	ER17-28	Tiny
<i>Gilberta tenuifolia</i>	20-30	<1 %	10cm	ER17-59,3	Daisy (20-30% cover in Spring)
<i>Goodenia berardiana</i>	+	<1 %	20-30cm	ER17-6,8	Goodenia
<i>Hedypnois rhagadioloides</i>	+	<1 %	15cm	ER17-19	
<i>Hypochaeris glabra</i>	+	<1 %	20cm	ER17-20	?Sonchus
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+/-1%	<1 %	12cm	ER17-58	(=GH9-50)
<i>Linum trigynum</i>	+	<1 %	15cm	ER17-11	
<i>Lomandra</i> (Moora twisty)	+	<1 %	20cm	ER17-14	
<i>Lupinus angustifolius</i>	+	<1 %	20cm		
<i>Neurachne alopecuroidea</i>	+/-1	<1 %		ER17-1	Neurachne
<i>Parentucellia latifolia</i>	+	<1 %	10cm	ER17-16	Parentucellia
<i>Pentaschistis</i> sp. Moora (doubtful ID)	+	<1 %	10cm	ER17-21	?Vulpia
<i>Phyllangium sulcatum</i>	+	<1 %	10cm	ER17-18,2	
<i>Platysace cirrosa</i>	+	<1 %	12cm	=GH9-54	Perennial Trachymene Climber
<i>Podolepis lessonii</i>	1-2	1-5%	20cm	=ER15-13	Also ER17-35. Daisy
<i>Poranthera microphylla</i>	+	<1 %	2cm	ER17-24	?Polygala
<i>Romulea rosea</i>	+	<1 %	15cm	ER17-22	Romulea rosea
<i>Sowerbaea laxiflora</i>	+	<1 %	25cm	ER17-50	Revisit
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	ER17-53,5	Thysanotus Climber
<i>Trachymene ornata</i>	+	<1 %	15cm	=ER15-6	Trachymene white top
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Velleia cycnopotamica</i>	+	<1 %	10cm	ER17-25	"Open mouths"
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	20cm	ER17-17	Bromus
<i>Amyema miraculosa</i> subsp. <i>miraculosa</i>	+	<1 %	3m	ER17-31	Amyema (on Santalum)
<i>Calandrinia calyptrata</i>	+	<1 %	10cm	ER17-29,3	Calandrinia
<i>Crassula exserta</i>	+	<1 %	4cm	=ER15-5A	Crassula
<i>Erodium botrys</i>	+	<1 %	10cm	ER17-32	
<i>Lepidosperma leptostachyum</i>	+	<1 %	35cm	ER17-36	Lepidosperma
<i>Petrorhagia prolifera</i>	+	<1 %	35cm	ER17-34	
<i>Pityrodia dilatata</i>	+	<1 %	20cm	=ER15-7	Pityrodia
<i>Santalum spicatum</i>	+	<1 %	3m		
<i>Schoenus clandestinus</i>	+	<1 %	4cm	ER17-57	Western side of 30x30

<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	25cm	ER17-33	
<i>Stypandra glauca</i>	+	<1 %	30cm		
<i>Tricoryne elatior</i>	+	<1 %	30cm	ER17-37	?Tricoryne

Moor Site ERG018

Described by MET **Date** 3/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Eastern Ridge, south of the mine and near the farm house.

MGA Zone 50 **408020 m E** 6622743 **m N** -30.52403 **S lat** 116.041267 **E long**

Habitat: Just below the crest of a rounded low ridge. Very gently sloping to the west-south-west.

Soil: Gravelly to cobbly silty grey sand. Gravel and pebbles include a lot ferruginous material as well as chert.

Vegetation: *Eucalyptus loxophleba* subsp. *loxophleba*, *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* shrubland to high shrubland over *Borya sphaerocephala*, *Cheilanthes adiantoides* low open herbland/fernland.

Vegetation condition: Very good or very good to excellent. Low weed invasion, no significant grazing (there would have been some though).

Fire age: Not burnt for more than 10 years.

Notes: Datum - WGS84. Coordinates are for SW corner peg. The eucalypts are mallees. *Lomandra* (18-2) was found near base of York gum near NW peg; second found in NW corner. No '*Myriocephalus*' in 10x10 although this is abundant nearby. In a wet year there would be much more *Cheilanthes adiantoides*. About 10 dead *Xanthorrhoea* just out or in plot. One live one. Fire is reducing the number of *Xanthorrhoea* and probably also the *Allocasuarina huegeliana*.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	5-7m		
<i>Allocasuarina campestris</i>	20%	10-25%	2-3m		
<i>Allocasuarina huegeliana</i>	+	<1 %	7-9m		Outside plot
<i>Arctotheca calendula</i>	+	<1 %	5cm		Capeweed
<i>Austrostipa trichophylla</i>	+	<1 %	5-10cm	ER18-1,8	<i>Austrostipa</i>
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Blennospora drummondii</i>	+	<1 %	3cm	=ER16-20	Daisy
<i>Borya sphaerocephala</i>	>5%	5-10%	5-10cm		<i>Borya</i>
<i>Briza maxima</i>	+	<1 %	5cm		
<i>Bromus diandrus</i>	+	<1 %	10cm	=ER16	<i>Bromus</i>
<i>Burchardia umbellata</i>	+	<1 %	20cm	=ER16-1	<i>Burchardia</i>
<i>Caladenia vulgata</i>	+	<1 %	15cm	ER18-3	<i>Caladenia</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	5cm	ER18-6	<i>Chamaescilla</i>
<i>Cheilanthes adiantoides</i>	2	1-5%	10cm (locally common)		<i>Cheilanthes</i>
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	1-2cm	=ER16	<i>Crassula</i>
<i>Cyanicula deformis</i>			12cm	=ER17-51	Revisit. Blue beard orchid
<i>Desmocladus flexuosus</i>	+	<1 %	20-40cm	ER18-4,50	
<i>Dioscorea hastifolia</i>	+	<1 %	60cm		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	45cm	=ER19-51	Revisit. Climber
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	<5%	1-5%	6-8m		
<i>Hedypnois rhagadioloides</i>	+	<1 %	5cm	=ER16-13	cf <i>Urospermum</i>
<i>Hypochaeris glabra</i>	+	<1 %	2cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	ER18-5	cf <i>Hypoxis</i>
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moor: ERG18-7)	+	<1 %	85cm	ER18-7	<i>Lepidosperma</i>
<i>Lomandra</i> (Moor twisty)	+	<1 %	15cm	ER18-2	<i>Lomandra</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	5cm	=ER16	<i>Neurachne</i>
<i>Parentucellia latifolia</i>	+	<1 %	10cm		<i>Parentucellia</i>
<i>Platysace cirrosa</i>	+	<1 %	15cm	=ER16-9	
<i>Podolepis lessonii</i>	+	<1 %	10cm	=ER16	<i>Podolepis lessonii</i>
<i>Romulea rosea</i>	+	<1 %	15cm		
<i>Sowerbaea laxiflora</i>	+	<1 %	25cm		
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	ER18-17	Also recorded in 30x30. <i>Thysanotus manglesianus</i>
<i>Trachymene cyanopetala</i>	+	<1 %	5cm	=ER16-21	<i>Trachymene</i>
<i>Trachymene ornata</i>	+	<1 %	5cm		Woolly head
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %	1cm	ER18-12	Clover (yellow)
<i>Ursinia anthemoides</i>	+	<1 %	8cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm	=ER016	<i>Vulpia</i>
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.7m		
<i>Aira caryophyllea</i>	+	<1 %	65cm	ER18-14	<i>Aira</i>

Austrodanthonia caespitosa	+	<1 %	15cm	ER18-20	Austrodanthonia
Brunonia australis	+	<1 %	8cm	ER18-21	Brunonia australis
Dichopogon capillipes	+	<1 %	15cm		Dichopogon (amongst rocks)
Drosera aff. macrantha	+	<1 %	60cm	ER18-11	Drosera
Erodium botrys	+	<1 %	5-10cm	ER18-19	Pelargonium
Genus sp.	+	<1 %	12cm	ER18-15	Daisy
Gilberta tenuifolia	+	<1 %	10cm	ER18-9	'Myriocephalus'
Linum trigynum	+	<1 %	10cm		Linum
Lobelia sp. small flowers (K.F. Kenneally 7705)	+	<1 %	15cm	ER18-16	Lobelia
Podotheca angustifolia	+	<1 %	10cm	ER18-18	Podotheca
Stypandra glauca	+	<1 %	25cm	=ER15	Stypandra
Thysanotus dichotomus	+	<1 %	25cm	ER18-10	?Corynotheca
Trifolium hirtum	+	<1 %	7cm	ER18-13	Clover (red)

Moora Site ERG019

Described by BRM **Date** 4/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near south end of Eastern Ridge.

MGA Zone 50 **408027 m E** **6622852 m N** **-30.523047 S lat** **116.04135 E long**

Habitat: Narrow convex ridge top, sloping gently southward. Defined by small area of *Lepidosperma* (19-1) - apparently a natural soak.

Soil: Rocky, cobbly, pebbly brown sandy loam.

Vegetation: *Xanthorrhoea drummondii* open shrubland over *Lepidosperma pubisquamum* sedgeland with *Podolepis* sp., *Thysanotus manglesianus*, *Stypandra glauca* annual herbland with **Avena barbata*, **Aira caryophyllea* open annual grassland.

Vegetation condition: Very good. Some weeds.

Notes: Datum: WGS84. Track running east-west 5m south of plot (10x10) boundary. Area of 30x30 area search limited to small areas with *Lepidosperma pubisquamum* surrounding 10x10 plot.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	1	<1 %	1.3m		
<i>Aira caryophyllea</i>	30-40	25-33.3%	10cm	ER19-2	<i>Pentaschistis</i> (thick cover) juvenile
<i>Allocasuarina huegeliana</i>	+	<1 %	30cm		
<i>Anagallis arvensis</i>	+	<1 %	5cm	ER19-22	
<i>Arctotheca calendula</i>	+	<1 %	10cm		Capeweed
<i>Austrodanthonia setacea</i>	+	<1 %	25cm	=ER17-12	<i>Austrodanthonia</i>
<i>Austrostipa elegantissima</i>	1	<1 %	35cm	ER19-3	<i>Austrostipa</i> ? <i>elegantissima</i>
<i>Austrostipa nitida</i>	+	<1 %	40cm	ER19-24	<i>Austrostipa</i> #3
<i>Austrostipa variabilis</i>	+	<1 %		ER19-13	<i>Austrostipa</i> #2
<i>Avena barbata</i>	3-4	1-5%	1.2m		
<i>Blennospora drummondii</i>	+	<1 %	5cm	=ER17-23	? <i>Blennospora</i>
<i>Boronia coerulescens</i> subsp. <i>spinescens</i>	+	<1 %	35cm	ER19-5	<i>Boronia</i> ? <i>coerulescens</i>
<i>Briza maxima</i>	+	<1 %	40cm		
<i>Bromus diandrus</i>	+	<1 %	20cm	ER19-8	? <i>Bromus</i>
<i>Burchardia umbellata</i>	+	<1 %	40cm		
<i>Calotis hispidula</i>	+	<1 %	5cm	ER19-17	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	12cm	ER19-50	Revisit. Lilly
<i>Cheilanthes adiantoides</i>	1-2	1-5%	15cm	=ER15-10	<i>Cheilanthes</i>
<i>Comesperma integerrimum</i>	+	<1 %	60cm	ER19-12	(=ERG15-3) <i>Comesperma</i>
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %		=ER17	<i>Crassula</i>
<i>Cyanicula deformis</i>	+	<1 %	12cm	=ER17-51	Revisit. Blue beard orchid
<i>Daucus glochidiatus</i>	+	<1 %	15cm	=ER17-10	<i>Trachymene</i>
<i>Dichopogon capillipes</i>	+	<1 %		ER19-14	<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	+	<1 %	10cm	=ER15-1	
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	ER19-54	Revisit. <i>Diuris</i> orchid
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	35cm	ER19-51B	Revisit. Climbing
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	ER19-4,51	<i>Drosera micrantha</i>
<i>Ehrharta longiflora</i>	+	<1 %	35cm		
<i>Erodium botrys</i>	+	<1 %	20cm	=ER17-32	? <i>Pelargonium</i> pink flower
<i>Erodium cymnorum</i>	+	<1 %	10cm	ER19-23	Blue flower

<i>Galium murale</i>	+	<1 %	3cm	ER19-18	
Genus sp.	+	<1 %	3cm	ER19-16	Grass
<i>Gilberta tenuifolia</i>	+	<1 %	20cm	=ER17-3	Daisy (hanging heads)
<i>Gonocarpus nodulosus</i>	+	<1 %	20cm	ER19-21, 2	Also recorded in 30x30.
<i>Goodenia berardiana</i>	+	<1 %	30cm	=ER17-6	Goodenia
<i>Hypochaeris glabra</i>	+	<1 %	30cm	ER19-9	?Sonchus
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER17-58	Revisit.
<i>Lepidosperma pubisquameum</i>	50	50-75%	50cm	ER19-1	Vouchered. Possibly L. aff. <i>pubisquameum</i> .
<i>Neurachne alopecuroidea</i>	+	<1 %	15cm	=ER17-1	Neurachne
<i>Parentucellia latifolia</i>	+	<1 %	10cm	=ER17-16	*Parentucellia
<i>Pentaschistis</i> sp. Moora (doubtful ID)	+	<1 %	15cm	ER19-7	?Vulpia
<i>Petrorhagia prolifera</i>	+	<1 %	35cm	=ER17-34	?Wahlenbergia (single head, pink)
<i>Phyllangium sulcatum</i>	+	<1 %	5cm	ER19-20	
<i>Platysace cirrosa</i>	+	<1 %	20cm	ER19-6,15	Daisy
<i>Podolepis lessonii</i>	30-40	25-33.3%	25cm	=ER15-13	Podolepis
<i>Romulea rosea</i>	+	<1 %	20cm	=ER17-22	*Romulea rosea
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	35cm	ER19-10	Silene
<i>Sonchus oleraceus</i>	+	<1 %	35cm	ER19-19	
<i>Sowerbaea laxiflora</i>	+	<1 %	20cm		
<i>Stypandra glauca</i>	1	<1 %	30cm	=ER15-4	
<i>Thysanotus manglesianus</i>	+	<1 %	40cm	ER19-55	Revisit. Climbing (+ =ER17-53)
<i>Trachymene ornata</i>	2	1-5%	15cm	=ER15-6	Trachymene white tops
<i>Tripteris clandestina</i>	+	<1 %	25cm	ER19-52	Revisit. Stink daisy
<i>Ursinia anthemoides</i>	+	<1 %	15cm		
<i>Wahlenbergia capensis</i>	+	<1 %	20cm	ER19-11	Wahlenbergia capensis (Blue flower)
<i>Xanthorrhoea drummondii</i>	4%	1-5%	1.3-2m		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	15cm	ER19-56	Revisit.
<i>Waitzia nitida</i>	+	<1 %	15cm	=ER15-8	Waitzia high centre

Moora Site ERG020

Described by MET **Date** 4/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Southern end of Eastern Ridge on east side about 150m NW of buildings.

MGA Zone 50 **408063 m E** **6622661 m N** **-30.524773 S lat** **116.041708 E long**

Habitat: Upper eastern-facing slope of a low ridge.

Soil: Brown sandy loam amongst cobbles, boulders and low outcrop (massive chert underlying).

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris* open high shrubland to high shrubland over *Lepidosperma* (ERG20-1)

tussock sedgeland over *Cheilanthes adiantoides* low open ferns with *Podolepis lessonii*, **Ursinia*

anthemoides, **Briza maxima* annual herbland/grassland and *Dioscorea hastifolia* open lianes

Vegetation condition: Good to very good. A bit weedy for very good (in a wet year, the weeds would be more obvious).

Notes: Datum: WGS84. First coordinate is SW peg; 2nd NW peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	5-10%	5-10%	2-3m		
<i>Allocasuarina huegeliana</i>	+/-10%	5-10%	6-7m		
<i>Arctotheca calendula</i>	+	<1 %	5cm		
<i>Austrodanthonia caespitosa</i>	+	<1 %	20cm	ER20-5	Austrodanthonia
<i>Austrostipa hemipogon</i>	+	<1 %	25cm	ER20-12	Austrostipa
<i>Austrostipa trichophylla</i>	+	<1 %	10cm	ER20-7	Austrostipa
<i>Avena barbata</i>	+	<1 %	15cm		<i>Avena fatua</i>
<i>Boronia coerulescens</i> subsp. <i>spinescens</i>	+	<1 %	55cm	ER20-16,5	Boronia
<i>Briza maxima</i>	5	5-10%	10-20cm		
<i>Bromus diandrus</i>	+	<1 %	10cm	=ER16	Bromus
<i>Brunonia australis</i>	+	<1 %	8cm		
<i>Burchardia umbellata</i>	+	<1 %	20cm	=ER16	Burchardia
<i>Caesia alfordii</i>	+	<1 %	30cm	ER20-10	Lilly
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	10cm	=JT8-55	Revisit. Orchid
<i>Calandrinia</i> sp.	+	<1 %	5cm	ER20-15	Calandrinia
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	25cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	>5	5-10%	10-25cm		<i>Cheilanthes</i> (locally)

Comesperma integerrimum	+	<1 %	60cm	ER20-14	common) Comesperma
Cyanicula deformis	+	<1 %	12cm	=ER17-51	Revisit. Blue beard orchid
Desmocladius flexuosus	+	<1 %	15cm	ER20-51	Revisit.
Dichopogon capillipes	+	<1 %	10-20cm		Dichopogon
Dioscorea hastifolia	5-10	5-10%	10-130cm		
Drosera macrantha subsp. macrantha	+	<1 %	25cm	ER20-4	Drosera
Drosera sp.	+	<1 %	20cm	ER20-8	Drosera trailing on the ground
Ehrharta longiflora	+	<1 %	20cm		
Eriochilus dilatatus	+	<1 %	20cm	ER20-52	Revisit.
Goodenia berardiana	+	<1 %	10cm	ER20-6	Also recorded in 30x30. Goodenia ann. herb Juvenile
Hibbertia subvaginata	+	<1 %	10cm		
Hypochaeris glabra	+	<1 %	2cm		
Lepidosperma aff. leptostachyum (Moor: ERG18-7)	+	<1 %	60cm	ER20-18	Lepidosperma
Lepidosperma sp.	5-10	5-10%	35-55cm	ER20-1	Lepidosperma
Lomandra aff. micrantha subsp. micrantha	+	<1 %	30cm	ER20-13	Lomandra
Neurachne alopecuroidea	2	1-5%	10cm	=ER16	Neurachne
Opercularia vaginata	+	<1 %	15-25cm	ER20-3	Opercularia
Parentucellia latifolia	+	<1 %	10cm		Parentucellia
Pentaschistis airoides	+	<1 %	10cm	=ER16-8	?Aira
Phyllangium sulcatum	+	<1 %	5-12cm	ER20-2	"Mitrasceme"
Platysace cirrosa	+	<1 %	15cm	=ER16-9	?Trachymene
Podolepis lessonii	2	1-5%	10-20cm		Podolepis lessonii
Podotheca angustifolia	+	<1 %	10cm	Not=ER18-	Podotheca
Sowerbaea laxiflora	+	<1 %	20cm		
Stypandra glauca	+	<1 %	30cm		Stypandra
Thysanotus manglesianus	+	<1 %	170cm	ER20-9	Thysanotus ?manglesii
Thysanotus sp.	+	<1 %	15cm		Thysanotus manglesii (flowering)
Trachymene cyanopetala	+	<1 %	5cm	=ER16-21	Trachymene
Trachymene ornata	+	<1 %	10cm		
Tricoryne elatior	+	<1 %	25cm	ER20-11	Tricoryne
Ursinia anthemoides	2	1-5%	10-25cm		
Acacia acuminata subsp. acuminata	+	<1 %	5-6m		
Acacia lasiocarpa var. sedifolia	+	<1 %	1.3m	ER20-17,5	Acacia aff. pulchella
Austrostipa elegantissima	+	<1 %	60cm		Austrostipa elegantissima
Dianella revoluta var. divaricata	+	<1 %	50cm		Dianella revoluta
Erodium botrys	+	<1 %	10cm	=ER18-19	Erodium
Eucalyptus loxophleba subsp. loxophleba	+	<1 %			
Gilberta tenuifolia	+	<1 %	8-15cm	=ER18-9	"Myriocephalus"
Hypoxis occidentalis var. occidentalis	+	<1 %	20cm	=ER17-58	Revisit.
Lawrencella rosea	+	<1 %	15cm	ER20-54	Revisit. Daisy
Lupinus angustifolius	+	<1 %	15cm		Blue lupin
Pityrodia dilatata	+	<1 %	20cm		Revisit. (common)
Revisit. (common)					
Podolepis canescens	+	<1 %	15cm	ER20-19	Podolepis
Pterostylis sanguinea	+	<1 %	1cm	=CH10-51	Revisit. Flat leaf
Romulea rosea	+	<1 %	10cm		
Tripteris clandestina	+	<1 %	20cm	=JT3-50	Revisit. Stink daisy
Xanthorrhoea drummondii	+	<1 %	70cm		

Moor**Site** ERG021**Described by** BRM **Date** 4/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** Small ridge just west of north end of Eastern Ridge.**MGA Zone** 50 **407640 m E** **6624567 m N** **-30.507543 S lat** 116.037469 **E long****Habitat:** Low ridge crest and edge of crest with very gentle east facing slope.**Soil:** Skeletal brown sandy loam in a matrix of rocky, cobbly chert with exposed chert outcrop.**Rock Type:** Chert

Vegetation: Kunzea praestans high shrubland over Hibbertia subvaginata shrubland over Stypandra glauca very open herbland over Cheilanthes adiantoides very open fernland with Dioscorea hastifolia open

Vegetation condition: Very good (a few weeds).

Notes: Datum: WGS84. 1st coord listed for NW peg; 2nd coord for SE peg. Open sample pit 20m to north. Very small area of this vegetation community. : "30x30" search restricted to small area around 10x10 plot with same community.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	1.3m		
Acacia aristulata	+	<1 %	15cm	ER21-10	Acacia aristulata
Allocasuarina huegeliana	+	<1 %	4m		
Avena barbata	+	<1 %	25cm		
Briza maxima	+	<1 %	20cm		
Burchardia umbellata	+	<1 %	40cm		Burchardia
Caladenia flava subsp. flava	+	<1 %	20cm	ER21-4	Orchid
Chamaescilla corymbosa var. corymbosa	+	<1 %	12cm	=ER19-50	Revisit.
Cheilanthes adiantoides	+	<1 %	15cm	ER21-SN	Also recorded in 30x30.
Crassula exserta	+	<1 %	5cm	=ER15-5A	Crassula
Cyanicula deformis	+	<1 %	10cm	=ER17-51	Revisit. Blue beard orchid
Daucus glochidiatus	+	<1 %	4cm	ER21-9	Trachymene
Dichopogon capillipes	+/-1	<1 %	20cm	ER21-5	Dichopogon
Dioscorea hastifolia	2-3	1-5%	60cm		
Drosera macrantha subsp. macrantha	+	<1 %	20cm	ER21-7,52	Drosera
Ehrharta longiflora	+	<1 %	20cm		
Hibbertia subvaginata	20-30%	25-33.3%		ER21-2	Hibbertia subvaginata
Hypochaeris glabra	+	<1 %	2cm		Revisit.
Hypoxis occidentalis var. occidentalis	+	<1 %	12cm	=ER17-58	Revisit.
Kunzea praestans	20-30%	25-33.3%	2-2.5m	ER21-1	Kunzea praestans
Lepidosperma leptostachyum	+	<1 %	30cm	ER21-3	Lepidosperma
Neurachne lepecuroidea	+	<1 %	20cm	=ER17-1	Neurachne
Pentaschistis pallida	+	<1 %	15cm	ER21-6	*Pentaschistis
Pterostylis sanguinea	+	<1 %	20cm	ER21-50	Revisit.
Pterostylis setulosa	+	<1 %	10cm	ER21-53	Revisit. Flat leaf
Stypandra glauca	1-2	1-5%	20cm	=ER15-4	Stypandra glauca
Trachymene ornata	+	<1 %	10cm	=ER15-6	Trachymene white head
Trachymene pilosa	+	<1 %	4cm	ER21-8	Trachymene ?pilosa
Ursinia anthemoides	+	<1 %	10cm		
Vulpia myuros var. hirsuta	+	<1 %		ER21-11	
Allocasuarina campestris	+	<1 %	1.9m		Revisit.
Diuris aff. recurva	+	<1 %	20cm	=JT7-58	Revisit. Orchid

Moora Site ERG022

Described by MET **Date** 4/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Eastern ridge, in the section cut off from the rest of the ridge by the farm track to Kiaka Rd. 50m ENE of old test pits.

MGA Zone 50 **407637 m E** **6624651 m N** **-30.506785 S lat** **116.037445 E long**

Habitat: Gentle detrital (colluvial) slope NW-facing, just below areas of outcrop (boulders and outcrop).

Soil: Very gravelly to cobbly grey brown silty sand with a thin litter layer in places. Mostly gravel surface.

Vegetation: Eucalyptus loxophleba subsp. loxophleba low woodland over Allocasuarina campestris scattered tall shrubs over Brunonia australis, Podolepis lessonii, Waitzia sp. annual herbland.

Vegetation condition: Good to very good. Close to very good, but a little weedy for that (although season not a good one).

Notes: Datum: WGS84. Only a very small area remains undisturbed (a few times the area of the quadrat).

Downslope there was more of the Podolepis and less of the Brunonia. An extremely rare remnant of the colluvial slopes of the chert floristic community type.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	15 cm		juvenile
Aira caryophyllea	>2%	1-5%	5-10 cm	ER22-5	*Aira
Arctotheca calendula	+	<1 %	10 cm		
Austrodanthonia setacea	+	<1 %	5 cm	ER22-15	Austrodanthonia
Austrostipa trichophylla	+/-1	<1 %	5 cm	ER22-7	Austrostipa

<i>Avena barbata</i>	+	<1 %	10-15 cm		
<i>Briza maxima</i>	+	<1 %	10-30 cm		
<i>Brunonia australis</i>	<=15%	10-25%	5-20 cm	ER22-1	<i>Brunonia australis</i>
<i>Caladenia denticulata</i>	+	<1 %	12 cm	=JT6-56	Revisit ?Orchid
<i>Calandrinia calyptrata</i>	+	<1 %	3-5 cm	ER22-8	<i>Crassula</i>
<i>Calandrinia</i> sp.	+	<1 %	2 cm	ER22-50	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15 cm	=JT5-55	Revisit. Lilly
<i>Cheilanthes adiantoides</i>	<5%	1-5%	10 cm		<i>Cheilanthes</i> (locally common)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	5 cm	ER22-10	<i>Crassula</i>
<i>Daucus glochidiatus</i>	+	<1 %	10 cm	ER22-12	<i>Trachymene</i>
<i>Dichopogon capillipes</i>	+	<1 %	10 cm	ER22-17	<i>Dichopogon</i> ?
<i>Dioscorea hastifolia</i>	+	<1 %	10-60 cm		
<i>Ehrharta longiflora</i>	+	<1 %	10-40 cm		
<i>Erodium botrys</i>	+	<1 %	8 cm	ER22-11	<i>Erodium</i>
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	>10%	10-25%	7 m		
<i>Gilberta tenuifolia</i>	+	<1 %	8 cm	=ER18-9	" <i>Myriocephalus</i> "
<i>Hibbertia subvaginata</i>	+	<1 %	80 cm		
<i>Hypochaeris glabra</i>	+	<1 %	3 cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	10 cm	ER22-16	<i>Hypoxis</i> ?
<i>Neurachne alopecuroidea</i>	+	<1 %	7 cm	=ER16	<i>Neurachne</i>
<i>Opercularia vaginata</i>	+	<1 %	10 cm	=ER20	<i>Opercularia</i>
<i>Parentucellia latifolia</i>	+	<1 %	5-8 cm		* <i>Parentucellia</i>
<i>Pentaschistis</i> sp.	+	<1 %	8 cm	ER22-4	* <i>Grass</i>
<i>Podolepis lessonii</i>	2	1-5%	5-20 cm		<i>Podolepis lessonii</i> ? (flower button)
<i>Podotheca angustifolia</i>	+	<1 %	5 cm	=ER18	<i>Podotheca</i>
<i>Poranthera microphylla</i>	+	<1 %	1-4 cm	ER22-3	<i>Monotaxis</i>
<i>Schoenus clandestinus</i>	+	<1 %	5 cm	ER22-9,52	<i>Schoenus</i>
<i>Thysanotus manglesianus</i> ER22-18,20. Revisit.	+	<1 %	15 cm	ER22-51	Also recorded in 30x30;
<i>Trachymene ornata</i>	+	<1 %	10 cm		
<i>Ursinia anthemoides</i>	+	<1 %	10-25 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15 cm	ER22-6,14	? <i>Vulpia</i>
<i>Wahlenbergia gracilentia</i>	+	<1 %	10 cm	ER22-13	<i>Wahlenbergia</i>
<i>Waitzia nitida</i>	+	<1 %	10-20 cm	ER22-2	<i>Waitzia</i>
<i>Allocasuarina campestris</i>	+	<1 %	3 m		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	10 cm	ER22-53	Revisit. ? <i>revoluta</i> (juv)
<i>Pterostylis sanguinea</i>	+	<1 %	2 cm	=CH10-51	Revisit. Flat leaf base (leaves 2-3 cm long)
<i>Thysanotus patersonii</i>	+	<1 %	70 cm	ER22-19	<i>Thysanotus manglesii</i>
<i>Tripteris clandestina</i>	+	<1 %	12 cm	=JT3-50	Revisit. Stink daisy

Moora Site ERG023

Described by BRM **Date** 4/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: North end of small ridge adjacent to northern end of Eastern Ridge.

MGA Zone 50 **407584 m E** **6624653 m N** **-30.506763 S lat** **116.036893 E long**

Habitat: Mid to upper gentle slope, north-facing, on low ridge.

Soil: Skeletal brown sandy loam in pebbly, cobbly, rocky, bouldery matrix.

Vegetation: *Eucalyptus loxophleba* subsp. *loxophleba* low scattered trees over *Schoenia cassiniana*, *Brunonia australis* annual herbland.

Vegetation condition: Very good: no disturbance and few weeds. (Note: drill point 5m NW of plot)

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord for SE peg.

Revisit. Limited 30x30 search *Eucalyptus leucophloia* areas. Didn't include *Allocasuarina campestris* areas.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	20cm		
<i>Allocasuarina huegeliana</i>	+	<1 %	90cm		
<i>Arctotheca calendula</i>	+	<1 %	5cm		
<i>Austrodanthonia caespitosa</i>	+	<1 %	20cm	ER23-5	<i>Austrodanthonia</i> hairy base
<i>Austrodanthonia setacea</i>	+	<1 %	30cm	=ER17-12	<i>Austrodanthonia</i>
<i>Austrostipa variabilis</i>	+	<1 %		ER23-3,10	Also recorded in 30x30.
<i>Avena barbata</i>	+	<1 %	30cm		

<i>Briza maxima</i>	+	<1 %	20cm		
<i>Brunonia australis</i>	2-5	1-5%	20cm	ER23-2	<i>Brunonia australis</i>
<i>Caesia alfordii</i>	+	<1 %	30cm	ER23-9,53	
<i>Caladenia denticulata</i>	+	<1 %	15cm	=JT6-56	Revisit. ?
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15cm	=JT5-55	(=GH9-52) Lilly
<i>Cheilanthes adiantoides</i>	1-2	1-5%	15cm	=ER15-10	<i>Cheilanthes</i>
<i>Daucus glochidiatus</i>	+	<1 %	30cm	ER23-7	<i>Trachymene</i>
<i>Dichopogon capillipes</i>	+	<1 %	15cm	ER23-51	Revisit. Flat
<i>Dioscorea hastifolia</i>	+	<1 %	10cm		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20cm	ER23-52	Revisit. Climbing
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	10-15%	10-25%	8m		
<i>Gilberta tenuifolia</i>	2-3	1-5%	15cm	=ER17-3	?Gilberta
<i>Goodenia berardiana</i>	+	<1 %	2cm	=ER17-6	<i>Goodenia</i>
<i>Hibbertia subvaginata</i>	+	<1 %	70cm		
<i>Hypochaeris glabra</i>	+	<1 %	15cm	ER23-6	? <i>Sonchus</i>
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=JT2	Revisit.
<i>Kennedia prostrata</i>	+	<1 %	10cm		creeping
<i>Linum trigynum</i>	+	<1 %	20cm	ER23-4	<i>Dichopogon</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	30cm	=ER17-1	<i>Neurachne</i>
<i>Parentucellia latifolia</i>	+	<1 %	10cm		* <i>Parentucellia</i>
<i>Podolepis lessonii</i>	3-5	1-5%		=ER15-13	<i>Podolepis</i>
<i>Schoenia cassiniana</i>	15-20	10-25%	30cm	ER23-1,55	<i>Lawrencella</i>
<i>Stypandra glauca</i>	+	<1 %	20cm		
<i>Thysanotus manglesianus</i>	+	<1 %	25cm	ER23-50,5	Also recorded in 30x30. Revisit. Upright
<i>Trachymene cyanopetala</i>	+	<1 %	10cm	=ER21-9	<i>Trachymene</i> (hairy head)
<i>Trachymene ornata</i>	+	<1 %	10cm	=ER15-6	<i>Trachymene</i> (white top)
<i>Ursinia anthemoides</i>	+	<1 %	15cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	20cm	ER23-8	Grass
<i>Waitzia nitida</i>	1-2	1-5%		=ER15-8	<i>Waitzia</i>
<i>Borya sphaerocephala</i>	+	<1 %	10cm		<i>Borya</i>
<i>Ehrharta longiflora</i>	+	<1 %	30cm		
<i>Lepidosperma costale</i>	+	<1 %	35cm	ER23-11	<i>Lepidosperma</i>

GARDINER'S HILL

Moora

Site GH001

Described by BRM Date 25/10/02 Type: QUADRAT 10x10 m, 30x30

Location: Philip and Jenny Gardiner's block, east side near bore and tank.

MGA Zone 50 408826 m E 6617782 m N -30.568852 S lat 116.049231 E long

Habitat: South to south-east facing gentle slope of low ridge, upper slope.

Soil: Gravelly brown sand in rocky matrix.

Rock Type: Chert.

Vegetation: *Allocasuarina huegeliana* low open forest over *Dryandra sessilis* open scrub over *Kunzea praestans* open shrubland over *Calytrix leschenaultia*, *Hibbertia subvaginata* low open shrubland over *Desmocladius flexuosus* very open sedgeland.

Vegetation condition: Very good to excellent (a few weeds).

Fire age: Not burnt for more than 20 years.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg.

30x30 search area was limited on the south side by a change in veg community.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	15 cm		
<i>Allocasuarina huegeliana</i>	40-50%	33.3-50%	6m		
<i>Anagallis arvensis</i>	+	<1 %	3 cm	GH1-14	<i>Anagallis</i>
<i>Austrodanthonia acerosa</i>	+	<1 %	15cm	GH1-8	
<i>Austrostipa hemipogon</i>	+	<1 %		GH1-21	
<i>Austrostipa scabra</i>	+	<1 %	40 cm	GH1-12	twisty
<i>Austrostipa variabilis</i>	+	<1 %	30cm	GH1-6	
<i>Blennospora drummondii</i>	+	<1 %	4cm		<i>Blennospora</i>
<i>Borya sphaerocephala</i>	+	<1 %	3 cm		<i>Borya</i>
<i>Briza maxima</i>	+	<1 %	15cm		
<i>Calandrinia calypttrata</i>	+	<1 %	20 cm	GH1-13	
<i>Calothamnus sanguineus</i>	1	<1 %	1.3m	GH1-1	<i>Calothamnus</i>

<i>Calytrix leschenaultii</i>	2-3	1-5%	90cm		?sanguineus purple
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20cm	GH1-2	Chamaescilla
<i>Comesperma integerrimum</i>	+	<1 %	45 cm	GH1-15	
<i>Desmocladius flexuosus</i>	5	5-10%	20cm		
<i>Dichopogon capillipes</i>	+	<1 %	15 cm	GH1-51	Revisit. Lilly
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30 cm	GH1-11,57	Also recorded in 30x30.
<i>Dryandra sessilis</i> var. <i>sessilis</i>	40%	33.3-50%	3-3.5m		<i>Dryandra sessilis</i>
<i>Eriochilus helonomos</i>	+	<1 %	15 cm	=CH14-61	Revisit. Orchid
<i>Hibbertia subvaginata</i>	1-2	1-5%	70cm		
<i>Hyalosperma cotula</i>	+	<1 %	10cm	GH1-5	White daisy
<i>Kunzea praestans</i>	3	1-5%	1.8m		
<i>Neurachne alopecuroidea</i>	+	<1 %	25 cm	GH1-16	
<i>Podolepis canescens</i>	+	<1 %	15cm	GH1-7	Yellow daisy
<i>Podotheca angustifolia</i>	+	<1 %	5cm	GH1-4	Podotheca
<i>Pterostylis sanguinea</i>	+	<1 %	15 cm	=GH1-50	Revisit.
<i>Pterostylis setulosa</i>	+	<1 %	15cm	GH1-3	Orchid (lge leaf base)
<i>Stylidium cordifolium</i>	+	<1 %	30 cm	GH1-10,52	Stylidium #2
<i>Stylidium repens</i>	+	<1 %	10 cm	GH1-9	Stylidium ?repens
<i>Trachymene pilosa</i>	+	<1 %	10 cm		short hairs
<i>Urospermum picroides</i>	+	<1 %	15cm	=CH11-10	
<i>Ursinia anthemoides</i>	+/-1	<1 %	20cm		
<i>Arctotheca calendula</i>	+	<1 %	12 cm		Revisit. Cape weed
<i>Astroloma serratifolium</i>	+	<1 %	15 cm	GH1-55	Revisit.
<i>Avena barbata</i>	+	<1 %	40 cm		
<i>Bromus diandrus</i>	+	<1 %	20 cm		Bromus
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12 cm	GH1-53	Revisit. Orchid
<i>Cheilanthes adiantoides</i>	+	<1 %	6 cm		Revisit.
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30 cm	=CH11-58	Revisit.
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1 cm	GH1-56	Revisit. Flat leaf. Eryth.
<i>Isopogon divergens</i>	+	<1 %	1.6 m	=CH17-2	Isopogon
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moor: ERG18-7)	+	<1 %	35 cm	GH1-18	
<i>Melaleuca calyptroides</i>	+	<1 %	40 cm	=CH17-1	Melaleuca ?calyptroides
<i>Nemcia acuta</i>	+	<1 %	30 cm	GH1-19	
<i>Opercularia vaginata</i>	+	<1 %	20 cm	=CH17-10	Opercularia
<i>Podolepis lessonii</i>	+	<1 %	4 cm	GH1-54	Revisit. ?Daisy
<i>Stackhousia monogyna</i>	+	<1 %	35 cm	GH1-17	Stackhousia sp.
<i>Thysanotus manglesianus</i>	+	<1 %	1.1 m	=CH11-8	
<i>Tripterococcus brunonis</i>	+	<1 %	35 cm	GH1-20	Tripterococcus

Moor Site GH002

Described by MET **Date** 25/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Gardener property west of tank.

MGA Zone 50 **408760 m E** 6617842 **m N** -30.568306 **S lat** 116.048548 **E long**

Habitat: West-facing gentle upper slope of a low ridge.

Soil: Gravelly, pebbly grey silty sand with outcropping chert.

Rock Type: Chert.

Vegetation: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* tall open shrubland to tall shrubland over *Melaleuca calyptroides* open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Borya sphaerocephala* low open herbland and *Podolepis canescens*, **Ursinia anthemoides* scattered annual herbs.

Vegetation condition: Good to very good, closer to very good. Weed invasion quite low, has been grazed. Fenced-off

about 3 years ago.

Notes: Datum: WGS84. 1st coord is for SE peg; 2nd coord is for NW peg.

30x30: Only 5m north and 20m south searched. Rest was different veg community.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30cm		SW corner
<i>Allocasuarina huegeliana</i>	4%	1-5%	4m		
<i>Amphipogon caricinus</i>	+	<1 %	5cm	GH2-8A	
<i>Anagallis arvensis</i>	+	<1 %	8cm		blue
<i>Austrostipa elegantissima</i>	+	<1 %	30cm		
<i>Austrostipa macalpinei</i>	+	<1 %	5cm	GH2-5	

<i>Austrostipa trichophylla</i>	+	<1 %	6cm	GH2-6	
<i>Blennospora drummondii</i>	+	<1 %	5cm	GH2-3	Daisy
<i>Borya sphaerocephala</i>	5-10%	5-10%	5cm		Borya
<i>Caladenia</i> sp.	+	<1 %	10cm		dead
<i>Calandrinia calyptrata</i>	+	<1 %	5-8cm	GH2-16	
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	1%	1-5%	1.8m		
<i>Calytrix leschenaultii</i>	3	1-5%	90cm		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10 cm	=CH12-52	Revisit. Lilly
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2-4cm		
<i>Crassula exserta</i>	+	<1 %	5-7cm	GH2-15	
<i>Desmocladus flexuosus</i>	+	<1 %	5cm		Desmocladus
<i>Dichopogon capillipes</i>	+	<1 %	25 cm	GH2-50	Revisit. (=CH10-52)
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1 cm	=GH1-56	Revisit. Flat leaf
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	35cm	GH2-13,52	
<i>Gilberta tenuifolia</i>	+	<1 %	10cm	GH2-10	Daisy
<i>Hyalosperma cotula</i>	1	<1 %	5-8cm	GH2-2	
<i>Hypochoeris glabra</i>	+	<1 %	2cm		
<i>Kunzea praestans</i>	5	5-10%	2.3m		
<i>Melaleuca calyptroides</i>	8-10%	5-10%	1-1.5m		
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	5cm	GH2-14	
<i>Neurachne alopecuroidea</i>	1	<1 %	5cm	GH2-11	
<i>Parentucellia latifolia</i>	+	<1 %	12cm	GH2-7	Scrophulariaceae
<i>Pentaschistis pallida</i>	+	<1 %	5-10cm	GH2-9	
<i>Podolepis canescens</i>	1	<1 %	5-20cm	GH2-1,53	
<i>Podotheca angustifolia</i>	+	<1 %	5cm	GH2-4,54	Podotheca
<i>Pterostylis sanguinea</i>	+	<1 %	10 cm	=CH10-51	Revisit. Flat leaf
<i>Regelia megacephala</i>	25-30%	25-33.3%	2-3m		
<i>Stackhousia monogyna</i>	+	<1 %	30cm	GH2-12	
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	GH2-17	Thysanotus patersonii
<i>Trachymene cyanopetala</i>	+	<1 %	5cm		Trachymene: not
<i>Trachymene ornata</i>	+	<1 %	5cm		ornata or pilosa
<i>Tripterococcus brunonis</i>	+	<1 %	30cm	=GH1	
<i>Ursinia anthemoides</i>	1	<1 %	5-10cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10cm		
<i>Xanthorrhoea drummondii</i>	<=5	1-5%	1.5-1.9m		
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	30 cm	=CH10-56	Revisit. Orchid
<i>Cyanicula deformis</i>	+	<1 %	20 cm	=CH12-57	Revisit. Orchid
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	35 cm	GH2-51	Revisit.
<i>Isopogon divergens</i>	+	<1 %	1.3m		
<i>Nemcia acuta</i>	+	<1 %	15cm(juv)		

Moora Site GH003

Described by BRM **Date** 31/10/03 **Type:** QUADRAT 10x10 m, 30x30

Location: Near eastern boundary of Gordon's block.

MGA Zone 50 **408709 m E** **6617635 m N** **-30.57017 S lat** **116.047998 E long**

Habitat: Gentle mid to upper slope, south-west facing at southern end of chert ridge.

Soil: Cobbly, pebbly, gravelly fine grey sand.

Rock Type: Chert

Vegetation: *Regelia megacephala* open scrub over *Kunzea praestans*, *Melaleuca calyptroides* shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs over *Borya sphaerocephala*, *Neurachne alopecuroidea* very open low herbland/grassland with *Podolepis lessonii* very open annual herbland.

Vegetation condition: Good to very good. Some weeds and evidence of grazing effects (fairly open in places).

Fire age: Not burnt for more than 7 years.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg.

This area of *Regelia* ids fairly variable with more open patches dominated by *Kunzea* and *Melaleuca*.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %			
<i>Anagallis arvensis</i>	+	<1 %	10cm		Anagallis
<i>Astroloma serratifolium</i>	+	<1 %	15cm	GH3-2,32	
<i>Austrostipa elegantissima</i>	+	<1 %	60cm	GH3-18	
<i>Austrostipa trichophylla</i>	+	<1 %	30cm	GH3-14	

<i>Austrostipa variabilis</i>	+	<1 %	35cm	GH3-15	Twisty
<i>Avena barbata</i>	+	<1 %	30cm		
<i>Borya sphaerocephala</i>	5	5-10%	5m		Borya
<i>Briza maxima</i>	+	<1 %	15cm		
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15cm	GH3-9	Orchid
<i>Calytrix leschenaultii</i>	1	<1 %	1m		purple
<i>Cassytha pomiformis</i>	+	<1 %	50cm	=CH17-5	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20cm	=GH1-2	
<i>Cyanicula deformis</i>	+	<1 %	12cm	=CH12-57	Revisit. Blue orchid
<i>Desmocladius flexuosus</i>	+	<1 %	15cm		
<i>Dichopogon capillipes</i>	+	<1 %	25cm	GH3-16	Dichopogon
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	25cm	=GH2-5?	Revisit.
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	45cm	=CH11-50	Revisit. Climbing
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	35cm	GH3-19,50	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	3.5m		
<i>Ehrharta longiflora</i>	+	<1 %	20cm		
<i>Eriochilus helonomos</i>	+	<1 %	25cm1	=CH14-61	Revisit. Orchid
				1-leaf/stem	
<i>Hibbertia subvaginata</i>	1	<1 %	1m		
<i>Hyalosperma cotula</i>	+	<1 %	10cm	GH3-7	small white daisy
<i>Hypochaeris glabra</i>	+	<1 %	1cm		Revisit.
<i>Kunzea praestans</i>	5-6%	5-10%	1.5m		
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	35cm	GH3-20,27	
<i>Melaleuca calyptroides</i>	5-8%	5-10%	1.1m	=CH17-1	
<i>Millotia myosotidifolia</i>	+	<1 %	4cm	GH3-8	
<i>Neurachne alopecuroidea</i>	1	<1 %	15cm	GH3-21	
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	45cm	GH3-22	Olearia
<i>Opercularia vaginata</i>	+	<1 %	30cm	=CH17-10	
<i>Orthrosanthus laxus</i> var. <i>gramineus</i>	+	<1 %	30cm	GH3-24	Orthrosanthus
<i>Parentucellia latifolia</i>	+	<1 %	10cm	GH3-13	Parentucellia
<i>Pentaschistis pallida</i>	+	<1 %	10cm	GH3-4	
<i>Podolepis canescens</i>	2-3	1-5%	25cm	GH3-1,53	Yellow
<i>Podolepis lessonii</i>	+	<1 %	12cm	GH3-51	Revisit. ?Daisy
<i>Podotheca angustifolia</i>	+	<1 %	3cm	GH3-3	Podotheca
<i>Pterostylis sanguinea</i>	+	<1 %	25cm	GH3-11,50	Orchid
<i>Pterostylis sargentii</i>	+	<1 %	30cm	GH3-10	Orchid
<i>Regelia megacephala</i>	50%	50-75%	3-3.5m		
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	35cm	GH3-17,54	Silene
<i>Sonchus oleraceus</i>	+	<1 %	20cm	GH3-12	Sonchus
<i>Stackhousia monogyna</i>	+	<1 %	30cm	GH3-23,26	Stackhousia
<i>Stylidium miniatum</i>	+	<1 %	4cm	GH3-6	
<i>Stylidium repens</i>	+	<1 %	15cm	GH3-5	
<i>Thysanotus manglesianus</i>	+	<1 %	40cm	GH3-52	Also recorded in 30x30.
<i>Trachymene pilosa</i>	+	<1 %	4cm		
<i>Tripterococcus brunonis</i>	+	<1 %	30cm	GH3-25	Tripterococcus
<i>Urospermum picroides</i>	+	<1 %	10cm	=CH11-10	
<i>Ursinia anthemoides</i>	+	<1 %	30cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	6cm		Vulpia
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.3m		
<i>Allocasuarina huegeliana</i>	+	<1 %	1.2m		juvenile
<i>Burchardia umbellata</i>	+	<1 %	30cm		Burchardia
<i>Calothamnus sanguineus</i>	+	<1 %	35cm	GH3-31	Grazed
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	=GH1-56	Revisit. Flat
<i>Dryandra fraseri</i>	+	<1 %	35cm	GH3-29	Dryandra ?fraseri
<i>Goodenia hassallii</i>	+	<1 %	50cm	GH3-33	
<i>Lechenaultia biloba</i>	+	<1 %	35cm	GH3-28	
<i>Lepidosperma leptostachyum</i>	+	<1 %	35cm	GH3-30	

Moora Site GH004**Described by** MET **Date** 31/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** Gardiner property**MGA Zone** 50 **408519 m E** 6617661 **m N** -30.569921 **S lat** 116.046019 **E long****Habitat:** Fairly flat to gently sloping area on low part of a ridge.**Soil:** Very pebbly to gravelly light grey silty fine sand (light brown deeper) amongst cobbles and boulders.

(Possibly some is outcrop).

Vegetation: Allocasuarina huegeliana (Acacia acuminata) low woodland over Kunzea praestans, Xanthorrhoea drummondii high open shrubland to high shrubland over Melaleuca calyptroides low open shrubland over Opercularia vaginata herbland and low annual herbland/grassland.

Vegetation condition: Good to very good. Some grazing damage (now fenced-off). Low-moderate weeds, mostly Briza

and other small species.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg.

30x30 search kept away from Allocasuarina huegeliana stand on NW side.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia lasiocarpa var. sedifolia	+	<1 %	50cm	GH4-5	Typical. Field det = Acacia cf. pulchella
Agrostocrinum scabrum	<1	<1 %	55cm	GH4-3,52	
Allocasuarina campestris	1	<1 %	1m(3d)		
Allocasuarina huegeliana	15-20%	10-25%	5-7.5m		
Astroloma serratifolium	+	<1 %	5cm	GH4-19	
Austrodanthonia caespitosa	+	<1 %	3cm	GH4-17	
Austrodanthonia setacea	+	<1 %	8cm	GH4-12	
Austrostipa nitida	+	<1 %	10cm	GH4-20	
Avena barbata	+	<1 %	30cm		
Borya sphaerocephala	+	<1 %	4cm		Borya
Briza maxima	>1	1-5%	5-10cm		
Burchardia umbellata	+	<1 %	20cm		
Calytrix leschenaultii	2	1-5%	0.4-0.7m		purple
Chamaescilla corymbosa var. corymbosa	+	<1 %	3cm		dead
Cheilanthes adiantoides	1	<1 %	10cm		C. austrotenuifolia
Desmocladius flexuosus	5	5-10%	10cm	GH4-4	Desmocladius flexuosus??
Dichopogon capillipes	+	<1 %	5cm	GH4-8	Lilly Dichopogon
Dioscorea hastifolia	+	<1 %	70cm		
Drosera aff. macrantha	+	<1 %	40 cm	GH4-50	Revisit. Climber
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	2 cm	GH4-51	Revisit.
Drosera macrantha subsp. macrantha	+	<1 %	3 cm	=CH12-53	Also recorded in 30x30. Also GH4-21. Revisit. Lilly
Erodium botrys	+	<1 %	3cm	GH4-18	
Genus sp.	+	<1 %	10-12cm		'pink'
Hibbertia subvaginata	1	<1 %	5(juv) 40 cm		
Hyalosperma cotula	+	<1 %	10cm	GH4-10	
Hypochaeris glabra	+	<1 %	3cm		
Hypoxis occidentalis var. occidentalis	+	<1 %	15 cm	=GH9-50	Revisit. Yellow lilly
Kunzea praestans	10%	10-25%	0.6-2.1m		
Lepidosperma aff. leptostachyum (Moora: ERG18-7)	+	<1 %	10-20cm	GH4-9	
Melaleuca calyptroides	>=5%	5-10%	50-90cm	GH4-1	
Neurachne alopecuroidea	1	<1 %	5-8cm		Neurachne
Olearia dampieri subsp. eremicola	<=5%	1-5%	1.6m		Olearia aff axillaris
Opercularia vaginata	10	5-10%	5-20cm	GH4-2	
Pentaschistis pallida	+	<1 %	5-12cm	GH4-11	
Podolepis canescens	+	<1 %	10-20cm	GH4-14	
Podotheca angustifolia	+	<1 %	5cm		Podotheca usual
Pterostylis sanguinea	+	<1 %	7cm	GH4-13	
Stylidium repens	+	<1 %	10cm	GH4-7	
Trachymene pilosa	+	<1 %	8cm		
Trachymene sp.	+	<1 %	20cm		Perennial, linear leaf
Tripteris clandestina	+	<1 %	20 cm	GH4-54	Revisit. ?Daisy
Ursinia anthemoides	+	<1 %	5-15cm		
Vulpia myuros var. hirsuta	2	1-5%	10-15cm		
Waitzia nitida	+	<1 %	15cm	GH4-6	
Xanthorrhoea drummondii	3	1-5%	1.5-2.5(d)		
Acacia acuminata subsp. acuminata	1	<1 %	5-6m		
Austrostipa elegantissima	+	<1 %	40cm		
Caladenia flava subsp. flava	+	<1 %	2 cm	=CH10-56	Revisit. Orchid
Calothamnus aff. quadrifidus Moora-Watheroo	+	<1 %	1.6m		
Crassula colorata var. colorata	+	<1 %	5cm		
Cyanicula deformis	+	<1 %	12 cm	=CH12-57	Revisit. Blue orchid
Diuris aff. recurva	+	<1 %	35 cm	=GH9-5	Revisit. Orchid

Dryandra sessilis var. sessilis	+	<1 %	3.2m		
Leporella fimbriata	+	<1 %	1 cm	GH4-53	Revisit. Orchid (SE side) (Maybe just outside the 30x30 boundary)
Trachymene cyanopetala	+	<1 %			Trachymene not pilosa/not ornata

Moora

Site GH005

Described by BRM Date 31/10/03 Type: QUADRAT 10x10 m, 30x30

Location: Eastern most ridge on Gardiner's bush block.

MGA Zone 50 408385 m E 6617631 m N -30.570181 S lat 116.044619 E long

Habitat: East-facing upper slope (rocky breakaway) on low ridge.

Soil: Gravelly, cobbly, bouldery brown loamy sand.

Rock Type: Chert.

Vegetation: Acacia acuminata subsp. acuminata scattered low trees over Trymalium ledifolium var. rosmarinifolium

open shrubland over Neurachne alopecuroidea scattered grasses and Cheilanthes adiantoides open fernland with Schoenia cassiniana, Podolepis lessonii annual hermland.

Vegetation condition: Good to very good.

Fire age: Not burnt for more than 10 years.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE coord.

30x30 searched extra 20-30m each side of plot along breakaway, but not the ridge crest or valley floor above and below the plot.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	5%	5-10%	6-8m		Acacia acuminata
Allocasuarina huegeliana	+	<1 %	1.5m		
Austrodanthonia caespitosa	+	<1 %	10cm	GH5-12	hairy leaf
Austrodanthonia setacea	+	<1 %	40cm	GH5-8	
Austrostipa elegantissima	+	<1 %	35cm	GH5-11	
Austrostipa variabilis	+	<1 %	30cm	GH5-10,13	twisty
Avena barbata	+	<1 %	35cm		
Briza maxima	+	<1 %	20cm		
Bromus diandrus	+	<1 %	15cm		
Burchardia umbellata	+	<1 %	35cm		
Caesia alfordii	+	<1 %	30cm	GH5-22	Lilly
Caladenia flava subsp. flava	+	<1 %	10cm	=CH10-56	Revisit. Orchid
Chamaescilla corymbosa var. corymbosa	+	<1 %	10cm	=CH12-52	Revisit. Lilly
Cheilanthes adiantoides	20-25%	10-25%	25cm	GH5-4	10-15% Cheilanthes at August 2003 revisit
Cyanicula deformis	+	<1 %	10cm	=CH12-57	Revisit. Blue orchid
Desmocladius flexuosus	1	<1 %	20cm		
Dianella revoluta var. divaricata	1	<1 %	1m	GH5-9	Dianella revoluta
Dichopogon capillipes	+	<1 %	10cm	=GH3-16	
Dioscorea hastifolia	+	<1 %	35cm		Dioscorea
Drosera aff. macrantha	+	<1 %	20cm	=CH11-50	Revisit. Climbing
Drosera macrantha subsp. macrantha	+	<1 %	30cm	GH5-5	CHECK field Drosera sp
Ehrharta longiflora	+	<1 %	25cm		
Goodenia arthrotricha	+	<1 %	35cm	GH5-15	
Goodenia berardiana	+	<1 %	30cm	GH5-23	Lilly
Hyalosperma cotula	+	<1 %	10cm	=GH3-7	small white daisy
Hypoxis occidentalis var. occidentalis	+	<1 %	15cm	=GH9-50	Revisit.
Kennedia prostrata	+	<1 %	10cm		
Lagenifera huegelii	+	<1 %	10cm	GH5-14,50	Lagenifera
Lepidosperma costale	+	<1 %	30cm	GH5-16	
Lomandra effusa	+	<1 %	40cm	GH5-18	
Neurachne alopecuroidea	1	<1 %	30cm		
Parentucellia latifolia	+	<1 %	20cm	=GH3-13	Parentucellia
Pentaschistis pallida	+	<1 %	10cm	GH5-21	
Podolepis lessonii	10-15%	10-25%	25cm	GH5-3	
Schoenia cassiniana	15-20	10-25%	30cm	GH5-2,51	Pink/white daisy
Sowerbaea laxiflora	+	<1 %	15cm	=GH9-57	Revisit.
Stypandra glauca	+	<1 %	20cm	GH5-17	Stypandra
Thysanotus manglesianus	+	<1 %	40cm		Thysanotus ?patersonii
Trachymene ornata	+	<1 %	15cm		White head

Trachymene pilosa	+	<1 %	20cm	GH5-6	
Trymalium ledifolium var. rosmarinifolium	5-10%	5-10%	1.7m	GH5-1	
Urospermum picroides	+	<1 %	10cm	=CH11-10	
Ursinia anthemoides	+	<1 %	20cm		
Vulpia myuros var. hirsuta	+	<1 %	10cm		Vulpia
Waitzia nitida	+	<1 %	30cm	GH5-7	Yellow daisy
Xanthorrhoea drummondii	+	<1 %	1.5m		
Calytrix leschenaultii	+	<1 %	90cm	GH5-20	purple
Lepidosperma leptostachyum	+	<1 %	50cm	GH5-19	
Olearia dampieri subsp. eremicola	+	<1 %	30cm	=GH3-22	

Moora Site GH006

Described by MET **Date** 31/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Gardiner's bush block on East Dalaroo Rd, about 12km N of Moora.

MGA Zone 50 **408372 m E** 6617553 **m N** -30.570884 **S lat** 116.044477 **E long**

Habitat: Upper east-facing slopes at the end of a ridge.

Soil: Gravelly to pebbly brown silty sand amongst cobbles and outcrop.

Vegetation: Eucalyptus wandoo subsp. wandoo open woodland over Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low open woodland over Xanthorrhoea drummondii open shrubland over Trymalium ledifolium var. rosmarinifolium low open shrubland over Cheilanthes adiantoides, Austrostipa spp. open fern/grassland

Vegetation condition: Good to very good (some weeds). May have been heavily grazed.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	5-7%	5-10%	4-7m		Acacia acuminata
Aira caryophylla	+	<1 %	8cm	GH6-5	
Austrodanthonia acerosa	+	<1 %	10cm	GH6-10	
Austrodanthonia caespitosa	+	<1 %	10cm	GH6-4	hairy
Austrostipa elegantissima	+	<1 %	30cm	GH6-3,17	
Austrostipa scabra	+	<1 %	8cm	GH6-16	
Avena barbata	+	<1 %	25cm		
Borya sphaerocephala	+	<1 %	6cm		Borya
Briza maxima	+	<1 %	10-15cm		
Burchardia umbellata	+	<1 %	15cm	GH6-15	Burchardia
Caesia alfordii	+	<1 %	15cm	GH6-9	Lilly
Caladenia flava subsp. flava	+	<1 %	10cm	GH6-14	Dead
Calandrinia calyptata	+	<1 %		GH6-18	
Chamaescilla corymbosa var. corymbosa	+	<1 %	10cm	GH6-53	Revisit: ?lilly = ?CH12-52
Cheilanthes adiantoides	5	5-10%	10-15cm		
Crassula colorata var. colorata	+	<1 %	3cm		
Daucus glochidiatus	+	<1 %	9cm		
Desmocladius flexuosus	+	<1 %	8cm	=GH4	
Dianella revoluta var. divaricata	+	<1 %	40cm		
Dichopogon capillipes	+	<1 %	10cm	=GH4	
Dioscorea hastifolia	+	<1 %	30cm		
Drosera macrantha subsp. macrantha	+	<1 %	10cm	=GH5-5	Also GH6-56 in 30x30. Revisit: CHECK field Lagenifera sp
Drosera sp.	+	<1 %	10cm	GH6-13	Climbing
Ehrharta longiflora	+	<1 %	45cm		Dead
Eucalyptus wandoo subsp. wandoo	15%	10-25%	10-12m		Eucalyptus wandoo
Genus sp.	+	<1 %	10cm	GH6-7	Poaceae (grazed)
Goodenia sp.	+	<1 %	10cm	GH6-8	Small annual
Hibbertia subvaginata	1	<1 %	1-1.2m		
Hyalosperma cotula	+	<1 %	5-10cm	=GH4	White
Hypochoeris glabra	+	<1 %	3cm		
Hypoxis occidentalis var. occidentalis	+	<1 %	10 cm	=GH9-50	Also recorded in 30x30. Also GH6-59A. Revisit. Yellow Lilly
Lagenifera huegelii	+	<1 %	2cm	GH6-22	Daisy
Lawrencella rosea	+	<1 %	20 cm	GH6-57	Revisit. Daisy
Lepidosperma aff. leptostachyum (Moora: ERG18-7)	+	<1 %	15cm	GH6-11	
Lobelia sp. small flowers (K.F. Kenneally 7705)	+	<1 %	12cm	GH6-19	
Lolium perenne	+	<1 %	5cm	GH6-20	

Lomandra (Moora twisty)	+	<1 %	20 cm	GH6-54	Revisit.
Lomandra aff. micrantha subsp. micrantha	+	<1 %	20cm	GH6-2	
Neurachne alopecuroidea	+	<1 %	6cm		
Phyllangium sulcatum	+	<1 %	10cm	GH6-6	Mitrasacme
Platysace cirrosa	+	<1 %	15cm		Perennial Trachymene "unknown"
Podotheca angustifolia	+	<1 %	7cm		
Pterostylis aff. rufa	+	<1 %		GH6-23	
Pterostylis sanguinea flat leaf	+	<1 %	12cm	GH6-50	Revisit: Pterostylis tall
Schoenia cassiniana	1	<1 %	10-20cm		Daisy pink/white
Sollya heterophylla	+	<1 %	15cm	GH6-21	
Sowerbaea laxiflora	+	<1 %	20cm	=GH9-57	Revisit: ?Thysanotus
Stypandra glauca	+	<1 %	10cm	GH6-12	Stypandra (common)
Thysanotus manglesianus	+	<1 %	40cm	GH6-51,52	Revisit: Climber
Trachymene cyanopetala	+	<1 %	8cm		
Trachymene ornata	+	<1 %	12cm		
Trachymene pilosa	+	<1 %	10cm		
Trymalium ledifolium var. rosmarinifolium	1-2%	1-5%	0.3-1m	GH6-1	
Ursinia anthemoides	1	<1 %	10-20cm		
Vulpia myuros var. hirsuta	+	<1 %	8cm		
Waitzia sp.	+	<1 %	10-15cm	=CH4	
Xanthorrhoea drummondii	2-3%	1-5%	1.5-1.9m		
Austrostipa hemipogon	+	<1 %		GH6-SN	
Calytrix leschenaultii	+	<1 %	1m		Calytrix purple
Cyanicula deformis	+	<1 %	8cm	=CH12-57 (NE corner)	Revisit: Blue orchid
Dampiera lavandulacea	+	<1 %	10cm	GH6-25,55	Dampiera?
Eriochilus helonomos	+	<1 %	30cm	=CH14-61	Revisit: Pterostylis tall
Gilberta tenuifolia	+	<1 %	10-20cm	GH6-31	Daisy
Glischrocaryon flavescens	+	<1 %	70cm	GH6-30	
Goodenia arthrotricha	+	<1 %	25cm	GH6-33	
Hypoxis glabella var. leptantha	+	<1 %	10cm	GH6-59B	Revisit: small yellow lilly flower
Lomandra effusa	+	<1 %	25cm	GH6-27	
Melaleuca radula	+	<1 %	40cm(2m)	GH6-28	
Olearia dampieri subsp. eremicola	+	<1 %	50cm		Olearia aff axillaris
Orthrosanthus laxus var. gramineus	+	<1 %	25cm	GH6-29	
Podolepis lessonii	+	<1 %	10-25cm	GH6-32	
Stenanthemum tridentatum	+	<1 %	5cm	GH6-26,58	

Moora Site GH007

Described by BRM **Date** 1/11/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near SW corner of Gardiner's block, about 100m east of western boundary

MGA Zone 50 **408366 m E** **6617473 m N** **-30.571605 S lat** **116.044407 E long**

Habitat: Gentle, south-facing lower slope of low ridge.

Soil: (Surface) Gravelly brown sand.

Rock Type: Chert.

Vegetation: Eucalyptus loxophleba subsp. loxophleba, Acacia acuminata subsp. acuminata low open woodland over Cheilanthes adiantoides fernland with Gilberta tenuifolia, Podolepis lessonii, Hyalosperma glutinosum subsp. glutinosum annual herbland.

Vegetation condition: Good to very good. Very open understorey - probably some long term disturbance to shrub layer.

Fire age: Not burnt for more than 7 to 10 years.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg. Lot of wood debris in plot suggests not burnt for long time.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	5%	5-10%	5m		Acacia acuminata
Anagallis arvensis	+	<1 %	4cm		
Austrodanthonia acerosa	+	<1 %	30cm	GH7-8	
Austrostipa elegantissima	+	<1 %	30cm	GH7-21	
Austrostipa scabra	+	<1 %	30cm	GH7-23	Grass
Austrostipa variabilis	+	<1 %	30cm	GH7-6	
Avena barbata	+	<1 %	35cm		

<i>Borya sphaerocephala</i>	3	1-5%	3cm		Borya
<i>Bromus diandrus</i>	+	<1 %	15cm		
<i>Burchardia umbellata</i>	+	<1 %	15cm	=GH9-52	Revisit.
<i>Calandrinia calyptrata</i>	+	<1 %	20cm	GH7-22,26	
<i>Cheilanthes adiantoides</i>	30-35%	25-33.3%	10cm	=GH5-4	
<i>Cyanicula deformis</i>	+	<1 %	15cm	=CH12-57	Revisit. Blue beard orchid
<i>Daucus glochidiatus</i>	+	<1 %	10cm	GH7-15	hairy heads
<i>Dichopogon capillipes</i>	+	<1 %	30cm	GH7-11	
<i>Dioscorea hastifolia</i>	+	<1 %	30cm		Dioscorea
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20cm	GH7-52	Also GH7-24,55 (30x30). Revisit. Erect
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	8-10%	5-10%	8-9m	GH7-1	Stringy grey course bark; smooth bark on upper branches.
<i>Galium murale</i>	+	<1 %	4cm	GH7-20	
<i>Gilberta tenuifolia</i>	30-40%	33.3-50%	20cm	GH7-2	Daisy hanging heads
<i>Goodenia berardiana</i>	+	<1 %	15cm	GH7-16	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	1-2	1-5%	20cm	GH7-4	yellow daisy
<i>Hypoxis glabella</i> var. <i>leptantha</i>	+	<1 %	4cm	GH7-50	Revisit. Small yellow lilly flower
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	=GH9-50	Revisit. Yellow daisy
<i>Lagenifera huegelii</i>	+	<1 %	4cm	GH7-18	
<i>Lobelia</i> sp. small flowers (K.F. Kenneally 7705)	+	<1 %	6cm	GH7-9	single head
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm		Neurachne
<i>Oxalis corniculata</i>	+	<1 %	4cm	GH7-17,53	
<i>Pentaschistis pallida</i>	+	<1 %	10cm	GH7-12	
<i>Phyllangium sulcatum</i>	+	<1 %	10cm	GH7-10	
<i>Podolepis lessonii</i>	3-5%	1-5%	30cm	GH7-3	
<i>Prasophyllum gracile</i>	+	<1 %	15cm	GH7-19	Orchid
<i>Sowerbaea laxiflora</i>	+	<1 %	12cm	=GH9-57	Revisit.
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	GH7-14, 51	Thysanotus ?patersonii
<i>Trachymene cyanopetala</i>	+	<1 %	10cm	GH7-13	Trachymene hairy
<i>Trachymene ornata</i>	+	<1 %	5cm		White heads
<i>Urospermum picroides</i>	+	<1 %	15cm	=CH11-10	
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15cm		Vulpia
<i>Waitzia nitida</i>	1	<1 %	25cm	GH7-5,7	
<i>Allocasuarina huegeliana</i>	+	<1 %	5-6m		
<i>Amblysperma</i> sp. <i>Moora</i> (GH7-57)	+	<1 %	10cm	GH7-57	Revisit. Herb
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	3cm	=CH12-52	Revisit. Lilly
<i>Ehrharta longiflora</i>	+	<1 %	20cm		
<i>Erodium cygnorum</i>	+	<1 %	4cm	=CH14-53	Revisit. ?
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	+	<1 %	5m		
<i>Hedypnois rhagadioloides</i>	+	<1 %	20cm	GH7-28	
<i>Lomandra effusa</i>	+	<1 %	25cm	GH7-54	Revisit.
<i>Ptilotus spathulatus</i> forma <i>spathulatus</i>	+	<1 %	4cm	GH7-56	Revisit. Herb
<i>Rhyncharrhena linearis</i>	+	<1 %	30cm	GH7-25	Climber
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	30cm	GH7-27	Silene

Moora Site GH008

Described by MET **Date** 1/11/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Gardiner's block, about 12 km north of Moora, on East Dalaroo Rd.

MGA Zone 50 **408305 m E** **6617853 m N** **-30.568172 S lat** **116.043805 E long**

Habitat: Slight rise on ridge.

Soil: Gravelly to pebbly light grey silty sand, amongst cobbles and outcrop.

Vegetation: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii*, *Kunzea praestans* open shrubland to tall open shrubland over *Calytrix leschenaultii* scattered low shrubs to low open shrubland over annual herb/grassland.

Vegetation condition: Difficult to assess. Good; too weedy for very good (although no very aggressive weeds, except

Ehrharta). Also *Xanthorrhoea drummondii* suffering deaths and unknown grazing impacts.

Notes: Datum: WGS84. 1st coord is NW peg; 2nd coord is for SE peg.

The *Kunzea* and *Calytrix* occur in patches with each more abundant where it occurs.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	3cm(juv)		Acacia acuminata
Allocauarina huegeliana	25%	25-33.3%	5-8m		
Arctotheca calendula	+	<1 %	12cm		Revisit.
Austrostipa nitida	+	<1 %	10cm	GH8-3	
Avena barbata	+	<1 %	40cm		
Briza maxima	+	<1 %	5-10cm		
Burchardia umbellata	+	<1 %	20cm		
Caladenia flava subsp. flava	+	<1 %	4cm	=CH10-56	Revisit.:
				Caladenia orchid	
Calandrinia calyprata	1	<1 %	5cm	=GH6	
Calytrix leschenaultii	2	1-5%	0.5m		
Chamaescilla corymbosa var. corymbosa	+	<1 %	10cm	=CH12-52	Revisit. Lilly
Cheilanthes adiantoides	+	<1 %	5-12cm		
Comesperma integerrimum	+	<1 %	15-35cm	GH8-7	
Comesperma virgatum	+	<1 %	65cm		
Crassula colorata var. colorata	+	<1 %	3-4cm		
Crassula exserta	+	<1 %	3-4cm	GH8-6	
Desmocladius flexuosus	1	<1 %	10-15cm	=GH4	
Dichopogon capillipes	+	<1 %	12cm	GH8-51	Revisit. Dichopogon flat
Drosera aff. macrantha	+	<1 %	20cm	=CH11-50	Revisit. Climbing
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	1cm	GH8-52	Revisit. Drosera flat base
Drosera macrantha subsp. macrantha	+	<1 %	15cm	GH8-5,50	Climbing
Dryandra sessilis var. sessilis	4	1-5%	1.8(5)m		Dryandra sessilis
Ehrharta longiflora	5	5-10%	5cm		
Hibbertia subvaginata	1	<1 %	10(juv)-90cm		
Hypochaeris glabra	3-5%	1-5%	3cm		
Kunzea praestans	15	10-25%	1-2.8m		
Neurachne alopecuroidea	+	<1 %	5cm		
Pentaschistis pallida	8	5-10%	5-15cm	GH8-1	
Podolepis lessonii	1	<1 %	10-20cm	=GH6-32	
Pterostylis sanguinea	+	<1 %	15cm	GH8-4	
Silene gallica var. gallica	+	<1 %	5-10cm	GH8-2	
Sowerbaea laxiflora	+	<1 %	15cm	=GH9-57	
Thysanotus manglesianus	+	<1 %	1m		T. patersonii
Trachymene cyanopetala	+	<1 %	10cm		Not T. pilosa/T.ornata
Trachymene pilosa	+	<1 %	10cm		
Ursinia anthemoides	<5	1-5%	10-25cm		
Vulpia myuros var. hirsuta	5	5-10%	10-15cm		
Xanthorrhoea drummondii	10	5-10%	1.5-3m		
Acacia aristulata	+	<1 %	10cm(juv)		
Agrostocrinum scabrum	+	<1 %	60cm	GH8-9,53	Chocolate lilly
Austrodanthonia sp.	+	<1 %	5cm		Glabrous
Calothamnus aff. quadrifidus Moora-Watheroo	+	<1 %	2.5m		
Cyanicula deformis	+	<1 %	15cm	=CH12-57	Blue orchid
Dioscorea hastifolia	+	<1 %	3cm		
Erodium botrys	+	<1 %	2cm	GH8-54	
Hyalosperma cotula	+	<1 %		=GH4-10	White
Hypoxis occidentalis var. occidentalis	+	<1 %	12cm	=GH9-50	Lilly
Leporella fimbriata	+	<1 %	1cm	GH8-55	Orchid
Leucopogon sp. Yanchep (M. Hislop 19,861)	+	<1 %	40cm	GH8-8	
Melaleuca calyptroides	+	<1 %	2.2m		Melaleuca common
Opercularia vaginata	+	<1 %	10cm	=GH6	
Stylidium caricifolium	+	<1 %	25cm		Big grass like

Moora Site GH009

Described by BRM **Date** 1/11/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near western boundary near north end of Gardiner's block.

MGA Zone 50 **408299 m E** **6617965 m N** **-30.567161 S lat** **116.043752 E long**

Habitat: Gently sloping rocky breakaway on upper north-west-facing slope of medium height ridge.

Soil: Very gravelly, cobbly, bouldery fine brown sand.

Rock Type: Chert. Exposed sheet rock and boulders cover more than 60-70% of ground surface.

Vegetation: Regelia megacephala, (Dryandra sessilis var. sessilis) open scrub over Hibbertia subvaginata scattered low shrubs over Cheilanthes adiantoides very open fernland with Dioscorea hastifolia very

Vegetation condition: Good (heavy weed infestation in parts).

Fire age: Not burnt for more than 7 years.

Notes: Datum: WGS84. Plot is not square. 1st coord is for SE peg; 2nd coord is for NW peg.

This is part of a fairly small *Regelia* community on a NW-facing chert breakaway slope.

30x30 search avoided NE corner (*Allocasuarina campestris* veg community) and was limited in area to the north, south and east by different veg communities.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Anagallis arvensis</i>	+	<1 %	10cm		
<i>Austrodanthonia acerosa</i>	+	<1 %	35cm	GH9-18	Hairy short leaves
<i>Austrodanthonia setacea</i>	+	<1 %	30cm	GH9-10	
<i>Austrostipa scabra</i>	+	<1 %	35cm	GH9-11	twisty
<i>Austrostipa variabilis</i>	+	<1 %	60cm	GH9-17	
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Borya sphaerocephala</i>	+	<1 %	10cm		
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Bromus diandrus</i>	+	<1 %	10cm		Bromus
<i>Burchardia umbellata</i>	+	<1 %	30cm	GH9-52	Revisit.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	4cm	=CH10-56	Revisit. Orchid
<i>Calandrinia</i> sp.	+	<1 %	2cm	GH9-51	Revisit.
<i>Calytrix leschenaultii</i>	+	<1 %	40cm		purple
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=CH12-52	Revisit. Lilly
<i>Cheilanthes adiantoides</i>	3-4	1-5%	15cm	=GH5-4	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	GH9-7	Crassula
<i>Cyanicula deformis</i>	+	<1 %	10cm	=CH12-57	Revisit. Blue orchid
<i>Desmocladus flexuosus</i>	+	<1 %	20cm		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	60cm	=GH5-9	
<i>Dichopogon capillipes</i>	+	<1 %	20cm	=CH10-52	Revisit.
<i>Dioscorea hastifolia</i>	3-5	1-5%	2m		Dioscorea
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30cm	=GH2	Revisit.
<i>Drosera</i> aff. <i>macrantha</i> 45cm	+	<1 %	15cm (but	=CH11-50	Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20cm	GH9-53	Revisit. Climbing
<i>Dryandra sessilis</i> var. <i>sessilis</i>	4%	1-5%	3m		Dead on revisit
<i>Ehrharta longiflora</i>	3-4	1-5%	30cm		
<i>Erodium botrys</i>	+	<1 %	20cm	GH9-9	hairy stem
<i>Goodenia berardiana</i>	+	<1 %	20cm	=GH7-16	
<i>Hibbertia subvaginata</i>	1	<1 %	70cm		
<i>Hyalosperma cotula</i>	+	<1 %	10cm	=GH3-7	small white daisy
<i>Hypochaeris glabra</i>	3-4	1-5%	20cm	GH9-8	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	GH9-50	Revisit. Yellow lilly
<i>Linum trigynum</i>	+	<1 %	20cm	GH9-15	
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm		Neurachne
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	30cm	=GH3-22	
<i>Parentucellia latifolia</i>	+	<1 %	20cm	GH9-6	Parentucellia
<i>Pentaschistis</i> sp.	+	<1 %	10cm	GH9-5	
<i>Petrorhagia prolifera</i>		open lianes.	+	<1 % 35cm	GH9-16
<i>Platysace cirrosa</i>	+	<1 %	15cm	GH9-54	Revisit. Climbing
<i>Podolepis canescens</i>	1	<1 %	25cm	GH9-2,56	Also recorded in 30x30.
<i>Podolepis lessonii</i>	+	<1 %	12cm	=GH3-51	Revisit. ?Daisy
<i>Podotheca angustifolia</i>	+	<1 %	3cm	=GH3-3	
<i>Pterostylis sanguinea</i>	+	<1 %	30cm	GH9-12	Orchid
<i>Regelia megacephala</i>	60-70%	50-75%	3-4m		
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	20cm	GH9-4	Silene
<i>Stypandra glauca</i>	+	<1 %	20cm		
<i>Thysanotus dichotomus</i>	+	<1 %	30cm	GH9-1,58	Also recorded in 30x30.
<i>Thysanotus manglesianus</i>	+	<1 %	30cm	=GH7-14	<i>Thysanotus patersonii</i>
<i>Trachymene ornata</i>	+	<1 %	3cm	GH9-55	Revisit. ?pilosa
<i>Tricoryne elatior</i>	+	<1 %	30cm	GH9-3	
<i>Trifolium hirtum</i>	+	<1 %	3cm	GH9-14	
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	~1	1-5%	10cm		Vulpia
<i>Waitzia acuminata</i>	+	<1 %	35cm	GH9-13	pink white daisy
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.3m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	5m		<i>Acacia acuminata</i>

<i>Allocasuarina huegeliana</i>	+	<1 %	3m		
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	+	<1 %	2.5m	GH9-19	<i>Calothamnus quadrifidus</i>
<i>Eriochilus helonomos</i>	+	<1 %	15cm	=CH14-61	Revisit. 1-leaf stem orchid
<i>Goodenia arthrotricha</i>	+	<1 %	40cm	GH9-20	
<i>Nemcia acuta</i>	+	<1 %	10cm		
<i>Sowerbaea laxiflora</i>	+	<1 %	20cm	GH9-57	Revisit. Fleshy

Moora Site GH010

Described by BRM **Date** 1/11/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near north end of remnant in Gardiner's block.

MGA Zone 50 **408405 m E** **6618051 m N** **-30.566393 S lat** **116.044865 E long**

Habitat: Upper slope of a rocky ridge side, east-facing, moderate to steep slope.

Soil: Silty fine grey sand, gravelly to pebbly, amongst boulders and outcrop. Top 5cm humous rich.

Rock Type: Chert

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Calytrix leschenaultii*, *Hibbertia subvaginata* low open shrubland over Asteraceae, Poaceae annual herb/grassland.

Vegetation condition: Difficult to assess. Probably good. Too many weeds for very good. Also probably grazing damage.

Notes: Datum: WGS84. First coord is for NW peg; 2nd coord is for SE peg.

Many dead *X. drummondii* and *Allocasuarina huegeliana* nearby - no regeneration.

30x30 search limited to N and S side (not on crest to west and lower slope to east).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina huegeliana</i>	10	5-10%	6-8m		
<i>Arctotheca calendula</i>	+	<1 %	5cm		Capeweed
<i>Austrodanthonia</i> sp.	+	<1 %	5cm		glabrous
<i>Austrostipa macalpinei</i>	+	<1 %	25cm	GH10-2	
<i>Austrostipa variabilis</i>	+	<1 %	30cm	GH10-7	
<i>Avena barbata</i>	+	<1 %	30cm		
<i>Briza maxima</i>	+	<1 %	5-15cm		
<i>Burchardia umbellata</i>	+	<1 %	15cm	=GH9-52	Lilly
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12cm	=CH10-56	<i>Caladenia</i> orchid
<i>Calandrinia</i> sp.	+	<1 %	5cm	=GH6	
<i>Calytrix leschenaultii</i>	4	1-5%	0.4-1.0m		
<i>Cheilanthes adiantoides</i>	5	5-10%	10-15cm		<i>Cheilanthes</i>
<i>Desmocladius flexuosus</i>	1	<1 %	10cm		usual
<i>Dichopogon capillipes</i>	+	<1 %	25cm	=CH10-52	
<i>Dioscorea hastifolia</i>	1	<1 %	10cm		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	15cm	GH10-51,1	Also recorded in 30x30.
<i>Dryandra sessilis</i> var. <i>sessilis</i> juv)4m	7	5-10%	(3cm		<i>Dryandra sessilis</i>
<i>Ehrharta longiflora</i>	5	5-10%	10-30cm		
Genus sp.	+	<1 %	3-5cm	GH10-3	Daisy
<i>Gilberta tenuifolia</i>	+	<1 %	5-12cm	GH10-6	Daisy
<i>Goodenia</i> sp.	+	<1 %	10cm	=GH6	
<i>Hibbertia subvaginata</i>	1	<1 %	15-50cm		
<i>Hyalosperma cotula</i>	+	<1 %	5-8cm	=GH4-10	white
<i>Hypochoeris glabra</i>	+	<1 %	3cm		
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	10cm	GH10-8	
<i>Lobelia</i> sp. small flowers (K.F. Kenneally 7705)	+	<1 %	5cm	=?10-6	
<i>Neurachne alopecuroidea</i>	+	<1 %	3cm		<i>Neurachne</i>
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	+	<1 %	40cm		<i>Olearia</i> aff. <i>axillaris</i>
<i>Opercularia vaginata</i>	+	<1 %	8cm	=GH6	<i>Opercularia</i>
<i>Pentaschistis pallida</i>	+	<1 %	5-12cm	GH10-4	
<i>Podolepis lessonii</i>	+	<1 %	15cm	=GH6	Common
<i>Podotheca angustifolia</i>	+	<1 %	12cm	GH10-50,5	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	20cm	=GH1-50	<i>Pterostylis</i> orchid
<i>Schoenia cassiniana</i>	+	<1 %	20cm		Daisy pink/white
<i>Solanum nigrum</i>	+	<1 %	20cm	GH10-1	
<i>Trachymene pilosa</i>	+	<1 %	5-10cm		
<i>Tripteris clandestina</i>	+	<1 %	25cm	GH10-53	Daisy weed

<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	1	<1 %	1.4m	GH10-5	Open shrub, bark light grey, leaves dark green above; pale green
<i>Ursinia anthemoides</i>	5	5-10%	10-20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	6cm		
<i>Xanthorrhoea drummondii</i>	6%	5-10%	1.5-2.3m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	6m		<i>Acacia acuminata</i>
<i>Austrostipa trichophylla</i>	+	<1 %	8cm	GH10-9	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=CH12-52	Lilly
<i>Daucus glochidiatus</i>	+	<1 %	20cm	GH10-10	
<i>Hypoxis glabella</i> var. <i>leptantha</i>	+	<1 %	15cm	=CH14-59	Hypoxis
<i>Pleurosorus rutifolius</i>	+	<1 %	5cm	GH10-12	fern
<i>Trachymene ornata</i>	+	<1 %	8cm		

JOHN TONKIN'S

Moora

Site JT001

Described by BRM Date 10/10/02 Type: QUADRAT 10x10 m, 30x30

Location: Ridge on John Tonkin's property.

MGA Zone 50 409072 m E 6626085 m N -30.493956 S lat 116.052523 E long

Habitat: Gently sloping, west-facing upper slope on side of rounded crest of low ridge.

Soil: Pebbly, cobbly rocky brown sand.

Rock Type: Chert.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high open shrubland over *Melaleuca calyptroides* scattered shrubs over *Hibbertia subvaginata* low open shrubland over **Avena barbata*, **Pentaschistis pallida*, **Vulpia myuros* var. *hirsuta* annual grassland.

Vegetation condition: Poor to good. High weed cover and probably past grazing, but vegetation structure intact.

Fire age: 5-10 years since burnt.

Notes: Datum: WGS84. 1st coord is for SW peg; 2nd coord is for NE peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	1	<1 %	3.5m		
<i>Acacia aristulata</i>	+	<1 %	20cm	JT1-21	<i>Acacia aristulata</i> (juv)
<i>Acacia restiacea</i>	+	<1 %	35cm	JT1-24	<i>Acacia</i>
<i>Allocasuarina huegeliana</i>	1-2%	1-5%	5m		
<i>Arctotheca calendula</i>	+	<1 %	5cm		
<i>Austrodanthonia setacea</i>	+	<1 %	20cm	JT1-15	<i>Austrodanthonia</i>
<i>Austrostipa elegantissima</i>	+	<1 %	45cm	JT1-19	<i>Austrostipa</i> ?elegantissima
<i>Austrostipa nitida</i>	+	<1 %	30cm	JT1-16	<i>Austrostipa</i> (twisted)
<i>Austrostipa variabilis</i>	1-2	1-5%	35cm	JT1-7	<i>Austrostipa</i>
<i>Avena barbata</i>	5-10	5-10%	70cm		
<i>Borya sphaerocephala</i>	+	<1 %	2CM		Revisit.
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Bromus diandrus</i>	+	<1 %	20cm	JT1-33	Grass
<i>Burchardia umbellata</i>	+	<1 %	25cm	JT1-51	Revisit.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15cm	JT1-31,52	<i>Caladenia</i>
<i>Calandrinia calypttrata</i>	+	<1 %	2cm	JT1-32	? <i>Calandrinia</i>
<i>Calytrix leschenaultii</i>	+	<1 %	50cm	JT1-3	<i>Calytrix</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20cm	=CH9-13	<i>Chamaescilla</i>
<i>Cheilanthes adiantoides</i>	+	<1 %	10cm	=ER15-10	<i>Cheilanthes</i>
<i>Comesperma integerrimum</i>	+	<1 %	30cm	JT1-20	shrub ? <i>Rhagodia</i> (heavily grazed)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	5cm	JT1-11	<i>Crassula</i>
<i>Crassula exserta</i>	+	<1 %	10cm	JT1-25	<i>Crassula</i> #2
<i>Cristonia biloba</i>	+	<1 %	20cm	JT1-23	pea
<i>Desmocladius flexuosus</i>	+	<1 %	10cm	JT1-8	<i>Desmocladius</i> ? <i>flexuosa</i>
<i>Dichopogon capillipes</i>	+	<1 %	10cm	JT1-12	<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	+	<1 %	10cm		
<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	+	<1 %	30cm	JT1-4	<i>Diplopeltis</i>
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20cm	JT1-6,50	<i>Drosera</i>
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	3cm		juvenile
<i>Ehrharta longiflora</i>	+	<1 %	35cm		
<i>Erodium botrys</i>	+	<1 %	10cm	JT1-9,18	? <i>Pelargonium</i>

<i>Euphorbia drummondii</i> subsp. <i>drummondii</i>	+	<1 %	4cm	JT1-22	(pink flower) Euphorbiaceae
<i>Hibbertia subvaginata</i>	10	5-10%	1m		
<i>Hypochaeris glabra</i>	5	5-10%	15cm	JT1-10	Sonchus
<i>Kunzea praestans</i>	5-7	5-10%	2.5m		
<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>	+	<1 %	15cm	JT1-29	
<i>Lolium perenne</i>	+	<1 %	30cm	JT1-28	?Rye grass
<i>Melaleuca calyptroides</i>	2	1-5%	1.4m	JT1-1	Melaleuca
<i>Neurachne alopecuroidea</i>	+	<1 %	15cm	=ER17-1	Neurachne
<i>Pentaschistis pallida</i>	5-10	5-10%	10cm	JT1-5,26	*Pentaschistis
<i>Petrorhagia prolifera</i>	+	<1 %	20cm	JT1-13	?Wahlenbergia (single pk flower)
<i>Pityrodia dilatata</i>	+	<1 %	15cm	=ER15-7	<i>Pityrodia dilatata</i>
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	35cm	JT1-17	* <i>Silene</i>
<i>Stylidium repens</i>	+	<1 %	10cm	JT1-30	<i>Stylidium</i>
<i>Thysanotus manglesianus</i>	+	<1 %	40cm	JT1-2	<i>Thysanotus</i>
<i>Trifolium hirtum</i>	+	<1 %	10cm	JT1-14	* <i>Trifolium</i>
<i>Tripteris clandestina</i>	+	<1 %	15cm	JT1-27	Daisy
<i>Ursinia anthemoides</i>	+	<1 %	20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	3-5	1-5%	15cm	JT1-X	*Grass (cylinder head)
<i>Allocasuarina campestris</i>	+	<1 %	2.5m		
<i>Cyanicula deformis</i>	+	<1 %	10cm	=CH12-57	Revisit. Blue beard orchid
<i>Opercularia vaginata</i>	+	<1 %	30cm	JT1-34	<i>Opercularia</i>
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	<1 %	30cm	JT1-35	<i>Ptilotus polystachyus</i>

Moora Site JT002

Described by MET **Date** 10/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Near western boundary of John Tonkin's property between East Coomberdale Rd and Kiaka Rd.

MGA Zone 50 **408890 m E** **6626073 m N** **-30.494051 S lat** **116.050626 E long**

Habitat: Moderate slope, south-facing, on a low ridge.

Soil: Gravelly, pebbly light brown silty sand with cobbles, boulders and low outcrop of chert.

Vegetation: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland to low open forest over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Podolepis lessonii*, *Trachymene* spp. annual herbland.

Vegetation condition: Good to very good. The good condition quite surprising given more degraded to west and clearing less than 50m to east.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Pentaschistis</i> sp. Moora (doubtful ID)	+		8 cm	JT2-55	
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	>15%	10-25%	6-8m		
<i>Aira caryophyllea</i>	+	<1 %	10-15cm	JT2-12	Aira
<i>Allocasuarina huegeliana</i>	<=10%	5-10%	4-5m		
<i>Arctotheca calendula</i>	+	<1 %	5cm		
<i>Austrodanthonia acerosa</i>	+	<1 %	10cm	JT2-9,16	<i>Austrodanthonia</i>
<i>Austrostipa</i> sp.	+	<1 %			<i>Austrostipa</i>
<i>Avena barbata</i>	+	<1 %	40cm		<i>Avena fatua</i>
<i>Blennospora drummondii</i>	+	<1 %	5-8cm	JT2-17	Asteraceae
<i>Borya sphaerocephala</i>	+	<1 %	5cm		<i>Borya</i>
<i>Briza maxima</i>	+	<1 %	10-20cm		
<i>Bromus diandrus</i>	+	<1 %	10cm	JT2-22	<i>Bromus</i>
<i>Caesia</i> (Moora hairy stem)	+	<1 %	10 cm	=JT5-53	Revisit.
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	12 cm	=CH10-56	Revisit. Hairy leaf orchid
<i>Calytrix leschenaultii</i>	+	<1 %	30cm		<i>Calytrix</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	5cm	JT2-2	<i>Chamaescilla</i>
<i>Cheilanthes adiantoides</i>	>1%	1-5%	8-15cm		<i>Cheilanthes</i>
<i>Comesperma volubile</i>	+	<1 %	15cm		<i>Com. volubile</i> (juv)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	5cm	JT2-19	<i>Crassula colorata</i>
<i>Crassula decumbens</i> var. <i>decumbens</i>	+	<1 %	3cm	JT2-20	<i>Crassula</i>
<i>Cyanicula deformis</i>	+	<1 %	12 cm	=CH12-57	Revisit. Blue beard orchid
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1 cm	JT2-51	Revisit. Flat base
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	10cm	JT2-7,52	Also JT2-54 in 30x30.
<i>Ehrharta longiflora</i>	+	<1 %	10-30cm		

<i>Elythranthera brunonis</i>	+	<1 %	12cm	JT2-21	Orchid
<i>Galium murale</i>	+	<1 %	25cm	JT2-5	Galium
<i>Goodenia berardiana</i>	+	<1 %	10-15cm	JT2-18	Goodenia
<i>Haemodorum simulans</i>	+	<1 %	5cm	JT2-14,29	Also recorded in 30x30.
<i>Haemodorum</i>					
<i>Hypochaeris glabra</i>	+	<1 %	1-5cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	3-5%	<1 %	10cm	JT2-11,50	?Hypoxis
<i>Neurachne alopecuroidea</i>	+	<1 %	5-10cm	JT2-3	Neurachne
<i>Opercularia vaginata</i>	5	5-10%	10-30cm	JT2-1	Opercularia
<i>Parentucellia latifolia</i>	+	<1 %	8cm		Parentucellia
<i>Phyllangium sulcatum</i>	+	<1 %	5cm	JT2-6	"Mitrasacme"
<i>Podolepis lessonii</i>	+	<1 %	10-25cm		Podolepis (button)
<i>Poranthera microphylla</i>	+	<1 %	1cm		Monotaxis
<i>Rhodanthe laevis</i>	+	<1 %	10cm	JT2-8	Asteraceae
<i>Romulea rosea</i>	+	<1 %	12cm		Romulea rosea
<i>Schoenus clandestinus</i>	+	<1 %	5cm	JT2-13	Schoenus
<i>Thysanotus manglesianus</i>	+	<1 %	30 cm	JT2-53,28	Also recorded in 30x30. Revisit. Climber
<i>Trachymene cyanopetala</i>	+	<1 %	5-15cm	JT2-4	Trachymene
<i>Trachymene ornata</i>	+	<1 %	7-12cm		
<i>Trifolium subterraneum</i>	+	<1 %	1 cm	=JT5-52	Revisit. Clover
<i>Ursinia anthemoides</i>	+	<1 %	8-12cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10-20cm	JT2-10,15	Poaceae
<i>Xanthorrhoea drummondii</i>	+	<1 %			long dead
<i>Burchardia umbellata</i>	+	<1 %	20cm		Burchardia
<i>Calandrinia eremaea</i>	+	<1 %	5-8cm	JT2-25	Calandrinia
<i>Desmocladius flexuosus</i>	+	<1 %	10cm		Desmocladius
<i>Hibbertia subvaginata</i>	+	<1 %	60cm		
<i>Hyalosperma cotula</i>	+	<1 %	8-10cm	JT2-23	Rhodanthe
<i>Kunzea praestans</i>	+	<1 %	(0.4)2.2m		
<i>Melaleuca calyptroides</i>	+	<1 %	1.5m	=JT1	Melaleuca
<i>Petrorhagia prolifera</i>	+	<1 %	20cm		"pink"
<i>Stackhousia monogyna</i>	+	<1 %	40cm	JT2-24	Stackhousia
<i>Stylidium septentrionale</i>	+	<1 %	5cm	=CH8	Stylidium
<i>Stypandra glauca</i>	+	<1 %	20cm		
<i>Thysanotus multiflorus</i>	+	<1 %	25cm	JT2-27	Thysanotus
<i>Waitzia nitida</i>	+	<1 %	20cm	JT2-26	Waitzia

Moora**Site JT003****Described by** BRM **Date** 10/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** Ridge in John Tonkins**MGA Zone** 50 **408919 m E** **6625718 m N** **-30.497256 S lat** 116.050897 **E long****Habitat:** Top of broad crest of a low chert ridge, gently sloping and north-west facing.**Soil:** Pebbly, cobbly, brown loamy sand amongst chert sheet rock.**Rock Type:** Chert.**Vegetation:** *Kunzea praestans*, (*Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii*) high shrubland over *Melaleuca calyptroides* open shrubland over *Hibbertia subvaginata* low shrubland over *Desmocladius flexuosus*, *Stylidium septentrionale* scattered sedges and herbs.**Vegetation condition:** Very good (some weeds).**Fire age:** Not burnt for more than 5 to 10 years.**Notes:** Datum: WGS84. 1st coord is for SE peg; 2nd coord is for NW peg.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	(10)40cm	JT3-9	<i>Acacia aristulata</i>
<i>Arctotheca calendula</i>	+	<1 %	10cm		*Capeweed
<i>Austrostipa nitida</i>	+	<1 %	30cm	JT3-4	<i>Austrostipa</i>
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Briza maxima</i>	+	<1 %	25cm		
<i>Burchardia umbellata</i>	+	<1 %	15cm	JT3-53	Revisit.
<i>Caladenia denticulata</i>	+	<1 %	12cm	=JT6-56	Revisit. ?
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	10cm	=JT8-55	Revisit. Hairy leaf orchid (?flava)
<i>Calandrinia</i> sp. Blackberry	+	<1 %	10cm	JT3-10	
<i>Calytrix leschenaultii</i>	+	<1 %	60cm	=JT1-3	<i>Calytrix</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=JT5-55	Revisit. Lilly
<i>Cheilanthes adiantoides</i>	+	<1 %	15cm	JT3-25	<i>Cheilanthes</i>

<i>Comesperma integerrimum</i>	+	<1 %	35cm	JT3-2,12	Also JT3-54. Straggly shrub.
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	1-2cm	JT3-51	Revisit.
<i>Cristonia biloba</i>	+	<1 %	25cm	JT3-15	pea
<i>Desmocladius flexuosus</i>	+	<1 %	15cm	JT3-1	Desmocladius
<i>Dichopogon capillipes</i>	+	<1 %	5cm	=JT9-51	Revisit. Flat
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30cm	JT3-11,52	<i>Drosera</i>
<i>Dryandra sessilis</i> var. <i>sessilis</i>	4%	1-5%	3.5m	JT3-3	<i>Dryandra sessilis</i>
<i>Hibbertia subvaginata</i>	10-15	10-25%	80cm		
<i>Hypochaeris glabra</i>	1-2	1-5%	20cm	JT3-58	* <i>Sonchus</i>
<i>Kunzea praestans</i>	10-15	10-25%	2.5m		
<i>Lomandra</i> (<i>Moor</i> a twisty)	+	<1 %	30cm	JT3-14	<i>Lomandra</i>
<i>Melaleuca calyptroides</i>	5	5-10%	1.8m	=JT1-1	<i>Melaleuca</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	30cm	=ER17-1	<i>Neurachne</i>
<i>Parentucellia latifolia</i>	+	<1 %	10cm		<i>Parentucellia</i>
<i>Pentaschistis pallida</i>	5	5-10%		JT3-8	<i>Pentaschistis</i>
<i>Podolepis lessonii</i>	+	<1 %	15cm	JT3-6	<i>Podolepis lessonii</i>
<i>Podotheca gnaphalioides</i>	+	<1 %	10cm	JT3-5	<i>Podotheca</i>
<i>Pterostylis sanguinea</i>	+	<1 %	12cm	=JT10-54	Also JT3-56, 57 in 30x30. Revisit. Blue beard orchid
<i>Scaevola phlebopetala</i>	+	<1 %	10cm	JT3-7	Goodeniaceae
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %		=JT1-17	*? <i>Silene</i>
<i>Stylidium cordifolium</i>	+	<1 %	15cm	JT3-16	
<i>Stylidium repens</i>	2	1-5%	10cm	=JT1-30	<i>Stylidium</i>
<i>Stylidium septentrionale</i>	+	<1 %	10cm	=CH9-4	<i>Stylidium</i>
<i>Thysanotus manglesianus</i>	+	<1 %	35cm	=JT1-2	<i>Thysanotus</i>
<i>Trachymene cyanopetala</i>	+	<1 %	5cm	JT3-13	<i>Trachymene</i>
<i>Trifolium hirtum</i>	+	<1 %	10cm	=JT1-14	<i>Trifolium</i> (pink heads)
<i>Tripteris clandestina</i>	+	<1 %	25cm	JT3-50	Revisit. Stink daisy
<i>Ursinia anthemoides</i>	1-2	1-5%	25cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	1	<1 %	15cm	=CH7-20	Grass (cyl head)
<i>Xanthorrhoea drummondii</i>	1	<1 %	2.2m		
<i>Acacia hemiteles</i>	+	<1 %	1.1m	JT3-22	<i>Acacia</i>
<i>Allocasuarina campestris</i>	+	<1 %	2.5m		
<i>Astroloma serratifolium</i>	+	<1 %	10cm	JT3-19	<i>Astroloma</i>
<i>Austrodanthonia setacea</i>	+	<1 %	30cm	JT3-20	<i>Austrodanthonia</i>
<i>Austrostipa variabilis</i>	+	<1 %	35cm	JT3-24	<i>Austrostipa</i>
<i>Cheilanthes distans</i>	+	<1 %	10cm	JT3-18	<i>Cheilanthes</i> #2 (hairy)
<i>Cyanicula gemmata</i>	+	<1 %	3cm	JT3-55	Revisit. (=JT6-54) Hairy spade leaf orchid (West border of 10x10+ a few beyond)
<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	+	<1 %	20cm	JT3-23	
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	20cm	=JT7-58	Revisit.
<i>Dryandra fraseri</i>	+	<1 %	40cm	JT3-21	<i>Dryandra</i> (small upright rounded shrub)
<i>Ehrharta longiflora</i>	+	<1 %	30cm		
<i>Erodium botrys</i>	+	<1 %	15cm	=JT1-9	? <i>Geraniaceae</i>
<i>Millotia myosotidifolia</i>	+	<1 %	10cm	JT3-17,26	Daisy
<i>Pityrodia dilatata</i>	+	<1 %	12cm		Revisit. <i>Pityrodia</i> (common)

Moora Site JT004

Described by BRM **Date** 10/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: John Tonkin's property, between Coomberdale East Rd and Kiaka Rd, on west side adjacent to Arthur and Rhonda Tonkin's property.

MGA Zone 50 **408852 m E** 6625867 **m N** -30.495907 **S lat** 116.050212 **E long**

Habitat: Gentle, northwest-facing, mid to lower slope on a ridge system.

Soil: Gravelly, pebbly (and some small cobbles) light grey silty sand.

Vegetation: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland to high shrubland over *Melaleuca calyptroides* open heath over *Stylidium septentrionale*, *Desmocladius flexuosus* low open herb/sedgeland.

Vegetation condition: Very good to excellent.

Fire age: Not burnt for more than 10 years.

Notes: Datum: WGS84. 1st coord is for NW peg; 2nd coord is for se peg. *Pterostylis* orchid present (too far deteriorated for ID).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Aira caryophyllea	+	<1 %	8-10cm	=JT2-12	*Aira
Allocauarina huegeliana	1-2%	1-5%	2-7m		
Allocauarina sp.	+	<1 %	1.8 m		Revisit. ?congestaes
Apium annuum	+	<1 %	3cm	JT4-11	Apium
Arctotheca calendula	+	<1 %	5cm		Capweed
Austrostipa elegantissima	+	<1 %	30cm	JT4-17	Austrostipa elegantissima
Austrostipa trichophylla	+	<1 %	8cm	JT4-18A	Austrostipa
Borya sphaerocephala	+	<1 %	3cm		Borya
Briza maxima	+	<1 %	5cm		
Bromus diandrus	+	<1 %	5cm	=JT2	Bromus
Caesia (Moorra hairy stem)	+	<1 %	20 cm	JT4-51,53	Revisit. Herb
Caladenia denticulata	+	<1 %	6 cm	=JT6-56	Revisit. ?
Calytrix leschenaultii	+	<1 %	1m	JT4-3	Calytrix
Chamaescilla corymbosa var. corymbosa	+	<1 %	5cm	=JT2	Chamaescilla
Crassula colorata var. colorata	+	<1 %	3cm	=JT2-19	Crassula colorata
Desmocladius flexuosus	<=2%	1-5%	20cm	JT4-7	Desmocladius
Drosera aff. macrantha	+	<1 %	15 cm	JT4-52	Revisit. Climbing
Drosera macrantha subsp. macrantha	+	<1 %	20cm	JT4-6	Drosera
Genus sp.	+	<1 %	3-5cm	JT4-12	Asteraceae
Genus sp.	+	<1 %	10cm	=JT2	
Hibbertia subvaginata	+	<1 %	1m	JT4-4	
Homalosciadium homalocarpum	+	<1 %	3cm	JT4-10B	
Hypochaeris glabra	+	<1 %	5cm		
Kunzea praestans	+/-10%	5-10%	2-3.5m		
Laxmannia ramosa subsp. ramosa	+	<1 %	8cm	JT4-16	Lilly
Levenhookia stipitata	+	<1 %	3cm	JT4-10	Levenhookia
Melaleuca calyptroides	45%	33.3-50%	0.8-1.4m	JT4-1	Melaleuca
Millotia tenuifolia var. tenuifolia	+	<1 %	3cm	JT4-13,10	Millotia
Neurachne alopecuroidea	+	<1 %	10cm	JT4-9	Neurachne
Paracaleana carinata	+	<1 %	3-5cm		Parentucellia
Pentaschistis sp. Moorra (doubtful ID)	+	<1 %	10cm	JT4-8	Poaceae
Phyllangium sulcatum	+	<1 %	8cm	JT4-15	"Mitrasacme"
Podolepis lessonii	+	<1 %	10-20cm		Podolepis (button)
Podotheca angustifolia	+	<1 %	5cm	JT4-5	Podotheca
Stylidium repens	+	<1 %	5cm	JT4-14	Stylidium repens
Stylidium septentrionale	+/-10%	5-10%	5-8cm	JT4-2	Stylidium
Thysanotus manglesianus	+	<1 %	20 cm	JT4-50	Revisit. Small
Trachymene cyanopetala	+	<1 %	5cm	=JT2-4	Trachymene
Trachymene ornata	+	<1 %	10cm		
Trachymene pilosa	+	<1 %	5cm		
Ursinia anthemoides	+	<1 %	8-15cm		
Vulpia myuros var. hirsuta	+	<1 %	10cm		
Wahlenbergia gracilentia	+	<1 %	10cm	JT4-19	Wahlenbergia
Xanthorrhoea drummondii	1	<1 %	2m		
Acacia acuminata subsp. acuminata	+	<1 %	4cm		
Caladenia flava subsp. flava	+	<1 %	3 cm	=JT8-55	Revisit. Hairy leaf ?flava
Cheilanthes adiantoides	+	<1 %	10cm		Cheilanthes
Cyanicula deformis	+	<1 %	6 cm	=JT8-54	Revisit. Blue beard orchid
Cyanicula gemmata	+	<1 %	3 cm	=JT3-55	Revisit. 1 x Hairy spade leaf Orchid (+ 1 On south side) (SW)
Dichopogon capillipes	+	<1 %	10cm		Dichopogon
Drosera erythrorhiza subsp. erythrorhiza	+	<1 %	2 cm	JT4-54	Revisit. Flat leaf base
Pterostylis recurva	+	<1 %	12 cm	JT4-56	Revisit. (No flower. With flat base Pterostylis)
Pterostylis sanguinea	+	<1 %	1 cm	=JT4-55	Revisit. Flat base
Silene gallica var. gallica	+	<1 %	15cm		Silene

Moorra**Site** JT005**Described by** BRM **Date** 10/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** John Tonkin's property, about 60m downslope of JT2**MGA Zone** 50 **408906 m E** **6626039 m N** **-30.494359 S lat** **116.05079 E long****Habitat:** Mid-slope of gentle south-facing slope on low ridge.

Soil: Gravelly, pebbly, cobbly brown loamy sand amongst exposed sheet rock. Rock covers about 15-20% of surface.

Rock Type: Chert.

Vegetation: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Podolepis lessonii*, *Trachymene ornata* open annual herbland.

Vegetation condition: Good to very good. (Some weeds).

Fire age: Not burnt for more than 10years.

Notes: Datum: WGS84. 1st coord for NE peg; 2nd coord for SW peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	5	5-10%	7-8m		
<i>Aira caryophyllea</i>	+	<1 %	15cm	JT5-1	* <i>Pentstemon</i>
<i>Allocasuarina campestris</i>	5	5-10%	3m		
<i>Allocasuarina huegeliana</i>	15-20%	10-25%	7m		
<i>Arctotheca calendula</i>	+	<1 %	10cm		* <i>Capeweed</i>
<i>Austrodanthonia acerosa</i>	+	<1 %	20cm	JT5-6	<i>Austrodanthonia</i>
<i>Austrostipa nitida</i>	+	<1 %	30cm	JT5-7,15	Also recorded in 30x30.
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Bromus diandrus</i>	+	<1 %	20cm		* <i>Bromus</i>
<i>Caesia</i> (Moora hairy stem)	+	<1 %	20cm	JT5-12,53	Lilly
<i>Calytrix leschenaultii</i>	+	<1 %	50cm	=JT1-3	<i>Calytrix leschenaultii</i> (purple)
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20cm	=CH9-13	<i>Chamaescilla</i>
<i>Cheilanthes adiantoides</i>	+	<1 %		=JT3-25	<i>Cheilanthes</i>
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	JT5-2	<i>Crassula</i> #1
<i>Crassula exserta</i>	+	<1 %	3cm	JT5-3	<i>Crassula</i> #3
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	JT5-51	Revisit. Flat
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	JT5-54	Revisit. Climber
<i>Ehrharta longiflora</i>	+	<1 %	20cm		
<i>Haemodorum simulans</i>	+	<1 %	20cm	JT5-10	<i>Haemodorum</i> ID?
<i>Hypochaeris glabra</i>	+	<1 %	35cm	JT5-13	* <i>Sonchus</i>
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>				=GH9-50	Revisit.
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %	10cm	JT5-8A	? <i>Daisy</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	4cm	=ER17-1	<i>Neurachne</i>
<i>Parentucellia latifolia</i>	+	<1 %	4cm		* <i>Parentucellia</i>
<i>Petrorhagia prolifera</i>	+	<1 %	30cm	=JT1-13	<i>Wahlenbergia</i> (single pink flower)
<i>Phyllangium sulcatum</i>	+	<1 %	10cm	JT5-4	
<i>Platysace cirrosa</i>	+	<1 %	10cm	JT5-18	
<i>Podolepis lessonii</i>	5-10%	5-10%	20cm	=JT3-6	<i>Podolepis lessonii</i>
<i>Rhodanthe laevis</i>	+	<1 %	15cm	JT5-11	
<i>Schoenus clandestinus</i>	+	<1 %	3cm	JT5-9	<i>Schoenus</i>
<i>Trachymene cyanopetala</i>	+	<1 %	4cm	JT5-5	<i>Trachymene</i>
<i>Trachymene ornata</i>	3-5	1-5%	20cm	=CH7-9	<i>Trachymene</i> white top
<i>Trifolium hirtum</i>	+	<1 %	2cm	JT5-52	Revisit. Clover
<i>Tripteris clandestina</i>	+	<1 %	35cm	JT5-14	<i>Daisy</i>
<i>Ursinia anthemoides</i>	+	<1 %	15cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15cm	=CH7-20	Grass (cyl heads)
<i>Xanthorrhoea drummondii</i>	+	<1 %	2.5m		
<i>Borya sphaerocephala</i>	+	<1 %	2cm		Revisit.
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Desmocladius flexuosus</i>	+	<1 %	15cm		
<i>Dichopogon capillipes</i>	+	<1 %	10cm	=JT1-12	<i>Dichopogon</i>
<i>Kunzea praestans</i>	+	<1 %	2m		
<i>Opercularia vaginata</i>	+	<1 %	20cm	JT1-34	<i>Opercularia</i>
<i>Pterostylis</i> sp.	+	<1 %	4cm	JT5-56	Revisit
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	20cm	JT1-17	?* <i>Silene</i>
<i>Stackhousia monogyna</i>	+	<1 %	35cm	JT5-17	<i>Stackhousia</i>
<i>Stylidium septentrionale</i>	+	<1 %	10cm	JT5-16	<i>Stylidium</i>
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	=GH6-52	Revisit.

Moora

Site JT006

Described by MET

Date

11/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: South-western corner of John Tonkin's property about 25m from boundary fence.

MGA Zone 50 409009 **m E** 6625325 **m N** -30.500809 **S lat** 116.051801 **E long**

Habitat: Gentle slope just below the crest of a low ridge, facing slightly westerly.

Soil: Light grey-brown gravelly, pebbly silty sand with cobbles frequent on the surface.

Vegetation: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* scattered low trees to low open woodland over *Allocasuarina campestris* open to closed scrub over *Cheilanthes adiantoides*, *Dichopogon capillipes*, *Stylidium septentrionale* open fern/herbland.

Vegetation condition: Very good. Low weed invasion, but significant fire damage (death of *Acacia acuminata*, *Xanthorrhoea drummondii*).

Notes: Datum: WGS84. Only 3 pegs. 1st coord is for SW peg, 2nd coord is for NW peg; 3rd coord is for NE peg. 30x30m search avoided the area to the north-east, as more open and more rocky.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	>5%	5-10%	2.5-3.5m		6 dead
<i>Aira caryophylla</i>	+	<1 %		JT6-12B	
<i>Allocasuarina campestris</i> m	80%	>75%	(1.7)2-3.4		
<i>Avena barbata</i>	+	<1 %	45cm		
<i>Briza maxima</i>	+	<1 %	10-20cm		
<i>Burchardia umbellata</i>	+	<1 %	40cm	JT6-14	Burchardia
<i>Caladenia denticulata</i>	+	<1 %	20 cm	JT6-56	Revisit. ?
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3 cm	=CH10-56	Revisit. Hairy leaf orchid
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	15 cm	JT6-18	Also recorded in 30x30. Also =JT5-55. Revisit. Lilly
<i>Cheilanthes adiantoides</i>	>2	1-5%	10-15cm		Cheilanthes
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm		
<i>Cyanicula deformis</i>	+	<1 %	15 cm	=CH12-57	Revisit. Blue beard orchid
<i>Cyanicula gemmata</i>	+	<1 %	1 cm	JT6-54	Revisit. Hairy spade leaf orchid - 3 near SW peg)
<i>Desmocladius flexuosus</i>	+	<1 %	30cm		Desmocladius
<i>Dichopogon capillipes</i>	+/- 1%		20 cm	JT6-8,50	Revisit.
<i>Dioscorea hastifolia</i>	+	<1 %	15cm		
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	20-60 cm	=JT6-52	Revisit. Climbing
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	30cm	JT6-1,17	Drosera
<i>Ehrharta longiflora</i>	+	<1 %	40cm		
<i>Hypochaeris glabra</i>	+	<1 %	5cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15 cm	=JT2-50	Revisit.
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm	JT6-4	Neurachne
<i>Pentaschistis pallida</i>	+	<1 %	5-10cm	JT6-12A	Aira
<i>Pentaschistis</i> sp. <i>Moor</i> a (doubtful ID)	+	<1 %	8-15cm	JT6-9	Poaceae
<i>Petrorhagia prolifera</i>	+	<1 %	10cm		"pink"
<i>Podolepis lessonii</i>	+	<1 %	10cm		Podolepis (button)
<i>Rhodanthe laevis</i>	+	<1 %	4cm	JT6-15	Daisy
<i>Schoenia cassiniana</i>	+	<1 %	5cm		Daisy (pink & white)
<i>Schoenus clandestinus</i>	+	<1 %	8cm	JT6-5,57	Schoenus
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	15cm	JT6-10	*Silene
<i>Stylidium septentrionale</i>	2%	1-5%	10cm	JT6-2,51	Stylidium
<i>Stypandra glauca</i>	+	<1 %	20cm	JT6-13	Stypandra glauca
<i>Thysanotus manglesianus</i>	+	<1 %	60 cm	=JT2-53	Also JT6-11 in 30x30. Revisit. Climbing
<i>Trachymene cyanopetala</i>	+	<1 %	5cm	JT6-6	?Trachymene
<i>Trachymene ornata</i>	+	<1 %	5cm		
<i>Trachymene pilosa</i>	+	<1 %	8cm		
<i>Trifolium hirtum</i>	+	<1 %	1 cm	=JT5	Revisit. Clover
<i>Tripteris clandestina</i>	+	<1 %	20cm	JT6-7	Daisy
<i>Ursinia anthemoides</i>	+	<1 %	10-25cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10-15cm	JT6-3	Vulpia myuros
<i>Xanthorrhoea drummondii</i>	2	1-5%	2.1m		
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	2.2m		Acacia 'not aristulata'
<i>Arctotheca calendula</i>	+	<1 %	5cm		
<i>Borya sphaerocephala</i>	+	<1 %	2 cm		Revisit. (Near SW peg)
<i>Calytrix leschenaultii</i>	+	<1 %	50cm		Calytrix (blue)
<i>Drosera macrophylla</i> subsp. <i>macrophylla</i>	+	<1 %	2 cm	JT6-58	Revisit. Flat base
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	4m		Dryandra sessilis

Kunzea praestans	+	<1 %	2.4m		
Melaleuca sp.	+	<1 %	1.4m		Melaleuca
Pterostylis sanguinea	+	<1 %	12 cm	=CH10-51	Revisit. Flat leaf base (Western edge of 30x30)
Waitzia nitida	+	<1 %	15cm	JT6-19	Waitzia
Wurmbea drummondii	+	<1 %	5 cm	JT6-55	Revisit.

Moora Site JT007

Described by BRM **Date** 11/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: Southern most ridge on John Tonkin's property. Gravel pit and Ridgeway's property to south.

MGA Zone 50 **409060 m E** 6625331 **m N** -30.500759 **S lat** 116.052332 **E long**

Habitat: Gentle upper-mid slope, east-facing, on low ridge.

Soil: Gravelly, pebbly, Cobbly brown loamy sand. Soil skeletal amongst rocks and exposed sheet rock.

Rock Type: Chert.

Vegetation: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata scattered low trees over Kunzea praestans, (Dryandra sessilis) scattered tall shrubs over Melaleuca calyptroides, (Allocasuarina campestris) open heath over Calytrix leschenaultii low open shrubland over Desmodium flexuosa, Stylidium septentrionale scattered sedges and herbs.

Vegetation condition: Very good to excellent.

Fire age: Not burnt for more than 7 to 10 years.

Notes: Datum: WGS84. 1st coord is for SW peg; 2nd coord is for NE peg. Nemcia 10m from NW peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	2.0m		
Aira caryophyllea	+	<1 %		JT7-10B	
Allocasuarina campestris	+	<1 %	1.8m		
Allocasuarina huegeliana	+	<1 %	2.5m		
Arctotheca calendula	+	<1 %	10cm		Capeweed
Avena barbata	+	<1 %	35cm		
Briza maxima	+	<1 %	20cm		
Burchardia umbellata	+	<1 %	20cm		Burchardia
Caladenia flava subsp. flava	+	<1 %	3cm	JT7-52	Revisit. (?=CH10-56) Hairy leaf orchid
Calothamnus sanguineus	+	<1 %	35cm	JT7-15	Calothamnus
Calytrix leschenaultii	5-8%	5-10%	90cm	JT7-1	Calytrix
Chamaescilla corymbosa var. corymbosa	+	<1 %	12cm	=CH12-52	Revisit. Lilly
Cheilanthes adiantoides	+	<1 %	10cm	=JT3-25	Cheilanthes
Crassula colorata var. colorata	+	<1 %	3cm	JT7-14	Crassula
Cyanicula deformis	+	<1 %	12cm	=CH12-57	Revisit. Blue beard orchid
Desmodium flexuosum	1	<1 %	20cm	JT7-5	Desmodium flexuosum
Dichopogon capillipes	+	<1 %	20cm	JT7-7,51	Dichopogon
Diplopeltis huegelii subsp. lehmannii	+	<1 %	30cm	JT7-4	Diplopeltis
Drosera aff. macrantha	+	<1 %	20cm	JT7-6,53	Also JT7-54, JT7-60 (30x30). Drosera (climber).
Dryandra sessilis var. sessilis	+	<1 %	2cm		Dryandra sessilis
Hibbertia subvaginata	+	<1 %	20cm		
Hypochaeris glabra	+	<1 %	20cm	=JT1-10	*Sonchus
Kunzea praestans	1-2%	1-5%	2-2.2m		
Lomandra (Moora twisty)	+	<1 %	20cm	JT7-16	Lomandra
Melaleuca calyptroides	60-70%	50-75%	1.2m	JT7-3	Melaleuca
Neurachne alopecuroidea	+	<1 %	10cm	=ER17-1	Neurachne
Parentucellia latifolia	+	<1 %	10cm		Parentucellia
Pentastichis pallida	+	<1 %	10cm	JT7-10A	*Pentastichis
Podolepis lessonii	+	<1 %	20cm	=JT3-6	Podolepis lessonii
Podotrocha angustifolia	+	<1 %	10cm	JT7-13	Podotrocha
Pterostylis setulosa	+	<1 %	12cm	JT7-56	Revisit. Flat leaf
Silene gallica var. gallica	+	<1 %	25cm	=JT1-17	?Silene
Stylidium repens	1	<1 %	10cm	=JT1-30	Stylidium
Stylidium septentrionale	1	<1 %	10cm	JT7-2	Stylidium (pink)
Thysanotus manglesianus	+	<1 %	30cm	JT7-9,55	Also JT7-59. Thysanotus
Trachymene cyanopetala	+	<1 %	10cm	JT7-12	Trachymene hairy
Trachymene ornata	+	<1 %	10cm	JT7-11	Trachymene white heads
Trachymene pilosa	+	<1 %	4cm	JT7-8	Trachymene (short hairs)

<i>Trifolium hirtum</i>	+	<1 %	10cm	=JT1-14	*Trifolium (pink head)
<i>Ursinia anthemoides</i>	+	<1 %	30cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	15cm	=CH7-20	Grass (cylinder heads)
<i>Acacia hemiteles</i>	+	<1 %	1.1m	JT7-17	Acacia
<i>Astroloma serratifolium</i>	+	<1 %	10cm	JT7-61	Revisit.
<i>Nemcia acuta</i>	+	<1 %	30cm	JT7-19	Nemcia
<i>Opercularia vaginata</i>	+	<1 %	25cm	=CH9-31	Opercularia
<i>Pityrodia dilatata</i>	+	<1 %	30cm	JT7-18	Pityrodia
<i>Urospermum picroides</i>	+	<1 %		JT7-20	*Sonchus
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		

Moora Site JT008

Described by MET **Date** 11/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: John Tonkin's property, 200m north-NE of the SW corner.

MGA Zone 50 **408835 m E** **6625542 m N** **-30.498838 S lat** **116.050007 E long**

Habitat: Mid to upper, south-west facing slope on ridge.

Soil: Gravelly, Pebbly grey silty sand amongst cobbles and boulders.

Vegetation: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala*, *Kunzea praestans* high shrubland over *Melaleuca calyptroides* shrubland over *Desmocladius flexuosus* scattered sedges and **Briza maxima*, *Podotheca angustifolia* very open annual grass/herbland.

Vegetation condition: Very good. (Too weedy to be Excellent).

Notes: Datum: WGS84. 1st coord is for SW peg, 2nd coord is for NE peg and 3rd coord is for SE peg. No NW peg. *Xanthorrhoea* population seems to be declining rapidly. A few young (about 30cm high) *Kunzea*.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	<5%	1-5%	5m		
<i>Acacia aristulata</i>	+	<1 %	25cm		
<i>Allocasuarina campestris</i>	1	<1 %	1m		
<i>Austrostipa nitida</i>	+	<1 %	10cm	JT8-7	<i>Austrostipa</i>
<i>Avena barbata</i>	+	<1 %	20cm		
<i>Briza maxima</i>	>2	1-5%	2-25cm		
<i>Bromus diandrus</i>	+	<1 %	10-15cm	JT8-6	* <i>Bromus</i>
<i>Burchardia umbellata</i>	+	<1 %	25 cm	=GH9-52	Also JT8-12 (30x30). Revisit.
<i>Caladenia denticulata</i>	+	<1 %	10 cm	=JT6-56	Revisit. ?
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3 cm	JT8-55	Revisit. (?=CH10-56) Hairy leaf
<i>Calandrinia calyptrata</i>	+	<1 %	5cm	JT8-8	<i>Calandrinia</i>
<i>Calytrix leschenaultii</i>	1	<1 %	30-150cm		<i>Calytrix</i> (blue)
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	5 cm	=JT5-55	Revisit. Lilly
<i>Cheilanthes adiantoides</i>	1	<1 %	10-15cm		<i>Cheilanthes</i>
<i>Comesperma integerrimum</i>	+	<1 %	45 cm	JT8-51	Revisit. ?volubile
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3-5cm	JT8-60	
<i>Cyanicula deformis</i>	+	<1 %	12 cm	JT8-54	Revisit. (?=CH12-57)
<i>Desmocladius flexuosus</i>	1	<1 %	15-30cm		<i>Desmocladius</i>
<i>Dichopogon capillipes</i>	+	<1 %	10cm	=JT6	<i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	+	<1 %	1.2m		
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	25 cm	=JT7-58	Revisit.
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	15cm	JT8-10,56	Also recorded in 30x30.
<i>Ehrharta longiflora</i>	+	<1 %	25cm		
<i>Erodium botrys</i>	+	<1 %	5cm	JT8-2	<i>Erodium</i>
Genus sp.	+	<1 %	5cm		Clover(yellow)
Genus sp.	+	<1 %	10cm		Clover (pink)
<i>Hibbertia subvaginata</i>	+	<1 %	65cm		
<i>Hypochoeris glabra</i>	>1	1-5%	3cm		
<i>Kunzea praestans</i>	10-15	10-25%	(1.2)2.5-4m		
<i>Melaleuca calyptroides</i>	25	25-33.3%	1.5-1.8m	JT8-1	<i>Melaleuca</i>
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm	=JT6	<i>Neurachne</i>
<i>Olearia dampieri</i> subsp. <i>eremicola</i>	1	<1 %	10cm	JT8-4	<i>Olearia</i> aff. <i>axillaris</i>
<i>Parentucellia latifolia</i>	+	<1 %	5cm		<i>Parentucellia</i>
<i>Pentaschistis pallida</i>	+	<1 %	5-10cm	=JT6	<i>Aira</i>
<i>Petrorhagia prolifera</i>	+	<1 %	10-15cm		"pink"

Podolepis lessonii	1	<1 %	5-10cm		Podolepis (button)
Podotheca angustifolia	+	<1 %	3cm	=JT4	Podotheca
Pterostylis setulosa	+	<1 %	12 cm	JT8-59	Revisit. (?CH10-51) Flat leaf base
Regelia megacephala	15-20%	10-25%	4-5m		
Silene gallica var. gallica	+	<1 %	10-15cm	=JT6	*Silene
Stylidium repens	+	<1 %	8cm	JT8-9	Stylidium ?repens
Stylidium septentrionale	<=1%	1-5%	8cm	=JT6	Stylidium
Thysanotus manglesianus	+	<1 %	30-200cm	JT8-3,52	Also JT8-53. Thysanotus
Trifolium hirtum	+	<1 %	2 cm	=JT6	Revisit. Clover
Urospermum picroides	+	<1 %	10cm	JT8-5	Asteraceae
Ursinia anthemoides	>1	1-5%	10-25cm		
Vulpia myuros var. hirsuta	+	<1 %	10cm		
Xanthorrhoea drummondii	2	1-5%	1.6m		
Allocasuarina huegeliana	+	<1 %	4 m		Revisit.
Austrostipa scabra	+	<1 %	35cm	JT8-11	Poaceae
Austrostipa variabilis	+	<1 %		JT8-SN	
Caesia (Moora hairy stem)	+	<1 %	20 cm	JT8-57	Revisit.
Calothamnus aff. quadrifidus Moora-Watheroo	+	<1 %	2m		Calothamnus
Comesperma volubile	+	<1 %	70cm		
Daviesia dielsii	+	<1 %	1.2m		(Rare). 2m across
Dryandra sessilis var. sessilis	+	<1 %	3.5 m		Revisit.
Nemcia acuta	+	<1 %	30 cm	JT08-58	Revisit.
Stylidium caricifolium	+	<1 %	20cm	JT8-13	Stylidium(8-13) was found 5m west of SW peg. See detailed description in field notes.
Stypandra glauca	+	<1 %	10cm		

Moora Site JT009

Described by BRM **Date** 11/10/02 **Type:** QUADRAT 10x10 m, 30x30

Location: John Tonkin's ridge, several hundred meters north of Ridgeway's fence line and just east of Arthur & Rhonda Tonkin's fence line.

MGA Zone 50 **408850 m E** **6625476 m N** **-30.499434 S lat** **116.050157 E long**

Habitat: North-facing, gently sloping mid-slope of low chert ridge.

Soil: Skeletal cobbly, pebbly, gravelly brown loamy sand amongst exposed sheet rock and boulders.

Rock Type: Chert.

Vegetation: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata scattered low trees over Allocasuarina campestris, (Calothamnus aff. quadrifidus Moora-Watheroo) open scrub over Neurachne alopecuroidea, Desmocladius flexuosus, Stylidium septentrionale scattered grasses, sedges and

Vegetation condition: Very good. Some weeds (low cover).

Fire age: Not burnt for more than 5 to 10 years.

Notes: Datum: WGS84. 1st coord is for NE peg; 2nd coord is for SW peg.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
Acacia acuminata subsp. acuminata	+	<1 %	2m		
Allocasuarina campestris	40%	33.3-50%	2.5m		
Allocasuarina huegeliana	+	<1 %	3.5m		
Arctotheca calendula	+	<1 %	10cm	JT9-16	
Austrodanthonia acerosa	+	<1 %	10cm	JT9-9	Austrodanthonia
Avena barbata	+	<1 %	30cm		
Borya sphaerocephala	+	<1 %	10cm		Borya
Briza maxima	+	<1 %	20cm		
Bromus diandrus	+	<1 %	20cm	JT9-15	*Bromus
Calandrinia calyptata	+	<1 %	10cm	JT9-14	Calandrinia
Calothamnus aff. quadrifidus Moora-Watheroo	3-4%	1-5%	2.5(4)m	JT9-1	Calothamnus quadrifidus
Chamaescilla corymbosa var. corymbosa	+	<1 %	6cm	=JT5-55	Revisit. Lilly
Cheilanthes adiantoides	+	<1 %	15cm	=JT3-25	Cheilanthes (not hairy)
Crassula colorata var. colorata	+	<1 %	4cm	JT9-13	Crassula
Cyanicula deformis	+	<1 %	12cm	=CH12-57	Revisit. Blue beard orchid
Daviesia dielsii	+	<1 %	1.8m	JT9-3	1 shrub
Desmocladius flexuosus	+	<1 %	20cm	=JT7-5	Desmocladius flexuosus
Dichopogon capillipes	+	<1 %	12cm	JT9-50,51	Revisit.
Diuris aff. recurva	+	<1 %	30cm	=JT7-58	Revisit. Orchid
Drosera macrantha subsp. macrantha	+	<1 %	35cm	JT9-52	Revisit. Climber
Ehrharta longiflora	+	<1 %	35cm		

<i>Erodium botrys</i>	+	<1 %	4cm	JT9-8	?Geraniaceae pink flr
<i>Haemodorum paniculatum</i>	+	<1 %	40cm	JT9-10	Lomandra
<i>Hypochaeris glabra</i>	+	<1 %	10cm	=JT1-10	*Sonchus
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	12cm	=JT2	Revisit.
<i>Kunzea praestans</i>	+	<1 %	4cm		
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	30cm	JT9-6	Lepidosperma
<i>Melaleuca calyptroides</i>	+	<1 %	1.6m	=JT7-3	Melaleuca
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm	JT9-2	Neurachne
<i>Opercularia vaginata</i>	+	<1 %	10cm	=CH9-31	Opercularia
<i>Pentaschistis pallida</i>	+	<1 %	15cm	=JT7-10	Pentaschistis
<i>Petrorhagia prolifera</i>	+	<1 %	25cm	=JT1-13	?Wahlenbergia (single pink flr)
<i>Platysace cirrosa</i>	+	<1 %	20cm	JT9-11,55	
<i>Podolepis lessonii</i>	+	<1 %	20cm	=JT3-6	Podolepis lessonii
<i>Schoenus clandestinus</i>	+	<1 %	4cm	JT9-4	Schoenus
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	20cm	JT9-12	*Silene
<i>Stylidium septentrionale</i>	+/-1	<1 %	10cm	JT7-2	Stylidium (pink)
<i>Stypandra glauca</i>	+	<1 %	30cm	JT9-5	Stypandra
<i>Trachymene cyanopetala</i>	+	<1 %	10cm	=JT7-12	Trachymene hairy
<i>Trachymene ornata</i>	herbs.	+	<1 %	10cm	=JT7-11
<i>Trachymene</i> white head					
<i>Tripteris clandestina</i>	+	<1 %	10cm	JT9-53,54	Revisit. Herb
<i>Ursinia anthemoides</i>	+	<1 %	30cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	20cm	JT9-7	Grass (cyl head)
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	+	<1 %	35cm	JT9-17	Daviesia ?hakeoides
<i>Drosera macrophylla</i> subsp. <i>macrophylla</i>	+	<1 %	1cm	=JT6	Revisit. Flat - White flower
Genus sp.	+	<1 %	40cm		
<i>Pterostylis</i> sp.	+	<1 %	12cm	JT9-56	Revisit. Flat leaf
<i>Waitzia nitida</i>	+	<1 %	10cm	=ER15-8	Waitzia
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.8m		

Moora**Site JT010****Described by** MET **Date** 11/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** John Tonkin's property, SW corner on second ridge from west**MGA Zone** 50 **409103 m E** 6625844 **m N** -30.496133 **S lat** 116.052825 **E long****Habitat:** West facing moderate boulder/outcrop slope.**Soil:** Gravelly, pebbly light grey silty sand amongst outcrop and boulders.**Vegetation:** *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans* high shrubland over *Hibbertia subvaginata* shrubland.**Vegetation condition:** Poor to good. Too weedy for good.**Notes:** Datum: WGS84. 1st coord is for NW peg; 2nd coord is for SE peg. Quite disturbed, but probably hasn't lost any strata. The *Hibbertia* probably has more cover now than before disturbance and the *Kunzea* less. The site includes some *Actinostrobos* individuals. There was just one small patch of these (6 plants).**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	4m		Dead
<i>Acacia aristulata</i>	+	<1 %	10-20cm		6 plants
<i>Actinostrobos arenarius</i>	3%	1-5%	1.6-2.1m	JT10-1	Actinostrobos (see detailed description in field notes)
<i>Arctotheca calendula</i>	+	<1 %	5-10cm		
<i>Austrostipa hemipogon</i>	+	<1 %	40cm	JT10-5	
<i>Avena barbata</i>	1-2	1-5%	15-40cm		
<i>Briza maxima</i>	>2	1-5%	10-20cm		
<i>Bromus diandrus</i>	10	5-10%	15cm	=JT8	*Bromus
<i>Burchardia umbellata</i>	+	<1 %	30cm	=JT8-6	Burchardia
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	2 cm	=CH10-56	Revisit. Hairy leaf (?flava)
<i>Cheilanthes adiantoides</i>	>2%	1-5%	10cm		Cheilanthes (austro)
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2-6cm		
<i>Crassula exserta</i>	+	<1 %	5cm	JT10-3	Crassula
<i>Desmocladus flexuosus</i>	+	<1 %	10cm		
<i>Dichopogon capillipes</i>	+	<1 %	20 cm	JT10-51,5	Revisit. (+CH10-52)
<i>Dioscorea hastifolia</i>	+	<1 %	5-10cm		

<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20 cm	JT10-51	Revisit. Climber
<i>Ehrharta longiflora</i>	10	5-10%	10-40cm		
<i>Erodium botrys</i>	+	<1 %	8cm	JT10-2	
Genus sp.	+	<1 %	3cm		Clover(red/pink)
<i>Hibbertia subvaginata</i>	>20%	10-25%	(0.4)0.6-1.3m		
<i>Hypochaeris glabra</i>	5	5-10%	5cm		
<i>Kunzea praestans</i>	>=15%	10-25%	2-3.7m		
<i>Neurachne alopecuroidea</i>	+	<1 %	5-10cm	=JT6	*aira
<i>Petrorhagia prolifera</i>	+	<1 %	12cm		"pink"
<i>Pleurosorus rutifolius</i>	+	<1 %	7cm	JT10-4	fern
<i>Podotheca gnaphalioides</i>	+	<1 %	15cm	JT10-8	Podotheca
<i>Pterostylis exserta</i> (ms)	+	<1 %	15cm	JT10-6	Hood transparent between veins; veins brownish green dull.
<i>Pterostylis sanguinea</i>	+	<1 %	2 cm	JT10-54	Revisit. Flat leaf
<i>Thysanotus manglesianus</i>	+	<1 %	30 cm	=CH10-57	Revisit. Climber
<i>Trachymene cyanopetala</i>	+	<1 %	20 cm	=JT5-5	Revisit. Lilly
<i>Trifolium hirtum</i>	+	<1 %	2 cm	=JT5	Revisit. Clover
<i>Tripteris clandestina</i>	+	<1 %	45 cm	JT10-53	Revisit. Yellow daisy
<i>Urospermum picroides</i>	+	<1 %	5-20cm	JT10-7	Asteraceae
<i>Ursinia anthemoides</i>	2	1-5%	10-20cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	>1	1-5%	10-20cm		
<i>Caladenia denticulata</i>	+	<1 %	20 cm	JT10-56	Revisit. Hairy - sheathing base leaf
<i>Calytrix leschenaultii</i>	+	<1 %	1m		Calytrix (blue)
<i>Cyanicula deformis</i>	+	<1 %	10 cm	=CH12-57	Revisit. Blue beard orchid
<i>Melaleuca calyptroides</i>	+	<1 %	1-1.6m	=JT8	Melaleuca
<i>Muehlenbeckia adpressa</i>	+	<1 %	70cm	JT10-9	
<i>Nuytsia floribunda</i>	+	<1 %	5m		
<i>Pityrodia dilatata</i>	+	<1 %	25cm		
<i>Xanthorrhoea drummondii</i>	+	<1 %	3.2m		

Moora**Site JT011****Described by** BRM **Date** 11/10/02 **Type:** QUADRAT 10x10 m, 30x30**Location:** Main western ridge, John Tonkin's.**MGA Zone** 50 **408964 m E** **6625740 m N** **-30.497061 S lat** **116.051368 E long****Habitat:** Flat crest of low chert ridge.**Soil:** Gravelly, pebbly, cobbly brown loamy sand in matrix of exposed sheet rock.**Rock Type:** Chert. Rock cover of surface about 40 to 50%.**Vegetation:** *Kunzea praestans* high shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low shrubland over *Desmocladius flexuosa*, *Stylidium septentrionale* scattered sedges and herbs.**Vegetation condition:** Good to very good. (Considerable weed invasion).**Fire age:** Not burnt for more than 5 to 10 years.**Notes:** Datum: WGS84. 1st coord is for SW peg; 2nd coord is for NE peg.**Species List:**

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30cm		
<i>Arctotheca calendula</i>	+	<1 %	10cm		Capeweed
<i>Austrostipa nitida</i>	+	<1 %	35cm	JT11-4,19	Also recorded in 30x30.
<i>Avena barbata</i>	+	<1 %	35cm		
<i>Briza maxima</i>	+	<1 %	20cm		
<i>Bromus diandrus</i>	+	<1 %	15cm	=JT9-15	Bromus
<i>Caladenia denticulata</i>	+	<1 %	10cm	=JT6-56	Revisit. ?
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	20cm	JT11-10	Orchid
<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo	3-4	1-5%	3-5.4	=JT9-1	Calothamnus
<i>Calytrix leschenaultii</i>	1-2	1-5%	50cm	=JT7-1	
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	4cm	JT11-14	Crassula
<i>Crassula exserta</i>	+	<1 %	10cm	JT11-7	Crassula
<i>Cristonia biloba</i>	+	<1 %	10cm	JT11-3	pea
<i>Cyanicula deformis</i>	+	<1 %	12cm	=JT8-54	Revisit. Blue beard orchid
<i>Cyanicula gemmata</i>	+	<1 %	1cm	=JT6-54	Revisit. Hairy spade orchid (2 under <i>Kunzea</i> in centre of plot).
Also 1 about to flower 50J0408960 WGS84 UTM66					
<i>Desmocladius flexuosus</i>	2	1-5%	15cm	=JT7-5	<i>Desmocladius flexuosus</i>

<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	35cm	JT11-51	Revisit. Climber
<i>Hibbertia</i> <i>subvaginata</i>	10-15%	10-25%	1m		
<i>Hypochaeris</i> <i>glabra</i>	3-4%		2cm		Revisit.
<i>Kunzea</i> <i>praestans</i>	15-20%	10-25%	2.5m		
<i>Melaleuca</i> <i>calyptroides</i>	+	<1 %	1.5m	=JT7-3	Melaleuca
<i>Millotia</i> <i>myosotidifolia</i>	+	<1 %	5cm	JT11-11	tiny daisy
<i>Neurachne</i> <i>alopeuroidea</i>	+	<1 %	30cm	=JT9-2	Neurachne
<i>Parentucellia</i> <i>latifolia</i>	+	<1 %	10cm		Parentucellia
<i>Pentaschistis</i> <i>pallida</i>	+	<1 %	10cm	=JT7-10	Pentaschistis
<i>Petrorhagia</i> <i>prolifera</i>	+	<1 %	20cm	=JT1-13	? <i>Wahlenbergia</i> single pink flower head
<i>Pityrodia</i> <i>dilatata</i>	+	<1 %	20cm	JT7-18	<i>Pityrodia</i>
<i>Podolepis</i> <i>canescens</i>	+	<1 %	25cm	JT11-13	<i>Waitzia</i>
<i>Podolepis</i> <i>lessonii</i>	+	<1 %	12cm	=JT3-6	<i>Podolepis lessonii</i>
<i>Podotheca</i> <i>angustifolia</i>	+	<1 %	4cm	=JT7-13	<i>Podotheca</i>
<i>Silene</i> <i>gallica</i> var. <i>gallica</i>	+	<1 %	25cm	=JT9-12	? <i>Silene</i>
<i>Sonchus</i> <i>oleraceus</i>	+	<1 %	20cm	JT11-16	
<i>Stylidium</i> <i>cordifolium</i>	+	<1 %	30cm	JT11-5	<i>Stylidium</i> white flower
<i>Stylidium</i> <i>repens</i>	1	<1 %	10cm	=JT1-30	<i>Stylidium</i> 'repens'
<i>Stylidium</i> <i>septentrionale</i>	2-3	1-5%	10cm	=JT7-2	<i>Stylidium</i> 'pink'
<i>Thysanotus</i> <i>manglesianus</i>	+	<1 %	40cm	JT11-8,50	<i>Thysanotus</i> Climbing
<i>Trachymene</i> <i>cyanopetala</i>	+	<1 %	10cm	=JT7-12	<i>Trachymene</i>
<i>Trachymene</i> <i>ornata</i>	+	<1 %	5cm	=JT7-11	<i>Trachymene</i> white top
<i>Trachymene</i> <i>pilosa</i>	+	<1 %	5cm	=JT7-8	<i>Trachymene</i> short hairs
<i>Trifolium</i> <i>hirtum</i>	+	<1 %	10cm	JT11-9	? <i>Trifolium</i>
<i>Tripterococcus</i> <i>brunonis</i>	+	<1 %	30cm	JT11-6,15	? <i>Tricoryne</i>
<i>Ursinia</i> <i>antheroides</i>	+	<1 %	30cm		
<i>Vulpia</i> <i>myuros</i> var. <i>hirsuta</i>	+	<1 %	15cm	=JT9-7	Grass (cylinder head)
<i>Xanthorrhoea</i> <i>drummondii</i>	+	<1 %	35cm		
<i>Acacia</i> <i>restiacea</i>	+	<1 %	30cm	JT11-18	? <i>Acacia</i> prostrate
<i>Allocasuarina</i> <i>campestris</i>	+	<1 %	1-6m		Revisit.
<i>Allocasuarina</i> <i>huegeliana</i>	+	<1 %	3m		Revisit.
<i>Chamaescilla</i> <i>corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10cm	=JT5-55	Revisit. Lilly
<i>Diplopeltis</i> <i>huegelii</i> subsp. <i>lehmannii</i>	+	<1 %	35cm	=JT7-4	<i>Diplopeltis</i>
<i>Dryandra</i> <i>sessilis</i> var. <i>sessilis</i>	+	<1 %			
<i>Stackhousia</i> <i>monogyna</i>	+	<1 %	30cm	JT11-17	<i>Stackhousia</i>
<i>Tripteris</i> <i>clandestina</i>	+	<1 %	25cm	=JT3-50	Revisit. Stink daisy
<i>Waitzia</i> <i>nitida</i>	+	<1 %	20cm	=ER15-8	<i>Waitzia</i>

Moora Site JT012

Described by BRM **Date** 24/08/03 **Type:** QUADRAT 10x10 m, 30x30

Location: Broad crest of John Tonkin's western most ridge, about 80m north of his southern boundary (with Ridgeways). About 50m west of JT6.

MGA Zone 50 **408958 m E** **6625359 m N** **-30.500498 S lat** **116.051272 E long**

Habitat: Flat area on broad crest of a low ridge.

Soil: Gravelly, pebbly brown sandy loam.

Vegetation: *Acacia acuminata* low woodland over *Cheilanthes adiantoides*, *Hypoxis* sp. very open fern/herbland and *Gilberta tenuifolia*, *Podolepis lessonii* open annual herbland.

Vegetation condition: Very good (some weeds). An unusual open area and therefore not sure if some disturbance many years ago,

Notes: *Podolepis lessonii* appears to grow in areas with no canopy. *Cheilanthes* patchy - mainly at base of trees.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	18-22	10-25%	7-8m		
<i>Arctotheca</i> <i>calendula</i>	+	<1 %	15cm		<i>Arctotheca</i>
<i>Avena</i> <i>barbata</i>	+	<1 %	30cm		
<i>Borya</i> <i>sphaerocephala</i>	+	<1 %	2cm	JT12-13	
<i>Caesia</i> (Moora hairy stem)	+	<1 %	6cm	JT12-9	? <i>Dichopogon</i> sp.
<i>Caesia</i> <i>alfordii</i>	+	<1 %	25cm	JT12-14	<i>Dichopogon</i> #2
<i>Chamaescilla</i> <i>corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	=ER19-50	? <i>Chamaescilla</i> <i>corymbosa</i>
<i>Cheilanthes</i> <i>adiantoides</i>	6-8%	5-10%	15cm		Common <i>Cheilanthes</i>

<i>Crassula exserta</i>	+	<1 %	2-3cm	JT12-10	Crassula
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	20cm	JT12-12,2	Also recorded in 30x30. Climbing <i>Drosera</i>
<i>Drosera macrophylla</i> subsp. <i>macrophylla</i>	+	<1 %	2cm	JT12-3	
<i>Ehrharta longiflora</i>	+	<1 %	30cm		
<i>Gilberta tenuifolia</i>	10-15	10-25%	10-15cm	JT12-1	Daisy #1
<i>Gonocarpus nodulosus</i>	+	<1 %	12cm	JT12-22	
<i>Goodenia berardiana</i>	+	<1 %	25cm	=ER8-52	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	+	<1 %	25cm	JT12-17	Long flr stalk daisy
<i>Hypochaeris glabra</i>	+	<1 %	1cm		
<i>Hypoxis</i> sp.	3-5	1-5%	15cm	=?	SPECIES NOT RESOLVABLE
<i>Neurachne alopecuroidea</i>	+	<1 %	10cm		
<i>Opercularia vaginata</i>	1-2%	1-5%	20cm	JT12-4	
<i>Phyllangium sulcatum</i>	+	<1 %	6cm	JT12-21	
<i>Podolepis lessonii</i>	10-15	10-25%	10-15cm	JT12-2	Daisy #2
<i>Rhodanthe laevis</i>	+	<1 %	12cm	JT12-18	Flat leaf grey daisy
<i>Rhodanthe manglesii</i>	+	<1 %	15cm	=CHN9-11	Daisy, amplexicaule leaf
<i>Schoenus clandestinus</i>	+	<1 %	2-3cm	JT12-6	Schoenus
<i>Thysanotus manglesianus</i>	+	<1 %	20cm	JT12-5,11	Thysanotus fleshy leaf
<i>Trachymene pilosa</i>	+	<1 %	3cm	JT12-8	Trachymene ?pilosa
<i>Trifolium subterraneum</i>	+	<1 %	2-3cm	JT12-7	Clover
<i>Tripteris clandestina</i>	+	<1 %	15cm	=JT3-50	Stink daisy
<i>Ursinia anthemoides</i>	+	<1 %	20cm		Ursinia
<i>Wahlenbergia capensis</i>	+	<1 %	5cm	JT12-20	
<i>Wurmbea drummondii</i>	+	<1 %	3cm	JT12-19	
<i>Austrodanthonia</i> sp.	+	<1 %	2cm	JT12-15	
<i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	+	<1 %	35cm	JT12-16	"Radish"
<i>Briza maxima</i>	+	<1 %	30cm		
<i>Bromus diandrus</i>	+	<1 %	25cm		
<i>Cyanicula deformis</i>	+	<1 %	10cm	=JT8-54	'Blue Beard' <i>Caladenia</i>
<i>Erodium cygnorum</i>	+	<1 %	10cm	=ER17-52	? <i>Erodium</i>
<i>Waitzia nitida</i>	+	<1 %	25cm	JT12-24	Big yellow-flr daisy

RIDGEWAY'S

Moora

Site SW1

Described by BRM **Date** 25/08/03 **Type:** QUADRAT 10x10 m, 30x30

Location: East side of western most ridge on Ridgeways property, about 200-250m north of Kiaka Rd.

MGA Zone 50 **409402 m E** 6625048 **m N** -30.503338 **S lat** 116.055871 **E long**

Habitat: Mid to upper slope (below breakaway) on moderate east-facing slope of low ridge

Soil: Gravelly, pebbly, cobbly, bouldery brown loam, with some exposed sheet rock.

Rock Type: Chert?

Vegetation: *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) low woodland to low open forest over *Podolepis lessonii*, *Ehrharta longiflora*, (*Hypochaeris glabra*, *Avena barbata*) open annual herb/grassland.

Vegetation condition: Poor to very poor. Heavily infested with weeds, native species depauperate.

Notes: Many old *Xanthorrhoea drummondii* deaths on slopes and ridge top. Some of the few remaining live *X. drummondii* have symptoms of '28' parrot damage. A few dead *Acacia acuminata*. *Allocasuarina huegeliana* is very scattered. *Allocasuarina campestris* fallen in plot; only one on slope visible from plot.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	35-40%	33.3-50%	4-6m	SW1-1	
<i>Allocasuarina campestris</i>	2%	1-5%	2m		fallen
<i>Allocasuarina huegeliana</i>	3%	<1 %	5-6m		
<i>Arctotheca calendula</i>	1%	1-5%	10cm		Capeweed
<i>Austrodanthonia acerosa</i>	+	<1 %	10cm	SW1-8B	Grass
<i>Austrostipa exilis</i>	+	<1 %	20cm	SW1-11	PRIORITY Determination provisional. Red base.
<i>Austrostipa trichophylla</i>	+	<1 %	15 cm	SW1-8A	
<i>Avena barbata</i>	1%	1-5%	5-30cm		
<i>Brachyscome perpusilla</i>	+	<1 %		SW1-7B	
<i>Briza maxima</i>	+	<1 %	30cm		Dead

<i>Cheilanthes adiantoides</i>	1-2%	1-5%	10-15cm		common <i>Cheilanthes</i>
<i>Comesperma integerrimum</i>	+	<1 %	5cm	SW1-4	heavily grazed
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	3cm	SW1-10	
<i>Dichopogon capillipes</i>	+	<1 %	5cm	SW1-3	? <i>Dichopogon</i>
<i>Dioscorea hastifolia</i>	+	<1 %	3cm		
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	15cm	SW1-6	<i>Drosera</i> Climber
<i>Ehrharta longiflora</i>	6-7%	5-10%	15-40cm		
<i>Galium murale</i>	+	<1 %	3cm	SW1-7	pale green herb
<i>Hypochaeris glabra</i>	2-3%	1-5%	2cm		
<i>Hypoxis</i> sp.	+	<1 %	12cm	=?	NOT RESOLVABLE
<i>Neurachne alopecuroidea</i>	+	<1 %	4cm		
<i>Podolepis lessonii</i>	10-20%	10-25%	10-20m	=JT12-2	Daisy
<i>Trachymene ornata</i>	+	<1 %	6cm	SW1-5	<i>Trachymene</i> ? <i>pilosa</i>
<i>Trifolium subterraneum</i>	+	<1 %	2cm	SW1-2	Clover
<i>Urospermum picroides</i>	+	<1 %	4cm	SW1-9	? <i>Sonchus</i>
<i>Ursinia anthemoides</i>	+	<1 %	10cm		
<i>Xanthorrhoea drummondii</i>	+	<1 %			long dead
<i>Bromus diandrus</i>	+	<1 %	25cm	=ER10-58	<i>Bromus</i>
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	4cm	=ER19-50	? <i>Chamaescilla</i>
<i>Desmocladius flexuosus</i>	+	<1 %	12cm	SW1-12	
<i>Erodium cygnorum</i>	+	<1 %	3cm	=ER17-52	? <i>Erodium</i>
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	15-20cm	SW1-13	?
<i>Tripteris clandestina</i>	+	<1 %	20cm	=JT3-50	stink daisy

WASTE DUMP (proposed)

Moora

Site WDM001

Described by MJH Date 22/10/00 Type: QUADRAT 10x10 m, 30x30

Location: This area is a proposed waste dump extension to the south of the mine. This site was approx. 600 m east of the entry to 'Goonderoo' from the Midlands Road and 250 m north of the farm track.

MGA Zone 50 407374 m E 6623162 m N -30.520197 S lat 116.034573 E long

Habitat: Mid-slope of gently sloping south facing hill.

Soil: Grey sandy loam

Rock Type: Chert boulders, cobbles and gravel, ~80% cover.

Vegetation: *Regelia megacephala* high shrubland to open scrub over *Kunzea praestans* open shrubland over *Hibbertia subvaginata* scattered shrubs to open shrubland.

Vegetation condition: Good. There are some obvious grazing signs, vegetation deaths and litter from mining activities.

Fire age: Old

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %	1 m	WD1-16,5	
<i>Allocasuarina campestris</i>	+	<1 %	2 m		
<i>Anagallis arvensis</i>	+	<1 %	4cm	=WDM2-6	Revisit.
<i>Arctotheca calendula</i>	+	<1 %	12cm		Revisit. Capeweed
<i>Aristida contorta</i>	+	<1 %	15 cm	WD1-5	
<i>Austrostipa variabilis</i>	+	<1 %	20 cm	WD1-11	Grass
<i>Avena barbata</i>	+	<1 %	35cm.	WDM1-57	Revisit.
<i>Briza maxima</i>	+	<1 %	10 cm		
<i>Burchardia umbellata</i>					
<i>Caladenia denticulata</i>	+	<1 %	20cm	WDM1-50	Revisit. Spider orchid
<i>Caladenia flaccida</i> subsp. <i>flaccida</i>	+	<1 %	10cm.	=WOR2-59	Revisit.
<i>Calandrinia</i> sp.	+	<1 %	2cm	WDM1-60	Revisit.
<i>Calytrix leschenaultii</i>	+	<1 %			
<i>Centrolepis pilosa</i>	+	<1 %	<5 cm	WD1-9	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	3cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	+	<1 %			
<i>Crassula exserta</i>	+	<1 %	2cm	WDM1-61	Revisit.
<i>Desmocladius flexuosus</i>	+	<1 %	20 cm	WD1-10	
<i>Dichopogon capillipes</i>	+	<1 %	20cm	WDM1-59	Revisit.
<i>Dioscorea hastifolia</i>	+	<1 %			
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	25cm	=WOR2-72	Revisit. Orchid
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	1.2m	WDM1-3,5	Revisit.
<i>Gilberta tenuifolia</i>	1-2	1-5%	5-10 cm	WD1-2a	

<i>Goodenia</i> sp.	+	<1 %	5 cm	WD1-8B	
<i>Hibbertia</i> subvaginata	<5	1-5%	1-1.5 m		
<i>Hyalosperma</i> cotula	+	<1 %	8 cm	WD1-14	White daisy
<i>Hypochaeris</i> glabra	2-3%	1-5%	2cm		Revisit.
<i>Kunzea</i> praestans	<5	1-5%	<2 m		
<i>Lepidosperma</i> leptostachyum	+	<1 %	35cm	WDM1-55,	Also recorded in 30x30.
<i>Lepidosperma</i> sp.	+	<1 %	35cm	WDM1-54	Revisit. Specimen missing 9/2005
<i>Nemcia</i> acuta	+	<1 %	0.1-1 m	WD1-6	
<i>Neurachne</i> alopecuroidea	+	<1 %	10 cm	WD1-12	
<i>Parentucellia</i> latifolia	+	<1 %	2-10 cm	WD1-8A	
<i>Pentaschistis</i> airoides	+	<1 %	<5 cm	WD1-7	
<i>Petrorhagia</i> velutina					
<i>Plantago</i> debilis	+	<1 %	5cm	WDM1-62	Revisit.
<i>Platysace</i> cirrosa	+	<1 %	3 cm	WD1-13	Redet 05/05 Met
<i>Podolepis</i> lessonii	5-7%	5-10%	20cm	WD1-2b,5	
<i>Podotheca</i> angustifolia	+	<1 %	3cm	= GH10-52	Revisit. Daisy
<i>Regelia</i> megacephala	70-80	>75%	2-3 m		
<i>Romulea</i> rosea	+	<1 %	10 cm	WD1-1	
<i>Sonchus</i> oleraceus	+	<1 %	5cm	WDM1-58	Revisit.
<i>Thysanotus</i> manglesianus	+	<1 %	70cm	=WOR2-64	Revisit. Climber
<i>Trachymene</i> ornata	+	<1 %	3cm	WDM1-56	Revisit.
<i>Trifolium</i> arvense var. arvense	+	<1 %	8 cm	WD1-15	
<i>Ursinia</i> anthemoides	+	<1 %	5cm		Revisit.
<i>Vulpia</i> myuros var. hirsuta	+	<1 %	10-15 cm	WD1-4	
<i>Xanthorrhoea</i> drummondii	+	<1 %	2-3 m		
<i>Acacia</i> aristulata	+	<1 %	20 cm	WD1-17	
<i>Allocasuarina</i> huegeliana	+	<1 %	90cm		Revisit. Juvenile. Just outside 10x10 on west side.
<i>Astroloma</i> serratifolium	+	<1 %	20cm	WDM1-64	Revisit.
<i>Austrostipa</i> elegantissima	+	<1 %	80 cm	WD1-19	
<i>Austrostipa</i> tenuifolia				WD1-20	
<i>Borya</i> sphaerocephala	+	<1 %	2cm		Revisit.
<i>Comesperma</i> integerrimum	+	<1 %	40cm	WDM1-68	Revisit.
<i>Cryptandra</i> glabriflora					=WO4
<i>Cyanicula</i> deformis	+	<1 %	12cm	=ER17-51	Blue beard orchid
<i>Dianella</i> revoluta var. divaricata	+	<1 %	35cm	WDM1-63	Revisit.
<i>Eriochilus</i> dilatatus	+	<1 %	4cm	=WOR2-62	Revisit. Leaf 1/2 opposite stem orchid
<i>Hypoxis</i> glabella var. leptantha	+	<1 %	10cm	WDM1-67	Revisit. #2
<i>Hypoxis</i> occidentalis var. occidentalis	+	<1 %	10cm	=ER17-58	Revisit.
<i>Melaleuca</i> calyptroides	+	<1 %	1 m	WD1-18	heavily grazed
<i>Pityrodia</i> dilatata	+	<1 %	20cm		Revisit.
<i>Podotheca</i> aff. gnaphalioides (Moora WDM1-65)	+	<1 %	30cm	WDM1-65	Revisit. Daisy

Moora Site WDM002

Described by BRM **Date** 22/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: This area is a proposed waste dump extension to the south of the mine. This site was approx. 650 m east of the entry to 'Goonderoo' from the Midlands Road and 200 m north of the farm track.

MGA Zone 50 **407393 m E** 6623095 **m N** -30.520803 **S lat** 116.034765 **E long**

Habitat: Moderate west facing mid-slope.

Soil: Gravelly (quartz), sandy clay.

Rock Type: Chert outcrops, ~ 10-20% cover.

Vegetation: *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris* shrubland over *Schoenus clandestinus*, *Borya sphaerocephala*, *Austrostipa tenuifolia*, *Austrodanthonia acerosa* open sedge/herb/grassland

Vegetation condition: Good. Some grazing, but structure and floristics apparently not significantly changed.

Notes: Fairly open area of Sheoak low woodland; several dead Sheoak trunks in the area.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia</i> restiacea	+	<1 %		WD2-19,5	
<i>Allocasuarina</i> campestris	30	25-33.3%	<1.8	WD2-1	
<i>Allocasuarina</i> huegeliana	4	1-5%	8 m		
<i>Austrodanthonia</i> acerosa	+	<1 %		WD2-18	
<i>Austrostipa</i> tenuifolia	+	<1 %		WD2-9	

<i>Borya sphaerocephala</i>	2-3	1-5%		WD2-4	
<i>Briza maxima</i>	+	<1 %			
<i>Bromus diandrus</i>	+	<1 %		WD2-8	Grass
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	3cm	=WOR2-59	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	2cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>	+	<1 %			=WO1-19
<i>Cyanicula deformis</i>	+	<1 %	10cm	=ER17-51	Revisit. Blue beard
<i>Dichopogon capillipes</i>	+	<1 %	15cm	=WDM1-5	Revisit.
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1cm	WDM2-52,	Also recorded in 30x30. Large flat leaves.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	1m	WDM2-53	Revisit.
<i>Eriochilus dilatatus</i>	+	<1 %	3cm	WOR2-62	Revisit. Leaf 1/2 opposite stem
<i>Gilbertia tenuifolia</i>	+	<1 %		WD2-6	Daisy
<i>Goodenia berardiana</i>	+	<1 %	6 cm	WD2-13A	Admixture in WD2-13
<i>Hibbertia subvaginata</i>	+	<1 %	1 m		
<i>Hyalosperma cotula</i>	+	<1 %		WD2-2	Daisy
<i>Hypochaeris glabra</i>	+	<1 %		WD2-10	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	1-2%	1-5%	15cm	=ER17-58	Revisit.
<i>Leporella fimbriata</i>	+	<1 %	1cm	WDM2-55	Revisit. Small flat orchid leaf. In west corner of plot. =WO1-4
<i>Neurachne alopecuroidea</i>	+	<1 %			
<i>Parentucellia latifolia</i>	+	<1 %		WD2-14	
<i>Pentaschistis airoides</i>	+	<1 %		WD2-5	
<i>Podolepis lessonii</i>	+	<1 %		WD2-7	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	12cm	WDM2-58	Revisit. Tall
<i>Pterostylis setulosa</i>	+	<1 %	10cm	WDM2-54	Revisit. Flat base
<i>Schoenus clandestinus</i>	5	5-10%		WD2-3,51	
<i>Stylidium calcaratum</i>	+	<1 %		WD2-16	
<i>Trachymene cyanopetala</i>	+	<1 %		WD2-13	
<i>Trachymene ornata</i>	+	<1 %		WD2-15	
<i>Tricoryne arenicola</i>	+	<1 %		WD2-20	PRIORITY 2
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %		WD2-22	
<i>Ursinia anthemoides</i>	+	<1 %			=WO1-17
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		WD2-17	
<i>Xanthorrhoea drummondii</i>	1	<1 %	1.8 m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %		WD2-32	
<i>Arctotheca calendula</i>	+	<1 %	20cm		Revisit.
<i>Calytrix leschenaultii</i>	+	<1 %		WD2-26	
<i>Comesperma integerrimum</i>	+	<1 %	60cm	WDM2-56	Revisit.
<i>Daviesia dielsii</i>	+	<1 %		WD2-28	1, DRF
<i>Desmocladius flexuosus</i>	+	<1 %	20cm	WDM2-57	Revisit.
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	30cm	=WDM1-6	Revisit.
<i>Dioscorea hastifolia</i>	+	<1 %	60cm		Revisit.
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %			=WO1-23
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	6 cm		juv
<i>Haemodorum simulans</i>	+	<1 %		WD2-24	
<i>Lepidobolus chaetocephalus</i>	+	<1 %		WD2-29	
<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>	+	<1 %		WD2-30	sedge
<i>Romulea rosea</i>	+	<1 %	35cm		Revisit.
<i>Stypandra glauca</i>	+	<1 %		WD2-27	
<i>Thysanotus manglesianus</i>	+	<1 %		WD2-25	

Moora Site WDM003

Described by MET **Date** **Type:** QUADRAT 10x10 m, 30x30

Location: This area is a proposed waste dump extension to the south of the mine. This site was approx. 700 m east of the entry to 'Goonderoo' from the Midlands Road and 150 m north of the farm track.

MGA Zone 50 **407501 m E** 6622996 **m N** -30.521704 **S lat** 116.035882 **E long**

Habitat: Moderate slope on south end of a ridge

Soil: Light greyish-brown gravelly, pebbly silt-fine sand.

Rock Type: Chert gravel to pebble strew (>80% of surface) with some scattered angular cobbles. Partially cleared immediately south of 30x30.

Vegetation: *Eucalyptus loxophleba* subsp. *loxophleba* scattered low trees over *Allocasuarina campestris* open scrub to open heath over *Borya sphaerocephala*, *Cheilanthes adiantoides*, *Schoenus clandestinus* open herb/fern/sedgeland and **Briza maxima*, **Pentaschistis airoides* very open annual grassland.

Vegetation condition: Very good (-excellent). Would be excellent but has some weed invasion. Towards lower edge of

stand becomes G-VG due to higher weed invasion. Several Xanthorrhoea dead.

Fire age: ?2 ages: 1, +/-15 yrs; 2, >15 yrs.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	+/-60	50-75%	1.8-3.4 m		
<i>Arctotheca calendula</i>	+	<1 %	10cm	WDM3-53	Revisit.
<i>Austrodanthonia acerosa</i>	+	<1 %	8 cm	wd3-24	Redet 2005
<i>Austrodanthonia setacea</i>	+	<1 %	20 cm	WD3-10	
<i>Austrostipa elegantissima</i>	+	<1 %	1 m	WD3-23,5	
<i>Avena barbata</i>	+	<1 %	5-10 cm		
<i>Borya sphaerocephala</i>			2-4 cm	WD3-3	
<i>Briza maxima</i>	+/-1	<1 %	5-15 cm		
<i>Caladenia denticulata</i>	+	<1 %	30cm	=WDM1-5	Revisit. Spider orchid
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	3cm	=ER19-50	Revisit.
<i>Cheilanthes adiantoides</i>			5-20 cm	WD3-2	
<i>Cyanicula deformis</i>	+	<1 %	15cm	=ER17-51	Blue beard orchid
<i>Dichopogon capillaris</i>	+	<1 %	5 cm	WD3-14	
<i>Dioscorea hastifolia</i>	+	<1 %	40cm		Revisit.
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	50 cm	WD3-6,50	
<i>Ehrharta longiflora</i>	+	<1 %	30 cm	WD3-11	
<i>Eriochilus dilatatus</i>	+	<1 %	4cm	=WOR2-62	Revisit. Leaf 1/2 opposite stem orchid
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	>5	5-10%	4-5.5 m	WD3-1	
<i>Gilberta tenuifolia</i>	+	<1 %	4-6 cm	WD3-8	
<i>Haemodorum paniculatum</i>	+	<1 %	15 cm	WD3-15	
<i>Hypochaeris glabra</i>	+	<1 %	2 cm		
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15cm	=ER17-58	Revisit.
<i>Neurachne alopecuroidea</i>	+	<1 %	4-6 cm		
<i>Parentucellia latifolia</i>	+	<1 %	5-6 cm		
<i>Pentaschistis airoides</i>	+	<1 %	4-6 cm		=WO3-25
<i>Platysace cirrosa</i>	+	<1 %	10/12cm	=WOR2-66	Revisit. Climber
<i>Podolepis lessonii</i>	+	<1 %	5-15 cm	WD3-4	Daisy
<i>Pterostylis sanguinea</i>	+	<1 %	1cm	WDM3-54	Revisit. Large leaf to leaf 3cm long.
<i>Pterostylis setulosa</i>	+	<1 %	12cm	WDM3-55	Revisit. (Small flat leaf)
<i>Rhodanthe laevis</i>	+	<1 %	5 cm	WD3-13	
<i>Schoenus clandestinus</i>	+	<1 %	5 cm	WD3-5	
<i>Sonchus oleraceus</i>	+	<1 %	20 cm		
<i>Stypantra glauca</i>	+	<1 %	30-60 cm	WD3-20	
<i>Thysanotus manglesianus</i>	1%	<1 %	60 cm	WD3-7,51	
<i>Trachymene ornata</i>	+	<1 %	3-7 cm	WD3-9	
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %	4 cm		
<i>Tripteris clandestina</i>	+	<1 %	10cm	WDM3-52	Revisit. Stink daisy
<i>Ursinia anthemoides</i>	+	<1 %	20 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	20 cm	WD3-12	
<i>Xanthorrhoea drummondii</i>	+	<1 %	70 cm		Dead
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %	1.5-2.4 m	WD3-16	
<i>Austrostipa variabilis</i>	+	<1 %	15 cm	WD3-18	
<i>Comesperma integerrimum</i>	+	<1 %			the big creeper
<i>Crassula exserta</i>	+	<1 %	1-2 cm	WD3-21	
<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+	<1 %	1 cm	WD3-22	ssp.??
<i>Romulea rosea</i>	+	<1 %	15 cm		
<i>Trachymene cyanopetala</i>	+	<1 %	4-6 cm	WD3-17	

WESTERN ORE BODY

Moora

Site WOR001

Described by BRM **Date** 21/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. The site is approximately 500 m ENE of the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407167 m E** **6623310 m N** **-30.518845 S lat** **116.032429 E long**

Habitat: Crest of north-south trending low ridge. To west, moderate-steep slope; to E, gentle slope. Near the

high point of the ridge.

Soil: Light grey fine silty sand.

Rock Type: Chert outcrop, ~60% surface cover.

Vegetation: *Regelia megacephala* open scrub over *Hibbertia subvaginata* low shrubland to open heath.

Vegetation condition: Very good between grid lines. Some weeds.

Notes: No defined herb or very low shrub layers.

Gridlines along N and S plot boundaries, some disturbance. Earthworks S side.

Revisit - Now cleared for mining.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia congesta</i> subsp. <i>congesta</i>	1%	<1 %	1 m	WO1-28	1 shrub
<i>Acacia stenoptera</i>	1%	<1 %	50 cm	WO1-3	
<i>Amphipogon caricinus</i>	+	<1 %	30 cm	WO1-4	
<i>Austrodanthonia setacea</i>	+	<1 %		WO1-13	Grass
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %		WO1-20	
<i>Briza maxima</i>	+	<1 %		WO1-22	
<i>Burchardia umbellata</i>	+	<1 %		WO1-14	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %		WO1-18	Orchid
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %		WO1-25	
<i>Cheilanthes adiantoides</i>	+	<1 %		WO1-19	
<i>Comesperma integerrimum</i>				WO1-30	Climber
<i>Dichopogon capillipes</i>	+	<1 %		WO1-15	
<i>Dioscorea hastifolia</i>	+	<1 %		WO1-16	Climber
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		WO1-23	
<i>Ehrharta longiflora</i>	+	<1 %	15 cm	WO1-5	Grass
<i>Elythranthera brunonis</i>	+	<1 %		WO1-27	Orchid
<i>Hibbertia subvaginata</i>	25-35%	25-33.3%	0.5-1.3 m	WO1-2	
<i>Kunzea praestans</i>	1%	<1 %	1.8 m	WO1-1	
<i>Lepidosperma leptostachyum</i>	+	<1 %		WO1-12	sedge
<i>Pentaschistis airoides</i>	+	<1 %		WO1-6	Grass
<i>Pityrodia dilatata</i>	+	<1 %		WO1-10	
<i>Pterostylis vittata</i>	+	<1 %		WO1-11	
<i>Regelia megacephala</i>	+/-35%	33.3-50%	(0.5)2-3		
<i>Stypantra glauca</i>	+	<1 %		WO1-9	
<i>Tripterococcus brunonis</i>	+	<1 %		WO1-24	
<i>Ursinia anthemoides</i>	+	<1 %		WO1-8	Daisy
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		WO1-7	Grass
<i>Xanthorrhoea drummondii</i>	<1%	<1 %	1.7 m		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	3%	1-5%			
<i>Acacia aristulata</i>	+	<1 %		WO1-42	
<i>Allocasuarina campestris</i>	+	<1 %	<2 m	WO1-51	S side of plot
<i>Anagallis arvensis</i>	+	<1 %		WO1-40	weed
<i>Austrodanthonia acerosa</i>	+	<1 %		WO1-35	Grass
<i>Austrostipa tenuifolia</i>	+	<1 %		WO1-34	Grass
<i>Avena barbata</i>	+	<1 %			
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %		WO1-45	from N gridline
<i>Calytrix leschenaultii</i>	+	<1 %		WO1-33	
<i>Desmocladius flexuosus</i>	+	<1 %		WO1-38	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %		WO1-32	
<i>Lepidosperma tenue</i>	+	<1 %		WO1-50	sedge, S side of plot
<i>Neurachne alopecuroidea</i>	+	<1 %		WO1-36	Grass
<i>Opercularia vaginata</i>	+	<1 %		WO1-39	
<i>Orobanche minor</i>	+	<1 %		WO1-48	from S gridline
<i>Podolepis lessonii</i>	+	<1 %		WO1-37	Daisy
<i>Scaevola phlebopetala</i>	+	<1 %		WO1-47	from S gridline
<i>Stylidium caricifolium</i>	+	<1 %		WO1-53	S side of plot
<i>Trachymene ornata</i>	+	<1 %		WO1-43	from N gridline
<i>Wahlenbergia gracilentia</i>	+	<1 %		WO1-46	?? from N gridline

Moora

Site WOR002

Described by MJH **Date** 21/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. Towards N end of the N-S ridge of the Western Orebody, approximately 600 m NE of the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407142 m E** **6623441 m N** **-30.517661 S lat** **116.03218 E long**

Habitat: West facing slope, moderate slope below site and gentle above. Well below crest of ridge.

Soil: Silty fine grey-brown sandy loam.

Rock Type: Chert outcrop - gravel ~60% cover

Vegetation: *Regelia megacephala* open scrub to closed scrub over *Cheilanthes adiantoides* very open fernland with **Bromus diandrus*, *Podolepis lessonii*, *Trachymene cyanopetala* annual grass/herbland and *Comesperma integerrimum* open lianes

Vegetation condition: Very good. Weed invasion greater downslope towards paddock. Some *Regelia* deaths.

Notes: Open underneath, little defined herb or shrub layer.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Anagallis arvensis</i>	+	<1 %	<5	WO2-19,6	
<i>Arctotheca calendula</i>	1-2%	1-5%	12 cm		Revisit. Capeweed
<i>Austrodanthonia acerosa</i>	+	<1 %	<25 cm	WO2-11	Grass
<i>Austrostipa elegantissima</i>	+	<1 %	<30 cm	WO2-10	
<i>Avena barbata</i>	+	<1 %	20 cm	WO2-17	
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %	20 cm	WOR2-77	Revisit.
<i>Briza maxima</i>	+	<1 %	<15 cm		
<i>Bromus diandrus</i>	40-50	33.3-50%	20 cm	WO2-9	
<i>Burchardia umbellata</i>	+	<1 %	30 cm	=GH9-52	Revisit.
<i>Caladenia denticulata</i>	+	<1 %	20 cm	WOR2-56	Revisit. Orchid
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	5 cm	WOR2-59	Revisit.
<i>Calandrinia</i> sp.	+	<1 %	2 cm	WOR2-69	Revisit.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	12 cm	WOR2-55	Revisit.
<i>Cheilanthes adiantoides</i>	<5%	1-5%	5-10 cm	WO2-6	
<i>Comesperma integerrimum</i>	3-4%		1.7 m	WOR2-83	Revisit.
<i>Crassula colorata</i> var. <i>colorata</i>	+	<1 %	2 cm	WOR2-70	Revisit.
<i>Cyanicula deformis</i>	+	<1 %	15 cm	WOR2-52	Revisit. Blue beard
<i>Desmocladius flexuosus</i>	+	<1 %	35 cm	WOR2-54	Revisit.
<i>Dichopogon capillipes</i>	+	<1 %	20 cm	WOR2-50	Revisit.
<i>Dioscorea hastifolia</i>	+	<1 %	50 cm	WO2-2	Climber
<i>Diuris</i> aff. <i>recurva</i>	+	<1 %	30 cm	WOR2-78	Revisit.
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30 cm	WOR2-51	Revisit. Climbing
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	<1 %	1 cm	WOR2-63	Revisit. Flat
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	2 m		
<i>Ehrharta longiflora</i>	+	<1 %	30 cm	WO2-8	
<i>Eriochilus dilatatus</i>	+	<1 %	3 cm	WOR2-62	Revisit. Leaf 1/2
opposite stem orchid					
<i>Hibbertia subvaginata</i>	+	<1 %	<1.5 m	WO2-1	
<i>Hypochoeris glabra</i>	+	<1 %	15-20 cm	WO2-23	
<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>	+	<1 %	15 cm	=ER17-58	Revisit.
<i>Kunzea praestans</i>	+	<1 %	1-2.5 m	WO2-12	
<i>Lawrencella rosea</i>	+	<1 %	12 cm	WOR2-57	Revisit. Pink daisy
<i>Lepidosperma leptostachyum</i>	+	<1 %	<60 cm	WO2-5,84	Also recorded in 30x30.
<i>Neurachne alopecuroidea</i>	+	<1 %	12 cm	WO2-5a,7	
<i>Platysace cirrosa</i>	+	<1 %	25 cm	WOR2-66	Revisit. Climber
<i>Podolepis lessonii</i>	+	<1 %	4 cm	=ER1-58	Also WO2-16 (30x30).
Revisit. Daisy					
<i>Podotheca angustifolia</i>	+	<1 %	3 cm	=GH10-52	Revisit. Daisy
<i>Pterostylis recurva</i>	+	<1 %	20 cm	WOR2-65	Revisit. Tall
<i>Pterostylis sanguinea</i>	+	<1 %	1 cm	WOR2-58	Revisit. Flat base
<i>Regelia megacephala</i>	60-100	50-75%	2-3 m		
<i>Romulea rosea</i>	+	<1 %	20 cm	WOR2-82	Revisit.
<i>Schoenus clandestinus</i>	+	<1 %	<30 cm	WO2-3	
<i>Schoenus pleiostemoneus</i>	+	<1 %	10 cm	WOR2-68	Revisit. Grass
<i>Silene gallica</i> var. <i>gallica</i>	+	<1 %	30 cm	WOR2-74	Revisit.
<i>Spergularia arvensis</i>	+	<1 %	30 cm	wor2-75	Revisit.
<i>Stypandra glauca</i>	<1%	<1 %	80 cm		Revisit.
<i>Thysanotus manglesianus</i>	+	<1 %	90 cm	WOR2-64,	Revisit. Climber
<i>Trachymene cyanopetala</i>	<5	1-5%	5 cm	WO2-7,53	?
<i>Trifolium subterraneum</i>	+	<1 %	2 cm	WOR2-60	Revisit. Clover
<i>Tripteris clandestina</i>	+	<1 %	10 cm	WOR2-76	Revisit.
<i>Ursinia anthemoides</i>	+	<1 %	<20 cm	WO2-4	Daisy
<i>Allocasuarina huegeliana</i>	+	<1 %	< 7 m		Revisit.

<i>Austrostipa tenuifolia</i>	+	<1 %	40-60 cm	WO2-22	Grass
<i>Austrostipa trichophylla</i>	+	<1 %	10 cm	WOR2-80	Revisit.
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	60 cm	WO2-15	pea
<i>Calytrix leschenaultii</i>	+	<1 %	50 cm	WO2-13	
<i>Cryptandra glabriflora</i>	+	<1 %	30 cm	WO2-21	Myrtaceae
<i>Erodium cynorum</i>	+	<1 %	5 cm	=ER17-52	Revisit. ?
<i>Petrorhagia prolifera</i>	+	<1 %	20 cm	=ER8-65	Revisit.
<i>Petrorhagia velutina</i>	+	<1 %	30 cm	WO2-24	
<i>Pityrodia dilatata</i>	+	<1 %	30-45 cm	WO2-18,6	
<i>Podolepis gracilis</i>	+	<1 %	<30 cm	WO2-14	Yellow daisy
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	<1 %	20 cm	WOR2-81	Revisit. Daisy
<i>Stylidium septentrionale</i>	+	<1 %	10 cm	WOR2-79	Revisit.
<i>Xanthorrhoea drummondii</i>	+	<1 %	0.5-2 m		

Moora Site WOR003

Described by MET **Date** **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. This site is on the lower western slope, near the N-S centre, approximately 450 m ENE from the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407129 m E** **6623263 m N** **-30.519266 S lat** **116.032029 E long**

Habitat: Midslope of a lower ridge on lower part of outcrop zone.

Soil: Light grey silt/silty fine sand, gravelly amongst cobbles(-boulders and outcrop), 50-60% cover.

Vegetation: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis*, *Kunzea praestans*, *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* shrubland to open heath over *Neurachne alopecuroidea*, *Austrostipa mollis*, *Cheilanthes adiantoides* very open grassland/fernland and **Briza maxima*, *Podolepis lessonii*, **Avena barbata* very open annual grass/herbland.

Vegetation condition: Very good. Moderate weed invasion of non-aggressive species, probably reducing native annual cover.

Fire age: >15/20 years.

Notes: A narrow strip along the lower edge of the vegetated area, about 3 m outside quadrat to W is cleared. Dense *Regelia* stand to E (+/-3-4 m) of quadrat. Not wide enough for 30x30 m, so 20 m at each end of plot searched. Revisit - New mine pit/cleared for mining.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	30-50 cm	WO3-19	2 plants
<i>Acacia stenoptera</i>	+	<1 %	35 cm	WO3-26	
<i>Allocasuarina huegeliana</i>	1	<1 %	1.8 m	WO3-1	+outside plot
<i>Austrodanthonia acerosa</i>	+	<1 %	30 cm	WO3-33	Poaceae
<i>Austrostipa elegantissima</i>	+	<1 %	30 cm	WO3-9	
<i>Austrostipa mollis</i>	+	<1 %	40 cm	WO3-31	
<i>Austrostipa tenuifolia</i>	+	<1 %	35 cm	WO3-13	=WO3-9?
<i>Avena barbata</i>	+	<1 %	10-25 cm		
<i>Blennospora drummondii</i>	+	<1 %	5 cm	WO3-29	small grey daisy
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	40 cm	WO3-18	
<i>Briza maxima</i>	>2	1-5%	5-20 cm		
<i>Bromus diandrus</i>	+	<1 %	8 cm	WO3-22	poaceae
<i>Burchardia umbellata</i>	+	<1 %	30 cm	WO3-10	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	10 cm	WO3-17	
<i>Calytrix leschenaultii</i>	+	<1 %	50 cm	WO3-2	
<i>Cheilanthes adiantoides</i>	2-3	1-5%	8-1 cm	WO3-8	
<i>Comesperma integerrimum</i>	+	<1 %	0.4-1.3 m	WO3-7	
<i>Desmocladius flexuosus</i>	1-2	1-5%	15-20 cm	WO3-3	
<i>Dichopogon capillipes</i>	+	<1 %	10 cm	WO3-20	Lilly
<i>Dioscorea hastifolia</i>	+	<1 %	40 cm	WO3-16	
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	30 cm	WO3-28b	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>				WO3-28a	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	5	5-10%	(5cm)3.8	WO3-12	
<i>Ehrharta longiflora</i>	+	<1 %	10 cm		
<i>Goodenia berardiana</i>	+	<1 %	6 cm	WO3-24	
<i>Hibbertia subvaginata</i>	+/-30	25-33.3%	0.5-1.4 m		
<i>Hypochaeris glabra</i>			2 cm		
<i>Kunzea praestans</i>	2-3	1-5%	2-3 m		
<i>Neurachne alopecuroidea</i>	>2	1-5%	10 cm	WO3-4	

<i>Orthrosanthus laxus</i> var. <i>gramineus</i>	+	<1 %	25cm	WO3-27	
<i>Parentucellia latifolia</i>	+	<1 %	7 cm	WO3-30	
<i>Pentaschistis airoides</i>	+	<1 %	5-10 cm	WO3-25	
<i>Podolepis lessonii</i>	+	<1 %	5 cm	WO3-14	
<i>Pterostylis vittata</i>	+	<1 %	15 cm	WO3-5	
<i>Romulea rosea</i>	+	<1 %	15 cm		
<i>Thysanotus manglesianus</i>	+	<1 %	20 cm	WO3-11	
<i>Trachymene ornata</i>	+	<1 %	7 cm	WO3-21	
<i>Trachymene pilosa</i>	+	<1 %	5 cm	WO3-15	
<i>Ursinia anthemoides</i>	+	<1 %	5-20 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	5 cm	WO3-23	
<i>Xanthorrhoea drummondii</i>	+	<1 %	30 cm		juv
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+	<1 %	5-9 m		
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %	80 cm	WO3-38	at lower edge of stand
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	8 cm	WO3-36	
<i>Crassula exserta</i>	+	<1 %	1-3 cm	WO3-35	
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	15 cm		juv
<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)	+	<1 %	30 cm	WO3-37	
<i>Opercularia vaginata</i>	+	<1 %	15 cm	WO3-34	
<i>Pityrodia dilatata</i>	+	<1 %	55 cm	WO3-39	

Moora Site WOR004

Described by MJH **Date** 21/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. This site is towards the southern end of the ridge, approximately 400 m ENE of the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407201 m E** 6623218 **m N** -30.519678 **S lat** 116.032775 **E long**

Habitat: Crest of north-south trending ridge, moderate slope to east, gentle slope to west.

Soil: Grey sandy loam with gravel.

Rock Type: Chert outcrop, cobbles-gravel. ~70% cover.

Vegetation: *Regelia megacephala* open heath to open scrub over *Hibbertia subvaginata* low shrubland to shrubland.

Veg Condition

Notes: No defined herb or grass layers when recorded. Revisit - Subsequently cleared and location is a mine pit.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia aristulata</i>	+	<1 %	15 cm	WO4-22	4 specimens of
<i>Anagallis arvensis</i>	+	<1 %	5 cm	WO4-19	
<i>Austrodanthonia setacea</i>	+	<1 %	30 cm	WO4-27	
<i>Austrostipa variabilis</i>				WO4-6A	
<i>Avena barbata</i>	+	<1 %	20-50 cm		
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	<1 %	15 cm	WO4-6	
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	60 cm	WO4-1	=WO2-15
<i>Briza maxima</i>	+	<1 %	10 cm	WO4-17	
<i>Bromus diandrus</i>	+	<1 %	15 cm	WO4-18	Grass
<i>Burchardia umbellata</i>	+	<1 %	45 cm	WO4-2	
<i>Caladenia flava</i> subsp. <i>flava</i>	+	<1 %	15 cm	WO4-13	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	20 cm	WO4-23	
<i>Cheilanthes adiantoides</i>	+	<1 %	10 cm	WO4-15	
<i>Cryptandra glabriflora</i>	+	<1 %	<1 m	WO4-4	
<i>Dichopogon capillipes</i>	+	<1 %	30 cm	WO4-7	
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		WO4-26	
<i>Hibbertia subvaginata</i>	20-30	10-25%	1-1.5 m		
<i>Lepidosperma leptostachyum</i>	+	<1 %		WO4-25	
<i>Neurachne alopecuroidea</i>	+	<1 %	20-60 cm	WO4-16	Grass-Amphipogon?
<i>Parentucellia latifolia</i>	+	<1 %	10 cm	WO4-30	
<i>Pentaschistis airoides</i>	<5	1-5%	10 cm	WO4-8	
<i>Podolepis lessonii</i>	+	<1 %	10 cm	WO4-14	Yellow daisy
<i>Regelia megacephala</i>	70-80	>75%	1.5-3 m		
<i>Stylidium caricifolium</i>	+	<1 %	45 cm	WO4-21	
<i>Stypandra glauca</i>	+	<1 %	1 m	WO4-3	
<i>Thomasia grandiflora</i>	+	<1 %	0.8-1 m	WO4-24	
<i>Trachymene pilosa</i>	+	<1 %	10 cm	WO4-12	
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %	5 cm	WO4-31	

<i>Urospermum picroides</i>	+	<1 %	10 cm	WO4-11	
<i>Ursinia anthemoides</i>	+	<1 %	10 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %	10 cm	WO4-5	Grass
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.5-2.5 m		
<i>Acacia stenoptera</i>	+	<1 %	30 cm	WO4-32	
<i>Allocasuarina campestris</i>	+	<1 %	1 m	WO4-42	
<i>Allocasuarina huegeliana</i>	+	<1 %	3-5 m		
<i>Austrostipa mollis</i>	+	<1 %	60 cm	WO4-35	
<i>Comesperma integerrimum</i>	+	<1 %	20 cm	WO4-41	
<i>Dioscorea hastifolia</i>					
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	4 m		
<i>Ehrharta longiflora</i>	+	<1 %			
<i>Kunzea praestans</i>	+	<1 %	1 m		
<i>Pentaschistis pallida</i>	+	<1 %	15-20 cm	WO4-36	
<i>Pityrodia dilatata</i>	+	<1 %	20-30 cm		
<i>Thysanotus manglesianus</i>				WO4-34	
<i>Trachymene ornata</i>	+	<1 %	10 cm	WO4-38	

Moora Site WOR005

Described by BRM **Date** 22/10/00 **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. This site is towards the southern end of the ridge, approximately 350 m ENE of the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407193 m E** **6623189 m N** **-30.519939 S lat** **116.032689 E long**

Habitat: Western slope of north-south trending ridge, towards south end. (Breakaway).

Soil: Grey fine sand.

Rock Type: Chert outcrop, ~70% surface cover.

Vegetation: *Regelia megacephala* open scrub over *Xanthorrhoea drummondii* scattered shrubs over *Hibbertia subvaginata* open shrubland to low open shrubland over *Burchardia umbellata*, *Austrodanthonia acerosa* scattered herbs and grasses and **Trifolium arvense* var. *arvense*, **Vulpia myuros* var. *hirsuta* scattered annual herb/grassland.

Vegetation condition: Very good, but has gridlines either side.

Notes: Revisit - Cleared and mined (23 m into new pit from south side).

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Acacia stenoptera</i>	+	<1 %		WO5-20	
<i>Allocasuarina campestris</i>	1	<1 %	1.5 m	WO5-1	
<i>Amphipogon caricinus</i>	+	<1 %		WO5-5	
<i>Austrodanthonia acerosa</i>	+	<1 %		WO5-22	Grass
<i>Avena barbata</i>	+	<1 %			
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %		WO5-14	
<i>Briza maxima</i>	+	<1 %			
<i>Bromus diandrus</i>	+	<1 %		WO5-11	Grass
<i>Burchardia umbellata</i>	+	<1 %		WO5-21	
<i>Cheilanthes adiantoides</i>	+	<1 %		WO5-15	
<i>Comesperma integerrimum</i>	+	<1 %		WO5-3	Climber
<i>Crassula exserta</i>	+	<1 %		WO5-8	
<i>Dichopogon capillipes</i>	+	<1 %		WO5-6	Lilly
<i>Dioscorea hastifolia</i>	+	<1 %		WO5-26	Climber
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %		WO5-9	
<i>Ehrharta longiflora</i>	+	<1 %		WO5-31	Grass
<i>Hibbertia subvaginata</i>	10	5-10%	1 m		
<i>Hypochaeris glabra</i>	+	<1 %		WO5-33	
<i>Kunzea praestans</i>	+	<1 %		WO5-30	
<i>Lepidosperma leptostachyum</i>	+	<1 %		WO5-7	sedge
<i>Lepidosperma tenue</i>	+	<1 %		WO5-25	sedge
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	<1 %		WO5-12	
<i>Parentucellia latifolia</i>	+	<1 %		WO5-28	
<i>Pentaschistis airoides</i>	+	<1 %		WO5-10	Grass
<i>Regelia megacephala</i>	50	50-75%	2 m		
<i>Stylidium caricifolium</i>	+	<1 %		WO5-13	
<i>Stypandra glauca</i>	+	<1 %		WO5-4	Lilly
<i>Thomasia grandiflora</i>	+	<1 %		WO5-29	
<i>Trachymene ornata</i>	+	<1 %		WO5-2	
<i>Trachymene pilosa</i>	+	<1 %		WO5-27	

<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %		WO5-17	
<i>Urospermum picroides</i>	+	<1 %		WO5-18;3	Daisy
<i>Ursinia anthemoides</i>	+	<1 %			
<i>Vulpia myuros</i> var. <i>hirsuta</i>	+	<1 %		WO5-16	Grass
<i>Xanthorrhoea drummondii</i>	2	1-5%	2.5 m		
<i>Acacia aristulata</i>	+	<1 %		WO5-36	
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	<1 %		WO5-44	
<i>Austrodanthonia setacea</i>	+	<1 %		WO5-43	
<i>Centaureum tenuiflorum</i>	+	<1 %		WO5-37	pink flower
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %		WO5-41	
<i>Daucus glochidiatus</i>	+	<1 %		WO5-39	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	+	<1 %	8 cm	WO5-34	
<i>Elythranthera brunonis</i>	+	<1 %		WO5-35	Orchid
<i>Podolepis lessonii</i>	+	<1 %		WO5-46	Daisy

Moora Site WOR006

Described by MET **Date** **Type:** QUADRAT 10x10 m, 30x30

Location: The westernmost ridge of the mine. This site is towards the southern end of the ridge, approximately 500 m ENE of the entry to 'Goonderoo' from the Midlands Road.

MGA Zone 50 **407202 m E** **6623285 m N** **-30.519074 S lat** **116.032792 E long**

Habitat: Gentle mid-slope on east side of ridge, close to cleared area.

Soil: Gravelly, pebbly grey-brown (some humus) silt/fine sand between cobbles and boulders. Has a thin litter layer.

Rock Type: ~25% cover of cobbles/small boulders.

Vegetation: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii* scattered tall shrubs over *Kunzea praestans* high open shrubland to high shrubland, over *Hibbertia subvaginata* open heath over *Desmocladius flexuosus*, *Neurachne alopecuroidea*, *Cheilanthes adiantoides* open sedge/grass/fernland with **Pentaschistis airoides*, **Briza maxima*, **Avena barbata* very open annual grassland.

Vegetation condition: Good. Would be Very Good except for weed invasion.

Fire age: >10-15 years.

Notes: *Dryandra sessilis* var. *sessilis* large, and skirts on *Xanthorrhoea* sometimes to ground. Revisit - Subsequently excavated as part of mine pit.

Species List:

Name	Cover	C Class	Height	Specimen	Notes
<i>Allocasuarina campestris</i>	+	<1 %	1.3 m	WO6-7	
<i>Austrodanthonia caespitosa</i>	+	<1 %	7 cm	WO6-18	
<i>Austrodanthonia setacea</i>	+	<1 %	15 cm	WO6-1	Poaceae
<i>Austrostipa mollis</i>	+	<1 %	75 cm	WO6-9	
<i>Austrostipa trichophylla</i>	+	<1 %	6 cm	WO6-5	
<i>Austrostipa variabilis</i>	+	<1 %		WO6-9A	
<i>Avena barbata</i>	+	<1 %	15-20 cm		
<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)	+	<1 %	55 cm	WO6-6	
<i>Briza maxima</i>	+	<1 %	5-10 cm		
<i>Bromus diandrus</i>	+	<1 %	3-5 cm		Poaceae=WO3-22
<i>Burchardia umbellata</i>	+	<1 %	25 cm		=WO3-10
<i>Caesia</i> (Moora hairy stem)	+	<1 %		WO6-4	Redet 14/3/05 MET
<i>Calytrix leschenaultii</i>	<5	1-5%	1-1.2 m		
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	+	<1 %	10-20 cm	WO6-2	
<i>Cheilanthes adiantoides</i>	+	<1 %	5-10 cm		
<i>Comesperma integerrimum</i>	+	<1 %	65 cm		=wo3-7
<i>Desmocladius flexuosus</i>	1-2	1-5%	10-15 cm		
<i>Dianella revoluta</i> var. <i>divaricata</i>	+	<1 %	15 cm		
<i>Dichopogon capillipes</i>	+	<1 %	5 cm		=WO3-20
<i>Dioscorea hastifolia</i>	+	<1 %	1 m		
<i>Drosera</i> aff. <i>macrantha</i>	+	<1 %	50 cm	WO6-3	
<i>Dryandra sessilis</i> var. <i>sessilis</i>	>5	5-10%	4.5 m		
<i>Ehrharta longiflora</i>	+	<1 %	10-15 cm		
<i>Hibbertia subvaginata</i>	35-40	33.3-50%	1-1.5 m		
<i>Hypochaeris glabra</i>	+	<1 %	4 cm		
<i>Kunzea praestans</i>	+/-15	10-25%	2-3.5 m		
<i>Neurachne alopecuroidea</i>	+	<1 %	5 cm		=WO3-4
<i>Parentucellia latifolia</i>	+	<1 %	5 cm		
<i>Pentaschistis airoides</i>	>2	1-5%	3-10 cm		=WO3-25

<i>Schoenia cassiniana</i>	+	<1 %	10 cm	WO6-10	
<i>Stypandra glauca</i>	+	<1 %	40 cm	WO6-8	
<i>Thysanotus manglesianus</i>	+	<1 %	35 cm		
<i>Trifolium arvense</i> var. <i>arvense</i>	+	<1 %	6 cm	WO6-11A	Split.
<i>Trifolium repens</i> var. <i>repens</i>	+	<1 %		WO6-11B	Split from WO6-11B
<i>Ursinia anthemoides</i>	+	<1 %	10-15 cm		
<i>Vulpia myuros</i> var. <i>hirsuta</i>	1	<1 %	3-8 cm		=WO3-23
<i>Acacia aristulata</i>	+	<1 %	40 cm	WO6-16	1 plant.
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	<1 %	50 cm		=WO3-38
<i>Acacia stenoptera</i>	+	<1 %	40 cm		=WO3-26
<i>Aristida contorta</i>	+	<1 %	20 cm	WO6-21	
<i>Borya sphaerocephala</i>	+	<1 %	2 cm	WO6-14	
<i>Haemodorum simulans</i>	+	<1 %	35 cm	WO6-12	
<i>Hyalosperma cotula</i>	+	<1 %	8-15 cm	WO6-13	
<i>Nuytsia floribunda</i>	+	<1 %	6+ m		
<i>Pityrodia dilatata</i>	+	<1 %	45 cm		
<i>Podolepis lessonii</i>	+	<1 %	8-15 cm	WO6-17	
<i>Trachymene cyanopetala</i>	+	<1 %	4-6 cm	WO6-15	
<i>Tripterococcus brunonis</i>	+	<1 %	40 cm	WO6-20	
<i>Xanthorrhoea drummondii</i>	+	<1 %	1.5-3.1 m		

Arthur and Rhonda Tonkin's

Moora **Site** **ART001**

Described by Malcolm Trudgen **Date** 23/09/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 408257 **mE** 6626155 **mN**

Habitat: West-south-westerly to westerly facing gentle upper slope of a ridge.

Soil: Gravely, grey, silty fine sand amongst cobbles and boulders. Coomberdale chert near surface.

Rock Type: Chert

Vegetation: *Regelia megacephala* open scrub over *Ricinocarpos muricatus* scattered shrubs over *Dichopogon capillipes*, *Lepidosperma tenue* scattered herbs and sedges and **Ursinia anthemoides*, *Hypochaeris glabra*, *Ehrharta longiflora*, **Vulpia myuros* annual herb/grassland with *Dioscorea hastifolia* open lianes.

Vegetation: Condition: Good, would be very good but high cover of small annual weed species.

Notes: Seasonal conditions: second driest year on record. Cover of all but large shrubs lower than in a higher rainfall year. SE corner is ~1m SSW of a *Xanthorrhoea*. To the south of quadrat changes to *Allocasuarina humilis* and *Melaleuca* (pink) below break away to Southeast Jarrah/*Allocasuarina*/*Dryandra*. *Xanthorrhoea* dead: alive ratio: 4:1.

SPECIES LIST:

Quad	Name	Cover	Class	Height	Specimen	Notes
	<i>Allocasuarina humilis</i>	1%		1.8 m	nc	
	<i>Anagallis arvensis</i>	+		0.03 m	nc	blue
	<i>Arctotheca calendula</i>	+		0.08 m	nc	
	<i>Avena barbata</i>	+		0.30 m	nc	
	<i>Bromus diandrus</i>	<1%		0.08-0.12	ART-xx	
	<i>Burchardia umbellata</i>	+		0.40 m	ART01-04	
	<i>Caladenia flava</i> subsp. <i>flava</i>	+		0.10 m	ART01-02	
	<i>Caladenia</i> sp.	+		0.15 m	ART01-X	spiderorchid
	<i>Cheilanthes austrotenuifolia</i>	+		0.10m	ART01-XX	
	<i>Cheilanthes distans</i>	+		0.08 m	ART01-XX	Out (in 30x30 m)
	<i>Crassula colorata</i> var. <i>acuminata</i>	+		0.03 m	ART01-11	
	<i>Crassula exserta</i>				ART01-XX	Bis,
	<i>Desmocladus flexuosus</i>	+		0.10 m	nc	
	<i>Dichopogon capillipes</i>	<1%		0.10-0.15	ART01-05	Lily
	<i>Dioscorea hastifolia</i>	>5%		0.10)0.4-1.	nc	
	<i>Drosera</i> aff. <i>macrantha</i>	+		0.50 m	ART01-03	
	<i>Ehrharta longiflora</i>	>1%		0.10-0.35	nc	
	<i>Hibbertia subvaginata</i>	+		1.1 m	nc	common
	<i>Hypochaeris glabra</i>				nc	

<i>Kennedia prostrata</i>	+	0.05 m	ART01-13	
<i>Lepidosperma tenue</i>	1-2%	0.45 m	ART01-07	
<i>Lolium perenne</i>	+		ART01-x	
<i>Parentucellia latifolia</i>	+	0.05 m	ART01-14	
<i>Petrorhagia prolifera</i>	+	0.05-0.08	ART01-XXx	pink
<i>Podolepis canescens</i>	+	0.08-0.12	ART01-XX	Out (in 30x30 m)
<i>Regelia megacephala</i>	38%	(0.301.5-3.	nc	
<i>Rhodanthe polycephala</i>	+	0.05 m	ART01-12	
<i>Ricinosarpus muricatus</i>	5%	1.4-1.7 m	ART01-01	
<i>Silene gallica</i> var. <i>gallica</i>	+	0.10 m	ART01-Xxy	
<i>Stypantra glauca</i>	+	0.80 m	ART01-06	blue lily
<i>Trifolium arvense</i> var. <i>arvense</i>	+	0.05-0.10	ART01-09	clover hairy, oblong
<i>Trifolium campestre</i> var. <i>campestre</i>	+	0.05 m	ART01-08	clover-yellow
<i>Trifolium hirtum</i>	+	0.05-0.10	ART01-10	clover bristly
<i>Ursinia anthemoides</i>	>1%	0.05-0.15	nc	
<i>Vulpia myuros</i>	+		C	
<i>Xanthorrhoea drummondii</i>	+	1.7 m	nc	

Moora **Site** ART002

Described by Malcolm Trudgen **Date** 24/09/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 408210 **mE** 6626037 **mN**

Habitat: Southerly facing upper slope (~50 m below crest).

Soil: Gravely-pebbly (chert). Light grey silty fine siliceous sand.

Rock Type: Chert

Vegetation: *Allocasuarina humilis* open heath over *Stylidium septentrionale*, *Borya laciniata*, *Cheilanthes adiantoides* open herbland/ferland.

Vegetation Condition:

Notes: Seasonal conditions: second driest year on record. Site Soil: is quite dry. Some litter under shrubs. Bare ground: ~40%. Upslope ~10 m has *Regelia* scattered over *Allocasuarina*. ~10 m to the south has been cleared. PEG W 1120 N 1960 2 m SSE of SE corner of quadrat.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	<i>Allocasuarina humilis</i>			(0.7)1.2-1.	nc	
	<i>Arctotheca calendula</i>	+		0.05 m	nc	
	<i>Borya laciniata</i>	>1%		1.5 m	ART02-02	
	<i>Bromus diandrus</i>	+		0.05 m	nc	Out (in 30x30 m)
	<i>Caladenia flava</i> subsp. <i>flava</i>	+		0.04 m	nc	
	<i>Cheilanthes adiantoides</i>	1%		0.05 m	ART02-05b	maiden Hair fern
	<i>Crassula colorata</i>	+		0.03	nc	Out (in 30x30 m)
	<i>Desmocladius flexuosus</i>	+		0.10 m	nc	
	<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	+			ART02-06b	
	<i>Drosera</i> aff. <i>macrantha</i>	+		0.10 m	ART02-08	climber
	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>	+		0.01 m	nc	leaves lax.
	<i>Ehrharta longiflora</i>	+		0.04 m	nc	
	Genus sp.	+		0.05 m	ART02-06	inadequate material
	Genus sp.	+		0.08 m	ART02-09	inadequate material
	<i>Hypochaeris glabra</i>	+		0.02 m	nc	
	<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+		0.02 m	ART02-07	
	<i>Pentaschistis airoides</i>	+		0.05 m	ART02-04	
	<i>Stylidium septentrionale</i>	<5%		0.05-0.08	ART02-01	
	<i>Thysanotus manglesianus</i>	+		0.50 m	ART02-05a	
	<i>Trachymene cyanopetala</i>	+		0.03 m	ART02-03	
	<i>Ursinia anthemoides</i>	+		0.15 m	nc	Out (in 30x30 m)
	<i>Vulpia myuros</i>	+		0.05 m	nc	

Moora **Site** ART003

Described by Malcolm Trudgen **Date** 24/09/2010 **Type** QUADRAT 10x30 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 408555 **mE** 6626174 **mN**

Habitat: Slight ridge between two chert ridges at both ends, but mostly to the north/north-north-west.

Soil: Gravelly pebbly light grey silt, fine siliceous sand. Pebbles and gravel are Coomberdale Chert.

Rock Type: Chert

Vegetation: Eucalyptus loxophleba subsp. loxophleba low woodland to low open forest over Melaleuca concreta over Austrostipa trichophylla scattered low tussocks (with scattered introduced herbs and grasses)

Vegetation Condition: Good

Notes: Seasonal conditions: second driest year on record. To avoid edge effects and to get a good 30 m transect this record is 10-15 m wide, with ~20 m being searched beyond each end. High cover of annual weeds. Moraea setifolia: population >100 in transect and past southern end, most plants are flowering.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia ligustrina	+		6 m	ART03-xx	
	Amyema preissii	+			ART03-xx	on Acacia
	Arctotheca calendula	+		0.05 m	nc	capeweed
	Atriplex suberecta	+		0.25 m	ART03-xx	spreading
	Austrodanthonia acerosa	+			ART03-xx	
	Austrostipa trichophylla				ART03-xx	
	Brachyscome perpusilla	+			ART03-xx	
	Bromus diandrus	+			ART03-xx	
	Calandrinia calyptrata	+			ART03-xx	
	Cotula turbinata	+			ART03-xx	
	Crassula colorata var. acuminata	+		0.05 m	ART03-xx	
	Dysphania melanocarpa forma melanocarpa	+		0.15 m	ART03-xx	
	Ehrharta brevifolia var. cuspidata	+		0.10 m	ART03-xx	short flowers, Voucher
	Ehrharta longiflora	+			nc	
	Emex australis	+		0.10 m	ART03-xx	
	Erodium botrys	+			ART03-xx	
	Eucalyptus loxophleba subsp. loxophleba	>=40%		(8)15-20	nc	york gum
	Hypochoeris glabra	C		0.10 m	nc	0.10 m plus flowers
	Lamarckia aurea	+			ART03-xx	
	Maireana marginata	+			ART03-xx	
	Melaleuca concreta	+		2.4 m	ART03-xx	
	Moraea setifolia	+			MET23,609	
	Pentaschistis airoides	+		0.05-0.08	ART03-xx	
	Polycarpon tetraphyllum	+			ART03-xx	
	Ptilotus spathulatus forma spathulatus	+		0.05 m	ART03-xx	
	Schismus barbatus	+		0.07 m	ART03-xx	0.07 m plus culm
	Senecio glossanthus	+			ART03-xx	
	Solanum nigrum	+			ART03-xx	
	Sonchus asper	+			ART03-xx	
	Trachymene cyanopetala	+			ART03-xx	
	Vulpia myuros	+			ART03-xx	

Moora Site ART004

Described by Malcolm Trudgen **Date** 16/10/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 408782 **mE** 6625729 **mN**

Habitat: Upper north facing sloped ridge.

Soil: Gravelly pebbles, very silty fine siliceous sand amongst cobbles and boulders.

Rock Type: Coomberdale Chert.

Vegetation: Acacia acuminata scattered low trees over Kunzea praestans (Dryandra sessilis) open scrub over Hibbertia racemosa low shrubland over Desmocladus flexuosus low open shrubland and Cheilanthes adiantoides, Cheilanthes distans low open fernland.

Vegetation Condition:

Notes: Seasonal conditions: second driest year on record. Desmocladus is very grazed by kangaroos. Some Dryandra seedlings present. Vegetation: changes just outside north corner of quadrat to Melaleuca shrubland.

Xanthorrhoea at SE corner.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia acuminata subsp. acuminata	+		5 m	nc	
	Amyema preissii	+			ART04-26	Out (in 30x30 m) on jarrah
	Austrostipa trichophylla	+		0.35 m	ART04-10b	
	Avena barbata	1%		0.15 m	ART04-10	
	Brachypodium distachyon	+		0.18 m	ART04-19	
	Briza maxima	+		0.12 m	nc	
	Calytrix leschenaultii	+		0.75 m	ART04-20	
	Cheilanthes adiantoides	1%		0.07 m	ART04-02	ART04-04
	Cheilanthes distans	+		0.05 m	ART04-21	
	Crassula exserta	+		0.03 m	ART04-15	
	Desmocladus flexuosus	2%		0.15 m	ART04-05	
	Dichopogon capillipes	+		0.10 m	nc	Out (in 30x30 m)
	Dioscorea hastifolia	+			nc	
	Diplopeltis huegelii subsp. lehmannii	+		0.03 m	ART04-17	
	Drosera aff. macrantha	+		0.20 m	ART04-03a	
	Dryandra sessilis var. sessilis	3%		3.5-4.5 m	ART04-24	=PJ9957
	Ehrharta longiflora	+		0.20 m	ART04-11	
	Genus sp.	+		0.05 m	ART04-14	unknown
	Hibbertia subvaginata	25-30%		0.6-1 m	nc	
	Hypochaeris glabra	+		0.05 m	nc	
	Kunzea praestans	40%		(1.5)2.5-3	nc	
	Laxmannia ramosa subsp. ramosa	+		0.15 m	ART04-06	
	Melaleuca calyptroides	+		1.5 m	ART04-25	Out (in 30x30 m)
	Millotia myosotidifolia	+		0.05 m	ART04-23	
	Neurachne alopecuroidea	+		0.05 m	nc	
	Nuytsia floribunda	+		5 m	nc	
	Pentaschistis airoides	+		0.07 m	ART04-12	
	Petrorhagia prolifera	+		0.10 m	ART04-07b	
	Podotheca gnaphalioides	+		0.12 m	ART04-01	
	Silene gallica var. gallica	+			ART04-07a	bristly
	Trachymene cyanopetala	+		0.05 m	ART04-22	
	Tripteris clandestina	+			ART04-03	
	Urospermum picroides	+		0.10 m	ART04-16	ART04-13
	Ursinia anthemoides	+		0.04 m	ART04-18	
	Vulpia myuros	3%		0.10 m	ART04-08	
	Xanthorrhoea drummondii	>1%		2.4 m	nc	

Moora Site ART005

Described by Malcolm Trudgen **Date** 16/10/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 **408600 mE** **6625604 mN**

Habitat: West-south-westerly to westerly facing gentle upper slope of a ridge.

Soil: Gravelly pebbles, very silty fine siliceous sand amongst cobbles and boulders.

Rock Type: Coomberdale Chert.

Vegetation: Allocasuarina huegeliana scattered low trees over Regelia megacephala high shrubland over Cheilanthes adiantoides Low open herbland.

Vegetation Condition:

Notes: Cheilanthes sp. total Cover <5%

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia acuminata subsp. acuminata	+		4 m	nc	
	Agrostocrinum scabrum	+		0.08 m	ART05-08	
	Allocasuarina huegeliana	1%		5 m	nc	
	Arctotheca calendula	+		0.05 m	nc	
	Avena barbata	1%		0.60 m	nc	
	Briza maxima	1%		1.2 m	nc	

Caladenia flava subsp. flava	+	0.12 m	ART05-15	
Calandrinia sp.	+	0.04 m	ART05-14	
Cheilanthes adiantoides	<5%	0.10 m	ART05-02	ART05-05
Crassula colorata var. colorata	+	0.02 m	ART05-01	
Daucus glochidiatus	+	0.05 m	ART05-04	
Dichopogon capillipes	+	0.10 m	ART05-13	
Dioscorea hastifolia	1%	1.7 m	nc	
Drosera sp.	+	0.20 m	ART05-12	
Ehrharta longiflora	1%	0.30 m	nc	
Erodium botrys	+	0.10 m	ART05-10	
Hibbertia subvaginata	+	0.30 m	nc	
Hypochaeris glabra	2%	0.10 m	nc	
Hypoxis glabella var. leptantha	+	0.08 m	ART05-19	
Millotia myosotidifolia	+	0.08 m	ART05-16	
Parentucellia latifolia	+	0.04 m	ART05-18	
Pentaschistis airoides	+	0.50 m	ART05-09	
Petrorhagia prolifera	+	0.05 m	ART05-11	
Regelia megacephala	28%	2.5-3.5 m	nc	
Stypantra glauca	+	0.25 m	ART05-03	
Trachymene ornata	+	0.05 m	ART05-06	
Trifolium arvense var. arvense	+	0.03 m	ART05-17	
Urospermum picroides	+	0.05 m	nc	monoculus
Ursinia anthemoides	2%	0.20 m	nc	
Vulpia myuros	2%	0.10 m	ART04-08=	

Moora **Site** **ART006**

Described by Malcolm Trudgen **Date** 16/10/2010 **Type** QUADRAT 25x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 408681 **mE** 6625521 **mN**

Habitat: East-west trending flowline with gentle slope between XXX parts of a north-south trending ridge.

Soil: Gravelly pebbles, brownish-grey sandy (fine) silty amongst large pebbles and cobbles.

Rock Type: Chert.

Vegetation: Allocasuarina huegeliana, Acacia acuminata low open woodland over Allocasuarina campestris high shrubland over Cheilanthes adiantoides open fernland and Asteraceae / Poaceae (mature/weedy) annual herb/grassland.

Vegetation Condition:

Notes: Seasonal conditions: second driest year on record. Transect 25 m long.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia acuminata subsp. acuminata	<=5%		5-7 m	nc	jam
	Allocasuarina campestris	25%		2-3 m	nc	
	Allocasuarina huegeliana	<=5%		4-7 m	nc	
	Arctotheca calendula	+		0.05 m	nc	
	Austrostipa trichophylla	+		0.15 m	ART06-07	
	Avena barbata	2%		0.35 m	nc	
	Brachypodium distachyon	1%		0.25 m	ART06-06	
	Briza maxima	+		0.10 m	nc	
	Cheilanthes adiantoides	1%		0.05 m	ART06-11	
	Daucus glochidiatus	+		0.03 m	nc	
	Desmodium flexuosus	+		0.10 m	nc	
	Dichopogon capillipes	+		0.20 m	ART06-13	
	Dioscorea hastifolia	+		1.5 m	nc	
	Ehrharta longiflora	+		0.10 m	nc	
	Erodium botrys	<=1%		0.45 m	ART06-04	
	Euphorbia drummondii subsp. drummondii	+		0.03 m	ART06-03	
	Hypochaeris glabra	1%		0.05 m	nc	
	Linum trigynum	+		0.07 m	ART06-09	
	Neurachne alopecuroidea	+		0.08 m	nc	
	Pentaschistis airoides	+		0.08 m	ART06-14	
	Petrorhagia prolifera	+		0.05 m	ART06-05	
	Podolepis lessonii	<=10%		0.20 m	ART06-02	

<i>Ptilotus gaudichaudii</i> var. <i>parviflorus</i>	+	0.10 m	ART06-10
<i>Schoenia cassiniana</i>	5-10%	0.30 m	ART06-01
<i>Silene gallica</i> var. <i>gallica</i>	+	0.15 m	ART06-08
<i>Stylidium septentrionale</i>	+	0.05 m	ART06-15
<i>Thysanotus manglesianus</i>	+	1.5 m	ART06-12
<i>Trachymene cyanopetala</i>	+	0.08 m	ART06-16
<i>Trachymene ornata</i>	+	0.10 m	nc
<i>Urospermum picroides</i>	+	0.08 m	ART04-16=
<i>Ursinia anthemoides</i>	8%	0.20 m	nc
<i>Vulpia myuros</i>	3%	0.10 m	nc

Moora **Site** **ART007**

Described by Malcolm Trudgen **Date** 17/10/2010 **Type** RAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 410277 **mE** 6625428 **mN**

Habitat: Upper west facing slope of a ridge (north-south trending).

Soil: Gravelly pebbly grey, fine silty siliceous sand.

Rock Type: Chert

Vegetation: *Allocasuarina huegeliana* low woodland over *Xanthorrhoea drummondii* scattered shrubs over *Hibbertia racemosa*, *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland over *Cheilanthes austrotenuifolia* low open fernland with *Ursinia anthemoides*, *Dioscorea hastifolia* XXXXXXXX annual herbland

Vegetation Condition:

Notes: Seasonal conditions: second driest year on record. *Allocasuarina* litter under trees. Occasional small patches of *Kunzea praestans*. Most of *Xanthorrhoea* dead, (apparently) fire killed and would have been ~3% cover before deaths. *Xanthorrhoea* at NE corner of quadrat.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	<i>Acacia acuminata</i> subsp. <i>acuminata</i>	+		5.5 m	nc	on edge
	<i>Allocasuarina campestris</i>	+		2.4 m	nc	Out (in 30x30 m)
	<i>Allocasuarina huegeliana</i>	25%		4-5.6 m	nc	
	<i>Austrostipa elegantissima</i>	+		0.25 m	ART07-07	Out (in 30x30 m)
	<i>Austrostipa trichophylla</i>	+		0.10 m	ART07-13	
	<i>Avena barbata</i>	1		0.35 m	nc	
	<i>Briza maxima</i>	+		0.05-0.07	nc	
	<i>Bromus diandrus</i>	+			ART07-xx	
	<i>Cheilanthes austrotenuifolia</i>	1		0.08-0.12	nc	
	<i>Crassula exserta</i>	+			ART07-12	
	<i>Daucus glochidiatus</i>	+		0.05 m	ART07-01	
	<i>Desmocladus flexuosus</i>	+		0.10 m	nc	
	<i>Dichopogon capillipes</i>	+			ART07-11	
	<i>Dioscorea hastifolia</i>	2%		0.15 m	nc	
	<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>	+		0.10 m	nc	Out (in 30x30 m)
	<i>Drosera</i> sp.	+		0.10 m	ART07-10	inadequate material
	<i>Ehrharta longiflora</i>	+		0.05 m	nc	
	<i>Elymus</i> sp.	+		0.10 m	ART07-09	inadequate material
	<i>Hibbertia subvaginata</i>	1%		0.30-0.60	nc	
	<i>Hypochaeris glabra</i>	+		0.05 m	nc	
	<i>Kunzea praestans</i>	+		2.5 m	nc	
	<i>Lolium perenne</i>	+		0.10 m	ART07-14	
	<i>Neurachne alopecuroidea</i>	+		0.03 m	ART07-04	
	<i>Pentaschistis airoides</i>	+		0.04 m	ART07-08	
	<i>Petrorhagia proliferata</i>	+		0.05 m	ART07-05	
	<i>Silene gallica</i> var. <i>gallica</i>	+		0.04 m	ART07-03	
	<i>Stypandra glauca</i>	+		0.10 m	nc	
	<i>Trachymene ornata</i>	+		0.07 m	nc	
	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	+		0.40-0.70	nc	
	<i>Urospermum picroides</i>	+		0.05 m	ART04-16=	
	<i>Ursinia anthemoides</i>	</=5%		0.10-0.25	nc	
	<i>Vulpia myuros</i>	+		0.10 m	ART07-02	
	<i>Xanthorrhoea drummondii</i>	</=3%		1.9 m	nc	mostly dead.

Moora Site ART008**Described by** Malcolm Trudgen **Date** 17/10/2010 **Type** QUADRAT 10x10 m**MGA Zone** 50 408257 **mE** 6626155 **mN****Location:** North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.**MGA Zone** 50 408155 **mE** 6627780 **mN****Habitat:** Crest of a ridge north-south trending.**Soil:** Gravelly pebbly light grey silty fine siliceous sand with Allocasuarina needle litter layer 1-2(3) cm thick.**Rock Type:** Coomberdale Chert.**Vegetation:** Allocasuarina huegeliana, Acacia acuminata low open forest over Xanthorrhoea drummondii open shrubland over Lomandra aff. micrantha subsp. micrantha, Neurachne alopecuroidea, Austrostipa trichophylla scattered low grasses and herbs and *Ehrharta longiflora, *Avena fatua annual grassland.**Vegetation Condition:****Notes:** Seasonal conditions: second driest year on record. No Hibbertia or small shrubs. Xanthorrhoea drummondii numbers are declining due to death. However, the live: dead ratio is approximately (currently) the same.**SPECIES LIST:**

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia acuminata subsp. acuminata	5%		5-7 m	nc	
	Allocasuarina huegeliana	>/-25%		5-8 m	nc	
	Austrostipa trichophylla	+		0.25 m	ART08-05	
	Avena barbata	2%		0.40 m	nc	
	Briza maxima	+		0.08 m	nc	
	Bromus diandrus	+		0.03 m	ART08-06	
	Calandrinia calyprata	+		0.03 m	ART08-03	
	Cheilanthes distans	+		0.05 m	ART08-04	
	Comesperma integerrimum	+		0.70 m	ART08-11	Out (in 30x30 m)
	Convolvulus angustissimus subsp. angustissimus	+		0.60 m	ART08-10	Out (in 30x30 m)
	Crassula colorata var. acuminata	+		0.03 m	ART08-08	Out (in 30x30 m)
	Dioscorea hastifolia	+		0.20 m	nc	
	Ehrharta longiflora	5%		0.15-0.60	nc	
	Hypochaeris glabra	+		0.05 m	nc	
	Kunzea praestans	+		1 m	nc	
	Lomandra (Moora twisty)	+		0.15 m	ART08-07	
	Lomandra aff. micrantha subsp. micrantha	1%		0.15 m	ART08-02	
	Neurachne alopecuroidea	1%		0.10 m	ART08-01	
	Pentastichis sp.	+		0.05 m	nc	
	Petrorhagia dubia	+		0.05 m	=	= Glabrous SILENE
	Pityrodia dilatata	+		0.10 m	ART08-09	
	Schoenia cassiniana	+		0.10 m	nc	
	Stypandra glauca	+		0.05 m	nc	
	Trachymene ornata	+		0.05 m	nc	
	Urospermum picroides	+		0.05 m	nc	'Sonchus' bristly
	Ursinia anthemoides	1%		0.10-0.15	nc	
	Vulpia myuros	+		0.10 m	nc	
	Xanthorrhoea drummondii	3%		1.5-2.2 m	nc	

Moora Site ART009**Described by** Malcolm Trudgen **Date** 17/10/2010 **Type** QUADRAT 10x10 m**Location:** North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.**MGA Zone** 50 408488 **mE** 6626805 **mN****Habitat:** Southerly facing midslope at the southern end of a ridge.**Soil:** Gravelly pebbly very silty light grey siliceous fine sand amongst cobbles and outcrop of Coomberdale Chert.**Rock Type:** Coomberdale Chert (at depth)**Vegetation:** Kunzea praestans, Dryandra sessilis high shrubland to open scrub over Xanthorrhoea drummondii open shrubland over Hibbertia racemosa low open shrubland over *Avena, *Bromus diandrus, Hypochaeris glabra annual grass/herbland.**Vegetation Condition:** Good.

Notes: Very poor season, drought year (second driest year on record). Xanthorrhoea numbers are declining through death.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Arctotheca calendula	+		0.02 m	nc	
	Austrostipa trichophylla	1%		0.20 m	ART09-02	
	Avena barbata	2%		0.10-0.30	nc	
	Brachypodium distachyon	+			C	
	Briza maxima	+		0.03-0.05	nc	
	Calytrix leschenaultii	+		0.40 m	C	blue
	Cheilanthes austrotenuifolia	+		0.05 m	nc	
	Crassula colorata var. colorata	+		0.03 m	ART09-05	
	Cynosurus echinatus	1%		0.10 m	ART09-01	
	Desmocladus flexuosus	1-2%		0.10 m	nc	
	Dioscorea hastifolia	+		0.20 m	nc	
	Diplopeltis huegelii subsp. lehmannii	+		0.30 m	nc	
	Dryandra sessilis var. sessilis	2%		3.5-5 m	ART09-xx	
	Ehrharta longiflora	2%		0.20 m	nc	
	Enchylaena tomentosa var. tomentosa	+		0.15 m	ART09-04	
	Erodium botrys	1%		0.05 m	ART09-03	
	Hibbertia subvaginata	<5%		0.40-0.90	nc	
	Hypochaeris glabra	<5%		0.05 m	nc	
	Kunzea praestans	>25%		2.8-4.5 m	nc	
	Melaleuca calyptroides	+		2 m	ART09-08	
	Neurachne alopecuroidea	+		0.07 m	nc	Out (in 30x30 m)
	Nuytsia floribunda	+		3-6 m	nc	
	Opercularia vaginata	+		0.25 m	ART09-06	Out (in 30x30 m)
	Pentaschistis airoides	+		0.05 m	nc	
	Petrorhagia dubia	+		0.05 m	nc	
	Silene gallica var. gallica	+		0.05 m	nc	
	Thysanotus manglesianus	+		1.4 m	ART09-07	
	Urospermum picroides	+		0.10 m	nc	bristly
	Ursinia anthemoides	2%		0.10 m	nc	
	Vulpia myuros	+		0.15 m	nc	
	Xanthorrhoea drummondii	<=1%		2-3 m	nc	

Moora Site ART010

Described by Malcolm Trudgen **Date** 17/10/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 **407669 mE** **6625875 mN**

Habitat: North-west facing moderate upper slope to crest of the northern end of a low ridge.

Soil: Gravelly pebbly very silty fine light grey siliceous sand with 1-2 cm litter layer of Allocasuarina needles; amongst cobbles and boulders of Coomberdale Chert.

Rock Type: Coomberdale Chert at depth.

Vegetation: Allocasuarina huegeliana low open forest over Allocasuarina campestris, Xanthorrhoea drummondii shrubland/ high shrubland over Hibbertia racemosa low open shrubland over Austrostipa trichophylla, Austrostipa hemipogon scattered grasses.

Vegetation Condition: Very good.

Notes: Seasonal conditions: second driest year on record. Allocasuarina needles are suppressing weeds; which have very low cover. Some dead Xanthorrhoea but not a high percentage.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Allocasuarina campestris	10-15		1.7-2.2 m	nc	
	Allocasuarina huegeliana	30		4-6 m	nc	
	Austrodanthonia acerosa	+		0.10 m	ART10-07	ART10-15
	Austrostipa hemipogon	<1		0.20 m	ART10-06	
	Austrostipa trichophylla	+		0.15 m	ART10-14	Out (in 30x30 m)
	Avena barbata	1		0.15-0.25	nc	
	Borya laciniata	+		0.05 m	ART10-08	
	Briza maxima	+		0.03 m	nc	

Burchardia umbellata	+	0.10 m	nc	
Calandrinia calyptata	+	0.05 m	ART10-10	
Cheilanthes austrotenuifolia	2	0.03 m	nc	
Desmocladius flexuosus	>1	0.10 m	ART10-05	
Dichopogon capillipes	+	0.03 m	ART10-03	
Dioscorea hastifolia	1	0.10-0.50	nc	
Drosera aff. macrantha	+	0.20 m	ART10-12	Out (in 30x30 m)
Ehrharta longiflora	+	0.15-0.20	nc	
Hibbertia subvaginata	<5	0.5-0.8 m	nc	
Hordeum leporinum	+	0.05 m	nc	
Hypochaeris glabra	+	0.02 m	nc	
Lomandra (Moora twisty)	+	0.20 m	ART10-04	
Neurachne alopecuroidea	+	0.05 m	ART10-02	
Pentaschistis airoides			ART10-09	
Petrorhagia prolifera	+	0.04 m	ART10-11	
Pityrodia dilatata	+	0.20 m	ART10-01	on edge of quadrat
Schoenia cassiniana	+	0.08 m	nc	
Stypandra glauca	+	0.20 m	nc	
Trachymene cyanopetala	+	0.05 m	ART10-13	Out (in 30x30 m)
Trachymene ornata	+	0.03 m	nc	Out, in 30x30 m
Urospermum picroides	+	0.05 m	=	bristly
Ursinia anthemoides	+	0.10 m	nc	
Vulpia myuros	+	0.05 m	nc	
Xanthorrhoea drummondii	<=5	1.5-2.2 m	nc	

Moora Site ART011

Described by Malcolm Trudgen **Date** 17/10/2010 **Type** QUADRAT 10x10 m

Location: North of Kiaka Road, East of Midlands Road, approximately 17 km North of Moora.

MGA Zone 50 **407635 mE** **6625755 mN**

Habitat: Moderate westerly facing midslope of a ridge.

Soil: Grey-brown gravelly pebbly silty grey fine siliceous sand.

Rock Type: Chert

Vegetation: Eucalyptus accedens scattered trees over Acacia acuminata, Allocasuarina huegeliana low woodland over Xanthorrhoea drummondii scattered shrubs/tall shrubs over annual grassland and herbland.

Vegetation Condition: Good?

Notes: Seasonal conditions: second driest year on record. Gilberta tenuifolia: daisy yellow, reflexed bracts, abundant on lower slopes. Gilberta tenuifolia: daisy yellow, reflexed bracts, abundant on lower slopes

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia acuminata subsp. acuminata	10-20%		4-7 m	nc	jam
	Allocasuarina huegeliana	1%		7-8 m	nc	
	Austrodanthonia caespitosa	+			ART11-02	
	Austrostipa trichophylla	1			ART11-05	
	Avena barbata	>15%		0.50 m	nc	
	Borya sp.	+		0.03 m	nc	
	Cheilanthes austrotenuifolia	1%		0.03 m	nc	
	Desmocladius flexuosus	+		0.10 m	nc	
	Dichopogon capillipes	+		0.07 m	ART11-08	
	Dioscorea hastifolia	+		0.30 m	nc	
	Elymus sp.	+		0.05 m	nc	Inadequate material
	Enchylaena tomentosa var. tomentosa	+		0.10 m	nc	
	Eucalyptus wandoo subsp. wandoo	1-2%		7-13 m	ART11-01	
	Gilberta tenuifolia	+		0.05-0.07	ART11-09	
	Goodenia berardiana	+		0.15 m	ART11-07	
	Neurachne alopecuroidea	+			nc	
	Pentaschistis sp.	+		0.08 m	nc	
	Petrorhagia dubia	+		0.10 m	nc	
	Podolepis lessonii	<5%			nc	
	Ptilotus drummondii var. drummondii	+		0.15 m	ART11-06	
	Ptilotus polystachyus var. polystachyus	+		0.15 m	ART11-04	

Schoenia cassiniana	+	0.15 m	nc	
Trachymene ornata	+	0.05 m	nc	
Urospermum picroides	+	0.15 m	nc	Monoculus monstrossa
Ursinia anthemoides	+		nc	
Vulpia myuros	+	0.05 m	nc	
Waitzia nitida	+		ART11-03	
Xanthorrhoea drummondii	<5%	1.5-3 m	nc	

APPENDIX 7: Vegetation Classification of the survey area

Introductory notes

This appendix contains a classification of the vegetation of the Coomberdale Chert Threatened Ecological Community, which is located on a group of chert ridges north of Moora. The vegetation is classified at three levels; vegetation alliance, vegetation association and plant community. Descriptions are provided for each of these levels. The distribution of the plant communities described are shown on Map 5 by their codes and of the alliances by colour (with a key to the alliances by colour given on the map).

Most of this vegetation is either:

- on outcrop of the Coomberdale Chert;
- on soils overlaying the Coomberdale Chert;
- on soils derived from the Coomberdale Chert (e.g. loamy soils with much chert gravel on slopes adjacent to outcrop of Coomberdale Chert); or
- on soils with a significant contribution from the Coomberdale Chert (e.g. soils on dolerite dykes with a surface layer that contains significant amounts of gravel from the Coomberdale Chert).

Some remnant vegetation described and mapped within the survey area was probably not derived from chert. This includes some small areas of sand and some valley floors that may have relatively little influence in the development of their soil from the Coomberdale Chert.

Where plant communities were defined from releve descriptions, those releve descriptions are shown in this appendix. Where plant communities were defined wholly or in part from quadrat descriptions, only the quadrat name is given as details of the quadrats are included in another appendix in this report (Appendix 6).

Vegetation Alliance 1: *Eucalyptus salmonophloia* woodlands to open forests

Salmon gum open forest occurred in a few locations in the study area, in small valleys between low ridges and in a few places in the remnant vegetation at the base of the chert ridges on the edge of broad valley floors now largely cleared for farming.

Vegetation Association Es: *Eucalyptus salmonophloia* (*Eucalyptus wandoo* subsp. *wandoo*) over *Dodonaea inaequifolia* high open shrubland.

Plant Communities:

Es1: *Eucalyptus salmonophloia*, (*Eucalyptus wandoo* subsp. *wandoo*) woodland over *Dodonaea inaequifolia* high shrubland over *Acacia erinacea* open shrubland over *Austrostipa scabra*, *Austrostipa elegantissima*, *Austrostipa trichophylla*, *Austrodanthonia setacea* scattered grasses.

One quadrat (CAH16) was recorded in this plant community.

Vegetation Association EsEl: *Eucalyptus salmonophloia* woodland over *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over scattered *Acacia erinacea* and scattered herbs and grasses including *Ptilotus divaricatus* var. *divaricatus*, *Rhodanthe polycephala* and **Bromus diandrus*.

Plant Communities:

EsEl.1: *Eucalyptus salmonophloia* woodland over *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over (*Rhagodia preissii* ssp. *preissii* scattered shrubs) over *Ptilotus divaricatus* var. *divaricatus*, *Rhodanthe polycephala* scattered herbs

Two releves were recorded in this plant community: releves CR52 and G329.

Releve CR52

Date: 23/11/03

Location: Cairn Hill Reserve (eastern boundary).

AMG84: 50J 0407779/UTM 66 21175 (WGS 84; GPS unit).

Site description: Lower slope and valley floor at base of east-facing slope of low rocky ridge (flat to very gently sloping to the east).

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus salmonophloia* (10-20%, 18-20m,) woodland over *Eucalyptus loxophleba* subsp. *loxophleba* (20-30%, 8-10m) low woodland over *Acacia ligustrina* (+, 3-3.5m) scattered tall shrubs over *Rhagodia preissii* ssp. *preissii* scattered shrubs over *Ptilotus divaricatus* var. *divaricatus*, *Lepidium rotundum*, *Rhodanthe polycephala* scattered herbs.

Associated species: *Crassula colorata*, *Acacia erinacea*.

Releve G329

Date: 17/2/05

Location: Gardiner's Property

AMG84: 50J 0407385/UTM 66 18820(WGS 84; GPS unit).

Vegetation description: *Eucalyptus salmonophloia*, *Eucalyptus loxophleba* subsp. *loxophleba* low open forest over **Bromus diandrus* annual grassland.

EsEl.2: *Eucalyptus salmonophloia* open forest over *Eucalyptus loxophleba* subsp. *loxophleba* low open woodland over (*Acacia erinacea* scattered shrubs) over *Ptilotus divaricatus* var. *divaricatus*, *Maireana marginata*, *Maireana enchylaenoides* very open herbland.

This plant community differed by having a number of Chenopod herb species present. It occurred at Gardiner's Hill. Releves GHR266 and GHR267.

Releve GHR267

Date: 15/1/04

Location: Gardiner's hill

AMG84: 50J 0408382/UTM 66 17316 (WGS 84; GPS unit).

Site description: Gentle, north-west facing floor of broad drainage line (elevation 250 m).

Vegetation description: *Eucalyptus salmonophloia* (40-50%) open forest over *Eucalyptus loxophleba* subsp. *loxophleba* ((8)10-12 m) (5%) low open woodland over *Acacia microbotrya* scattered tall shrubs over *Templetonia smithiana* (1.3m), *Acacia erinacea* scattered shrubs over *Ptilotus divaricatus* var. *divaricatus* scattered low shrubs over *Maireana marginata* (2-3%) (patchy), *Maireana enchylaenoides*, *Calandrinia* sp. (3-5%) (patchy), *Crassula colorata* var. *colorata* very open herbland over *Austrostipa elegantissima*, *Austrodanthonia setacea*, *Austrostipa trichophylla* scattered grasses and *Ehrharta longiflora* very open annual grassland.

Associated species: *Austrostipa elegantissima*, *Maireana brevifolia* (generally slightly upslope on the lower slopes), *Lythrum trigynum* (patches of closed herbland further down drainage line).

Condition: Very good - low weed cover.

Note: similar to CR52.

Releve GHR267

Date: 15/1/04

Location: Gardiner's Hill

AMG84: 50J 0408292/UTM 66 17568 (WGS 84; GPS unit).

Site description: Gentle, south-west facing lower to mid slope at base of rocky ridge

Rock type: Unknown.

Vegetation description: *Eucalyptus salmonophloia* (30-50%) open forest over *Eucalyptus loxophleba* subsp. *loxophleba* (5-10%) low open woodland over *Ptilotus divaricatus* var. *divaricatus*, *Maireana marginata*, *Maireana enchylaenoides*, *Atriplex suberecta* (30 cm) scattered low herbs over *Calandrinia* sp. (5-10%) very open to open herbland with *Bromus diandrus* scattered annual grasses.

Condition: Very good to excellent.

Notes: Upslope from unit R266. (Elevation 248 m).

Vegetation Alliance 2: *Eucalyptus wandoo* subsp. *wandoo* woodlands and open forests

Vegetation Association Ew: *Eucalyptus wandoo* subsp. *wandoo* low woodland or open forest over open herb/grassland that included *Opercularia vaginata*, *Lomandra effusa*, *Orthrosanthus laxus*, *Crassula colorata* var. *colorata*, *Trachymene pilosa* and *Waitzia nitida* herbs and *Austrodanthonia setacea* and *Austrostipa exilis* grasses.

Plant Communities:

Ew.1: *Eucalyptus wandoo* subsp. *wandoo* woodland over scattered herbs.

Quadrats ERG4 and CAH20; releves NBPD6 and CSR326.

Releve NBPD6

Date: 12/04

Location: Doblestein's property.

AMG84: 50J 409150/UTM 6621500 (WGS 84; GPS unit).

Site description: Ridge

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* low open woodland.

Notes: Off map. *Eucalyptus wandoo* subsp. *wandoo* low open woodland on the eastern side of NW to SE line along the ridge crest (York gum on the west side). Photo: BM13-19.

Releve CSR326

Date: 17/2/05

Location: Kim Chester's property.

AMG84: 50J 0407619/UTM 66 19640 (WGS 84; GPS unit).

Site description: Moderate, east-facing slope of low ridge.

Soil: Gravelly, pebbly brown sand.

Rock type: Chert?

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (40-50%) low open forest over *Avena barbata*, *Ehrharta longiflora* annual grassland.

Condition: Very poor (annual grassland of weeds).

Ew.2: *Eucalyptus wandoo* subsp. *wandoo* woodland over *Allocasuarina campestris* high shrubland (probably an intermediate unit). Quadrat ERG16 (see description in Appendix 6).

Ew.3: *Eucalyptus wandoo* subsp. *wandoo* woodland over *Acacia acuminata* subsp. *acuminata* low woodland over herbland/sedgeland/grassland. Releves CR5, CR6, GHR296 and ATR012.

Releve CR5.

Date: 7/11/03

Location: South-east corner of Cairn Hill.

AMG84: 50J 0407804/UTM 66 20140 (WGS 84; GPS unit).

Site description: East facing, moderate mid slope to lower slope of a low ridge.

Soil: Cobbly, gravelly brown clayey loam.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* woodland over *Acacia acuminata* subsp. *acuminata* low woodland over *Allocasuarina campestris* scattered tall shrubs over *Opercularia vaginata*, *Lomandra effusa*, *Orthrosanthus laxus*, *Waitzia nitida* very open herbland.

Associated species: *Austrostipa elegantissima*, *Cheilanthes adiantoides*, *Crassula colorata* var. *colorata*, *Neurachne alopecuroidea*, *Ptilotus manglesii* (lower slopes).
Condition: Excellent (disturbance (old tracks) near by).

Releve CR6 (~CR5)

Date: 8/11/03

Location: Southern boundary of Cairn Hill.

AMG84: 50J 0407832/UTM 66 20037 (WGS 84; GPS unit).

Site description: Gently sloping mid-slope, east facing, of low ridge.

Soil: Gravelly, cobbly brown loamy sand.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (~35-40%) open forest over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* scattered tall shrubs over *Ptilotus drummondii* var. *drummondii* (+), *Dichopogon capillipes* scattered herbs over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses.

Associated species: *Austrodanthonia setacea*, *Austrostipa exilis*, *Vulpia myuros* var. *hirsuta*, *Ursinia anthemoides*, *Trachymene cyanopetala*, *Crassula colorata* var. *colorata*.

Condition: Excellent.

Notes: Similar and near CR5 but soil with less clay and much less *Acacia acuminata* subsp. *acuminata* and herb/sedge layer different.

Releve GHR296

Date: 18/1/04

AMG84: 50J 0408455/UTM 66 17005 (WGS 84; GPS unit).

Location: Gardiner's Hill

Site description: Moderate, east-facing lower slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* scattered trees over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Neurachne alopecuroidea* scattered tall grasses with *Podolepis canescens* (30%), *Lawrencella rosea* (3-5%), *Gilberta tenuifolia* (5-10%) herbland and *Cheilanthes adiantoides* very open fernland.

Condition: Very good.

Ew.4: *Eucalyptus wandoo* subsp. *wandoo* woodland over *Olearia dampieri* subsp. *eremicola*, *Hibbertia subvaginata* open (low) shrubland (probably an intermediate unit). Releve ERR189.

Releve ERR189

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407907/UTM 66 23764 (WGS 84; GPS unit).

Site description: Moderate, east-facing rocky lower slope of low rocky ridge (elevation 253 m).

Soil: Gravelly, pebbly, cobbly brown sand amongst rocks and rock outcrop (~10-20% of surface cover).

Rock type: chert.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (20-25%) woodland over *Olearia dampieri* subsp. *eremicola* (2-3%) open shrubland over *Trymalium ledifolium* var. *rosmarinifolium* (2-3%), *Hibbertia subvaginata* (+) (more along boundary of unit) low open shrubland over *Lepidosperma tenue* (2-3%), *Neurachne alopecuroidea* (+) very open sedgeland/grassland with *Stypandra glauca* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Burchardia umbellata*, *Trachymene pilosa*, *Acacia acuminata* subsp. *acuminata*, *Dioscorea hastifolia*, *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Very good (some annual weeds – *Ehrharta longiflora*, *Avena barbata*).

Vegetation Association EwDi: *Eucalyptus wandoo* subsp. *wandoo* low open forest over *Dodonaea inaequifolia* scattered tall shrubs to high shrubland.

Plant Communities:

EwDi.1: *Eucalyptus wandoo* subsp. *wandoo* scattered low trees/trees over *Allocasuarina huegeliana* low woodland over *Dodonaea inaequifolia* scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland.

Recorded at quadrat CAH10 and releve CR1.

Releve CR1

Date: 7/11/03

Location: Mid southern boundary of Cairn Hill Reserve, in valley (North of CAH 16).

AMG84: 50J 0407560/UTM 66 20092 (WGS 84; GPS unit).

Site description: Lower slope adjacent to valley floor.

Soil: Gravelly, brown loamy sand.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* woodland over *Dodonaea inaequifolia* high shrubland to open scrub over *Acacia erinacea* scattered shrubs over *Trymalium ledifolium* var. *rosmarinifolium* (upslope only) low open shrubland over *Neurachne alopecuroidea* scattered grasses with *Cheilanthes adiantoides* very open fernland.

Condition: Good to very good (weedy).

Notes: Similar to CAH16, but *Eucalyptus wandoo* subsp. *wandoo* rather than *Eucalyptus salmonophloia*. *Dodonaea* drops out as move up slope and *Trymalium* comes in.

Vegetation Association EwTI: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland.

Plant Communities:

EwTI.1: *Eucalyptus wandoo* ssp. *wandoo* open woodland over an *Allocasuarina huegeliana* and *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* open shrubland over *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland. Quadrat GH6.

EwTI.2: *Eucalyptus wandoo* ssp. *wandoo* open woodland over *Allocasuarina huegeliana* scattered trees and *Allocasuarina campestris* scattered tall shrubs over *Trymalium ledifolium* var. *rosmarinifolium* scattered low shrubs to low open shrubland. Releve CR15.

Releve CR15

Date: 9/11/03

Location: Cairn Hill, south end (near CAH13).

AMG84: 50J 0407530/UTM 66 20131 (WGS 84; GPS unit).

Site description: Moderately sloping, east-facing, lower to mid slope of low ridge.

Soil: Gravelly, cobbly, bouldery brown sand.

Vegetation description: *Eucalyptus wandoo* ssp. *wandoo* (10 to 30-40%) open woodland over *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium* (1 to 2-3%), *Xanthosia fruticulosa* scattered low shrubs to low open shrubland over *Neurachne alopecuroidea*, *Austrodanthonia setacea* scattered grasses with *Stypandra glauca* scattered low herbs and *Cheilanthes adiantoides* scattered ferns (dead).

Associated species: *Acacia microbotrya* (to 2-2.5 m), *Dichopogon capillipes*, *Sollya heterophylla*, *Trachymene pilosa*, *Austrodanthonia scabra*.

Vegetation Association EwAa: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* open scrub.

Plant Communities:

EwAa.1: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* open scrub over *Neurachne alopecuroidea* scattered grasses and *Borya sphaerocephala* very open herbland

Recorded at quadrat ART011 and Releve ATR012.

Releve ATR012

Date: 13/11/2010

MGA94: 50J 407671 mE 6625403 mN (WGS 84; GPS unit).

Location: Arthur and Rhonda Tonkin's property.

Site description: Gentle west facing mid slope or a low ridge.

Soil description: Pale brown clay on chert.

Rock type: Coomberdale Chert

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* open scrub over *Neurachne alopecuroidea* scattered grasses and *Borya sphaerocephala* very open herbland.

Associated species: **Avena barbata*, *Podolepis canescens*, *Podolepis lessonii*

Condition: Good.

Fire Age: >10 years.

Notes: Photos BM33

Vegetation Alliance 3: *Eucalyptus loxophleba* subsp. *loxophleba* low woodlands to low open forests

Vegetation Association El: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over scattered shrubs and very open herbland.

Plant Communities:

El.1: *Eucalyptus loxophleba* subsp. *loxophleba*, (*Allocasuarina huegeliana*) low woodland.

Recorded at Quadrat ERG17 and relevés CNR102 and ERR148.

Releve CNR102

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407817/UTM 66 22007 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing, lower slope of low rocky rise adjacent to valley drainage line.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (10-15%), *Acacia acuminata* subsp. *acuminata* (3-5%) low woodland over *Eremophyllum tenellum*, *Podolepis lessonii* (1-2%), *Waitzia nitida* (+) very open herbland.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Allocasuarina huegeliana*.

Notes: Area is very open relative to adjacent units (ie: no *Allocasuarina campestris*) and therefore may be disturbed.

Releve ERR148

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407978/UTM 66 24640 (WGS 84; GPS unit).

Site description: Mid slope of low rocky ridge, moderate slope, east-facing.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (20-25%), *Allocasuarina huegeliana* (5-6%), *Acacia acuminata* subsp. *acuminata* (5-8%) low open forest over *Waitzia nitida* (3-5%), *Podolepis lessonii* (3-5%) very open herbland and *Avena barbata*, *Briza maxima*, *Bromus diandrus* grassland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Dioscorea hastifolia*, *Allocasuarina campestris*, *Gilberta tenuifolia*, *Ptilotus polystachyus*.

Condition: Good. Quite high weed cover.

El.2: *Eucalyptus loxophleba* subsp. *loxophleba*, (*Acacia acuminata* subsp. *acuminata*) low woodland. Represented by quadrat GH7 and releves RM3, SWR260 and GHR269.

Releve RM3

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408663/UTM 66 22550 (WGS 84; GPS unit).

Site description: Crest (flat) of very shallow saddle with north-south orientation.

Soil: Gravelly brown loamy sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over *Schoenus clandestinus* scattered sedges and *Borya sphaerocephala* (1-2%), *Waitzia nitida*, *Gilberta tenuifolia*, *Podolepis lessonii*, *Hyalospermum glutinosum* ssp. *glutinosum* open herbland with *Avena barbata*, *Austrodanthonia* sp., *Austrostipa scabra* scattered grasses to very open grasslands.

Associated species: *Lomandra effusa*, *Acacia acuminata* subsp. *acuminata*, *Ptilotus manglesii*, *Neurachne alopecuroidea*, *Austrostipa elegantissima*.

Condition: Very good (low weed presence) Herb layer present.

Releve SWR260

Date: 15/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0407908/UTM 66 25131 (WGS 84; GPS unit).

Site description: Moderate, south-facing slope of low rocky ridge (elevation 235 m).

Soil: Gravelly, pebbly brown sand amongst boulders and rock outcrop (30-40% surface cover).

Rock type: Chert.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (20-30%), *Acacia acuminata* subsp. *acuminata* (5-10%) low woodland to low open forest over *Dryandra sessilis* var. *sessilis* (+) scattered tall shrubs over *Austrostipa nitida* scattered grasses with *Podolepis canescens* (3-5%), *Podolepis lessonii* (1-2%), *Trachymene cyanopetala* (+) very open herbland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Briza maxima* open annual grassland.

Associated species: *Dichopogon capillipes*, *Olearia dampieri* subsp. *eremicola*, *Tricoryne elatior*, *Waitzia nitida*.

Condition: Poor to good.

Notes: Grass trees dead (quite large).

Releve GHR269

Date: 15/1/04

Location: Gardiner's hill.

AMG84: 50J 0408355/UTM 66 17437 (WGS 84; GPS unit).

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (30-40%), *Acacia acuminata* subsp. *acuminata* (1-3%) low open forest over *Neurachne alopecuroidea* scattered grasses over *Waitzia nitida* (1-2%), *Eremophyllum tenellum* (+), *Gilberta tenuifolia*, *Lomandra effusa*, *Borya sphaerocephala* (+) very open herbland and *Ursinia anthemoides*, *Avena barbata*, *Pentaschistis pallida* very open annual grassland/herbland.

Associated species: *Dioscorea hastifolia*, *Dichopogon capillipes*.

Condition: Very good. Weed cover ranges from scattered to very open.

Notes: Similar to GH7.

E1.3: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Pityrodia dilatata* low open shrubland. Represented by releve D7.

Releve D7

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0408751/UTM 66 23470 (WGS 84; GPS unit).

Site description: West-facing slopes of low rise.

Rock type: Very rocky – chert.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Pityrodia dilatata* low open shrubland (in patches) over *Lepidosperma leptostachyum* scattered sedges and *Austrodanthonia caespitosa* (2-4%) (patchy), *Avena barbata* open grassland with *Opercularia vaginata*, *Gilberta tenuifolia*, *Podolepis lessonii*, *Tricoryne elatior* open herbland.

Associated species: *Neurachne alopecuroidea*, *Solanum oldfieldii*, *Trachymene pilosa*, *Kennedia prostrata*, *Cheilanthes adiantoides*, *Dichopogon capillipes*.

Condition: Good.

E1.4: *Eucalyptus loxophleba* subsp. *loxophleba* scattered trees to low woodland over daisy annual herbland. Recorded at two quadrats, ERG22 and ERG23, on the lower slopes at the base of a low ridge.

E1.5: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Trymalium ledifolium* subsp. *rosmarinifolium* scattered shrubs. Recorded on the lower rocky slope of a low ridge at releve CR17.

Releve CR17

Date: 9/11/03

Location: Cairn Hill.

AMG84: 50J 0407492/UTM 66 20230 (WGS 84; GPS unit).

Site description: Moderate, lower rocky slope, north-east facing of low ridge.

Soil: Gravelly, pebbly, cobbly, bouldery brown sand.

Vegetation description: *Eucalyptus loxophleba* low woodland (15-20%) over *Acacia acuminata* subsp. *acuminata* (2-3%), *Allocasuarina huegeliana* (2-3%) low open woodland over *Allocasuarina campestris* scattered tall shrubs to high open scrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* scattered low shrubs over *Stypanandra glauca* low, very open herbland over *Neurachne alopecuroidea*, *Cheilanthes adiantoides* scattered grasses and ferns.

Associated species: *Austrodanthonia setacea*, *Dichopogon capillipes*, *Austrostipa elegantissima*, *Millotia tenuifolia* var. *tenuifolia*, *Trachymene pilosa*.

Notes: Large areas of approximately this unit have *Allocasuarina huegeliana* scattered low trees in the structure.

Vegetation Association Elo: *Eucalyptus loxophleba* subsp. *loxophleba* low open to closed forest over scattered shrubs and very open herbland.

Note: Some degraded sites that are likely to have lost an original shrub layer have been placed here.

Plant Communities:

Elo.1: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over *Trymalium daphnifolium*. Recorded at quadrat CHN9.

Elo.2: *Eucalyptus loxophleba* subsp. *loxophleba* low open forest over *Dodonaea pinifolia* scattered shrubs. Recorded at releve CR66.

Releve CR66Date: 25/11/03Location: Cairn Hill Reserve.AMG84: 50J 0407119/UTM 66 21321 (WGS 84; GPS unit).Site description: Floor of small valley between low rocky ridges, gentle south-facing slope.Vegetation description: Eucalyptus loxophleba subsp. loxophleba (12-14 m – 50-60%) open forest over Dodonaea pinifolia scattered shrubs over Enchylaena tomentosa, Rhagodia drummondii scattered low shrubs over Austrodanthonia scabra, Austrodanthonia acerosa scattered grasses with Lomandra effusa, Chamaescilla corymbosa var. corymbosa, Calandrinia sp. (1-2%), Rhodanthe polycephala (1%), Crassula colorata var. colorata very open herbland.Associated species: Stylobasium australe (shrub ~ 40 cm), Dichopogon capillipes.**Elo.3:** *Eucalyptus loxophleba* subsp. *loxophleba* low open forest over very open herbland. Recorded at releves CR55, CNR96 and CNR101.Releve CR55Date: 23/11/03Location: Cairn Hill Reserve.AMG84: 50J 0407820/UTM 66 21420 (WGS 84; GPS unit).Site description: Valley flat.Soil: Gravelly, pebbly brown sandy loam (surface).Vegetation description: Eucalyptus loxophleba subsp. loxophleba (8-10 m, 30-40%) low woodland over Melaleuca concreta scattered tall shrubs to high open shrubland over Neurachne alopecuroidea, Austrostipa elegantissima scattered grasses with Rhodanthe polycephala (5-10%) open herbland.Releve CNR96Date: 28/11/03Location: Cairn Hill North.AMG84: 50J 0407604/UTM 66 21874 (WGS 84; GPS unit).Site description: Flat floor of broad shallow gully sloping very gently to the north between two low rocky rises.Soil: Gravelly, pebbly.Vegetation description: Eucalyptus loxophleba subsp. loxophleba (30-35%) low mallee woodland over Austrodanthonia scabra (2-3%) very open grassland with Ptilotus drummondii var. drummondii (+), Borya sphaerocephala (+), Calandrinia sp. (2-4%), Eremophyllum tenellum (2-4% mainly between mallee clumps) very open to open herbland.Associated species: Waitzia nitida, Hakea recurva ssp. recurva, Acacia acuminata subsp. acuminata.Releve CNR101Date: 28/11/03Location: Cairn Hill Reserve.AMG84: 50J 0407874/UTM 66 22028 (WGS 84; GPS unit).Site description: Broad drainage line of moderately wide valley (1/2 km) with low rocky ridges either side.Soil: Gravelly brown sand with rocks and small boulders (up to 1m diameter).Vegetation description: Eucalyptus loxophleba subsp. loxophleba (70-80%) closed forest over Rhodanthe polycephala (3-5%), Calandrinia sp. (3-5%), Ptilotus divaricatus var. divaricatus (+) very open herbland.Associated species: Waitzia nitida.Condition: Good, some weeds (especially rubbish).**Elo.4:** *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over *Santalum acuminatum* scattered shrubs. Recorded at releve SWR242.

Releve SWR242Date: 12/1/04Location: Stan Ridgeway's property (East).AMG84: 50J 0408783/UTM 66 25198 (WGS 84; GPS unit).Site description: Gentle, south-facing slope in narrow but flat (across) valley floor between two rocky (chert) low ridges.Rock type: Chert.Vegetation description: Eucalyptus loxophleba subsp. loxophleba (25-30%) low woodland over Acacia microbotrya scattered tall shrubs over Crassula colorata, Calandrinia sp. very open herbland with Bromus diandrus very open annual grassland.Associated species: Acacia acuminata subsp. acuminata.Condition: Poor to good.**Elo.5:** *Eucalyptus loxophleba* subsp. *loxophleba* low open forest. Releve EER142, EER142, ATR011Releve ERR142Date: 8/12/03Location: Eastern Ridge.AMG84: 50J 0407598/UTM 66 24698 (WGS 84; GPS unit).Site description: Very gently, north-facing lower slope at base of very low rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand.Vegetation description: Eucalyptus loxophleba subsp. loxophleba (60-70%) mallee low open forest over Austrostipa nitida, Austrodanthonia setacea, Avena barbata (1-2%), Bromus diandrus open grassland.Associated species: Dioscorea hastifolia.Condition: Poor to very poor. Very heavy weed infestation. Unit adjacent to paddocks.

Note: This community was placed in the association above in the 2006 report as El.5, but is considered better placed here.

Elo.6: *Eucalyptus loxophleba* subsp. *loxophleba* (*Casuarina obesa*) low open forest over ATR09-01, **Ehrharta longiflora* very open annual grasslandReleve ATR011Date: 12/11/2010MGA94: 50J 408074 mE 6627384 mN (WGS 84; GPS unit).Location: Arthur and Rhonda Tonkin's property.MGA84: 50J 408074 mE 6627384 mN (WGS 84; GPS unit).GDA: 50J 408074 mE 6627384 mN (WGS 84; GPS unit).Site description: Flow line at edge of broad flat plain.Vegetation description: Eucalyptus loxophleba subsp. loxophleba (*Casuarina obesa*) low open forest over ATR09-01, **Ehrharta longiflora* very open annual grassland.Condition: Very poor to Completely DegradedFire Age: > 10 years.Notes: High weed cover, small remnant in paddock with stock?

NB: Similar to vegetation type ATR1

Vegetation Association EIEo: *Eucalyptus loxophleba* subsp. *loxophleba*, *Eucalyptus obtusiflora* low open woodland over scattered tall shrubs over *Dodonaea inaequifolia* low woodland over scattered shrubs over scattered sedges and very open herbland.Plant Communities:**EIEo.1:** *Eucalyptus loxophleba* subsp. *loxophleba*, *Eucalyptus obtusiflora*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low open woodland over *Melaleuca radula*, *Acacia*

microbotrya scattered tall shrubs over *Dodonaea pinifolia*, *Hakea lissocarpha* low open shrubland over *Desmocladius flexuosus* scattered sedges with *Lawrencella rosea*, *Podolepis lessonii* very open herbland.

Recorded along the banks of a shallow creek in a deep gully, at releve CR58.

Releve: CR58

Date: 23/11/03

Location: Border between Cairn Hill Reserve and Cairn Hill North.

AMG84: 50J 0407470/UTM 66 21473 (WGS 84; GPS unit).

Site description: Creek bed of deep (10m) gully.

Soil: Gravelly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (5-10%), *Eucalyptus obtusiflora*, *Acacia acuminata* subsp. *acuminata* (3-4%), *Allocasuarina huegeliana* (1-2%) (one overhanging) low open woodland over *Melaleuca radula* (2%), *Acacia microbotrya* scattered tall shrubs over *Dodonaea pinifolia* (5-7%), *Hakea lissocarpha* low open shrubland over *Desmocladius flexuosus*, *Lepidosperma* sp. scattered sedges with *Lawrencella rosea*, *Podolepis lessonii* (2-3%) very open herbland and *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Comesperma integerrimum*, *Austrostipa elegantissima*, *Waitzia nitida*.

Vegetation Association EIXd: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland to low open forest over *Xanthorrhoea drummondii* scattered shrubs to high open shrubland.

Plant Communities:

EIXd.1: *Eucalyptus loxophleba* subsp. *loxophleba* low woodland to low open forest over *Xanthorrhoea drummondii* scattered shrubs to high open shrubland.

Represented by releves RM12, CSR323. and G341

Releve RM12

Date: 11/12/04

Location: Ron Manning's property.

AMG84: 50J 0408470/UTM 66 21827 (WGS 84; GPS unit).

Site description: Gentle, west-facing slope of low ridge.

Rock type: Chert (very rocky with rock outcrop).

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* scattered low trees over *Xanthorrhoea drummondii* high open shrubland over *Allocasuarina campestris* scattered tall shrublands over **Briza maxima*, (*Neurachne alopecuroidea*) very open grassland with *Tricoryne elatior*, (*Gilberta tenuifolia*) herbland.

Associated species: *Haemodorum simulans*, *Cheilanthes adiantoides*, *Dichopogon capillipes*, *Podolepis lessonii*, *Austrodanthonia* sp., *Acacia acuminata* subsp. *acuminata* (juvenile).

Condition: Good.

Notes: Fire >10 years.

Releve CSR323

Date: 16/2/05

Location: Kim Chester's property, south of Cairn Hill.

AMG84: 50J 0407604/UTM 66 19348 (WGS 84; GPS unit).

Site description: Steep, east-facing mid slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* low woodland over *Xanthorrhoea drummondii*, *Dryandra sessilis* var. *sessilis*, *Allocasuarina campestris* scattered tall shrubs over *Avena barbata*, *Vulpia myuros* var. *hirsuta* annual grassland.

Condition: Poor to very poor.

Releve G341

Date: 18/2/05

Location: West of Gardiner's Hill.

AMG84: 50J 0407890/UTM 66 18002 (WGS 84; GPS unit).

Site description: Low rocky slope/breakaway on lower slope of valley.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, (*Acacia acuminata* subsp. *acuminata* (+)) low open forest over *Xanthorrhoea drummondii* scattered tall shrubs over **Avena barbata* open annual grassland.

Condition: Poor – very poor.

Vegetation Alliance 4: *Eucalyptus eudesmioides* low mallee woodlands to low mallee open forests

Vegetation Association Ee: *Eucalyptus eudesmioides* low mallee woodland to low mallee open forest over annual grassland.

Plant Communities:

Ee.1: See vegetation description for releve CSR319 below.

Represented by releve CSR319.

Releve CSR319

Date: 16/21/05

Location: Kim Chester's property, south of Cain Hill.

AMG84: 50J 0407251/UTM 66 19392 (WGS 84; GPS unit).

Site description: Moderate, west-facing slope of low rocky ridge.

Vegetation description: *Eucalyptus eudesmioides* low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over **Avena barbata*, **Bromus diandrus* open annual grassland.

Associated species:

Condition: Poor – Very Poor.

Vegetation Association EeDs: *Eucalyptus eudesmioides* low mallee open forest over *Dryandra sessilis* var. *sessilis* high open shrubland and *Hibbertia subvaginata* low open shrubland.

Plant Communities:

EeDs.1: *Eucalyptus eudesmioides* low open forest over *Dryandra sessilis* var. *sessilis* high open shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* low open shrubland over *Desmocladius flexuosus* scattered sedges.

Described from releve CR57.

Releve: CR57

Date: 23/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407647/UTM 66 21332 (WGS 84; GPS unit).

Site description: Flat, broad ridge top.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Eucalyptus eudesmioides* (60-70%), (4-8m) low open forest over *Dryandra sessilis* var. *sessilis* (5-7%) high open shrubland over *Hibbertia subvaginata* (2-3%), *Calytrix leschenaultii* (+) low open shrubland over *Desmocladius flexuosus* scattered sedges.

Associated species: *Baeckea* sp. *Moora* (R.Bone 1993/1), *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Trachymene pilosa*, *Neurachne alopecuroidea*, *Xanthorrhoea drummondii*, *Acacia acuminata* subsp. *acuminata*.

Vegetation Association EeKp: *Eucalyptus eudesmioides* low mallee woodland over *Kunzea praestans* scattered tall shrubs to high shrubland.

Plant Communities:

EeKp.1: *Allocasuarina huegeliana* scattered low trees over *Eucalyptus eudesmioides* low mallee woodland over *Xanthorrhoea drummondii* high open shrubland over *Kunzea praestans* open

shrubland over *Melaleuca calyptroides* open shrubland over *Baeckea* sp. Moora (R.Bone 1993/1), *Calytrix leschenaultii* low open heath over *Lepidosperma leptostachyum* scattered sedges.
Based on description of vegetation at releve CR61.

Releve CR61

Date: 24/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407417/UTM 66 20954 (WGS 84; GPS unit).

Site description: Moderate to steep, west-north-west facing mid-slope of a spur from a low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Eucalyptus eudesmioides* (20-25%) low mallee woodland over *Xanthorrhoea drummondii* (2-4%) high open shrubland over *Kunzea praestans* (10-15%) open shrubland over *Melaleuca calyptroides* (2-3%) open shrubland over *Baeckea* sp. Moora (R.Bone 1993/1) (40-50%), *Calytrix leschenaultii* (1-2%) low open heath over *Lepidosperma leptostachyum* scattered sedges.

EeKp2: *Allocasuarina huegeliana* low woodland over *Eucalyptus eudesmioides* low woodland over *Dryandra sessilis* subsp. *sessilis* scattered tall shrubs over *Kunzea praestans* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over *Hibbertia subvaginata* open shrubland over *Bossiaea* sp. Cairn Hill (M Henson CH2-28) scattered low shrubs over very open sedgeland with scattered herbs and scattered ferns.

Based on description of vegetation at releve CR79.

Releve CR79

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407016/UTM 66 21173 (WGS 84; GPS unit).

Site description: Moderate, south-facing mid to lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (10-15%) low woodland over *Eucalyptus eudesmioides* (20-25%) low woodland over *Dryandra sessilis* subsp. *sessilis* scattered tall shrubs over *Kunzea praestans* (1-2%) scattered tall shrubs over *Xanthorrhoea drummondii* (2-3%) scattered shrubs over *Hibbertia subvaginata* (3%) open shrubland over *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Xanthosia fruticulosa* (1-2%) scattered low shrubs over *Lepidosperma leptostachyum*, *Desmocladus flexuosus* very open sedgeland with *Stypantra glauca* (+) scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Sollya heterophylla*, *Neurachne alopecuroidea*, *Dichopogon capillipes*.

Notes: Very small unit.

EeKp.3: *Allocasuarina huegeliana*, *Eucalyptus eudesmioides* subsp. *eudesmioides*, (*Acacia acuminata* subsp. *acuminata* (+)) low woodland over *Allocasuarina campestris*, *Kunzea praestans*, *Melaleuca radula* high shrubland over *Dodonaea pinifolia* low open shrubland over scattered sedges.

Based on the description of vegetation at releve CR87.

Releve CR87

Date: 27/11/03

Location: Cairn Hill Reserve (near north boundary).

AMG84: 50J 0406986/UTM 66 21462 (WGS 84; GPS unit).

Site description: Lower slope, gently to moderately sloping, north-east facing of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Eucalyptus eudesmioides* (10-15%), (*Acacia acuminata* subsp. *acuminata* (+)) low woodland over *Allocasuarina campestris* (15-20%),

Kunzea praestans (1-2%), Melaleuca radula (3-5%), high shrubland over Dodonaea pinifolia (4-5%) low open shrubland over Lepidosperma leptostachyum, Desmocladius flexuosus scattered sedges.
Associated species: Trachymene pilosa, Calytrix leschenaultii, Neurachne alopecuroidea.

Vegetation Association EeId: *Eucalyptus eudesmioides* low mallee woodland over *Xanthorrhoea drummondii* and *Isopogon divergens* scattered shrubs.

Plant Communities:

EeId.1: See releve CR31 vegetation description.

Releve CR31

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407381/UTM 66 20425 (WGS 84; GPS unit).

Site description: South-west facing moderate upper slope.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and exposed sheet rock.

Vegetation description: *Eucalyptus eudesmioides* low mallee woodland (10-15%) (in clumps) over *Xanthorrhoea drummondii*, *Isopogon divergens* scattered shrubs over *Astroloma serratifolium* scattered low shrubs over *Lepidobolus chaetocephalus*, *Lepidosperma tenue* scattered sedges with *Styandra glauca*, *Stylidium septentrionale* very open herbland.

Associated species: *Daviesia dielsii*, *Chamaescilla corymbosa* var. *corymbosa*, *Melaleuca radula*, *Dichopogon capillipes*, *Hakea incrassata*, *Dampiera lavandulacea* (~ 30 cm).

Vegetation Association EeRm: *Eucalyptus eudesmioides* low mallee open forest over *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Regelia megacephala* high open shrubland.

Plant Communities:

EeRm.1: See releve CR28 vegetation description.

Releve CR28

Date: 15/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 407340/UTM 66 20530 (WGS 84; GPS unit).

Site description: Unusual vegetation under *Eucalyptus eudesmioides* subsp. *eudesmioides*.

Vegetation description: *Eucalyptus eudesmioides* (50-70%) (3.5-4 m) low mallee open forest over *Calothamnus* aff. *quadrifidus* Moora-Watheroo (5-10%), *Regelia megacephala* (2-3%) (with more on adjacent slopes), *Alyogyne huegelii* ssp. *grossulariifolia*, *Allocasuarina campestris* high open shrubland to high shrubland over *Acacia congesta* subsp. *congesta* (2-3%), *Hibbertia subvaginata* (1-2%), *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (C28-3) (3-4%) open shrubland over *Lepidosperma tenue* scattered sedges.

Associated species: *Dianella revoluta* var. *divaricate*, *Thomasia grandiflora*, *Dioscorea hastifolia*, *Desmocladius flexuosus*, *Dichopogon capillipes*.

Vegetation Alliance 5: *Eucalyptus camaldulensis* open forest to low mallee open forests

Vegetation Association Ec: *Eucalyptus camaldulensis* open forest.

Plant Communities:

Ec.1: See releve CSR346 description.

Releve CSR346

Date: 18/02/05

Location: Kim Chester's property, south of Cain Hill.

AMG84: 50J 0406900/UTM 66 19760 (WGS 84; GPS unit).

Site description: Creek line in valley floor.

Vegetation description: *Eucalyptus camaldulensis* open forest.

Condition: Poor

Vegetation Alliance 6: *Eucalyptus obtusiflora* low woodlands to low open forests

Vegetation Association Eo: *Eucalyptus obtusiflora*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low mallee open forest over *Acacia erinacea* scattered shrubs over a very open herbland.

Plant Communities:

Eo.1: See releve CNR127 vegetation description below.

Releve CNR127

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407444/UTM 66 21737 (WGS 84; GPS unit).

Site description: Flat floor of a dyke, gently sloping north-west, adjacent to top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown loamy sand.

Vegetation description: *Eucalyptus obtusiflora* (50-60%), (*Eucalyptus loxophleba* subsp. *loxophleba* (3-5%)) low mallee open forest over *Acacia erinacea* scattered shrubs over *Ptilotus divaricatus* var. *divaricatus* (3-5%) very open herbland with *Rhodanthe polycephala* (2-4%), *Calandrinia* sp. (+) very open herbland.

Associated species: *Comesperma integerrimum*.

Vegetation Association EoTd: *Eucalyptus obtusiflora* low mallee woodland to low open forest over *Trymalium daphnifolium*, *Acacia erinacea* shrubland.

Plant Communities:

EoTd.1: *Eucalyptus obtusiflora* mallee scrub to closed mallee scrub over *Trymalium daphnifolium*, *Acacia erinacea* shrubland over *Austrodanthonia setacea*, *Austrostipa elegantissima* scattered low grasses.

One quadrat (CAH14) was recorded in this plant community.

Vegetation Alliance 7: *Eucalyptus horistes* low woodlands to low open forests

Vegetation Association EhAh: *Eucalyptus horistes* mallee woodland over *Allocasuarina huegeliana* low open woodland over scattered shrubs.

Plant Communities:

EhAh.1: See releve CNR121 vegetation description below.

Only a small area of this unit, described at releve CNR121.

Releve CNR121

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407470/UTM 66 21643 (WGS 84; GPS unit).

Site description: Flat area on top of low rock ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus horistes* (20-30%) mallee woodland over *Allocasuarina huegeliana* (5-8%) low open woodland over *Xanthorrhoea drummondii* (1-2%) scattered open shrubland.

Condition: Very disturbed and a very small unit, description not reliable.

Vegetation Association EhEe: *Eucalyptus horistes*, (*Eucalyptus eudesmioides* subsp. *eudesmioides*) mallee woodland to low open forest.

Plant Communities:

EhEe.1: *Eucalyptus horistes*, (*Eucalyptus eudesmioides* (+)) low open forest over annual grassland. Based on the description at releve CSR327.

Releve CSR327

Date: 17/2/05

Location: Kim Chester's property, south of Cain Hill.

AMG84: 50J 0407395/UTM 66 19571 (WGS 84; GPS unit).

Site description: Gentle, west-facing lower slope of low ridge.

Soil:

Rock type: Chert, cobbles.

Vegetation description: *Eucalyptus horistes*, (*Eucalyptus eudesmioides* (+)) low open forest over *Ehrharta longiflora*, *Vulpia myuros* var. *hirsuta* annual grassland.

Associated species:

Condition: Very poor (weed grassland).

EhEe.2: *Eucalyptus horistes*, (*Eucalyptus eudesmioides* subsp. *eudesmioides*) low open mallee woodland over *Allocasuarina campestris*, *Regelia megacephala* high open shrubland to high shrubland over *Melaleuca calyptroides* open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Schoenus brevisetis*, *Lepidosperma leptostachyum* scattered sedges and very open herbland.

Based on the description at releve CR20 (see below).

Releve CR20

Date: 9/11/03

Location: Cairn Hill, southern boundary.

AMG84: 50J 0407372/UTM 66 20015 (WGS 84; GPS unit).

Site description: Lower, moderate slope, south-facing of lower ridge.

Soil: Gravelly, pebbly, dark grey loamy sand.

Vegetation description: *Eucalyptus horistes* (20-30%, 4-5 m) (*Eucalyptus eudesmioides* subsp. *eudesmioides*) low open mallee woodland over *Allocasuarina campestris* (10%), *Regelia megacephala* (1-2%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (1-2%), *Kunzea praestans* (1-2%), *Xanthorrhoea drummondii* (1-2%) high open shrubland to high shrubland over *Melaleuca calyptroides* (2-3%) open shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii*, *Xanthosia fruticulosa* scattered low shrubs over *Schoenus brevisetis*, *Lepidosperma leptostachyum*, *Desmocladus flexuosus* scattered sedges with *Stylidium cordifolium*, *Goodenia glareicola*, *Stylidium septentrionale* very open herbland.

Associated species: *Nemcia acuta*, *Eucalyptus eudesmioides* subsp. *eudesmioides*, *Leptomieria preissiana* (tree 3 to 3.5 m, appears parasitic growing from base of the *Eucalyptus horistes*), *Neurachne alopecuroidea*, *Baeckea* sp. Moora (R. Bone 1993/1).

Notes: Larger vegetation unit includes areas where *Eucalyptus eudesmioides* is the dominant *Eucalyptus*.

Vegetation Alliance 8: *Eucalyptus pruiniramis* low woodland

Vegetation Association Ep: *Eucalyptus pruiniramis* low mallee woodland.

Plant Communities:

Ep.1: Based on the description at releve G347 (see below).

Releve G347.

Releve G347

Date: 12/12/04

Location: Location: Phil & Jenny Gardiner's property, small remnants, just east of Cairn Hill.

AMG84: 50J 0408502East/UTM 66 20294 (WGS 84; GPS unit).

Site description: flat? Crest of low rise, in undulating area.

Rock type: Chert (some exposed outcrop)

Vegetation description: *Eucalyptus pruiniramis* low mallee woodland.

Associated species:

Condition: Good

Notes: very small area with clump of a few *Eucalyptus pruiniramis* mallees. *Eucalyptus pruiniramis* mallee also collected nearby.

Vegetation Alliance 9: *Allocasuarina huegeliana* low woodlands to low open forests

Vegetation Association Ah: *Allocasuarina huegeliana* low woodland to low closed forest over scattered shrubs.

Plant Communities:

Ah.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low closed forest (over *Allocasuarina campestris* scattered tall shrubs) over *Crassula colorata* scattered herbs and very open annual grassland.

Relevés SWR238, SWR240 and SWR262.

Releve SWR238

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408944/UTM 66 24976 (WGS 84; GPS unit).

Site description: Moderate, south-facing slope along edge of very low chert ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (80-90%), *Eucalyptus loxophleba* subsp. *loxophleba* (1-2%), *Acacia acuminata* subsp. *acuminata* (1-2%) low closed forest over *Crassula colorata* scattered herbs with *Avena barbata*, *Ehrharta longiflora*, *Bromus diandrus* very open annual grassland.

Condition: Poor (to very poor).

Releve SWR240

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408911/UTM 66 25175 (WGS 84; GPS unit).

Site description: South-facing gentle rocky upper slope of low chert ridge (elevation 255 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (40-50%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open forest over *Allocasuarina campestris* (+) scattered tall shrubs over *Austrostipa* sp. scattered grasses and *Podolepis lessonii* scattered herbs with *Avena barbata*, *Bromus diandrus*, *Ehrharta longiflora* very open annual grassland.

Condition: Poor to very poor.

Releve SWR262

Date: 15/1/04

Location: Stan Ridgeway's property (west).

AMG84: 50J 0407903/UTM 66 25270 (WGS 84; GPS unit).

Site description: Gentle, east-facing upper slope of low rocky ridge (elevation 229 m).

Soil: Gravelly brown sand with rocks and boulders.

Rock type: Blue 'dolerite'?

Vegetation description: *Allocasuarina huegeliana* (60-70%), *Acacia acuminata* subsp. *acuminata* (1-2%), *Santalum acuminatum* (4-5 m, 2-3%) (in patches) low open forest to low closed forest over *Olearia dampieri* subsp. *eremicola*, *Allocasuarina campestris* (+) scattered tall shrubs over *Neurachne alopecuroidea*, *Austrodanthonia setacea* scattered grasses with *Cheilanthes adiantoides* very open fernland and *Avena barbata*, *Briza maxima* very open annual grassland.

Associated species: *Dioscorea hastifolia*, *Wahlenbergia preissii*, *Phyllangium paradoxum*, *Chamaescilla corymbosa* var. *corymbosa*.

Ah.2: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Xanthorrhoea drummondii*, (*Allocasuarina campestris*) scattered shrubs over *Neurachne alopecuroidea* very open grassland/sedgeland with very open herbland/fernland. Releves CNR92 and ERR145.

Releve CNR92

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407743/UTM 66 21630 (WGS 84; GPS unit).

Site description: Crest of very low rise (rocky).

Vegetation description: *Allocasuarina huegeliana* (5-10 (20%)), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over *Xanthorrhoea drummondii* (1-2%) scattered shrubs over *Lepidosperma tenue* (2-3%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Boronia coerulescens* subsp. *spinescens* (+), *Stypandra glauca*, *Hyalospermum glutinosum* ssp. *glutinosum* (1%), *Podolepis lessonii* (1-2%), *Gilberta tenuifolia* (3-5%) very open herbland with *Cheilanthes adiantoides* (3-5%) very open fernland.

Associated species: *Lepidosperma pubisquameum*, *Dichopogon capillipes*.

Condition: Quite a lot weeds (including Clover, therefore Poor to Good).

Releve ERR145

Date: 9/12/03

Location: Eastern Ridge.

AMG84: 50J 0407610/UTM 66 23933 (WGS 84; GPS unit).

Site description: Gentle to moderate, west-facing mid to upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with boulders and some rocks (NT).

Vegetation description: *Allocasuarina huegeliana* (5-8%), *Acacia acuminata* subsp. *acuminata* (5-6%) low open woodland to low woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* scattered tall shrubs over *Lepidosperma leptostachyum*, *Neurachne alopecuroidea* scattered sedges/grasses to very open sedgeland over *Waitzia nitida*, *Podolepis lessonii*, *Gilberta tenuifolia* scattered herbs to very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Goodenia berardiana*, **Avena barbata* (2-3%), **Ehrharta longiflora* (5%), **Bromus diandrus*.

Condition: Poor to very poor. Some areas with less weeds => good condition. Very weedy and may be partially cleared.

Notes: 1) Sedgeland of *Lepidosperma pubisquameum* in small areas nearby.

2) Probably disturbed – hard to say – a very open area with *Allocasuarina campestris* scrub areas nearby.

Ah.3: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Podolepis lessonii*, *Trachymene ornata* open annual herbland.

Quadrats JT2 and JT5.

Ah.4: *Allocasuarina huegeliana* low woodland to low open forest over (*Kunzea praestans*, *Xanthorrhoea drummondii*, *Allocasuarina campestris*) scattered tall shrubs over *Xanthosia fruticulosa* scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered grasses and sedges with *Stypandra glauca* very open herbland.

Quadrat CAH8 and releves CR4 and CR43.

Releve CR4.

Date: 7/11/07

Location: Cairn Hill (Southern end).

AMG84: 50J 0407713/UTM 66 20134 (WGS 84; GPS unit).

Site description: Very gently sloping, north-facing upper slope to crest of low ridge.

Soil: Gravelly, cobbly, bouldery grey sand.

Vegetation description: *Allocasuarina huegeliana* (40-50%) low open forest over *Kunzea praestans*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo (+), *Regelia megacephala* (+) scattered tall shrubs to high open shrubland over *Xanthosia fruticulosa* (5-10%) low open shrubland over *Stypandra glauca* (+) scattered herbs over *Lepidosperma tenue*, *Desmocladus flexuosus* scattered sedges.

Associated species: *Neurachne alopecuroidea*, *Dichopogon capillipes*, *Trymalium ledifolium* var. *rosmarinifolium*, *Lawrencella rosea*.

Releve CR43.

Date: 22/11/03

Location: Cairn Hill.

AMG84: 50J 0407717/UTM 66 20600 (WGS 84; GPS unit).

Site description: North-east facing short breakaway (chert) slope above shallow gully near crest of low ridge.

Soil: Gravelly, pebbly, cobbly, bouldery brown sand.

Vegetation description: *Allocasuarina huegeliana* (40-50%), (*Acacia acuminata* subsp. *acuminata* (+) low open forest over *Allocasuarina campestris* (2% (~ 5-8% on adjacent slope)), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-3%) high open shrubland over *Xanthorrhoea drummondii* (3-4%) open shrubland over *Hibbertia subvaginata* (1-2%), *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (1%), *Xanthosia fruticulosa* scattered low shrubs to low open shrubland over *Lepidosperma leptostachyum* (1%), *Desmocladus flexuosus* (1-2%), *Neurachne alopecuroidea* scattered sedges and grasses with *Stypandra glauca* very open herbland.

Associated species: *Dichopogon capillipes*, *Acacia aristulata*, *Calytrix leschenaultii*, *Dioscorea hastifolia*, *Cheilanthes adiantoides*, *Lawrencella rosea*, *Podotheca angustifolia*.

Vegetation Association AhAc: *Allocasuarina huegeliana* low woodland to low open forest over *Allocasuarina campestris* scattered shrubs to high open shrubland.

The plant communities referred to this association often have small amounts of additional tree species in the upper layers.

Plant Communities:

AhAc.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* low open woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Lepidosperma tenue* scattered sedges/grasses with very open herbland/fernland.

Relevés ERR177, ERR178, ERR180 and G343.

Releve ERR177

Date: 24/12/03

AMG84: 50J 0408065/UTM 66 23003 (WGS 84; GPS unit).

Location: Eastern Ridge.

Site description: Moderate, east-facing mid to upper slope of low rocky ridge.

Rock type: ?Chert (poor quality).

Vegetation description: *Allocasuarina huegeliana* (2-5%), *Acacia acuminata* subsp. *acuminata* (2-3%), *Eucalyptus loxophleba* subsp. *loxophleba* (2-3%) low open woodland over *Allocasuarina campestris* (2) 5-10%), *Xanthorrhoea drummondii* (3-4%) high open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Lepidosperma tenue* (1-2%), *Neurachne alopecuroidea*, *Austrodanthonia acerosa* scattered sedges/grasses with *Stypandra glauca* (+), *Podolepis lessonii* (2-3%) very open herbland with *Cheilanthes adiantoides* scattered ferns to very open fernland and *Avena barbata*, *Briza maxima* very open annual grassland.

Associated species: *Pityrodia* sp., *Phyllanthus calycinus*, *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*.

Condition: Good to very good. Some weed cover in *Avena barbata*, *Briza maxima*, *Hypochaeris glabra*.

Notes: Very similar to R171.

Releve ERR178

Date: 24/12/03

Location: Eastern Ridge.

AMG84: 50J 0408061/UTM 66 23052 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid to upper slope of low ridge (elevation 244 m).

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Eucalyptus loxophleba* subsp. *loxophleba* (1-2%), *Acacia acuminata* subsp. *acuminata* (1-2%) low open woodland over *Allocasuarina campestris* (+), *Xanthorrhoea drummondii* scattered tall shrubs over *Lepidosperma tenue* (2-4%), *Austrodanthonia acerosa* (1-2%), *Neurachne alopecuroidea* (+) very open sedgeland/grassland with *Pityrodia* sp. (+), *Tricoryne elatior* (+), *Podolepis lessonii* (2-3%), *Borya sphaerocephala* (1-2%) very open herbland and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Thysanotus dichotomus*, *Dichopogon capillipes*, *Stypandra glauca*, *Gilberta tenuifolia*, *Phyllanthus calycinus*.

Releve ERR180

Date: 24/12/03

Location: Eastern Ridge.

AMG84: 50J 0407919/UTM 66 23058 (WGS 84; GPS unit).

Site description: Gentle, south to south-west facing upper slope adjacent to ridge top of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Acacia acuminata* subsp. *acuminata* (2-3%), (*Eucalyptus loxophleba* subsp. *loxophleba* (1-2%)) low open woodland over *Allocasuarina campestris* (2-3%) scattered tall shrubs (high open shrubland in small clumps) over *Xanthorrhoea drummondii* (2-3%) scattered shrubs to open shrubland over *Lepidosperma tenue* (+), *Schoenus clandestinus* (2-3%), *Austrodanthonia acerosa* very open sedgeland/grassland over *Gilberta tenuifolia* (10-20%), *Borya sphaerocephala* (2-3 (5-10%)) open herbland with areas of annual *Avena barbata* very open annual grassland.

Condition: Very good (Main weeds *Avena barbata* and *Hypochaeris glabra*. Unknown amount of physical disturbance (clearing) in this area. Quite a lot of tree debris down. Small patchy clumps of *Allocasuarina campestris* scrub with large open areas between. Herbland is intact.)

Releve G343

Date: 18/2/05

Location: Gardiner's property.

AMG84: 50J 0407447/UTM 66 17889 (WGS 84; GPS unit).

Site description: South-facing gentle slope of low ridge.

Vegetation description: *Allocasuarina huegeliana* (30-40%), (*Acacia acuminata* subsp. *acuminata* (+)), *Eucalyptus loxophleba* subsp. *loxophleba* (2-4%) low open forest over *Allocasuarina campestris* (5-15%) high open shrubland to high shrubland over **Avena barbata* open annual grasses.

Associated species:

Condition: Poor.

AhAc.2: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii*, (*Kunzea praestans*) high open shrubland over *Hakea lissocarpa*, *Calytrix leschenaultii* low open shrubland over *Lepidosperma tenue* scattered sedges/grasses and very open herbland/fernland.

Releve ERR198

Releve ERR198

Date: 4/1/04

Location: Eastern Ridge.

AMG84: 50J 0407866/UTM 66 23121 (WGS 84; GPS unit).

Site description: Gentle, west-south-west facing rocky mid slope of low rocky ridge.

Soil: (NT) gravelly, pebbly, cobbly brown sand with high % of rock cover on surface.

Rock type: = site R168

Vegetation description: *Allocasuarina huegeliana* (10-15%), *Acacia acuminata* subsp. *acuminata* (3-5%) low woodland over *Allocasuarina campestris* (5-10%), *Xanthorrhoea drummondii* (2-5%), (*Kunzea praestans* (+)) high open shrubland over *Hakea lissocarpa* (2-3%) (80 cm), *Calytrix leschenaultii* (+) low open shrubland over *Lepidosperma tenue* (1%), *Schoenus clandestinus* (+), *Desmocladius flexuosus*, *Neurachne alopecuroidea*, *Austrodanthonia caespitosa* (1%) scattered sedges/grasses to very open sedgeland/grassland with *Borya sphaerocephala* (1-2%), *Gilberta tenuifolia* (3-5%) very open herbland and *Cheilanthes adiantoides* (1-3%) scattered ferns to very open fernland.

Associated species: *Dioscorea hastifolia*, *Burchardia umbellata*, *Dianella revoluta* var. *divaricata*, *Dichopogon capillipes*, *Podolepis lessonii*, *Pityrodia dilatata*, *Stypandra glauca*.

Condition: Very good (low weed cover).

Notes: Similar to R168. *Hakea lissocarpa* not consistent distribution in area. More on mid to lower slope.

AhAc.3: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low open forest over *Allocasuarina campestris* high open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Neurachne alopecuroidea* scattered grasses/sedges and very open herbland. Relevés CR48, ERR184 and ERR185.

Releve CR48

Date: 21/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407788/UTM 66 21074 (WGS 84; GPS unit).

Site description: Small unit down slope (moderate east-facing chert slope – short slope) of small *Regelia megacephala* scrub unit.

Vegetation description: *Allocasuarina huegeliana* (30-40%), *Acacia acuminata* subsp. *acuminata* (5-10%) low open forest over *Allocasuarina campestris* (3-5%) high open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered grasses/sedges.

Notes: Lot of *Allocasuarina huegeliana* lying on ground (recent storm damage) => estimated normal cover (before storm).

Releve ERR184

Date: 1/1/04

Location: Eastern Ridge.

AMG84: 50J 0407710/UTM 66 23708 (WGS 84; GPS unit).

Site description: Rocky gentle, west-facing slope on edge of ridge top and immediately upslope of breakaway on low rocky ridge (elevation 264 m).

Soil: Gravelly, pebbly brown sand with high surface cover of cobbles and rock.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over (*Allocasuarina campestris* scattered tall shrubs)/*Hibbertia subvaginata* (1-2%) scattered low shrubs over *Neurachne alopecuroidea*, *Austrodanthonia setacea*, *Lepidosperma tenue* very open grassland/sedgeland with *Stypandra glauca* scattered herbs and *Gilberta tenuifolia* very open low herbland with *Cheilanthes adiantoides* scattered ferns.

Condition: Very good (not many weeds).

Releve ERR185

Date: 2/1/04

Location: Eastern Ridge.

AMG84: 50J 0407780/UTM 66 23744 (WGS 84; GPS unit).

Site description: Gentle, west-facing upper slope of ridge top, just below crest of ridge (elevation 270 m).

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and outcrop (sheet rock) (20-30% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-8%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over *Allocasuarina campestris* (1-2%) scattered tall shrubs over *Xanthorrhoea drummondii* (1-2%) scattered tall shrubs over *Hibbertia subvaginata* (3-4% (5-10%)) open shrubland over *Austrodanthonia caespitosa*, *Austrodanthonia setacea*, *Neurachne alopecuroidea*, *Lepidosperma* sp., *Lepidosperma tenue* very open grassland/sedgeland with *Podolepis lessonii*, *Gilberta tenuifolia* very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Olearia dampieri* subsp. *eremicola*, *Waitzia nitida* *Waitzia nitida*, *Thysanotus dichotomous*, *Burchardia umbellata*, *Lawrencella rosea*, *Dryandra sessilis* var. *sessilis*.

Condition: Very good (only scattered *Avena barbata*, *Briza maxima*).

AhAc.4: *Allocasuarina huegeliana* low open woodland over *Santalum acuminatum* low open woodland over *Allocasuarina campestris* high open shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28) low open shrubland over scattered grasses and scattered herbs.

Releve CNR116.

Releve CNR116

Date: 3/12/03

Location: Cairn Hill North.

AMG84: 50J 0407322/UTM 66 22355 (WGS 84; GPS unit).

Site description: Gentle to moderate, west-facing rocky slope (short slope) on edge of dyke, near ridge top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with 15% surface rock outcropping.

Vegetation description: *Allocasuarina huegeliana* (5-10%) low open woodland over *Santalum acuminatum* (8-10%) low open woodland over *Allocasuarina campestris* (5-10%) high open shrubland over *Hibbertia subvaginata* (3-4%), *Calytrix leschenaultii* (+), *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (+) low open shrubland over *Neurachne alopecuroidea* scattered grasses with *Stypantra glauca* scattered herbs.

Associated species: *Acacia acuminata* subsp. *acuminata*, *Dichopogon capillipes*, *Eucalyptus loxophleba* subsp. *loxophleba*.

AhAc.5: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open forest over *Allocasuarina campestris*, *Ricinocarpos muricatus* scattered tall shrubs over *Hibbertia subvaginata* scattered low shrubs.

Releve ATR004.

Releve ATR004

Date: 10/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 50J 408694 mE 6625459 mN (WGS 84; GPS unit).

Site description: Moderate north facing slope of ridge.

Rock type: Chert (high rock cover > 80%)

Vegetation description: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open forest over *Allocasuarina campestris*, *Ricinocarpos muricatus* scattered tall shrubs over *Hibbertia*

subvaginata scattered low shrubs.

Associated species: *Austrostipa elegantissima*, *Dichopogon capillipes*, **Ursinia anthemoides*

Condition: Good

Vegetation Association AhDf: *Allocasuarina huegeliana* low open forest over *Stylobasium australe* scattered shrubs and *Dryandra fraseri*, *Calytrix depressa* low open shrubland over *Lepidosperma leptostachyum* very open sedgeland.

Plant Communities:

AhDf.1: See releve CR72 vegetation description below.

Releve CR72. This plant community was recorded from the flat valley floor on the western boundary of Cairn Hill.

Releve CR72

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406872/UTM 66 20452 (WGS 84; GPS unit).

Site description: Flat on edge of wide, flat plain.

Soil: (surface) Brown sand.

Vegetation description: *Allocasuarina huegeliana* (30-35%), *Acacia acuminata* subsp. *acuminata* (5-10%) low open forest/*Allocasuarina campestris* (1-2%)(5%) scattered tall shrubs over *Stylobasium australe* (1-2%), *Dryandra fraseri* (1-2%), *Calytrix depressa* low open shrubland over *Lepidosperma leptostachyum* (3-5%) very open sedgeland with *Podolepis canescens* (5-10%), *Ptilotus declinatus* (+) open herbland.

Associated species: *Keraudrenia velutina* subsp. *velutina*, *Dianella revoluta* var. *divaricate*, *Dichopogon capillipes*, *Neurachne alopecuroidea*.

Notes: Close to railway line (west side) and gravel pit (east side) and some signs of disturbance – not sure how much.

Vegetation Association AhDp: *Allocasuarina huegeliana* low woodland to low open forest over *Dodonaea pinifolia* scattered shrubs over *Xanthosia fruticulosa* low open shrubland.

Plant Communities:

AhDp.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Dodonaea pinifolia* low open shrubland to scattered low shrubs over scattered sedges and scattered herbs and ferns.

Releve CNR130.

Releve CNR130

Date: 5/12/03

Location: Cairn Hill North.

AMG84: 50J 0407459/UTM 66 21779 (WGS 84; GPS unit).

Site description: Moderately steep, west-facing breakaway slope (short slope about 15m long) between top of low rocky ridge and floor of a dyke.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop.

Vegetation description: *Allocasuarina huegeliana* (30-40%), *Acacia acuminata* subsp. *acuminata* (+) low woodland to low open forest over *Dodonaea pinifolia* (2-3%) low open shrubland to *Xanthosia fruticulosa* scattered low shrubs over *Lepidosperma leptostachyum* scattered sedges with *Stypandra glauca* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Lawrencella rosea*.

AhDp.2: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open forest over *Eucalyptus eudesmioides* low woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* high open shrubland over *Melaleuca radula*, *Dodonaea pinifolia* scattered shrubs over scattered sedges and very open herbland.

Releve CR65.

Releve CR65

Date: 24/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407538/UTM 66 21202 (WGS 84; GPS unit).

Site description: Steep to moderate, west-facing breakaway/slope (short slope) 5-8m high).

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: Allocasuarina huegeliana (35-40%), Acacia acuminata subsp. acuminata (5-8% - mainly immediately above breakaway) low open forest over Eucalyptus eudesmioides (20-25%) low woodland over Allocasuarina campestris (5-8%), Xanthorrhoea drummondii high open shrubland over Melaleuca radula, Dodonaea pinifolia scattered shrubs Xanthosia fruticulosa (2-3%) low open shrubland over Desmocladius flexuosus, Lepidosperma tenue scattered sedges with scattered herbs.

Associated species: Dichopogon capillipes, Bossiaea sp. Cairn Hill (M Henson CH2-28) (base of breakaway), Burchardia umbellata, Stypandra glauca, Daviesia hakeoides subsp. subnuda, Calytrix leschenaultii.

Notes: Very small unit. Similar to unit CAH13, but has Eucalyptus eudesmioides subsp. eudesmioides.

Vegetation Association AhDs: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland.

Plant Communities: AhDs.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii*, (*Allocasuarina campestris*) scattered tall shrubs.

Relevés CNR113, SWR226, CSR322 and JTR246.

Releve CNR113

Date: 3/12/03

Location: Cairn Hill North.

AMG84: 50J 0407362/UTM 66 22044 (WGS 84; GPS unit).

Site description: Gently sloping, west-facing shallow drainage line leading down slope from dyke.

Soil: Gravelly, pebbly brown sand.

Vegetation description: Allocasuarina huegeliana (20-25%), Acacia acuminata subsp. acuminata (10-15%), Eucalyptus loxophleba subsp. loxophleba (10-15%) low open forest over Dryandra sessilis var. sessilis scattered shrubs over Allocasuarina campestris (3-5%) high open shrubland over Desmocladius flexuosus scattered sedges with Cheilanthes adiantoides scattered ferns.

Associated species: Xanthorrhoea drummondii.

Condition: Good. Quite heavy weed invasion (*Avena barbata*, *Ursinia anthemoides*).

Releve SWR226

Date: 11/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409075/UTM 66 24937 (WGS 84; GPS unit).

Site description: Moderate, south-facing lower slope of low rocky chert ridge.

Soil: Gravelly, pebbly brown sand with boulders and rock outcrop (~80-90% of surface covered by rock).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (40-50%), Acacia acuminata subsp. acuminata (5%) low open forest over Dryandra sessilis var. sessilis scattered tall shrubs over Xanthorrhoea drummondii scattered shrubs over Cheilanthes adiantoides (2-3%) very open fernland.

Associated species: Calytrix leschenaultii, Lomandra sp., Chamaescilla corymbosa var. corymbosa

Condition: Very good (low weed cover of *Avena barbata*, *Ehrharta longiflora*).

Releve CSR322Date: 16/2/05Location: Kim Chester's property.AMG84: 50J 0407592/UTM 66 19328 (WGS 84; GPS unit).Site description: Crest and upper slopes of low rocky ridge.Rock type: Chert.Vegetation description: *Allocasuarina huegeliana* (40-50%), *Acacia acuminata* subsp. *acuminata* (5-10%) low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs over *Avena barbata*, *Ehrharta longiflora*, **Pentaschistis airoides* annual grassland.Condition: Poor – very poor (annual grassland of weeds).Releve JTR246Date: 13/1/04Location: John Tonkin's property.AMG84: 50J 0408915/UTM 66 26942 (WGS 84; GPS unit).Site description: Moderate, east-facing mid slope of low rocky ridge (elevation 260 m).Rock type: Chert.Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (5-6%) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (1-2%) scattered tall shrubs over *Allocasuarina campestris* scattered tall shrubs to high open shrubland (patches) over *Cheilanthes adiantoides* scattered ferns with *Avena barbata*, *Hypochaeris glabra*, *Bromus diandrus* closed annual grassland/herbland.Condition: Very poor to degraded.

AhDs.2: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* low open shrubland over scattered sedges and grasses.

This plant community was distinguished by having a low (open) shrubland of *Hibbertia subvaginata*. Quadrat GH10 and relevés GHR281, GHR284 and GHR298.

Releve GHR281Date: 16/1/04Location: Gardiner's hill.AMG84: 50J 0408344/UTM 66 17761 (WGS 84; GPS unit).Site description: Saddle on top of low rocky ridge between 2 crests. (elevation 262 m).Rock type: Chert.Vegetation description: *Allocasuarina huegeliana* (30-40%) low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (1-2%) scattered high shrubs over *Calytrix leschenaultii* (2-4%), *Hibbertia subvaginata* (+) low open shrubland over *Desmodium flexuosum* (+), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Podolepis canescens* (5-10%), *Lawrencella rosea* (1-2%), *Borya sphaerocephala* (+), *Opercularia vaginata* (+) open herbland and *Cheilanthes adiantoides* very open fernland.Associated species: *Nuytsia floribunda*, *Dichopogon capillipes*.Condition: Very good.Notes: Similar to GHR280.Releve GHR284Date: 17/1/04Location: Gardiner's hill.AMG84: 50J 0408281/UTM 66 17889 (WGS 84; GPS unit).Site description: Gentle, west-facing slope on top of low rocky ridge.Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-6%), (*Acacia acuminata* subsp. *acuminata* (+)) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* (5-6%), *Calytrix leschenaultii* (2-3%) open shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses over *Opercularia vaginata* (+), *Borya sphaerocephala* (+) scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Nuytsia floribunda*, *Dichopogon capillipes*, *Calytrix leschenaultii*.

Releve GHR298

Date: 18/1/04

Location: Gardiner's hill.

AMG84: 50J 0408539/UTM 66 17679 (WGS 84; GPS unit).

Site description: Flat crest of low rocky ridge (elevation 260 m).

Soil: Very gravelly, pebbly brown sand amongst boulders and rock outcrop (about 10-15% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (25-30%), *Acacia acuminata* subsp. *acuminata* (+) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (1-2%) scattered tall shrubs over *Olearia dampieri* subsp. *eremicola*, *Calytrix leschenaultii* (1-2%), *Hibbertia subvaginata* (1%) low open shrubland over *Schoenus clandestinus*, *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (+), *Podolepis canescens* (+) scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Podotheca angustifolia*, *Burchardia umbellata*, *Trachymene pilosa*.

Condition: Very good (low weed cover).

Notes: Similar to GHR280. No *Trymalium ledifolium* var. *rosmarinifolium*.

AhDs.3: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Calytrix leschenaultii*, (*Olearia dampieri* subsp. *eremicola*) open shrubland over scattered sedges/grasses

This plant community occurred on rocky ridge slopes at Gardiner's Hill and included *Trymalium ledifolium* var. *rosmarinifolium* low open shrublands. Relevés GHR 280, GHR283 and GHR 307.

Releve GHR280

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408342/UTM 66 17700 (WGS 84; GPS unit).

Site description: Crest and gentle, west-facing upper slope from crest on low rocky ridge (elevation 263 m).

Soil: Gravelly, pebbly, cobbly brown sand with rocks, boulders and outcrop (about 30% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (30-40%), *Acacia acuminata* subsp. *acuminata* (+) low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (2-4%), (*Olearia dampieri* subsp. *eremicola*) (+) high open shrubland over *Hibbertia subvaginata* (3-5%), *Calytrix leschenaultii* (2-3%), *Trymalium ledifolium* var. *rosmarinifolium* (1-2%) low open shrubland over *Desmocladius flexuosus* (1%), *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (+), *Opercularia vaginata* (3-5%), *Thysanotus dichotomus* (+), *Podolepis canescens* (1-2%) very open herbland with *Cheilanthes adiantoides* very open fernland and *Ehrharta longiflora*, *Ursinia anthemoides*, *Hypochaeris glabra* open grassland/herbland.

Associated species: *Podotheca angustifolia*, *Dichopogon capillipes*, *Goodenia arthrotricha*, *Trachymene pilosa*.

Condition: Good (quite weedy).

Releve GHR283Date: 17/1/04Location: Gardiner's hill.AMG84: 50J 0408268/UTM 66 17789 (WGS 84; GPS unit).Site description: Moderate, west-facing slope of low rocky ridge.Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Xanthorrhoea drummondii* (2-3%) scattered tall shrubs (high open shrubland upslope) over *Olearia dampieri* subsp. *eremicola* (+), *Trymalium ledifolium* var. *rosmarinifolium* (2-3%) low open shrubland to open scrub over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Lawrencella rosea* (5-10%), *Podolepis canescens* (15-20%) open herbland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Ehrharta longiflora*, *Briza maxima* open annual grassland.

Associated species: *Hibbertia subvaginata*, *Calytrix leschenaultii*, *Trachymene pilosa*, *Rhodanthe polycephala*, *Dichopogon capillipes*.

Condition: Good to very good – patches of high weed cover.

Notes: Similar to GHR279.

Releve GHR307Date: 7/12/04Location: Gardiner's hill.AMG84: 50J 0408573/UTM 66 18147 (WGS 84; GPS unit).Site description: Steep, south-facing slope of ridge.Soil: Gravelly, pebbly, cobbly rocky brown sand in matrix of outcrop.Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (3-5%), *Xanthorrhoea drummondii* (3-5%), (*Calothamnus* aff. *quadrifidus* Moora-Watheroo (+), *Melaleuca radula* (+), *Kunzea praestans* (3-5%)) high open shrubland to high shrubland over *Trymalium ledifolium* var. *rosmarinifolium* (1-2%), *Hakea recurva* subsp. *recurva* (1-2%), *Calytrix leschenaultii* low open shrubland over *Desmocladius flexuosus*, *Schoenus clandestinus* scattered sedges and *Podolepis lessonii*, *Borya sphaerocephala* very open herbland.

Associated species:

Condition: Good (moderate weed cover of *Avena barbata*, *Briza maxima*).

AhDs.4: See releve GHR305 vegetation description below.

Releve GHR305.

Releve GHR305Date: 7/12/04Location: Gardiner's hill, Central block.AMG84: 50J 0408611/UTM 66 17765 (WGS 84; GPS unit).Site description: Moderate, west-facing lower slope.Soil: Gravelly, pebbly, cobbly rocky brown sand.Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Calothamnus* aff. *quadrifidus* Moora-Watheroo scattered tall shrubs over *Xanthorrhoea drummondii* open shrubland over *Olearia dampieri* subsp. *eremicola* (1-2%) *Melaleuca radula* (1-2%) open shrubland over *Hakea lissocarpa* (3-5%), *Calytrix leschenaultii* (1-2%) low open shrubland over *Desmocladius flexuosus* (1-2%), *Schoenus clandestinus* very open sedgeland and *Borya sphaerocephala*, *Podolepis canescens*, *Hyalosperma cotula*, *Lomandra effusa* open herbland and *Cheilanthes adiantoides* very open fernland.

Associated species: *Lepidobolus chaetocephalus*, *Opercularia vaginata*, *Verticordia densiflora* var. *densiflora* (35 cm), *Dichopogon capillipes*.

Condition: Very good.

Vegetation Association AhDsKp: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high shrubland over *Kunzea praestans* scattered tall shrubs to high open shrubland.

Plant Communities:

AhDsKp.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high shrubland over *Kunzea praestans*, *Allocasuarina campestris* high open shrubland to high shrubland over (*Hibbertia subvaginata*), *Calytrix leschenaultii* scattered low shrubs to low open shrubland.

Relevés CNR95, CNR129 and CNR132.

Releve CNR95

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407612/UTM 66 21740 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of (short slope about 70 m long) low rocky ridge.

Vegetation description: *Allocasuarina huegeliana* (40-50%), *Eucalyptus loxophleba* subsp. *loxophleba* (2-3%), *Acacia acuminata* subsp. *acuminata* (1-2%) low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (5-10%), *Kunzea praestans* (3-5%) high shrubland over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered grasses/sedges with *Cheilanthes adiantoides* (1%) scattered ferns.

Associated species: *Podotheca angustifolia*, *Xanthorrhoea drummondii*, *Dichopogon capillipes*, *Dioscorea hastifolia*.

Releve CNR129

Date: 5/12/03

Location: Cairn Hill North.

AMG84: 50J 0407491/UTM 66 21800 (WGS 84; GPS unit).

Site description: Very gently sloping, north-facing flat top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders.

Vegetation description: *Allocasuarina huegeliana* (35-40%), *Acacia acuminata* subsp. *acuminata* (5-7%) low open forest over *Dryandra sessilis* var. *sessilis* (1-2%) scattered tall shrubs over *Allocasuarina campestris* (2-3%), *Kunzea praestans* (+), *Xanthorrhoea drummondii*, *Regelia megacephala* scattered tall shrubs over *Hibbertia subvaginata* (1%), *Calytrix leschenaultii* (1%), *Xanthosia fruticulosa* scattered low shrubs over *Lepidosperma leptostachyum*, *Neurachne alopecuroidea* scattered sedges/grasses.

Notes: - Unit CNR129 includes some area where *Hibbertia subvaginata* is about 2-3(5)% and *Xanthosia fruticulosa* about 8-10%.

Releve CNR132

Date: 5/12/03

Location: Cairn Hill North.

AMG84: 50J 0407488/UTM 66 22084 (WGS 84; GPS unit).

Site description: Gentle to moderate, east-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (10-12%), *Acacia acuminata* subsp. *acuminata* (2-3%) low woodland over *Dryandra sessilis* var. *sessilis* (4-5%) high open shrubland over *Allocasuarina campestris* (10-15%), (*Kunzea praestans*) (+) high shrubland over *Hibbertia subvaginata* (+), *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses.

Associated species: *Trachymene pilosa*, *Podotheca angustifolia*, *Goodenia berardiana*.

Notes: 1) Similar to R97 but more *Allocasuarina campestris* and not *Kunzea praestans* open scrub. 2) An extremely variable vegetation which should possibly be mosaic of *Allocasuarina campestris* open scrub (eg: R115) to high open shrubland under *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland with something else.

AhDsKp.2: *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high shrubland over *Kunzea praestans* scattered tall shrubs to high open shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland. Relevés CR78, JTR221, JTR223, SWR228, JTR248, JTR256 and G335.

Releve: CR78

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406972/UTM 66 21144 (WGS 84; GPS unit).

Site description: Moderate, south-facing lower slope (below steep rocky slope) of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (40-50%) low open forest over *Dryandra sessilis* var. *sessilis* (3-4%) high open shrubland over *Kunzea praestans* (15-25%) (2-3 m) high shrubland over *Acacia congesta* subsp. *congesta* (1%), *Hibbertia subvaginata* (6%) open shrubland over *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (8-10%) low open shrubland over *Desmocladius flexuosus* (3-5%) very open sedgeland.

Associated species: *Trachymene ornata*, *Lawrencella rosea*, *Dichopogon capillipes*, *Dioscorea hastifolia*, *Trachymene pilosa*, *Xanthorrhoea drummondii* (2%), *Cheilanthes adiantoides*.

Releve JTR221

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408840/UTM 66 26044 (WGS 84; GPS unit).

Site description: Gentle, west of south-facing mid slope of very low rocky ridge.

Rock type: Chert.

Soil: See R220.

Vegetation description: *Allocasuarina huegeliana* (5-10%) low open woodland over *Dryandra sessilis* var. *sessilis* (1-2%) scattered tall shrubs over *Kunzea praestans* (+) scattered tall shrubs over *Calytrix leschenaultii* (+), *Hibbertia subvaginata* (+) scattered low shrubs over *Desmocladius flexuosus*, *Lepidobolus chaetocephalus* scattered scrub with *Borya sphaerocephala* scattered herbs and *Ehrharta longiflora*, *Pentaschistis pallida*, *Vulpia myuros* var. *hirsuta*, *Hypochaeris glabra* annual grassland/herbland.

Condition: Very poor to poor – partially cleared or severe grazing effects and very high weed cover.

Releve JTR223

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408961/UTM 66 26336 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low rocky ridge (elevation 281 m).

Soil: Gravelly, pebbly brown silty sand with rocks and rock outcrop (10-15%).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (10-15%) low woodland over *Dryandra sessilis* var. *sessilis* (2-5%) high open shrubland over *Kunzea praestans* scattered tall shrubs over *Hibbertia subvaginata* (5-10%) open shrubland over *Desmocladius flexuosus* scattered sedges with *Avena barbata*, *Ehrharta longiflora*, *Hypochaeris glabra* annual grassland/herbland.

Associated species: *Melaleuca calyptroides*, *Xanthorrhoea drummondii*, *Dichopogon capillipes*.

Condition: Good.

Releve SWR228Date: 11/1/04Location: Stan Ridgeway's property (East).AMG84: 50J 0409080/UTM 66 25034 (WGS 84; GPS unit).Site description: Similar to R227.Vegetation description: Allocasuarina huegeliana (5-10%), Acacia acuminata subsp. acuminata (3-5%) low open woodland to low woodland over Dryandra sessilis var. sessilis (2-5%) high open shrubland over Xanthorrhoea drummondii scattered shrubs over Hibbertia subvaginata, Trymalium ledifolium var. rosmarinifolium scattered low shrubs over Desmocladius flexuosus scattered sedges and Cheilanthes adiantoides very open fernland.Associated species: Kunzea praestans.Condition: Good.Releve JTR248Date: 13/1/04Location: John Tonkin's property.AMG84: 50J 0409150/UTM 66 27363 (WGS 84; GPS unit).Site description: Rock top and sides of low rocky ridge.Rock type:Vegetation description: Allocasuarina huegeliana (10-15%) low woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Kunzea praestans, Xanthorrhoea drummondii scattered tall shrubs over Hibbertia subvaginata scattered low shrubs over Desmocladius flexuosus scattered sedges with Avena barbata, Hypochaeris glabra closed annual grassland/herbland.Associated species: Acacia restiaceaCondition: Very poor (high weed cover).Releve JTR256Date: 14/1/04Location: John Tonkin's property.AMG84: 50J 0409354/UTM 66 25563 (WGS 84; GPS unit).Site description: Steep, east-facing upper slope of low rocky ridge (elevation 263 m).Rock type: Chert.Vegetation description: Allocasuarina huegeliana (5-8%) low open woodland over Dryandra sessilis var. sessilis (5-10%) high open shrubland over Kunzea praestans (2-3%), (Xanthorrhoea drummondii (+)) high open shrubland over Hibbertia subvaginata, Calytrix leschenaultii, Trymalium ledifolium var. rosmarinifolium scattered low shrubs over Desmocladius flexuosus (1-2%), Lepidosperma tenue scattered sedges to very open sedgeland with Stypantra glauca (1-2%) scattered low herbs and Cheilanthes adiantoides scattered ferns and Avena barbata, Briza maxima, Sonchus oleraceus, Ursinia anthemoides very open annual grassland/herbland.Associated species: Acacia aristulata.Condition: Poor to good (high weed cover).Releve G335Date: 18/2/05Location: Gardiner's property, just east of Morgan's.AMG84: 50J 0407089/UTM 66 17650 (WGS 84; GPS unit).Site description: Crest of very low rocky ridge.Rock type: Chert.Vegetation description: Allocasuarina huegeliana (2-5%), (Acacia acuminata subsp. acuminata (+), Eucalyptus loxophleba subsp. loxophleba (+) scattered low trees to low open woodland over Dryandra sessilis var. sessilis (2-4%), Xanthorrhoea drummondii (2-4%), (Kunzea praestans (+)) high open shrubland over Hibbertia subvaginata, Calytrix leschenaultii low open shrubland over *Avena barbata, Ehrharta longiflora open annual grassland.Condition: Good.

AhDsKp.3: *Allocasuarina huegeliana* low open forest over *Dryandra sessilis* open scrub over *Kunzea praestans* open shrubland over *Calytrix leschenaultia*, *Hibbertia subvaginata* low open shrubland over *Desmocladius flexuosus* very open sedgeland.

This plant community was differentiated by having *Dryandra sessilis* var. *sessilis* form an open scrub under an *Allocasuarina huegeliana* low open forest. Quadrat GH1.

AhDsKp.4: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland over *Dryandra sessilis* var. *sessilis* high shrubland over *Kunzea praestans* high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) shrubland over scattered sedges/grasses/herbs.

This plant community was distinguished by having a *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland to shrubland. Relevés CNR94 and CNR122.

Releve CNR94

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407624/UTM 66 21644 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid slope of a short slope.

Soil: Gravelly, pebbly, cobbly brown sand amongst rock outcrop (~ 5-10% of surface cover).

Vegetation description: *Allocasuarina huegeliana* (15-25%), *Acacia acuminata* subsp. *acuminata* (+) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (3-7%), *Kunzea praestans* (1%), *Xanthorrhoea drummondii* (2-4%) open shrubland over *Calytrix leschenaultii* (5-7%), *Baeckea* sp. Moora (R. Bone 1993/1) (5-7%) low open shrubland to low shrubland over *Schoenus clandestinus* (+), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Borya sphaerocephala* (7-10%), *Stylidium septentrionale* (+), *Podolepis lessonii* (2-5%), *Gilberta tenuifolia* (1-2%) open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Trachymene cyanopetala*, *Lawrencella rosea*, *Thysanotus manglesianus*, *Melaleuca radula*.

Releve CNR122

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407594/UTM 66 21525 (WGS 84; GPS unit).

Site description: Very gently sloping, south-west facing ridge top on low rocky ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (2-3%) low woodland over *Dryandra sessilis* var. *sessilis* (10-15%) high shrubland over *Kunzea praestans* (2-3%) high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) (20-30%), *Calytrix leschenaultii* (2-3%) shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stylidium septentrionale* scattered herbs.

Associated species: *Acacia lasiocarpa* var. *sedifolia*, *Lawrencella rosea*, *Trachymene pilosa*, *Chamaescilla corymbosa* var. *corymbosa*.

Vegetation Association AhHr: *Allocasuarina huegeliana* low open forest over *Hakea recurva* subsp. *recurva* scattered tall shrubs.

This vegetation association included one plant community that was recorded at Gardiner's Hill.

Plant Communities:

AhHr.1: See the vegetation description for releve GHR282 below.

Releve GHR282.

Releve GHR282

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408321/UTM 66 17127 (WGS 84; GPS unit).

Site description: Gentle, south-east facing slope on top of low rocky rise.

Rock type: ?Sandstone.

Vegetation description: *Allocasuarina huegeliana* (5-10%) low open woodland over *Hakea recurva* subsp. *recurva* (1-2%) scattered tall shrubs over *Allocasuarina campestris* (+) scattered tall shrubs over *Calytrix leschenaultii* (1-2%), (*Acacia lasiocarpa* var. *sedifolia* (1.2 m)) scattered shrub to open shrubland over *Lepidosperma tenue*, *Neurachne alopecuroidea*, *Austrodanthonia setacea*, *Desmocladus flexuosus*, *Schoenus clandestinus* (1%) very open sedgeland/grassland with *Borya sphaerocephala* (5-10%), *Opercularia vaginata* (1-2%), *Stypandra glauca* (+), *Lomandra effusa* open herbland.

Associated species: *Gastrolobium obovatum*, *Baeckea crispiflora* var. *tenuior*, *Stenanthemum tridentatum*, *Blennospora drummondii*, *Hyalospermum glutinosum* ssp. *glutinosum*, *Burchardia umbellata*.

Condition: Good to very good (but grazed and low weed cover).

Vegetation Association AhHs: *Allocasuarina huegeliana* low open woodland to low woodland over *Hibbertia subvaginata* low open shrubland to low shrubland.

Plant Communities:

AhHs.1: *Allocasuarina huegeliana* low open woodland to low woodland (over *Xanthorrhoea drummondii* scattered tall shrubs) over *Hibbertia subvaginata* low open shrubland to low shrubland over very open sedgeland/grassland/herbland.

Relevés ERR140, ERR153, ERR169 and ERR179.

Site number: ERR140

Date: 8/12/03

Location: Eastern Ridge.

AMG84: 50J 0407599/UTM 66 24586 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of very low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and outcrop.

Vegetation description: *Allocasuarina huegeliana* (10-15%), *Acacia acuminata* subsp. *acuminata* (5-6%) low woodland over *Allocasuarina campestris* scattered tall shrubs over *Hibbertia subvaginata* (5-6%) low open shrubland over *Lepidosperma tenue* (2-3% (5-10%)) very open sedgeland with *Stypandra glauca* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Waitzia nitida*, *Dioscorea hastifolia*.

Condition: Very good. Few weeds.

Notes: Very similar to CWR139 but no *Eucalyptus loxophleba* subsp. *loxophleba* on slopes and more *Lepidosperma tenue*.

Releve ERR153

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407952/UTM 66 24473 (WGS 84; GPS unit).

Site description: Moderately steep, east-facing slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with boulders and some outcrop (2-3%).

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris* (1-2%) scattered tall shrubs over *Hibbertia subvaginata* (10-12%), *Oleara dampieri* subsp. *eremicola* (1-2%), *Calytrix leschenaultii* (+) open shrubland to shrubland over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dioscorea hastifolia*, *Burchardia umbellata*, *Dichopogon capillipes*, *Xanthorrhoea drummondii*, *Acacia congesta* subsp. *congesta*, *Austrodanthonia acerosa*, *Opercularia vaginata*.

Releve ERR169

Date: 22/12/03

Location: Eastern Ridge.

AMG84: 50J 0408066/UTM 66 22936 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid to upper slope of low rocky ridge (elevation 241 m).

Rock type: - Chert! Mixture (2 rocks?) but a lot chert.

Vegetation description: *Allocasuarina huegeliana* (3-5%) low open woodland over *Xanthorrhoea drummondii* (1-2%) scattered tall shrubs over *Hibbertia subvaginata* (1.1-1.4 m, (15) 20-30%), *Calytrix leschenaultii* (1%) shrubland over *Lepidosperma tenue* (2-3%), (*Lepidosperma* sp. (+)), *Austrodanthonia caespitosa*, *Neurachne alopecuroidea*, *Austrostipa mollis* very open sedgeland/grassland with *Stypandra glauca*, *Podolepis lessonii* scattered herbs with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Dioscorea hastifolia*, *Acacia acuminata* subsp. *acuminata*, *Dichopogon capillipes*.

Condition: Good to very good.

Releve ERR179

Date: 24/12/03

Location: Eastern Ridge.

AMG84: 50J 0407959/UTM 66 23246 (WGS 84; GPS unit).

Site description: Moderate, east-facing upper rocky slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (10-20%), *Acacia acuminata* subsp. *acuminata* (5-8%) low woodland over *Xanthorrhoea drummondii* (1-4%) scattered tall shrubs to high open shrubland over *Hibbertia subvaginata* (10-20%) shrubland over *Lepidosperma tenue* (1-2%), *Austrodanthonia caespitosa* (1-2%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Borya sphaerocephala* (1-2%), *Stypandra glauca* (1%), *Gilberta tenuifolia* (2-3%), *Podolepis lessonii* very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Thomasia grandiflora*, *Kunzea praestans*, *Calytrix leschenaultii*, *Pityrodia dilatata*, *Dioscorea hastifolia*, *Burchardia umbellata*, *Olearia dampieri* subsp. *eremicola*, *Scaevola glandulifera*.

Condition: Good to very good (much of it very good). Some weeds.

Notes: Very similar to R164 and R169.

Vegetation Association AhKp: *Allocasuarina huegeliana* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs to high open shrubland.

Plant Communities:

AhKp.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open forest over *Kunzea praestans* scattered tall shrubs to high shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) scattered low shrubs to low open shrubland over scattered sedges/grasses/herbs.

This plant community was differentiated by having an *Hibbertia subvaginata* scattered low shrubs to low open shrubland. Releves DR135a, ERR183, JTR212, JTR218 and JTR220.

Releve DR135 (R135a)

Date: 6/12/03

Location: Waste Dump Area.

AMG84: 50J 0407389/UTM 66 23070 (WGS 84; GPS unit).

Site description: Moderate, west-facing lower slope of low rocky ridge.

Soil: (NT) Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (30-40%) low open forest over *Kunzea praestans* scattered tall shrubs over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Podolepis lessonii* (1-2%) scattered herbs.

Releve ERR183

Date: 1/1/04

Location: Eastern Ridge.

AMG84: 50J 0407643/UTM 66 23789 (WGS 84; GPS unit).

Site description: Mid to upper moderately, west-facing rocky slope of low rocky ridge.

Soil: (NT) Gravelly, pebbly, cobbly brown sand amongst boulders and outcrop (30-40% surface cover).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (10-20%), (Acacia acuminata subsp. acuminata (2-3%)) low woodland over Kunzea praestans (3-4%) high open shrubland over Hibbertia subvaginata (3-5 to (10-15%)) open shrubland to shrubland over Pityrodia dilatata scattered low shrubs over Lepidosperma sp., Lepidosperma tenue, Austrodanthonia setacea, Neurachne alopecuroidea very open grassland/sedgeland with Stypantra glauca (3-5%), Borya sphaerocephala (1-2%) very open herbland with Cheilanthes adiantoides scattered ferns.

Associated species: Burchardia umbellata, Dioscorea hastifolia, Lawrencella rosea, Chamaescilla corymbosa var. corymbosa.

Condition: Very good. Some annual weeds (Briza maxima) Avena barbata <1-2%), also Ursinia anthemoides.

Releve JTR212

Date: 10/1/04

Location: John Tonkin's property.

AMG84: 50J 0408847/UTM 66 25827 (WGS 84; GPS unit).

Site description: Very gentle, north-west facing slope at base of low rocky ridges at head of drainage line (head of valley floor) (elevation 256 m).

Soil: Gravelly, pebbly, cobbly brown sand with boulders and rock outcrop (5%).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (40-50%), Acacia acuminata subsp. acuminata (3-5%) low open forest over Kunzea praestans (4-5%) high open shrubland over Hibbertia subvaginata (1-2%), Calytrix leschenaultii (+) scattered low shrubs to low open shrubland over Desmocladius flexuosus (1%) scattered sedges.

Condition: Good to very good.

Releve JTR218

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408868/UTM 66 26026 (WGS 84; GPS unit).

Site description: Gentle, south-facing lower slope on ridge top near end of ridge (elevation 254 m).

Soil: Gravelly, pebbly silty sand.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (30-40%), Acacia acuminata subsp. acuminata (+) low woodland over Calytrix leschenaultii (3-5%), (Hibbertia subvaginata)(+) low open shrubland over Lepidobolus chaetocephalus (+), Schoenus clandestinus (2-5%), Desmocladius flexuosus (+), Austrodanthonia setacea (1-2%) very open sedges/grasses to open sedges/grasses with Borya sphaerocephala (1-3%), Stylidium septentrionale (+), Podolepis lessonii (1-2%) very open herbland with Vulpia myuros var. hirsuta very open annual grassland.

Associated species: Kunzea praestans.

Condition: Very good.

Releve JTR220

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408873/UTM 66 26085 (WGS 84; GPS unit).

Site description: Mid slope of low rocky ridge, west of south-facing, gentle slope.

Soil: Gravelly, pebbly brown silty fine sand with cobbles and some rock outcrop (3-5%).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (15-20%) low woodland over *Kunzea praestans* (10-20%) high shrubland over *Calytrix leschenaultii* (1-2%), *Hibbertia subvaginata* (+) scattered low shrubs over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala*, *Stylidium septentrionale* very open herbland and *Pentaschistis pallida*, *Avena barbata*, *Briza maxima*, *Hypochaeris glabra*, *Vulpia myuros* var. *hirsuta* annual grassland/herbland.

Condition: Poor to good.

AhKp.2: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland to low open forest over *Kunzea praestans*, *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over (*Hibbertia subvaginata*, *Calytrix leschenaultii*) open shrubland over scattered sedges/grasses/herbs/ferns.

This plant community was differentiated by having a *Xanthorrhoea drummondii* high shrubland and a (*Calytrix leschenaultii*, *Hibbertia subvaginata*) low open shrubland. Releve CR73, CNR98, ERR199, JTR255, GHR287, GHR303, D10, ERR171 and CNR135.

Releve CR73

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406932/UTM 66 20797 (WGS 84; GPS unit).

Site description: Moderately steep, west-facing mid to upper slope of rocky (chert) ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop.

Vegetation description: *Allocasuarina huegeliana* (4-5 m, 30-40%) low open forest over *Acacia congesta* subsp. *congesta* (3-4%), *Kunzea praestans* (2%), high open shrubland over *Hibbertia subvaginata* (3%) open shrubland over *Stypantra glauca* (10-15%) open herbland over *Borya sphaerocephala* (1-2%) scattered low herbs and *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Burchardia umbellata*, *Dichopogon capillipes*, *Regelia megacephala*, *Lawrencella rosea*, *Dioscorea hastifolia*, *Xanthorrhoea drummondii*, *Neurachne alopecuroidea*.

Releve CNR98

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407521/UTM 66 21985 (WGS 84; GPS unit).

Site description: Gentle, east-facing, mid to lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst rock outcrop and boulders.

Vegetation description: *Allocasuarina huegeliana* (40-50%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open forest over *Kunzea praestans* (2-3%), *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Hibbertia subvaginata* (2-4%), *Calytrix leschenaultii* open shrubland over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Pityrodia dilatata*, *Dioscorea hastifolia*, *Dichopogon capillipes*, *Burchardia umbellata*.

Condition: Very good (some weeds).

Releve ERR199

Date: 4/1/04

Location: Eastern Ridge.

AMG84: 50J 0407810/UTM 66 23213 (WGS 84; GPS unit).

Rock type: =R168 (with occasional piece of chert cobble/rock on surface – probably blown across in mine blasts - mine about 70m away).

Vegetation description: *Allocasuarina huegeliana* (40-50%), *Acacia acuminata* subsp. *acuminata* (5-10%) low open forest over *Kunzea praestans* (1-2%) scattered tall shrubs (NB: about another 2-3% dead) over *Xanthorrhoea drummondii* (3-5%) high open shrubland over *Calytrix leschenaultii*

scattered low shrubs over *Lepidosperma tenue* (+), *Neurachne alopecuroidea* (1%), *Desmocladus flexuosus* (+) scattered sedges/grasses with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Stypandra glauca*.

Condition: Very good.

Releve JTR255

Date: 14/1/04

Location: John Tonkin's property.

AMG84: 50J 0409319/UTM 66 25506 (WGS 84; GPS unit).

Site description: Gentle, south-east facing slope on crest of low rocky ridge (elevation 276 m).

Soil: See 254.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5) 10-15%), (*Acacia acuminata* subsp. *acuminata* (1-3%)) low open woodland to low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (3-5%), *Allocasuarina campestris* (+), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (+), *Xanthorrhoea drummondii* (+) high open shrubland over *Hibbertia subvaginata* (2-5%), *Trymalium ledifolium* var. *rosmarinifolium* (1-3%) open shrubland over *Acacia aristulata* scattered low shrubs over *Desmocladus flexuosus* (2-3%), *Lepidosperma tenue* (+) very open sedgeland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Briza maxima*, *Hypochaeris glabra* (30-40%) annual grassland/herbland.

Associated species: *Diplopeltis huegelii* ssp. *lehmannii*, *Dichopogon capillipes*, *Dioscorea hastifolia*, *Austrostipa* sp., *Muehlenbeckia adpressa*.

Condition: Poor to good (very high weed cover may have displaced some species).

Notes: Similar to JTR248.

Releve GHR287

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408426/UTM 66 17829 (WGS 84; GPS unit).

Site description: Flat crest of low rocky ridge (elevation 269 m).

Soil: Gravelly, pebbly brown silty fine sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (15-25%), (*Acacia acuminata* subsp. *acuminata* (+)) low open woodland over *Xanthorrhoea drummondii* (4-5%) high open shrubland over *Kunzea praestans* scattered tall shrubs over *Calytrix leschenaultii* scattered low shrubs over *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Podolepis canescens* (10-20%) open daisy herbland over *Borya sphaerocephala* (3-5%) very open low herbland and *Hypochaeris glabra*, *Pentaschistis pallida* very open annual grassland/herbland.

Associated species:

Condition: Very good – too many weeds for ‘excellent’.

Notes: 1) *Kunzea praestans* and *Calytrix leschenaultii* heavily grazed.

2) *Allocasuarina huegeliana* often in ‘groups’.

3) *Xanthorrhoea drummondii* observed with severe ‘28’ parrot damage (3 dead). Many healthy plants remain.

Site number: GHR303

Date: 6/12/04

Location: Gardiner's hill.

AMG84: 50J 0408815/UTM 66 17857 (WGS 84; GPS unit).

Site description: Flat crest of low ridge.

Soil: Gravelly, rocky brown sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (40-50%) low open forest over *Allocasuarina campestris* (+) scattered tall shrubs over *Xanthorrhoea drummondii* (+), *Kunzea praestans* (3-5%)

open shrubland over *Calytrix leschenaultii* (2-3%) low open shrubland over *Schoenus clandestinus* (3-5%) very open sedgeland with *Borya sphaerocephala* (20-30%), *Podolepis canescens* (1-2%) herbland.

Associated species: *Melaleuca calyptroides*, *Lomandra effusa*, *Goodenia hassallii*, *Isopogon divergens*, *Calytrix depressa*.

Condition: Very good to excellent.

Releve D10

Date: 10/12/04

Location: Doblestein's property.

AMG84: 50J 0408946/UTM 66 22379 (WGS 84; GPS unit).

Site description: Gentle, west-facing slope of low ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland over *Xanthorrhoea drummondii* high open shrubland over *Kunzea praestans* scattered shrubs over *Hibbertia subvaginata*, *Calytrix leschenaultii*, *Pityrodia dilatata* low open shrubland to low shrubland over *Desmocladius flexuosus*, *Schoenus clandestinus* scattered sedges and *Neurachne alopecuroidea*, *Avena barbata*, *Ehrharta longiflora* scattered grasses with *Gilberta tenuifolia*, *Podolepis lessonii* very open herbland.

Associated species: *Dichopogon capillipes*, *Allocasuarina campestris*.

Condition: Good.

Releve CNR135

Date: 6/12/03

Location: Cairn Hill North.

AMG84: 50J 0407316/UTM 66 21722 (WGS 84; GPS unit).

Site description: Moderate sloping, west-facing mid slope of lower rock ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (2-3%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland over *Kunzea praestans* (2-3%), *Xanthorrhoea drummondii* (2%) high open shrubland over *Hibbertia subvaginata* (1-2%), *Calytrix lechenaultii* (+) scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Podolepis lessonii* (~1%) scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Releve ERR171

Date: 22/12/03

Location: Eastern Ridge.

AMG84: 50J 0408058/UTM 66 22888 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid to upper slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (2-3%) scattered low trees to low open woodland over *Xanthorrhoea drummondii* (4-5%) high open shrubland over *Calytrix leschenaultii* (1%), *Phyllanthus calycinus* (1%), *Kunzea praestans* (90 cm) scattered low shrubs over *Lepidosperma tenue* (2-4%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Stypandra glauca*, *Ptilotus polystachyus*, *Podolepis lessonii*, *Gilberta tenuifolia* scattered herbs to very open herbland.

Condition: Good to very good. Quite a lot of *Avena barbata* and *Briza maxima*.

AhKp.3: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland to low open forest over *Kunzea praestans*, *Allocasuarina campestris*, (*Xanthorrhoea drummondii*) high open shrubland to high shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland over scattered sedges/grasses/herbs/ferns.

This plant community an *Allocasuarina campestris* high open shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland. Relevés ERR147, ERR182 and ERR192.

Releve ERR147Date: 9/12/03Location: Eastern Ridge.AMG84: 50J 0407757/UTM 66 24077 (WGS 84; GPS unit).Site description: Rock flat ridge top of long low rocky ridge (Elevation 260 m).Vegetation description: *Allocasuarina huegeliana* (5-8%), *Acacia acuminata* subsp. *acuminata* (5-6%), (*Eucalyptus loxophleba* subsp. *loxophleba* (+)) low woodland over *Allocasuarina campestris* (6-7%), *Kunzea praestans* (2-6 (15%)) high open shrubland to high shrubland over *Hibbertia subvaginata* (juvenile (+)) scattered shrubs over *Lepidosperma leptostachyum*, *Neurachne alopecuroidea* scattered sedges/grasses.Associated species: *Dichopogon capillipes*, *Podolepis lessonii*, *Thysanotus manglesianus*.Condition: Good to very good – some weeds.Releve ERR182Date: 24/12/03Location: Eastern Ridge.AMG84: 50J 0407799/UTM 66 23168 (WGS 84; GPS unit).Site description: Moderate, west-facing mid slope of low rocky ridge (elevation 244 m).Vegetation description: *Allocasuarina huegeliana* (30-40%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open forest over *Xanthorrhoea drummondii* (2-3%), *Kunzea praestans* (1-2%), *Allocasuarina campestris* (+ (1-2%)) high open shrubland over *Calytrix leschenaultii* (2-3%), *Hakea lissocarpa* (1%), *Hibbertia subvaginata* (+) open shrubland over *Schoenus clandestinus* (+), *Desmocladius flexuosus*, *Neurachne alopecuroidea*, *Lepidosperma tenue* scattered sedges/grasses with *Gilberta tenuifolia* (3-5%) very open herbland.Associated species: *Podolepis lessonii*.Notes: Similar to R168, R187 and R197.Releve ERR192Date: 3/1/04Location: Eastern Ridge.AMG84: 50J 0407892/UTM 66 23636 (WGS 84; GPS unit).Site description: Steep, east-facing upper slope of low rocky ridge.Rock type: Chert.Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* low open woodland over *Kunzea praestans* (5-10%), *Allocasuarina campestris* (1-2%), *Xanthorrhoea drummondii* (1-2%) high open shrubland to high shrubland over *Hibbertia subvaginata* (1-2%) low open shrubland over *Neurachne alopecuroidea* (+), *Lepidosperma tenue* scattered sedges/grasses with *Stypantra glauca*, *Podolepis lessonii* scattered herbs and *Cheilanthes adiantoides* scattered ferns.Condition: Very good (some weeds).Notes: Similar to R187.**Vegetation Association AhRm:** *Allocasuarina huegeliana* low open forest over *Regelia megacephala*, *Allocasuarina campestris* high open shrubland.Notes: The composition of the main shrub layer varies significantly, usually both *Regelia megacephala* and *Allocasuarina campestris* are present, but in some stands only one is present.Plant Communities:**AhRm.1:** See the vegetation description for releve CR75 below.

Releve CR75.

Releve CR75Date: 26/11/03Location: Cairn Hill Reserve.

AMG84: 50J 0406979/UTM 66 20756 (WGS 84; GPS unit).

Site description: Flat crest (narrow) of low rocky ridge.

Soil: Gravelly, pebbly brown sand amongst boulders and rock outcrop (90% of surface).

Vegetation description: *Allocasuarina huegeliana* (50-60%) low open forest over *Regelia megacephala* (5-10%) high open shrubland over *Xanthorrhoea drummondii* scattered shrubs over *Stypanandra glauca* (15-20%) open herbland.

Associated species: *Dichopogon capillipes*, *Dioscorea hastifolia*, *Hibbertia subvaginata*.

Notes: This is very similar to CR74 and is a neighbour to it.

AhRm.2: See the vegetation description for releve CR69 below.

This plant community occurred on the ridge slopes and included a *Kunzea praestans* high shrubland. Releve CR69.

Releve CR69

Date: 25/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407224/UTM 66 20829 (WGS 84; GPS unit).

Site description: Gentle, south facing slope on edge of crest of low rocky ridge.

Soil: Gravelly, pebbly cobbly brown sand with some boulders and rock outcrop.

Vegetation description: *Allocasuarina huegeliana* (40-60%) low open forest over *Allocasuarina campestris* (5-6%), *Regelia megacephala* (1-2%) high open shrubland over *Kunzea praestans* (10-15%), *Acacia congesta* subsp. *congesta* (1%) high open shrubland over *Melaleuca calyptroides* (+) scattered shrubs over *Xanthosia fruticulosa* (1-2%) scattered low shrubs over *Desmocladius flexuosus* scattered sedges and *Stypanandra glauca* (+) very open herbland.

Associated species: *Dichopogon capillipes*, *Cheilanthes adiantoides*, *Dioscorea hastifolia*.

Vegetation Association AhRmAc: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, *Allocasuarina campestris* open scrub over *Ricinocarpos muricatus* scattered shrubs to open shrubland

Plant Communities:

AhRmAc.1: See the vegetation description for releve ATR003 below.

Releve ATR003, ATR005

Releve ATR003

Date: 10/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 50J 408762 mE 6625491 mN (WGS 84; GPS unit).

Site description: Moderate, north facing slope of low ridge.

Rock type: Chert (20% outcropping)

Vegetation description: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, *Allocasuarina campestris* open scrub over *Ricinocarpos muricatus* scattered shrubs to open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Lepidosperma tenue* scattered sedges.

Associated species: *Cheilanthes distans*, **Ursinia anthemoides*

Releve ATR005

Date: 10/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 50J 408630 mE 6625609 mN (WGS 84; GPS unit).

Site description: Crest of low rocky ridge.

Rock type: Chert, >50% outcropping/

Vegetation description: (*Allocasuarina huegeliana* scattered low trees) over *Regelia megacephala*

high shrubland to open scrub over *Ricinocarpos muricatus* scattered shrubs to open shrubland over **Avena barbata*, **Ehrharta longiflora* open grassland with **Hypochaeris glabra*, **Ursinia anthemoides* open herbland.

Associated species: *Cheilanthes distans*, *Dioscorea* sp., *Stypandra glauca*, **Urospermum picroides*

Condition: Good

Fire Age: >10 years

Notes: Moderate weed cover amongst rocks
ATR03 is very similar to ATR05 (probably fragmented To ATR05)
on south facing slopes and east facing slope doesn't have tree layer.

Vegetation Association AhTl: *Allocasuarina huegeliana* low woodland to low open forest over *Trymalium ledifolium* var. *rosmarinifolium*, *Hibbertia subvaginata*, *Xanthosia fruticulosa* low open shrubland over scattered sedges and grasses and *Cheilanthes adiantoides* scattered ferns.

Plant Communities:

AhTl.1: *Acacia huegeliana* low open forest over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland over *Neurachne alopecuroidea*, *Desmocladius flexuosa* very open grass/sedgeland with *Dioscorea hastifolia* very open lianes.

This plant community, recorded at Cairn Hill. Quadrat CAH13.

AhTl.2: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Trymalium ledifolium* var. *rosmarinifolium*, *Hibbertia subvaginata* low open shrubland to open shrubland over scattered herbs and *Cheilanthes adiantoides* ferns and very open annual grassland.

Quadrat ERG6, releve ERR159.

Releve ERR159

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407963/UTM 66 24166 (WGS 84; GPS unit).

Site description: Steep, south-east facing mid to upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with boulders and outcrop (NT).

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (3-5%) low woodland over *Allocasuarina campestris* (1-2%), *Acacia congesta* subsp. *congesta* (1-2%) scattered tall shrubs over *Hibbertia subvaginata* (1-2%), *Trymalium ledifolium* var. *rosmarinifolium* (1-2%) scattered shrubs to open shrubland over *Avena barbata*, *Ehrharta longiflora* very open grassland with *Rhodanthe polycephala* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Blennospora drummondii*, *Dichopogon capillipes*, *Dryandra sessilis* var. *sessilis*, *Acacia aristulata*.

Vegetation Association AhXd: *Allocasuarina huegeliana* low open woodland to low woodland over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over scattered low shrubs.

Plant Communities:

AhXd.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Xanthorrhoea drummondii* high shrubland over *Calytrix leschenaultii* scattered low shrubs over scattered to very open sedgeland/grassland with very open herbland.

Relevés ERR168, ERR170, GHR302 and ATR013.

Releve ERR168

Date: 22/12/03

Location: Eastern Ridge.

AMG84: 50J 0408004/UTM 66 22885 (WGS 84; GPS unit).

Site description: Gentle, south-facing slope on ridge top on a long, low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with high rock and boulder surface cover.

Vegetation description: Allocasuarina huegeliana (15-20%), Acacia acuminata subsp. acuminata (3-5%) low woodland over Xanthorrhoea drummondii (5-10%), (Allocasuarina campestris (+)) high open shrubland over Hakea lissocarpa (+), Calytrix leschenaultii (+), Phyllanthus calycinus scattered low shrubs over Lepidosperma sp., Lepidosperma leptostachyum, Desmocladus flexuosus (+), Neurachne alopecuroidea (>1%), Austrodanthonia caespitosa (>1%), Austrostipa nitida scattered to very open sedgeland/grassland with Stypantra glauca (+), Borya sphaerocephala (+), Gilberta tenuifolia (2-3 (5%)), Eremophyllum tenellum (+), Podolepis lessonii (+/- 1%), Pityrodia sp. very open herbland and Avena barbata (1-2%) scattered annual grasses to very open annual grassland and Cheilanthes adiantoides very open fernland.

Associated species: Burchardia umbellata, Dichopogon capillipes, Trachymene ornata, Chamaescilla corymbosa var. corymbosa, Tricoryne elatior, Dioscorea hastifolia, Sowerbaea laxiflora.

Condition: Good to very good.

- 1) Unusual area with unknown amount of disturbance; includes small area of old machinery dump.
- 2) Some weeds (especially *Avena barbata* in some areas).
- 3) Include old track. Many trees/shrubs lying on the ground – blown over?

Notes: Very unusual area with herbaceous ground cover (only scattered clumps of low shrubs), lot of Xanthorrhoea drummondii, very few Allocasuarina campestris shrubs except odd individual or few small clumps. Hard to tell if disturbance had a role.

Releve ERR170

Date: 22/12/03

Location: Eastern Ridge.

AMG84: 50J 0407058/UTM 66 22909 (WGS 84; GPS unit).

Site description: Gentle to moderate, east-facing mid to upper slope of low rocky ridge.

Rock type: Chert (mainly).

Vegetation description: Allocasuarina huegeliana (2-3%) scattered low trees over Xanthorrhoea drummondii (4-5%) high open shrubland over Calytrix leschenaultii scattered low shrubs over Lepidosperma sp. (10-12% (15)), Lepidosperma sp. open sedgeland with Stypantra glauca (+), Podolepis lessonii, Gilberta tenuifolia very open herbland and Avena barbata, Briza maxima scattered annual grasses to very open annual grassland and Cheilanthes adiantoides scattered ferns.

Associated species: Acacia acuminata subsp. acuminata, Lepidosperma tenue, Dioscorea hastifolia, Dichopogon capillipes, Dianella revolute var. divaricata, Burchardia umbellata.

Condition: Good. (Quite a lot of weeds).

Releve GHR302

Date: 6/12/04

Location: Near south-east fenceline of Gardener's block.

AMG84: 50J 0408716/UTM 66 17575 (WGS 84; GPS unit).

Site description: Gentle, south-facing lower to mid slope of ridge.

Soil: Gravelly sand (with a few chert pebbles and cobbles).

Rock type: Chert, pebbles and cobbles.

Vegetation description: Allocasuarina huegeliana (50-70%), (Acacia acuminata subsp. acuminata (+)) low open forest over Xanthorrhoea drummondii scattered shrubs over Calytrix leschenaultii scattered low shrubs over Borya sphaerocephala (3-5%), Podolepis canescens (3-5%), Trachymene pilosa open herbland and Neurachne alopecuroidea scattered grasses and open annual grassland.

Associated species: Burchardia umbellata, Avena barbata (+), Olearia dampieri subsp. eremicola (+), Hyalosperma cotula, Eucalyptus loxophleba subsp. loxophleba.

Condition: Excellent (low weed cover).

Releve ATR013Location: Arthur and Rhonda Tonkin's property.MGA94: 407673 mE 6625817 mN (WGS 84; GPS unit).Soil description: Brown sandy loamRock type: ChertVegetation description: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low woodland to low open forest over *Xanthorrhoea drummondii* scattered low shrubs to low open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Austrodanthonia* sp. (specimen ATR13-01), *Neurachne alopecuroidea* scattered grasses.Associated species: **Avena barbata*, *Borya sphaerocephala*, *Cheilanthes distans*, *Dioscorea* sp., *Opercularia vaginata*, *Trymalium ledifolium* var. *rosmarinifolium*, **Ursinia anthemoides*Condition: Good.Fire Age: >10 years.Notes: Photos BM34-36
AhXd1**AhXd.2:** *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Xanthorrhoea drummondii*, (*Allocasuarina campestris*) scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Olearia dampieri* subsp. *eremicola* low open shrubland over scattered sedges and grasses with very open herbland.

This plant community was recorded on rocky slopes and included *Trymalium ledifolium* var. *rosmarinifolium* scattered shrubs to low open shrubland. Releves D1, D2, D4, ERR191 and GHR279.

Releve D1Date: 9/12/04Location: Doblestein's property.AMG84: 50J 0409377/UTM 66 24433 (WGS 84; GPS unit).Site description: Moderate to steep, west-facing slope of low ridge.Rock type: Extensive chert outcropping (chert ridge slope)Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Xanthorrhoea drummondii* scattered tall shrubs to high open shrubland over *Kunzea praestans* scattered shrubs over *Trymalium ledifolium* var. *rosmarinifolium*, *Pityrodia dilatata*, *Acacia lasiocarpa* var. *sedifolia* low open shrubland to low shrubland over *Avena barbata*, *Briza maxima* annual open grassland and *Stypandra glauca*, *Podolepis lessonii* very open herbland and *Cheilanthes adiantoides* scattered ferns and *Neurachne alopecuroidea* scattered native grasses.Associated species: *Dichopogon cap*, *Ehrharta longiflora*, *Austrodanthonia* sp., *Ursinia anthemoides*, *Dioscorea hastifolia*, *Burchardia umbellata*.Condition: Poor (to very poor) annual open grassland.\Notes: Photo:BM12-16Releve D2Date: 9/12/04Location: Doblestein's property.AMG84: 50J 0408955/UTM 66 24373 (WGS 84; GPS unit).Site description: Moderate west-facing slope of low ridge.Rock type: 70% Chert rock outcrop.Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Olearia dampieri* subsp. *eremicola*, *Trymalium ledifolium* var. *rosmarinifolium* scattered low shrubs over *Neurachne alopecuroidea*, *Austrodanthonia* sp. scattered grasses and *Dichopogon capillipes*, *Trachymene pilosa*, *Podolepis*

lessonii very open herbland and Cheilanthes adiantoides very open fernland with Ehrharta longiflora, Avena barbata very open annual grassland.

Associated species: Dioscorea hastifolia, Chamaescilla corymbosa var. corymbosa.

Condition: Good?

Notes: Photo:BM12-19 (looking east)

Releve D4

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0409019/UTM 66 24073 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low ridge.

Rock type: Chert rock (lot of rock outcrop).

Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata scattered low trees to low open woodland over Xanthorrhoea drummondii scattered tall shrubs to high open shrubland over Solanum oldfieldii, Pityrodia dilatata scattered low shrubs over Lepidosperma leptostachyum scattered sedges and Avena barbata open annual grassland with Gilberta tenuifolia (3-5%), Hyalospermum glutinosum ssp. glutinosum, Waitzia nitida open herbland.

Associated species: Dichopogon capillipes, Tricoryne elatior, Opercularia vaginata, Trymalium ledifolium var. rosmarinifolium.

Condition: Poor.

Notes: Photo: BM12-21

Releve ERR191

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407972/UTM 66 23518 (WGS 84; GPS unit).

Site description: Moderate, east-facing rocky mid slope of low rocky ridge

Rock type: Chert. Boulders and rock outcrop about 30-40% surface cover.

Vegetation description: Allocasuarina huegeliana (5-8%) low open woodland over Allocasuarina campestris (1-2%), Melaleuca radula (1%), Xanthorrhoea drummondii (1-2%) high open shrubland to scattered tall shrubs over Olearia dampieri subsp. eremicola (1-2%) scattered shrubs over Calytrix leschenaultii (1%) scattered low shrubs over Lepidosperma tenue (4-5%) very open sedgeland with Gilberta tenuifolia (3-5%), Podolepis lessonii very open herbland and Avena barbata very open annual grassland.

Condition: Good to very good.

Releve GHR279

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408365/UTM 66 17634 (WGS 84; GPS unit).

Site description: Flat crest of low rocky (chert) ridge (elevation 262 m).

Soil: Gravelly brown sand with rocks, boulders and rock outcrop (about 25% surface cover).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (lot of dead trees - possibly old fire) (5%), Acacia acuminata subsp. acuminata (2-3%) low open woodland over Xanthorrhoea drummondii (5-10%), Allocasuarina campestris (+), (Melaleuca radula (+)) high open shrubland over Olearia dampieri subsp. eremicola scattered shrub over Calytrix leschenaultii (1-2%), Trymalium ledifolium var. rosmarinifolium (2-3%) low open shrubland over Lepidosperma sp., Schoenus clandestinus, Neurachne alopecuroidea, Desmocladius flexuosus over Podolepis lessonii (1-2%), Podolepis canescens (5-10%), Goodenia arthrotricha (+), Opercularia vaginata (1-2%) open herbland with Cheilanthes adiantoides scattered ferns and Ehrharta longiflora, Avena barbata open annual grassland.

Associated species: *Pityrodia dilatata*, *Dioscorea hastifolia*, *Waitzia nitida*, *Lawrencella rosea*, *Dianella revoluta* var. *divaricate*
Condition: Good to very good.

AhXd.3: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low woodland to low open forest over *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* scattered low shrubs to low shrubland over scattered grasses/sedges with very open herbland and scattered ferns.
 Releves G334 and RM5.

Releve G334

Date: 18/2/05

Location: Gardiner's property, just east of Morgan's block.

AMG84: 50J 0407062/UTM 66 17515 (WGS 84; GPS unit).

Site description: Gentle, south-east facing slope of low ridge.

Vegetation description: *Allocasuarina huegeliana* (60%), (*Acacia acuminata* subsp. *acuminata* (+)) low open forest over *Xanthorrhoea drummondii* high open shrubland over *Hibbertia subvaginata* scattered low shrubs over **Ehrharta longiflora* **Avena barbata* very open annual grassland.

Condition: Good.

Releve RM5

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408054/UTM 66 22351 (WGS 84; GPS unit).

Site description: Moderate, north-facing lower to mid slope of ridge.

Soil: Gravelly, pebbly, cobbly brown sand in matrix of boulders and rock outcrop.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* (*Pityrodia dilatata* lower on slope) low open shrubland to low shrubland over *Lepidosperma tenue* very open to open sedgeland with *Austrodanthonia caespitosa*, *Neurachne alopecuroidea* scattered grasses with *Hyalosperma cotula*, *Podolepis lessonii*, *Opercularia vaginata* very open herbland and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dioscorea hastifolia*, *Stypanandra glauca*, *Dichopogon capillipes*, *Waitzia nitida*.

Condition: Good to very good.

Notes: Last fire more than 10 years ago.

AhXd.4: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over very open sedgeland/grassland with *Opercularia vaginata* very open herbland to herbland.

This plant community differed by having an *Opercularia vaginata* open herbland. Releves RM1 and RM7.

Releve RM1

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408478/UTM 66 22559 (WGS 84; GPS unit).

Site description: Moderate, west-facing lower to mid slope of ridge.

Soil: Gravelly, pebbly brown sand in matrix of rock outcrops.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Pityrodia dilatata* scattered low shrubs (patches of low open shrubland to low shrubland) over *Austrodanthonia*

caespitosa, Neurachne alopecuroidea very open to open sedgeland and scattered grasses with Opercularia vaginata (10-15%), Stypantra glauca (+), Hyalosperma cotula, Gilberta tenuifolia (1-2%), Podolepis lessonii open herbland and Cheilanthes adiantoides scattered ferns.

Associated species: Dichopogon capillipes, Tricoryne elatior, Dryandra sessilis var. sessilis, Dioscorea hastifolia, Kennedia prostrata, Austrostipa elegantissima.

Condition: Very good (low weed cover).

Notes: Similar to sites D4 and D7. Photo: BM12-23 (looking SW)

Releve RM7

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408145/UTM 66 22208 (WGS 84; GPS unit).

Site description: Moderate, east-facing slope of low ridge.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low open woodland over (Allocasuarina campestris scattered tall shrubs) over Xanthorrhoea drummondii scattered tall shrubs over Lepidosperma tenue open sedgeland with Opercularia vaginata very open herbland to herbland.

Associated species: Waitzia nitida, Podolepis lessonii, Neurachne alopecuroidea.

Condition: Good to very good.

Notes: Fire > 7 years.

AhXd.5: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low woodland to low open forest over Xanthorrhoea drummondii high open shrubland over Neurachne alopecuroidea scattered grasses.

Releve: ATR010

Releve ATR010

Date: 12/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408106 mE 6627865 mN (WGS 84; GPS unit).

Site description: Moderate west facing mid to upper slope of ridge.

Soil description: Brown sand.

Rock type: Chert

Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low woodland to low open forest over Xanthorrhoea drummondii high open shrubland over Neurachne alopecuroidea scattered grasses.

Associated species: *Avena barbata, Crassula colorata var. acuminata, Dioscorea sp., *Ehrharta longiflora, Lawrencella rosea, *Pentastichis airoides, Thysanotus manglesianus, *Ursinia anthemoides, Wahlenbergia gracilentia

Condition: Poor

Fire Age: >10 years.

Notes: Photos BM30-32. NB: this similar to unit AhXd1. The eastern side of this ridge has Xanthorrhoea drummondii as scattered shrubs.

Vegetation Alliance 10: Casuarina obesa open forest

Vegetation Association Co: Casuarina obesa open forest.

Plant Communities:

Co.1: See the vegetation description for releve SWR258 below.

Relevés SWR258, ATR009

Releve SWR258

Date: 15/1/04

Location: Stan Ridgeway's property (West).

AMG84: 50J 0408022/UTM 66 25166 (WGS 84; GPS unit).

Site description: Flats at base of low rocky ridge (elevation 223 m).

Soil: Brown clayey loam.

Vegetation description: Casuarina obesa (10-12 m) (30-40%) open forest over (80-90%) closed annual grassland.

Associated species:

Condition: Probably very poor to degraded (very high weed cover and signs of very intense stock use).

Releve ATR009

Date: 12/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408501 mE 6627666 mN (WGS 84; GPS unit).

Site description: Low lying area (depression) on valley floor.

Soil description: Pale grey-brown, light clay (sampled)

Vegetation description: Casuarina obesa low open forest over annual weed closed grassland.

Condition: Very Poor-Completely Degraded.

Fire Age: >7-10 years.

Notes: Photos BM29. ATR09 similar to Co.

Vegetation Alliance 11: Acacia acuminata low woodlands to low open forests

Vegetation Association Aa: *Acacia acuminata* subsp. *acuminata* low open forest over scattered grasses sedges and very open herbland.

Plant Communities:

Aa.1: *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Cheilanthes adiantoides* very open fernland and *Hypoxis* sp., *Gilberta tenuifolia*, *Podolepis lessonii* open annual herbland.

Quadrats JT12 and SW1. Relevés SWR251, SWR259, GHR263 and RM4.

Releve SWR251

Date: 13/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408719/UTM 66 25196 (WGS 84; GPS unit).

Site description: West-facing lower slope of low rocky ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (30-40%) low open forest over *Podolepis lessonii* (10-15%), *Crassula colorata* open herbland and *Avena barbata*, *Pentastichis pallida*, *Ehrharta longiflora* very open to open annual grassland.

Associated species: *Dichopogon capillipes*.

Condition: Poor to good.

Releve SWR259

Date: 15/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0407934/UTM 66 25178 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope on low rocky ridge (elevation 223 m).

Soil: Gravelly, pebbly brown sand with rocks and boulders.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (20-25%) low woodland over *Austrostipa nitida*, *Schoenus clandestinus* (+) scattered sedges/grasses with *Podolepis lessonii* (2-3%), *Waitzia nitida* (1-2%), *Crassula colorata* (+) very open herbland and *Cheilanthes adiantoides*

scattered ferns and *Avena barbata*, *Hypochaeris glabra*, *Pentaschistis pallida* (total cover 15-20%) open annual grassland/herbland.

Associated species: *Dichopogon capillipes*.

Condition: Poor to good (quite high weed cover and hard to find *Cheilanthes adiantoides*, *Crassula* etc).

Notes: Similar to SWR 251.

Releve GHR263

Date: 15/1/04

Location: Gardiner's hill.

AMG84: 50J 0408400/UTM 66 17196 (WGS 84; GPS unit).

Site description: Very gentle, south-east facing ridge top of low rocky rise (elevation 248 m).

Rock type: Coomberdale Chert

Vegetation description: *Acacia acuminata* subsp. *acuminata* (2-5%) low open woodland over *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Waitzia nitida* (+), *Borya sphaerocephala* (2-5%), *Podolepis lessonii* (+) very open herbland to open herbland with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Vulpia myuros* var. *hirsuta* very open annual grassland.

Associated species: *Dichopogon capillipes*.

Condition: Good – quite a lot of weeds but still good herb layer.

Releve RM4

Date: 10/12/04

Photo: BM13-2

Location: Ron Manning's property.

AMG84: 50J 0408667/UTM 66 22642 (WGS 84; GPS unit).

Site description: Gentle, north-facing slope of ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* low woodland over *Schoenus clandestinus* open sedge land and *Austrodanthonia* sp. *Neurachne alopecuroidea*, *Avena barbata* scattered grasses with *Borya sphaerocephala* (1-2%), *Waitzia nitida*, *Gilberta tenuifolia*, *Podolepis lessonii* open herbland.

Condition: Good to very good.

Aa.2: *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* scattered tall shrubs over scattered sedges/ with *Gilberta tenuifolia*, *Podolepis lessonii*, *Waitzia nitida* open herbland and *Cheilanthes adiantoides* very open fernland.

This plant community was distinguished by having a *Xanthorrhoea drummondii* high open shrubland. Releves D3, D5, NBPD1 and NBPD2.

Releve D3

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0408991/UTM 66 24168 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low ridge.

Rock type: Chert – rocky with considerable outcropping (greater than 10 %).

Vegetation description: *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Schoenus clandestinus* scattered sedges and *Avena barbata* very open annual grassland with *Borya sphaerocephala*, *Gilberta tenuifolia* (10-15%), *Podolepis lessonii*, *Waitzia nitida* over open herbland and *Cheilanthes adiantoides* very open fernland.

Associated species: *Austrostipa* sp., *Tricoryne elatior* (+), *Dichopogon capillipes*, *Comesperma integerrimum*, *Austrodanthonia* sp., *Allocasuarina huegeliana*, *Eucalyptus loxophleba* subsp. *loxophleba*.

Condition: Good.

Notes: Photo BM12-20

Releve D5

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0409028/UTM 66 24032 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of ridge.

Rock type: 70% rock cover (chert) of surface, including > 40% rock outcrop.

Vegetation description: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low open woodland over *Xanthorrhoea drummondii* high open shrubland over *Lepidosperma leptostachyum* open sedgeland over *Avena barbata* very open to scattered annual grasses with *Podolepis lessonii*, *Gilberta tenuifolia*, *Waitzia nitida* very open to open herbland.

Condition: Good.

Notes: Similar to and just south of site D4.

Notes: Photo_BM12-22

Releve: NBPD1

Date: 12/04

Location: Doblestein's property.

AMG84: 50J 0409333/UTM 66 23991 (WGS 84; GPS unit).

Site description: Low chert ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* high open shrubland over some remnant low shrubs and herbs (*Pityrodia dilatata*, *Opercularia vaginata*) and annual grasslands.

Associated species: *Hibbertia subvaginata*.

Condition: Very poor.

Notes: Disturbed Remnant: can't identify original vegetation type. Photo: BM12-14 (looking south)

Releve NBPD2

Date: 12/04

Location: Doblestein's property.

AMG84: 50J 0409493/UTM 66 24381 (WGS 84; GPS unit).

Site description: Crest and slopes of low chert ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* high open shrubland to scattered tall shrubs over *Avena barbata*, *Ehrharta longiflora*, *Briza maxima* annual grassland and *Ptilotus drummondii* var. *drummondii*, *Waitzia nitida*, *Lawrencella rosea* open herbland.

Associated species: Also *Austrostipa* sp., *Austrodanthonia* sp., *Cheilanthes adiantoides*, *Podolepis lessonii*, *Neurachne alopecuroidea*, *Chamaescilla corymbosa* var. *corymbosa*, *Brunonia australis*.

Condition: Poor to very poor. Number of daisy herbs and native grasses and other herbs still remain.

Notes: A disturbed Remnant: The same as the *Acacia acuminata* subsp. *acuminata* vegetation unit.

Some York gum scattered round lower slopes. Photo: BM12-15

Aa.3: *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) low open woodland to low open forest over scattered sedges/grasses/herbs and *Cheilanthes adiantoides* scattered ferns.

This plant community was distinguished by having *Allocasuarina huegeliana* present in the tree layer. Releves ERR174 and SWR237.

Releve ERR174

Date: 23/12/03

Location: Eastern Ridge.

AMG84: 50J 0408075/UTM 66 22787 (WGS 84; GPS unit).

Site description: Gentle, east-facing lower slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (3-5%), (*Allocasuarina huegeliana* (+)) scattered low trees to low open woodland over *Neurachne alopecuroidea*, *Schoenus clandestinus* scattered sedges/grasses and *Borya sphaerocephala* (5-10%), *Eremophyllum tenellum* (3-5%) open herbland with *Avena barbata*, *Briza maxima* very open to open annual grassland.

Condition: Poor to good. Unsure of extent of physical disturbance.

Releve SWR237

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408963/UTM 66 24981 (WGS 84; GPS unit).

Site description: Rocky boulder outcrop (70-80% surface cover) *Calandrinia* sp. chert ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (40-50%), (*Allocasuarina huegeliana*) low open forest over *Crassula colorata*, scattered herbs and *Cheilanthes adiantoides* scattered ferns with *Ehrharta longiflora*, *Avena barbata*, *Pentastichis pallida* very open weedland.

Condition: Poor – very weedy between the rocks.

Vegetation Association AaAc: *Acacia acuminata* subsp. *acuminata* low woodland over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over very open herbland.

Plant Communities:

AaAc.1: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland to low open forest over *Allocasuarina campestris* high shrubland over annual grassland.

This plant community differed by having *Allocasuarina huegeliana* present in the tree layer.

Releve N13.

Releve N13

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409313/UTM 66 25046 (WGS 84; GPS unit).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (30-40%), *Allocasuarina huegeliana* (2-4%) low woodland to low open forest over *Allocasuarina campestris* (15-30%) high shrubland over *Avena barbata*, *Bromus diandrus* annual grassland.

Condition: Very poor – couldn't see any herb/sedge natives in this area.

AaAc.2: *Acacia acuminata* subsp. *acuminata* (10-15 (30%)) low woodland to low open forest over *Allocasuarina campestris* ((+) 5-10%) scattered tall shrubs to high open shrubland over scattered grasses with very open herbland and *Cheilanthes adiantoides* scattered ferns.

Relevés CR8, CR54, JTR225 and G331.

Releve CR8

Date: 8/11/03

Location: South-east corner of Cairn Hill.

AMG84: 50J 0407924/UTM 66 20114 (WGS 84; GPS unit).

Site description: Gentle to moderate steep banks and adjacent slope of creek.

Soil: Brown sandy loam (surface).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (40%) low open forest over *Allocasuarina campestris* (1-2 (10%)) scattered tall shrubs to high open shrubland over *Cheilanthes adiantoides* (3-5%) very open fernland and *Schoenus clandestinus*, *Austrodanthonia acerosa*, *Austrostipa eremophila* scattered grasses/sedges with *Waitzia nitida* (3-5 to 10%), *Opercularia vaginata* (2-5%), *Ptilotus declinatus* (1-2%) open herbland.

Condition: Very good.

Releve CR54

Date: 23/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407710/UTM 66 21424 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing lower slope of low broad rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (30-40%) low open forest over *Allocasuarina campestris* scattered tall shrubs over *Austrodanthonia scabra*, *Neurachne alopecuroidea* scattered grasses with *Podolepis canescens* (50%) very open herbland.

Associated species: *Trachymene cyanopetala*, *Lomandra effusa*, *Dichopogon capillipes*.

Notes: Similar unit to CR8.

Releve JTR225

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408972/UTM 66 26462 (WGS 84; GPS unit).

Site description: Gentle, west-facing upper slope (from edge of crest) on low rocky ridge (elevation 283 m).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-15 (30%)) low woodland over *Allocasuarina campestris* ((+) 5-10%) high open shrubland over *Borya sphaerocephala* (+), *Podolepis lessonii* (3-5%), *Gilberta tenuifolia* very open herbland with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Pentaschistis pallida*, *Ehrharta longiflora* annual grassland (patchy).

Condition: Good (lot of weed cover, competing with herb layer).

Notes: Similar to JT12.

Releve G331

Date: 17/2/05

Location: Gardiner's property.

AMG84: 50J 0407398/UTM 66 18495 (WGS 84; GPS unit).

Site description: Moderate, south-facing slope of low ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (30-40%) low open forest over *Allocasuarina campestris* scattered tall shrubs over **Avena barbata* open grassland.

AaAc.3: *Acacia acuminata* subsp. *acuminata* (30-40%), (*Allocasuarina huegeliana*) (3-5%) low woodland to low open forest over *Allocasuarina campestris* (2-3%), *Xanthorrhoea drummondii* (+) high open shrubland over scattered sedges/grasses/herbs with *Cheilanthes adiantoides* scattered ferns.

This plant community was distinguished by having *Allocasuarina huegeliana* present in the tree layer and a *Xanthorrhoea drummondii* high open shrubland.

Relevés CNR100 and SWR208.

Releve CNR100

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407705/UTM 66 21999 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing lower slope of low rocky rise.

Soil: Gravelly, pebbly, cobbly brown sand amongst rocks and outcrop (~ 1-5% cover).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (20-40%), *Allocasuarina huegeliana* (2-3%) low open forest over *Allocasuarina campestris* ((3) 5-10%), *Xanthorrhoea drummondii* scattered shrubs over *Schoenus clandestinus* (1-2%), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Gilberta tenuifolia* (3-5%) very open herbland and *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Baeckea* sp. *Moora* (R. Bone 1993/1), *Dichopogon capillipes*, *Stypandra glauca*, *Thysanotus manglesianus*, *Tricoryne arenicola*.

Condition: Good (some weeds).

Releve SWR208

Date: 9/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409249/UTM 66 25209 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand (NT).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (30-40%), *Allocasuarina huegeliana* (3-5%) low woodland to low open forest over *Allocasuarina campestris* (2-3%), *Xanthorrhoea drummondii* (+) high open shrubland over *Borya sphaerocephala* (+), *Crassula colorata* var. *colorata* scattered herbs with *Cheilanthes adiantoides* scattered ferns and *Avena barbata* and *Parentucellia latifolia* scattered annual scattered grasses/herbs.

Associated species: *Podolepis lessonii*.

Condition: Good to very good – possibly signifying grazing effects on herb layer.

Notes: - >10 dead *Xanthorrhoea drummondii* within 15m radius.

Vegetation Association AaDs: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Dryandra sessilis* var. *sessilis* (*Xanthorrhoea drummondii*) scattered tall shrubs over very open herbland.

Plant Communities:

AaDs.1: *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) low woodland to low open forest over *Dryandra sessilis* var. *sessilis*, (*Xanthorrhoea drummondii*) scattered tall shrubs over scattered grasses with very open herbland and *Cheilanthes adiantoides* scattered ferns.

Relevés SWR227, SWR261 and N18.

Releve SWR227

Date: 11/1/04

Location Ridgeways East.

AMG84: 50J 0409089/UTM 66 24992 (WGS 84; GPS unit).

Site description: Moderate, east-facing rocky mid slope of low rocky ridge.

Soil: as per site R226.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-15%), (*Allocasuarina huegeliana*) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over *Trymalium ledifolium* var. *rosmarinifolium* scattered low shrubs over *Cheilanthes adiantoides* very open fernland and *Avena barbata*, *Ursinia anthemoides*, *Hypochaeris glabra*, *Ehrharta longiflora* (Total =5-10%) very open annual grassland/herbland.

Associated species: *Diplopeltis huegelii* ssp. *lehmannii* (small shrub to 40 cm (grazed); on border with next unit north).

Condition: Good.

Releve SWR261

Date: 15/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0407858/UTM 66 25165 (WGS 84; GPS unit).

Site description: Gentle, south-east facing upper slope of low rocky ridge (elevation 227 m).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (20-30%), *Allocasuarina huegeliana* (5-10%) low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Austrostipa nitida* scattered grasses with *Podolepis lessonii* very open herbland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Ursinia anthemoides*, *Briza maxima* open annual grassland/herbland.

Associated species: *Waitzia nitida*, *Trachymene cyanopetala*, *Phyllangium paradoxum*.

Condition: Very poor to poor (to good).

Notes: Similar to N18.

Releve N18 SW

Date: 10/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409378/UTM 66 24929 (WGS 84; GPS unit).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (40-50%), *Allocasuarina huegeliana* (5-10%), (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over annual grassland/herbland.

AaDs.2: See the vegetation description for releve CR88 below.

This plant community was distinguished by the presence of an *Opercularia vaginata* herbland.

Releve CR88.

Releve CR88

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406930/UTM 66 21600 (WGS 84; GPS unit).

Site description: Gentle, north-east facing lower slope near end of low rocky ridge.

Soil: Very gravelly, pebbly brown sand with some small boulders (30-40 cm diameter).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (15-25%), *Allocasuarina huegeliana* (15-20%) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (3%) scattered shrubs over *Opercularia vaginata* (10-15%), *Lawrencella rosea* (5-10%) open herbland to herbland.

Associated species: *Podolepis canescens*, *Blennospora drummondii*, *Dichopogon capillipes*, *Cheilanthes adiantoides*, *Ptilotus polystachyus*.

Notes: Similar to creek unit CR8.

Vegetation Association AaDsKp: *Acacia acuminata* subsp. *acuminata* low woodland over *Dryandra sessilis* var. *sessilis* (*Xanthorrhoea drummondii*) scattered tall shrubs over *Kunzea praestans* scattered tall shrubs to high open shrubland over very open herbland.

Plant Communities:

AaDsKp.1: See the vegetation description for releve JTR249 below.

This plant community had *Hibbertia vaginata* scattered low shrubs.

Releve JTR249.

Releve JTR249

Date: 13/1/04

Location: John Tonkin's property.

AMG84: 50J 0409178/UTM 66 27211 (WGS 84; GPS unit).

Site description: Very gentle, south-facing slope along top of low rocky ridge.

Rock type: chert

Vegetation description: *Acacia acuminata* subsp. *acuminata*, *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* (3-5%) high open shrubland over *Xanthorrhoea drummondii* (2-3%), *Kunzea praestans* (+) high open shrubland over *Hibbertia subvaginata* (+), *Acacia restiacea* scattered low shrubs over *Avena barbata*, *Hypochaeris glabra* closed annual grassland/herbland.

Condition: Poor to very poor.

AaDsKp.2: See the vegetation description for releve SWR230 below.

This plant community had a *Melaleuca calyptroides* open shrubland.

Releve SWR230.

Releve SWR230Date: 11/1/04Location: Stan Ridgeway's property (East).AMG84: 50J 0409010/UTM 66 25195 (WGS 84; GPS unit).Site description: Very gentle, west-facing upper slope of low rocky ridge (elevation 250 m).Soil: Gravelly, pebbly brown sand with rocks, boulders and outcrop (~5-10%).Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-20%), *Allocasuarina huegeliana* (2-3%) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (4-5%), (*Allocasuarina campestris* (+)) high open shrubland over *Melaleuca calyptroides* (3-5%) open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus* (1%) scattered sedges with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Ehrharta longiflora*, *Vulpia myuros* var. *hirsuta* (Total =10-20%) annual open grassland to grassland.Associated species: *Xanthorrhoea drummondii*, *Olearia dampieri* subsp. *eremicola*.Condition: Good to very good (high weed cover).**Vegetation Association AaEI:** *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* low woodland to low open forest over very open grassland/herbland.Plant Communities:**AaEI.1:** See the vegetation description for releve G342 below.This plant community had scattered *Xanthorrhoea drummondii* and *Olearia dampieri* subsp. *eremicola* in the shrub layer.

Releve G342.

Releve G342Date: 18/2/05Location: Phil & Jenny Gardiner's property.AMG84: 50J 0408142/UTM 66 17844 (WGS 84; GPS unit).Site description: Crest and upper slopes of small, high rocky ridge.Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-15%), *Eucalyptus loxophleba* subsp. *loxophleba* (5-6%), *Allocasuarina huegeliana* (+) low woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Olearia dampieri* subsp. *eremicola* scattered shrubs over *Gilberta tenuifolia* very open herbland and **Avena barbata* very open grassland.Condition: Good – very good.**AaEI.2:** *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* low open forest over open annual grassland/herbland.

Releve SWR217.

Releve SWR217Date: 10/1/04Location: Stan Ridgeway's property (East).AMG84: 50J 0409389/UTM 66 24865 (WGS 84; GPS unit).Site description: Moderate, mid slope, north-east facing, of low rocky ridge (elevation 238 m).Soil: Gravelly, pebbly brown loamy sand with boulders and rock outcrop (about 50% surface cover).Rock type: Chert.Vegetation description: *Acacia acuminata* subsp. *acuminata* (40-50%), *Eucalyptus loxophleba* subsp. *loxophleba* (5%) low open forest over *Avena barbata*, *Hypochaeris glabra*, *Ehrharta longiflora*, *Briza maxima* (5-10%) open annual grassland/herbland.**AaEI.3:** *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low open woodland over *Allocasuarina campestris* scattered tall shrubs over open herbland and very open annual grassland.This plant community was distinguished by the *Allocasuarina campestris* scattered tall shrubs layer.

Relevés ERR149 and GHR268.

Releve ERR149

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407845/UTM 66 24674 (WGS 84; GPS unit).

Site description: Gentle, west-facing upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop (80% surface cover).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (5 m, 10-15%) low woodland over *Allocasuarina campestris* scattered tall shrubs over *Austrostipa nitida*, *Avena barbata* (1-2%), *Ehrharta longiflora* (3-5%), *Austrodanthonia acerosa* (1-2%) very open annual grassland/grassland, *Lawrencella rosea*, *Podolepis lessonii* very open herbland with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Trachymene ornata*, *Dichopogon capillipes*, *Eucalyptus loxophleba* subsp. *loxophleba*, *Rhodanthe polycephala*, *Phyllangium paradoxum* (15 cm).

Condition: Good – high weed cover – *Avena barbata*, *Ehrharta longiflora*.

Releve GHR268

Date: 15/1/04

Location: Gardiner's hill.

AMG84: 50J 0408390/UTM 66 17403 (WGS 84; GPS unit).

Site description: Gentle, north-west facing lower slope of low rocky rise (elevation 242 m).

Rock type: Chalky sand stone.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (8-10%), *Eucalyptus loxophleba* subsp. *loxophleba* (+) low open woodland over (*Allocasuarina campestris* (+) scattered shrubs) over *Eremophyllum tenellum* (3-5%), *Gilberta tenuifolia* (2-3%), *Podolepis lessonii* (+), *Waitzia nitida* (+), *Borya sphaerocephala* (3-5%) open herbland and *Vulpia myuros* var. *hirsuta*, *Avena barbata*, *Pentastichis pallida* scattered annual grasses (open annual grassland adjacent to unit R266).

Associated species: *Allocasuarina huegeliana*.

Condition: Very good in places to good to poor (more weed cover on edge of unit).

Notes: = to R263.

Vegetation Association AaHr: *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees over *Hakea recurva* subsp. *recurva* scattered tall shrubs to high open shrubland over very open herbland.

Plant Communities:

AaHr.1: *Acacia acuminata* subsp. *acuminata* low open woodland over *Hakea recurva* ssp. *recurva* (2-3%) scattered tall shrubs to high open shrubland over very open sedgeland/annual grassland/grassland with *Borya sphaerocephala*, *Eremophyllum tenellum*, *Waitzia nitida* open herbland and very open *Cheilanthes adiantoides* fernland.

Relevés SWR257, GHR264 and GHR277

Releve SWR257

Date: 14/11/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408700/UTM 66 25016 (WGS 84; GPS unit).

Site description: Gentle, south-west facing slope on very low rocky rise.

Soil: Gravelly reddish – brown sandy loam.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (5-10%) low open woodland over *Hakea recurva* ssp. *recurva* (3-4 m) scattered tall shrubs over *Avena barbata*, *Pentastichis pallida*, *Hypochaeris glabra* very open annual grassland/herbland.

Condition: Poor to very poor.

Notes: See N25

Releve GHR264Date: 15/1/04Location: Gardiner's hill.AMG84: 50J 0408391/UTM 66 17221 (WGS 84; GPS unit).Site description: Very, very gentle, north-west facing slope just off west of low rocky rise (adjacent to flow line) (elevation 250 m).Soil: Gravelly brown loamy sand with rock outcrop (about 5% surface cover).Vegetation description: *Acacia acuminata* subsp. *acuminata* (5-8%) low open woodland over *Hakea recurva* ssp. *recurva* scattered tall shrubs over *Lepidosperma tenue* (10-15%), (*Austrodanthonia caespitosa*, *Neurachne alopecuroidea*) open sedgeland/grassland with *Caesia* sp. *Moora* (1%), *Borya sphaerocephala* (5-10%), *Eremophyllum tenellum* (1-2%), *Waitzia nitida* (+), *Podolepis lessonii* (1-2%) open herbland and *Cheilanthes adiantoides* very open fernland.Notes: High lichen cover of ground amongst patches of *Lepidosperma tenue*.Releve GHR277Date: 16/1/04Location: Gardiner's hill.AMG84: 50J 0408435/UTM 66 17343 (WGS 84; GPS unit).Site description: Gentle, west-facing slope of low rise.Rock type: Shaley rock ?Vegetation description: *Acacia acuminata* subsp. *acuminata* (3-5%) (NB: numerous dead trees still standing), (*Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees to low open woodland over *Hakea recurva* ssp. *recurva* (2-3%) high open shrubland over *Austrostipa tricophylla*, *Neurachne alopecuroidea*, *Schoenus clandestinus* very open sedges/grassland with *Waitzia nitida* (2-5%), *Eremophyllum tenellum* (1-2%), *Ptilotus drummondii* var. *drummondii* (+), *Borya sphaerocephala* (2-3%) open herbland and *Cheilanthes adiantoides* (2-5%) very open fernland.Associated species: *Stenanthemum tridentatum*.Condition: Very good (good cover of natives and only a few weeds).Notes: Similar to 263.**AaHr.2:** See the vegetation description for releve GHR265 below.This plant community differed by having an *Allocasuarina campestris* scattered tall shrubs component and a *Dodonaea pinifolia* low open shrubland over *Stenanthemum tridentatum* scattered low shrubs.

Releve GHR265.

Releve GHR265Date: 15/1/04Location: Gardiner's hill.AMG84: 50J 0408372/UTM 66 17262 (WGS 84; GPS unit).Site description: Gentle, north-east facing slopes adjacent to drainage line (elevation 253 m NB: lower by 1-2 m than R264!).Rock type: Coomberdale Chert (laterite on west side up slope with York gum on it)Vegetation description: *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees over *Hakea recurva* ssp. *recurva*, (*Allocasuarina campestris*) scattered tall shrubs over *Dodonaea pinifolia* (on laterite?) (2-3%) low open shrubland, *Stenanthemum tridentatum* (12 cm, grazed) (+) over *Lepidosperma* sp., *Austrodanthonia caespitosa*, *Schoenus clandestinus* (2-3%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Eremophyllum tenellum* (3-5%), *Waitzia nitida* (2-3%), *Borya sphaerocephala* (1-2%) very open herbland to open herbland and *Cheilanthes adiantoides* scattered ferns.Associated species: *Melaleuca radula*, *Gastrolobium obovatum* (35 cm), *Austrostipa elegantissima* (60 cm), *Blennospora drummondii*, *Caesia* sp. *Moora*.Condition: Very good (low weed cover).Notes: Small unit and not very 'fine'.

Vegetation Association AaHs: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low woodland over *Allocasuarina campestris* scattered tall shrubs over *Hibbertia subvaginata* low open shrubland to low shrubland.

Plant Communities:

AaHs.1: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low woodland over *Allocasuarina campestris* scattered tall shrubs over *Hibbertia subvaginata* low open shrubland to low shrubland over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses/herbs with *Cheilanthes adiantoides* scattered ferns.

There was one plant community in this vegetation association. It was only recorded on the Eastern Ridge.

Relevés ERR139 and ERR164.

Releve ERR139

Date: 8/12/03

Location: Eastern Ridge.

AMG84: 50J 0407621/UTM 66 24633 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of very low rocky ridge.

Soil: Gravelly, pebbly, cobbly bouldery brown sand amongst outcrop (~ 20-30% of surface).

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris* scattered tall shrubs over *Hibbertia subvaginata* (6-7%) low open shrubland (about 90 cm) over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stypandra glauca* (2-3%) very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Podolepis lessonii*, *Acacia aristulata*, *Chamaescilla corymbosa* var. *corymbosa*.

Note: Similar to ERG10.

Releve ERR164

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407815/UTM 66 23950 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing, shoulder of ridge top (upper slope).

Soil: Gravelly, pebbly, cobbly brown sand (NT) amongst boulders and outcrop (rock cover ~ 70%).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (15-20%), *Allocasuarina huegeliana* (2-3%) low woodland over (*Allocasuarina campestris* (2-3%) high open shrubland to high shrubland) over *Hibbertia subvaginata* (15-20%), (*Calytrix leschenaultii* (+), *Trymalium ledifolium* var. *rosmarinifolium* (1%)) low shrubland over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Burchardia umbellata*, *Thysanotus dichotomus*, *Trymalium ledifolium* var. *rosmarinifolium*, *Dioscorea hastifolia*, *Dichopogon capillipes*, *Trachymene pilosa*, *Chamaescilla corymbosa* var. *corymbosa*, *Pityrodia dilatata*, *Dryandra sessilis* var. *sessilissil*.

Condition: Very good (low weed cover).

Notes: AMG84: 50J 0407842/UTM 66 23815 (WGS 84; GPS unit). Low woodland varies to *Allocasuarina huegeliana* (10-20%), *Acacia acuminata* subsp. *acuminata* (3-5 %).

Vegetation Association AaKp: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs to high open shrubland over very open herbland.

Plant Communities:

AaKp.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs (at top of breakaway) over *Pityrodia dilatata* scattered low shrubs over *Stypandra glauca* open herbland and annual open grassland. Quadrat ERG15.

AaKp.2: See the vegetation description for releve SWR233 below.

This plant community was differentiated by having *Allocasuarina campestris* and *Xanthorrhoea drummondii* in the high open shrubland layer.

Releve SWR233.

Releve: SWR233

Date: 11/11/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409097/UTM 66 25187 (WGS 84; GPS unit).

Site description: Moderate to steep, east-facing, rock mid slope of low rocky ridge (Elevation – 247 m).

Soil: Gravelly brown sand amongst boulders and rocky outcrop.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (15-20%) (*Allocasuarina huegeliana* (+)) low woodland over *Kunzea praestans* (1-3%), *Allocasuarina campestris* (5-6%), *Xanthorrhoea drummondii* (2-3%) high open shrubland over *Lepidosperma tenue*, *Desmocladus flexuosus* (1%) scattered sedges with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Briza maxima*, *Hypochaeris glabra* annual grassland/herbland.

Associated species: *Podolepis lessonii*, *Dichopogon capillipes*, *Austrostipa* sp.

Vegetation Association AaMcor: (*Eucalyptus wandoo* scattered trees) over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca coroncarpa* low open shrubland over very open herbland.

Plant Communities:

AaMcor.1: See the vegetation description for releve N26 below.

Releve N26.

Releve N26

Date: 1/12/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408286/UTM 66 17056 (WGS 84; GPS unit).

Site description: Small laterite ironstone area (disturbed?).

Vegetation description: (*Eucalyptus wandoo* subsp. *wandoo* scattered low trees) over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca coroncarpa* low open shrubland over *Austrodanthonia caespitosa* very open grassland.

Vegetation Association AaMr: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Melaleuca radula* scattered tall shrubs to high shrubland.

Plant Communities:

AaMr.1: See the vegetation description for releve CR53 below.

This plant community had an *Allocasuarina campestris* high shrubland strata.

Releve CR53.

Releve CR53

Date: 23/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407699/UTM 66 21384 (WGS 84; GPS unit).

Site description: Gentle east facing mid slope of a low broad ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (15%), *Allocasuarina huegeliana* (5%) low woodland over *Allocasuarina campestris* (10-15%) high shrubland over *Melaleuca radula* (1.5m, 15-20%) shrubland over *Neurachne alopecuroidea* scattered grasses with *Opercularia vaginata*, *Dichopogon capillipes* scattered herbs.

Associated species: *Trachymene pilosa*, *Desmocladius flexuosus*, *Austrostipa elegantissima*, *Podolepis lessonii*.

AaMr.2: (*Eucalyptus wandoo* subsp. *wandoo* scattered low trees) over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca radula* scattered shrubs over *Schoenus clandestinus* open sedgeland/grassland with *Borya sphaerocephala* very open herbland and *Cheilanthes adiantoides* very open fernland.
Releves CR14 and GHR278.

Releve CR14

Date: 8/11/03

Location: Cairn Hill (east-south-east boundary).

AMG84: 50J 0407922/UTM 66 20234 (WGS 84; GPS unit).

Site description: Moderately sloping, south-east-facing mid to lower slope of lower ridge.

Soil: Gravelly grey-brown sand.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (1-2% to 5%) scattered low trees to low open woodland over *Acacia acuminata* subsp. *acuminata* (20-30%), *Allocasuarina huegeliana* (20-30%) low woodland over *Melaleuca radula* (2-3 m, +) scattered shrubs over *Calytrix leschenaultii* scattered low shrubs over *Cheilanthes adiantoides* (dead, 5-10 to 20-30%) open fernland and *Schoenus clandestinus* (1-2%), *Neurachne alopecuroidea* scattered grasses/sedges with *Lomandra effusa* (1-2%), *Opercularia vaginata* (3-5%), *Borya sphaerocephala* (5-10%) open herbland.

Associated species: *Glischrocaryon flavescens*, *Chamaescilla corymbosa* var. *corymbosa*, *Trachymene ornata*, *Caesia alfordii*, *Waitzia nitida*, *Stylidium septentrionale*.

Condition: Very good (some weeds especially *Ursinia anthemoides*).

Notes: Includes more open woodland with *Allocasuarina campestris* high open scrub to open scrub.

Releve GHR278

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408379/UTM 66 17494 (WGS 84; GPS unit).

Site description: Moderate, south-facing mid slope at end of low rocky ridge (elevation 249 m).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca radula* scattered shrubs over *Schoenus clandestinus* (1%), *Lepidosperma tenue* (25-30%), *Neurachne alopecuroidea* open sedgeland/grassland with *Borya sphaerocephala* very open herbland and *Cheilanthes adiantoides* very open fernland.

Associated species: *Waitzia nitida*, *Caesia* sp. *Moora*, *Calandrina* sp., *Sollya heterophylla* (edge), (*Eucalyptus wandoo* subsp. *wandoo*), *Eucalyptus loxophleba* subsp. *loxophleba*.

Condition: Very good.

Notes: Similar to R264.

Vegetation Association AaTl: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Trymalium ledifolium* var. *rosmarinifolium* open shrubland.

Plant Communities:

AaTl.1: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Trymalium ledifolium* var. *rosmarinifolium* open shrubland over *Neurachne alopecuroidea* scattered grasses and *Cheilanthes adiantoides* open fernland with *Schoenia cassiniana*, *Podolepis lessonii* annual herbland.

Quadrat GH5.

Vegetation Alliance 12: *Banksia prionotes* scattered low trees.

Vegetation Association Bp: *Banksia prionotes* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland.

Plant Communities:

Bp.1: (*Banksia prionotes*), *Acacia acuminata* subsp. *acuminata* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Xanthorrhoea drummondii*, *Allocasuarina campestris* scattered tall shrubs over *Baekkea crispiflora* var. *tenuior*, *Hakea lissocarpha* scattered low shrubs over annual grassland.

This plant community was recorded near the head of a gully between low ridges.

Releve CH314.

Releve CH314

Date: 12/12/04

Location: Kim Chester's property.

AMG84: 50J 0408310/UTM 66 20042 (WGS 84; GPS unit).

Site description: Very gentle, south-facing slope of drainage line between low ridges.

Soil: Pale grey sand.

Vegetation description: (*Banksia prionotes*), *Acacia acuminata* subsp. *acuminata* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Xanthorrhoea drummondii*, *Allocasuarina campestris*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo scattered tall shrubs over *Calytrix leschenaultii*, *Baekkea crispiflora* var. *tenuior*, *Hakea lissocarpha* scattered low shrubs over *Vulpia myuros* var. *hirsuta*, *Pentaschistis pallida*, *Avena barbata* annual grassland.

Associated species: *Eremaea beaufortoides* aff. var. *lachnosanthe* (small fruit form), *Erodium* sp., *Calytrix strigosa*.

Condition: Poor to very poor.

Notes: Fire > 10 years.

Bp.2: *Banksia prionotes* scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Leptospermum erubescens*, *Grevillea amplexicans* ssp. *semivestita*, *Kunzea praestans* high shrubland over *Calytrix leschenaultii* scattered low shrubs over open (annual) grassland and *Podolepis lessonii* very open herbland.

This plant community was recorded on the crest of a low rise. It included a *Leptospermum erubescens*, *Grevillea amplexicans* subsp. *semivestita*, *Kunzea praestans* high shrubland. Releve G315.

Releve G315

Date: 12/12/04

Photo: BM13-14

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408388/UTM 66 20272 (WGS 84; GPS unit).

Site description: Crest of low rise in series of ridges.

Soil: Yellow sand.

Rock type: < 2% exposed rock (?Chert).

Vegetation description: *Banksia prionotes* scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Leptospermum erubescens*, *Grevillea amplexicans* ssp. *semivestita*, *Kunzea praestans* high shrubland (but lot of *Leptospermum erubescens* grazed down to 30-40 cm) over *Calytrix leschenaultii* scattered low shrubs over *Vulpia myuros* var. *hirsuta*, (*Neurachne alopecuroidea*) open grassland and *Podolepis lessonii* very open herbland.

Associated species: *Baekkea crispiflora* var. *tenuior*

Condition: Poor to good.

Notes: More than 10 years since fire. Difficult to describe because heavily grazed.

Mapping Note: G315a: *Banksia prionotes* not present in unit.

Vegetation Alliance 13: *Allocasuarina campestris* high shrublands to open and closed scrub.

Vegetation Association Ac: *Allocasuarina campestris* open to closed scrub over scattered sedges/grasses/herbs.

Plant Communities:

Ac.1: *Allocasuarina campestris* open heath to closed heath over scattered sedges/grasses with *Borya sphaerocephala* (+) scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Relevés CR25, CNR106, DR136, JTR203, GHR271, GHR288, GHR293, GHR301 and CSR333.

Releve CR25

Date: 14/11/03

Location: Cairn Hill.

AMG84: 50J 0407324/UTM 66 20197 (WGS 84; GPS unit).

Site description: Mid slope of steep, west-facing slope of low to medium ridge (altitude = 241m).

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina campestris* (60-70%) open scrub over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Stylidium septentrionale* (1-2%), *Borya sphaerocephala* (1-2%) very open herbland.

Associated species: *Schoenus clandestinus*, *Trachymene pilosa*, *Trachymene ornata*, *Chamaescilla corymbosa* var. *corymbosa*, *Pterostylis* sp., *Blennospora drummondii*, *Trachymene cyanopetala*, *Podolepis canescens*.

Releve CNR106

Date: 29/11/03

Location: Cairn Hill North.

AMG84: 50J 0407136/UTM 66 22476 (WGS 84; GPS unit).

Site description: West-facing, gently sloping lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina campestris* (60-70%) open to closed scrub over *Xanthorrhoea drummondii* scattered shrubs over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea*, *Schoenus clandestinus* scattered grasses/sedges with *Borya sphaerocephala* (2-4%), *Stypantra glauca* (+) very open herbland.

Releve DR136 (R136a)

Date: 7/12/03

Location: Waste Dump Area.

AMG84: 50J 0407521/UTM 66 23049 (WGS 84; GPS unit).

Site description: Gently sloping, south-west facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina campestris* (60-70%) open heath to closed heath over *Lepidosperma tenue*, *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stypantra glauca*, *Borya sphaerocephala* (+) scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Podolepis lessonii*, *Dichopogon capillipes*.

Releve JTR203

Date: 9/1/04

Location: John Tonkin's property.

AMG84: 50J 0408853/UTM 66 25340 (WGS 84; GPS unit).

Site description: Flat low rocky ridge top.

Soil: Very gravelly, pebbly, cobbly.

Rock type: Chert low grade.

Vegetation description: *Allocasuarina campestris* (>90%) closed scrub over scattered *Cheilanthes adiantoides* ferns and scattered herbs.

Associated species: *Podolepis lessonii*.

Condition: Very good + (very low weed cover).

Releve GHR271

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408286/UTM 66 17186 (WGS 84; GPS unit).

Site description: Gently, west-facing slope of low rocky ridge.

Vegetation description: Allocasuarina campestris closed scrub over Amphipogon caricinus, Desmodium flexuosus, Schoenus clandestinus, Lepidobolus chaetocephalus scattered sedges with Borya sphaerocephala (2-3%), Stylium septentrionale very open herbland and Cheilanthes adiantoides scattered ferns.

Associated species: Austrostipa elegantissima.

Condition: Very good (very few weeds - Ursinia anthemoides).

Releve GHR288

Date: 17/1/04

Location: Gardiner's hill

AMG84: 50J 0408433/UTM 66 17808 (WGS 84; GPS unit).

Site description: Flat crest of low rocky ridge.

Rock type: Chert.

Vegetation description: Allocasuarina campestris (80-90%) closed scrub over Neurachne alopecuroidea, Schoenus clandestinus scattered sedges/grasses with Podolepis canescens scattered herbs.

Associated species: Chamaescilla corymbosa var. corymbosa, Trachymene pilosa.

Condition: Good to very good.

Releve GHR293

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408514/UTM 66 17385 (WGS 84; GPS unit).

Site description: Gentle, south-west facing slope of low rocky ridge (elevation 258 m).

Rock type: Chert.

Vegetation description: Allocasuarina campestris (80-90%) closed scrub over Schoenus clandestinus (4-5%), Neurachne alopecuroidea very open sedgeland/grassland with Borya sphaerocephala (5-6%), Stylium septentrionale (+), Opercularia vaginata (+) very open herbland and Cheilanthes adiantoides scattered ferns.

Associated species: Dianella revoluta var. divaricata, Amphipogon caricinus, Lomandra effusa.

Condition: Very good.

Notes: Varies to Allocasuarina campestris (50-60%) open scrub over Schoenus clandestinus, Neurachne alopecuroidea very open sedges/grasses with Borya sphaerocephala (25-30%), Stylium septentrionale (1-2%), Lomandra effusa open herbland.

Releve GHR301

Date: 6/12/034

Location: Gardiner's hill, east side of block, (just east of near eastern fence line).

AMG84: 50J 0408933/UTM 66 17855 (WGS 84; GPS unit).

Site description: Mid – lower slope of ridge, gently sloping, east facing.

Soil: Gravelly, pebbly, cobbly grey-brown sand.

Rock type: ?Chert.

Vegetation description: Allocasuarina campestris (60-70%) open to closed scrub over Calytrix leschenaultii scattered low shrubs over Schoenus clandestinus very open sedgeland and Borya sphaerocephala (15-20%), Podolepis canescens (3-5%) open herbland and Avena barbata, open annual grassland.

Associated species: Neurachne alopecuroidea, Thysanotus manglesianus, Dichopogon capillipes, Calothamnus aff. quadrifidus Moora-Watheroo, Briza maxima.

Condition: Very good.

Notes: (similar to GHR293).

Releve CSR333Date: 18/2/05Location: Kim Chester's property.AMG84: 50J 0407197/UTM 66 18976 (WGS 84; GPS unit).Site description: Moderate, west-facing mid slope of low ridge.Rock type: Chert.Vegetation description: *Allocasuarina campestris* (50-70%), (*Xanthorrhoea drummondii* (+)) open to closed scrub over **Avena barbata*, **Bromus diandrus* annual grassland.Condition: Poor – very poor.

Ac.2: (*Acacia acuminata* subsp. *acuminata* (+ (3-5%)) scattered low trees to low open woodland over *Allocasuarina campestris* (90%) closed scrub over scattered grasses/sedges with *Cheilanthes adiantoides* scattered ferns and *Borya sphaerocephala* scattered herbs.

This plant community differed by having an *Acacia acuminata* subsp. *acuminata* scattered low trees to low open woodland strata. Relevés CNR111, CNR114, ERR176, JTR204, JTR224, JTR244, GHR285, CH309, G313 and G330.

Releve: CNR111Date: 2/12/03Location: Cairn Hill North.AMG84: 50J 0407123/UTM 66 22624 (WGS 84; GPS unit).Site description: North-facing, gently sloping, mid slope of low rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand.Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (80-90%) closed scrub over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Stylidium septentrionale* scattered herbs and *Cheilanthes adiantoides* scattered ferns.Associated species: *Lawrencella rosea*, *Dioscorea hastifolia*, *Thysanotus manglesianus*, *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Acacia acuminata* subsp. *acuminata*, *Borya sphaerocephala*.Releve CNR114Date: 3/12/03Location: Cairn Hill North.AMG84: 50J 0407286/UTM 66 22102 (WGS 84; GPS unit).Site description: Gently sloping, west-facing upper slope of low rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand.Vegetation description: *Acacia acuminata* subsp. *acuminata* (+ (3-5%)) scattered low trees to low open woodland over *Allocasuarina campestris* (90%) closed scrub over *Neurachne alopecuroidea* (+), *Schoenus clandestinus* (1%) scattered grasses/sedges with *Cheilanthes adiantoides* scattered ferns and *Borya sphaerocephala* scattered herbs.Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Thysanotus manglesianus*, *Comesperma integerrimum*.Notes: Similar to CHN1, but with *Acacia acuminata* subsp. *acuminata* scattered tree layer.Releve ERR176Date: 23/12/03Location: Eastern Ridge.AMG84: 50J 0407968/UTM 66 23044 (WGS 84; GPS unit).Site description: Gentle, south-west facing slope of low rocky ridge.Soil: Gravelly, pebbly with few cobbles, brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (40-50%) open scrub over *Schoenus clandestinus* scattered sedges with *Borya sphaerocephala* (2-(5-10%)), *Gilberta tenuifolia* (5-10%) (not under *Allocasuarina campestris*) and *Podolepis lessonii* (1-2%) open herbland to herbland.

Condition: Very good (only few weeds). Maybe some disturbance associated with old cleared track nearby.

Releve JTR204

Date: 9/1/04

Location: John Tonkin's property.

AMG84: 50J 0408977/UTM 66 25430 (WGS 84; GPS unit).

Site description: Flat to very gently sloping, north-west facing, slope on low rocky ridge (elevation 260 m).

Soil: Very gravelly, pebbly silty fine sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (5-8%) low open woodland over *Allocasuarina campestris* (60-70%) open scrub over *Schoenus* sp. scattered sedges with *Borya sphaerocephala* (+), *Podolepis lessonii* (+) scattered herbs to very open herbland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Briza maxima* scattered annual grasses.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Very good (not many weeds).

Releve JTR224

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0409055/UTM 66 26361 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of low rocky ridge.

Vegetation description: (*Acacia acuminata* subsp. *acuminata*) scattered low trees over *Allocasuarina campestris* (80-90%) closed scrub over *Schoenus clandestinus* scattered sedges over *Borya sphaerocephala*. (2-3%), *Podolepis lessonii* (+) very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Trachymene ornata*, *Crassula colorata*.

Condition: Very good. Low weed cover.

Releve JTR244

Date: 13/1/04

Location: John Tonkin's property.

AMG84: 50J 0409071/UTM 66 26430 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of rocky low ridge (elevation 274 m).

Soil: Gravelly, pebbly brown sand with outcrop/boulders (5-10%).

Rock type: Chert?

Vegetation description: *Acacia acuminata* subsp. *acuminata* (3-5%), *Allocasuarina huegeliana* (3-5%), (*Eucalyptus loxophleba* subsp. *loxophleba* (+)) low open woodland over *Allocasuarina campestris* (70-90%) closed scrub over *Desmodium flexuosus*, *Schoenus clandestinus* scattered sedges with *Borya sphaerocephala* (2-3%) (heavily grazed), *Podolepis lessonii* (1-2%) very open herbland and *Avena barbata*, *Vulpia myuros* var. *hirsuta* scattered to very open annual grassland.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Very good (low weed cover).

Releve GHR285

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408246/UTM 66 18007 (WGS 84; GPS unit).

Site description: Moderate, north-west facing mid to lower slope of low rocky ridge.

Soil: Gravelly, pebbly silty fine sand.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (4-5m) (70-80%) closed scrub over *Schoenus clandestinus* scattered sedges with *Borya sphaerocephala* scattered herbs and *Cheilanthes adiantoides* (5-6%) very open fernland.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Very good (few *Hypochaeris glabra* weeds).

Releve CH309

Date: 11/12/04

Location: Kim Chester's property.

AMG84: 50J 0408092/UTM 66 21425 (WGS 84; GPS unit).

Site description: Crest of low rise.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* closed scrub over *Schoenus clandestinus* very open sedgeland and *Borya sphaerocephala* very open herbland.

Associated species: *Melaleuca radula*, *Thysanotus manglesianus*, *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Podolepis lessonii*, *Dichopogon capillipes*.

Condition: Good to very good.

Releve G313

Date: 11/12/04

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408443/UTM 66 20952 (WGS 84; GPS unit).

Site description: Gentle, north-facing slope of low ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* open to closed scrub over *Calytrix leschenaultii* scattered low shrubs over *Pentaschistis pallida* very open annual grassland with *Borya sphaerocephala* very open herbland.

Associated species: *Kunzea praestans* (nearby), *Baekkea crispiflora* (common or small leaf form) (nearby), *Podolepis lessonii*, *Daviesia dielsii*, *Baekkea* sp. *Moora* (nearby).

Condition: Good to very good.

Releve G330

Date: 17/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407379/UTM 66 18588 (WGS 84; GPS unit).

Site description:

Vegetation description: *Acacia acuminata* subsp. *acuminata* (+) scattered low trees over *Allocasuarina campestris* (50-60%) open scrub over **Avena barbata*, **Bromus diandrus* annual open grassland.

Condition: Poor – very poor (high weed cover).

Ac.3: *Eucalyptus loxophleba* subsp. *loxophleba*, (*Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*) low open woodland over *Allocasuarina campestris* open scrub over *Calytrix leschenaultii* low open shrubland over scattered sedges/grasses and *Borya sphaerocephala* very open herbland.

This plant community had a *Eucalyptus loxophleba* subsp. *loxophleba*, (*Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*) scattered low trees to low open woodland layer. Quadrats ERG12, ERG18 and WDM3. Relevés CNR104, CNR133, ERR141, ERR151, ERR162, G336, NBPD5 and NBPD3.

Releve CNR104

Date: 28/11/03

Location: North-east end of Cairn Hill North.

AMG84: 50J 0407452/UTM 66 22235 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of short slope of low rocky ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: Eucalyptus loxophleba subsp. loxophleba (5-10%), Acacia acuminata subsp. acuminata (+), Allocasuarina huegeliana (+) low open woodland over Allocasuarina campestris (60-70%) open scrub over Calytrix leschenaultii (2-3%) low open shrubland over Desmocladius flexuosus, Neurachne alopecuroidea scattered sedges/grasses and Borya sphaerocephala (2-7%) very open herbland.

Associated species: Chamaescilla corymbosa var. corymbosa, Trachymene cyanopetala, Lepidosperma tenue, Hibbertia subvaginata.

Releve CNR133

Date: 6/12/03

Location: Cairn Hill North.

AMG84: 50J 0407356/UTM 66 21800 (WGS 84; GPS unit).

Site description: Narrow drainage bed in steep walled gully between low rocky ridges.

Vegetation description: Eucalyptus loxophleba subsp. loxophleba, Acacia acuminata subsp. acuminata scattered low trees over Allocasuarina campestris (4-4.5 m, 80-90%) closed scrub over Cheilanthes adiantoides (3-5%) very open fernland.

Associated species: Thysanotus manglesianus, Dichopogon capillipes, Dioscorea hastifolia.

Condition: Good. Heavy weed infestation (Avena barb, Ehrharta longiflora, Hypochaeris glabra).

Releve ERR141

Date: 8/12/03

Location: Eastern Ridge.

AMG84: 50J 0407660/UTM 66 24516 (WGS 84; GPS unit).

Site description: Very gently sloping, east-facing, rocky lower slope of very low ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and outcrop.

Vegetation description: Eucalyptus loxophleba subsp. loxophleba (1-2%), Acacia acuminata subsp. acuminata (1%) scattered low trees over Allocasuarina campestris (50-60%) open scrub over Neurachne alopecuroidea scattered grasses with Cheilanthes adiantoides scattered ferns.

Associated species: Dichopogon capillipes, Thysanotus manglesianus, Dioscorea hastifolia, Goodenia berardiana.

Condition: Very good - some weeds.

Notes: Unit also includes area with scattered Allocasuarina huegeliana.

Releve ERR151

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407867/UTM 66 24598 (WGS 84; GPS unit).

Site description: Top of spur between low ridges.

Soil: (See ERG150).

Vegetation description: Eucalyptus loxophleba subsp. loxophleba (10% - (regrowth to 4,5 m)), Allocasuarina huegeliana (3-5%) low open woodland to low woodland over Allocasuarina campestris (40-50%) open scrub over Calytrix leschenaultii scattered low shrubs over Lepidosperma tenue scattered sedges.

Associated species: Dichopogon capillipes, Chamaescilla corymbosa var. corymbosa.

Condition: Good to very good – low weed cover.

Releve ERR162

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407925/UTM 66 24060 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing lower to mid slope of low rocky ridge.

Vegetation description: Eucalyptus loxophleba subsp. loxophleba scattered low trees over Allocasuarina campestris (60-80%) open to closed scrub over Gilbertia tenuifolia, Podolepis lessonii

(1-3%) very open herbland with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Bromus diandrus* scattered annual grasses.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Good to very good. Some weeds.

Notes: Similar to R141, but with no *Acacia acuminata* subsp. *acuminata*.

Releve G336

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407172/UTM 66 17687 (WGS 84; GPS unit).

Site description: Gentle, south-facing slope of low rounded ridge.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (3-5%), *Acacia acuminata* subsp. *acuminata* (+) scattered low trees over *Allocasuarina campestris* (40-60%), (*Xanthorrhoea drummondii* (+)) open scrub over *Austrostipa* sp. **Avena barbata* scattered grasses and *Gilberta tenuifolia*, *Podolepis lessonii* *Waitzia nitida* very open herbland.

Condition: Good to very good.

Releve NBPD3

Date: 9/12/03

Location: Doblestein's property.

AMG84: 50J 0408932/UTM 66 23714 (WGS 84; GPS unit).

Site description:

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* low woodland over *Allocasuarina campestris* scattered tall shrubs over *Avena barbata* annual grassland and *Gilberta tenuifolia* very open herbland.

Condition: Very poor condition.

Releve: NBPD5

Date: 9/12/03

Location: Doblestein's property.

AMG84: 50J 0409211/UTM 66 23477 (WGS 84; GPS unit).

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) low open woodland over *Allocasuarina campestris* open to closed scrub over *Gilberta tenuifolia*, *Podolepis lessonii* very open herbland and *Avena barbata*, *Pentstemonis pallida* annual grassland.

Condition: Poor to good condition.

Ac.4: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Allocasuarina campestris* closed scrub over *Neurachne alopecuroidea* scattered grasses with scattered herbs and *Cheilanthes adiantoides* scattered ferns.

This plant community differed by having an *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low open woodland layer. Quadrats ERG1 and JT6. Relevés CNR93, CNR99, CNR103, CNR108, ERR161, ERR165, ERR173, ER175, ERR181, ERR186, ERR188, ERR194, ERR196, SWR205, SWR209, JTR210, SWR241, GHR297, GHR304, G311 and RM10.

Releve CNR93

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407719/UTM 66 21736 (WGS 84; GPS unit).

Site description: Crest of very low rocky rise (ridge).

Soil: Gravelly, pebbly, cobbly rocky brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-15%), (*Allocasuarina huegeliana*) (+) low woodland similar to *Allocasuarina campestris* (70-80%) closed scrub. Similar to *Schoenus*

clandestinus, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* (3-5%) very open fernland and *Podolepis lessonii* (1-2%), *Gilberta tenuifolia* (1-2%) very open herbland.
Associated species: Salmon gum, *Thysanotus manglesianus*, *Trachymene ornata*, *Burchardia umbellata*, *Comesperma integerrimum*.

Releve CNR99

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407647/UTM 66 22053 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing upper slope (adjacent to ridge top) of very low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (3-5%), *Acacia acuminata* subsp. *acuminata* (1%) scattered low trees to low open woodland over *Allocasuarina campestris* (40-50%), *Xanthorrhoea drummondii* (2-3%) open scrub over *Schoenus clandestinus* (1-5%), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Boronia coerulescens* subsp. *spinescens*, *Stypantra glauca* (+), *Gilberta tenuifolia*, *Podolepis lessonii* (1-2%) scattered herbs with *Cheilanthes adiantoides* (1%) scattered ferns.

Associated species: *Trachymene cyanopetala*, *Waitzia nitida*, *Trachymene ornata*, *Dichopogon capillipes*.

Releve CNR103

Date: 28/11/03

Location: Cairn Hill North.

AMG84: 50J 0407600/UTM 66 22173 (WGS 84; GPS unit).

Site description: Gentle, north-facing upper slope of low rocky rise (ridge).

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (5-6%), *Acacia acuminata* subsp. *acuminata* (+) low open woodland over *Allocasuarina campestris* (80-100%) closed scrub over *Neurachne alopecuroidea* scattered grasses with *Rhodanthe polycephala* scattered herbs and *Cheilanthes adiantoides* (+/-1%) scattered ferns.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Thysanotus manglesianus*, *Xanthorrhoea drummondii*, *Stypantra glauca*.

Releve CNR108

Date: 2/12/03

Location: Cairn Hill North.

AMG84: 50J 0407023/UTM 66 22582 (WGS 84; GPS unit).

Site description: Gentle lower slope, west-facing, of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (3-4%) scattered low trees to low open woodland over *Allocasuarina campestris* (70-80%) open to closed scrub over *Stypantra glauca*, *Chamaescilla corymbosa* var. *corymbosa*, *Dichopogon capillipes* scattered herbs with *Cheilanthes adiantoides* (2-4%) very open fernland.

Associated species: *Neurachne alopecuroidea*, *Thysanotus manglesianus*, *Acacia acuminata* subsp. *acuminata*.

Notes: Mapping unit generally has *Acacia acuminata* subsp. *acuminata* as scattered low trees in tree layer.

Releve ERR161

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407835/UTM 66 24064 (WGS 84; GPS unit).

Site description: Mid slope of low ridge, east-facing moderate slope (elevation 250 m).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (2-4%), (*Allocasuarina huegeliana*) low open woodland over *Allocasuarina campestris* (50-60%) open to closed scrub over *Cheilanthes adiantoides* scattered ferns with *Avena barbata*, *Briza maxima*, *Ehrharta longiflora* very open annual grassland.

Associated species: *Acacia congesta* subsp. *congesta*, *Hibbertia subvaginata* (upslope), *Ursinia anthemoides*, *Dichopogon capillipes*, *Dioscorea hastifolia*.

Condition: Good to very good. Generally weed cover is low, except in openings in the scrub.

Releve ERR165

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407836/UTM 66 23994 (WGS 84; GPS unit).

Site description: East-facing, moderate upper slope of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana* (2-3%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over *Allocasuarina campestris* (50-70%) open scrub over *Lepidosperma tenue* scattered sedges.

Condition: Very good (few weeds).

Notes: Only small patches.

Releve ERR173

Date: 23/11/03

Location: Eastern Ridge.

AMG84: 50J 0408044/UTM 66 22604 (WGS 84; GPS unit).

Site description: Gentle, south-west facing slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-6%), *Acacia acuminata* subsp. *acuminata* (4-5%) low open woodland to low woodland over *Allocasuarina campestris* (50-60%) open scrub over *Neurachne alopecuroidea* scattered sedges/grasses to very open sedgeland with *Stypandra glauca* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Condition: Very good (low weed cover).

Releve ERR175

Date: 23/12/03

Location: Eastern Ridge.

AMG84: 50J 0407892/UTM 66 22957 (WGS 84; GPS unit).

Site description: Gentle, south-west facing slope of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (70-80%) closed scrub over *Borya sphaerocephala* (1%), *Gilberta tenuifolia* (2-3%) very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Burchardia umbellata*, *Trachymene cyanopetala*.

Condition: Very good - not much weed cover.

Releve ERR181

Date: 24/12/03

Location: Eastern Ridge.

AMG84: 50J 0407895/UTM 66 23015 (WGS 84; GPS unit).

Site description: Gentle to moderate west-facing slope of low rocky ridge.

Rock type: See R168.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland to low woodland over *Allocasuarina campestris* (20-30% (50-60% in patches), *Xanthorrhoea drummondii*, *Acacia congesta* subsp. *congesta* open scrub over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Gilberta tenuifolia* (5-10%), *Podolepis lessonii* (+) very open herbland to open herbland and *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Ehrharta longiflora* very open annual grassland.

Associated species: Dioscorea hastifolia, Burchardia umbellata, Lomandra sp.

Condition: Good to very good (some weeds).

Notes: Similar to R180.

Releve ERR186

Date: 2/1/04

Location: Eastern Ridge.

AMG84: 50J 0407810/UTM 66 23521 (WGS 84; GPS unit).

Site description: Steep, west-facing, breakaway slope near top of low rocky ridge.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana scattered low trees over Allocasuarina campestris (30-40%), (Xanthorrhoea drummondii (1-2%)) open scrub over Lepidosperma tenue (2-3%), Neurachne alopecuroidea (+), Austrodanthonia caespitosa very open sedgeland/grassland with Borya sphaerocephala scattered herbs and Cheilanthes adiantoides scattered ferns.

Associated species: Waitzia nitida, Dichopogon capillipes, Gilberta tenuifolia.

Condition: Good to very good. Quite a few weeds.

Releve ERR188

Date: 2/4/04

Location: Eastern Ridge.

AMG84: 50J 0407703/UTM 66 23553 (WGS 84; GPS unit).

Site description: Gentle, south-facing lower slope of low rocky ridge (elevation 255 m).

Soil: Gravelly, pebbly, cobbly brown sand.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (3-5%), Acacia acuminata subsp. acuminata (1-2%) low open woodland over Allocasuarina campestris (50-60%), (Xanthorrhoea drummondii (1-2%)) open scrub over Calytrix leschenaultii scattered low shrubs over Desmocladus flexuosus, Lepidosperma tenue scattered sedges with Borya sphaerocephala (2-4%) very open herbland.

Associated species: Acacia lasiocarpa var. sedifolia

Condition: Very good to excellent.

Notes: Much of the Allocasuarina campestris is 1-1.2m high => regrowth, perhaps from fire (burnt trunk of Allocasuarina huegeliana nearby).

Releve ERR194

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407954/UTM 66 23609 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of low rocky ridge.

Rocky type: Chert.

Vegetation description: Allocasuarina huegeliana scattered low trees over Allocasuarina campestris (50-60%), Xanthorrhoea drummondii (+) open scrub over Lepidosperma tenue (2-3%), Lepidosperma sp. very open sedges with Podolepis lessonii scattered herbs.

Condition: (Good) to very good – some weeds present.

Releve ERR196

Date: 4/1/04

Location: Eastern Ridge.

AMG84: 50J 0407773/UTM 66 23273 (WGS 84; GPS unit).

Site description: West-facing, moderate lower slopes of low rocky ridge.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana scattered low trees over Allocasuarina campestris (50-60%), Xanthorrhoea drummondii (2-3%) open scrub over Lepidosperma tenue, Schoenus clandestinus (2-4%), Neurachne alopecuroidea (+), Desmocladus flexuosus very open

sedgeland/grassland with *Borya sphaerocephala* (2-5%), *Stylidium septentrionale* (+) very open low herbland.

Condition: Very good.

Releve SWR205

Date: 9/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409243/UTM 66 25111 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly brown sand with rock outcrop (5-10% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (70-80%) open to closed scrub over *Borya sphaerocephala* scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Condition: Very good (low weed cover (<1%)).

Notes: Quite a few mosses present.

Releve: SWR209

Date: 9/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409374/UTM 66 25296 (WGS 84; GPS unit).

Site description: Gentle to moderate, east-facing upper slope of low rocky ridge (elevation 163 m).

Soil: Gravelly, pebbly brown sand (NT).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (5-10%), *Allocasuarina huegeliana* (4-5%) low woodland over *Allocasuarina campestris* (80%) closed scrub over *Borya sphaerocephala* scattered herbs with *Avena barbata*, *Ursinia anthemoides*, *Briza maxima* scattered annual grasses/herbs to very open annual grassland/herbland.

Associated species:

Condition: Good to very good.

Releve JTR210

Date: 10/1/04

Location: John Tonkin's property.

AMG84: 50J 0409026/UTM 66 25523 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid to lower slope of low rocky ridge (elevation 251 m).

Soil: Gravelly, pebbly, cobbly brown silty fine sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (1-2%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland over *Allocasuarina campestris* (80-90%) closed scrub over *Lepidobolus chaetocephalus*, *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stylidium septentrionale*, *Borya sphaerocephala* and *Cheilanthes adiantoides* scattered herbs and ferns.

Associated species: *Burchardia umbellata*.

Condition: Very good –only scattered annual weeds (*Vulpia myuros* var. *hirsuta*, *Briza maxima*).

Releve SWR241

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408888/UTM 66 25243 (WGS 84; GPS unit).

Site description: Very gentle, south-facing upper slope of low rocky ridge (elevation 255 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (5-10%) low open woodland to low woodland over *Allocasuarina campestris* (40-50%) open scrub over

Lepidosperma tenue scattered sedges with Podolepis lessonii (2-3%), Rhodanthe polycephala (1-2%) very open herbland with Cheilanthes adiantoides scattered ferns and Avena barbata, Vulpia myuros var. hirsuta, Hypochaeris glabra very open annual grassland/herbland.

Condition: Good to very good.

Releve GHR297

Date: 18/1/04

Location: Gardiner's hill.

AMG84: 50J 0408441/UTM 66 17964 (WGS 84; GPS unit).

Site description: Moderate, north-east facing upper slope of low rocky ridge (elevation 266 m).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata, Eucalyptus salmonophloia (6-7 m) low open woodland over Allocasuarina campestris (5-6m, 30% NB: a lot blown over and dead) high shrubland to open scrub over Schoenus clandestinus, Neurachne alopecuroidea scattered sedges/grasses with Calandrinia sp. (1-2%), Trachymene pilosa (+), Podolepis canescens very open herbland with Cheilanthes adiantoides (2-3%) very open fernland and Ursinia anthemoides, Ehrharta longiflora, Pentaschistis pallida annual open herbland/grassland.

Associated species: Dichopogon capillipes, Dioscorea hastifolia, Trymalium ledifolium var. rosmarinifolium (juvenile).

Condition: Very good on slope, but Poor to Good at top of slope (high weed cover = annual grassland/herbland).

Releve GHR304

Date: 7/12/04

Location: Gardiner's Hill.

AMG84: 50J 0408629/UTM 66 17903 (WGS 84; GPS unit).

Site description: Moderate, west-facing slope of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Rock type: Chert (considerable exposed rock in parts)

Vegetation description: (Allocasuarina huegeliana scattered low trees) over Allocasuarina campestris (50%) open scrub over Xanthorrhoea drummondii scattered shrubs to open shrubland over Calytrix leschenaultii scattered low shrubs over Desmocladius flexuosus, Schoenus clandestinus scattered sedges and Cheilanthes adiantoides very open fernland with Podolepis canescens, (Stypantra glauca), Borya sphaerocephala very open herbland.

Associated species: Goodenia hassallii, Avena barbata, Ursinia anthemoides, Opercularia vaginata, Olearia dampieri subsp. eremicola, Allocasuarina huegeliana.

Condition: Very good.

Releve G311

Date: 11/12/04

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408519/UTM 66 21437 (WGS 84; GPS unit).

Site description: Gentle, north-west facing lower slope of ridge.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana, (Acacia acuminata subsp. acuminata) low open woodland over Allocasuarina campestris, Xanthorrhoea drummondii high open shrubland to high shrubland over Avena barbata, Vulpia myuros var. hirsuta, Ehrharta longiflora very open annual grassland to annual grassland and with Cheilanthes adiantoides scattered ferns.

Associated species: Waitzia nitida, Podolepis lessonii, Dichopogon capillipes, Thysanus manglesianus, Chamaescilla corymbosa var. corymbosa.

Condition: Very poor to poor.

Notes: > 10 years since fire.

Releve RM10

Date: 11/12/04

Location: Ron Manning's property.

AMG84: 50J 0408169/UTM 66 21688 (WGS 84; GPS unit).

Site description: Gentle, east-facing slope of low ridge.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered low trees over *Allocasuarina campestris*, (*Xanthorrhoea drummondii* (+)) open scrub over *Ehrharta longiflora*, *Avena barbata*, (*Neurachne alopecuroidea*) open grassland and *Podolepis lessonii*, *Borya sphaerocephala* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Waitzia nitida*.

Notes: > 10 years since fire.

Ac.5: *Allocasuarina campestris* open to closed scrub over *Calytrix depressa* scattered low shrubs over scattered grasses with scattered herbs.

This plant community differed by having a *Calytrix depressa* scattered low shrub layer. Relevés CR12 and CNR125.

Releve CR12

Date: 8/11/03

Location: Cairn Hill.

AMG84: 50J 0407869/UTM 66 20373 (WGS 84; GPS unit).

Site description: East-facing, gently sloping, upper slope of low ridge.

Soil: Grey gravelly, pebbly silty sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (80-90%) closed scrub over *Baeckea crispiflora* var. *tenuior* scattered shrubs over *Calytrix depressa* scattered shrubs over *Neurachne alopecuroidea* scattered grasses with *Stypandra glauca* (2-3%), *Borya sphaerocephala* (2-3%) very open herbland.

Associated species: *Cheilanthes adiantoides*, *Trachymene cyanopetala*, *Schoenus clandestinus*.

Notes: Similar to CR10 but different *Calytrix*.

Releve CNR125

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407551/UTM 66 21812 (WGS 84; GPS unit).

Site description: Gently sloping, east-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly brown sand (NT).

Vegetation description: *Allocasuarina campestris* (60-70%), *Xanthorrhoea drummondii* (+) open to closed scrub over *Calytrix depressa*, *Baeckea* sp. *Moora* (R. Bone 1993/1) scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Goodenia hassallii* scattered herbs over *Borya sphaerocephala* (1-2%) scattered low herbs to very open herbland.

Associated species: *Tricoryne arenicola*, *Melaleuca radula*.

Ac.6: See the vegetation description for releve CR86 below.

This plant community differed by having *Dryandra fraseri* associated scattered low shrubs. It occurred on the valley floor near the western boundary of Cairn Hill.

Releve CR86.

Releve CR86

Date: 27/11/03

Location: Near the western boundary of Cairn Hill

AMG84: 50J 0406831/UTM 66 21075 (WGS 84; GPS unit).

Site description: Flat to very gently sloping, west-facing lower slope at base of low rocky ridge on edge of wide plain.

Soil: Gravelly, pebbly pale brown loamy fine sand.

Vegetation description: *Allocasuarina campestris* (80-90%), (*Xanthorrhoea drummondii* (2%)) closed scrub over *Dryandra fraseri* (5-7%), *Astroloma serratifolium* low open shrubland over *Lepidosperma leptostachyum*, *Schoenus clandestinus* (+), *Neurachne alopecuroidea* scattered sedges/grasses with *Dampiera lavandulacea* (+), *Podolepis lessonii* (1%), *Borya sphaerocephala* (1%) scattered herbs.

Associated species: *Burchardia umbellata*, *Trachymene ornata*, *Trachymene cyanopetala*, *Dianella revoluta* var. *divaricate*.

Ac.7: *Allocasuarina campestris* open to closed heath over *Melaleuca calyptroides* scattered shrubs over *Calytrix leschenaultii* scattered low shrubs over *Stylidium septentrionale* very open herbland. This plant community differed by having *Melaleuca calyptroides* associated scattered low shrubs. Relevés CR3 and CR80.

Releve CR3

Date: 7/11/03

Location: Southern end of Cairn Hill.

AMG84: 50J 0407738/UTM 66 20032 (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil: Gravelly grey sand.

Vegetation description: *Allocasuarina campestris* (70-80%) open to closed heath over *Melaleuca calyptroides* scattered shrubs over *Calytrix leschenaultii* scattered low shrubs over *Stylidium septentrionale* very open herbland.

Notes: Mapping Unit CR4 is a mosaic with CH13 on nearby slopes.

Releve CR80

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406891/UTM 66 21164 (WGS 84; GPS unit).

Site description: Lower gentle west-facing slope.

Vegetation description: *Allocasuarina campestris* (80-90%), (*Xanthorrhoea drummondii* (+)) closed scrub over *Melaleuca calyptroides* scattered shrubs over *Calytrix leschenaultii* scattered low shrubs over *Lepidosperma leptostachyum*, *Desmocladus flexuosus* scattered sedges with *Stylidium septentrionale* (5-8%), *Borya sphaerocephala* (2-3%) very open herbland.

Associated species: *Kunzea praestans* (juvenile).

Ac.8: (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*) scattered low trees over *Allocasuarina campestris* open to closed scrub over *Hibbertia subvaginata* scattered low shrubland over very open sedgeland and open herbland.

This plant community differed by having *Hibbertia subvaginata* associated scattered low shrubs. Quadrats CHN1 and ERG11 and releve G338.

Releve G338

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407105/UTM 66 17935 (WGS 84; GPS unit).

Site description: Gentle, west-facing slope of very low rocky ridge.

Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees over *Allocasuarina campestris* (20-30%) (*Dryandra sessilis* (+), *Xanthorrhoea drummondii* (2-3%)) high shrubland over *Hibbertia subvaginata* scattered low shrubland over *Schoenus clandestinus* very open sedgeland and *Borya sphaerocephala* open herbland.

Condition: Good – very good.

Vegetation Association AcAa: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris* high open shrubland to high shrubland.

Plant Communities:

AaAc.1: See the vegetation description for releve D6 below.

Releve D6.

Releve D6

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0408902/UTM 66 23657 (WGS 84; GPS unit).

Site description: Very gentle, north-east facing slopes of low rise.

Rock type: (Rocky)

Vegetation description: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris* high open shrubland (patches) to high shrubland over *Lepidosperma leptostachyum* scattered sedges) and *Avena barbata* very open to open annual grassland and *Gilberta tenuifolia*, *Podolepis lessonii* open herbland to herbland.

Condition: Poor to good.

Vegetation Association AcAh: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low open forest over *Allocasuarina campestris* high open shrubland to open to closed scrub.

Plant Communities:

AcAh.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland to open forest over *Allocasuarina campestris* open scrub over very open herbland and scattered ferns.

This plant community included *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open forest over *Allocasuarina campestris* open to closed scrub.

Quadrat EOR1 and releves ERR146 and SWR250

Site number: ERR146

Date: 9/12/03

Location: Eastern Ridge.

AMG84: 50J 0407744/UTM 66 24167 (WGS 84; GPS unit).

Site description: Rocky gently sloping, north-east facing upper slope adjacent to ridge top.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop.

Vegetation description: *Allocasuarina huegeliana* (50-60%), (*Acacia acuminata* subsp. *acuminata* (1-2%)) open forest over *Allocasuarina campestris* (30-40%) open scrub over *Borya sphaerocephala* scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Podolepis lessonii*, *Waitzia nitida*, *Gilberta tenuifolia*, *Kunzea praestans*.

Condition: Very good (not many weeds).

Releve SWR250

Date: 13/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408716/UTM 66 25295 (WGS 84; GPS unit).

Site description: Gentle, west-facing upper slope on low rocky ridge (elevation 254 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (40-50%) low open forest over *Allocasuarina campestris* (40-70%) open scrub over *Rhodanthe polycephala* (3-5%) very open herbland with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Hypochaeris glabra* very open to open annual grassland/herbland.

Condition: Good to very good.

AcAh.2: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Allocasuarina campestris* high shrubland to open and closed scrub over open sedgeland/grassland/herbland.

Quadrats ERG20, WDM002 and releves ERR150, JTR252, EER143, JTR236, JTR247, CSR320 and MR345.

Releve ERR150

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407802/UTM 66 24592 (WGS 84; GPS unit).

Site description: Gentle, west-facing mid to lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand (NT).

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Eucalyptus loxophleba* subsp. *loxophleba* (4-5%) (regrowth) low woodland over *Allocasuarina campestris* (15-20%), (*Acacia congesta* subsp. *congesta* (1%)) high shrubland over *Lepidosperma tenue* scattered sedges and *Podolepis lessonii* (2-3%) very open herbland.

Associated species: *Waitzia nitida*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo.

Condition: Good to very good – some to many weeds. May be some disturbance.

Notes: *Eucalyptus loxophleba* subsp. *loxophleba* seems to be regeneration from fire. Also may have been some physical disturbance in the area.

Releve JTR252

Date: 14/1/04

Location: John Tonkin's property.

AMG84: 05J 409263/UTM 66 25499 (WGS 84; GPS unit).

Site description: Moderate, south-west facing mid to upper slope of low rocky ridge (elevation 279 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (25-30%) low woodland over *Allocasuarina campestris* (10-20%) high shrubland over *Desmocladus flexuosus*, *Schoenus clandestinus* (3-5%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Podolepis lessonii* (3-5%), *Borya sphaerocephala* (1-2%) very open herbland to open herbland with *Cheilanthes adiantoides* scattered ferns and *Avena barbata* very open annual grassland.

Associated species: *Olearia dampieri* subsp. *eremicola*, *Xanthorrhoea drummondii*.

Condition: Good to very good.

Notes: Similar to J5 and J2.

Releve ERR143

Date: 8/12/03

Location: Eastern Ridge.

AMG84: 50J 0407670/UTM 66 24263 (WGS 84; GPS unit).

Site description: Gentle, north-facing upper slope on ridge top (not crest but highest tranverse point) of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst some outcrop (3-5% of surface).

Vegetation description: *Allocasuarina huegeliana* (8-10%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland to low woodland over *Allocasuarina campestris* (70-80%), *Xanthorrhoea drummondii* (+) closed scrub over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Podolepis lessonii* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Hibbertia subvaginata*, *Dioscorea hastifolia*, *Burchardia umbellata*, *Gilberta tenuifolia*.

Condition: Very good with some weeds - *Avena barbata*, *Briza maxima*.

Releve JTR236Date: 12/1/04Location: John Tonkin's property.AMG84: 50J 0408798/UTM 66 25467 (WGS 84; GPS unit).Site description: Moderate/gentle, west-facing lower slope of low rocky ridge (elevation 270 m).Soil: Brown loamy sand amongst rocks, boulders and outcrop (about 50 % surface cover).Rock type: Chalky chert.Vegetation description: Allocasuarina huegeliana (20-25%), (Acacia acuminata subsp. acuminata (+)) low woodland over Allocasuarina campestris (70-90%) closed scrub over Desmocladius flexuosus, Schoenus clandestinus scattered sedges with Cheilanthes adiantoides scattered ferns.Associated species: Dioscorea hastifolia, Stypanandra glauca, Blennospora drummondii.Condition: Very good.Releve JTR247Date: 13/1/04Location: John Tonkin's property.AMG84: 50J 0409114/UTM 66 27507 (WGS 84; GPS unit).Site description: Very gentle, north-facing slope of top of low rocky ridge, near end of ridge (elevation 233 m).Rock type: Chert.Vegetation description: Allocasuarina huegeliana (20-30%), Acacia acuminata subsp. acuminata (+) low woodland to low open forest over Dryandra sessilis var. sessilis scattered tall shrubs over Allocasuarina campestris (70-80%) closed scrub over Desmocladius flexuosus scattered sedges and Cheilanthes adiantoides scattered ferns with Avena barbata, Ehrharta longiflora annual grassland.Associated species: Podolepis lessonii, Schoenus clandestinus.Condition: Poor (high weed cover).Releve CSR320Date: 16/2/05Location: Kim Chester's property, north-west corner, south of Cairn Hill.AMG84: 50J 0406983/UTM 66 19570 (WGS 84; GPS unit).Site description: Crest and gently sloping west-facing upper slope of low rocky ridge.Vegetation description: Allocasuarina huegeliana (15-20%) low woodland over Allocasuarina campestris (30-40%), (Xanthorrhoea drummondii (+), Dryandra sessilis var. sessilis (+)) open scrub over Avena barbata annual grassland.Condition: Poor – very poor (Heavy infestation of Avena barbata).Releve MR345Date: 18/2/05Location: Phil & Jenny Gardiner's property.AMG84: 50J 0407013/UTM 66 17181 (WGS 84; GPS unit).Site description: Crest of low rocky ridge.Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low woodland over Allocasuarina campestris open scrub over Acacia restiacea scattered low shrubs over *Avena barbata open annual grassland.Associated species:Condition: Good.**Vegetation Association AcAhu:** *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris*, *Allocasuarina humilis* open scrub over *Hibbertia subvaginata* shrubland.Plant Communities:**AcAhu.1:** See the vegetation description of releve CR41 below.

This plant community occurred on a steep, lower to mid slope of a low chert ridge.

Releve CR41.

Releve CR41

Date: 21/11/03

Location: Cairn Hill.

AMG84: 50J 0407585/UTM 66 20384 (WGS 84; GPS unit).

Site description: Lower to mid slope of west-facing steep slope of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders (~90% surface cover in rock = chert).

Vegetation description: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina humilis* (10-15%), *Allocasuarina campestris* (15-20%) open scrub over *Hibbertia subvaginata* (15-20%) shrubland over *Thomasia grandiflora* (1%), *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (+), *Xanthosia fruticulosa* (1-2%) scattered low shrubs to low open shrubland over *Dichopogon capillipes* scattered herbs.

Associated species: *Regelia megacephala*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Cheilanthes adiantoides*, *Xanthorrhoea drummondii*.

Notes: Narrow strip along base of chert breakaway below *Regelia megacephala* scrub on west-facing slope.

Vegetation Association AcAs: *Acacia scirpifolia*, *Acacia saligna* high open shrubland over *Allocasuarina campestris*, (*Calothamnus quadrifidus* var. Moora-Watheroo) closed scrub over *Melaleuca calyptroides*, *Acacia congesta* subsp. *congesta* open shrubland.

Plant Communities:

AcAs.1: See the vegetation description of releve CR71 below.

Releve CR71.

Releve CR71

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407129/UTM 66 20617 (WGS 84; GPS unit).

Site description: Valley floor, flat and broad between 2 low ridges. No clear drainage line seen.

Soil: Gravelly, pebbly, cobbly pale brown sand.

Vegetation description: *Acacia scirpifolia* (3-5%, 3 m to 3.5 m tall shrub), *Acacia saligna* (2-4%) high open shrubland over *Allocasuarina campestris* (80-90%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (5-10%) closed scrub over *Melaleuca calyptroides* (3-4%), *Acacia congesta* subsp. *congesta* (1%) open shrubland over *Calytrix leschenaultii* (1%) scattered low shrubs over *Desmocladius flexuosus* (10-12%) open sedgeland with *Stylidium septentrionale* (1-2%) scattered herbs.

Associated species: *Baeckea crispiflora*, *Trachymene ornata*, *Hakea lissocarpha*, *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Neurachne alopecuroidea*, *Lepidobolus chaetocephalus*, *Allocasuarina huegeliana*, *Stypantra glauca*, *Acacia restiacea*.

Vegetation Association AcB: *Allocasuarina campestris* open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland to open heath.

Plant Communities:

AcB.1: (*Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* scattered low trees) over *Allocasuarina campestris* open to closed scrub over *Melaleuca radula* scattered shrubs to open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii* scattered shrubs to low open shrubland over *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with very open herbland.

This plant community differed by having a *Melaleuca radula* component in the shrubland and *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs to open shrubland under an *Allocasuarina campestris* open scrub. Relevés CR37, CR90 and CR91.

Releve CR37

Date: 20/11/03

Location: Cairn Hill

AMG84: 50J 0407692/UTM 66 20673 (WGS 84; GPS unit).

Site description: Moderate, mid to lower north-facing slope.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (50-60%) open scrub over *Melaleuca radula* (2-3%) open shrubland over *Baeckea* sp. *Moora* (R. Bone 1993/1) (3-5%), *Calytrix leschenaultii* (3-5%) low open shrubland over *Lepidobolus chaetocephalus*, *Neurachne alopecuroidea* scattered sedges and grasses with *Stylidium septentrionale* (3-5%), *Borya sphaerocephala* (2-3%) very open herbland.

Associated species: *Trachymene cyanopetala*, *Lawrencella rosea*, *Hakea lissocarpha*, *Schoenus clandestinus*, *Verticordia huegelii* var. *stylosa*, *Goodenia hassallii*, *Xanthorrhoea drummondii*, *Podolepis lessonii*.

Notes: Very similar to CR32

Releve CR90

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407039/UTM 66 21549 (WGS 84; GPS unit).

Site description: Gently sloping, north-east facing lower slopes.

Vegetation description: *Allocasuarina campestris* (60-80%) open scrub to closed scrub over *Xanthorrhoea drummondii* scattered shrubs over *Baeckea* sp. *Moora* (R. Bone 1993/1), *Melaleuca radula*, *Calytrix leschenaultii* scattered low shrubs to low open shrubland over *Astroloma serratifolium* scattered low shrubs over *Neurachne alopecuroidea*, *Schoenus clandestinus* (+) scattered grasses/sedges with *Stylidium septentrionale* (1-2%), *Borya sphaerocephala* (+), *Podolepis lessonii* scattered herbs to very open herbland.

Releve CR91

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407126/UTM 66 21426 (WGS 84; GPS unit).

Site description: Gently sloping, north-east facing lower slopes of low ridge.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (2-5%), *Allocasuarina huegeliana* (2-3%) scattered low trees to low open woodland over *Allocasuarina campestris* (80-90%) closed scrub over *Melaleuca radula* (1-2%), *Baeckea* sp. *Moora* (R. Bone 1993/1) (1%), *Calytrix leschenaultii* (+) scattered shrubs over *Lepidobolus chaetocephalus*, *Schoenus clandestinus* (1-2%), *Neurachne alopecuroidea* scattered sedges/grasses with *Styandra glauca* (1-2%) scattered herbs.

Notes: Similar to CR90 but has tree layer and similar to CR89, but that had *Eucalyptus eudesmioides* as tree species.

AcB.2: (*Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees) over *Allocasuarina campestris* (70-80%) open to closed scrub over *Baeckea* sp. *Moora* (R. Bone 1993/1) (2-3%), (*Baeckea crispiflora* var. *tenuior*, *Calytrix leschenaultii*) scattered low shrubs to open shrubland over scattered grasses/sedges with very open herbland.

Relevés CR10, CR21 and CNR119.

Releve CR10

Date: 8/11/03

Location: Eastern side of Cairn Hill.

AMG84: 50J 0407774/UTM 66 20341 (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil: Gravelly, pebbly pale brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees over *Allocasuarina campestris* (60-80%) open to closed scrub over *Baeckea* sp. *Moora* (R.

Bone 1993/1), *Baeckea crispiflora* (common or small leaf form) (40 cm-1.8m), *Calytrix leschenaultii* scattered low shrubs over *Desmocladus flexuosus* scattered sedges with *Stylidium septentrionale* (5-10%), *Borya sphaerocephala* (5-10%) open herbland.

Associated species: *Acacia acuminata* subsp. *acuminata*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Trachymene cyanopetala*, *Neurachne alopecuroidea*, *Milotia tenuifolia* var. *tenuifolia*.

Condition: Excellent (few weeds).

Releve CR21

Date: 14/11/03

Location: Cairn Hill (southern boundary).

AMG84: 50J 0407385/UTM 66 19969 (WGS 84; GPS unit).

Site description: Very gently sloping, south-facing lower slope of low rocky (chert) ridge.

Soil: Gravelly, pebbly, cobbly pale brown sand.

Vegetation description: *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora-Watheroo (+), *Kunzea praestans* (1-2%) open to closed scrub (70-90%) over *Baeckea crispiflora* var. *tenuior*, *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland over *Lepidosperma leptostachyum*, *Lepidobolus chaetocephalus*, *Lepidosperma* sp P1 small head (M.D. Tindale 166A) scattered sedges with *Stylidium septentrionale* (1-5%), *Borya sphaerocephala* (1-3%) very open herbland.

Associated species: *Xanthorrhoea drummondii*, *Gompholobium glutinosum* (shrub straggly to 35 cm), *Schoenus clandestinus*.

Notes: Includes area on east side with small open areas of *Kunzea praestans* vegetation amongst *Allocasuarina campestris* scrub.

Releve CNR119

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407499/UTM 66 21565 (WGS 84; GPS unit).

Site description: Very gently sloping, west-facing floor of shallow depression area on top of low rocky ridge.

Soil: Very gravelly, pebbly brown sand (tested).

Vegetation description: *Allocasuarina campestris* (70-80%) open to closed scrub over *Baeckea* sp. Moora (R. Bone 1993/1) (2-3%), *Calytrix leschenaultii* (1-2%) open shrubland over *Astroloma serratifolium*, *Neurachne alopecuroidea*, *Amphipogon caricinus*, *Lepidosperma* sp. scattered grasses/sedges with *Borya sphaerocephala* (2-3%), *Stylidium septentrionale* very open herbland.

Associated species: *Lawrencella rosea*, *Trachymene pilosa*, *Trachymene cyanopetala*.

Notes: Quite a lot of 'gaps' in area due to disturbance.

AcB.3: See the vegetation description for releve CR32 below.

This plant community was recorded on a lower slope and on a broad ridge top and differed by having a *Baeckea* sp. Moora (R. Bone 1993/1), *Melaleuca calyptroides* (open) shrubland to open heath under an *Allocasuarina campestris* closed scrub. Releve CR32 and CR56.

Releve CR32

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407473/UTM 66 20529 (WGS 84; GPS unit).

Site description: Gently sloping, west-facing lower slope of low ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Allocasuarina campestris* (70-80%) closed scrub over *Baeckea* sp. Moora (R. Bone 1993/1) (5-10%), *Melaleuca calyptroides* (3-5%) shrubland over *Stylidium septentrionale* (2-4%), *Borya sphaerocephala* very open herbland.

Associated species: *Schoenus clandestinus*, *Stypanandra glauca*, *Baeckea crispiflora*, *Hakea incrassata*, *Pimelea imbricata* var. *piligera*, *Lepidobolus chaetocephalus*, *Trachymene cyanopetala*, *Calytrix leschenaultia*.

Notes: Burnt few years ago? *Allocasuarina campestris* burnt in recent years? (about 90 cm to 1.3 m high).

Releve CR56

Date: 23/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407573/UTM 66 21426 (WGS 84; GPS unit).

Site description: Gently sloping north-west facing low ridge top.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (+) scattered low trees over *Allocasuarina campestris* (35-40%), *Xanthorrhoea drummondii* (2-3 m, 1-2%) open scrub over *Melaleuca radula* (1%), *Kunzea praestans* (2%) scattered tall shrubs to high open shrubland over *Baeckea* sp. Moora (R.

Bone 1993/1) (30-35%), *Melaleuca calyptroides*, *Calytrix leschenaultii* (3-4%) shrubland to low shrubland over *Neurachne alopecuroidea* scattered grasses with *Stylidium septentrionale* (3-5%), *Borya sphaerocephala* (2-3%) very open herbland.

Associated species: *Lawrencella rosea*, *Schoenus clandestinus*, *Burchardia umbellata*, *Trachymene cyanopetala*, *Blennospora drummondii*, *Opercularia vaginata*.

Notes: 1) Unit similar to R42 and R47 but has *Allocasuarina huegeliana* scattered.

AcB.4: *Allocasuarina huegeliana* scattered low trees over *Dryandra sessilis* var. *sessilis*, (*Xanthorrhoea drummondii*) scattered tall shrubs to high open shrubland over *Allocasuarina campestris* shrubland to closed scrub over *Baeckea* sp. Moora (R. Bone 1993/1), (*Melaleuca calyptroides*) scattered shrubs to open shrubland over very open herb/grass/sedgeland.

This plant community was recorded at three sites on the broad top of a low ridge in Cairn Hill and Cairn Hill North and was differentiated by having a strata of scattered *Allocasuarina huegeliana* low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs.

Quadrat CAH3 and releves CR42 and CNR118.

Releve CR42

Date: 21/11/03

Location: Cairn Hill.

AMG84: 50J 0407667/UTM 66 20395 (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Dryandra sessilis* ssp. *sessilis*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Xanthorrhoea drummondii* scattered tall shrubs over *Allocasuarina campestris* (70-80%) closed shrub over *Melaleuca calyptroides* (3-5%), *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Borya sphaerocephala* (1-2%), *Styandra glauca* (+) very open herbland

Associated species: *Acacia aristulata*, *Daviesia dielsii*, *Trachymene pilosa*.

Releve CNR118

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407619/UTM 66 21523 (WGS 84; GPS unit).

Site description: Flat top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with rock outcrop (~ 5-10%).

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Dryandra sessilis* var. *sessilis* (2-3%) high open shrubland over *Allocasuarina campestris* (70-80%) closed scrub over *Baeckea* sp. Moora (R. Bone 1993/1), *Kunzea praestans*, *Calytrix*

leschenaultii scattered shrubs over Neurachne alopecuroidea, Desmocladus flexuosus scattered grasses/sedges with Stypandra glauca scattered herbs.

Notes: 1) This unit was in small patches in a mosaic of units.

2) This unit recorded immediately adjacent to CNR117.

Vegetation Association AcCq: *Allocasuarina campestris*, *Calothamnus quadrifidus* var. Moora-Watheroo open to closed scrub.

Plant Communities:

AcCq.1: *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees to low open woodland over *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora-Watheroo) open to closed scrub over scattered grasses/sedges/herbs.

Quadrat JT9 and releve SWR207.

Releve SWR207

Date: 9/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409245/UTM 66 25159 (WGS 84; GPS unit).

Site description: Gentle to moderate, west-facing mid to upper slope of low rocky ridge (elevation 245 m).

Soil: Gravelly, pebbly, cobbly brown sand with some boulders and rock outcrop (~1-2% surface cover).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (5-10%) low open woodland to low woodland over *Allocasuarina campestris* (70-80%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-3%) closed scrub over *Borya sphaerocephala* scattered herbs.

Associated species: ? none.

Condition: Very good (low weed cover).

AcCq.2: *Allocasuarina campestris*, (*Acacia congesta* subsp. *congesta*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo) closed scrub over *Melaleuca calyptroides* scattered shrubs over (*Baekkea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii*) scattered low shrubs over scattered sedges and grasses and very open herbland.

This plant community was differentiated by having a *Melaleuca calyptroides* scattered shrubs to open shrubland layer. Releves CR9, CR44 and CR67.

Releve CR9

Date: 8/11/03

Location: South-east corner of Cairn Hill,

AMG84: 50J 0407726/UTM 66 20092 (WGS 84; GPS unit).

Site description: Flat to very gently sloping north-west facing crest of low ridge.

Soil: Gravelly, pebbly, cobbly grey sand with some exposed sheet rock.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris* (~40-50%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-5 m, (2-5%) open scrub over *Melaleuca radula* (+), *Melaleuca calyptroides* (1-2%), *Kunzea praestans* (1%) scattered shrubs to open shrubland over *Baekkea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii*, *Xanthosia fruticulosa* scattered low shrubs over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (5-10% dead), *Stylidium septentrionale* open herbland.

Associated species: *Waitzia nitida*, *Desmocladus flexuosus*, *Stypandra glauca*, *Cheilanthes adiantoides*, *Podotheca angustifolia*, *Trachymene cyanopetala*, *Xanthorrhoea drummondii*.

Condition: Excellent to very good (some weeds).

Releve CR44

Date: 22/11/03

Location: Cairn Hill.

AMG84: 50J 0407605/UTM 66 20364 (WGS 84; GPS unit).

Site description: Steep, south-west facing mid slope of rocky ridge.

Soil: Gravelly, pebbly, cobbly brown loamy sand.

Vegetation description: *Allocasuarina campestris* (60-70%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-3%) open scrub to closed scrub over *Acacia congesta* subsp. *congesta* (2-3%), *Melaleuca calyptroides* (3-5%) open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus*, *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stylidium septentrionale* (3-5%), *Borya sphaerocephala* (1-2%) very open herbland.

Associated species: *Melaleuca radula*, *Isopogon divergens*, *Baeckea* sp. Moora (R. Bone 1993/1), *Regelia megacephala*, *Astroloma serratifolium*.

Releve CR67

Date: 25/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407166/UTM 66 20980 (WGS 84; GPS unit).

Site description: Moderate steep, north-facing lower to mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop.

Vegetation description: *Allocasuarina campestris* (70-80%), *Acacia congesta* subsp. *congesta* (3-4%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo closed scrub over *Melaleuca calyptroides* (1-2%) scattered shrubs over *Stypandra glauca* (1-2%) very open herbland.

Associated species: *Regelia megacephala* (1 to 2-3% in some parts of slope), *Dichopogon capillipes*, *Thysanotus manglesianus*, *Cheilanthes adiantoides*, *Dioscorea hastifolia*, *Xanthosia fruticulosa*, *Lawrencella rosea*.

Notes: This is an *Allocasuarina campestris* scrub unit on rocky chert slopes.

AcCq.3: See vegetation description for releve CR36 below.

This plant community differed by having a scattered *Astroloma serratifolium* and *Hakea lissocarpha* low shrub layer. Releve CR36.

Releve CR36

Date: 20/11/03

Location: Cairn Hill.

AMG84: 50J 0407676/UTM 66 20777 (WGS 84; GPS unit).

Site description: West-facing moderate mid slope.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Santalum acuminatum*, *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (60-70%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (3-5%) open to closed scrub over *Calytrix leschenaultii* (1-2%), *Hakea lissocarpha* (+), *Astroloma serratifolium* scattered low shrubs over *Desmocladius flexuosus* (1-2%), *Lepidobolus chaetocephalus* (+), *Schoenus clandestinus* (1-2%) very open sedgeland with *Stypandra glauca*, *Stylidium septentrionale*, *Borya sphaerocephala*, very open herbland.

Associated species: *Acacia aristulata*, *Kunzea praestans*, *Baeckea* sp. Moora (R. Bone 1993/1), *Lawrencella rosea*, *Xanthorrhoea drummondii*, *Regelia megacephala*.

Vegetation Association AcDs: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Allocasuarina campestris* open to closed scrub.

Plant Communities:

AcDs.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees to low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Allocasuarina campestris* open to closed scrub over scattered sedges.

Relevés JTR200 and CH310.

Releve JTR200Date: 9/1/04Location: John Tonkin's property.AMG84: 50J 0409083/UTM 66 25383 (WGS 84; GPS unit).Site description: Moderate, east-facing slope of low ridge.Soil: Very gravelly, pebbly brown sand with some rock outcrop and boulders (10%).Rock type: Chert.Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata scattered low trees over Dryandra sessilis var. sessilis (6-7%) high open shrubland over Allocasuarina campestris (50-60%) (regrowth: mainly about 1.1 m to 1.4 m high only) open scrub over Calytrix leschenaultii scattered low shrubs over Desmocladius flexuosus (3-5%), Lepidosperma sp. (+), Neurachne alopecuroidea very open sedgeland/grassland with Styliidium septentrionale very open herbland.Associated species: Kunzea praestans (seedlings), Chamaescilla corymbosa var. corymbosa, Xanthorrhoea drummondii, Melaleuca calyptroides.Condition: Very good (low weed cover).Releve CH310Date: 11/12/04Location: Kim Chester's property.AMG84: 50J 0408123/UTM 66 21456 (WGS 84; GPS unit).Site description: Gentle, east-facing upper slope of low ridge.Rock type: Chert.Vegetation description: Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low open woodland to low woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Allocasuarina campestris open to closed scrub over Desmocladius flexuosus scattered sedges.Associated species:Condition: Good**AcDs.2:** *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris*, (*Kunzea praestans*, *Xanthorrhoea drummondii*) open scrub over *Calytrix leschenaultii* scattered low shrubs over scattered sedges with very open herbland.This plant community was distinguished by the presence of *Kunzea praestans* in the open scrub layer. Releves EOR137 and JTR202.Releve EOR137Date: 7/12/03Location: Eastern ore body.AMG84: 50J 0407551/UTM 66 23071 (WGS 84; GPS unit).Site description: Moderate sloping, south-west facing upper slope of low rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand amongst outcrop (~ 5 %).Vegetation description: Allocasuarina huegeliana (~ 3-5 %) low open woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Allocasuarina campestris (20-30%), Kunzea praestans (1-2%), Acacia congesta subsp. congesta (1%), Xanthorrhoea drummondii (+) open scrub over Hibbertia subvaginata (3-5%), (*Calytrix leschenaultii*) open shrubland over Desmocladius flexuosus, Neurachne alopecuroidea scattered sedges/grasses with Borya sphaerocephala scattered herbs.Associated species: Acacia lasiocarpa sedifolia, Daviesia dielsii, Burchardia umbellata, Pityrodia dilatata, Chamaescilla corymbosa var. corymbosa.Notes: Regrowth from fire or some disturbance - Allocasuarina campestris stand only about 1 to 1.4 m high.Releve JTR202

Date: 9/1/04

Location: John Tonkin's property.

AMG84: 50J 0409084/UTM 66 25453 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope on low rocky ridge.

Soil: Very gravelly, pebbly brown sand with rock outcrops (~10% surface area).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (3%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland to low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (30-40% (50)), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (1-2%), *Kunzea praestans* (+), *Xanthorrhoea drummondii* (+) open scrub over *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus* scattered sedges with *Stylidium septentrionale* very open herbland.

AcDs.3: (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*) low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Allocasuarina campestris*, (*Melaleuca radula*, *Xanthorrhoea drummondii*) high shrubland to open scrub over *Calytrix leschenaultii* scattered low shrubs over scattered grasses and herbs.

This plant community differed by having a high open shrubland of *Melaleuca radula* and *Xanthorrhoea drummondii*. Relevés CNR120, CNR136.

Releve CNR120

Date: 4/12/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407478/UTM 66 21504 (WGS 84; GPS unit).

Site description: Moderate to steeply sloping, south-facing upper slope of deep gully (10m deep).

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Allocasuarina campestris* (40-50%), *Xanthorrhoea drummondii* (3-5%), *Melaleuca radula* (1-2%) open scrub over *Calytrix leschenaultii* (1-2%) scattered low shrubs over *Lepidosperma leptostachyum*, *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered sedges/grasses with *Stypandra glauca* scattered herbs.

Associated species: *Hakea lissocarpha*, *Stypandra glauca*, *Kunzea praestans*, *Dichopogon capillipes*, *Burchardia umbellata*.

Releve CNR136

Date: 6/12/03

Location: Cairn Hill North.

AMG84: 50J 0407380/UTM 66 21717 (WGS 84; GPS unit).

Site description: Upper slope of low rocky ridge, west-facing.

Vegetation description: *Allocasuarina huegeliana* (10-15%), *Acacia acuminata* subsp. *acuminata* (1-2%) low woodland over *Dryandra sessilis* var. *sessilis* (4-5%) high open shrubland over *Allocasuarina campestris* (15-18%), *Melaleuca radula* (+), *Xanthorrhoea drummondii* (4%) high shrubland over *Calytrix leschenaultii* scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Podolepis lessonii* (1-2%) scattered herbs.

Notes: Similar to CNR135 but upslope with *Dryandra sessilis* var. *sessilis* high open shrubland.

AcDs.4: (*Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* high open shrubland to high shrubland over scattered sedges/grasses with scattered ferns (and annual grassland/herbland).

This plant community differed by having a high open shrubland of *Xanthorrhoea drummondii*. Relevés CWR138, JTR245, JTR253 and CSR321.

Releve: CWR138

Date: 7/12/03

Location: West of Western Ridge.

AMG84: 50J 0407059/UTM 66 23375 (WGS 84; GPS unit).

Site description: Gently sloping mid slope, west-facing, of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand (NT).

Vegetation description: Allocasuarina huegeliana scattered low trees over Dryandra sessilis var. sessilis scattered tall shrubs over Allocasuarina campestris (20-25%), Xanthorrhoea drummondii (2-3%) high shrubland over Lepidosperma tenue, Schoenus clandestinus, Desmodium flexuosus, Neurachne alopecuroidea scattered sedges/grasses with Cheilanthes adiantoides scattered ferns.

Vegetation Condition: Poor to very poor condition

Releve JTR245

Date: 13/1/04

Location: John Tonkin's property.

AMG84: 50J 0409029/UTM 66 26530 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of rocky low ridge (elevation 274 m).

Soil: Gravelly, pebbly brown sand with outcrop/boulders (5-10%).

Rock type: Chert?

Vegetation description: Acacia acuminata subsp. acuminata (1-3%), Allocasuarina huegeliana (1-2(5%)) scattered low trees to low open woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Allocasuarina campestris (15-25%), Xanthorrhoea drummondii (2-5%) high shrubland over Desmodium flexuosus, Lepidosperma sp. scattered sedges and Podolepis lessonii, Borya sphaerocephala scattered herbs with Avena barbata, Hypochaeris glabra, Briza maxima (50-70%) annual grassland/herbland.

Associated species:

Condition: Poor to very poor. (Heavy weed infestation and grazing effects).

Releve JTR253

Date: 14/1/04

Location: John Tonkin's property.

AMG84: 50J 0409423/UTM 66 26114 (WGS 84; GPS unit).

Site description: Moderate to steep, east-facing mid to upper slope on low rocky ridge (elevation 285 m??).

Rock type: Chert.

Vegetation description: Acacia acuminata subsp. acuminata (Allocasuarina huegeliana) scattered low trees to low open woodland over Dryandra sessilis var. sessilis (2-3%) scattered tall shrubs to high open shrubland over Allocasuarina campestris (5-15%), Xanthorrhoea drummondii (1-2%) high open shrubland to high shrubland over Crassula colorata, Borya sphaerocephala with Cheilanthes adiantoides scattered ferns and Avena barbata, Hypochaeris glabra closed annual grassland/herbland.

Associated species:

Condition: Very poor to degraded.

Notes: Similar to R245.

Releve CSR321

Date: 16/2/05

Location: Kim Chester's property, south of Cairn Hill.

AMG84: 50J 0407606/UTM 66 19256 (WGS 84; GPS unit).

Site description: Steep, south-facing mid slope of low rocky ridge.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana (10-15%) low open woodland over Allocasuarina campestris (10-15%), (Dryandra sessilis var. sessilis (+)) high open shrubland to high shrubland over Xanthorrhoea drummondii high open shrubland over Avena barbata, Vulpia myuros var. hirsuta annual grassland.

Associated species:

Condition: Poor – very poor (annual grassland of weeds).

Vegetation Association AcEe: *Eucalyptus eudesmioides* scattered low mallees to low mallee woodland over *Allocasuarina campestris* open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) scattered low shrubs to low shrubland.

Plant Communities:

AcEe.1: *Eucalyptus eudesmioides* scattered low mallees to low mallee woodland over *Allocasuarina campestris*, (*Kunzea praestans*, *Regelia megacephala*) open scrub over *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1) shrubland over scattered sedges, grasses and herbs..

This plant community differed by having a *Kunzea praestans*, *Regelia megacephala* high shrubland component and a *Melaleuca calyptroides* open shrubland to shrubland component. Quadrat CAH6 and releve CR27 and CR29.

Releve CR27 (?same as CAH6)

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407366/UTM 66 20501 (WGS 84; GPS unit).

Site description: Gently sloping, south-east facing rocky (chert) crest of low ridge.

Soil: Gravelly, pebbly, cobbly pale brown sand amongst boulders and exposed sheet rock.

Vegetation description: *Eucalyptus eudesmioides* scattered low mallees over *Allocasuarina campestris* (80 cm burnt? – 30-40%), *Kunzea praestans* (3-5%), (*Regelia megacephala* (+)) open scrub over *Melaleuca calyptroides* (10-15%), *Baeckea* sp. Moora (R. Bone 1993/1) (5-8%) shrubland over *Desmodium flexuosus*, *Neurachne alopecuroidea* scattered sedges and grasses with *Stylidium septentrionale* scattered herbs.

Associated species: *Calothamnus sanguineus*, *Xanthorrhoea drummondii*, *Dryandra sessilis* var. *sessilis*, *Acacia acuminata* subsp. *acuminata*, *Acacia pulchella* var. *goadbyi*, *Burchardia umbellata*, *Lawrencella rosea*, *Millotia tenuifolia* var. *tenuifolia*, *Hibbertia subvaginata*.

Notes: 1) *Allocasuarina campestris* ~ 1 m high => appears hot fire here 2-3 years ago => regrowth. But *Eucalyptus* are 3-5 m and *Regelia* to 3.5 m => maybe longer since fire.

2) Variable scrub dominant in area. Few patches *Regelia megacephala* high open shrubland, *Kunzea praestans* high open shrubland. *Melaleuca calyptroides* and *Baeckea* dominant with *Allocasuarina campestris*.

Releve: CR29

Date: 15/11/03

Location: Cairn Hill

AMG84: 50J 0407266/UTM 66 20484 (WGS 84; GPS unit).

Site description: West-south-west facing, moderate sloping mid slope of low rocky ridge.

Soil: Gravelly, pebbly brown sand amongst exposed sheet rock.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Eucalyptus eudesmioides* scattered mallees (clumps) over *Allocasuarina campestris* (35-50%), *Kunzea praestans* (3-5%), (*Regelia megacephala*) open scrub over *Melaleuca calyptroides* (15-20%) shrubland over *Xanthosia fruticulosa* scattered low shrubs over *Styphandra glauca*, *Stylidium septentrionale*, *Borya sphaerocephala* scattered low herbs with *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered grasses and scattered sedges.

Associated species: *Baeckea* sp. Moora (R. Bone 1993/1), *Isopogon divergens*, *Xanthorrhoea drummondii*.

Notes: 1) Very variable vegetation on these slopes.

2) Very similar to CR27 unit on crest, but *Allocasuarina huegeliana* comes in on upper to mid slope

AcEe.2: *Eucalyptus eudesmioides* low woodland to low open forest over *Allocasuarina campestris* closed scrub over *Baeckea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii* scattered low shrubs to low open shrubland over scattered sedges with very open herbland
 Quadrat CAH18 and releve CR89.

Releve CR89

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406999/UTM 66 21580 (WGS 84; GPS unit).

Site description: Gently sloping north to north-east facing lower slope on edge of broad flat plain.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus eudesmioides* (3-5% in clump) low open woodland over *Allocasuarina campestris* (70-80%) closed scrub over *Xanthorrhoea drummondii* scattered shrubs over *Baeckea* sp. Moora (R. Bone 1993/1) (1-2%), *Calytrix leschenaultii* (+) scattered low shrubs over *Lepidosperma leptostachyum* scattered sedges with *Stylidium septentrionale* (2-3%) very open herbland

Associated species: *Dodonaea pinifolia*, *Neurachne alopecuroidea*, *Kunzea praestans*, *Schoenus clandestinus*, *Borya sphaerocephala* (+).

Notes: ~ CH18 *Eucalyptus eudesmioides* low open woodland over *Allocasuarina campestris* closed scrub.

Vegetation Association AcEI: *Eucalyptus loxophleba* subsp. *loxophleba* low open woodland to low open forest over *Allocasuarina campestris* open scrub.

Plant Communities:

AcEI.1: *Eucalyptus loxophleba* subsp. *loxophleba* low open forest over *Allocasuarina campestris* open to closed scrub over scattered sedges/grasses.

This plant community had a low open forest of *Eucalyptus loxophleba* subsp. *loxophleba*. Relevés CNR110 and ERR144.

Releve CNR110

Date: 2/12/03

Location: Cairn Hill North.

AMG84: 50J 0407047/UTM 66 22684 (WGS 84; GPS unit).

Site description: Gentle, west-facing lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (30-40%) low open forest over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (70-80%) closed scrub over *Neurachne alopecuroidea* scattered grasses.

Releve ERR144

Date: 8/12/03

Location: Eastern Ridge.

AMG84: 50J 0407843/UTM 66 24184 (WGS 84; GPS unit).

Site description: Saddle between two low rocky ridges along a drainage line/fault.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (40-50%) low open forest over *Allocasuarina campestris* (30-40%) (variable and patchy) open scrub (to high open shrubland) over *Lepidosperma tenue*, *Neurachne alopecuroidea* (+), *Schoenus clandestinus* (+) scattered sedges/grasses.

Condition: Very good.

Notes: Lot of bare ground.

AcEI.2: *Eucalyptus loxophleba* subsp. *loxophleba* low open woodland over *Allocasuarina campestris* open scrub over scattered sedges/grasses/herbs.

This plant community had a low open woodland of *Eucalyptus loxophleba* subsp. *loxophleba*.
Relevés ERR172 and ERR193.

Releve: ERR172

Date: 23/12/03

Location: Eastern Ridge.

AMG84: 50J 0407985/UTM 66 22688 (WGS 84; GPS unit).

Site description: West-facing moderate slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand (NT) amongst boulders and rock outcrop (50-60% of surface) (elevation 232 m).

Rock type: Chert.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (5-8%) low open woodland over *Allocasuarina campestris* (50-60%) open scrub over *Lepidosperma tenue* (1%), *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (1-2%) scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Condition: Excellent (not many weeds).

Releve ERR193

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407910/UTM 66 23509 (WGS 84; GPS unit).

Site description: Gentle, east-facing, upper slope of rocky low ridge.

Rock type: Chert on slopes.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (15-20%) low open woodland over *Allocasuarina campestris* (60-70%) open scrub over *Lepidosperma* sp. very open sedgeland.

Associated species: *Dioscorea hastifolia*, *Dichopogon capillipes*, *Trachymene pilosa*, *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Good to very good (high weed cover in parts).

Vegetation Association AcEw: *Eucalyptus wandoo* subsp. *wandoo* low open woodland over *Allocasuarina campestris* open to closed scrub.

Plant Communities:

AcEw.1: *Eucalyptus wandoo* subsp. *wandoo* low open woodland over *Allocasuarina campestris* (none under *E. wandoo* subsp. *wandoo* trees) open to closed scrub over scattered herbs and ferns.
Relevés ERR167 and GHR292.

Releve ERR167

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407960/UTM 66 23904 (WGS 84; GPS unit).

Site description: Gentle, east-facing low to mid slope of low rocky ridge (elevation 240 m).

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (4-5%) low open woodland over *Allocasuarina campestris* (70-80%, NB: none under *Eucalyptus wandoo* subsp. *wandoo*) open to closed scrub over *Podolepis lessonii* (1%), *Dichopogon capillipes* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dioscorea hastifolia*, *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Very good. Low weed cover.

Releve GHR292

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408258/UTM 66 18076 (WGS 84; GPS unit).

Site description: *Eucalyptus wandoo* subsp. *wandoo* scattered trees to open woodland over *Allocasuarina campestris* open scrub.

AcEw.2: *Eucalyptus wandoo* subsp. *wandoo* low mallee woodland over *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora-Watheroo) high shrubland to open scrub over scattered shrubs over *Desmocladius flexuosus* scattered sedges with scattered herbs.

This plant community differed by having a *Calothamnus quadrifidus* var. Moora-Watheroo high shrubland component. Relevés CR40 and CR70.

Releve CR40

Date: 21/11/03

Location: Cairn Hill.

AMG84: 50J 0407546/UTM 66 20424 (WGS 84; GPS unit).

Site description: 'Shelf of dyke' on fault band – band of *Eucalyptus wandoo* subsp. *wandoo* to the north on lower to mid slopes of low ridge, west-facing.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* low mallee woodland over *Allocasuarina campestris* (30-50%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (1-2%) open scrub over *Melaleuca calyptroides* (1-2%), *Acacia congesta* subsp. *congesta* scattered shrubs over *Desmocladius flexuosus* scattered sedges with scattered herbs.

Releve CR70

Date: 25/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407166/UTM 66 20531 (WGS 84; GPS unit).

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* low mallee open woodland (~30%) over *Allocasuarina campestris* (15-20%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (5-7%) high shrubland over *Thomasia grandiflora*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Hibbertia subvaginata* scattered low shrubs over *Desmocladius flexuosus* (5-6%) very open sedgeland.

Associated species: *Stylobasium australe* (shrub about 1 m).

AcEw.3: *Eucalyptus wandoo* subsp. *wandoo* scattered low trees to low open woodland over *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees to low open woodland over *Allocasuarina campestris* open to closed scrub over scattered sedges and low open fern/herbland.

This plant community differed by having an *Acacia acuminata* subsp. *acuminata*, (*Allocasuarina huegeliana*) scattered low trees to low open woodland layer.

Quadrat CAH12 and relevés CR13 and CR16.

Releve CR13

Date: 8/11/03

Location: Cairn Hill, south-east corner.

AMG84: 50J 0407917/UTM 66 20378 (WGS 84; GPS unit).

Site description: East-facing, moderate sloping, mid slope of low ridge.

Soil: Gravelly, pebbly, cobbly grey silty sand.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (2-5%) scattered low trees to low open woodland over *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (40-50%) open scrub over *Borya sphaerocephala* (10-15%), *Styandra glauca* (1-2%) open herbland and *Cheilanthes adiantoides* (2-3%) very open fernland with *Stygidium septentrionale* (1-2%) open herbland.

Associated species: *Blennospora drummondii*, *Trachymene cyanopetala*, *Trachymene ornata*, *Neurachne alopecuroidea*, *Lomandra effusa* on lower slopes as is scattered *Baekkea* sp. Moora (R. Bone 1993/1).

Notes: Cf CR7- CR7 was on rocky (chert) slope => hence *Xanthosia fruticulosa* etc.

Releve CR16Date: 9/11/03Location: Cairn Hill (south end).AMG84: 50J 0407512/UTM 66 20098 (WGS 84; GPS unit).Site description: Moderately sloping, east-facing, rocky upper slope of low ridge.Soil: Gravelly, bouldery brown sand amongst large areas of exposed sheet rock.Vegetation description: Eucalyptus wandoo ssp. wandoo scattered trees over *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (+) scattered low trees to low open woodland over *Allocasuarina campestris* (50-80%) open to closed scrub over *Neurachne alopecuroidea* scattered grasses with *Dichopogon capillipes*, *Stypantra glauca* very open herbland.Associated species: *Trachymene pilosa*, *Acacia aristulata*, *Dryandra sessilis* var. *sessilis* ssp. *ses*, *Goodenia arthrotricha* (50J 0407512/UTM 66 20103), *Trichoryne elatior*, *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Trymalium ledifolium* var. *rosmarinifolium*, *Cheilanthes adiantoides*.**AcEw.4:** See vegetation description for releve CR7 below.This plant community was described from a breakaway rocky slope of a low ridge with scattered *Kunzea praestans* and *Melaleuca calyptroides* present and typical breakaway slope species present (*Xanthosia fruticulosa*, *Stypantra glauca* and *Trymalium ledifolium* subsp. *rosmarinifolium*).

Releve CR7.

Releve CR7Date: 8/11/03Location: Cairn Hill Reserve, near southern boundary.AMG84: 50J 0407780/UTM 66 20048 (WGS 84; GPS unit).Site description: Rocky (chert) upper slope, (moderate slope, east facing) on low ridge.Soil: Gravelly, cobbly, bouldery grey sand.Vegetation description: Eucalyptus wandoo subsp. wandoo (5-10%), (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*) low open woodland over *Allocasuarina campestris* (40-50%) *Kunzea praestans* (1-2%) open to closed scrub over *Melaleuca calyptroides* scattered shrubs over *Calytrix leschenaultii*, *Xanthosia fruticulosa* scattered low shrubs with *Stypantra glauca* very open herbland.Associated species: *Waitzia nitida*, *Neurachne alopecuroidea*, *Austrostipa exillis*, *Desmocladus flexuosus*, *Xanthosia fruticulosa*, *Dichopogon capillipes*, *Trymalium ledifolium* var. *rosmarinifolium* in lower part of unit.Condition: Excellent.Notes: Similar to CH10, CR2 also CAH 13.**Vegetation Association AcHa:** *Allocasuarina campestris* scattered tall shrubs over *Hypocalymma angustifolium* low open shrubland over *Pityrodia dilatata* low open shrubland.Plant Communities:**AcHa.1:** See vegetation description for releve GHR275 below.Releve GHR275Date: 16/1/04Location: Gardiner's hill.AMG84: 50J 0408295/UTM 66 17171 (WGS 84; GPS unit).Site description: very gentle, west-facing crest of very low ?chert ridge.Rock type:Vegetation description: (*Allocasuarina campestris* scattered tall shrubs) over *Hypocalymma angustifolium* (1-2%) low open shrubland over *Pityrodia dilatata* (30 cm) (15-20%) low open shrubland over *Neurachne alopecuroidea*, *Lepidosperma tenue* scattered sedges/grasses with *Dampiera lavandulacea* (15-20%), *Opercularia vaginata* (1-2%) open herbland.

Associated species: *Acacia aristulata*, *Daviesia dielsii*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Calytrix leschenaultii*, *Orthrosanthus laxus*, *Melaleuca calyptroides*, *Burchardia umbellata*, *Xanthorrhoea drummondii*, *Astroloma serratifolium*.

Condition: Very good.

AcHa.2: See vegetation description for releve GHR273 below.

This plant community differed by having *Dryandra fraseri* and *Hakea lissocarpha* in the low open shrubland over a low open shrubland of *Acacia aristulata* with only scattered *Pityrodia dilatata*.

Releve GHR273.

Releve GHR273

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408295/UTM 66 17191 (WGS 84; GPS unit).

Site description: Crest of low rocky ridge (elevation 250 m).

Rock type: Grey chert.

Vegetation description: (*Allocasuarina campestris* (+)) scattered tall shrubs over *Melaleuca radula* scattered shrub over *Dryandra fraseri* (60-80 cm) (2-3%), *Hakea lissocarpha*, *Hypocalymma angustifolium* low open shrubland over *Acacia aristulata* (2-3%) low open shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea*, *Lepidosperma tenue* scattered sedges/grasses with *Dampiera lavandulacea* (5-10%), *Opercularia vaginata* ((+) 2%), *Stypantra glauca* (+) open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Burchardia umbellata*, *Pityrodia dilatata*, *Daviesia dielsii*, *Melaleuca calyptroides*.

Condition: Very good (some annual weeds – *Ursinia anthemoides*, *Avena barbata*).

Vegetation Association Achs: *Allocasuarina campestris* open to closed scrub over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.

Plant Communities:

Achs.1: *Allocasuarina campestris* (high open shrubland) to closed scrub over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) scattered low shrubs to low open shrubland over scattered sedges/grasses/herbs.

Relevés CNR115, ERR155 and ERR195.

Releve CNR115

Date: 3/12/03

Location: Cairn Hill North.

AMG84: 50J 0407394/UTM 66 21894 (WGS 84; GPS unit).

Site description: Crest of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina campestris* (70-80%) closed scrub over *Xanthorrhoea drummondii* scattered shrubs over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stypantra glauca*, *Stylidium septentrionale*, *Borya sphaerocephala* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Dryandra sessilis* var. *sessilis*.

Releve ERR155

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407905/UTM 66 24545 (WGS 84; GPS unit).

Site description: Mid slope of low rocky ridge, east-facing, gentle slope.

Soil: Gravelly, pebbly, cobbly brown sand with boulders and rock outcrop.

Vegetation description: *Allocasuarina campestris* (80%), *Acacia congesta* subsp. *congesta* (1-2%) closed scrub over *Hibbertia subvaginata* (<1%) scattered low shrubs over *Stypandra glauca* scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Burchardia umbellata*, *Chamaescilla corymbosa* var. *corymbosa*, *Dichopogon capillipes*, *Dioscorea hastifolia*, *Allocasuarina huegeliana* (on lower slopes).

Condition: Very good. Weed cover <3% (low).

Releve ERR195

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407967/UTM 66 23428 (WGS 84; GPS unit).

Site description: Steep, east-facing mid slope of low rocky ridge (elevation 262 m).

Soil: (NT) Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop (50% +).

Vegetation description: *Allocasuarina campestris* (3-5%), *Xanthorrhoea drummondii* (2-3%) high open shrubland over *Hibbertia subvaginata* (3-5%), *Calytrix leschenaultii* (1%) low open shrubland over *Lepidosperma tenue*, *Desmocladus flexuosus*, *Neurachne alopecuroidea*, *Austrodanthonia caespitosa* scattered sedges/grasses with *Stypandra glauca* scattered herbs.

Associated species: *Dioscorea hastifolia*, *Dichopogon capillipes*, *Burchardia umbellata*, *Acacia aristulata*, *Olearia dampieri* subsp. *eremicola*, *Baeckea crispiflora* var. *tenuior* (shrub x 5) (nearby about 10 m north).

AcHs.2: *Allocasuarina huegeliana* and *Acacia acuminata* subsp. *acuminata*, (*Eucalyptus loxophleba* subsp. *loxophleba*) scattered low trees to low open woodland over *Allocasuarina campestris* high open shrubland to open scrub over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) scattered low shrubs to open shrubland.

This community differed by having an *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland.

Quadrat ERG7 and relevés ERR160, ERR163, ERR152, ERR154, ERR156 and RM15.

Releve ERR154

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407947/UTM 66 24417 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana* (8-10%) low open woodland over *Allocasuarina campestris* (15%) high open shrubland over *Hibbertia subvaginata* (1%) scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Stypandra glauca*, *Podolepis lessonii*, *Lawrencella rosea* scattered herbs to very open herbland and *Avena barbata*, *Ehrharta longiflora* very open annual grassland and *Cheilanthes adiantoides* scattered ferns.

Condition: Good (some weed infestation).

Releve ERR156

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407864/UTM 66 24419 (WGS 84; GPS unit).

Site description: Gentle, west-facing, upper slope of low rocky ridge with boulders and outcrop (cover 20-30%).

Soil: See R155.

Vegetation description: *Allocasuarina huegeliana* (1-2%), *Acacia acuminata* subsp. *acuminata* (<1%), *Eucalyptus loxophleba* subsp. *loxophleba* (<1%) scattered low trees over *Allocasuarina campestris* (50%), (*Xanthorrhoea drummondii* (1-2%), *Kunzea praestans* (<1%), *Acacia congesta* subsp. *congesta* (1-2%)) open scrub over *Hibbertia subvaginata* (1-2%), *Calytrix leschenaultii* (<1%)

scattered low shrubs over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Dioscorea hastifolia*, *Trachymene pilosa*.

Notes: Similar to R155 but with low tree strata.

Releve ERR160

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407741/UTM 66 24270 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid slope of low ridge (Elevation 254 m).

Soil: Gravelly, pebbly, cobbly brown sand (NT) amongst boulders and rock outcrop (~ 50-70% cover).

Vegetation description: *Allocasuarina huegeliana* ((2-3%) 5-6%), *Acacia acuminata* subsp. *acuminata* (1%), *Eucalyptus loxophleba* subsp. *loxophleba* (1%) low open woodland over *Allocasuarina campestris* (20-25%) high shrubland over *Hibbertia subvaginata* (5-10%), *Calytrix leschenaultii* (+) open shrubland over *Lepidosperma tenue* (1-2%) scattered sedges with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Goodenia berardiana*, *Dichopogon capillipes*, *Dioscorea hastifolia*, *Olearia dampieri* subsp. *eremicola*, *Borya sphaerocephala*.

Condition: Very good to excellent. Very few weeds.

Notes: Similar to R139, R155.

Releve ERR163

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407815/UTM 66 24031 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid to upper rocky slope of low rocky ridge (elevation 254 m).

Soil: Gravelly, pebbly, cobbly brown sand (NT) amongst boulders and outcrop (rock cover ~ 50-60% surface cover).

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (1-2%) low open woodland over *Allocasuarina campestris* (5-15%), (*Kunzea praestans* (+)) high open shrubland to high shrubland over *Hibbertia subvaginata* (2-3%), *Trymalium ledifolium* var. *rosmarinifolium* (1%), *Olearia dampieri* subsp. *eremicola* (+), *Calytrix leschenaultii* (+) open shrubland over *Neurachne alopecuroidea* scattered grasses with *Cheilanthes adiantoides* scattered ferns and *Podolepis lessonii* very open herbland.

Associated species: *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Lawrencella rosea*, *Dioscorea hastifolia*, *Eucalyptus loxophleba* subsp. *loxophleba*.

Releve ERR152

Date: 20/12/03

Location: Eastern Ridge.

AMG84: 50J 0407907/UTM 66 24591 (WGS 84; GPS unit).

Site description: Mid slope, east-facing moderate slope on low rocky ridge.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba* (5-6 m, 5%), *Allocasuarina huegeliana* (3.5 m, 2-3%) low open woodland over *Allocasuarina campestris* (30-35%), *Acacia congesta* subsp. *congesta* (<1%) open scrub over *Hibbertia subvaginata* (3-5%) low open shrubland over *Neurachne alopecuroidea* scattered grasses with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dioscorea hastifolia*, *Chamaescilla corymbosa* var. *corymbosa*.

Releve RM15

Date: 11/12/04

Location: Ron Manning's property.

AMG84: 50J 0408807/UTM 66 21554 (WGS 84; GPS unit).

Site description: Gentle, east-facing slope.

Vegetation description: Eucalyptus loxophleba subsp. loxophleba, Allocasuarina huegeliana, Acacia acuminata subsp. acuminata low open woodland over Xanthorrhoea drummondii scattered tall shrubs to high open shrubland over Allocasuarina campestris high open shrubland over Hibbertia subvaginata, Calytrix leschenaultii low open shrubland over Borya sphaerocephala open herbland.

Condition: Good.

Notes: Similar to site D10. Ecotonal unit. More than 10 years since last fire.

Vegetation Association AcId: *Allocasuarina campestris* open to closed scrub over *Isopogon divergens* open shrubland.

Plant Communities:

AcId.1: *Allocasuarina campestris* open to closed scrub over *Xanthorrhoea drummondii* high open shrubland over *Isopogon divergens*, *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland to shrubland over *Calytrix leschenaultii*, *Dryandra fraseri* scattered low shrubs to low open shrubland with scattered sedges and very open herbland.

This plant community included a *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1), (*Calothamnus sanguineus*) open shrubland to shrubland and *Calytrix leschenaultii*, *Dryandra fraseri* scattered low shrubs. Relevés CR34 and CR47.

Releve CR34

Date: 15/11/03

Location: Cairn Hill

AMG84: 50J 0407591/UTM 66 20635 (WGS 84; GPS unit).

Site description: Flat crest of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst exposed sheet rock.

Vegetation description: *Allocasuarina campestris* (40-50%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (3-4%) open scrub over *Isopogon divergens* (4-5%), *Melaleuca calyptroides* (2-3%), *Baeckea* sp. Moora (R. Bone 1993/1) (3-4%) open shrubland over *Hibbertia subvaginata* (1-2%), *Calytrix leschenaultii* (1-2%), *Dryandra fraseri* (2-3%), *Xanthosia fruticulosa* (1-2%) low open shrubland over *Stylidium septentrionale* (1-2%), *Borya sphaerocephala* (2-3%) very open herbland with *Desmocladius flexuosus* scattered sedges.

Associated species: *Lawrencella rosea*, *Acacia acuminata* subsp. *acuminata*, *Xanthorrhoea drummondii*, *Calothamnus sanguineus*, *Dampiera lavandulacea* (40 cm), *Neurachne alopecuroidea*, *Hakea incrassata*, *Goodeniaceae hassallii*, *Daviesia dielsii*.

Releve CR47

Date: 22/11/03

Location: Cairn Hill.

AMG84: 50J 0407700/UTM 66 20945 (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil: Gravelly, pebbly, cobbly brow sand.

Vegetation description: *Allocasuarina campestris* (70-80%) closed scrub over *Xanthorrhoea drummondii* (3-4%) high open shrubland over *Melaleuca calyptroides* (10-12%), *Isopogon divergens* (3-5%), *Calothamnus sanguineus* (1-2%), *Daviesia dielsii* (3-4%), *Baeckea* sp. Moora (R. Bone 1993/1) (3-4%) shrubland over *Calytrix leschenaultii* scattered low shrubs with *Stylidium septentrionale*, *Borya sphaerocephala* scattered herbs.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Thysanotus manglesianus*, *Hakea incrassata*, *Dryandra fraseri*, *Kunzea praestans*, *Acacia pulchella*, *Neurachne alopecuroidea*.

Notes: 1) Include this releve because no tree layer.

2) Has scattered *Acacia acuminata* subsp. *acuminata* about 50 m south. *Allocasuarina campestris* only about 0.8-1 m high regrowth => % of *Melaleuca* and *Kunzea* etc; shrubland cover decreases *Allocasuarina campestris* gets higher height and cover.

AcId.2: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris*, *Kunzea praestans* high shrubland to open scrub over *Melaleuca calyptroides*, *Isopogon divergens* shrubland over *Calytrix leschenaultii* scattered low shrubs to low open shrubland over very open herbland.

This plant community differed by having an *Allocasuarina huegeliana* scattered low tree layer along with *Kunzea praestans* high open shrubland and *Melaleuca calyptroides* shrubland component. Quadrat CAH17 and releve CR23.

Releve CR23

Date: 14/11/03

Location: Cairn Hill.

AMG84: 50J 0407443/UTM 66 20155 (WGS 84; GPS unit).

Site description: Very gently sloping, west-facing, upper slope just adjacent to crest of low ridge (elevation =262 m).

Soil: Gravelly, pebbly, cobbly brown sand with exposed boulders/bare rock.

Vegetation description: *Allocasuarina huegeliana* (+) low scattered trees over *Allocasuarina campestris* (30-40%), *Kunzea praestans* (1-3% (15-20%)) open scrub over *Melaleuca calyptroides* (10-15%), *Isopogon divergens* (5-8%) shrubland over *Calytrix leschenaultii*, *Xanthosia fruticulosa* (+) scattered low shrubs over *Neurachne alopecuroidea* scattered grasses with *Stygidium septentrionale* (1-2%), *Borya sphaerocephala* (1-2%) very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dryandra fraseri*, *Dryandra sessilis* var. *sessilis*, *Desmocladus flexuosus*, *Dichopogon capillipes*

AcId.3: *Allocasuarina campestris* closed scrub over *Isopogon divergens* open shrubland over scattered grasses. Quadrat CAH19.

Vegetation Association AcMr: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris*, (*Melaleuca radula*) open scrub.

Plant Communities:

AcMr.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris*, *Melaleuca radula* open scrub over *Calytrix leschenaultii*, (*Astroloma serratifolium*) scattered low shrubs to low open shrubland scattered low shrubs over scattered sedges/grasses with very open herbland and scattered ferns.

Relevés CNR134 and GHR295.

Releve CNR134

Date: 6/12/03

Location: Cairn Hill North.

AMG84: 50J 0407261/UTM 66 21751 (WGS 84; GPS unit).

Site description: Very gently sloping, west-facing lower slope (floor area adjacent to drainage line?) of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (3-5%) low woodland over *Allocasuarina campestris* (50-60%), (*Melaleuca radula* (1-2%)) open scrub over *Calytrix leschenaultii* scattered shrubs over *Lepidosperma tenue*, *Schoenus clandestinus* (+), *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala*, *Podolepis lessonii* (1-2%) scattered herbs with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Eucalyptus loxophleba* subsp. *loxophleba* (near drainage line).

Releve GHR295

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408483/UTM 66 17508 (WGS 84; GPS unit).

Site description: Gentle, west-facing lower mid slope of low rocky ridge (elevation 255 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (5%) low open woodland to low woodland over *Allocasuarina campestris* (20-25%), *Melaleuca radula* (8-10%) open scrub over *Calytrix leschenaultii* scattered low shrubs over *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (5-6%) very open herbland and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Podolepis canescens*, *Podolepis lessonii*, *Kunzea praestans*.

Condition: Very good.

AcMr.2: *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Melaleuca radula*) closed scrub over *Calytrix leschenaultii*, (*Astroloma serratifolium*) scattered low shrubs over scattered sedges and herbs.

This plant community differed by having no tree layer and an *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora Watheroo, *Melaleuca radula*) closed scrub.

Quadrat CAH4 and releves CR26 and CR38.

Releve CR26

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407433/UTM 66 20399 (WGS 84; GPS unit).

Site description: Moderate sloping, east-facing mid slope.

Soil: Gravelly, pebbly, cobbly brown loamy sand.

Vegetation description: *Allocasuarina campestris* (80-90%) (*Calothamnus* aff. *quadrifidus* Moora-Watheroo) closed scrub over *Melaleuca radula*, *Acacia congesta* subsp. *congesta* scattered shrubs over *Desmocladius flexuosus* (1-3%), *Lepidosperma tenue* scattered sedges to very open sedgeland with *Cheilanthes adiantoides* (5-10% dead) open fernland and *Dichopogon capillipes* very open herbland.

Associated species: *Acacia restiacea*, *Dioscorea hastifolia*, *Daviesia dielsii*, *Burchardia umbellata*, *Stypandra glauca*, *Astroloma serratifolium*.

Notes: *Grevillea biternata* at AMG84: 50J 04074393/UTM 66 20462 (WGS 84; GPS unit).

Releve CR38 (~ to CR37)

Date: 21/11/03

Location: Cairn Hill.

AMG84: 50J 0407609/UTM 66 20840 (WGS 84; GPS unit).

Site description: Mid, south-west facing moderate slope on low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: (*Allocasuarina huegeliana*) scattered low trees over *Allocasuarina campestris* (70-80%), (*Calothamnus* aff. *quadrifidus* Moora-Watheroo (1-2%), *Melaleuca radula* (2-4%)) closed scrub over *Calytrix leschenaultii*, *Astroloma serratifolium* (1-2%) scattered low shrubs to low open shrubland over *Neurachne alopecuroidea* (+), *Lepidosperma leptostachyum* scattered grasses and sedges with *Chamaescilla corymbosa* var. *corymbosa* (+), *Stypandra glauca* (+), *Borya sphaerocephala* (1%) scattered herbs with *Cheilanthes adiantoides* (+) scattered ferns.

Associated species: *Schoenus clandestinus*, *Blennospora drummondii*, *Styloidium septentrionale*, *Trachymene pilosa*, *Dichopogon capillipes*

Notes: 1) ~ to CR37 and in the same valley.

2) Scattered *Acacia acuminata* subsp. *acuminata* on lower slopes.

3) Quite a lot of old disturbance in the area (old tracks, old gridlines).

AcMr.3: *Acacia acuminata* subsp. *acuminata* scattered low trees to low open woodland over *Allocasuarina campestris* open scrub to closed scrub over *Melaleuca radula* scattered shrubs over scattered sedges and grasses.

This plant community differed by having an *Acacia acuminata* subsp. *acuminata* scattered low trees to low open woodland tree layer. Relevés CR18, CR19 and CR59.

Releve CR18

Date: 9/11/03

Location: Cairn Hill.

AMG84: 50J 0407233/UTM 66 20013 (WGS 84; GPS unit).

Site description: Mid slope of long, gentle, west facing slope of low ridge.

Soil: Gravelly brown sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* closed scrub (80-100%) over *Neurachne alopecuroidea* scattered grasses and *Cheilanthes adiantoides* fernland with *Trachymene ornata*, *Chamaescilla corymbosa* var. *corymbosa*, *Millotia tenuifolia* var. *tenuifolia* very open herbland.

Associated species: *Melaleuca radula* (near openings), *Dioscorea hastifolia*, *Podolepis lessonii*, *Stylidium septentrionale*.

Notes: Downslope more open (~40-50% = open scrub), with more *Borya sphaerocephala* and *Stylidium septentrionale*, *Stypandra glauca*, *Melaleuca radula* and less *Cheilanthes adiantoides*. Also some yellow *Calytrix depressa* and *Baeckea crispiflora* var. *tenuior*.

Releve CR19

Date: 9/11/03

Location: Cairn Hill.

AMG84: 50J 0407170/UTM 66 20094 (WGS 84; GPS unit).

Site description: Gently sloping west-facing mid slope of low ridge (long slope).

Soil: Brown gravelly sand.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* open to closed scrub (40-50 to 70-80%) (more open upslope) over *Melaleuca radula*, *Baeckea crispiflora* var. *tenuior* scattered shrubs over *Borya sphaerocephala* (3-5%), *Stylidium septentrionale* (3-5%), *Cheilanthes adiantoides* (1-2%), *Podolepis lessonii* open herbland with *Neurachne alopecuroidea* scattered grasses.

Associated specie: *Trachymene cyanopetala*, *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Xanthorrhoea drummondii*.

Releve CR59 (small unit)

Date: 23/11/03

Location: Cairn Hill.

AMG84: 50J 0407716/UTM 66 21314 (WGS 84; GPS unit).

Site description: Gentle, east-facing upper slope of low rocky ridge (where breakaway normally is but not very rocky).

Vegetation description: *Acacia acuminata* subsp. *acuminata* (10-15%), (*Eucalyptus loxophleba* subsp. *loxophleba* (+)) low open woodland over *Allocasuarina campestris* (50-60%) open scrub over *Melaleuca radula* scattered shrubs over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges and grasses.

Vegetation Association AcMs: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* open to closed scrub over *Melaleuca sclerophylla* open shrubland.

Plant Communities:

AcMs.1: See the vegetation description for releve GHR272 below.

Releve GHR272.

Releve GHR272Date: 16/1/04Location: Gardiner's hill.AMG84: 50J 0408283/UTM 66 17208 (WGS 84; GPS unit).Site description: Gentle, west-facing slope of low (chert) rocky rise.Soil:Rock type: ? Sandstone.Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* (60-70%) open to closed scrub over *Melaleuca sclerophylla* (3-5%) open shrubland over *Schoenus clandestinus* (1%), *Desmocladius flexuosus*, *Lepidobolus chaetocephalus*, *Neurachne alopecuroidea*, *Lepidosperma leptostachyum* very open sedgeland/grassland with *Borya sphaerocephala* (1-2%), *Stylidium septentrionale* (1-2%) very open herbland.Associated species: *Burchardia umbellata*, *Amphipogon caricinus*, *Trachymene cyanopetala*, *Podolepis lessonii*, *Blennospora drummondii*, *Crassula colorata* var. *colorata*, *Beackea crispiflora* var. *tenuior* (~80-90 cm).Condition: Very good to excellent (very few weeds and good number of species present).**Vegetation Association AcRm:** *Regelia megacephala* high open shrubland to shrubland over *Allocasuarina campestris* open to closed scrub.Plant Communities:**AcRm.1:** See the vegetation description for releve CNR105 below.This unit was probably an intermediate vegetation unit. It occurred on an upper slope of a low chert ridge with a *Regelia megacephala* scrub unit upslope and an *Allocasuarina campestris* scrub unit downslope. Releve CNR105.Releve CNR105Date: 29/11/03Location: Cairn Hill North.AMG84: 50J 0407217/UTM 66 22414 (WGS 84; GPS unit).Site description: Gently sloping, west-facing upper slope of rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand.Vegetation description: *Regelia megacephala* (10-12%) high open shrubland to open scrub over *Allocasuarina campestris* (60-70%) open scrub over *Neurachne alopecuroidea* scattered grasses with *Borya sphaerocephala* (1-2%) scattered herbs.Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Lawrencella rosea*, *Burchardia umbellata*.Notes: Site CNR105 very similar to site CR67.**AcRm.2:** See the vegetation description for releve CR39 below.This plant community, which occurred on a chert breakaway, differed by having a *Santalum acuminatum* low open woodland and included a *Calothamnus* aff. *quadrifidus* Moora Watheroo high open shrubland. Releve CR39.Releve CR39Date: 21/11/03Location: Cairn Hill.AMG84: 50J 0407659/UTM 66 20494 (WGS 84; GPS unit).Site description: Steep mid to upper, west-facing slope of low ridge (chert breakaway).Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and sheet rock.Vegetation description: *Santalum acuminatum* low open woodland over *Regelia megacephala* (5-8%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (3-5%), *Allocasuarina campestris* (30-40%) open scrub over *Lepidosperma tenue* scattered sedges with *Stypandra glauca*, *Dichopogon capillipes* very open low herbland.

Associated species: *Lawrencella rosea*, *Dioscorea hastifolia*, *Pityrodia dilatata*, *Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii*, *Xanthosia fruticulosa*, *Cheilanthes adiantoides*.

AcRm.3: See the vegetation description for releve CR2 below.

This plant community differed by having an *Allocasuarina huegeliana* scattered low trees layer, a *Calothamnus* aff. *quadrifidus* Moora Watheroo, *Kunzea praestans* high shrubland component and *Melaleuca calyptroides* scattered shrubs. Releve CR2.

Releve CR2

Date: 7/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407696/UTM 66 20035 (WGS 84; GPS unit).

Site description: Moderate west facing rocky chert slope of a low ridge.

Soil: Skeletal gravelly loam brown sand amongst chert boulders.

Vegetation description: *Allocasuarina huegelii* scattered low trees over *Allocasuarina campestris* (50-60%), *Regelia megacephala* (10-20%) *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-5%), *Kunzea praestans* (2-5%) open to closed scrub over *Melaleuca calyptroides* (2-5%) scattered shrubs to open shrubland over *Stypandra glauca* open herbland.

Associated species: *Hibbertia subvaginata*, *Xanthosia fruticulosa*

Condition: Excellent.

Notes: Some areas where *Regelia megacephala* is 30-40% and little *Allocasuarina campestris*.

AcRm.4: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* and *Regelia megacephala* open to closed scrub over *Ricinocarpos muricatus* scattered shrubs over **Vulpia myuros*, **Avena barbata* very open grassland
Releve ATR007

Releve ATR007

Date: 12/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA: 94410277 mE 6625428 mN (WGS 84; GPS unit).

Site description: Gentle west facing upper slope of low ridge.

Soil description: Brown sand (?) (north of sampled)

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris* and *Regelia megacephala* open to closed scrub over *Ricinocarpos muricatus* scattered shrubs over **Vulpia myuros*, **Avena barbata* very open grassland.

Associated species: *Dioscorea* sp., **Ursinia anthemoides*

Condition: Good

Fire Age: >10 years

Notes: Photos BM19. This is a transitional vegetation unit

Vegetation Alliance 14: *Allocasuarina microstachya* open scrub.

Vegetation Association Am: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina microstachya*, (*Kunzea praestans*) open scrub over *Calytrix leschenaultii*, *Calytrix depressa* scattered low shrubs over scattered sedges/grasses and open herbland.

Plant Communities:

Am.1: See the vegetation description for releve GHR300 below.

Only one small area of this plant community was found in the survey area, at Gardiner's Hill.
Releve GHR300.

Releve GHR300

Date: 18/11/04

Location: Gardiner's hill.

AMG84: 50J 0408795/UTM 66 17814(WGS 84; GPS unit).

Vegetation description: Allocasuarina huegeliana scattered low trees over Allocasuarina microstachya (2.1m) (40-60%), (Kunzea praestans) open scrub over Calytrix leschenaultii, Calytrix depressa scattered low shrubs over Neurachne alopecuroidea, Schoenus clandestinus scattered sedges/grasses with Borya sphaerocephala (3-5%), Gilberta tenuifolia (+), Podolepis lessonii (+), Podolepis canescens (3-5%) open herbland.

Associated species: Dianella revolute var. divaricata, Lawrencella rosea.

Notes: Very small unit.

Vegetation Alliance 15: Regelia megacephala high shrubland to open and closed scrub

Regelia megacephala high shrubland to open and closed scrub occurred on the exposed chert slopes and sometimes crests of the chert ridges in the study area. In places *Regelia megacephala* scrub stands occurred in low open woodlands and occurred with different associated tree and shrub species which varied depending on the area within the study area.

Vegetation Association Rm: *Regelia megacephala* open scrub.

Plant Communities:

Rm.1: *Regelia megacephala* open scrub over annual grassland and *Stypandra glauca* scattered herbs.

Releve CSR332.

Releve CSR332

Date: 18/2/05

Location: Kim Chester's property.

AMG84: 50J 0407236/UTM 66 19110 (WGS 84; GPS unit).

Site description: Moderate to steep, west-facing mid slope of low ridge.

Soil:

Rock type: Chert.

Vegetation description: *Regelia megacephala* (30-40 (60%) open scrub over **Ehrharta longiflora*, **Avena barbata*, *Bromus diandrus* annual grassland with *Stypandra glauca* scattered herbs.

Associated species:

Condition: Poor – very poor (very weedy).

Vegetation Association RmAh: *Allocasuarina huegeliana* low open woodland to low open forest over *Regelia megacephala* open scrub over scattered sedges and herbs.

Plant Communities:

RmAh.1: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Hibbertia subvaginata*, (*Xanthosia fruticulosa*) (low) open shrubland over *Stypandra glauca* very open herbland.

This plant community was differentiated by having *Kunzea praestans* high open shrubland and *Hibbertia subvaginata* low open shrubland. Quadrats CAH15 and CHN5. Releve CR74.

Releve CR74

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406933/UTM 66 20762 (WGS 84; GPS unit).

Site description: Steep, west facing mid to upper slope of rocky (chert) low ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (5%) low open woodland over *Regelia megacephala* (30-40%), *Kunzea praestans* (5-10%) open scrub over *Hibbertia subvaginata* (3-4%) open shrubland over *Lepidosperma leptostachyum* scattered sedges with *Stypandra glauca* (10-15%) open herbland.

Associated species: *Dichopogon capillipes*, *Burchardia umbellata*, *Dioscorea hastifolia*, *Lawrencella rosea*.

Notes: cf. CAH15 (south facing slope). Mpg unit R74A (CAH, north-west corner)

Similar to R74 but *Allocasuarina huegeliana*/*Regelia megacephala* closed scrub at base of steep rocky chert slope (west-facing).

RmA.h.2: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala* open scrub over *Hibbertia subvaginata* scattered low shrubs over scattered sedges/grasses with *Stypandra glauca* very open herbland and very open annual grassland/herbland.

This plant community was differentiated by having a *Hibbertia subvaginata* low open shrubland strata (no *Kunzea praestans* strata). Releves CNR109 and GHR291.

Releve CNR109 (~R74/R85)

Date: 2/12/03

Location: Cairn Hill North.

AMG84: 50J 0407025/UTM 66 22616 (WGS 84; GPS unit).

Site description: West-facing, gently to moderately sloping rocky lower slope of rocky low ridge.

Soil: Gravelly, pebbly, cobbly brown sand?.

Vegetation description: *Allocasuarina huegeliana* (5-10%) low open woodland over *Regelia megacephala* (15-20%), *Allocasuarina campestris* (5-8%) open scrub over *Hibbertia subvaginata*, *Xanthosia fruticulosa* (2-3%) scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered grasses/sedges with *Stypandra glauca* (1%), *Dichopogon capillipes* very open herbland with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Acacia congesta* subsp. *congesta*, *Xanthorrhoea drummondii*.

Condition: Good. Lot of weeds (*Avena barbata*, *Ursinia anthemoides*, *Briza maxima*).

Releve GHR291

Date: 13/11/04

Location: Gardiner's hill.

AMG84: 50J 0408323/UTM 66 18076 (WGS 84; GPS unit).

Site description: Moderate, north-west facing upper slope of low rocky ridge.

Soil:

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-10% live) low open woodland over *Regelia megacephala* (35-50%) open scrub over *Hibbertia subvaginata* scattered low shrubs over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Stypandra glauca*, *Podolepis canescens* (1-2%) very open herbland and *Avena barbata*, *Hypochaeris glabra*, very open annual grassland/herbland.

Associated species: *Dioscorea hastifolia*, *Chamaescilla corymbosa* var. *corymbosa*, *Podotheca angustifolia*.

Condition: Good to very good (patchy weeds).

Notes: This unit is broken up by ~R281. This unit was recorded as site N27.

RmA.h.3: See the vegetation description for releve CSR325 below.

Releve CSR325.

Releve CSR325

Date: 17/2/05

Location: Kim Chester's property, south of Cairn Hill.

AMG84: 50J 0407579/UTM 66 19585 (WGS 84; GPS unit).

Site description: Crest and gentle south-west to west-facing, upper slope of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (3-5%) low open woodland over *Regelia megacephala* ((5) 20%), (*Xanthorrhoea drummondii* (2-3%)) high open shrubland to high shrubland over **Avena barbata*, **Ehrharta longiflora*, **Vulpia myuros* var. *hirsuta* annual grassland.

Associated species:

Condition: Very poor (annual grassland of weeds).

RmA.h.4: See the vegetation description for releve CR85 below.

In this plant community, *Allocasuarina huegeliana* formed a low open forest over a *Regelia megacephala* open scrub on the lower slopes of a chert ridge in the north-west corner of Cairn Hill. Releve CR85.

Releve CR85

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406894/UTM 66 21403 (WGS 84; GPS unit).

Site description: Moderate, west-facing slope at base of steep rocky slope of low rocky ridge.

Soil: Gravel.

Vegetation description: *Allocasuarina huegeliana* (30-50%) low open forest over *Regelia megacephala* (80-90%) closed scrub over *Dodonaea pinifolia* (1%) scattered shrubs over *Stypandra glauca* scattered herbs with *Cheilanthes adiantoides* (2-4%) very open fernland,

Associated species: *Thysanotus manglesianus*, *Dichopogon capillipes*, *Xanthosia fruticulosa*.

Vegetation Association RmB: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Baeckea* sp. Moora (R. Bone 1993/1) low open shrubland.

Plant Communities:

RmB.1: Quadrat CHN8 and releve CR50.

Releve CR50

Date: 23/11/03

Location: Cairn Hill.

AMG84: 50J 0407730/UTM 66 21135 (WGS 84; GPS unit).

Site description: Moderate east-facing upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rocky outcrop (chert).

Vegetation description: *Allocasuarina huegeliana* (1-2%) *Acacia acuminata* subsp. *acuminata* (1-2%) scattered low trees to low open woodland over *Regelia megacephala* (35-45%), *Xanthorrhoea drummondii* (1-2%) open scrub over *Kunzea praestans* (4-5%) high open shrubland (to 2m) over *Baeckea* sp. Moora (R. Bone 1993/1) (2-3%), *Calytrix leschenaultii* (1-2%) open shrubland over *Hibbertia subvaginata* (1-2%) scattered low shrubs over *Desmocladus flexuosus* (1-2%), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Burchardia umbellata*, *Podolepis lessonii* scattered herbs with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Pityrodia dilatata*, *Acacia aristulata*, *Dioscorea hastifolia*, *Trachymene pilosa*, *Dichopogon capillipes*, *Blennospora drummondii*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Waitzia nitida*.

Notes: Unit is downslope of CR49.

Vegetation Association RmDs: *Regelia megacephala*, (*Dryandra sessilis* var. *sessilis*) open scrub. One plant community was included in this vegetation association.

Plant Communities:

RmDs.1: *Regelia megacephala*, (*Dryandra sessilis* var. *sessilis*) open scrub (over *Hibbertia subvaginata* scattered low shrubs) over very open fernland very open lianes.
 Quadrat GH9 and releve G328.

Releve G328

Date: 17/2/05

Location: Phil & Jenny Gardiner's property, south of Cairn Hill.

AMG84: 50J 0408144/UTM 66 19365 (WGS 84; GPS unit).

Site description: Moderate, west-facing slope of very low ridge.

Soil:

Rock type: Chert.

Vegetation description: *Regelia megacephala* (30-40%), (*Xanthorrhoea drummondii* (+), *Dryandra sessilis* var. *sessilis* (+)) open scrub over **Avena barbata* annual grassland.

Associated species:

Condition: Very poor – high weed cover.

Vegetation Association RmEe: *Eucalyptus eudesmioides* scattered low trees to low woodland over *Regelia megacephala* open to closed scrub.

Plant Communities:

RmEe.1: *Eucalyptus eudesmioides* scattered low trees to low woodland over *Regelia megacephala*, *Kunzea praestans* open scrub over *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland over very open sedgeland/herbland.

This plant community was distinguished by having a *Kunzea praestans* high shrubland and *Melaleuca calyptroides* scattered shrubs to open shrubland.

Quadrat CAH2 and releve CR30.

Releve CR30

Date: 15/11/03

Location: West Cairn Hill.

AMG84: 50J 0407249/UTM 66 20522 (WGS 84; GPS unit).

Site description: Moderate, west-south-west facing mid to upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and exposed sheet rock.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Eucalyptus eudesmioides* scattered mallees over *Regelia megacephala* (20-35%), *Kunzea praestans* (20-30%), *Allocasuarina campestris* (3-5%) open scrub over *Melaleuca calyptroides*, *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland over *Hibbertia subvaginata* scattered low shrubs over *Desmocladius flexuosus* scattered sedges with *Stypantra glauca* low open herbland.

Associated species: *Lawrencella rosea*, *Dichopogon capillipes*, *Dianella revoluta* var. *divaricate*, *Trachymene pilosa*, *Cheilanthes adiantoides*, *Dioscorea hastifolia*, *Xanthosia fruticulosa*.

RmEe.2: See the vegetation description for releve CSR324 below.

The very poor condition of vegetation at this site may have affected the vegetation structure and species and therefore the vegetation classification.

Releve CSR324.

Releve CSR324

Date: 17/2/05

Location: Kim Chester's property, south of Cairn Hill.

AMG84: 50J 0407545/UTM 66 19474 (WGS 84; GPS unit).

Site description: Moderate, south-west facing slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly grey sand in matrix of rock outcrop and rocks, boulders.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-20%) low open woodland to low woodland over *Eucalyptus eudesmioides* low open woodland (5-10%) over *Regelia megacephala* (20-30 (40%)) high shrubland to open scrub over *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* scattered low shrubs over **Avena barbata*, **Vulpia myuros* var. *hirsuta*, *Ehrharta longiflora* annual grassland.

Associated species:

Condition: Poor to very poor – very weedy.

Vegetation Association RmHs: *Regelia megacephala* open scrub over *Hibbertia subvaginata* low open shrubland to low shrubland.

Plant Communities:

RmHs.1: *Regelia megacephala* open scrub over *Hibbertia subvaginata* (low) shrubland over very open grassland with scattered annual herbs and grasses.
Quadrats ERG5, ERG8, WOR1, WOR4 and WOR5.

RmHs.2: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* high shrubland to open scrub over *Hibbertia subvaginata* scattered (low) shrubs over *Stypandra glauca* scattered herbs to very open herbland with scattered sedges and very open annual grassland.

This plant community differed by the presence of a low tree layer (scattered *Allocasuarina huegeliana*). Quadrats EOR2 and EOR3 and releve NBRM1.

Releve NBRM1

Date: 12/04

Location: Ron Manning's property.

AMG84: 50J 0408075/UTM 66 22325(WGS 84; GPS unit).

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* open to closed scrub over *Hibbertia subvaginata* scattered low shrubs over *Lepidosperma tenue* scattered sedges.

Condition: Good to very good condition.

RmHs.3: See the vegetation description for releve ERR166 below.

This plant community was differentiated by having a low tree layer (scattered *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*), an *Allocasuarina campestris* high open shrubland and *Hibbertia subvaginata* scattered shrubs. Releve ERR166.

Releve ERR166

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407813/UTM 66 23919 (WGS 84; GPS unit).

Site description: Gentle, east-facing slope on eastern edge of ridge top of low rocky ridge.

Soil: Very gravelly, pebbly, cobbly with boulders and lots of rock outcrop.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (3.5-4 m) (1-2%), *Allocasuarina huegeliana* (<1%) scattered low trees over *Regelia megacephala* (40-50%), *Allocasuarina campestris* (3-5%) open scrub over *Hibbertia subvaginata* (1-2%), *Calytrix leschenaultii* (<1%) scattered shrubs over *Lepidosperma tenue*, *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Dioscorea hastifolia*, *Dichopogon capillipes*, *Podolepis lessonii*, *Burchardia umbellata*.

Condition: Good to very good. Low weed presence (*Avena barbata*, *Briza maxima*, *Ursinia anthemoides*).

Vegetation Association RmKp: *Regelia megacephala* high shrubland to open scrub over *Kunzea praestans* high open shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.

Plant Communities:

RmKp.1: *Regelia megacephala* high shrubland over *Kunzea praestans* open scrub over *Hibbertia subvaginata*, *Xanthosia fruticulosa* over *Stypandra glauca* very open herbland.
Releve CR68.

Releve CR68

Date: 25/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407166/UTM 66 20727 (WGS 84; GPS unit).

Site description: Gentle, south-west facing lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst rock outcrop and boulders.

Vegetation description: *Regelia megacephala* (10-15%) high shrubland over *Kunzea praestans* (30-40%) open scrub over *Xanthosia fruticulosa* (4-5%) low open shrubland over *Stypandra glauca* (+) very open herbland.

Associated species: *Hibbertia subvaginata* (juvenile), *Lawrencella rosea*, *Dianella revoluta* var. *divaricate*, *Allocasuarina huegeliana*, *Dichopogon capillipes*.

RmKp.2: *Regelia megacephala*, (*Kunzea praestans*) high shrubland to open to closed scrub over (*Hibbertia subvaginata*, *Xanthosia fruticulosa*) scattered shrubs to low open shrubland over *Stypandra glauca* very open herbland and scattered sedges.

This plant community differed by having a lower cover of *Kunzea praestans* (high open shrubland to high shrubland) over *Hibbertia subvaginata* scattered shrubs.

Quadrats CHN2, CAH7, CAH11, WOR2 and WDM1. Relevés CR60, CR76 and CNR128.

Releve CR60

Date: 24/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407498/UTM 66 21096 (WGS 84; GPS unit).

Site description: Moderate to steep, west-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and sheet rock.

Vegetation description: *Regelia megacephala* (50-60%) open scrub over *Kunzea praestans* (3-4%), *Calothamnus* aff. *quadrididus* Moora-Watheroo (1-2%), *Allocasuarina campestris* (1%) high open shrubland over *Hibbertia subvaginata* (2-3%), *Pityrodia dilatata* (+), *Xanthosia fruticulosa* (1-2%) scattered low shrubs to low open shrubland over *Lepidosperma leptostachyum* (+) scattered sedges with *Stypandra glauca* (5-8%) open herbland.

Associated species: *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Dioscorea hastifolia*, *Dichopogon capillipes*, *Burchardia umbellata*, *Pterostylis* sp., *Nuytsia floribunda*, *Trachymene pilosa*, *Acacia aristulata*, *Cheilanthes adiantoides*, *Xanthorrhoea drummondii*, *Allocasuarina huegeliana*.

Notes: 1) Similar to CR33 but CR33 has 5-10% *Melaleuca calyptroides*. No *Melaleuca calyptroides* at this unit.

2) *Allocasuarina huegeliana* – 1 tree 7 m away. Overall, no tree layer. Very few *Allocasuarina huegeliana* in this unit.

Releve CR76

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406920/UTM 66 20699 (WGS 84; GPS unit).

Site description: Moderately to steep, west facing lower to mid slope.

Soil: Gravelly, pebbly, cobbly brown sand with some exposed rock outcrop.

Vegetation description: *Regelia megacephala* (4-5%) high open shrubland over *Kunzea praestans* (10-12%) high open shrubland to open scrub over *Stypandra glauca* (5-7%) very open herbland over *Borya sphaerocephala* (10-15%) low open herbland.

Associated species: *Allocasuarina huegeliana*, *Xanthorrhoea drummondii*, *Hibbertia subvaginata*, *Cheilanthes adiantoides*, *Burchardia umbellata*.

Releve CNR128

Date: 5/12/03

Location: Cairn Hill North.

AMG84: 50J 0407498/UTM 66 21710 (WGS 84; GPS unit).

Site description: Flat, very gently sloping, east-facing slope on crest of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst rock outcrop (covers about 30% of surface).

Vegetation description: *Regelia megacephala* (60-70%) open to closed scrub (*Kunzea praestans* (+) where *Regelia megacephala* scrub more open) over *Hibbertia subvaginata*, *Xanthosia fruticulosa* (1%) scattered shrubs over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with scattered herbs.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Dichopogon capillipes*, *Trachymene pilosa*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28)

RmKp.3: *Regelia megacephala*, *Kunzea praestans* open scrub over *Hibbertia subvaginata*, *Calytrix leschenaultii* low scattered shrubs over **Avena barbata*, very open grassland with **Ursinia anthemoides* very open herbland. Releve ATR006

Releve ATR006

Date: 11/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408681 mE 6625521 mN (WGS 84; GPS unit).

Site description: Upper slope to crest of low ridge

Soil description: Brown sand.

Rock type: Chert >50% rock cover

Vegetation description: *Regelia megacephala*, *Kunzea praestans* open scrub over *Hibbertia subvaginata*, *Calytrix leschenaultii* low scattered shrubs over **Avena barbata*, very open grassland with **Ursinia anthemoides* very open herbland.

Associated species: *Acacia acuminata* subsp. *acuminata*, *Allocasuarina campestris*, *Melaleuca calyptroides*, *Pityrodia dilatata*, *Ricinocarpos muricatus*

Notes: Photos BM18

Vegetation Association RmKpMc: *Regelia megacephala* open to closed scrub and *Kunzea praestans* high open shrubland to open scrub over *Melaleuca calyptroides* open shrubland to shrubland over *Hibbertia subvaginata* low open shrubland.

Plant Communities:

RmKpMc.1: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala*, *Kunzea praestans* open scrub over *Melaleuca calyptroides*, *Hibbertia subvaginata* open shrubland over *Stypandra glauca* open herbland.

This plant community included a *Kunzea praestans* high shrubland to open scrub and a *Melaleuca calyptroides*. open shrubland in its structure. Releves CR24, ATR002

Releve CR24

Date: 14/11/03

Location: Cairn Hill.

AMG84: 50J 0407407/UTM 66 20132 (WGS 84; GPS unit).

Site description: Gently sloping, west-facing upper slope of low rocky ridge.

Soil: Gravelly, pebbly brown sand with extensive area of exposed sheet rock (~20-30%).

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* (15-20%, 30-40), *Kunzea praestans* (30%) open scrub over *Melaleuca calyptroides* (5-10%), *Hibbertia subvaginata* (2-3%), *Xanthosia fruticulosa* (5%) open shrubland over *Stypantra glauca* (5-6%) low open hermland.

Associated species: *Allocasuarina campestris* (few small juvenile), *Blennospora drummondii*, *Trachymene pilosa*.

Notes: 1) Large parts of this area look "broken down" eg: lightning strike? *Tricoryne elatior*, *Stylidium septentrionale*, *Calothamnus* aff. *quadrifidus* Moora-Watheroo.

2) Less *Allocasuarina huegeliana* and lots more *Kunzea praestans*, *Melaleuca calyptroides* than CAH15.

4) Amount of *Regelia megacephala* covers varies greatly. As *Regelia* cover increases so *Kunzea* and *Melaleuca* cover decreased.

Releve ATR002

Date: 10/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408210 mE 6626037 mN (WGS 84; GPS unit).

Site description: Gentle, north facing upper slope of low chert ridge.

Rock type: Chert

Vegetation description: *Regelia megacephala*, (*Kunzea praestans*) open scrub over *Melaleuca calyptroides* scattered shrubs over *Hibbertia subvaginata* scattered low shrubland over *Desmocladius flexuosus* scattered herbs.

Associated species: *Millotia tenuifolia*, **Petrorhagia dubia*, *Stylidium repens*, *Stypantra glauca*, **Ursinia anthemoides*, *Xanthorrhoea drummondii*

Condition: Very good.

Fire Age: >7-10 years

RmKpMc.2: (*Allocasuarina huegeliana* scattered low trees over) *Regelia megacephala* tall shrubland to open and closed scrub over *Kunzea praestans*, *Melaleuca calyptroides* open shrubland to shrubland over *Calytrix leschenaultii* scattered low shrubs over *Borya sphaerocephala* low open hermland and scattered annual herbs.

This plant community had a lower *Kunzea praestans* cover (high open shrubland) and a higher cover of *Melaleuca calyptroides* (open shrubland to shrubland).

Quadrats GH2, GH3, CAH1 and JT8.

RmKpMc.3: *Regelia megacephala*, *Kunzea praestans*, *Allocasuarina campestris* open scrub over *Melaleuca calyptroides* scattered shrubs to open shrubland over *Hibbertia subvaginata* scattered low shrubs over scattered sedges/grasses/herbs.

This plant community differed by having an *Allocasuarina campestris* component of the shrub or scrub layer.

Quadrat CHN4. Relevés CR11 and CR33.

Releve CR11

Date: 11/11/03

Location: Cairn Hill, south-east corner.

AMG84: 50J 0407841/UTM 66 20347 (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil: Gravelly, pebbly, cobbly grey sand with exposed sheet rock (chert).

Vegetation description: *Regelia megacephala* (20-30%), *Allocasuarina campestris* (5-10%), *Kunzea praestans* (10-15%) high open scrub over *Melaleuca calyptroides* (3-5%) open shrubland over *Hibbertia subvaginata* (2-3%), *Baeckea* sp. *Moora* (R. Bone 1993/1) (+), *Calytrix leschenaultii* (+) low open shrubland over *Neurachne alopecuroidea* scattered grasses.

Associated species: *Trachymene cyanopetala*, *Trachymene pilosa*, *Podotheca angustifolia*, *Blennospora drummondii*, *Millotia tenuifolia* var. *tenuifolia*, *Crassula colorata* var. *colorata*, *Stypantra glauca*, *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana*.

Condition: Very good to excellent.

Notes: Varies considerably, with *Regelia megacephala* lower cover and areas with *Melaleuca calyptroides* open heath. Areas of *Baeckea* sp. *Moora* (R. Bone 1993/1) low open heath.

Releve CR33

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407523/UTM 66 20619 (WGS 84; GPS unit).

Site description: West-facing, moderate sloping mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and exposed sheet rock (chert).

Vegetation description: *Regelia megacephala* (60-70%), (*Allocasuarina campestris*) (5-6%) open scrub over *Melaleuca calyptroides* (5-10%) open shrubland over *Hibbertia subvaginata* (2-3%) low open shrubland over *Lepidosperma leptostachyum* scattered sedges with *Stypantra glauca*, *Dichopogon capillipes* low open herbland and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Calothamnus* aff. *quadrifidus* *Moora-Watheroo*, *Kunzea praestans*, *Trachymene pilosa*, *Dioscorea hastifolia*, *Xanthosia fruticulosa*.

Vegetation Alliance 16: *Kunzea praestans* high shrubland to open and closed scrub

Vegetation Association KpAh: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* scattered shrubs to low open shrubland.

Plant Communities:

KpAh.1: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata* scattered low shrubs to shrubland over very open herbland/sedgeland/grassland.

Quadrats ERG14, ERG2 and releves CR82, CR83, CR84, CNR107 and RM6.

Releve: CR82

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406875/UTM 66 21600 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop (surface cover about 70%).

Vegetation description: *Allocasuarina huegeliana* (5-7%) low open woodland over *Kunzea praestans* (6-8%) high open shrubland over *Hibbertia subvaginata* (1-2%), *Xanthosia fruticulosa* (2-3%) scattered low shrubs over *Stypantra glauca* (6-8%), *Borya sphaerocephala* (1-2%) very open herbland with (dead) *Cheilanthes adiantoides* (3-5%) very open fernland.

Associated species: *Burchardia umbellata*, *Dioscorea hastifolia*, *Dichopogon capillipes*, *Pityrodia dilatata*.

Releve CR83

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407040/UTM 66 21301 (WGS 84; GPS unit).

Site description: Moderate to gentle, east-facing mid-slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (10-20%) low woodland over *Kunzea praestans* (40-50%), (*Xanthorrhoea drummondii* (2%)) open scrub over *Hibbertia subvaginata*, *Xanthosia fruticulosa* (3-5%) low open shrubland over *Desmocladus flexuosus* (3-4%), *Neurachne alopecuroidea* (+) very open sedgeland/grassland with very open herbland and *Cheilanthes adiantoides* (2-4%) very open fernland.

Associated species: *Dichopogon capillipes*, *Dryandra sessilis* var. *sessilis*, *Lawrencella rosea*, *Podotheca angustifolia*, *Burchardia umbellata*, *Dioscorea hastifolia*, *Thysanotus manglesianus*.

Notes: Similar to CH8.

Releve CR84

Date: 27/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406930/UTM 66 21351 (WGS 84; GPS unit).

Site description: Moderate to steep mid to upper west-facing slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop (80-90% surface has rock cover).

Vegetation description: *Allocasuarina huegeliana* (8-10%) low open woodland over *Kunzea praestans* (20-30%) high shrubland over *Hibbertia subvaginata* (4-5%) open shrubland over *Dodonaea pinifolia* (1%), *Xanthosia fruticulosa* (3-4%) low open shrubland over *Stypantra glauca* (3-4%) open herbland and *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Dichopogon capillipes*, *Dioscorea hastifolia*, *Lawrencella rosea*, *Waitzia nitida*.

Releve CNR107

Date: 29/11/03

Location: Cairn Hill North.

AMG84: 50J 0407067/UTM 66 22602 (WGS 84; GPS unit).

Site description: Moderate, west-facing mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with boulders and outcrop.

Vegetation description: *Allocasuarina huegeliana* (5-8%) low open woodland over *Kunzea praestans* (10-20%), *Allocasuarina campestris* (5-10%) open scrub over *Hibbertia subvaginata* (2-3%), *Xanthosia fruticulosa* (5-6%) low open shrubland over *Neurachne alopecuroidea* scattered grasses with *Stypantra glauca* (1-2%) very open herbland and *Cheilanthes adiantoides* (1-2%) scattered ferns.

Associated species: *Xanthorrhoea drummondii*, *Burchardia umbellata*, *Dichopogon capillipes*, *Dioscorea hastifolia*.

Releve: RM6

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408068/UTM 66 22137 (WGS 84; GPS unit).

Site description: Gentle to moderate, west-facing lower to mid slope of low ridge.

Rock type: Chert (lots of outcropping).

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans* high open shrubland to high shrubland over *Hibbertia subvaginata* low open shrubland over *Lepidosperma tenue* very open sedgeland and *Ehrharta longiflora*, *Briza maxima* very open annual grassland with *Hyalosperma cotula* very open herbland and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Vulpia myuros* var. *hirsuta*, *Dioscorea hastifolia*, *Xanthorrhoea drummondii*, *Dichopogon capillipes*, *Neurachne alopecuroidea*.

Condition: Good to very good.

Notes: Fire more than 7 years ago.

Vegetation Association KpAhB: *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* high shrubland to open scrub over shrubland including *Melaleuca calyptroides* and *Baekkea* sp. Moora (R. Bone 1993/1) scattered shrubs to open shrubland.

Plant Communities:

KpAhB.1: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Allocasuarina campestris*) open scrub over *Melaleuca calyptroides*, *Baekkea* sp. Moora (R. Bone 1993/1) (4-5%) scattered shrubs to open shrubland over (*Hibbertia subvaginata*) scattered shrubs to low open shrubland over low open shrubland over very open grass/herbland. Quadrats CAH9, CHN6 and CHN7 and relevés CR35 and CR46.

Releve CR35

Date: 15/11/03

Location: Cairn Hill.

AMG84: 50J 0407681/UTM 66 20743 (WGS 84; GPS unit).

Site description: Lower, west-facing gentle to moderate slope.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees over *Kunzea praestans* (40-50%) (very variable), *Allocasuarina campestris* (5-10%), *Xanthorrhoea drummondii* (2-3%) open scrub over *Calothamnus sanguineus* (5-6%), *Melaleuca calyptroides* (2-3%), *Baekkea* sp. Moora (R. Bone 1993/1) (4-5%) open shrubland over *Calytrix leschenaultii*, *Astroloma serratifolium* scattered low shrubs over *Lepidobolus chaetocephalus*, *Desmocladus flexuosus*, *Schoenus brevisetis* (+), *Amphipogon caricinus*, *Neurachne alopecuroidea* (+) very open sedgeland/grassland with *Lomandra effusa* (+), *Borya sphaerocephala* (2-3%) very open herbland.

Associated species: *Hakea lissocarpha* (shrub to 90 cm-1m), *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Schoenus clandestinus*, *Goodenia hassallii*, *Stypandra glauca*, *Austrostipa elegantissima*, *Verticordia densiflora* var. *densiflora*, *Gompholobium glutinosum* (15 m – downslope ~20 cm high).

Releve CR46

Date: 22/11/03

Location: Cairn Hill.

AMG84: 50J 0407822/UTM 66 20461 (WGS 84; GPS unit).

Site description: Crest of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with some boulders and exposed sheet rock.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris* (5-8%), (*Regelia megacephala* (+)) high open shrubland over *Kunzea praestans* (20-30%) shrubland over *Melaleuca calyptroides* (10-15%), *Baekkea* sp. Moora (R. Bone 1993/1) (5-10%) shrubland over *Calytrix leschenaultii* scattered low scrub over *Stypandra glauca*, *Borya sphaerocephala* (+), *Stylidium septentrionale* scattered herbs.

Associated species: *Calothamnus sanguineus*, *Xanthorrhoea drummondii* (dead), *Trachymene cyanopetala*, *Blennospora drummondii*, *Trachymene pilosa*, *Neurachne alopecuroidea*, *Acacia aristulata*, *Podotheca angustifolia*.

KpAhB.2: (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees) over *Dryandra sessilis* var. *sessilis* high open shrubland over *Kunzea praestans*, (*Allocasuarina campestris*) open to closed scrub over *Baekkea* sp. Moora (R. Bone 1993/1), *Calytrix leschenaultii*, (*Hibbertia subvaginata*) (low) open shrubland over scattered sedges/grasses/herbs.

This plant community differed by having a *Dryandra sessilis* var. *sessilis* high open shrubland strata and generally no *Melaleuca calyptroides* open shrubland.
 Quadrat CAH5 and releves CNR117, CNR126 and CNR131.

Releve CNR117

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407607/UTM 66 21539 (WGS 84; GPS unit).

Site description: Flat top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with some rock and rock outcrop (<5%).

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (2-3%) low woodland over *Dryandra sessilis* var. *sessilis* (5-10%) high open shrubland over *Kunzea praestans* (30-40(50-60%)) (very variable), (*Allocasuarina campestris*) (+) open scrub over *Baeckea* sp. *Moora* (R. Bone 1993/1) (3-5%) open shrubland over *Calytrix leschenaultii* (1-2%) scattered low shrubs over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Styandra glauca* scattered herbs.

Associated species: *Blennospora drummondii*, *Trachymene pilosa*, *Podolepis lessonii*, *Podotheca angustifolia*, *Trachymene cyanopetala*, *Burchardia umbellata*, *Lawrencella rosea*.

Notes: Similar to unit R97 and very similar to CHN6 (but with no *Hibbertia subvaginata* and R97 didn't have *Baeckea* sp. *Moora* (R Bone 1993/1)).

Releve: CNR126

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407219/UTM 66 21600 (WGS 84; GPS unit).

Site description: Moderate to gentle west-facing lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with rock outcrop (about 3-5% of surface cover).

Vegetation description: *Dryandra sessilis* var. *sessilis* (3-5%) high open shrubland over *Kunzea praestans* (30-40%), *Xanthorrhoea drummondii* (2-3%), *Allocasuarina campestris* (2-3%) open scrub over *Baeckea* sp. *Moora* (R. Bone 1993/1) (10-15%), *Hibbertia subvaginata* (1-2%), *Calytrix leschenaultii* (1-2%) shrubland over *Lepidosperma leptostachyum*, *Lepidobolus chaetocephalus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Opercularia vaginata* (5-7%), *Borya sphaerocephala* (+), *Styidium septentrionale* (1-2%) very open herbland.

Associated species: *Tricoryne elatior*, *Blennospora drummondii*, *Lawrencella rosea*, *Trachymene pilosa*, *Podolepis lessonii*.

Releve CNR131

Date: 5/12/03

Location: Cairn Hill North.

AMG84: 50J 0407514/UTM 66 21887 (WGS 84; GPS unit).

Site description: Moderate, east-facing upper slope of low rocky ridge (elevation 272 m).

Soil: Gravelly, pebbly, cobbly brown sand with rocks and boulders.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland to low woodland over *Dryandra sessilis* var. *sessilis* (4-5%) high open shrubland over *Kunzea praestans* (15-20%), *Allocasuarina campestris* (1-2%) high shrubland over *Hibbertia subvaginata* (15-20%) shrubland over *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Dichopogon capillipes*, *Dianella revoluta* var. *divaricate*, *Baeckea* sp. *Moora* (R. Bone 1993/1), *Calytrix leschenaultii*, *Xanthosia fruticulosa*.

KpAhB.3: See vegetation description for releve CR63 below.

This plant community was distinguished by having *Allocasuarina humilis* in the open scrub on a rocky chert slope. Releve CR63.

Releve CR63Date: 24/11/03Location: Cairn Hill Reserve.AMG84: 50J 0407403/UTM 66 21231 (WGS 84; GPS unit).Site description: South-west facing, gently sloping, upper slope of low rocky ridge.Soil: Gravelly, pebbly brown sand.Vegetation description: (*Allocasuarina huegeliana* scattered low trees) over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (50-60%), *Allocasuarina humilis* (1-2%), *Xanthorrhoea drummondii* (3-5%) open scrub over *Melaleuca calyptroides* (4-5%), *Isopogon divergens* (7-8%), *Calothamnus sanguineus* (1-2%), *Baeckea* sp. *Moora* (R.Bone 1993/1) (4-5%) open shrubland over *Neurachne alopecuroidea* scattered grasses with *Styloidium septentrionale*, *Borya sphaerocephala* scattered herbs.Associated species: *Burchardia umbellata*, *Schoenus brevisetis*, *Lawrencella rosea*, *Trachymene pilosa*, *Schoenus nanus*, *Xanthosia fruticulosa*.**Vegetation Association KpAhDs:** *Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata* low open shrubland.Plant Communities:**KpAhDs.1:** (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*) scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) (low) open shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea* very open sedgeland/grassland with *Cheilanthes adiantoides* very open fernland. This plant community had a *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland over *Hibbertia subvaginata* low open shrubland.

Relevés CR49, CNR97, RM13, JTR254 and SWR216.

Releve CR49Date: 23/11/03Location: Cairn Hill.AMG84: 50J 0407747/UTM 66 21073 (WGS 84; GPS unit).Site description: East-facing, moderate rocky (chert) upper slope of short slope of low rocky ridge.Soil: Gravelly, pebbly, cobbly brown sand amongst boulders and exposed rock.Vegetation description: *Allocasuarina huegeliana* (3-5%) low open woodland over *Dryandra sessilis* var. *sessilis* (3-4%) high open shrubland over *Kunzea praestans* (30-40%) open scrub over *Hibbertia subvaginata* (3-4%), *Calytrix leschenaultii* (1-2%) low open shrubland over *Desmocladius flexuosus* (1%), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Cheilanthes adiantoides* (3-5%) very open fernland with *Dichopogon capillipes* scattered herbs.Associated species: *Nuytsia floribunda*, *Burchardia umbellata*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Baeckea* sp. *Moora* (R.Bone 1993/1), *Dioscorea hastifolia*, *Thysanotus manglesianus*, *Podolepis lessonii*, *Chamaescilla corymbosa* var. *corymbosa*, *Podotheca angustifolia*, *Allocasuarina humilis*.Releve CNR97Date: 28/11/03Location: Cairn Hill North.AMG84: 50J 0407511/UTM 66 21908 (WGS 84; GPS unit).Site description: Mid to upper, north-east facing gentle slope of low rocky ridge.Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (2-3%) low open woodland over *Dryandra sessilis* var. *sessilis* (3-5%) high open shrubland over *Kunzea praestans* (25-30%), (*Xanthorrhoea drummondii* (2-4%)), *Allocasuarina campestris* (5-6%) open scrub over *Hibbertia subvaginata* (2-3%), *Calytrix leschenaultii* (+), *Xanthosia fruticulosa* (4-

5%) low open shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with very open herbland.

Associated species: *Dichopogon capillipes*, *Chamaescilla corymbosa* var. *corymbosa*, *Lawrencella rosea*, *Thysanotus manglesianus*, *Cheilanthes adiantoides*, *Trachymene pilosa*.

Releve RM13

Date: 11/12/04

Location: Ron Manning's property.

AMG84: 50J 0408751/UTM 66 21586 (WGS 84; GPS unit).

Site description: Gentle, north-facing upper slope of ridge.

Rock type: Chert (lot of rock outcrop).

Vegetation description: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*, *Nuytsia floribunda*) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* scattered tall shrubs over *Kunzea praestans* high shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* low open shrubland over *Desmocladius flexuosus* very open sedgeland and *Vulpia myuros* var. *hirsuta*, *Briza maxima*, *Avena barbata* open grassland with *Opercularia vaginata*, *Podolepis lessonii* open herbland.

Associated species: *Chamaescilla corymbosa* var. *corymbosa*, *Rhodanthe polycephala*, *Pityrodia dilatata*, *Neurachne alopecuroidea*.

Condition: Good to poor.

Notes: More than 10 years since fire. Photo: BM13-8, 9 (Looking Sth).

Site number: JTR254

Date: 14/1/04

Location: John Tonkin's property.

AMG84: 50J 0409361/UTM 66 25371 (WGS 84; GPS unit).

Site description: Moderate, east-facing mid to upper slope of low rocky ridge (elevation 270 m).

Soil: Very gravelly, pebbly, cobbly brown sand amongst boulders and rock outcrop (30-40%).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (15-25%), (*Xanthorrhoea drummondii* (+)) high shrubland over *Hibbertia subvaginata* (5-8%) open shrubland over *Pityrodia dilatata* scattered low shrubs over *Desmocladius flexuosus* (2-5%), *Neurachne alopecuroidea* (+) very open sedgeland/grassland with *Cheilanthes adiantoides* very open fernland and *Avena barbata*, *Bromus diandrus*, *Hypochaeris glabra*, *Briza maxima* annual grassland/herbland.

Condition: Good (high weed cover).

Notes: Other unit species: *Trymalium ledifolium* var. *rosmarinifolium*, *Acacia aristulata*, *Calytrix leschenaultii*.

Releve SWR216

Date: 10/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409073/UTM 66 25080 (WGS 84; GPS unit).

Site description: Gentle, east-facing upper slope of low rocky ridge (elevation 239 m).

Rock type:

Vegetation description: *Acacia acuminata* subsp. *acuminata* (+) scattered low trees over *Dryandra sessilis* var. *sessilis* (10-12%) high open shrubland to high shrubland over *Kunzea praestans* (10-15%), (*Xanthorrhoea drummondii* (1%)) high shrubland over *Hibbertia subvaginata* (3-5%) low open shrubland over *Desmocladius flexuosus* (1%), *Neurachne alopecuroidea* scattered sedges/grasses with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Ehrharta longiflora*, *Hypochaeris glabra* (10-12%) open annual grassland/herbland.

Associated species: *Millotia tenuifolia* var. *tenuifolia*, *Dichopogon capillipes*.

Condition: Good to very good.

KpAhDs.2: *Allocasuarina huegeliana*, *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Xanthorrhoea drummondii*) scattered tall shrubs to high shrubland over *Hibbertia subvaginata* (shrubland to) open heath over very open sedgeland/grassland/fernland and very open annual grassland.

This plant community differed by having a *Kunzea praestans*, (*Xanthorrhoea drummondii*) high open shrubland over *Hibbertia subvaginata* low heath.
Quadrats ERG9, WOR3 and WOR6.

KpAhDs.3: See the vegetation description for releve G317 below.

This plant community differed by not having *Hibbertia subvaginata* in the low shrub layer. Releve G317.

Releve G317

Date: 12/12/04

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408514/UTM 66 20780 (WGS 84; GPS unit).

Site description: Gentle, north-west facing slope of low ridge.

Soil:

Rock type: Chert (5% outcropping).

Vegetation description: *Allocasuarina huegeliana*, *Nuytsia floribunda* scattered tall shrubs over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (heavily grazed), (*Allocasuarina campestris*) high shrubland over *Calytrix leschenaultii* low open shrubland over *Vulpia myuros* var. *hirsuta*, *Pentastichis pallida* very open annual grassland and *Podolepis lessonii* very open herbland.

Associated species:

Condition: Poor to good.

Notes: Last fire more than 7 years ago.

Vegetation Association KpAhMc: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered trees to low open woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* open shrubland to shrubland.

Plant Communities:

KpAhMc.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees over *Kunzea praestans*, (*Allocasuarina campestris*) open to closed scrub over *Melaleuca calyptroides* open shrubland to shrubland over scattered sedges/herbs.

Relevés CR22 and CR45.

Releve CR22

Date: 14/11/03

Location: Cairn Hill.

AMG84: 50J 0407321/UTM 66 20214 (WGS 84; GPS unit).

Site description: Moderate to steep, north-west facing mid slope of low to moderately high rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand around exposed base sheet rock.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans* (50-60%), *Allocasuarina campestris* (5-10%), *Regelia megacephala* (1%), *Calothamnus* aff. *quadrifidus* Moora-Watheroo (+) open scrub to closed scrub over *Melaleuca calyptroides* (5%) open shrubland over *Lepidosperma tenue* scattered sedges and *Cheilanthes adiantoides* scattered ferns with *Styandra glauca* (1%) *Stylidium septentrionale* (1-2%), *Borya sphaerocephala* (1-2%) very open herbland.

Associated species: *Xanthorrhoea drummondii*, *Neurachne alopecuroidea*, *Acacia restiacea*, *Opercularia vaginata*, *Podolepis canescens*, *Hakea incrassata*, *Lepidosperma* sp P1 small head (M.D.)

Tindale 166A), *Trachymene cyanopetala*, *Schoenus brevisetis*, *Hakea incrassata*, *Chamaescilla corymbosa* var. *corymbosa*, *Xanthosia fruticulosa* (1-2%).

Releve CR45

Date: 22/11/03

Location: Cairn Hill.

AMG84: 50J 0407704/UTM 66 20283 (WGS 84; GPS unit).

Site description: South-facing moderate, mid slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans* (40-50%), *Allocasuarina campestris* (3-5%) open scrub over *Melaleuca calyptroides* (25-30%) shrubland over *Calytrix leschenaultii* (3-5%) scattered low scrub over *Desmocladius flexuosus* scattered sedges.

Associated species: *Xanthosia fruticulosa*, *Acacia aristulata*, *Chamaescilla corymbosa* var. *corymbosa*, *Burchardia umbellata*, *Trachymene pilosa*, *Hibbertia subvaginata*, *Xanthorrhoea drummondii*, *Acacia acuminata* subsp. *acuminata*.

Vegetation Association KpDs: *Dryandra sessilis* var. *sessilis* high open shrubland over *Kunzea praestans* (*Xanthorrhoea drummondii*) open scrub over *Hibbertia subvaginata* scattered low shrubs. This association has no tree layer.

Plant Communities:

KpDs.1: (*Nuytsia floribunda* scattered low trees over) *Dryandra sessilis* var. *sessilis* high open shrubland over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered (low) shrubs to (low) heath over *Desmocladius flexuosus*, *Neurachne alopecuroidea* very open sedgeland/grassland and *Cheilanthes adiantoides* very open fernland.

Relevés CR62, G339, D9, SWR229.

Releve CR62

Date: 24/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407522/UTM 66 21078 (WGS 84; GPS unit).

Site description: Upper slope, west-facing moderate slope of low rocky (chert) ridge.

Soil: Gravelly, pebbly, cobbly brown sand with some boulders and exposed rock.

Vegetation description: *Nuytsia floribunda*, *Dryandra sessilis* var. *sessilis* scattered low trees over *Kunzea praestans* (15-20%) open shrubland over *Hibbertia subvaginata* (40-50%) heath over *Calytrix leschenaultii* (4-5%), *Xanthosia fruticulosa* (1-2%) low open shrubland over scattered herbs with *Cheilanthes adiantoides* scattered ferns.

Associated species: *Lawrencella rosea*, *Neurachne alopecuroidea*, *Burchardia umbellata*, *Opercularia vaginata*, *Trachymene pilosa*, *Blennospora drummondii*, *Styandra glauca*, *Allocasuarina humilis*.

Releve D9

Date: 10/12/04

Location: Doblestein's property.

AMG84: 50J 0408985/UTM 66 22510 (WGS 84; GPS unit).

Site description: Moderate, north-facing slope of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand in matrix of rock outcrop/boulders.

Rock type: Chert.

Vegetation description: *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* high open shrubland to high shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* low shrubland to shrubland over *Desmocladius flexuosus* very open sedgeland and *Avena barbata*, *Ehrharta calycina*, *Lolium perene*, *Pentaschistis pallida* open grassland.

Associated species: *Dichopogon capillipes*, *Dioschorea hastifolia*, *Austrodanthonia acerosa*, *Cheilanthes adiantoides* (+), *Podotheca angustifolia*, *Bossia* sp. Cairn Hill, *Linum trigynum*, *Neurachne alopecuroidea*.

Condition: Good to very good.

Notes: Last fire more than 7 years ago. Photo: BM13-3, 4, 5.

Releve SWR229

Date: 11/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409038/UTM 66 25112 (WGS 84; GPS unit).

Site description: Moderate, south-west facing upper slope of low rocky ridge.

Rock type: Chert.

Vegetation description: *Dryandra sessilis* var. *sessilis* (5-10%) high open shrubland over *Kunzea praestans* (50-70%) open scrub over *Xanthorrhoea drummondii* scattered tall shrubs over *Hibbertia subvaginata* (1-2%), *Calytrix leschenaultii* (+) scattered low shrubs over *Desmocladus flexuosus* (2-3%), *Neurachne alopecuroidea* very open sedgeland/grassland with *Cheilanthes adiantoides* very open fernland with *Vulpia myuros* var. *hirsuta*, *Briza maxima* scattered annual grasses.

Associated species: *Burchardia umbellata*.

Condition: Very good.

Notes: Variant of SWR216.

Releve G339

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407154/UTM 66 17948 (WGS 84; GPS unit).

Site description: Gentle, south-facing upper slope of low ridge.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* scattered low trees over *Dryandra sessilis* var. *sessilis* (5-10%) high open shrubland over *Kunzea praestans* (10-15%), (*Allocasuarina campestris* (1-2%), *Xanthorrhoea drummondii* (+)) high shrubland over *Hibbertia subvaginata*, (*Gastrolobium acutum*) scattered low shrubs over *Austrostipa* sp. (+), **Avena barbata*, *Briza maxima* open grassland.

Condition: Good.

Notes: 3 x *Nemcia acuta*.

Vegetation Association KpDsMc: *Dryandra sessilis* var. *sessilis* scattered tall shrubs to high open shrubland over *Kunzea praestans* high shrubland to open scrub over *Melaleuca calyptroides* scattered shrubs to shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.

Plant Communities:

KpDsMc.1: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Allocasuarina campestris*, *Xanthorrhoea drummondii*) high open shrubland to open scrub over *Melaleuca calyptroides* scattered shrubs to open shrubland over (*Hibbertia subvaginata*), *Calytrix leschenaultia* low open shrubland over scattered sedges/grasses with *Borya sphaerocephala* very open hermland and annual grassland.

This plant community differed by having a tree strata (*Allocasuarina huegeliana* (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low woodland).

Quadrat JT1. Relevés SWR206, JTR211, SWR215, JTR222, SWR234, JTR234, JTR243, GHR286, GHR299 and GHR306.

Releve SWR206

Date: 9/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409333/UTM 66 25138 (WGS 84; GPS unit).

Site description: Gentle, south-facing slope on top of spur of low rocky ridge.

Soil: Gravelly, pebbly brown sand with rocks and rock outcrop (3-5% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5%), *Acacia acuminata* subsp. *acuminata* (1-2%) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (4-5%; 1.8-5m) high open shrubland over *Melaleuca calyptroides* (1.8-2m; 1-3%), *Xanthorrhoea drummondii* (+) open shrubland over *Hibbertia subvaginata* (3-5%), (*Calytrix leschenaultia*) low open shrubland over *Desmocladius flexuosus* scattered sedges with *Borya sphaerocephala* (5-10%), *Podolepis lessonii* (1-3%), *Erodium* sp. open herbland with *Avena barbata*, *Erodium botrys* open annual grassland/herbland.

Associated species: *Acacia congesta* subsp. *congesta*, *Austrostipa* sp.

Condition: Poor to (good). High weed cover, but a lot of species still present.

Notes: SWR206 description recorded as 'N14'.

Releve JTR211

Date: 10/1/04

Location: John Tonkin's property.

AMG84: 50J 0408908/UTM 66 25795 (WGS 84; GPS unit).

Site description: Gentle, west of north-facing upper slope on top of low rocky ridge (elevation 255 m).

Soil: Gravelly, pebbly silty fine sand with scattered cobbles.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Dryandra sessilis* var. *sessilis* (2-3%) scattered tall shrubs over *Kunzea praestans* (2-3.5m) (30-40%), (*Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-2.5 m (5 m)) (2-3%) open heath over *Melaleuca calyptroides* (4-5%) open shrubland over *Hibbertia subvaginata* (2-3%), *Calytrix leschenaultii* (1-2%) low open shrubland over *Desmocladius flexuosus* (1%), *Schoenus clandestinus*, *Neurachne alopecuroidea* (+) scattered sedges/grasses over *Borya sphaerocephala* (2-3%), *Stylidium septentrionale* (1%) low very open herbland with *Cheilanthes adiantoides* scattered ferns and 3-5% annual weedland (*Avena barbata*, *Vulpia myuros* var. *hirsuta*, *Pentaschistis pallida*, *Hypochaeris glabra*).

Associated species: *Podolepis lessonii*, *Millotia tenuifolia* var. *tenuifolia*, *Podotheca angustifolia*, *Austrostipa variabilis*.

Condition: Good to very good – native sp. present, but significant weed cover (although patchy).

Releve SWR215

Date: 10/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409077/UTM 66 25154 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid slope of low rocky ridge (elevation 246 m).

Soil: Gravelly grey silty sand with boulders and outcrop (10-15% of surface).

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata* (3-5 (15%)), *Allocasuarina huegeliana* (+) low woodland over *Dryandra sessilis* var. *sessilis* (2-3%) high open shrubland over *Kunzea praestans* (10-15%), (*Allocasuarina campestris* (1-3%), *Xanthorrhoea drummondii* (1-2%)) high shrubland over *Melaleuca calyptroides* (5-7%) open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus* (+), *Neurachne alopecuroidea* scattered sedges/grasses with *Podolepis lessonii*, *Borya sphaerocephala* (+) scattered low herbs and *Cheilanthes adiantoides* (+) scattered ferns and *Ehrharta longiflora*, *Vulpia myuros* var. *hirsuta*, *Avena barbata* (5-10%) annual open grassland.

Associated species: *Dichopogon capillipes*, *Austrostipa* sp. *Trichoryne elatior*.

Condition: Good to very good. Quite high weed cover.

Releve JTR222Date: 11/1/04Location: John Tonkin's property.AMG84: 50J 0408815/UTM 66 26106 (WGS 84; GPS unit).Site description: Gentle, south-west facing mid slope of low rocky ridge (elevation 261 m).Soil: Very gravelly brown silty fine sand with some outcrop (2-5%).Rock type: Chert.Vegetation description: Allocasuarina huegeliana low open woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Kunzea praestans (15-25%) high shrubland over Melaleuca calyptroides scattered shrubs over Hibbertia subvaginata (3-5%), Calytrix leschenaultii (+) low open shrubland over Desmocladius flexuosus, Neurachne alopecuroidea scattered sedges/grasses and Borya sphaerocephala, Opercularia vaginata scattered herbs to very open herbland and Avena barbata, Hypochaeris glabra, Vulpia myuros var. hirsuta open annual grassland/herbland.Associated species: Pityrodia dilatata, Nemcia acuta, Acacia aristulata, Podolepis lessonii, Stylium septentrionale.Condition: (Poor) to good (lot of weed cover but still has a good number of species).Notes: Similar to site JT1; similar to R211 but no Calothamnus aff. quadrifidus Moora-Watheroo and has Pityrodia dilatata, Nemcia acuta and Acacia aristulata.Releve JTR234Location: John Tonkin's property.Date: 12/1/04AMG84: 50J 0408900/UTM 66 25598 (WGS 84; GPS unit).Site description: Very gentle, south-west facing upper slope on top of low rocky ridge (elevation 251 m).Soil: Very gravelly, pebbly brown sand.Rock type: Chert.Vegetation description: Allocasuarina huegeliana scattered low trees over Dryandra sessilis var. sessilis (2-3%) scattered tall shrubs over Kunzea praestans (40-50%) open scrub over Melaleuca calyptroides scattered shrubs over Calytrix leschenaultii scattered low shrubs over Desmocladius flexuosus, Neurachne alopecuroidea scattered sedges/grasses with Opercularia vaginata (15-25%), Podolepis lessonii (2-3%) open herbland.Associated species: Podotheca angustifolia, Dryandra fraseri, Allocasuarina campestris, Xanthorrhoea drummondii, Calothamnus aff. quadrifidus Moora-Watheroo.Condition: Good to very good – not sure of extent of any previous clearing/fire and: - how natural this stand is. It's an area of old disturbance.Releve JTR243Date: 13/1/04Location: John Tonkin's property.AMG84: 50J 0409006/UTM 66 26610 (WGS 84; GPS unit).Site description: Moderate, east-facing mid slope of low rocky ridge (elevation 275 m).Soil: Very gravelly brown silty fine sand with rocks, boulders and outcrop on surface (about 30-40% surface cover).Vegetation description: Acacia acuminata subsp. acuminata, (Allocasuarina huegeliana (+)) scattered low trees over Dryandra sessilis var. sessilis (1-2%) scattered tall shrubs over Kunzea praestans (mainly heavily grazed regrowth) (5-6%), Allocasuarina campestris (2-4%), Xanthorrhoea drummondii (2-3%) high open shrubland over Calytrix leschenaultii (grazed), Hibbertia subvaginata, Acacia restiacea scattered low shrubs over Desmocladius flexuosus (1-2%), Austrostipa sp. scattered sedges/grasses with Cheilanthes adiantoides scattered ferns and Borya sphaerocephala scattered herbs and Avena barbata, Pentaschistis pallida, Ursinia anthemoides annual grassland/herbland.Associated species: Kennedia prostrata, Ptilotus polystachyus, Podolepis lessonii, Melaleuca calyptroides (on west side of ridge).

Condition: Poor to very poor (very high weed cover).

Notes: Similar to R222.

Releve GHR286

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408326/UTM 66 17940 (WGS 84; GPS unit).

Site description: Gentle, north-west facing slope just below crest of low rocky ridge (elevation 267 m).

Soil: Gravelly, pebbly brown fine sand with some rock outcrop (~10-12%).

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana scattered low trees over Dryandra sessilis var. sessilis scattered tall shrubs over Kunzea praestans (10-15%), Allocasuarina campestris (+), Xanthorrhoea drummondii (1-3%) high shrubland over Olearia dampieri subsp. eremicola, Melaleuca calyptroides scattered shrubs over Hibbertia subvaginata, Calytrix leschenaultii scattered low shrubs over Schoenus clandestinus (1-2%), Neurachne alopecuroidea (+) scattered sedges/grasses with Borya sphaerocephala (3-5%), Podolepis canescens (3-5%) very open to open herbland.

Associated species: Goodenia hassallii, Olearia dampieri subsp. eremicola, Isopogon divergens, Daviesia dielsii, Calothamnus sanguineus (80 cm).

Condition: Good to very good (Hypochaeris glabra, Pentaschistis pallida very open annual grassland/sedgeland).

Notes: Heavily grazed (especially Kunzea praestans).

Mpg unit Notes: Kunzea praestans cover varies up to 20-30% high shrubland to open scrub.

Releve GHR299

Date: 18/1/04

Location: Gardiner's hill.

AMG84: 50J 0408915/UTM 66 17785 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid – upper slope of low rocky ridge (elevation 273 m).

Soil: Very gravelly brown silty fine sand.

Rock type: ?Chert.

Vegetation description: Allocasuarina huegeliana scattered low trees over Kunzea praestans (5-10%), Allocasuarina campestris (3-5%) high open shrubland over Melaleuca calyptroides (2-4%) open shrubland over Dryandra fraseri (5-15%), Calytrix leschenaultii (1-2%) low open shrubland to open shrubland over Desmodium flexuosus, Lepidosperma tenue, Neurachne alopecuroidea, Schoenus clandestinus scattered sedges/grasses with Borya sphaerocephala (5-10%), Stypantra glauca (+), Podolepis lessonii (1-3%) very open herbland to open herbland.

Associated species: Hakea lissocarpa, Xanthorrhoea drummondii, Podotheca angustifolia, Chamaescilla corymbosa var. corymbosa, Calothamnus sanguineus.

Condition: Good – very good.

Releve GHR306

Date: 7/12/04

Location: Gardiner's hill.

Location: North-east end of block.

AMG84: 50J 0408809/UTM 66 18068 (WGS 84; GPS unit).

Site description: Very gently, north-west facing crest of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand with low % cover of exposed chert.

Rock type: Chert.

Vegetation description: Allocasuarina huegeliana low open woodland to low woodland over Dryandra sessilis var. sessilis scattered tall shrubs over Xanthorrhoea drummondii scattered tall shrubs over Kunzea praestans (10-20%) open shrubland to shrubland over Melaleuca calyptroides (5-12%) low open shrubland to low shrubland over Calytrix leschenaultii scattered low shrubs over

Borya sphaerocephala (1-2%), *Opercularia vaginata* (1%), *Podolepis canescens* (1-2%) very open herbland and *Vulpia myuros* var. *hirsuta* very open annual grassland and *Desmocladius flexuosus* scattered sedges.

Associated species: *Isopogon divergens*, *Podotheca angustifolia*, *Pentaschistis pallida*, *Cassytha pomiformis*, *Hakea recurva* subsp. *recurva*, *Dryandra fraseri*.

Condition: Very good.

Notes: Similar to site GHR229, but GHR299 had no *Dryandra fraseri*.

KpDsMc.2: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high shrubland over *Melaleuca calyptroides* scattered shrubs to open shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low shrubland over *Desmocladius flexuosus*, *Stylidium septentrionale* scattered sedges and herbs.

This plant community had no tree layer. Quadrats JT3, JT11 and releve JTR213, ATR008.

Releve JTR213

Date: 10/1/04

Location: John Tonkin's property.

AMG84: 50J 0408882/UTM 66 25750 (WGS 84; GPS unit).

Site description: Very gentle, north-west facing lower slope of low rocky ridge (elevation 258 m).

Soil: Gravelly, pebbly, cobbly brown silty sand with rock outcrop (30-40% surface cover).

Rock type: Chert.

Vegetation description: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* (5-6%) high open shrubland over *Melaleuca calyptroides* (2%) scattered shrubs over *Hibbertia subvaginata* (15-20%), *Calytrix leschenaultii* (1%) low shrubland over *Desmocladius flexuosus* (1%) scattered sedges.

Associated species: *Xanthorrhoea drummondii*, *Dioscorea hastifolia*, *Austrostipa variabilis*.

Condition: Good to very good (weed cover 5% - *Pentaschistis pallida*, *Briza maxima*, *Hypochaeris glabra*, *Avena barbata*).

Releve ATR008

Date: 12/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408581 mE 6626911 mN (WGS 84; GPS unit).

Site description: Crest of low ridge.

Soil description: Brown sand.

Rock type: Chert

Vegetation description: (*Acacia acuminata* subsp. *acuminata* scattered low trees) over *Kunzea praestans*, (*Dryandra sessilis*, *Xanthorrhoea drummondii*) high shrubland to open scrub over *Hibbertia subvaginata*, *Calytrix leschenaultii* low open shrubland over **Avena barbata*, *Austrostipa trichophylla*, **Vulpia myuros* scattered sedges/grasses with *Desmocladius flexuosus*, **Erodium botrys* herbland.

Associated species: *Allocasuarina campestris*, *Allocasuarina huegeliana*, *Amyema preissii*, *Banksia sphaerocarpa* var. *sphaerocarpa*, *Diplopeltis huegelii* subsp. *lehmannii*, *Melaleuca calyptroides*, *Neurachne alopecuroidea*, *Nuytsia floribunda*, *Ptilotus polystachyus* var. *polystachyus*

Condition: Poor

Fire Age: >10 years.

Notes: Photos BM22-23. Heavily grazed, high weed cover, modified strata.

KpDsMc.3: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low woodland to

low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, *Xanthorrhoea drummondii* open shrubland to tall open shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs to low open shrubland over annual herb/grassland.

This plant community differed by having a tree layer and a *Xanthorrhoea drummondii* high open shrubland strata. Quadrats GH4 and GH8.

Vegetation Association KpEe: *Eucalyptus eudesmioides* low woodland over *Kunzea praestans* open scrub over *Melaleuca calyptroides* and *Baeckea* sp. Moora (R. Bone 1993/1) open shrubland.
Plant Communities:

KpEe.1: See the vegetation association description above.

This unit was recorded at Cairn Hill. Releve CR64

Releve CR64

Date: 24/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407301/UTM 66 21262 (WGS 84; GPS unit).

Site description: Moderate to steep, west-south-west facing mid to upper slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Vegetation description: *Eucalyptus eudesmioides* (15-20%) low mallee woodland over *Kunzea praestans* (50-60%), *Xanthorrhoea drummondii* open scrub over *Melaleuca calyptroides* (5-7%), *Baeckea* sp. Moora (R. Bone 1993/1) (3-5%) open shrubland over *Hibbertia subvaginata* (2%) scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered grasses/sedges with scattered herbs.

Associated species: *Acacia aristulata*, *Bossiaea* sp. Cairn Hill (M Henson CH2-28), *Nem acut*, *Burchardia umbellata*, *Allocasuarina huegeliana*, *Allocasuarina humilis*, *Xanthosia fruticulosa*.

Vegetation Association KpHs: *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* (low) open shrubland to (low) open heath over scattered to very open sedgeland/grassland/herbland..

Plant Communities:

KpHs.1: *Kunzea praestans* high shrubland to open scrub over *Hibbertia subvaginata* open shrubland to open heath over very open herb/fernland.

Quadrats ERG3, ERG21 and JT10. Releve CR77.

Releve CR77

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407009/UTM 66 20626 (WGS 84; GPS unit).

Site description: Gently sloping lower slopes, south facing, of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with some boulders and rock outcrop.

Vegetation description: *Kunzea praestans* (2-2.5 m, 60-70%) open to closed scrub over *Acacia congesta* subsp. *congesta* (+) scattered shrubs over *Hibbertia subvaginata* (2-3%) low open shrubland over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges and grasses with very open herbland.

Associated species: *Nuytsia floribunda*, *Dichopogon capillipes*, *Burchardia umbellata*, *Cryptandra glabriflora* (erect shrub, 70 cm), *Lawrencella rosea*, *Cheilanthes adiantoides*, *Xanthosia fruticulosa* (1-2%).

KpHs.2: *Kunzea praestans*, (*Allocasuarina campestris*) open scrub to high shrubland over *Hibbertia subvaginata* scattered shrubs over scattered herbs.

This plant community had an *Allocasuarina campestris* component in the open scrub. Quadrat CHN3.

Vegetation Association KpXd: *Xanthorrhoea drummondii* high open shrubland over *Kunzea praestans* high open shrubland.

Plant Communities:

KpXd.1: *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland over *Calytrix leschenaultii* scattered low shrubs over scattered sedges/grasses with very open herbland. Relevés GHR289 and G340.

Releve GHR289

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408419/UTM 66 17870 (WGS 84; GPS unit).

Site description: Flat, broad crest of low rocky ridge.

Rock type: Chert.

Vegetation description: *Xanthorrhoea drummondii* (3-5%) high open shrubland over *Kunzea praestans* (regrowth) (2%) scattered tall shrubs over *Calytrix leschenaultii*, scattered low shrubs over *Neurachne alopecuroidea*, *Desmocladius flexuosus* scattered sedges/grasses with *Podolepis canescens* (1-2%), *Borya sphaerocephala* (2-3%) very open herbland and *Hypochaeris glabra* very open annual herbland.

Associated species: *Stackhousia monogyna*, *Podolepis lessonii*.

Condition: Very good.

Releve G340

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407087/UTM 66 18025 (WGS 84; GPS unit).

Site description: Gentle, south-facing mid slope of low rounded ridge.

Vegetation description: *Allocasuarina huegeliana* (2-5%) scattered low trees to low open woodland over *Xanthorrhoea drummondii* (5-10%) high open shrubland over *Kunzea praestans* (5-10%) high open shrubland over *Daviesia dielsii* scattered low shrubs to low open shrubland over *Avena barbata* open annual grassland and *Podolepis lessonii* very open herbland and *Schoenus clandestinus* very open sedgeland.

Condition: Good.

Vegetation Alliance 17: *Melaleuca calyptroides* open to closed heath

Vegetation Association Mc: *Kunzea praestans* high open shrubland over *Melaleuca calyptroides* open to closed heath over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs to low open shrubland.

Plant Communities:

Mc.1: *Kunzea praestans* high open shrubland over *Melaleuca calyptroides* open to closed heath over *Hibbertia subvaginata*, *Calytrix leschenaultii* low open shrubland over *Desmocladius flexuosus* scattered sedges/grasses with *Stylidium septentrionale*, *Borya sphaerocephala* scattered herbs. Relevés JTR214 and JTR235.

Releve JTR214

Date: 10/1/04

Location: John Tonkin's property.

AMG84: 50J 0408966/UTM 66 25593 (WGS 84; GPS unit).

Site description: Flat ridge top of low rocky ridge (very shallow saddle in ridge top) (elevation 263 m).

Soil: Very gravelly, pebbly brown sand (90% of surface covered by chert gravel/pebbles).

Rock type: Chert.

Vegetation description: Kunzea praestans (2-4%), Allocasuarina campestris (+) high open shrubland over Melaleuca calyptroides (40-50% (60%)) open heath over Hibbertia subvaginata, Calytrix leschenaultii scattered low shrubs to low open shrubland over Desmodium flexuosus (1%), Neurachne alopecuroidea (+) scattered sedges/grasses with Stylidium septentrionale (+), Borya sphaerocephala (+), Podolepis lessonii (+) scattered herbs to very open herbland.

Associated species: Isopogon divergens, Trachymene pilosa, Podotheca angustifolia, Acacia acuminata subsp. acuminata.

Condition: Very good.

Releve JTR235

Date: 12/1/04

Location: John Tonkin's property.

AMG84: 50J 0408865/UTM 66 25628 (WGS 84; GPS unit).

Site description: Flat to very very gently, south-west facing, slope on crest of low rocky ridge (elevation 264 m).

Soil: Very gravelly, pebbly brown silty sand with some boulders and sheet rock (<1%).

Rock type: Chert.

Vegetation description: Kunzea praestans (2-5%) high open shrubland over Melaleuca calyptroides (60-80%) open to closed heath over Hibbertia subvaginata, Calytrix leschenaultii (1-2%) low open shrubland over Desmodium flexuosus (1-2%) scattered sedges with Stylidium septentrionale (1%), Borya sphaerocephala (+) scattered herbs.

Associated species: Daviesia dielsii, Astroloma serratifolium (35 cm), Podotheca angustifolia, Chamaescilla corymbosa var. corymbosa.

Condition: Very good (very low weed presence).

Mc2: See the vegetation description for releve SWR231 below.

This plant community differed by having an upper strata of scattered *Dryandra sessilis* var. *sessilis*.
Releve SWR231.

Releve SWR231

Date: 11/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0409032/UTM 66 25230 (WGS 84; GPS unit).

Site description: Very gentle, south-facing slope on ridge top of low rocky ridge.

Soil: Gravelly brown sand amongst boulders and rock outcrop (~5-10%).

Vegetation description: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over Kunzea praestans (5-10%) high open shrubland over Melaleuca calyptroides (40-50%) open heath over Hibbertia subvaginata scattered low shrubs over Desmodium flexuosus scattered sedges with Cheilanthes adiantoides scattered ferns with Vulpia myuros var. hirsuta, Pentaschistis pallida, Hypochaeris glabra, Trifolium arvense var. arvense very open annual grassland/herbland.

Associated species: Millotia tenuifolia var. tenuifolia, Daviesia dielsii.

Condition: Good to very good (but with significant weed cover).

Notes: High moss cover. Similar to JT7 but with more Kunzea praestans. Very similar to R214.

Mc.3: See the vegetation description for releve CR51 below.

This plant community differed by having an upper strata of scattered *Dryandra sessilis* var. *sessilis* and a *Baekkea* sp. Moora (R. Bone 1993/1) open shrubland. Releve CR51.

Releve CR51

Date: 23/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0407692/UTM 66 21211 (WGS 84; GPS unit).

Site description: Gentle north-facing slope along top of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with some boulders and rock outcrops.

Vegetation description: *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii*, *Kunzea praestans* (1-2%) high open shrubland over *Melaleuca calyptroides* (50-60%), *Baeckea* sp. *Moor* (R.Bone 1993/1) (5-10%), *Calytrix leschenaultii* (1.6m, 1-2%) open to closed heath over *Desmocladus flexuosus*, *Neurachne alopecuroidea*, *Amphipogon caricinus* scattered sedges/grasses with *Stylidium septentrionale*, *Borya sphaerocephala* scattered herbs.

Associated species: *Dichopogon capillipes*, *Daviesia dielsii*, *Acacia acuminata* subsp. *acuminata* (juv), *Blennospora drummondii*, *Hibbertia subvaginata* (juv), *Burchardia umbellata*.

Notes: May be associated with some surface soil disturbance.

Mc.4: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high open shrubland to high shrubland over *Melaleuca calyptroides* open heath over open herbland/sedgeland.

This plant community differed by having a low tree layer (*Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees). Quadrats JT4 and JT7.

Vegetation Alliance 18: *Hibbertia subvaginata* low shrublands to low open heath

Vegetation Association Hs: *Hibbertia subvaginata* open heath.

Plant Communities:

Hs.1: *Hibbertia subvaginata*, (*Calytrix leschenaultii*) (low) open heath over scattered sedges with very open herbland and very open annual grassland.

Relevés ERR157 and RM14.

Releve ERR157

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407960/UTM 66 24119 (WGS 84; GPS unit).

Site description: Moderate, south-east facing lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly brown sand with rock outcrop and boulders (cover about 15-20%).

Vegetation description: *Hibbertia subvaginata* (50-60%) open heath over *Avena barbata*, *Briza maxima* very open annual grassland with *Chamaescilla corymbosa* var. *corymbosa* scattered herbs and *Cheilanthes adiantoides* scattered ferns.

Associated species: *Hypochaeris glabra*, *Dichopogon capillipes*, *Ursinia anthemoides*.

Condition: Poor to good – heavy weed infestation in much of area.

Releve RM14

Date: 11/12/04

Location: Ron Manning's property.

AMG84: 50J 0408787/UTM 66 21649 (WGS 84; GPS unit).

Site description: Gentle, east-facing lower slope of low ridge.

Soil: Very pebbly, gravelly brown sand with about 3-5 % exposed rock outcrop.

Rock type: Chert.

Vegetation description: *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low open heath over *Desmocladus flexuosus* scattered sedges and *Pentaschistis pallida* very open annual grassland with *Borya sphaerocephala*, *Podolepis lessonii* very open herbland.

Associated species: *Kunzea praestans*, *Allocasuarina huegeliana*, *Avena barbata*, *Dryandra sessilis* var. *sessilis*.

Condition: Good to poor.

Notes: More than 10 years since fire. Photo: BM13-11

Vegetation Association HsAh: *Allocasuarina huegeliana* scattered trees over *Hibbertia subvaginata* (low open shrubland) to open heath.

Plant Communities:

HsAh.1: *Allocasuarina huegeliana* low open woodland over *Hibbertia subvaginata* open heath over *Pityrodia dilatata* low shrubland over scattered grasses and scattered annual grasses.

This plant community was recorded on rocky, south-facing slopes on the Eastern Ridge and differed by having a *Pityrodia dilatata* low shrubland. Quadrat ERG13.

HsAh.2: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*, *Eucalyptus loxophleba* subsp. *loxophleba* scattered low trees over *Allocasuarina campestris* high open shrubland, over *Hibbertia subvaginata* open heath over very open herbland/sedgeland/grassland.

This plant community was also recorded on rocky, south-facing slopes on the Eastern Ridge and was distinguished by its *Allocasuarina campestris* high open shrubland. Quadrat ERG10.

HsAh.3: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans* scattered shrubs to open shrubland over *Hibbertia subvaginata* low open shrubland over very open sedgeland and open annual grassland.

This plant community had a *Kunzea praestans* scattered shrubs to open shrubland over *Hibbertia subvaginata* low open shrubland. Releve D8.

Releve: D8

Date: 9/12/04

Location: Doblestein's property.

AMG84: 50J 0409186/UTM 66 23654 (WGS 84; GPS unit).

Site description: West-facing moderate slope of low ridge.

Rock type: > 70% surface cover of rock, chert.

Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans* scattered shrubs to open shrubland over *Hibbertia subvaginata* low open shrubland over *Lepidosperma leptostachyum*, *Desmocladus flexuosus* very open sedgeland and *Avena barbata*, *Vulpia myuros* var. *hirsuta* open annual grassland.

Associated species:

Condition: Poor (grazing damage).

Vegetation Association HsDs: *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Hibbertia subvaginata* low shrubland.

Plant Communities:

HsDs.1: See the vegetation description for releve G337 below.

Releve G337.

Releve G337

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407411/UTM 66 17755 (WGS 84; GPS unit).

Vegetation description: *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* (5-8%) high open shrubland over *Hibbertia subvaginata* (20-25%) low shrubland over **Avena barbata*, **Briza maxima* open annual grassland.

Associated species: *Kunzea praestans*, *Xanthorrhoea drummondii*, *Calytrix leschenaultii*.

Condition: Good.

Vegetation Alliance 19: *Xanthorrhoea drummondii* high open shrubland
Vegetation Association Xd

Plant Communities:

Xd.1: See the vegetation description for releve NBRM2 below.
Releve NBRM2.

Releve NBRM2

Date: 12/04

Location: Ron Manning's property.

AMG84: 50J 0408650/UTM 66 22100(WGS 84; GPS unit).

Soil: Very cobbly, pebbly, rocky ground.

Vegetation description: Xanthorrhoea drummondii high open shrubland over grassland/herbland/sedgeland.

Notes: Fire less than 3 months ago. Difficult to determine vegetation type, but no sign of trees or shrubs other than Xanthorrhoea drummondii.

Vegetation Alliance 20: Miscellaneous heaths**Vegetation Alliance 20/1: Dryandra sessilis high shrubland**

Vegetation Association Ds: *Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii* high open shrubland over *Allocasuarina campestris* scattered tall shrubs.

Plant Communities:

Ds.1: See the vegetation description for releve CSR318 below.

Releve CSR318.

Releve CSR318

Date: 16/2/05

Location: Kim Chester's property, south of Cairn Hill.

AMG84: 50J 0407284/UTM 66 19345 (WGS 84; GPS unit).

Site description: Crest of low rocky ridge on western side of chert ridge.

Soil: Gravelly, pebbly, cobbly brown sand in matrix of rocks, boulders, rock outcrop.

Rock type: Chert.

Vegetation description: *Dryandra sessilis* var. *sessilis* (3-5%), *Xanthorrhoea drummondii* (1-2%) high open shrubland over *Allocasuarina campestris* scattered tall shrubs over **Avena barbata*, **Pentstemon airoides* annual grassland.

Associated species:

Condition: Very poor – high weed cover, absence of low shrubs, herbs?

Vegetation Association DsHs: *Allocasuarina huegeliana*, (*Acacia acuminata*) scattered low trees to low open woodland over *Dryandra sessilis* var. *sessilis* high open shrubland to open scrub over *Hibbertia subvaginata* low shrubland.

Plant Communities:

DsHs.1: See the vegetation association description above.

Relevés CR81, G312 and G344.

Releve CR81

Date: 26/11/03

Location: Cairn Hill Reserve.

AMG84: 50J 0406914/UTM 66 21205 (WGS 84; GPS unit).

Site description: Gently sloping, west-facing lower slope at base of steep rocky slope of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana*, *Nuytsia floribunda*, *Eucalyptus eudesmioides* scattered low trees over *Dryandra sessilis* var. *sessilis* (20-30%) high shrubland over *Hibbertia subvaginata* (10-15%), *Bossiaea* sp. Cairn Hill (M Henson CH2-28) (6-8%) low shrubland over *Desmocladus flexuosus* (1-2%) scattered sedges.

Associated species: *Kunzea praestans*, *Calytrix leschenaultii*, *Trachymene pilosa*, *Eucalyptus eudesmioides* subsp. *eudesmioides*.

Releve G312

Date: 11/12/04

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408791/UTM 66 21337 (WGS 84; GPS unit).

Site description: Gentle, south-facing slope of crest of low ridge.

Rock type: Chert.

Vegetation description: *Nuytsia floribunda*, (*Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata*) scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low shrubland to low open heath over *Desmocladius flexuosus* very open sedgeland and *Vulpia myuros* var. *hirsuta*, *Briza maxima* annual grassland.

Associated species:

Condition: Poor to good.

Notes: Similar to site RM14. Last fire more than 10 years ago. Photo: BM13-11

Releve G344

Date: 18/2/05

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0407190/UTM 66 17236 (WGS 84; GPS unit).

Site description: Crest of low rocky ridge.

Vegetation description: *Allocasuarina huegeliana* (3-5%), (*Acacia acuminata* subsp. *acuminata* (+)) low open woodland over *Dryandra sessilis* var. *sessilis* (10-15%) high shrubland over *Hibbertia subvaginata* (10-15%) low shrubland over *Podolepis lessonii* very open herbland and **Avena barbata* open grassland.

Condition: Good – very good.

Notes: Similar to unit G337.

Vegetation Association DsKp: *Dryandra sessilis* var. *sessilis* high shrubland to open scrub over *Kunzea praestans*, *Leptospermum erubescens* high shrubland over *Acacia pulchella*, *Baekkea* aff. *preissiana*, *Daviesia dielsii*, *Dryandra nivea* ssp. *nivea* (narrow leaf, mound) *Banksia sphaerocarpha* low open shrubland.

Plant Communities:

DsKp.1: See the vegetation description for releve G316 below.

This plant community was recorded on the gentle slopes of a broad low rise with some exposed chert. Releve G316.

Releve G316

Date: 12/12/04

Photo: BM13-16

Location: Phil & Jenny Gardiner's property.

AMG84: 50J 0408483/UTM 66 20280 (WGS 84; GPS unit).

Site description: Gentle, south-east facing slope of low rise in undulating area.

Rock type: Chert (some exposed outcrop)

Vegetation description: (*Nuytsia floribunda* scattered low trees) over *Dryandra sessilis* var. *sessilis* high shrubland to open heath over *Kunzea praestans* (10-15%), *Leptospermum erubescens*, *Grevillea amplexicans* ssp. *semivestita* high shrubland over *Acacia pulchella* var. *glaberrima*, *Baekkea* aff. *preissiana*, *Daviesia dielsii*, *Dryandra nivea* ssp. *nivea* 'narrow leaf mound' (30 cm), *Banksia sphaerocephala* var. *sphaerocephala* low open shrubland over *Vulpia myuros* var. *hirsuta*, *Neurachne alopecuroidea* very open to open grassland and *Podolepis lessonii* scattered herbs

Associated species: *Jacksonia foliosa*, *Jacksonia floribunda* (3.5 m), *Petrophile brevifolia*, *Allocasuarina huegeliana*.

Condition: Good.

Notes: Heavily grazed area. More than 7 years since fire.

Vegetation Alliance 20/2: *Melaleuca concreta* open scrub.

Vegetation Association Mco: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca concreta* open scrub over scattered low shrubs over scattered sedges.

Plant Communities:

Mco.1: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca concreta* open scrub over *Baeckea* sp. Moora (R.Bone 1993/1) scattered low shrubs over scattered sedges and herbs.

This plant community occurred in a small area of a linear depression (?dyke) that occurred near the Cairn Hill North ridge crest. Releve CNR112.

Releve CNR112

Date: 3/12/03

Location: Cairn Hill North.

AMG84: 50J 0407346/UTM 66 22198 (WGS 84; GPS unit).

Site description: Gently sloping, west-facing slope adjacent to ridge to and at head of a linear 'dyke'?

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Melaleuca concreta* (30-40%) open scrub over *Baeckea* sp. Moora (R.Bone 1993/1) scattered low shrubs over *Schoenus clandestinus*, *Lepidosperma tenue* scattered sedges with *Borya sphaerocephala* (+), *Stylidium septentrionale septentrionale* scattered herbs.

Associated species: *Melaleuca radula*, *Trymalium daphnifolium* (shrub to 2m).

Notes: 1) Unit has *Allocasuarina campestris* mixing in scrub layer at margins.

2) Unit R112 at 50J 0407421/UTM 66 21885 (WGS 84; GPS unit) had *Melaleuca concreta* scrub to 4 m high.

Mco.2: *Melaleuca concreta* open to closed scrub over *Melaleuca sclerophylla*, *Olearia dampieri* subsp. *eremicola* open shrubland over scattered grasses and herbs with *Cheilanthes adiantoides* open fernland.

This plant community occurred in a small area in the south-east corner of Gardiner's Hill and differed in not having a tree layer and having a *Melaleuca sclerophylla*, *Olearia dampieri* subsp. *eremicola* open shrubland. Releve GHR276.

Releve GHR276

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408294/UTM 66 17292 (WGS 84; GPS unit).

Site description: Very small unit (35 m by 15 m) (elevation 247 m).

Rock type:

Vegetation description: *Melaleuca concreta* (3.5-6 m) (60-70%) open to closed scrub over *Melaleuca sclerophylla* (2-3% - maybe ecotonal from adjacent unit R270), *Olearia dampieri* subsp. *eremicola* (1.8 m, +) open shrubland over *Austrodanthonia acerosa*, *Ausrostipa elegantissima* scattered grasses with *Waitzia nitida*, *Podolepis lessonii*, *Crassula colorata* var. *colorata* scattered herbs and *Cheilanthes adiantoides* (5-10%) open fernland.

Associated species: *Acacia ericksoniae* (shrub 35 cm high, north end of unit).

Condition: Very good.

Vegetation Alliance 20/3: *Melaleuca radula* high shrubland to open scrub

Vegetation Association Mr: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) scattered low trees to low woodland over *Melaleuca radula*, (*Calothamnus* aff. *quadrifidus* Moora Watheroo, *Xanthorrhoea drummondii*) high shrubland to open scrub.

Plant Communities: See the vegetation association description above.

Mr.1: Relevés GHR294, GHR294a and GHR308.

Releve GHR294

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408441/UTM 66 17592 (WGS 84; GPS unit).

Site description: Moderate, west-facing lower – mid slope of low rock ridge (elevation 257 m).

Soil: Gravelly clayey loam to loamy clay.

Rock type: Chert.

Vegetation description: *Acacia acuminata* subsp. *acuminata*, (10-15%), *Allocasuarina huegeliana* (5-10%) low woodland over *Melaleuca radula* (25-30% (50%)) (patchy) open scrub over *Schoenus clandestinus* (1-2%), *Neurachne alopecuroidea* (+) with *Borya sphaerocephala* (10-15%), *Opercularia vaginata* (1-2%), *Podolepis lessonii* (1-2%) open herbland and *Cheilanthes adiantoides* (2-3%) very open fernland.

Condition: Very good (low weed cover).

Releve GHR294a

Date: 17/1/04

Location: Gardiner's hill.

AMG84: 50J 0408570/UTM 66 17925(WGS 84; GPS unit).

Site description: Upper slope part of unit.

Rock type:

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (+) low woodland over *Calothamnus* aff. *quadrifidus* Moora-Watheroo (+), *Xanthorrhoea drummondii* (2-3%) high open shrubland over *Melaleuca radula* (to 5 m) (5-10%) open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Desmocladius flexuosus*, *Neurachne alopecuroidea* (+), *Schoenus clandestinus* (+) scattered sedges/grasses with *Borya sphaerocephala* (15-20%), *Opercularia vaginata* (2-3%), *Podolepis lessonii* (3-5%), *Stylidium septentrionale* (+) open herbland.

Associated species: *Melaleuca calyptroides*, *Blennospora drummondii*, *Trymalium ledifolium* var. *rosmarinifolium*.

Releve GHR308

Date: 7/12/04

Location: Gardiner's hill, north end of block.

AMG84: 50J 0408621/UTM 66 18060 (WGS 84; GPS unit).

Site description: Moderate, north-east facing slope of low ridge.

Soil: Gravelly, pebbly, cobbly brown sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Melaleuca radula* (30-40%), (*Xanthorrhoea drummondii* (+)) high shrubland to open scrub over *Schoenus clandestinus*, *Lepidosperma pubisquameum* (+), *Lepidobolus chaetocephalus* scattered sedges with *Opercularia vaginata* (3-5%). *Podolepis lessonii* (3-5%), *Borya sphaerocephala* (1-2%) very open herbland to open herbland and *Avena barbata*, *Pentaschistis pallida* open annual grassland.

Associated species: *Calothamnus* aff. *quadrifidus* Moora-Watheroo, *Hakea recurva* ssp. *recurva*.

Condition: Good to very good.

Vegetation Alliance 20/4: *Melaleuca sclerophylla* open heath

Vegetation Association Ms: *Melaleuca sclerophylla*, *Hypocalymma angustifolium* open heath over *Dodonaea pinifolia*, *Gastrolobium obovatum* low open shrubland.

Plant Communities:

Ms.1: See the vegetation description for releve GHR270 below.

This plant community was recorded from one small area in the south-west corner of Gardiner's Hill. Releve GHR270.

Releve GHR270

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408330/UTM 66 17228 (WGS 84; GPS unit).

Site description: Gentle, north-east facing slope of low rocky rise (elevation 253 m).

Soil: Gravelly brown clayey loam amongst rock outcrop (5% surface cover).

Rock type: Not chert (? sandstone)

Vegetation description: *Melaleuca sclerophylla* (40%), *Hypocalymma angustifolium* (3-5%), open heath over *Dodonaea pinifolia* (5-10%), *Gastrolobium obovatum* (+) low open shrubland over *Schoenus clandestinus*, *Lepidosperma tenue* (around rock outcrop), *Lepidosperma* sp., *Neurachne alopecuroidea*, *Desmocladus flexuosus* scattered sedges/grasses with *Borya sphaerocephala* (5-8%), *Stylidium septentrionale* (1-2%), *Caesia* sp. Moora open herbland.

Associated species: *Stenanthemum tridentatum*, *Eremophyllum tenellum*, *Calytrix depressa* (upslope in unit).

Condition: Very good to excellent.

Vegetation Alliance 20/5: *Baeckea* sp. Moora (R. Bone 1993/1) low open heath

Vegetation Association B: *Allocasuarina huegeliana* scattered low trees to low open woodland over *Allocasuarina campestris*, (*Xanthorrhoea drummondii*) high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1), (*Calytrix leschenaultii*) low shrubland to low open heath.

Plant Communities:

B.1: See the vegetation association description above.

This plant community was recorded on the top of a low ridge in the Cairn Hill North area. Quadrat CHN10 and releve CNR123.

Releve CNR123 (~very similar to CHN10)

Date: 4/12/03

Location: Cairn Hill North. just outside of CHN10.

AMG84: 50J 0407561/UTM 66 21707 (WGS 84; GPS unit).

Site description: Gentle, east-facing mid slope below rocky crest of low rocky ridge.

Soil: Gravelly, pebbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (10-15%) low woodland over *Allocasuarina campestris* (5-8%), *Xanthorrhoea drummondii* high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) (60-70%), *Calytrix leschenaultii* (1-2%) open heath over *Schoenus clandestinus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (3-4%) very open herbland.

Associated species: *Goodenia hassallii*, *Tricoryne arenicola*, *Lawrencella rosea*, *Leptibolous chaetocephalus*, *Melaleuca radula*.

Notes: This unit can result from disturbance (partial clearing) of R119 unit or perhaps hot fire.

Vegetation Alliance 20/6: *Calytrix leschenaultii* open heath

Vegetation Association Cl: *Allocasuarina campestris*, *Kunzea praestans* scattered tall shrubs over *Calytrix leschenaultii*, (*Hibbertia subvaginata*) open heath.

Plant Communities:

Cl.1: See the vegetation association description above.

The described community was described on a very gently sloping base of a low ridge slope at releve ERR158. Another stand of this plant community was recorded at site ERR190, which occurred on a lower slope of a low chert ridge and varied significantly by having a low open woodland of *Eucalyptus wandoo* subsp. *wandoo* (possibly indicating underlying doleritic soils).
Relevés ERR158, ERR190

Releve ERR158

Date: 21/12/03

Location: Eastern Ridge.

AMG84: 50J 0407950/UTM 66 24089 (WGS 84; GPS unit).

Site description: Very gently sloping, south-east facing base of slope of low rocky ridge.

Soil: Gravelly, pebbly, very cobbly brown loamy sand.

Vegetation description: *Allocasuarina campestris* (1-2%), *Kunzea praestans* (1-2% (10%)) scattered tall shrubs over *Calytrix leschenaultii* (.9-1.2 m) (50-60%) *Hibbertia subvaginata* (1-2%-(5%)) open heath over *Bromus diandrus*, *Briza maxima* very open annual grassland and *Desmocladus flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Podolepis lessonii*, *Borya sphaerocephala* (1-2%) scattered herbs.

Associated species: *Xanthorrhoea drummondii*, *Chamaescilla corymbosa* var. *corymbosa*.

Condition: Poor to good with considerable weed cover.

Releve ERR190

Date: 3/1/04

Location: Eastern Ridge.

AMG84: 50J 0407970/UTM 66 23710 (WGS 84; GPS unit).

Site description: Gentle to moderate, east-facing lower slope of low rocky ridge (elevation 256 m).

Soil: Gravelly, pebbly brown sand with surface covering of gravel, pebbles and cobbles.

Rock type: Chert.

Vegetation description: *Eucalyptus wandoo* subsp. *wandoo* (3-5%), *Allocasuarina huegeliana* (3-5%) low open woodland over *Kunzea praestans* (3-5%), *Allocasuarina campestris* (+), *Xanthorrhoea drummondii* (2-3%) high open shrubland over *Calytrix leschenaultii* (15-20 (30-40%)) low shrubland to low open heath over *Neurachne alopecuroidea* scattered grasses with *Borya sphaerocephala* (2-3%), *Podolepis lessonii* (1-2%) very open herbland with *Avena barbata*, *Briza maxima* very open to open annual grassland and *Hypochaeris glabra* annual open herbland.

Associated species: *Olearia dampieri* subsp. *eremicola*, *Dichopogon capillipes*, *Solanum oldfieldii*.

Condition: Poor to good. High weed cover in parts. (Very poor to Degraded along downslope boundary).

Vegetation Association CIAh: *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland to low woodland over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland over *Calytrix leschenaultii* open heath.

Plant Communities:

CIAh.1: *Allocasuarina huegeliana* low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans*, *Xanthorrhoea drummondii* scattered tall shrubs over *Calytrix leschenaultii*, (*Hibbertia subvaginata*) open heath over scattered sedges/grasses with very open herbland.

This plant community, recorded on John Tonkin's, differed by having a *Dryandra sessilis* var. *sessilis* scattered tall shrub layer and a *Hibbertia subvaginata* low open shrubland component.
Releve JTR219.

Releve JTR219

Date: 11/1/04

Location: John Tonkin's property.

AMG84: 50J 0408855/UTM 66 26011 (WGS 84; GPS unit).

Site description: Gentle, west of south-facing lower slope on top of and near end of, low rocky ridge (elevation – see R217).

Soil: Very gravelly, pebbly brown silty fine sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-7%) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* (1-2%) scattered tall shrubs over *Kunzea praestans* (1-2%) scattered tall shrubs over *Calytrix leschenaultii* (30-40%) (1.3m), *Hibbertia subvaginata* (5-10%) (1.3 m) open heath over *Desmocladius flexuosus*, *Neurachne alopecuroidea* scattered sedges/grasses with *Borya sphaerocephala* (2-3%), *Podolepis lessonii*, *Stylidium septentrionale* very open herbland and *Vulpia myuros* var. *hirsuta*, *Pentaschistis pallida*, *Avena barbata*, *Hypochaeris glabra* (3-8%) very open annual grassland/herbland.

Condition: Good to very good.

ClAh.2: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland to high shrubland over *Calytrix leschenaultii* low shrubland over scattered sedges/grasses and very open herbland.

This community was recorded from rocky ridge slopes on the Eastern Ridge. Relevés ERR187 and ERR197.

Releve ERR187

Date: 2/4/04

Location: Eastern Ridge.

AMG84: 50J 0407734/UTM 66 23563 (WGS 84; GPS unit).

Site description: Gentle, south-facing slope of low rocky ridge (elevation 250 m).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (+) low woodland over *Kunzea praestans* ((+) 3-5 (10%)), *Xanthorrhoea drummondii* (2%), *Allocasuarina campestris* (+) high open shrubland over *Calytrix leschenaultii* (15-20%(25)) low shrubland over *Desmocladius flexuosus* (1%), *Neurachne alopecuroidea* (1%) scattered sedges/grasses with *Borya sphaerocephala* (1-2%) scattered low herbs.

Associated species: *Podotheca angustifolia*, *Waitzia nitida*, *Podolepis lessonii*, *Blennospora drummondii*.

Condition: Very good.

Releve ERR197

Date: 4/1/04

Location: Eastern Ridge.

AMG84: 50J 0407760/UTM 66 23327 (WGS 84; GPS unit).

Site description: West-facing, moderate lower slope of low rocky ridge.

Soil: Gravelly, pebbly, cobbly light brown silty sand amongst boulders and rock outcrop (20-30% surface cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (5-10%), *Acacia acuminata* subsp. *acuminata* (1-2%) low open woodland over *Kunzea praestans* (2-5%), *Xanthorrhoea drummondii* (4-5%) high open shrubland to high shrubland over *Calytrix leschenaultii* (20-30%), (*Acacia lasiocarpa* var. *sedifolia* (+)) low shrubland over *Lepidosperma tenue* (1%), *Desmocladius flexuosus* (+), *Neurachne alopecuroidea* (+) scattered sedges/grasses with *Borya sphaerocephala* (3-5%), *Stylidium septentrionale* (3-5%), *Gilberta tenuifolia* (1-2%) very open to open low herbland.

Associated species: *Dryandra sessilis* var. *sessilis*, *Hakea lissocarpha*, *Podolepis lessonii*, *Pityrodia dilatata*.

Condition: Very good to excellent.

Vegetation Alliance 20/7: *Calytrix depressa* low open heath

Vegetation Association Cd: *Allocasuarina campestris* scattered tall shrubs over *Melaleuca radula*, *Hypocalymma angustifolium* open shrubland over *Calytrix depressa* low shrubland.

Plant Communities:

Cd.1: See the vegetation description for releve GHR274 below.

This plant community was recorded on the slopes of a low ridge in Gardiner's Hill. Releve GHR274.

Releve GHR274

Date: 16/1/04

Location: Gardiner's hill.

AMG84: 50J 0408345/UTM 66 17197 (WGS 84; GPS unit).

Site description: Very gentle, east-facing slope including rocky sandstone ridge adjacent and downslope to narrow chert ridge.

Rock type: Sandstone.

Vegetation description: *Allocasuarina campestris* scattered tall shrubs over *Melaleuca radula* (to 1.2m), *Hypocalymma angustifolium* (+) open shrubland over *Calytrix depressa* (25-30%) low shrubland over *Schoenus clandestinus* (3-4%), *Lepidosperma tenue* (3-5%), *Neurachne alopecuroidea* (+) open sedges/grassland with *Borya sphaerocephala* (2-3%), *Dampiera lavandulacea* (1%), *Stylidium septentrionale* (+) very open hermland.

Associated species: *Gastrolobium obovatum*, *Astroloma serratifolium*, *Stenanthemum tridentatum* (25 cm), *Podolepis lessonii*, *Dichopogon capillipes*.

Condition: Very good to excellent (very few weeds).

Vegetation Association CdAh: *Allocasuarina huegeliana* low woodland over *Allocasuarina campestris*, *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) scattered shrubs over *Calytrix depressa* low open heath.

Plant Communities:

CdAh.1: See the vegetation association description above.

Very small areas of this plant community were recorded on the top of the low ridge at Cairn Hill North. Releve CNR124.

Releve CNR124

Date: 4/12/03

Location: Cairn Hill North.

AMG84: 50J 0407558/UTM 66 21749 (WGS 84; GPS unit).

Site description: Upper slopes, gently east sloping, just below rocky crest of low ridge.

Soil: Very gravelly, pebbly brown sand.

Vegetation description: *Allocasuarina huegeliana* (15-20%) low woodland over *Allocasuarina campestris* (2-3%), *Kunzea praestans* (1-2%), *Xanthorrhoea drummondii* (1-2%) high open shrubland over *Baeckea* sp. Moora (R. Bone 1993/1) (1-2%) scattered shrubs over *Calytrix depressa* (30-40%) low open heath over *Borya sphaerocephala* (3-5%) very open hermland.

Associated species: *Tricoryne elatior*, *Goodenia hassallii*, *Podolepis lessonii*.

Notes: 1 of 2 (40 m south) very small areas of this unit.

Vegetation Alliance 20/8: *Calothamnus* aff. *quadrifidus* Moora-Watheroo high shrubland

Vegetation Association CqMc: *Calothamnus* aff. *quadrifidus* Moora Watheroo high shrubland over *Xanthorrhoea drummondii* scattered shrubs over *Melaleuca calyptroides* shrubland.

Plant Communities:

CqMc.1: See the vegetation association description above.

One plant community was included in this vegetation association. Releve SWR232.

Releve SWR232Date: 11/1/04Location: Stan Ridgeway's property (East).AMG84: 50J 0409072/UTM 66 25211 (WGS 84; GPS unit).Site description: Gentle, east-facing mid slope of low rocky ridge (elevation 249 m).Soil: Very gravelly, pebbly, cobbly brown sand.Rock type: Chert.Vegetation description: Calothamnus aff. quadrifidus Moora-Watheroo (2-3.5 m) (15-25%) high open shrubland over Xanthorrhoea drummondii scattered shrubs over Melaleuca calyptroides (20-25%) shrubland over Desmocladus flexuosus, Schoenus clandestinus scattered sedges with Stylidium septentrionale scattered herbs.Associated species: Crassula colorata var. colorata, Daviesia dielsii, Acacia acuminata subsp. acuminata.**Vegetation Association CqAh:** *Allocasuarina huegeliana* scattered low trees over *Calothamnus* aff. *quadrifidus* Moora Watheroo, (*Kunzea praestans*, *Allocasuarina campestris*) high open shrubland to high shrubland over *Hibbertia subvaginata* scattered low shrubs to low open shrubland.Plant Communities:**CqAh.1:** See the vegetation association description above.

One plant community was included in this vegetation association. Releves JTR201 and GHR290.

Releve JTR201Date: 9/1/04Location: John Tonkin's property.AMG84: 50J 0409185/UTM 66 25477 (WGS 84; GPS unit).Site description: Very gently sloping, south-west facing slope on top of end of low rocky ridge (elevation 256 m).Soil: Brown sand amongst a lot of rock outcrop rocks and boulders (60-70% of surface)Rock type: Chert.Vegetation description: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2.2m to 3.5-4.5m) (15-20%), *Kunzea praestans* (1-2%), *Allocasuarina campestris* (1-2%) high open shrubland over *Hibbertia subvaginata* scattered low shrubs to low shrubland (patches) over *Lepidosperma tenue* scattered sedges with *Avena barbata*, *Vulpia myuros* var. *hirsuta*, *Ehrharta longiflora* (20-30%) annual grassland.Releve GHR290Date: 17/1/04Location: Gardiner's hill.AMG84: 50J 0408325/UTM 66 17972 (WGS 84; GPS unit).Site description: Gentle, north-west facing slope on edge of ridge top (upper slope).Rock type: Chert.Vegetation description: *Allocasuarina huegeliana* scattered low trees over *Calothamnus* aff. *quadrifidus* Moora-Watheroo (2-4%) high open shrubland over *Kunzea praestans*, *Allocasuarina campestris* scattered tall shrubs over *Calytrix leschenaultii* (2-3%), *Hibbertia subvaginata* (1-2%) low open shrubland over *Neurachne alopecuroidea* scattered grasses with *Podolepis canescens* (2-3%), *Borya sphaerocephala* (1-2%) very open herbland.Associated species: *Olearia dampieri* subsp. *eremicola*, *Xanthorrhoea drummondii*.Condition: Very good.**Vegetation Alliance 20/9: *Ricinocarpus muricatus* shrubland to open heath****Vegetation Association Rmu:** *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Ricinocarpus muricatus* shrubland to open heath.Plant Communities:

Rmu.1: See the vegetation association description above.

This plant community was described from the slopes of two low ridges in Ridgeway's property, just north of Kiaka Rd. Stands varied in the *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* cover and the cover of *Ricinocarpus muricatus*. Relevés SWR239, SWR239a and SWR239b.

Releve SWR239

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408935/UTM 66 25095 (WGS 84; GPS unit).

Site description: Gentle to moderate, south-facing, mid slope of long, rocky, low chert ridge.

Rock type:

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (15-20%) low open forest over *Ricinocarpus muricatus* (2.2 m) (1-2%) (patches), *Allocasuarina campestris* (+) scattered tall shrubs over *Desmocladius flexuosus* scattered sedges and *Podolepis lessonii*, *Crassula colorata* scattered herbs with *Cheilanthes adiantoides* scattered ferns and *Avena barbata*, *Hypochaeris glabra* very open annual grassland/herbland.

Associated species: *Dichopogon capillipes*, *Austrostipa* sp., *Austrodanthonia setacea*, *Kunzea praestans*.

Condition: Good – probably grazing impacts and weeds.

Releve SWR239a

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408816/UTM 66 25139 (WGS 84; GPS unit).

Site description: *Ricinocarpus muricatus* forms a shrubland (25-35%) to open heath.

Releve SWR239b

Date: 12/1/04

Location: Stan Ridgeway's property (East).

AMG84: 50J 0408756/UTM 66 25121 (WGS 84; GPS unit).

Site description: Moderate, west-facing slope on low rocky ridge.

Soil: Very gravelly dark brown loamy sand.

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (15-25%), *Acacia acuminata* subsp. *acuminata* (10-15%), (*Eucalyptus loxophleba* subsp. *loxophleba* (+)) low woodland to low open forest over *Ricinocarpus muricatus* (30-40%) open heath over *Podolepis lessonii* (1-2%), *Rhodanthe polycephala* (1-2%) very open herbland and *Avena barbata*, *Briza maxima*, *Ehrharta longiflora* open annual grassland.

Notes: Similar to SWR239a and SWR239.

Vegetation Alliance 20/10: *Ricinocarpus velutinus* open heath

Vegetation Association RvAh: *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over *Ricinocarpus velutinus* open heath.

Plant Communities:

RvAh.1: See the vegetation association description above.

One stand of this plant community was recorded in a remnant vegetation block about 500 meters east of the southern end of the Eastern Ridge. Releve RM2.

Releve RM2

Date: 10/12/04

Location: Ron Manning's property.

AMG84: 50J 0408590/UTM 66 22558 (WGS 84; GPS unit).

Site description: Moderate, west-facing upper slope of ridge.

Soil: Brown sand in matrix of rock outcrops over boulders (50-60% cover).

Rock type: Chert.

Vegetation description: *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland to low woodland over *Allocasuarina campestris* scattered tall shrubs over *Xanthorrhoea drummondii* scattered shrubs over *Ricinocarpus velutinus* (40-50%) open heath over *Lepidosperma tenue* scattered sedges to very open sedgeland and *Avena barbata*, *Briza maxima*, *Ehrharta calycina* (*Austrostipa mollis* (+)) very open grassland with *Hyalosperma cotula*, *Rhodanthe polycephala* scattered herbs and *Cheilanthes adiantoides* very open fernland.

Associated species: *Dioscorea hastifolia*, *Dichopogon capillipes*, *Goodenia arthrotricha*, *Waitzia nitida*, *Neurachne alopecuroidea*, *Stypandra glauca*, *Hibbertia subvaginata*, *Kunzea praestans* (+) (near southern end of unit).

Condition: Very good.

Notes: More than 7 years since last fire. Photo: BM12-24 (looking west of south), 25 (looking west of north)

Vegetation Alliance 21: Other miscellaneous

Vegetation Alliance 21/1: *Lepidosperma pubisquameum* sedgeland

Vegetation Association Lp: *Xanthorrhoea drummondii* open shrubland over *Lepidosperma pubisquameum* sedgeland with an annual herbland and open annual grassland.

Plant Communities:

Lp.1: *Xanthorrhoea drummondii* open shrubland over *Lepidosperma pubisquameum* sedgeland with *Stypandra glauca* annual herbland with open annual grassland.

This plant community occurred in one small area on the top of a low rocky ridge near the south end of Eastern Ridge. Quadrat ERG19.

Vegetation Alliance 22: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*)

low open forest

Vegetation Association CoAl.1: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest over *Acacia ligustrina* and *Hakea preissii* high open shrubland over **Cynosurus echinatus* and **Vulpia myuros* closed annual grassland.

Plant Communities:

CoAl.1: See the vegetation association description above.

Releve ATR001.

Releve ATR001

Date: 9/11/2010

Location: Arthur and Rhonda Tonkin's property.

MGA94: 408739 mE 6627586 mN (WGS 84; GPS unit).

Site description: Low flat plain.

Soil description: Brown clay.

Vegetation description: *Casuarina obesa* (*Eucalyptus loxophleba* subsp. *loxophleba*) low open forest over *Acacia ligustrina* and *Hakea preissii* high open shrubland over **Cynosurus echinatus* and **Vulpia myuros* closed annual grassland.

Associated species: *Acacia erinacea*, *Atriplex suberecta*, *Maireana brevifolia*, *Ptilotus spathulatus* forma *spathulatus*, *Salsola tragus* subsp. *tragus*

Notes: Photos BM4

APPENDIX 8: Species lists for each vegetation alliance within the Coomberdale Chert Threatened Ecological Community.

Family	Species
List for Vegetation Alliance 1: <i>Eucalyptus salmonophloia</i> woodlands to open forests.	
Adiantaceae	Cheilanthes adiantoides
Adiantaceae	Cheilanthes distans
Aspleniaceae	Pleurosorus rutifolius
Cupressaceae	Actinostrobus arenarius
Poaceae	Amphipogon caricinus
Poaceae	Aristida contorta
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa nitida
Poaceae	Austrostipa sp.
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta calycina
Poaceae	*Ehrharta longiflora
Poaceae	*Lolium perenne
Poaceae	*Pentaschistis airoides
Poaceae	*Pentaschistis pallida
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma aff. leptostachyum (Moora: ERG18-7)
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Lepidosperma sp.
Cyperaceae	Lepidosperma sp. P1 small head (M.D. Tindale 166A)
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus brevisetis
Cyperaceae	Schoenus clandestinus
Cyperaceae	Schoenus nanus

Family	Species
Restionaceae	Desmocladus flexuosus
Restionaceae	Lepidobolus chaetocephalus
Dasypogonaceae	Lomandra (Moora twisty)
Dasypogonaceae	Lomandra aff. micrantha subsp. micrantha
Dasypogonaceae	Lomandra effusa
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypandra glauca
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Laxmannia ramosa subsp. ramosa
Anthericaceae	Thysanotus manglesianus
Anthericaceae	Thysanotus sp.
Anthericaceae	Tricoryne elatior
Colchicaceae	Burchardia umbellata
Boryaceae	Borya laciniata
Boryaceae	Borya sphaerocephala
Haemodoraceae	Haemodorum paniculatum
Haemodoraceae	Haemodorum simulans
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	Orthrosanthus laxus var. gramineus
Iridaceae	*Romulea rosea
Orchidaceae	Caladenia denticulata
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Cyanicula deformis
Orchidaceae	Cyanicula gemmata
Orchidaceae	Diuris aff. recurva
Orchidaceae	Eriochilus helonomos
Orchidaceae	Pterostylis aff. nana
Orchidaceae	Pterostylis exserta (ms)
Orchidaceae	Pterostylis recurva
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa

Family	Species
Orchidaceae	<i>Pterostylis vittata</i>
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Casuarinaceae	<i>Allocasuarina humilis</i>
Casuarinaceae	<i>Allocasuarina</i> sp.
Proteaceae	<i>Dryandra fraseri</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Hakea incrassata</i>
Proteaceae	<i>Hakea lissocarpha</i>
Proteaceae	<i>Hakea recurva</i> subsp. <i>recurva</i>
Proteaceae	<i>Isopogon divergens</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Polygonaceae	<i>Muehlenbeckia adpressa</i>
Amaranthaceae	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>
Portulacaceae	<i>Calandrinia calyptrata</i>
Portulacaceae	<i>Calandrinia</i> sp.
Portulacaceae	<i>Calandrinia</i> sp. Blackberry (D.M. Porter 171)
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Caryophyllaceae	* <i>Silene gallica</i> var. <i>gallica</i>
Lauraceae	<i>Cassytha pomiformis</i>
Droseraceae	<i>Drosera</i> aff. <i>macrantha</i>
Droseraceae	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Droseraceae	<i>Drosera pallida</i>
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Crassulaceae	<i>Crassula exserta</i>
Mimosaceae	<i>Acacia acuminata</i> subsp. <i>acuminata</i>
Mimosaceae	<i>Acacia aestivalis</i>
Mimosaceae	<i>Acacia aristulata</i>
Mimosaceae	<i>Acacia congesta</i> subsp. <i>congesta</i>
Mimosaceae	<i>Acacia hemiteles</i>
Mimosaceae	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>
Mimosaceae	<i>Acacia microbotrya</i>
Mimosaceae	<i>Acacia pulchella</i> var. <i>goadbyi</i>
Mimosaceae	<i>Acacia restiacea</i>
Mimosaceae	<i>Acacia stenoptera</i>
Papilionaceae	<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)

Family	Species
Papilionaceae	<i>Cristonia biloba</i>
Papilionaceae	<i>Daviesia dielsii</i>
Papilionaceae	<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>
Papilionaceae	<i>Gastrolobium acutum</i>
Papilionaceae	<i>Gompholobium glutinosum</i>
Papilionaceae	<i>Nemcia acuta</i>
Papilionaceae	* <i>Trifolium arvense</i> var. <i>arvense</i>
Papilionaceae	* <i>Trifolium hirtum</i>
Papilionaceae	* <i>Trifolium repens</i> var. <i>repens</i>
Papilionaceae	* <i>Trifolium subterraneum</i>
Geraniaceae	<i>Erodium cygnorum</i>
Geraniaceae	* <i>Erodium botrys</i>
Linaceae	* <i>Linum trigynum</i>
Rutaceae	<i>Boronia ramosa</i> subsp. <i>anethifolia</i>
Polygalaceae	<i>Comesperma integerrimum</i>
Euphorbiaceae	<i>Euphorbia drummondii</i> subsp. <i>drummondii</i>
Stackhousiaceae	<i>Stackhousia monogyna</i>
Stackhousiaceae	<i>Tripterococcus brunonis</i>
Sapindaceae	<i>Diplopeltis huegelii</i> subsp. <i>lehmannii</i>
Sapindaceae	<i>Dodonaea pinifolia</i>
Rhamnaceae	<i>Cryptandra glabriflora</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Sterculiaceae	<i>Guichenotia micrantha</i>
Sterculiaceae	<i>Guichenotia sarotes</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>
Myrtaceae	<i>Baeckea</i> sp. Moora (R. Bone 1993/1)
Myrtaceae	<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo
Myrtaceae	<i>Calothamnus sanguineus</i>
Myrtaceae	<i>Calytrix leschenaultii</i>
Myrtaceae	<i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i>
Myrtaceae	<i>Kunzea praestans</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca radula</i>
Myrtaceae	<i>Regelia megacephala</i>
Myrtaceae	<i>Verticordia densiflora</i> var.

Family	Species
	densiflora
Apiaceae	Daucus glochidiatus
Apiaceae	Platysace cirrosa
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene pilosa
Apiaceae	Xanthosia fruticulosa
Epacridaceae	Astroloma serratifolium
Primulaceae	*Anagallis arvensis
Loganiaceae	Phyllangium sulcatum
Chloanthaceae	Pityrodia dilatata
Scrophulariaceae	*Parentucellia latifolia
Rubiaceae	Opercularia vaginata
Lobeliaceae	Isotoma hypocrateriformis
Goodeniaceae	Goodenia arthrotricha
Goodeniaceae	Goodenia berardiana
Goodeniaceae	Goodenia hassallii
Goodeniaceae	Lechenaultia biloba
Goodeniaceae	Scaevola phlebopetala
Stylidiaceae	Levenhookia stipitata
Stylidiaceae	Stylidium cordifolium
Stylidiaceae	Stylidium miniatum
Stylidiaceae	Stylidium repens
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Gilberta tenuifolia
Asteraceae	Hyalosperma cotula
Asteraceae	Lawrencella rosea
Asteraceae	Millotia myosotidifolia
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Podotheca gnaphalioides
Asteraceae	Quinetia urvillei
Asteraceae	Rhodanthe polycephala
Asteraceae	Schoenia cassiniana
Asteraceae	Waitzia nitida

Family	Species
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Hypochaeris radicata
Asteraceae	*Sonchus oleraceus
Asteraceae	*Tripteris clandestina
Asteraceae	*Urospermum picroides
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 2: Provisional list <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> woodlands and open forests.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa exilis
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa scabra
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Lolium perenne
Poaceae	*Pentaschistis airoides
Poaceae	*Pentaschistis pallida
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma aff. leptostachyum (Moora: ERG18- 7)
Cyperaceae	Lepidosperma costale
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladus flexuosus
Dasypogonaceae	Lomandra (Moora twisty)
Dasypogonaceae	Lomandra aff. micrantha subsp. micrantha
Dasypogonaceae	Lomandra effusa

Family	Species
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypandra glauca
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Caesia alfordii
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Sowerbaea laxiflora
Anthericaceae	Thysanotus dichotomus
Anthericaceae	Thysanotus manglesianus
Colchicaceae	Burchardia umbellata
Boryaceae	Borya sphaerocephala
Hypoxidaceae	Hypoxis glabella var. leptantha
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Hypoxidaceae	Hypoxis sp.
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	Orthrosanthus laxus
Iridaceae	Orthrosanthus laxus var. gramineus
Iridaceae	*Romulea rosea
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Cyanicula deformis
Orchidaceae	Eriochilus helonomos
Orchidaceae	Pterostylis aff. rufa
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Urticaceae	Parietaria debilis
Proteaceae	Dryandra sessilis var. sessilis
Santalaceae	Santalum acuminatum
Chenopodiaceae	Rhagodia drummondii
Amaranthaceae	Ptilotus drummondii var. drummondii
Amaranthaceae	Ptilotus gaudichaudii var. parviflorus
Amaranthaceae	Ptilotus manglesii
Portulacaceae	Calandrinia calyptata
Portulacaceae	Calandrinia sp.
Caryophyllaceae	*Petrorhagia dubia

Family	Species
Caryophyllaceae	*Silene gallica var. gallica
Droseraceae	Drosera macrantha subsp. macrantha
Droseraceae	Drosera sp.
Crassulaceae	Crassula colorata var. colorata
Crassulaceae	Crassula exserta
Pittosporaceae	Sollya heterophylla
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia erinacea
Mimosaceae	Acacia microbotrya
Papilionaceae	*Trifolium repens var. repens
Papilionaceae	*Trifolium subterraneum
Geraniaceae	Erodium cygnorum
Polygalaceae	Comesperma integerrimum
Polygalaceae	Comesperma volubile
Sapindaceae	Dodonaea inaequifolia
Rhamnaceae	Stenanthemum tridentatum
Rhamnaceae	Trymalium ledifolium var. rosmarinifolium
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus wandoo subsp. wandoo
Myrtaceae	Melaleuca radula
Haloragaceae	Glischrocaryon flavescens
Apiaceae	Apium annuum
Apiaceae	Daucus glochidiatus
Apiaceae	Platysace cirrosa
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene pilosa
Apiaceae	Xanthosia fruticulosa
Primulaceae	*Anagallis arvensis
Loganiaceae	Phyllangium sulcatum
Solanaceae	Solanum oldfieldii
Scrophulariaceae	*Parentucellia latifolia
Scrophulariaceae	*Zaluzianskya divaricata
Rubiaceae	Opercularia vaginata
Campanulaceae	Wahlenbergia gracilentia

Family	Species
Lobeliaceae	Lobelia sp. small flowers (K.F. Kenneally 7705)
Goodeniaceae	Dampiera lavandulacea
Goodeniaceae	Goodenia arthrotricha
Goodeniaceae	Goodenia berardiana
Goodeniaceae	Goodenia sp.
Asteraceae	Blennospora drummondii
Asteraceae	Gilberta tenuifolia
Asteraceae	Hyalosperma cotula
Asteraceae	Lagenophora huegelii
Asteraceae	Lawrencella rosea
Asteraceae	Millotia aff. tenuifolia (Moora: CH20-11)
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Rhodanthe laevis
Asteraceae	Rhodanthe polycephala
Asteraceae	Schoenia cassiniana
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hedypnois rhagadioloides
Asteraceae	*Hypochaeris glabra
Asteraceae	*Tripteris clandestina
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 3: <i>Eucalyptus loxophla</i> subsp. <i>loxophleba</i> low woodlands to low open forests.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrodanthonia sp.
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa nitida
Poaceae	Austrostipa scabra
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea

Family	Species
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Pentaschistis pallida
Poaceae	*Pentaschistis sp.
Poaceae	*Pentaschistis sp. Moora (doubtful ID)
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma costale
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladus flexuosus
Centrolepidaceae	Centrolepis sp.
Dasyogonaceae	Lomandra (Moora twisty)
Dasyogonaceae	Lomandra effusa
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypantra glauca
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Caesia alfordii
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Sowerbaea laxiflora
Anthericaceae	Thysanotus manglesianus
Anthericaceae	Thysanotus patersonii
Anthericaceae	Tricoryne elatior
Colchicaceae	Burchardia umbellata
Boryaceae	Borya sphaerocephala
Haemodoraceae	Haemodorum simulans
Hypoxidaceae	Hypoxis glabella var. leptantha
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	*Romulea rosea
Orchidaceae	Caladenia denticulata
Orchidaceae	Cyanicula deformis
Orchidaceae	Prasophyllum gracile
Orchidaceae	Pterostylis sanguinea

Family	Species
Orchidaceae	<i>Pterostylis setulosa</i>
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Hakea lissocarpha</i>
Proteaceae	<i>Hakea recurva</i> subsp. <i>recurva</i>
Santalaceae	<i>Santalum spicatum</i>
Loranthaceae	<i>Amyema miraculosa</i> subsp. <i>miraculosa</i>
Chenopodiaceae	<i>Enchylaena tomentosa</i>
Chenopodiaceae	<i>Rhagodia drummondii</i>
Chenopodiaceae	<i>Rhagodia preissii</i> subsp. <i>preissii</i>
Amaranthaceae	<i>Ptilotus divaricatus</i> var. <i>divaricatus</i>
Amaranthaceae	<i>Ptilotus drummondii</i> var. <i>drummondii</i>
Amaranthaceae	<i>Ptilotus holosericeus</i>
Amaranthaceae	<i>Ptilotus manglesii</i>
Amaranthaceae	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>
Amaranthaceae	<i>Ptilotus spathulatus</i> forma <i>spathulatus</i>
Portulacaceae	<i>Calandrinia calyptrata</i>
Portulacaceae	<i>Calandrinia remota</i>
Portulacaceae	<i>Calandrinia</i> sp.
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Caryophyllaceae	* <i>Silene gallica</i> var. <i>gallica</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Crassulaceae	<i>Crassula colorata</i>
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Crassulaceae	<i>Crassula exserta</i>
Surianaceae	<i>Stylobasium australe</i>
Mimosaceae	<i>Acacia acuminata</i> subsp. <i>acuminata</i>
Mimosaceae	<i>Acacia erinacea</i>
Mimosaceae	<i>Acacia microbotrya</i>
Papilionaceae	<i>Kennedia prostrata</i>
Papilionaceae	* <i>Lupinus angustifolius</i>
Geraniaceae	<i>Erodium cygnorum</i>
Geraniaceae	* <i>Erodium botrys</i>
Oxalidaceae	* <i>Oxalis corniculata</i>
Linaceae	* <i>Linum trigynum</i>

Family	Species
Polygalaceae	<i>Comesperma integerrimum</i>
Euphorbiaceae	<i>Poranthera microphylla</i>
Sapindaceae	<i>Dodonaea pinifolia</i>
Rhamnaceae	<i>Trymalium daphnifolium</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>
Myrtaceae	<i>Calytrix depressa</i>
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>
Myrtaceae	<i>Eucalyptus obtusiflora</i>
Myrtaceae	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>
Myrtaceae	<i>Melaleuca concreta</i>
Myrtaceae	<i>Melaleuca radula</i>
Apiaceae	<i>Daucus glochidiatus</i>
Apiaceae	<i>Platysace cirrosa</i>
Apiaceae	<i>Trachymene cyanopetala</i>
Apiaceae	<i>Trachymene ornata</i>
Apiaceae	<i>Trachymene pilosa</i>
Apiaceae	<i>Xanthosia fruticulosa</i>
Primulaceae	* <i>Anagallis arvensis</i>
Loganiaceae	<i>Phyllangium sulcatum</i>
Asclepiadaceae	<i>Rhyncharrhena linearis</i>
Chloanthaceae	<i>Pityrodia dilatata</i>
Solanaceae	<i>Solanum oldfieldii</i>
Scrophulariaceae	* <i>Parentucellia latifolia</i>
Plantaginaceae	<i>Plantago debilis</i>
Rubiaceae	<i>Opercularia vaginata</i>
Rubiaceae	* <i>Galium murale</i>
Campanulaceae	<i>Wahlenbergia gracilentia</i>
Lobeliaceae	<i>Lobelia</i> sp. small flowers (K.F. Kenneally 7705)
Goodeniaceae	<i>Brunonia australis</i>
Goodeniaceae	<i>Goodenia berardiana</i>
Goodeniaceae	<i>Velleia cynopotamica</i>
Asteraceae	<i>Amblysperma</i> sp. Moora (GH7-57)
Asteraceae	<i>Blennospora drummondii</i>
Asteraceae	<i>Brachyscome perpusilla</i>
Asteraceae	<i>Calotis hispidula</i>
Asteraceae	<i>Gilberta tenuifolia</i>

Family	Species
Asteraceae	Hyalosperma glutinosum subsp. glutinosum
Asteraceae	Lagenophora huegelii
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Rhodanthe manglesii
Asteraceae	Rhodanthe polycephala
Asteraceae	Rhodanthe pygmaea
Asteraceae	Schoenia cassiniana
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hedypnois rhagadioloides
Asteraceae	*Hypochaeris glabra
Asteraceae	*Tripteris clandestina
Asteraceae	*Urospermum picroides
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 4: <i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i> low mallee woodlands to low mallee open forests.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Bromus diandrus
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Lepidosperma tenue
Restionaceae	Desmocladus flexuosus
Restionaceae	Lepidobolus chaetocephalus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Stypantra glauca
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Dioscoreaceae	Dioscorea hastifolia
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Hakea incrassata
Proteaceae	Isopogon divergens

Family	Species
Pittosporaceae	Sollya heterophylla
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia congesta subsp. congesta
Papilionaceae	Bossiaea sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	Daviesia dielsii
Sapindaceae	Dodonaea pinifolia
Malvaceae	Alyogyne huegelii var. grossulariifolia
Sterculiaceae	Thomasia grandiflora
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Baeckea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus eudesmioides subsp. eudesmioides
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca radula
Myrtaceae	Regelia megacephala
Apiaceae	Trachymene pilosa
Apiaceae	Xanthosia fruticulosa
Epacridaceae	Astroloma serratifolium
Goodeniaceae	Dampiera lavandulacea
Stylidiaceae	Stylidium septentrionale
List for Vegetation Alliance 5: <i>Eucalyptus camaldulensis</i> open forest to low mallee open forests.	
Myrtaceae	Eucalyptus camaldulensis
List for Vegetation Alliance 6: <i>Eucalyptus obtusiflora</i> low woodlands to low open forests.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa variabilis
Poaceae	*Aira caryophylla
Poaceae	*Avena barbata
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma tenue

Family	Species
Dasygongonaceae	Lomandra sp.
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Dichopogon capillipes
Anthericaceae	Thysanotus manglesianus
Hypoxidaceae	Hypoxis glabella var. leptantha
Dioscoreaceae	Dioscorea hastifolia
Orchidaceae	Eriochilus helonomos
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis scabra
Chenopodiaceae	Maireana marginata
Chenopodiaceae	Rhagodia preissii subsp. preissii
Amaranthaceae	Ptilotus divaricatus var. divaricatus
Portulacaceae	Calandrinia sp.
Crassulaceae	Crassula colorata var. colorata
Mimosaceae	Acacia erinacea
Geraniaceae	Erodium cygnorum
Oxalidaceae	*Oxalis corniculata
Sapindaceae	Dodonaea inaequifolia
Rhamnaceae	Trymalium daphnifolium
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba
Myrtaceae	Eucalyptus obtusiflora
Apiaceae	Apium annum
Apiaceae	Daucus glochidiatus
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene sp.
Plantaginaceae	Plantago debilis
Asteraceae	Blennospora drummondii
Asteraceae	Calotis hispidula
Asteraceae	Rhodanthe polycephala
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
List for Vegetation Alliance 7: <i>Eucalyptus horistes</i> woodlands to low open forests.	
Poaceae	Neurachne alopecuroidea
Poaceae	*Ehrharta longiflora
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Schoenus brevisetis

Family	Species
Restionaceae	Desmocladus flexuosus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Santalaceae	Leptomeria preissiana
Papilionaceae	Nemcia acuta
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Baeckea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus eudesmioides subsp. eudesmioides
Myrtaceae	Eucalyptus horistes
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Regelia megacephala
Apiaceae	Xanthosia fruticulosa
Goodeniaceae	Goodenia glareicola
Stylidiaceae	Stylidium cordifolium
Stylidiaceae	Stylidium septentrionale
List for Vegetation Alliance 8: <i>Eucalyptus pruiniramis</i> low woodland.	
Myrtaceae	Eucalyptus pruiniramis
List for Vegetation Alliance 9: Provisional list <i>Allocasuarina huegeliana</i> low woodlands to low open forests.	
Adiantaceae	Cheilanthes adiantoides
Adiantaceae	Cheilanthes distans
Aspleniaceae	Pleurosorus rutifolius
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrodanthonia sp.
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa macalpinei
Poaceae	Austrostipa mollis
Poaceae	Austrostipa nitida
Poaceae	Austrostipa scabra
Poaceae	Austrostipa sp.

Family	Species
Poaceae	<i>Austrostipa trichophylla</i>
Poaceae	<i>Austrostipa variabilis</i>
Poaceae	<i>Neurachne alopecuroidea</i>
Poaceae	* <i>Aira caryophylla</i>
Poaceae	* <i>Avena barbata</i>
Poaceae	* <i>Briza maxima</i>
Poaceae	* <i>Bromus diandrus</i>
Poaceae	* <i>Ehrharta longiflora</i>
Poaceae	* <i>Pentaschistis airoides</i>
Poaceae	* <i>Pentaschistis pallida</i>
Poaceae	* <i>Pentaschistis</i> sp. Moora (doubtful ID)
Poaceae	* <i>Vulpia myuros</i>
Cyperaceae	<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)
Cyperaceae	<i>Lepidosperma costale</i>
Cyperaceae	<i>Lepidosperma leptostachyum</i>
Cyperaceae	<i>Lepidosperma pubisquameum</i>
Cyperaceae	<i>Lepidosperma</i> sp.
Cyperaceae	<i>Lepidosperma tenue</i>
Cyperaceae	<i>Schoenus clandestinus</i>
Restionaceae	<i>Desmocladus flexuosus</i>
Restionaceae	<i>Lepidobolus chaetocephalus</i>
Dasyopogonaceae	<i>Lomandra</i> aff. <i>micrantha</i> subsp. <i>micrantha</i>
Dasyopogonaceae	<i>Lomandra effusa</i>
Dasyopogonaceae	<i>Lomandra</i> sp.
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
Phormiaceae	<i>Dianella revoluta</i> var. <i>divaricata</i>
Phormiaceae	<i>Stypandra glauca</i>
Anthericaceae	<i>Caesia</i> (Moora hairy stem)
Anthericaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>
Anthericaceae	<i>Dichopogon capillipes</i>
Anthericaceae	<i>Sowerbaea laxiflora</i>
Anthericaceae	<i>Thysanotus dichotomus</i>
Anthericaceae	<i>Thysanotus manglesianus</i>
Anthericaceae	<i>Thysanotus multiflorus</i>
Anthericaceae	<i>Tricoryne elatior</i>
Colchicaceae	<i>Burchardia umbellata</i>
Boryaceae	<i>Borya sphaerocephala</i>

Family	Species
Haemodoraceae	<i>Haemodorum simulans</i>
Hypoxidaceae	<i>Hypoxis glabella</i> var. <i>leptantha</i>
Hypoxidaceae	<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>
Dioscoreaceae	<i>Dioscorea hastifolia</i>
Iridaceae	* <i>Romulea rosea</i>
Orchidaceae	<i>Caladenia denticulata</i>
Orchidaceae	<i>Caladenia flava</i> subsp. <i>flava</i>
Orchidaceae	<i>Cyanicula deformis</i>
Orchidaceae	<i>Diuris</i> aff. <i>recurva</i>
Orchidaceae	<i>Elythranthera brunonis</i>
Orchidaceae	<i>Eriochilus helonomos</i>
Orchidaceae	<i>Pterostylis sanguinea</i>
Orchidaceae	<i>Pterostylis setulosa</i>
Orchidaceae	<i>Pterostylis</i> sp.
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Proteaceae	<i>Dryandra fraseri</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Hakea lissocarpha</i>
Proteaceae	<i>Hakea recurva</i> subsp. <i>recurva</i>
Proteaceae	<i>Isopogon divergens</i>
Santalaceae	<i>Santalum acuminatum</i>
Loranthaceae	<i>Amyema preissii</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Amaranthaceae	<i>Ptilotus declinatus</i>
Amaranthaceae	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>
Portulacaceae	<i>Calandrinia calyptrata</i>
Portulacaceae	<i>Calandrinia eremaea</i>
Portulacaceae	<i>Calandrinia</i> sp.
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Caryophyllaceae	* <i>Silene gallica</i> var. <i>gallica</i>
Droseraceae	<i>Drosera</i> aff. <i>macrantha</i>
Droseraceae	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Crassulaceae	<i>Crassula colorata</i>
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Crassulaceae	<i>Crassula decumbens</i> var. <i>decumbens</i>

Family	Species
Crassulaceae	Crassula exserta
Surianaceae	Stylobasium australe
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia aristulata
Mimosaceae	Acacia congesta subsp. congesta
Mimosaceae	Acacia lasiocarpa var. sedifolia
Mimosaceae	Acacia restiacea
Mimosaceae	Acacia stenoptera
Papilionaceae	Bossiaea sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	Daviesia dielsii
Papilionaceae	Daviesia hakeoides subsp. subnuda
Papilionaceae	Gastrolobium obovatum
Papilionaceae	Kennedia prostrata
Papilionaceae	Nemcia acuta
Papilionaceae	*Trifolium hirtum
Papilionaceae	*Trifolium repens var. repens
Papilionaceae	*Trifolium subterraneum
Linaceae	*Linum trigynum
Rutaceae	Boronia coerulescens subsp. spinescens
Polygalaceae	Comesperma integerrimum
Polygalaceae	Comesperma volubile
Euphorbiaceae	Phyllanthus calycinus
Euphorbiaceae	Poranthera microphylla
Stackhousiaceae	Stackhousia monogyna
Stackhousiaceae	Tripterococcus brunonis
Sapindaceae	Diplopeltis huegelii subsp. lehmannii
Sapindaceae	Dodonaea pinifolia
Rhamnaceae	Stenanthemum tridentatum
Rhamnaceae	Trymalium ledifolium var. rosmarinifolium
Sterculiaceae	Keraudrenia velutina subsp. velutina
Sterculiaceae	Thomasia grandiflora
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Baekkea crispiflora var. tenuior
Myrtaceae	Baekkea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo

Family	Species
Myrtaceae	Calothamnus sanguineus
Myrtaceae	Calytrix depressa
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus eudesmioides subsp. eudesmioides
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba
Myrtaceae	Eucalyptus wandoo subsp. wandoo
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca radula
Myrtaceae	Regelia megacephala
Myrtaceae	Verticordia densiflora var. densiflora
Apiaceae	Apium annuum
Apiaceae	Daucus glochidiatus
Apiaceae	Platysace cirrosa
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene pilosa
Apiaceae	Trachymene sp.
Apiaceae	Xanthosia fruticulosa
Epacridaceae	Astroloma serratifolium
Primulaceae	*Anagallis arvensis
Loganiaceae	Phyllangium paradoxum
Loganiaceae	Phyllangium sulcatum
Chloanthaceae	Pityrodia dilatata
Chloanthaceae	Pityrodia sp.
Solanaceae	Solanum oldfieldii
Solanaceae	*Solanum nigrum
Scrophulariaceae	*Parentucellia latifolia
Rubiaceae	Opercularia vaginata
Rubiaceae	*Galium murale
Campanulaceae	Wahlenbergia gracilentia
Campanulaceae	Wahlenbergia preissii
Campanulaceae	*Wahlenbergia capensis
Lobeliaceae	Lobelia sp. small flowers (K.F. Kenneally 7705)
Goodeniaceae	Goodenia arthrotricha
Goodeniaceae	Goodenia berardiana

Family	Species
Goodeniaceae	<i>Goodenia hassallii</i>
Goodeniaceae	<i>Goodenia</i> sp.
Goodeniaceae	<i>Scaevola glandulifera</i>
Stylidiaceae	<i>Stylidium cordifolium</i>
Stylidiaceae	<i>Stylidium repens</i>
Stylidiaceae	<i>Stylidium septentrionale</i>
Asteraceae	<i>Blennospora drummondii</i>
Asteraceae	<i>Gilberta tenuifolia</i>
Asteraceae	<i>Hyalosperma cotula</i>
Asteraceae	<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>
Asteraceae	<i>Lawrencella rosea</i>
Asteraceae	<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>
Asteraceae	<i>Olearia dampieri</i> subsp. <i>dampieri</i>
Asteraceae	<i>Olearia dampieri</i> subsp. <i>eremicola</i>
Asteraceae	<i>Podolepis canescens</i>
Asteraceae	<i>Podolepis lessonii</i>
Asteraceae	<i>Podotheca angustifolia</i>
Asteraceae	<i>Rhodanthe laevis</i>
Asteraceae	<i>Rhodanthe polycephala</i>
Asteraceae	<i>Schoenia cassiniana</i>
Asteraceae	<i>Waitzia nitida</i>
Asteraceae	* <i>Arctotheca calendula</i>
Asteraceae	* <i>Hypochaeris glabra</i>
Asteraceae	* <i>Sonchus oleraceus</i>
Asteraceae	* <i>Tripteris clandestina</i>
Asteraceae	* <i>Urospermum picroides</i>
Asteraceae	* <i>Ursinia anthemoides</i>
List for Vegetation Alliance 10: Provisional list <i>Casuarina obesa</i> open forest.	
Casuarinaceae	<i>Casuarina obesa</i>
List for Vegetation Alliance 11: <i>Acacia acuminata</i> low woodlands to low open forests.	
Adiantaceae	<i>Cheilanthes adiantoides</i>
Poaceae	<i>Austrodanthonia acerosa</i>
Poaceae	<i>Austrodanthonia caespitosa</i>
Poaceae	<i>Austrodanthonia setacea</i>
Poaceae	<i>Austrodanthonia</i> sp.
Poaceae	<i>Austrostipa elegantissima</i>
Poaceae	<i>Austrostipa eremophila</i>

Family	Species
Poaceae	<i>Austrostipa exilis</i>
Poaceae	<i>Austrostipa nitida</i>
Poaceae	<i>Austrostipa</i> sp.
Poaceae	<i>Austrostipa trichophylla</i>
Poaceae	<i>Austrostipa variabilis</i>
Poaceae	<i>Neurachne alopecuroidea</i>
Poaceae	* <i>Aira caryophyllea</i>
Poaceae	* <i>Avena barbata</i>
Poaceae	* <i>Briza maxima</i>
Poaceae	* <i>Bromus diandrus</i>
Poaceae	* <i>Ehrharta longiflora</i>
Poaceae	* <i>Pentaschistis pallida</i>
Poaceae	* <i>Vulpia myuros</i>
Cyperaceae	<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)
Cyperaceae	<i>Lepidosperma costale</i>
Cyperaceae	<i>Lepidosperma leptostachyum</i>
Cyperaceae	<i>Lepidosperma tenue</i>
Cyperaceae	<i>Schoenus clandestinus</i>
Restionaceae	<i>Desmocladus flexuosus</i>
Dasypogonaceae	<i>Lomandra effusa</i>
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
Phormiaceae	<i>Dianella revoluta</i> var. <i>divaricata</i>
Phormiaceae	<i>Stypandra glauca</i>
Anthericaceae	<i>Caesia</i> (Moora hairy stem)
Anthericaceae	<i>Caesia alfordii</i>
Anthericaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>
Anthericaceae	<i>Dichopogon capillipes</i>
Anthericaceae	<i>Sowerbaea laxiflora</i>
Anthericaceae	<i>Thysanotus dichotomus</i>
Anthericaceae	<i>Thysanotus manglesianus</i>
Anthericaceae	<i>Tricoryne arenicola</i>
Anthericaceae	<i>Tricoryne elatior</i>
Colchicaceae	<i>Burchardia umbellata</i>
Colchicaceae	<i>Wurmbea drummondii</i>
Boryaceae	<i>Borya sphaerocephala</i>
Hypoxidaceae	<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>
Hypoxidaceae	<i>Hypoxis</i> sp.

Family	Species
Dioscoreaceae	<i>Dioscorea hastifolia</i>
Orchidaceae	<i>Caladenia flava</i> subsp. <i>flava</i>
Orchidaceae	<i>Cyanicula deformis</i>
Orchidaceae	<i>Diuris</i> aff. <i>recurva</i>
Orchidaceae	<i>Prasophyllum gracile</i>
Orchidaceae	<i>Pterostylis setulosa</i>
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Hakea recurva</i> subsp. <i>recurva</i>
Loranthaceae	<i>Amyema preissii</i>
Loranthaceae	<i>Lysiana casuarinae</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Amaranthaceae	<i>Ptilotus declinatus</i>
Amaranthaceae	<i>Ptilotus drummondii</i> var. <i>drummondii</i>
Amaranthaceae	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>
Portulacaceae	<i>Calandrinia calyprata</i>
Portulacaceae	<i>Calandrinia</i> sp.
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Caryophyllaceae	* <i>Silene gallica</i> var. <i>gallica</i>
Brassicaceae	* <i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>
Droseraceae	<i>Drosera</i> aff. <i>macrantha</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Droseraceae	<i>Drosera macrophylla</i> subsp. <i>macrophylla</i>
Crassulaceae	<i>Crassula colorata</i>
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Crassulaceae	<i>Crassula exserta</i>
Pittosporaceae	<i>Sollya heterophylla</i>
Mimosaceae	<i>Acacia acuminata</i> subsp. <i>acuminata</i>
Mimosaceae	<i>Acacia aristulata</i>
Mimosaceae	<i>Acacia restiacea</i>
Papilionaceae	<i>Gastrolobium obovatum</i>
Papilionaceae	<i>Kennedia prostrata</i>
Papilionaceae	* <i>Trifolium subterraneum</i>
Geraniaceae	<i>Erodium cygnorum</i>
Polygalaceae	<i>Comesperma integerrimum</i>
Sapindaceae	<i>Dodonaea pinifolia</i>

Family	Species
Rhamnaceae	<i>Stenanthemum tridentatum</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>
Myrtaceae	<i>Baeckea</i> sp. <i>Moora</i> (R. Bone 1993/1)
Myrtaceae	<i>Calytrix leschenaultii</i>
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>
Myrtaceae	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>
Myrtaceae	<i>Kunzea praestans</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca coronicarpa</i>
Myrtaceae	<i>Melaleuca radula</i>
Haloragaceae	<i>Glischrocaryon flavescens</i>
Haloragaceae	<i>Gonocarpus nodulosus</i>
Apiaceae	<i>Daucus glochidiatus</i>
Apiaceae	<i>Trachymene cyanopetala</i>
Apiaceae	<i>Trachymene ornata</i>
Apiaceae	<i>Trachymene pilosa</i>
Loganiaceae	<i>Phyllangium paradoxum</i>
Loganiaceae	<i>Phyllangium sulcatum</i>
Chloanthaceae	<i>Pityrodia dilatata</i>
Scrophulariaceae	* <i>Parentucellia latifolia</i>
Myoporaceae	<i>Eremophila undulata</i>
Rubiaceae	<i>Opercularia vaginata</i>
Rubiaceae	* <i>Galium murale</i>
Campanulaceae	* <i>Wahlenbergia capensis</i>
Goodeniaceae	<i>Brunonia australis</i>
Goodeniaceae	<i>Goodenia arthrotricha</i>
Goodeniaceae	<i>Goodenia berardiana</i>
Stylidiaceae	<i>Stylidium septentrionale</i>
Asteraceae	<i>Blennospora drummondii</i>
Asteraceae	<i>Brachyscome perpusilla</i>
Asteraceae	<i>Gilberta tenuifolia</i>
Asteraceae	<i>Hyalosperma cotula</i>
Asteraceae	<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>
Asteraceae	<i>Lagenophora huegelii</i>
Asteraceae	<i>Lawrencella rosea</i>
Asteraceae	<i>Olearia dampieri</i> subsp. <i>eremicola</i>

Family	Species
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
Asteraceae	Rhodanthe laevis
Asteraceae	Rhodanthe manglesii
Asteraceae	Schoenia cassiniana
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Tripteris clandestina
Asteraceae	*Urospermum picroides
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 12: <i>Banksia prionotes</i> scattered low trees.	
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Pentaschistis pallida
Poaceae	*Vulpia myuros
Xanthorrhoeaceae	Xanthorrhoea drummondii
Casuarinaceae	Allocasuarina campestris
Proteaceae	Banksia prionotes
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Grevillea amplexans subsp. semivestita
Proteaceae	Hakea lissocarpha
Mimosaceae	Acacia acuminata subsp. acuminata
Geraniaceae	*Erodium botrys
Myrtaceae	Baeckea crispiflora var. tenuior
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Calytrix strigosa
Myrtaceae	Eremaea beaufortioides var. lachnosanthe
Myrtaceae	Kunzea praestans
Myrtaceae	Leptospermum erubescens
Asteraceae	Podolepis lessonii
List for Vegetation Alliance 13: Provisional <i>Allocasuarina campestris</i> high shrublands open and closed scrub.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Amphipogon caricinus

Family	Species
Poaceae	Aristida contorta
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrodanthonia sp.
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa exilis
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa nitida
Poaceae	Austrostipa scabra
Poaceae	Austrostipa sp.
Poaceae	Austrostipa sp. Cairn Hill (M.E. Trudgen 21176)
Poaceae	Austrostipa tenuifolia
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Pentaschistis airoides
Poaceae	*Pentaschistis pallida
Poaceae	*Pentaschistis sp. Moora (doubtful ID)
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma aff. leptostachyum (Moora: ERG18-7)
Cyperaceae	Lepidosperma costale
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Lepidosperma sp.
Cyperaceae	Lepidosperma sp. P1 small head (M.D. Tindale 166A)
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus brevisetis
Cyperaceae	Schoenus clandestinus
Cyperaceae	Schoenus sp.
Restionaceae	Desmocladus flexuosus
Restionaceae	Lepidobolus chaetocephalus
Centrolepidaceae	Centrolepis drummondiana
Centrolepidaceae	Centrolepis pilosa

Family	Species
Dasypogonaceae	Lomandra (Moora twisty)
Dasypogonaceae	Lomandra aff. micrantha subsp. micrantha
Dasypogonaceae	Lomandra effusa
Dasypogonaceae	Lomandra sp.
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypandra glauca
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Caesia alfordii
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Laxmannia omnifertilis
Anthericaceae	Sowerbaea laxiflora
Anthericaceae	Thysanotus dichotomus
Anthericaceae	Thysanotus manglesianus
Anthericaceae	Thysanotus multiflorus
Anthericaceae	Thysanotus sp.
Anthericaceae	Tricoryne arenicola
Anthericaceae	Tricoryne elatior
Colchicaceae	Burchardia bairdiae
Colchicaceae	Burchardia umbellata
Colchicaceae	Wurmbea drummondii
Boryaceae	Borya sphaerocephala
Haemodoraceae	Conostylis androstemma
Haemodoraceae	Haemodorum paniculatum
Haemodoraceae	Haemodorum simulans
Hypoxidaceae	Hypoxis aff. glabella
Hypoxidaceae	Hypoxis glabella var. leptantha
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	Orthrosanthus laxus
Iridaceae	Orthrosanthus laxus var. gramineus
Iridaceae	*Romulea rosea
Orchidaceae	Caladenia denticulata
Orchidaceae	Caladenia flaccida subsp. flaccida
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Caladenia vulgata

Family	Species
Orchidaceae	Cyanicula deformis
Orchidaceae	Cyanicula gemmata
Orchidaceae	Diuris aff. recurva
Orchidaceae	Elythranthera brunonis
Orchidaceae	Eriochilus dilatatus
Orchidaceae	Eriochilus helonomos
Orchidaceae	Habenaria elongata
Orchidaceae	Leporella fimbriata
Orchidaceae	Pterostylis aff. nana
Orchidaceae	Pterostylis aff. rufa
Orchidaceae	Pterostylis recurva
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa
Orchidaceae	Pterostylis sp.
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Casuarinaceae	Allocasuarina humilis
Proteaceae	Dryandra fraseri
Proteaceae	Dryandra sessilis
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Hakea incrassata
Proteaceae	Hakea lissocarpha
Proteaceae	Isopogon divergens
Santalaceae	Santalum acuminatum
Polygonaceae	Muehlenbeckia adpressa
Chenopodiaceae	Rhagodia drummondii
Portulacaceae	Calandrinia calyptrata
Portulacaceae	Calandrinia sp.
Caryophyllaceae	*Petrohragia dubia
Caryophyllaceae	*Silene gallica var. gallica
Lauraceae	Cassytha pomiformis
Brassicaceae	*Brassica barrelieri subsp. oxyrrhina
Droseraceae	Drosera aff. macrantha
Droseraceae	Drosera erythrorhiza subsp. erythrorhiza
Droseraceae	Drosera macrantha subsp. macrantha
Droseraceae	Drosera macrophylla subsp. macrophylla
Droseraceae	Drosera pallida
Droseraceae	Drosera sp.

Family	Species
Crassulaceae	Crassula colorata
Crassulaceae	Crassula colorata var. colorata
Crassulaceae	Crassula decumbens var. decumbens
Crassulaceae	Crassula exserta
Surianaceae	Stylobasium australe
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia aristulata
Mimosaceae	Acacia congesta subsp. congesta
Mimosaceae	Acacia lasiocarpa var. sedifolia
Mimosaceae	Acacia pulchella
Mimosaceae	Acacia pulchella var. goadbyi
Mimosaceae	Acacia restiacea
Mimosaceae	Acacia saligna
Mimosaceae	Acacia scirpifolia
Papilionaceae	Bossiaea sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	Daviesia dielsii
Papilionaceae	Daviesia hakeoides subsp. subnuda
Papilionaceae	Gompholobium glutinosum
Papilionaceae	Kennedia prostrata
Papilionaceae	Nemcia acuta
Papilionaceae	*Lupinus angustifolius
Papilionaceae	*Trifolium arvense var. arvense
Papilionaceae	*Trifolium hirtum
Papilionaceae	*Trifolium repens var. repens
Papilionaceae	*Trifolium subterraneum
Geraniaceae	Erodium cygnorum
Geraniaceae	*Erodium botrys
Linaceae	*Linum trigynum
Rutaceae	Boronia coerulescens subsp. spinescens
Polygalaceae	Comesperma integerrimum
Stackhousiaceae	Stackhousia monogyna
Stackhousiaceae	Tripterococcus brunonis
Sapindaceae	Dodonaea inaequifolia
Sapindaceae	Dodonaea pinifolia
Rhamnaceae	Cryptandra glabriflora
Rhamnaceae	Trymalium ledifolium var. rosmarinifolium
Sterculiaceae	Thomasia grandiflora

Family	Species
Dilleniaceae	Hibbertia subvaginata
Thymelaeaceae	Pimelea imbricata var. piligera
Myrtaceae	Baeckea crispiflora
Myrtaceae	Baeckea crispiflora var. tenuior
Myrtaceae	Baeckea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calothamnus sanguineus
Myrtaceae	Calytrix depressa
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus eudesmioides
Myrtaceae	Eucalyptus eudesmioides subsp. eudesmioides
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba
Myrtaceae	Eucalyptus salmonophloia
Myrtaceae	Eucalyptus wandoo subsp. wandoo
Myrtaceae	Hypocalymma angustifolium
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca radula
Myrtaceae	Melaleuca sclerophylla
Myrtaceae	Melaleuca sp.
Myrtaceae	Regelia megacephala
Myrtaceae	Verticordia acerosa var. preissii
Myrtaceae	Verticordia huegelii var. stylosa
Apiaceae	Apium annuum
Apiaceae	Daucus glochidiatus
Apiaceae	Platysace cirrosa
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene pilosa
Apiaceae	Trachymene sp.
Apiaceae	Xanthosia fruticulosa
Epacridaceae	Astroloma serratifolium
Primulaceae	*Anagallis arvensis
Loganiaceae	Phyllangium sulcatum
Chloanthaceae	Pityrodia dilatata
Lamiaceae	Hemiandra incana

Family	Species
Scrophulariaceae	*Parentucellia latifolia
Rubiaceae	Opercularia vaginata
Campanulaceae	Wahlenbergia gracilentia
Lobeliaceae	Lobelia sp. small flowers (K.F. Kenneally 7705)
Goodeniaceae	Brunonia australis
Goodeniaceae	Dampiera lavandulacea
Goodeniaceae	Goodenia arthrotricha
Goodeniaceae	Goodenia berardiana
Goodeniaceae	Goodenia hassallii
Goodeniaceae	Lechenaultia biloba
Goodeniaceae	Scaevola glandulifera
Goodeniaceae	Scaevola phlebopetala
Stylidiaceae	Stylidium calcaratum
Stylidiaceae	Stylidium glabrifolium
Stylidiaceae	Stylidium miniatum
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Gilberta tenuifolia
Asteraceae	Hyalosperma cotula
Asteraceae	Lagenophora huegelii
Asteraceae	Lawrencella rosea
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Pterochaeta paniculata
Asteraceae	Rhodanthe laevis
Asteraceae	Rhodanthe polycephala
Asteraceae	Schoenia cassiniana
Asteraceae	Siloxerus humifusus
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hedypnois rhagadioloides
Asteraceae	*Hypochaeris glabra
Asteraceae	*Hypochaeris radicata
Asteraceae	*Sonchus oleraceus
Asteraceae	*Tripteris clandestina
Asteraceae	*Urospermum picroides

Family	Species
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 14: Allocasuarina microstachya open scrub.	
Poaceae	Neurachne alopecuroidea
Cyperaceae	Schoenus clandestinus
Boryaceae	Borya sphaerocephala
Casuarinaceae	Allocasuarina huegeliana
Casuarinaceae	Allocasuarina microstachya
Myrtaceae	Calytrix depressa
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Kunzea praestans
Asteraceae	Gilberta tenuifolia
Asteraceae	Lawrencella rosea
Asteraceae	Podolepis canescens
Asteraceae	Podolepis lessonii
List for Vegetation Alliance 15: Provisional list Regelia megacephala high shrubland to open and closed scrub.	
Adiantaceae	Cheilanthes adiantoides
Adiantaceae	Cheilanthes distans
Aspleniaceae	Pleurosorus rutifolius
Poaceae	Amphipogon caricinus
Poaceae	Aristida contorta
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa compressa
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa macalpinei
Poaceae	Austrostipa nitida
Poaceae	Austrostipa scabra
Poaceae	Austrostipa sp.
Poaceae	Austrostipa tenuifolia
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Eriachne ovata
Poaceae	Neurachne alopecuroidea
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima

Family	Species
Poaceae	* <i>Bromus diandrus</i>
Poaceae	* <i>Ehrharta longiflora</i>
Poaceae	* <i>Pentaschistis airoides</i>
Poaceae	* <i>Pentaschistis pallida</i>
Poaceae	* <i>Pentaschistis</i> sp.
Poaceae	* <i>Vulpia myuros</i>
Cyperaceae	<i>Lepidosperma</i> aff. <i>leptostachyum</i> (Moora: ERG18-7)
Cyperaceae	<i>Lepidosperma leptostachyum</i>
Cyperaceae	<i>Lepidosperma</i> sp.
Cyperaceae	<i>Lepidosperma tenue</i>
Cyperaceae	<i>Schoenus brevisetis</i>
Cyperaceae	<i>Schoenus clandestinus</i>
Cyperaceae	<i>Schoenus pleiostemoneus</i>
Restionaceae	<i>Desmocladus flexuosus</i>
Centrolepidaceae	<i>Centrolepis drummondiana</i>
Centrolepidaceae	<i>Centrolepis pilosa</i>
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
Phormiaceae	<i>Dianella revoluta</i> var. <i>divaricata</i>
Phormiaceae	<i>Stypantra glauca</i>
Anthericaceae	<i>Agrostocrinum scabrum</i>
Anthericaceae	<i>Caesia</i> (Moora hairy stem)
Anthericaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>
Anthericaceae	<i>Dichopogon capillipes</i>
Anthericaceae	<i>Sowerbaea laxiflora</i>
Anthericaceae	<i>Thysanotus dichotomus</i>
Anthericaceae	<i>Thysanotus manglesianus</i>
Anthericaceae	<i>Tricoryne elatior</i>
Colchicaceae	<i>Burchardia umbellata</i>
Boryaceae	<i>Borya laciniata</i>
Boryaceae	<i>Borya sphaerocephala</i>
Hypoxidaceae	<i>Hypoxis glabella</i> var. <i>leptantha</i>
Hypoxidaceae	<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>
Dioscoreaceae	<i>Dioscorea hastifolia</i>
Iridaceae	<i>Orthrosanthus laxus</i> var. <i>gramineus</i>
Iridaceae	* <i>Romulea rosea</i>
Orchidaceae	<i>Caladenia denticulata</i>
Orchidaceae	<i>Caladenia flaccida</i> subsp.

Family	Species
	<i>flaccida</i>
Orchidaceae	<i>Caladenia flava</i> subsp. <i>flava</i>
Orchidaceae	<i>Caladenia</i> sp.
Orchidaceae	<i>Cyanicula deformis</i>
Orchidaceae	<i>Cyanicula gemmata</i>
Orchidaceae	<i>Cyrtostylis huegelii</i>
Orchidaceae	<i>Diuris</i> aff. <i>recurva</i>
Orchidaceae	<i>Elythranthera brunonis</i>
Orchidaceae	<i>Eriochilus dilatatus</i>
Orchidaceae	<i>Eriochilus helonomos</i>
Orchidaceae	<i>Pterostylis recurva</i>
Orchidaceae	<i>Pterostylis sanguinea</i>
Orchidaceae	<i>Pterostylis sargentii</i>
Orchidaceae	<i>Pterostylis scabra</i>
Orchidaceae	<i>Pterostylis setulosa</i>
Orchidaceae	<i>Pterostylis</i> sp.
Orchidaceae	<i>Pterostylis spathulata</i>
Orchidaceae	<i>Pterostylis vittata</i>
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina campestris</i> subsp. <i>campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Casuarinaceae	<i>Allocasuarina humilis</i>
Proteaceae	<i>Dryandra fraseri</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Grevillea biternata</i>
Proteaceae	<i>Hakea incrassata</i>
Proteaceae	<i>Isopogon divergens</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Amaranthaceae	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>
Portulacaceae	<i>Calandrinia calyptrata</i>
Portulacaceae	<i>Calandrinia eremaea</i>
Portulacaceae	<i>Calandrinia</i> sp.
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Caryophyllaceae	* <i>Silene gallica</i> var. <i>gallica</i>
Caryophyllaceae	* <i>Spergula arvensis</i>
Lauraceae	<i>Cassytha pomiformis</i>
Droseraceae	<i>Drosera</i> aff. <i>macrantha</i>
Droseraceae	<i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>

Family	Species
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Droseraceae	<i>Drosera pallida</i>
Droseraceae	<i>Drosera</i> sp.
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Crassulaceae	<i>Crassula exserta</i>
Mimosaceae	<i>Acacia acuminata</i> subsp. <i>acuminata</i>
Mimosaceae	<i>Acacia aristulata</i>
Mimosaceae	<i>Acacia congesta</i> subsp. <i>congesta</i>
Mimosaceae	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>
Mimosaceae	<i>Acacia stenoptera</i>
Papilionaceae	<i>Bossiaea</i> sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	<i>Daviesia dielsii</i>
Papilionaceae	<i>Kennedia prostrata</i>
Papilionaceae	<i>Nemcia acuta</i>
Papilionaceae	* <i>Trifolium arvense</i> var. <i>arvense</i>
Papilionaceae	* <i>Trifolium hirtum</i>
Papilionaceae	* <i>Trifolium repens</i> var. <i>repens</i>
Papilionaceae	* <i>Trifolium subterraneum</i>
Geraniaceae	<i>Erodium cygnorum</i>
Geraniaceae	<i>Erodium botrys</i>
Linaceae	<i>Linum trigynum</i>
Rutaceae	<i>Boronia ramosa</i> subsp. <i>anethifolia</i>
Polygalaceae	<i>Comesperma integerrimum</i>
Polygalaceae	<i>Comesperma volubile</i>
Stackhousiaceae	<i>Stackhousia monogyna</i>
Stackhousiaceae	<i>Tripterococcus brunonis</i>
Sapindaceae	<i>Dodonaea pinifolia</i>
Rhamnaceae	<i>Cryptandra glabriflora</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Sterculiaceae	<i>Thomasia grandiflora</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>
Thymelaeaceae	<i>Pimelea imbricata</i> var. <i>piligera</i>
Myrtaceae	<i>Baeckea</i> sp. Moora (R. Bone 1993/1)
Myrtaceae	<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo
Myrtaceae	<i>Calothamnus sanguineus</i>
Myrtaceae	<i>Calytrix leschenaultii</i>

Family	Species
Myrtaceae	<i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i>
Myrtaceae	<i>Kunzea praestans</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Regelia megacephala</i>
Apiaceae	<i>Apium annuum</i>
Apiaceae	<i>Daucus glochidiatus</i>
Apiaceae	<i>Platysace cirrosa</i>
Apiaceae	<i>Trachymene cyanopetala</i>
Apiaceae	<i>Trachymene ornata</i>
Apiaceae	<i>Trachymene pilosa</i>
Apiaceae	<i>Xanthosia fruticulosa</i>
Epacridaceae	<i>Astroloma serratifolium</i>
Primulaceae	* <i>Anagallis arvensis</i>
Loganiaceae	<i>Phyllangium sulcatum</i>
Gentianaceae	* <i>Centaurium tenuiflorum</i>
Chloanthaceae	<i>Pityrodia dilatata</i>
Scrophulariaceae	* <i>Parentucellia latifolia</i>
Orobanchaceae	* <i>Orobanche minor</i>
Plantaginaceae	<i>Plantago debilis</i>
Rubiaceae	<i>Opercularia vaginata</i>
Campanulaceae	<i>Wahlenbergia gracilentia</i>
Goodeniaceae	<i>Dampiera lavandulacea</i>
Goodeniaceae	<i>Goodenia arthrotricha</i>
Goodeniaceae	<i>Goodenia berardiana</i>
Goodeniaceae	<i>Goodenia hassallii</i>
Goodeniaceae	<i>Goodenia</i> sp.
Goodeniaceae	<i>Lechenaultia biloba</i>
Goodeniaceae	<i>Scaevola anchusifolia</i>
Goodeniaceae	<i>Scaevola phlebopetala</i>
Stylidiaceae	<i>Levenhookia stipitata</i>
Stylidiaceae	<i>Stylidium caricifolium</i>
Stylidiaceae	<i>Stylidium cordifolium</i>
Stylidiaceae	<i>Stylidium glabrifolium</i>
Stylidiaceae	<i>Stylidium miniatum</i>
Stylidiaceae	<i>Stylidium repens</i>
Stylidiaceae	<i>Stylidium septentrionale</i>
Asteraceae	<i>Blennospora drummondii</i>
Asteraceae	<i>Gilberta tenuifolia</i>

Family	Species
Asteraceae	Hyalosperma cotula
Asteraceae	Lawrencella rosea
Asteraceae	Millotia myosotidifolia
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
Asteraceae	Podolepis gracilis
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca aff. gnaphalioides (Moora WDM1-65)
Asteraceae	Podotheca angustifolia
Asteraceae	Quinetia urvillei
Asteraceae	Waitzia acuminata
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Hypochaeris radicata
Asteraceae	*Sonchus oleraceus
Asteraceae	*Tripteris clandestina
Asteraceae	*Urospermum picroides
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 16: Provisional list Kunzea Praestans high shrubland to open & close scrub.	
Adiantaceae	Cheilanthes adiantoides
Adiantaceae	Cheilanthes distans
Aspleniaceae	Pleurosorus rutifolius
Cupressaceae	Actinostrobus arenarius
Poaceae	Amphipogon caricinus
Poaceae	Aristida contorta
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa hemipogon
Poaceae	Austrostipa nitida
Poaceae	Austrostipa sp.
Poaceae	Austrostipa trichophylla
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea

Family	Species
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta calycina
Poaceae	*Ehrharta longiflora
Poaceae	*Lolium perenne
Poaceae	*Pentaschistis airoides
Poaceae	*Pentaschistis pallida
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma aff. leptostachyum (Moora: ERG18-7)
Cyperaceae	Lepidosperma leptostachyum
Cyperaceae	Lepidosperma sp.
Cyperaceae	Lepidosperma sp. P1 small head (M.D. Tindale 166A)
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus brevisetis
Cyperaceae	Schoenus clandestinus
Cyperaceae	Schoenus nanus
Restionaceae	Desmocladus flexuosus
Restionaceae	Lepidobolus chaetocephalus
Dasyopogonaceae	Lomandra (Moora twisty)
Dasyopogonaceae	Lomandra aff. micrantha subsp. micrantha
Dasyopogonaceae	Lomandra effusa
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypandra glauca
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Laxmannia ramosa subsp. ramosa
Anthericaceae	Thysanotus manglesianus
Anthericaceae	Thysanotus sp.
Anthericaceae	Tricoryne elatior
Colchicaceae	Burchardia umbellata
Boryaceae	Borya laciniata
Boryaceae	Borya sphaerocephala
Haemodoraceae	Haemodorum paniculatum

Family	Species
Haemodoraceae	Haemodorum simulans
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	Orthrosanthus laxus var. gramineus
Iridaceae	*Romulea rosea
Orchidaceae	Caladenia denticulata
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Cyanicula deformis
Orchidaceae	Cyanicula gemmata
Orchidaceae	Diuris aff. recurva
Orchidaceae	Eriochilus helonomos
Orchidaceae	Pterostylis aff. nana
Orchidaceae	Pterostylis exserta (ms)
Orchidaceae	Pterostylis recurva
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa
Orchidaceae	Pterostylis vittata
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Casuarinaceae	Allocasuarina humilis
Casuarinaceae	Allocasuarina sp.
Proteaceae	Dryandra fraseri
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Hakea incrassata
Proteaceae	Hakea lissocarpha
Proteaceae	Hakea recurva subsp. recurva
Proteaceae	Isopogon divergens
Loranthaceae	Nuytsia floribunda
Polygonaceae	Muehlenbeckia adpressa
Amaranthaceae	Ptilotus polystachyus var. polystachyus
Portulacaceae	Calandrinia calyptata
Portulacaceae	Calandrinia sp.
Portulacaceae	Calandrinia sp. Blackberry (D.M. Porter 171)
Caryophyllaceae	*Petrohragia dubia
Caryophyllaceae	*Silene gallica var. gallica
Lauraceae	Cassytha pomiformis
Droseraceae	Drosera aff. macrantha
Droseraceae	Drosera erythrorhiza subsp.

Family	Species
	erythrorhiza
Droseraceae	Drosera macrantha subsp. macrantha
Droseraceae	Drosera pallida
Crassulaceae	Crassula colorata var. colorata
Crassulaceae	Crassula exserta
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia aestivalis
Mimosaceae	Acacia aristulata
Mimosaceae	Acacia congesta subsp. congesta
Mimosaceae	Acacia hemiteles
Mimosaceae	Acacia lasiocarpa var. sedifolia
Mimosaceae	Acacia microbotrya
Mimosaceae	Acacia pulchella var. goadbyi
Mimosaceae	Acacia restiacea
Mimosaceae	Acacia stenoptera
Papilionaceae	Bossiaea sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	Cristonia biloba
Papilionaceae	Daviesia dielsii
Papilionaceae	Daviesia hakeoides subsp. subnuda
Papilionaceae	Gastrolobium acutum
Papilionaceae	Gompholobium glutinosum
Papilionaceae	Nemcia acuta
Papilionaceae	*Trifolium arvense var. arvense
Papilionaceae	*Trifolium hirtum
Papilionaceae	*Trifolium repens var. repens
Papilionaceae	*Trifolium subterraneum
Geraniaceae	Erodium cygnorum
Geraniaceae	*Erodium botrys
Linaceae	*Linum trigynum
Rutaceae	Boronia ramosa subsp. anethifolia
Polygalaceae	Comesperma integerrimum
Euphorbiaceae	Euphorbia drummondii subsp. drummondii
Stackhousiaceae	Stackhousia monogyna
Stackhousiaceae	Tripterococcus brunonis
Sapindaceae	Diplopeltis huegelii subsp. lehmannii
Sapindaceae	Dodonaea pinifolia

Family	Species
Rhamnaceae	<i>Cryptandra glabriflora</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Sterculiaceae	<i>Guichenotia micrantha</i>
Sterculiaceae	<i>Guichenotia sarotes</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>
Myrtaceae	<i>Baeckea</i> sp. Moora (R. Bone 1993/1)
Myrtaceae	<i>Calothamnus</i> aff. <i>quadrifidus</i> Moora-Watheroo
Myrtaceae	<i>Calothamnus sanguineus</i>
Myrtaceae	<i>Calytrix leschenaultii</i>
Myrtaceae	<i>Eucalyptus eudesmioides</i> subsp. <i>eudesmioides</i>
Myrtaceae	<i>Kunzea praestans</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca calyptroides</i>
Myrtaceae	<i>Melaleuca radula</i>
Myrtaceae	<i>Regelia megacephala</i>
Myrtaceae	<i>Verticordia densiflora</i> var. <i>densiflora</i>
Apiaceae	<i>Daucus glochidiatus</i>
Apiaceae	<i>Platysace cirrosa</i>
Apiaceae	<i>Trachymene cyanopetala</i>
Apiaceae	<i>Trachymene ornata</i>
Apiaceae	<i>Trachymene pilosa</i>
Apiaceae	<i>Xanthosia fruticulosa</i>
Epacridaceae	<i>Astroloma serratifolium</i>
Primulaceae	* <i>Anagallis arvensis</i>
Loganiaceae	<i>Phyllangium sulcatum</i>
Chloanthaceae	<i>Pityrodia dilatata</i>
Scrophulariaceae	* <i>Parentucellia latifolia</i>
Rubiaceae	<i>Opercularia vaginata</i>
Lobeliaceae	<i>Isotoma hypocrateriformis</i>
Goodeniaceae	<i>Goodenia arthrotricha</i>
Goodeniaceae	<i>Goodenia berardiana</i>
Goodeniaceae	<i>Goodenia hassallii</i>
Goodeniaceae	<i>Lechenaultia biloba</i>
Goodeniaceae	<i>Scaevola phlebopetala</i>
Stylidiaceae	<i>Levenhookia stipitata</i>
Stylidiaceae	<i>Stylidium cordifolium</i>
Stylidiaceae	<i>Stylidium miniatum</i>

Family	Species
Stylidiaceae	<i>Stylidium repens</i>
Stylidiaceae	<i>Stylidium septentrionale</i>
Asteraceae	<i>Blennospora drummondii</i>
Asteraceae	<i>Gilberta tenuifolia</i>
Asteraceae	<i>Hyalosperma cotula</i>
Asteraceae	<i>Lawrencella rosea</i>
Asteraceae	<i>Millotia myosotidifolia</i>
Asteraceae	<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>
Asteraceae	<i>Olearia dampieri</i> subsp. <i>eremicola</i>
Asteraceae	<i>Podolepis canescens</i>
Asteraceae	<i>Podolepis lessonii</i>
Asteraceae	<i>Podotheca angustifolia</i>
Asteraceae	<i>Podotheca gnaphalioides</i>
Asteraceae	<i>Quinetia urvillei</i>
Asteraceae	<i>Rhodanthe polycephala</i>
Asteraceae	<i>Schoenia cassiniana</i>
Asteraceae	<i>Waitzia nitida</i>
Asteraceae	* <i>Arctotheca calendula</i>
Asteraceae	* <i>Hypochaeris glabra</i>
Asteraceae	* <i>Hypochaeris radicata</i>
Asteraceae	* <i>Sonchus oleraceus</i>
Asteraceae	* <i>Tripteris clandestina</i>
Asteraceae	* <i>Urospermum picroides</i>
Asteraceae	* <i>Ursinia anthemoides</i>
List for Vegetation Alliance 17: <i>Melaleuca calyptroides</i> open to closed heath.	
Adiantaceae	<i>Cheilanthes adiantoides</i>
Poaceae	<i>Amphipogon caricinus</i>
Poaceae	<i>Austrostipa elegantissima</i>
Poaceae	<i>Austrostipa trichophylla</i>
Poaceae	<i>Neurachne alopecuroidea</i>
Poaceae	* <i>Aira caryophylla</i>
Poaceae	* <i>Avena barbata</i>
Poaceae	* <i>Briza maxima</i>
Poaceae	* <i>Bromus diandrus</i>
Poaceae	* <i>Pentaschistis pallida</i>
Poaceae	* <i>Pentaschistis</i> sp. Moora (doubtful ID)
Poaceae	* <i>Vulpia myuros</i>
Restionaceae	<i>Desmocladus flexuosus</i>

Family	Species
Dasypogonaceae	Lomandra (Moora twisty)
Xanthorrhoeaceae	Xanthorrhoea drummondii
Anthericaceae	Caesia (Moora hairy stem)
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Laxmannia ramosa subsp. ramosa
Anthericaceae	Thysanotus manglesianus
Colchicaceae	Burchardia umbellata
Boryaceae	Borya sphaerocephala
Orchidaceae	Caladenia denticulata
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Cyanicula deformis
Orchidaceae	Cyanicula gemmata
Orchidaceae	Paracaleana carinata
Orchidaceae	Pterostylis recurva
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Casuarinaceae	Allocasuarina sp.
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Isopogon divergens
Caryophyllaceae	*Silene gallica var. gallica
Droseraceae	Drosera aff. macrantha
Droseraceae	Drosera erythrorhiza subsp. erythrorhiza
Droseraceae	Drosera macrantha subsp. macrantha
Crassulaceae	Crassula colorata var. colorata
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia hemiteles
Papilionaceae	Daviesia dielsii
Papilionaceae	Nemcia acuta
Papilionaceae	*Trifolium arvense var. arvense
Papilionaceae	*Trifolium hirtum
Sapindaceae	Diplopeltis huegelii subsp. lehmannii
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Baeckea sp. Moora (R. Bone 1993/1)

Family	Species
Myrtaceae	Calothamnus sanguineus
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca calyptroides
Apiaceae	Apium annuum
Apiaceae	Homalosciadium homalocarpum
Apiaceae	Trachymene cyanopetala
Apiaceae	Trachymene ornata
Apiaceae	Trachymene pilosa
Epacridaceae	Astroloma serratifolium
Loganiaceae	Phyllangium sulcatum
Chloanthaceae	Pityrodia dilatata
Scrophulariaceae	*Parentucellia latifolia
Rubiaceae	Opercularia vaginata
Campanulaceae	Wahlenbergia gracilentia
Stylidiaceae	Levenhookia stipitata
Stylidiaceae	Stylidium repens
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Millotia tenuifolia var. tenuifolia
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Urospermum picroides
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 18: <i>Hibbertia subvaginata</i> low shrublands to low open heath.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia acerosa
Poaceae	Austrodanthonia caespitosa
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Pentaschistis airoides

Family	Species
Poaceae	* <i>Pentaschistis pallida</i>
Poaceae	* <i>Vulpia myuros</i>
Cyperaceae	<i>Lepidosperma leptostachyum</i>
Restionaceae	<i>Desmocladius flexuosus</i>
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
Phormiaceae	<i>Stypandra glauca</i>
Anthericaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>
Anthericaceae	<i>Dichopogon capillipes</i>
Anthericaceae	<i>Thysanotus manglesianus</i>
Colchicaceae	<i>Burchardia umbellata</i>
Boryaceae	<i>Borya sphaerocephala</i>
Hypoxidaceae	<i>Hypoxis occidentalis</i> var. <i>occidentalis</i>
Dioscoreaceae	<i>Dioscorea hastifolia</i>
Orchidaceae	<i>Caladenia denticulata</i>
Orchidaceae	<i>Caladenia flava</i> subsp. <i>flava</i>
Orchidaceae	<i>Cyanicula deformis</i>
Orchidaceae	<i>Pterostylis setulosa</i>
Orchidaceae	<i>Pterostylis</i> sp.
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Portulacaceae	<i>Calandrinia calyptata</i>
Portulacaceae	<i>Calandrinia</i> sp.
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>
Droseraceae	<i>Drosera</i> sp.
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>
Mimosaceae	<i>Acacia acuminata</i> subsp. <i>acuminata</i>
Mimosaceae	<i>Acacia aristulata</i>
Mimosaceae	<i>Acacia congesta</i> subsp. <i>congesta</i>
Papilionaceae	<i>Kennedia prostrata</i>
Papilionaceae	* <i>Trifolium repens</i> var. <i>repens</i>
Papilionaceae	* <i>Trifolium subterraneum</i>
Polygalaceae	<i>Comesperma integerrimum</i>
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Dilleniaceae	<i>Hibbertia subvaginata</i>

Family	Species
Myrtaceae	<i>Calytrix leschenaultii</i>
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>
Myrtaceae	<i>Kunzea praestans</i>
Apiaceae	<i>Trachymene cyanopetala</i>
Apiaceae	<i>Trachymene ornata</i>
Loganiaceae	<i>Phyllangium sulcatum</i>
Chloanthaceae	<i>Pityrodia dilatata</i>
Scrophulariaceae	* <i>Parentucellia latifolia</i>
Goodeniaceae	<i>Goodenia berardiana</i>
Stylidiaceae	<i>Stylidium glabrifolium</i>
Asteraceae	<i>Olearia dampieri</i> subsp. <i>eremicola</i>
Asteraceae	<i>Podolepis lessonii</i>
Asteraceae	<i>Quinetia urvillei</i>
Asteraceae	<i>Waitzia nitida</i>
Asteraceae	* <i>Arctotheca calendula</i>
Asteraceae	* <i>Hypochaeris glabra</i>
Asteraceae	* <i>Urospermum picroides</i>
Asteraceae	* <i>Ursinia anthemoides</i>
List for Vegetation Alliance 19: <i>Xanthorrhoea drummondii</i> high open shrubland.	
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
List for Vegetation Alliance 20-1: <i>Dryandra sessilis</i> high shrubland.	
Poaceae	<i>Neurachne alopecuroidea</i>
Poaceae	* <i>Avena barbata</i>
Poaceae	* <i>Briza maxima</i>
Poaceae	* <i>Pentaschistis airoides</i>
Poaceae	* <i>Vulpia myuros</i>
Restionaceae	<i>Desmocladius flexuosus</i>
Xanthorrhoeaceae	<i>Xanthorrhoea drummondii</i>
Casuarinaceae	<i>Allocasuarina campestris</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Proteaceae	<i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i>
Proteaceae	<i>Dryandra nivea</i>
Proteaceae	<i>Dryandra sessilis</i> var. <i>sessilis</i>
Proteaceae	<i>Grevillea amplexans</i> subsp. <i>semivestita</i>
Proteaceae	<i>Petrophile brevifolia</i>
Loranthaceae	<i>Nuytsia floribunda</i>
Mimosaceae	<i>Acacia acuminata</i> subsp.

Family	Species
	acuminata
Mimosaceae	Acacia pulchella var. glaberrima
Papilionaceae	Bossiaea sp. Cairn Hill (M Henson CH2-28)
Papilionaceae	Daviesia dielsii
Papilionaceae	Jacksonia floribunda
Papilionaceae	Jacksonia foliosa
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Baekkea aff. preissiana (Schauer) Domin EAG 7109
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus eudesmioides subsp. eudesmioides
Myrtaceae	Kunzea praestans
Myrtaceae	Leptospermum erubescens
Apiaceae	Trachymene pilosa
Asteraceae	Podolepis lessonii
List for Vegetation Alliance 20-2: <i>Melaleuca conc</i> open scrub.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia acerosa
Poaceae	Austrostipa elegantissima
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Boryaceae	Borya sphaerocephala
Crassulaceae	Crassula colorata var. colorata
Mimosaceae	Acacia acuminata subsp. acuminata
Mimosaceae	Acacia ericksoniae
Rhamnaceae	Trymalium daphnifolium
Myrtaceae	Baekkea sp. Moora (R. Bone 1993/1)
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba
Myrtaceae	Melaleuca concreta
Myrtaceae	Melaleuca radula
Myrtaceae	Melaleuca sclerophylla
Stylidiaceae	Stylidium septentrionale
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis lessonii
Asteraceae	Waitzia nitida

Family	Species
List for Vegetation Alliance 20-3: <i>Melaleuca radu</i> high shrubland to open scrub.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Pentaschistis pallida
Cyperaceae	Lepidosperma pubisquameum
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladus flexuosus
Restionaceae	Lepidobolus chaetocephalus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Boryaceae	Borya sphaerocephala
Casuarinaceae	Allocasuarina huegeliana
Proteaceae	Hakea recurva subsp. recurva
Mimosaceae	Acacia acuminata subsp. acuminata
Rhamnaceae	Trymalium ledifolium var. rosmarinifolium
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Melaleuca calyptroides
Myrtaceae	Melaleuca radula
Rubiaceae	Opercularia vaginata
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Podolepis lessonii
List for Vegetation Alliance 20-4: <i>Melaleuca sclerophylla</i> open heath.	
Poaceae	Neurachne alopecuroidea
Cyperaceae	Lepidosperma costale
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladus flexuosus
Boryaceae	Borya sphaerocephala
Papilionaceae	Gastrolobium obovatum
Sapindaceae	Dodonaea pinifolia
Rhamnaceae	Stenanthemum tridentatum
Myrtaceae	Hypocalymma angustifolium
Myrtaceae	Melaleuca sclerophylla
Stylidiaceae	Stylidium septentrionale

Family	Species
List for Vegetation Alliance 20-5: <i>Baekkea</i> sp. Mo (R. Bone 1993/1) low open heath.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia caespitosa
Poaceae	Neurachne alopecuroidea
Poaceae	*Ehrharta longiflora
Cyperaceae	Lepidosperma aff. leptostachyum (Moora: ERG18-7)
Cyperaceae	Schoenus clandestinus
Restionaceae	Lepidobolus chaetocephalus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Thysanotus manglesianus
Anthericaceae	Tricoryne arenicola
Colchicaceae	Burchardia umbellata
Boryaceae	Borya sphaerocephala
Haemodoraceae	Haemodorum simulans
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Orchidaceae	Caladenia flava subsp. flava
Orchidaceae	Cyanicula deformis
Orchidaceae	Leporella fimbriata
Orchidaceae	Pterostylis sanguinea
Orchidaceae	Pterostylis setulosa
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Droseraceae	Drosera aff. macrantha
Droseraceae	Drosera erythrorhiza subsp. erythrorhiza
Papilionaceae	*Lupinus angustifolius
Thymelaeaceae	Pimelea imbricata var. piligera
Myrtaceae	Baekkea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calytrix depressa
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca radula
Haloragaceae	Gonocarpus nodulosus
Apiaceae	Trachymene cyanopetala
Goodeniaceae	Goodenia berardiana
Goodeniaceae	Goodenia hassallii

Family	Species
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Lawrencella rosea
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Quinetia urvillei
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Ursinia anthemoides
List for Vegetation Alliance 20-6: <i>Calytrix leschenaultii</i> open heath.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia caespitosa
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Pentaschistis pallida
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladus flexuosus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Stypandra glauca
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Colchicaceae	Burchardia umbellata
Boryaceae	Borya sphaerocephala
Dioscoreaceae	Dioscorea hastifolia
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Proteaceae	Dryandra sessilis var. sessilis
Proteaceae	Hakea lissocarpha
Mimosaceae	Acacia acuminata subsp. acuminata
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Eucalyptus wandoo subsp. wandoo

Family	Species
Myrtaceae	Kunzea praestans
Chloanthaceae	Pityrodia dilatata
Solanaceae	Solanum oldfieldii
Stylidiaceae	Stylidium septentrionale
Asteraceae	Blennospora drummondii
Asteraceae	Gilberta tenuifolia
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis lessonii
Asteraceae	Podotheca angustifolia
Asteraceae	Waitzia nitida
Asteraceae	*Hypochaeris glabra
List for Vegetation Alliance 20-7: <i>Calytrix depressa</i> low open heath.	
Poaceae	Neurachne alopecuroidea
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Anthericaceae	Dichopogon capillipes
Anthericaceae	Tricoryne elatior
Boryaceae	Borya sphaerocephala
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Papilionaceae	Gastrolobium obovatum
Rhamnaceae	Stenanthemum tridentatum
Myrtaceae	Baeckea sp. Moora (R. Bone 1993/1)
Myrtaceae	Calytrix depressa
Myrtaceae	Hypocalymma angustifolium
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca radula
Epacridaceae	Astroloma serratifolium
Goodeniaceae	Dampiera lavandulacea
Goodeniaceae	Goodenia hassallii
Stylidiaceae	Stylidium septentrionale
Asteraceae	Podolepis lessonii
List for Vegetation Alliance 20-8: <i>Calothan aff. quadrifidus</i> Moora-Watheroo high shrubland.	
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata

Family	Species
Poaceae	*Ehrharta longiflora
Poaceae	*Vulpia myuros
Cyperaceae	Lepidosperma tenue
Cyperaceae	Schoenus clandestinus
Restionaceae	Desmocladius flexuosus
Xanthorrhoeaceae	Xanthorrhoea drummondii
Boryaceae	Borya sphaerocephala
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Crassulaceae	Crassula colorata var. colorata
Mimosaceae	Acacia acuminata subsp. acuminata
Papilionaceae	Daviesia dielsii
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Calothamnus aff. quadrifidus Moora-Watheroo
Myrtaceae	Calytrix leschenaultii
Myrtaceae	Kunzea praestans
Myrtaceae	Melaleuca calyptroides
Stylidiaceae	Stylidium septentrionale
Asteraceae	Olearia dampieri subsp. eremicola
Asteraceae	Podolepis canescens
List for Vegetation Alliance 20-9: <i>Ricinocarpus muricatus</i> shrubland to open heath.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa sp.
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Ehrharta longiflora
Restionaceae	Desmocladius flexuosus
Anthericaceae	Dichopogon capillipes
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Crassulaceae	Crassula colorata
Mimosaceae	Acacia acuminata subsp. acuminata
Euphorbiaceae	Ricinocarpus muricatus
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba
Myrtaceae	Kunzea praestans
Asteraceae	Podolepis lessonii

Family	Species
Asteraceae	Rhodanthe polycephala
Asteraceae	*Hypochaeris glabra
List for Vegetation Alliance 20-10: <i>Ricinocarpus velutinus</i> open heath.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrostipa mollis
Poaceae	Neurachne alopecuroidea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Ehrharta calycina
Cyperaceae	Lepidosperma tenue
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Styandra glauca
Anthericaceae	Dichopogon capillipes
Dioscoreaceae	Dioscorea hastifolia
Casuarinaceae	Allocasuarina campestris
Casuarinaceae	Allocasuarina huegeliana
Mimosaceae	Acacia acuminata subsp. acuminata
Euphorbiaceae	Ricinocarpus velutinus
Dilleniaceae	Hibbertia subvaginata
Myrtaceae	Kunzea praestans
Goodeniaceae	Goodenia arthrotricha
Asteraceae	Hyalosperma cotula
Asteraceae	Rhodanthe polycephala
Asteraceae	Waitzia nitida
List for Vegetation Alliance 2-10: Other miscellaneous.	
Adiantaceae	Cheilanthes adiantoides
Poaceae	Austrodanthonia setacea
Poaceae	Austrostipa elegantissima
Poaceae	Austrostipa nitida
Poaceae	Austrostipa variabilis
Poaceae	Neurachne alopecuroidea
Poaceae	*Aira caryophyllea
Poaceae	*Avena barbata
Poaceae	*Briza maxima
Poaceae	*Bromus diandrus
Poaceae	*Ehrharta longiflora
Poaceae	*Pentaschistis sp. Moora (doubtful ID)
Cyperaceae	Lepidosperma pubisquameum

Family	Species
Xanthorrhoeaceae	Xanthorrhoea drummondii
Phormiaceae	Dianella revoluta var. divaricata
Phormiaceae	Styandra glauca
Anthericaceae	Chamaescilla corymbosa var. corymbosa
Anthericaceae	Dichopogon capillipes
Anthericaceae	Sowerbaea laxiflora
Anthericaceae	Thysanotus manglesianus
Colchicaceae	Burchardia umbellata
Hypoxidaceae	Hypoxis occidentalis var. occidentalis
Dioscoreaceae	Dioscorea hastifolia
Iridaceae	*Romulea rosea
Orchidaceae	Cyanicula deformis
Orchidaceae	Diuris aff. recurva
Casuarinaceae	Allocasuarina huegeliana
Caryophyllaceae	*Petrohragia dubia
Caryophyllaceae	*Silene gallica var. gallica
Droseraceae	Drosera aff. macrantha
Droseraceae	Drosera macrantha subsp. macrantha
Crassulaceae	Crassula colorata var. colorata
Mimosaceae	Acacia acuminata subsp. acuminata
Geraniaceae	Erodium cygnorum
Geraniaceae	*Erodium botrys
Rutaceae	Boronia coerulescens subsp. spinescens
Polygalaceae	Comesperma integerrimum
Haloragaceae	Gonocarpus nodulosus
Apiaceae	Daucus glochidiatus
Apiaceae	Trachymene ornata
Primulaceae	*Anagallis arvensis
Loganiaceae	Phyllangium sulcatum
Scrophulariaceae	*Parentucellia latifolia
Rubiaceae	*Galium murale
Campanulaceae	*Wahlenbergia capensis
Goodeniaceae	Goodenia berardiana
Asteraceae	Blennospora drummondii
Asteraceae	Calotis hispidula
Asteraceae	Gilberta tenuifolia
Asteraceae	Hyalosperma glutinosum subsp. glutinosum

Family	Species
Asteraceae	Podolepis lessonii
Asteraceae	Waitzia nitida
Asteraceae	*Arctotheca calendula
Asteraceae	*Hypochaeris glabra
Asteraceae	*Sonchus oleraceus
Asteraceae	*Tripteris clandestina
Asteraceae	*Ursinia anthemoides
List for Provisional Vegetation Alliance 22	
Casuarina obesa (Eucalyptus loxophleba	
subsp. loxophleba) over Acacia ligustrina	
Hakea preissii.	
Poaceae	*Cynosurus echinatus
Poaceae	*Vulpia myuros

Family	Species
Casuarinaceae	Casuarina obesa
Proteaceae	Hakea preissii
Chenopodiaceae	Atriplex suberecta
Chenopodiaceae	Maireana brevifolia
Chenopodiaceae	Salsola tragus subsp. tragus
Amaranthaceae	Ptilotus spathulatus forma spathulatus
Mimosaceae	Acacia erinacea
Mimosaceae	Acacia ligustrina
Myrtaceae	Eucalyptus loxophleba subsp. loxophleba

APPENDIX 9: Photographs of the vegetation of the survey area and of declared rare flora species

The vegetation type represented by each photograph is given. The code in bold (e.g. **Aa.1**) is the code used in the text (see Appendix 7) and on the vegetation map.

Photographs of the declared rare flora species *Acacia aristulata* and *Eucalyptus pruiniramis* are also provided.



Photograph 1. Aa.1 *Acacia acuminata* subsp. *acuminata* low woodland over *Schoenus clandestinus* open sedgeland and *Austrodanthonia* sp, *Neurachne alopecuroidea*, **Avena barbata* scattered grasses with *Borya sphaerocephala* (1-2%), *Waitzia nitida*, *Gilberta tenuifolia*, *Podolepis lessonii* open herbland. (Releve RM4, R. Manning's).



Photograph 2. Aa.2 *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* high open shrubland over some remnant low shrubs and herbs (*Pityrodia dilatata*, *Opercularia vaginata*) and annual grassland (Disturbed remnant). (Releve NBPD1, P&L Doblestein's).



Photograph 3. Aa.2 *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* high open shrubland to scattered tall shrubs over **Avena barbata*, **Ehrharta longiflora*, **Briza maxima* annual grassland and *Ptilotus drummondii* var. *drummondii*, *Waitzia nitida*, *Lawrencella rosea* open herbland. (Disturbed remnant). (Releve NBPD2, P&L Doblestein's)



Photograph 4. Aa.2 *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low open woodland over *Xanthorrhoea drummondii* high open shrubland over *Lepidosperma leptostachyum* open sedgeland over **Avena barbata* very open to scattered annual grasses with *Podolepis lessonii*, *Gilberta tenuifolia*, *Waitzia nitida* very open to open herbland. (Releve D5, P&L Doblestein's).



Photograph 5. AaKp.1 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Kunzea praestans* scattered tall shrubs (at top of breakaway) over *Pityrodia dilatata* scattered low shrubs over *Styphandra glauca* open herbland with *Dioscorea hastifolia* open lianes and **Avena barbata* annual open grassland. (Quadrat ERG15, Eastern Ridge)



Photograph 6. AaTl.1 *Acacia acuminata* subsp. *acuminata* scattered low trees over *Trymalium ledifolium* var. *rosmarinifolium* open shrubland over *Neurachne alopecuroidea* scattered grasses and *Cheilanthes adiantoides* open fernland with *Schoenia cassiniana*, *Podolepis lessonii* annual herbland. (Quadrat GH5, Gardiner's Hill).



Photograph 7. Ac.3 *Eucalyptus loxophleba* subsp. *loxophleba*, *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Allocasuarina campestris* shrubland to high shrubland over *Borya sphaerocephala*, *Cheilanthes adiantoides* low open herbland/fernland. (Quadrat ERG18, Eastern Ridge).



Photograph 8. Ac.4 *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* scattered low trees to low open woodland over *Allocasuarina campestris* open to closed scrub over *Cheilanthes adiantoides*, *Dichopogon capillipes*, *Stylidium septentrionale* open fern/herbland. (Quadrat JT6, J&J Tonkin's).



Photograph 9. Ac.4 *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* high open shrubland over **Avena barbata* very open annual grassland and with *Cheilanthes adiantoides* scattered ferns. (Releve G311, P&J Gardiner's).



Photograph 10. AcAh.2 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland to low woodland over *Allocasuarina campestris* high open shrubland over tussock sedgeland over *Cheilanthes adiantoides* low open ferns with *Podolepis lessonii* annual herbland/grassland and *Dioscorea hastifolia* open lianes. (Quadrat ERG20, Eastern Ridge).



Photograph 11. AcCq.1 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Allocasuarina campestris*, (*Calothamnus* aff. *quadrifidus* Moora-Watheroo) open scrub over *Neurachne alopecuroidea*, *Desmocladius flexuosus*, *Stylidium septentrionale* scattered grasses, sedges and herbs. (Quadrat JT9, J&J Tonkin's).



Photograph 12. AcId.2 *Allocasuarina huegeliana* scattered low trees over *Allocasuarina campestris*, *Kunzea praestans* high shrubland to open scrub over *Melaleuca calyptroides*, *Isopogon divergens* shrubland over *Calytrix leschenaultii* low open shrubland over *Borya sphaerocephala*, *Stylidium septentrionale* very open herbland. (Quadrat CH17, Cairn Hill Reserve).



Photograph 13. AcId.3 *Allocasuarina campestris* closed scrub over *Isopogon divergens* open shrubland over scattered low shrubs over *Neurachne alopecuroidea* scattered grasses. (Quadrat CH19, Cairn Hill Reserve).



Photograph 14. Ah.3 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland to low open forest over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Podolepis lessonii*, *Trachymene ornata* open annual herbland. (Quadrat JT5, J&J Tonkin's).



Photograph 15. Ah.3 *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* low woodland to low open forest over *Allocasuarina campestris* scattered tall shrubs to high open shrubland over *Podolepis lessonii*, *Trachymene* spp. annual herbland. (Quadrat JT2, J.& J. Tonkin's)



Photograph 16. Ah.4 *Allocasuarina huegeliana* low woodland to low open forest over *Kunzea praestans*, *Xanthorrhoea drummondii* scattered tall shrubs over *Xanthosia fruticulosa* low open shrubland to low shrubland over *Opercularia vaginata*, *Cheilanthes adiantoides*, *Neurachne alopecuroidea* very open low herbland/fernland/sedgeland. (Quadrat CH8, Cairn Hill Reserve).



Photograph 17. AhDs.2 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii* high open shrubland over *Calytrix leschenaultii*, *Hibbertia subvaginata* low open shrubland over *Cheilanthes adiantoides* very open fernland and **Ehrharta longiflora* annual grassland. (Quadrat GH10, Gardiner's Hill).



Photograph 18. AhDsKp.3 *Allocasuarina huegeliana* low open forest over *Dryandra sessilis* open scrub over *Kunzea praestans* open shrubland over *Calytrix leschenaultia*, *Hibbertia subvaginata* low open shrubland over *Desmocladius flexuosus* very open sedgeland. (Quadrat GH1, Gardiner's Hill).



Photograph 19. AhTl.1 *Acacia huegeliana* low open forest over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland over *Neurachne alopecuroidea*, *Desmocladius flexuosa* very open grass/sedgeland with *Dioscorea hastifolia* very open lianes. (Quadrat CH13, Cairn Hill Reserve).



Photograph 20. AhXd.2 *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*) low open woodland over *Xanthorrhoea drummondii* high open shrubland over *Kunzea praestans* scattered shrubs over *Trymalium ledifolium* var. *rosmarinifolium*, *Pityrodia dilatata*, *Acacia lasiocarpa* var. *sedifolia* low open shrubland to low shrubland over **Avena barbata* annual open grassland and *Stypandra glauca*, *Podolepis lessonii* very open herbland and *Cheilanthes adiantoides* scattered ferns and *Neurachne alopecuroidea* scattered native grasses. (Site D1, P&L Doblestein's).



Photograph 21. AhXd.4 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* scattered tall shrubs over *Pityrodia dilatata* scattered low shrubs over a very open sedgeland and *Austrodanthonia caespitosa*, *Neurachne alopecuroidea* scattered grasses with *Opercularia vaginata* (10-15%) open herbland and *Cheilanthes adiantoides* scattered ferns. (Site RM1, R. Manning's).



Photograph 22. Bp.2 *Banksia prionotes* scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Leptospermum erubescens*, *Grevillea amplexans* ssp. *semivestita*, *Kunzea praestans* high shrubland (*Leptospermum erubescens* heavily grazed) over *Calytrix leschenaultii* scattered low shrubs over **Vulpia myuros* var. *hirsuta*, (*Neurachne alopecuroidea*) open grassland and *Podolepis lessonii* very open herbland. (Releve G315, P&J Gardiner's).



Photograph 23. DsHs.1 *Nuytsia floribunda*, (*Allocasuarina huegeliana*) scattered low trees over *Dryandra sessilis* var. *sessilis* high open shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low open heath over *Desmocladius flexuosus* very open sedgeland and annual grassland. (Releve G312, P&J Gardiner's)



Photograph 24. DsKp.1 (*Nuytsia floribunda* scattered low trees) over *Dryandra sessilis* var. *sessilis* high shrubland to open heath over *Kunzea praestans*, *Leptospermum erubescens*, *Grevillea amplexicans* ssp. *semivestita* high shrubland over *Acacia pulchella* var. *glaberrima*, *Baeckea* aff. *preissiana*, *Daviesia dielsii*, *Dryandra nivea* 'narrow leaf mound', *Banksia sphaerocephala* var. *sphaerocephala* low open shrubland over open annual grassland and scattered herbs. (Releve G316, P&J Gardiner's).



Photograph 25. E1.1 *Eucalyptus loxophleba* subsp. *loxophleba*, (*Allocasuarina huegeliana*) low woodland over *Austrostipa trichophylla*, *Neurachne alopecuroidea*, *Caesia alfordii* scattered grasses and herbs with *Gilberta tenuifolia*, *Podolepis* sp. open annual herbland to annual herbland with *Dioscorea hastifolia* scattered lianes. (Quadrat ERG17, Eastern Ridge).



Photograph 26. E1.2 *Eucalyptus loxophleba* subsp. *loxophleba*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Cheilanthes adiantoides* fernland with *Gilberta tenuifolia*, *Podolepis lessonii*, *Hyalosperma glutinosum* subsp. *glutinosum* annual herbland. (Quadrat GH7, Gardiner's Hill).



Photograph 27. El.2 *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over *Schoenus clandestinus* scattered sedges and *Borya sphaerocephala* (1-2%), *Waitzia nitida*, *Gilberta tenuifolia*, *Podolepis lessonii*, *Hyalospermum glutinosum* ssp. *glutinosum* open herbland with **Avena barbata*, *Austrodanthonia* sp, *Austrostipa scabra* scattered grasses to very open grasslands. Releve RM3, R Manning's).



Photograph 28. El.4 *Eucalyptus loxophleba* subsp. *loxophleba* low scattered trees over *Schoenia cassiniana*, *Brunonia australis* annual herbland. (Quadrat ERG23, Eastern Ridge).



Photograph 29. E1.4 *Eucalyptus loxophleba* subsp. *loxophleba* low woodland over *Allocasuarina campestris* scattered tall shrubs over *Brunonia australis*, *Podolepis lessonii*, *Waitzia* sp. annual herbland. (Quadrat ERG22, Eastern Ridge).



Photograph 30. EoTd.1 *Eucalyptus obtusiflora* mallee scrub to closed mallee scrub over *Trymalium daphnifolium*, *Acacia erinacea* shrubland over *Austrodanthonia setacea*, *Austrostipa elegantissima* scattered low grasses. (Quadrat CH14, Cairn Hill Reserve).



Photograph 31. Ew.2 *Eucalyptus wandoo* subsp. *wandoo* low mallee woodland over *Allocasuarina campestris* high shrubland to open scrub over *Dichopogon capillipes* scattered herbs and **Ehrharta longiflora* open annual grassland. (Quadrat ERG16, Eastern Ridge).



Photograph 32. EwDi.1 *Eucalyptus wandoo* subsp. *wandoo* scattered low trees/trees over *Allocasuarina huegeliana* low woodland over *Dodonaea inaequifolia*, *Santalum acuminatum* scattered tall shrubs to high open shrubland over *Trymalium ledifolium* var. *rosmarinifolium*, *Xanthosia fruticulosa* low open shrubland over *Desmocladus flexuosus* low open sedgeland. (Quadrat CH10, Cairn Hill Reserve).



Photograph 33. EwTl.1 *Eucalyptus wandoo* subsp. *wandoo* open woodland over *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* low open woodland over *Xanthorrhoea drummondii* open shrubland over *Trymalium ledifolium* var. *rosmarinifolium* low open shrubland over open fern/grassland. (Quadrat GH6, Gardiner's Hill).



Photograph 34. KpAhB.1 *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans*, *Allocasuarina campestris* high shrubland over *Melaleuca calyptroides* shrubland over *Baekkea* sp. Moora (R. Bone 1993/1) low open shrubland over scattered grassland/sedgeland with scattered herbs. (Quadrat CH9, Cairn Hill Reserve).



Photograph 35. KpAhDs.1 *Allocasuarina huegeliana*, (*Acacia acuminata* subsp. *acuminata*, *Nuytsia floribunda*) low open woodland over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* high shrubland over *Hibbertia subvaginata* low open shrubland over *Desmocladius flexuosus* very open sedgeland with *Opercularia vaginata* open herbland and open annual grassland. (Releve RM13, R. Manning's).



Photograph 36. KpDs.1 *Nuytsia floribunda* scattered low trees over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Kunzea praestans* high shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* low shrubland to shrubland over *Desmocladius flexuosus* very open sedgeland and **Avena barbata* open grassland. (Releve D9, P&L Doblestein's).



Photograph 37. KpDsMc.1 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Xanthorrhoea drummondii*) high open shrubland over *Melaleuca calyptroides* scattered shrubs over *Hibbertia subvaginata* low open shrubland over **Avena barbata*, **Pentaschistis pallida*, **Vulpia myuros* var. *hirsuta* annual grassland. (Quadrat JT1, J&J Tonkin's).



Photograph 38. KpDsMc.2 *Kunzea praestans*, (*Dryandra sessilis* var. *sessilis*, *Xanthorrhoea drummondii*) high shrubland over *Melaleuca calyptroides* open shrubland over *Hibbertia subvaginata* low shrubland over *Desmocladius flexuosus*, *Stylidium septentrionale* scattered sedges and herbs. (Quadrat JT3, J&J Tonkin's).



Photograph 39. KpDsMc.2 *Kunzea praestans* high shrubland over *Hibbertia subvaginata*, (*Calytrix leschenaultii*) low shrubland over *Desmocladius flexuosa*, *Stylidium septentrionale* scattered sedges and herbs. (Quadrat JT11, J&J Tonkin's).



Photograph 40. KpDsMc.3 *Allocasuarina huegeliana* (*Acacia acuminata*) low woodland over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland to high shrubland over *Melaleuca calyptroides* low open shrubland over *Opercularia vaginata* herbland and low annual herbland/grassland. (Quadrat GH4, Gardiner's Hill).



Photograph 41. KpDsMc.3 *Allocasuarina huegeliana* low woodland to low open forest over *Dryandra sessilis* var. *sessilis* scattered tall shrubs over *Xanthorrhoea drummondii*, *Kunzea praestans* open shrubland to tall open shrubland over *Calytrix leschenaultii* scattered low shrubs to low open shrubland over annual herb/grassland. (Quadrat GH8, Gardiner's Hill).



Photograph 42. KpHs.1 *Kunzea praestans* high shrubland over *Hibbertia subvaginata* shrubland over *Stypandra glauca* very open herbland over *Cheilanthes adiantoides* very open fernland with *Dioscorea hastifolia* open herbland. (Quadrat ERG21, Eastern Ridge).



Photograph 43. KpHs.1 *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans* high shrubland over *Hibbertia subvaginata* shrubland. (Quadrat JT10, J&J Tonkin's).



Photograph 44. Lp.1 *Xanthorrhoea drummondii* open shrubland over *Lepidosperma pubisquameum* sedgeland with *Podolepis* sp., *Thysanotus manglesianus*, *Stypantra glauca* annual herbland with **Avena barbata*, **Aira caryophyllea* open annual grassland. (Quadrat ERG19, Eastern Ridge).



Photograph 45. Mc.4 *Allocasuarina huegeliana* scattered low trees over *Kunzea praestans*, *Xanthorrhoea drummondii* high open shrubland to high shrubland over *Melaleuca calyptroides* open heath over *Stylidium septentrionale*, *Desmocladius flexuosus* low open herb/sedgeland. (Quadrat JT4, J&J Tonkin's).



Photograph 46. Mc.4 *Allocasuarina huegeliana*, *Acacia acuminata* subsp. *acuminata* scattered low trees over *Kunzea praestans*, (*Dryandra sessilis*) scattered tall shrubs over *Melaleuca calyptroides*, (*Allocasuarina campestris*) open heath over *Calytrix leschenaultii* low open shrubland over *Desmocladius flexuosa*, *Stylidium septentrionale* scattered sedges and herbs. (Quadrat JT7, J&J Tonkin's).



Photograph 47. RmAh.1 *Allocasuarina huegeliana* low open woodland over *Regelia megacephala* open scrub over *Xanthosia fruticulosa*, *Hibbertia subvaginata* low open shrubland over *Stypandra glauca*, *Dichopogon capillipes* very open herbland. (Quadrat CH15, Cairn Hill Reserve).



Photograph 48. RmDs.1 *Regelia megacephala*, (*Dryandra sessilis* var. *sessilis*) open scrub over *Hibbertia subvaginata* scattered low shrubs over *Cheilanthes adiantoides* very open fernland with *Dioscorea hastifolia* very open lianes. (Quadrat GH9, Gardiner's Hill).



Photograph 49. RmKp.2 *Regelia megacephala*, *Kunzea praestans* high shrubland over *Xanthosia fruticulosa* low open shrubland over *Borya sphaerocephala* open herbland. (Quadrat CH7, Cairn Hill Reserve).



Photograph 50. RmKp.2 *Regelia megacephala* (*Kunzea praestans*) open scrub over *Allocasuarina campestris* scattered shrubs over *Hibbertia subvaginata*, *Xanthosia fruticulosa* low open shrubland over *Stypandra glauca* very open herbland with *Dioscorea hastifolia* very open lianes. (Quadrat CH11, Cairn Hill Reserve).



Photograph 51. RmKpMc.2 *Acacia acuminata* subsp. *acuminata*, *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala*, *Kunzea praestans* high shrubland over *Melaleuca calyptroides* shrubland over *Desmocladius flexuosus* scattered sedges and **Briza maxima*, *Podotheca angustifolia* very open annual grass/herbland. (Quadrat JT8, J&J Tonkin's).



Photograph 52. RmKpMc.2 *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala* tall open shrubland to tall shrubland over *Melaleuca calyptroides* open shrubland over *Calytrix leschenaultii* scattered low shrubs over *Borya sphaerocephala* low open herbland and *Podolepis canescens*, **Ursinia anthemoides* scattered annual herbs. (Quadrat GH2, Gardiner's Hill).



Photograph 53. RmKpMc.2 *Regelia megacephala* open scrub over *Kunzea praestans*, *Melaleuca calyptroides* shrubland over *Hibbertia subvaginata*, *Calytrix leschenaultii* scattered low shrubs over *Borya sphaerocephala*, *Neurachne alopecuroidea* very open low herbland/grassland. (Quadrat GH3, Gardiner's Hill).



Photograph 54. RvAh.1 *Allocasuarina huegeliana* (15-20%), *Acacia acuminata* subsp. *acuminata* (3-5%) low open woodland to low woodland over *Allocasuarina campestris*, *Xanthorrhoea drummondii* scattered tall shrubs over *Ricinocarpus velutinus* open heath over scattered sedges and *Austrostipa mollis* scattered grasses and herbs. (Releve RM2, R. Manning's).



Photograph 55: *Eucalyptus pruiniramis* (DRF) (P&J Gardiner's property).



Photograph 56. Exploration pit, north end of Eastern Ridge, with quadrat **ERG21** behind and to the left of the pit.



Photograph 57. *Acacia aristulata* (DRF) shrub.



Photograph 58. *Acacia aristulata*.

Appendix I

**Desktop Flora Searches and
Likelihood of Occurrence Assessment**



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 09-Feb-2023

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[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	33
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In buffer area only
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species

[\[Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area

FISH

Scientific Name	Threatened Category	Presence Text	Buffer Status
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
MAMMAL			
Dasyurus geoffroi Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In feature area
PLANT			
Acacia aristulata Watheroo Wattle [64822]	Endangered	Species or species habitat known to occur within area	In feature area
Acacia cochlocarpa subsp. cochlocarpa Spiral-fruited Wattle [23877]	Endangered	Species or species habitat may occur within area	In buffer area only
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In feature area
Banksia fuscobractea Dark-bract Banksia [83059]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Caladenia drakeoides Hinged Dragon Orchid [68687]	Endangered	Species or species habitat may occur within area	In buffer area only
Chamelaucium lullfitzii listed as Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [92777]	Endangered (listed as Chamelaucium sp. Gingin)	Species or species habitat may occur within area	In buffer area only
Chorizema humile Prostrate Flame Pea [32573]	Endangered	Species or species habitat may occur within area	In feature area
Conospermum densiflorum subsp. unicephalatum One-headed Smokebush [64871]	Endangered	Species or species habitat known to occur within area	In feature area
Dasymalla axillaris Native Foxglove [38829]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Daviesia dielsii Diels' Daviesia [19617]	Endangered	Species or species habitat known to occur within area	In feature area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eremophila scaberula Rough Emu Bush [16729]	Endangered	Species or species habitat likely to occur within area	In feature area
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat may occur within area	In buffer area only
Eucalyptus pruiniramis Midlands Gum, Jingymia Gum [56403]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Eucalyptus rhodantha Rose Mallee [9362]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Frankenia conferta Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area	In buffer area only
Gastrolobium appressum Scale-leaf Poison [7358]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Gastrolobium hamulosum Hook-point Poison [9212]	Endangered	Species or species habitat likely to occur within area	In feature area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat likely to occur within area	In feature area
Grevillea pythara Pythara Grevillea [64525]	Endangered	Species or species habitat may occur within area	In buffer area only
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat known to occur within area	In feature area
Synaphea quartzitica Quartz-loving Synaphea [64978]	Endangered	Species or species habitat known to occur within area	In feature area

REPTILE

Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area	In feature area
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SPIDER

Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat likely to occur within area	In feature area
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Listed Migratory Species

[[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50914]	WA	In buffer area only

Listed Marine Species [\[Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Manaling	Nature Reserve	WA	In buffer area only
Unnamed WA47694	Nature Reserve	WA	In buffer area only

EPBC Act Referrals					[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
North Kiaka Project Quartzite Mine Expansion	2021/9089		Assessment	In feature area
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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Appendix J

Dieback Management Plan



Phytophthora Dieback Management Plan

Simcoa Moora Mine Site and North
Kiaka Proposal



Phytophthora Dieback Management Plan

Simcoa Mine Site and North Kiaka Proposal

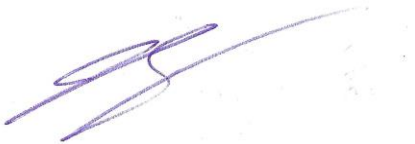
26 /07 /2022

Prepared for:

GHD
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Project reference: GSBL502-PDMP-Simcoa quartzite mines-2022-V1

Written and submitted by



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Senior Environmental Scientist

Record of Distribution

No. of copies	Report File Name	Report Status	Date	Prepared for:	Initials
1	GSBL502-PDMP-Simcoa quartzite mines-2022-V1	V1	26 July 2022	GHD	JS
1	GSBL502-PDMP-Simcoa quartzite mines-2022-V1	V1	26 July 2022	GSBL	JS

EXECUTIVE SUMMARY

Simcoa produce silicon for national and international markets from the company facility in Kemerton near Bunbury. Quartzite used for the production of silicon is currently sourced from the Simcoa Moora Mine and a new mine area is currently proposed for North Kiaka (North Kiaka Proposal). These two sites occupy adjoining land, separated by Kiaka Road, to the north of the Moora townsite.

Current Phytophthora Dieback management practises applied across the existing Simcoa Moora Mine are defined in the Standard Operating Procedure (SoP) – Moora Mine Hygiene Measures. However the Department of Mines, Industry Regulation and Safety (DMIRS) have advised that a Phytophthora Dieback survey of the proposal area will be required, together with Phytophthora Dieback management strategies. It is also assumed that similar requirements may be applied to the existing Simcoa Moora Mine.

In response to the DMIRS requirement, a survey was undertaken using a survey methodology referred to as Broad Area survey. Results of the Broad Area survey were used to determine the requirement for a detailed disease occurrence survey and associated Phytophthora Dieback Management Plan (PDMP).

In Western Australia, assessment and management of Phytophthora Dieback is overseen by the DBCA. The DBCA's primary tools for the management of Phytophthora Dieback include the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA 2015) and the *Phytophthora Dieback Management Manual* (DBCA 2020). These are applicable to an area termed the Vulnerable zone which is defined as all areas receiving greater than 600 mm of annual rain fall and areas of lower rainfall where natural or manmade features such as creek lines, drains and soaks collect water, i.e., where water gaining sites occur.

The average annual rainfall across Simcoa's existing and proposed mine areas is approximately 460 mm (BoM 2022) which places the site in the Vulnerable Zone but suggests that infestations are most likely to be limited to creek lines and gullies or other water gaining features. During the current assessment it was noted that most of the remnant native vegetation occurs along the elevated quartzite ridge that lies along the eastern side of Study Area. Separating high points along the ridge are gently sloping alluvial valleys that do not represent defined creek lines or any other features that may be considered water gaining sites.

The only vegetation within the Study Area that was considered to be within the Vulnerable Zone occurs in the western area, surrounding the Moora Mine Site administrative facility. All other areas of remnant vegetation are therefore not subject the requirement for Phytophthora Dieback management as they are not at threat from the plant pathogen.

The vegetation within the Vulnerable Zone was classified as Uninterpretable due to an absence of susceptible species. It has been further classified as unprotectable as it receives direct runoff from the Midlands Road which is an uncontrollable disease vector. Therefore, there are no areas of protectable vegetation occurring across the Simcoa site and there is no requirement for a Phytophthora Dieback Management Plan. Ongoing operations should continue under the direction of the existing SoP which addresses the requirement of basic Phytophthora Management and is considered suitable for the sites.

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1 INTRODUCTION

1.1 Background

Simcoa produce silicon for national and international markets from the company facility in Kemerton near Bunbury. Quartzite used for the production of silicon is currently sourced from the Simcoa Moora Mine and a new mine area is currently proposed for North Kiaka (North Kiaka Proposal). These two sites occupy adjoining land, separated by Kiaka Road, to the north of the Moora townsite.

The North Kiaka Proposal has been referred to the EPA for assessment and a Mine Closure Plan (MCP) has been provided to the Department of Mines, Industry Regulation and Safety (DMIRS). DMIRS have advised that a Phytophthora Dieback survey of the proposal area will be required, together with Phytophthora Dieback management strategies. It is also assumed that similar requirements may be applied to the existing Simcoa Moora Mine.

Phytophthora Dieback is an introduced soil borne plant pathogen that affects up to 40% of native plant species within Western Australia. Most commonly the disease is caused by *Phytophthora cinnamomi*, however, other introduced species such as *P. multivora* can also have significant impact under specific environmental conditions.

Phytophthora Dieback is commonly introduced to an area through infested soils carried as basic raw materials or on vehicles, plant and machinery, or by humans on foot. In favourable conditions for the pathogen, infestation can result in the collapse of entire vegetation communities. Once introduced to an area, Phytophthora Dieback will spread through further human vectoring and also via water movement and root to root contact, resulting in extensive infestations which may cause significant impact to native vegetation communities. There is currently no practical method of eradication of the pathogen.

1.2 Objectives

The objectives of this 2022 Phytophthora Dieback Management Plan (PDMP) are to:

- assess remnant vegetation across the existing and proposed mine areas to determine the current Phytophthora Dieback occurrence.
- determine the protectability of remnant vegetation across the existing and proposed mine areas to identify vegetation that requires protection from Phytophthora Dieback introduction and/or spread.
- develop site specific management controls to reduce the spread of Phytophthora Dieback within the site.

The aim of this Phytophthora Dieback Management Plan is to mitigate the potential impacts of Phytophthora Dieback on native vegetation within the Simcoa Moora Mine and North Kiaka Proposal (the Study Area) with consideration for operational requirements.

1.3 Scope of Works

The scope of works performed to achieve the PDMP objectives included:

- Desktop assessment of the Simcoa Moora Mine and North Kiaka Proposal footprints including review of all available historic disease occurrence data and assessment of the sites' vulnerability to disease.

- Broad Area survey across vegetated areas within the existing and proposed mine areas to identify assessable vegetation, susceptible vegetation and evidence of Phytophthora Dieback within the vegetation.
- collection of field data using a hand-held GPS unit. Field data included survey effort track files, disease evidence points, soil and tissue sample locations and mapped disease boundaries.
- development of this PDMP inclusive of current (2022) Broad Area disease occurrence data and recommendations for ongoing hygiene; and
- development and supply of associated spatial data with reference to the EPA Index of Biodiversity Surveys for Assessments (IBSA) requirements (note there is no IBSA template for Dieback assessment data and the IBSA template for *1_Survey details* has been adapted).

The Broad Area survey method is defined in *Phytophthora Dieback Interpreters Manual for Land managed by the department* (DBCA, 2015). Broad Area survey data provides planning and management information only. Comprehensive Survey is required for operational purposes.

1.4 Site Characteristics

Simcoa's operations subject to the Phytophthora Dieback assessment and this PDMP include the existing Simcoa Moora Mine and the North Kiaka Proposal which occupy adjoining properties situated north and south of Kiaka Road. The two sites are located approximately 15 km north of the Moora townsite.

The North Kiaka Proposal is approximately 1.5-2 km NNE of the existing Simcoa Moora Mine. The North Kiaka Proposal is expected to generate up to 130,000 tpa of lump quartz for downstream processing at the Kemerton Silicon Smelter located in the Kemerton Strategic Industrial Area 17 km north-east of Bunbury, Western Australia. The North Kiaka Proposal will be open-cut and above the water table and has a predicted Life of Mine of 18 years based on current resource estimates.

2 PHYTOPHTHORA DIEBACK REGULATION AND MANAGEMENT

2.1 Legislative Framework

The biodiversity conservation provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) includes policy prepared under the Act in relation to species, habitat and protected areas. The EPBC Act lists Phytophthora Dieback as a key threatening process that poses a significant threat to biodiversity values within Australia. Policy prepared under the EPBC Act includes the national *Threat Abatement Plan for disease in natural ecosystems caused by Phytophthora cinnamomi* (TAP) (Commonwealth of Australia (CoA) 2018), and recovery plans for threatened flora species and communities that include Dieback management considerations.

The TAP (CoA 2018) establishes a national framework to guide and coordinate Australia's response to Phytophthora Dieback. This identifies research, management and other actions to mitigate impact of the pathogen to natural values.

In Western Australia, Phytophthora Dieback management is regulated by the Department of Biodiversity Conservation and Attractions (DBCA) through implementation of the *Biodiversity Conservation Act* (2016) and the *Conservation and Land Management Act* (1984). The DBCA also has certain statutory obligations under the *Biosecurity and Agriculture Management Act* (2007) concerning biosecurity matters generally, including *Phytophthora* spp. assessment and management.

2.2 Current Western Australian Management

In Western Australia, assessment and management of Phytophthora Dieback is overseen by the DBCA who regulate standards, implementation of hygiene and maintain a registration system for appropriately qualified Phytophthora Dieback Interpreters. The DBCA's primary tools for the management of Phytophthora Dieback in Western Australia include the *Phytophthora Dieback Interpreters Manual for lands managed by the Department* (DBCA 2015) and the *Phytophthora Dieback Management Manual* (DBCA 2020).

The Dieback Working Group, composed of State agencies, local government authorities and community groups, also contribute to Phytophthora Dieback management in Western Australia through the development and distribution of management guidelines for community and industry groups. *Standard Dieback Signage - protocols for use* (Project Dieback, 2008) guides standardised signage across tenures to raise awareness and mitigate disease spread.

2.2.1 Phytophthora Dieback Assessment

The *Phytophthora Dieback Interpreters Manual for Lands managed by the Department* (DBCA 2015) presents defined Phytophthora Dieback assessment methodologies. It identifies several assessment methods that provide for either linear or non-linear assessment. Assessment methods may vary depending on the project type, disturbance activity and objectives of the assessment.

While this document refers to lands managed by the DBCA, it is recognised in Western Australia as Industry best practice and is routinely applied across State, local government, and private estate.

DBCA (2015) guidelines identify six potential disease hygiene categories based on presence/absence of the disease, or the unknown disease status of an area. An area can have an unknown disease status if

the vegetation at the site is not susceptible to the disease or it cannot be assessed because of disturbance, e.g., fire. As a result, even if the pathogen is present, there may be no interpretable signs.

Only areas with suitable remnant native vegetation can be assessed. Areas that have been cleared or significantly altered are excluded from survey. In some cases, small, excluded areas may be afforded a hygiene category if they are small enough to be influenced by adjacent surveyed vegetation or situated such that topographical influences can be used to determine disease presence or absence.

The six possible disease categories are listed and described below:

1. **Infested** – Areas a registered interpreter determines to have plant disease symptoms consistent with the presence of *Phytophthora cinnamomi*.
2. **Uninfested** – Areas determined by a registered interpreter to be free of plant disease symptoms that indicate the presence of *P. cinnamomi*.
3. **Uninterpretable** – Natural, undisturbed areas where susceptible plants are absent, or are too few to make a determination of the presence or absence of *P. cinnamomi*.
4. **Temporarily uninterpretable** – Areas where disease presence or absence cannot be determined due to a level and type of site disturbance that will recover within the short to medium term, e.g., fire, rehabilitation.
5. **Not yet resolved** – *Phytophthora* occurrence diagnosis cannot be made because of inconsistent or incomplete evidence (including sample results). The category is only to be used in low interpretability zones (400 mm to 600 mm rainfall range).
6. **Disease risk roads (DRR)** – Interpreters will use the DRR category to show the disease status is unknown because of suspected or apparent recent use under unknown hygiene conditions.

Following the determination of disease categories, protectable areas are identified to determine areas that are likely to remain free from the disease with the application of appropriate disease hygiene as required.

Protectable areas are defined in the *Phytophthora Dieback Management Manual (2020)* as being areas that are likely to be classified Uninfested but may also include areas that are Uninterpretable. Protectable areas may also include areas of high conservation and/or socioeconomic value (e.g., a small uninfested area which contains a known population of a susceptible species of threatened flora) and which fall within the Vulnerable Zone. The protectable area criteria include areas that:

- are situated in zones receiving greater than 600 mm per annum average rainfall, or in lower rainfall zones in areas that are water gaining (e.g., granite outcrops, impeded drainage or engineering works which aggregate rainfall)
- are determined to be free of Dieback by a registered Phytophthora Dieback Interpreter (Uninterpretable areas may be classified as protectable) and
- are positioned in the landscape and of sufficient size (greater than four ha with a minimum axis greater than 100 m) such that an Interpreter judges that Phytophthora Dieback will not autonomously infest it, in the short term (a period of up to several decades).

2.3 Phytophthora Dieback Management across the Simcoa Moora Mine

Current Phytophthora Dieback management practises applied across the existing Simcoa Moora Mine are defined in the *Standard Operating Procedure (SoP) – Moora Mine Hygiene Measures*.

The SoP defines the hygiene measures applicable to all vehicles that have the potential to introduce weed species and disease at the mine. The aim is to ensure that adequate measures are taken to minimise the introduction of weeds and *Phytophthora* spp. and their impact on vegetation of high conservation value, particularly the Coomberdale Chert Threatened Ecological Community (TEC), which occurs across the site.

Hygiene management focuses on the principle of “Clean on Entry” to occurrences of the TEC or rehabilitation areas. Therefore, all vehicles, plant and machinery must be clean of soil and vegetative matter prior to entering any areas near rehabilitation zones or haul roads near areas of native vegetation on the Simcoa Moora Mine site.

3 ASSESSMENT METHOD

In accordance with the agreed project scope of works, the field survey was undertaken using a survey methodology referred to as Broad Area survey. The Broad Area survey method is consistent with the DBCA guideline, *Phytophthora Dieback Interpreters Manual for Lands managed by the Department* (2015). The information produced using this method of survey provides planning level disease hygiene information for application across all assessable vegetation within the existing Simcoa Moora Mine and North Kiaka Proposal mining areas (the Study Area).

Due to the mobility of the disease through autonomous spread and human vectoring, all disease occurrence data has a limited life of 12 months. A summary of key survey activities performed across the Simcoa existing and proposed mine areas is provided below.

3.1 Desktop Interpretation

Both existing and proposed mine areas were subject to an initial desktop assessment involving a review of available reports including flora and vegetation reports, geotechnical reports, known disease occurrence data including the Vegetation Health Service (VHS) *Phytophthora* sample database and an examination of available aerial imagery to assess:

- the extent of assessable remnant native vegetation occurring within the existing and proposed mine areas;
- the known occurrence of *Phytophthora Dieback* within or influential to the existing and proposed mine areas;
- the occurrence of site specific or influential high risk disease vectors including but not limited to roads, creek lines and gravel pits; and
- evidence of existing disease signatures such as areas of obvious vegetation decline.

3.2 Field Survey

The Broad Area survey method involved assessment of linear disease occurrence along accessible tracks and other linear infrastructure, with an extrapolation of disease occurrence using topography, high-risk disease vectors and other influences. It should be noted that extrapolated areas were not subject to intensive ground coverage, but all large, vegetated areas were traversed on foot and small areas were visually assessed from elevated vantage points.

The current assessment was undertaken in July 2022 by a DBCA registered disease interpreter and included visual diagnosis of the disease within areas of assessable remnant vegetation within the Study Area. Visual diagnosis involves identification of susceptible species' deaths occurring in patterns consistent with disease spread, such as radiating from an identified vector. Plant deaths associated with *Phytophthora* are rapid and complete rather than partial. Further, the disease presents a chronologic pattern of deaths, with the oldest deaths closest to the disease vector and most recent deaths further from the vector, forming a disease front.

Following the visual diagnosis of the disease, infested areas, if identified, are mapped along roads, tracks and other high risk disease vectors, while small infestations may be mapped in their entirety. Areas of vegetation considered to be uninfested or uninterpretable are not classified, as small undetected infestations may occur within them but remain undetectable due to the reduced survey effort associated

with this method of survey. For management purposes these areas should be considered protectable from future introduction or spread of the disease.

This method may only be used for non-operational mapping to identify obvious infested sites. It is usually carried out in very large areas where a comprehensive assessment would be prohibitively expensive and there are no soil disturbance activities anticipated within 12 months. The resulting data is generally used for broadscale planning and targeting of areas for comprehensive assessment, if required.

Field data including disease presence and vegetation information was collected using a hand-held GPS unit and converted to ArcGIS™ shapefiles. Collected field data included all sample locations, a point file of all identified individual plant deaths attributed to *Phytophthora*, disease hygiene boundaries and track files of the area covered during survey.

3.2.1 Sampling Program

Sampling for Phytophthora Dieback includes the collection of soil and tissue samples from fresh deaths of plants considered to be reliable indicator species of *Phytophthora* expression. The samples are labelled and placed into heavy duty plastic bags before being forwarded to the DBCA Vegetation Health Service (VHS) laboratory for analysis.

4 PHYTOPHTHORA DIEBACK OCCURRENCE SURVEY RESULTS

The Regional location of the Simcoa Moora Mine and North Kiaka Proposal areas is shown in Figure 1. Figures 2-1 and 2-2 show the assessable vegetation and survey results from the Study Area

4.1 Desktop

4.1.1 Vegetation

Vegetation across the Study Area has been subject to several flora and vegetation surveys and nine separate vegetation alliances have been identified (Trudgen 2012). The native vegetation within the Study Area includes several occurrences of the conservation significant Threatened Ecological Community (TEC) “*Heath dominated by one or more Regelia megacephala, Kunzea praestans and Allocasuarina campestris on ridges and slopes of the chert hills of the Coomberdale Floristic Region*” (DPaW 2013).

From the report by Trudgen (2012), nine vegetation alliances have been identified across the Study Area. These include:

- *Allocasuarina campestris* high shrublands to open and closed scrub
- *Allocasuarina microstachya* open scrub
- *Regelia megacephala* high shrubland to open and closed scrub
- *Kunzea praestans* high shrubland to open and closed scrub
- *Melaleuca calyptroides* open to closed heath
- *Hibbertia subvaginata* low shrublands to low open heath
- *Xanthorrhoea drummondii* shrubland
- *Eucalyptus eudesmioides* mallee
- *Allocasuarina huegeliana* woodlands
- *Acacia acuminata* low woodlands

Trudgen (2012), defines vegetation condition as being variable, ranging from excellent to poor with the majority being in Good or better condition. Trudgen (2018) assessed vegetation condition across the North Kiaka Proposal area and defines vegetation condition ranging from Completely Degraded to Very Good.

Individual species listed in the available flora and vegetation reports identify the following species that are considered to be likely disease indicator species due to known susceptibility of these plant genera to *Phytophthora* species.

- *Banksia fraseri* var. *fraseri*.
- *Banksia sessilis*.
- *Xanthorrhoea drummondii*.

4.1.2 Assessable remnant native vegetation

As defined in the assessment criteria presented in Section 3, only areas with suitable remnant native vegetation can be assessed. Areas that have been cleared or significantly altered are excluded from

assessment (i.e., those classed as degraded or completely degraded under the Keighery (1994) condition scale).

A review of available aerial imagery identified potentially assessable vegetation occurring along the eastern side of the Simcoa Moora Mine with a small area surrounding the site office and associated infrastructure on the western side of the mine. Potentially assessable vegetation within the North Kiaka Proposal area occurs in defined pockets across the area, predominantly in the central and eastern portions of the site. A small area of potentially assessable vegetation occurs in the southwest of the proposed mine area. Aerial imagery also shows significant areas of vegetation in the northern section, however, these present as degraded and potentially un-assessable due to vegetation condition.

4.1.3 Geology

As described in the North Kiaka Approvals and Supporting Studies Geotechnical Desktop Study (GHD, 2021) the Study Area is underlain by Noonidine Chert, which outcrops in NNW-SSE trending parallel ridges. Between the ridges are gentle sloping valleys infilled with Colluvium at the margins and Alluvium elsewhere. Historical investigations are limited to the ridges and no information is available regarding the depth of valley soils. Where valleys are narrow and aligned parallel/perpendicular with ridges, they may represent preferentially weathered Dolerite Dykes.

4.1.4 Previous interpretation data

There were no previous *Phytophthora* Dieback assessment reports associated with the Simcoa existing and proposed mine areas available for review. A review of the VHS positive sample database shows that nearest known occurrence of *Phytophthora* occurs approximately 50 km to the west. These known locations do not influence the Study Area.

4.1.5 Land Use

Both sites are in the Moora Shire that is situated in the Western Australian Wheatbelt region. The region has been extensively cleared for agriculture which is the main land use that has influenced both sites. The existing Simcoa Moora Mine has also been subject to extensive excavation associated with the quarrying activities at the site.

There is limited public access to both sites and all remnant vegetation across the Simcoa Moora Mine is separated from mining activities by exclusion fencing.

4.1.6 Climate

The Bureau of Meteorology (BoM) broadly classifies the climate across the southwest region of Western Australia as warm summers with cold winters. The BoM maintains a network of weather stations across Australia to record weather data. The nearest stations to the project area with detailed annual average data include Berkshire Valley, Walebing, Barberton and Lupin Valley. The long-term average annual rainfall data from across these sites shows that annual average rainfall ranges between 429.0 mm at Berkshire Valley through to 500.5 mm at Lupin Valley (BoM 2022). The Study Area is situated roughly central to these sites and so average annual rainfall across the Study Area is likely to be around 460 mm.

The closest BoM weather station recording temperature data is located at Walebing. Records from this station show that the highest average maximum temperature is 33.9 °C in January while the lowest average minimum temperature is 16.1 °C in July (BoM 2022).

These are important figures as the accepted distribution of *Phytophthora* is generally restricted by the 400 mm isohyet with distribution in the 400 - 600 mm/yr zone further restricted to sites with high summer rainfall averages or associated with water gaining sites. Based on the BoM climate classification and rainfall data the Study Area experiences suitable climatic conditions for *Phytophthora* to have an impact, however, due to high summer temperatures and some years experiencing marginal rainfall it is unlikely that significant impact associated with *Phytophthora* Dieback will occur. This impact is also likely to be limited to creek lines, soaks and other water gaining sites.

4.2 Broad Area Survey Results

A summary of key statistics from the Broad Area survey is presented in Table 1 below:

Table 1: Summary of key statistics from the Simcoa Study Area

Simcoa Study Area – Summary of Key Statistics	
Area of Assessable Vegetation	164 ha
Infested Vegetation	0 ha
Uninterpretable Vegetation	149 ha
Uninfested Vegetation	15 ha

No visual evidence of *Phytophthora* Dieback was observed and no soil and tissue samples were collected. No Protectable Areas were identified within the Study Area.

4.3 Broad Area Survey Discussion

4.3.1 Environmental Conditions required for *Phytophthora* Dieback to impact vegetation

The spread of *Phytophthora* Dieback is dependent upon environmental conditions (moisture and temperature) and host availability. The variability of these factors produces an extremely wide range of disease syndromes in Western Australian vegetation communities. It is known that the impact of the disease may be greater in the higher rainfall areas and the impact and distribution of infested areas is reduced in the lower rainfall zones.

As identified in Section 1.4.4 the DBCA (2015, 2020) define the Vulnerable Zone for susceptibility to *Phytophthora* Dieback as all areas in the south west with average annual rainfall above 400 mm. Disease occurrence in the Vulnerable Zone is further refined in the 400 mm to 600 mm rainfall zone, as suitable environmental conditions in this lower rainfall zone will occur where natural or manmade features such as creek lines, drains and soaks that collect water exist, i.e., where water gaining sites occur.

The average annual rainfall across Simcoa's existing and proposed mine areas is approximately 460 mm (BoM 2022) which places the site in the Vulnerable Zone but suggests that infestations are most likely to be limited to creek lines and gullies or other water gaining features. During the current assessment it was noted that most of the remnant native vegetation occurs along the elevated quartzite ridge that lies along the eastern side of Study Area. Separating high points along the ridge are gently sloping alluvial valleys that do not represent defined creek lines or any other features that may be considered water gaining sites.

Based on these observations and the rainfall zone, it is considered that *Phytophthora Dieback* will not impact vegetation systems occurring along the elevated quartzite ridgeline in the east of the Study Area.

Vegetation occurring along Midlands Road and within the creek system to the north of Kiaka Road is a *Eucalyptus* woodland that is not described in the reviewed flora and vegetation report. It includes remnant vegetation in the west of the existing Simcoa Moora Mine, surrounding the mine administration centre and also vegetation in the very southern extent of the North Kiaka Proposal area. This vegetation includes low lying areas and at the time of assessment appeared to be very wet. The vegetation unit is considered to be a water gaining site that would provide a suitable environmental for *Phytophthora* species, however, no susceptible species were present in this vegetation. The vegetation in the creek line north of Kiaka Road was excluded from survey as the vegetation condition was rated Degraded due to ongoing and historic grazing which has removed all understorey species.

4.3.2 Environmental Conditions required for Assessment

Interpretation of vegetation for *Phytophthora Dieback* occurrence requires there to be suitable soil moisture that will stimulate disease activity, resulting in visible disease expression. The current survey was undertaken in July 2022. This survey timing was preceded by the 2021 winter season where above average rainfall was received and average rainfall was recorded for the preceding months of May and June, 2022 (BoM 2022). Subsurface soil conditions at the time of survey were visibly moist. These conditions are considered to provide a suitable environment for disease expression to be visible at the time of assessment if *Phytophthora Dieback* is present across the Study Area.

4.3.3 Disease Hygiene Categories

Following the Broad Area survey of all assessable areas of remnant vegetation across the Study Area it was determined that the majority of the assessable vegetation is classified as Uninterpretable for *Phytophthora Dieback*. This is due to either the complete absence of susceptible species or limited numbers of susceptible species being present. In some small areas, susceptible species including *B. sessilis* and *X. drummondii* occurred in limited numbers. Some old dead individuals were noted, however, no old or fresh deaths that presented as consistent with *Phytophthora Dieback* impact were noted, suggesting that *Phytophthora Dieback* is absent from the vegetation.

There are three small areas of Uninfested vegetation that were identified in the northern portion of the North Kiaka Proposal area. These are showing significant impact from grazing but were in Good condition at the time of survey. Suitable numbers of healthy *B. sessilis* and *X. drummondii* occurred in these areas and there was no visual disease expression. These areas are considered to be outside the Vulnerable Zone as defined in the PDMM (DBCA 2020) as they receive less than 600 mm of annual rainfall and do not represent water gaining sites.

It is important to note that these disease hygiene categories have been determined from a Broad Area survey which does not produce disease occurrence data suitable for operational application. The small Uninfested areas were subject to a more intensive ground coverage and are believed to represent accurate disease occurrence data, however, limited ground coverage was applied to the Uninterpretable areas. It was possible to gain several suitable vantage points where observation of large areas of vegetation could be made, consistent with the vantage point survey method (DBCA 2015). From these vantage points it could be seen that all Uninterpretable vegetation along the eastern ridgeline was uniform in appearance, supporting the Uninterpretable classification.

4.3.4 Protectable area assessment

As presented in Section 3, the criteria for Protectable Areas as defined in the PDMM (DBCA 2020) requires Protectable Areas to occur in the Vulnerable Zone and meet other criteria.

All vegetation occurring along the eastern quartzite ridgeline is considered outside the Vulnerable Zone on the basis of having average annual rainfall that is below 600 mm and an absence of water gaining sites that may generate suitable conditions for Phytophthora Dieback to survive.

All vegetation in low lying areas surrounding the Simcoa Moora Mine administration facility in the west of the Study Area are Uninterpretable. . . While Uninterpretable areas may be classified Protectable, this area may receive potentially infested drainage from roadside drains along Midlands Road. As disease absence cannot be determined by a registered Phytophthora Dieback Interpreter due to the absence of susceptible species it must be classified as unprotectable. Therefore, no Phytophthora Dieback Protectable Areas have been assigned across the Study Area.

4.4 Limitation of survey results

Phytophthora Dieback is a soil borne plant pathogen that spreads autonomously via root to root transmission, independently through the soil and also with the movement of water. The disease is also widely spread by human activities involving the movement of infested soil and plant material. As a result, the edge of a disease infestation is considered to be an actively spreading disease front, and all uninfested areas of vegetation that are associated with human vectors such as tracks and access ways are considered to be at risk of future infestation unless appropriate management is applied.

The disease occurrence data presented in this report is representative of the distribution of Phytophthora Dieback within assessable vegetation across the Simcoa Moora Mine and North Kiaka Proposal area at the time of assessment. It does not represent high confidence operational scale data. In accordance with DBCA guidelines (2015, 2020), operational scale data is required prior to any planned soil disturbance activities. Operational scale data is developed from disease occurrence surveys undertaken using either the Comprehensive Transect or Linear surveys methods which are defined in the *Phytophthora Dieback Interpreters Manual for Lands managed by the Department* (DBCA, 2015).

Operational scale Phytophthora Dieback occurrence data is valid for a period of 12 months from the date of assessment. After 12 months a disease re-check assessment is required and after three years a full re-assessment of the survey area will be required. As there are no Protectable Areas within the Study Area and the majority of the Study Area falls outside the Vulnerable Zone for Phytophthora, future re-check or re-assessment is not considered necessary.

5 PHYTOPHTHORA DIEBACK RISK ASSESSMENT

Application of the PDMM (DBCA, 2020) is intended for lands that occur within the Vulnerable Zone. The only vegetation within the Simcoa Moora Mine and North Kiaka Proposal area that occurs in the Vulnerable Zone is the woodland vegetation surrounding the Simcoa Moora Mine administration facility, situated along Midlands Road in the west of the Study Area.

The PDMM (DBCA 2020) requires proposed soil movement activities within the Vulnerable Zone to be subject to a risk assessment. The outcome of the risk assessment determines the need for a PDMP and assists to define the nature of Phytophthora Dieback mitigation strategies that are required. Any activity that has a Moderate or High Risk must be undertaken in accordance with a activity specific PDMP while activities determined to have a low risk may proceed using Basic Phytophthora Dieback Management procedures (defined in Section 5.2).

5.1 Disease Risk

The primary source of Phytophthora Dieback introduction and spread is through controllable or uncontrollable disease vectors. Controllable disease vectors include human movement of contaminated soil, water and vegetation carried on vehicles, machinery equipment and clothing, including footwear. Uncontrollable disease vectors include movement of infested soil on animals including feral pigs and by autonomous spread.

The risk of introducing and/or spreading Phytophthora Dieback is closely related to the soil moisture content at the time of the proposed activity, the nature of the activity and the consequence of introducing the disease on vegetation occurring in the area the activity is planned. These are further described below.

5.1.1 Soil Moisture

As Phytophthora Dieback spreads most readily in infested soil transported on vehicles, machinery, equipment and footwear, higher levels of soil moisture will increase the risk of disease spread as it increases the soil's capacity to adhere to these carriers. Soil moisture classifications are:

- **Dry** – where dust forms when exposed soil is disturbed.
- **Moist** – where soil is damp but does not stick to carriers.
- **Wet** – where soil and moisture combine so that soil sticks to carriers.

The amount of rainfall required to influence the classification of soil moisture varies with soil type and therefore must be regularly monitored throughout an activity. Soils across the Simcoa Moora Mine and North Kiaka Proposal area vary, but typically have a low clay content which will decrease the likelihood of soils adhering to carriers with moisture.

5.1.2 Activity Type

The likelihood of introducing or spreading Phytophthora Dieback is dependent on the availability of a source of inoculum and the nature of the activity. Variables that should be considered include the type of equipment used, area covered, access, need for imported materials, duration of activity and drainage from the activity area.

As the assessment of likelihood assumes implementation of basic Phytophthora Dieback management practices, we assume the source of Phytophthora Dieback that could be introduced or spread will originate from:



- a hygiene breach associated with poor hygiene clean down practice prior to clean entry into protected areas or
- an unknown infestation occurring within an area assessed as being protectable from the pathogen.

The assessment of likelihood must consider the potential for each activity to experience a hygiene breach and the possibility for an undetected infestation to occur within the activity area. The level of likelihood is therefore directly associated with:

- the number of vehicles, machines and equipment involved the activity
- the size of the area involved and
- the duration of the activity.

5.1.3 Consequence of introducing Phytophthora Dieback

The consequence of introducing Phytophthora Dieback is based on the predicted impact of the pathogen in a specific vegetation type. This will vary with position in the landscape, annual rainfall and soil types.

Table 2 below is from the PDMM (DBCA 2020) and presents the predicted impact ratings and associated consequence ratings as defined in the PDMM. While not represented in the DBCA table below, DBCA also have a consequence rating of Insignificant which is incorporated into risk assessment matrix tables presented below.

Table 2: Predicted impact rating, assessment scale and associated consequence rating

Assessment for the consequence of introducing Phytophthora Dieback		
Predicted Impact	Scale of Impact	Consequence Rating
Very High	> 50% overstorey will die	Severe
High	10% to 50% of overstorey will die	Significant
Moderate	< 10% of overstorey and high numbers of understorey will die	Moderate
Low	No overstorey and minimal understorey will die	Minor

As discussed in Section 5, occurrence of Phytophthora Dieback is limited by environmental conditions, especially rainfall. Due to the low average annual rainfall and the absence of water gaining sites across much of the area, the occurrence of Phytophthora Dieback across the Simcoa Moora Mine and North Kiaka Proposal areas is anticipated to be limited to the vegetation surrounding the Simcoa Moora Mine administration facility that has been classified as Uninterpretable and Unprotectable. Therefore, there are no protectable, susceptible communities within the Simcoa Moora Mine and North Kiaka Proposal areas and the consequence rating is Insignificant.

5.1.4 Calculation of Activity Risk

Tables 3 – 5 are from the PDMM (DBCA 2020) and provide a risk assessment matrix based on activity likelihood of introducing the pathogen and the consequence of introducing the pathogen for each soil moisture classification. If an activity is anticipated to occur over a range of soil moisture conditions then

the worst case scenario must be applied. Example:, a construction program spanning 6 months is likely to include periods of activity occurring in wet soil conditions and so the wet soil risk assessment table must be used to calculate activity risk.

Any activity that is considered to have a Moderate or High Risk rating is required to be subject to an activity specific PDMP using Phytophthora Dieback occurrence data developed through operational scale disease survey methods (DBCA 2015). The activity specific PDMP may require the implementation of a targeted comprehensive Phytophthora Dieback assessment of the activity site prior to activity to map the occurrence of the pathogen in the immediate vicinity and to identify site specific Clean on Entry (CoE) points. Completion of the activity specific PDMP and identification of CoE points will identify specific operational hygiene strategies designed to mitigate the risk of introducing Phytophthora Dieback to protectable areas. Clean on Entry is further defined in Section 5.2.

Low risk activities can proceed with the application of basic Phytophthora Dieback management principles which are defined in Section 5.2.

Table 3: risk matrix for activities performed in Dry Soil Conditions

Phytophthora Dieback Risk Assessment for Activities in Dry Soil					
Likelihood	Consequence				
	Insignificant	Minor	Moderate	Significant	Severe
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	Moderate	High	High
Possible	Low	Low	Moderate	Moderate	High
Unlikely	Low	Low	Low	Moderate	Moderate
Very Unlikely	Low	Low	Low	Low	Low

Table 4: risk matrix for activities performed in Moist Soil Conditions

Phytophthora Dieback Risk Assessment for Activities in Moist Soil					
Likelihood	Consequence				
	Insignificant	Minor	Moderate	Significant	Severe
Very Likely	Low	High	High	High	High
Likely	Low	Moderate	High	High	High
Possible	Low	Moderate	Moderate	High	High
Unlikely	Low	Low	Low	Moderate	High
Very Unlikely	Low	Low	Low	Moderate	Moderate

Table 5: risk matrix for activities performed in Wet Soil Conditions

Phytophthora Dieback Risk Assessment for Activities in Wet Soil					
Likelihood	Consequence				
	Insignificant	Minor	Moderate	Significant	Severe
Very Likely	Low	High	High	High	High
Likely	Low	High	High	High	High
Possible	Low	Moderate	High	High	High
Unlikely	Low	Moderate	Moderate	High	High
Very Unlikely	Low	Low	Low	Moderate	Moderate

NB: from Section 5.1.3, consequence rating for the Simcoa Moora Mine and North Kiaka Proposal areas is Insignificant. This results in a classification of Low risk for all soil moisture conditions.

In accordance with the PDMM, activities determined to have a Low risk do not require an activity specific PDMP and may proceed using Basic Phytophthora Dieback Management procedures.

5.2 Basic Phytophthora Dieback Management

Basic Phytophthora Dieback Management requires the standard of clean on entry (CoE) be applied across the Simcoa Moora Mine and North Kiaka Proposal areas. CoE is defined as the requirement for all vehicles, equipment, machinery and clothing including footwear to be clean and free from soil and or plant material prior to entering areas of remnant native vegetation. Basic Phytophthora Dieback Management practices include:

- no access to infested or unprotectable areas during moist or wet soil conditions.
- all personnel and site contractors to have completed Biosecurity awareness training. Basic Green Card training is a suitable standard of awareness training and is the requirement for operating on DBCA lands. A list of suitable Green Card training providers is available through the Dieback Working Group website.
- all external access points to remnant native vegetation on the Simcoa Moora Mine and North Kiaka Proposal areas are considered CoE points. All vehicles, equipment, machinery and clothing including footwear are to arrive at the Simcoa Moora Mine and North Kiaka Proposal areas in a hygienically clean state that is free from all soil and plant material.
- where practical, all activities undertaken in remnant vegetation should be performed during dry soil conditions.
- avoid driving through areas where Phytophthora Dieback may persist such as low-lying unprotectable areas, boggy creeks and puddles.
- carry mobile clean down kits (Commonwealth of Australia 2015) for minor, unplanned hygiene compliance.
- report any observed breaches of hygiene to the Supervising Manager.

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- Simcoa Standard Operating Procedure (SoP) – Moora Mine Hygiene Measures.**

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Figures

Phytophthora Dieback Occurrence Survey

Simcoa Moora Mine Site and North Kiaka Proposal



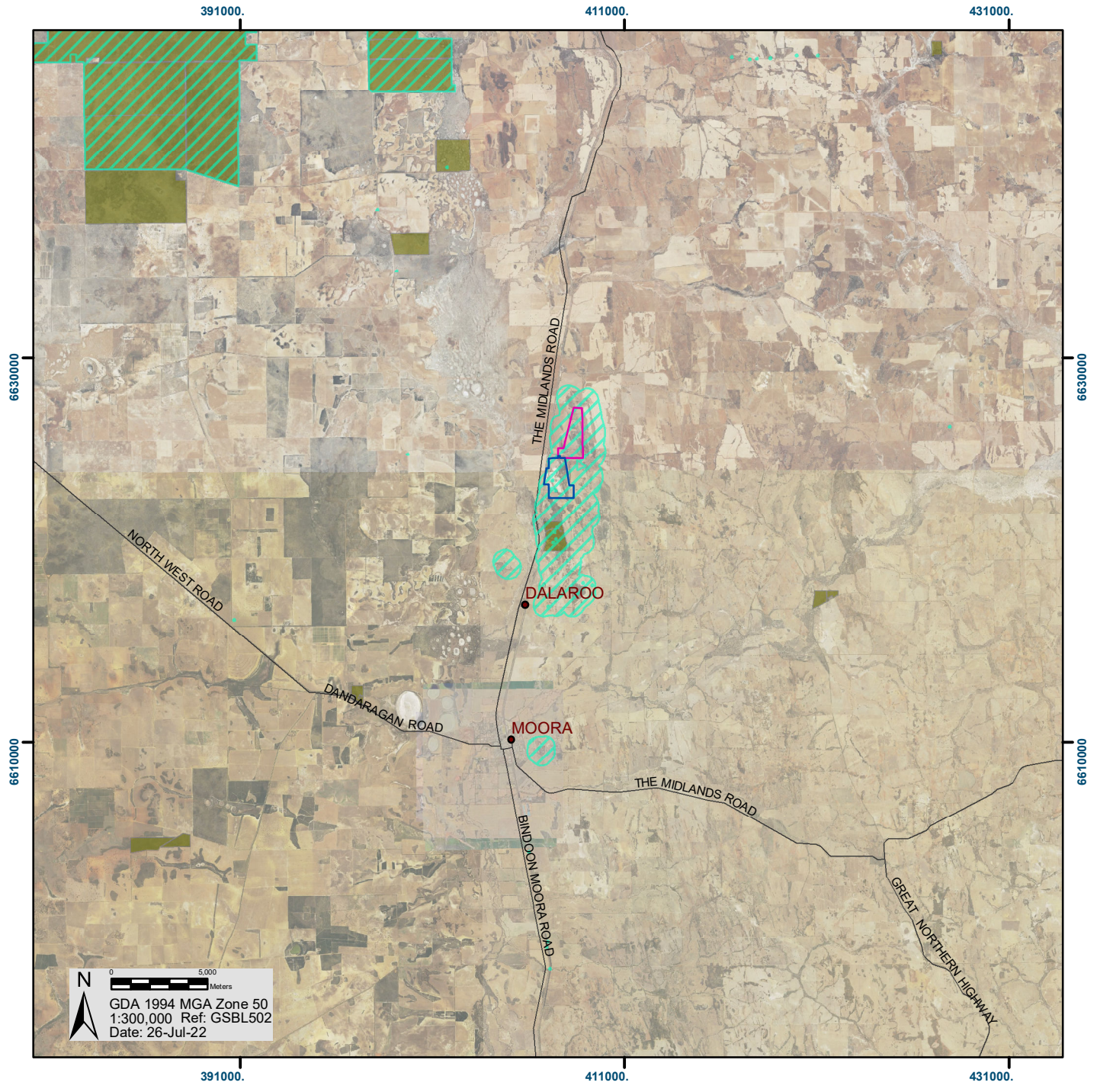


Figure 1 - Regional Location

- Simcoa Moora Mine Site
- North Kiaka Proposal
- DWER Environmentally Sensitive Areas
- DBCA Legislated Lands



Phytophthora Dieback Management Plan
 Simcoa Moora Mine Site and North Kiaka Proposal
 prepared for GHD, July 2022



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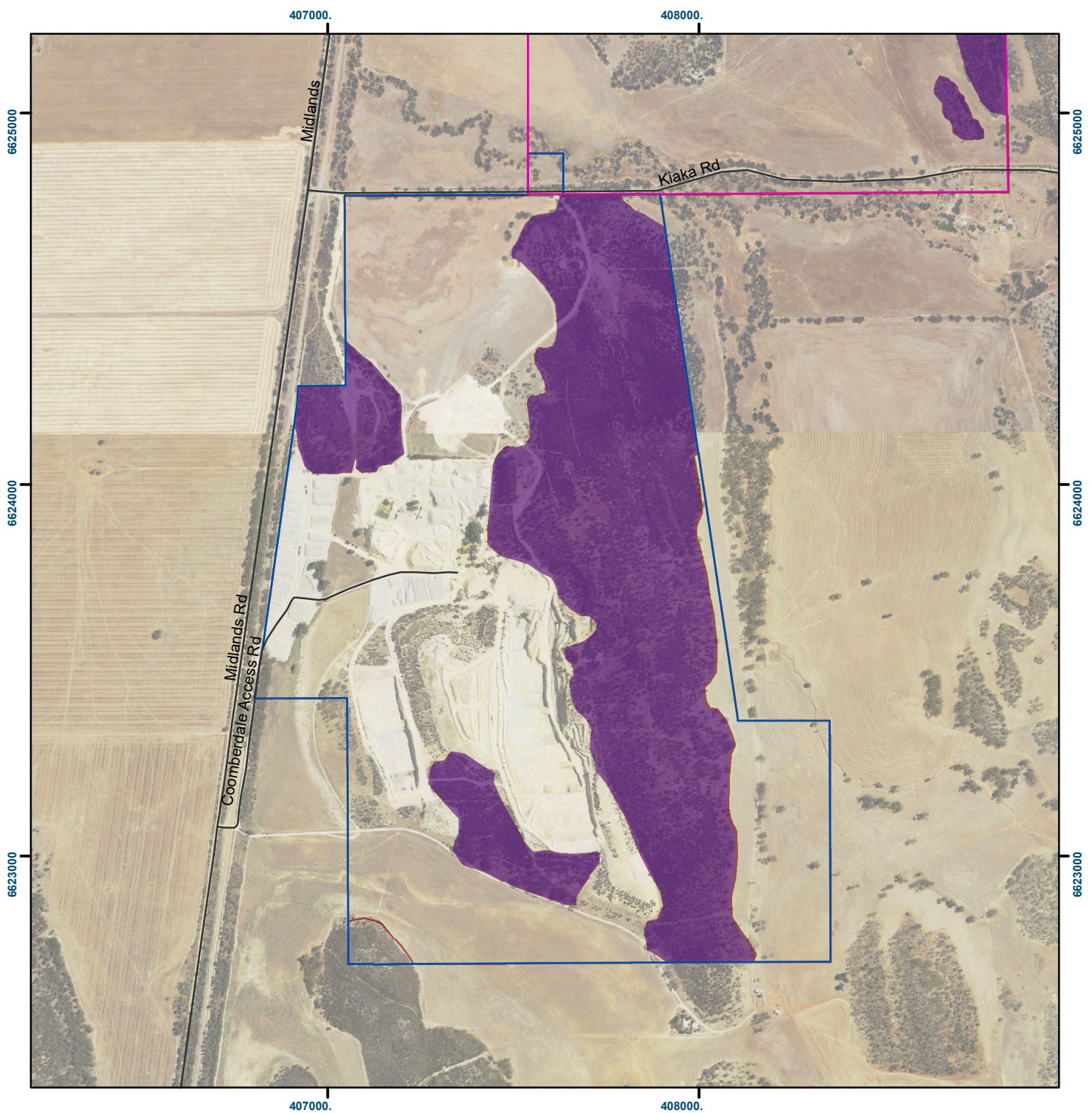
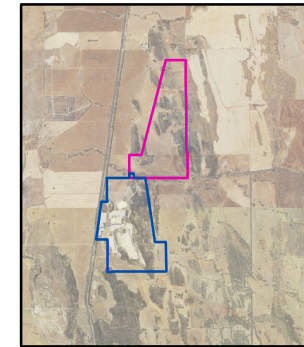


Figure 2-1 - Phytrophthora Dieback Occurrence Survey - Simcoa Moora Mine Site

Phytrophthora Dieback Status

- Uninfested
- Uninterpretable
- Excluded
- Simcoa Moora Mine Site
- North Kiaka Proposal



Phytrophthora Dieback Management Plan
 Simcoa Moora Mine Site and North Kiaka Proposal
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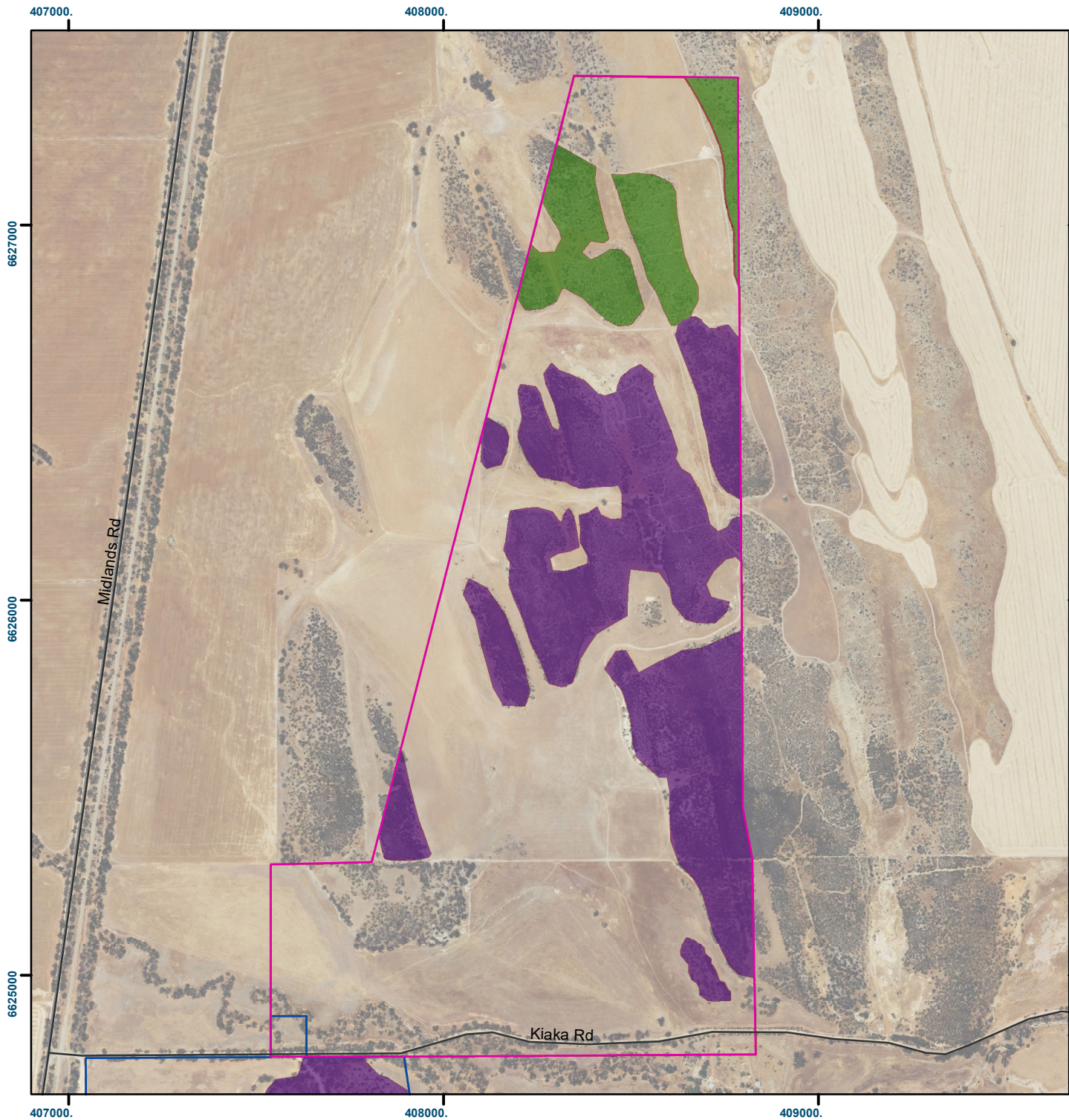
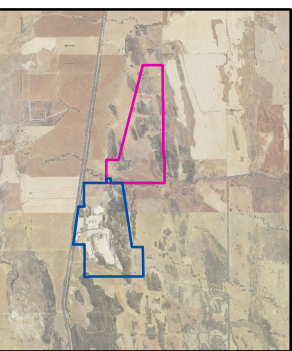


Figure 2-2 - Phytophthora Dieback Occurrence Survey - North Kiaka Proposal

- Phytophthora Dieback Status**
- Uninfested
 - Uninterpretable
 - Excluded
 - Simcoa Moora Mine Site
 - North Kiaka Proposal



Phytophthora Dieback Management Plan
 Simcoa Moora Mine Site and North Kiaka Proposal
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Appendix K

**Moora Quartzite Mine Rehabilitation Plan
(Ecoscape 2012)**



Moora Quartzite Mine Rehabilitation Plan - Final

Simcoa Operations Pty Ltd



COPYRIGHT STATEMENT FOR:

Moora Quartzite Mine Rehabilitation Plan - Final

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- Shannon Mackenzie, Director, Mine Earth
- Stacey Gregory, Principal Consultant, Mine Earth

Summary

Simcoa Operations Pty Ltd (Simcoa) operates a quartzite mine north of Moora in Western Australia. The mine contains silica dioxide, which Simcoa is currently extracting for their silicon Smelter in Kemerton, near Bunbury. Simcoa requires a Rehabilitation Plan (RP) so the mine can meet the requirements set by the Environmental Protection Agency (EPA), Department of Environment and Conservation (DEC) and Department of Mines and Petroleum (DMP).

The Rehabilitation Plan has been prepared in 3 stages:

1. **Rehabilitation Audit:** The Existing Environment was studied to determine what specific items need to be considered in the rehabilitation of the Mine Site (**Section 2**). Similarly, the Current Rehabilitation Practices were audited to determine any areas of improvement (**Section 3**).

As a result of this examination, both Sections contain text boxes termed “Rehabilitation Notes”. Each Note summarised an identified issue, recommended an action and listed which Section the action was addressed within the Rehabilitation Plan. A summary of the 28 Rehabilitation Notes is presented in **Table 1**.

2. **Domain Model Plan:** The Mine Site was divided by its site characteristics and end land uses into the following Rehabilitation Domains (**Section 4**):
 - a) *TEC Buffer* – the waste rock dumps to be rehabilitated with a species composition and structure similar to the adjacent Coomberdale Chert TEC
 - b) *Revegetation* – flat open areas to be rehabilitated with vegetation similar in composition and structure to the local vegetation community.
 - c) *Pasture* – low value fodder for cattle grazing
 - d) *Screening* – using local tree and large shrub species to visually screen the Mine Site from the adjacent Midland Road.

The open pits and any access roads or firebreaks to be retained were not to be rehabilitated, so were excluded from the domains.

Appropriate treatments were then determined for each Rehabilitation Domain to achieve their end land use while considering their site characteristics. The Domain Model Plan is summarised in **Table 2**.

3. **Rehabilitation Techniques:** Practical information was presented to aid site personnel in carrying out the recommended appropriate treatments in terms of landscape design (**Section 5**), revegetation techniques (**Section 6**), weed control (**Section 7**), mine hygiene (**Section 8**), monitoring and maintenance (**Section 9**) and revegetation trials (**Section 10**).

Table 1: Summary of Rehabilitation Notes for Simcoa's Moora Quartzite mine's rehabilitation works

No.	Issue	Action	Addressed
2.1 Physical Environment			
1	Most of the annual rainfall in the Mine Site occurs in winter.	Revegetation activities should be planned to utilise the winter rainfall (May to September) to maximise success of native seed germination and establishment.	Sections 6.2.5 and 6.3.3
2	The Mine Site may continue to receive lower than average rainfall in the near future, which may prolong or even prevent rehabilitation works meeting their KPIs.	Rainfall patterns should continue to be monitored and if the trend continues, the rehabilitation KPIs may need to be reconsidered and amended to those which are achievable in a drier environment	Section 6.6
3	The Mine Site has specific landform features.	Rehabilitation efforts should be directed towards resembling the local landforms where possible. Specific features that could be mimicked include rocky outcrops, local elevated hills and gentle slopes towards drainage and river flats.	Section 5.1
2.2 Biological Environment			
4	As the mining operation will result in surface geology being structurally changed, revegetation will be unable to restore all or any of the local vegetation associations.	Revegetation should be focused on returning a basic resemblance to local vegetation structure, rather than attempting to restore local vegetation associations, promoting local species that can grow in the broken rock substrate.	Section 6.2
5	A State listed TEC occurs within and adjacent to the Mine Site, part which is being cleared for mining activities.	Revegetation outcome should be focused on helping to conserve the identified TEC in terms of species diversity, promoting dominant species and in vegetation structure where possible.	Section 6.2
6	The Mine Site contains two threatened flora species - <i>Acacia aristulata</i> and <i>Daviesia dielsii</i> .	Revegetation trials should be conducted to determine whether it is possible to establish self sustainable populations of these species.	Sections 6.2 and 10.2
7	There is no quantified information on the original weed cover of the Mine Site, therefore it cannot be determined whether the EPA criterion of 10% weed cover is feasible.	Examine the remnant vegetation the in Mine Site to determine the weed cover.	Section 7.1
8	The Mine Site is known to contain 34 weed species, of different biological forms (grasses, geophytes or broad leaf herbs).	Weed control activities at Simcoa should be divided into addressing weed species according to their biology and method of control.	Section 7.4 and Appendix Five
9	The Mine Site is known to contain ten High Priority weed species which may be significant threats to the local vegetation and cause considerable weed cover in rehabilitated areas.	Weed control activities should be developed to identify and target individuals or populations of the High Priority weed species to minimise weed cover in rehabilitated areas to EPA completion criteria.	Section 7.3 and Appendix Five
10	Mining activities in the Mine Site may further fragment and isolate local remnant vegetation, which may impact on the long term sustainability of local fauna populations.	The rehabilitation design should consider providing ecological corridors where practicable for local fauna species to move between remnant vegetation.	Sections 4.2 and 4.3
11	The Mine Site may serve as a habitat for as many as six locally occurring conservation significant fauna species.	Rehabilitation should consider providing suitable fauna habitat, in terms of food source and breeding sites, to assist in the conservation of these species.	Section 6.1
12	The Mine Site and adjacent TEC are vulnerable to introduction of Dieback from unhygienic mine activities.	All rehabilitation activities within the Mine Site should include hygiene prevention and management procedures for possible introduction and spread of the plant diseases.	Section 8.1
3.1 Physical Design			
13	Ripping could be a useful technique for encouraging revegetation success in areas where soil is compacted and not composed of waste rock material.	Future revegetation work should consider ripping where appropriate and practical to relieve soil compaction for future revegetation works.	Section 5.2
14	After topsoil and remnant vegetation sources are depleted, future revegetation methods risk losing seed to wind and rain erosion.	Where practicable, soil scarification treatment should be considered prior to seeding to provide niches for seeds to be lodged in and to limit loss of seeds to wind and rain erosion.	Section 5.3
3.2 Revegetation Strategy			
15	There are not enough topsoil and mulch resources for future rehabilitation works.	New substitute sources and/or techniques are required to overcome this shortfall and ensure adequate revegetation success.	Sections 6.3 and 10.3
16	Current harvest time of vegetation may not be obtaining the maximum amount and diversity of viable seeds and propagules for revegetation.	Need to examine whether there is an optimal time for harvesting of vegetation in order to increase revegetation success.	Section 10.1.3

17	There has been native seed collected for rehabilitation works.	Seed collecting if practicable should continue in the Mine Site and in adjacent vegetation to improve abundance and diversity in revegetated areas.	Section 6.3.3
18	There is no procedure for the proper storage of collected native seeds.	A seed storage procedure needs to be developed for the storage of collected seeds to prolong their viability and to protect them from being eaten by bugs.	Section 6.3.3
19	Native seeding trials to date have been unsuccessful.	Further seeding trials are needed to improve revegetation success. Improvements may include testing for viability, dormancy breaking treatments, site preparation, timing and type seed mix. The trials need to be regularly monitored and reported upon so to select suitable species.	Section 10.1
20	Previous seeding trials for successful germination of conservation significant flora <i>Acacia aristulata</i> (TF) and <i>Daviesia dielsii</i> (TF) have been unsuccessful.	New revegetation trials need to be developed and implemented for threatened flora.	Section 10.2
21	There have been limited trials in using fertiliser and harvested vegetation to improve revegetation outcomes.	More detailed scientific trials are needed to determine methods of improving revegetation outcomes, particularly to overcome the limited topsoil and vegetation resources. Such methods may include soil scarification and variation in types, amount and chemical composition of fertiliser.	Section 10.3
22	Revegetation efforts have not yet met the EPA criterion for 70% native cover.	Need to improve revegetation efforts to increase native vegetation cover or renegotiate criterion if not practicably achievable.	Sections 6.3, 6.4, 6.5 and 10.1.3
23	The value of EPA criterion for native vegetation cover (70%) needs to be reconsidered as it may not be achievable in such site conditions.	Recommend that the EPA criterion wording be changed to “maximum achievable cover”.	Section 4.5
3.3 Weed Management Strategy			
24	Site staff are unable to identify significant weed species which may degrade revegetation works.	Develop a guide for assist site staff in identifying and controlling significant weed species	Sections 7 and Appendix Four
25	Weed cover in rehabilitated sites exceeds EPA criterion (<10%).	Implement a Weed Control Program to target weed species that are known to contribute to weed cover in rehabilitated sites.	Section 7
26	The value of the EPA criterion for weed cover (<10%) needs to be reconsidered as it may not be achievable in such site conditions.	Recommend that the EPA criterion wording be changed to “minimal achievable cover”.	Section 4.5
3.4 Mine Hygiene Procedure			
27	The Procedure does not discuss hygiene practices for incoming vegetation or soil materials for future rehabilitation works, which may be contaminated (topsoil, tubestock).	If such practices are to occur, the Procedure should be expanded to discuss how to minimise the risk of introducing diseases and/or weeds from such sources.	Section 8

Table 2: Summary of Domain Model Rehabilitation Plan for Simcoa's Moora Quartzite Mine

Rehabilitation Domain		Rehabilitation Works					
Name	Site Characteristics	End Land Uses		Physical Design	Revegetation	Weed Control	Hygiene Procedure
TEC Buffer	Waste rock material, elevated topography	A buffer for the adjacent TEC	Treatments	1. Topography - Resemble local hill landscape 2. Ripping – None (impractical) 3. Soil scarification - None (impractical)	1. Species selection - Local native species characteristic of adjacent TEC where possible 2. Methods - Topsoil, brush, broadcast seed, tubestock may be required for certain species	1. Strategy - Eradicate or reduce High Priority weed species populations while having minimal impact on revegetation and prevent their spread into the adjacent TEC if they are known to not already occur in TEC 2. Methods - Manual removal, wicker wiping, spot spraying	1. Plant Diseases – Prevent introduction of Dieback 2. Weeds - Prevent introduction of High Priority Weeds or new weed species into Domain and adjacent TEC
		An ecological corridor between the TEC and adjacent remnant vegetation		KPIs	1. Landform resembles local hill landscape 2. Vegetation successfully establishing in soil	1. Species composition and structure resembles adjacent TEC 2. Maximum achievable native cover 3. Self-sustaining populations of conservation significant flora	1. Minimal achievable weed cover 2. Low presence of High Priority Weeds
Revegetation	Compacted soil, relatively flat topography	Resemble local vegetation community	Treatments	1. Topography - Some gentle grading may be required adjacent to waste rock dumps 2. Ripping – if practical, relieve soil compaction where necessary 3. Soil scarification – When practical due to substrate, where any seeding or brush layering is to occur	1. Species selection – Local native species resembling local vegetation community 2. Methods - Topsoil, brush, broadcast seed, tubestock may be required for certain species	1. Strategy - Eradicate or reduce High Priority weed species populations while having minimal impact on revegetation 2. Methods - Manual removal, wicker wiping, spot spraying	1. Plant Diseases – Prevent introduction of Dieback 2. Weeds - Prevent introduction of High Priority Weeds or new weed species into Domain
		An ecological corridor between the TEC and adjacent remnant vegetation		KPIs	1. Relatively flat terrain 2. Vegetation successfully establishing in soil	1. Species composition and structure resembles local vegetation community 2. Maximum achievable native cover 3. Self-sustaining populations of conservation significant flora	1. Minimal achievable weed cover 2. Low presence of High Priority Weeds
Pasture	compacted soil, relatively flat topography, adjacent to paddocks	Low value pasture for cattle	Treatments	1. Topography - Some gentle grading may be required adjacent to waste rock dumps 2. Ripping – If practical, relieve soil compaction where necessary 3. Soil scarification - When practical due to substrate, where any seeding or brush layering is to occur	1. Species selection – Pasture species capable of growing in post-mine site soil 2. Method - Broadcast seeding	1. Strategy - General weed control 2. Method – Spot spraying	1. Plant Diseases – Prevent introduction of Dieback 2. Weeds - Prevent introduction of High Priority Weeds into Domain
				KPIs	1. Relatively flat terrain 2. Vegetation successfully establishing in soil	1. Species composition of pasture plants 2. Maximum achievable cover of pasture	1. Minimal achievable weed cover
Visual Screening	Compacted soil, relatively flat topography, adjacent to Midland Road	Visual screening of Mine Site from adjacent Midland Road	Treatments	1. Topography - Some gentle grading may be required 2. Ripping – If practical, relieve soil compaction where necessary 3. Soil scarification - Not required	1. Species selection – Large local tree and shrub species 2. Method - Tubestock	1. Strategy – Minimise weed cover to allow tubestock to establish and mature 2. Methods - Manual removal, wicker wiping, spot spraying	1. Plant Diseases – Prevent introduction of Dieback 2. Weeds - Prevent introduction of High Priority Weeds into Domain
				KPIs	1. Relatively flat terrain 2. Vegetation successfully establishing in soil	1. Species composition of local native trees and large shrubs 2. Maximum achievable native cover	1. Minimal achievable weed cover 2. Low presence of High Priority Weeds

1.0 Introduction

1.1 Background

Simcoa Operations Pty Ltd (Simcoa) operates a quartzite mine north of Moora in Western Australia, herein referred to as the 'Mine Site'. The mine contains silica dioxide, which Simcoa is currently extracting for their silicon Smelter in Kemerton, near Bunbury. Simcoa is currently operating the mine under the following leases:

- Mining Leases M70/191, M70/1292, M70425 and M70/424
- Exploration Lease E70/2750
- General Purpose Lease G70/71, G70/92 and G70/93.

Simcoa requires a Rehabilitation Plan (RP) so the mine can meet the environmental approvals and tenement conditions set by the Environmental Protection Agency (EPA), Department of Environment and Conservation (DEC) and Department of Mines and Petroleum (DMP).

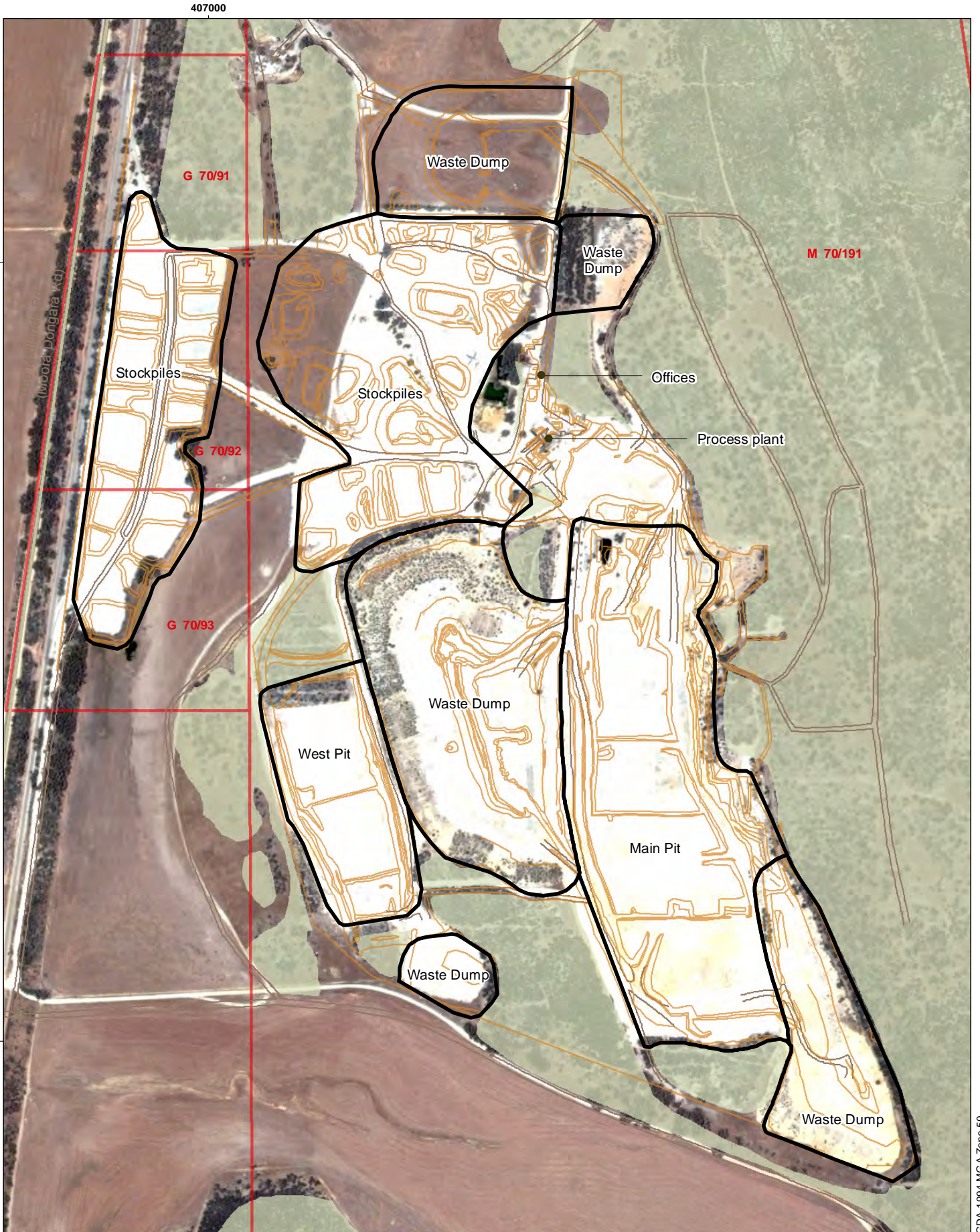
1.2 Mine Site

1.2.1 LOCATION

The Mine Site is located approximately 13 km north of Moora, adjacent to Geraldton Road. It is surrounded by some remnant vegetation and a privately owned wheat farm. Access to the mine is via Kiaka Road, which leads east from Midland Road. The Tenements occur in Interim Biogeographic Region for Australia (IBRA) region of the Avon Wheatbelt, specifically in the north-west portion of the Avon Wheatbelt 2 IBRA sub-region, approximately 2 km east to the Dandaragan Plateau subregion border.



Figure 1: Location of Mine Site



Imagery: Bing Maps Aerial (2010)

AUTHOR: JN
DATE: APRIL 2012

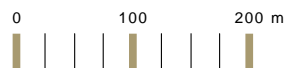
CHECKED: SB
PROJECT NO: 2681-11

MOORA QUARTZITE MINE REHABILITATION AND CLOSURE PLAN

CLIENT: SIMCOA



9 Stirling Hwy.
North Fremantle WA 6159
ph: (08) 9430 8955
web: www.ecoscape.com.au



Scale 1:6,500 @ A4

PROJECT LAYOUT

Figure 2

GDA 1994 MGA Zone 50

1.3 EPA Legal Compliance

1.3.1 RELEASE OF MINISTERIAL STATEMENT 0813

According to Ministerial Statement No 0813 (2009), Simcoa is required to progressively rehabilitate the mine site area in accordance with the following Ministerial conditions:

4. Re-establishment of vegetation in the rehabilitation area to be comparable in species composition with that of pre-mining vegetation such that the following criteria are met:
 - a) Revegetation to achieve the re-establishment of an area of vegetation coverage (not including weed species) of not less than 70 percent of the rehabilitation area as defined in Schedule 1.
 - b) Weed coverage less than 10 percent.
 - c) Within a timeframe specified in the rehabilitation schedule required.
5. A schedule of the rate of rehabilitation acceptable to the CEO.

The Ministerial Statement also states that Simcoa is to undertake the following:

- in liaison with DMP and DEC, monitor annually the performance of rehabilitation by condition 8-3.
- Submit annually a report of the rehabilitation performance monitoring required by condition 8-4 to the CEO.

It should be noted that the Ministerial Statement does not define how the rehabilitation is to be comparable in species composition, such as diversity or vegetation structure. As such this condition is open to interpretation. Further liaison is required between Simcoa, DEC and DMP to establish what KPIs may be used to determine whether the species composition of rehabilitated sites are satisfactory.

Also, the Ministerial Statement does not detail how the vegetation coverage and weed cover percentages were determined and whether they considered site factors. It is currently unknown whether these figures are achievable. Further liaison is recommended between Simcoa, DEC and DMP to establish what KPIs are to be used to determine what percentages of vegetation coverage and weeds of rehabilitated sites are deemed satisfactory.

1.3.2 SIMCOA'S COMPLIANCE TO MINISTERIAL STATEMENT 0813

Several environmental factors were known at the time of the Ministerial Statement, however they were not discussed in the report:

- Several species of Threatened Flora (TF) were located in the mine site lease, notably *Acacia aristulata* and *Daviesia dielsii*.
- Rehabilitation trials have shown that *Regelia megacephala* can be successfully regenerated but individual plants are unlikely to survive in the long term in the modified environment after mining, although the seed can be sustained.

- Part of the area is considered to be within the Chert Coomberdale Threatened Ecological Community (TEC). Of particular importance is the area adjoining Cairn Hill, which is located within the Simcoa leases (M70/424). Cairn Hill is considered to be the “jewel in the crown” of the Coomberdale Chert area as it is species rich and contains populations of conservation significant flora, including *Regelia megacephala*, *Acacia aristulata* and *Daviesia dielsii*.

Strategic Environmental Solutions (2001) submitted an amendment proposal, under S.46 of the Environmental Protection Act, which discussed these factors and proposed an alternative strategy to best conserve the Chert Coomberdale TEC while allowing Simcoa to continue mining operations in the Western Ridge mining area.

The EPA Bulletin 1027 (2001) “Extension of Quartz Mining and Strategy for Resource and Biodiversity Conservation” responded to the amendment proposal and concluded in the following recommended changes related to rehabilitation and conservation:

1. Simcoa is committed to carrying out rehabilitation trials with any DRF species removed by their mining operations. Rehabilitation trials with other priority species will also be established, in addition to the successful germination and establishment demonstrated with *Regelia megacephala* to date.
2. Simcoa would relinquish its Mining Lease over Cairn Hill in order to:
 - a) ensure that *Acacia aristulata* and other Declared Rare and Priority Flora species are protected in secure conservation reserves
 - b) obtain Government commitment to work co-operatively with Simcoa on a long-term strategy to meet the twin objectives of guaranteed mining access to the chert resources (for the Company) and conservation of representative examples of the Coomberdale TEC (for the State and community) in secure reserves.
3. Simcoa would be providing a package of other conservation benefits including botanical surveys, developing a strategic approach to mining to protect flora, possible purchase of land with significant conservation.

1.3.3 COMPLETION CRITERIA MEETING

In 2002, Simcoa met with key regulators and stakeholders (including the then CALM, DMP and consultants) to discuss completion criteria for Moora Quartzite mine (Simcoa 2002). The meeting agreed that since the original substrate is destroyed during the mining process, it was not practical to rehabilitate the site to its original species. In particular, it was agreed that the substrate had changed to one with could not support sustainable populations of *Regelia megacephala*.

The management of Cairn Hill was also discussed. It was proposed that Cairn Hill be handed over to DEC for conservation as an A-Class Reserve. This transfer would act as an offset to the mining activities within the Western Ridge and would result in better conservation of the Chert Coomberdale TEC. It was also acknowledged that the relinquishment of Cairn Hill would be an

“overcompensation” for the rights to mine the Western Ridge, so Simcoa would have “credit” for future mining works.

1.3.4 ACTIONS TO DATE

To date, Simcoa has completed or is undertaking the following actions (**Table 3**):

Table 3: Simcoa’s Actions to date in meeting environmental conditions

No.	Action	Environmental Condition
1	Handed over leases containing Cairn Hill to DEC	EPA Bulletin 1027 Criteria Meeting
2	Hired a botanist to completed an extensive botanic surveys of the region and share the reports with DEC: a) Trudgen and Associates (2006) <i>A Flora Survey, Floristic Analysis and Vegetation Survey of the Coomberdale Chert TEC</i> b) Trudgen and Associates (2012) <i>An extension of a flora survey, floristic analysis and vegetation survey of areas of the Coomberdale Chert TEC to include a further area.</i>	EPA Bulletin 1027
3	Fenced off the conservation sections of Cairn Hill	EPA Bulletin 1027
4	Produced compensation in the area north of Cairn Hill and arranged for the adjoining vegetation to Cairn Hill to be protected.	EPA Bulletin 1027
5	In liaison with DMP and DEC, monitor annually the performance of rehabilitation by condition 8-3.	Ministerial Statement 0813
6	Submit annually a report of the rehabilitation performance monitoring required by condition 8-4 to the CEO.	Ministerial Statement 0813

1.4 DMP Legal Compliance

The M70/191 and Tenement Conditions have the following rehabilitation requirements:

- Exploration: Unless otherwise directed by the District Mining Engineer:
 - o topsoil being removed and stockpiled for replacement prior to the excavation of costeans, trenches or pits
 - o all excavations being progressively refilled as sampling proceeds, and the topsoil returned as soon as possible
 - o all excavations and surface disturbances made by the tenement holder being refilled and the ground rehabilitated to the satisfaction of the property holder.
- The lease preparing a management and rehabilitation plan for the mine site including the results of trials into rehabilitation of the site back to native vegetation. Such plan being submitted to the State Mining Engineer for his written approval.
- All topsoil being removed ahead of all mining operations from sites such as pit areas, waste disposal areas, ore stockpile areas, pipeline, haul roads and new access roads and being stockpiled for later respreading or immediately respread as rehabilitation progresses.
- At the completion of operations, or progressively where possible, all access roads and other disturbed areas being covered with topsoil, deep ripped and revegetated with local native grasses, shrubs and trees to the satisfaction of the State Mining Engineer.

- On the completion of operations or progressively where possible, all waste dumps, tailing storage facilities, stockpiles or other mining related landforms must be rehabilitated to form safe, stable, non-polluting structures which are integrated with the surrounding landscape and support self-sustaining, functional ecosystem comprising suitable, local provenance or an alternatively agreed outcome to the satisfaction of an Environmental Officer, DMP.
- All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR.

1.5 Simcoa's Rehabilitation Commitment

Simcoa's rehabilitation strategy for Moora is as follows (Simcoa 2010):

"To carefully plan waste dumps as buffers adjacent to areas of the threatened ecological community of native vegetation in order to ameliorate further damage to these areas. Rehabilitation will involve the restoration of the land surface in order to maximise water retention and minimise erosion, and the revegetation with topsoil and seeds derived from local native plants, supplemented by locally derived seeds of rare vegetation where appropriate. All revegetated areas will be fenced off from stock. The mine work force will be educated regarding the significance and importance of the rare vegetation."

Simcoa's current rehabilitation objectives are as follows (Simcoa 2010):

- amelioration of degraded areas of the Coomberdale Quartzite "Threatened Ecological Community" adjacent to mining area
- establishment of stable vegetation of local plant species on waste dumps and other areas affected by mining
- re-establishment where appropriate of the geographically restricted species *Regelia megacephala*
- establishment of populations in the rehabilitation of the declared rare flora species found in the mined areas
- regular recording of rehabilitation, with the plots in the older rehabilitation areas recorded at three year intervals and the plots in the younger rehabilitation areas recorded annually
- stabilisation of slopes on waste dumps and minimisation of erosion
- waste dump construction including fine material and medium scale surface undulations to improve water retention and infiltration
- seed mix going into the rehabilitation areas (including seed for brush) chosen to suit the conditions prevailing in the rehabilitation sites

- seed applied to the regeneration areas sourced locally (ie within a few kilometres of the mine and preferably from areas adjacent to the Coomberdale Quartzite “Threatened Ecological Community”
- exclusion of stock from the rehabilitation area
- education of mine work force regarding the significance of the rare vegetation.

1.6 Rehabilitation Aim and Objectives

The aim of the Rehabilitation Plan is to revegetate a majority of the Mine Site to a state that resembles the original vegetation. The remaining areas are to be revegetated in a manner that will suit its end land use.

The objectives of the Rehabilitation Plan are focused on satisfying the Mine Closure Plan completion criteria:

1. to plan revegetation works so that rehabilitated areas will have maximum vegetation cover
2. to plan weed control works so that rehabilitated areas have minimal weed cover
3. to plan revegetation works that is practically achievable, will be self sustainable and satisfies the best suit end land use
4. to provide a schedule of rehabilitation that is acceptable to the EPA CEO.

An additional objective has been devised to consider the rare flora of the site:

5. To plan revegetation trials to determine the most successful methods of establishing self-sustaining conservation significant flora populations.

1.7 Structure of Report

1.7.1 REHABILITATION AUDIT

The existing environment was researched to determine the Mine Site’s original physical and biological characteristics. The data was then used as a baseline to determine factors relevant to successful rehabilitation of the site (**Section 2**), including:

- geology and topology
- vegetation structure
- site condition
- native and weed species

An audit was then performed to identify issues in Simcoa’s rehabilitation operations (**Section 3**) in terms of:

- Physical Design
- Revegetation
- Weed Control
- Mine Hygiene.

As a result of this examination, both Sections contain text boxes termed “Rehabilitation Notes”. Each Rehabilitation Note contains:

- an identified item relevant to the rehabilitation of the Mine Site (Issue)
- a recommendation how to address the Issue (Action)
- section numbers where the action was implemented in the Rehabilitation Plan (Addressed).

1.7.2 DOMAIN MODEL PLAN

Section 4 describes how the Rehabilitation Plan was developed. The Rehabilitation Domain Model (Mikli & Kaesehagen 2009) was used, which was based on the International Council on Mine Closure and Metals (ICMM 2008) Domain Model.

Areas to be revegetated can be divided into Domains with restoration goals, according to their site characteristics (eg soil characteristics and topography) and End Land Use (eg visual screen, fauna habitat, resemble original vegetation). Rehabilitation Treatments can then be designed for each domain to use or overcome site characteristics to reach their rehabilitation goal. Key performance indicators (KPI) are then developed to assess whether the Treatments are achieving the rehabilitation goals. This rehabilitation domain approach is summarised in **Figure 3**.

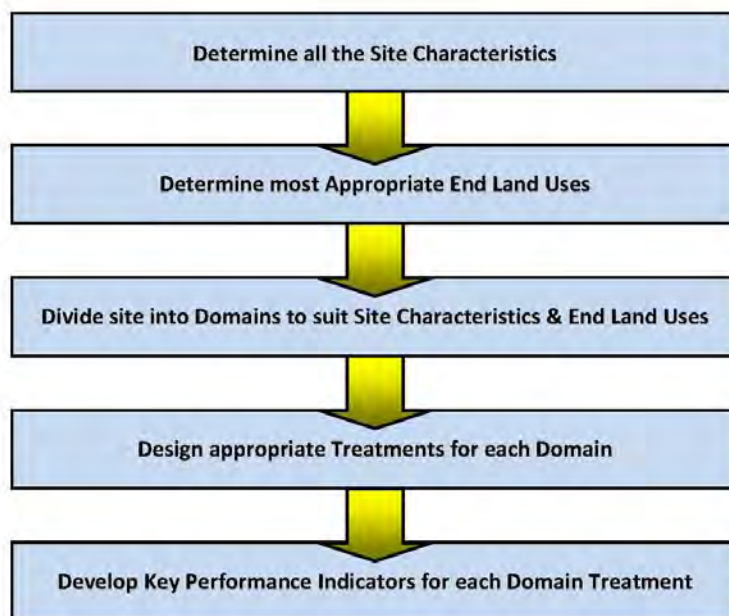


Figure 3: Rehabilitation Domain Model outline

1.7.3 OPERATIONS AND TECHNIQUES

The Rehabilitation Plan also contains detailed descriptions on rehabilitation practices. This information is to provide “hands on” practical information to educate site workers in how to implement the recommended treatments for each rehabilitation domain:

- **Section 5** details how to improve Physical Design, such as shaping of waste rock dumps. It also discusses various site preparation techniques to improve revegetation outcomes, such as ripping and soil scarification.
- **Section 6** explains how appropriate local native species have been chosen for revegetation works, as well as the following revegetation techniques:
 - o collection, storage, treatment and broadcasting of native seeds
 - o planting tubestock
 - o how to apply harvested vegetation to rehabilitated areas (brushing).
- **Section 7** details how the known weed species were prioritised in level of threat to rehabilitation, and how best to identify and control high priority weed species.
- **Section 8** expands on hygiene procedures to minimise the risk of introduction and spread of plant diseases and weeds.
- **Section 9** explains how to undertake monitoring of rehabilitated sites and determine appropriate maintenance activities.
- **Section 10** recommends a series of trials to find out how to improve revegetation outcomes, particularly in native diversity, establishing conservation significant flora and finding topsoil substitutes.

2.0 Existing Environment

The following section examines the environmental characteristics of the Mine Site to determine implications required to develop the Rehabilitation Plan. Notes on their implications for Rehabilitation are presented as boxed text throughout the Section.

2.1 Physical Environment

2.1.1 CLIMATE

The Mine Site is characterised by a mild Mediterranean type climate with hot dry summers and mild wet winters. The climate varies seasonally, with rainfall, temperature and winds following a well-defined annual cycle. The majority of the rainfall occurs in the winter months with 90% falling between April and October (**Figure 4**). The mean total rainfall is 473.5mm. Mean summer rainfall is minimal, between 11.1 and 14.0 mm. The amount of rainfall begins to increase in May and is highest in June with 89.7 mm, before beginning to decline in August. In the last four years, the mean rainfall has decreased by around a third to 322.3 mm.

Historic temperature records from the Walebing weather station, located approximately 12.5 km south-east of the Mine Site, indicate that lowest temperatures are in July with an average daily minimum and maximum temperature of approximately 5.4°C and 16.1°C, respectively. The Records from the Bureau of Meteorology (BOM 2011) indicate that highest temperatures occur in January with an average daily minimum and maximum temperatures of 16.7°C and 33.9°C, respectively.

REHABILITATION NOTE 1

Issue: Most of the annual rainfall in the Mine Site occurs in winter.

Action: Revegetation activities should be planned to utilise the winter rainfall (May to September) to maximise success of native seed germination and establishment.

Addressed: Sections 6.2.5 and 6.3.3

REHABILITATION NOTE 2

Issue: The Mine Site may continue to receive lower than average rainfall in the near future, which may prolong or even prevent rehabilitation works meeting their KPIs.

Action: Rainfall patterns should continue to be monitored and if the trend continues, the rehabilitation KPIs may need to be reconsidered and amended to those which are achievable in a drier environment.

Addressed: Section 6.6

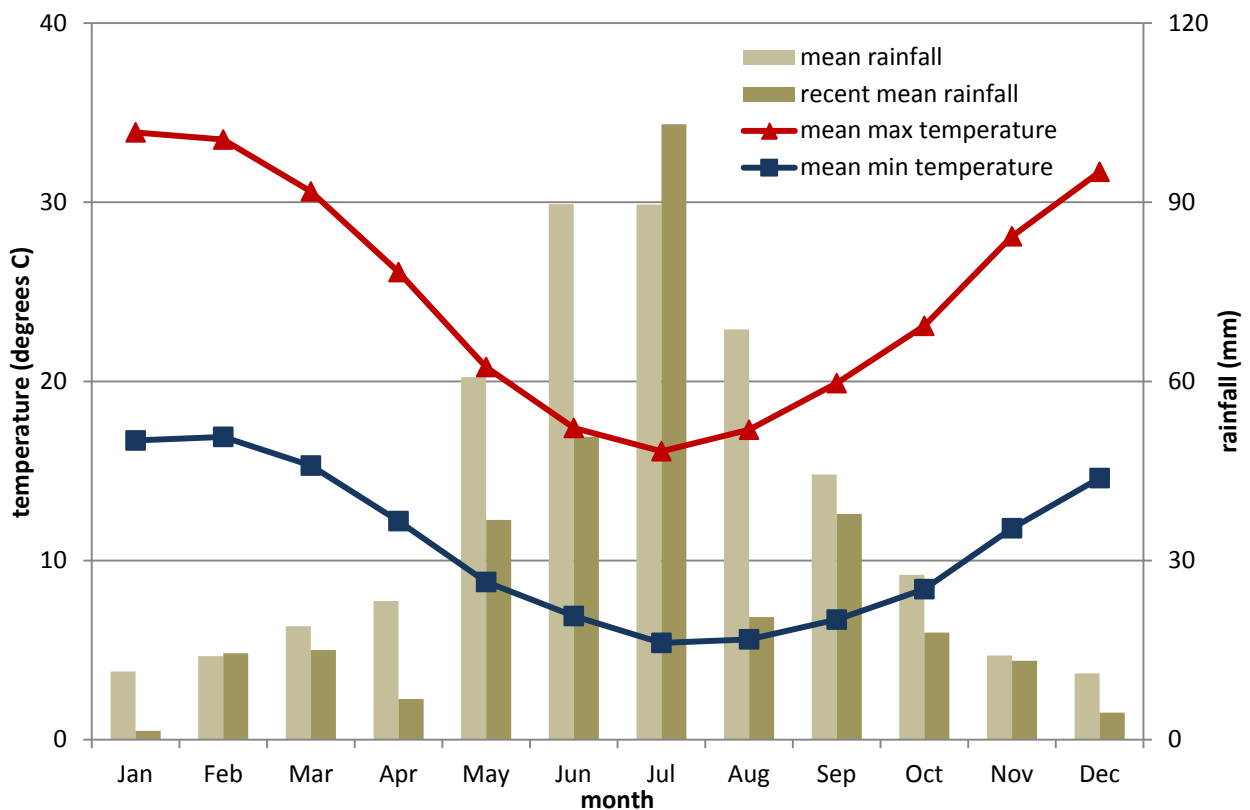


Figure 4: Mean monthly temperature and rainfall at Walebing weather station

2.1.2 GEOLOGY AND TOPOLOGY

Landform

The Department of Agriculture and Food (DAFWA 2007) *Soil Systems dataset* indicate the Mine Site is located within the Cooroo 7, Ranfurly 1 and Burabidge Hill 7 Soil sub-systems. The subsystems are detailed in **Table 4**.

Table 4: Mapped soil types at Mine Site (DAFWA 2007b)

System	Subsystem	Landform	Geology	Vegetation
Cooroo	258Cw_7	Very gently to moderately inclined hill slope and hill crests	Middle or late Proterozoic, Moora group, Noonidine Quartz; shallow soils.	Wandoo, Salmon Gum, Acacia spp.
Ranfurly	256Ra_1	Alluvial plain of Moore River	loamy earths, clays and minor sandy earths	Woodland of Eucalyptus salmonophloia, Eucalyptus wandoo, Eucalyptus loxophleba
Burabidge Hill	256Bg_7	Mid slope, gently undulating rises adjacent to valley plain and drainage line	Colluvium, lithic sand . Shallow to deep loamy duplex, red sandy earth and red shallow loam.	York Gum, Salmon Gum, Acacia spp.

Overall the site's landform can be described as open with low relief and local elevated hills, locally merging with undulated rises and depressions. There are some drainage lines cross the northern and south-western sections of the leases. The mine site itself is located on a topographic rise which backs onto a rocky outcrop to the east. A gentle slope occurs from the outcrop gradually to the west and onto the nearby Coonderoo River flats (Actis 2011). The area being mined consists of rocky outcrops. Very little topsoil is present.

REHABILITATION NOTE 3

Issue: The Mine Site has specific landform features.

Action: Rehabilitation efforts should be directed towards resembling the local landforms where possible. Specific features that could be mimicked include rocky outcrops, local elevated hills and gentle slopes towards drainage and river flats.

Addressed: Section 5.1

2.2 Biological Environment

2.2.1 VEGETATION

Vegetation Condition

There is little quantified information on the vegetation condition of the Mine Site before mining activities started. Trudgen (1985) described the vegetation as being in good condition in some parts and degraded or recently burnt in others. The main cause of the degradation was grazing from livestock and clearing.

However, Trudgen (2006) quantitatively describes the condition of the surrounding vegetation as mostly varying from Poor to Very Good, with some small areas being Very Poor to Degraded (Trudgen scale). It is highly likely that the Mine Site's pre-existing vegetation was also of Poor to Very Good condition. The Trudgen Condition Scale is detailed in **Table 5**.

A study of the adjacent vegetation by CALM (2000) listed weeds, grazing, clearance and fire as the main causes of degradation. It is most likely that weed cover has also considerably degraded the Mine Site's vegetation.

Table 5: Trudgen Condition Scale

Scale	Condition
Excellent	Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
Very Good	Some relatively slight signs of damage caused by the activities of European man.
Good	More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging.
Poor	Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires.
Very Poor	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.
Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; ie. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Vegetation Associations and Communities

A systematic survey of the native vegetation in Western Australia was undertaken by John S. Beard during the 1970s, who described vegetation systems within Western Australia at a scale of 1:250,000 in the south west of Western Australia and at a scale of 1:1,000,000 in the less developed areas of the state. The Vegetation Survey of Western Australia maps and explanatory memoirs (1974-1981) are credited to J.S. Beard.

Beard (1979) *Vegetation of the Perth Area, Western Australia* indicates two vegetation associations occur in the Mine Site:

- Unit 1041 - Low Woodland of Rock Sheoak (*Allocasuarina huegeliana*) and Jam (*Acacia acuminata*)
- Unit 142 – Medium woodland of York Gum (*Eucalyptus loxophleba*) and Salmon Gum (*Eucalyptus salmonophloia*).

However, this mapping is at regional scale and the borders of the associations can be slightly incorrect at ground level. Unit 1041 is typical of the rocky outcrops in the Mine Site, whereas Unit 142 is typical of the surrounding area. Only Unit 1041 occurs in the areas being mined.

Trudgen (1985) originally recorded four vegetation associations in the Mine Site. The vegetation associations corresponded to variations in surface geology and topology (eg rockiness, hills). Trudgen also described commonly occurring species in four degraded areas. Full descriptions of the four vegetation communities and common native species in the degraded areas are detailed in Table 6.

Table 6: Descriptions of four Vegetation Associations in Mine Site (Trudgen 1985)

Short description	Full Description	Occurrence
<i>Kunzea</i> sp. Open Scrub	60% <i>Kunzea praestans</i> with 5% <i>Banksia sessilis</i> and understorey of 40% <i>Hibbertia subvaginata</i> . Occasional emergent trees of <i>Allocasuarina huegeliana</i> and scattered individuals or shrubs and herbs such as <i>Bossiaea eriocarpa</i> , <i>Acacia scirpifolia</i> , <i>Isopogon divergens</i> and <i>Melaleuca scabra</i>	On slopes and in disturbed areas
<i>Regelia megacephala</i> Open Scrub	60% <i>Regelia megacephala</i> with 5% <i>Banksia sessilis</i> with an understorey of <i>Hibbertia subvaginata</i> and scattered <i>Olearia axillaris</i> . Occasional emergent trees of <i>Allocasuarina huegeliana</i> and <i>Acacia acuminata</i> and scattered individual shrubs of <i>Xanthorrhoea preissii</i> , <i>Trymalium floribundum</i> , <i>Cheilanthes austrotenuifolia</i> and <i>Stypantra imbricata</i> .	On rocky and high point areas of site, where higher ground is flat and deeper soils are developed
<i>Allocasuarina huegeliana</i> Low Open Woodland	15% <i>Allocasuarina huegeliana</i> with an understorey of 15% <i>Kunzea</i> sp, 5% <i>Calytrix leschenaultia</i> and scattered <i>Xanthorrhoea preissii</i> .	One small area, gentle slope
<i>Allocasuarina campestris</i> Open Scrub	40-50% <i>Allocasuarina campestris</i> with some <i>Xanthorrhoea preissii</i> , <i>Austrostipa elegantissima</i> , <i>Cheilanthes austrotenuifolia</i> , <i>Acacia acuminata</i> , <i>Hakea lissocarpha</i> and <i>Kunzea</i> sp.	Flat hilltop, Surrounded by degraded areas
Degraded Areas	Overstorey - <i>Allocasuarina huegeliana</i> , <i>Banksia sessilis</i> , <i>Acacia acuminata</i> Understorey – <i>Hibbertia subvaginata</i> , <i>Regelia megacephala</i> , <i>Olearia axillaris</i> Herbs and small shrubs – <i>Gyrostemon ramulosus</i>	Depressions, backfill, scrapes

REHABILITATION NOTE 4

Issue: As the mining operation will result in surface geology being structurally changed, revegetation will be unable to restore all or any of the local vegetation associations.

Action: Revegetation should be focused on returning a basic resemblance to local vegetation structure, rather than attempting to restore local vegetation associations, promoting local species that can grow in the broken rock substrate.

Addressed: Section 6.2

State and Federal Significance

Threatened Ecological Communities (TECs) are categorised at both State level (DEC 2010) and Commonwealth level (DEWHA 1999).

One State listed TEC (Coomberdale Quartz hills) has been recorded within and adjacent to the Mine Site. The description for the TEC is given in **Table 7**. Native flora known to occur in the TEC are listed in **Appendix One**.

Table 7: TEC recorded in Simcoa’s Moora Quartzite mine

No.	Name	Description	DEC Rating	DEWHA Rating
51	Coomberdale Quartz hills	Heath dominated by one or more of <i>Regelia megacephala</i> , <i>Kunzea praestans</i> and <i>Allocasuarina campestris</i> on ridges and slopes of the Quartz hills of the Coomberdale floristic region.	Endangered	-

REHABILITATION NOTE 5

Issue: A State listed TEC occurs within and adjacent to the Mine Site, part which is being cleared for mining activities.

Action: Revegetation outcome should be focused on helping to conserve the identified TEC in terms of species diversity, promoting dominant species and in vegetation structure where possible.

Addressed: Section 6.2

2.2.2 NATIVE FLORA

Native Flora Inventory

A total of 160 native flora species were recorded within and immediately adjacent to the Mine Site (Trudgen 1985, Griffin 1991, Parker 1991, CALM 2000, Trudgen 2007, Trudgen 2011). A full inventory of flora recorded on site is presented in **Appendix One**.

State and Federal Significance

Flora species require Threatened Flora (TF) or Priority conservation status where populations are geographically restricted or threatened by local processes. The DEC enforces regulations under Government of Western Australia’s *Wildlife Conservation Act* (GWA 1950) to conserve TF and protect significant populations. Rare flora species are gazetted under Sub-Section 2 of Section 23F of the *Wildlife Conservation Act*, thereby making it an offence to remove or damage rare flora without Ministerial approval. All Declared and Priority flora are listed in DEC (2011) *Declared Rare and Priority Flora List*. Flora are also classified and protected at a federal level through the Australian Government (1999) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A total of eight significant species are known to occur within and immediately adjacent to the Mine Site. Three species are listed as Endangered in the EBPC Act (Australian Government 1999) and four are listed as Threatened by DEC (2008). The remaining three species were rated between Priority 2 and Priority 4 by DEC (2008). The species identified are listed in **Table 8**. Of these, only three species (*Acacia aristulata*, *D. dielsii* and *R. megacephala*) have been recorded in the Mine Site (Trudgen 2011).

Table 8: Threatened and priority species known to occur in or adjacent to Mine Site

Scientific Name	Recorded In Mine Site	DEC	SEWPAC	Flowering Time
<i>Acacia aristulata</i>	*	Threatened	Endangered	Sep-Dec
<i>Baeckea</i> sp. Moora		Priority 3		Nov-Dec
<i>Cryptandra glabriflora</i>		Priority 2		May-Aug
<i>Daviesia dielsii</i>	*	Threatened	Endangered	Jul
<i>Goodenia arthrotricha</i>		Threatened		Oct-Nov
<i>Regelia megacephala</i>	*	Priority 4		Oct-Dec
<i>Synaphea quartzitica</i>		Threatened	Endangered	Jul-Aug
<i>Tricoryne</i> sp. Wongan Hills		Priority 2		(Unknown)

One species was previously reported as threatened or priority species but has now been classified as non-threatened. *Goodenia acutum* (previously *Nemcia acuta*) was previously rated at Priority 3 but is now declassified.

REHABILITATION NOTE 6

Issue: The Mine Site contains two threatened flora species - *Acacia aristulata* and *Daviesia dielsii*.

Action: Revegetation trials should be conducted to determine whether it is possible to establish self sustainable populations of these species.

Addressed: Sections 6.2 and 10.2

2.2.3 WEEDS

Weed Cover

There is little information available regarding the weed cover of the Mine Site before mining commenced. A baseline vegetation survey was conducted in the Mine Site by Trudgen (1985) did not include any quantified assessment weed cover. A study of the adjacent vegetation by CALM (2000) mentions that the weed cover is “high” in some areas (no other measurement details given). As a result, it cannot be determined whether the EPA criterion for 10% weed cover represents the pre-existing condition or whether it is a feasible benchmark.

The Mine Site currently contains some remnant vegetation. These areas may be used as reference sites to establish the Mine Site’s pre-mining weed cover.

REHABILITATION NOTE 7

Issue: There is no quantified information on the original weed cover of the Mine Site, therefore it cannot be determined whether the EPA criterion of 10% weed cover is feasible.

Action: Examine the remnant vegetation the in Mine Site to determine the weed cover.

Addressed: Section 7.1

Weed Inventory

A total of 34 weed species has been recorded in and immediately adjacent to the Mine Site. A weed inventory is provided in **Appendix One**.

Weed Life forms

Weed species were separated into three groups:

1. Grass weeds – 15 species
2. Geophyte weeds (ie those that propagate from bulbs, corms and tubers) – 2 species
3. Broad leaf herb weeds – 17 species.

Separation of weed species into groups was chiefly based according to their biology and similarities in methods of control. The grouping was to aid in understanding what types of weeds are the biggest threat to the Mine Site and what main control actions would be needed to reduce their diversity and presence.

REHABILITATION NOTE 8

Issue: The Mine Site is known to contain 34 weed species, of different biological forms (grasses, geophytes or broad leaf herbs).

Action: Weed control activities at Simcoa should be divided into addressing weed species according to their biology and method of control.

Addressed: Section 7.4 and Appendix Five

Priority Weeds

The priority rating of each recorded weed species was determined after examining:

- the ratings under the following weed evaluation systems:
 - o Environmental Weed Census and Prioritisation – Swan Coastal Plain (EWCP) by the DEC (DEC 2008)
 - o Environmental Weed Strategy of Western Australia (EWSWA) by the Department of Conservation and Land Management (CALM 1999)
 - o Dixon and Keighery (1995) Recommended methods to control specific weed species
- whether it was listed by Commonwealth of Western Australian governments:
 - o Weed of National Significance (WONS) (Weed Australia 2008)

- o DAFWA (1976) Agricultural and Related Resources Protection Act (ARRPA).

None of the recorded weed species were listed by WONS or ARRPA. Ten species were determined to be high priority to control, as they were deemed by EWCP and EWSWA as highly invasive species that can degrade native vegetation, or were observed to contribute to weed cover in revegetated waste rock dumps. Six of the species are grasses and four are broad leaf herbs.

The full methodology and ratings for all recorded weed species is presented in **Appendix Two**. The calculated High Priority weeds species are listed in **Table 9**.

Table 9: High Priority weeds species in Simcoa’s Moora Quartzite mine

Life Form	Scientific Name	Common Name	EWCP	EWSWA	Rehab sites
Grass	<i>Avena barbata</i>	Bearded Oat	Moderate	Very High	Common on dumps
	<i>Bromus diandrus</i>	Great Brome	High	Very High	
	<i>Cynodon dactylon</i>	Couch	Moderate	Very High	
	<i>Ehrharta calycina</i>	Perennial Veldt Grass	High	Very High	
	<i>Ehrharta longiflora</i>	Annual Veldt Grass	FAR	Moderate	common and high cover
	<i>Vulpia myuros</i> var. <i>hirsuta</i>	Rat’s Tail Fescue	Unrated	Unrated	Very common and contributes to weed cover
Broad Leaf Herb	<i>Centaurea melitensis</i>	Maltese Cockspur	Moderate	High	One recording of 15% cover
	<i>Hypochaeris glabra</i>	Flatweed	Moderate	High	common and sometimes high cover
	<i>Arctotheca calendula</i>	Capeweed	Moderate	High	occasionally contributes to weed cover
	<i>Erodium botrys</i>	Long Storkbill	FAR	Low	sometimes contributed to weed cover

REHABILITATION NOTE 9

Issue: The Mine Site is known to contain ten High Priority weed species which may be significant threats to the local vegetation and cause considerable weed cover in rehabilitated areas.

Action: Weed control activities should be developed to identify and target individuals or populations of the High Priority weed species to minimise weed cover in rehabilitated areas to EPA completion criteria.

Addressed: Section 7.3 and Appendix Five

2.2.4 FAUNA

Fauna Inventory

A total of 198 fauna species were determined by Bamford (2001) that may occur within and immediately adjacent to the Mine Site. Of these, 11 species are amphibians, 66 are reptiles, 96 are birds and 25 species are mammals, of which 5 are introduced.

Fauna Habitat

The Mine Site is connected to some of the adjacent vegetation. This connection is becoming weaker as vegetation is cleared for mining. The isolation of the remnant vegetation means that fauna populations have further difficulty in finding food sources, breeding partners and breeding habitat. This may have an impact in the long term sustainability of local fauna populations.

REHABILITATION NOTE 10

Issue: Mining activities in the Mine Site may further fragment and isolate local remnant vegetation, which may impact on the long term sustainability of local fauna populations.

Action: The rehabilitation design should consider providing ecological corridors where practicable for local fauna species to move between remnant vegetation.

Addressed: Sections 4.2 and 4.3

Conservation Significant Fauna

A total of 12 fauna species that may occur around the Mine Site were reported by Bamford (2001) as conservation significant. Recent revisions in the conservation ratings have meant the Square-tailed Kite (*Lophoictinia isura*) is no longer listed, reducing the number of conservation significant species to 11. A further five species were also removed as the area being mined does not have their habitat requirements (eg tall trees).

A list of the remaining six species and their habitat requirements is presented in **Table 10**.

Table 10. Conservation Significant Fauna expected to occur in Moora Quartzite Mine

Fauna Species	SEWPAC	DEC	Habitat Requirements
Mammal			
Chuditch (<i>Dasyurus geoffroii</i>)	Vulnerable	T	Any remnant vegetation
Reptile and Amphibian			
Carpet Python (<i>Morelia spilota</i>)		P4	Ridges and rocks
Bird			
Bush Stone-curlew (<i>Burhinus grallarius</i>)		P4	Open Woodland
Major Mitchell's Cockatoo (<i>Cacatua leadbeateri</i>)		Other	Banksia and Hakea for feeding
Rufous Fieldwren (<i>Calamanthus campestris</i> subsp. <i>montanellus</i>)		P4	Scrubby heath, saltbush
Crested Bellbird (<i>Oreoica gutturalis</i> subsp. <i>gutturalis</i>)		P4	Shrubland

REHABILITATION NOTE 11

Issue: The Mine Site may serve as a habitat for as many as six locally occurring conservation significant fauna species.

Action: Rehabilitation should consider providing suitable fauna habitat where practicable, in terms of food source and breeding, to assist in the conservation of these species.

Addressed: Section 6.1

Pest Fauna

Bamford (2001) determined that five introduced species may be present in the Mine Site. Of these, rabbits are considered to be the most serious potential threat as they may degrade revegetation efforts. However, there have been no signs to date of grazing, diggings or warrens have been observed on the waste rock dumps. This is most likely due to the hard substrate being unsuitable habitat. It is therefore considered unlikely that rabbits pose a significant threat to rehabilitation efforts.

2.2.5 DISEASES

The Mine Site received on average over 400 mm rainfall annual. This amount of rainfall places it within an area declared by (CALM 2003) as vulnerable to dieback infection (*Phytophthora cinnamomi*). DEC (2011) have issued management procedures for dieback of bushlands in the Moora District.

To date, there have been no known occurrences of any plant diseases within the Mine Site, although no formal testing has been conducted. It is critical that these diseases are not introduced to the Mine Site, otherwise it may threaten the adjacent TEC.

REHABILITATION NOTE 12

Issue: The Mine Site revegetation areas and adjacent TEC are vulnerable to introduction of dieback from unhygienic mine activities.

Action: All rehabilitation activities within the Mine Site should include hygiene prevention and management procedures for possible introduction and spread of dieback.

Addressed: Section 8.1

3.0 Current Rehabilitation Practices

The following section examines Simcoa's Rehabilitation works to determine areas of improvement to be incorporated into the Rehabilitation Plan. The information was collated from personal communication with Simcoa's staff Andrew Obal, Kees Visser and Daniel Mance. Rehabilitation Notes are presented throughout the Section as shaded boxed text.

3.1 Physical Design

Simcoa's Physical Design process involves the transferral of waste materials from mine pits and piling and shaping them into dumps that resemble the local hills. The process is further described below.

3.1.1 WASTE ROCK DUMPS

Waste rock dumps serve the purpose of storing undesired soil ground material away from mining activities.

Waste material (sand material <3mm, silt and low grade quartzite) are deposited onto the dumps using dump trucks. The dumps are then shaped using a dozer operated by an independent earthmoving contractor. The dozer operator pushes the material across the slope gradient to prevent the formation of erosion channels. The dumps are shaped on an incremental basis as material becomes available. Slopes are generally at around 20 degrees in order to prevent erosion. The dumps are contoured to fit in with the general landform of the area. The current dumps appear relatively stable and show little sign of erosion.

3.1.2 RIPPING

Soils may be compacted from use of heavy machinery. This compaction reduces soil aeration, moisture infiltration and root penetration. Seedlings are less likely to survive and establish in such conditions, leading to poor revegetation work over many years (Buchanan 1989). Deep ripping may relieve this compaction and promote faster and more successful revegetation.

Ripping is not required nor practical on the waste rock dumps. It is believed that the nature of the hard rock substrate makes the act unfeasible. Also, previous rehabilitation works have had some success in establishing seedlings without the need of ripping. However, ripping may be a useful technique in future revegetation works in other soil compacted locations on the Mine Site, such as for roads and hardstands. These areas are accessible to ripping machinery and are not composed of large waste rock material.

REHABILITATION NOTE 13

Issue: Ripping could be a useful technique for encouraging revegetation success in areas where soil is compacted and not composed of waste rock material.

Action: Future revegetation work should consider ripping where appropriate and practical to relieve soil compaction for future revegetation works.

Addressed: Section 5.2

3.1.3 SOIL SURFACE PREPARATION

A common revegetation technique is to scarify the soil surface before seeding. This scarification provides small niches for seed to be secured. This action can reduce the amount of seed lost to wind and rain erosion and increase the survival and establishment of germinated seeds.

Soil scarification is not currently performed in revegetation works. This treatment is not considered necessary in the current general rehabilitation works, as the main source of seeds are from the topsoil and remnant vegetation brushing. As these materials are blended before being spread onto the dumps, the seeds are secured by burial.

However, as the topsoil and remnant vegetation resources are limited, future revegetation works may need to use broadcast seed or branch layering as a replacement source of propagules. As the seeds from these methods are placed on the soil surface, they are vulnerable to being removed by erosion. Such practices should consider surface preparation to help secure the seeds.

It should be noted that soil surface preparation is similar to ripping as a practical method. It may not be achievable on difficult substrates such as waste rock dumps. However, it could be a feasible option on other sites such as on former roads and hardstands.

REHABILITATION NOTE 14

Issue: After topsoil and remnant vegetation sources are depleted, future revegetation methods risk losing seed to wind and rain erosion.

Action: Where practicable, soil scarification treatment should be considered prior to seeding to provide niches for seeds to be lodged in and to limit loss of seeds to wind and rain erosion.

Addressed: Section 5.3

3.2 Revegetation

Simcoa's main revegetation process is the removal of topsoil and vegetation material from remnant vegetation areas within the mining lease and spreading them onto newly constructed waste rock dumps. Several trials have been conducted to determine more efficient methods of revegetation. These processes and trials are further described below.

3.2.1 TOPSOIL AND BRUSH

Topsoil is a significant component in the success of a revegetation project. Good topsoil contains native plant propagules, mycorrhiza (symbiotic fungi), nutrients and organic matter. Harvested vegetation (brush) may also assist revegetation works through providing organic matter, native seeds and act as a barrier to wind and rain erosion. It is essential that these resources are efficiently used to maximise rehabilitation efforts (DMP 2011)..

Topsoil and brush are harvested before the commencement of active mining each year, usually around May. Harvest time is chosen to suit mining operations and to minimise storage time. It is currently unknown whether the brush contains any viable seeds (ie if the branches contain unopened capsules of mature seeds). Because there is extremely limited available topsoil and remnant vegetation in the Mine Site, all material is harvested and used regardless of its quality (eg weeds).

The remnant vegetation is cleared and pushed into heaps. No active mulching occurs – the size of the brush is the result of the clearing act by machinery (broken branches of shrubs). Topsoil is limited in distribution as cap rock is exposed in many locations. Where topsoil does occur, it is then scraped up to 10cm using a dozer. Both the mulch and vegetation are combined together into a dump truck by a wheeled loader and then piled into temporary storage areas.

The topsoil /brush mix is usually used within a week. The short time frame means that the temporary piles do not need to be covered. The heights of the storage piles are currently unknown. The mixture is then spread onto newly completed dumps as they become available, at an approximate thickness of 2 to 3 cm; the surface ratio being three to five times larger than the area cleared.

The amount of topsoil and mulch resources is limited; it is estimated that there is only 4 ha of remnant vegetation available. It has been identified that this amount is inadequate to meet future rehabilitation needs. Future rehabilitation works will need to consider new revegetation techniques to overcome the shortage of topsoil and seed source.

REHABILITATION NOTE 15

Issue: There are not enough topsoil and mulch resources for future rehabilitation works.

Action: New substitute sources and/or techniques are required to overcome this shortfall and ensure adequate revegetation success.

Addressed: Sections 6.3 and 10.3

REHABILITATION NOTE 16

Issue: Current harvest time of vegetation may not be obtaining the maximum amount and diversity of viable seeds and propagules for revegetation.

Action: Need to examine whether there is an optimal time for harvesting of vegetation in order to increase revegetation success.

Addressed: Section 10.1.3

3.2.2 SEED COLLECTION

Simcoa commissioned Rhonda Tonkin from Western Wildflower Farm to collect native seeds in 2004, 2005 and 2006. Seed was only collected within the Mine Site, not from any adjacent or nearby areas. Seed collection was stopped as it was determined that it was difficult to collect enough seed to make it a viable rehabilitation option.

The total amount of stored is currently unknown, but it is understood that it was only enough for revegetation trials (discussed below in **Section 3.2.3**), not large scale rehabilitation works. Species that were collected are listed in **Appendix One**. A small amount of seed is left over from the trial and is currently stored within sealed paper envelopes in the office. There are currently no procedures for the storage of collected native seeds.

Simcoa staff have also collected seed on an ad hoc basis. No specific species are targeted. Seeds are dried in the office before being spread. Some germination has been observed by the Mine Site Manager. No detailed records have been kept of Simcoa's seed collecting activities.

A seed collection program should be reconsidered, particularly when the topsoil and vegetation resources are known to be inadequate to complete future rehabilitation works. Seed collection need not be restricted to the Mine Site, it should expand to adjacent vegetation areas so to maximise the diversity and amount of seeds while still preserving provenance. Any seed collection activities will require an appropriate seed collection licence from the DEC.

To date, there has been no program to specifically collect seeds from conservation significant flora within the Mine Site. A seed collection program is particularly important for significant flora, to maximise size of sustainable populations in rehabilitation works.

REHABILITATION NOTE 17

Issue: There has been little native seed collected for rehabilitation works.

Action: Seed collecting if practicable should continue in the Mine Site and in adjacent vegetation to improve abundance and diversity in revegetated areas.

Addressed: Section 6.3.2

REHABILITATION NOTE 18

Issue: There is no procedure for the proper storage of collected native seeds.

Action: A seed storage procedure needs to be developed for the storage of collected seeds to prolong their viability and to protect them from being eaten by bugs.

Addressed: Section 6.3.3

3.2.3 SEEDING TRIALS

Simcoa conducted two direct seeding trials to determine whether the species diversity could be increased on the dumps. The first trial was conducted in July 2004 and the second in June 2005, both in the Main Waste Dump Area 24 (Trudgen 2007). Species tested are listed in **Appendix One**.

The timing of the seeding was considered to not be optimal, as the site had missed one to two months of autumn-winter rainfall. Emerging seedlings would have little time to establish before the dry hot spring and summer. This would have resulted in a significant level of seedling mortality.

There was no site preparation before seed broadcasting, such as surface scarification. Topsoil had not previously been spread on this slope. As a result, many seeds may have been removed by wind or rain. Remaining seedlings would have found it difficult to establish into the waste material, resulting in even more mortalities.

The quantity of seeds used per species was related to its mature plant size or life form. Amounts of seed were expressed in terms of proportions, rather than actual quantities or ratios:

- Tall shrubs – small proportion
- Medium shrubs – small to moderate proportion
- Small shrubs – large proportion
- Sedges, herbs, grasses and annuals – small to moderate size

There is some question on the composition of the seed mix. No tree species were included in the species mix, despite several species occurring in the area. Also, small shallow rooted and annual species are sometimes not included in revegetation works as many of these species generally cannot survive and be self-sustaining in early revegetation conditions. Often these species are introduced when the site has vegetation cover, or eventually colonise from adjacent native vegetated areas. It is also unknown whether any of the seeds were viable, as they had not been tested for viability before the trials commenced.

Very few seeds were observed to have germinated from the trials (Simcoa Operations Pty Ltd, 2005, 2006, 2007, 2008). Neither trial was successful in establishing plants from broadcast seed.

REHABILITATION NOTE 19

Issue: Native seeding trials to date have been unsuccessful.

Action: Further seeding trials are needed to improve revegetation success. Improvements may include testing for viability, dormancy breaking treatments, site preparation, timing and type seed mix. The trials need to be regularly monitored and reported upon so to select suitable species.

Addressed: Section 10.1.1

3.2.4 THREATENED FLORA TRIAL

A seeding trial has been conducted using the two Threatened flora species recorded in the Mine Site:

- *Daviesia dielsii* in Area 13 in 2005
- *Acacia aristulata* in Area 20 in 2006.

Seeds were broadcast within a 1m radius of a marked peg. Seeds were not tested for viability or treated for dormancy. The surface was not scarified. Neither of these species have been observed during annual monitoring in either plots since the start of the trial (Simcoa Operations Pty Ltd, 2005, 2006, 2007, 2008). Neither trial was successful in establishing populations of either Threatened flora species.

REHABILITATION NOTE 20

Issue: Previous seeding trials for successful germination of conservation significant flora *Acacia aristulata* (TF) and *Daviesia dielsii* (TF) have been unsuccessful.

Action: New revegetation trials need to be developed and implemented for threatened flora.

Addressed: Section 10.2

3.2.5 BRUSH AND FERTILISER TRIALS

Simcoa has conducted several small revegetation trials.

One trial was conducted using combinations of fertiliser and brush (Griffin and Associates 1991; Parker 1991). The following results and comments are noted:

1. **Fertiliser** - Fertiliser appeared to assist weed growth and not native plant growth. However, the report does not contain details such as the chemical composition or type of fertiliser used. It is still possible that an appropriate fertiliser treatment may assist in enhancing rehabilitation works, particularly when topsoil and brush material sources are exhausted.
2. **Brush** - The trial demonstrated that the brush material of *Regelia megacephala*, *Allocasuarina huegeliana* and *Allocasuarina campestris*, containing capsules, released their seeds which successfully germinated. The authors believe that the topsoil is devoid of these particular species, making brushing or seeding a necessary process to establish these species onto rehabilitation sites.

A second trial was conducted in 2008, using only branches (Trudgen 2011). Approximately two cubic metres of branches of *Regelia megacephala* and *Allocasuarina huegeliana*, bearing seed capsules, were laid across a 0.2 ha bare section of a recently constructed waste rock dump. No seedlings had been observed to have germinated in February 2012. It is highly probable that the seeds were blown away by the wind, as the branches were spread far apart and the soil surface was not prepared in a manner to provide niches to capture the seeds (eg surface scarification). It is also currently unknown whether the seeds in the branch capsules were viable at the time of harvest.

REHABILITATION NOTE 21

Issue: There have been limited trials in using fertiliser and harvested vegetation to improve revegetation outcomes.

Action: More detailed scientific trials are needed to determine methods of improving revegetation outcomes, particularly to overcome the limited topsoil and vegetation resources. Such methods may include soil scarification and variation in types, amount and chemical composition of fertiliser.

Addressed: Section 10.3

3.2.6 REVEGETATION MONITORING

Formal independent rehabilitation monitoring has been conducted roughly every three years by Trudgen and Associates. Simcoa conducts internal monitoring of its rehabilitation annually to comply with the EPA criteria. Current monitoring records also do not record total native vegetation cover, only that of individual species, making it difficult to determine whether rehabilitation works are reaching the EPA criterion of 70% native cover. By summing the individual covers, a rough figure could be estimated for each quadrat. The latest monitoring report (Trudgen 2011) indicated that almost all of the quadrats have approximately 30-50% native cover. Only Quadrat R91/02 exceeded the 70% threshold (~75%).

It should be questioned why the 70% native vegetation figure was set by the EPA. It must be realised that such a figure may be impractical to achieve in this mine site's conditions. It is recommended that this criterion be revaluated and perhaps reworded to "maximum achievable cover". For this to occur, Simcoa will need to negotiate with the OEPA and complete a S.46c variation to conditions.

The cover is mostly comprised of a low diversity of large perennial trees and shrubs, mostly:

- *Regelia megacephala* (P4)
- *Allocasuarina huegeliana*
- *Allocasuarina congesta*
- *Hibbertia subvaginata*.

Over time, *Allocasuarina* plants have outcompeted the other local native species and dominate the revegetation. There is a severe decline in native diversity, with species such as *R. megacephala* disappearing on the older waste rock dumps.

The Two TF species have been recorded in the rehabilitation works. However, the priority flora *R. megacephala* has not been successfully established as a self-sustaining population, because the species cannot compete against other shrub species in broken substrate material.

REHABILITATION NOTE 22

Issue: Revegetation efforts have not yet met the EPA criterion for 70% native cover.

Action: Need to improve revegetation efforts to increase native vegetation cover or renegotiate criterion if not practicably achievable.

Addressed: Sections 6.3, 6.4, 6.5 and 10.1.3

REHABILITATION NOTE 23

Issue: The value of EPA criterion for native vegetation cover (70%) needs to be reconsidered as it may not be achievable in such site conditions.

Action: Recommend that the EPA criterion wording be changed to “maximum achievable cover”.

Addressed: Section 4.5

3.3 Weed Management

3.3.1 CURRENT PRACTICES

There are few weed control activities occurring in the Mine Site. Tracks and incoming vehicles and equipment are inspected for weed seeds as part of Simcoa’s hygiene practices (refer to **Section 3.4**). No other formal weed monitoring or control is conducted within the Mine Site, particularly in the remnant vegetation or rehabilitation areas. There is a potential risk of weeds being introduced from the remnant vegetation areas into the rehabilitation areas via topsoil.

A weed inventory of the Mine Site is known, however their threat statuses has not been identified before this report, nor whether they were listed by DEC or SEWPAC. Mine staff are not trained how to identify or control any significant weed species.

It should be noted that weed management is exacerbated by the Mine Site being adjacent to pastures and roads. Simcoa cannot prevent new weed species entering the site from these land uses.

REHABILITATION NOTE 24

Issue: Site staff are unable to identify significant weed species which may degrade revegetation works.

Action: Develop a guide for assist site staff in identifying and controlling significant weed species

Addressed: Sections 7 and Appendix Four

3.3.2 CURRENT WEED INFESTATION

Weed cover in the rehabilitation areas has been regularly measured as part of rehabilitation reports by Trudgen Consulting. Weed cover has been observed to increase over time, being around 5-10% in its first year, and increasing to over 40% after 5 years. This cover exceeds the EPA criterion of 10% cover. As discussed in **Section 2.2.3**, the major weed species contributing to weed cover were:

- Annual Veldt Grass (*Ehrharta longiflora*)
- Rat's Tail Fescue (*Vulpia myuros var. hirsuta*)
- Flatweed (*Hypochaeris glabra*)
- Cape Weed (*Arctotheca calendula*)
- Long Storkbill (*Erodium botrys*).

These weed species need to be targeted to reduce weed cover in order to improve rehabilitation success and for the mine to meet the EPA criterion.

Similar to native vegetation cover, it must be questioned as to how the EPA set the criterion for weed cover at 10%. There has been no record to indicate what the previous weed cover was in the pre-mining vegetation. It should be accepted that such a figure may not be practical for the Mine Site. It is recommended that this figure be reconsidered and perhaps the wording changed to "minimal achievable weed cover". Similar for native cover, Simcoa will need to negotiate with the OEPA and complete a S.46c variation to conditions.

REHABILITATION NOTE 25

Issue: Weed cover in rehabilitated sites exceeds EPA criterion (<10%).

Action: Implement a Weed Control Program to target weed species that are known to contribute to weed cover in rehabilitated sites.

Addressed: Section 7

REHABILITATION NOTE 26

Issue: The value of the EPA criterion for weed cover (<10%) needs to be reconsidered as it may not be achievable in such site conditions.

Action: Recommend that the EPA criterion wording be changed to "minimal achievable cover".

Addressed: Section 4.5

3.4 Hygiene Practices

3.4.1 CURRENT PRACTICES

Simcoa prepared Standard Operation Procedure No 11 in 2006 that outlines procedures for minimising the introduction of weeds and diseases in the Mine Site.

The document details:

- why the procedures are important (the protection of vegetation of high conservation significance)
- who is responsible for ensuring this procedure is followed and enforced
- what equipment is to be assessed.

The document also details a procedure for all incoming vehicles to be stopped at inspection points and examined for any soil, slurry or vegetation material. Any discovered material is to be cleaned before the vehicle may proceed further into the Mine Site. In addition, all tracks and hygiene points are to be inspected monthly for weeds by the Mine Manager and weed control to be carried out as necessary.

The Procedure No 11 also does not discuss hygiene practices for incoming vegetation or soil materials, as the only items currently entering the site are equipment, infrastructure and personnel. However, future rehabilitation practices may result in the importation of such material which could potentially be contaminated (eg topsoil, tubestock).

REHABILITATION NOTE 27

Issue: The Procedure No. 11 does not discuss hygiene practices for incoming vegetation or soil materials for future rehabilitation works, which may be contaminated (topsoil, tubestock).

Action: If such practices are to occur, the Procedure should be expanded to discuss how to minimise the risk of introducing diseases and/or weeds from such sources.

Addressed: Section 8

4.0 Domain Model Rehabilitation Plan

The following plan follows the system Rehabilitation Domain Model (Mikli and Kaesehagen (2009), which is based on the ICMM (2008) Domain Model.

4.1 Determine all Site Characteristics

The following site characteristics were considered in establishing Rehabilitation Domains:

- **Soil characteristics:** Most of the Mine Site contains primarily quartz and minimal soil, whereas the waste rock dumps contain quartzite, sand material and silt.
- **Landform:** the Mine Site is open relief with local elevated hills and a ridge, with the exception of the waste rock dumps.
- **Topography:** There is some natural variation in topography in the Mine Site, which has been increased as a result of the construction of open pits and waste rock dumps.
- **Compaction:** Some of the flat areas in the Mine Site are compacted from heavy vehicles, particularly hardstands, infrastructure areas and roads. The waste rock dumps may be also be compacted as a result of their formation.
- **Adjacent land uses:** The Mine Site has three adjacent land uses:
 - o Conservation (Coomberdale Chert TEC and remnant vegetation)
 - o Pasture (cattle fodder)
 - o Transport – Midland Road and Railway.

4.2 Determine End Land Uses

The Mine Site could be divided into its End Land Use. Five End Land Uses were identified:

1. **TEC Buffer:** The waste rock dumps occur adjacent to the Coomberdale Chert TEC. This rehabilitation domain may act as a buffer to prevent degradation of the TEC from edge effects such as weed invasion. The buffer may also contribute as an ecological corridor for local native fauna to adjacent remnant vegetation.
2. **Resemble Native Vegetation:** Some flat areas may be revegetated to resemble the local native vegetation in terms of structure and diversity, as part of the EPA requirements. The revegetated areas may also contribute as an ecological corridor for local native fauna between adjacent remnant vegetation and the TEC. It should be noted that the level of resemblance will be practically restricted by the altered substrate material.
3. **Pasture:** Some flat areas may be converted to a low value pasture for cattle grazing or as a thoroughfare for cattle to be moved between paddocks. Suitable sites should be located adjacent to existing paddocks for easy access to cattle.
4. **Screening:** Part of the Mine Site may be planted with local trees and large shrubs to screen it from the public's view from Midlands Road.

5. **No Rehabilitation End Land Use:** The Open Pits have no future practical end land use. Also, some of the existing roads and tracks may be kept to serve as firebreaks and/or access roads. These areas do not require to be rehabilitated if they are to be used.

4.3 Divide Mine Site into Domains

4.3.1 REHABILITATION DOMAINS

The Rehabilitation Domains were modelled on the seven Mine Closure Domains by Mine Earth (**Map 1** in **Appendix Three**). The Mine Closure Domains were either combined or further divided, according to their site characteristics and possible end land uses (Table 11).

Table 11: Rehabilitation Domains for Mine Site

Mine Closure Domain	Site Characteristic	End Land Uses	Rehabilitation Domain
Landforms (Waste Rock Dumps and ROM Pad)	Waste rock material, elevated topography	A buffer for the adjacent TEC An ecological corridor between the TEC and adjacent remnant vegetation	TEC Buffer
Ore Processing and Handling	Compacted soil, relatively flat topography, close to Landforms	Resemble local vegetation community An ecological corridor between the TEC and adjacent remnant vegetation	Revegetation
Non-process Infrastructure	Compacted soil, relatively flat topography, close to Landforms	Low value pasture	Pasture
Water Infrastructure			
Other Assets			
Roads and Hardstand Areas		Some roads/ tracks to be retained for access/ firebreaks	No Rehabilitation End Land Use
Open Pit	Deep inert pit	None	
OPTION	Adjacent and parallel to roads	Screening Mine Site from Public	Screening

The Rehabilitation Domains are presented in **Map 2** in **Appendix Three**.

4.4 Design Appropriate Treatments for each Rehabilitation Domain

The following section describes what activities are required for the End Land Use of each Rehabilitation Domain. There are four main activities described. Note that the “No End land Use” domain has been excluded, as it has no rehabilitation requirements.

4.4.1 PHYSICAL DESIGN

Three Physical Design features have been identified as necessary for the Rehabilitation Domains:

1. **Topography:** changing the shape of the area
2. **Ripping:** relieving soil compaction (where practical)
3. **Soil Scarification:** to improve revegetation success of any seeding works (where practical).

The three Physical Design techniques are further discussed in **Section 5**. The requirements for each Rehabilitation Domain is summarised in **Table 12**.

Table 12: Treatments for Rehabilitation Domains

Rehabilitation Domain	Physical Design Treatment		
	Topography	Ripping	Soil Scarification
TEC Buffer	Resemble local hill landscape	None (impractical)	None (impractical)
Revegetation	Some gentle grading may be required adjacent to waste rock dumps	If practical, relieve soil compaction where necessary	When practical due to substrate, where any seeding or brush layering is to occur
Pasture	Some gentle grading may be required adjacent to waste rock dumps	If practical, relieve soil compaction where necessary	When practical due to substrate, where any seeding or brush layering is to occur
Visual Screening	Some gentle grading may be required	If practical, relieve soil compaction where necessary	Not required

4.4.2 REVEGETATION

Two main factors need to be considered when revegetating a Rehabilitation Domain:

1. **Species selection:** Selecting appropriate plant species appropriate to substrate, rather than what species originally occurred in that location
2. **Revegetation Method:** selecting which methods are most efficient to revegetation of the Domain

Revegetation techniques are discussed in **Section 5**. The revegetation requirements for each Rehabilitation Domain is summarised in **Table 13**.

Table 13: Revegetation Treatments for Rehabilitation Domains

Rehabilitation Domain	Revegetation Treatment	
	Species Selection	Method
TEC Buffer	Local native species characteristic of adjacent TEC where possible	Topsoil, brush, broadcast seed, tubestock may be required for certain species
Revegetation	Local native species resembling local vegetation community	Topsoil, brush, broadcast seed, tubestock may be required for certain species
Pasture	Pasture species capable of growing in post-mine site soil	Broadcast seeding
Visual Screening	Large local tree and shrub species	Tubestock

4.4.3 WEED CONTROL

As discussed in **Sections 2.2.3** and **3.3**, High Priority weed species are a threat as they can reduce rehabilitation success and are a threat to the adjacent TEC. There are two weed control factors that should be considered for each Rehabilitation Domain:

1. **Strategy:** What the weed control should do to aid the Domain in reaching its End Land Use
2. **Method:** Which techniques are best to carry out the weed control in each Domain.

It should be noted that manual control is only practical for individual plants or small populations. Herbicides will be required for larger infestations. Herbicide control techniques are discussed in **Section 5**. The weed control requirements for each Rehabilitation Domain is summarised in **Table 14**.

Table 14: Weed Control Treatments for Rehabilitation Domains

Rehabilitation Domain	Weed Control Treatment	
	Strategy	Method
TEC Buffer	<ul style="list-style-type: none"> - Eradicate or reduce High Priority weed species populations while having minimal impact on revegetation - Prevent their spread into the adjacent TEC if they are known to not already occur in the TEC 	Manual removal, wicker wiping, spot spraying
Revegetation	Eradicate or reduce High Priority weed species populations while having minimal impact on revegetation	Manual removal, wicker wiping, spot spraying
Pasture	General weed control	Spot spraying
Visual Screening	Minimise weed cover to allow tubestock to establish and mature	Manual removal, wicker wiping, spot spraying

4.4.4 MINE HYGIENE

As discussed in **Sections 2.2.5** and **3.4**, mine hygiene procedures should be in place in each Rehabilitation Domain to minimise the introduction and spread of:

1. Plant Diseases: particularly Dieback
2. Weeds: particularly High Priority Weeds

An update on mine hygiene procedures is discussed in **Section 5**. The mine hygiene requirements for each Rehabilitation Domain is summarised in **Table 15**.

Table 15: Mine Hygiene Treatments for Rehabilitation Domains

Rehabilitation Domain	Mine Hygiene Treatment	
	Plant Diseases	Weeds
TEC Buffer	Prevent introduction of Dieback	Prevent introduction of High Priority Weeds or new weed species into Domain and adjacent TEC
Revegetation	Prevent introduction of Dieback	Prevent introduction of High Priority Weeds or new weed species into Domain
Pasture	Prevent introduction of Dieback	Prevent introduction of High Priority Weeds or new weed species into Domain
Visual Screening	Prevent introduction of Dieback	Prevent introduction of High Priority Weeds or new weed species into Domain

4.5 Develop Detailed Key Performance Indicators

Key Performance Indicators (KPIs) are needed to measure how works in the Rehabilitation Domains are reaching their End Land Use and meeting EPA criteria. The following

Table 16 summarises the KPIs of each activity for each Rehabilitation Domain.

It should be noted that the following KPIs are general statements and are not quantified measurements:

- minimal achievable weed cover (at variance to the EPA criteria of less than 10%)
- maximum achievable native cover (at variance to the EPA criteria of more than 70%)
- Species composition and structure resembles Adjacent TEC on comparable substrate.
- Species composition and structure resembles local vegetation community on comparable substrate.

As rehabilitation progresses and what can be practically achieved becomes apparent, Simcoa should liaise with the DMP, EPA and DEC to agree on definitions for the exact and practical thresholds for these KPIs.

Table 16: Key Performance Indicators for measuring rehabilitation works in Domains

Rehabilitation Domain	Key Performance Indicator			
	Physical Design	Revegetation	Weed Control	Mine Hygiene
TEC Buffer	<ol style="list-style-type: none"> 1. Landform resembles local hill landscape 2. Vegetation successfully establishing in soil 	<ol style="list-style-type: none"> 1. Species composition and structure resembles Adjacent TEC 2. Maximum achievable native cover 3. Self-sustaining populations of conservation significant flora 	<ol style="list-style-type: none"> 1. Minimal achievable weed cover 2. Low presence of High Priority Weeds 	<ol style="list-style-type: none"> 1. No Dieback infections 2. No new weed species detected
Revegetation	<ol style="list-style-type: none"> 3. Relatively flat terrain 4. Vegetation successfully establishing in soil 	<ol style="list-style-type: none"> 4. Species composition and structure resembles local vegetation community 5. Maximum achievable native cover 6. Self-sustaining populations of conservation significant flora 	<ol style="list-style-type: none"> 3. Minimal achievable weed cover 4. Low presence of High Priority Weeds 	<ol style="list-style-type: none"> 3. No Dieback infections 4. No new weed species detected
Pasture	<ol style="list-style-type: none"> 5. Relatively flat terrain 6. Vegetation successfully establishing in soil 	<ol style="list-style-type: none"> 7. Species composition of pasture plants 8. Maximum achievable cover of pasture 	<ol style="list-style-type: none"> 5. Minimal achievable weed cover 	<ol style="list-style-type: none"> 5. No Dieback infections 6. No new weed species detected
Screening	<ol style="list-style-type: none"> 7. Relatively flat terrain 8. Vegetation successfully establishing in soil 	<ol style="list-style-type: none"> 9. Species composition of local native trees and large shrubs 10. Maximum achievable native cover 	<ol style="list-style-type: none"> 6. Minimal achievable weed cover 7. Low presence of High Priority Weeds 	<ol style="list-style-type: none"> 7. No Dieback infections 8. No new weed species detected

5.0 Physical Design Techniques

Physical design generally refers to the shaping and grading of a site to provide stability, hydrological compatibility and visual compatibility with the surrounding area. The site must be prepared to reduce risk of rain and wind erosion. Drainage must be considered to prevent long term gullying or degradation to revegetation efforts. Slopes should be designed to reduce the velocity of runoff as the catchment of the slope increases. The final shape of the works should also be similar to the surrounding landscape to allow the site to look natural and blend in and not be an eyesore (Mineral Council of Australia 1998).

In this report, physical design also refers to the physical preparation of the site to enhance rehabilitation works. The main two factors discussed are ripping (to relieve soil compaction) and surface scarification (for seed broadcasting).

5.1 Topography

5.1.1 WASTE ROCK DUMPS

The waste rock dumps should be constructed in a manner that can maximise the disposal volume of waste material within a limited surface area, while providing slopes that are gentle enough to reduce water erosion from rain and allow establishment of vegetation. DMP generally recommends that the slope should be less than 20° , however this angle may vary from site to site, depending on soil stability – more stable dumps can be 20° slightly higher while less stable dumps should be considerably lower. Also, the slopes should not have an overly convex profile (Figure 5).

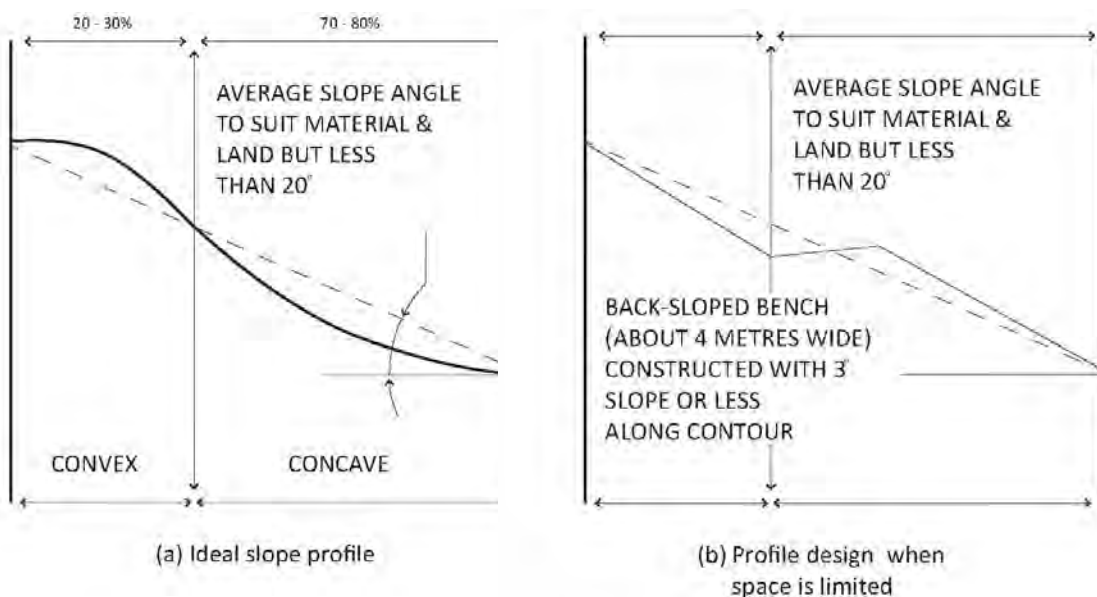


Figure 5: Shaping overburden dumps (Minerals Council of Australia 1998)

If erosion is proven to be a significant issue to the site, contour benches or other erosion control methods should be integrated into the design. Benches should be located in the middle of the slope.

The following guide describes limits of operating equipment on slopes (Minerals Council of Australia 1998):

- Ripping – up to 28 degrees
- Normal agricultural machinery – up to 19 degrees
- Bulldozers to push material up slopes – up to 22 degrees
- Spreading of topsoil – up to 19 degrees.

The dumps should also resemble the surrounding hill landscape in terms of height and size. Avoid long straight ridges and sharp angles, as this is visually unnatural. The natural shaping should also assist in reducing erosion as it will mimic the natural landscape's geological formation in response to local climate conditions.

Drainage from waste rock dumps can be directed into the surrounding area, however the surrounding surface elevation must be considered as it will affect water flow and drainage. Even slight variations in surface elevation can affect soil moisture levels and subsequent vegetation types that can be established. Concentrated water flow may also degrade the surrounding land. Water can also be directed into the pits, provided the water is not of low quality.

The maximum recommended slopes suitable for the surrounding land uses are as follows:

- pasture – 15 degrees
- roads – 12 degrees.

If possible, materials used in the construction of waste rock dumps should include those that have moisture holding capacity. This will improve the moisture holding retention within the dumps and should encourage revegetation growth. Examples of materials include organic matter (vegetation, manure, compost) and clay. It is acknowledged that securing such material may be impractical.

5.1.2 GRADING

As discussed above, any flat land adjacent to waste rock dumps are susceptible to drainage issues. Ponding and erosion may occur as a result of the surface elevation directing water flow. Gentle grading is recommended to adjust the soil surface to a gentle slope away from the dumps. This will reduce the velocity of waste rock drainage while dissipating the volume. This should also reduce the overall soil moisture profile and thus minimise any affect on vegetation type (eg no dampland vegetation).

5.2 Ripping Compacted Soil

Soils may be compacted from use of heavy machinery during construction. This compaction reduces soil aeration, moisture infiltration and root penetration. Seedlings are highly unlikely to survive and establish in such conditions, leading to poor or failed revegetation work over many years (Buchanan 1989).

Deep ripping may relieve this compaction and promote faster and more successful revegetation. Ripping should occur sometime before planting (a few months to up to a year) so the soil has time to settle and moisture penetrate deeply into the ground. It should be done when the soil is dry, to maximise shattering and reduce any clay glazing. Ripping should follow the contours of the land to allow capture and absorption of rain water. The ideal depth is between 0.5 and 1m. The distance between rips should match the depths (Buchanan 1989; Dalton 1993).

It should be noted that ripping should occur before any application of residual herbicides, to minimise penetration of the herbicides into the soil profile containing tree roots. If ripping must be done after application of residual herbicides, the ripper should have wings to throw away the contaminated soil from where the seed and tubestock are to be planted (Dalton 1993).

Ripping is only practical on substrates without large rock material. Therefore this treatment may not be considered for waste rock dumps.

5.3 Soil Scarification

Soil scarification is the preparation of the soil surface to maximise seed germination and establishment. It is useful for both brushing (when branches are laid on top of soil) and seed broadcasting methods. It involves the mechanical harrowing of the surface to provide niches for seed to lodge in, to reduce it being removed by wind or rainfall. It also increases the chances of the seeds to successfully extend their radicles (embryo roots) into the soil and begin to establish. Suitable soil scarification may greatly increase the number of native plants establishing in a rehabilitated area, particularly on slopes where wind and rain may easily remove any seeds lying on top of the soil surface (EPA 1995, MCA 1998).

There are several soil scarification technique options, depending on the size and access of the area. Small or difficult to access sites may be raked by hand, while larger and flatter areas may be scraped using machinery. Scarification should occur immediately before seeding.

Like ripping, soil scarification is only practical on substrates without large rock material. Therefore this treatment may not be considered for waste rock dumps.

6.0 Revegetation Techniques

6.1 Species Selection

6.1.1 CANDIDATE SPECIES

Seeds should be sourced from local provenance (usually within 5km of the Mine Site). They also need to be those matching the vegetation complexes. Provenance is paramount to preserving local genetics of plants.

Ideally the species used in revegetation would consist of the entire suite of plants that naturally occur at the site. This requires a comprehensive species list and the ability to propagate all the species. Additional species can be determined by examining the relevant literature for species which occurred in matching soil and vegetation associations. Appropriate species should be chosen based upon whether they were most likely to have been local and whether they were practical for the revegetation process.

All species used for seeding into Vacant Crown Land (VCL) usually needs to be accepted by DEC before they can be used.

Not all local plants may be included in seed collection. Many species are known to be extremely poor in either seed germination or establishment. It is expected that other local species should colonise the site over time.

A candidate species list should be developed after considering the following factors (Mineral Council of Australia 1998):

- have proven to grow well in previous revegetated areas within the local area, as these species demonstrate promise in establishment and survival in disturbed conditions
- are observed to grow in habitats that match the soil and drainage conditions of the rehabilitated site
- can produce sufficient viable seed to harvest economically
- have fauna habitat value, particular to conservation significant fauna
- are legume species that are good colonisers and will improve soil fertility
- are conservation significant flora, to assist in increasing their populations.

6.1.2 REHABILITATION DOMAIN SPECIES

The candidate list should then be broken down into separate Rehabilitation Domain species lists; those that suit the end land use and site characteristics of each Rehabilitation Domain:

- **TEC Buffer:** local native species that are characteristic or at least occur in the adjacent Coomberdale Chert TEC and provide habitat value to significant fauna

- **Revegetation:** local native species that are characteristic or at least occur in the local remnant vegetation and provide habitat value to significant fauna
- **Screening:** local native trees and large shrubs.

The Pasture Domain differs from the other Rehabilitation Domains in that its end land use requires exotic pasture plants. The species selection for this Domain should instead be a commercial blend of fodder species which should not present a weed threat to the natural revegetation areas.

The Rehabilitation Domain species lists are presented in **Appendix One**.

6.2 Seeding

6.2.1 PROS AND CONS

Seeding is typically a highly economical, practical and reliable method of establishing many species in large areas. Further, seeding may result in a random distribution of species, allowing for a more natural appearance to revegetated sites (Minerals Council of Australia 1998). Also, seeding allows for more wind-stable mature plants to establish, as the root systems have not been disturbed (Dalton 1993).

However, seeding may not be effective for certain works:

- The price of a seed mix is highly variable as some species prices may vary from as little as \$50/kg to over \$7000/kg (Tranen 2010).
- Seeds of species desired for rehabilitation may not be available in suitable quantities.
- Seeds of species required may not be highly viable and able to readily quickly establish on the site.
- Seeds are vulnerable to predation by local fauna such as insects and birds.
- Emerging seedlings may not be able compete with present weeds.
- Some species may not respond well to standard seed treatment (eg require a specialised dormancy breaking treatment) (Minerals Council of Australia 1998).
- Success of seed germination and seedling establishment is highly vulnerable to seasonal variations (Dalton 1993).

Species should only be chosen for direct seeding if proven to have:

- decent viability and germination success
- can be obtained commercially in sufficient quantities
- are economically affordable.

ALCOA has recently released a report of germination trials of over 1100 species that occur in the Swan Coastal Plain and Jarrah Forest that may assist in selecting species of decent to high germination success (Cromer 2007). The commercial and economic status of species seed can be obtained through consultation with seed suppliers.

6.2.2 COLLECTION AND PURCHASE

Ideally plant material should be sourced from near the site, with no more than one third of the available seed being collected from any individual plant and numerous “parent” plants used. This avoids issues of:

- inbreeding where too few “parents” are used and the seedlings produced lack vigour
- genetic pollution due to the introduction of dissimilar genetic material (from a different area) which can result in sterile plants or a form of a species not native to the site becomes rampant.

However sourcing material nearby maybe quite difficult due to extensive disturbance and/or clearing in the vicinity and there is presently a dearth of information in the public domain with regard to the distances at which genetic variation becomes important for native species. The precautionary principle needs to be taken in sourcing material as close to the site as possible and attention given to record keeping and obvious morphological differences between plants occurring onsite and seedlings planted.

The following items are important in securing native seeds (EPA 1995, MCA 1998, DMP 2011):

- Collection should focus on the seed of species that are known to be practical to collect, have at least reasonable level of viability and retain that viability for at least several years.
- Most native species are collected during the summer months (from spring flowering) however there are species (such as *Macrozamia*) that are best collected during winter.
- Seeds of some species (such as *Clematis*) are recalcitrant (very short lived). Such species should only be collected if they are planned to be used the following winter.
- Seeds should be collected when fully ripened to maximise viability. Collecting too early both damages the reproductivity of the plant and greatly lowers revegetation success.
- Seed collection must be undertaken with the appropriate licence from the DEC. Pickers must have their licences updated to be permitted to collect in the desired areas.
- It is forbidden to collect from road reserves or road sides, unless the collector has special permission from the Main Roads Department and the DEC.
- Collectors must seek and obtain permission from land owners before collecting seed from private land.
- Only 20% of seeds may be collected from a plant and from an area. This is to maintain sustainability of both the plant population and future seed collection.
- Seed collecting should be conducted in a manner that does not harm the parent plant. (Technically only seed pods are to be taken, although this is often impractical - so the ends of branches together with the seed pods are cut off with secateurs for many species). Removal of the entire plant is forbidden.
- Records must be maintained by the collector as to the location, amount and date of seed collected of each species.

- Declared and Priority species must not be collected without special written permission from the DEC.
- OS&H issue - Collectors should wear full PPE (boots, pants and long sleeved shirt, hat, safety sunnies, gloves and sunscreen) in the field.

Ideally it is advantageous to have seeds independently tested for viability so to understand their likelihood for germination success, but this option can be expensive. Viability results can also be compared to Alcoa's germination records to work out any "bad batches" of seed. In some cases, companies can refuse purchase of seeds if the viability of a seed batch is below expectations.

A Native Species Identification Guide is located in **Appendix Five**. The guide is to assist in identifying the most important native flora species for revegetation, in order to assist in seed collection. The species were selected if they were one or more of the following:

- conservation significant
- locally dominant
- characteristic of the Coomberdale Chert TEC.

6.2.3 SEED STORAGE

The following items are important for efficient storage of seeds (EPA 1995, MCA 1998, DMP 2011):

- Seeds should be kept in airtight bags that have been treated with CO₂ so as to kill any insects present in the seed collection. The seed material should be inspected for pest damage, mould and fungus on a regular basis and action taken to avoid seed deterioration.
- Seeds should be stored in vermin proof containers above ground level, away from light, in secure, dry, well-ventilated storage facilities protected from temperature extremes (preferably air conditioned).
- It should be noted that seeds of certain plant species can only be stored for several years before they lose viability. Records must be maintained to ensure that the seeds are replaced within a period of time to ensure the entire stock is of high viability. Ideally the old seeds should be broadcasted back in their appropriate vegetation community, as some seeds may still germinate and contribute to the area's flora presence.
- Some species (such as *Persoonia*) require to be immediately stored in refrigerated conditions after collection to preserve viability.

6.2.4 SEED TREATMENT

Seed batches should be treated to break their dormancy before they are sown. Up to 75% of the seeds should be treated to encourage germination in the first year. The remaining dormant seed will form part of the soil seed bank and are expected to germinate in later years, assisting in promoting long term revegetation success. The two main types of seed treatment are described below.

Smoke

It is well known that smoke contributes greatly to the germination of Australian native seeds. Work by Kings Park has isolated the chemical responsible and have named it karrikin (Flematti et al. 2004), after the Noongar word for smoke “karrik”. Karrikin is a plant growth regulator that is formed and released from the burning of plant material. It acts as a stimulant to break seed dormancy. The commonly accepted theory is that native plants have adapted to produce seeds that germinate after a bushfire, to take advantage of the ash nutrients released and of space and light.

Seed smoking is now a common practice in revegetation. There are two main methods to smoke seeds. Many commercial seed suppliers have a seed smoking chamber and offer it as a service. Smoke water (smoke bubbled through water) is also commercially available. Seeds can be treated by simply spraying a thin layer of the liquid.

All species should receive smoke treatment, as this treatment cannot damage the seeds and can only promote germination.

Scarification

Many native seeds, such as legumes, have hard seed coats which are impermeable to air and water. Germination of the seeds cannot occur until the coat is cracked. In nature this is done over time by sand scarification in the top soil. Revegetating areas with such seed may result in seed germination not occurring for many years.

To hasten revegetation success, the seeds may be artificially scarified to crack the seed coats. One methods include brief exposure in boiling water (EPA 2005), however this is impractical for large scale works. A more appropriate method is to used specialised scarification machines that use coarse sandpaper to mechanically abrade the seeds. Many native seed suppliers have such machines and offer them as a service.

All species with hard coated seeds, such as members of *Acacia* genera, should be scarified to promote germination. No fine or soft seeds should be scarified, as this will most likely damage the seeds.

6.2.5 BROADCASTING SEED

Seeding rates vary from site to site and depend on local condition and the type and condition of the seeds. The generally accepted industry rates for native seed broadcasting are:

- completely bare areas – 6 to 8 kg/ ha
- areas with some remnant vegetation – 3 to 4 kg/ ha.

Inert material (eg sand) should be mixed into the seed mix as filler. Seeds should ideally be broadcasted in early winter just after first rains to allow minimal loss from predation and wind before the rain can settle the seeds into the soil and start germination (EPA 2005).

Seeds used for revegetation need to first be tested for viability to ensure an adequate percentage of the seeds are alive. Seed batches purchased from suppliers need to be independently tested by a qualified seed testing laboratory to determine percentage viability of each species. Seed batches that are found to have percentage viabilities below than what is expected for that species will be returned to the supplier and the purchase refunded.

6.3 Brushing

6.3.1 PROS AND CONS

One problem in using broadcast seeding in revegetation is the limited choice of species to collect seeds from. Species that retain unopened fruit for over a year (bradysporous species) are rarely used in seed mixtures as such because of the difficulty of collection. One potential method of direct seeding such species is by spreading foliage with the capsules directly onto the site. The seeds are then shed when the capsules dry out (EPA 1995; Nicholls 1983). This process, termed brushing, may prove to be a relatively cheap and easy method of revegetating spoils using Myrtaceae genera with capsule fruits, such as *Calothamnus*, *Kunzea*, *Melaleuca* and *Regelia*.

Brushing is used successfully in Western Australia. Mulch of stripped native vegetation provides 85 % of the germinable seeds that occur on rehabilitated sand mine soils at Eneabba (Peterson & Herpich 1996). Thirty one taxa, from Myrtaceae, Casuarinaceae and Proteaceae, including species of *Melaleuca*, *Leptospermum* and *Eucalyptus*, established from seeds in the applied mulch (Bellairs 1990).

In addition to seed provision, brushing is valuable in rehabilitation for restoring insects and other biota; some nutrient recycling; and, formation of micro-sites (Pywell, Webb & Putwain 1995; Ross, Simcock & Gregg 1995). When the branches dry, the seeds are released into a secondary mulch of fallen leaves, which may assist in forming a seedbed, allowing long-term germination of up to five years (Nicholls 1983). The branches may also improve the growing environment by increasing humidity and temperature (Porteous 1993), providing organic matter and protection from wind and water erosion (Bell, Carter & Hetherington 1986) and reducing the entry of grasses and other weeds to the site. Some consider this method potentially more economical than broadcast seeding (Pywell, Webb & Putwain 1995).

6.3.2 METHOD

There are several steps for brushing to be successful. Firstly, the site of harvesting must be easily accessible to transport the branches, and also must be near the revegetation site, so the species are ecologically suited to the new site (Nicholls 1983).

Secondly, the method of harvesting and applying the branches is important. Dense, brush like branches are ideal for brushing, as the material is easy to cut, transport and lay (Nicholls 1983). The branches should be laid thickly enough to break the impact of rain, but not so thickly as to prevent germination (Porteous 1993). Fifty to sixty percent cover is usually ideal on standard slopes (Nicholls 1983), lowering to thirty percent cover on gentle slopes (Simcock *pers comm.*). The branches should be laid across the slope to capture falling debris and reduce run off. Material can be tied down with stakes or biodegradable netting on sites with steep slopes or wind problems (Nicholls 1983; Porteous 1993).

6.4 Climate Change

Recent local climate patterns have indicated a significant drop in total annual rainfall. Revegetation activities are totally dependent on the Mine Site receiving adequate rainfall for seedlings to germinate and for revegetation to establish and survive. Irrigation is not an option as the installation is cost prohibitive and the Mine Site is unlikely to secure enough water.

If the amount of rainfall continues to decline or not occur over a suitable period, the EPA criteria and associated KPIs will become increasingly difficult to achieve. In such circumstances, Simcoa will need to liaise with DMP, EPA and DEC over how to address the low rainfall and whether the completion criteria may be amended.

7.0 Weed Control Techniques

7.1 Collecting Baseline Data on Weed Cover

It is vital that baseline data be obtained for an understanding of the weed cover. This will allow for a proper evaluation of the rehabilitation efforts and help determine any impediments. It will also help in the evaluation of the EPA criterion of 10% weed cover and determine whether they are suitable and realistic for the site.

As there is still some remnant vegetation in the Mine Site, these areas can be used as reference sites. It is recommended that at least 3 sites across the site be surveyed to establish any variation in the weed cover. An area of 10 m by 10m should be randomly chosen at each site and the percentage weed cover determined. Surveying should be conducted in late Spring to coincide with the annual monitoring works.

The results of this baseline assessment will help determine the next course of action:

- If the baseline percentage weed cover average proves to be close to the current rehabilitation sites (>40%), Simcoa should submit an S.46c variation to conditions to amend the EPA criterion of 10% weed cover to a figure that matches the pre-existing environment. Weed control works should not be necessary.
- If the baseline percentage weed cover proves to be close to 10%, weed control activities will be required to reduce weed cover in the rehabilitation areas to meet the EPA criterion.
- If the baseline proves to be between the EPA criterion and the rehabilitation dumps (ie 20-30%), Simcoa should both submit a S.46c form and undertake weed control activities.

7.2 Weed Strategy

If it is determined that rehabilitation sites' weed cover exceeds the baseline weed cover, weed control work will be required to reduce the presence of weeds. A strategy is required to best reduce weed cover with minimal time and with minimal resources.

The following Weed Strategy has a two stage approach:

1. **Species-led Control:** A species-led control should first be undertaken. High Priority Weeds should be targeted first to eliminate or at least reduce their populations.
2. **Site-led Control:** Once High Priority weeds are controlled, a site-led control should be undertaken to reduce any areas that have high weed cover.

7.3 Weed Species Priority

As discussed in the previous section, resources should be first focused at controlling High Priority weeds, as these are considered the most invasive and threatening to the Mine Site. However, weed species which were determined as High Priority should not be excluded from control activities if there are enough resources available.

In general:

- species with a final rating of 5 or 6 (High Priority) should be targeted first
- species with a final rating of 3 or 4 (Moderate Priority) should be controlled opportunistically if resources allow after targeted control of High Priority Weeds
- species with a final rating of 1 or 2 (Low Priority) should be controlled opportunistically if resources allow after control of Moderate and High Priority Weeds.

It should also be noted that as weed control of priority species progresses, other weed species which previously may not have been rated as highly, may become more important. Therefore, it is important to keep weed control programmes flexible and updated according to monitoring data, to ensure that as bushland condition changes and weed species dominance changes, the control activities are adjusted accordingly.

The priority of all known weed species in and around the Mine Site is presented in **Table 16**. Guide sheets on how to identify and control each High Priority weed species are provided in **Appendix Five**. A table summarising how to control all weed species is also presented in **Appendix Five**.

7.4 Optimal Times to Control Weeds

Most weed species have optimal times of the year when they should be controlled. Weed control operations are best conducted targeting many species as possible during their optimal times to reduce the number of site visits required. This would reduce the need for management and minimise the costs and resources. It is more important to target all high priority weed species during these operations, and only include moderate and low priority weed species if resources allow.

The optimal times to target the most amount of weed species is in August (27 species). This is common time where plants are actively growing from the winter rain and being more susceptible to absorbing the herbicide, and before the can set seed. Further works are required in May and November to target the remaining five species whose active growth and seed set times occurs in other times of the year.

The optimal times are presented in **Table 16**.

Table 17: Optimal control times for controlling weeds in Simcoa Quartzite Mine, Moora

PRIORITY	WEED SPECIES		OPTIMAL CONTROL TIME														
	Scientific Name	Common Name	J	F	M	A	M	J	J	A	S	O	N	D			
High	<i>Avena barbata</i>	Bearded Oat								■	■	■	■	■			
	<i>Bromus diandrus</i>	Great Brome								■	■	■	■	■			
	<i>Centaurea melitensis</i>	Maltese Cockspur								■	■	■	■	■			
	<i>Cynodon dactylon</i>	Couch	■	■										■	■	■	
	<i>Ehrharta calycina</i>	Perennial Veldt Grass							■	■	■	■	■	■			
	<i>Ehrharta longiflora</i>	Annual Veldgrass									■	■	■	■	■		
	<i>Hypochaeris glabra</i>	Smooth Cats Ear						■	■	■	■	■	■	■	■		
	<i>Arctotheca calendula</i>	Cape Weed								■	■	■	■	■	■	■	
	<i>Erodium botrys</i>	Long Storksbill							■	■	■	■	■	■	■		
	<i>Vulpia myuros var. hirsuta</i>	Rat's Tail Fescue								■	■	■	■	■	■		
Moderate	<i>Aira caryophyllea</i>	Silvery Hair Grass									■	■	■	■	■		
	<i>Aira cupaniana</i>	Silvery Hair Grass									■	■	■	■	■		
	<i>Briza maxima</i>	Blowfly Grass								■	■	■	■	■	■		
	<i>Bromus rubens</i>	Red Brome									■	■	■	■	■		
	<i>Erodium cicutarium</i>	Common Storkbill							■	■	■	■	■	■	■		
	<i>Helichrysum luteoalbum</i>	Jersey Cudweed									■	■	■	■	■	■	
	<i>Pentameris airoides</i>	False Hair Grass									■	■	■	■	■		
	<i>Petrorhagia dubia</i>	Velvet Pink									■	■	■	■	■		
	<i>Polypogon monspeliensis</i>	Annual Barbgrass									■	■	■	■	■		
	<i>Romulea rosea</i>	Guildford Grass									■	■	■	■	■		
	<i>Solanum nigrum</i>	Black Nightshade										■	■	■	■	■	
	<i>Sonchus oleraceus</i>	Common Sowthistle										■	■	■	■	■	
	<i>Urospermum picroides</i>	False Hawkbit										■	■	■	■	■	
	<i>Ursinia anthemoides</i>	Ursinia							■	■	■	■	■	■	■		
	<i>Trifolium arvense</i>	Hare's Foot Clover										■	■	■	■		
Low	<i>Brachypodium distachyon</i>	False Broome									■	■	■	■	■		
	<i>Bromus alopecuroides</i>	Weedy Brome									■	■	■	■	■		
	<i>Conyza bonariensis</i>	Flaxleaf Fleabane									■	■	■	■	■		
	<i>Cucumis myriocarpus</i>	Prickly Paddy Melon	■	■										■	■	■	
	<i>Lysimachia arvensis</i>	Pimpernel	■	■								■	■	■	■	■	
	<i>Oxalis corniculata</i>	Yellow Wood Sorrel									■	■	■	■	■		
	<i>Avellinia michelii</i>	Avellinia									■	■	■	■	■		
	<i>Monoculus monstrosus</i>	Stinking Roger									■	■	■	■	■		
	<i>Zaluzianskya divaricata</i>	Spreading Nightphlox									■	■	■	■	■		

■ Optimal control time

7.5 Weed Types

It is important to understand the biology of each identified weed species in order to determine the best way to control them. Knowledge should focus on how the plant grows and propagates in order to both remove the existing plants and to prevent future generations. As such, the identified weed species were separated into four types, according to their biology and the type of control methods.

The following section describes the biology of each of the four weed types and notes which of the above control method are the most effective to control that type. It also lists which weed species belongs to that weed type and their priority.

7.5.1 GRASSES, SEDGES AND RUSHES

Grass, sedge and rush species are all monocots. As such, they have similar physiology which makes them susceptible to certain herbicides that may not be as harmful to broad leaf plants. Using grass selective herbicides such as Fusilade® may assist in controlling monocot weeds while having minimal impact to adjacent broad leaf native plants. Herbicides may be applied through wicker wiping or spot spraying.

Many of these species are highly competitive with native plants and can dominate the understorey. Most monocot weeds, particularly annuals, produce high numbers of seeds to ensure seedling recruitment in the following year. It is therefore vital to control infestations before they set seed to prevent further spread of these populations.

Cynodon dactylon (Couch) is a lawn grass, so can also spread by rhizomes and stolons. If the grasses cover the ground, effectively forming a lawn, they may in some circumstances be controlled by smothering them in black plastic in summer. If the grasses are invading into bushland areas, they may be controlled by manually gathering the spreading rhizomes/ stolons and removing them off the site.

A total of 15 weeds species were grasses. Six of them are rated High Priority:

- *Avena barbata* (Bearded Oat).
- *Bromus diandrus* (Great Brome)
- *Cynodon dactylon* (Couch)
- *Ehrharta calycina* (Perennial Veldt Grass)
- *Ehrharta longifolia* (Annual Veldt Grass)
- *Vulpia myuros* var. *hirsuta*.

The remaining nine grass species are Low to Moderate Priority to control:

- *Aira caryophyllea* (Silver Hair Grass)
- *Aira cupiana* (also Silver Hair Grass)
- *Avellinia michelii* (Avellinia)
- *Brachypodium distachyon* (False Brome)
- *Briza maxima* (Blowfly Grass)
- *Bromus alopecuroides* (Weedy Brome)
- *Bromus rubens* (Red Brome)
- *Pentameris airoides* (False Hair Grass)
- *Polypogon monspeliensis* (Annual Barbglass).

No sedge or rush weed species were recorded.

7.5.2 GEOPHYTES

Many geophyte weeds are 'garden escapes'; originally planted in people's gardens for aesthetics where seeds have entered adjacent bushland. Most of these species are Irises (family Iridaceae) from the cape region of South Africa. The similar climate and soil types made the Perth metropolitan region and south west highly suitable for these species to proliferate and become major environmental weeds. The Geraldton Sandplain region is generally less ideal but still suitable for many geophyte species.

Only two geophyte species has been recorded in the Mine Site:

- *Oxalis corniculata* (Yellow Wood Sorrel) – Low Priority
- *Romulea rosea* (Guildford Grass) – Moderate Priority.

Geophyte weeds are plants capable of reproducing through underground propagules such as bulbs, corms and tubers. Normal weed control practices are inefficient, as the parent plant may be killed, but the plants may return from sprouting underground propagules. Weed control therefore requires targeting the propagules as well as the parent plant.

If the populations are small, it may be practical to manually remove the plants. Care must be taken to dig around each plant and ensure that all of the underground propagules are also removed, otherwise new plants will appear in the following year.

Certain herbicides such as chlorsulfuron, metsulfuron and 2, 2 DPA are often used to control geophytes, as they can poison both the parent plant and the underground propagules. Such herbicides are best applied when the plants are flowering to maximise the absorption into the propagules. Application can be carried out by either wicker wiping or spot spraying, depending on the species (eg wicker wiping is ineffective on Guildford Grass but is highly effective on Watsonia). Special care must be taken to ensure that adjacent native plants are not exposed to these harmful chemicals.

7.5.3 BROAD LEAF HERBS

Along with grasses, broad leaf herbs are usually the most common type of weed species in a bushland. Most species do not invade good condition bushland, rather they are opportunists that enter when a site is disturbed. Broad leaf herbs are generally easier to control than geophytes, as they only spread by seed and do not have underground propagules. Such weeds should therefore be controlled before they can set seed, as this is their only method of reproduction.

Broad leaf herbs can be controlled through most general methods. Small populations should be manually removed before they set seed. Care must be taken to remove the crown and taproot, otherwise plants may resprout. Most species are susceptible to glyphosate when actively growing, although other herbicides may be required on some glyphosate tolerant species. Herbicide

application may be though either wicker wiping or spot spraying, depending on the size and nature of the infestation in each reserve.

Four of the recorded broad leaf herb species are rated as High Priority to control:

- *Arctotheca calendula* (Cape Weed)
- *Centaurea melitensis* (Maltese Cockspur)
- *Erodium botrys* (Long Storkbill)
- *Hypochaeris glabra* (Flatweed).

The remaining 14 species are rated Low to Moderate priority to control:

- *Conyza bonariensis* (Flaxleaf Fleabane)
- *Cucumis myriocarpus* (Prickly Paddy Melon)
- *Erodium cicutarium* (Common Storkbill)
- *Helichrysum luteoalbum* (Jersey Cudweed)
- *Lysimachia arvensis* (Pimpernel)
- *Monoculus monstrosus* (Stinking Roger)
- *Pentameris airoides* (False Hair Grass)
- *Petrorhagia dubia* (Velvet Pink)
- *Solanum nigrum* (Black Nightshade)
- *Sonchus oleraceus* (Common Sowthistle)
- *Urospermum picroides* (False Hawkbit)
- *Ursinia anthemoides* (Ursinia)
- *Trifolium arvense* (Hare's Foot Clover)
- *Zaluzianskya divaricata* (Spreading Nightphlox).

7.6 Herbicide Control Methods

A variety of control methods for each weed species has been provided in **Appendix Five**. Weed management recommendations are based on information from Moore and Moore (2008) *Herbiguide*, Brown and Brooks (2002) *Bushland Weeds*, and Dixon and Keighery (1995) *Recommended Methods to Control Specific Weed Species*.

It is necessary that the application of herbicides be in accordance to labelling requirements or the manufacturers Materials Safety Data Sheet (MSDS) and must be undertaken by personnel trained in the use of herbicide chemicals. The application of any herbicide for purposes not specified on the labelling requires an Off-Label Permit from the National Registration Authority in Canberra.

The application of herbicides must also be in accordance with water catchment restrictions. Chemical based weed control strategies in particular must recognise potential adverse impacts on water resources such as lakes, wetlands, streams, rivers and dams. Clearly, significant control

measures must be implemented in Public Drinking Water Sources Areas for the water we consume. The Department of Water's (DOW 2000) *Statewide Policy No.2 Pesticides in Public Drinking Water Sources Areas* will provide further advice on this matter.

Timing is crucial in having an effective impact on weeds. Generally, weed populations should be targeted when actively growing (ie usually in spring) to allow maximum uptake of the chemical, but before flowering, to prevent seed spread. In certain cases, this time window can sometimes be reduced to target weed species without harming native species (eg many annual grass weed species flower before native grasses) (Hussey & Wallace 2003). However, it should be noted that the timing for the targeting of specific weeds presented in this report is an estimate only, as it can vary according to time of year of fire and the impact of fire on native vegetation and the soil seed bank.

Where possible, a variety of herbicides were recommended for controlling each weed species. It is up to Simcoa to decide which herbicide is the most appropriate to use, depending on costs and availability of the herbicides.

It should also be noted that the herbicide treatments are a suggestion only and many were adapted from large scale agriculture rates. The types and rates of herbicides should be verified by a qualified weed scientist before any such methods are used on the Mine Site.

Details of herbicides recommended for controlling weeds in the Mine Site are also provided in **Appendix Four**.

7.6.1 TECHNIQUES

There are several recommended techniques in applying herbicides to weed species. These methods vary as to which is the most effective in treating certain weed species, depending on:

- form of weed (eg herb, shrub or tree)
- the size and distribution of weed populations in the area
- effectiveness in targeting the weeds without harming adjacent native plants.

1. Wicker Wiping

Herbaceous weed species may be treated with herbicide by wicker wiping. This involves sponge or rope soaked in a concentrated herbicide solution which is wiped against the leaves of the plant (Dixon & Keighery 1995). Wiping is often more effective in targeting weed plants and not harming adjacent native plants, however this process may be more labour intensive. Weeds most ideal for this treatment are small populations of small shrubs and broadleaf herbs.

2. Spot Spraying

Spot spraying involves fine spraying a weak solution of herbicide over the foliage of the weeds. Certain tree species may also be treated by spot spraying the base of the trunks with herbicides

diluted in diesel. Care must be taken to avoid spraying adjacent native plants. Use of selective herbicides may reduce impact of herbicides on native flora (Dixon & Keighery 1995).

Recommended dosages of each herbicide given were calculated for a 10L knapsack.

8.0 Mine Hygiene Procedure

8.1 Dieback Hygiene

8.1.1 DIEBACK MANAGEMENT

Prevention

There are two main factors in introducing plant diseases to the Mine Site:

- vehicle and foot traffic
- import of equipment and supplies.

It should be noted that Simcoa can only provide facilities and procedures to minimise the introduction and spread of diseases; the threats cannot be completely prevented.

Simcoa's site staff should continue to be trained in:

- identifying any disease outbreak
- knowing how to control the outbreak or minimise its spread.

Simcoa site staff should be given appropriate equipment to prevent diseases from being introduced into rehabilitated areas. The staff should continue to inspect and clean all footwear and vehicles before going to rehabilitated areas. Similar to vehicles, all incoming equipment should be inspected and cleaned if necessary (Hussey & Wallace 2003).

All incoming materials may potentially contain disease. Therefore Simcoa should ensure that materials only come from disease free sources. This includes any rehabilitation material, such as tubestock and soil. Such material may be obtained from certified sources (CALM 2003).

Any visiting contractors or consultants should be briefed on hygiene procedures before entering the site. This briefing may be part of the site induction.

8.2 Weed Hygiene

8.2.1 INTRODUCTION AND SPREAD OF WEEDS

Similar to plant diseases, weed seeds may be introduced and spread to the Mine Site through equipment, vehicles and footwear. It may also be introduced from infested adjacent lands, including the pasture and local vegetation. Remnant revegetation within the Mine Site contain weeds, however the exact species and infestation levels are currently unknown.

8.2.2 WEED MANAGEMENT

Prevention

All incoming equipment and vehicles should be examined and cleaned before being allowed to enter the Mine Site. This can be done at the same time and use the same facilities as disease inspections. Any on ground staff should be educated in how to clean their footwear to remove any weed seeds.

Any materials imported for revegetation works (such as tubestock, seeds and soil) should come from certified sources to minimise risk of weeds being introduced.

Control of weeds onsite

All on site Simcoa staff should be trained to identify and control High Priority Weeds. All areas should be routinely inspected and controlled for weeds; this includes along tracks and roads, around buildings and equipment and in remnant bushland. The Weed Management Guide Sheets in **Appendix Five** will aid in educating staff in effective identification and control.

9.0 Monitoring and Maintenance

9.1 Monitoring

Monitoring is essential to verify the progress of the Rehabilitation Plan and whether the works are suiting the End Land Uses and are progressing towards meeting the KPIs and EPA Criteria.

The current established quadrats should be continued to be monitored. New quadrats should be established each time an area has received initial revegetation work (ie topsoil and brush, any seeding or tubestock).

Items to be formally assessed include, but are not limited to, the following:

- native species diversity
- vegetation structure
- native vegetation cover
- weed species
- weed cover
- vegetation condition
- causes of any degradation of plant health
- signs of erosion or other site degradation.

The assessment should also make any comments and recommendations for maintenance of amendments in rehabilitation practices, if required.

9.2 Maintenance

Maintenance shall be conducted as deemed necessary by Simcoa to ensure each of the revegetation areas will comply with the KPIs and EPA criteria.

9.2.1 TREATMENTS

The following maintenance works may be required for each Rehabilitation treatment:

- **Physical Design:** infilling any gullies formed by erosion, minor reshaping or grading to redirect water flow
- **Revegetation:** infill planting of tubestock, seed broadcasting, brush layering
- **Weed Control:** targeting of High Priority weed species to reduce their cover
- **Hygiene:** containment of any disease outbreak.

Maintenance activities should follow the guidelines and procedures described in the relevant Sections of this report (**Sections 5 to 8**).

10.0 Revegetation Trials

As discussed in **Section 3.2**, trials are required to improve revegetation success and to meet the EPA criteria. The following trials are recommended to improve native species diversity, establish self-sustaining populations of conservation significant flora and to determine appropriate substitute material for topsoil and brush.

It should be noted that although much effort has been given here to detail each trial, such works should be further designed and conducted by an experienced restoration ecologist.

10.1 Diversity Trials

The diversity of the revegetation works may be improved by determining what other local native species may establish in the rehabilitation areas.

10.1.1 DIVERSITY TRIAL 1 – BROADCAST SEEDING

Seeding trials may determine which species may successfully establish the waste rock dumps via seeding. Such species can then be introduced in current and future rehabilitation areas to increase their native diversity.

A list of suitable candidate species for this trial has been presented in **Appendix One**. All species are known to be collectable and are generally reliable to have decent to high viability. The seed mix should be made in a manner that ensures that each species is fairly balanced. If there is only little seed of a particular species available, this should be considered in the assessment process (ie such species cannot be expected to produce as many seedlings as a species that had higher amount in the seed mix).

Prior to broadcasting, the seeds should be treated to break dormancy. All seeds should receive smoke treatment and hard coated seeds should be scarified. Broadcasting should be on at the start of winter rainfall (ie around end of May/ start of June). Seed treatment and broadcasting are further discussed in **Section 6.3**.

An appropriate sowing rate for the seeding trials is 10 kg/ ha (10g/ 10 sq m). Although the hectare rate may seem excessive, it will ensure that enough seeds of each species are present to germinate within the small trial area.

Trial plots should be at least 10 m by 10 m, marked with stakes and the position recorded with a handheld GPS. The surface within each trial areas should be scarified using a rake to ensure enough seeds may be lodged and not blown or washed away.

At least 3 (ideally 5), replicate trial plots are recommended to provide enough data for proper statistical analysis. Trials also may be repeated in various placements to determine whether certain species are more ideal for those conditions. For example, some native species may germinate and establish better on top of the waste rock dumps, while others perform better in more sheltered positions.

Each trial plot should be monitored on an annual basis. Any weeds observed should be removed in a manner that will not disturb the native seedlings (eg manual removal). Monitoring should occur for at least five years to determine which species can successfully establish in rehabilitated areas.

Monitoring should record the following for each native species:

- number of seedlings (abundance)
- health
- an estimate of average height
- cover.

The results of the trial should determine which species are most successful in establishing in the rehabilitated areas and whether they can contribute to native diversity and vegetation cover.

10.1.2 DIVERSITY TRIAL 2 – OPTIMAL HARVEST TIME FOR REMNANT VEGETATION

The topsoil and remnant vegetation material are simultaneously harvested in May to June, when mining activities occur. The current practice occurs on the logic that the topsoil and vegetation brush should be transferred as soon as possible onto newly structured waste rock dumps, so to minimise the degradation of the topsoil. It is also more practical to combine and spread the topsoil and brushing across the dumps in one operation.

While this practice is optimal for topsoil management, it is questionable as to whether the practice is optimal for obtaining the maximum amount of native seeds from harvesting the native vegetation in May to June. It is possible that the seeds being retained in the some of the species' capsules are immature or have already been released. If so, this means that the vegetation harvesting is resulting in a lower diversity and amount of seeds for rehabilitation. It also may be possible to harvest vegetation that contains less *Allocasuarina* seeds, so to delay, or even prevent, these species dominating on rehabilitation areas.

The following trial is to determine whether there is an optimal time to harvest the remnant native vegetation to improve the success of brushing in rehabilitation efforts.

Firstly, each species needs to be assessed for whether they retain their seeds (bradysporous) or drop their seeds into the seed soil bank (geosporous). Mature specimens of each bradysporous species should be inspected in the field and capsules opened every month for a year to determine when the seeds are viable. Records of their viability period of each bradysporous species should be kept. The

optimal time may then be determined when most bradysporous species have viable seeds retained in their capsules (and if possible, when mature *Allocasuarina* plants do not have viable seeds). When this optimal time is determined, the harvest time may be reconsidered in terms of practicability of site works.

10.2 Conservation Significant Species Trials

Under EPA Bulletin 1027 (2001), Simcoa has committed to conducting trials with any threatened flora removed by their mining operations. Trials should be conducted on the following threatened flora:

- *Acacia aristulata* (T)
- *Daviesii dielsii* (T).

Revegetation trials are needed to best use available seed sources to maximise population size for all conservation significant species. However, as *Acacia aristulata* and *Daviesii dielsii* are both Commonwealth and State listed, seeds may be unavailable or limited. Simcoa will need permission from the DEC to harvest any seeds of threatened flora from nearby local native vegetation.

Previous records indicate that some seedlings of both species have established on overburden dumps (Trudgen 2007), so both species have the potential to have self-sustaining populations.

10.2.1 CONSERVATION SIGNIFICANT SPECIES SEEDING TRIAL

Further trials should be conducted to test whether populations of the threatened species *A. aristulata* and *D. dielsii* may be established from seeding.

A seeding trial similar to that described in **Section 10.1.1** should be conducted. The only difference in the trial method is that the trial areas may be reduced to 5m x 5m. The seeding rate may also need to be reduced if there are not enough seeds available.

10.3 Topsoil Substitute Trials

It has been noted that the Mine Site will soon run out of topsoil and remnant vegetation. Both have been vital for current revegetation practices, particularly as a supply of native seeds and propagules and in supplying a “bed” for plants to establish in. While seed collection has been recommended to address the shortfall in propagules (**Section 3.3.2**), trials are needed to find suitable topsoil substitutes for future revegetation works.

A number of by-product materials have been identified on site that may prove appropriate:

- silt from the settlement pond
- 0-3 mm silica/ quartz fines.

Other locally available materials near the Mine Site should also be searched for, such as soil from nearby properties. Any imported material should be first be weed free and tested for contaminants and diseases (as part of the Mine Hygiene Procedures, further detailed in **Section 9**).

All of these materials should be first tested to determine whether they present any OSH concerns. Provided they are inert/ harmless, trials could be conducted to determine whether either or a combination of these materials may improve the growing conditions of seedlings compared to growing directly on the overburden material.

The trials should be conducted in a manner similar to the seeding trials, only the plot size should be expanded to allow for combination of substitute materials. For example, if only silt and silica/quartz fines are available, each plot area should be expanded to 20 m x 20 m and divided into four sections of 10 m of 10 m, with each section receiving one of the following treatments:

- no treatment (control)
- silt
- silica/ quartz fines
- silt and silica/ quartz fines.

If the substitute topsoil trials indicate that seedlings are suffering from nutrient deficiency, fertiliser trials may be considered. Such treatment should be done cautiously, using low amounts of native plant fertiliser, to discourage proliferation of weeds.

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Appendix One: Flora Tables

Table 18: Species inventory of native vegetation in and adjacent to Simcoa's Moora Quartzite Mine

Family	Species	Weed	EPBC	DEC
AMARANTHACEAE	<i>Ptilotus ?divaricatus</i>			
	<i>Ptilotus polystachyus</i>			
APAIACEAE	<i>Hydrocotyle callicarpa</i>			
	<i>Trachymene cyanopetala</i>			
	<i>Trachymene ornata</i>			
	<i>Trachymene pilosa</i>			
	<i>Xanthosia fruticosa</i>			
ASPARAGACEAE	<i>Chamaescilla</i> sp.			
	<i>Dichopogon capillipes</i>			
	<i>Thysanotus manglesianus</i>			
	<i>Thysanotus patersonii</i>			
ASTERACEAE	<i>Arctotheca calendula</i>	*		
	<i>Blennospora drummondii</i>			
	<i>Centaurea melitensis</i>	*		
	<i>Conyza bonariensis</i>	*		
	<i>Gilberta tenuifolia</i>			
	<i>Helichrysum luteoalbum</i>	*		
	<i>Hyalosperma cotula</i>			
	<i>Hypochaeris glabra</i>	*		
	<i>Millotia tenuifolia</i>			
	<i>Olearia axillaris</i>			
	<i>Olearia dampieri</i> subsp. <i>eremicola</i>			
	<i>Podolepis canescens</i>			
	<i>Podolepis gracilis</i>			
	<i>Podolepis lessonii</i>			
	<i>Rhodanthe citrina</i>			
	<i>Rhodanthe laevis</i>			
	<i>Rhodanthe manglesii</i>			
	<i>Senecio glossanthus</i>			
	<i>Senecio quadridentatus</i>			
	<i>Sonchus oleraceus</i>	*		
<i>Urospermum picroides</i>	*			
<i>Ursinia anthemoides</i>	*			
<i>Waitzia nitida</i>				
<i>Monoculus monstrosus</i>	*			
BORYACEAE	<i>Borya sphaerocephala</i>			
CAMPANULACEAE	<i>Wahlenbergia gracilentia</i>			
CASUARINACEAE	<i>Allocasuarina campestris</i>			
	<i>Allocasuarina huegeliana</i>			
CAYOPHYLLACEAE	<i>Petrorhagia dubia</i>	*		
	<i>Silene gallica</i> var. <i>gallica</i>			
CHENOPODIACEAE	<i>Salsola tragus</i> subsp. <i>tragus</i>			
COLCHICACEAE	<i>Burchardia congesta</i>			
CRASSULACEAE	<i>Crassula colorata</i>			
CUCURBITACEAE	<i>Cucumis myriocarpus</i>	*		
CYPERACEAE	<i>Gahnia drummondii</i>			
	<i>Lepidosperma</i> aff. <i>costale</i>			
	<i>Lepidosperma tenue</i>			
DILLENiaceae	<i>Hibbertia subvaginata</i>			
DIOSCOREACEAE	<i>Dioscorea hastifolia</i>			
DROSERACEAE	<i>Drosera erythrorhiza</i>			
	<i>Drosera macrantha</i>			
ECDEIOCOLEACEAE	<i>Ecdeiocolea monostachya</i>			
ERICACEAE	<i>Astroloma pallidum</i>			
EUPHORBIACEAE	<i>Beyeria lechenaultii</i>			
	<i>Ricinocarpos muricatus</i>			

Family	Species	Weed	EPBC	DEC
FABACEAE	<i>Acacia ?erinacea</i>			
	<i>Acacia ?scabra</i>			
	<i>Acacia acuminata</i> subsp. <i>acuminata</i>			
	<i>Acacia alata</i>			
	<i>Acacia aristulata</i>		Endangered	Threatened
	<i>Acacia congesta</i> subsp. <i>congesta</i>			
	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>			
	<i>Acacia microbotrya</i>			
	<i>Acacia restiacea</i>			
	<i>Acacia saligna</i>			
	<i>Acacia scirpifolia</i>			
	<i>Acacia stenoptera</i>			
	<i>Bossiaea eriocarpa</i>			
	<i>Bossiaea</i> sp. Cairn Hill			
	<i>Daviesia dielsii</i>		Endangered	Threatened
	<i>Daviesia gracilis</i>			
	<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>			
	<i>Gompholobium</i> sp.			
<i>Kennedia prostrata</i>				
<i>Trifolium arvense</i> var. <i>arvense</i>	*			
GERANIACEAE	<i>Erodium botrys</i>	*		
	<i>Erodium cicutarium</i>	*		
GOODENIACEAE	<i>Goodenia arthrotricha</i>			Threatened
	<i>Goodenia berardiana</i>			
	<i>Scaevola phlebopetala</i>			
	<i>Velleia trinervis</i>			
GYROSTEMONACEAE	<i>Gyrostemon ramulosus</i>			
HALORAGACEAE	<i>Glischrocaryon aureum</i>			
	<i>Gonocarpus nodulosus</i>			
HEMEROCALLIDACEAE	<i>?Agrostocrinum</i> sp.			
	<i>Dianella revoluta</i>			
	<i>Stypantra glauca</i>			
	<i>Tricoryne</i> sp. Wongan Hills			Priority 2
IRIDACEAE	<i>Patersonia graminea</i>			
	<i>Romulea rosea</i>	*		
LAMIACEAE	<i>Pityrodia dilatata</i>			
LAURACEAE	<i>Cassytha ?flava/ glabella/ ?racemosa</i>			
LORANTHACEAE	<i>Nuytsia floribunda</i>			
MALVACEAE	<i>Alyogyne huegelii</i> var. <i>grossulariifolia</i>			
	<i>Guichenotia micrantha</i>			
MYRTACEAE	<i>Babingtonia camphorosmae</i>			
	<i>Baeckea</i> sp. Moora			Priority 3
	<i>Calothamnus hirsutus</i>			
	<i>Calothamnus quadrifidus</i>			
	<i>Calothamnus sanguineus</i>			
	<i>Calytrix leschenaultii</i>			
	<i>Eucalyptus camaldulensis</i> var. <i>?obtusa</i>			
	<i>Eucalyptus loxophleba</i> var. <i>loxophleba</i>			
	<i>Eucalyptus salmonophloia</i>			
	<i>Eucalyptus wandoo</i>			
	<i>Kunzea praestans</i>			
	<i>Melaleuca cordata</i>			
	<i>Melaleuca holosericea</i>			
	<i>Melaleuca scabra</i>			
	<i>Melaleuca</i> sp.			
	<i>Melaleuca uncinata</i>			
<i>Regelia megacephala</i>			Priority 4	
<i>Verticordia nitens</i>				

Family	Species	Weed	EPBC	DEC
ORCHIDACEAE	<i>Caladenia</i> sp.			
	<i>Diuris</i> sp.			
	<i>Elythranthera brunonis</i>			
	<i>Leporella fimbriata</i>			
OXALIDACEAE	<i>Oxalis corniculata</i>	*		
PITTOSPORACEAE	<i>Billardiera heterophylla</i>			
POACEAE	<i>Aira cupaniana</i>	*		
	<i>Amphipogon strictus</i>			
	<i>Aristida contorta</i>			
	<i>Austrodanthonia caespitosa</i>			
	<i>Austrodanthonia acerosa</i>			
	<i>Austrostipa elegantissima</i>			
	<i>Austrostipa nitida</i>			
	<i>Austrostipa</i> sp.			
	<i>Austrostipa</i> sp. Kiaka Rd			
	<i>Austrostipa trichophylla</i>			
	<i>Austrostipa variabilis</i>			
	<i>Avena barbata/fatua</i>	*		
	<i>Brachypodium distachyon</i>	*		
	<i>Briza maxima</i>	*		
	<i>Bromus alopecuroides</i>	*		
	<i>Bromus diandrus</i>	*		
	<i>Bromus rubens</i>	*		
	<i>Cynodon dactylon</i>	*		
	<i>Ehrharta calycina</i>	*		
	<i>Neurachne alopecuroidea</i>			
	<i>Pentameris airoides</i>	*		
	<i>Rytidosperma setaceum</i>			
	<i>Vulpia myuros</i> var. <i>hirsuta</i>	*		
<i>Aira caryophylla</i>	*			
<i>Ehrharta calycina</i>	*			
<i>Polypogon monspeliensis</i>	*			
<i>Avellinia michelii</i>	*			
POLYGALACEAE	<i>Comesperma integerrimum</i>			
POLYGONACEAE	<i>Muehlenbeckia adpressa</i>			
PRIMULACEAE	<i>Lysimachia arvensis</i>	*		
PROTEACEAE	<i>Banksia fraseri</i>			
	<i>Banksia hewardiana</i>			
	<i>Banksia sessilis</i>			
	<i>Hakea lissocarpha</i>			
	<i>Hakea subsulcata</i>			
	<i>Isopogon divergens</i>			
	<i>Synaphea quartzitica</i>			Threatened
	<i>Grevillea biternata</i>			
PTERIDACEAE	<i>Cheilanthes austrotenuifolia</i>			
RESTIONACEAE	<i>Desmocladius asper</i>			
	<i>Desmocladius flexuosus</i>			
RHAMNACEAE	<i>Cryptandra glabriflora</i>			
	<i>Cryptandra glabriflora</i>			Priority 2
	<i>Trymalium daphnoides</i>			
	<i>Trymalium ledifolium</i>			
	<i>Trymalium odoratissimum</i>			
RUBIACEAE	<i>Opercularia vaginata</i>			
RUTACEAE	<i>Boronia ramosa</i> subsp. <i>anethifolia</i>			
RUTACEAE	<i>Diplolaena angustifolia</i>			
SAPINDACEAE	<i>Dodonaea pinifolia</i>			
SCROPHULARIACEAE	<i>Zaluzianskya divaricata</i>	*		

Family	Species	Weed	EPBC	DEC
SOLANACEAE	<i>Solanum nigrum</i>	*		
	<i>Anthocercis littorea</i>			
	<i>Solanum oldfieldii</i>			
STYLIDIACEAE	<i>Stylidium caricifolium</i>			
	<i>Stylidium leptophyllum</i>			
STYLIDIACEAE	<i>Stylidium</i> sp.			
XANTHORRHOEACEAE	<i>Xanthorrhoea drummondii</i>			
TOTAL	178	34	2	8

Table 19: Recommended Revegetation Species for Simcoa's Moora Quartzite Mine

STRUCTURE		SPECIES	STATUS		REVEGETATION DOMAINS			FAUNA HABITAT			REVEGETATION METHOD		
Life form	Height	Scientific Name	EPBC	DEC	TEC Buffer	Revegetation	Screening	Nesting	Food Source	Shrubland	Open Woodland	Seed and Tubestock	Tubestock only
Tall Tree	4-10m	<i>Allocasuarina huegeliana</i>			*	*	*	*			*	*	
	5-20m	<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i>			*	*	*	*	*		*	*	
	15m	<i>Eucalyptus loxophleba</i> var. <i>loxophleba</i>				*	*	*	*			*	
	4-30m	<i>Eucalyptus salmonophloia</i>					*	*	*		*	*	
	3-25m	<i>Eucalyptus wandoo</i>					*	*	*		*	*	
Small Tree/ Shrub	1-7m	<i>Acacia acuminata</i> subsp. <i>acuminata</i>			*	*	*		*			*	
	7m	<i>Acacia microbotrya</i>				X	*		*			*	
	1.5-6m	<i>Acacia saligna</i>			X	X	*		*			*	
	1-4m	<i>Acacia scirpifolia</i>			*	*	*		*			*	
	1-3m	<i>Allocasuarina campestris</i>			**	**	*					*	
	0.5-5m	<i>Banksia sessilis</i>			**	**	*		*			*	
	4.5m	<i>Xanthorrhoea drummondii</i>			**	**	*		*		*	*	
Large Shrub	2-4m	<i>Alyogyne huegelii</i>					X		*	*		*	
	0.2-6m	<i>Banksia fraseri</i>			**	**	X		*	*		*	
	1-5m	<i>Banksia hewardiana</i>			*	*	X		*	*		*	
	1-3m	<i>Hakea subsulcata</i>			*	*	X		*	*		*	
	2-5m	<i>Regelia megacephala</i>		P4	**	**	X			*		*	
Medium Shrub	0.3-2.1m	<i>Acacia alata</i>				X			*	*		*	
	0.5-2.5m	<i>Acacia congesta</i> subsp. <i>congesta</i>			*	*			*	*		*	
	0.5-1.5m	<i>Acacia restiacea</i>				X			*	*		*	
	0.3-1.5m	<i>Calothamnus hirsutus</i>			*	*			*	*		*	
	0.9-2m	<i>Calothamnus quadrifidus</i>			**	**			*	*		*	
	0.2-2m	<i>Calothamnus sanguineus</i>				X			*	*		*	
	0.3-1.5m	<i>Diplolaena angustifolia</i>			*	*				*		*	
	0.4-1.5m	<i>Hakea lissocarpa</i>				X			*	*		*	
	1-2m	<i>Kunzea praestans</i>			**	**				*		*	
	0.3-2m	<i>Melaleuca cordata</i>			*	*			*	*		*	
	0.2-1.7m	<i>Melaleuca holosericea</i>			*	*			*	*		*	
	0.2-1.5m	<i>Melaleuca scabra</i>				X			*	*		*	
	0.5-3m	<i>Olearia ?axillaris</i>				X				*		*	
	0.5-2m	<i>Olearia dampieri</i> subsp. <i>eremicola</i>				X				*		*	
Small Shrub	0.25-1m	<i>Acacia aristulata</i>	E	T	**	**			*	*	*	*	
	0.2-1m	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>				X			*	*	*	*	
	0.2-0.7m	<i>Acacia stenoptera</i>				X			*	*	*	*	
	0.2-1m	<i>Bossiaea eriocarpa</i>			*	*				*	*	*	
	0.2-1m?	<i>Bossiaea</i> sp. Cairn Hill				X				*	*	*	
	0.15-1m	<i>Calytrix leschenaultii</i>			**	**				*	*	*	*
	0.5-0.9m	<i>Daviesia dielsii</i>	E	T	**	**			*	*	*	*	
	0.3-0.6m	<i>Daviesia gracilis</i>				X			*	*	*	*	
	0.2-0.8m	<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>			*	*			*	*	*	*	
	0.2-1m	<i>Dodonaea pinifolia</i>			*	*				*	*	*	
	0.3-1m	<i>Gompholobium</i> sp.				X				*	*	*	
	0.15-1.2m	<i>Hibbertia subvaginata</i>				**				*	*	*	*
	0.3-0.6m	<i>Pityrodia ?dilatata</i>				X				*	*	*	*
Perennial Herb	0.3-1.5m	<i>Dianella revoluta</i>			*	*						*	
	0.3-0.8m	<i>Gahnia drummondii</i>				X						*	
	0.2-0.5m	<i>Patersonia graminea</i>			*	*						*	
	prostrate	<i>Kennedia prostrata</i>			X	*			*			*	
	0.05-0.3m	<i>Scaevola phlebopetala</i>			X	*						*	
	0.15-0.5m	<i>Thysanotus patersonii</i>			X	*						*	
TOTAL		48	2	3	30	47	17	4	31	32	19	48	2

Appendix Two: Prioritising Weeds

METHODOLOGY OF PRIORITISING WEEDS

RATING SYSTEMS

The priority ratings of each weed species were determined after examining:

- the ratings under the following weed evaluation systems:
 - Environmental Weed Census and Prioritisation (EWCP) by the DEC (2008)
 - Environmental Weed Strategy of Western Australia (EWSWA) by the Department of Conservation and Land Management (CALM 1999)
 - Dixon and Keighery (1995) Recommended methods to control specific weed species
- whether it was listed by Commonwealth of Western Australian governments:
 - Weed of National Significance (WONS) (Weed Australia 2008)
 - DAFWA (1976) Agricultural and Related Resources Protection Act (ARRPA).

The role of EWSWA is to highlight which weed species pose significant environmental risk in Western Australia. The EWSWA rating provides a basis for determining which weeds are most critical to control. The three characteristics used for determining the EWSWA rating are:

- *invasiveness* – ability to invade bushland in good to excellent condition
- *distribution* – wide current or potential distribution including consideration of known history of wide distribution elsewhere in the world
- *environment impacts* – ability to change the structure, composition and function of ecosystems, in particular to form a monoculture in a vegetation community.

EWSWA weed species were rated accordingly:

- *High* – have all three of the characteristics
- *Moderate* – have two of the characteristics
- *Mild* – have one of the characteristics
- *Low* – not deemed to have any of the characteristics.

However, EWSWA is a general guide for prioritising weeds across the State. EWCP rates weeds species as a threat in Swan Coastal Plain bushland conditions. A total of eight ratings are used, according to the risk each species poses to environmental assets in the region, based on invasiveness, ecological impact, current and potential distribution, and thus priority for management. In order of descending, priority, they are:

- Very High
- High
- Further Assessment Required (FAR)/ High
- Moderate/ High
- Moderate
- Low/ Moderate
- Low
- Further Assessment required (FAR)

Dixon and Keighery (1995) developed a rating system for 145 weed species. The rating system classified each species according to the threat they pose to bushland in the Perth Metropolitan region. The three classifications used were:

- *Priority 1* – major weeds, which are the most serious weeds within their ecosystem, often affecting many reserves or habitats in ways likely to permanently degrade them -
- *Priority 2* – nuisance weeds, which are generally found only in a few locations or ecosystems, usually in disturbed areas
- *Priority 3* – minor weeds, which have little known effect and occur in smaller numbers or are less competitive than *Priority 2* weeds.

The type of control for ARRPA declared weed species are listed below:

- *P1* – Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and feed.
- *P2* – Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
- *P3* – Control infestation in such a way that prevents the spread of seed or plant parts within and form the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
- *P4* – Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.

WONS was jointly declared by the Minister for Forestry and Conservation, the Minister for Agriculture, Fisheries and Forestry and the Minister for The Environment in 1999 as part of the *National Weeds Strategy*. The four characteristics used for determining where the species was of national significance were:

- invasiveness
- impacts
- potential for spread
- socioeconomic and environmental values.

Ranking Priority Weeds

The above sources were used to rank the recorded weed species in order of priority for control. Both the EWCP (Swan Natural Resource Management 2008) and EWSWA (CALM 1999) ratings were used because it allowed most weeds identified in the Reserve to be assigned a rating and thereby ranked. If only one source had been used, some of the weed species would have not been assigned a rating score.

The use of two rating systems does result in some conflict when assigning a ranking for a weed species. To overcome this issue, a matrix scoring system was developed to enable the ranking of the weed species. The matrix scoring system is summarised in **Table 20**. For the purposes of this study, the system gave a slight bias to the EWCP system, as this system was more relevant for the Reserve.

In addition, as weed species listed under either ARRPA or WONS are required by legislation to be controlled, any of these listed weed species recorded were automatically given a rating of 6.

Table 20: Matrix scoring system for rating weed priority

RATING SYSTEM		EWSWA				
		Unrated	Low	Mild	Moderate	High
EWCP	Unrated	1	1	3	4	5
	FAR	1	1	3	4	5
	Low	2	2	3	4	5
	L/M	2	3	4	4	5
	M	3	4	4	4	5
	M/H	4	4	4	5	6
	FAR/H	5	5	5	5	6
	H	5	5	5	6	6
	VH	6	6	6	6	6

If any weed species not assigned a rating by these any of the previous sources, the Dixon and Keighery (1995) rating system would then be used:

- Priority 1 = Rating 6
- Priority 2 = Rating 4
- Priority 3 = Rating 2

If any weed species were not given a rating by any of the previous systems, they would receive a default rating of 1.

If a species could not be fully identified, it was rated to highest known rating within that genus.

The priority of each weed species was then classified by the final rating:

- Species given a rating of 5 or 6 were *High Priority Weeds*.
- Species with a final rating of 3 or 4 were *Moderate Priority Weeds*.
- Species with a rating of 1 or 2 were *Low Priority Weeds*.

RESULTS

STATE AND NATIONAL SIGNIFICANCE

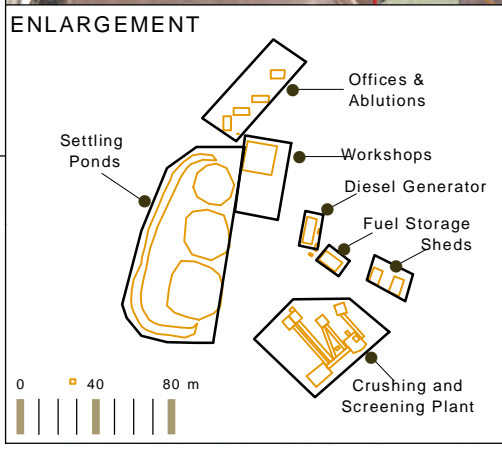
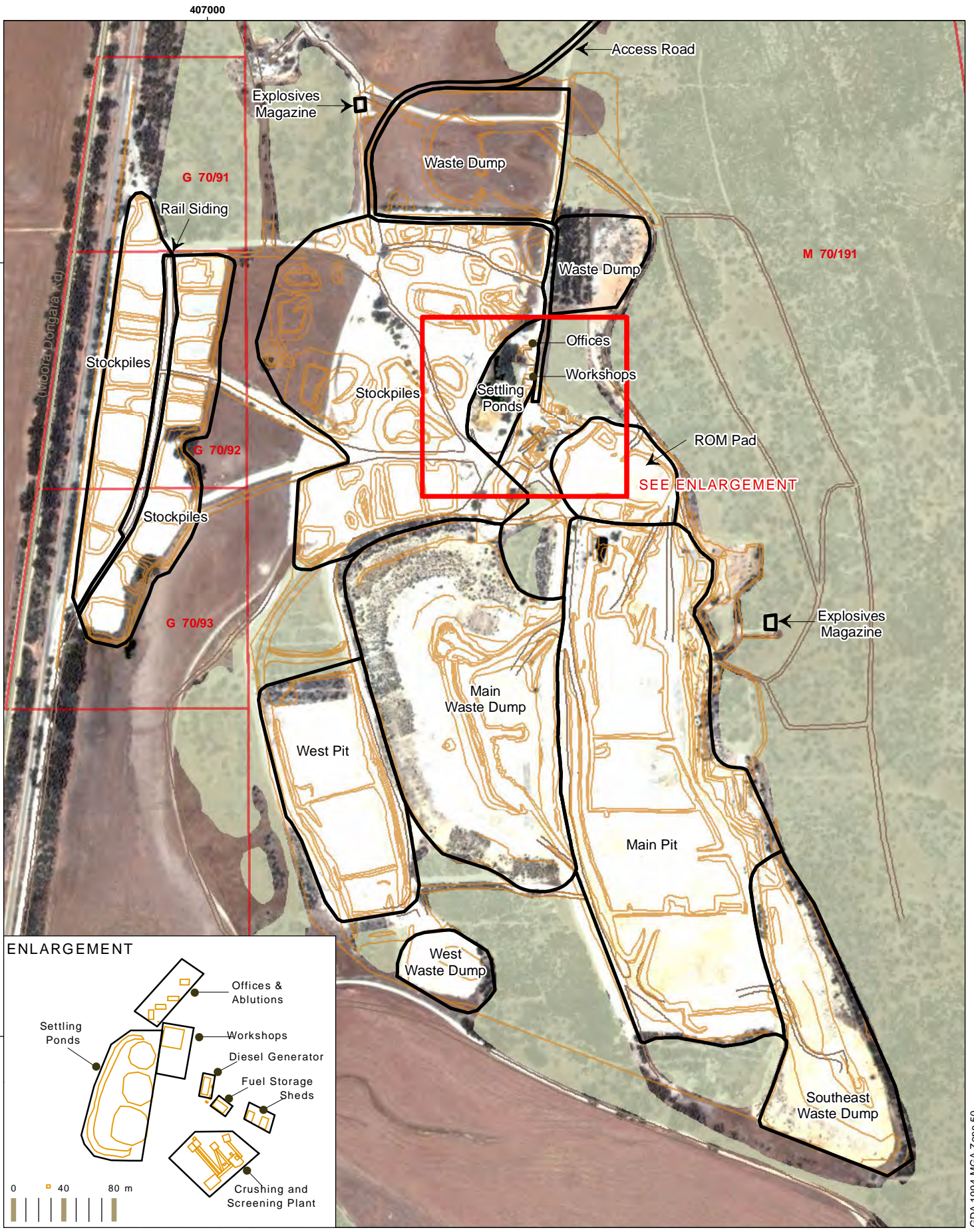
None of the recorded weed species were listed by WONS and/or ARRPA so no species had their rating scores increased to 6 (High Priority).

Arctotheca calendula (Capeweed), *Hypochaeris glabra* (Smooth Cat's Ear) and *Romulea rosea* (Guildford Grass) had calculated scores of 6 (High Priority). These species were not considered to be threats to the local area, so their scores were downgraded to 4 (Moderate Priority). Similarly, *Lysimachia arvensis* (Pimpernel) was calculated as 4 (Moderate Priority), but was downgraded to 2 (Low Priority).

Table 21: Priority rating of weed species in Moora Quartzite Mine

WEED SPECIES		PRIORITISATION								
Scientific Name	Common Name	EWSWA	EWCP	WONS	ARRPA	Dixon & Keighery	Calculated Rating	Local significance	Final Rating	PRIORITY
<i>Avena barbata/fatua</i>	Bearded Oat/ Wild Oat	Moderate	Very High			1	6		6	High
<i>Bromus diandrus</i>	Great Brome	High	Very High			3	6			
<i>Centaurea melitensis</i>	Maltese Cockspur	Moderate	High			3	6			
<i>Cynodon dactylon</i>	Couch	Moderate	Very High			1	6			
<i>Ehrharta calycina</i>	Perennial Veldt Grass	High	Very High			1	6			
<i>Aira cupaniana</i>	Silvery Hair Grass	Moderate	Unrated			3	4		4	Moderate
<i>Arctotheca calendula</i>	Cape Weed	Moderate	High			3	6	No		
<i>Briza maxima</i>	Blowfly Grass	Moderate	FAR			2	4			
<i>Bromus rubens</i>	Red Brome	Moderate	FAR			3	4			
<i>Helichrysum luteoalbum</i>	Jersey Cudweed	Moderate	Low			3	4			
<i>Hypochaeris glabra</i>	Smooth Cats Ear	Moderate	High			3	6	No		
<i>Pentameris airoides</i>	False Hair Grass	Moderate	Moderate				4			
<i>Petrorhagia dubia</i>	Velvet Pink	Mild	Moderate			3	4			
<i>Romulea rosea</i>	Guildford Grass	High	FAR			1	5	No		
<i>Solanum nigrum</i>	Black Nightshade	Moderate	Moderate			2	4			
<i>Sonchus oleraceus</i>	Common Sowthistle	Moderate	FAR			3	4			
<i>Urospermum picroides</i>	False Hawkbit	Moderate	Moderate			3	4			
<i>Ursinia anthemoides</i>	Ursinia	Moderate	Moderate			3	4			
<i>Brachypodium distachyon</i>	False Broome	Low	FAR			3	2			
<i>Bromus alopecuross</i>	Weedy Brome	Low	Low				2			
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Low	Low			3	2			
<i>Cucumis myriocarpus</i>	Prickly Paddy Melon	Unrated	Low			3	2			
<i>Lysimachia arvensis</i>	Pimpernel	Moderate	FAR			3	4	No		
<i>Oxalis corniculata</i>	Yellow Wood Sorrel	Low	Low				2			
<i>Zaluzianskya divaricata</i>	Spreading Nightphlox	Low	Unrated				1		1	

Appendix Three: Maps



Imagery: Bing Maps Aerial (2010)

AUTHOR: JN
 DATE: JUNE 2012
 CHECKED: SB
 PROJECT NO: 2681-11

MOORA QUARTZITE MINE REHABILITATION AND CLOSURE PLAN
 CLIENT: SIMCOA



9 Stirling Hwy.
 North Fremantle WA 6159
 ph: (08) 9430 8955
 web: www.ecoscape.com.au

MINE CLOSURE DOMAINS

Scale 1:6,500 @ A4



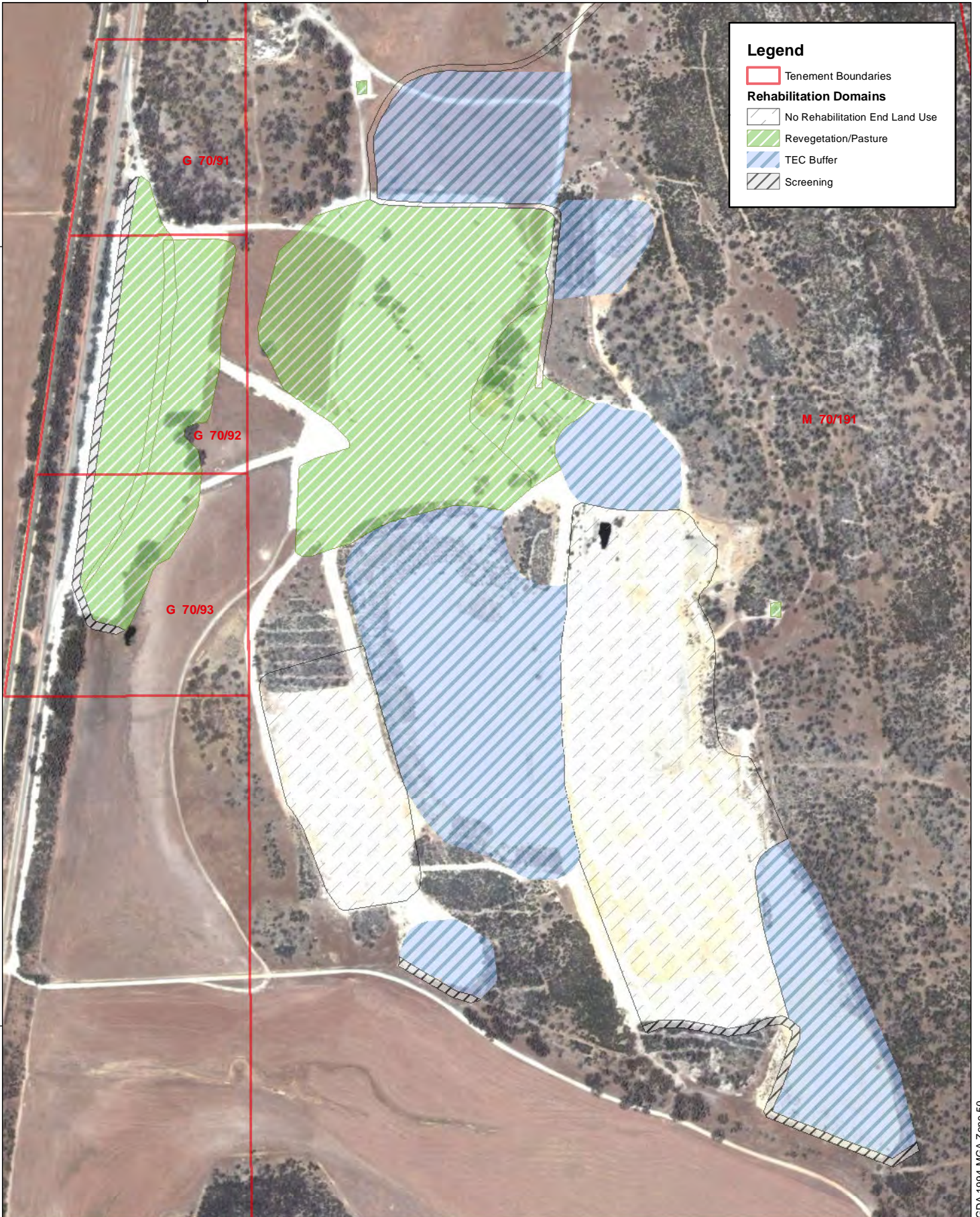
MAP 1

GDA 1994 MGA Zone 50

407000

6624000

6623000



Legend

- Tenement Boundaries
- Rehabilitation Domains**
- No Rehabilitation End Land Use
- Revegetation/Pasture
- TEC Buffer
- Screening

Imagery: Bing Maps Aerial (2010)

GDA 1994 MGA Zone 50

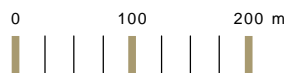
AUTHOR: JN
DATE: JUNE 2012

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REHABILITATION DOMAINS

MAP 2

Appendix Four: Weed Management

The following pages provide descriptions and a variety of control methods the weed and aggressive native species recorded in and around the Mine Site. Individual Weed Management Guide Sheets are provided for the high priority weed species. A summary of control methods for all of the weeds species is presented in **Table 22**.

Weed management recommendations are based on information from:

1. Brown and Brooks (2002) *Bushland Weeds*
2. Dixon and Keighery (1995) *Recommended methods to control specific weed species*
3. Moore and Wheeler (2008) *Southern Weeds and their control*.

Herbicide recommendations have superscripted numbers assigned to them to indicate which of these sources above provided the information on herbicide type and dosage.

The quantities of herbicides suggested for spot spraying rate have been calculated for a 10L backpack. It should be noted that surfactants should not be used near and wetlands or waterways. It is recommended that selective herbicides be implemented where practical to limit their impact on adjacent native plants.

Information on each of the recommended herbicide brands are summarised in **Table 12**.

It should be noted that manual control should always be considered first before using herbicides.

Bearded Oat (*Avena barbata*)



DESCRIPTION	
Appearance	Tufted annual grass to 1.5m tall. The loosely branched, usually one-sided inflorescence has large drooping, spikelets. The mature seeds are usually straw-coloured. Flowers in spring.
Habitat	Common species in uncropped situations, including roadsides, wasteland and disturbed bushland, occasionally extending into crop margins.
Comments	Easy to control. Native of the Mediterranean.
CONTROL	
Priority	High
Timing	July to October
Manual Control	Manually remove small populations before they set seed.
Wicker Wipe	Wicker wipe with 1:2 Roundup® to water.
Spot Spray	5 mL quizalofop (100g/L) or 8 mL Fusilade® Forte or 1 mL Verdict®520, plus 100 mL spray oil applied in winter before flowering will provide control with little effect on broad-leaved species ^(1 & 2) 100 mL of glyphosate in non-selective situations ⁽²⁾ .

Great Brome (*Bromus diandrus*)



DESCRIPTION	
Appearance	Tufted annual grass to 90cm with softly hairy, flat or loosely folded leaves. Flowering spikes are either erect or drooping, to 15 – 25 cm long, and consist of a compound arrangement of oblong spikelets with very prominent, rough awns to 60 mm long.
Habitat	Widespread and serious weed of offshore islands, wetlands, road verges, granite rocks, pastures and crops throughout the south-west of WA.
Comments	Competes with natives. Fire hazard.
CONTROL	
Priority	High
Timing	June to August
Manual Control	Manually remove small populations before they set seed.
Wicker Wipe	Wicker wipe with 1:2 glyphosate to water.
Spot Spray	<ul style="list-style-type: none"> • 10 mL quizalofop (100g/L) plus 100 mL spray oil ^(1,2 & 3) • 16 mL Fusilade® Forte plus 100 mL spray oil ⁽²⁾ • 2 mL Verdict® 520 plus 100 mL spray oil ⁽²⁾ • 10 mL glyphosate ⁽²⁾

Couch (*Cynodon dactylon*)



DESCRIPTION	
Appearance	Prostrate perennial grass, spreading both above and below ground to several metres across, rooting at the nodes, and bluish-green leaves. Flowers in late spring and summer, producing windmill-like (digitate) inflorescences comprising two to seven purplish spikes.
Habitat	Mainly in highly disturbed areas. It is widely planted as a lawn grass and it invades wetlands and river edges in southern Western Australia.
Comments	Competes with native species. It is native to the Kimberley and the tropics worldwide.
CONTROL	
Priority	High
Timing	November to February
Manual Control	Shade out with black plastic during spring and autumn.
Wicker Wipe	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.
Spot Spray	<ul style="list-style-type: none"> • 100 mL glyphosate + 25 mL Pulse when the grass is actively growing provides the best control. Repeat every 8 weeks or when regrowth reaches about 5 cm tall ^(1 & 2). • Selective control can usually be achieved by spraying 16 mL Verdict®520 or 80 mL quizalofop (100g/L) or 125 mL Fusilade®Forte, plus 100 mL spray oil ⁽²⁾.

Annual Veldt Grass (*Ehrharta longiflora*)



DESCRIPTION	
Appearance	Tufted annual to 30cm tall. The greenish-purple inflorescence is a narrow panicle, to 15cm long, flowering in spring.
Habitat	It is a widespread weed of offshore islands, coastal dunes and sandy soils, from Shark Bay to Eucla and inland along disturbed creek lines and grazed woodlands in the western Wheatbelt.
Comments	Smothers small plants and competes with natives. A serious fire hazard.
CONTROL	
Priority	High
Timing	August to October
Manual Control	Manually remove small populations before they set seed.
Wicker Wipe	Not recommended.
Spot Spray	<ul style="list-style-type: none"> 20 mL quizalofop (100g/L), or 32 mL Fusilade® Forte, or 4 mL Verdict®520, plus 100 mL spray oil before flowering stem emerges provides good control with little damage to broad-leaf species ^(1 & 2) In non-selective situations 40 mL glyphosate applied up to flowering provides good control ⁽²⁾

Photo Sources: <http://florabase.calm.wa.gov.au/browse/photo/349>

Perennial Veldt Grass (*Ehrharta calycina*)



DESCRIPTION	
Appearance	Tufted perennial grass to 80cm tall. The inflorescence is a drooping erect panicle of reddish-purple flowers, 7-22cm long. Flowers in spring.
Habitat	Widespread weed of roadsides and bushland on sandy soils, from Geraldton to Esperance and is especially common on the Swan Coastal Plain.
Comments	Serious environmental weed.
CONTROL	
Priority	High
Timing	June to September
Manual Control	Manual remove small populations before they set seed, ensuring crown removal. Do not slash.
Wicker Wipe	Wicker wipe with 1:2 glyphosate to water.
Spot Spray	<ul style="list-style-type: none"> 80 mL quizalofop (100g/L) + wetting agent, follow up in subsequent years; utilise unplanned fires and spray regrowth and seedlings with 4 – 6 weeks ⁽¹⁾.

Rat's Tail Fescue (*Vulpia myuros*)



DESCRIPTION

Appearance	Annual tufted grasses to 70 cm high with fairly narrow one-sided inflorescence of numerous stalked spikelets each with 3-12 florets. The outer segment of each floret (lemma) has a straight bristle (awn)
Habitat	A weed of agricultural land and disturbed areas.
Comments	All are native to Europe and flower from late winter to early summer.

CONTROL

Priority	High
Timing	July to September
Manual Control	Manually remove small populations before they set seed.
Wicker Wipe	Not recommended.
Spot Spray	<ul style="list-style-type: none"> • 5 mL glyphosate(450g/L) plus 25 mL wetting agent per 10 L water applied in winter before flowering will provide reasonably selective control in bushland. Use higher rates for higher levels of control in non selective situations. ⁽²⁾ • 10 mL simazine(500g/L) per 10 L of water applied before the Rat-tailed Fescue emerges or up to the 4 leaf stage in early winter will provide good control with little damage to most established native species. The grass selective herbicides such as Fusilade® and Verdict® have little effect on these grasses. ⁽²⁾

Photo Sources: <http://www.eol.org/pages/1115255>
http://plants.usda.gov/java/largeImage?imageID=feme_001_avd.tif

Capeweed (*Arctotheca calendula*)



DESCRIPTION

Appearance

An annual daisy with a flat basal rosette of deeply lobed leaves. The leaves are 3 to 25 cm long, green on the upper surface but the lower surface white-hairy. Flowers in late winter and spring producing daisy flower heads, up to 6 cm in diameter held on individual stalks, with the radiating yellow petals and tiny central black florets.

Habitat

A common weed of pastures, crops and roadsides, but also quite common in disturbed bushland. Mainly in disturbed areas where extra water/nutrients encourage lush growth.

Comments

Native of South Africa.

CONTROL

Priority

High

Timing

June to November

Manual Control

Manually remove small populations before they set seed.

Wicker Wipe

Wicker wipe with 1: 2 glyphosate to water.

Spot Spray

- 2.5 g Lontrel®750 + 25 mL wetting agent applied in early growth stages will provide good control and is safe on many native species^(1 & 2)
- 10 mL glyphosate is also fairly selective in bushland and roadside situations if applied when young or at the budding stage⁽²⁾

Flatweed (*Hypochaeris glabra*)



DESCRIPTION

Appearance

Flatweeds are annuals or short-lived perennials, with a basal rosette of leaves and yellow, dandelion-like flower heads at the top of slender, leafless stalks. The species has smooth leaves and heads up to 1.5cm across.

Habitat

Common weeds of lawns, horticultural areas, roadsides and bushland throughout the south-west.

Comments

Native to Europe, competes with native herbs especially in richer soils and disturbed areas.

CONTROL

Priority

High

Timing

May to September

Manual Control

Use a weed fork to extract the taproot. Manually remove small populations before they set seed.

Wicker Wipe

Wicker wipe rosettes with 1: 2 glyphosate to water.

Spot Spray

- 4 g Lontrel®750 + 25 mL wetting agent ⁽¹⁾
- For small infestations 50 mL Tordon®75-D will control growing plants and leave a soil residual to control seedlings for 12 months ⁽²⁾
- 100 mL glyphosate ⁽³⁾

Photo Sources: [http://www.rbgsyd.nsw.gov.au/data/assets/image/0009/84546/Trifolium arvense flower 620.JPG](http://www.rbgsyd.nsw.gov.au/data/assets/image/0009/84546/Trifolium_arvense_flower_620.JPG)

Long Storkbill (*Erodium botrys*)



DESCRIPTION

Appearance

Sprawling annual herb to 40 cm high, with stalked, shiny deeply dissected leaves. The blue to purple flowers are in stalked clusters, each flower with 5 free petals. The distinctive 9-12 cm fruit is long, beak-like and splits into 5 fruitlets which, when mature, separate and twist so that each seed is attached to a spirally-twisted corkscrew-like awn. Flowers in winter and spring.

Habitat

Common weed of pasture, wasteland and roadsides.

Comments

Relatively tolerant to glyphosate. Native to the Mediterranean region

Priority

High

Timing

May to July

Manual Control

Manually remove small populations before they set seed.

Wicker Wipe

Not recommended

Spot Spray

- 80 mL 2,4-DB(400g/L) or 6 mL Lontrel® applied before flowering provides reasonably selective control in bushland (SW)
- For highly selective control, use Verdict®520 at 2 mL plus 100 mL oil on actively growing seedlings. (SW)
-

Photo Source http://upload.wikimedia.org/wikipedia/commons/f/f8/Erodium_botrys_2005-02-20.jpg
http://www.flowersinIsrael.com/Erodiumbotrys_page.htm
<http://www.flickr.com/photos/44055945@N06/5551235750/>

Maltese Cockspur (*Centaurea melitensis*)



DESCRIPTION	
Appearance	Erect biennial to 80cm with lobed leaves and yellow, thistle-like flower heads borne terminally or on short upper branches. The bracts below the heads have a short, often reddish spine. The stems have non-prickly wings. It flowers in spring and summer.
Habitat	Usually occurs in disturbed areas
Comments	Native to the Mediterranean
CONTROL	
Priority	High
Timing	July to October
Manual Control	Manually remove small populations before they set seed.
Wicker Wipe	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.
Spot Spray	No specific information, try: <ul style="list-style-type: none"> • 20 mL Access® for selective control • 100 mL Roundup® for non-selective control

Photo Source <http://uirig.altervista.org/cpm/albums/bot-units44/centaurea-melitensis10280.jpg>
<http://beavercreek.nau.edu/Animal%20and%20Plant%20pages/species%20images/Invasive/Plants/Centaurea%20M.jpg>
<http://www.researchlearningcenter.com/bloom/pics/S9190CXR.jpg>

Table 22: Control methods for weed species recorded at Moora Quartzite Mine

WEED SPECIES				CONTROL RECOMMENDATIONS				
Scientific Name	Common Names	Life form	Comments	Manual Control	Wicker Wipe	Spot Spray @10L water + 25mL surfactant	Blanket Spray per ha	Herbicide Timing
Grasses								
<i>Aira caryophyllaea</i> and <i>Aira cupaniana</i>	Silvery Hairgrasses	Annual	Competes with small herbs	Not recommended	Not recommended	No specific information, try: <u>Selective control</u> 10 mL Fusilade® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try <u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Aug-Oct
<i>Avellinia michelii</i>	Avellinia	Annual	Competes with natives	Not recommended	Not recommended	No specific information, try: <u>Selective control</u> 10 mL Fusilade® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try <u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep
<i>Avena barbata</i>	Bearded Oat	Annual	Occurs mainly in highly disturbed areas. Easy to control.	Manually remove small populations before they set seed.	Wicker wipe with 1:2 Roundup® to water.	<u>Selective control</u> 5 mL Fusilade® 5 mL Sertin® 5 mL Targa® 2 mL Verdict® <u>Non-selective control</u> 50 mL Roundup® 10 mL Spray-seed®	<u>Selective control</u> 500 mL Fusilade® 300 mL Targa® 100 mL Verdict® 500 mL Sertin® <u>Non-selective control</u> 2 L Roundup®	Jul-Oct
<i>Brachypodium distachyon</i>	False Brome	Annual	Common weed of the bushlands near paddocks.	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 10 mL Fusilade® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try <u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep
<i>Briza maxima</i>	Blowfly Grass	Annual	Easy to control	Manually remove small populations before they set seed.	Wicker wipe with 1:2 Roundup® to water.	<u>Selective control</u> 10 mL Fusilade® 200 g Propon® 10 mL Verdict® 5 mL Sertin® 10 mL Targa® <u>Non-selective control</u> 50 mL Roundup® 10 mL Spray-seed®	No specific information, try <u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Jun-Sep
<i>Bromus alopecuroides</i> , <i>Bromus diandrus</i> , <i>Bromus rubens</i>	Weedy Brome Great Brome Red Brome	Annual	Cometes with natives, fire hazard	Manually remove small populations before they set seed.	Wicker wipe with 1:2 Roundup® to water.	<u>Selective control</u> 16 mL Fusilade® Forte 10 mL Targa® 2 mL Verdict® 520 <u>Non-selective control</u> 10 mL Roundup®	<u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Jun-Aug

WEED SPECIES			CONTROL RECOMMENDATIONS					
<i>Cynodon dactylon</i>	Couch	Perennial	Competes with natives	Shade out with black plastic during spring and autumn	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	<u>Selective control</u> 125 mL Fusilade® Forte 16 mL Verdict®520 80 mL Targa® <u>Non-selective control</u> 100 mL Roundup®	<u>Selective control</u> 4 L Fusilade® 4 L Targa® 200 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Nov-Feb
<i>Ehrharta calycina</i>	Perennial Veldt Grass	Perennial	Serious environmental weed	Manual remove small populations before they set seed, ensuring crown removal. Do not slash.	Wicker wipe with 1:2 Roundup® to water.	<u>Selective control</u> 5 mL Fusilade® 5 mL Sertin® 5 mL Targa® 2 mL Verdict® <u>Non-selective control</u> 50 mL Roundup® 10 mL Spray-seed®	<u>Selective control</u> 300 ml Targa® 100 ml Verdict® <u>Non-selective control</u> 2L Roundup®	Jun-Sep
<i>Ehrharta longiflora</i>	Annual Veldt Grass	Annual	Smothers small plants and competes with natives	Manually remove small populations before they set seed.	Not recommended	<u>Selective control</u> 32 mL Fusilade® Forte 4 mL Verdict®520 <u>Non-selective control</u> 40 mL Roundup® 10 mL Spray-seed®	<u>Selective control</u> 1 L Fusilade® 80 mL Verdict® <u>Non-selective control</u> 400 mL Roundup®	Aug-Oct
<i>Pentameris airoides</i>	False Hair Grass	Annual	Very common and widespread weed of granite rocks, woodlands, shrublands and disturbed sites. Competes with small herbs.	Not recommended	Not recommended	No specific information, try: <u>Selective control</u> 10 mL Fusilade® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try <u>Selective control</u> 2L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Aug-Oct
<i>Polypogon monspeliensis</i>	Annual Barbgrass	Annual	Prefers moist soils	Manually remove small populations before they set seed.	Not recommended	No specific information, try: <u>Selective control</u> 10 mL Fusilade® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try <u>Selective control</u> 2 L Fusilade® 100 mL Verdict® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep
<i>Vulpia myuros</i> var. <i>hirsuta</i>	Rat's Tail Fescue	Annual	Resistant to Fusilade and similar grass specific herbicides	Manually remove small populations before they set seed.	Not recommended	<u>Selective control</u> 10 ml Simazine® 500 <u>Non-selective control</u> 100 mL Roundup®	<u>Selective control</u> 500 mL Select® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep
Geophytes								
<i>Oxalis corniculata</i>	Yellow Wood Sorrel	Perennial	Flowers in spring and summer, reproducing from seeds produced in explosive, cylindrical capsules.	Not recommended because corms tend to break off unless soil is very loose.	Wicker wipe with 1: 2 Roundup® to water.	<u>Selective control</u> 0.1 g Ally® 0.1 g Brushoff® 0.2 g Glean® <u>Non-selective control</u> 100 mL glyphosate	No specific information, try, <u>Selective control</u> 50 g Logran 300 mL Spinnaker	Jul-Sep
<i>Romulea rosea</i>	Guildford Grass	Perennial	A weed of roadsides and pasture, also commonly occurring in bushland.	Not recommended because corms tend to break off unless soil is very loose.	Not recommended	<u>Selective control</u> 0.2 g Ally® 0.2 g Brushoff® 0.5 g Glean® 1 g Raptor®	<u>Selective control</u> 20 g Ally® 20 g Brushoff® 2 L Gramoxone®	Jul-Aug

WEED SPECIES			CONTROL RECOMMENDATIONS					
Herbs								
<i>Arctotheca calendula</i>	Cape Weed	Annual	Mainly in disturbed areas where extra water/nutrients encourage lush growth.	Manually remove small populations before they set seed.	Wicker wipe with 1: 2 Roundup® to water.	<u>Non-selective control</u> 100 mL Roundup®	<u>Selective control</u> 500-1000 mL Access® 500 mL Gramoxone®	Jun-Nov
<i>Centaurea melitensis</i>	Maltese Cockspur	Biennial	Usually occurs in disturbed areas	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Jul-Oct
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Annual	Produces large numbers of seed therefore difficult to control	Hand pulling after stem elongation is only effective on loose soils. Manually remove small populations before they set seed.	Wicker wipe with 1: 2 Roundup® to water.	<u>Selective control</u> 4 g Lontrel®750 <u>Non-selective control</u> 50 mL Tordon®75-D	<u>Selective control</u> 500 mL Lontrel® <u>Non-selective control</u> 50 mL Tordon® 75-D	Jun-Sep
<i>Cucumis myriocarpus</i>	Prickly Paddy Melon	Annual	Usually occurs in disturbed areas. Smothers native plants	Collect and destroy fruit before they release seeds.	Wicker wipe with 1: 2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup® 10 mL Spray-seed®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Oct-Jan
<i>Erodium botrys, Erodium cicutarium</i>	Long Storkbill, Common Storkbill	Annual	Commonly found on farmland, especially pastures. Relatively tolerant to glyphosate.	Manually remove small populations before they set seed.	Not recommended	<u>Selective control</u> 6 mL Lontrel® 2 mL Verdict®	<u>Selective control</u> 4 L Buticide® 100mL Verdict® <u>Non-selective control</u> 2 L Spray-Seed®	May-Jul
<i>Helichrysum luteoalbum</i>	Jersey Cudweed	Annual	Prefers damp sites	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Aug-Nov
<i>Hypochaeris glabra</i>	Flat Weed	Annual	Competes with native herbs, especially in disturbed areas.	Use a weed fork to extract the taproot. Manually remove small populations before they set seed.	Wicker wipe rosettes with 1: 2 Roundup® to water.	<u>Selective control</u> 4 g Lontrel®750 <u>Non-selective control</u> 100 mL Roundup® 50 mL Tordon®75-D	<u>Selective control</u> 500 mL Lontrel <u>Non-selective control</u> 2-3 L Roundup®	May-Sep
<i>Lysimachia arvensis</i>	Pimpernel	Annual	Competes with small herbs. Mainly a problem in moist badly disturbed areas when the plants become more vigorous. Therefore only worth controlling in these areas.	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	<u>Selective control</u> 1.5 g Ally® 1.5 g Brushoff® 1.5 g Glean® <u>Non-selective control</u> 50-100 mL Roundup®	<u>Selective control</u> 15g Glean <u>Non-selective control</u> 500 mL Roundup®	Aug-Jan
<i>Monoculus monstrosus</i>	Stinking Roger	Annual	Prefers damp sites	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep

WEED SPECIES			CONTROL RECOMMENDATIONS					
<i>Petrorhagia dubia</i>	Velvet Pink	Annual	More vigorous on disturbed sites. Competes with native plants.	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Jun-Sep
<i>Solanum nigrum</i>	Black Nightshade	Annual-Biennial	Readily spread by birds into bushland	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	<u>Selective control</u> 20 mL Starane® 20 mL Access®	<u>Selective control</u> 1 L Starane® 1 L Access®	Jul-Dec
<i>Sonchus oleraceus</i>	Common Sowthistle	Annual	Mainly occurs in disturbed areas, growth is more vigorous where there is less competition. Native to Eurasia and North Africa.	Manually remove small populations before they set seed.	Wicker wipe with 1: 2 Roundup® to water.	<u>Selective control</u> 80 mL Buticide® 100 mL Tordon®75-D <u>Non-selective control</u> 50-75 mL Roundup®	<u>Selective control</u> 4 L Buticide®	Jun-Aug
<i>Trifolium arvense</i>	Hare's Foot Clover	Annual	A common weed of natural and cultivated land	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	<u>Selective control</u> 0.1g Ally® 0.1 g Brushoff® 1 g Logran® 10 mL Lontrel® 10 mL Tordon® 75-D <u>Non-selective control</u> 100 mL Roundup®	<u>Selective control</u> 500mL Lontrel® 50 g Logran®	Jul-Sep
<i>Urospermum picroides</i>	False Hawkbit	Annual	Occurs in disturbed areas	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Jul-Sep
<i>Ursinia anthemoides</i>	Ursinia	Annual	Usually in disturbed areas. So common may not be practical to control in most instances.	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	<u>Non-selective control</u> 50-75 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	May-Jul
<i>Zaluzianskya divaricata</i>	Spreading Nightphlox	Annual	Widespread and often abundant on roadsides, in paddocks and disturbed woodlands t	Manually remove small populations before they set seed.	No specific information. Suggest wicker wiping with 1:2 Roundup® to water.	No specific information, try: <u>Selective control</u> 20 mL Access® <u>Non-selective control</u> 100 mL Roundup®	No specific information, try: <u>Selective control</u> 500 mL Access® <u>Non-selective control</u> 500 mL Roundup®	Jul-Oct

Appendix Five: Native Species Identification Guide

The following guide is to help identify fourteen local native species and aid in seed collection. Species presented have at least one of the following attributes:

- Conservation significance
- Locally dominant
- Are characteristic of the Chert Coomberdale TEC.

With the exception of *Calothamnus quadrifidus*, all images shown were taken from the DEC Florabase website.

***Acacia acuminata* (Jam)**

DESCRIPTION	
Growth Form	Small Tree/ Shrub
Appearance	Stems upright and stiff with smooth grey bark
	Flowers up to 3cm long rods
	Leaves bright green, very thin, almost terete, up to 7.5 cm long Pods brownish, flat and narrow
Size	Height 1 - 7 m
	Width up to 4 m
Flowering	Yellow
	July - October
Habitat	Variety of soils and habitats
Conservation Status	Commonwealth - None
	State - None
Comments	Food source for local native fauna
	Prefers sunny positions on western facing slopes
Revegetation Significance	Locally dominant flora

***Acacia aristulata* (Watheroo Wattle)**



DESCRIPTION	
Growth Form	Small Shrub
Appearance	Stems erect or scrambling, white-grey and waxy
	Leaves light green, soft, thin and oblong, 7-10 x 2-3.5 mm
	Flowers globular 5-6 mm in width
Size	Seed pods once coiled to irregular twisted, <6 cm long x 4-5 mm wide
	Height 0.25 - 1 m Width up to 1 m
Flowering	Cream - White – Pale Yellow September - December
Habitat	Loamy or clayey sand over chert Low rocky ridges and hills, outcrops
Conservation Status	Commonwealth - Endangered State - Threatened
Comments	Food source for local native fauna
Revegetation Significance	Conservation significant flora

***Allocasuarina campestris* (Rock Sheoak)**

DESCRIPTION	
Growth Form	Small Tree/ Shrub
Appearance	Erect stem with slightly rough brown bark
	Needle dull green leaves, up to 20 cm long
	Male flowers 5 - 28 mm long
Size	Female flowers small globule with red filaments
	Cones cylindrical, 19-42 mm long
Flowering	Height 1 - 3 m
	Width up to 2 m
Habitat	Red, conifer
	May - January
Conservation Status	Lateritic and sandy soils
	Commonwealth - None
Comments	State - None
	Potential nesting site for local native birds when mature
Revegetation Significance	Locally dominant flora
	Trees drop large amount of leaves, which smother ground, restricting weeds

***Allocasuarina huegeliana* (Rock Sheoak)***Allocasuarina huegeliana*

Photos: S.M. Armstrong & H. Adamson

DESCRIPTION	
Growth Form	Tall Tree
Appearance	Stem erect and branching with rough grey bark
	Needle like leaves up to 10 cm long
	Male flowers light brown, similar in appearance to leaves
Size	Female flowers small globular spike
	Fruit ovoid conifer, 15-30 mm x 10-20 mm, brown turning grey over time
Flowering	Height 4 - 10 m
	Width up to 5m
Habitat	Red - Brown, conifer
	May - January
Conservation Status	Associated with granite
	Commonwealth - None
Comments	State - None
	Potential nesting site for local native birds when mature
Revegetation Significance	Locally dominant flora

Banksia fraseri

DESCRIPTION	
Growth Form	Large Shrub
Appearance	Stem is erect, scraggly with soft hairy branches
	Leaves are fern like, with stiff narrow leaflets, up to 10 cm long Flowers up to 6 cm in width Wood fruit produce 2 seeds per capsule
Size	Height 0.2 – 6 m
	Width up to 1 m
Flowering	Yellow – Green
	April - September
Habitat	Sand, limestone, laterite, granite
	Hill slopes and breakaways
Conservation Status	Commonwealth - None
	State - None
Comments	Food source for local native fauna Formerly named <i>Dryandra fraseri</i>
Revegetation Significance	Chert Coomberdale TEC characteristic flora

***Banksia sessilis* (Parrot Bush)**

DESCRIPTION	
Growth Form	Small Tree/ Shrub
Appearance	Stem erect, densely textured and round crown
	Leaves bluish green, broad holly like and prickly, up to 6 cm long Flowers 5 cm in width, at end of branches Wood fruit produce 2 seeds per capsule
Size	Height 0.5 - 5 m
	Width up to 2m
Flowering	Cream – Yellow April - November
Habitat	Sand, limestone, laterite, granite
Conservation Status	Commonwealth - None
	State - None
Comments	Food source for local native fauna Formerly named <i>Dryandra sessilis</i> Rapid coloniser of cleared sandy sites
Revegetation Significance	Locally dominant flora

***Calothamnus quadrifidus* (One Sided Bottlebrush)**

DESCRIPTION	
Growth Form	Medium Shrub
Appearance	Shape can be erect, compact or spreading, woody stem Leaves are flat, narrow and up to 2.5 cm long, can be slightly hairy Flowers and fruit occur along base of mature stems
Size	Height 0.9 - 2 m Width up to 2m
Flowering	Red June - December
Habitat	Wide variety of soils and habitats
Conservation Status	Commonwealth - None State - None
Comments	Food source for local native fauna
Revegetation Significance	Chert Coomberdale TEC characteristic flora

Calytrix leschenaultii

DESCRIPTION	
Growth Form	Small Shrub
Appearance	Erect compact stems
	Glabrous leaves, blade to linear shaped, 1-4 x 0.6-1.7 mm
	Flowers at end of stems, with 5-7 mm long petals and numerous stamens
Size	Seed at end of short stalk with bracts
	Height 0.15 - 1 m
Flower Colour	Width up to 1 m
	Purple - Violet - Pink – Blue
Habitat	June - November
	Sand, laterite, loam
Conservation Status	Commonwealth - None
	State - None
Comments	Species highly variable in appearance.
Revegetation Significance	Chert Coomberdale TEC characteristic flora

***Daviesia dielsii* (Diels' Daviesia)**

DESCRIPTION	
Growth Form	Small Shrub
Appearance	Stems widely branching, spiny with dense branchlets, sometimes hairy
	Leaves flat and oblique/oval with a sharp point 2-4 x 1-3 mm
Size	Flowers small, rise from axils in upper leaves, 5-6 mm long
	Fruit triangular pod, about 1 cm long, convex
Flowering	Height 0.5 - 0.9 m
	Width up to 1.8 m
Habitat	Orange - Red
	July - August
Conservation Status	Sandy, Gravelly soils
	Commonwealth - Endangered
Comments	State - Threatened
	Food source for local native fauna
Revegetation Significance	Species has both hairy and hairless varieties
	Conservation significant flora

***Eucalyptus loxophleba* (York Gum)***Eucalyptus loxophleba*

Photos: B.R. Maslin & S.J. Patrick

DESCRIPTION	
Growth Form	Tall Tree
Appearance	Base of trunk has rough grey bark, becoming fibrous and peeling at top Main branches are smooth and tan coloured
	Leaves dark green, lanceolate and smooth Flower buds occur in groups of 5 to 12 Fruits are green cup-shaped capsules
Size	Height up to 15 m
	Width up to 3 m
Flowering	White
Habitat	July - December, or January - February
Conservation Status	Variety of habitats, near drainage lines
	Commonwealth - None State – None
Comments	Food source for local native fauna
	Nesting site for local native birds when mature
Revegetation Significance	Locally characteristic flora

***Eucalyptus wandoo* (Wandoo)**



DESCRIPTION	
Growth Form	Tall Tree
Appearance	Smooth white-yellow bark, may be powdery
	Stem erect and branching
	Leaves pale green, lanceolata, tapering up to 12 cm long
	Flower buds green and horned
Size	Fruit dark brown, grooved capsules
	Height 3 - 25 m
Flowering	Width up to 6 m
	Cream – White
Habitat	December - May
	Sandy loam, clay loam, gravel, laterite, granite
Conservation Status	Stony rises, undulating terrain
	Commonwealth - None
Comments	State – None
	Food source for local native fauna
Revegetation Significance	Nesting site for local native birds when mature
	Locally dominant flora

Kunzea praestans

DESCRIPTION	
Growth Form	Medium Shrub
Appearance	Several erect stems with many branches
	Oblong and rounded leaves, stiff, 5-7 x 2-3mm
	Flowers at ends of branches, round, up to 1 cm wide
Size	Fruit small woody capsules, 3 mm wide and up to 6mm long when open
	Height 1 - 2 m
Flowering	Width up to
	Pink – Purple
Habitat	September - October
	Laterite soils, hill slopes
Conservation Status	Commonwealth - None
	State - None
Comments	Plants may vary from being glabrous to hairy
Revegetation Significance	Known to hybridise with other Kunzea species.
	Locally dominant flora

Regelia megacephala

DESCRIPTION	
Growth Form	Large Shrub
Appearance	Erect stem, rigid and branching
	Leaves rounded, small and finely haired Flowers occur at end of branches, up to 1.5 cm wide Fruit woody capsules, up to 1 cm wide
Size	Height 2 - 5 m
	Width up to 1.5 m
Flowering	Purple - Red
	October - December
Habitat	Quartzite hills
Conservation Status	Commonwealth - None
	State - Priority 4
Comments	Naturally restricted to quartzite hills in Moora region
Revegetation Significance	Conservation significant flora

***Xanthorrhoea drummondii* (Grass Tree)**

DESCRIPTION	
Growth Form	Small Tree/ Shrub
Appearance	Tree like monocot
	Trunk erect, often single
	Leaves green, stiff, up to 1m long and narrow, densely packed at top of trunk
Size	Flowers occur on single spike, up to 2m long
	Height up to 4.5 m Width up to 1 m
Flowering	Cream – White September – November, usually after fire
Habitat	Sand, laterite
Conservation Status	Commonwealth - None
	State - None
Comments	Food source for local native fauna
Revegetation Significance	Locally common flora

Appendix L

**Weed Review of Moora Mine
Rehabilitation**

A Report on the Rehabilitation of Mine Waste at the Simcoa Moora Chert Mine based on monitoring in October 2022

Prepared for:

Simcoa Operations Pty. Ltd.

By: Malcolm Trudgen

M.E. Trudgen & Associates

March 2023

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1.0 INTRODUCTION

1.1 Purpose of this report

The purpose of this report is to provide a review of the progress of the rehabilitation of vegetation on mine waste dump areas, at Simcoa Operations Pty Ltd ("Simcoa") in Moora, over the three years to October 2022 and to comment on appropriate future rehabilitation treatments and monitoring. This report is a development of previous reports by Trudgen 2016 & 2020; Trudgen *et al* 2013; Trudgen *et al* 2010; Morgan 2007; Trudgen 2004, and Trudgen *et al* 2001b,.

1.2 Location of the mine and rehabilitation areas

The mine and rehabilitation areas are located about fifteen kilometres north of Moora on the east side of the Midlands road, some 185 km north of Perth (see Figure 1).

1.3 The mine

The Simcoa chert mine is based on chert deposits on Mining Lease M70/191. A second pit was developed in 2004. Waste material includes scalps (chert less than 25 mm diameter), overburden as well as sand and silt from the settling ponds (Parker *et al.* 1998). The overburden can include a range of material up to cobbles and small boulders.

1.4 Vegetation of the Coomberdale Chert - a "Threatened Ecological Community"

The chert ridges being mined lie in the Coomberdale Floristic Region of Griffin (1992a). This floristic/vegetation unit is differentiated from other such units at a regional scale. Unlike the other units described at the same level by Griffin, it is of quite restricted occurrence, being found only on the chert outcrops and associated soils on the adjoining slopes of the Coomberdale Chert. The Coomberdale Floristic Region consists of a series of plant communities and associations often dominated by various mixtures of *Regelia megacephala*, *Kunzea praestans* and *Allocasuarina campestris* frequently with a sparse overstorey of *Allocasuarina huegeliana*, or *Acacia acuminata* (Jam) or *Eucalyptus loxophleba* ssp. *loxophleba* (York Gum). There is much variation, including various combinations of these taxa.

More recently, the heath communities dominated by one or more of *Regelia megacephala*, *Kunzea praestans* and *Allocasuarina campestris* that occur on the Coomberdale Chert ridges and slopes have been classified as a "Threatened Ecological Community" (Hamilton-Brown 2000).

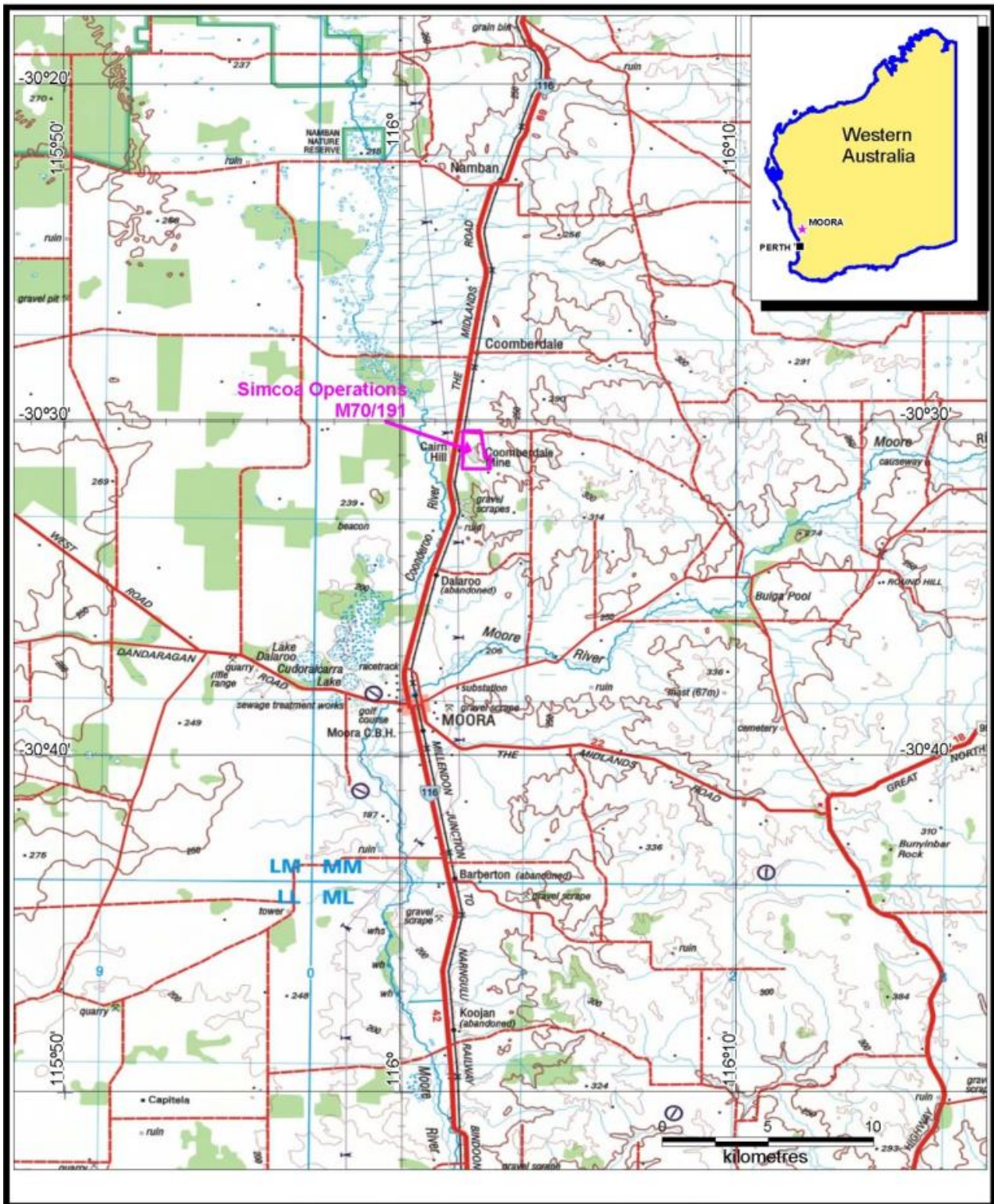


Figure 1: Location of the Simcoa quartzite mine located north of Moora.

"Ecological Community" is a catch-all phrase that is applied to various levels of vegetation types or fauna "communities" that are perceived to be rare or in need of protection. The Department of Biodiversity, Conservation and Attractions (formerly the Department of Parks and Wildlife and other titles) manages lists of vegetation types needing special attention for its protection (e.g.,

English and Blyth 1997) and advises the relevant Minister of which should be listed as Threatened Ecological Communities.

Prior to mining, the current Main Pit area had vegetation of *Kunzea praestans* open scrub and *Regelia megacephala* open scrub and two small areas of *Allocasuarina campestris* open scrub (Trudgen 1985). The West Pit area had vegetation of *Kunzea praestans* open scrub and *Regelia megacephala* open scrub (Trudgen *et al.* 2006). The vegetation in both areas vegetation would have been referable to the Coomberdale Chert Threatened Ecological Community.

As well as having restricted vegetation, the Coomberdale Chert Threatened Ecological Community is known to be the habitat a number of Declared Rare and Priority flora species as well as poorly known flora species that are not currently assigned to either of those categories.

1.5 Comparison of the rehabilitation on the waste dumps and the threatened ecological community using floristic analysis

Floristic analyses carried out by Trudgen *et al.* (2001a) included the December 2000 rehabilitation quadrat data allowing the rehabilitation vegetation of the waste dumps to be compared to plots in native vegetation on the chert ridges.

When the weeds were excluded from the floristic analysis, the eight rehabilitation quadrats formed a group separate from the native vegetation on the chert ridges. That is, floristic analyses showed that the vegetation of quadrats in the waste dumps rehabilitation area were most similar to each other, and were quite different to the quadrats of the native vegetation close by, as well as to that of distant chert ridges. More detailed results and discussion of the floristic analyses (including the dendrograms) are given in Trudgen *et al.* (2001a). It was not considered useful to repeat such analyses for this update report.

2.0 SIMCOA'S REHABILITATION OBJECTIVES

The objectives for rehabilitation at the Simcoa mine site were noted in the EMMP (Parker *et al.* 1998). They are to:

- Create stable slopes on the waste to minimise erosion,
- Establish a stable vegetation composed of local native plant species;
- Re-establish the geographically restricted species *Regelia megacephala* in appropriate areas.

Subsequently, in 2002 Simcoa undertook to include Declared Rare Flora and Priority Flora in rehabilitation trials as a commitment made as part of the environmental impact assessment procedures carried out for the Western Ridge pit (Strategic Environmental Solutions, 2001).

3.0 BACKGROUND TO SIMCOA WASTE DUMP REHABILITATION

The first rehabilitation carried out at the Simcoa Moora mine site was the establishment (in May 1991) of a native vegetation rehabilitation trial on the western slope of the North Waste Dump (Griffin, 1991). Since then, more than forty-seven (47) separate areas of rehabilitation have been established on the waste dumps, these and the locations of the waste dumps are shown on Figure 2.

Rehabilitation was next undertaken on the north and north-west-facing slopes of the Main Waste Dump (referred to in the January 2001 rehabilitation report (Trudgen *et al.*, 2001b) as the West Waste Dump, see Figure 2). Rehabilitation commenced in this area in 1993, with further areas treated in 1994, 1995-96, 1997, 1998, 1999, 2000, 2001, 2002, 2004, 2005, 2006, 2007, 2008, 2011 and 2013. Rehabilitation treatment typically consisted of battering of the slopes followed by addition of topsoil, chert rubble and scalps. After which *Regelia megacephala*, *Allocasuarina huegeliana* and *Allocasuarina campestris* brush and seed were applied as deemed necessary to assist rehabilitation in areas of low regeneration from topsoil stored seed. A new waste dump was started in 2010. Battering in this area began in 2013 and the lower slopes had topsoil spread in 2015.

More recently, waste from the Main Pit has been used to develop the South-East Waste Dump (see Figure 2). Sections of slopes of the South-East Waste Dump were re-vegetated in 2005 and 2006, as well as a small linear area in 2001. Waste from the more recently developed West Pit has been stockpiled in the Main Waste Dump area (see Figure 2). Sections of slopes of the Main Waste Dump were re-vegetated in 2005 and 2006.

Several earlier reports have provided details of the rehabilitation on the waste from the Moora mine. Griffin reported on the May 1991 rehabilitation trial on the North Waste Dump (Griffin 1991; Griffin 1992b; Griffin 1993). Since then, updated reports of the rehabilitation program have been written in 1995, 1998, 2001, 2004, 2007, 2010, 2014, 2016, and 2020 as part of triennial reports on the mining operation (Parker *et al.*, 1998, Trudgen *et al.* 2001b, Morgan and Trudgen 2004, Trudgen and Hannart 2014, Trudgen 2016, 2020).

The rehabilitation techniques tested in the 1991 rehabilitation treatment on the North Waste Dump were a covering of top soil (stored after being collected during mining operations) over the waste dump slope, with various treatments of combinations of *Regelia* brush (with seed in the capsules which were released on drying of the brush), extra seed (of *Allocasuarina campestris* and

Allocasuarina huegeliana) and areas with and without fertiliser (Griffin 1993 and Parker *et al.* 1998).

The treatments were repeated in areas up-slope and down slope of a centre line across the rehabilitation area, with each sub-area containing two plots of each treatment to give a total of 32 plots (Griffin 1991). The plots were separated by a buffer zone. In reviewing the progress of the trial, Griffin (1993) concluded that the factorial experiment should be considered complete, having demonstrated the basic practicality of establishing native species on the chert wastes and indicating the degree of success of the rehabilitation. The trial had shown that *Regelia megacephala*, *Allocasuarina huegeliana* and *Allocasuarina campestris* could be germinated from seed on the waste dump and could establish in the waste dump soils. As all three species hold their seed in capsules on the shrubs, unless release is triggered by events such as fire or death caused by drought, little seed of these species is found in the top soil where they occur, making seed application a necessary part of re-vegetation. The trial also demonstrated that a range of perennial native species had germinated from seed occurring naturally in the topsoil spread on the trial area. Finally, it was shown that the addition of fertiliser had a limited influence and it was recommended that fertiliser should not be added in future rehabilitation.

In 1993, 45 native plant species were recorded from the trial area, with the greatest vegetation cover due to five species: *Acacia congesta* subsp. *congesta*, *Kennedia prostrata*, *Hibbertia subvaginata*, *Regelia megacephala* and *Allocasuarina huegeliana*. The first three germinated from natural seed stores in the topsoil.

Griffin (1993) noted that a central belt of greatly reduced density and cover ran across the slope. He concluded that although the area coincided with the trial treatment of *Allocasuarina huegeliana* and *Allocasuarina campestris* added seed, the most likely cause was inadequate soil moisture holding capacity. Consequently, Griffin recommended the investigation of construction of the waste dumps to improve their moisture holding capacity.

Griffin (1993) also noted that the three species for which seed was added in the trial, *Regelia megacephala*, *Allocasuarina huegeliana* and *Allocasuarina campestris*, progressively declined in numbers over the three seasons to 1993. On the other hand, *Hibbertia subvaginata* (germinated from seed in top soil) had a big increase in numbers in 1992, but a big decrease in 1993 to lower numbers than in November 1991. Annual native species dramatically declined in numbers of

species found between November 1991 and November 1993. Weeds, though increasing in cover, were considered to have a limited impact. There was little sign of erosion.

Four ten by 10 metre quadrats were established in the 1991 rehabilitation area in 2000 (Trudgen *et al* 2001b) to collect data on ongoing changes in that area in the same size quadrat as used in other areas of the re-vegetation. The sites established by Griffin (see above) were pegged with wooden pegs and these were no longer able to be used to locate his quadrats

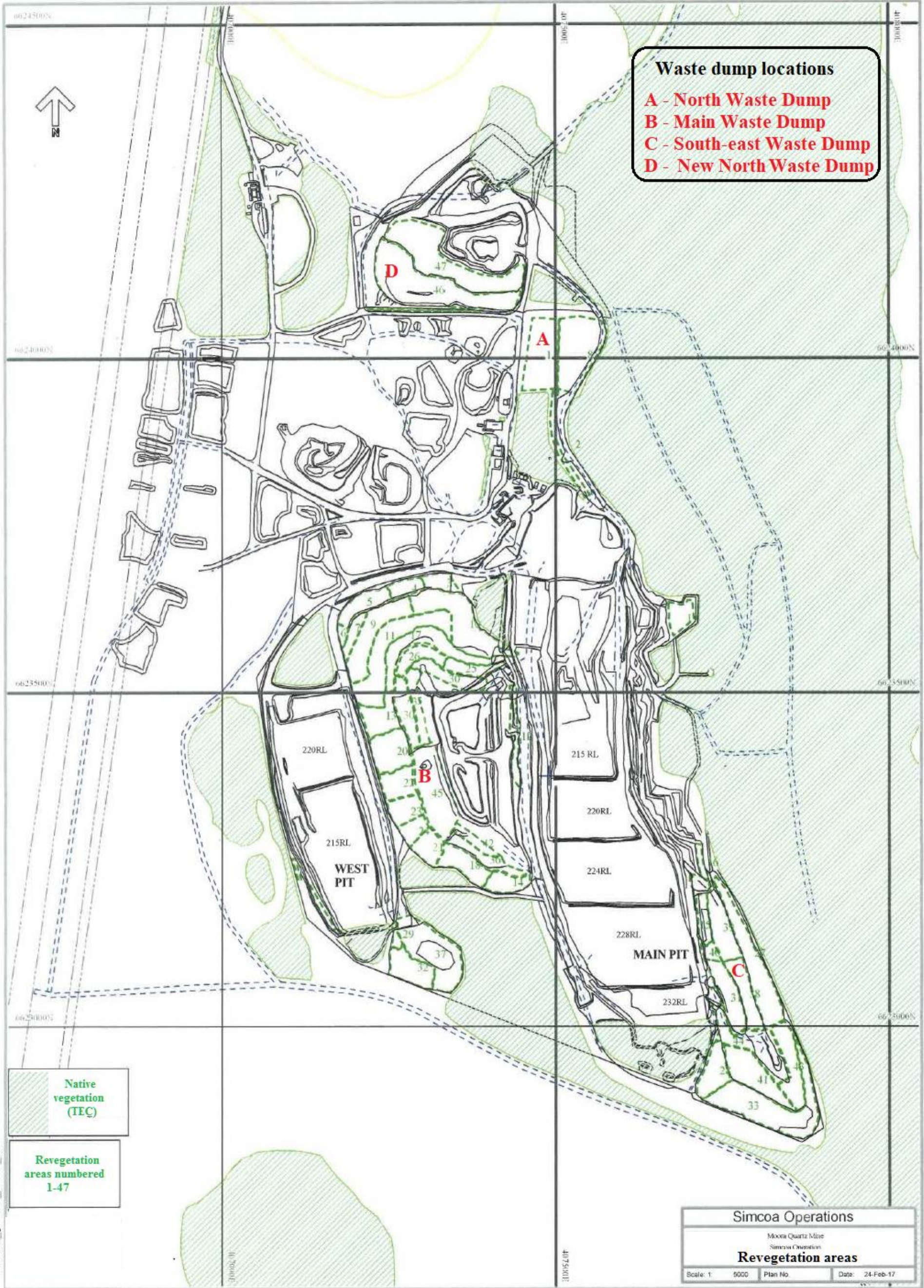


Figure 2: Location of rehabilitation areas and waste dumps

4.0 METHODS OF THE REHABILITATION MONITORING

4.1 Re-scoring of previously established quadrats

The seventeen 10 by 10 metre quadrats re-scored in 2016 and 2019 were rescored in October 2022. This included one in Area 37 not rescored in 2013. In addition two quadrats were installed and recorded on the New North Waste Dump and two quadrats not recorded in 2013, 2016 and 2019 were recorded. The locations of the quadrats are shown on Figure 3 and listed in Table 1 with the years each recorded in. Apart from the two new quadrats the quadrats were established between 2000 and 2010 on waste dump areas treated for rehabilitation between 1991 and 2007 and previously re-scored in 2004, 2007, 2010, 2013 and 2016 (see Table 1) depending on when they were established.

Table 1. Quadrats established on rehabilitation areas from 1991-2007 and years recorded between 2004 and 2022

Quadrat ID	Year area treated	Year quadrat established	Recorded 2004	Recorded 2007	Recorded 2010	Recorded 2013	Recorded 2016	Recorded 2019	Recorded 2022
R91/01	1991	2000	2004	2007	2010	2013	2016	2019	2022
R91/02	1991	2000	2004	2007	2010	2013	2016	2019	2022
R91/03	1991	2000	2004	2007	2010	2013	2016	2019	2022
R91/04	1991	2000	2004	2007	2010	2013	2016	2019	2022
R96/01	1996	2000	2004	2007	2010	2013	2016	2019	2022
R96/02	1996	2000	2004	2007	2010	2013	2016	2019	2022
R98/01	1998	2000	2004	2007	2010	2013	2016	2019	2022
R98/02	1998	2000	2004	2007	2010	2013	2016	2019	2022
R00/01	2000	2004	--	2007	2010	2013	2016	2019	2022
R00/02	2000	2004	--	2007	2010	2013	2016	2019	2022
R01/01	2001	2004	--	2007	2010	--	-	-	2022
R01/02	2001	2004	--	2007	2010	2013	2016	2019	2022
R02	2002	2007	--	--	2010	2013	2016	2019	2022
R04(22)	2004	2007	--	--	2010	2013	2016	2019	2022
R04/(23)	2004	2007	--	--	2010	--	-	-	2022
R05(27)	2005	2007	--	--	2010	2013	2016	2019	2022
Area 33	2005	2010	--	--	--	2013	2016	2019	2022
Area 37	2006	2010	--	--	--	--	2016	2019	2022
Area 41	2007	2010	--	--	--	2013	2016	2019	2022

The detailed data for each quadrat is given in Appendix 1 and include:

- The location of at least the North-East and South-West corners (all four corners are permanently pegged) using a hand-held GPS (accurate to approximately 3 to 5 m). Coordinates were recorded in WGS 84, Zone 50 (unless stated otherwise).

- A list of all species present with height, percentage foliage cover estimation and where practicable number of individuals for 2022 and (for comparison) the cover for 2016 and 2019;
- A vegetation description based on Aplin's (1979) modification of Specht's classification (see Appendix 2);
- The total cover of annual weeds, total native annuals were recorded where appropriate;
- The number of plants alive and dead was recorded for selected taxa;
- Landform and substrate characteristics;
- Photographs.

For some introduced annual species with numerous small individuals, only estimates of numbers could be made.

4.2 Specimen collection and identification

Any taxon not readily identified in the field was collected, pressed and identified later. A few specimens were of insufficient quality for identification, lacking flowering material. To ensure consistency between years with the naming of specimens, the material from previous years was reviewed in 2016 and 2017 and a small number of corrections made and the taxonomy updated. Collections from 2022 were identified to be consistent with the earlier work. Where taxonomy has changed names have been updated to be consistent with FloraBase.

4.3 Treatment of imprecise cover estimates

When an imprecise percentage estimate was made for percentage foliage cover of species (such as 10-15%), it was converted to a mid-point for calculation purposes. Where other estimates were made an appropriate value was used (e.g. > 10% was converted to 12%, < 10% was converted to 8%, < 5% was converted to 3.5%, < 1% was converted to 0.5%, "+" was converted to 0.1%)

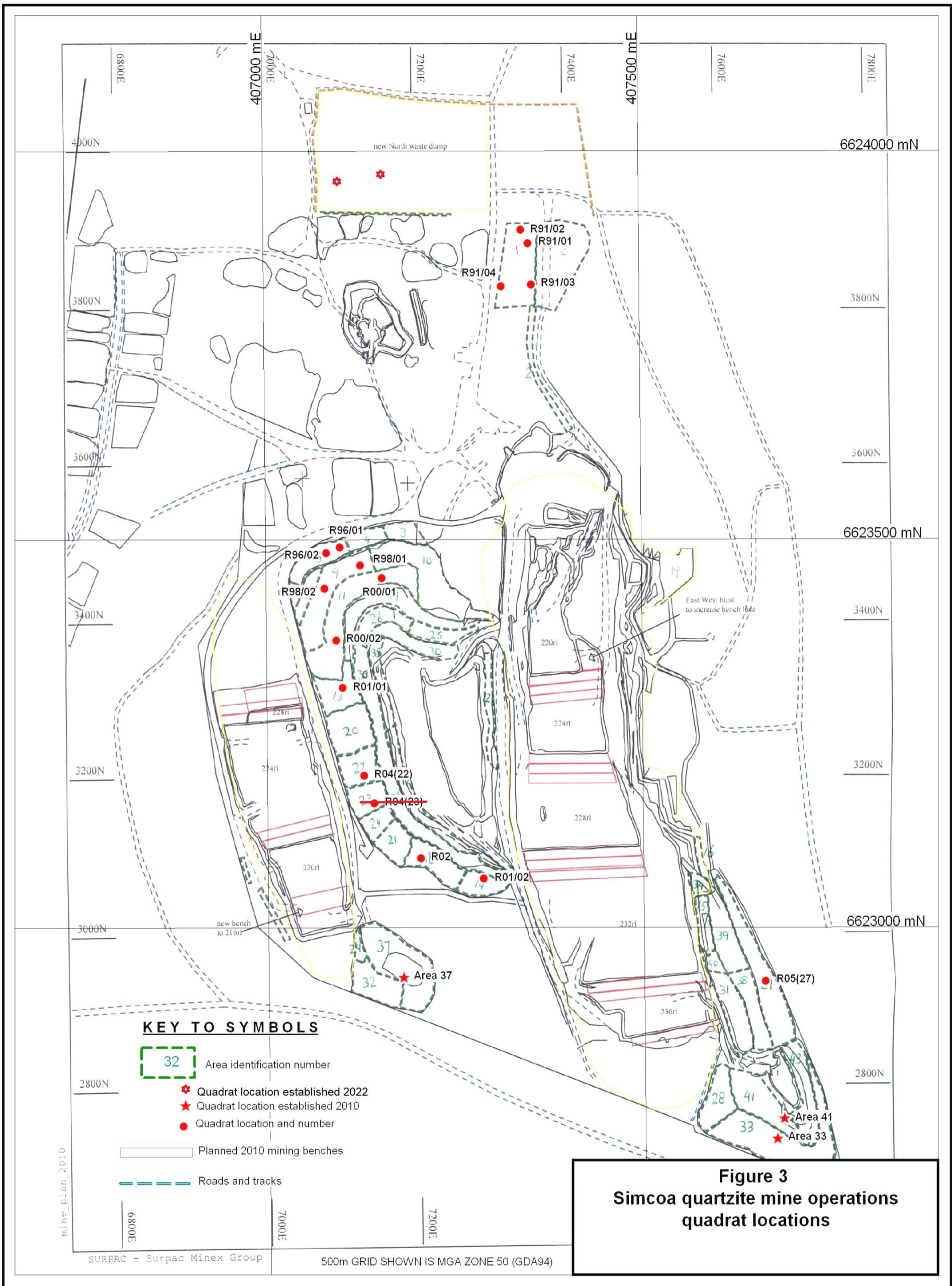


Figure 3: Location of quadrats in the SIMCOA chert mine rehabilitation areas
Notes: Quadrat R04/23 was located in an area that has been re-mined.

5.0 LIMITATIONS OF THE SURVEY AND ANALYSIS

The survey of the rehabilitation areas was limited by the fact that the 10 by 10 metre quadrats used are only a sample of the vegetation in each rehabilitation area. Consequently, the vegetation described in the quadrats is an approximation of the vegetation of each area sampled, not an exact measure. Also, the species list from the quadrats in the rehabilitation areas is not likely to be a complete list of what is in each rehabilitation area or to show the exact state of the whole rehabilitation area. However, given the number of quadrats sampled, these limitations should not significantly affect the results of the survey.

Visits to the quadrats have occurred during different seasons in different years over the period the rehabilitation areas have been monitored. This has caused some difficulty in the cover assessments of some species. This has mainly been the annual weed species, particularly *Hypochaeris glabra* (Flatweed) and *Erodium botrys*, these species die fairly early in the dry season and are then difficult to either count or estimate their cover.

Earlier in the rehabilitation monitoring the juvenile stage of some plant species in the more recently rehabilitated areas made identification of some of the species difficult when some of the quadrats were first established, but this was not a problem in 2016, 2019 and 2022. To ensure consistency of identification of specimens a reference set of specimens was made and new specimens compared to the specimens in it to confirm identifications.

Two quadrats were not recorded in 2013. Quadrat R01/01 on the main waste dump was not found as the geocode was in AGD84, not WGS 84, while Quadrat 04/(23) on the main waste dump had been re-mined for gravel product. The quadrat from “Area 37” on the south waste dump not re-scored in 2013 was re-scored in 2016. All the previously recorded quadrats were recorded in 2022 and two new ones established on the New North Waste Dump.

6.0 CLIMATE VARIATION IN THE MOORA AREA AND PROBABLE IMPACTS ON THE REHABILITATION

Table 2a gives summary details of the variation in rainfall at Barberton (9.9 km south from Moora) from 1911 to 2022. It shows the lowest annual rainfall recorded at Barberton to be 214 mm and the highest to be 790 mm. However it shows the median to be 438 mm. Comparing the annual rainfall at Barberton from 2009 to 2022 (see Table 2b) to the median, shows that the deviance from the median is much less for those years above the median compared to those years below the median. This deviance is highest for 2019, as the annual rainfall at Barberton in that year was 257 mm.

From the data in the two tables it is reasonably clear that the rehabilitation received lower than median rainfall in seven years over the 14 year period in Table 2b. Also, it is obvious that while in 2019 the rehabilitation received very low rainfall in 2021 and 2022 it received higher than median rainfall.

Table 2a: Monthly and annual rainfall variation for Barberton from 1911 to 2022

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	13.9	16.3	19.4	23.8	56.6	83.0	83.4	64.4	38.2	23.8	13.5	8.9	447.1
Lowest	0.0	0.0	0.0	0.0	1.5	9.0	8.2	10.3	4.7	1.2	0.0	0.0	214.0
5th %ile	0.0	0.0	0.0	0.9	9.0	28.9	31.8	24.6	11.9	3.6	0.0	0.0	311.8
10th %ile	0.0	0.0	0.0	1.8	17.5	40.0	43.8	30.5	15.0	6.4	0.6	0.0	336.8
Median	2.9	6.1	9.4	19.2	54.8	78.5	80.1	63.4	35.7	19.4	9.6	4.3	438.8
90th %ile	38.5	48.8	56.2	50.8	102.0	134.4	125.0	106.4	64.4	46.9	32.9	24.1	566.8
95th %ile	58.0	58.7	67.2	61.0	116.2	151.3	147.9	117.3	71.2	55.6	39.5	30.3	614.7
Highest	157.8	266.0	121.0	120.4	163.0	212.9	216.3	139.0	89.9	101.5	60.2	60.0	790.6

From: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=008005

Rainfall was extremely poor prior to the 2013 survey (see Table 2b below) with a dry winter (although wetter than in 2010 which was the second driest on record), with June only having 9 mm (Table 2b). The two years before 2010 had higher rainfall and equally importantly no winter month with low rainfall. The dry period extended into 2014 and 2015, with the latter year having much lower rainfall in September than is usual for the area. In contrast, 2016 had higher rainfall, but 36 mm of that occurred in January, when it would have much less effect, because of high evaporation, it also had fairly low rainfall in September and October. 2019 and 2020 had low rainfall, but 2021 and 2022 had higher than median rainfall.

Table 2b: Monthly and annual rainfall for Barberton (9.9 km to Moora) from 2011 to 2022

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<u>2009</u>	3	8.8	1	1.8	29.4	72	116.6	77.8	46	23.6	24.8	0	404.8
<u>2010</u>	0	0	64.8	4.6	58.8	26.4	62.4	47.8	24.8	2.6	5	12.8	310
<u>2011</u>	13.2	37.2	31.4	7.6	55.4	64.6	81.2	47.8	39.4	56.4	15.4	27	476.6
<u>2012</u>	88.8	60.4	0.2	6.6	5.2	98.2	8.2	53.2	64.4	6.4	54.1	14	459.7
<u>2013</u>	31	0	41.4	18	74.6	9	60.2	72.8	64	17.6	0.6	1	390.2
<u>2014</u>	6.6	0	12.2	41.4	80	38.5	73.7	30.8	52.4	14.4	4.6	4.4	359
<u>2015</u>	9	41.6	37.8	12.6	26.6	43.8	90.2	88.6	16	9	14.8	4	394
<u>2016</u>	35.8	0	38	59.8	43.2	90.4	76.2	75.6	31.2	12.4	8.4	9.6	480.6
<u>2017</u>	106.2	48.8	13.6	0.4	17.8	24.6	82.2	93	37.8	16	9.2	16.4	466
<u>2018</u>	60.6	11.2	2.2	1.2	47.6	52.4	120	113.2	16.8	41.6	6.8	4.8	478.4
<u>2019</u>	0.8	0.8	0.4	13.8	5.4	104.2	43.8	51.4	8.6	24.4	2.6	0.8	257
<u>2020</u>	0.4	44.8	5.6	5.6	29.3	41.0	25.0	67.8	24.6	3.1	38.4	1.2	286.8
<u>2021</u>	6.6	57.6	72.4	21.6	56.2	46.4	147.2	47.8	21.8	57.4	13.4	0.0	548.4
<u>2022</u>	0.0	12.8	56.2	70.2	43.0	60.4	57.8	139.0	45.0	19.2	14.0	0.0	517.6

From:http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=008005

From the discussion above, it seems likely that over the long term low rainfall years (interacting with low water retention in the waste) have had an impact on the survival of perennial shrubs in the rehabilitation. The dry years preceding 2016 undoubtedly had a significant impact on the plants in the rehabilitation areas, as did the low rainfall in 2019.

7.0 RESULTS

7.1 Changes in overall species complement in the quadrats between 2013 and 2022

The overall species complement found in the quadrats recorded has changed at each recording from 2013 to 2022. The changes are shown in Table 3, with species presence at a recording year, or more than one year, indicated by colour coding in the table.

The largest group (middle blue in the table) was recorded in all four recording years covered by the table and has sixty-two (62) species, of which twenty-six (26) are weeds. This group includes the main native and weed species in the rehabilitation; that is those that are more common in the quadrats and are more abundant (more individuals of annual species or more cover of perennial species). The comparable group in the 2019 data has lost one native (*Acacia stenoptera*) and two weed species (**Conyza bonariensis* and **Orobanche minor*), however these were species that only occurred infrequently in the rehabilitation.

Table 3 also shows that twenty-four (24) native species have been lost from the rehabilitation quadrats between 2013 and 2022. It is uncommon for species that have been lost to turn up again, but it does happen. *Dryandra sessilis* was recorded in 2013 then not until 2022, however the plant recorded in 2022 was a small seedling and its survival is uncertain. The species that have been lost are ones that have been uncommon in the quadrats, such as *Acacia stenoptera*. The latter species although lost from the quadrats is still present in the rehabilitation with very low occurrence.

Interestingly, while native species have been lost from the quadrats others have spontaneously appeared. The species that have spontaneously appeared have low frequency of occurrence. Some, such as *Dichopogon capillipes* and a *Microtis* species, are gradually becoming more common but are fairly small perennials and will never provide much biomass. Ten species that were not recorded in the previous three recordings were recorded in 2022 (see end of Table 3), however eight of these are very small to small annual species and may be lost again if weed cover increases in the quadrats they were recorded in. Relevant here is that these species were mostly recorded in the younger quadrats that have lower weed cover.

Austrostipa elegantissima and *Thysanotus manglesii* (both native perennials) appear to be exceptions to this trend and to be able to persist (and apparently increase) in quadrats with significant weed levels.

Table 3: Changes in species occurrences in the rehabilitation between 2013, 2016, 2019 and 2022

Notes: The dates indicate which years a species was recorded. Red text means an introduced species. Each colour indicates a different set of years species occurred in (the set years are given in the first row of a group).

<i>Acacia aristulata</i> [2013 only]	<i>Calytrix</i> aff. <i>leschenaultii</i> (Moora)	* <i>Vulpia myuros</i>
<i>Billardiera heterophylla</i>	* <i>Centaurea melitensis</i>	<i>Wahlenbergia preissii</i>
<i>Cotula</i> sp.	<i>Cheilanthes austrotenuifolia</i>	<i>Waitzia nitida</i>
<i>Cryptandra glabriflora</i>	<i>Comesperma integerrimum</i>	<i>Calandrinia calyptata</i> [2016 only]
* <i>Cynodon dactylon</i>	<i>Desmocladius asper</i>	<i>Calandrinia remota</i>
<i>Guichenotia micrantha</i>	<i>Dioscorea hastifolia</i>	<i>Drosera</i> sp. (small rosette)
<i>Muehlenbeckia adpressa</i>	* <i>Ehrharta longiflora</i>	<i>Grevillea biternata</i>
<i>Quoya dilatata</i>	* <i>Erodium botrys</i>	* <i>Lamarkia aurea</i>
<i>Salsola tragus</i> subsp. <i>tragus</i>	<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i>	<i>Podotheca</i> aff. <i>gnaphalioides</i> (Moora)
<i>Senecio glossanthus</i>	<i>Gilberta tenuifolia</i>	* <i>Trifolium tomentum</i> var. <i>tomentum</i>
<i>Senecio quadridentatus</i>	<i>Goodenia berardiana</i>	<i>Podotheca angustifolia</i> [2016 & 2022]
<i>Solanum oldfieldii</i>	* <i>Hedynois rhagadioloides</i>	<i>Daviesia hakeoides</i> ssp. [2016, 2019]
<i>Dryandra sessilis</i> [2013 & 2022]	<i>Hibbertia subvaginata</i>	<i>Aristida contorta</i> [2016, 2019 & 2022]
* <i>Solanum nigrum</i>	* <i>Hypochaeris glabra</i>	<i>Brunonia australis</i>
<i>Rytidosperma caespitosum</i> [2013,16]	<i>Kennedia prostrata</i>	<i>Cheilanthes adiantoides</i>
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	<i>Kunzea praestans</i>	<i>Cuscuta</i> sp.
<i>Alyogyne huegelii</i> v. <i>grossulariifolia</i>	<i>Lepidosperma tenue</i>	<i>Dichopogon capillipes</i>
<i>Daucus glochidiatus</i> [2013,16 & 22]	* <i>Lysimachia arvensis</i>	<i>Drosera macrantha</i>
* <i>Orobanche minor</i>	Moss sp.	* <i>Lupinus cosentinii</i>
<i>Acacia stenoptera</i> [2013,16, 2019]	* <i>Parentucellia latifolia</i>	<i>Microtis</i> sp.
* <i>Conyza bonariensis</i>	* <i>Pentameris airoides</i>	<i>Neurachne alopecuroidea</i>
<i>Acacia acuminata</i> [2013, 16, 19 & 22]	* <i>Petrorhagia dubia</i>	* <i>Trifolium hirtum</i>
<i>Acacia congesta</i> subsp. <i>congesta</i>	<i>Podolepis lessonii</i>	* <i>Wahlenbergia capensis</i>
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	<i>Ptilotus polystachyus</i> var.	<i>Apium annuum</i> [2019 only]
* <i>Aira caryophyllea</i>	<i>Regelia megacephala</i>	<i>Caladenia flava</i>
<i>Allocasuarina campestris</i>	* <i>Romulea rosea</i>	<i>Pterostylis exserta?</i>
<i>Allocasuarina huegeliana</i>	<i>Rytidosperma acerosum</i>	<i>Pterostylis</i> sp. [2019 & 2022]
* <i>Arctotheca calendula</i>	<i>Senecio diaschides</i>	<i>Crassula colorata</i> var. <i>acuminata</i>
<i>Austrostipa elegantissima</i>	* <i>Silene gallica</i> var. <i>gallica</i>	<i>Rhodanthe laevis</i>
<i>Austrostipa</i> sp. Cairn Hill	* <i>Sonchus oleraceus</i>	<i>Phyllangium sulcatum</i> [2022 only]
<i>Austrostipa trichophylla</i>	<i>Stylidium caricifolium</i>	<i>Euphorbia drummondii</i> subsp. <i>drum.</i>
<i>Austrostipa variabilis</i>	<i>Thysanotus patersonii</i>	<i>Homalosciadium homalocarpum</i>
* <i>Avena barbata</i>	<i>Trachymene cyanopetala</i>	<i>Hyalosperma glutinosum</i> ssp.
<i>Blennospora drummondii</i>	<i>Trachymene ornata</i>	<i>Crassula colorata</i> var. <i>colorata</i>
<i>Bossiaea moylei</i>	<i>Trachymene pilosa</i>	<i>Podolepis canescens</i>
* <i>Brachypodium distachyon</i>	* <i>Trifolium arvense</i> var. <i>arvense</i>	<i>Podotheca gnaphalioides</i>
* <i>Brassica barrelieri</i> ssp. <i>oxyrrhina</i>	* <i>Trifolium repens</i> var. <i>repens</i>	<i>Rhagodia preissii</i> ssp. <i>preissii</i>
* <i>Briza maxima</i>	* <i>Monoculus monstrosus</i>	<i>Wahlenbergia gracilentia</i>
* <i>Bromus diandrus</i>	* <i>Urospermum picroides</i>	<i>Stylidium septentrionale</i>
* <i>Bromus rubens</i>	* <i>Ursinia anthemoides</i>	

7.2 Changes in plant family and species numbers in the rehabilitation

Table 4 gives the changes in the presence of plant families and numbers of species in each plant family in the rehabilitation from 2016 to 2022. It shows that there is some change at the family level with Chenopodiaceae, Loganiaceae and Euphorbiaceae recorded for the first time since before 2013. As the species gained from these families are native species, this is a positive for the rehabilitation. This should be tempered by the fact that two of the species are small annuals and may not survive future increased weed competition. Also, the number of plants is not large so the effect on biomass is limited; still it indicates some ability of native species to spontaneously invade the rehabilitation.

An interesting feature of the information in the table is that some species that were not recorded in 2019 were recorded in the same quadrats they were recorded in in 2016. This appears likely to be due to the fact that 2019 was much drier than 2022. An example of this loss and regain is the occurrence of *Orobancha minor*. This species is an underground root parasite that does not have chlorophyll, what is observed above ground is short lived flowering stems. It appears that conditions were not suitable for flowering in 2019 for this species, so it did not appear above ground. On the other hand conditions in 2022 suited it and more stems were observed than in 2016.

Overall, there were sixteen reoccurrences or new occurrences of native species in 2022 compared to 2019, with only three native species being lost. There were four gains or reoccurrences of weed species. From 2013 to 2022 there has been an increase of native plus weed species from eighty-four (84) to ninety-seven (97), with a drop to seventy-nine in 2019 due to the dry year and a rebound to ninety-seven in 2022 due to the wetter year. There was some small change in the numbers of genera, with part of this being losses and then regains, for example *Goodenia* and *Brunonia* have been lost then regained, while *Homalosciadium* has been gained and *Apium* lost from 2019 to 2022.

Table 4: Losses and gains in species and plant families between 2013 and 2022 in the sixteen quadrats recorded from 2013 on

Notes: Some families no longer separated in recent studies are maintained to allow comparisons with earlier reports in this series (e.g. the Pea family (Papilionaceae) is maintained as separate from the Wattle family (Mimosaceae)). Except for one fern family and one moss, the families are all flowering plants.

Family	Number species 2013	Number species 2016	Number species 2019	Number species 2022	Changes from 2013 to 2022
Amaranthaceae	1	1	1	1	No change all years.
Apiaceae	1	1	1	2	2019: 1 native species and genus (<i>Apium</i>) gained and 1 native species and genus (<i>Daucus</i>) lost. 2022: 2 native species gained (<i>Homalosciadium</i> & <i>Daucus</i>) and <i>Apium</i> lost.
Araliaceae	3	3	3	3	2022: No change. Three species of <i>Trachymene</i> still

					present
Asparagaceae	1	2	2	2	2016: 1 native species and genus (<i>Dichopogon</i>) gained, <i>Thysanotus</i> still present. 2022: No change.
Asteraceae	18	16	14	20	2016: Two native Senecio lost and one native Podotheca gained. All annuals. One weed species (a <i>Cotula</i>) lost. 2019: 3 native species and 2 genera (<i>Millotia</i> , <i>Podotheca</i>) lost and 1 native species and genus (<i>Rhodanthe</i>) gained. 2022: One weed (* <i>Conyza bonariensis</i>) and one native (<i>Podotheca</i> aff. <i>gnaphalioides</i>) lost. Two weeds regained (* <i>Hedypnois rhagadioloides</i> and * <i>Sonchus oleraceus</i>) and four natives regained (two <i>Podotheca</i> , <i>Gilberta</i> and <i>Podolepis canescens</i>).
Brassicaceae	1	1	1	1	No change all years.
Moss	1	1	1	1	No change all years.
Campanulaceae	1	2	2	2	2016: One annual species gained. 2019: No change. 2022: No change.
Caryophyllaceae	2	2	2	2	No change all years.
Casuarinaceae	2	2	2	2	No change all years.
Chenopodiaceae	0	0	0	1	2016: One annual native species and genus lost (<i>Salsola</i>). 2022: One species gained (<i>Rhagodia preissii</i>).
Convolvulaceae	0	1	1	1	2016: One <i>Cuscuta</i> species gained. 2019: No change. 2022: No change.
Crassulaceae	0	0	1	1	2019: 1 species of <i>Crassula</i> gained. 2022: Second variety gained,
Cyperaceae	1	1	1	1	No change all years.
Dilleniaceae	1	1	1	1	No change all years.
Dioscoreaceae	1	1	1	1	No change all years.
Droseraceae	0	2	0	1	2016: Two native species gained (two <i>Drosera</i> species). 2019: 2 native species lost and 1 genus (<i>Drosera</i>). 2022: 1 <i>Drosera</i> gained.
Euphorbiaceae	0	0	0	1	2022: <i>Euphorbia drummondii</i> gained.
Geraniaceae	2	2	2	2	No change all years.
Goodeniaceae	1	2	0	2	2016: One native species and genus gained (<i>Brunonia</i>). 2019: One native species and genus lost (<i>Brunonia</i>). 2022: <i>Goodenia</i> and <i>Brunonia</i> regained.
Hemerocallidaceae	1	1	1	0	2022: One species lost (<i>Chamaescilla corymbosa</i>).
Iridaceae	1	1	1	1	No change all years.
Loganiaceae	0	0	0	1	2022: One genus and species gained (<i>Phyllangium</i>).
Malvaceae	1	0	0	0	2016: One perennial species and genus (<i>Alyogyne</i>) lost (but still adjacent to the quadrat). 2022: No change.
Mimosaceae	5	5	4	4	2016: One native species lost & one gained. Both perennial. 2019: One native species lost. 2022: No change.
Myrtaceae	4	4	4	4	No change all years.
Orchidaceae	0	1	4	3	2016: One native species and genus gained (<i>Microtis</i>). 2019: 3 native species and 2 genera gained (<i>Caladenia</i> and <i>Pterostylis</i>). 2022: <i>Caladenia</i> lost.
Orobanchaceae	1	1	0	1	2022: * <i>Orobanche minor</i> re-appeared.
Papilionaceae	4	7	6	6	2016: Three weed species gained and one genus (<i>Lupinus</i>). 2019: 1 species lost. 2022: No change.
Pittosporaceae	1	0	0	0	2016: One native species and genus lost (<i>Billardiera</i>).
Poaceae	16	18	17	17	2016: 2 native genera <i>Neurachne</i> (perennial) & <i>Aristida</i> (annual) gained. 1 weed species and genus (<i>Cynodon</i>) lost & one annual weed species & genus (<i>Lamarkia</i>) gained. 2019: 1 species and 1 genus (<i>Lamarkia</i>) lost. 2022: No change.

Polygalaceae	1	1	1	1	2022: No change.
Polygonaceae	1	0	0	0	2016: One native species and genus lost (<i>Muehlenbeckia</i>). 2022: No change.
Portulacaceae	0	2	0	2	2016: Two native species and one genus (<i>Calandrinia</i>) gained. 2019, 2 species and 1 genus (<i>Calandrinia</i>) lost. 2022: 2 <i>Calandrinia</i> regained.
Primulaceae	1	1	0	1	2019, 1 species and 1 genus (<i>Lysimachia</i>) lost. 2022: * <i>Lysimachia</i> regained
Proteaceae	1	0	0	1	2016: One native species and genus lost (<i>Dryandra</i>). 2022: <i>Dryandra</i> regained.
Pteridaceae (Ferns)	1	2	2	2	2016: One native species of <i>Cheilanthes</i> gained. 2022: No change.
Restionaceae	1	1	1	1	No change all years.
Rhamnaceae	1	0	0	0	2016: One native species and genus lost (<i>Cryptandra</i>).
Scrophulariaceae	0	1	1	1	2016: One weed species and genus (* <i>Parentucellia</i>) gained. 2022: No change.
Solanaceae	2	0	0	1	2016: One native and one weed species of <i>Solanum</i> lost. 2022: One weed gained.
Sterculiaceae	1	0	0	0	2016: One native species and genus lost (<i>Guichenotia</i>).
Stylidiaceae	2	2	1	2	2016: 1 <i>Stylidium</i> lost & 1 <i>Stylidium</i> gained (native perennials). 2019, 1 species lost. 2022: One <i>Stylidium</i> regained.
Verbenaceae	1	0	0	0	2016: One native species and genus lost (<i>Quoya</i>). 2022: No change

7.3 Families and genera with the most species

The two families with the most species recorded in 2022 are the same as in all previous years; Poaceae (Grass family) and Asteraceae (Daisy family). Of interest is that these two families have different stability in their species numbers in the rehabilitation. The Poaceae have been almost stable from 2013, while the Asteraceae have fluctuated significantly in species numbers. While the Poaceae had sixteen species in 2013 and increased to eighteen in 2016 since then it has been stable on seventeen species. Over the same period the Asteraceae had eighteen in 2013, dropped to sixteen in 2016 and fourteen in 2019. It then rebounded to 2022. This family is apparently more influenced by seasonal conditions than the Poaceae. Both of these families have a mixture of weeds and native species in the quadrats.

The next most speciose family in the quadrats is the Papilionaceae (Pea family) with six species, the same as in 2019. This family increased from four to seven species in 2016, but has had six since 2019. The Mimosaceae (Wattle family) had five species in 2013 and 2016 dropped to four in 2019 and has stayed there.

Three of the four genera with the most species (Table 5) are native genera. *Acacia* (Mimosaceae, Wattle family) a genus of woody shrubs and trees, *Austrostipa* (Poaceae, Grass family) a genus of mostly small tussock grasses and *Trachymene* a genus of small herbaceous annuals belonging to the

Araliaceae. **Trifolium* (Clovers, Pea family) is the other genus with several species in the rehabilitation and had four species recorded in 2016, up from two in 2013 and dropping to three in 2019 and 2022.

Table 5: Genera with the highest number of taxa recorded in 2022

Genus	Number of species in the rehabilitation
<i>Acacia</i> (native)	4 (two lost since 2013)
<i>Austrostipa</i> (native)	4 (same as 2013 on)
* <i>Trifolium</i> (weed)	3 (2 in 2013, 4 in 2016, 3 in 2019 on)
<i>Trachymene</i> (native)	3 (same as 2013, 2016, 2019 and 2022)

7.4 Frequently recorded species in quadrats – changes from 2013 to 2022

The species most frequently recorded in the quadrats recorded are a combination of native species and weeds. At previous recordings, the native species (particularly the perennial ones) were gradually declining in their presence in quadrats while the weeds were gradually increasing in presence. The wet year in 2022 (and possibly the year before) has to some degree reversed this. However, the reversal is significantly in seedlings and juvenile plants of native species and these have to establish, including survive the 2022/2023 summer. The changes from 2013 through to 2022 for frequently recorded species are shown in Table 6.

The four largest native perennial species that are more common in the quadrats are *Regelia megacephala* (a Priority 4 native shrub), *Allocasuarina huegeliana* (a tree Sheoak), *Allocasuarina campestris* (a shrub Sheoak) and *Acacia congesta* subsp. *congesta*. The most frequently occurring smaller shrub is *Hibbertia subvaginata*.

In a turnaround since 2019, *Acacia congesta* subsp. *congesta* was recorded at eleven quadrats up from six in 2019. However, at five quadrats only seedlings or juvenile plants were recorded in 2022 and it remains to be seen if they can survive to be adults. Of interest is that three of the quadrats with *Acacia congesta* seedlings are from the oldest (1991, North Waste Dump) group of quadrats that have high weed invasion and high *Allocasuarina huegeliana* cover. As 2019 was dry year and 2022 a wetter year, it seems likely that rainfall differences are the cause of the drop in the number of quadrats with *Acacia congesta* in 2019 and the increase in 2022.

Allocasuarina huegeliana has remained present in all quadrats from 2013 to 2022, although there have been some changes in the numbers of individuals in quadrats. After declining to present in

nine quadrats in 2016 *Allocasuarina campestris* increased presence in one quadrat in each of 2019 and 2022.

The total number of plants of *Allocasuarina campestris* declined, mostly due to the drop from ca. 300 plants in 2019 to ca. 120 plants in 2022 in quadrat 98/01. However, there were some small drops in numbers of plants in other quadrats. *Allocasuarina huegeliana* had small drops in numbers in some quadrats but also had a large drop in quadrat 98/02 where juvenile plants recorded in 2019 largely did not survive to 2022. However, three plants had established in this quadrat, a more sustainable number.

Regelia megacephala was present in eleven quadrats in 2022, down from twelve in 2019. The number of individual *Regelia* plants dropped from ca. 289 in 2019 to 73 in 2022, this was largely the loss of unsustainable density of young plants in some quadrats.

Hibbertia subvaginata was present in twelve quadrats in 2019 dropping to eleven in 2022, the total number of *Hibbertia* plants dropped from ca. 356 in 2019 to ca. 233 in 2022 this was largely the loss of smaller plants from quadrats where more plants than sustainable germinated. *Thysanotus patersonii/manglesii* two closely related climbers were present in quadrats in six quadrats in 2019 increasing to nine in 2022. This species pair (which are difficult to tell apart if not in flower) is unusual in that they appear to be able to invade fairly weedy sites and increase their presence in them.

Austrostipa trichophylla is a small perennial native grass that increased slightly in the number of quadrats it occurred in between 2013 and 2016, but declined between 2016 and 2019 and again between 2019 and 2022.

Of the three native annuals in the most frequently occurring species, two (*Trachymene cyanopetala* and *Ptilotus polystachyus* var. *polystachyus*) both occurred in more quadrats in 2016 than in 2019 and then occurred in more quadrats in 2022. The third species (the annual daisy *Podolepis lessonii*) increased between 2013 and 2016 and again between 2016 and 2019 but then was lost from one quadrat in 2022. This species tends to be fairly abundant in the native vegetation stands it occurs in and it may continue to increase where weeds are less abundant. However, it may decline if weed levels continue to increase.

Table 6: The most frequently recorded species in the quadrats in 2013, 2016 and 2019

Notes: To maintain valid comparison with 2013, the 16 quadrats recorded then and in 2016 are used (one recorded in 2016 but not 2013 is omitted). An * denotes a weed species. Grey highlight means a decrease in the number of quadrats a native species was recorded in. Blue highlight means an increase for native species, light brown an increase for a weed and green a decrease for a weed.

Species [Highlighted species are annuals]	2013 # of quadrats occurred in	2016 # of quadrats occurred in	2019 # of quadrats occurred in	2022 # of quadrats occurred in
<i>Acacia congesta</i> subsp. <i>congesta</i>	6	9	6	11
<i>Allocasuarina campestris</i>	11	9	10	11
<i>Allocasuarina huegeliana</i>	16	16	16	16
<i>Austrostipa trichophylla</i>	10	10	7	7
<i>Hibbertia subvaginata</i>	13	11	12	11
<i>Podolepis lessonii</i>	4	9	12	11
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	1	6	2	6
<i>Regelia megacephala</i>	14	11	12	11
<i>Thysanotus patersonii</i>	4	3	6	9
<i>Trachymene cyanopetala</i>	7	10	8	9
* <i>Arctotheca calendula</i>	9	11	10	15
* <i>Avena barbata</i>	15	14	15	15
* <i>Brachypodium distachyon</i>	5	7	6	8
* <i>Briza maxima</i>	12	12	11	5
* <i>Bromus rubens</i>	1	4	6	6
* <i>Ehrharta longiflora</i>	15	15	15	15
* <i>Erodium botrys</i>	12	8	9	11
* <i>Hypochaeris glabra</i>	16	15	16	16
* <i>Lupinus cosentinii</i>	0	3	7	2
* <i>Pentameris airoides</i>	12	13	6	7
* <i>Trifolium arvense</i> var. <i>arvense</i>	12	12	7	8
* <i>Monoculus monstrosus</i>	0	10	11	11
* <i>Urospermum picroides</i>	13	14	8	10
* <i>Ursinia anthemoides</i>	16	16	16	16
* <i>Vulpia myuros</i>	16	15	16	11

Several of the most commonly occurring weed species occur in most of the quadrats (see Table 6 above). Several of these species, including **Arctotheca calendula*, **Brachypodium distachyon* and **Urospermum picroides* have invaded more quadrats by 2022 than in 2019. Others that are in most of the sixteen quadrats have maintained the number they were recorded in in 2019, while three were recorded in fewer quadrats. Two of this three, **Briza maxima* and **Vulpia myuros* are smaller annuals and may be being out-competed by the larger weed grasses. The notable decrease was **Lupinus cosentinii*, this robust annual seemed from previous data likely to increase, but was lost from five quadrats. It may be just a random variation, or may reflect the fact that the species prefers less harsh sites, such as lower slopes in the New North Waste Dump.

7.5 Losses and gains of native species at quadrats by life form

While losses and gains of the most commonly recorded species give one view of what is happening in the regeneration, overall losses and gains of species of different life forms gives a further

understanding of the evolution of the composition of the rehabilitation vegetation. Table 7 shows the losses and gains of native species of different life forms from the sixteen quadrats recorded in 2013, 2016, 2019 and 2022.

There was no change in the tree life form, with *Allocasuarina huegeliana* in all quadrats, *Eucalyptus camaldulensis* (River Red Gum) in three and *Acacia acuminata* (Jam) in one. For the four large shrubs, *Acacia congesta* subsp. *congesta* was gained at five quadrats (but mostly seedlings) and *Allocasuarina campestris* at one. While *Regelia megacephala* was lost at one quadrat and *Kunzea praestans* was not changed. There are few species of small shrubs in the rehabilitation (which is a feature of the natural vegetation of the chert vegetation), with *Hibbertia subvaginata* the only such species common in the rehabilitation, it was lost at one quadrat in the 2022 data. Two other small shrubs that are present in the rehabilitation are *Calytrix* aff. *leschenaultii* (Moora) and *Bossiaea moylei*, which were both lost at one quadrat.

At the 2019 recording the two shrub categories (see Table 7) had more losses than gains, continuing the trend in the 2016 results. This was taken to indicate that the loss of shrubs seen in the oldest rehabilitation (the 1991 area) was also happening in the younger areas. At the 2022 recording there has been some reversal in the large shrub category. In 2022 *Acacia congesta* subsp. *congesta* was recorded at five quadrats it was not recorded at in 2019, while *Allocasuarina campestris* and *Dryandra sessilis* were each recorded at one additional quadrat. *Kunzea praestans* was unchanged and *Regelia megacephala* was lost at one quadrat. However, the gains were of seedlings and juveniles and may or may not survive to become adults.

The small shrub category unfortunately has lost three species from one quadrat each (*Calytrix* aff. *leschenaultii*, *Acacia lasiocarpa* and *Acacia stenoptera*) and has gained a new species (*Rhagodia preissii*) at one quadrat. These species are not common in the rehabilitation, but the losses do show a continuation of a trend. On the other hand *Hibbertia subvaginata* has maintained presence in all the eleven quadrats it was recorded at in 2019.

Perennial herbs were gained at nine quadrats and lost at three in 2022, compared to gained at five and lost at 2 quadrats in 2019. The species involved are all quite small but include two (*Dichopogon capillipes* and a *Microtis*) that seem able to survive and invade weedy areas. The contribution of these taxa to the rehabilitation at this stage is quite small.

Native climbing and running species were gained at eight quadrats at the 2022 recording, up from six at in 2019. In contrast to 2019, there were no losses of this life form. The most common species in this group are *Thysanotus patersonii* and *Thysanotus manglesii*, which are both climbers that have annual stems and perennial tubers.

There are two small *Cheilanthes* (Rock Ferns) that occur in the rehabilitation (and in the Chert native vegetation), they were gained at six quadrats and lost in none at the 2022 recording. This is of the change from 2016 to 2019 where there were five losses and two gains.

There was minor change in the perennial grasses, with the somewhat surprising loss of *Austrostipa elegantissima* from two quadrats. Other changes were the loss of *Austrostipa trichophylla* from one quadrat and the loss of *Rytidosperma acerosum* from one quadrat and gain at another. The only native annual grass in the rehabilitation is *Aristida contorta* which was gained at three quadrats. This species was recorded at one quadrat in 2016, but not in 2019.

The largest numbers of gains of native species at quadrats was for annual herbs, as was the case at the 2016 and 2019 recordings. The gain of a species at quadrats 43 times is quite significant with the loss of species at quadrats ten times somewhat less so. Most of the gains were at quadrats with lower weed cover (usually in younger areas of the rehabilitation. The larger numbers of losses and gains in this category compared to other categories is a reflection of the fact that it has the most species. The most significant aspect of the gains is that species that were not recorded in the rehabilitation before or not since 2013 were recorded.

The totals at the bottom of Table seven show that gains of species at quadrats in 2022 was nearly four times as high as losses. This is a reversal from the 2019 recording when losses outnumbered gains and a higher proportion of gains than in 2016. It seems likely that the dry year in 2019 (and some other years) suppressed species and there has been some recovery. However, as the gains have mostly been in annual herbs the long term impact on rehabilitation success is not as great as it at first seems.

Table 7: Losses and gains of native species at quadrats by life form

Notes: The table covers the 16 quadrats recorded in 2013, 2016, 2019 and 2022.

Life form	Species gained at number of quadrats in 2016	Species lost at number of quadrats in 2016	Species gained at number of quadrats in 2019	Species lost at number of quadrats in 2019	Species gained at number of quadrats in 2022	Species lost at number of quadrats in 2022
Trees	1	1	2	0	0	0
Large shrubs	3	6	0	3	7	1
Small/medium shrubs	5	10	1	2	1	3
Perennial grasses	8	11	3	5	2	3
Annual grasses	1	0	0	1	3	0
Annual herbs	35	11	17	26	43	10
Perennial herbs	3	1	5	2	9	3
Ferns	6	0	1	4	6	0
Climber/creeper [#]	4	11	6	5	8	0
Totals	66	51	35	49	79	20

[#]All climbers except *Kennedia prostrata*.

7.6 Losses and gains of weed species at quadrats by life form

The range of life forms in the weed species in the rehabilitation is less than in the native species, with only three weed species present in the rehabilitation not being either an annual herb or an annual grass. Table 8a shows the numbers of weed species lost and gained at quadrats by life form between 2013 and 2016, 2016 and 2019 and 2019 to 2022.

Table 8a: Losses and gains of weed species at quadrats by life form

Notes: The table covers the 16 quadrats recorded in 2013, 2016 and 2019.

Life form	Number of quadrats species gained at 2016	Number of quadrats species lost at 2016	Number of quadrats species gained at 2019	Number of quadrats species lost at 2019	Number of quadrats species gained at 2022	Number of quadrats species lost at 2022
Annual herbs	56	12	10	47	44	13
Annual grasses	10	6	8	18	5	18
Small short lived shrub (* <i>Solanum nigrum</i> [#])	0	1	-	-	1	0
Perennial root parasite (* <i>Orobancha minor</i>)	3	0	0	5	0	1
Perennial herb (* <i>Romulea rosea</i>)	0	1	1	0	1	1

[#] **Solanum nigrum* often behaves as an annual in dryer habitats.

Table 8a shows that for annual grass weeds the rate of invasion of quadrats (quadrats gained at) dropped in 2019 and then dropped further in 2022. This is probably simply due to the number of quadrats the members of this group of species were not already in being low. On the other hand the number of quadrats where members of this group were lost increased to eighteen in 2019 and stayed at eighteen in 2022. This is a reflection of the fact that the smaller grass weeds were in many quadrats before the weed cover became high and as it has increased they have been out-competed by larger other weed species (both grasses and herbs).

The gains in the annual herb category has shown more response to seasonal conditions, with a drop from 56 to ten between 2016 and 2019 and then a rise between 2019 and 2022 of 44 species at quadrats. The loss in this category shows the reverse, in 2016 the loss was 12 and in 2019 it was 47, but it then drops to 13 in 2022, this is again probably a result of the dry year in 2019.

Some of the introduced grasses, particularly *Ehrharta longiflora* and to a lesser degree *Brachypodium distachyon* increased significantly in cover in some quadrats between 2016 and 2019. However, between 2019 and 2022 the changes were mixed, with a few sites showing increase in cover of *Ehrharta longiflora* and others showing decreases or little change. The data for *Brachypodium distachyon* is similar with two sites showing a significant decrease and others either little change or reappearance at low cover after being lost in 2019. Table 8b shows the cover and estimated number of plants of *Ehrharta longiflora* at the 2016, 2019 and 2022 recordings of the quadrats, with overall losses and gains of species.

Table 8b: Changes in cover and number of individuals of *Ehrharta longiflora* at quadrats and overall loss and gains of species

Notes: The quadrats are in age sequence with the oldest four (1991) at the top and the youngest (2007) at the bottom. The table includes all the 17 quadrats recorded in 2016 and 2019. The columns with highlighted header cells related to *Ehrharta longiflora*.

Quadrat	Species	Cover 2016	Cover 2019	Cover 2022	Est. number plants 2016	Est. number plants 2019	Est. number plants 2022	# species lost (gained) 2016/19	# species lost (gained) 2019/22
R91/01	<i>Ehrharta longiflora</i>	< 10%	> 25%	< 5%	> 400 small plants	> 1500 plants (most small).	Ca. 200	13 (3)	5 (10)
R91/02	<i>Ehrharta longiflora</i>	> 20%	> 25%	20%	> 300 plants	> 500 plants.	> 1,000	10 (4)	2 (9)
R91/03	<i>Ehrharta longiflora</i>	15%	≤ 30%	> 25%	> 500 plants	> 1,500 plants	> 1,500 plants	10 (1)	6 (10)
R91/04	<i>Ehrharta longiflora</i>	15%	35%	> 35%	> 600 plants	> 2,000 plants	> 2,000 plants	10 (1)	5 (5)
R96/01	<i>Ehrharta longiflora</i>	>10%	10%	≤10%	> 400 plants	> 4500 plants	Ca. 1,000	10 (2)	0 (7)
R96/02	<i>Ehrharta longiflora</i>	5-10%	5-10%	< 5%	> 150 plants	> 150 plants.	> 150 plants.	5 (3)	1 (7)

R98/01	<i>Ehrharta longiflora</i>	3-5%	+	+	>150 plants	1 plant!	[Few]	7 (6)	6 (9)
R98/02	<i>Ehrharta longiflora</i>	≥ 4%	≥ 4%	5%	> 200 plants.	> 200 plants.	> 500 plants	4 (0)	0 (10)
R00/01	<i>Ehrharta longiflora</i>	≤ 10%	≤ 5%	2%	> 500 plants.	> 500 plants.	> 200 plants	10 (2)	6 (7)
R00/02	<i>Ehrharta longiflora</i>	≥ 3%	1-2%	10%	> 300 plants.	> 300 plants.	> 500 plants	10 (7)	8 (10)
R01/02	<i>Ehrharta longiflora</i>	< 5%	< 5%	1%	> 200 plants.	> 500 plants.	< 100 plants	4 (2)	2 (9)
R02	<i>Ehrharta longiflora</i>	5%	5%	< /= 5%	> 400 plants.	> 400 plants.	> 400 plants	9 (5)	6 (11)
R04(22)	<i>Ehrharta longiflora</i>	4%	5%	5%	> 100 plants.	> 100 plants.	> 1,000 plants	5 (1)	1 (6)
R05(27)	<i>Ehrharta longiflora</i>	1-2%	1-2%	< 3%	> 100 plants.	> 100 plants.	> 400 plants	3 (7)	3 (10)
Area 33	<i>Ehrharta longiflora</i>	1-2%	< 1%	1-2%	> 100 plants.	> 100 plants?	> 200 plants	3 (2)	2 (14)
¹ Area 37	<i>Ehrharta longiflora</i>	2%	< 1%	< 1%	> 150 plants	< 100 plants	< 50 plants	9 (3)	2 (1)
[#] Area 41	[Not present]	-	-		-	-	-	4 (8)	6 (6)

[#]This quadrat had low weed cover in both recording years, but is very exposed with a rocky surface and also has low overall cover. ¹This quadrat also has a rocky surface and low weed cover, but has high cover of native species.

The right hand column of Table 8b gives the number of species (native and weeds combined) lost and gained between 2016 and 2019. At 2019, the overall trend was of more species lost and fewer gained in older quadrats than younger ones that correlates with higher cover and number of individuals of **Ehrharta longiflora*. However, in the 2022 data three of the older quadrats had high gains although the highest gains were in the younger quadrats. The results may be partly due to a “bounce back” from the dry period at 2019, as the older quadrats had high losses of species in that period.

The variation seems to be largely due to variation in the material underlying quadrats (and possibly their degree of slope), which (with an overlay of age that becomes more significant as quadrats age) appears to favour different weed species (and survival/regeneration of native species). There is then likely to be some interaction (competition) between weed species.

7.7 Species richness for the different ages of the rehabilitation

The species richness (number of species in a quadrat) of the different ages of the rehabilitation (see Table 9 below) has varied quite markedly. While the data is such that it is not easy to be definitive about trends it is apparent that native species diversity (especially perennial species) has generally declined and weed diversity has increased as quadrats become older. Overlain on this is a drop in both native and weed species in the 2019 data due to the dry period around that year and some

recovery in the number of both categories in the 2022 data. It remains to be seen whether or not the drop in 2019 actually masked some overall (native plus weed) increase in diversity.

The recovery in native species is largely of annual species and cryptophytes (species with perennial below ground organs (bulbs etc.) and annual above ground stems. However, there has been sporadic germination of native perennial species as well. It seems that factors like slope and rehabilitation material have a significant effect, with the latter possibly being more significant.

Table 9: Species richness in the rehabilitation quadrats for 2013, 2016, 2019 and 2022

Notes: The table covers the 16 quadrats recorded in 2013, 2016, 2019 and 2022 and the quadrat from Area 37 not recorded in 2013. Note the different number of quadrats for different ages, the numbers are averages when there is more than one quadrat for an establishment year (highlighted pale blue years). The numbers in red are the number of years since areas were regenerated.

Year quadrats established and codes	Number of quadrats	2013 Total # species & % weed species	2016 Total # species & % weed species	2019 Total # species & % weed species	2022 Total # species & % weed species
1991 R91 quadrats	4	37 species [22yrs] 17 weeds (46%)	50 species [25yrs] 26 weeds (52%)	31 species [28yrs] 15 weeds (48.4%)	24 species [31yrs] 10 weeds (45%)
1996 R96 quadrats	2	27 species [17yrs] 22 weeds (81.5%)	27 species [20yrs] 20 weeds (74%)	20 species [23yrs] 14 weeds (70%)	23 species [26yrs] 15 weeds (65%)
1998 R98 quadrats	2	25 species [15yrs] 11 weeds (44%)	29 species [18yrs] 17 weeds (59%)	24 species [21yrs] 12 weeds (50%)	24 species [24yrs] 15 weeds (60%)
2000 R00 quadrats	2	23 species [13yrs] 14 weeds (70%)	40 species [16yrs] 21 weeds (52.5%)	34 species [19yrs] 16 weeds (47%)	27 species [22yrs] 13 weeds (48%)
2001 R01 quadrat	1	13 species [12yrs] 9 weeds (69%)	21 species [15yrs] 14 weeds (67%)	16 species [18yrs] 11 weeds (68.8%)	23 species [21yrs] 13 weeds (57%)
2002 R02 quadrat	1	35 species [11yrs] 14 weeds (40%)	39 species [14yrs] 17 weeds (44%)	35 species [17yrs] 13 weeds (37%)	40 species [20yrs] 15 weeds (38%)
2004 R04 quadrat	1	32 species [9yrs] 17 (53%)	27 species [12yrs] 16 weeds (59%)	20 species [15yrs] 13 weeds (65%)	26 species [18yrs] 17 weeds (65%)
2005 qdts R05 & Area 33	2	33 species [8yrs] 13 weeds (39.4%)	36 species [11yrs] 14 weeds (38.9%)	37 species [14yrs] 14 weeds (37.8%)	37 species [17yrs] 13 weeds (35%)
2006 Area 37 qdt	1	Not recorded.	33 species [7yrs] 12 weeds (36%)	28 species [10yrs] 10 weeds (35.7%)	29 species [13yrs] 11 weeds (38%)
2007 Area 41 qdt	1	15 species [6yrs] 9 weeds (60%)	21 species [9yrs] 10 weeds (48%)	23 species [12yrs] 10 weeds (43.5%)	22 species [15yrs] 8 weeds (36%)

7.8 Records of Declared rare, priority and other significant flora in the rehabilitation

The species of particular conservation interest recorded in the rehabilitation quadrats in 2022 were *Regelia megacephala* (Priority 4), *Bossiaea moylei* (Priority 2) and a geographically restricted unnamed species of *Calytrix* (a Starflower) related to *Calytrix leschenaultii* (called here *Calytrix* aff. *leschenaultii* (Moora)). The latter species has only been recognised as distinct, it is fairly common

in the Chert Threatened Ecological Community, but is geographically quite restricted (it is also very pretty when in flower). It is likely to be given a Priority Flora designation in due course.

Two other species of significant flora that were recorded in in the quadrats in 2103 (and earlier years), the Declared Rare Flora species *Acacia aristulata* (found in two quadrats in 2013) and the Priority 2 species *Cryptandra glabriflora* were no longer present in 2016. The record of *Cryptandra glabriflora* in 2013 at one quadrat in the area rehabilitated in 2002 was the only record for this species in the rehabilitation quadrats. Prior to 2013, *Acacia aristulata* has also been lost from rehabilitation areas established in 1991 and 1996, in locations where it had been previously recorded. Another declared rare flora species *Daviesia dielsii* had been recorded before 2013 in the rehabilitation areas established in 1996 and 1998, but has not reappeared. It is possible that some seed of *Daviesia dielsii* and *Acacia aristulata* may be present in the seed bank in the rehabilitation areas; if that is the case then the species may appear after fire or in better years. The records of relevant species are shown in Table 10 for 2013 on.

The grass Tree (*Xanthorrhoea*) that is common in the vegetation of the Chert Threatened Ecological Community is now considered to be a distinct species that it is restricted to that vegetation and is another geographically restricted species. It has previously been referred to *Xanthorrhoea drummondii*, a name that has been misapplied to several undescribed taxa as well as applied to the real entity (which occurs further south). It has not yet been recorded in the rehabilitation.

Table 10: Declared rare, priority and other significant flora in the rehabilitation 2013 to 2022

Note: DRF = Declared Rare Flora; P2, P4 = Priority Flora 2, 4: Geog Restr. = Geographically Restricted. Plants in quadrats lost between two years highlighted grey. Plants present in a highlighted pale green. NN01 and NN02 are the two quadrats installed and recorded on the “New North” waste dump in 2022.

Species and status	Quadrat	Presence/absence 2013	Presence/absence 2016	Presence/absence 2019	Presence/absence 2022
Acacia aristulata Declared Rare	R04(22)	Present	Lost	-	-
	R05(27)	Present	Lost	-	-
	NN01	Not relevant	Not relevant	Not relevant	Present
	NN02	Not relevant	Not relevant	Not relevant	Present
Calytrix aff. Leschenaultii (Moora) Geographically restricted	Area 33	Present	Present	Present	Present
	R02	Present	Lost	-	-
	Area 37	(Quadrat not recorded in 2013)	Present	Present	Present
	R05(27)	Not present	Present	Present	Present
Cryptandra glabriflora Priority 2	R02	Present	Lost	-	-

Regelia megacephala Priority 4	R91/02	Present	Present	Present	Present
	R91/03	Present	Present	Present	Present
	R91/04	Present	Present	Present	Present
	R96/01	Present	Lost	-	-
	R96/02	Present	Present	Present	Present
	R98/01	Present	Present	Present	Present
	R98/02	Present	Present	Present	Present
	R00/01	Present	Present	Present	Lost
	R00/02	Present	Present	Present	Present
	R01/02	Present	Present	Present	Present
	R02	Present	Present	Present	Present
	R04(22)	Present	Present		
	R05(27)	Present	Lost	-	-
	Area 33	Present	Present	Present	Present
	Area 37	(Quadrat not recorded in 2013)	Present	Present	Present
Bossiaea moylei Priority 2	R00/02	Lost	Present	-	-
	R04(22)	Present	Present	Present	Present
	Area 37	(Quadrat not recorded in 2013)	Present	Present	Present

A number of other priority flora or DRF species, including: *Baekkea* sp. Moora (P1), *Goodenia arthrotricha* (P1), *Nemcia acuta* (P3), and *Tricoryne arenicola* (P2) are known from the Coomberdale Chert Threatened Ecological Community. Their absence from the rehabilitation is probably due to them being unevenly spread in the TEC and seed not being present in the areas topsoil was obtained from. The low occurrence of these species in the TEC is probably due to being restricted to very specific habitats (especially soil profile characteristics).

The rehabilitation progress to date has shown that the Priority 4 species *Regelia megacephala* can be successfully germinated and grown on the waste dumps when new areas are rehabilitated. However, there has been a general decline in the abundance of the species correlated with increased cover of *Allocasuarina huegeliana* and increase in weed cover. There have been exceptions to this in quadrats with low weed cover when old plants have died, their retained seed has fallen and conditions have suited germination and establishment. One event different to this is that in quadrat R91/04, which has moderate to high cover of weeds and moderate cover of *Allocasuarina huegeliana* had a young *Regelia* in 2022, the first young plant of this species in the four 1991 quadrats for quite some years.

7.9 Changes in the vegetation of the 1991 rehabilitation on the North Waste Dump

The 1991 rehabilitation area is the oldest, but the current set of quadrats was established in 2000 as earlier wooden pegs were no longer identifiable. Before 2000, the 1991 area was invaded by the native tree *Allocasuarina huegelii* (the winged seed of which can be wind distributed). The subsequent development of low woodland to low open forest of this species in the area has affected the survival of other species. The density and age of the *Allocasuarina* in this area is not typical of other rehabilitation areas, this is probably partly due to the different age of stands and partly due to different slopes and soil conditions. However, this does not mean that the processes affecting the vegetation in this area do not have similarities to the processes in the other areas. More attention is given to this area because it is the oldest area of the rehabilitation and therefore should offer insight to what long term outcomes for the rehabilitation will be. In addition, it is the only area with four quadrats, making the analyses for this area somewhat more robust statistically.

7.9.1 Changes in cover of tree and shrubs species in the 1991 rehabilitation

Figure 4 shows the changes in the average cover in the four quadrats since 2000 of the five perennial species that are or have been most significant in the vegetation structure developed in the 1991 rehabilitation on the North Waste Dump.

Prior to the 2016 recording, the tree species *Allocasuarina huegelii* had been increasing in cover, but in the 2016 data there was a fairly dramatic. There was then a slight increase in and a moderate increase in 2022. The large shrub *Regelia megacephala* had shown a drop in cover from 2000 to 2010 and then a slight rise to 2013, since then it has declined significantly. However, in 2022 there was one young plant suggesting that limited recovery is possible for this species. *Allocasuarina campestris* had stabilised at about 10% average cover in the four quadrats between 2010 and 2013, dropped in cover in 2016 and has increased somewhat since then. *Acacia congesta* had been recorded in three of the quadrats, but by 2010 had decreased to virtually no cover. In 2022 there were four juvenile plants in one quadrat and two seedlings in another, indicating that there is soil stored seed of this species. *Hibbertia subvaginata* has also dropped to very low cover, although there was a slight increase in 2022.

It seems likely that the dry years in 2109 and prior to 2016 (see climate section) caused parts of the drops in cover of species in the 1991 rehabilitation area, but that it effected different species somewhat differently.

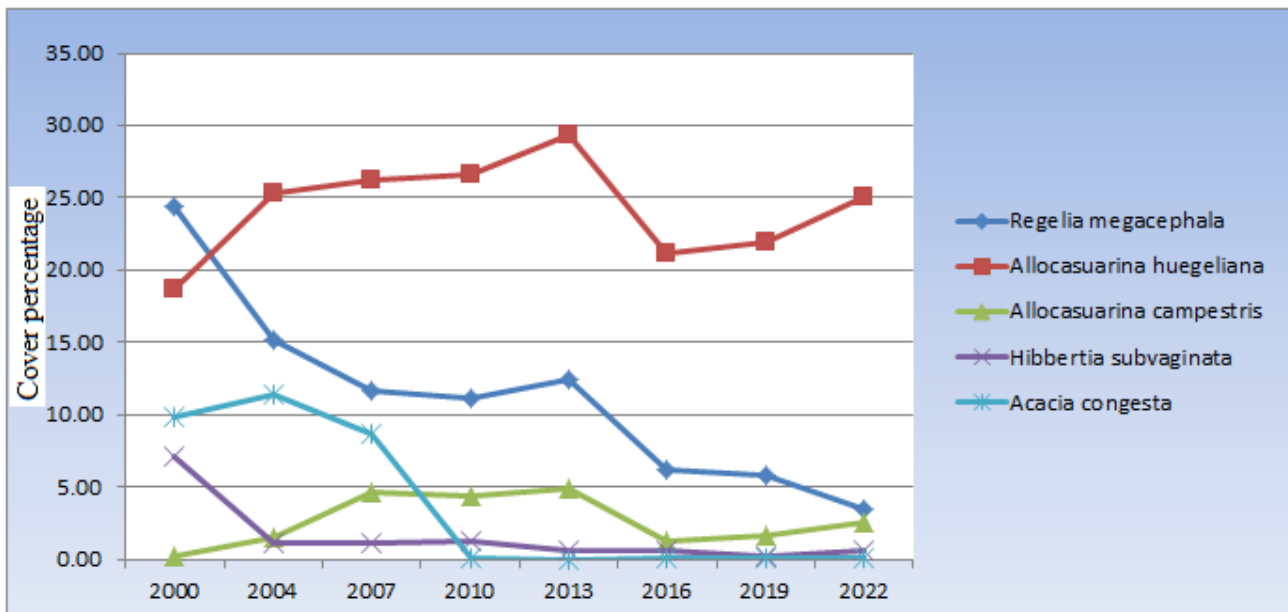


Figure 4: Average percentage cover of five perennial species in the four quadrats in the 1991 rehabilitation on the North Waste Dump

Figure 5 (see below) shows the average number of live and (recently) dead *Regelia megacephala* plants in the four quadrats in the 1991 area rehabilitation. While both categories show a downward trend, there has been significant germination of the *Regelia* at times; with many of the individuals that have been recorded in different years being seedling (which if they die soon after a recording may no longer be available to score as “dead” at the next recording). It is likely that the main reason none of these young *Regelia* plants have established is because the *Allocasuarina huegeliana* is too strong a competitor for water in the summers after germination. There were two juveniles of the *Regelia* in one of the quadrats at the 2019 recording and one young plant in one in 2022.

Acacia congesta subsp. *congesta*, the only *Acacia* species recorded in all four quadrats in the north waste dump rehabilitation in the 2000-2007 surveys, had almost completely disappeared from the 1991 quadrats by 2010. In that year, it was only present in quadrat R91/04 with cover recorded as “+” (= much less than 1% cover). In the 2016 data it was present as seedlings in two of the four quadrats, in 2019 was not present, but in 2022 was present in two quadrats as either juveniles or seedlings. It seems there is soil stored seed of this species in the 1991 area, but that survival through summer is a barrier to successful establishment.

The smaller shrub *Hibbertia subvaginata*, which is common in the Chert Threatened Ecological Community, was present in three quadrats in 2013 at low cover; by 2016 it was only present in two quadrats but had increased in cover at one of these. At the 2019 recording the *Hibbertia* was still

present in two quadrats with one plant in each with cover of < 1% and 1-2%. In 2022 only change for this species was a slight drop in cover.

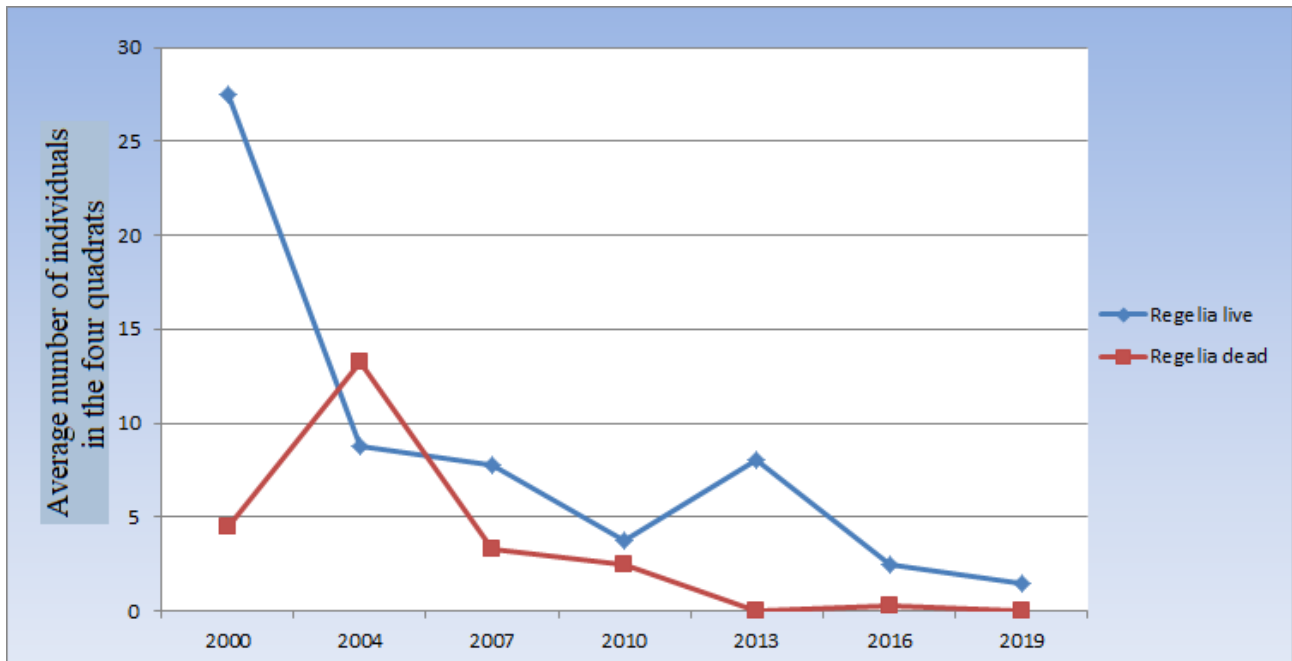


Figure 5: Average number of live and dead *Regelia megacephala* plants in the four quadrats in the 1991 rehabilitation on the North Waste Dump

It seems likely that the loss in cover of perennial species between 2013 and 2019 has been caused by a combination of the rainfall being little over the median to well below it (see Table 2a and Table 2b above) and the effect of the tree *Allocasuarina huegelii* on the other species discussed. This may partially be reversed if there are a series of good years (at least for those species with soil stored seed), but there is a likelihood that *Allocasuarina huegelii* will be the perennial species that is able to take most advantage of any series of good years. If the area is burnt, it is likely that some of the species will regenerate from seed. However, the same process, invasion of *Allocasuarina huegeliana* followed by displacement of the others species would probably recur.

7.9.2 Changes in average and total number of native species and weed species in the 1991 rehabilitation

The average numbers of species of native perennial, native annual and weeds in the four 1991 rehabilitation quadrats has changed with some parallels between the categories over the period of the recordings. The three groups increased in parallel between 2010 and 2016 and then all three declined. The reasons for this similarity in changes have probably changed somewhat over time due to changes in species composition (particularly changes in the *abundance* of possibly allelopathic weeds). The very low rainfall in 2019 is likely to have had a significant impact on that years data,

but there is no similar effect in 2016 from the dryer years in 2014 and 2015, so the impact of dry years has some limitations.

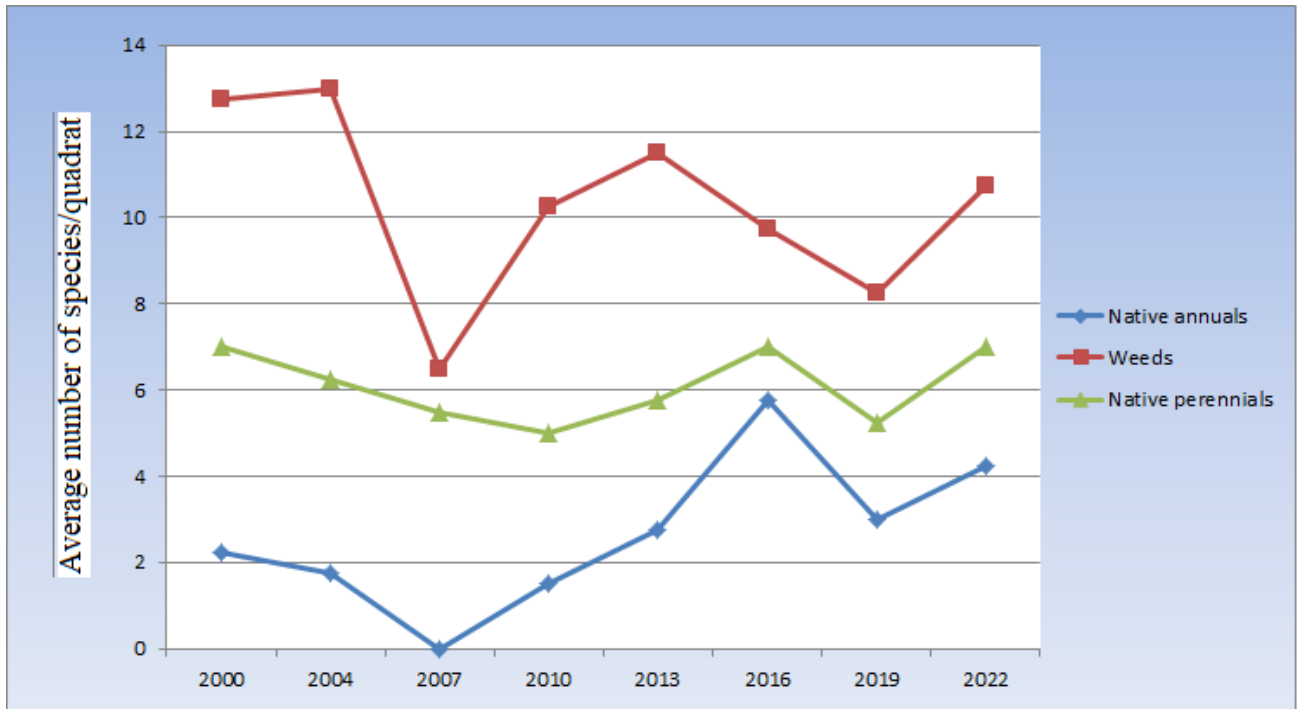


Figure 6: Average number of species of native perennial, native annual and weeds in the four 1991 rehabilitation year quadrats

It is important to realise that the averaged figures in Figure 6, while important to show overall trends, do not show the detail of what has happened. The drop in the two categories of native species in the figure has been caused by twenty-five (25) occurrences of species recorded at a quadrat in 2016 not being recorded in that quadrat in 2019. Similarly, the drop in the average number of weeds per quadrat has been caused by eighteen (18) occurrences of species recorded at a quadrat in 2016 not being recorded in that quadrat in 2019. Similar levels of change were observed between the presences and absences of annual species in 2019 and 2022. It seems that there is significant variation in the annual species that appear in these quadrats (possibly responding to climate factors) from year to year, with some species invading and some possibly still present as weed, but not germinating.

Figure 7 shows the total number of species in four categories (weeds, native annuals, native perennials and total natives) in the four 1991 rehabilitation year quadrats. This is done to allow for the fact that differential loss and gain in different quadrats *might* mask trends to some degree. However, this somewhat different view of the data simply shows that the trends are the same as for the averaged data. The inclusion of a combined category for all native species does highlight that the trends are the same for native and introduced (weed) species.

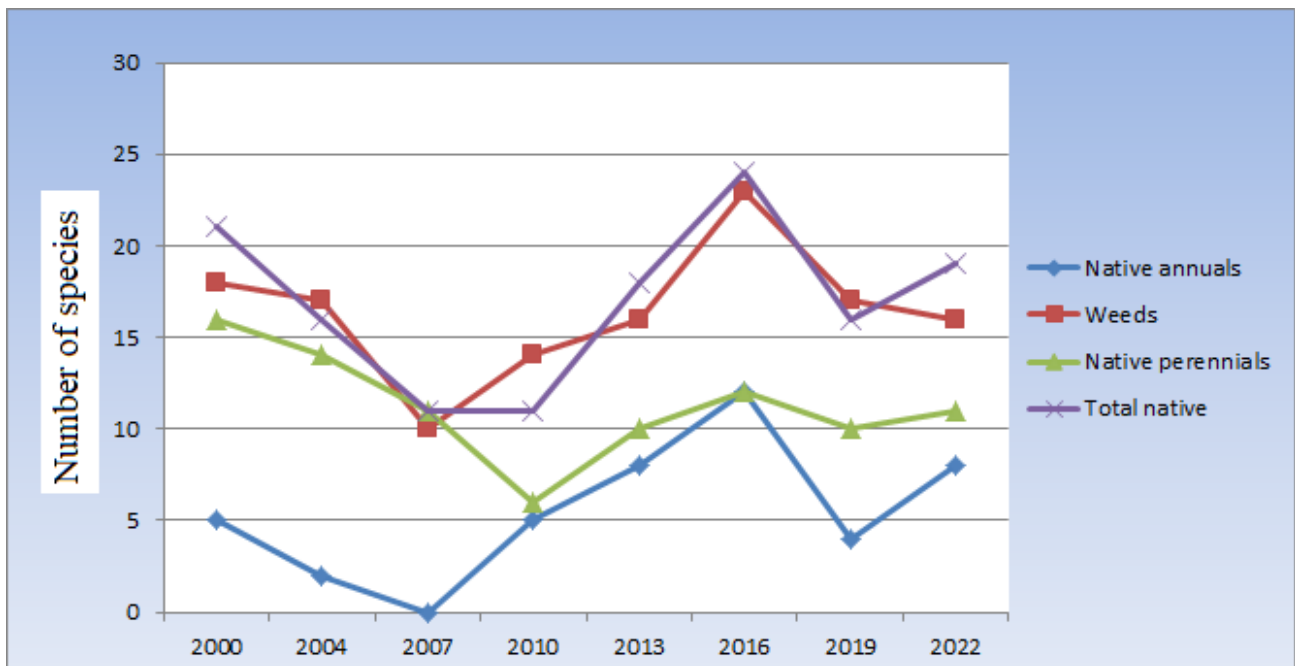


Figure 7: Total number of species in the 1991 rehabilitation for weeds, all native species, native perennial species and native annual species.

The overall result for the 1991 year rehabilitation is that the tree layer (*Allocasuarina huegeliana*) is affected by annual rainfall, but recovers from dry years. On the other hand the large shrub layers is decreasing in cover and diversity. In contrast to these patterns, the mostly annual lower layer is fluctuating in diversity of native species with recovery in 2022 from a drop in 2019. The weed component is showing similar fluctuation to the native annuals, but this may change if more aggressive species come to dominate.

7.9.3 Changes in average cover of native species and weeds in the 1991 rehabilitation

With the exception of 2007, there has been a fairly steady increase in the average cover of weeds in the 1991 rehabilitation area since 2000. In contrast, the average cover of native species has fluctuated (Figure 8) being highest in 2007, dropping to 2013 and then fluctuating. The weed cover has increased even in 2019, a dry year, when the height estimates of weed species was usually less than in 2016.

The increase in the cover of native species in 2016 was mainly due to increased cover of native annual species, particularly *Podolepis lessonii*. While the latter species did still increase in cover between 2016 and 2019 this was offset by decreases in the cover of other native species.

Unfortunately this species decreased in cover between 2019 and 2022.

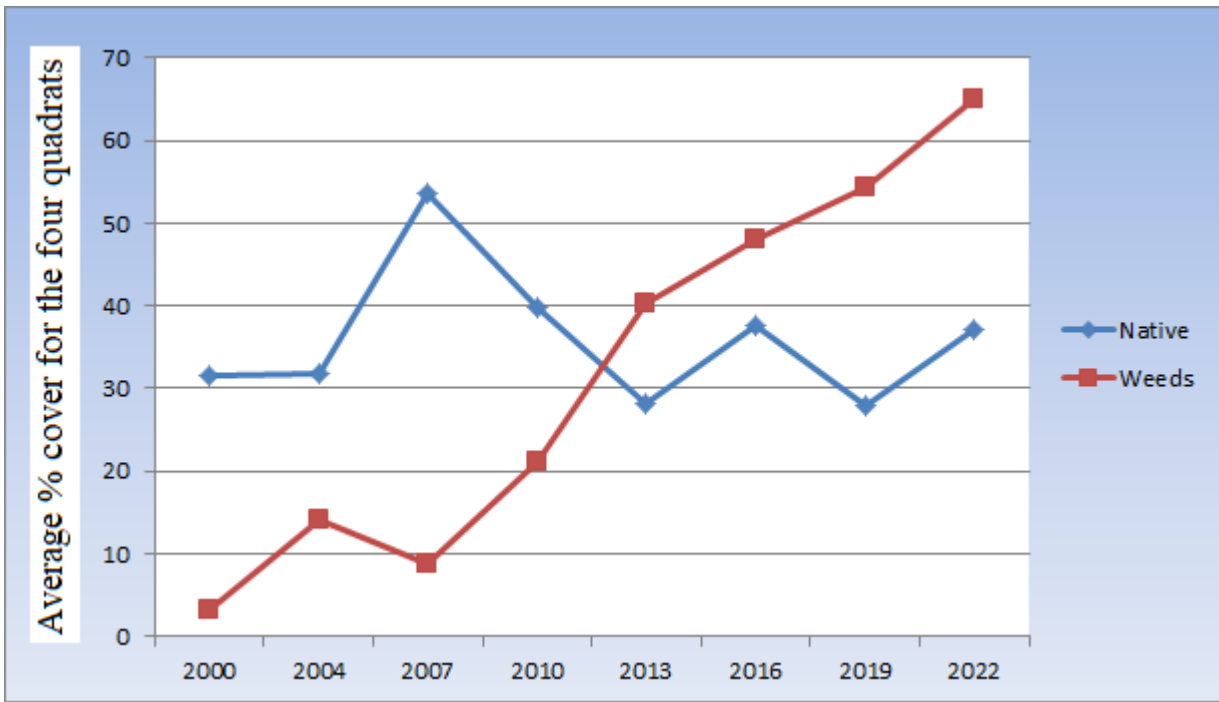


Figure 8: Average cover from 2000 to 2022 of native and weed species in the 1991 rehabilitation

7.10 Changes in the vegetation of the 1996 rehabilitation area on the Main Waste Dump

The 1996 rehabilitation area is the second oldest, with the recording of the two quadrats beginning in 2000. After initially rising, the average number of native perennials in this area has gradually dropped, with the loss of both *Acacia congesta* and *Hibbertia subvaginata* from both quadrats over time and the loss of *Regelia megacephala* from one quadrat in 2016 and a drop from two to one plants in the other in 2022. . There were no further losses of native perennial species at the 2019 recording, although one native annual (*Calandrinia* sp.) was lost, but reappeared in 2022.

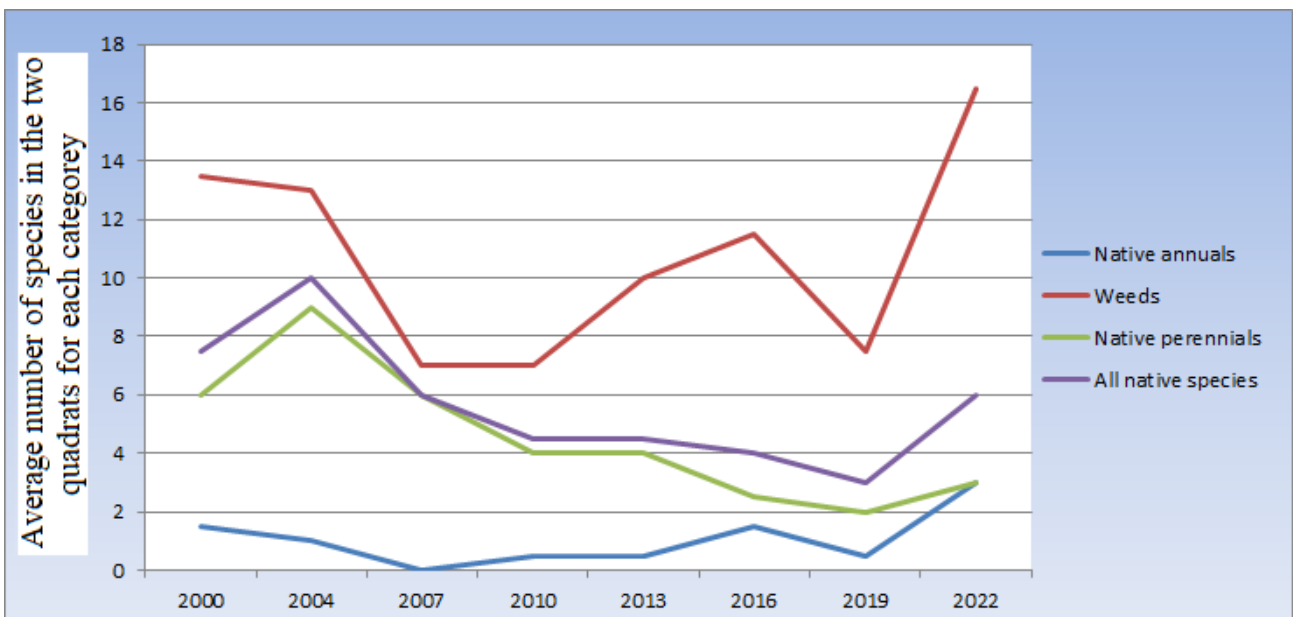


Figure 9: Average numbers of species in the 1996 rehabilitation for all weeds, all native species, native perennial species and native annual species

In contrast, the number of weed species (all annuals) at first dropped and has then risen at the 2013 and 2016 recordings before dropping in 2019 and increasing significantly in 2022. The drop in 2019 was presumably due to that being a dry year and the rise in 2022 because of that and the preceding year having higher rainfall. *Lupinus cosentinii* was first recorded in one of the quadrats in 2019, but was not in it in 2022, although it was observed outside the quadrat. This species appears to be spread in animal droppings, it has large seeds and occurrences in the rehabilitation on the main waste dump are mostly small. This weed may be restricted in abundance by the hard soil surface on much of the rehabilitation.

The number of native annual species has always been low, but after dropping in the 2004 and 2007 data increased slightly in 2016, dropped again in 2019 and then increased. In fact only two occurrences of native annuals were recorded in 2019, for an average of one species per quadrat. In 2022, two more annuals were recorded in one of the quadrats (*Aristida contorta* and *Calandrinia colorata* var. *colorata*).

The cover of *Regelia megacephala* was originally high (Figure 10) as this species was seeded into the rehabilitation by spreading brush containing the fruit. After a steep decline in cover it increased somewhat in 2007 before declining as young plants recorded in 2010 failed to survive the series of dry years before 2016. This trend has continued to the 2019 recording when only two plants were recorded in quadrat R96/02 down from four plants in 2016. By 2022 this had dropped to one plant.

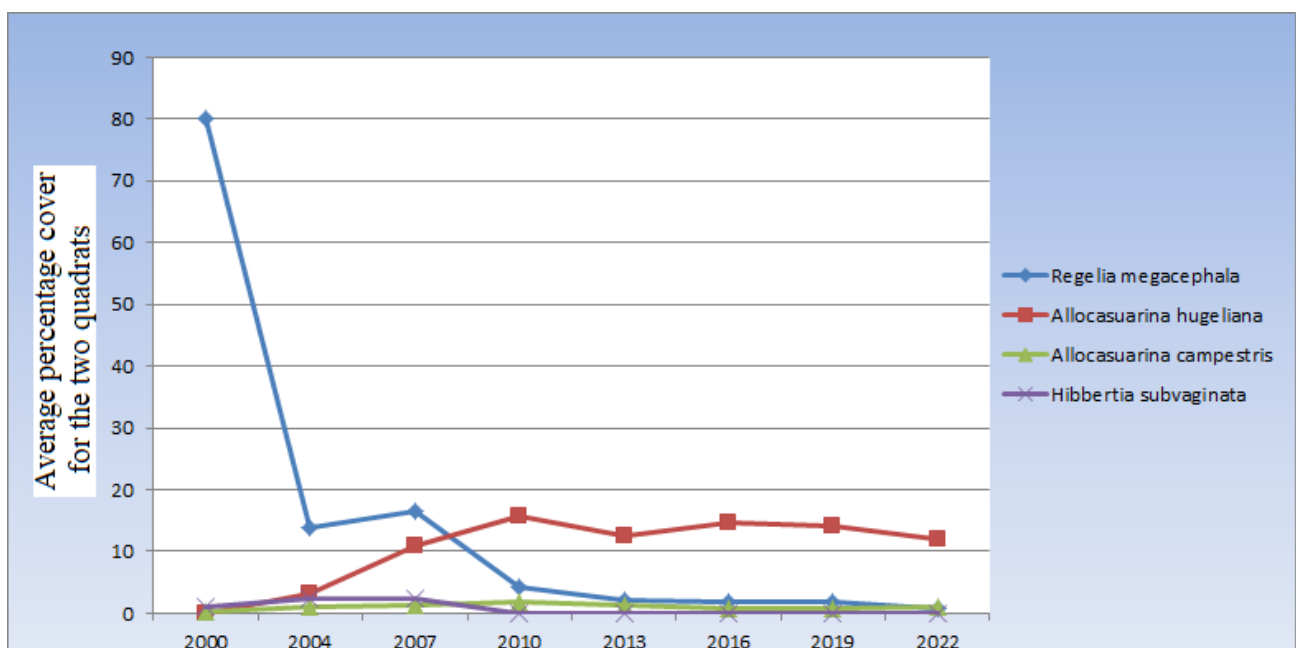


Figure 10: Average percentage cover of selected native perennial species in the 1996 area rehabilitation.

The drop in the average number of native perennial species has been paralleled by a drop in the cover of these species. Only *Allocasuarina huegeliana* has significantly increased in cover, but this species has also declined slightly in 2022. Unfortunately, the cover of weed species has increased over time to the point that the two quadrats had average weed cover of about 75% in 2016. This has stayed the same with average cover of 75.6% for the two quadrats in 2019. This seems to have occurred in a particularly dry year because although the individual plants of the weeds were smaller than in other years, *there were many more of most them*. By 2022, the average cover of weeds (noting that there is more than one overlapping layer) was 114%, but was much higher in one of the quadrats than in the other.

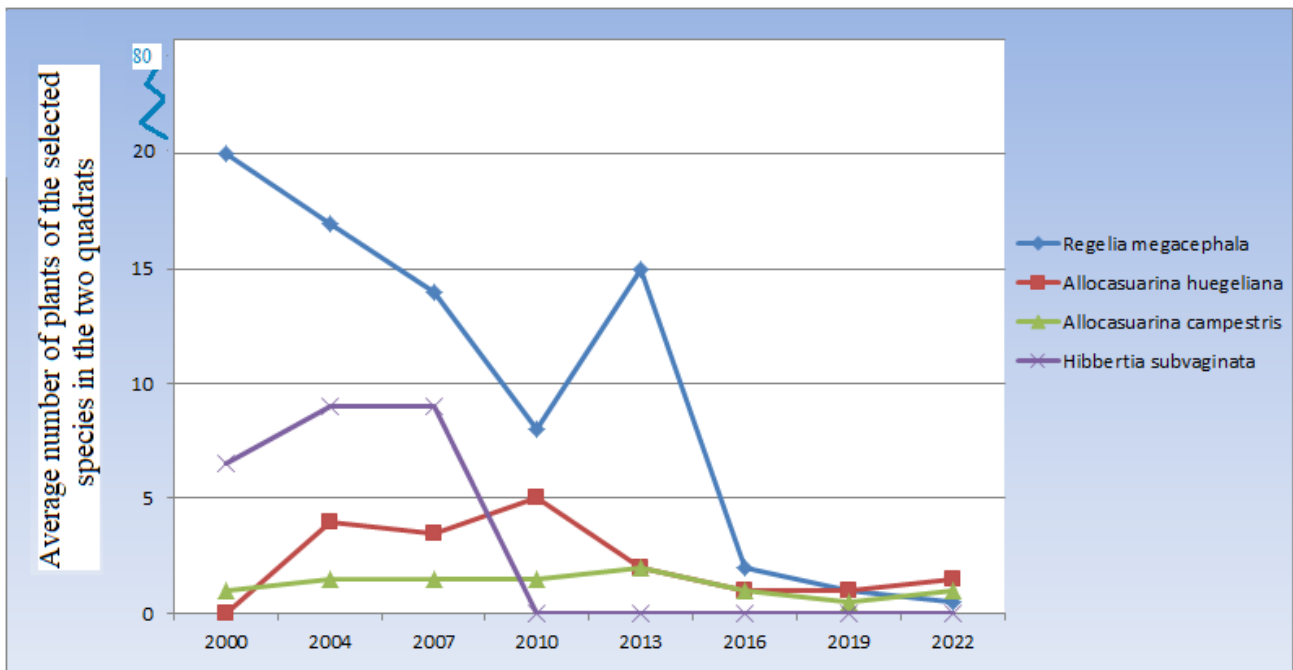


Figure 11: Average number of plants of larger perennial native species in the 1996 area rehabilitation.

The weed species with highest cover in 2016 were **Arctotheca calendula* (Capeweed), **Avena barbata* (Wild Oats), **Ehrharta longiflora* (an annual Veldt grass) and **Hypochaeris glabra* (Flatweed), all fairly aggressive species. The same species mostly had high covers in 2019, although the cover of **Arctotheca calendula* dropped significantly and **Vulpia myuros* increased significantly. These changes probably reflect the effect of the low rainfall in 2019 on the differential success of different weed species. By 2022 the situation was similar except that **Erodium cicutarium* and **Erodium botrys* also had high cover. The high cover of weeds in this pair of quadrats is probably inhibiting the germination and establishment of native species.

Figure 11 shows the average number of plants of the larger species in the two 1996 quadrats, they are all shrubs except for *Allocasuarina huegelii*, which is a tree. This figure clearly shows that re-establishment of most species is not occurring, although the more detailed numbers of plants (see Table 11) show that *Regelia megacephala* goes through bouts of germination, but that the individuals do not survive to become adult plants. The series of dry years prior to 2016 have had some impact on that (especially the large drop in numbers of *Regelia megacephala* from 2013 to 2016). However, it is likely that the surface and slope of the rehabilitation areas is a significant factor in limiting re-establishment of species from seed, with high weed cover levels another significant factor.

Table 11 also shows the loss of the two conservation species *Daviesia dielsii* and *Acacia aristulata* after 2007, and also the loss of the small shrub species *Acacia lasiocarpa* and *Acacia stenoptera*. It is possible that there is seed of these species in the soil and that they could re-appear after fire (all have long lived seed); however the soil surface is likely to limit this as is the high cover of weeds.

Table 11: Average number of plants of selected taxa recorded in the 1996 area quadrats from 2000 to 2019

Species ↓ Year ⇨	2000	2004	2007	2010	2013	2016	2019	2022
<i>Regelia megacephala</i>	78	17	14	8	15	2	1	0.5
<i>Allocasuarina huegeliana</i>	0	4	3.5	5	2	1	1	1 [#]
<i>Allocasuarina campestris</i>	1	1.5	1.5	1.5	2	1	0.5	0.5 [#]
<i>Hibbertia subvaginata</i>	6.5	9	9	0	0	0	0	0
<i>Acacia congesta</i>	2	3	2	0	0	0	0	0
<i>Acacia aristulata</i>	1	2	2	0	0	0	0	0
<i>Acacia stenoptera</i>	1	1	0	0	0	0	0	0
<i>Daviesia dielsii</i>	1	1	1	0	0	0	0	0
<i>Acacia lasiocarpa</i>	0	1	0	0	0	0	0	0
# In 2022, <i>Allocasuarina campestris</i> had one plant in and one overhanging and <i>Allocasuarina huegeliana</i> had two plants in and one overhanging.								

7.11 Changes in the vegetation of the 1998 rehabilitation area on the Main Waste Dump

The 1998 rehabilitation area is the third oldest, with the recording of the two quadrats beginning in 2000.

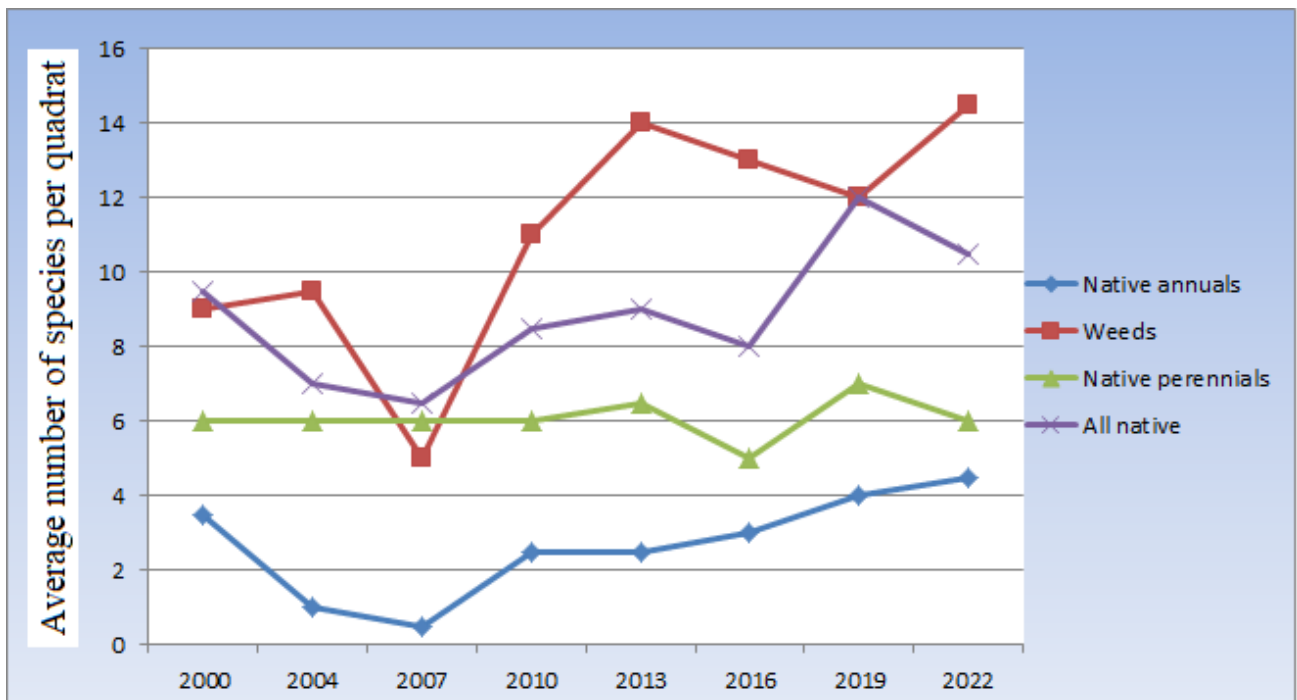


Figure 12: Average number of species in the 1998 rehabilitation for all weeds, all native species, native perennial species and native annual species

After staying constant until 2010, the average number of native perennials in this area rose slightly and then dropped slightly and has risen slightly and dropped again (see Figure 12). In contrast, the average number of weed species (those present are all annuals) dropped to five in 2007 and then rose to fourteen in 2013 before dropping to thirteen in the 2016 data, dropping to twelve in the 2019 data before rising to nearly fifteen in 2022. As in other areas of the rehabilitation, there have been losses and gains between recordings of species that are apparently partly driven by dryer and wetter years and partly by competition between species.

After dropping between 2000 and 2007, the average number of native annuals returned to three species in 2016, and four in 2019, then nearly five in 2022. The native annuals include small species that may not survive in the quadrats if weed cover increases; in fact one was lost in 2022.

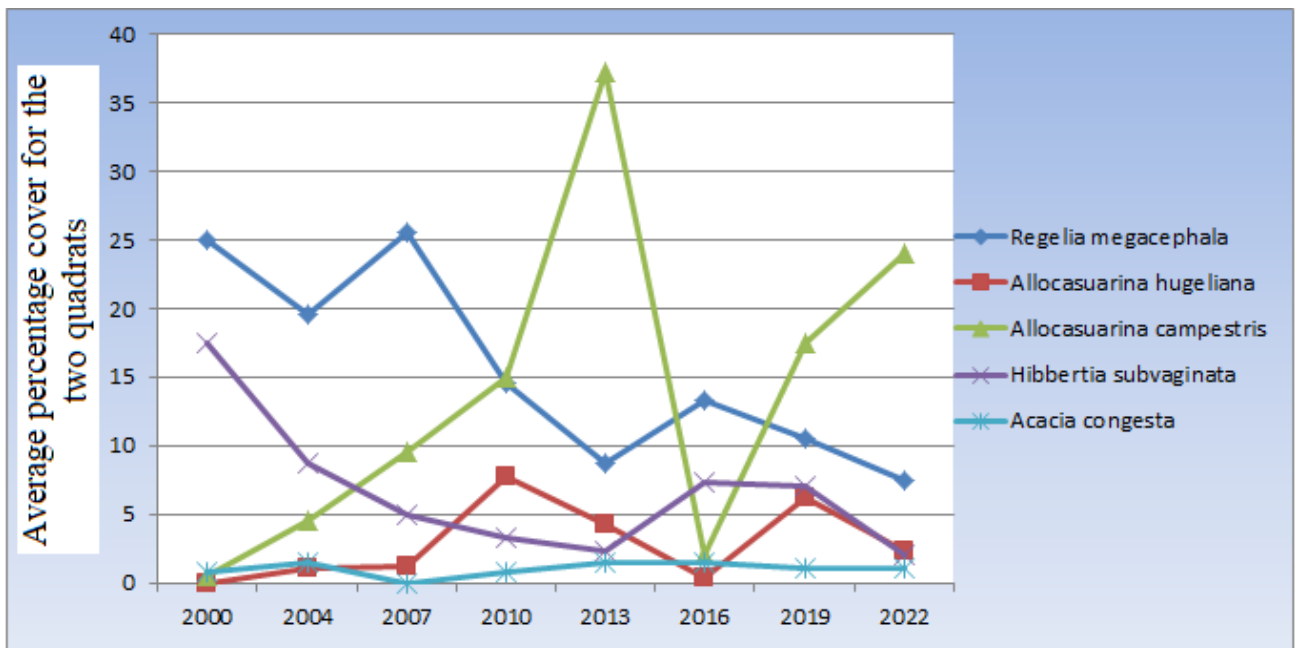


Figure 13: Average percentage cover of the larger perennial species in the two 1998 area quadrats

Figure 13 shows the average percentage cover in the two 1998 rehabilitation area quadrats of the tree *Allocasuarina huegeliana* and the larger native shrubs including *Regelia megacephala* and *Allocasuarina campestris*. *Regelia megacephala* gradually declined in cover until 2013 except for 2007, but by 2016 increased in cover before dropping again by 2022. *Hibbertia subvaginata* has declined in cover from 200 to 2013 then risen to about 7% cover in 2016, maintained this cover to 2019 and then dropped to low cover again in 2022.

In contrast to this *Allocasuarina campestris* has had a boom and bust performance history in regard to average cover in the two quadrats. Its cover dropped precipitously between 2013 and 2016, but rose just as quickly between 2016 and 2019 before just rising slightly to 2022. This sequence of events is related to significant germination events (giving the peaks) and the failure of the seedlings to persist to adult size (giving the troughs). *Allocasuarina huegeliana* has had similar, but less pronounced, changes in cover until dropping to low cover in 2022.

The remaining species, *Acacia congesta* has had low cover since 2000 and was almost absent in 2007, but regained some cover and has maintained that to 2022.

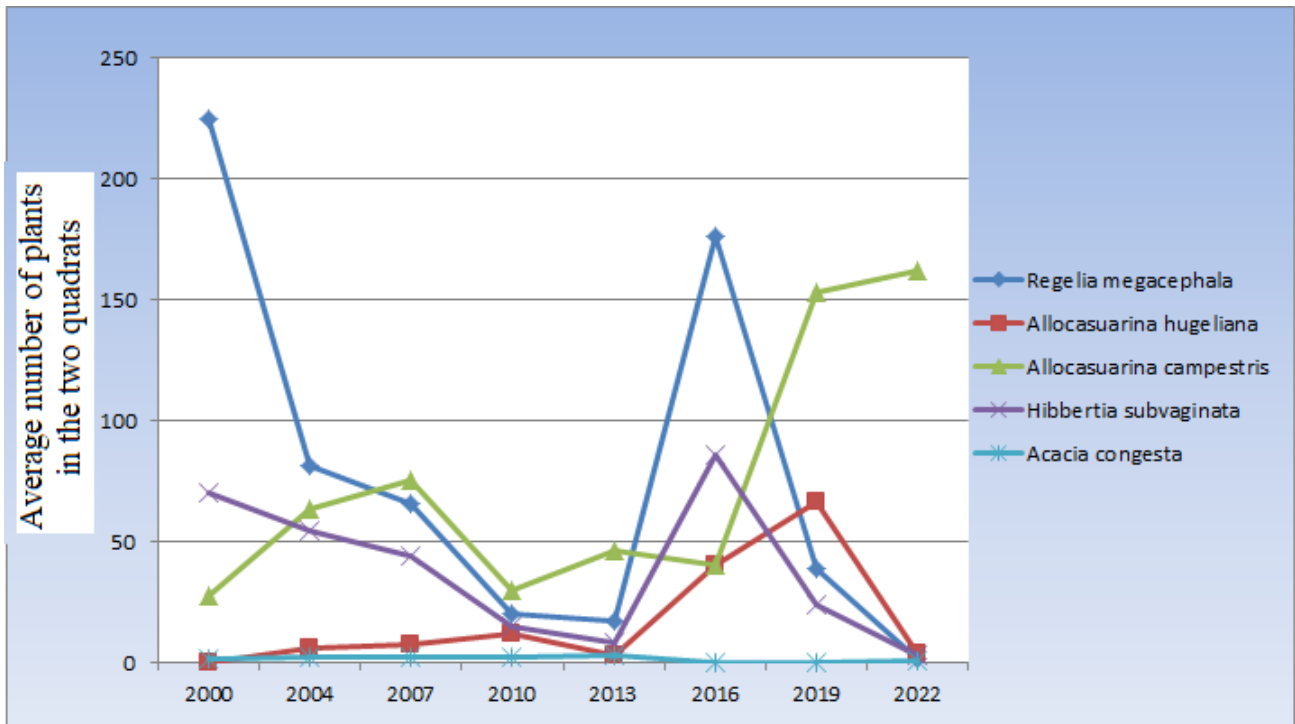


Figure 14: Average number of plants of the larger perennials in the two 1998 area quadrats

Comparing Figure 13 to Figure 14 shows (as noted above for *Allocasuarina campestris*) that the observed booms and busts in species occurrences is largely based on successive germination events and die-offs following them, as much of the cover in 2013 and 2016 of the *Allocasuarina campestris*, *Regelia megacephala* and *Allocasuarina huegeliana* is due to large numbers of juvenile plants. This is again the case in the 2019 data for which these three species again have large numbers of juvenile plants. However by 2022 *Hibbertia subvaginata*, *Allocasuarina huegeliana* and *Regelia megacephala* had dropped significantly in numbers as many juvenile plants had not survived. [Note that a correction has been made to the *Allocasuarina* data for 2016 as it was apparent in the field in 2019 that *Allocasuarina* seedlings had been mis-identified in the field in 2016.]

As the area has not been burnt, the boom and bust in seedling/juvenile numbers suggests that water availability in summer is driving lack of survival to larger size (and higher age, which would mean more seed) in these species. Also noteworthy, is that *Acacia congesta* in this area, as in some others, starts with low numbers of individuals, and stays at low numbers (or sometimes dies out), presumably because seed does not build up in the soil due to the often smooth surface and slopes.

7.12 Changes in the vegetation of the 2000 rehabilitation area on the Main Waste Dump

The 2000 area rehabilitation is the fourth oldest, with the recording of the two quadrats (R00/01 and R00/02) beginning in 2004. The average percentage cover in the two quadrats of the six largest species in this area is shown in Figure 15. These include the trees *Allocasuarina huegeliana* and *Eucalyptus camaldulensis* (which grows naturally nearby, near the southern end of its limit in Western Australia), and four shrubs that occur in most of the rehabilitation areas.

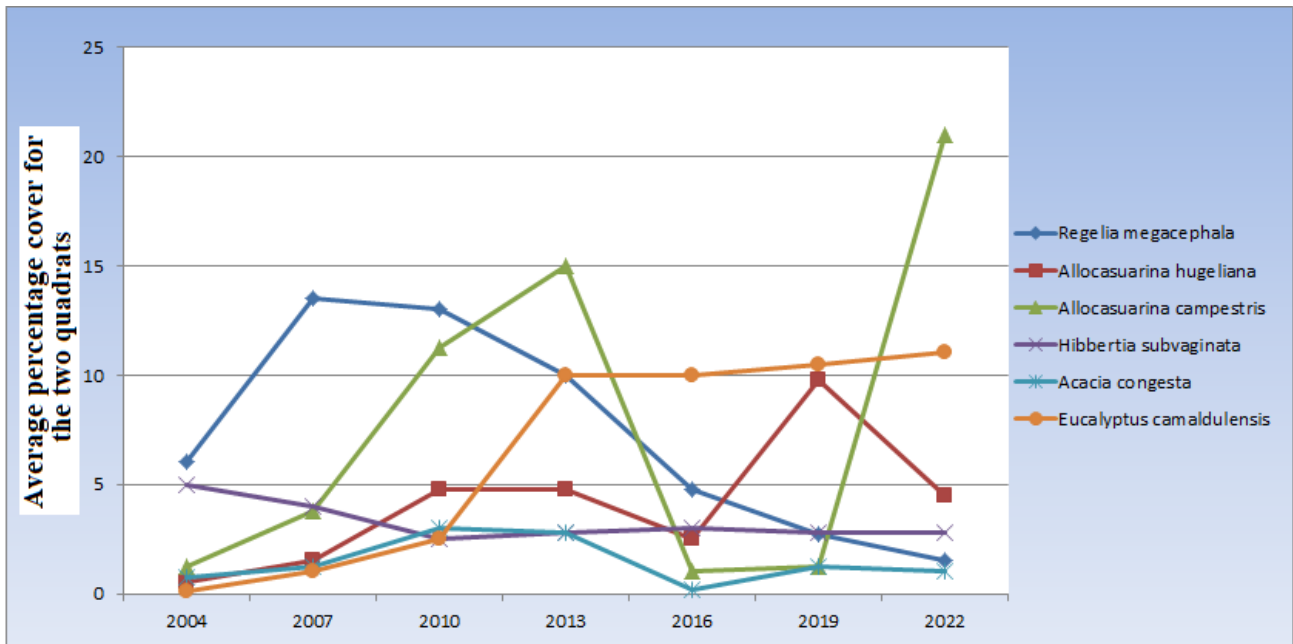


Figure 15: Average percentage cover of the larger perennial species in the two 2000 area quadrats

Figure 15 is somewhat misleading at first sight, as the “dramatic” changes are actually much less than they first appear as most of the cover averages are below 15% cover. However, the changes graphed for the two quadrats are real and the overall situation is evident from combining the information in Figure 15 and Figure 16. The latter figure shows the average number of individuals in the two 2000 area quadrats that average cover is given for in the former.

The two quadrats had steadily improving average cover until 2013 and then the average cover drops, presumably due to the dry years preceding 2016. Even the one moderate sized *Eucalyptus camaldulensis* stalled in growth in cover over this period before slightly increasing in cover to 2019 and 2022. The moderate rainfall in 2017 and 2018 combined with the low rainfall in 2019 is presumably responsible for the continuing fall in the cover of *Regelia megacephala*, although this has continued to 2022 in spite of higher rainfall. *Allocasuarina huegeliana* has increased significantly in cover in the same period until 2019 after which it dropped in cover. There has been a significant recruitment of *Allocasuarina campestris* between 2019 and 2022; following death of

older plants prior to the 2019 recording (the seed held on the older plats would have been released when they died).

Hibbertia subvaginata dropped greatly in number of plants but less in cover from 2004 to 2010, but has since stayed fairly constant, except for more plants in 2016 after which it has dropped somewhat. *Acacia congesta* has had low numbers since 2004, but as the plants can be quite wide had modest cover between 2010 and 2013 after which it has been quite low.

Regelia megacephala also drops until 2010 in numbers of plants, but then rises in 2013 before steadily dropping to 2022. However, the cover of the species has dropped more slowly as the plants can become quite large. The other species have all had relatively low numbers since 2004, but are all still present in spite of the dry years.

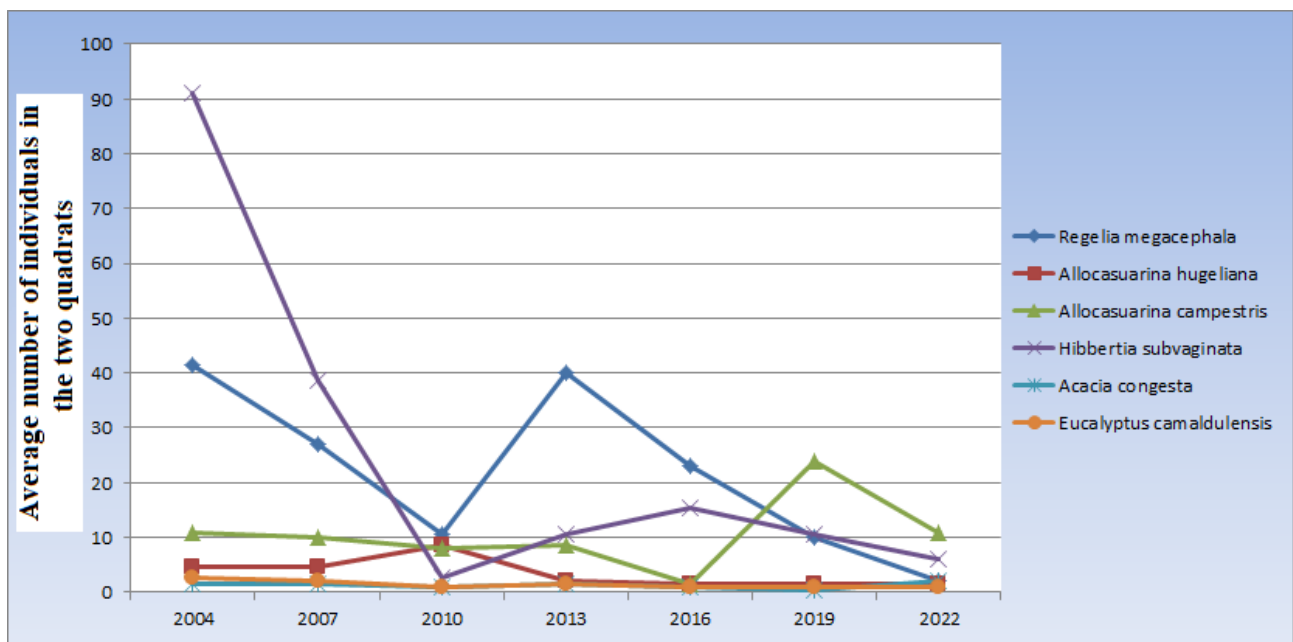


Figure 16: Average number of plants of the larger perennials in the two 2000 area quadrats

Note: The line for *Acacia congesta* is largely obscured by that for *Eucalyptus camaldulensis*, but the *Acacia* remains present into 2022.

Table 12 (see below) shows the numbers of native perennials, native annuals and weeds (the weeds are all annuals, except for *Romulea rosea* which is a small cryptophyte) present in the two year 2000 quadrats for the first two years and last three years of recording. The table shows that the number of native annuals has declined from six species to three species then risen to nine species in 2022. Native perennials have increased from eleven to eighteen species. Two of these (a *Pterostylis* species – a small orchid – and the grass *Rytidosperma acerosum*) are quite small and are unlikely to

survive as weed cover increases. On the other hand, *Austrostipa elegantissima* and *Thysanotus patersonii* are perennials and both can survive in fairly weedy areas.

Interestingly, the weeds have increased, decreased then increases in the number of species present. This is apparently partly due to variation in rainfall (and its timing) and partly due to competition between species.

Table 12: Numbers of native annual, native perennial and weed species in the 2000 area rehabilitation for selected years

Category	2004	2006	2016	2019	2022
Native annuals	6	6	4	3	9
Native perennials	11	13	13	14	18
Weed	15	21	18	15	24

7.13 Changes in the vegetation of the younger rehabilitation areas on the Main Waste Dump and smaller waste dumps

There are a number of quadrats in areas rehabilitated after 2000 that either have one quadrat, are not very old or for various reasons (including parts of the waste dump having been re-mined for gravel) have not been recorded in every third year. Only brief comments will be made on them here as the sample sizes (number of quadrats and duration of recording) are not long enough to make graphing or other analyses worthwhile, particularly give the other records analysed above that give an adequate account of the progression of the rehabilitation.

Quadrat R01/02

Quadrat R01/02 is located in the area rehabilitated in 2001. It had $\leq 30\%$ cover of *Allocasuarina huegeliana* in 2002, an increase from $\leq 20\%$ cover in 2019, 15% in 2016 and 5-6% in 2013. It had 2-3% cover of *Regelia megacephala* in 2019, the same as in 2016, which is less than in 2013 (5-6%), but had dropped to 1-2% in 2022. There were seven young *Regelia* plants in 2019, but only two plants in 2022. This quadrat had four native perennial species present in both 2016 and 2019, but six in 2022. The two new perennial species were *Thysanotus manglesii* and *Dichopogon capillipes*. Weed cover had increased significantly between 2016 and 2019 with *Brachypodium distachyon* increasing from 10% to $\geq 20\%$. However, this species dropped to $> 5\%$ cover in 2022, some other weed species also dropped in cover.

Quadrat R02

Quadrat R02 is located in the area rehabilitated in 2002. This quadrat has quite high diversity of native species, with sixteen (16) native perennial species and nine (9) native annual species including *Aristida contorta* and *Hyalosperma glutinosum* subsp. *glutinosum* which had not been recorded in the quadrat before. *Crassula colorata* and *Waitzia nitida*, both recorded in the quadrat in 2019 but not in 2016 were again absent from the quadrat. Unfortunately the weeds were also diverse, with fifteen (15) species in 2022 down from eighteen in 2016 and up one from 2019.

The cover of **Brachypodium distachyon* dropped from 50-60% cover in 2016 to 30% in 2019 and 20% in 2022. *Regelia megacephala* increased from 15% cover to 20% cover. *Cheilanthes austrotenuifolia* was present after being absent in 2019, while *Chamaescilla corymbosa* var. *corymbosa*, which is common in parts of the native vegetation but rare in the rehabilitation, was lost.

Quadrat R04(22)

Quadrat R04(22) is located in the area rehabilitated in 2004. It had five native perennials in 2016 and the same five in 2019. However, in 2022 it had juveniles of two more perennial native species: *Acacia congesta* subsp. *congesta* and *Allocasuarina campestris*. The largest change in the cover of the native perennials was an increase in the cover of *Allocasuarina huegeliana* from $\geq 15\%$ in 2016 to $\geq 20\%$ in 2019 and $\geq 30\%$ in 2022. There were three annual native species present in 2016, but none were recorded in 2019, while two were in 2022.

One good outcome for this quadrat in 2022 was the persistence of *Bossiaea moylei* (the new name for *Bossiaea* sp. Cairn Hill) a priority two species with three plants present (down from four in 2019). There were fifteen weed species present in 2019 with two others having been lost since 2016 and *Bromus rubens* having been gained. One of the weeds present in 2019 was lost in 2022, but two others were gained.

Quadrat R05(27)

Quadrat R05(27) is located in an area treated for rehabilitation in 2005 on the main waste dump. While *Acacia congesta* decreased from $\leq 20\%$ in 2016 to 8% in 2019, it increased to 12% in 2022. Similarly, *Allocasuarina campestris* declined from $\leq 20\%$ in 2016 to 15% in 2019, but increased back to $\leq 20\%$ in 2022. In contrast to those two species, *Allocasuarina huegeliana* increased from $\leq 10\%$ in 2016 to 15% in 2019 and to $\leq 25\%$ in 2022. Ten native perennials were present in quadrat

R05 in 2016 and 2019, with one lost (*Austrostipa trichophylla*) and one gained (*Comesperma integerrimum*) between these years. By 2022 there were eleven native perennials, but three had been some change in the species. Four native annual species were present in the quadrat in 2016 and six in 2019. The six present in 2019 were still present in 2022 with a further six.

Twelve weed species were present in 2016 with thirteen present in 2022 after some minor changes. None of the weeds had high cover in 2019, with **Hypochaeris glabra* at < 5% cover being the highest. This species increased to $\leq 10\%$ cover in 2022 while **Ehrharta longiflora* had 3% and **Vulpia myuros* had 2% cover. The others had < 1% or just “+” cover.

Quadrat in Area 33

This quadrat is in an area treated for rehabilitation in 2005 on the south-east waste dump and has previously only been recorded in 2010, 2013, 2016 and 2019. Eleven perennial native species were present in 2016, 2019 and 2022. Two others were present in 2016, but one of these was lost in 2019, while one was gained in 2022.

The only significant change in cover in the eleven species was that the cover of *Acacia congesta* dropped from 50% in 2016 to 20% in 2019, but it stayed at that level to 2022. It seems likely that the drop was largely due to the low rainfall in 2019, but some *Acacia* species are not long-lived and that cannot be discounted. Of interest is the increase in the cover of *Thysanotus patersonii* (a native climbing lily) from 2% in 2016 to 5% in 2019; however it did not increase further by 2022. This species is gradually increasing in cover and presence in quadrats and may come to be more significant.

Five native annual species were present in from 2016 to 2022, with a further seven present in 2022. This big increase is a reflection of the low weed cover and therefore a lack of suppression.

Eight weed species were present from 2016 to 2022. Another was lost in 2019, but appeared again in 2022. Three others were gained in 2022.

Quadrat in Area 37

This quadrat is located in an area treated for rehabilitation in 2006 and that had *Regelia* brush applied in 2007. It is on the small south-west waste dump and previously has only been recorded in 2010, 2016 and 2019.

Nine perennial species were recorded from 2016 to 2022, four others were recorded only in 2016 and one 2016 and 2019. Three more were recorded only in 2019 and three only in 2022. The loss of *Acacia congesta* subsp. *congesta*, *Grevillea biternata* and *Acacia lasiocarpa* var. *sedifolia* after 2016 is significant as these are medium sized to large shrubs. The loss was offset to some degree by the recruitment of *Allocasuarina campestris* another large shrub. The priority two species *Bossiaea moylei* (previously *Bossiaea* sp. Cairn Hill) has maintained two individuals in the quadrat, although its cover has decreased.

Six native annual species were recorded in the quadrat in 2016, of which three were also recorded in 2019 and 2022. Only one additional native annual was recorded in 2022, the daisy *Podotrochea angustifolia*.

Eight weed species were present in the quadrat in from 2016 to 2022, two others were present in 2016 and 2019, one only in 2019, one in 2016 and 2022 and two only in 2022. Unlike other quadrats in the rehabilitation, there had been no significant increase in weed cover. In fact several species had lower cover in 2019 and 2022 than in 2016. *Brachypodium distachyon*, which has increased significantly in some other quadrats maintained low cover, probably due to soil characteristics.

Quadrat in Area 41

This quadrat is in an area treated for rehabilitation in 2007 and in 2010 a direct planting trial of approximately 100 plants of *Allocasuarina campestris*, and *Allocasuarina huegeliana* was carried out as this site was barren of other plants. It is on the south-east waste dump and has previously only been recorded in 2010, 2013, 2016 and 2019.

Three native perennial species were recorded in the quadrat in Area 41 in 2016 that were also recorded in 2019 and 2022. One other was only recorded in 2016 and one only in 2019. One was recorded in 2019 and 2022, while three were only recorded in 2022 (including a seedling of *Dryandra sessilis*).

Three native annual species were recorded in 2016, two of which were not recorded in later years and one that was also recorded in 2019. One was only recorded in 2019, two in 2019 and 2022 and two only in 2022.

Seven weed species (all annuals) present in 2016 were also present in 2019 and 2022, three others were present in 2016 and 2019, one was only present in 2016, one only in 2019 and one only in 2022. The increases in weed cover in 2022 compared to earlier years is fairly low, except for **Ursinia anthemoides* (< 10%) and **Hypochaeris glabra* (< 5%).

8.0 DISCUSSION

The major aim of the rehabilitation: to establish vegetation on the waste dumps comprised of native species found in the Coomberdale Chert Threatened Ecological community, especially those prominent in its vegetation, is being met to a moderate degree. However:

- The vegetation structure developed is less than desirable in many areas, often lacking the high cover of large shrubs found in natural *Regelia megacephala* and *Allocasuarina campestris* stands. Also in many quadrats the *Regelia* is losing cover and number of individuals (although there are episodes of recruitment);
- The stability of the vegetation (resistance to dry periods) is less than that of the natural stands (although some of those have also declined), and the cover of the larger shrubs is likely to continue to suffer in low rainfall periods;
- The average diversity of native species in individual quadrats is less than desirable. Although there is ongoing recruitments of native species in some quadrats this is mostly either annual species unlikely to survive increasing weed levels, or smaller perennial species.
- In many places the cover of weeds is higher than desirable. A feature of the recording has been that in many of the quadrats weed cover has increased significantly often even in dryer years.

The problems apparent in the rehabilitation are based in two main facts. Firstly the waste is unlike the substrate of the Coomberdale Chert Threatened Ecological Community (TEC) which is quite different to the waste in structure. Where *Regelia megacephala* is dominant in the TEC the substrate is massive chert, not highly broken up chert material. Where other species, such as *Allocasuarina campestris* are dominant in natural stands the substrate is less massive, but is still not so broken up and has more water retaining capacity. The second major problem is that the waste areas (and the TEC) are in a highly fragmented environment with many weed species present in the paddocks surrounding them. Other factors that complicate the effects of these two main factors are that some of the slopes of the waste material are steeper than in the TEC and decreasing and more erratic rainfall due to climate change and land clearing.

These factors have continued to interact in the period between the 2019 and 2022 recordings to result in ongoing loss of *Regelia megacephala*, one of the defining species of the Coomberdale Chert Threatened Ecological Community and a priority species for the rehabilitation. On the other

hand, earlier decline of *Allocasuarina campestris*, the other main large shrub species in the TEC, has on balance stopped (as it had in 2019). In fact this species has increased in some quadrats.

In the older quadrats there is usually some loss of native species although some species continue to invade, but these are (almost entirely) either annual species or smaller perennial species. In tandem with this (and probably the main cause of it) there is a general increase in weed cover and often in the number of species. However, where weed cover is quite high the more aggressive weeds are causing the loss of the smaller less aggressive weeds.

While *Allocasuarina huegeliana* has been seen as not desirable, as it is not one of the main species that has been used in the definition of the TEC, it does occur in the TEC and is dominant in some areas of it. Thus if it dominates some areas of the waste dumps over time, this should be seen as a good thing, as it means more diversity in vegetation structure on the waste. If it dominated all the waste areas, this would not be desirable, but this seems unlikely at the current time.

The changes in the presence and absence of native species in the quadrats, i.e. the loss of some species from the quadrats and the gains of others, is of significant interest from the point of view of the diversity of the rehabilitation and the life forms of the species present. It seems that there is an ongoing process of winnowing out of species (perennial and annual) not suited to the waste material (or outcompeted by weeds) and the appearance of others that are suited. The loss of some species of perennials may be apparent; they may be present as seed and reappear after fire or when conditions suit

It seems likely that the native flora part of the floristic composition of the rehabilitation will take a considerable time to reach stability, and that the final composition will be affected by seed mobility (the ability of species to migrate into the waste areas from areas of the TEC), the ability to survive there and competition from weeds. Application of seed of selected species from the TEC would improve the rate of movement of native species into the TEC, this should be a mixture of annual species and perennial species that are not present in the rehabilitation (or only have low numbers) and which would improve the structure of the rehabilitation vegetation. Two species that have been observed to have good survival in more disturbed areas of the TEC should be included in this: *Calytrix* aff. *leschenaultii* and *Kunzea praestans*.

It is clear from the 2016, 2019 and 2022 data from the quadrats that weed cover is increasing, sometimes markedly, although in some quadrats there have been decreases of more prolific species

such as **Brachypodium distachyon*. The worst weeds include **Hypochaeris glabra* (Flatweed), **Erodium botrys* and the annual grasses **Brachypodium distachyon*, **Ehrharta longiflora* (an annual Veldt Grass) and **Avena barbata* (Wild Oats). The ability of these species to seed profusely, germinate in numbers and survive to seed in different seasons (“dry” or “wet”) at a range of sizes make them aggressive competitors. Several of the other weed species are also increasing in number and spread over the rehabilitation, including **Monoculus monstrosus* and **Bromus rubens*. The latter species is likely to become significant in future years.

Where weed cover is high it is very likely to be inhibiting germination and establishment of native species and further increases in weed cover is likely to become more problematic in affecting the ongoing germination and establishment of native species in the rehabilitation areas. Given the range of species of weeds present there are practical limitations to what can be done about this. However, selective control of the grass (Poaceae) species is possible and may have little impact on the native grasses. To be successful, this would need to be done consistently for several years to prevent these species building up again while giving native species an opportunity to build up in abundance.

The other major group in the weeds is the Daisy family (Asteraceae), selective control of these without affecting native species is much less likely to be possible, but their control needs to be investigated.

9.0 RECOMMENDATIONS

The recommendations made in the earlier rehabilitation reports (e.g. Morgan and Trudgen, 2004; Trudgen and Hannart 2013) are still applicable to the ongoing rehabilitation of Simcoa's waste dumps and are therefore repeated below with some minor additions.

Recommendation 1. The following set of points should be accepted as the aims for rehabilitation at the Simcoa Moora Chert mine:

- Where possible, the location of waste dumps and subsequent establishment of rehabilitation vegetation should be planned to ameliorate degradation of the areas of the Coomberdale Chert threatened ecological community adjacent to mining areas;
- Rehabilitation should aim for the establishment of a stable vegetation composed of local native plant species on waste dumps and other areas affected by mining;
- Where appropriate the geographically restricted species *Regelia megacephala* and other species of priority and declared rare flora should be included in the rehabilitation;
- Waste dump slopes should be stable and erosion minimised by adequate density of rehabilitation vegetation and by avoiding steep slopes.

Recommendation 2. The various rehabilitation quadrats should be recorded at appropriate intervals and in the appropriate season.

The rehabilitation monitoring would record better data if conducted during late September or early October. [The 2019 recording was in mid-late October in a dry year and this was somewhat later than desirable.] [The 2022 recording was carried out in early to mid-October and some quadrats were somewhat dryer than desirable, but most were not.]

Recommendation 3. Waste dump construction should include sufficient fine material to ensure that the density (cover) of the rehabilitation vegetation attainable is not significantly below that of nearby areas of native vegetation, and the surface of the waste dumps should be appropriately roughened to ensure that infiltration of rainwater is sufficient to recharge subsoil water storage.

Lack of subsoil water storage has been identified as a probable limiting factor on the density of the older rehabilitation stands. The only way to rectify this in waste dumps in the future is to include fine material (slimes etc.) to increase subsoil water storage.

Recommendation 4. The seed mix going into rehabilitation areas (including seed from brush) should be continually reviewed as rehabilitation stands are assessed, to further improve the rehabilitation. Additional species that should be added in oncoming years include *Calytrix* aff. *leschenaultii*, *Kunzea praestans*, *Dryandra sessilis* and a range of annual species.

Recommendation 5. The seed applied to regeneration areas should continue to be sourced locally (i.e. within a few kilometres of the mine and preferably from areas of the Coomberdale Chert Threatened Ecological Community).

Recommendation 6. Stock should continue to be excluded from the rehabilitation areas.

Recommendation 7. Similar quantities of *Regelia megacephala* brush should be used in future rehabilitation areas to that used in most of the past areas. The seed from brush should be supplemented by seed collected from a range of species.

Recommendation 8. Depending on the amounts and species available, seed of the declared rare and priority flora species found in the Coomberdale Chert Threatened Ecological Community should be included in seed applied to rehabilitation areas. Assistance with glasshouse germination trials of the seed of the DRF and priority species should be sought from an appropriate body.

Recommendation 9. An ongoing seed collection program should be carried out to ensure that sufficient quantities and diversity of seed from native species found on the Coomberdale Chert Threatened Ecological Community are available for the rehabilitation program.

Recommendation 10. A suitable person/company should be engaged to supply nursery-raised seedlings (or plants grown from cuttings) of Declared Rare and Priority Flora species from the Coomberdale Chert Threatened Ecological Community for the rehabilitation.

Recommendation 11: A standard 'best practice' rehabilitation treatment should be applied whenever possible. This would currently include:

- The battering of slopes and across slope ripping and preparation of the area (slopes should not be so steep that this cannot be safely undertaken);
- The application of topsoil;
- The application of *Regelia megacephala* brush mixed with low amounts of *Allocasuarina campestris* brush;
- Hand planting of seedlings of Declared Rare and Priority Flora; and
- Direct seeding of a general mix of native species seed from the Coomberdale Chert Threatened Ecological Community (seed of *Allocasuarina huegeliana* should be avoided or only used in very small quantities).

Recommendation 12: Harvesting of topsoil should be given high importance to ensure that as much as possible is obtained. The machinery available to harvest this important resource should be reviewed to ensure that it is suitable. Topsoil harvesting and spreading should be included in the mine planning to ensure that it occurs at the best time and is applied as quickly as possible after harvesting.

Recommendation 13: Training of mine staff not currently familiar with the rehabilitation treatments and standards should be carried out to ensure there is a ‘knowledge bank’ at the mine. A Rehabilitation Procedures Manual should be part of this, if it does not already exist.

Recommendation 14: Seed of *Acacia acuminata* (Jam) should be included in the seed applied to new areas of rehabilitation, and also in some trial areas of existing rehabilitation to assess the capacity of this species to suppress weed germination or establishment. [It should be noted that where weeds are already established, that suppression might be limited.]

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11.0 APPENDICES

Appendix 1: Data for quadrats rescored in 2022

Notes: To allow comparison of cover and species changes between 2016, 2019 and 2022 the cover for each year is included in the table for the quadrats. If there is a cover for 2016, it implies the species was recorded in that year, other data for the 2016 recording is available in Trudgen (2016). The dates below are for the 2022 recording, dates for the early visits are given in the earlier reports (Trudgen 2016, 2020). The soil and habitat data is from the earlier reports (there has been no significant change except possibly a small increase in litter in some quadrats). Geocodes were checked in the field in 2022.

Pale blue highlight of a species indicates that it was recorded in 2022 in a quadrat, but not in 2016 or 2019. Changes in species composition between earlier years (2013-2016 and 2016-2019) are indicated in text for quadrats.

Site: R91/01

Described by: Malcolm Trudgen **Date:** 06/10/2022 **Type:** Quadrat

Location: North Waste dump. **Geocode:** Zone 50 6624050 S, 407489 E [WGS84]

Habitat: West facing moderate slope of ridge.

Soil: Topsoil returned over mine waste. Gravelly, pebbly, cobbly, grey silt with some fine sand.

Vegetation: Allocasuarina huegeliana low open woodland over Allocasuarina campestris high open shrubland; over *Avena barbata,*Ehrharta longiflora grassland; over *Vulpia myuros, *Pentaschistis airoides, *Erodium botrys, *Hypochaeris glabra, Podolepis lessonii grass/herbland.

Vegetation change 2016-2019: Not significant. **Species changes 2013-2016:**Species lost Blennospora drummondii; Hibbertia subvaginata; Ptilotus polystachyus; Lupinus cosentinii; Tripteris clandestina; Orobanche minor; Podotheca aff. gnaphalioides (Moor WDM1-65); & Goodenia berardiana. **Species changes 2016-2019:** Thirteen species recorded in 2016 were not recorded in 2016. Of these eight were native species (mostly annual species, some may have been missed due to the dry conditions). Two native species were recorded that were not recorded in 2016. See table for species.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
*Arctotheca calendula	-	-	-	Not recorded.	2-3%	5-15 cm	First recording.
Acacia congesta	+	-	-	Not recorded.	+	5-15 cm	2 seedlings.
Allocasuarina campestris	4%	4%	2-3 m	1 live, 1 dead.	>/= 5%	2.4 m	One plant.
Allocasuarina huegeliana	8%	8%	6 m	3 live (1 large and two young).	</= 10%	3.5(6) m	One + 1 overhanging.
Austrostipa trichophylla	< 5%	< 1%	20 cm	10 plants.	< 1%	40 cm	15-20 plants.
*Avena barbata	-	> 10%	15-50 cm	> 600 plants.	10-15 %	30-70 cm	> 600 plants.
*Brachypodium distachyon	< 1%	-	-	Not recorded.	1-2%	15-25 cm	> 200 plants.
*Briza maxima	+	> 5%	20 cm	> 600 plants.	-	-	Not seen.
*Bromus diandrus	+	-	-	Not recorded.	-	-	Not seen.
Cheilanthes austrotenuifolia	+	-	-	Not recorded.	+	15 cm	2 plants.

<i>Cuscuta</i> sp.	-	+	10 cm	1 plant.	-	-	Not seen.
* <i>Ehrharta longiflora</i>	< 10%	> 25%	10-30 cm	>1500 plants (mostly small).	< 5%	10-25 cm	About 200 plants.
* <i>Erodium botrys</i>	5%	< 5%	5-10 cm	> 300 plants.	> 5%	5-15cm	> 500 plants?
<i>Euphorbia drummondii</i> subsp. <i>drummondii</i>	-	-	-		+	3-6 cm	> 30 plants.
<i>Gilberta tenuifolia</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Goodenia berardiana</i>	1%	-	-	Not recorded.	< 1%	15-35 cm	10-20 plants.
* <i>Hypochaeris glabra</i>	≥ 20%	> 10%	5 cm	> 500 plants.	< 20%	5-15 cm	> 1500 plants?
<i>Kennedia prostrata</i>	+	-	-	Not recorded.	+	5-10 cm	19 plants.
* <i>Lupinus cosentinii</i>	+	+	10-20 cm	18 plants; most died before fruiting.	+	30 cm	3 plants.
Moss sp.	1-2%	-	-	Not recorded.	+	1 cm	A patch.
* <i>Orobanche minor</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Pentameris airoides</i>	2%	< 2%	5-10 cm	~ 200 plants.	-	-	Not seen.
<i>Podolepis canescens</i>	-	-	-	-	< 1%	20-40 cm	20 plants.
<i>Podolepis lessonii</i>	10%	>10%	10-15 cm	> 500 plants.	1%	10-30 cm	About 40 plants.
<i>Podotheca</i> aff. <i>gnaphalioides</i> (Moora WDM1-65)	+	-	-	Not recorded.	-	-	Not seen.
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	1%	-	-	Not recorded.	-	-	Not seen.
<i>Rytidosperma acerosum</i>	+	+	15 cm	1 plant.	-	-	Not seen.
* <i>Sonchus oleraceus</i>	-	-	-	-	+	15 cm	1 plant.
<i>Thysanotus patersonii</i>	+	+	20 cm	2 plants.	-	-	Not seen.
<i>Trachymene cyanopetala</i>	-	+	5 cm	-	1-2%	5-10 cm	2-300 plants.
* <i>Trifolium arvense</i> var. <i>arvense</i>	-	+	8 cm	< 5 plants.	< 1%	8 cm	33 plants.
* <i>Monoculus monstrosus</i>	+	+	15 cm	> 20 plants.	+	40 cm	14 plants.
* <i>Urospermum picroides</i>	> 1%	-	-	Not recorded.	+	10-35 cm	-
* <i>Ursinia anthemoides</i>	5%	<	10-15 cm	1 plant.	2%	10-50 cm	About 200 plants
* <i>Vulpia myuros</i>	10%	> 25%	5-10 cm	~ 1500 plants.	+	20 cm	1 plant
<i>Waitzia nitida</i>	+	-	-	Not recorded.	+	25 cm	2 plants.



Quadrat R91/01 in 2004 from NW corner



Quadrat R91/01 in 2007 from SE corner



Quadrat R91/01 in 2010.



Quadrat R91/01 in 2013.



Quadrat R91/01 in 2016 (from NW corner).



Quadrat R91/01 in 2019 (from SW corner).



Quadrat R91/01 in 2019 (from NW corner).



Quadrat R91/01 in 2022 (from NW corner).



Quadrat R91/01 in 2022 (from south side).



Quadrat R91/01 in 2022 (from SW corner).

Site: R91/02

Described by: Malcolm Trudgen **Date:** 06/10/2022 **Type:** Quadrat

Location: North Waste dump. Geocode: Zone 50 6624060 S, 407478 E [WGS84]

Habitat: West facing mid-slope of a waste dump slope.

Soil: Mine waste with some topsoil returned. Pale grey gravelly to cobbly(+) fine silty sand.

Rock Type: Chert mine waste.

Vegetation: *Allocasuarina huegeliana* low open forest; over *Regelia megacephala*, *Allocasuarina campestris* high shrubland; over **Avena barbata*, **Ehrharta longiflora* and **Hypochaeris glabra* open grassland.

Notes: Species lost since 2013: *Acacia congesta* subsp. *congesta*; **Lysimachia arvensis*. Species gained since 2013: *Trachymene cyanopetala*; *Waitzia nitida*; *Brunonia australis*; **Monoculus monstrosus*; *Kennedia prostrata*; *Gilberta tenuifolia*. There were some large **Brassica* plants nearby and a patch east of the quadrat.

NOTES: Part of the large *Regelia megacephala* had fallen, it was sprouting but not rooting.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
* <i>Aira caryophyllea</i>	5%	< 2%	5-8 cm	> 200 plants	+	15 cm	5 plants
<i>Allocasuarina</i>	1%	2-3%	3-3.5 m	2 live plants.	4-5%	3-4 m	4 live plants

campestris							and one dead.
Allocasuarina huegeliana	40%	45%	6(8)m	Cover estimate imprecise.	40%	(4)8 m	9 live plants and five dead.
*Arctotheca calendula	-	0.3%	15 cm	14 plants	2-3%	15-20 cm	> 30 plants.
Austrostipa trichophylla	-	-	-	Not recorded.	+	5-15 (35) cm	6 plants.
*Avena barbata	15%	20%	10-30(40) cm	> 500-1,000 plants	< 20%	40-70 cm	>1,000 plants
*Briza maxima	+/- 2%	< 5%	15-20 cm	> 500 plants	-	-	Not seen.
*Bromus diandrus	-	+	20 cm	< 10 plants	-	-	Not seen.
Brunonia australis	+	-	-	Not recorded.	-	-	Not seen.
Calandrinia sp.	-	-	-	-	+	5-8 cm	About 10 plants.
Cheilanthes adiantoides	-	-	-	-	+	15 cm	Two plants
Cheilanthes austrotenuifolia	+	-	-	Not recorded.	+	15 cm	One plant.
Daucus glochidiatus	+	-	-	Not recorded.	-	-	Not seen.
*Ehrharta longiflora	> 20%	> 25%	10-25 cm	> 500 plants.	> 20%	10-45 cm	> 1,000 plants
*Erodium botrys	-	+	3 cm	5 plants.	2%	3-10 cm	> 80 plants.
Euphorbia drummondii subsp. drummondii	-	-	-	-	+	3-8 cm	10 plants.
Gilberta tenuifolia	+	-	-	Not recorded.	-	-	Not seen.
Goodenia berardiana	2%	-	-	Not recorded.	+	20 cm	16 plants.
*Hypochaeris glabra	5%	≤ 5%	5 cm	> 200 plants.	> 15%	5 cm	> 1,000 plants.
Kennedia prostrata	+	+	5 cm	2 plants.	+	5-10 cm	6 plants
*Lupinus cosentinii	-	+	30 cm	2 plants.	+	40 cm	1 plant.
Moss sp.	-	≤ 1%	2 cm	Several patches.	> 4%	1 cm	Several patches.
*Pentameris airoides	< 5%	-	-	Not recorded.	-	-	Not seen.
Podolepis lessonii	-	2%	5-15 cm	> 400 plants	+	5-15 cm	3 plants.
Ptilotus polystachyus	-	-	-	-	+	7 cm	One plant.
Regelia megacephala	8%	8%	4 m	1 live plant.	< 5%	4 m	1 live plant.
*Romulea rosea	+	-	-	Possibly missed as very fine.	-	-	Not seen.
Rytidosperma acerosum	1%	1%	20 cm	20 plants.	1%	5-10 cm	About 20 plants
*Sonchus oleraceus	-	-	-	-	+	10-18 cm	4 plants.
Thysanotus patersonii	1%	1-2%	1 m	10-15 plants (climber,	> 2%	1-1.7 m	7 plants.

				intermixed).			
<i>Trachymene cyanopetala</i>	1-2%	1-2%	5-8 cm	> 100 plants	-	-	Seen just out.
<i>Trachymene pilosa</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Trifolium arvense</i> var. <i>arvense</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Monoculus monstrosus</i>	+	< 1%	8-15 cm	> 50 plants.	+	50 cm	One plant.
* <i>Urospermum picroides</i>	3%	-	-	Not recorded.	+	8-20 cm	< 20 plants.
* <i>Ursinia anthemoides</i>	5%	> 15%	10-20 cm	> 500-1,000 plants	> 20%	10-60 cm	> 1,000 plants
* <i>Wahlenbergia capensis</i>	-	-	-	-	+	25 cm	One plant
* <i>Vulpia myuros</i>	1%	1%	10 cm	> 200 plants.	-	-	Not seen.
<i>Waitzia nitida</i>	+	+	10 cm	1 plant	-	-	Seen just out.



Quadrat R91/02 in 2004



Quadrat R91/02 in 2007



Quadrat R91/02 in 2010



Quadrat R91/02 in 2013



Quadrat R91/02 in 2013 (from NW corner).



Quadrat R91/02 in 2019



Quadrat R91/02 in 2022 from NW corner.



Quadrat R91/02 in 2022 from west side.

Site: R91/03

Described by: Malcolm Trudgen **Date:** 06/10/2022 **Type:** Quadrat **Location:** North Waste dump.

Geocode: Zone 50 6623992 S, 407493 E [WGS84]

Habitat: Moderate west facing mid-slope.

Soil: Overburden over mine waste. Some fine silty soil present.

Rock Type: Chert mine waste.

Vegetation: *Allocasuarina huegeliana* low woodland over *Regelia megacephala* high open shrubland over *Hibbertia subvaginata* low scattered shrubs over *Avena barbata*, *Ehrharta longiflora*, *Ursinia anthemoides*, *Hypochaeris glabra*, *Vulpia myuros* annual grassland/herbland.

Notes: Plants gained since 2013: *Arctotheca calendula*; *Podolepis lessonii*; *Cheilanthes adiantoides*; *Monoculus monstrosus*; *Orobanche minor*; *Kennedia prostrata*; *Acacia stenoptera*; *Petrorhagia dubia*. Plants lost since 2013: *Silene gallica* var. *gallica*;

NOTES: 2019: The *Ehrharta* was small, except where under the cover of *Regelia*. Total weed cover was > 50%.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i>	-	-	-	-	+	10 cm	2 seedlings.
<i>Acacia stenoptera</i>	+	-	-	Not recorded.	-	-	Not seen
<i>Allocasuarina huegeliana</i>	20-25%	20-25%	8 m	3 live plants, 1 overhanging in	>/= 30%	8 m	3 live plants, 1 overhanging

				SE corner & 1 dead (old).			in SE corner, 1 dead (old).
* <i>Arctotheca calendula</i>	+	≤ 2%	5 cm	> 100 plants, all small.	> 20%	5-20 cm	> 1,000 plants
<i>Austrostipa trichophylla</i>	2-3%	+	10 cm	1 plant (60 - plants in 2016).	+	10-38 cm	13 plants
* <i>Avena barbata</i>	≥ 10%	5%	25-90 cm	> 500 plants.	5%	25-90 cm	4-500 plants
* <i>Briza maxima</i>	1%	2%	10-20cm	> 200 plants.	-	-	Not seen.
<i>Cheilanthes adiantoides</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Ehrharta longiflora</i>	15%	≤ 30%	30-70 cm	> 1,500 plants.	> 25%	30-130 cm	> 1,500 plants
* <i>Erodium botrys</i>	> 5%	< 5%	7 cm	> 200 plants	1%	34 cm	< 50 plants.
<i>Goodenia berardiana</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Hibbertia subvaginata</i>	< 1%	< 1%	60 cm	1 large plants (no dead ones seen).	< 1%	60 cm	1 large plant.
* <i>Hypochaeris glabra</i>	> 15%	≤ 5	10 cm	> 200 plants.	< 10%	10 cm	> 500 plants.
<i>Kennedia prostrata</i>	+	-	-	Not recorded.	+	-	7 plants.
<i>Lepidosperma tenue</i>	+	+	35 cm	1 large, 1 small	+	35 cm	1 large plant.
* <i>Lupinus cosentinii</i>	-	+	25Cm	1 plant.	-	-	Not seen.
Moss sp.	+	+	2 cm	-	-	-	Not seen.
* <i>Orobanche minor</i>	+	-	-	Not recorded.	+	-	7 plants.
* <i>Pentameris airoides</i>	1%	-	-	Not recorded.	-	-	Not seen.
* <i>Petrorhagia dubia</i>	+	-	-	Not recorded.	+	20 cm	-
<i>Podolepis canescens</i>	-	-	-	-	+	20 cm	1 plant.
<i>Podolepis lessonii</i>	1-2%	2-3%	10-20 cm	> 250 plants.	+	10-30 cm	13 plants.
<i>Podotheca gnaphalioides</i>	-	-	-	-	+	15 cm	1 plant
<i>Ptilotus polystachyus</i>	-	-	-	-	+	10-30 cm	10-15 plants
<i>Regelia megacephala</i>	-	≥ 8%	2 m	1 large plant in NE corner.	> 8%	2 m	1 large plant in NE corner.
<i>Rytidosperma acerosum</i>	-	-	-	-	+	10 cm	1 plant
* <i>Sonchus oleraceus</i>	-	-	-	-	+	10 cm	Juvenile.
<i>Trachymene cyanopetala</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Trifolium arvense</i> var. <i>arvense</i>	1-2%	-	-	Not recorded.	+	10-15 cm	7 plants.
* <i>Monoculus monstrosus</i>	+	1%	80 cm	> 50 plants.	1%	60-90 cm	> 50 plants.
* <i>Urospermum picroides</i>	2%	-	-	Not recorded.	-	-	Not seen.
* <i>Ursinia anthemoides</i>	5%	2%	10-15 cm	> 300 plants	2%	10-45 cm	> 200 plants.
* <i>Vulpia myuros</i>	< 10%	+	10-20 cm	< 500 plants.	-	-	Not seen.
<i>Waitzia nitida</i>	+	+	15 cm	1 plant.	-	-	Not seen.



Quadrat R91/03 in 2004



Quadrat R91/03 in 2007



Quadrat R91/03 in 2010 (from NW corner)



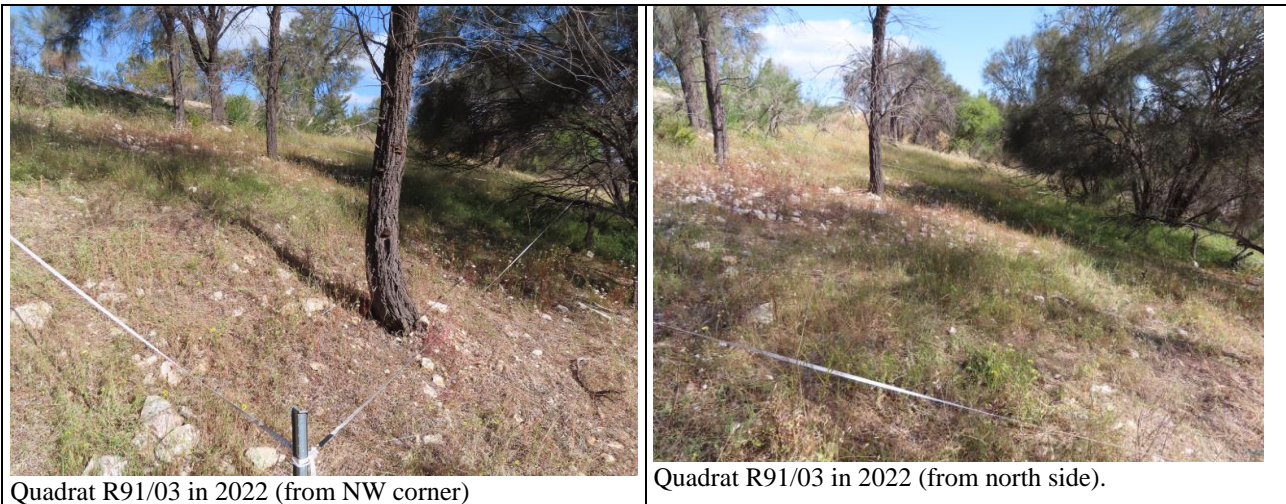
Quadrat R91/03 in 2013



Quadrat R91/03 in 2016 (from NW corner)



Quadrat R91/03 in 2019 (from NW corner)



Quadrat R91/03 in 2022 (from NW corner)

Quadrat R91/03 in 2022 (from north side).

Site: R91/04

Described by: Malcolm Trudgen **Date:** 06/10/2022 **Type:** Quadrat

Location: North Waste dump. **Geocode:** Zone 50 6623993 S, 407455 E [WGS84]

Habitat: Moderate to steep, west-facing lower slope of waste dump.

Soil: Mine waste with some topsoil returned. Pale grey gravelly to cobbly fine silty sand.

Rock Type: Chert waste

Vegetation: *Allocasuarina huegeliana* low woodland over *Regelia megacephala* high shrubland over *Hibbertia subvaginata* low scattered shrubs over **Avena barbata*, **Pentaschistis airoides*, **Briza maxima*, **Vulpia myuros*, **Hypochaeris glabra*, **Ehrharta longiflora* open herbland/grassland.

Notes: Only seedlings were present in 2013 & 2016, so there was no establishment from the 2013 germination. Plants gained since 2013: *Monoculus monstrosus*; *Waitzia nitida*; *Bromus rubens*; *Petrorhagia dubia*; *Comesperma integerrimum*; *Sonchus oleraceus*; *Lupinus cosentinii*; *Brassica barrelieri*; *Arctotheca calendula*; *Senecio diaschides*.

NOTES 2019: Total weed cover ~ 65%. Photo five from SW corner, six from W side. The *Cuscuta* record is the first for the Moora Chert survey area.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	-	-	Not recorded.	+	20 cm	4 juvenile plants in a cluster.
<i>Allocasuarina huegeliana</i>	12%	12-15%	7-8 m	Two large live plants (1 overhanging?).	15%	7-8 m	Two large live plants (& 2 overhanging).
* <i>Arctotheca calendula</i>	+	-		Not recorded.	-	-	Not seen.
* <i>Avena barbata</i>	10%	> 10%	20-40 (100) cm	> 600 plants.	> 10%	20-90 (120) cm	> 700 plants
* <i>Brassica barrelieri</i>	+	+	15 cm	1 dead plant (with seed).	+	30 cm	On west edge of quadrat.
* <i>Briza maxima</i>	< 1%	< 1%	10-15 cm	< 100 plants	-	-	Not seen.
* <i>Bromus rubens</i>	+	-	-	Not recorded.	-	-	Not seen.

<i>Cheilanthes austrotenuifolia</i>	+	+	10 cm	Two plants?	+	10 cm	2 plants.
<i>Comesperma integerrimum</i>	+	-	-	Not recorded.	< 1%	70 cm	1 plant.
<i>Cuscuta</i> sp.	-	+	10 cm	Growing over several species.	+	10 cm	2 patches.
* <i>Ehrharta longiflora</i>	15%	35%	10-50	> 2,000 plants.	> 35%	10-50 (105) cm	> 2,000 plants.
<i>Hibbertia subvaginata</i>	1-2%	≤ 1%	95 cm	1 plant.	1-2%	1 m	2 plants.
* <i>Hypochaeris glabra</i>	> 20%	< 15%	5 cm	> 400 plants	15-20%	5-10 cm	> 1,000 plants.
<i>Kennedia prostrata</i>	1-2%	+	4 cm	5 plants.	+	5-10 cm	14 plants
* <i>Lupinus cosentinii</i>	+	+	20 cm	4 dead plants.	-	-	Not seen.
Moss sp.	2%	-	-	Not recorded.	+	2 cm	In patches.
* <i>Pentameris airoides</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Petrorhagia dubia</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Podolepis lessonii</i>	> 5%	10-15%	7-15 cm	> 600 plants.	2%	10-20 cm	> 200 plants.
<i>Regelia megacephala</i>	12%	< 6%	(0.55)2 m	2 adults, 2 juveniles.	1%	(0.55)2 m	1 adult and 1 young plant.
<i>Rhagodia preissii</i> ssp. <i>preissii</i>	-	-	-	-	+	40 cm	1 plant.
<i>Senecio diaschides</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Sonchus oleraceus</i>	+	-	-	Not recorded.	+	10 cm	2 plants
<i>Trachymene cyanopetala</i>	+	+	7 cm	~ 20 plants.	-	-	Not seen.
* <i>Trifolium arvense</i> var. <i>arvense</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Monoculus monstrosus</i>	+	+	10-15 cm	> 10 plants	-	-	Not seen.
* <i>Urospermum picroides</i>	3-4%	< 1%	10 cm	< 30 plants.	< 1%	10-25 (60) cm	< 25 plants.
* <i>Ursinia anthemoides</i>	>10%	< 10%	10-35cm	> 500 plants.	< 5%	15-40 cm	> 300 plants.
* <i>Vulpia myuros</i>	+	5%	10 cm	> 800 plants	-	-	Not seen.
<i>Waitzia nitida</i>	+	+	20-30 cm	2 plants.	+	25 cm	1 plant.



Quadrat R91/04 in 2004



Quadrat R91/04 in 2007



Quadrat R91/04 in 2010



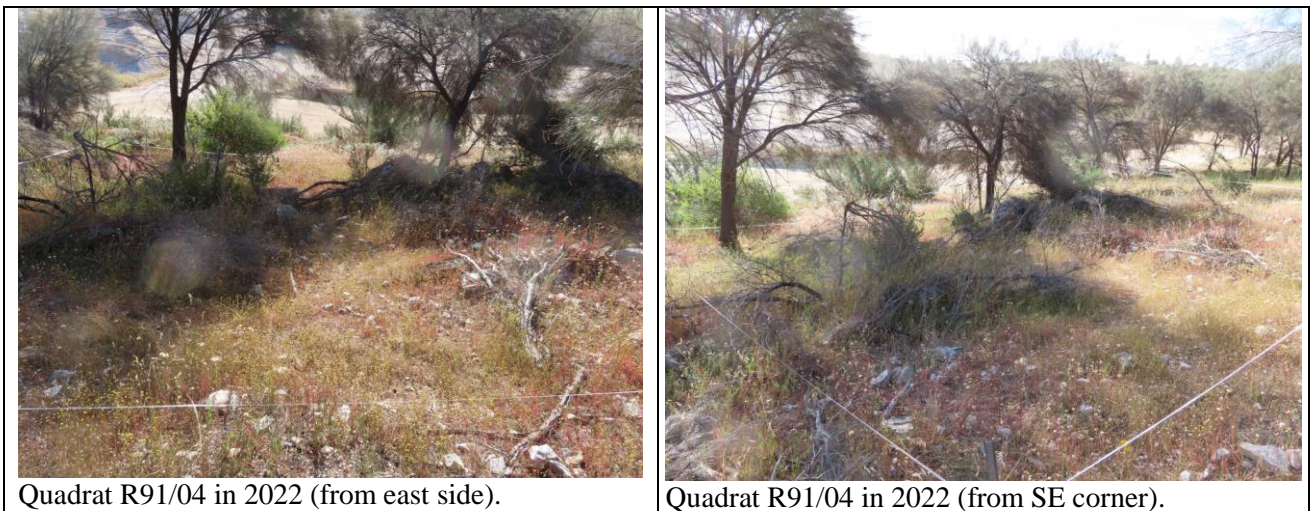
Quadrat R91/04 in 2013



Quadrat R91/04 in 2016 (from near NE corner).



Quadrat R91/04 in 2019 (from west side).



Quadrat R91/04 in 2022 (from east side).

Quadrat R91/04 in 2022 (from SE corner).

Site: R96/01

Described by: Malcolm Trudgen Date: 07/10/2022 Type: Quadrat

Location: Main Waste dump. Geocode: Zone 50 6623639 S, 407225 E [WGS84]

Habitat: North facing moderate to steep lower slope of waste dump.

Soil: Gravelly, fine silty pale brown sand with chert boulders. Topsoil thin, returned over mine waste.

Rock Type: Chert mine waste.

Vegetation: *Allocasuarina huegeliana* low open woodland; over *Regelia megacephala* and *Allocasuarina campestris* open shrubland; over **Ehrharta longiflora*, **Ursinia anthemoides*, **Erodium cicutarium*, **Avena barbata* open grassland; over, **Vulpia myuros*, **Hypochaeris glabra* very open herbland.

Notes: Species lost between 2013 and 2016: *Ptilotus polystachyus* var. *polystachyus*; *Regelia megacephala* (all dead); *Solanum nigrum*; *Sonchus oleraceus*. Species gained between 2013 & 2016: *Monoculus monstrosus*; *Lamarckia aurea*; *Trifolium hirtum*; *Calandrinia* sp.; *Bromus rubens*.

Notes 2019: Total weed cover 65-75%.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Allocasuarina campestris</i>	1-2%	2%	2 m	1 live plant and 1 overhanging.	2%	2.2 m	1 live plant and 1 overhanging.
<i>Allocasuarina huegeliana</i>	10-12%	10-12%	6-7 m	1 live	< 10%	6-7 m	1 live and 2 overhanging.
* <i>Arctotheca calendula</i>	35%	≤ 1	5-10 cm	> 700 plants	> 30%	5-10 cm	> 700 plants.
<i>Austrostipa trichophylla</i>	< 1%	+	10 cm	3 plants (height is leaves).	< 1%	10 cm	3 plants.
* <i>Avena barbata</i>	< 10%	≤ 10%	20-90 cm	> 500 plants.	5-10%	20-90 cm	> 500 plants.
* <i>Brachypodium distachyon</i>	+	-	-	Not recorded.	< 1%	50 cm	-
* <i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	+	-	-	Not recorded.	< 1%	50-75 cm	4 plants.
* <i>Bromus diandrus</i>	-	< 1%	15-20	> 30 plants.	< 1%	40 cm	> 30 plants.

			cm				
* <i>Bromus rubens</i>	< 1%	< 0.5%	15-25cm	> 20 plants.	5%	15-25 cm	> 200 plants
<i>Calandrinia</i> sp.	< 1%	-	-	Not recorded.	+	5 m	Edge SW corner.
* <i>Centaurea melitensis</i>	<1%	-	-	Not recorded.	> 15%	30-70 cm	-
<i>Cheilanthes austrotenuifolia</i>	-	-	-	-	+	12 cm	-
<i>Crassula colorata</i> var. <i>acuminata</i>	-	-	-	-	+	2-5 cm	> 100 plants
* <i>Ehrharta longiflora</i>	>10%	10%	20-40 cm	> 4500 plants	</= 10%	20-40 cm	Ca. 1,000 plants.
* <i>Erodium cicutarium</i>	≥ 5%	> 15%	10-30 cm	> 500 plants	25%	10-30 cm	>/= 1,000 plants.
* <i>Hedypnois rhagadioloides</i>	< 5%	-	-	Not recorded.	< 10%	15-60 cm	-
* <i>Hypochaeris glabra</i>	> 20%	< 5%	5-10 cm	< 300 plants	> 40%	5-10 cm	> 1,000 plants.
* <i>Lamarckia aurea</i>	+	-	-	Not recorded.	-	-	Not seen.
Moss sp.	+	-	-	Not recorded.	-	-	Not seen.
* <i>Orobanche minor</i>	+	-	-	Not recorded.	+	20 cm	5 stems.
* <i>Pentameris airoides</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Ptilotus polystachyus</i>	-	+	15-30 cm	3 plants.	+	15-30 cm	6 plants, SW corner.
* <i>Silene gallica</i> var. <i>gallica</i>	+	+	10 cm	1 plant.	>/= 1%	10 cm	> 30 plants.
* <i>Trifolium arvense</i> var. <i>arvense</i>	1%	< 1%	5-10 cm	~ 10 plants.	2%	10-25 cm	Ten plants.
* <i>Trifolium hirtum</i>	+	0.5%	8-15 cm	> 50 plants.	> 5%	10-20 cm	> 100 plants.
* <i>Monoculus monstrosus</i>	+	+	15-50 cm	-	3%	30-70 cm	Ca. 100 plants.
* <i>Urospermum picroides</i>	-	-	-	Not recorded.	-	-	Not seen.
* <i>Ursinia anthemoides</i>	1-2%	5%	10-25 cm	< 200 plants.	1%	25 cm	< 100 plants.
* <i>Vulpia myuros</i>	+	20%	8-15 cm	> 1,500 small plants.	+	30 cm	< 10 plants.



<p>Quadrat R96/01 in 2004</p>	<p>Quadrat R96/01 in 2007</p>
	
<p>Quadrat R96/01 in 2010</p>	<p>Quadrat R96/01 in 2013</p>
	
<p>Quadrat R96/01 in 2016 (from NE corner)</p>	<p>Quadrat R96/01 in 2019 (from NE corner)</p>
	
<p>Quadrat R96/01 in 2022 (from near NE corner).</p>	<p>Quadrat R96/01 in 2022 (from SE corner).</p>

Site: R96/02**Described by:** Malcolm Trudgen **Date:** 07/10/2022 **Type:** Quadrat**Location:** Main Waste dump. **Geocode:** Zone 50 6623623 S, 407199 E [WGS84]**Habitat:** Moderate, north facing lower slope.**Soil:** Limited, returned over mine waste.**Vegetation:** *Allocasuarina huegeliana* low woodland; over *Allocasuarina campestris* scattered shrubs; over *Regelia megacephala* regeneration low open shrubland; over **Avena barbata*, **Ehrharta longiflora*, **Erodium botrys* **Vulpia myuros*, **Arctotheca calendula* open grassland.**Notes:** Species lost between 2013 & 2016: *Allocasuarina campestris*; *Austrostipa* sp.; *Brachypodium distachyon*; *Conyza bonariensis*; *Sonchus oleraceus*; *Trifolium repens* var. *repens*. Species gained between 2013 and 2016: *Ptilotus polystachyus* var. *polystachyus*.,Notes 2019: Total weed cover 40-50%. The *Arctotheca* changed significantly in cover.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Allocasuarina huegeliana</i>	15-20%	15%	6m	1 plant (spreading tree, some dead branches).	15%	6m	1 plant (spreading tree, some dead branches).
* <i>Arctotheca calendula</i>	35-40%	5-10%	5-10 cm	~ 500 plants (mostly dead).	> 20%	15 cm	Ca. 500 plants (mostly dying).
<i>Aristida contorta</i>	-	-	-	-	+	15 cm	11 plants in SW corner.
* <i>Avena barbata</i>	< 5%	5-10%	20-90 cm	~ 400 plants.	< 5%	40-110 cm	Ca. 400 plants.
* <i>Bromus diandrus</i>	-	1%	20 cm	~ 50 plants.	< 1%	20 cm	Ca. 50 plants.
* <i>Bromus rubens</i>	-	+	10-15 cm	30-50 plants.	1-2%	10-25 cm	30-50 plants.
<i>Crassula colorata</i> var. <i>colorata</i>	-	-	-	-	</= 1%	2-6 cm	> 500 60 1,,000 plants.
* <i>Ehrharta longiflora</i>	5-10%	5-10%	10-20 cm	> 150 plants.	< 5%	10-20 cm	> 150 plants.
* <i>Erodium botrys</i>	10-15%	≤ 15%	10-25 cm	> 400 plants (some large).	Ca. 20%	10-35 cm	> 400 plants (some large).
* <i>Hypochaeris glabra</i>	5-10%	10%	5-25 cm	> 400 plants.	50%	5-25 cm	> 400 plants.
* <i>Lupinus cosentinii</i>	-	+	20 cm	4 plants.	-	-	Just out.
Moss	-	-	-	-	</= 1%	2 cm	-
* <i>Orobanche minor</i>	+	-	-	Not recorded.	</= 1%	10-30 cm	> 40 stems.
* <i>Pentameris airoides</i>	< 1%	-	-	Not recorded.	+	15 cm	-
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	+	40 cm	2 plants.	1%	40-100 cm	8 plants.
<i>Regelia megacephala</i>	3-4%	4	0.8-2.2 m	2 plants, no seedlings.	1-2%	1.2 m	1 plant, no seedlings
* <i>Silene gallica</i> var. <i>gallica</i>	+	-	-	Not recorded.	1%	30-45 cm	In NE corner.
* <i>Trifolium arvense</i> var. <i>arvense</i>	< 1%	-	-	Not recorded.	+	10-15 cm	-
* <i>Monoculus monstrosus</i>	< 1%	< 1%	20-40 cm	-	2%	20-40 cm	-

*Urospermum picroides	1-2%	1%	10-30 cm	> 50 plants	1%	10-55 cm	> 70 plants.
*Ursinia anthemoides	< 1%	< 5%	10-20 cm	> 400 plants.	5%	10-20 cm	> 400 plants.
*Vulpia myuros	-	> 20%	10-20 cm	> 2,000 plants.	> 10%	10-20 cm	500-1,000 plants.



Quadrat R96/02 in 2004



Quadrat R96/02 in 2007



Quadrat R96/02 in 2010



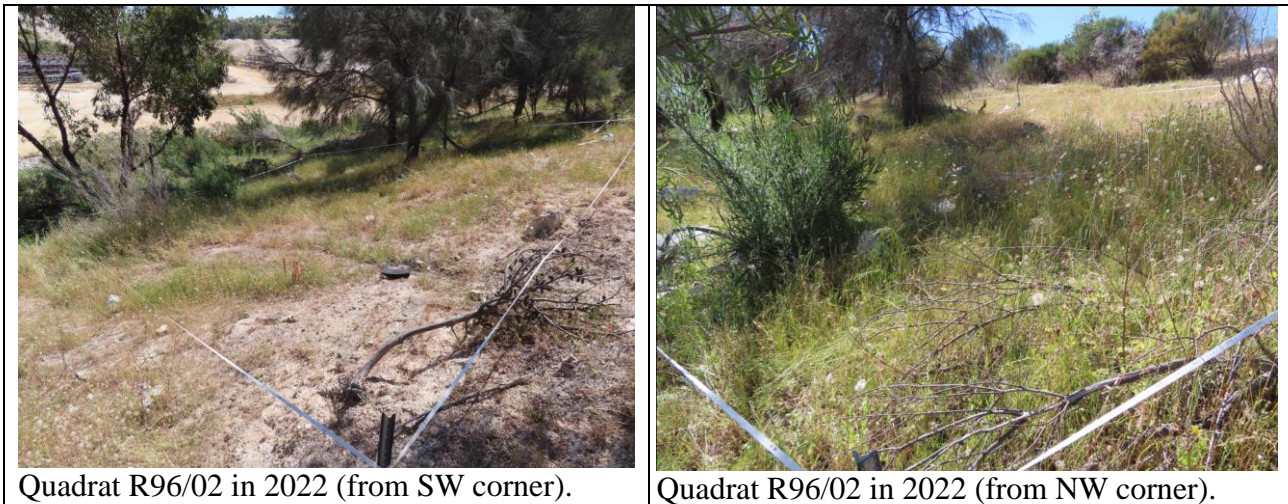
Quadrat R96/02 in 2013 (from SW corner).



Quadrat R96/02 in 2016 (from SW corner).



Quadrat R96/02 in 2019 (from SW corner).



Quadrat R96/02 in 2022 (from SW corner).

Quadrat R96/02 in 2022 (from NW corner).

Site: R98/01

Described by: Malcolm Trudgen **Date:** 07/10/2022 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623614 S, 407248 E [WGS84]

Habitat: Gentle, NW facing slope (from crest of waste dump).

Soil: Surface of fine-medium gravel and cobbles.

Rock Type: Chert mine waste.

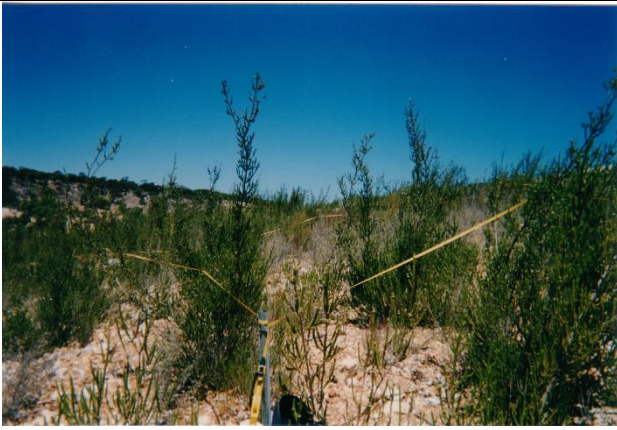
Vegetation: *Allocasuarina campestris*, *Acacia congesta* subsp. *congesta* open shrubland over *Hibbertia subvaginata* low shrubland; over **Avena barbata*, **Vulpia myuros*, **Ursinia anthemoides*, **Urospermum picroides*, *Trachymene cyanopetala* annual grass/herbland

Notes: Species lost since 2013: *Allocasuarina huegeliana* (some seedlings counted as *Allocasuarina campestris* may be *A. huegeliana*); *Austrostipa elegantissima*; *Blennospora drummondii*; *Senecio glossanthus*; *Wahlenbergia preissii*. Species gained since 2013: *Arctotheca calendula*; *Hypochaeris glabra*; *Aira caryophyllea*.

Notes 2019: A big germination of *Allocasuarina huegeliana*. Six species, five native, gained since 2016. The *Lupinus* likely to increase in cover. Many juvenile *Allocasuarina*.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	3%	2%	1.3 m	1 plant, 2 m across.	3%	1.7 m	1 plant, 2 m across & a 7 cm seedling.
* <i>Aira caryophyllea</i>	+	+	5-10 cm	> 100 plants.	-	-	Not seen
<i>Allocasuarina campestris</i>	< 5 %	25-35%	(0.1)1.2-2.3 m	4 adult plants (3%) and ca. 300 juveniles 10-70 cm.	30%	30-140 cm & 2.2 m	3 adult (2.2 m) & 100-120 young 30-140 cm
<i>Allocasuarina huegeliana</i>	-	2-3%	0.8-1.7 m	11 plants, all juvenile.	2-3%	1.7-3 m	4 young plants.
* <i>Arctotheca calendula</i>	-	-	-	-	< 1%	5-10 cm	-
<i>Aristida contorta</i>	-	-	-	-	+	10 cm	> 20 plants.
* <i>Lysimachia arvensis</i> var. <i>arvensis</i>	3%	-	-	Not recorded.	+	10-15 cm	-
<i>Apium annuum</i>	-	+	1.5 cm	> 50 plants.	-	-	Not seen.
* <i>Arctotheca calendula</i>	3%	+	3 cm	< 10 plants.	+	3 cm	< 10 plants.

<i>Austrostipa trichophylla</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Avena barbata</i>	+	+	10-20 cm	50-100 plants.	-	-	1 plant just out.
* <i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Blennospora drummondii</i>	-	+	5 cm	> 50 plants.	-	-	Not seen.
* <i>Briza maxima</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Bromus diandrus</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Bromus rubens</i>	-	-	-	-	+	10-15 cm	-
* <i>Centaurea melitensis</i>	-	-	-	-	≤ 1%	10-20 cm	> 200 plants.
<i>Crassula colorata</i> var. <i>colorata</i>	-	-	-	-	+	2-7 cm	< 20 plants.
* <i>Ehrharta longiflora</i>	3-5%	+	20 cm	1 plant!	+	10-60 cm	-
* <i>Erodium botrys</i>	-	-	-	-	+	10-25 cm	+
<i>Eucalyptus camaldulensis?</i>	-	< 1%	1.6 m	1 plant, juvenile.	1%	2.8 m	1 young tree.
* <i>Hedypnois rhagadioloides</i>	-	-	-	-	2%	15-30 cm	> 20 plants
<i>Hibbertia subvaginata</i>	10-12%	10%	< 10-50 cm	29 adult and 5 juvenile (≤ 10 cm) plants	2%	80-130 cm	4 plants.
* <i>Hypochaeris glabra</i>	5%	1-2%	5 cm	~ 200 plants.	> 5%	5 cm	> 1,000 plants
* <i>Lupinus cosentinii</i>	-	+	25 cm	4 plants.	-	-	Not seen.
* <i>Pentameris airoides</i>	< 1%	-	-	Not recorded.	-	-	Not seen.
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Podotheca gnaphalioides</i>	-	-	-	-	+	7-18 cm	5 plants.
<i>Regelia megacephala</i>	5-10%	1%	0.2-1.5 m cm	2 sub-mature (1.5 m) and 5 juvenile (20-50 cm).	+	1.6 m	1 plant.
<i>Thysanotus patersonii</i>	-	+	60 cm	1 plant.	+	60-130 cm	5 plants.
<i>Trachymene cyanopetala</i>	+	1%	5-8 cm	> 500 plants.	3%	5-8 cm	> 1,000 plants
<i>Trachymene ornata</i>	+	+	5 cm	5+ plants.	+	5-7 cm	Ca. 64 plants
* <i>Trifolium arvense</i> var. <i>arvense</i>	+	+	5-10 cm	2 plants.	+	10 cm	2 plants
* <i>Urospermum picroides</i>	1%	+	5-8 cm	< 50 plants.	-	-	Not seen
* <i>Ursinia anthemoides</i>	1%	3%	8-12 cm	> 800 plants.	2-3%	20-40 cm	> 400 plants.
* <i>Vulpia myuros</i>	1%	≤ 5%	7-10 cm	> 1,000 plants.	+	10 cm	1 plant



Quadrat R98/01 in 2004



Quadrat R98/01 in 2013



Quadrat R98/01 in 2016 Photograph 1



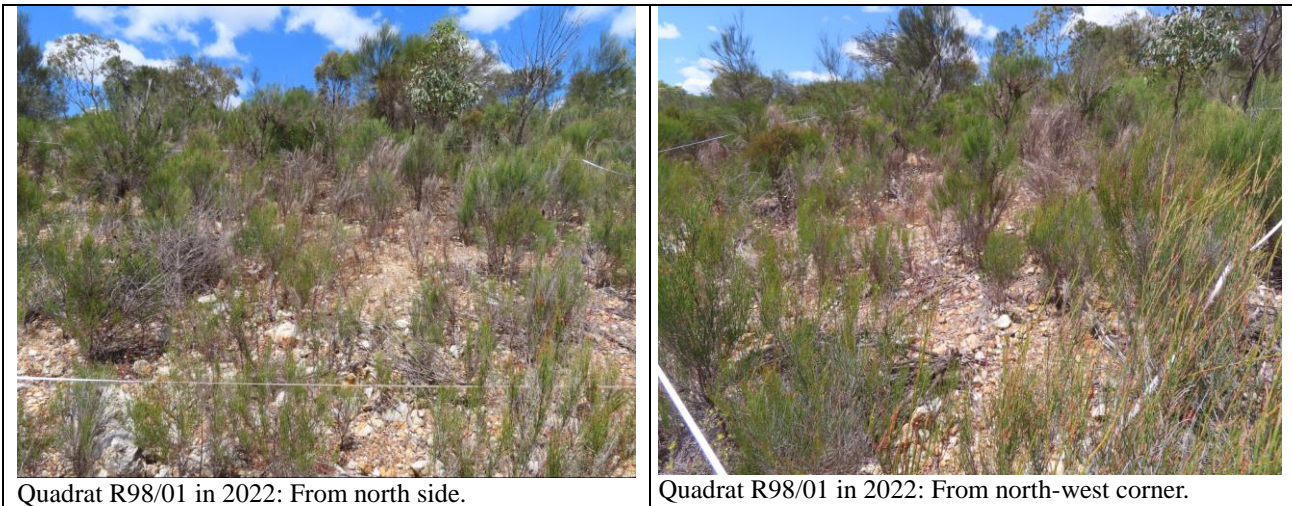
Quadrat R98/01 in 2016 Photograph 2



Quadrat R98/01 in 2019: From north side



Quadrat R98/01 in 2019: From north-west corner



Quadrat R98/01 in 2022: From north side.

Quadrat R98/01 in 2022: From north-west corner.

Site: R98/02

Described by: Malcolm Trudgen **Date:** 07/10/2022 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623601 N, 407214 E [WGS84]

Habitat: Upper moderate slope of waste dump, NW facing.

Soil: Gravelly, cobbly silty sand. Lots of surface rock.

Rock Type: Chert mine waste

Vegetation: *Regelia megacephala*, (*Allocasuarina huegeliana*) high shrubland; over *Allocasuarina campestris* shrubland; over *Hibbertia subvaginata* open shrubland; over **Avena barbata*, **Ehrharta longiflora* **Vulpia myuros* very open grassland.

Notes: Species lost since 2013: *Bromus diandrus*; *Cotula* sp.; *Silene gallica* var. *gallica*; *Wahlenbergia preissii*. Species gained since 2013: *Erodium botrys*; *Petrorhagia dubia*; *Trachymene cyanopetala*; *Podolepis lessonii*; *Ptilotus polystachyus* var. *polystachyus*; *Austrostipa trichophylla*; and *Arctotheca calendula*. There has been confusion between 2016 and 2019 identifying the juvenile *Allocasuarina*. This has been sorted out and most individuals are (and were) *Allocasuarina campestris* [corrected in table[#]].

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Allocasuarina campestris</i>	3-4%	#10-12%	1-1.9 m	2 large (1.2-1.6 m). Juveniles assigned to this species in 2016 should have been assigned to <i>Allocasuarina huegeliana</i> .	</= 20%	(5)40-120 cm & 2 m	Two plants 2 m tall rest mostly 40-120 cm, a few ca. 5 cm.
<i>Allocasuarina huegeliana</i>	< 1%	#1-2%	0.2-1.6 m	ca. 120 juveniles	>/= 1%	(1.3)2.5-2.8 m	Three plants.
<i>*Arctotheca calendula</i>	+	-	-	Not recorded.	< 1%	5 cm	30-50 plants.
<i>Austrostipa trichophylla</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>*Avena barbata</i>	1-2%	1-2%	20-50 cm	100-200 plants.	2%	20-50 cm	> 300 plants.
<i>*Brachypodium distachyon</i>	-	-	-	-	+	7 cm	One plant.

* <i>Ehrharta longiflora</i>	≥ 4%	≥ 4%	10-45 cm	> 200 plants.	5%	10-75 cm	> 500 plants.
* <i>Erodium botrys</i>	+	+	5 cm	5 plants.	1%	5 cm	Ca. 100 plants.
<i>Hibbertia subvaginata</i>	3-4%	4%	50-1400 cm	13 plants.	2%	110 cm	2 plants.
* <i>Hypochaeris glabra</i>	10%	> 5%	5-10 cm	> 500 pants (? > 1,000) [impossible to estimate number of plants.]	> 15%	5-10 cm	Ca. 1,000 plants, but dead so difficult to assess.
* <i>Lysimachia arvensis</i>	-	-	-	-	+	7 cm	-
Moss sp.	+	-	-	Not recorded.	-	-	Not seen.
* <i>Pentameris airoides</i>	1%	1%	5 cm	> 100 plants.	1%	5 cm	> 100 plants.
* <i>Petrorrhagia dubia</i>	+	-	-	Not recorded.	+	40 cm	4 plants.
<i>Podolepis lessonii</i>	+	+	15 cm	1 plant.	+	15 cm	Ca. 15 plants
<i>Podotheca gnaphalioides</i>	-	-	-	-	-	-	Just out.
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Regelia megacephala</i>	20%	20%	0.2-3 m	19 “large” plants (> 1.2 m) and 49 smaller plants (most > 35 cm).	15%	< 60 cm -	2 plants: 12 < 60 cm others 1-2.8 m.
* <i>Silene gallica</i> ssp. <i>gallica</i>	-	-	-	-	+	15 cm	< 5 plants
<i>Thysanotus patersonii</i>	-	-	-	-	+	90 cm	1 plant.
<i>Trachymene cyanopetala</i>	+	-	-	Not recorded.	+	5 cm	-
* <i>Trifolium arvense</i> var. <i>arvense</i>	1%	+	5-12 cm	< 30 plants.	2%	5-12 cm	>= 200 plants.
* <i>Trifolium hirtum</i>	-	-	-	-	+	10 cm	< 20 plants.
* <i>Monoculus monstrosus</i>	-	-	-	-	+	15-40 cm	< 30 plants.
* <i>Urospermum picroides</i>	1-2%	+	5-6 cm	< 30 plants.	+	10-50 cm	< 30 plants.
* <i>Ursinia anthemoides</i>	+	1%	15 cm	> 400 plants.	1%	8-25 cm	< 200 plants.
* <i>Vulpia myuros</i>	1%	1-2%	5-10 cm	> 500 plants.	+	10 cm	< 20 plants.
* <i>Wahlenbergia capensis</i>	-	-	-	-	+	7-10 cm	> 100 plants.



Quadrat R98/02 in 2004



R98/02 in 2007



Quadrat R98/02 in 2010



Quadrat R98/02 in 2013



Quadrat R98/02 in 2016 (from NE corner).



Quadrat R98/02 in 2019 (from NE corner).



Quadrat R98/02 in 2022 (from SE corner)



Quadrat R98/02 in 2022 (from NE corner).

Site: R00/01**Described by:** Malcolm Trudgen **Date:** 07/10/2022 **Type:** Quadrat**Location:** Main Waste dump. **Geocode:** Zone 50 6623607 S, 407293 E [WGS84]**Habitat:** North-facing mid-slope of tall waste dump.**Soil:** Chert mine waste including some brown, silty fine sand with lots of gravel, cobbles, rocks and boulders.**Vegetation:** *Allocasuarina huegeliana* scattered low trees over *Regelia megacephala*, *Allocasuarina campestris* high open shrubland over *Hibbertia subvaginata* low open shrubland over **Erodium botrys*, **Hypochaeris glabra*, **Ehrharta longiflora*, **Avena barbata* open herbland/grassland.**Notes:** Species added since 2013: *Brachypodium distachyon*; *Trachymene cyanopetala*; *Trachymene ornata*; *Sonchus oleraceus*; *Petrorhagia dubia*; *Urospermum picroides*; *Briza maxima*; *Eucalyptus camaldulensis* (probably, juvenile); *Monoculus monstrosus*; *Orobanche minor*; *Centaurea melitensis*; *Ptilotus polystachyus* var. *polystachyus*; *Austrostipa elegantissima*. Species lost since 2013: *Bromus diandrus*. There was probably confusion in 2019 between *Allocasuarina campestris* and *Allocasuarina huegeliana*.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	< 1%	< 1%	80 cm	1 plant.	2%	1.4 m	1 plant
<i>Allocasuarina campestris</i>	2%	2-3%	1.6 m	2 plants, 1 juvenile. 4 older dead (1.5 m +).	>/= 20%	0.5-2 m	22 plants
<i>Allocasuarina huegeliana</i>	2%	15-20%	(0.3)4.5 m	1 large plant (4.5 m) and 46 younger (0.3-1.5 m) 1 large plant (4.5 m) and 46 younger (0.3-1.5 m)	2-3%	1.6-2.8 m	2 plants. Ah & Ac were confused in the 2019 data. Corrected in 2022.
* <i>Arctotheca calendula</i>	-	+	5 cm	1 plant.	+	5 cm	< 20 plants.
<i>Austrostipa elegantissima</i>	1%	1%	70 cm	2 plants.	-	-	Not recorded
<i>Austrostipa</i> sp.	+	-	-	Not recorded.	-	-	Not seen
<i>Austrostipa trichophylla</i>	+	+	7 cm	2 plants (height is leaves).	-	-	Not seen
* <i>Avena barbata</i>	15%	5-8%	10-30 cm	> 500 plants.	>/= 5%	10-90 cm	> 500 plants.
* <i>Brachypodium distachyon</i>	+	+	-	Not recorded.	-	-	Not seen
* <i>Briza maxima</i>	+	+	10-20 cm	< 10 plants.	-	-	Not seen
* <i>Centaurea melitensis</i>	+	-	-	Not recorded.	-	-	Not seen
<i>Dichopogon capillipes</i>	-	-	-	-	+	10 cm	1 plant.
* <i>Ehrharta longiflora</i>	10%	≤ 5%	10-25 cm	> 500 plants.	2%	10-60 cm	> 200 plants.
* <i>Erodium botrys</i>	> 5%	< 1%	8-15 cm	< 100 plants.	3%	8-15 cm	> 200 plants.
<i>Eucalyptus camaldulensis</i>	+	< 1%	1.4 m	1 juvenile.	2%	2.5 m	1 young plant.
<i>Goodenia berardiana</i>	-	-	-	-	+	25 cm	3 plants.
<i>Hibbertia subvaginata</i>	2%	3%	80-120	7 plants.	2%	100-	2 plants.

			cm			130 cm	
* <i>Hypochaeris glabra</i>	3-5%	1%	5-8 cm	> 100 plants.	> 15%	5-8 cm	> 800 plants.
<i>Microtis</i> sp.							
* <i>Monoculus monstrosus</i>	+	-	-	Not recorded.	1%	20-50 cm	> 30 plants
* <i>Orobanche minor</i>	+	-	-	Not recorded.	-	-	Not seen
* <i>Pentameris airoides</i>	+	+	5-10 cm	> 100plants.	-	-	Not seen
* <i>Petrohragia dubia</i>	+	-	-	Not recorded.	+	25 cm	1 plant.
<i>Podolepis lessonii</i>	1-2%	3-4%	5-15 cm	> 500 plants.	4%	10-25 cm	> 300 plants
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	+	-	-	Not recorded.	-	-	Not seen
<i>Regelia megacephala</i>	6%	2%	150-200cm	2 adult plants + 1 overhanging and 1 young plant (50 cm).	-	-	All dead.
* <i>Silene gallica</i> var. <i>gallica</i>	-	-	-	Not recorded.	< 1%	45 cm	> 30 plants.
* <i>Sonchus oleraceus</i>	+	-	-	Not recorded.	+	35 cm	-
<i>Thysanotus patersonii</i>	-	+	50 cm	1 plant	+	1.4 m	2 plants.
<i>Trachymene cyanopetala</i>	+	+	5 cm	1 plant.	+	5 cm	1 plant.
<i>Trachymene ornata</i>	+	-	-	Not recorded.	+	3-6 cm	> 30 plants.
* <i>Urospermum picroides</i>	1-2%	+	5-8 cm	40-50 plants.	< 5%	12-30 cm	> 400 plants.
* <i>Ursinia anthemoides</i>	+	< 1%	5-15 cm	> 200 plants.	1%	20 cm	> 20 plants.
* <i>Vulpia myuros</i>	< 1%	2-3%	5-12 cm	> 500 plants.	-	-	Not seen
* <i>Wahlenbergia capensis</i>	-	+	12 cm	1 plant.	+	20 cm	5 plants



Quadrat R00/01 in 2004



Quadrat R00/01 in 2007



Quadrat R00/01 in 2010



Quadrat R00/01 in 2013



Quadrat R00/01 in 2016.



Quadrat R00/01 in 2019 (from SW corner).



Quadrat R00/01 in 2022 (from south side).



Quadrat R00/01 in 2022 (from SW corner).

Site: R00/02

Described by: Malcolm Trudgen **Date:** 11/10/2022 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623528 S, 407224 E [WGS84]

Habitat: Moderate, west-facing slope.

Soil: Chert mine waste including some brown, silty fine sand with lots of gravel, cobbles, rocks and boulders.

Rock Type: Chert mine waste

Vegetation: *Eucalyptus camaldulensis* var. *obtusa*, *Allocasuarina huegeliana* scattered trees; over *Regelia megacephala* high open shrubland over *Hibbertia subvaginata*, *Acacia congesta* subsp. *congesta* low open shrubland; over **Avena barbata*, **Briza maxima* **Hypochaeris glabra*, **Trifolium arvense* var. *arvense*, **Vulpia myuros* annual open grass/herbland.

Notes: Species gained since 2013: *Acacia lasiocarpa* var. *sedifolia*; *Bossiaea moylei*; *Sonchus oleraceus*; *Trachymene ornata*; *Cheilanthes adiantoides*; *Trachymene cyanopetala*; *Microtis* sp.; *Goodenia berardiana*; *Monoculus monstrosus*; *Arctotheca calendula*. Species lost since 2013: *Rytidosperma* sp.; *Parentucellia latifolia*

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	+	-	-	Not recorded.	+	7-12 cm	3 seedlings.
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	+	+	80 cm	1 plant, ca. 5 years old.	-	-	Not seen.
* <i>Aira caryophyllea</i>	< 1%	> 1%	8-10 cm	> 500 plants.	-	-	Not seen.
<i>Allocasuarina huegeliana</i>	3%	2%	4.2 m	1 plant.	6%	5-6 m	1 plant & 1 overhanging.
* <i>Arctotheca calendula</i>	+	+	5 cm	1 plant.	+	15 cm	2 plants.
<i>Austrostipa variabilis</i>	< 5%	+	8-10 cm	16 plants (height is leaves, 2 taxa?).	< 1%	10-15 cm.	23 plants.
* <i>Avena barbata</i>	2%	1-2%	15-45cm	> 350 plants	3%	45-115 cm	> 350 plants.
<i>Blennospora drummondii</i>	-	+	1-5 cm	> 50 plants.	-	-	Not seen.
<i>Bossiaea moylei</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Brachypodium distachyon</i>	-	+	20 cm	< 30 plants	+	20-35 cm	< 20 plants.
* <i>Briza maxima</i>	+	+	10-15cm	> 100 plants.	-	-	Not seen.
* <i>Bromus diandrus</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Bromus rubens</i>	-	+	12 cm	8-10 plants.	-	-	Not seen.
<i>Cheilanthes adiantoides</i>	+	+	8 cm	3 small patches.	+	10 cm	3 small patches.
* <i>Ehrharta longiflora</i>	≥ 3%	1-2%	10-35 cm	> 300 plants.	10%	10-75 cm	> 500 plants
* <i>Erodium botrys</i>	3%	≤ 2%	5-10 cm	> 300 plants.	≤ 5%	5-20 cm	> 400 plants.
<i>Eucalyptus camaldulensis</i> var. <i>obtusa</i>	20%	20%	7 m	1 plant.	20%	7+ m	1 plant, very open.
<i>Goodenia berardiana</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Hibbertia subvaginata</i>	-	2-3%	15-145 cm	14 plants, most fairly old.	3-4%	70-150 cm	9 adults and 1 juvenile.
* <i>Hypochaeris glabra</i>	> 5%	< 5%	5-10 cm	> 700 plants	> 30%	5-10 cm	> 2,000 plants.
<i>Microtis</i> sp.	+	-	-	Not recorded.	+	-	10 stems in 2 groups.
* <i>Monoculus monstrosus</i>	+	+	10-20 cm	> 10 plants.	< 1%	10-20 cm	> 70 plants.
* <i>Parentucellia latifolia</i>	-	+	7 cm	< 10 plants.	+	4-9 cm	< 10 plants.
* <i>Petrorhagia dubia</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Podolepis lessonii</i>	5%	< 5%	5-15 cm	> 1,000 plants	> 5%	5-15 cm	> 1,500 plants
<i>Podotheca</i>	-	-	-	-	+	15 cm	1 plant.

<i>gnaphalioides</i>							
<i>Pterostylis</i> sp.	-	+	8 cm	1 plant.	-	-	Not seen.
<i>Ptilotus polystachyus</i>	-	-	-	-	+	35 cm	1 plant.
<i>Regelia megacephala</i>	7%	≥ 3%	20 cm - 2+ m	3 adults (2-6 m, 1 on edge of quadrat) & 11 juveniles (30-50 (100) cm) and 3 seedlings.	< 3%	1-1.6 m	3 young adult plants and one juvenile (20 cm).
<i>Rytidosperma acerosum</i>	-	+	15 cm	7 plants.	+	8 cm	9 plants.
* <i>Silene gallica</i> var. <i>gallica</i>	+	-	-	Not recorded.	+	-	A few plants
* <i>Solanum nigrum</i>	-	-	-	-	+	15 cm	1 plant.
* <i>Sonchus oleraceus</i>	+	-	-	Not recorded.	+	7-30 cm	2 plants.
<i>Thysanotus manglesii</i>	-	-	-	-	+	60-140 cm	3 plants.
<i>Trachymene cyanopetala</i>	< 1%	-	-	Not recorded.	+	2-5 cm	> 30 plants
<i>Trachymene ornata</i>	+	-	-	Not recorded.	+	3-5 cm	11 plants.
* <i>Trifolium arvense</i> var. <i>arvense</i>	<1%	+	5-8 cm	30-40 plants.	+	5-8 cm	25-35 plants.
* <i>Urospermum picroides</i>	1%	+	15 cm	> 40 plants.	</= 1%	10-20 cm	> 70 plants.
* <i>Ursinia anthemoides</i>	+	≤ 1%	8-25 cm	> 200 plants.	< 5%	10-35 cm	> 200 plants.
* <i>Vulpia myuros</i>	< 1%	< 1%	8-12 cm	< 100 plants.	-	-	Not seen.



Quadrat R00/02 in 2004



Quadrat R00/02 in 2007



Site: R01/02

Described by: Malcolm Trudgen **Date:** 13/10/2022 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623221 S, 407438 E [WGS84]

Habitat: Moderate, south-facing slope of waste dump.

Soil: Very gravelly, pebbly brown silty fine sand with rocks and boulders

Rock Type: Chert Mine waste

Vegetation: *Allocasuarina huegeliana*, *Regelia megacephala* high shrubland over *Hibbertia subvaginata* open shrubland to low shrubland; over *Erodium botrys* herbland with *Ehrharta longiflora*, *Avena barbata*, *Brachypodium distachyon*, *Romulea rosea* open grassland.

Notes: There was better (more) *Regelia* regeneration outside the quadrat than in it. *Acacia stenoptera* dead in 2013, also in 2016 (same plants?). Species lost since 2013: *Hibbertia subvaginata*. Species gained since 2013: *Pentameris airoides*; *Hypochaeris glabra*; *Monoculus monstrosus*; *Cheilanthes*

adiantoides; *Trifolium arvense* var. *arvense*; *Sonchus oleraceus*.

NOTES 2019: At the 2022 recording the quadrat had a lot of *Allocasuarina* litter that made cover assessment of the smaller plants difficult.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
* <i>Arctotheca calendula</i>	-	-	-	-	+	8 cm	14 plants.
<i>Allocasuarina huegeliana</i>	15%	≤ 20%	5-6 m	2 trees and 1 overhanging.	≤ 30%	6-8 m	2 trees & 3 overhanging.
<i>Austrostipa</i> sp. Cairn Hill (M.E. Trudgen 21176)	> 2-3%	< 1%	10-12 cm	5 plants (height is for leaves).	+	10-12 cm	5 plants.
* <i>Avena barbata</i>	10%	≤ 10%	15-60 cm	500-1,000 plants.	< 5%	15-60 cm	< 1,000 plants.
* <i>Brachypodium distachyon</i>	10%	≥ 20%	10-15 cm	> 2,000 small plants.	> 5%	10-50 cm	≤ 1,500 plants.
* <i>Briza maxima</i>	< 1%	< 1%	6-12 cm	Ca. 100 plants.	+	10 cm	< 20 plants.
* <i>Bromus rubens</i>	-	-	-	-	+	20 cm	1 plant.
<i>Cheilanthes adiantoides</i>	+	+	15 cm	1 plant SW corner of quadrat.	+	7-15 cm	5 plants.
<i>Dichopogon capillipes</i>	-	-	-	-	+	5 cm	4 plants.
<i>Ehrharta longiflora</i>	< 5%	< 5%	10-90 cm	> 500 plants.	1%	10-70 cm	< 100 plants
<i>Erodium botrys</i>	< 20%	≥ 2%	5-20 cm	> 200 small plants.	< 2%	5-10 cm	< 200 small plants
<i>Hypochaeris glabra</i>	60%	< 5%	5-10 cm	Ca. 1,000 very small plants.	15%	3 cm	> 2,000 very small plants.
<i>Lupinus cosentinii</i>	-	+	10 cm	1 plant, dead, did not fruit.	-	-	Not seen.
<i>Monoculus monstrosus</i>	+	+	8-10 cm	< 20 plants.	< 1%	10-50 cm	> 30 plants.
Moss sp.	+	-	-	Not recorded.	+	1 cm	A patch.
<i>Pentameris airoides</i>	+	-	-	Not recorded.	+	10-20 cm	-
<i>Podolepis lessonii</i>	-	+	10 cm	1 plant, fruiting.	-	-	Not seen.
<i>Regelia megacephala</i>	1-2%	3%	1-1.5 m	7 young plants.	1-2%	2 m	2 plants.
<i>Romulea rosea</i>	5%	< 5%	10-20 cm	> 800 plants	< 5%?	10-20 cm	> 1,000 plants.
<i>Senecio diaschides</i>	-	-	-	-	+	12 cm	1 juvenile.
<i>Sonchus oleraceus</i>	+	-	-	Not recorded.	+	10-30 cm	2 plants.
<i>Thysanotus manglesii</i>	-	-	-	-	+	50 cm	1 plant
<i>Trifolium arvense</i> var. <i>arvense</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Urospermum picroides</i>	+	-	-	Not recorded.	+	5-10 cm	9 plants.
<i>Ursinia anthemoides</i>	< 1%	1%	10-15 cm	> 250 plants	1%	10-35 cm	< 100 plants.
<i>Vulpia myuros</i>	< 1%	> 3%	10-15cm	> 1,000 plants	> 3%	10-15 cm	< 1,000 plants.



Quadrat R01/02 in 2007



Quadrat R01/02 in 2010



Quadrat R01/02 in 2013



Quadrat R01/02 in 2016 (from NE corner)



Quadrat R01/02 in 2019 (from NE corner)



Quadrat R01/02 in 2019 (from north side)



Quadrat R01/02 in 2022 (from NE corner)



Quadrat R01/02 in 2022 (from north side)



Quadrat R01/02 in 2022 (from NW corner)

Site: R02

Described by: Malcolm Trudgen **Date:** 11/10/2022 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623264 S, 407343 E [WGS84]

Habitat: Mid to upper, south-facing slope of waste dump

Soil: sandy, gravelly, cobbly, rocky waste dump material

Vegetation: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala*, *Acacia congesta* subsp. *congesta*, *Allocasuarina campestris*, *Kunzea praestans* shrubland over *Hibbertia subvaginata* open shrubland over *Brachypodium*, *distachyon*, *Ehrharta longiflora*, *Hypochaeris glabra*, *Ursinia anthemoides*, **Avena barbata* open grassland over **Erodium botrys*, **Hypochaeris glabra* annual grass/herbland

Notes: Species gained since 2013: *Arctotheca calendula*; *Daucus glochidiatus*; *Goodenia berardiana*; *Trifolium arvense* var. *arvense*; *Cheilanthes adiantoides*; *Monoculus monstrosus*; *Neurachne alopecuroidea*; *Drosera macrantha*; *Centaurea melitensis*; *Parentucellia latifolia*. Species lost since 2013: *Calytrix* aff. *leschenaultii* (Moorra); *Cryptandra glabriflora*; *Dryandra sessilis*; *Guichenotia micrantha*; *Hedypnois rhagadioloides*; *Senecio quadridentatus*; *Trachymene pilosa*.

Notes 2019: It seems likely the *Brachypodium* is wiping out other species.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	1%	2%	50-80 cm	2 plants, one 50 cm & one 80 cm.	1-2%	80-110 cm	3 plants.
<i>Acacia stenoptera</i>	+	+	40 cm	1 live and 1 dead plant.	-	-	Not seen.
* <i>Aira caryophylla</i>	+	+	10 cm	< 100 plants	+	10 cm	< 20 plants.
<i>Allocasuarina campestris</i>	6-7%	8-10%	5 m	3 plants.	>/= 12%	(1)2.2-5 m	2 large in & 1 overhanging & 1 small
<i>Allocasuarina huegeliana</i>	5%	5%	3-5 m	2 plants (1 3 m and 1 5 m tall).	6%	5-6 m	2 plants.
* <i>Arctotheca calendula</i>	+	< 1%	5 cm	> 70 plants.	< 1%	5 cm	10-15 plants.
<i>Aristida contorta</i>	-	-	-	-	+	20 cm	1 plant.
<i>Austrostipa elegantissima</i>	-	+	30 cm	1 plant (height is leaves).	+	20 cm	1 plant.
<i>Austrostipa trichophylla</i>	1-2%	+	15 cm	3 plants.	+	15 cm	4 plants.

* <i>Avena barbata</i>	2%	≤ 2%	20-50 cm	> 200 plants.	< 2%	20-90 cm	> 200 plants.
<i>Blennospora drummondii</i>	+	< 1%	5-8 cm	> 50 plants	+	5-8 cm	2 plants.
* <i>Brachypodium distachyon</i>	50-60%	30%	10-15 cm	> 2,000 plants.	20%	10-15 cm	> 2,000 plants.
* <i>Briza maxima</i>	1%	< 1%	5-20 cm	< 100 plants.	< 1%	5-20 cm	< 100 plants.
* <i>Bromus rubens</i>	-	+	7 cm	2 plants.	-	-	Not seen.
* <i>Centaurea melitensis</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	-	+	?	1 plant. Leaves gone (in fruit).	-	-	Not seen.
<i>Cheilanthes adiantoides</i>	+	+	10 cm	8 plants.	≤ 1%	10 cm	12 plants.
<i>Cheilanthes austrotenuifolia</i>	+	-	-	Not recorded.	+	10 cm	3 plants.
<i>Comesperma integerrimum</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Crassula colorata</i> var. <i>acuminata</i>	-	+	3 cm	1 plant.	-	-	Not seen.
<i>Daucus glochidiatus</i>	+	-	-	Not recorded.	+	25 cm	1 plant.
<i>Desmocladius asper</i>	+	+	15 cm	2 plants.	+	15-20 cm	3 plants.
<i>Dichopogon capillipes</i>	-	+	45 cm	2 plants (height is for inflorescence).	+	12 cm	4 plants.
<i>Dioscorea hastifolia</i>	+	+	0.3-1.2 m	4 plants.	+	0.3-1.2 m	8 plants.
<i>Drosera macrantha</i>	+	-	-	Not recorded.	+	15 cm	2 plants.
* <i>Ehrharta longiflora</i>	5%	5%	15-60 cm	> 400 plants.	≤ 5%	15-60 cm	> 400 plants.
* <i>Erodium botrys</i>	2%	< 2%	5 cm	> 300 plants.	< 1%	5 cm	< 100 plants.
<i>Goodenia berardiana</i>	+	-	-	Not recorded.	+	10-30 cm	Ca 15 plants.
<i>Hibbertia subvaginata</i>	10%	10-12%	0.2-1.5 m	28 plants.	10-12%	50-130 cm	24 plants.
<i>Hyalosperma glutinosum</i> ssp. <i>glutinosum</i>	-	-	-	-	+	12 cm	1 plant.
* <i>Hypochaeris glabra</i>	20%	20%	5 cm	> 800 plants.	≤ 1%	5 cm	Ca. 100 plants.
<i>Kunzea praestans</i>	1%	> 1%	2.4 m	1 plant.	1.5%	3 m	1 plant.
* <i>Lysimachia arvensis</i>	1%	-	-	Not recorded.	+	5-10 cm	3 plants.
* <i>Monoculus monstrosus</i>	+	+	15 cm	< 10 plants.	+	10-50 cm	10-20 plants.
Moss sp.	+	-	-	Not recorded.	+	1 cm	-
<i>Neurachne alopecuroidea</i>	+	+	8 cm	1 plant (height is the leaves).	+	8 cm	1 plant.
* <i>Parentucellia latifolia</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Pentameris airoides</i>	-	-	-	-	+	10-15 cm	> 40 plants

<i>Podolepis lessonii</i>	+	≥ 1%	5-20 cm	> 300 plants.	+	10-20 cm	3 plants.
<i>Regelia megacephala</i>	15%	20%	(0.1)0.9-2.5 m	6 adults (1.5-2.5 m) and 170 seedlings to juveniles (10-90 cm).	20%	(0.1)0.6-3 m	4 large (1.5-3 m), 8 medium (70-150 cm) and 42 small (10-60 cm) plants
* <i>Romulea rosea</i>	1%	1-2%	10-15 cm	> 300 plants.	1%	10-15 cm	Ca. 200 plants.
* <i>Silene gallica</i> var. <i>gallica</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Thysanotus patersonii</i>	1%	1%	0.3-1.2 m	10 plants (in fruit).	+	30-60 cm	5 plants.
<i>Trachymene cyanopetala</i>	< 1%	+	5-10 cm	2 plants.	+	5-10 cm	Ca. 50 plants.
<i>Trachymene ornata</i>	-	-	-	-	+	5-7 cm	Ca. 50 plants.
* <i>Trifolium arvense</i> var. <i>arvense</i>	+	+	13 cm	2 plants.	-	-	Not seen.
* <i>Urospermum picroides</i>	+	-	-	Not recorded.	+	5-15 cm	< 20 plants.
* <i>Ursinia anthemoides</i>	3%	5%	10-15 cm	> 500 plants.	1%	10-35 cm	< 100 plants.
* <i>Vulpia myuros</i>	2-3%	2-3%	7-10 cm	> 600 plants	+	7-10 cm	Ca. 10 plants.
<i>Waitzia nitida</i>	-	+	8 cm	1 plant	-	-	Not seen.



Quadrat R02 in 2006



Quadrat R02 in 2010



Quadrat R02 in 2013



Quadrat R02 in 2016 (from SW corner)



Quadrat R02 in 2019 (from SW corner)



Quadrat R02 in 2019 (from west side)



Quadrat R02 in 2022 (from SW corner)



Quadrat R02 in 2022 (from west side)

Site: R04(22)

Described by: Malcolm Trudgen **Date:** 17/10/2016 **Type:** Quadrat

Location: Main Waste dump. **Geocode:** Zone 50 6623344 S, 407273 E [WGS84, SE peg]

Habitat: Moderate, west-facing mid slope of waste dump.

Soil: Silty, sandy, gravelly, cobbly, rocky waste material

Vegetation: *Allocasuarina huegeliana* low woodland over *Regelia megacephala* open shrubland over *Hibbertia subvaginata* low open shrubland over **Brachypodium distachyon*, **Ehrharta longiflora*, **Trifolium arvense* var. *arvense*, **Hypochaeris glabra*, **Erodium botrys* annual grass/herbland

Notes: Species gained since 2013: *Parentucellia latifolia*; *Aristida contorta*. Species lost since 2013: *Acacia aristulata*; *Acacia lasiocarpa* var. *sedifolia*; *Acacia stenoptera*; *Allocasuarina campestris*; *Alyogyne huegelii* (was overhanging, has receded but still alive); *Lysimachia arvensis*; *Goodenia berardiana*; *Guichenotia micrantha*; *Hedyotis* sp.; *Romulea rosea*; *Stylidium caricifolium*; *Sonchus oleraceus*;

NOTES 2019: Very difficult to estimate covers. Total weed cover 25-35%. Photos from NW corner and West side.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	-	-	-	-	+	15 cm	1 Juvenile.
<i>Allocasuarina campestris</i>	-	-	-	-	< 1%	1.5 m	1 plant.
<i>Allocasuarina huegeliana</i>	≥ 15%	≥ 20%	(0.5)4-7 m	4 adult plants (4-7 m) and 4 juvenile (50 cm) and 1 overhanging on west side of quadrat.	>= 30%	6-8 m	4 adult plants, 1 overhanging on west side of quadrat.
* <i>Arctotheca calendula</i>	-	-	-	-	+	5-15 cm	9 plants.
<i>Aristida contorta</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Austrostipa trichophylla</i>	<1%	+	8-15 cm	11 plants. Height is leaves.	+	8-15 cm	5 plants.
* <i>Avena barbata</i>	3-4%	< 5%	20-60 cm	> 500 plants.	<= 5%	20-90 cm	> 700 plants.
<i>Bossiaea moylei</i>	1%	< 1%	25-30 cm	4 plants.	1%	20-60 cm	3 plants.
* <i>Brachypodium distachyon</i>	15-20%	< 10%	0.10-0.25m	~ 2,000 plants.	< 10%	7-15 cm	> 2,000 plants.
* <i>Briza maxima</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Bromus rubens</i>	-	+	12 cm	> 40 plants.	+	8 cm	Ca. 10 plants.
* <i>Centaurea melitensis</i>	+	2%	6-10 cm	> 100 plants.	< 5%	6-10 cm	> 600 plants.
* <i>Ehrharta longiflora</i>	4%	5%	15-55 cm	> 100 plants.	5%	15-55 cm	> 1,000 plants.
* <i>Erodium botrys</i>	5%	2-3%	5-7 cm	> 200 plants.	2-3%	5-15 cm	> 400 plants.
<i>Goodenia berardiana</i>	-	-	-	-	+	20 cm	6 plants.
<i>Hibbertia subvaginata</i>	5-6%	≤ 5%	40-100 cm	10 plants.	2%	40-90 cm	5 plants.
* <i>Hypochaeris glabra</i>	30%	30%	5-20 cm	> 1,000 plants	<= 40%	5-20 cm	> 3,000 plants.
* <i>Lysimachia arvensis</i>	-	-	-	-	+	-	< 10 plants.
* <i>Monoculus monstrosus</i>	-	-	-	-	+	15-35 cm	-
* <i>Parentucellia latifolia</i>	+	+	10 cm	> 20 plants.	-	-	Not seen.
* <i>Pentameris airoides</i>	1%	2%	5-10 cm	> 400 plants	+	5-10 cm	Ca. 20 plants.
* <i>Petrorhagia dubia</i>	+	-	-	Not recorded	-	-	Not seen.

<i>Ptilotus polystachyus</i>	+	-	-	Not recorded	+	30 cm	1 plant.
<i>Regelia megacephala</i>	2-3%	< 1%	90 cm	2 young plants in west of quadrat.	< 1%	30-160 cm	1 young plant and 1 overhanging.
* <i>Silene gallica</i> var. <i>gallica</i>	< 1%	+	8-10 cm	< 100 plants	</= 1%	8-10 cm	> 150 plants.
<i>Trachymene cyanopetala</i>	+	-	-	Not recorded	-	-	Not seen.
* <i>Trifolium arvense</i> var. <i>arvense</i>	15%	2%	5-10 cm	> 100 plants.	2%	5-10 cm	> 200 plants.
* <i>Trifolium repens</i> var. <i>repens</i>	1%	+	10 cm	> 20 plants.	< 4%	10 cm	> 200 plants.
* <i>Urospermum picroides</i>	< 1%	< 1%	6-10 cm	> 50 plants.	1-2%	6-20 cm	> 150 plants.
* <i>Ursinia anthemoides</i>	1-2%	1%	8-12 cm	> 250 plants.	>/= 5%	8-12 cm	Ca. 1,000 plants
* <i>Vulpia myuros</i>	1%	≤ 10%	15 cm	> 2,000 plants	< 10%	15 cm	> 2,000 plants.



Quadrat R04/22 in 2006 (year established)



Quadrat R04/22 in 2010



Quadrat R04/22 in 2013



Quadrat R04/22 in 2016



Quadrat R04/22 in 2019 (from NW corner)



Quadrat R04/22 in 2019 (from west side)



Quadrat R04/22 in 2022 (from NW corner)



Quadrat R04/22 in 2019 (from west side)

Site: R05(27)

Described by: Malcolm Trudgen **Date:** 18/10/2019 **Type:** Quadrat

Location: South Eastern Waste dump. **Geocode:** Zone 50 6623088 S, 407806 E [WGS84]

Habitat: Moderate, east-facing slope of waste dump

Soil: silty, pebbly, cobbly, rocky waste dump material

Rock Type: Chert Mine waste

Vegetation: *Allocasuarina huegeliana*, *Regelia megacephala* high shrubland; over *Allocasuarina campestris*, *Acacia congesta* subsp. *congesta*, *Acacia lasiocarpa* var. *sedifolia* *Hibbertia subvaginata* (*Kunzea praestans*) open heath; over **Avena barbata*, **Briza maxima* **Hypochaeris glabra*, **Vulpia myuros* very open herbland.

Notes: Species lost since 2013: *Acacia aristulata*; *Rytidosperma acerosum*; *Gilberta tenuifolia*; *Regelia megacephala*; *Silene gallica* var. *gallica*; *Trifolium arvense*; *Wahlenbergia preissii*. Species gained since 2013: *Arctotheca calendula*; *Podolepis lessonii*; *Blennospora drummondii*; *Monoculus monstrosus*.

Notes 2019: General observations from data: 2019 records for weeds tend to be shorter, but more individuals. Where weeds are low, native plants can invade, but then as weeds increase, are lost again.

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	≤ 20%	8%	90cm	4 plants (1 in poor condition).	12%	0.5-2 m	2 live & 1 dead plants
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	1-2%	1-2%	50-110 cm	3 plants.	1-2%	(0.05)0.4-1.3 m	2 adult and two seedlings.
<i>Allocasuarina campestris</i>	≤ 20%	15%	(0.5)1.5-2.2 m	8 plants (1 stunted, in poor condition).	≤ 20%	2-2.5 m	6 plants.
<i>Allocasuarina huegeliana</i>	≤ 10%	15%	4.5-5 m	3 plants.	≤ 25%	6-7 m	3 plants.
* <i>Arctotheca calendula</i>	+	+	5 cm	> 20 plants.	+	5-10 cm	< 50 plants.
<i>Austrostipa elegantissima</i>	-	≤ 1%	1 m	1 plant.	≤ 1%	90 cm	2 plants.
<i>Austrostipa trichophylla</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Avena barbata</i>	+	+	10-30 cm	Ca. 50 plants	< 1%	10-70 cm	Ca. 100 plants.
<i>Blennospora drummondii</i>	+	+	2-3 cm	Ca. 10 plants.	+	2-3 cm	> 50 plants.
* <i>Briza maxima</i>	+	< 1%	5-15 cm	Ca 200 plants	< 1%	5-10 cm	< 50 plants.
* <i>Bromus rubens</i>	+	+	8-15 cm	5 plants.	+	15 cm	1 plant.
<i>Brunonia australis</i>	-	-	-	-	+	15 cm	3 plants.
<i>Calytrix</i> aff. <i>leschenaultii</i> (Moora)	-	+	10 cm	1 plant.	-	-	Not seen.
<i>Comesperma integerrimum</i>	-	+	70 cm	1 plant.	+	50 cm	1 plant.
* <i>Ehrharta longiflora</i>	1-2%	1-2%	10-25 cm	> 100 plants.	< 3%	10-25 cm	> 400 plants.
<i>Gilberta tenuifolia</i>	-	-	-	-	+	8-12 cm	> 40 plants.
<i>Hibbertia subvaginata</i>	8-10%	10%	60-140 cm	46 plants, some senescent.	15%	60-140 cm	14 plants.
* <i>Hypochaeris glabra</i>	< 5-10%	< 5%	5 cm	> 500 plants.	≤ 10%	5 cm	> 1,000 plants.
<i>Kunzea praestans</i>	< 1%	≤ 1%	1.8 m	1 plant.	1-25	2.3 m	1 plant.
<i>Lawrencella rosea</i>	-	+	20 cm	2 plants.	+	20 cm	1 plant.
* <i>Lysimachia arvensis</i>	+	-	-	Not recorded.	+	6 cm	1 plant.
<i>Microtis</i> sp.	-	-	-	-	+	15 cm	1 plant.
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Monoculus monstrosus</i>	+	+	20 cm	2 plants.	+	10-35 cm	> 20 plants.
Moss	-	-	-	-	2-3%	1 cm	Patches.
<i>Parentucellia latifolia</i>	-	-	-	-	+	5 cm	< 20 plants.
* <i>Pentameris airoides</i>	> 1%	> 1%	5-10 cm	> 500 plants.	+	5-10 cm	< 30 plants.
<i>Podolepis lessonii</i>	< 1%	1-2%	8-15 cm	> 300 plants.	+	10-15	5 plants.

						cm	
<i>Podotheca gnaphalioides</i>	-	-	-	-	+	8 cm	1 plant.
<i>Pterostylis exserta?</i>	-	+	7 cm	1 plant.	-	-	Not seen.
* <i>Romulea rosea</i>	+	+	8-15 cm	? [not recorded].	+	8-15 plants.	-
<i>Stipa elegantissima</i>	-	-	-	-	</= 1%	90 cm	2 plants.
<i>Stylidium caricifolium</i>	-	-	-	-	+	35 cm	1 plant.
<i>Trachymene cyanopetala</i>	-	+	3-5 cm	> 100 plants.	+	5 cm	11 plants.
<i>Trachymene ornata</i>	+	+	7 cm	24 plants.	+	6 cm	13 plants.
<i>Trachymene pilosa</i>	-	-	-	-	+	4-12 plants	> 30 plants.
* <i>Trifolium hirtum</i>	-	+	2-5 cm	30-40 plants.	+	2-5 cm	20-15 plants.
* <i>Urospermum picroides</i>	+	+	5-12 cm	> 40 plants.	-	-	Not recorded.
* <i>Ursinia anthemoides</i>	1%	> 2%	7-15 cm	> 400 plants.	1%	7-15 cm	</= 200 plants.
* <i>Vulpia myuros</i>	2%	> 3%	7-10 cm	> 1,000 plants.	2%	7-10 cm	> 500 plants.
<i>Wahlenbergia gracilentia</i>	-	-	-	-	+	12 cm	1 plant.
<i>Waitzia nitida</i>	-	+	6-12 cm	Ca. 35 plants.	+	12 cm	1 plant.



Quadrat R05(27) in 2006 (year established)



Quadrat R05(27) in 2010 (from SW corner)



Quadrat R05(27) in 2013



Quadrat R05(27) in 2019 (from NE corner)



Quadrat R05(27) in 2019 (from near SE corner)



Quadrat R05(27) in 2019 (from south side)



Quadrat R05(27) in 2022 (from SE corner)



Quadrat R05(27) in 2022 (from east side)

Site: Area 33

Described by: Malcolm Trudgen **Date:** 18/10/2019 **Type:** Quadrat

Location: South-east waste dump. **Geocode:** Zone 50 6622882 S, 407822 E [WGS84]

Habitat: Southerly facing moderate to steep slope.

Soil: Mixed chert gravel to boulders, some fines.

Vegetation: *Allocasuarina huegeliana* low open woodland over *Regelia megacephala* high open shrubland over *Acacia congesta* subsp. *congesta* (*Allocasuarina campestris*) open heath over *Hibbertia subvaginata* (*Acacia lasiocarpa* var. *sedifolia*) low shrubland over **Aira caryophyllea*, **Vulpia myuros*, **Hypochaeris glabra* open annual grassland/herbland

Notes: Species gained since 2013: *Lysimachia arvensis*; *Austrostipa elegantissima*; *Brachypodium distachyon*; moss sp.; *Trachymene pilosa*; *Podolepis lessonii*; *Drosera* sp.; *Blennospora drummondii*;

Acacia restiacea. Species lost since 2013: *Lepidosperma* sp.; *Sollya heterophylla*;

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia acuminata</i>	+	+	2.2 m	1 plant.	< 1%	3.4 m	1 plant.
<i>Acacia congesta</i> subsp. <i>congesta</i>	50%	20%	1.4-1.8 m	6 older plants (2 senescent) and 1 seedling (3 cm).	20%	5 cm & 1.3-1.6 m	Three plants, 1 a seedling.
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	3%	> 2%	1.4 m	3 plants.	< 1%	6 cm & 1.2 m	2 plants, 1 a seedling.
* <i>Aira caryophylla</i>	≥ 10%	< 5%	5-8 cm	> 1,000 plants.	< 2%	5-8 cm	< 500 plants.
<i>Allocasuarina campestris</i>	4%	7%	1.1-2 m	5 [6] plants.	≥ 10%	1-1.2 m	6 plants.
<i>Allocasuarina huegeliana</i>	9%	10-12%	(1.3)5-6 m	6 plants, 1 a juvenile 1.3 m tall.	15%	(1.7)5-6 m	6 plants.
* <i>Arctotheca calendula</i>	-	-	-	-	+	10 cm	1 plant.
<i>Austrostipa elegantissima</i>	+	2-3%	1-1.2 m	4 plants, height is for the panicles.	5-10%	8? plants	1 m
<i>Austrostipa trichophylla</i>	+	+	10 cm	2 plants.	+	10 cm	1 plant.
* <i>Avena barbata</i>	-	-	-	-	+	20-95 cm	Ca. 50 plants.
<i>Blennospora drummondii</i>	+	+	2-3 cm	> 200 plants.	+	2-3 cm	> 100 plants.
* <i>Brachypodium distachyon</i>	+	1%	8-12 cm	> 50 plants	< 1%	15-35 cm	50-100 plants.
* <i>Briza maxima</i>	-	+	8-15 cm	> 100 plants.	+	8-15 cm	> 100 plants.
<i>Calytrix</i> aff. <i>leschenaultii</i> (Moora)	+	+	40 cm	2 plants.	+	50-110 cm	3 plants
<i>Comesperma integerrimum</i>	-	-	-	-	+	1 m	+
<i>Crassula colorata</i> var. <i>colorata</i>	-	-	-	-	+	2-5 cm	< 10 plants.
<i>Daucus glochidiatus</i>	-	-	-	-	+	12 cm	1 plant.
<i>Dichopogon capillipes</i>	-	-	-	-	+	15 cm	1 plant.
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	1.5%	1.5%	80 cm	1 plant. Erroneously referred to <i>Acacia restiacea</i> in earlier reports.	-	-	Not seen.
<i>Drosera</i> sp.	+	-	-	Not recorded.	-	-	Not seen.
* <i>Ehrharta longiflora</i>	1-2%	< 1%	10-20 cm	> 100 plants?	1-2%	12-45 cm	> 200 plants.
* <i>Erodium botrys</i>	-	-	-	-	+	1 cm	1 plant.
<i>Hibbertia subvaginata</i>	15-20%	≤ 20%	0.3-1.4 m	41 plants.	< 20%	(7)30-150 cm	39 plants & 4 seedlings
<i>Homalosciadium homalocarpum</i>	-	-	-	-	+	4 cm	4 plants.

* <i>Hypochaeris glabra</i>	-	2%	3 cm	> 500 plants, height is for the leaves.	5%	3 cm	> 1,000 plants.
* <i>Lysimachia arvensis</i>	+	-	-	Not recorded.	+	4-7 cm	7 plants.
<i>Microtis</i> sp.	-	-	-	-	+	25 cm	10 stems.
Moss sp.	4%	4%	2 cm	-	4%	2 cm	Patches.
<i>Phyllangium sulcatum</i>	-	-	-	-	+	5 cm	1 plant.
<i>Podolepis lessonii</i>	+	+	8-15 cm	> 20 plants.	+	8-12 cm	16 plants
<i>Podotheca angustifolia</i>	-	-	-	-	+		10 plants.
<i>Regelia megacephala</i>	6-7%	5%	2-3.7 m	5 adult plants.	55	2-3.7 m	3 adult plants.
* <i>Romulea rosea</i>	-	+	15 cm	> 50 plants.	< 1%	15 cm	> 100 plants.
<i>Thysanotus patersonii</i>	2%	5%	0.5-1.2 m	> 20 plants? [Not countable.]	5%	0.5-1.2 m	> 20 plants? [Not countable.]
<i>Trachymene cyanopetala</i>	+	+	2-8 cm	> 40 plants.	+	4-20 cm	> 50 plants.
<i>Trachymene ornata</i>	-	+	4 cm	< 30 plants.	-	-	Not seen.
<i>Trachymene pilosa</i>	+	+	2 cm	< 20 plants.	+	5-10 cm	< 20 plants.
* <i>Urospermum picroides</i>	-	-	-	-	+	10 cm	3 plants.
* <i>Ursinia anthemoides</i>	< 1%	< 1%	10-20 cm	> 100 plants	1-2%	10-30 cm	> 400 plants.
* <i>Vulpia myuros</i>	2%	2%	10-15 cm	> 500 plants	< 1%	10-15 cm	< 150 plants.
<i>Wahlenbergia gracilentia</i>	-	-	-	-	+	10-15 cm	> 50 plants.



Quadrat Area 33 in 2013



Quadrat Area 33 in 2016



Quadrat Area 33 in 2019 (from NW corner)



Quadrat Area 33 in 2019 (from south side)



Quadrat Area 33 in 2022 (from NW corner)



Quadrat Area 33 in 2022 (from south side)

Site: Area 41

Described by: Malcolm Trudgen **Date:** 18/10/2019 **Type:** Quadrat

Location: South-east waste dump. **Geocode:** Zone 50 6622903 S, 407834 E [WGS84]

Habitat: Moderate to steep southerly facing slope.

Soil: Mixed chert (quartz) silt to boulders

Rock Type: Mixed chert (quartz) silt to boulders, mine waste.

Vegetation: *Allocasuarina huegeliana* low woodland over *Acacia congesta* low scattered shrubs over *Hibbertia subvaginata* scattered low shrubs *Kennedia prostrata* scattered creepers over **Conyza bonariensis*, **Senecio diaschides*, **Pentameris airoides* low open annual grassland/herbland

Notes: Species lost since 2013: *Ptilotus polystachyus* var. *polystachyus*; *Salsola tragus* subsp. *tragus*; *Sonchus oleraceus*. Species gained since 2013: *Bromus rubens*; *Silene gallica* var. *gallica*; *Wahlenbergia capensis*; *Allocasuarina campestris*; *Acacia congesta* subsp. *congesta*; *Microtis* sp.; *Wahlenbergia preissii*; *Millotia tenuifolia* var. *tenuifolia*; *Petrorhagia dubia*.

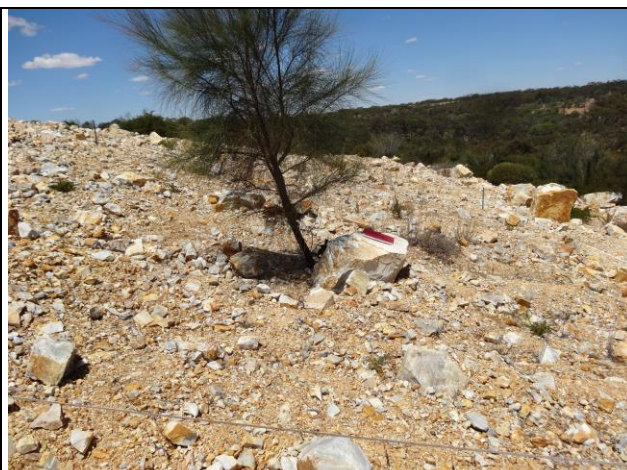
Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	1%	≥ 10%	-	1 large plant (spreading, height ca. 1.3 m?) and 1 juvenile (15 cm).	15-20%	(3)50-150 cm	8 shrubs (4 stressed) & 1 seedling.
<i>Allocasuarina</i>	+	+	45 cm	1 plant, juvenile	1%	1.3 m	1 plant.

campestris				~ 0.25%.			
Allocasuarina huegeliana	12% ?	4%	4 m	1 plant.	1%	-	1 overhanging and 1 dead.
Arctotheca calendula	-	+	7 cm	1 plant.	+	5-10 cm	10 plants.
Austrostipa elegantissima	-	+	15 cm	1 juvenile plant (on S side of quadrat).	-	-	Not seen.
Austrostipa trichophylla	+	-	-	Not recorded.	-	-	Not seen.
*Avena barbata	+	+	10-35 cm	20 plants.	< 1%	10-35 cm	Ca. 100 plants.
*Briza maxima	+	1%	10-20 cm	200-300 plants.	< 1%	15-55 cm	150-200 plants.
*Bromus rubens	+	-	-	Not recorded.	-	-	Not seen.
Brunonia australis	-	-	-	-	+	12 cm	2 plants.
Cheilanthes adiantoides	-	+	5 cm	1 plant.	+	5 cm	4 plants.
Cheilanthes austrotenuifolia	-	-	-	-	+	5 cm	4 plants.
*Conyza bonariensis	< 1%	+	10-20 cm	< 20 plants.	-	-	Not seen.
Dryandra sessilis	-	-	-	-	+	5 cm	1 seedling.
Gilberta tenuifolia	-	-	-	-	+	5-9 cm	12 plants.
Hibbertia subvaginata	1%	3%	20-50 cm	17 plants (including 2 seedlings).	</= 5%	20-130 cm	11 plants (4 were seedlings).
*Hypochaeris glabra	+	≤ 1%	2-3 cm	Mostly dead and very small.	< 5%	2-3 cm	> 1,000 plants.
Kennedia prostrata	+	≤ 1%	10 cm	5 plants, including 2 seedlings.	4%	10-20 cm	2 large (to 3 m across) & 11 small plants.
Microtis sp.	+	+	15 cm	3 plants (near SE corner).	+	15 cm	2 plants.
Millotia tenuifolia var. tenuifolia	+	-	-	Not recorded.	-	-	Not seen.
Monoculus monstrosus	-	+	10-15 cm	< 10 plants.	-	-	Not seen.
*Pentameris airoides	3%	2-3%	5-12 cm	> 1,000-2,000 plants.	< 1%	10-15 cm	< 300 plants.
*Petrohragia dubia	+	+	10-30 cm	> 50 plants	-	-	Not seen.
Podolepis lessonii	-	+	6-12 cm	4 plants.	+	12 cm	1 plant.
Rhodanthe laevis	-	+	6 cm	1 plant.	+	9 cm	1 plant.
Senecio diaschides	≥ 2%	+	10-20 cm	2 plants.	-	-	Not seen.
*Silene gallica var. gallica	+	-	-	Not recorded.	-	-	Not seen.
*Sonchus oleraceus	-	-	-	-	+	15 cm	1 plant.
Thysanotus manglesii	-	-	-	-	+	60 cm	4 plants
*Ursinia anthemoides	1-2%	< 5%	10-20	> 500-1,000	<	10-40	> 2,000 plants.

			cm	plants.	10%	cm	
* <i>Vulpia myuros</i>	1-2%	2%	8-15 cm	> 300-400 plants.	+	10-25 cm	< 150 plants
<i>Wahlenbergia capensis</i>	+	+	5 cm	1 plant.	-	-	Not seen.
<i>Wahlenbergia preissii</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Waitzia nitida</i>	-	+	5-10 cm	6 plants.	-	-	Not seen.



Quadrat Area 41 in 2013



Quadrat Area 41 in 2016



Quadrat Area 41 in 2019 (from SE corner)



Quadrat Area 41 in 2019 (from east side)



Quadrat Area 41 in 2022 (from SE corner)



Quadrat Area 41 in 2022 (from east side)

Site: Area 37**Described by:** Malcolm Trudgen **Date:** 18/10/2019. **Type:** Quadrat**Location:** South-west waste dump. **Geocode:** Zone 50 6623082 S, 407315 E [WGS84]**Habitat:** South facing moderate to steep slope.**Soil:** Mixed chert gravel to boulders, some fines.**Rock Type:** Mixed chert gravel to boulders, mine waste.**Vegetation:** Allocasuarina huegeliana low open woodland over Regelia megacephala (Grevillea biternata)shrubland over Hibbertia subvaginata low shrubland over Pentameris airoides, Briza maxima, Vulpia myuros, Ursinia anthemoides, Hypochaeris glabra open annual grassland/herbland**Notes:** Species gained since 2010: Blennospora drummondii; Desmocladus asper; Acacia congesta subsp. congesta; Trifolium arvense var. arvense; Monoculus monstrosus; Dichopogon capillipes; Trachymene pilosa; Gilberta tenuifolia; Erodium botrys. Species lost since 2010: Arctotheca calendula; Avena barbata; Cynodon dactylon; Goodenia berardiana; Polypogon monspeliensis; Ptilotus polystachyus var. polystachyus; Solanum nigrum; Urospermum picroides; Waitzia nitida; Genus sp. (? Senecio diaschides).

Species list	Cover 2016	Cover 2019	Height 2019	Notes 2019	Cover 2022	Height 2022	Notes 2022
Acacia congesta subsp. congesta	+	-	-	Not recorded.	-	-	Not seen.
Acacia lasiocarpa var. sedifolia	≥ 1	-	-	Not recorded.	-	-	Not seen.
Allocasuarina campestris	-	+	90 cm	1 plant & 1 just out of east side.	+	70 cm	1 plant & 1 just out of east side.
Allocasuarina huegeliana	8-10%	≥ 10%	(0.25)1.2-6.5 m	16 plants including 3 juveniles (15-30 cm, on east side of quadrat).	15%	(1.9)3-7 m	14 plants, 5 smaller than others.
Austrostipa trichophylla	-	+	5-8 cm	2 plants.	-	-	Not seen.
Blennospora drummondii	-	+	2-3 cm	≥ 10 plants.	+	(1) 2-3 cm	> 100 plants.
Bossiaea moylei	1-2%	< 1%	20 cm	2 plants.	+	20 cm	1 plant.
*Brachypodium distachyon	+	+	7-10 cm	> 80 plants.	1-2%	7-25 cm	> 150 plants.
*Briza maxima	> 5%	1-2%	10-20 cm	> 400 plants.	1%	10-40 cm	100-200 plants.
Caladenia flava.	-	+	7 cm	1 plant.	-	-	Not seen.
Calytrix aff. leschenaultii (Moora)	+	< 1%	0.3-1m	1 adult plant and 2 young plants 15 cm tall.	< 1%	50-85 cm	3 plants (fruiting).
Cheilanthes adiantoides	-	+	7 cm	1plant.	-	-	Not seen. (Misdet?)
Cheilanthes austrotenuifolia	-	-	-	-	+	10 cm	6 plants.
Desmocladus asper	+	+	15 cm	2 plants.	+	20 cm	2 plants.
Dichopogon capillipes	+	+	7 cm	1 plant, height is for the leaves.	+	7 cm	6 plants.
*Ehrharta longiflora	2%	< 1%	10-15 cm	< 100 plants.	< 1%	10-75 cm	< 50 plants.

* <i>Erodium botrys</i>	< 1%	-	-	Not recorded.	-	-	Not seen.
<i>Gilberta tenuifolia</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Goodenia berardiana</i>	-	-	-	-	+	7 cm	1 plant.
<i>Grevillea biternata</i>	4%	-	-	Not recorded.	-	-	Not seen.
<i>Hibbertia subvaginata</i>	25% %	≤ 40%	0.2-1.4 m	128 plants.	</= 40%	40-160 cm	115 plants.
* <i>Hypochaeris glabra</i>	≥ 2%	< 1%	3-4 cm	< 100 plants.	-	-	Not seen (missed?).
<i>Lasiopetalum</i> sp.	+	-	-	Not recorded.	-	-	Not seen.
* <i>Lysimachia arvensis</i>	+	-	-	Not recorded.	+	5 cm	11 plants.
* <i>Monoculus monstrosus</i>	+	+	7-15 cm	≥ 10 plants.	+	7-15 cm	> 10 plants.
* <i>Pentameris airoides</i>	7%	< 1%	4-6 cm	< 100 plants.	2-3%	5-10 cm	> 200 plants.
<i>Podotheca angustifolia</i>	+	-	-	Not recorded.	+	10 cm	1 plant.
<i>Pterostylis</i> sp.	-	-	-	-	+	6 cm	1 plant.
<i>Regelia megacephala</i>	25%	≤ 20%	0.1-1.8 m	8 Adult & 4 seedlings to juvenile (0.1-1.1 m).	</= 10%	2.2-6 m	5 adult plants.
* <i>Romulea rosea</i>	+	+	20 cm	> 150 plants.	1%	10-20 cm	200-300 plants.
<i>Rytidosperma acerosum</i>	+	+	10 cm	2 plants.	+	8 cm	1 plant.
* <i>Sonchus oleraceus</i>	-	-	-	-	+	7 cm	1 plant.
<i>Stylidium caricifolium</i>	+	+	8 cm	4 plants (in flower).	-	-	Not seen.
<i>Stylidium septentrionale</i>	-	-	-	-	+	8 cm	2 plants.
<i>Thysanotus manglesii</i>	-	-	-	-	+	1 m	1 plant.
<i>Trachymene cyanopetala</i>	+	+	2-5 cm	≤ 100 plants.	+	2-5 cm	Ca. 100 plants
<i>Trachymene ornata</i>	+	+	2-4 cm	≤ 50 plants.	+	2-4(10) cm	Ca. 25 plants.
<i>Trachymene pilosa</i>	+	-	-	Not recorded.	-	-	Not seen.
* <i>Trifolium arvense</i> var. <i>arvense</i>	+	+	4 cm	2 plants.	-	-	Not seen.
* <i>Trifolium hirtum</i>	-	+	10 cm	1 plant.	-	-	Not seen.
* <i>Ursinia anthemoides</i>	3%	1-2%	7-15 cm	> 300 plants.	< 2%	7-35 cm	> 300 plants.
* <i>Urospermum picroides</i>	-	-	-	-	+	10 cm	2 plants.
* <i>Vulpia myuros</i>	4%	+	10-25 cm	> 100 plants.	+	10-25 cm	> 100 plants.
<i>Wahlenbergia gracilentata</i>	+	-	-	Not recorded.	-	-	Not seen.
<i>Wahlenbergia preissii</i>	-	+	12 cm	3 plants.	+	15 cm	4 plants



Quadrat Area 37 in 2016 (From NW corner)



Quadrat Area 37 in 2019 (From NW corner)



Quadrat Area 37 in 2019 (From SW corner)



Quadrat Area 37 in 2022 (From SW corner)



Quadrat Area 37 in 2022 (From West side)



Quadrat Area 37 in 2022 (From NW corner)

Site: NEW01

Described by: Malcolm Trudgen **Date:** 13/10/2022. **Type:** Quadrat (10 x 10 m).

Location: New North Waste Dump. **Geocodes** [WGS84]: Zone 50: NW corner 407245E 6624146 S; NE corner 407255 E 6624147; SE corner 407257 E 6624136 S; SW corner 407257 E 6624136 S.

Habitat: West facing lower (to mid) slope of a large mine waste dump.

Soil: Pale brown, hard setting, silty to gravelly soil between rocks and boulders of chert.

Rock Type: Mixed chert gravel to boulders, mine waste.

Vegetation: *Allocasuarina huegeliana*, *Regelia megacephala* high open shrubland over *Acacia congesta* subsp. *congesta* (*Allocasuarina campestris*) shrubland over *Hibbertia subvaginata*

scattered low shrubs with **Lupinus cosentinii* annual herbland over **Ehrharta longiflora*, **Avena barbata* (**Brachypodium distachyon*) annual grassland over **Hypochaeris glabra* (**Erodium botrys*) low annual herbland

Notes: The quadrat site was selected to have the main perennial species in the rehabilitation present. Much of the surrounding area had fewer *Acacia* and *Allocasuarina* plants. Some adjoining areas (especially on the lowest slopes) had very high cover of **Lupinus cosentinii* (Lupin) which is overwhelming other species.

Species list	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	15-18%	1.5-1.7 m	5 plants (3 in corners of quadrat).
<i>Acacia aristulata</i>	< 1%	40 cm	2 plants
<i>Allocasuarina campestris</i>	3%	(.5)1.6-1.8 m	5 plants, 1 on north edge.
<i>Allocasuarina huegeliana</i>	3%	4 m	1 plant
<i>*Arctotheca calendula</i>	1-2%	10-30 cm	> 100 plants.
<i>Aristida contorta</i>	+	30 cm	10-15 plants.
<i>Austrostipa variabilis</i>	2%	20-35 cm	> 55 plants
<i>*Avena barbata</i>	+15%	60-110 cm	> 2,500 plants.
<i>*Brachypodium distachyon</i>	< 5%	20-50 cm	-
<i>Crassula colorata</i> var. <i>colorata</i>	+	5-7 cm	< 10 plants.
<i>*Ehrharta longiflora</i>	20-25%	60-120 cm	> 3,000 plants.
<i>*Erodium botrys</i>	3%	50 cm	> 300 plants.
<i>Hibbertia subvaginata</i>	1-2%	40-70 cm	5 plants.
<i>*Hypochaeris glabra</i>	15-20%	2-7 cm (leaves)	> 2,500 Inflorescences to 50 cm.
<i>*Lolium rigidum</i>	+	45 cm-	1 plant.
<i>*Lupinus cosentinii</i>	< /= 25%	(30)50-140 cm	700-900 plants.
<i>Maireana brevifolia</i>	1%	60 cm	1 plant.
<i>*Monoculus monstrosus</i>	1-2%	(20)50-90 cm	50-100 plants.
<i>*Orobanche minor</i>	+%	10-20 cm	2 stems.
<i>Ptilotus polystachyus</i>	1%	(10)30-90 cm	< 40 plants.
<i>*Raphanus raphanistrum</i>	1%	70-135 cm	8 plants.
<i>Regelia megacephala</i>	4-5%	(1)1.5-2.5 m	6 plants.
<i>*Sonchus oleraceus</i>	+	10-40 cm	6 plants.
<i>*Trifolium arvense</i> var. <i>arvense</i>	+	15 cm	< 10 plants.
<i>*Trifolium hirtum</i>	+	15 cm	12 plants.
<i>*Ursinia anthemoides</i>	< 1%	15-30 cm	> 100 plants?
<i>*Vulpia myuros</i>	< 1%	40 cm	> 100 plants?



Site: NEW02

Described by: Malcolm Trudgen **Date:** 13/10/2022. **Type:** Quadrat (10 x 10 m).

Location: New North Waste Dump. **Geocodes** [WGS84]: Zone 50: NW corner 407303E 6624152 S; NE corner 407312 E 6624149; SE corner 407306 E 6624138 S; SW corner 407296 E 6624145 S.

Habitat: South-west facing, mid to upper slope of a large mine waste dump.

Soil: Mine waste, mostly gravelly (chert) with very pale fines and a few boulders..

Rock Type: Chert, gravel to boulders.

Vegetation: *Allocasuarina huegeliana* high open shrubland over *Acacia congesta* subsp. *congesta* shrubland over *Hibbertia subvaginata* scattered low shrubs annual grassland over **Hypochaeris glabra* (**Ursinia anthemoides*) low annual herbland

Notes: The quadrat site was selected to have the main perennial species in the rehabilitation present.

**Raphanus raphanistrum* and **Avena barbata* were present just outside the quadrat, while *Acacia stenoptera* and **Lupinus cosentinii* were nearby.

Species list	Cover 2022	Height 2022	Notes 2022
<i>Acacia congesta</i> subsp. <i>congesta</i>	15%	50-160 cm m	5 plants.
<i>Acacia acuminata</i>	< 1%	(0.6)2.3-3 m	3 plants.
<i>Acacia aristulata</i>	> 1%	35 cm	1 plant, 1.2 m across.
<i>Allocasuarina huegeliana</i>	4%	(0.6)4 m	3 plants; 2 x 4 m & 1 x 0.6 m.
* <i>Arctotheca calendula</i>	+	5-12 cm	5 plants.
<i>Aristida contorta</i>	+	15-20 cm	7 plants.
<i>Austrostipa variabilis</i>	< 1%	10-15 cm	34 plants
* <i>Bromus rubens</i>	+	20 cm	1 plant.
<i>Crassula colorata</i> var. <i>colorata</i>	+	5 cm	1 plant.
<i>Crassula decumbens</i> var. <i>decumbens</i>	+	5 cm	2 plants
* <i>Conyza bonariensis</i>	+	30 cm	4 plants.
<i>Eucalyptus</i> sp.	< 1%	2 m	1 plant.
<i>Hibbertia subvaginata</i>	< 1%	60 cm	2 plants.
* <i>Hypochaeris glabra</i>	< 10%	1 cm (leaves)	1,000- 2,000 plants.
* <i>Monoculus monstrosus</i>	1%	15-35 cm	> 40 plants.
* <i>Pentameris airoides</i> ssp. <i>airoides</i>	2%	10-20 cm	2 stems.
* <i>Petrorhagia velutina</i>	< 1%	7-12 cm	> 800 plants.
<i>Ptilotus polystachyus</i>	+	25 cm	2 plants.
* <i>Silene gallica</i> var. <i>gallica</i>	+	20 cm	4 plants.
* <i>Silene</i> sp.	< 1%	10-25 cm	> 30 plants
* <i>Trifolium arvense</i> var. <i>arvense</i>	< /= 2%	5-12 cm	150-200 plants.
* <i>Trifolium hirtum</i>	+	5 cm	2 plants.
* <i>Ursinia anthemoides</i>	< 5%	10-20(50) cm	800-1,000 plants, dead at survey.
* <i>Vulpia myuros</i>	2%	10-30 cm	> 500 plants



Quadrat NEW 02 (From SE corner)



Quadrat NEW 02 (From east side)

Appendix 2: Vegetation structural table of Specht with modifications by Aplin and Trudgen

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

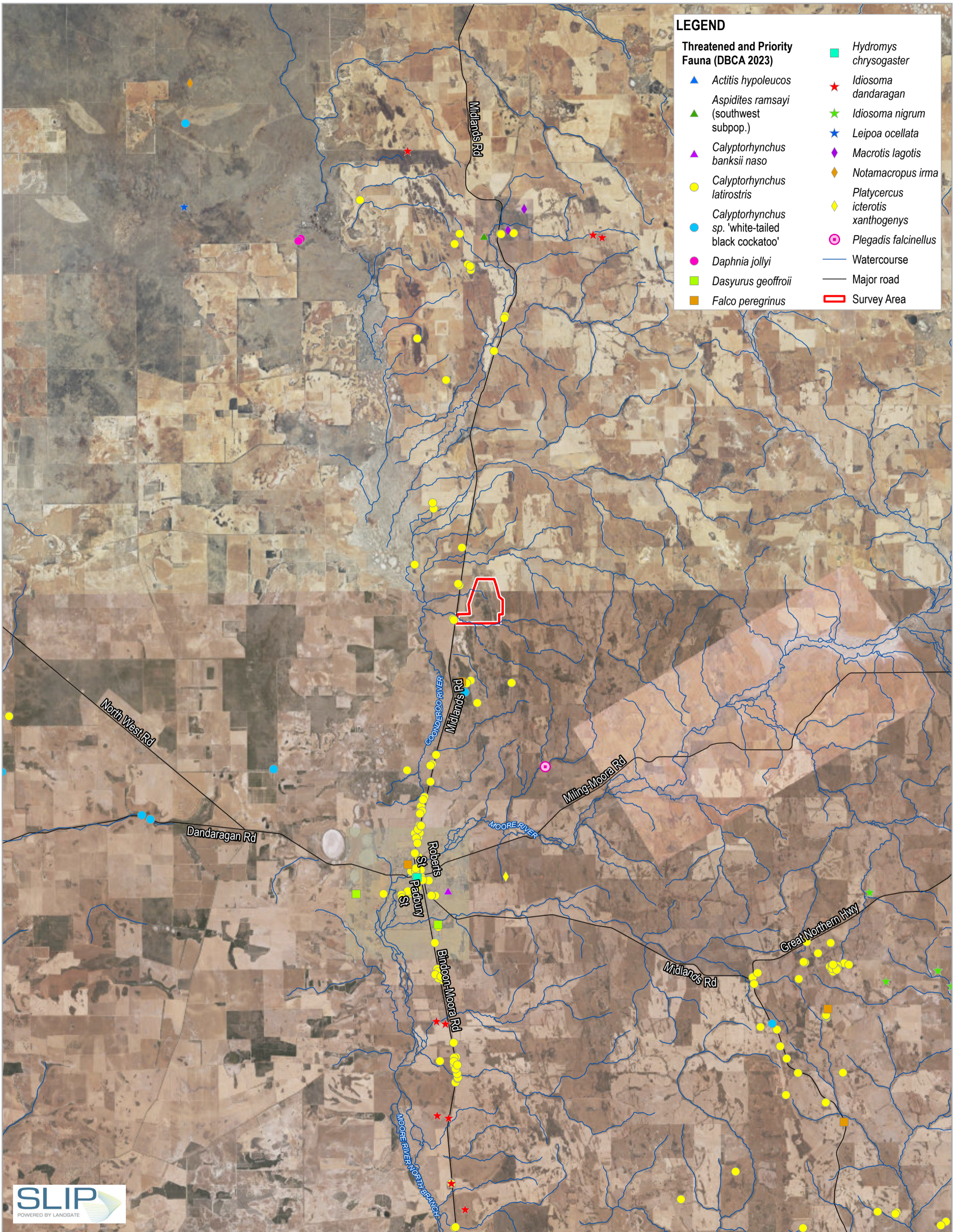
Grasslands then divided into:

Tussock grasslands (perennial tussock species, e.g. *Eragrostis* species);

Hummock grasslands (*Triodia* and *Plectrachne* species that form hummocks)

Curly spinifex grassland (*Plectrachne pungens*, which does not form hummocks) (follows J.S. Beard).

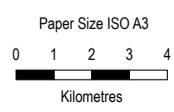
Annual tussock grassland (e.g. annual *Sorghum* species).



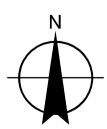
LEGEND

Threatened and Priority Fauna (DBCA 2023)

- | | |
|--|----------------------------------|
| ▲ <i>Actitis hypoleucos</i> | ■ <i>Hydromys chrysogaster</i> |
| ▲ <i>Aspidites ramsayi</i> (southwest subpop.) | ★ <i>Idiosoma dandaragan</i> |
| ▲ <i>Calyptorhynchus banksii naso</i> | ★ <i>Idiosoma nigrum</i> |
| ● <i>Calyptorhynchus latirostris</i> | ★ <i>Leipoa ocellata</i> |
| ● <i>Calyptorhynchus</i> sp. 'white-tailed black cockatoo' | ◆ <i>Macrotis lagotis</i> |
| ● <i>Daphnia jollyi</i> | ◆ <i>Notamacropus irma</i> |
| ■ <i>Dasyurus geoffroii</i> | ◆ <i>Platycercus icterotis</i> |
| ■ <i>Falco peregrinus</i> | ◆ <i>Platycercus xanthogenys</i> |
| | ○ <i>Plegadis falcinellus</i> |
| | — Watercourse |
| | — Major road |
| | ▭ Survey Area |



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Simcoa Operations Pty. Ltd.
Simcoa - Nth Kiaka Level 2 Fauna Study

Biological Constraints

Project No. 12518217
Revision No. 0
Date 13 Mar 2023

FIGURE 2



North Kiaka Proposed Mine Expansion

Fauna Assessment Report

Simcoa Operations Pty Ltd

23 June 2021

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Executive summary

Simcoa Operations Pty Ltd (Simcoa) is proposing to expand operations for a new quartzite mine located approximately 15 km north of Moora in the Wheatbelt of Western Australia (WA). Simcoa engaged GHD Pty Ltd (GHD) to undertake several studies to support the approvals process for the expansion.

This report documents the outcomes of the single season Level 2 fauna survey of the greenfields mine location to identify key ecological constraints.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.

The survey area comprised six broad fauna habitat types: Wandoo Woodland, Kyaka Brook- Riparian/ Dam/small Water Body, Mallee Woodland, Mixed Shrublands on Low hills, Quartzite Outcropping formations and Disturbed areas.

The conservation value of each habitat type has been rated based on condition, structural complexity, faunal diversity and habitat for conservation significant fauna (i.e. contains essential habitat for breeding and/or feeding). Habitat values for each of the six types is considered high to moderate value. A large portion of the survey area is disturbed and comprises existing mines, tracks, land cleared for agriculture and other purposes and old fencing. These areas have low environmental significance.

The DBCA *NatureMap* search identifies 204 vertebrate fauna taxa previously recorded within 20 km of the survey area (DBCA 2018). This total included seven amphibians, 157 birds, one fish, 8 mammals and 31 reptiles.

The trapping program recorded 97 vertebrate fauna species utilising the survey area, including 16 mammals, 63 birds and 18 reptiles. Of these, five introduced species were identified and are mammals.

One conservation significant fauna species was identified as present and an additional one potentially occurring in the survey area based on a combination of observations and habitat assessment.

Species known to persist in the survey area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – listed under Schedule 2 (Endangered) under the State *Biodiversity Conservation Act 2016* (BC Act) and Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Species likely to be present in the survey area:

- Peregrine Falcon (*Falco peregrinus*) – Other special Protection under the BC Act.

Of these conservation significant species identified, the Carnaby's Black Cockatoo is the only species that would rely on the resources (foraging habitat present) within the survey area to persist in the region. The survey area (and foraging habitat) is within 12 km of known breeding areas of Carnaby's Black Cockatoo which are critical to the survival of chicks during the breeding season

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Appendices

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Appendix B	Relevant legislation, conservation codes and background information
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Acronyms

Term	Definition
%	Percentage
°C	Degree Celsius
BC Act	<i>Biodiversity Conservation Act 2016 (State)</i>
cm	Centimetres
DAWE	Department of Water and Environment (Commonwealth)
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter breast height
DEE	Department of Environment and Energy (Commonwealth)
EP Act	<i>Environmental Protection Act 1986 (State)</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
GHD	GHD Pty Ltd
ha	Hectare
IBRA	Interim Biogeographic Regionalisation of Australia
km	Kilometre
L	Litre
m	Metre
Mining Act	<i>Mining Act 1978 (State)</i>
mm	Millimetre
PMST	Protected Matters Search Tool
RiWI Act	<i>Rights in Water and Irrigation Act 1914 (State)</i>
Simcoa	Simcoa Operations Pty Ltd
SOPs	Standard Operating Procedures
SRE	Short-range endemic
State Agreement Act	<i>Silicon (Kemerton) State Agreement Act 1987 (State)</i>
WA	Western Australia

1. Introduction

1.1 Project background

Simcoa Operations Pty Ltd (Simcoa) operates the Moora Quartzite Mine (the Existing Mine) and Kemerton Silicon Smelter (the Smelter) to produce high grade silicon for both domestic and export markets. High purity quartzite is mined at the Existing Mine, located 15 kilometre (km) north of Moora on tenements M70/191, G70/91, G70/92 and G70/93, in the Wheatbelt region of Western Australia (WA) and then transported via truck to the Smelter located in the Kemerton Strategic Industrial Area approximately 17 km north-east of Bunbury in the South West of WA (Figure 1 in Appendix A).

The Existing Mine and Smelter are governed by the provisions of the Silicon (Kemerton) *State Agreement Act 1987* (the State Agreement Act) in addition to environmental approvals issued in accordance with Parts IV and V of the *Environmental Protection Act 1986* (EP Act), the *Mining Act 1978* (Mining Act) and the *Rights in Water and Irrigation Act 1911* (RiWI Act).

Simcoa is proposing to develop a new greenfield quartzite mine at North Kiaka (the Proposed Mine) on tenement M70/1292. The Proposed Mine is located approximately 2 km north of the Existing Mine. Development of the Proposed Mine is not currently explicitly covered by any of the approvals for the Existing Mine.

As part of development of the proposed mine at North Kiaka, several studies are required to support the approvals process. This report documents the outcomes of the single season Level 2 fauna survey of the greenfields mine location to identify key ecological constraints.

1.2 Purpose of this report

The purpose of the survey is to document the outcomes of the fauna assessment and identify key ecological constraints within the proposed area in order to inform the environmental approvals required for the proposed expansion of the mine area.

1.3 Survey area

The survey area encompasses four proposed pits, waste rock landforms and infrastructure areas approximately 2 km north of the Existing Mine and covers approximately 471.66 hectares (ha) as shown in Figure 1 in Appendix A.

1.4 Scope of works

The scope of works was to undertake a Level 2 vertebrate fauna survey for the site. This includes:

- Description and mapping of fauna habitat types
- Inventory of vertebrate fauna taxa
- Identification of any conservation significant fauna and habitats
- Identification of any pest species present
- Preparation of the Fauna Assessment Report.

1.5 Relevant legislation, conservation codes and background information

In WA, some fauna are protected under both Australian Government and State Government legislation. In addition, regulatory authorities also provide a range of guidance and information on expected standards and protocols for environmental surveys.

The following guiding documents informed the survey methodology and reporting of this fauna assessment:

- *Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3* (Environmental Protection Authority (EPA) 2002).
- *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (Formerly Statement 56) (EPA 2016a)
- *Technical Guidance, Terrestrial Fauna Surveys* (EPA 2016b).

1.6 Limitations and assumptions

This report: has been prepared by GHD Pty Ltd (GHD) for Simcoa Operations Pty. Ltd. and may only be used and relied on by Simcoa Operations Pty. Ltd. for the purpose agreed between GHD and the Simcoa Operations Pty. Ltd. as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Simcoa Operations Pty. Ltd. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Simcoa Operations Pty. Ltd. and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Methodology

2.1 Desktop assessment

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information relating to the study area and assist in survey design.

This included a review of:

- The Department of the Environment and Energy (DEE) (now the Department of Department of Agriculture, Water and the Environment (DAWE)) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area (DEE 2018a) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCA) *NatureMap* database for fauna species previously recorded within the study area (DBCA 2007) (Appendix C)
- Bamford (2001), *Vertebrate Fauna of the Simcoa Operations Pty Ltd Moora Mine (Western Ridge)* Unpublished Report
- Existing datasets including previous broad-scale vegetation mapping of the survey area, aerial photography, geology/soils and landscape information to provide background information on the variability of the environment, likely vegetation units and fauna habitats and to identify areas with the potential to contain Threatened and Priority fauna species.

The known biological constraints were mapped and are shown on Figure 2 in Appendix A.

2.2 Field survey

2.2.1 Field survey details and timing

Field surveys consisted of a 12-day (19 - 30 November 2018) Level 2 trapping program and reconnaissance survey. Glen Gaikhorst, Brad Maryan and Timothy Moulds undertook the surveys over this time. The field survey incorporated Short-Range Endemic (SRE) trapping and survey assessment. The SRE data are provided in a separate report produced by Invertebrate Solutions (2019).

2.2.2 Permits and ethics

A Regulation 17 Licence to Take Fauna for Scientific Purposes was obtained from DBCA prior to undertaking the fauna survey (Licence Number: 08-003052-1). The fauna survey (specifically trapping and animal handling) was undertaken in accordance with Standard Operating Procedures (SOPs) which were required to be followed under the conditions of GHD's fauna trapping permit. At the time of survey, compliance with these SOPs was accepted by DBCA as evidence of ethical treatment of animals:

2.2.3 Habitat assessment

The survey area was assessed for habitat type, structural complexity, connectivity, disturbance, type and extent of resource availability and value for fauna. Specifically, the assessment included:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, mid-storey, understorey, and ground cover).
- Presence/absence of refuge including fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/breakaways, and the type and extent of each refuge
- Location of the habitat within the survey area in comparison to the habitat within the surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the survey area
- Identification and evaluation of key habitat features, and types identified during the desktop assessment relevant to fauna of conservation significance

- Evaluation of the likelihood of occurrence of conservation significant fauna within the environments present (based on presence of suitable habitats and species recorded)
- A representative photograph of each habitat type.

2.2.4 Fauna identification and nomenclature

Species Identification

Identification of fauna species was made in the field using available field guides and electronic guides (Table 1). Where identification was not possible, photographs of specimens were collected to be identified following the field survey.

Table 1 Fauna references

Fauna group	Field guide
Mammals	Menkhorst and Knight (2010), Van Dyck and Strahan (2008)
Bats	Churchill (2008), Menkhorst and Knight (2010)
Birds	Morcombe (2004)
Reptiles	Wilson and Swan (2017), Storr <i>et al.</i> (1999), Storr <i>et al.</i> (2002)
Amphibians	Tyler and Doughty (2009)

Nomenclature

Nomenclature used in this report follows that used by the WA Museum as reported on NatureMap. This nomenclature is deemed the most up-to-date species information for WA fauna, with the exception of birds, which follows Christidis and Boles (2008).

2.2.5 Trapping program

Trapping for terrestrial fauna was undertaken using a series of standardised systematic trapping quadrat sites (quadrats) comprising a combination of pit-fall, Elliott box, cage and funnel traps. Details of each trap type used are provided below. Where possible two quadrats were established per habitat type identified within the survey area. Some habitat areas were too small to establish two sites therefore only one was used. A total of six quadrats were used for the survey area. Each quadrat was systematically surveyed (trapped) for a minimum of seven nights. Quadrats were checked twice daily (as a minimum) in the early morning and late afternoon to avoid prolonged heat exposure to trapped fauna. Trapping locations are displayed in Table 2 and presented in Figure 3 in Appendix A. The trapping program was supplemented with additional survey effort.

Table 2 Trapping Program locations

Trap Site number	Habitat type	Location		Nights deployed
		Easting	Northing	
Site 1	Mixed Shrubs on small Quartzite hill	116.05223	-30.49192	7
Site 2	Mixed Shrubs on small Quartzite hill	116.05083	-30.49653	7
Site 3	Casuarina and Jam Shrubland	116.05135	-30.49940	7
Site 4	Mixed Shrubs on small Quartzite hill	116.04805	-30.49306	7
Site 5	Eucalyptus Low Woodland	116.04702	-30.49304	7
Site 6	Quartzite Ridgeline	116.04750	-30.49861	7
Total				42

Pit-trap with drift fence

Six pit-fall traps were established at each quadrat within the survey area. Pit-fall traps comprised of 20 litre (L) plastic buckets (30 centimetre (cm) diameter, 40 cm deep) at each quadrat. A 50 metre (m) long flywire drift fence (30 cm high) bisected the pits; directing fauna into them. Pits were spaced at seven metre intervals along the fence. Soil and an egg carton were placed within each pit to provide shade and protection for captured animals. Pit-fall traps were used to assess both vertebrate and invertebrate fauna.

Funnel traps

Ten funnel traps were used along each drift fence. Traps were placed such that animals were directed into them from the drift fence in between the pit traps. Funnel traps were covered with insulating materials to minimise heat or cold exposure to animals.

Elliott box traps

Ten Elliott box traps were used at each quadrat site. Traps were placed approximately ten metres apart and baited with universal bait (a mixture of peanut butter, rolled oats and sardines). Elliott traps were located within shady areas or covered with vegetation to minimise heat exposure to captured animals.

Cage traps

Five cage traps were placed randomly in each quadrat. Cage traps were deployed in shaded areas or shaded with hessian bags and baited with universal bait.

Avifauna

Avifauna surveys were undertaken at each of the quadrat sites. Each survey comprised of a 20 minute (minimum) census of birds within an undefined 2 ha area, which is the standard method used by Birds Australia for the Bird Atlas project. Birds detected visually (using binoculars) and/or aurally over a 20 minute period were recorded. Numbers of each species observed were also recorded.

All systematic bird surveys were undertaken within four hours of dawn or two hours of dusk, as these are the times of day when birds are most active. In addition to systematic surveys, observations of birds were also made opportunistically.

Camera traps

Motion sensor cameras (Reconyx-Hyperfire) were deployed for a period of at least eight to 25 nights at selected intervals over the survey area. Camera locations were selected to target areas where potential significant species might be recorded i.e. hollow logs with evidence of use. Cameras were baited with sardines to attract fauna species within the survey area. For each camera location the time and date deployed and recovered, and the GPS coordinates were recorded. Camera locations are presented in Table 3 and illustrated in Figure 3 in Appendix A. Data from the cameras were downloaded onto a computer and analysed for the presence of fauna following the field survey.

Table 3 Camera trap locations

Camera number	Habitat type	Location		Nights deployed
		Easting	Northing	
77	Casuarina and Jam Shrubland	116.04526	-30.49533	23
43	Mixed Shrubs on small Quartzite hill	116.05244	-30.49369	25
44	Mixed Shrubs on small Quartzite hill	116.05444	-30.49554	25
45	Casuarina and Jam on Quartzite hill	116.05470	-30.49898	25
41	Casuarina and Jam on Quartzite hill	116.05060	-30.50073	25
GG	Exposed Quartzite ridgeline	116.04904	-30.49876	25
30	Mixed Shrubs on small Quartzite hill	116.04716	-30.49035	25
2	Casuarina and Jam on Quartzite hill	116.04904	-30.48932	25
42	Mixed Shrubs on small Quartzite hill	116.05024	-30.48608	25
77 dam	Banks of small water body	116.04124	-30.50270	8
Total				231

Bat Surveys

Bat Detectors (SM2 and SM4 Songmeters) were deployed for a period of 1 - 2 nights at each quadrat with additional assessments undertaken in heavily wooded areas. Bat detectors were positioned in areas where bat species might be recorded (i.e. utilising water bodies, flyways or caves). Bat detectors were set to record from 25 minutes pre-dusk to 25 minutes post-dawn. For each detector, the time and date deployed and recovered, and the GPS coordinates were recorded. Bat detector locations are shown in Table 4 and mapped in Figure 3 in Appendix A.

Data from the bat detectors were downloaded onto a computer and analysed for the presence of bats following the field survey. Data from the detectors were assessed by Glen Gaikhorst and verified by Craig Grabham.

Table 4 Bat Detector locations

Bat detector number	Habitat type	Location		Nights deployed
		Easting	Northing	
Site 1	Mixed Shrubs on small Quartzite hill	116.05178	-30.49076	1
Site 2	Mixed Shrubs on small Quartzite hill	116.05111	-30.49640	2
Site 3	Casuarina and Jam Shrubland	116.05173	-30.49947	1
Site 4	Mixed Shrubs on small Quartzite hill	116.04905	-30.49301	2
Site 5	Eucalyptus Low Woodland	116.04697	-30.49337	1
Site 6	Quartzite Ridgeline	116.04735	-30.49859	1
Regional	Mixed Shrubs on small Quartzite hill	116.04527	-30.48497	1
Total				9

2.3 Other searches

Rare and threatened species may have a patchy, disparate distribution through landscapes. To provide the best opportunity to determine the presence and relative prevalence of these species, this study employed a variety of sampling methods. The systematic sampling was applied throughout the trapping program with additional sampling methods also applied at these sites. Furthermore, other areas that were not assessed through the systematic trapping effort were also surveyed using non-systematic techniques including those mentioned below.

2.3.1 Active search

Active searching was undertaken to detect amphibians, reptiles, mammals and birds. Surveys comprised of searching the ground layer (overturning logs, rocks and leaf litter) and low vegetation (under bark and in tree stumps) and recording all individuals observed. Species presence was also determined via secondary evidence, in the form of scats, tracks, feathers, burrows and remains. Each trapping site was surveyed for a minimum of one hour including the general area around it. An additional eight active search sites within the survey area were searched using this method and locations for these are presented in Table 6 and Figure 3 in Appendix A.

2.3.2 Nocturnal searching

Spot lighting was undertaken to locate nocturnal species that may otherwise remain unrecorded using other survey techniques. Handheld or head mounted spotlights were used for a minimum of one hour at each trapping line and within the general area.

2.3.3 Opportunistic observations

Opportunistic observations involve the recording of fauna taxa (physical presence and/or signs of presence) spatially throughout the survey area. Opportunistic observations include physical observations (sighting or hearing fauna), and indirect evidence (scats, tracks, diggings, nests, feathers, bones, pellets) which indicate the current or recent activity of a species. Wherever possible, numbers of individuals, microhabitat use and other relevant information was recorded. Opportunistic observations were recorded outside of the diurnal, nocturnal or general trap site surveys (for example when driving, walking to sites, checking camera traps and bat detectors).

2.3.4 Targeted searches

Malleefowl (*Leipoa ocellata*)

The survey area was searched by opportunistic observations to identify Malleefowl mounds, digs, prints and scats. While this was primarily designed to assess for the presence of Malleefowl, all species observed were recorded opportunistically.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo were surveyed across the survey area to identify feeding evidence, potential and actual Black Cockatoo trees, roosting and evidence of use by Black Cockatoos. The aim of this survey is to detect the presence/use of Carnaby's Black Cockatoo however other species observed were recorded opportunistically. It should be noted that this assessment excludes the identification of individual trees within the required diameter at breast high (DBH) criteria, and instead a tree plot based count was adopted. Twelve plots were undertaken measuring 50 metre (m) x 50 m in size. All trees of a suitable size (DBH >300 mm) were recorded within each plot. The locations of the tree plots are listed in Table 5 and presented on Figure 3 in Appendix A. This assessment can therefore be used to estimate the number of potential breeding trees per hectare. Significant habitat such as foraging or potential breeding (trees recorded with hollows) were recorded individually and are mapped on Figure 5 in Appendix A.

Table 5 Black Cockatoo Tree plots undertaken

Tree Plot	Location	
	Easting	Northing
Tree Plot 1	116.03999	-30.49879
Tree Plot 2	116.04132	-30.50111
Tree Plot 3	116.04119	-30.50201
Tree Plot 4	116.04482	-30.49132
Tree Plot 5	116.04279	-30.48612
Tree Plot 6	116.04515	-30.48328

Tree Plot	Location	
	Easting	Northing
Tree Plot 7	116.04934	-30.50172
Tree Plot 8	116.05028	-30.50473
Tree Plot 9	116.03708	-30.50446
Tree Plot 10	116.03172	-30.50272
Tree Plot 11	116.03187	-30.50166
Tree Plot 12	116.03128	-30.50520

2.4 Survey effort

Survey effort is described as the amount and type of survey that is undertaken during an assessment. The type of survey and amount of time spent on each survey for this Level 2 fauna assessment is provided in Table 6. Each trapping site was sampled over seven (minimum) consecutive trap-nights. Additionally each site underwent two (minimum) nights of bat acoustics monitoring, and at least 60 minutes of nocturnal searches, active searches and bird surveys.

The total trapping effort consisted of 1,260 trap-nights (total trap effort), 520 minutes of bird assessments, 1,080 minutes of active searches, 390 minutes of night searches, nine nights of bat detection and 231 camera deployment nights. Table 6 shows the survey effort undertaken for this project.

Table 6 Fauna survey effort

Fauna Tapping				Elliot traps		Pit Traps		Cage Traps		Funnel traps		Bat Detector	Bird search	Active search	Night search
Sites	Easting	Northing	Nights Open		trap nights		trap nights		trap nights		trap nights	trap nights	minutes		
Site 1	116.05223	-30.49192	7	10	70	6	42	2	14	10	70	1	60	60	60
Site 2	116.05083	-30.49653	7	10	70	6	42	2	14	10	70	2	60	60	60
Site 3	116.05135	-30.49940	7	10	70	6	42	2	14	10	70	1	60	100	60
Site 4	116.04805	-30.49306	7	10	70	6	42	2	14	10	70	2	60	60	60
Site 5	116.04702	-30.49304	7	10	70	6	42	2	14	12	84	1	60	60	60
Site 6	116.04750	-30.49861	7	10	70	0	0	2	14	12	84	1	60	80	60
Cage line	116.05076	-30.49531	7	0	0	0	0	14	98			1			30
Active search 1	116.04153	-30.50176											20	60	
Active search 2	116.04960	-30.50226											20	80	
Active search 3	116.05044	-30.48568											20	120	
Active search 4	116.04983	-30.49315											20	60	
Active search 5	116.04901	-30.49003											20	60	
Active search 6	116.04492	-30.48484											20	60	
Active search 7	116.04364	-30.49322											20	60	
Active search 8	116.04443	-30.49582											20	60	
Total			42		420		210		182		448	9	520	1,080	390

2.5 Fauna survey limitations

Guidance Statement No. 56 (EPA 2004) states that fauna and faunal assemblage survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with the fauna component of this field survey are discussed in Table 7.

Table 7 Fauna survey limitations

Limitations	Constraints	Impact on Survey outcomes
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions, e.g. pitfall trapping in waterlogged soils or inability to use pitfall traps because of rocky terrain)	Nil	All fauna groups were able to be sampled with no constraints. The survey team was able to sink pit traps at all sites except site 6 which was solid rock. This site received the remainder of the trap design.
Proportion of fauna identified, recorded and/or collected	Nil	All fauna was identified and released on site.
Proportion of the task achieved and further work which might be needed.	Nil	All tasks were achieved from the survey, additional Black Cockatoo monitoring/data may be required in the future if Wandoo areas are impacted by future works.
Remoteness and/or access problems	Minor	There were no issues with remoteness as the survey area is located within an agricultural area. Most areas of the survey area were able to be accessed during the surveys.

3. Desktop assessment

3.1 Previous studies

A review of existing fauna assessments that have been undertaken within the survey area is presented in Table 8.

Table 8 Previous fauna site investigations

Project	Location and key findings	Location and relevance to this survey area
Vertebrate Fauna of the Simcoa Operations Pty Ltd Moora Mine (Western Ridge) (Bamford Consulting Ecologists and Western Wildlife Ecological Consultants 2001).	<p>This study involved a vertebrate fauna desktop search and brief site inspection. The site inspection occurred on the Simcoa Operations Ltd mining lease approximately 15 km north of Moora. The inspection covered three areas: Western Ridge, Eastern Ridge and Cairn Hill.</p> <p>The final species list included 11 species of frogs, 66 species of reptiles, 96 species of birds and 25 species of mammals (5 of which are introduced) which are either known or thought to potentially occur within the area.</p> <p>No conservation significant species were identified during the brief site inspection; however 12 conservation species were identified to potentially occur around the site.</p>	<p>The three sites inspected in the assessment were proposed mining areas at the time of the inspection. While no map was provided, both the inspected sites and the Proposed Mine that is the focus of this study are located approximately 15 km north of Moora and can be presumed to be either in close proximity to one another or potentially overlap in survey areas.</p>

3.2 Climate

The survey area is located within the Avon Wheatbelt subregion of WA. The climate of this region is classified as semi-arid (dry), warm Mediterranean. The closest current weather station to the site is in Badgingarra Research Station (Station ID: 009037) located approximately 56 km northwest of Moora town site. Climate data from this station indicates:

- Mean maximum temperature ranges from 17.5°C in July to 34.7°C in February
- Mean minimum temperature ranges from 7.1°C in August to 17.8°C in February
- Mean annual rainfall is 480.8 millimetres (mm) with an average of 92.8 rain days per year (WeatherZone 2018).

The weather conditions over the survey period are presented below in Table 9. The site conditions were dry and warm during the survey.

Table 9 Weather data for survey period 9 - 19 October 2018

Date	Min temp (°C)	Max temp (°C)	Rainfall (mm)
19/11/18	-	23.2	-
20/11/18	8.4	24.9	-
21/11/18	10.8	28.7	0.0
22/11/18	15.0	34.1	0.0
23/11/18	11.5	25.0	0.0
24/11/18	8.8	25.9	0.0
25/11/18	5.1	24.0	0.0
26/11/18	8.0	24.6	0.0

Date	Min temp (°C)	Max temp (°C)	Rainfall (mm)
27/11/18	9.7	29.5	0.0
28/11/18	11.4	31.3	0.0
29/11/18	12.2	28.4	0.0
30/11/18	12.0	28.4	0.0

3.3 Regional biogeography

The survey area is situated in the South-West Botanical Province (Beard and Burns 1976), or the Interim Biogeographic Regionalisation of Australia (IBRA) of the Avon Botanical District. The survey area lies within the Avon Wheatbelt bioregion (Thackway *et al.* 1995).

3.4 Geology and soils

3.4.1 Geology

The dominant rocks of the survey area belong to the Middle Proterozoic Moora Group. These are sedimentary rocks, which are separated from the Archaean rocks of the Darling Plateau by a series of poorly defined faults (Griffin 1992).

The survey area is located within the Noondine Chert stratigraphic unit. The Noondine Chert Formation (originally Coomberdale Chert), which outcrops frequently in the survey area, is a part of the Coomberdale Subgroup of the Moora Group. "It consists of bedded chert, chert breccia, orthoquartzite, silicified limestone and dolomite and contains significant siliceous siltstone and sandstone beds, and minor claystone." (Carter and Lipple 1982).

3.4.2 Land systems, landforms and soil

The survey area sits on a narrow and discontinuous series of low Chert hills that are formed from the higher (and presumably more resistant to erosion) parts of the Noondine Chert Formation. Two land systems of the Moora group are present and include the Coorow and Coomberdale Landscape (both Chert subsystems) (Geological Survey of Western Australia 2001).

The soils on the chert ridges vary in depth from skeletal on the blocky outcropping chert, to gravelly, loamy sands lower down the slopes (Griffin, 1992). The surface soil was often pale grey, silty, fine sand. Sands in the valleys consist of more clay and eroded rock material (Trudgen *et al.* 2012)

3.5 Land use

There are no DBCA managed lands located within the Proposed Mine. There are three DBCA managed lands within a 20 km radius of the Proposed Mine boundary, with the nearest being Cairn Hill Nature Reserve, an Class A nature reserve located approximately 1.27 km to the south. Table 10 displays DBCA managed lands within a 20 km buffer of the survey area.

Table 10 DBCA managed lands within 20 km of the survey area

ID	Classification	Name	Distance from survey area boundary
R 47694	Class A Nature Reserve	Cairn Hill Nature Reserve	1.27 km south
R 28674	Class A Nature Reserve	Manaling Nature Reserve	10.9 km north-west
R 23316	Class A Nature Reserve	Namban Nature Reserve	13.6 km north-west

3.6 Vegetation

The vegetation for the survey area has been assessed and mapped and can be viewed in Trudgen *et al.* (2012).

3.7 Fauna diversity

The *NatureMap* database identified 204 vertebrate fauna taxa previously recorded within 20 km of the survey area (DBCA 2018). This total included seven amphibians, 157 birds, one fish, 8 mammals and 31 reptiles. Of the total number of vertebrates present, three are feral species.

The complete list from the *NatureMap* search can be seen in Appendix C.

3.8 Conservation significant fauna

Searches of the EPBC Act PMST (DEE 2018), DBCA and *NatureMap* database (DBCA 2007) identified the presence/potential presence of 15 conservation significant fauna species (refer to Appendix C). Species identified by the PMST as marine and migratory marine were excluded from this assessment as no marine habitats were present within or nearby the survey area. However, species identified by the PMST as migratory terrestrial/wetland were considered as part of this assessment.

4. Results

4.1 Fauna habitats

There were six broad habitat types recorded in the survey area during the field survey. These different habitat types are closely aligned with the different vegetation types and landforms within the survey area. The habitat types recorded in the survey area are described in Table 11 and mapped in Figure 4 in Appendix A. The six broad fauna habitat types are:

- Wandoo Woodland
- Kyaka Brook - Riparian / Dam / small water body
- Mallee Woodland
- Mixed Shrublands on Low hills
- Quartzite Outcropping formations
- Disturbed areas.

4.1.1 Fauna habitat linkages

The fauna habitat available in the survey area is locally and regionally fragmented. Locally much of the survey area has been cleared or altered. Patches of native vegetation mostly occur on low hill tops where the soils are too rocky for agricultural purposes. Between hills, the vegetation has been cleared and comprises pasture or cropping areas. The hill tops provide islands of vegetation for species to persist and are loosely connected to adjacent areas north and south of similar habitats.

With approximately 90% of the landscape cleared in the Shire of Moora for agricultural purposes, there is little habitat remaining for fauna species. There are three reserves within the Shire with the closest approximately 4 km away.

Some habitat areas are present to the west and northwest of the survey area that consist of a mosaic of drainage areas including salt lakes and adjoining habitat. However, broadacre agricultural land is established between these sites. Groups such as avian species are most likely to benefit from these habitats provided they are able to move across the landscape. Small sedentary species which are able to utilise the remaining habitat may also persist.

4.1.2 Quality of habitat

The quality of the fauna habitats has been affected by the impacts described above Section 4.1.1. Whilst the vegetation was mostly intact on the hills, the impact of fragmentation and grazing in some environments was evident, particularly the fringing shrublands, however generally the mapped habitats were in poor to good condition. With this in mind, the overall quality of the remainder of the survey area is in degraded condition (due to clearing or over grazing).

The survey results (i.e. species recorded) identified that the micro habitats within the environments played a significant part in the species present. Species that can persist or utilise very hard substrates were present. This environmental structure reduced the opportunity for specialised or digging species to hide or create refugia and therefore reducing the species present.

Where woodland areas persisted the micro habitats available provide high quality resources for a diverse suite of fauna particularly reptiles, bats, birds and mammals. This environment supported numerous woodland species such as Black-headed Monitor, Common Brushtail Possum and numerous Bat species. Wandoo (*Eucalyptus wandoo*) recorded provides known breeding environments for Carnaby's Black Cockatoo. The Common Brushtail Possum record would be considered regionally significant (although not conservation listed) due to the species being patchily distributed through the northern wheatbelt region.

4.1.3 Habitat Scatter Plot

The similarity between sites based on the GHD trapping data was examined using PRIMER. The cluster analysis (Chart 1) and resulting dendrogram (Chart 2) showed that according to the species recorded the habitat surveyed demonstrate uniqueness in the species recorded and demonstrate isolating or clustering. This is particularly the case for the Mixed Shrublands where 3 (Sites 1, 2, 3) of the four sites are tightly clustered with one outlier (Site 4). The Mallee Woodland and Quartzite Outcropping sites lack of species recorded looks to have isolated apart from the remaining quadrats.

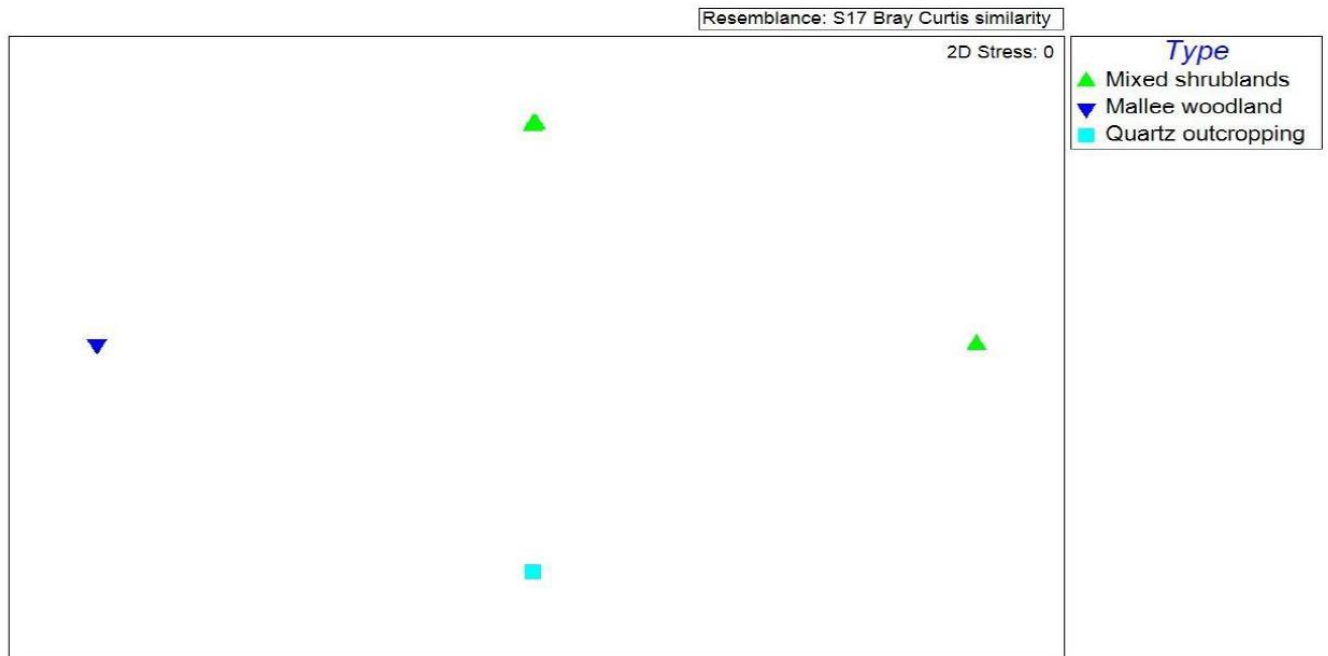


Chart 1 Cluster Analysis for Trap Data

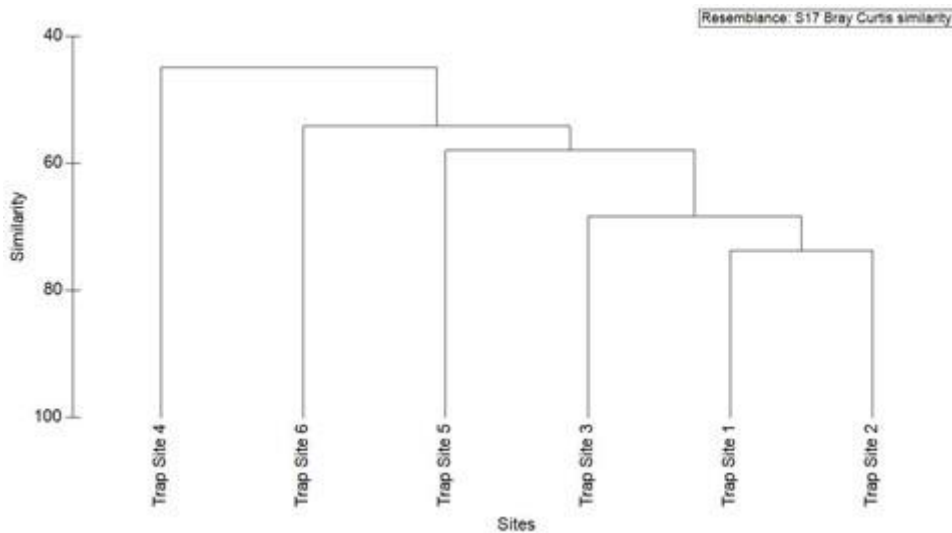






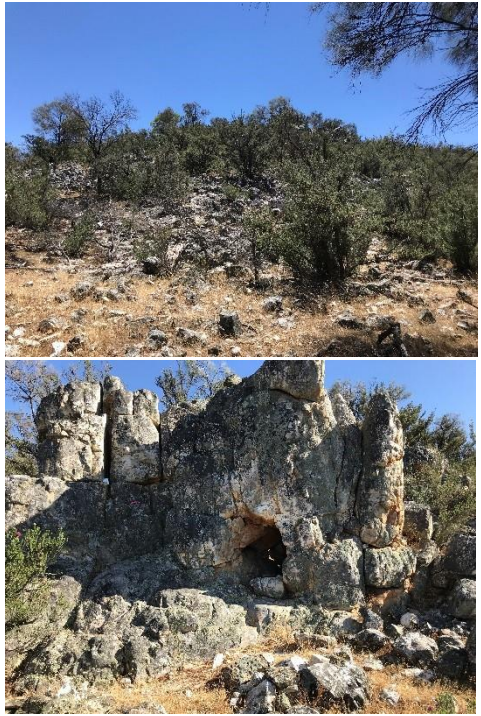

Chart 2 Dendrogram of Similarity of Trapping Data

Table 11 Major habitat types within the survey area

Description	Extent in the Survey area	Representative Images
<p>Wandoo Woodland</p> <p>This habitat type occurs in a small portion of the survey area in the rail corridor along the western edge of the survey area. This habitat is dominated by Wandoo (<i>Eucalyptus wandoo</i>) with a mixed understorey of <i>Dodonaea</i> sp. <i>Acacia</i> sp, chenopods and low shrubs and herbs. The overstorey consist of open woodland of Wandoo trees (DBH >300 mm) at a density of approximately 7 trees per 50 x 50 m quadrat. These trees were often large (to 2 m) and provided small, medium and large hollows. Large hollows were present in approximately 1 trees per 50 x 50 m quadrat (based on stem density counts of trees with DBH > 300 mm). The shrub/midstorey layer was sparse but sometimes moderate to dense in small patches and consisted of <i>Acacia</i>, <i>Dodonaea</i> and chenopod species. The soils consisted of brown clay loam with small areas of gravel incursion.</p> <p>The majority of the Wandoo Woodland area appeared long unburnt (>20 years) given the lack of historical fire scar evidence.</p> <p>The woodland provides good denning and breeding opportunities for small native ground mammals, birds and reptiles. Seven species of bird were recorded nesting in this habitat. The Ringneck Parrot (<i>Barnardius zonarius</i>), Tree Martins (<i>Petrochelidon nigricans</i>), Galah (<i>Eolophus roseicapilla</i>) and Pied Butcherbird (<i>Cracticus nigrogularis</i>). Animal tracks, digs and occasional small burrows were recorded in this habitat type.</p> <p>Fallen branches and logs were common in this habitat type with many having a range of hollow sizes. The persistence of logs is probably an artefact of the lack of fire history. Leaf-litter and other forms of non-vascular ground cover (dead plant material) was common beneath trees and shrubs.</p> <p>Conservation significant fauna</p> <p>Part of a larger linear corridor of contiguous remnant vegetation along the Midlands Road extending throughout the very western edge of the survey area. This habitat provides breeding, foraging and roosting habitat for Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>). The Peregrine Falcon (<i>Falco peregrinus</i>) may also utilise selected hollows for breeding but would also utilise the area for hunting and loafing.</p> <p>High Value</p>	<p>1.38 ha</p>	
<p>Kyaka Brook - Riparian/Dam</p> <p><i>Eucalyptus wandoo</i> and/ or <i>E. loxophleba</i> woodland along Kyaka Brook over mixed introduced grasses and herbs. <i>Allocasuarina huegeliana</i> is present surrounding the small dam.</p> <p>An ephemeral brook/drainage line that runs from the south western corner of the survey area east and crosses Kiaka Road outside of the survey area. A small dam is positioned just north of the brook in the low lying section of the paddock. Flow from the dam would intersect to brook. The main drainage line follows the gradient of the survey area, generally flowing from east to west. The creek and other small ephemeral drainage lines supports generally narrow, linear woodlands and was more structurally diverse than the surrounding habitats (which is primarily shrublands). The vegetation along these drainage lines is dominated by <i>Eucalyptus wandoo</i> and <i>E. loxophleba</i> and mixed scattered shrubs. The understorey consist of introduced herbs and grasses and was mostly</p>	<p>11.04 ha</p>	

Description	Extent in the Survey area	Representative Images
<p>degraded. Areas had some litter and debris present including large branches and logs creating numerous usable habitat options for fauna species.</p> <p>The drainage lines have a mosaic of substrates with a complex and variable mix of rocky, stony and sandy profiles. The substrates would vary and erode in response to rainfall and flooding. There was no evidence of fire in this habitat.</p> <p>These linear patches of habitat provide a corridor for the movement of fauna through the local landscape. Small birds would utilise this denser vegetation for foraging, movement and nesting.</p> <p>Conservation significant fauna</p> <p>The increased structural diversity and substrate variation in this environment is likely to support a broader suit of fauna species than the surrounding habitat types. Additionally, these drainage lines would be utilised as corridors for species. The Carnaby's Black Cockatoo may utilise the Wandoo habitat for breeding purposes where hollows are available and where adequate foraging habitat located in proximity to wandoo. The Peregrine Falcon would utilise these well vegetated corridors for hunting/foraging.</p> <p>High Value</p>		
<p>Mallee Woodland</p> <p>Mallee Woodland of <i>Eucalyptus loxophleba</i> over scattered shrubs and very open herb and grass lands in fine sandy soils.</p> <p>The Mallee Woodland compiled a series of very small remnant areas throughout the survey area. The woodland comprised fine sands over a deeper layer of heavy loams. The dominant plant species were <i>Acacia</i> and <i>Dodonaea</i> with herbs and grasses. The main areas of mallee woodlands were located in the mid to lower slopes of the survey area and mostly cleared due to this habitat being aligned to desirable agricultural soils. It was also evident that cattle highly utilised these areas for shade and cover due to the grazing (showing signs of heavy grazing, soil compaction and trampling) noticeably impacted the ground layer. The Mallee Woodland had very little sign of fauna activity (which is represented in trapping site 5 data) but is probably an artefact of the small habitat areas remaining and the high impact and use by agricultural species. However bats and other small hollow utilising species were present in this habitat.</p> <p>Conservation significant fauna</p> <p>The Mallee Woodlands present in the survey area appeared not to produce large hollows for species like Carnaby's Black Cockatoo. However, could be utilised for roosting as required. The Peregrine Falcon would utilise these areas for hunting/foraging.</p> <p>Moderate Value</p>	11.12 ha	

Description	Extent in the Survey area	Representative Images
<p>Mixed shrublands on low hills</p> <p>Mixed Shrublands of <i>Acacia</i>, <i>Banksia</i>, <i>Regelia</i>, <i>Kunzia</i>, <i>Allocasuarina</i>, <i>Hibbertia</i>, <i>Xanthorrhoea</i> and <i>Melaleuca</i> on rocky low hills</p> <p>The Mixed Shrublands vary in composition of species and quality according to historical disturbances and location in the environment. The mixed Shrublands has areas of singular species dominance such as <i>Allocasuarina</i> and <i>Banksia sessilis</i>, however these areas were relatively small. The patches of vegetation where fencing is not present show signs of edge or fringe effect from grazing, however outside of these are generally in good conditions. Some portions of the mixed shrubland such as those in the north eastern section of the survey area are quite degraded and open, and likely historically cleared. This habitat was diverse in structure and was evidently sculptured by the base rock ultimately forming the low hills. Some areas were exposed rock while others heavy rocky loam. There were high points in the environment and areas where water ran or temporarily pooled. The environment had areas of good ground covers, litter, small logs or debris. There was no evidence of fire in this environment.</p> <p>This habitat would provide a variety of habitat resources for fauna species, and patches had a greater structural diversity than the surrounding shrublands. The lack of sandy soils was evident in the fauna assemblages trapped during the programs. This was particularly evident by the paucity of burrowing species trapped. No Striped skink (<i>Ctenotus</i> sp.) or Gould's monitors (<i>Varanus gouldii</i>) were recorded during the survey which would typically be represented.</p> <p>Conservation significant fauna</p> <p>The <i>Banksia sessilis</i> present in this habitat was recorded to be highly utilised by Carnaby's Black Cockatoo as a foraging species. Twenty-nine individuals of Carnaby's Black Cockatoo were recorded within the survey area foraging on this species. The Peregrine Falcon would utilise these well vegetated corridors for hunting/foraging.</p> <p>High Value</p>	<p>175.01 ha</p>	

Description	Extent in the Survey area	Representative Images
<p>Quartzite Outcropping formations</p> <p>Mixed Shrublands of <i>Acacia</i>, <i>Banksia</i>, <i>Regelia</i>, <i>Kunzia</i> and <i>Allocasuarina</i>, amongst quartzite outcropping</p> <p>Quartzite outcrops occurred in two small areas of the survey area. The formations are usually associated with low vegetation types due to the shallow soils and comprise <i>Acacia</i>, <i>Banksia</i>, <i>Regelia</i>, <i>Kunzia</i> and <i>Allocasuarina</i> and an abundance of grasses and herbs. The environment had areas of good ground covers, litter and debris but lacked logs due to vegetation present. However, the outcropping with exfoliating rock, crevices and slabbing provides excellent cover for a range of fauna species. There was no evidence of fire in this habitat.</p> <p>The Common Wallaroo appears to be the most common mammal to frequent or reside in this habitat type. Cracks and ledges formed in the granite and its loose stones provide a majority of the habitat for reptiles and small mammals to hide. The small caves may provide refugia for bat species.</p> <p>Conservation significant fauna</p> <p>The <i>Banksia sessilis</i> present in this habitat was recorded to be highly utilised by Carnaby's Black Cockatoo as a foraging species. The Peregrine Falcon would utilise these well vegetated corridors for hunting/foraging.</p> <p>High Value</p>	4.02 ha	
<p>Disturbed areas</p> <p>Vast areas of the survey area had previously been cleared for agriculture, tracks, mines and old fence lines. These areas provide very little habitat value to fauna species.</p>	269.09 ha	

4.2 Fauna diversity

The November (Level 2) 2018 fauna surveys recorded 97 vertebrate fauna species utilising the survey area, including 16 mammals, 63 birds and 18 reptiles. The compiled species list can be found in Table 17 in Appendix D. A breakdown of the fauna assemblages for the GHD 2018 survey results is provided below.

4.2.1 Mammals

The surveys recorded 16 mammal species within the survey area, including five introduced and 11 native mammals. The composition of native species includes six bats, two macropod, a small dasyurid, Possum, Echidna and five introduced mammals. The most specious family was the microchiropteran Vespertilion bats (4 species), macropods (two species), Molossid bats (two species), with dasyurid, Bovid, canid, felid, Murid, Phalangerid and Tachyglossid each having a single species. Two hundred and twenty-seven individual mammals (excluding feral species and bats) were recorded over the trapping program between five species, with the most abundant being the Western Grey Kangaroo and Common Wallaroo. Two hundred and fourteen Western Grey Kangaroo sightings were recorded (94% of total native mammal recordings) with eight Common Wallaroo (3.5% of total native mammal recordings).

Bats were only recorded via echolocation, therefore only presence or absence information could be collected. Some species overlap in call identification and therefore may represent multiple species (such as in the *Nyctophilus* group). In any case, in this region there are no species of conservation significance. A breakdown of mammal families recorded during the surveys is provided in Table 12.

Table 12 Mammal families recorded during the field surveys

Mammal Family	No. of species
Bovidae (Ruminants)	1
Canidae (Dog)	1
Dasyuridae (Dunnarts)	1
Felidae (Cat)	1
Leporidae (Rabbit)	1
Molossidae (Freetail Bats)	2
Muridae (Rodents)	1
Macropodidae (Kangaroos)	2
Phalangeridae	1
Tachyglossidae (Echidna)	1
Vespertilionidae (Bats)	4
Total	16

4.2.2 Birds

The bird surveys (from the Level 2) identified 63 bird species from 32 families. The most specious families were the *Meliphagidae* (eight species), *Cacatuidae* (five species) and *Acanthizidae* (five species). Seven hundred and eighty eight individual bird sightings were recorded over the trapping program. The most abundant species were the Galah with 81 records (10% of total bird recordings), Weebills with 73 records (9.3% of total bird recordings), Yellow-rumped Thornbill with 39 records (4.9% of total bird records) and Australian Magpie with 35 records (4.4% of total bird recordings). A breakdown of bird families recorded during the survey is provided in Table 13.

Table 13 Bird families recorded during field surveys

Bird Family	No. of species
Accanthizidae (Weebill/Gerygone)	5
Accipitridae (Diurnal birds of prey)	3
Anatidae (Ducks)	1
Ardeidae (Heron)	2
Artamidae (Magpie group)	4
Cacatuidae (Cockatoo group)	5
Campephagidae (Cuckoo-shrikes)	2
Casuariidae (Emu)	1
Columbidae (Doves)	2
Corvidae (Crow)	1
Cuculidae (Cuckoos)	1
Falconidae (Falcons)	3
Halcyonidae (Kingfishers)	2
Hirundinidae (Swallows)	2
Maluridae (Wrens)	2
Megaluridae (Songlarks)	2
Meliphagidae (Honeyeaters)	8
Meropidae (Bee eater)	1
Monarchidae (Lark)	1
Motacillidae (Pipit)	1
Nectariniidae (Mistletoebird)	1
Neosittidae (Sittella)	1
Pachycephalidae (Whistlers)	2
Pardalotidae (Pardalote)	1
Petroicidae (Robin)	1
Phasianidae (Quail)	1
Pomatostomidae (Babblers)	1
Psittacidae (Parrots)	2
Rhipiduridae (Fantail)	1
Strigidae (Boobook)	1
Timaliidae (Silvereye)	1
Turnicidae (Button Quail)	1
Total	63

4.2.3 Reptiles

A total of 18 reptile species were recorded during the field surveys from eight families. The most specious families were Elapidae (5 species) and Scincidae (4 species). One hundred and sixty four reptiles were recorded in the survey area over the trapping program. The most abundant species were Tree Dtella with 55 records (34% of total reptile recordings), Common dwarf Skink with 29 records (18% of total reptile recordings) and Bobtail with 21 records (13% of total reptile recordings). A breakdown of reptile families recorded during the survey is provided in Table 14.

Table 14 Reptile families recorded during the field surveys

Reptile Family	No. of species
Agamidae (Dragons)	2
Diplodactylidae (Geckos)	1
Elapidae (Snakes)	5
Gekkonidae (Geckos)	2
Pygopodidae (Legless Lizards)	2
Scincidae (Skinks)	4
Typhlopidae (Blind Snakes)	1
Varanidae (Monitors)	1
Total	18

4.2.4 Introduced Species

Mammals comprised the only group in which introduced fauna were recorded. In total five species were observed and included:

- Sheep (*Ovis aries*)
- Red Fox (*Vulpes vulpes*)
- Cat (*Felis catus*)
- European Rabbit (*Oryctolagus cuniculus*)
- House Mouse (*Mus musculus*).

The Sheep are managed fauna by the property owners, while the remaining species are considered feral fauna species to the region.

4.3 Conservation Significant Fauna

One conservation significant fauna species was recorded within the survey area during the field survey, this was the:

- Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) – listed under Schedule 2 (Endangered) under the State BC Act and Endangered under the Commonwealth EPBC Act.

4.3.1 Likelihood of occurrence assessment

In addition to the field survey results, an assessment on the likelihood of conservation significant species occurring in the survey area was undertaken. This assessment is based on species’ biology, habitat requirements, the quality and availability of suitable habitat as determined during the field survey, and records of the species in the survey area and locality. Species- specific searches of the DBCA *NatureMap* database with a buffer radius of 20 km were also conducted in order to gather information about the broader regional occurrence of species to further inform the likelihood of occurrence assessment. Some species identified in the Protected Matters Search tool are not realistically considered to occur in the survey area or are not terrestrial vertebrate species and have been excluded from the assessment.

In total 19 species (2 mammals, 1 freshwater fish, 1 reptile and 15 birds) were recorded from desktop assessment as potentially occurring in the survey area. Of these only two were recorded or are likely to utilise the habitats present in the survey area. Table 15 summarises the species of conservation significance that are either known or considered likely to occur in the survey area. A brief description of these species and their associated habitat types within the survey area are described below. The parameters of assessment for this likelihood of occurrence assessment and the full likelihood of occurrence assessment are provided in Appendix D.

Table 15 Summary of likelihood of occurrence assessment for conservation significant fauna species deemed known or likely to occur

Species	EPBC Act	WC Act/ DPaW	Assessment outcome
Birds			
Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>)	En	En	Known. The species was recorded in the survey area and feeding observations were recorded throughout the survey area.
Peregrine Falcon (<i>Falco peregrinus</i>)	-	OS	Likely. The species is known from the region, however use would be opportunistic and utilised for foraging purposes only. No breeding habitat is present in the survey area.

Key – OS = Other Species Protection, Special Protection under BC Act. En= Endangered, Endangered under BC and EPBC Acts.

4.3.2 Fauna species recorded in the survey area

4.3.2.1 Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo is endemic to the south-west of Western Australia with a wide- spread distribution. Carnaby's Black Cockatoo nest in hollows of live or dead eucalypts, primarily smooth-barked Salmon Gum and Wandoo (Saunders 1979, 1982) though breeding has been reported in other wheatbelt tree species and some tree species on the Swan Coastal Plain and jarrah forest (Saunders 1979, 1982; Storr 1991; Johnstone and Storr 2004). Success in breeding is dependent on the quality and proximity of feeding habitat within 12 km of nesting sites (Saunders 1977, 1986; Saunders and Ingram 1987). Along with the trees that provide nest hollows, the protection, management and increase of this feeding habitat that supports the breeding of Carnaby's Black Cockatoo is a critical requirement for the conservation of the species.

At least 29 Carnaby's Black Cockatoo individuals were recorded flying and foraging within the survey area. The largest group recorded was nine birds with the smallest three. The locations the birds were observed is record in Figure 5 in Appendix A. No roosting areas were recorded in the survey area and none would be expected in the south western corner of the survey area (where the only large/tallest trees are present). The remaining vegetation present is not suitable for roosting.

Carnaby's Black Cockatoo are known to utilise habitat within the survey area and feeding evidence was recorded from across the site. Evidence was represented by old and fresh chewed *Banksia sessilis*, in particular snapped branches on the ground. Some examples of *B.sessilis* identified as feeding is represented in Plate 1, Plate 2 and Plate 3. The locations of all feeding records observed is record in Figure 5 in Appendix A.

Three large hollows were recorded during the survey that have been potentially utilised for breeding in the past. These hollows are present in Wandoo (*Eucalyptus wandoo*) and lie in the south west corner of the survey area. There are no Wandoo present outside of this portion of the survey area. The three hollows are mapped on Figure 5 in Appendix A.

Twelve tree plots were undertaken within the survey area to provide an accurate estimate of density of suitable potential breeding trees for breeding by Carnaby's Black Cockatoo within the delineated habitat types. These plots provide a close approximation to quantify suitable trees within an area to assist in approval process In total 12 plots were recorded with both Wandoo and Mallee Woodland with the dominant species being Wandoo and York Gum. From the plot data approximately 3 - 4 York Gum were recorded in Mallee Woodland within a 50 m x 50 m plot. When in Wandoo Woodland approximately 7 Wandoo and 2 York Gum are present within a 50 m x 50 m plot. Small, medium and large hollows were present within plots, but no Carnaby's Black Cockatoo were recorded breeding at the time of the survey within any of the plots. Table 16 shows the data collected for each of the tree plots.

Table 16 Results from the tree plot assessments

Tree Plots(50 x 50m)	York Gum	Wandoo	Comment
Tree Plot 1	3		1 small hollow
Tree Plot 2	5		5 small hollows
Tree Plot 3	2		2 small hollows
Tree Plot 4	1		2 small hollows
Tree Plot 5	2		-
Tree Plot 6	6		3 small, 1 medium hollow. Galah nesting in medium.
Tree Plot 7	4		6 small hollows, bees in one
Tree Plot 8	3		-
Tree Plot 9	4		1 small hollow
Tree Plot 10	2	13	3 large hollows in Wandoo, 1 small in York
Tree Plot 11	3	6	1 small hollows in Wandoo, 1 small in York
Tree Plot 12	2	5	2 small hollows in Wandoo, 2 small in York



Plate 1 Fresh and old *Banksia sessilis* snipping's on the ground



Plate 2 *Fresh Banksia sessilis snippings's still in shrub*



Plate 3 *Old Banksia sessilis snippings's at the base of a shrub*

4.3.2.2 Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Special Protection under the BC Act.

The Peregrine Falcon is a large falcon species which predominantly preys aerially on medium sized birds such as Pigeon, Galah and ducks. The species prefers areas with deep gorges or large cliff faces with riparian or plain habitat surrounding. The Peregrine Falcon nests primarily on ledges of cliffs, shallow tree hollows, and ledges of buildings in cities (Morcombe 2004). The Peregrine Falcon is wide ranging, mobile and aerial in nature, and therefore is likely to utilise all of the habitats within the survey area.

No large rocky cliff faces are present within the survey area, however habitat is available to the species in the remainder of the survey area for foraging. There are no suitable nesting areas for this species present within the survey area.

Given the availability of suitable habitat in the local area and surrounding region, and that the Peregrine Falcon is a wide ranging and highly mobile species, the available habitat is unlikely to be significant for the Peregrine Falcon at either the local or regional levels.

4.3.3 Accumulation curve

An accumulation curve was run for the data collected during the field survey within eight models in Primer V6. The UGE curve is typically used for ecological assessment and in this instance demonstrate poor fit to the data and fails to reach a curve asymptote (very few new species were recorded) after trap night 7 (Chart 3). This is probably true to form whereby the sampling is undertaken in a dominant habitat type of limited species diversity. With additional habitat types the species diversity would have increased therefore producing an asymptotic accumulation curve

In this instance the accumulation curve does not represent the effort and diversity of the study. The raw data of the known species in the region (of reptile, small mammal and frogs from *NatureMap*) suggests approximately 25 species could utilise the dominant habitat present in the survey area. This study recorded 18 species, similar in numbers to those presented above, suggesting that a large percentage of the species present were recorded during the survey

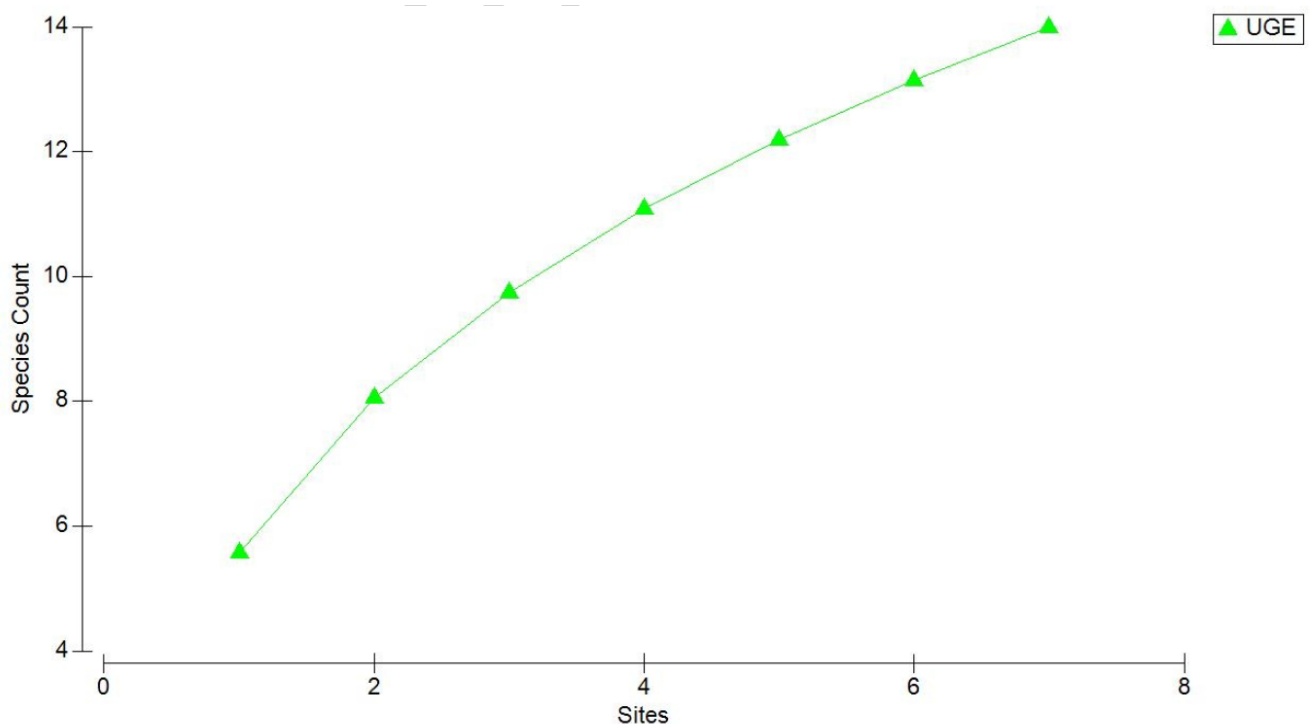


Chart 3 Accumulation Curve for the trap data

5. Conclusion

The survey area comprises of six broad fauna habitat types:

- Wandoo Woodland
- Kyaka Brook- Riparian / Dam / small Water Body
- Mallee Woodland
- Mixed Shrublands on Low hills
- Quartzite Outcropping formations
- Disturbed areas.

The conservation value of each habitat type has been rated based on condition, structural complexity, faunal diversity and habitat for conservation significant fauna (i.e. contains essential habitat for breeding and/or feeding). Habitat values for the six types are all considered high to moderate value. A large portion of the survey area is disturbed and comprises of existing mines, tracks, cleared agricultural lands, old fencing and historical cleared areas, these areas have low significance.

The DBCA *NatureMap* search identifies that 204 vertebrate fauna taxa previously recorded within 20 km of the survey area (DBCA 2018). This total included seven amphibians, 157 birds, one fish, 8 mammals and 31 reptiles.

The trapping program recorded 97 vertebrate fauna species utilising the survey area, including 16 mammals, 63 birds and 18 reptiles. Of these, five introduced species were identified and were all mammals. Based on the database search the trapping program produced approximately half of the predicted species for the area. There are several possible reasons for the low fauna diversity. Firstly, the remnant areas of habitat are fragmented with a history of disturbance. Secondly the remnant habitats are positioned within the environment on heavy rock and soils unsuitable for a large number of species to utilise. This was evident in the trapping data where groups of reptiles that are normally very common in the environment were not sampled i.e. Burtons Legless Lizard, Gould's Monitor, *Ctenotus fallens* and *Morethia obscura*. It is likely that a different suite of faunal groups would be present in other times in the year i.e. amphibians in autumn/winter and seasonally moving species. Additionally, the area has few previous comprehensive or systematic surveys and as such the opportunities to compare results to other studies in the area are limited.

One conservation significant fauna species was identified as present and an additional one potentially occurring in the survey area based on a combination of observations and habitat assessment. Species known to persist in the survey area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – listed under Schedule 2 (Endangered) under the State BC Act and Endangered under the Commonwealth EPBC Act.

Species likely to be present in the survey area:

- Peregrine Falcon (*Falco peregrinus*) – Other special Protection under the BC Act.

Of the conservation significant species discussed in this Report, the Carnaby's Black Cockatoo is the only species relies on the resources (foraging habitat present) within the survey area in order to persist in the region. The survey area (and foraging habitat) is also within approximately 12 km of known breeding areas of Carnaby's Black Cockatoo which is critical to the survival of chicks during the breeding season.

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Appendices

Appendix A

Figures

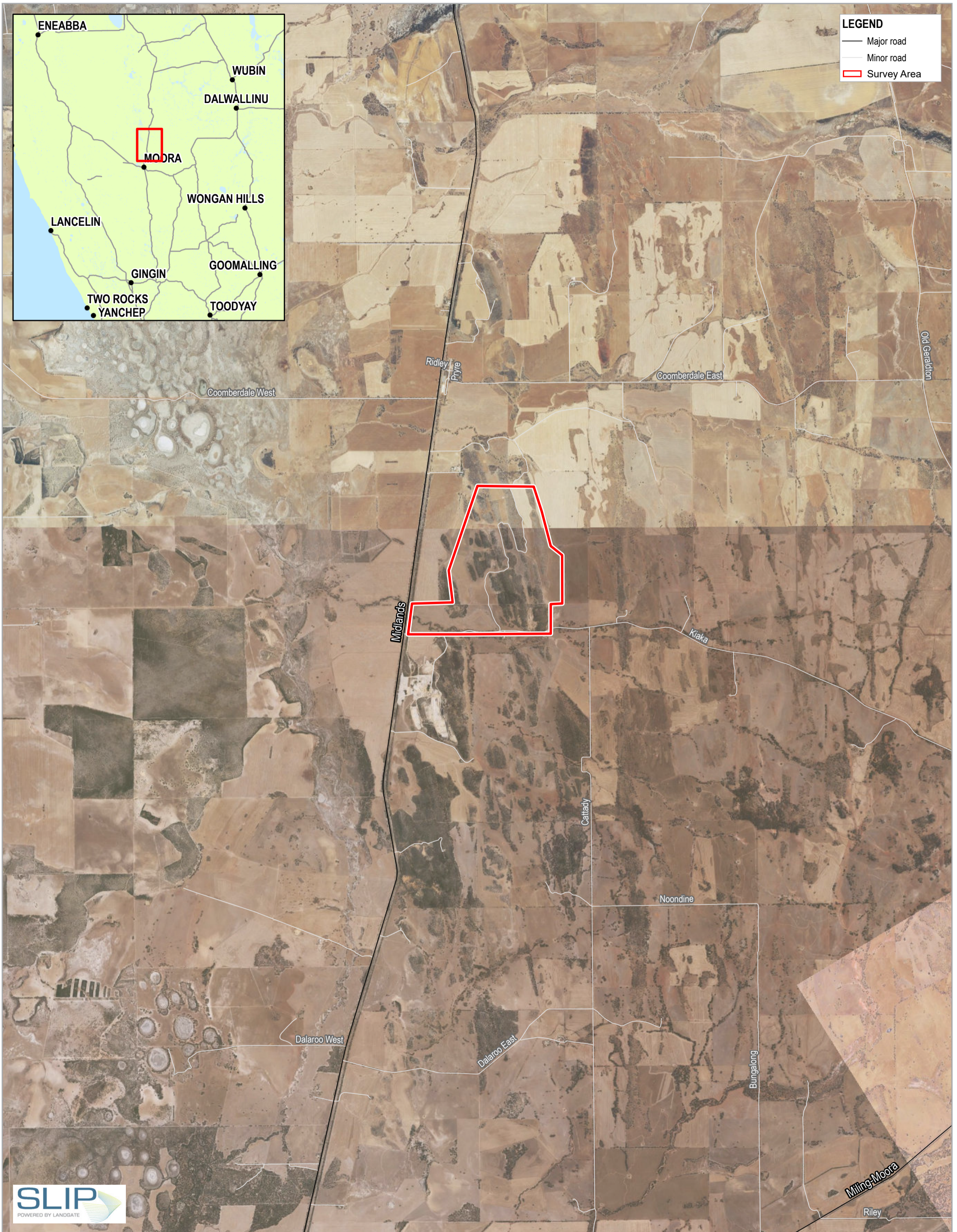
Figure 1 *Project Location*

Figure 2 *Biological Constraints*

Figure 3 *Fauna Methods*

Figure 4 *Fauna Habitats*

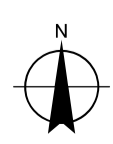
Figure 5 *Fauna Results*



LEGEND
 — Major road
 — Minor road
 □ Survey Area



Paper Size ISO A3
 0 0.5 1 1.5 2
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50

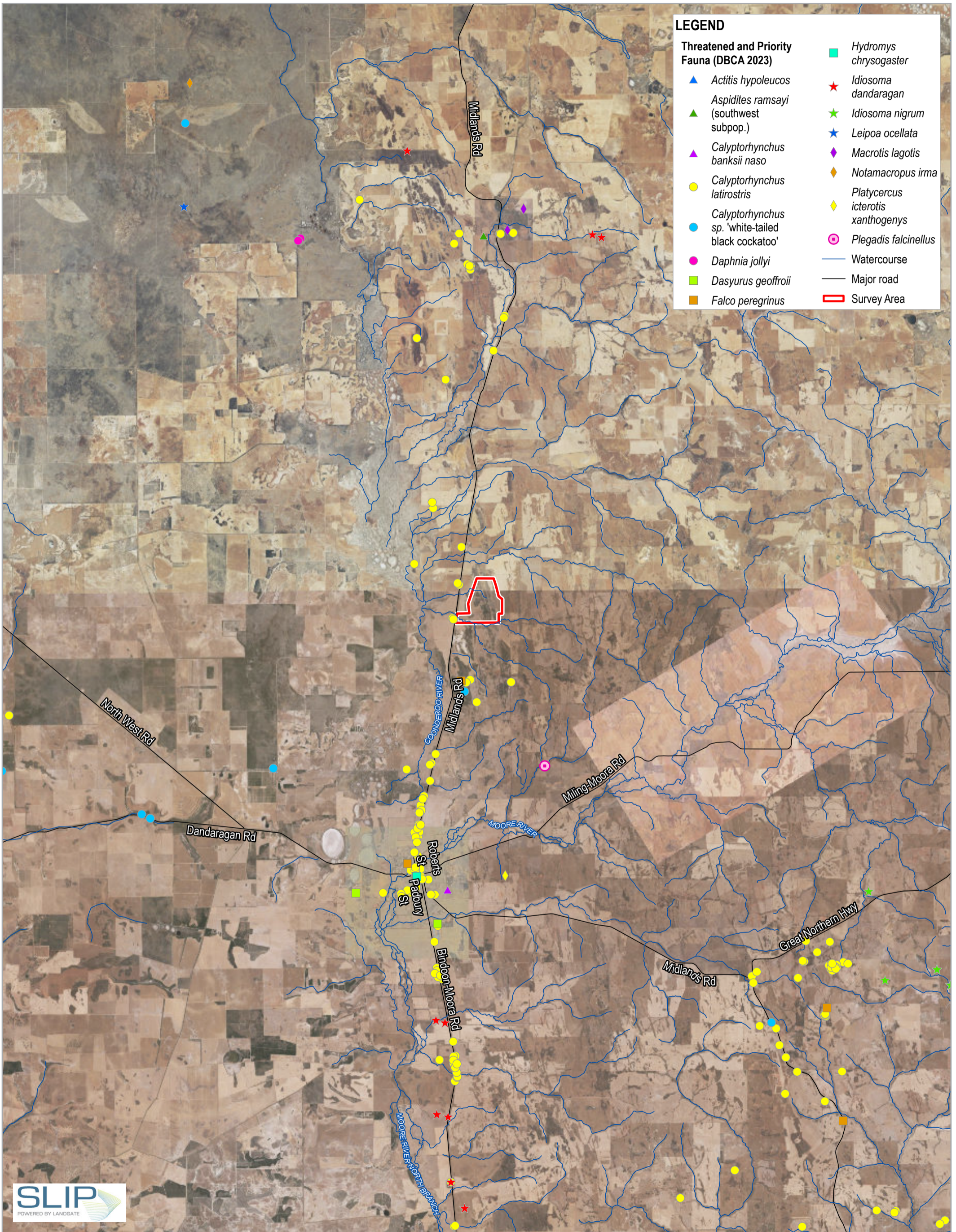


Simcoa Operations Pty. Ltd.
 Simcoa - Nth Kiaka Level 2 Fauna Study

Project No. 12518217
 Revision No. 0
 Date 23 Jun 2021

Project Location

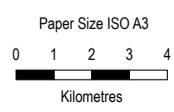
FIGURE 1



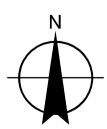
LEGEND

Threatened and Priority Fauna (DBCA 2023)

- | | |
|--|----------------------------------|
| ▲ <i>Actitis hypoleucos</i> | ■ <i>Hydromys chrysogaster</i> |
| ▲ <i>Aspidites ramsayi</i> (southwest subpop.) | ★ <i>Idiosoma dandaragan</i> |
| ▲ <i>Calyptorhynchus banksii naso</i> | ★ <i>Idiosoma nigrum</i> |
| ● <i>Calyptorhynchus latirostris</i> | ★ <i>Leipoa ocellata</i> |
| ● <i>Calyptorhynchus</i> sp. 'white-tailed black cockatoo' | ◆ <i>Macrotis lagotis</i> |
| ● <i>Daphnia jollyi</i> | ◆ <i>Notamacropus irma</i> |
| ■ <i>Dasyurus geoffroii</i> | ◆ <i>Platycercus icterotis</i> |
| ■ <i>Falco peregrinus</i> | ◆ <i>Platycercus xanthogenys</i> |
| | ○ <i>Plegadis falcinellus</i> |
| | — Watercourse |
| | — Major road |
| | ▭ Survey Area |



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

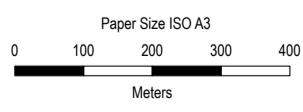
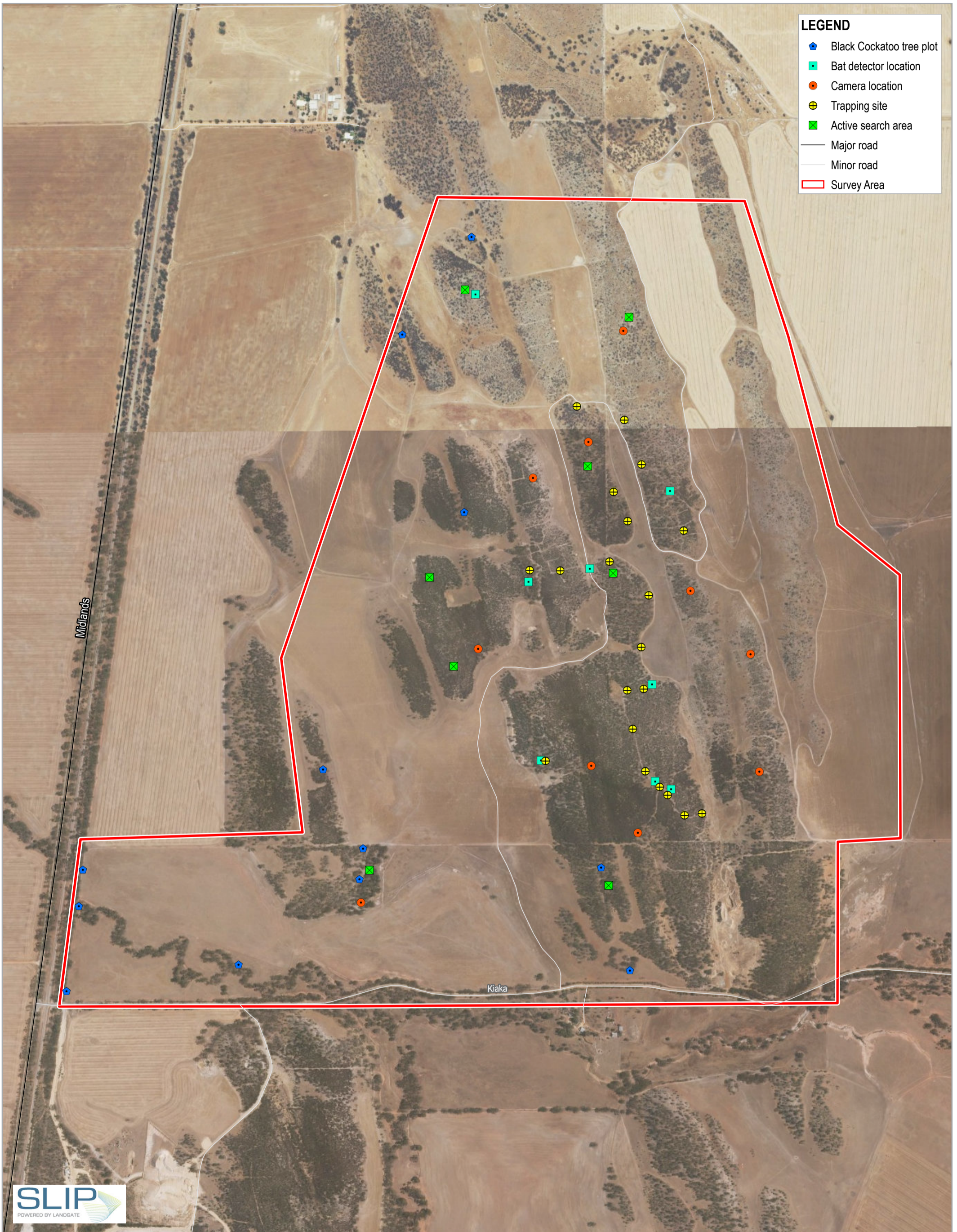


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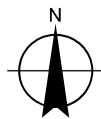
Biological Constraints

Project No. 12518217
Revision No. 0
Date 13 Mar 2023

FIGURE 2



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

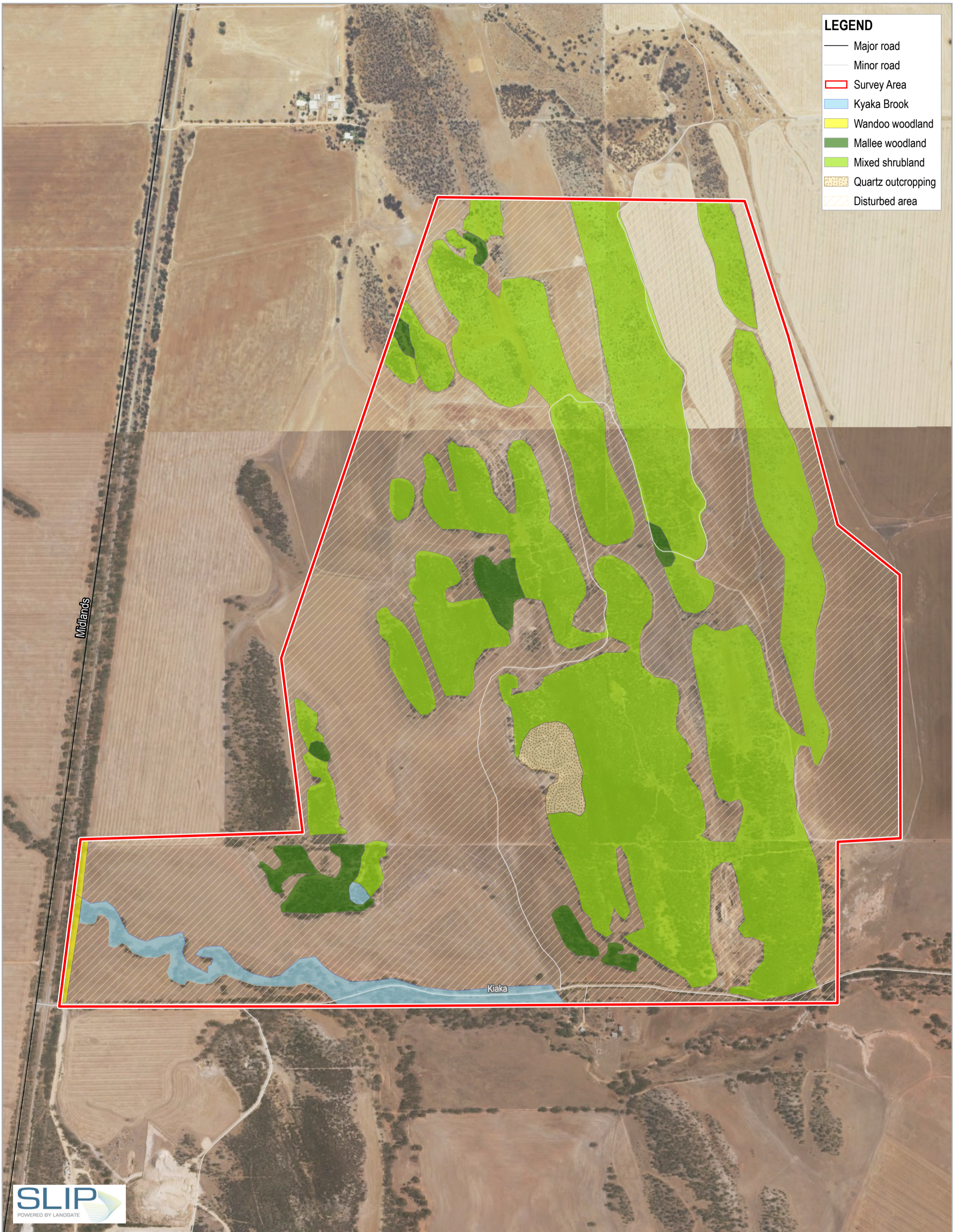


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Fauna Methods

Project No. 12518217
Revision No. 0
Date 23 Jun 2021

FIGURE 3



LEGEND

- Major road
- Minor road
- ▭ Survey Area
- ▭ Kyaka Brook
- ▭ Wandoo woodland
- ▭ Mallee woodland
- ▭ Mixed shrubland
- ▭ Quartz outcropping
- ▭ Disturbed area

Midlands

Kiaka

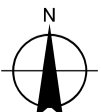


Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

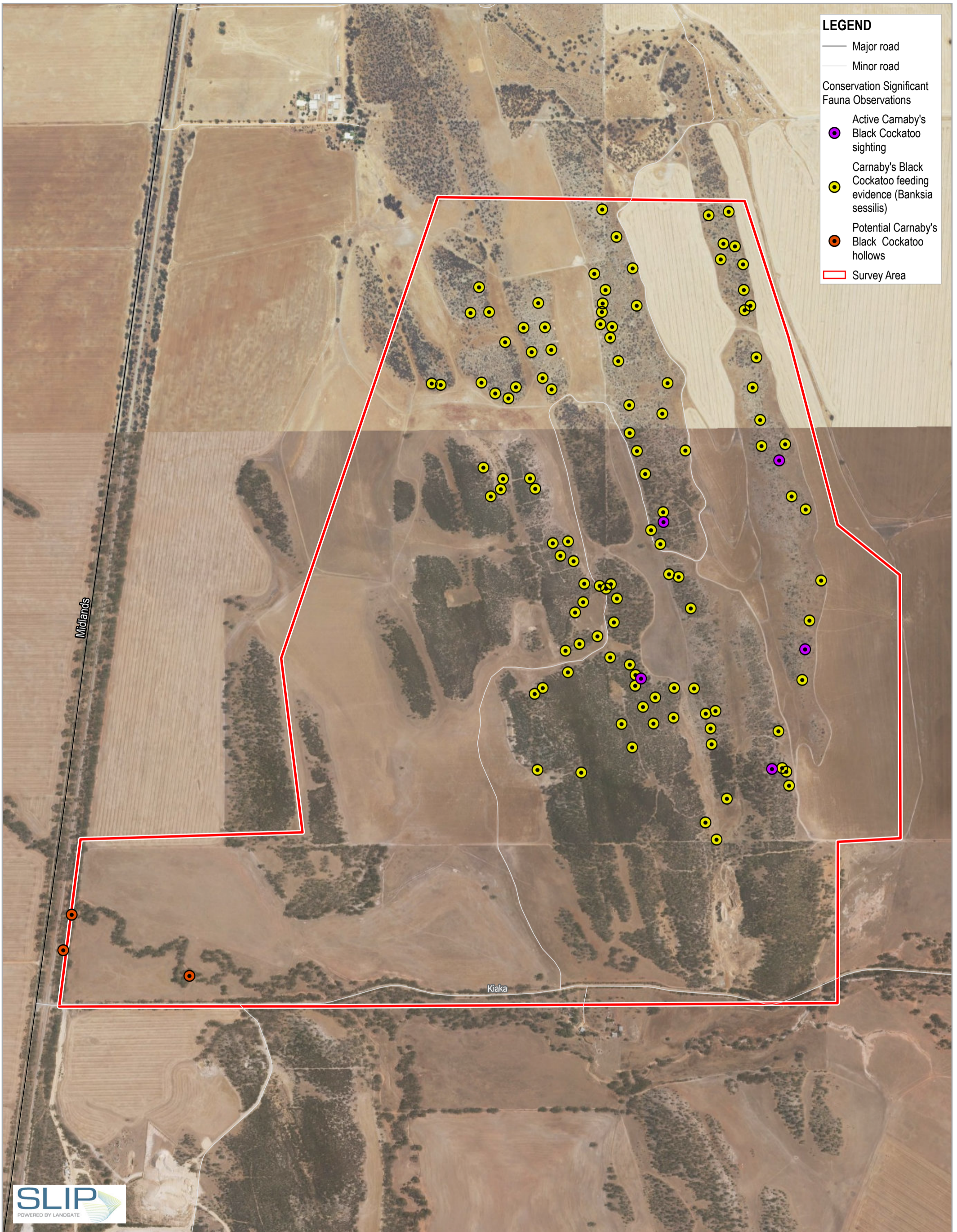


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Fauna Habitats

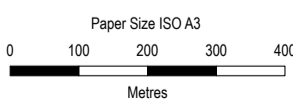
Project No. 12518217
Revision No. 0
Date 23 Jun 2021

FIGURE 4

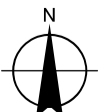


LEGEND

- Major road
- Minor road
- Conservation Significant Fauna Observations
- Active Carnaby's Black Cockatoo sighting (purple circle)
- Carnaby's Black Cockatoo feeding evidence (Banksia sessilis) (yellow circle)
- Potential Carnaby's Black Cockatoo hollows (orange circle)
- Survey Area (red outline)



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 50



Simcoa Operations Pty. Ltd.
 Simcoa - Nth Kiaka Level 2 Fauna Study

Fauna Results

Project No. 12518217
 Revision No. 0
 Date 23 Jun 2021

FIGURE 5

igdhnefghdAU/Perth/Projects/61374553745501 - Fauna Study/GIS/Maps/Working/613745501_FaunaStudy/613745501_FaunaStudy.aprx
 Print date: 23 Jun 2021 - 16:12
 Data source: GHD: Survey area - 20180627, Conservation significant fauna observations - 20190213, Landgate: Roads - 20190138, Imagery - 20171202 (accessed: 20190212)/Landgate_Subscription_Imagery/WANow: Landgate / SLIP. Created by: bjonas2

Appendix B

**Relevant legislation, conservation codes
and background information**

Relevant legislation

Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of the Environment and Energy (DEE).

State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

- a) Native vegetation should not be cleared if it comprises a high level of biodiversity.
- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
- c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
- d) Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.
- e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
- f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
- g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
- h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

- i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.
- j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

State Biodiversity and Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation, protection and promotion of the ecologically sustainable use of biodiversity components in Western Australia. The BC Act replaced both the *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act) as of 1 January 2016. To attain the objectives of the BC Act, principles of ecological sustainable development have been established:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biodiversity and ecological integrity should be a fundamental consideration in decision-making
- Improved valuation, pricing and incentive mechanisms should be promoted

The BC Act is administered by the Department of Biodiversity Conservation and Attractions (DBCA)

State Biosecurity and Agriculture Management Act 2007

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976*. The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

Fauna

Conservation significant fauna

Species of significant fauna are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the BC Act can warrant referral to the DEE and/or the EPA.

The Federal conservation level of fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for Conservation of Nature (IUCN).

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

Under the BC Act aligns with the EPBC Act in that fauna can be Specially Protected, listed as Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia. Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

For the purposes of this assessment, all species listed under the EPBC Act, BC Act and DBCA Priority species are considered conservation significant.

Conservation categories and definitions for EPBC Act and BC Act listed fauna species

Conservation category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A) A species known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or B) A species that has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.

Conservation category	Definition
Critically Endangered	A species facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered	A) A species not critically endangered; and B) A species facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A) A species not critically endangered or endangered; and B) A species facing a high risk of extinction in the wild in the medium-term, as determined in accordance with the prescribed criteria.
Conservation Dependent	A) The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or B) The following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that Section 180 provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Conservation codes for DBCA listed Priority fauna

Priority category	Definition
Priority 1	<p>Poorly-known taxa</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 2	<p>Poorly-known taxa</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 3	<p>Poorly-known taxa</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it</p>

Priority category	Definition
	not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	<p>Rare, Near Threatened and other taxa in need of monitoring</p> <p>A. Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.</p> <p>B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.</p>

Other significant fauna

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

Appendix C

Desktop searches

EPBC Act PMST Report (20 km buffer)

NatureMap (20 km buffer)



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/11/18 17:21:56

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 20.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	43
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	17
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat likely to occur within area
Plants		

Name	Status	Type of Presence
Acacia aprica Blunt Wattle [64821]	Endangered	Species or species habitat may occur within area
Acacia aristulata Watheroo Wattle [64822]	Endangered	Species or species habitat known to occur within area
Acacia cochlocarpa subsp. cochlocarpa Spiral-fruited Wattle [23877]	Endangered	Species or species habitat known to occur within area
Acacia cochlocarpa subsp. velutinosa Velvety Spiral Pod Wattle [65112]	Critically Endangered	Species or species habitat may occur within area
Banksia fuscobracteata Dark-bract Banksia [83059]	Critically Endangered	Species or species habitat may occur within area
Caladenia drakeoides Hinged Dragon Orchid [68687]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
Chorizema humile Prostrate Flame Pea [32573]	Endangered	Species or species habitat likely to occur within area
Conospermum densiflorum subsp. unicephalatum One-headed Smokebush [64871]	Endangered	Species or species habitat known to occur within area
Dasymalla axillaris Native Foxglove [38829]	Critically Endangered	Species or species habitat may occur within area
Daviesia dielsii Diels' Daviesia [19617]	Endangered	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eremophila scaberula Rough Emu Bush [16729]	Endangered	Species or species habitat known to occur within area
Eucalyptus absita Badgingarra Box [24260]	Endangered	Species or species habitat likely to occur within area
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat may occur within area
Eucalyptus dolorosa Dandaragan Mallee, Mount Misery Mallee [56709]	Endangered	Species or species habitat may occur within area
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	Species or species habitat may occur within area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Eucalyptus pruiniramis Midlands Gum, Jinglymia Gum [56403]	Endangered	Species or species habitat known to occur within area
Eucalyptus rhodantha Rose Mallee [9362]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Frankenia conferta Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area
Gastrolobium appressum Scale-leaf Poison [7358]	Vulnerable	Species or species habitat may occur within area
Gastrolobium hamulosum Hook-point Poison [9212]	Endangered	Species or species habitat likely to occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat known to occur within area
Grevillea pythara Pythara Grevillea [64525]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat known to occur within area
Jacksonia pungens Pungent Jacksonia [64920]	Endangered	Species or species habitat may occur within area
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat may occur within area
Synaphea quartzitica Quartz-loving Synaphea [64978]	Endangered	Species or species habitat known to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Verticordia staminosa subsp. staminosa Wongan Featherflower [55825]	Endangered	Species or species habitat may occur within area

Reptiles

Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
--	------------	--

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

Migratory Marine Birds

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur
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Name	Threatened	Type of Presence within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Karamarra	WA
Long Pool	WA
Manaling	WA
Namban	WA
Unnamed WA47694	WA
Watheroo	WA

Invasive Species[\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within

Name	Status	Type of Presence area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.48235 116.04478

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

NatureMap Species Report

Created By Guest user on 13/11/2018

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Species Group All Animals
Method 'By Circle'
Centre 116° 02' 53" E, 30° 29' 21" S
Buffer 20km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
2.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
3.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
4.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
5.	<i>Acanthiza lineata</i>			
6.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
7.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
8.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
9.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
10.	24282 <i>Accipiter fasciatus</i> subsp. <i>fasciatus</i> (Brown Goshawk)			
11.	<i>Acercella falcipes</i>			
12.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
13.	24301 <i>Aegotheles cristatus</i> subsp. <i>cristatus</i> (Australian Owlet-nightjar)			
14.	<i>Agraptocorixa eurynome</i>			
15.	<i>Agraptocorixa parvipunctata</i>			
16.	<i>Alboa worooa</i>			
17.	<i>Allodessus bistrigatus</i>			
18.	<i>Alona</i> cf. <i>rigidicaudis</i> s.l. (CB, but may be multiple spp.)			
19.	<i>Alona rigidicaudis</i>			
20.	<i>Amblyomma triguttatum</i>			
21.	<i>Aname mainae</i>			
22.	24310 <i>Anas castanea</i> (Chestnut Teal)			
23.	24312 <i>Anas gracilis</i> (Grey Teal)			
24.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
25.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
26.	<i>Anisops baylii</i>			
27.	<i>Anisops gratus</i>			
28.	<i>Anisops</i> sp.			
29.	<i>Anisops thienemanni</i>			
30.	25241 <i>Antaresia stimsoni</i> subsp. <i>stimsoni</i> (Stimson's Python)			
31.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
32.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
33.	24599 <i>Anthus australis</i> subsp. <i>australis</i> (Australian Pipit)			
34.	<i>Antiporus</i> sp.			
35.	<i>Apocyclops dengizicus</i>			
36.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
37.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
38.	<i>Araneus cyphoxis</i>			
39.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
40.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
41.	<i>Argiope protensa</i>			
42.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
43.	<i>Artamus cinereus</i> subsp. <i>cinereus</i>			
44.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
45.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
46.	<i>Austrochiltonia subtenuis</i>			
47.	<i>Austrolestes annulosus</i>			
48.	<i>Austrolestes aridus</i>			
49.	24318 <i>Aythya australis</i> (Hardhead)			
50.	<i>Barnardius zonarius</i>			
51.	<i>Bdelloidea</i> sp.			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
52.	<i>Bdelloidea</i> sp. 2:2			
53.	<i>Bennelongia australis</i> lineage			
54.	<i>Bennelongia barangaroo</i> lineage			
55.	<i>Berosus</i> <i>discolor</i>			
56.	<i>Berosus</i> sp.			
57.	<i>Bezzia</i> sp. 1 (SAP)			
58.	24319 <i>Biziura lobata</i> (Musk Duck)			
59.	<i>Boeckella</i> <i>trianticulata</i>			
60.	<i>Brachionus</i> cf. <i>plicatilis</i> (SAP)			
61.	<i>Brachionus</i> <i>plicatilis</i> s.l.			
62.	<i>Brachionus</i> <i>urceolaris</i> s.l.			
63.	42380 <i>Brachyurophis fasciolatus</i> subsp. <i>fasciolatus</i> (Narrow-banded Shovel-nosed Snake)			
64.	42381 <i>Brachyurophis semifasciatus</i> (Southern Shovel-nosed Snake)			
65.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
66.	24722 <i>Cacatua leadbeateri</i> (Major Mitchell's Cockatoo)			
67.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
68.	24723 <i>Cacatua pastinator</i> subsp. <i>butleri</i> (Butler's Corella)			
69.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
70.	24427 <i>Cacomantis flabelliformis</i> subsp. <i>flabelliformis</i> (Fan-tailed Cuckoo)			
71.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
72.	<i>Calamoecia</i> <i>ampulla</i>			
73.	<i>Calamoecia</i> sp. 342 (ampulla variant) (CB)			
74.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
75.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
76.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
77.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
78.	<i>Candonocypris novaezelandiae</i>			
79.	<i>Ceinidae</i> sp.			
80.	<i>Ceratopogonidae</i> sp.			
81.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
82.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattle Bat)			
83.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
84.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
85.	47909 <i>Cheramoeca leucosterna</i> (White-backed Swallow)			
86.	<i>Chironominae</i> sp.			
87.	<i>Chironomus</i> aff. <i>alternans</i> (V24) (CB)			
88.	<i>Chroicocephalus novaehollandiae</i>			
89.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
90.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
91.	24434 <i>Chrysococcyx osculans</i> (Black-eared Cuckoo)			
92.	24288 <i>Circus approximans</i> (Swamp Harrier)			
93.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
94.	<i>Cladopelma curtilvalva</i>			
95.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
96.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i> (Grey Shrike-thrush)			
97.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
98.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
99.	25592 <i>Corvus coronoides</i> (Australian Raven)			
100.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
101.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
102.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
103.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
104.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
105.	24422 <i>Cracticus tibicen</i> subsp. <i>dorsalis</i> (White-backed Magpie)			
106.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
107.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
108.	<i>Cryptochironomus griseidorsum</i>			
109.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
110.	24886 <i>Ctenophorus reticulatus</i> (Western Netted Dragon)			
111.	25027 <i>Ctenotus australis</i>			
112.	<i>Culicidae</i> sp.			
113.	<i>Culicoides</i> sp.			
114.	24322 <i>Cygnus atratus</i> (Black Swan)			
115.	<i>Cypricercus salinus</i>			
116.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
117.	<i>Daphnia carinata</i>			
118.	<i>Daphnia cephalata</i>			
119.	<i>Daphnia</i> sp.			
120.	<i>Daphnia truncata</i>			

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Area	Query
121.	25673 <i>Daphnositta chrysoptera</i> (Varied Sittella)				
122.	24092 <i>Dasyurus geoffroi</i> (Chuditch, Western Quoll)				
123.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)		T		
124.	24939 <i>Delma grayii</i>				
125.	25296 <i>Demiansia psammophis</i> subsp. <i>reticulata</i> (Yellow-faced Whipsnake)				
126.	<i>Diacypris compacta</i>				
127.	<i>Diacypris spinosa</i>				
128.	25607 <i>Dicaeum hindiridaceum</i> (Mistletoebird)				
129.	<i>Dicrotelopes conjunctus</i>				
130.	<i>Dingosa serrata</i>				
131.	24940 <i>Diplodactylus pulcher</i>				
132.	24470 <i>Dromaius novaehollandiae</i> (Emu)				
133.	<i>Dytiscidae</i> sp.				
134.	<i>Echeneis naucrates</i>				
135.	25251 <i>Echiopsis curta</i> (Bardick)				
136.	<i>Ecnomus pansus</i>				
137.	<i>Ecnomus pansus</i>				
138.	<i>Egretta novaehollandiae</i>				
139.	24290 <i>Elianus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)				
140.	<i>Enochrus elongatus</i>				
141.	<i>Enochrus eyrensis</i>				
142.	<i>Eolophus roseicapillus</i>				
143.	24662 <i>Eopsaltria georgiana</i> (White-breasted Robin)				
144.	<i>Ephyridae</i> sp. 6 (SAP)				
145.	24567 <i>Epithanura albifrons</i> (White-fronted Chat)				
146.	24570 <i>Epithanura tricolor</i> (Crimson Chat)				
147.	24379 <i>Erythronyx cinclus</i> (Red-kneed Dotterel)				
148.	<i>Eucyrtops riparia</i>				
149.	24368 <i>Eurostoopodus argus</i> (Spotted Nightjar)				
150.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)				
151.	24472 <i>Falco cenchroides</i> subsp. <i>cenchroides</i> (Australian Kestrel, Nankeen Kestrel)				
152.	24474 <i>Falco longipennis</i> subsp. <i>longipennis</i> (Australian Hobby)				
153.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S		
154.	<i>Forcyptomyia</i> sp.				
155.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)				
156.	24763 <i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)				
157.	24959 <i>Geryora variegata</i>				
158.	25530 <i>Gerygone fusca</i> (Western Gerygone)				
159.	47962 <i>Glyciphila melanops</i> (Tawny-crowned Honeyeater)				
160.	24443 <i>Gralina cyanoleuca</i> (Magpie-lark)				
161.	<i>Gymnocheilus</i> sp. 1 (SAP)				
162.	<i>Gymnocheilus</i> sp. 3 (SAP)				Y
163.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)				
164.	<i>Halipus</i> sp.				
165.	24689 <i>Haliobaena caerulea</i> (Blue Petrel)				
166.	25410 <i>Heletoporus eyrei</i> (Moaning Frog)				
167.	25412 <i>Heleporus psammophilus</i> (Sand Frog)				
168.	<i>Hemiodulla tau</i>				
169.	24961 <i>Heteronotia binotii</i> (Bynoe's Gecko)				
170.	<i>Hexarthra n. sp. a</i> (cf. <i>fennica</i> with 777 unci teeth) (SAP)				
171.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)				
172.	24775 <i>Himantopus himantopus</i> subsp. <i>leucocephalus</i> (Black-winged Stilt)				
173.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)				
174.	<i>Hydraenidae</i> sp.				
175.	<i>Hydrochus australis</i>				
176.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4		
177.	<i>Hydrophilidae</i> sp.				
178.	<i>Hyphydrus</i> sp.				
179.	<i>Ilyocypris spiculata</i> (ms name) (SAP)				
180.	<i>Ilyodromus candollei</i>				
181.	<i>Kerrella australis</i>				
182.	<i>Kerferulus interinctus</i>				
183.	24367 <i>Lalage tricolor</i> (White-winged Tiller)				
184.	<i>Lanceles lanceolatus</i>				
185.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)				
186.	<i>Latoropsis cf. brehmi</i> (SAP)				
187.	25131 <i>Leista distinguenda</i>				
188.	25148 <i>Leista lineopunctulata</i>				
189.	<i>Leydigia cf. leydigii</i> (SAP)				
190.	25005 <i>Lialis burtonis</i>				

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
191.	25659 <i>Lichenostomus leucotis</i> (White-eared Honeyeater)			
192.	24576 <i>Lichenostomus leucotis</i> subsp. <i>novaenorciae</i> (White-eared Honeyeater)			
193.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
194.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
195.	<i>Limbodessus inornatus</i>			
196.	<i>Limbodessus shuckhardi</i>			
197.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
198.	<i>Limnoxenus zelandicus</i>			
199.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
200.	<i>Macrothrix breviseta</i>			
201.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
202.	<i>Malurus cyaneus</i>			
203.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
204.	24544 <i>Malurus lamberti</i> subsp. <i>assimilis</i> (Variegated Fairy-wren)			
205.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
206.	24549 <i>Malurus leucopterus</i> subsp. <i>leuconotus</i> (White-winged Fairy-wren)			
207.	24551 <i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
208.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
209.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
210.	24838 <i>Megalurus gramineus</i> subsp. <i>gramineus</i> (Little Grassbird)			
211.	<i>Megaporus howittii</i>			
212.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
213.	25184 <i>Menetia greyii</i>			
214.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
215.	<i>Mesocyclops brooksi</i>			
216.	<i>Mesostigmata</i> sp.			
217.	<i>Mesoveliidae</i> sp.			
218.	<i>Metacyclops/Pescecylops</i> sp.			
219.	<i>Micronecta robusta</i>			
220.	<i>Missulena granulosa</i>			
221.	<i>Missulena occatoria</i>			
222.	<i>Monohelea</i> sp. 3 (SAP)			
223.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
224.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
225.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
226.	<i>Mytilocypris mytiloides</i>			
227.	<i>Naididae</i> (ex <i>Tubificidae</i>)			
228.	<i>Necterosoma penicillatus</i>			
229.	<i>Necterosoma</i> sp.			
230.	<i>Nematoda</i> sp.			
231.	25426 <i>Neobatrachus pelobatoides</i> (Humming Frog)			
232.	<i>Notalina spira</i>			
233.	<i>Notonectidae</i> sp.			
234.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
235.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
236.	<i>Oecetis</i> sp.			
237.	<i>Oniscidae</i> sp.			
238.	<i>Orthetrum caledonicum</i>			
239.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
240.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
241.	24624 <i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i> (Rufous Whistler)			
242.	<i>Paracymus pygmaeus</i>			
243.	<i>Paramerina levidensis</i>			
244.	25253 <i>Parasuta gouldii</i>			
245.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
246.	24380 <i>Peltohyas australis</i> (Inland Dotterel)			
247.	<i>Pescecylops</i> sp. 442=462=465=CB2 (<i>salinarum</i> in Morton)			
248.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
249.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
250.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
251.	24666 <i>Phalacrocorax melanoleucos</i> subsp. <i>melanoleucos</i> (Little Pied Cormorant)			
252.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
253.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
254.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
255.	<i>Planorbidae</i> sp.			
256.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
257.	24746 <i>Platycercus icterotis</i> subsp. <i>xanthogenys</i> (Western Rosella (inland))		P4	
258.	24748 <i>Platycercus varius</i> (Mulga Parrot)			
259.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
260.	24751 <i>Platycercus zonarius</i> subsp. <i>zonarius</i> (Port Lincoln Parrot)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
261.	<i>Platycypris baueri</i>			
262.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
263.	<i>Pleuroxus inermis</i>			
264.	24679 <i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
265.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
266.	<i>Polypedilum nubifer</i>			
267.	30854 <i>Polytelis anthopeplus</i> subsp. <i>westralis</i> (Regent Parrot)			
268.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
269.	34013 <i>Pomatostomus superciliosus</i> subsp. <i>ashbyi</i> (White-browed Babbler (western wheatbelt))			
270.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
271.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
272.	24770 <i>Porzana pusilla</i> subsp. <i>palustris</i> (Baillon's Crane)			
273.	<i>Procladius paludicola</i>			
274.	<i>Procladius villosimanus</i>			
275.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
276.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
277.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
278.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
279.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
280.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
281.	<i>Pyralidae</i> sp.			
282.	24278 <i>Pyrrholaemus brunneus</i> (Redthroat)			
283.	<i>Raveniella cirrata</i>			
284.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
285.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
286.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
287.	24454 <i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i> (Willie Wagtail)			
288.	<i>Salpesia squalida</i>			Y
289.	<i>Sandalodes joannae</i>			
290.	<i>Sarscyridopsis aculeata</i>			
291.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
292.	24279 <i>Sericornis frontalis</i> subsp. <i>maculatus</i> (White-browed Scrubwren)			
293.	<i>Sigara mullaka</i>			
294.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
295.	30948 <i>Smicromis brevirostris</i> (Weebill)			
296.	24108 <i>Sminthopsis crassicaudata</i> (Fat-tailed Dunnart)			
297.	24528 <i>Sterna hybrida</i> subsp. <i>javanica</i> (Whiskered Tern)			
298.	<i>Sternopriscus multimaculatus</i>			
299.	<i>Sternopriscus</i> sp.			
300.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
301.	<i>Storena formosa</i>			
302.	<i>Stratiomyidae</i> sp.			
303.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
304.	24936 <i>Strophurus michaelsoni</i>			
305.	24942 <i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>			
306.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
307.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
308.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
309.	30871 <i>Taeniopygia guttata</i> subsp. <i>castanotis</i> (Zebra Finch)			
310.	<i>Tanypodinae</i> sp.			
311.	<i>Tanytarsus barbitarsis</i>			
312.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
313.	<i>Tanytarsus nr bispinosus</i> (SAP)			
314.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
315.	<i>Tasmanocoenis tillyardi</i>			
316.	<i>Testudinella patina</i>			
317.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
318.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
319.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
320.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
321.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
322.	24309 <i>Todiramphus sanctus</i> subsp. <i>sanctus</i> (Sacred Kingfisher)			
323.	<i>Triplectides australis</i>			
324.	<i>Trogloderes dewae</i>			
325.	48147 <i>Turnix varius</i> (Painted Button-quail)			
326.	24851 <i>Turnix velox</i> (Little Button-quail)			
327.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
328.	<i>Urodacus novaehollandiae</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
329.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
330.	<i>Xanthagrion erythroneurum</i>			
331.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereeye)			

Conservation Codes

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix D

Fauna Data

Fauna species list

Fauna likelihood of occurrence assessment guideline and definitions

Fauna likelihood of occurrence assessment

Species identified from remote camera Trapping Data

Table 17 Compiled species list

Family	Species	Common Name	Status	This survey
Birds				Totals
<i>Acanthizidae</i>	<i>Acanthiza apicalis</i>	Inland Thornbill		34
<i>Acanthizidae</i>	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill		39
<i>Acanthizidae</i>	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill		22
<i>Acanthizidae</i>	<i>Smicronis brevirostris occidentalis</i>	Weebill		73
<i>Acanthizidae</i>	<i>Pyrrholaemus brunneus</i>	Redthroat		2
<i>Accipitridae</i>	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk		2
<i>Accipitridae</i>	<i>Accipiter fasciatus</i>	Brown Goshawk		3
<i>Accipitridae</i>	<i>Aquila audax</i>	Wedge-tailed Eagle		5
<i>Anatidae</i>	<i>Anus gracilis</i>	Grey Teal		11
<i>Ardeidae</i>	<i>Ardea pacifica</i>	White-necked Heron		2
<i>Ardeidae</i>	<i>Egretta novaehollandiae</i>	White-faced Heron		5
<i>Artamidae</i>	<i>Artamus cinereus</i>	Black-faced Woodswallow		14
<i>Artamidae</i>	<i>Cracticus tiibicen dorsalis</i>	Australian Magpie		35
<i>Artamidae</i>	<i>Cracticus nigrogularis</i>	Pied Butcherbird		11
<i>Artamidae</i>	<i>Cracticus torquatus</i>	Grey Butcherbird		5
<i>Cacatuidae</i>	<i>Cacatua pastinator butleri</i>	Western Corella		6
<i>Cacatuidae</i>	<i>Cacatua sanguinea</i>	Little Corella		4
<i>Cacatuidae</i>	<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	En, En	29
<i>Cacatuidae</i>	<i>Eolophus roseicapilla</i>	Galah		81
<i>Cacatuidae</i>	<i>Nymphicus hollandicus</i>	Cockatiel		18
<i>Campephagidae</i>	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		23
<i>Campephagidae</i>	<i>Lalage sueurii</i>	White-winged Triller		12
<i>Casuariidae</i>	<i>Dromaius novaehollandiae</i>	Emu		1
<i>Columbidae</i>	<i>Ocyphaps lophotes</i>	Crested Pigeon		8
<i>Columbidae</i>	<i>Phaps chalcoptera</i>	Common Bronzewing		9
<i>Corvidae</i>	<i>Corvus coronoides perplexus</i>	Australian Raven		19
<i>Cuculidae</i>	<i>Cacomantis pallidus</i>	Pallid Cuckoo		3
<i>Falconidae</i>	<i>Falco cenchroides cenchroides</i>	Nankeen Kestrel		5
<i>Falconidae</i>	<i>Falco longipennis</i>	Hobby Falcon		4
<i>Falconidae</i>	<i>Falco berigora</i>	Brown Falcon		2
<i>Halcyonidae</i>	<i>Todiramphus sanctus</i>	Sacred Kingfisher		3
<i>Halcyonidae</i>	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher		1
<i>Hirundinidae</i>	<i>Petrochelidon nigricans</i>	Tree Martin		5
<i>Hirundinidae</i>	<i>Cheramoeca leucosterna</i>	White-backed Swallow		4
<i>Maluridae</i>	<i>Malurus splendens</i>	Splendid Fairy-wren		4
<i>Maluridae</i>	<i>Malurus lamberti</i>	Variiegated Fairy-wren		6
<i>Meliphagidae</i>	<i>Manorina flavigula</i>	Yellow-throated Miner		2

Family	Species	Common Name	Status	This survey
Birds				Totals
<i>Meliphagidae</i>	<i>Anthochaera carunculata</i>	Red Wattlebird		13
<i>Meliphagidae</i>	<i>Lichenostomus leucotis</i>	White-eared Honeyeater		5
<i>Meliphagidae</i>	<i>Lichenostomus virescens virescens</i>	Singing Honeyeater		17
<i>Meliphagidae</i>	<i>Lichmera indistincta</i>	Brown Honeyeater		34
<i>Meliphagidae</i>	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater		4
<i>Meliphagidae</i>	<i>Glyciphila melanops</i>	Tawny-crowned Honeyeater		2
<i>Meliphagidae</i>	<i>Purnella albifrons</i>	White-fronted Honeyeater		7
<i>Meropidae</i>	<i>Merops ornatus</i>	Rainbow bee-eater		0
<i>Monarchidae</i>	<i>Grallina cyanoleuca</i>	Magpie-lark		7
<i>Megaluridae</i>	<i>Cincloramphus mathewsi</i>	Rufous Songlark		1
<i>Megaluridae</i>	<i>Cincloramphus cruralis</i>	Brown Songlark		3
<i>Motacillidae</i>	<i>Anthus novaeseelandiae</i>	Richards Pipit		16
<i>Nectariniidae</i>	<i>Dicaeum hirundinaceum</i>	Mistletoebird		4
<i>Neosittidae</i>	<i>Daphoenositta chrysoptera</i>	Varied Sittella		4
<i>Pachycephalidae</i>	<i>Colluricincla harmonica</i>	Grey Shrike-thrush		11
<i>Pachycephalidae</i>	<i>Pachycephala rufiventris</i>	Rufous Whistler		21
<i>Pardalotidae</i>	<i>Pardalotus striatus</i>	Striated Pardalote		5
<i>Petroicidae</i>	<i>Petroica goodenovii</i>	Red-capped Robin		26
<i>Phasianidae</i>	<i>Coturnix ypsilophora</i>	Brown Quail		17
<i>Pomatostomidae</i>	<i>Pomatostomus superciliosus</i>	White-browed Babbler		nests
<i>Psittacidae</i>	<i>Barnadius zonarius semitorquatus</i>	Australian Ringneck		34
<i>Psittacidae</i>	<i>Polytelis anthopeplus</i>	Regent Parrot		20
<i>Rhipiduridae</i>	<i>Rhipidura leucophrys leucophrys</i>	Willie Wagtail		3
<i>Strigidae</i>	<i>Ninox novaeseelandiae</i>	Boobook Owl		3
<i>Timaliidae</i>	<i>Zosterops lateralis</i>	Silvereye		27
<i>Turnicidae</i>	<i>Turnix velox</i>	Little Button Quail		2
Reptiles				
<i>Agamidae</i>	<i>Pogona minor</i>	Western Bearded Dragon		8
<i>Agamidae</i>	<i>Ctenophorus reticulatus</i>	Western Netted Dragon		1
<i>Diplodactylidae</i>	<i>Diplodactylus granariensis</i>	Western Stone Gecko		13
<i>Elapidae</i>	<i>Brachyurophis semifasciatus</i>	Southern Shovel-nosed Snake		1
<i>Elapidae</i>	<i>Demansia psammophis reticulata</i>	Reticulated Whip Snake		1
<i>Elapidae</i>	<i>Pseudechis australis</i>	Mulga Snake		1
<i>Elapidae</i>	<i>Peudonaja mengdeni</i>	Gwardar		1
<i>Elapidae</i>	<i>Simoselaps bertholdi</i>	Jan's Banded Snake		2
<i>Gekkonidae</i>	<i>Gehyra variegata</i>	Tree Dtella		55
<i>Gekkonidae</i>	<i>Heteronotia binoei</i>	Binoe's Gecko		3

Family	Species	Common Name	Status	This survey
Birds				Totals
<i>Pygopodidae</i>	<i>Aprasia repens</i>	Sand-plain Worm Lizard		3
<i>Pygopodidae</i>	<i>Delma fraseri</i>	Frasier's Legless Lizard		2
<i>Scincidae</i>	<i>Cryptoblephorus buchananii</i>	Buchanan's Snake-eyed Skink		8
<i>Scincidae</i>	<i>Lerista distinguenda sp. Nov</i>	South-west Four-toed Lerista		4
<i>Scincidae</i>	<i>Menetia greyii</i>	Common Dwarf Skink		30
<i>Scincidae</i>	<i>Tiliqua rugosa</i>	Bobtail		21
<i>Typhlopidae</i>	<i>Anilius australis</i>	Southern Blind Snake		1
<i>Varanidae</i>	<i>Varanus tristis tristis</i>	Black-headed Monitor		9
Mammals				
<i>Bovidae</i>	<i>Ovis aries</i>	Sheep	Int	scat
<i>Canidae</i>	<i>Vulpes vulpes</i>	Red Fox	Int	24
<i>Dasyuridae</i>	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		1
<i>Felidae</i>	<i>Felis catus</i>	Cat	Int	2
<i>Leporidae</i>	<i>Oryctolagus cuniculus</i>	European Rabbit	Int	1
<i>Macropodidae</i>	<i>Macropus fuliginosus</i>	Western Grey Kangaroo		214
<i>Macropodidae</i>	<i>Macropus robusta</i>	Euro, Common Wallaroo		8
<i>Molossidae</i>	<i>Mormopterus kitcheneri</i>	South-western Free-tailed Bat		X
<i>Molossidae</i>	<i>Tadarida australis</i>	White-striped Freetail Bat		X
<i>Muridae</i>	<i>Mus musculus</i>	House Mouse	Int	4
<i>Phalangeridae</i>	<i>Trichosurus vulpecula</i>	Common Brushtail Possum		3
<i>Tachyglossidae</i>	<i>Tachyglossus aculeatus</i>	Echidna		1
<i>Vespertilionidae</i>	<i>Chalinolobus gouldii</i>	Gould's Wattle Bat		X
<i>Vespertilionidae</i>	<i>Chalinolobus morio</i>	Chocolate Wattle Bat		X
<i>Vespertilionidae</i>	<i>Nyctophilus geoffroyi or gouldii</i>	Long-eared Bats		X
<i>Vespertilionidae</i>	<i>Vespadelus regulus</i>	Southern Forest Bats		X

Table 18 Fauna likelihood of occurrence assessment guidelines

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the survey area.
Likely	Species are likely to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the survey area.
Unlikely	Species assessed as unlikely include those species previously recorded within 10 km of the survey area however: <ul style="list-style-type: none"> – There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area. – The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area. OR Those species that have a known distribution overlapping with the survey area however: <ul style="list-style-type: none"> – There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). – The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.
Highly unlikely	Species that are considered highly unlikely to occur in the survey area include: <ul style="list-style-type: none"> – Those species that have no suitable habitat within the survey area. – Those species that have become locally extinct, or are not known to have ever been present in the region of the survey area.

Source information - desktop searches

NM – DBCA NatureMap (accessed July 2018)

PMST – DEE Protected Matters Search Tool (PMST) to identify fauna listed under the EPBC Act potentially occurring within study area (accessed Oct 2018)

Table 19 Definitions

Term	Description
study area	a 40 km buffer around the survey area
survey area	the area subject to the current survey
region	the area within an approximate 40 km radius of the survey area
Cr	Critically endangered
En	Endangered
Vu	Vulnerable
IA	International agreement
Mi, Ma	Migratory, Marine
CD	Conservation dependent
OS	Other specially protected fauna
P1 – P4	Priority 1 – Priority 4

Table 20 Fauna Likelihood of Occurrence Assessment

Taxonomy	Common Name	Status		Species Information	Likelihood of Occurrence	Source
		EPBC Act	WC Act/DBCA			
Birds						
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi, Ma	IA	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. Sometimes they occur on rocky shores. They are widespread from Cape Arid to Carnarvon, around coastal and subcoastal plains of Pilbara Region to south-west and east Kimberley Division. Inland records indicate the species is widespread and scattered from Newman, east to Lake Cohen, south to Boulder and west to Meekatharra.	Highly Unlikely. The survey area has no suitable habitat for this species	DBCA
<i>Calidris ferruginea</i>	Curlew Sandpiper	Cr Mi	Cr, IA	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh, brackish waters and occasionally around floodwaters (DOTE 2016).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi, Ma	IA	In Australia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum (DotE 2016). The bird can be seen on the Swan Coastal Plain but is rare to scarce on Lake Thompson, and as well on any freshwater wetland in the southwest with shallow, well-grassed margins. They are seen at Lake Warden, Esperance, and at Lake McLarty (Nevill 2013).	Highly Unlikely. The survey area has no suitable habitat for this species	DBCA
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	En	En	Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum, wandoo, marri, jarrah and karri, and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. Breeding activity is restricted to eucalypt woodlands mainly in the semi-arid and subhumid interior, from Kalbarri in the north, Three Springs District south to the Stirling Range, west to Cockleshell Gully and east to Manmanning. The species has expanded its breeding range westward and south into the jarrah-marri forests of the Darling Scarp and into the tuart forests of the Swan Coastal Plain, including the Yanchep area, Lake Clifton and near Bunbury.	Known. The species was observed during the survey. Feeding evidence and potential breeding areas are present in the survey area.	DBCA, EPBC
<i>Apus pacificus</i>	Fork-tailed swift	Mi, Ma	IA	In WA there are sparsely scattered records along the coast, ranging from the Eyre Bird Observatory and up the west coast. They are widespread in coastal and sub-coastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. The species is regularly seen in the Pilbara and Kimberley following cyclone and major storm activity. This species is almost exclusively aerial, flying less than 1 m to at least 300 m above ground. This species is considered rare in the south-west region (DotE 2016).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Tringa nebularia</i>	Common Greenshank	Mi, Ma	IA	The Common Greenshank is found in a wide variety of inland wetlands and coastal habitats of varying salinity. It occurs in sheltered coastal areas typically with large mudflats and saltmarsh, mangroves or seagrass, including embayments, harbours, river estuaries, deltas and lagoons, but less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, clay pans and saltflats, and artificial wetlands. They occur around most of the coast from Cape Arid in the south to Carnarvon in the north-west (DotE 2016).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi, Ma	IA	The Common Sandpiper is found along all coastlines of Australia and uses a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around open narrow and steep muddy margins or rocky shores. The species has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, mangroves, billabongs, reservoirs, dams and clay pans, and occasionally piers and jetties. It is often found near mangroves, and sometimes in areas of mud littered with rocks or snags. Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and Western Australia (DotE 2016).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (south-east Western Australia). The Malleefowl is associated with long unburnt thick vegetation and occupies shrublands and low woodlands that are dominated by mallee vegetation, native pine Callitris woodlands, Acacia shrublands, Broombush vegetation or coastal heathlands. The breeding habitat is characterised by light soil and an abundant leaf litter, which is used in the construction of nesting mounds (Frith 1959; Marchant & Higgins 1993). The nest is a conspicuous large mound of sand or soil and organic matter (Jones and Goth 2008, Morcombe 2004).	Unlikely. Although this species is wide spread, populations are patchily disbursed and in this region persist in dense low shrubland of Mallee and Acacia. No habitat was considered suitable for this species due to its	DBCA, EPBC

Taxonomy	Common Name	Status		Species Information	Likelihood of Occurrence	Source
		EPBC Act	WC Act/DBCA			
					fragmented nature and no evidence of the species was recorded.	
<i>Numenius madagascariensis</i>	Eastern Curlew	Cr Mi	Cr, IA	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves, and in coastal saltworks and sewage farms (Marchant & Higgins 1993). They are found commonly along the north coast of WA, but rarely south of Shark Bay (Morcombe 2004). They are uncommon further south of Geraldton (Nevill 2013).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Motacilla cinerea</i>	Grey Wagtail	Mi	IA	The Grey Wagtail is an opportunistic migrant to Australia. The species typically migrates to Indonesia occasionally landing in Australia. Most records for the species are from Northern Australia and South Australia (Morcombe 2004). The non-breeding habitat only of the Grey Wagtail has a strong association with water, particularly rocky substrates along water courses but also lakes and marshes (DotE 2016). It can be found mainly in banks and rocks in fast-running freshwater habitats: rivers, creeks, streams, and around waterfalls, both in forest and open country; but occurs almost anywhere during migration (Johnstone & Storr 2004).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
<i>Oxyura australis</i>	Blue-billed Duck		P4	The blue-billed duck is a small Australian almost entirely aquatic duck (Morcombe 2004). The blue-billed duck is endemic to Australia's temperate regions, ranging from the south west of WA, extending to southern Queensland, through NSW and Victoria, to Tasmania. The species is readily seen on freshwater lakes and billabongs where deep fresh water is present (Morcombe 2004).	Highly Unlikely. The survey area has no suitable habitat for this species	DBCA
<i>Falco peregrinus</i>	Peregrine Falcon		OS	The Peregrine Falcon is seen occasionally anywhere in the south-west of WA. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe, 2004).	Likely. Species is known from the region, however use would be opportunistic and utilised for foraging purposes only. No breeding habitat was present.	DBCA
<i>Pezoporus occidentalis</i>	Night Parrot	En	Cr	The Night Parrot inhabits arid and semi-arid areas that are characterized by having dense, low vegetation. Based on accepted and recent records, the habitat of the Night Parrot consists of Triodia grasslands in stony or sandy environments and of samphire and chenopod shrublands, on floodplains and claypans, and on the margins of salt lakes, creeks or other sources of water. The distribution of the Night Parrot is very poorly understood however recent observations have recorded the species near to Lorna Glen (East of Wiluna), Pilbara and southern Kimberley.	Highly Unlikely. The species is not known to persist in the region. No habitat was present for this species to persist.	DBCA
<i>Platycercus icterotis subsp. xanthogenys</i>	Western Rosella		P4	The wheatbelt subspecies of Western Rosella lives in woodland, and its persistence is associated with habitat remnants. The main food of the western subspecies is the seeds of casuarinas, but it also takes seeds from grass, weedy herbs and fruit. Nesting of this subspecies is in hollows.	Unlikely. The species was not recorded during the survey and very little Eucalyptus Woodland with hollows is present suitable for the species. Feeding habitat is present and may be utilised opportunistically.	DBCA
<i>Rostratula australis</i>	Australian Painted Snipe	En	En	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia, canegrass, or sometimes tea-tree. It sometimes uses areas that are lined with trees, or that have some scattered fallen or washed-up timber (DotE 2016). In the south west it can be found around Carnarvon and wetlands north of Perth, particularly those west of Moora and Gin Gin (Nevill 2013).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
Reptiles						
<i>Egernia stokesii subsp. badia</i>	Western Spiny-tailed Skink	En	Vu	The Western Spiny-tailed Skink (brown form) was originally known from a limited number of sites in the northern and central wheatbelt of Western Australia. Most records of the brown form Western Spiny-tailed Skink are in York Gum (<i>Eucalyptus loxophleba</i>) woodland with some records in Gimlet (<i>E. salubris</i>) and Salmon Gum (<i>E. salmonophloia</i>) woodland. Populations persist in woodland patches as small as one hectare and completely surrounded by wheatfields. Sites with the greatest number of individuals contain numerous fallen logs and were subjected to low-intensity grazing by domestic stock. Hollow logs are used as refuge sites in woodland habitat. Preferred refuges consist of piles of several, overlapping, hollow logs providing a combination of basking and shelter sites. An increasing number of skinks are being located in altered habitat under piles of wood, scrap metal or under buildings on private property (DotE 2016).	Unlikely. The species was not recorded during the survey and very little Eucalyptus Woodland with suitable micro habitats were available.	DBCA, EPBC
Fishes						
<i>Nannatherina balstoni</i>	Balston's Pygmy Perch	V	V	Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west Western Australia, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (Allen et al. 2002).	Highly Unlikely. The survey area has no suitable habitat for this species	EPBC
Mammals						

Taxonomy	Common Name	Status		Species Information	Likelihood of Occurrence	Source
		EPBC Act	WC Act/DBCA			
<i>Hydromys chrysogaster</i>	Water-rat, Rakali		P4	Water-rats live primarily in a wide variety of freshwater habitats, from sub-alpine streams and other inland waterways to lakes, swamps, farm dams and irrigation channels and are thought to be one of the few native species to have at least partially benefited from human encroachment (Gardner and Serena, 1995).	Highly Unlikely. The survey area has no suitable habitat for this species	DBCA
<i>Dasyurus geoffroii</i>	Chuditch	Vu	Vu	The Chuditch inhabits eucalypt forest (especially Jarrah), dry woodland and mallee shrublands of semi arid environs. In the Avon Region the species is known from forest around Mundaring, Toodyay and pockets of areas around the Swan Valley. There is a population persisting around the Julimar Forest and this would be the closest population to the survey area. This population is a translocated and monitored population that primarily persists within the large and intact remnant forest in the area. Although this species can travel large distances and has a large home range it is highly unlikely to be present in the Moora region due to the region being highly fragmented and unmanaged (for predators).	Highly unlikely. The species has not been recorded in the survey area and the species is considered regionally extinct.	EPBC

Table 21 Species recorded on Remote Camera

Species	Common Name	Status										
			Cam G2	Cam GG	Cam 30	Cam 77	Cam 43	Cam 41	Cam 77D	Cam 42	Cam 44	Cam 45
Birds												
<i>Anus gracilis</i>	Grey Teal									11		
<i>Ardea pacifica</i>	White-necked Heron									2		
<i>Egretta novaehollandiae</i>	White-faced Heron									5		
<i>Cracticus tibicen</i>	Australian Magpie							1				
<i>Eolophus roseicapilla</i>	Galah									2		
<i>Phaps chalcoptera</i>	Common Bronzewing							1	3	1		3
<i>Corvus coronoides</i>	Australian Raven									5		1
<i>Grallina cyanoleuca</i>	Magpie-lark									5		
<i>Coturnix ypsilophora</i>	Brown Quail											1?
Reptiles												
<i>Tiliqua rugosa</i>	Bobtail						1	4	1			
Mammals												
<i>Vulpes vulpes</i>	Red Fox	int	1		1	2	3			3		2
<i>Felis catus</i>	Cat	int					1					
<i>Macropus fuliginosus</i>	Western Grey Kangaroo		7	3	1	7	11	15	15	3	3	4
<i>Macropus robusta</i>	Euro				3					1		1
<i>Mus musculus</i>	House Mouse	int									1	2
<i>Trichosurus vulpecula</i>	Common Brushtail Possum							3				
<i>Tachyglossus aculeatus</i>	Echidna							1				



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Appendix N

**Subterranean Fauna Desktop Assessment
(Invertebrate Solutions 2019)**

Desktop Assessment of Subterranean Fauna for the North Kiaka Quartzite Mine, Moora, Western Australia



Report by Invertebrate Solutions for
Simcoa Contracting Ltd on behalf of
GHD Pty Ltd

June 2019

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Invertebrate Solutions. (2019). Desktop assessment of subterranean fauna for the North Kiaka Quartzite Mine, Moora, Western Australia. Unpublished report to GHD, June 2019.

Report Number 2018ISJ1002_F01_20190619

Prepared for: Simcoa Contracting Ltd, on behalf of GHD Pty Ltd

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Executive Summary

Simcoa Operations Pty Ltd (Simcoa Operations) is proposing to construct and operate a quartzite quarry at the North Kiaka Project area (the Project), with processing and associated infrastructure at the adjacent existing Simcoa operations to the south. The proposed mine is located approximately 20 kilometres (km) north of Moora in the Wheatbelt region of Western Australia.

Mining of the quartzite will occur above groundwater and will include a simple open cut operation with clearing and topsoil stockpiling, overburden drilling and blasting followed by conventional removal with truck.

Invertebrate Solutions has been requested by GHD Pty Ltd (GHD) on behalf of Simcoa Operations to undertake a desktop assessment for subterranean fauna (stygo fauna and troglo fauna) for the North Kiaka Project area.

The North Kiaka Project is located primarily in Noondine Chert surrounded by lower lying colluvium and alluvium to the west of the Project area and minor outcrops of the Mokadine Formation to the south east. The colluvium and alluvium lithologies to the west of the Project area have a low suitability for both troglo fauna and stygo fauna habitat due to the absence of interconnected voids in these fine grained units. The Noondine Chert is known to contain palaeokarst and subsurface voids that is highly suitable habitat for stygo fauna (Appleyard 2002). The Noondine Chert is the target lithology for the North Kiaka Quartzite Project and previous subterranean fauna surveys for the existing Simcoa operations revealed the existence of a stygal community within the local groundwater. The Noondine Chert formation located within North Kiaka Project is also known to contain at least four species of stygo fauna.

Searches of the Western Australian Museum databases for Crustaceans and Arachnids/Myriapods were undertaken of a rectangle of approximately 50 km sides centred on the North Kiaka quartzite project. The results of these filtered for subterranean species revealed no specimen records of any subterranean fauna held by the Western Australian Museum.

The known stygo fauna previously recorded by Knott and Goater 2005, do not occur within the current North Kiaka Project area with the records being to the north of the proposed development area and within the existing approved operations.

Due to the presence of stygo fauna within a fractured rock aquifer within the Project area, there is a moderate likelihood that habitat exists for troglo fauna within the unsaturated zone of the Noondine Chert. No core photos were available for examination to confirm the presence or absence of suitable fracturing that provides interconnected void space in the upper rock strata that may provide habitat for troglo fauna.

The mining pit excavation is anticipated to have a low to moderate impact upon any local stygo fauna community and a low impact on potential troglo fauna as no dewatering is anticipated to occur thus limiting any potential impacts.

The waste rock storage areas are anticipated to have a low risk of impact to stygo fauna and troglo fauna, dependent upon it not significantly altering subsurface hydrology or clogging

subterranean voids with fine sediment. This risk will be minimised by locating the waste rock dump on the colluvium units within the North Kiaka Project area.

The construction and operation of other associated surface mine infrastructure are expected to pose a Low risk to stygofauna and potential troglifauna.

The following recommendations are made with regard to the potential development of the North Kiaka Project:

- The surface clearing footprint and positioning of infrastructure should be tailored to minimise clearing within and adjacent to any identified subterranean fauna habitat. The impacts to this habitat should be assessed in a detailed manner following finalisation of the surface footprint of the Project.
- The storage of hydrocarbons on site should be limited and all storage areas fully bunded.

1. Introduction

Simcoa Operations Pty Ltd (Simcoa Operations) is proposing to construct and operate a quartzite quarry at the North Kiaka Project area (the Project), with processing and associated infrastructure at the adjacent existing Simcoa operations to the south. The proposed mine is located approximately 20 kilometres (km) north of Moora in the Wheatbelt region of Western Australia.

Mining of the quartzite will occur above groundwater and will include a simple open cut operation with clearing and topsoil stockpiling, overburden drilling and blasting followed by conventional removal with truck.

Invertebrate Solutions has been requested by GHD Pty Ltd (GHD) on behalf of Simcoa Operations to undertake a desktop assessment for subterranean fauna (stygo fauna and troglifauna) for the North Kiaka Project area.

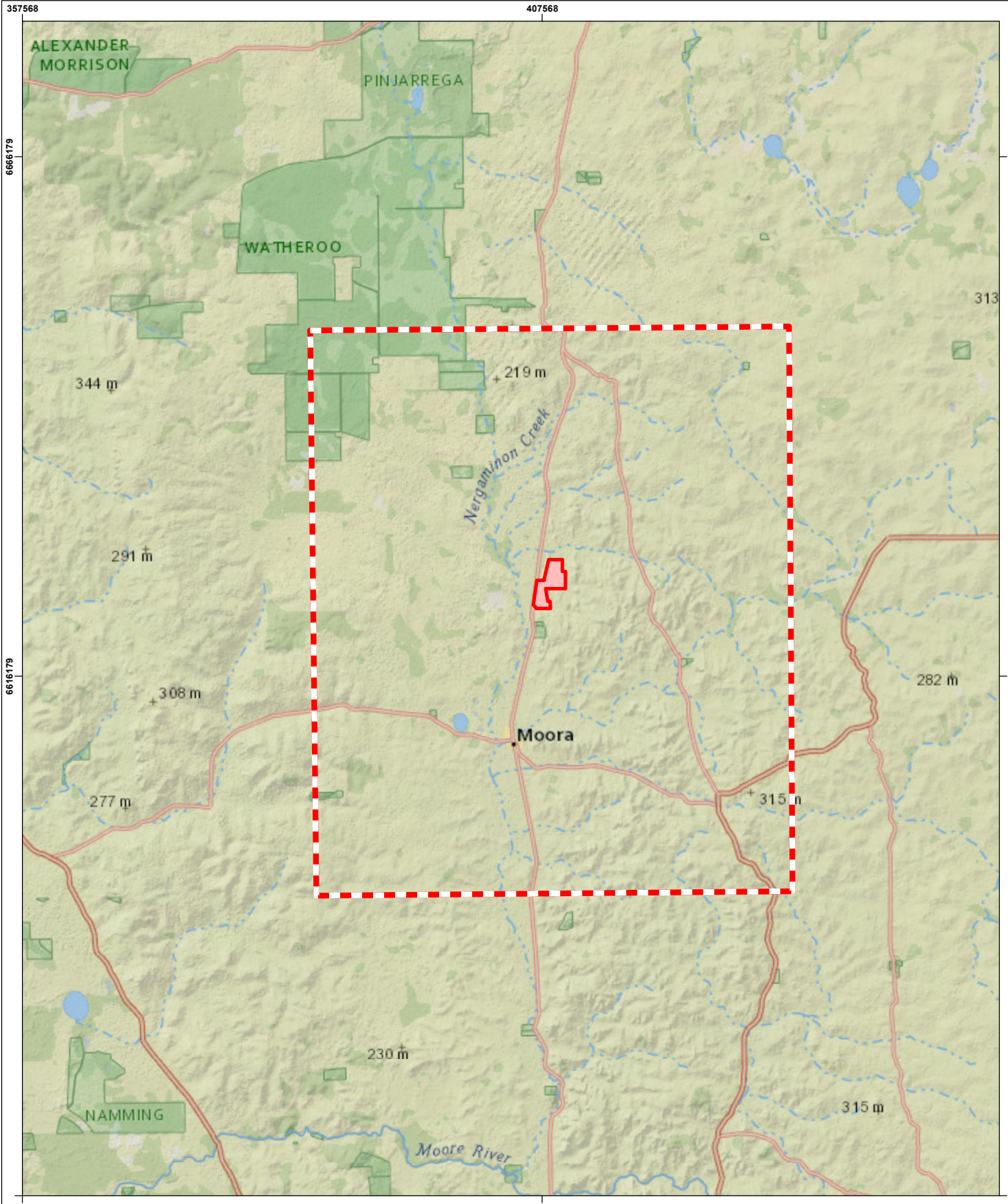
Subterranean fauna are comprised of stygo fauna (aquatic subterranean dependent species) and troglifauna (air breathing subterranean dependent species) which are known to be relatively diverse on a worldwide scale in Western Australia. Many species of subterranean fauna have highly restricted ranges, due to habitat connectivity issues and evolutionary history. Stygo fauna and troglifauna are known to occur widely in much of Western Australia with many locally endemic species present.

The high degrees of local endemism and lack of habitat connectivity make subterranean fauna susceptible to impacts from sometimes localised projects, with species' extinction a real possibility if they are not adequately considered during project planning phases.



1.1. Purpose of this report

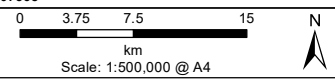
GHD has requested Invertebrate Solutions to undertake the following scope of works for the North Kiaka Project area, Moora, Western Australia:

- Undertake a desktop review for stygo fauna and troglifauna presence.
- Undertake a risk assessment for impacts to stygo fauna and troglifauna from the proposed development.
- Provide recommendations to minimise potential impacts and any suggested requirements for further work to comply with relevant legislation.
- Provide a written report containing the above items.



Legend

-  Dekstop Study Area
-  Site Boundary



-NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP



- LOCALITY MAP SOURCED FROM LANDGATE 2006
 - NATGEO WORLD MAP FROM OPEN SOURCE



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PROJECT ID		DATE	
North Kiaka Quartzite Mine		24/01/2019	
HORIZONTAL DATUM AND PROJECTION			
GDA 1994 MGA Zone 50			
CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

Client: Simcoa Operations Ltd

Figure 1
 Subterranean Fauna Desktop
 Assessment, North Kiaka
 Quartzite Mine, Moora, WA

1.2. Purpose of this report

GHD has requested Invertebrate Solutions to undertake the following scope of works for the North Kiaka Project area, Cape Range, Western Australia:

- Undertake a desktop review for stygofauna and troglifauna presence.
- Undertake a risk assessment for impacts to stygofauna and troglifauna from the proposed development.
- Provide recommendations to minimise potential impacts and any suggested requirements for further work to comply with relevant legislation.
- Provide a written report containing the above items.

1.3. Study Area

The proposed mine is located approximately 20 kilometres (km) north of Moora in the Wheatbelt region of Western Australia and is shown in Figure 1. The desktop study area comprised a rectangle of approximately 50 km sides bounded by the north west corner (30.281015°S, 115.807140°E) and the south east corner (30.771696°S, 116.286079°E) centred on the North Kiaka quartzite project.



1.4. Documents examined

The following documents have been examined in the compilation of this report, along with other referenced scientific papers used to provide general background:

- Geological Survey of Western Australia (1982). Moora 1:250,000 Sheet SF 50-10 Geological Map, Geological Survey of Western Australia.
- Knott, B. and Goater, S. (2005). Moora Quartzite Mine Stygofauna Pilot Study.
- Moulds, T.A. (2007a). Subterranean fauna of the Eneabba, Jurien and South Hill River (Nambung) karst areas, Western Australia. Unpublished report to the Department of Environment and Conservation Mid West Region, 27p.
- Moulds, T.A. (2007b). October sampling of subterranean invertebrate fauna of the Eneabba, Jurien and South Hill River (Nambung) karst areas, Western Australia. Unpublished report to the Department of Environment and Conservation Mid West Region, 10p.

This report has been prepared with regard to the Technical Guidance – subterranean fauna survey (EPA2016a), Technical Guidance – sampling methods for subterranean fauna (EPA2016b), and the Environmental Factor Guideline – Subterranean Fauna (EPA 2016c).

1.5. Conservation Legislation and Guidance Statements

Subterranean fauna are protected under state legislation via the newly enacted Biodiversity Conservation (BC) Act (2016) which came into force on 1st January 2019, replacing the outdated Wildlife Conservation (WC) Act (1950). The new BC Act is aligned with the federal Environment Protection and Biodiversity Conservation (EPBC) Act (1999). The assessment of subterranean fauna for environmental impact assessment (EIA) is undertaken in Western Australia with regard to the Technical Guidance – Subterranean Fauna Survey (EPA2016a), Technical Guidance – Sampling

Methods for Subterranean Fauna (EPA2016b) and the Environmental Factor Guideline – Subterranean Fauna (EPA 2016c).

At the State level, the BC Act provides a list of species that have special protection as species listed under Part 2 of Biodiversity Conservation Act, 2016. This notice is updated periodically by the Department of Biodiversity, Conservation and Attractions (DBCA) (formerly the Department of Parks and Wildlife (DPaW) and the current list (November 2018) includes numerous subterranean species mainly from the Cape Range and Pilbara regions. Included in the list are crustaceans, arachnids and myriapods that are considered to be “rare or likely to become extinct, as critically endangered fauna, or are declared to be fauna that is in need of special protection” (DPaW 2015). In addition to the specially protected fauna, DBCA also maintains a list of Priority fauna that are considered to be of conservation significance but do not meet the criteria for formal listing under the BC Act. The Priority fauna list is irregularly updated by DBCA and, although it offers no formal legislative protection, these species are generally considered in the EIA process.

The Biodiversity Conservation Act now provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), along with threatening processes. Several subterranean ecological communities are recognised as Threatened including the Bundera Cenote Anchialine community on Cape Range, Cameron’s Cave near the townsite of Exmouth on Cape Range, stygal root mat communities in both the Yanchep and Margaret River regions and stygobionts in the Ethel Gorge aquifer in the Pilbara.

The federal EPBC Act protects both species and ecological communities. The most relevant listings for subterranean fauna include the Bundera Cenote on the western side of the Cape Range which contains a unique anchialine ecosystem including the stygal Cape Range Remipede *Kumonga exleyi* (Yager and Humphreys 1996) that is listed as Vulnerable. The Cape Range gudgeon *Milyeringa veritas* and the Cape Range blind eel *Ophisternon candidum* (Humphreys 2008) are also listed as Vulnerable species from subterranean habitats on the Cape Range.

1.6. Classifications of subterranean dependence

Subterranean fauna is a collective term that refers to both troglofauna (terrestrial subterranean fauna inhabiting air voids) and stygofauna (aquatic subterranean fauna) (Humphreys 2000).

Extensive amounts of jargon has historically been associated with subterranean fauna and multiple forms of classification have been used through time (Sket 2008). The most commonly accepted and used terms divide troglofauna into categories that describe a particular species’ degree of dependence upon the subterranean environment. Due to the reliance upon ecological information to determine if a species is a troglobite, the concept of troglomorphy (Christiansen 1962), specific morphological adaptations to the subterranean environment, is used to define obligate subterranean species. The term troglomorphy, initially confined to morphology has since been used to describe both morphological or behavioural adaptations (Howarth 1973). This combination provides a practical system, easily applied in the field and with minimum of detailed ecological study required (Sket 2008). The level of subterranean dependency for different ecological groupings is described below:

- Troglobiont: animals that are obligate subterranean species, and mostly show morphological adaptation to subterranean habitats (troglomorphisms) including depigmentation, loss or

reduction of eyes, elongation of appendages, flightlessness or wing reduction, and extra sensory hairs.

- Troglaphiles: animals that can complete their entire lifecycle within a cave but possess no specific adaptations to the cave environment. These species are capable of living outside caves in suitably dark and moist epigeal habitats.
- Troglaxenes: animals that use the subterranean environment, but require surface environments to complete part of their lifecycle (generally either feeding or breeding). Common troglaxenes are cave dwelling bats, cave swiftlets and cave crickets that leave subterranean habitats to feed.

The terms above refer to stygofauna when the prefix is altered to stygo (Humphreys 2000).

Species which inhabit the deep soil habitat (Edaphophiles) often exhibit convergent morphological adaptations to those animals found exclusively within caves, such as eyelessness, body flattening, loss of pigmentation etc. Soil dwelling species commonly do not show highly restricted distributions as they are less easily isolated in evolutionary timeframes, thus only true troglotic animals are the focus of surveys for subterranean fauna. Taxa discussed in this study were assessed upon their combination of loss/reduction of eyes, and reduction in pigmentation, wing development, and elongation of appendages to assess if a taxa was an edaphophile or truly reliant upon the subterranean habitat (Troglont).

1.7. Report Limitations and Exclusions

This study was limited to the written scope provided to the client by Invertebrate Solutions (30th July 2018) and in Section 1.2. This study was limited to the extent of information made available to Invertebrate Solutions at the time of undertaking the work. Information not made available to this study, or which subsequently becomes available may alter the conclusions made herein.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Invertebrate Solutions has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Invertebrate Solutions described in this report (this section and throughout this report). Invertebrate Solutions disclaims liability arising from any of the assumptions being incorrect.

Invertebrate Solutions has prepared this report on the basis of information provided by GHD on behalf of Simcoa Operations and others (including Government authorities), which Invertebrate Solutions has not independently verified or checked beyond the agreed scope of work. Invertebrate Solutions does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.8. Assumptions and Limitations

Invertebrate Solutions has made the following assumptions in the writing of this report and its subsequent conclusions:

- The potential impacts identified and assessed in Section 4 are not necessarily exhaustive and may change with additional detail regarding the potential development.
- No core photos were made available to assess the potential for habitat for troglofauna above the saturated zone.
- No dewatering will be required for the mining proposal and operations will not occur below the local watertable.
- No groundwater will be abstracted within the Project area for construction or other purposes.
- The impacts to subterranean fauna may require additional investigation following finalisation of the development plan.

2. Desktop Methods

The subterranean fauna desktop review comprises of two distinct sections:

- An assessment of the likelihood that subterranean species are present in the habitats located within the study area.
- Consideration of the potential impacts to subterranean species that may occur as a result of the proposal.

2.1 Likelihood of Subterranean fauna occurrence

The likelihood of stygofauna and troglafauna species occurring in the study area was assessed using a combination of regional information, geological, hydrogeological and database searches including:

- Analysis of published and unpublished reports concerning subterranean fauna from the region.
- Available geological maps.
- Geological, geotechnical and hydrogeological information available for the Study area.
- Results of a Protected Matters Search from the Federal Government's Department of the Environment and Energy website.
- Records of fauna held by the Western Australian Museum.

Based on the analysis of all available information the study area was assigned a level of likelihood to support subterranean fauna of either 'Low', 'Moderate', 'High', or 'Definite'.

2.2 Potential Impacts to Subterranean Fauna

The potential impacts of the installation of infrastructure and general construction activities on subterranean fauna may be categorised as being either direct or indirect impacts.

Direct impacts are the obvious and unavoidable destruction or degradation of habitat that occurs in excavation for footings and other subsurface excavations, including associated aquifer dewatering. Indirect impacts are generally gradational, and more difficult to predict and manage because they may occur at moderate to large distances from the project footprint. These impacts may be expressed some time after development has been undertaken.

Some examples include changes to hydrology, nutrient and microclimate regimes, contamination, reduced habitat area, water quality, and population viability. The zone of influence for indirect impacts may be considerably larger than the immediate area of the disturbance area. Potential indirect impacts of development include:

- Alteration of surface hydrology that affects groundwater recharge regimes, sedimentation, and water quality (e.g. under and adjacent to infrastructure areas, roads and hard packed surfaces).
- Reduction in organic inputs beneath areas cleared of vegetation and sealed surfaces.
- Vibration disturbance from construction and operational activities.
- Surface and groundwater contamination from plant equipment and infrastructure (e.g. chemical pollutants, hydrocarbons or waste water of lower quality).

- Changes to subterranean microclimate in rock masses surrounding clearing areas (exposure of subterranean habitat to desiccation).
- Risk of species extinction from reduction and/or fragmentation in habitat.
- Cumulative impacts from nearby developments

The Project aspects were reviewed to assess the potential severity of impact to potential subterranean habitats. In evaluating the relevance of these factors to the Project, consideration was given to the magnitude, duration and spatial extent of the impacts, where known. This assessment has taken the approach of considering these broad categories of potential impacts and evaluating their occurrence and relative severity. The impacts were then assigned a level of either 'Low', 'Moderate', or 'High' according to their potential degree to adversely affect the EPA's objective to maintain representation, diversity, viability and ecological function at the species, population and assemblage level for subterranean fauna.

Where an impact is designated as 'Low' no further consideration to this factor is required if all assumptions made throughout this report are correct.

3. Desktop Subterranean Fauna Review

3.1 Subterranean fauna in the Wheatbelt

Knowledge of subterranean fauna within the Wheatbelt is less than the more comprehensively surveyed areas of the Pilbara and Yilgarn. Sporadic surveys for troglofauna have been undertaken from the limestone caves near the coast from the 1970s to recent years (Moulds 2007a, 2007b, WASG 2016). To the east of the karstic calcarenite coastal band, on the eastern side of the Darling fault some pilot surveys for stygofauna have been undertaken in other lithologies including quartzite north of Moora at the Kiaka Quartzite mine (Knott and Goater 2005).

On the western side of the Darling Fault to the North Kiaka Project, troglofauna are known to occur throughout the karstic areas of the coastal Tamala limestones (Moulds 2007a, 2007b). These are moderately diverse although the diversity of troglobionts is low. Several species of troglofauna do appear to be restricted in range to this limestone band although sampling at a regional scale has been ad hoc and research is required.

The Yarragadee aquifer, occurring to the west of the Darling Fault, is a confined aquifer and the deepest of the three aquifers (Gnangara Mound and Leederville Aquifer) that combine to form the Yarragadee formation. The Yarragadee formation is comprised of poorly sorted sandstones that are highly porous and can therefore store large amounts of water also making it prospective habitat for stygofauna. No published results for any stygofauna sampling is available for the deeper Yarragadee aquifer, however, stygofauna has been sampled within the superficial Gnangara Mound as part of regional stygofauna sampling (Bennelongia 2008). This sampling has shown that stygofauna do occur within the unconfined aquifer, but with low species richness. A moderately extensive regional sampling program recorded only 11 from within the Gnangara Mound between Guilderton in the north, east to the Darling fault and south to the Swan River (Bennelongia 2008). This aquifer does not occur within the North Kiaka Project area.

When stygofauna is present it does, however, show high levels of endemism with 98% of the stygobites and 83% of the other groundwater species occur only within the Pilbara (Halse et al. 2014). Recent analysis by Halse et al. (2014) has shown that there is little correlation between water quality and geology for predicting the presence of stygofauna, however, the non-random siting of groundwater wells in highly transmissive locations within various geologies has undoubtedly created a bias in the data. The use of predictive modelling has shown that some of the highest diversity areas in the Pilbara for stygofauna are within Quaternary alluvial aquifers (Halse et al. 2014).

3.2 Conservation Significant Fauna and Habitats

A search was undertaken for conservation significant subterranean fauna for the Study Area using both the DPaW Wildlife Conservation (Specially Protected Fauna) Notice 2018 (DPaW 2018) and the Protected Matters Search Tool (PMST) of the Australian Government's Department of the Environment and Energy (DEE). No subterranean species were found to be listed under either of these resources. A full description of the DPaW conservation codes are shown in Appendix 1.

3.3 Subterranean Fauna Habitat in the Project Area

The North Kiaka Project is located primarily in Noondine Chert surrounded by lower lying colluvium and alluvium to the west of the Project area and minor outcrops of the Mokadine Formation to the south east (Table 1, Plate 1). The colluvium and alluvium lithologies to the west of the Project area have a low suitability for both troglifauna and stygofauna habitat due to the absence of interconnected voids in these fine grained units. The lateritic unit may provide some limited habitat for stygofauna in the saturated zone depending upon the degree of weathering present.

The Yarragadee sandstones and conglomerates that provide highly suitable habitat for stygofauna, with known occurrences of stygofauna from the Yarragadee formation near Lancelin (Bennelongia 2008) are located on the western side of the Darling Fault which separates the Noondine Chert within the Project area from this stygofauna habitat.

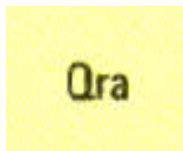
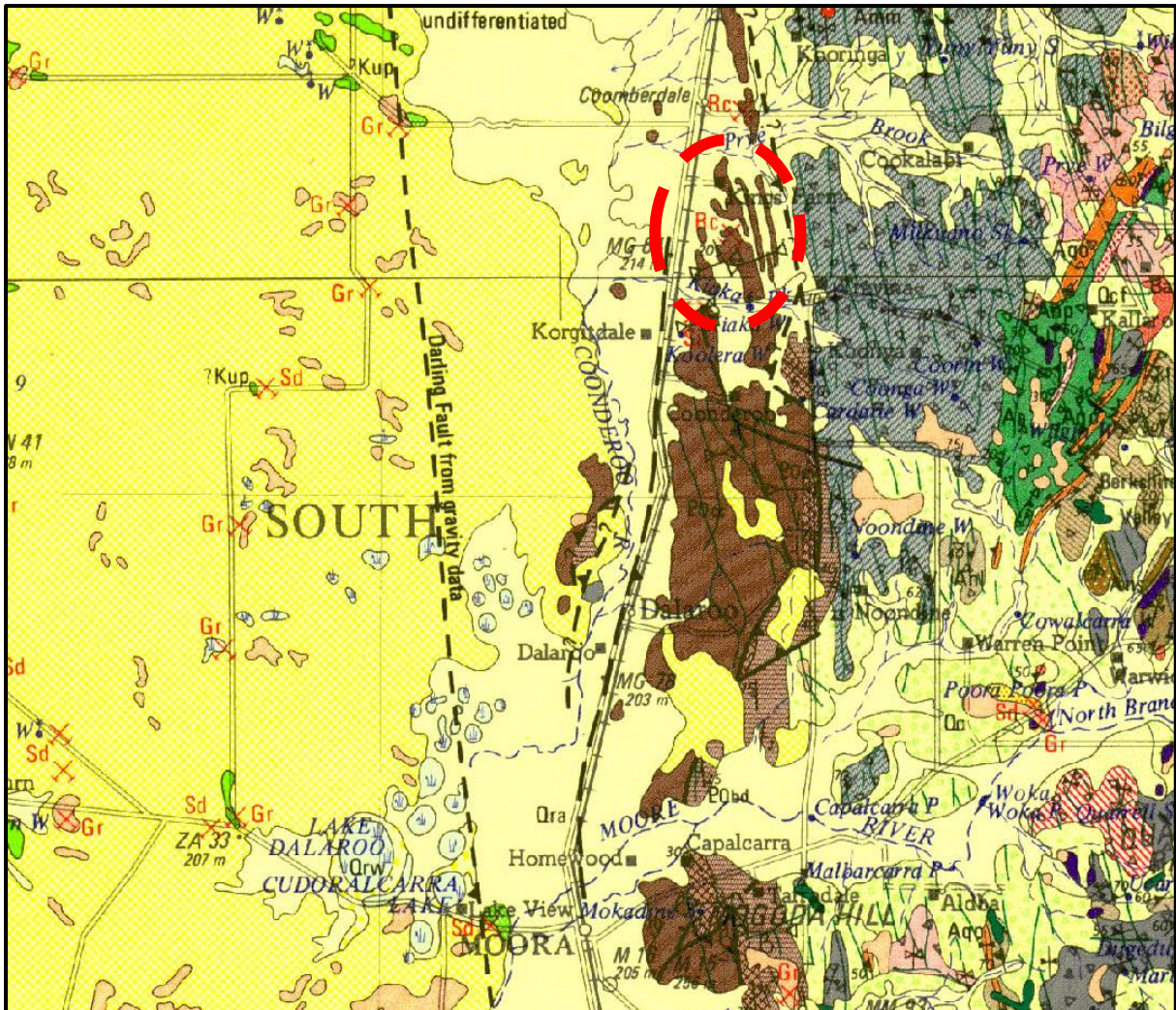
The Noondine Chert is known to contain palaeokarst and subsurface voids that is highly suitable habitat for stygofauna (Appleyard 2002). The Noondine Chert is the target lithology for the North Kiaka Quartzite Project and previous subterranean fauna surveys for the existing Simcoa operations (Knott and Goater, 2005) revealed the existence of a stygal community within the local groundwater. The Noondine Chert formation located within North Kiaka Project is also known to contain at least four species of stygofauna (Knott and Goater 2005).

The Mokadine Formation that has minor outcrops to the south east of the North Kiaka Project area would provide a low to moderate likelihood of containing stygofauna habitat, unless it is highly fractured within the saturated zone. The likelihood of troglifauna habitat being present within this formation is low due to a general absence of interconnected void space in sandstone units.

The basement Archean migmatites also has a low likelihood of stygofauna or troglifauna habitat unless it is highly fractured which is generally uncommon in such lithologies.

Table 1 Geological units in the North Kiaka Project and Subterranean fauna habitat potential.

Unit	Description / Remarks	Subterranean Fauna Suitability
Colluvium and alluvium	Quartz sand and soil	Low for stygofauna and troglifauna.
Yarragadee Formation	Sandstone and conglomerate (situated across the Darling Fault to the Project area)	Moderate/High for stygofauna. Low/Moderate for troglifauna.
Noondine Chert	Chert and orthoquartzite with minor sandstone and dolomite	Stygofauna known to occur in the Noondine Chert Moderate for troglifauna
Mokadine Formation	Arkose with sandstone siltstone, claystone and chert	Low/Moderate for stygofauna (unless highly fractured) Low for troglifauna
Archean basement migmatite	Partially remelted Archean metamorphic rock	Low for stygofauna and troglifauna unless highly fractured.



Qra
Ora – Colluvium and alluvium



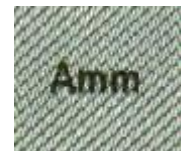
JKY
JKY – Yarragadee Formation



POcc
POcc – Noondine Chert



POc
POc – Mokadine formation



Amm
Amm – Migmatite basement

Plate 1 Inset of the geology surrounding the North Kiaka Quartzite Project. The brown units represent the Noondine chert. The red dashed line shows the approximate position of the Proposed development.

3.4 Likelihood of stygofauna presence

A search was undertaken of the Western Australian Museum databases for Crustaceans (WAM 2018a) and Arachnids/Myriapods (WAM 2018b). The desktop study area comprised a rectangle of approximately 50 km sides bounded by the north west corner (30.281015°S, 115.807140°E) and the south east corner (30.771696°S, 116.286079°E) centred on the North Kiaka quartzite project. The results of these filtered for subterranean stygofauna species. No stygofauna has previously been recorded from the Project area from Western Australian Museum database records (WAM 2018a and 2018b), however, records of stygofauna recorded by Knott and Goater (2005) are summarised in Table 2 and locations are shown in Figure 2.

Table 2 Stygofauna recorded by Knott and Goater 2005 from the Simcoa Quartzite Project.

Higher Classification	Family	Genus and Species	Notes
Nematoda		<i>Undetermined genus and species</i>	Bore MT35
Oligochaeta	Naidae	<i>Undetermined genus and species</i>	Bore M1455
Bathynellaceae	Parabathynellidae	<i>Undetermined genus sp1</i>	identified by Knott and Goater 2005 to family only, Site M1099
	Bathynellid	<i>Undetermined genus sp2</i>	identified by Knott and Goater 2005 to family only Site MT36

The known stygofauna previously recorded by Knott and Goater 2005, do not occur within the current North Kiaka development area (Figure 2), with the records being to the north of the proposed development area and within the existing approved operations. Images of the Parabathynellid species 1 from bore M1099 are shown in Plate 2.

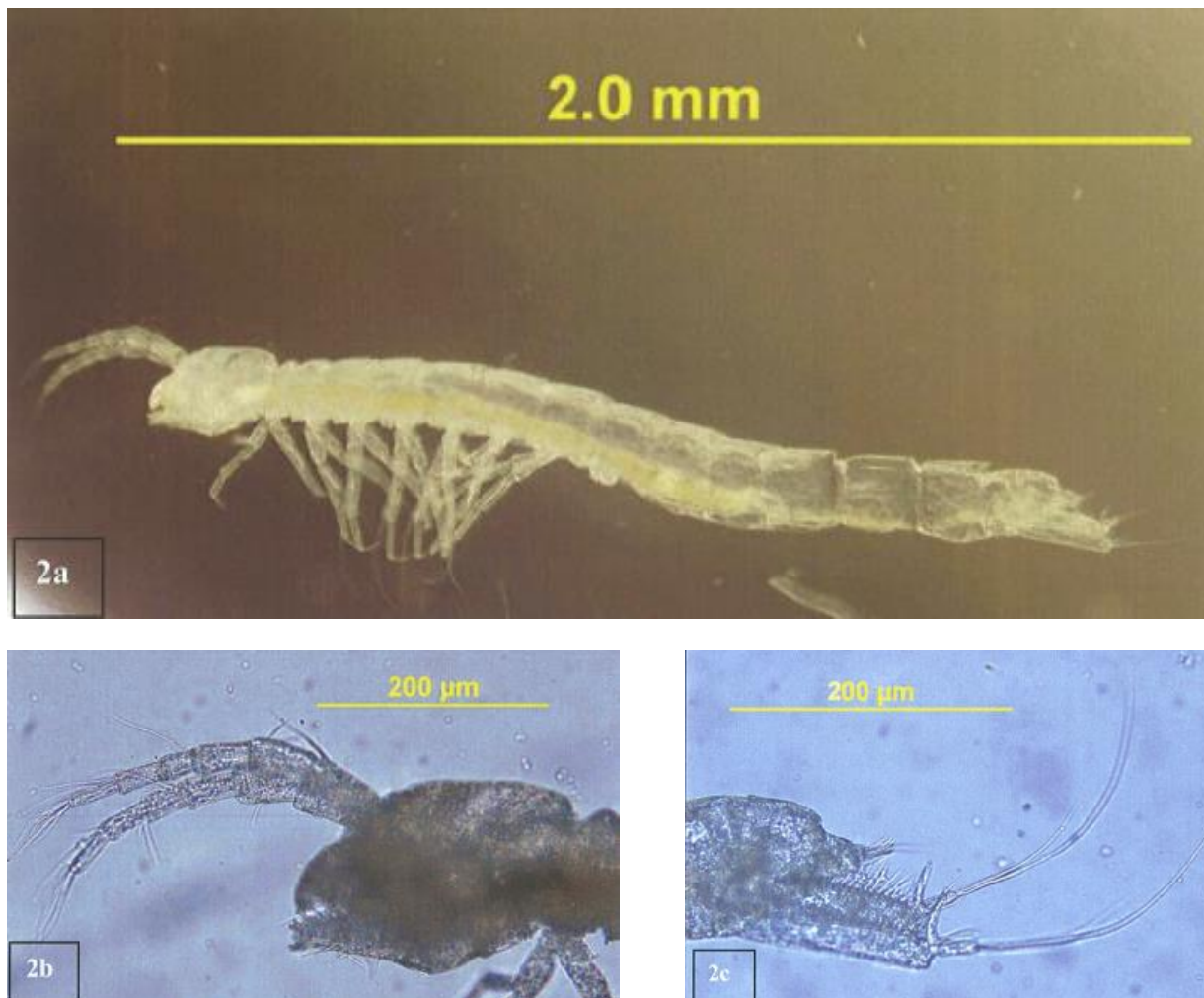


Plate 2 Images of the Parabathynellid specimens recorded by Knott and Goater 2005 from bore M1099 from the Simcoa Quartzite Mine Area (Images after Knott and Goater 2005)

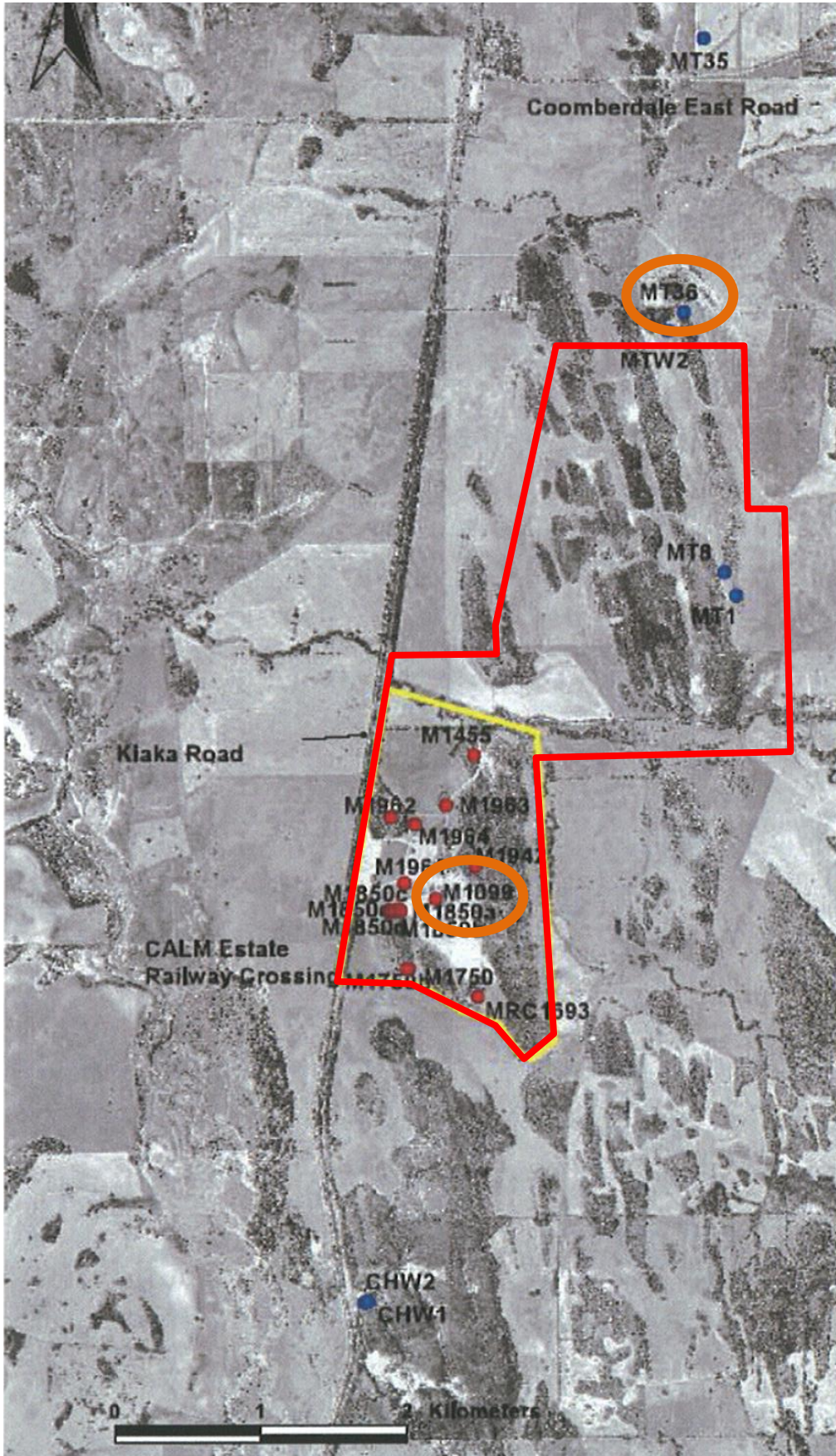


Figure 2 Stygofauna sampling location from Knott and Goater 2005 (Figure 1), with the locations of stygal Parabathnellids marked in orange and the approximate boundary of the North Kiaka Project in red.

3.5 Likelihood of troglofauna presence

A search was undertaken of the Western Australian Museum databases for Crustaceans (WAM 2018a) and Arachnids/Myriapods (WAM 2018b). The desktop study area comprised a rectangle of approximately 50 km sides bounded by the north west corner (30.281015°S, 115.807140°E) and the south east corner (30.771696°S, 116.286079°E) centred on the North Kiaka quartzite project. The results of these filtered for subterranean troglofauna species. No troglofauna has previously been recorded from the Project area from Western Australian Museum database records (WAM 2018a and 2018b), however, no sampling within the immediate Project area has occurred.

The overlaying colluvium, known as the Mesovoid Shallow Substratum (MSS) is virtually un-sampled within the Wheatbelt, but is increasingly known worldwide to contain significant troglobiont communities (Ortuño 2013), however, the sand and soil dominated nature of this colluvium makes the likelihood low that it will contain troglofauna in this particular area.

Due to the presence of stygofauna within a fractured rock aquifer within the Project area, there is a moderate likelihood that habitat exists for troglofauna within the unsaturated zone of the Noondine Chert. No core photos were available for examination to confirm the presence or absence of suitable fracturing that provides interconnected void space in the upper rock strata that may provide habitat for troglofauna.

4. Subterranean Fauna Risk Assessment

This preliminary risk assessment is based primarily upon the proposed open cut mining operations for the North Kiaka Project. The anticipated activities at the North Kiaka Project area include land clearing, construction of buildings and surface access roads, storage of hydrocarbons and minor excavation for the purposes of building footings. The anticipated mining activities include no mining below the local watertable and this assessment of impact is based no dewatering occurring during the life of the project.

4.1 Preliminary Risk Assessment for Stygofauna

The mining pit excavation is anticipated to have a low to moderate impact upon any local stygofauna community (Table 3) as no dewatering is anticipated to occur thus limiting any potential impacts to stygofauna in the local area.

The waste rock storage areas are anticipated to have a low risk of impact to stygofauna, dependent upon it not significantly altering subsurface hydrology or clogging subterranean voids with fine sediment. This risk will be minimised by locating the waste rock dump on the colluvium units within the North Kiaka Project area.

The construction and operation of other associated surface mine infrastructure are expected to pose a Low risk to stygofauna.

Table 3 Risk of impact to stygofauna from resource development

Disturbance mechanism	Likelihood of disturbance occurring	Subterranean fauna presence	Risk of Impact to Stygofauna Community if present
Pit excavation	Definite	Stygofauna Confirmed	Low/Moderate
Dewatering	Nil	Confirmed	Very High
Waste rock storage facility altering subsurface hydrology and nutrient inputs	Moderate	Low (if not positioned on Noondine Chert Formation)	Low
Surface infrastructure including roads, buildings and laydown areas	Definite	Low	Very Low

4.2 Preliminary Risk Assessment for Troglifauna

The mining pit excavation is anticipated to have a low impact upon any local troglifauna community (Table 4) as the pits are relatively small and habitat for troglifauna is anticipated to remain outside of the proposed mining areas.

The waste rock storage areas are anticipated to have a low risk of impact to troglifauna, dependent upon it not significantly altering subsurface hydrology or clogging subterranean voids with fine sediment. This risk will be minimised by locating the waste rock dump on the colluvium units within

the North Kiaka Project area and away from the Noonidine Chert that would provide potential troglofauna habitat.

The construction and operation of other associated surface mine infrastructure are expected to pose a Low risk to troglofauna.

Table 4 Risk of impact to troglofauna from resource development

Disturbance mechanism	Likelihood of disturbance occurring	Subterranean fauna presence	Risk of Impact to Stygofauna Community if present
Pit excavation	Definite	Troglofauna Moderate	Low
Dewatering	Nil	Confirmed	Moderate
Waste rock storage facility altering subsurface hydrology and nutrient inputs	Moderate	Low (if not positioned on Noonidine Chert Formation)	Low
Surface infrastructure including roads, buildings and laydown areas	Definite	Low	Very Low

4.3 Cumulative impacts

Cumulative impacts in the local region are expected to be minimal with the only other major impacts being the existing quarry operation to the south of the proposed North Kiaka Quartzite Project. The primary cumulative impacts from the developments is land clearance and excavation of small mining pits and potentially altered hydrology, however, these are relatively small in the scale of the Central Wheatbelt with minimal clearing of native vegetation to occur. It is anticipated that the North Kiaka Project will not add significantly to the cumulative impacts to subterranean fauna in the local area.

5. Conclusions and Recommendations

The North Kiaka Project is located primarily in Noondine Chert surrounded by lower lying colluvium and alluvium to the west of the Project area and minor outcrops of the Mokadine Formation to the south east. The colluvium and alluvium lithologies to the west of the Project area have a low suitability for both troglifauna and stygofauna habitat due to the absence of interconnected voids in these fine grained units. The Noondine Chert is known to contain palaeokarst and subsurface voids that is highly suitable habitat for stygofauna (Appleyard 2002). The Noondine Chert is the target lithology for the North Kiaka Quartzite Project and previous subterranean fauna surveys for the existing Simcoa operations revealed the existence of a stygal community within the local groundwater. The Noondine Chert formation located within North Kiaka Project is also known to contain at least four species of stygofauna.

Searches of the Western Australian Museum databases for Crustaceans and Arachnids/Myriapods were undertaken of a rectangle of approximately 50 km sides centred on the North Kiaka quartzite project. The results of these filtered for subterranean species revealed no specimen records of any subterranean fauna held by the Western Australian Museum.

The known stygofauna previously recorded by Knott and Goater 2005, do not occur within the current North Kiaka development area with the records being to the north of the proposed development area and within the existing approved operations.

Due to the presence of stygofauna within a fractured rock aquifer within the Project area, there is a moderate likelihood that habitat exists for troglifauna within the unsaturated zone of the Noondine Chert. No core photos were available for examination to confirm the presence or absence of suitable fracturing that provides interconnected void space in the upper rock strata that may provide habitat for troglifauna.

The mining pit excavation is anticipated to have a low to moderate impact upon any local stygofauna community and a low impact on potential troglifauna as no dewatering is anticipated to occur thus limiting any potential impacts.

The waste rock storage areas are anticipated to have a low risk of impact to stygofauna and troglifauna, dependent upon it not significantly altering subsurface hydrology or clogging subterranean voids with fine sediment. This risk will be minimised by locating the waste rock dump on the colluvium units within the North Kiaka Project area.

The construction and operation of other associated surface mine infrastructure are expected to pose a Low risk to stygofauna and potential troglifauna.

5.1 Recommendations

The following recommendations are made with regard to the potential development of the North Kiaka Project:

- The storage of hydrocarbons on site should be limited and all storage areas fully bunded.

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Appendix 1

Department of Parks and Wildlife Conservation Codes (November 2015)



CONSERVATION CODES

For Western Australian Flora and Fauna

Specially protected fauna or flora are species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected fauna and flora are:

T Threatened species

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN Endangered species

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU Vulnerable species

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX Presumed extinct species

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA Migratory birds protected under an international agreement

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD Conservation dependent fauna

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS Other specially protected fauna

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix 2

Protected Matters Search Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 16/01/19 11:04:31

[Summary](#)

[Details](#)

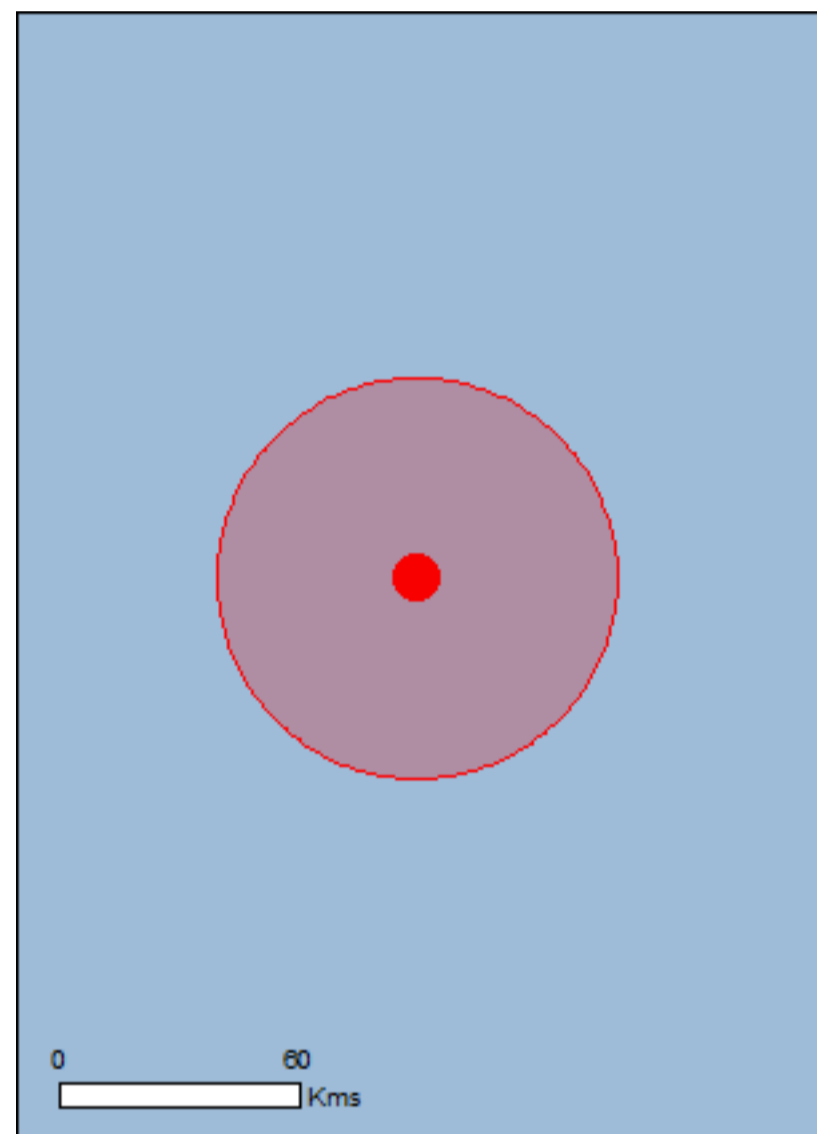
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

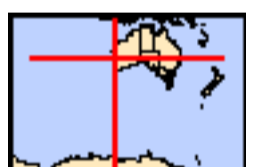
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 50.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	78
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	26
Regional Forest Agreements:	None
Invasive Species:	19
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[[Resource Information](#)]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area

Listed Threatened Species

[[Resource Information](#)]

Name	Status	Type of Presence
------	--------	------------------

Birds

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
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Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
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Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
---	-----------------------	--

Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
--	------------	--

Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
--	------------	--

Fish

Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
--	------------	--

Mammals

Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
---	------------	--

Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat may occur within area
---	------------	--

Phascogale calura Red-tailed Phascogale, Red-tailed Wambenger,	Vulnerable	Species or species
---	------------	--------------------

Name	Status	Type of Presence
Kenngoor [316]		habitat likely to occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia aprica Blunt Wattle [64821]	Endangered	Species or species habitat likely to occur within area
Acacia aristulata Watheroo Wattle [64822]	Endangered	Species or species habitat known to occur within area
Acacia ataxiphylla subsp. magna Large-fruited Tammin Wattle [64823]	Endangered	Species or species habitat may occur within area
Acacia cochlocarpa subsp. cochlocarpa Spiral-fruited Wattle [23877]	Endangered	Species or species habitat known to occur within area
Acacia cochlocarpa subsp. velutinosa Velvety Spiral Pod Wattle [65112]	Critically Endangered	Species or species habitat likely to occur within area
Acacia forrestiana Forest's Wattle [17235]	Vulnerable	Species or species habitat known to occur within area
Acacia recurvata Recurved Wattle [64825]	Endangered	Species or species habitat known to occur within area
Acacia splendens Splendid Wattle, Dandaragan Wattle [81510]	Endangered	Species or species habitat known to occur within area
Acacia vassalii Vassal's Wattle [6144]	Endangered	Species or species habitat known to occur within area
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Banksia fuscobracteata Dark-bract Banksia [83059]	Critically Endangered	Species or species habitat known to occur within area
Banksia serratuloides subsp. perissa Northern Serrate Dryandra [82767]	Critically Endangered	Species or species habitat likely to occur within area
Banksia serratuloides subsp. serratuloides Southern Serrate Dryandra [82768]	Vulnerable	Species or species habitat known to occur within area
Caladenia drakeoides Hinged Dragon Orchid [68687]	Endangered	Species or species habitat known to occur within area
Calectasia pignattiana Stilted Tinsel Lily [82018]	Vulnerable	Species or species habitat likely to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Chorizema humile Prostrate Flame Pea [32573]	Endangered	Species or species habitat known to occur within area
Conospermum densiflorum subsp. unicephalatum One-headed Smokebush [64871]	Endangered	Species or species habitat known to occur within area
Darwinia acerosa Fine-leaved Darwinia [9004]	Endangered	Species or species habitat known to occur within area
Darwinia carnea Mogumber Bell, Narrogin Bell [9736]	Endangered	Species or species habitat likely to occur within area
Darwinia chapmaniana Chapman's Bell [64877]	Endangered	Species or species habitat likely to occur within area
Dasymalla axillaris Native Foxglove [38829]	Critically Endangered	Species or species habitat likely to occur within area
Daviesia dielsii Diels' Daviesia [19617]	Endangered	Species or species habitat known to occur within area
Daviesia euphorbioides Wongan Cactus [3477]	Endangered	Species or species habitat may occur within area
Drakaea concolor Kneeling Hammer-orchid [56777]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Eremophila pinnatifida Pinnate-leaf Eremophila [64894]	Endangered	Species or species habitat likely to occur within area
Eremophila scaberula Rough Emu Bush [16729]	Endangered	Species or species habitat known to occur within area
Eremophila vernicosa Resinous Poverty Bush [64596]	Vulnerable	Species or species habitat likely to occur within area
Eremophila viscida Varnish Bush [2394]	Endangered	Species or species habitat may occur within area
Eucalyptus absita Badgingarra Box [24260]	Endangered	Species or species habitat known to occur within area
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat may occur within area
Eucalyptus dolorosa Dandaragan Mallee, Mount Misery Mallee [56709]	Endangered	Species or species habitat likely to occur within area
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat likely to occur within area
Eucalyptus pruiniramis Midlands Gum, Jingymia Gum [56403]	Endangered	Species or species habitat known to occur within area
Eucalyptus recta Silver Mallet [56430]	Endangered	Species or species habitat known to occur within area
Eucalyptus rhodantha Rose Mallee [9362]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Frankenia conferta Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area
Gastrolobium appressum Scale-leaf Poison [7358]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium hamulosum Hook-point Poison [9212]	Endangered	Species or species habitat known to occur within area
Glyceria drummondii Nangetty Grass [14008]	Endangered	Species or species habitat known to occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area
Grevillea calliantha Foote's Grevillea, Cataby Grevillea, Black Magic Grevillea [56339]	Endangered	Species or species habitat may occur within area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Grevillea dryandroides subsp. hirsuta Hairy Phalanx Grevillea [64577]	Endangered	Species or species habitat likely to occur within area
Grevillea pythara Pythara Grevillea [64525]	Endangered	Species or species habitat likely to occur within area
Grevillea sp. Gillingarra (R.J.Cranfield 4087) [86383]	Critically Endangered	Species or species habitat known to occur within area
Gyrostemon reticulatus Net-veined Gyrostemon [8491]	Critically Endangered	Species or species habitat likely to occur within area
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Haloragis platycarpa Broad-fruited Haloragis [15371]	Critically Endangered	Species or species habitat likely to occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat known to occur within area
Hemiandra rutilans Sargents Snakebush, Colourful Snakebush [17932]	Endangered	Species or species habitat likely to occur within area
Jacksonia pungens Pungent Jacksonia [64920]	Endangered	Species or species habitat known to occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat likely to occur within area
Ptychosema pusillum Dwarf Pea [11268]	Vulnerable	Species or species habitat may occur within area
Rhagodia acicularis Wongan Rhagodia [11145]	Vulnerable	Species or species habitat likely to occur within area
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat likely to occur within area
Spirogardnera rubescens Spiral Bush [15667]	Endangered	Species or species habitat likely to occur within area
Synaphea quartzitica Quartz-loving Synaphea [64978]	Endangered	Species or species habitat known to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Verticordia staminosa subsp. staminosa Wongan Featherflower [55825]	Endangered	Species or species habitat may occur within area
Reptiles		
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Boothendarra	WA
Dandarangan	WA
Gillingarra	WA
Gunyidi	WA
Jam Hill	WA
Jocks Well	WA
Karamarra	WA
Koodjee	WA
Long Pool	WA
Manaling	WA
Martinjinni	WA
Merewana	WA
NTWA Bushland covenant (0066)	WA
NTWA Bushland covenant (0115)	WA

Name	State
Namban	WA
Pinjarrega	WA
Unnamed WA23179	WA
Unnamed WA26575	WA
Unnamed WA28710	WA
Unnamed WA39322	WA
Unnamed WA42209	WA
Unnamed WA43811	WA
Unnamed WA44081	WA
Unnamed WA45337	WA
Unnamed WA47694	WA
Watheroo	WA

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
<p>Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]</p>		<p>Species or species habitat likely to occur within area</p>
<p>Carrichtera annua Ward's Weed [9511]</p>		<p>Species or species habitat may occur within area</p>
<p>Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]</p>		<p>Species or species habitat may occur within area</p>
<p>Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]</p>		<p>Species or species habitat may occur within area</p>
<p>Genista sp. X Genista monspessulana Broom [67538]</p>		<p>Species or species habitat may occur within area</p>
<p>Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]</p>		<p>Species or species habitat may occur within area</p>
<p>Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]</p>		<p>Species or species habitat likely to occur within area</p>

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.49626 116.04327

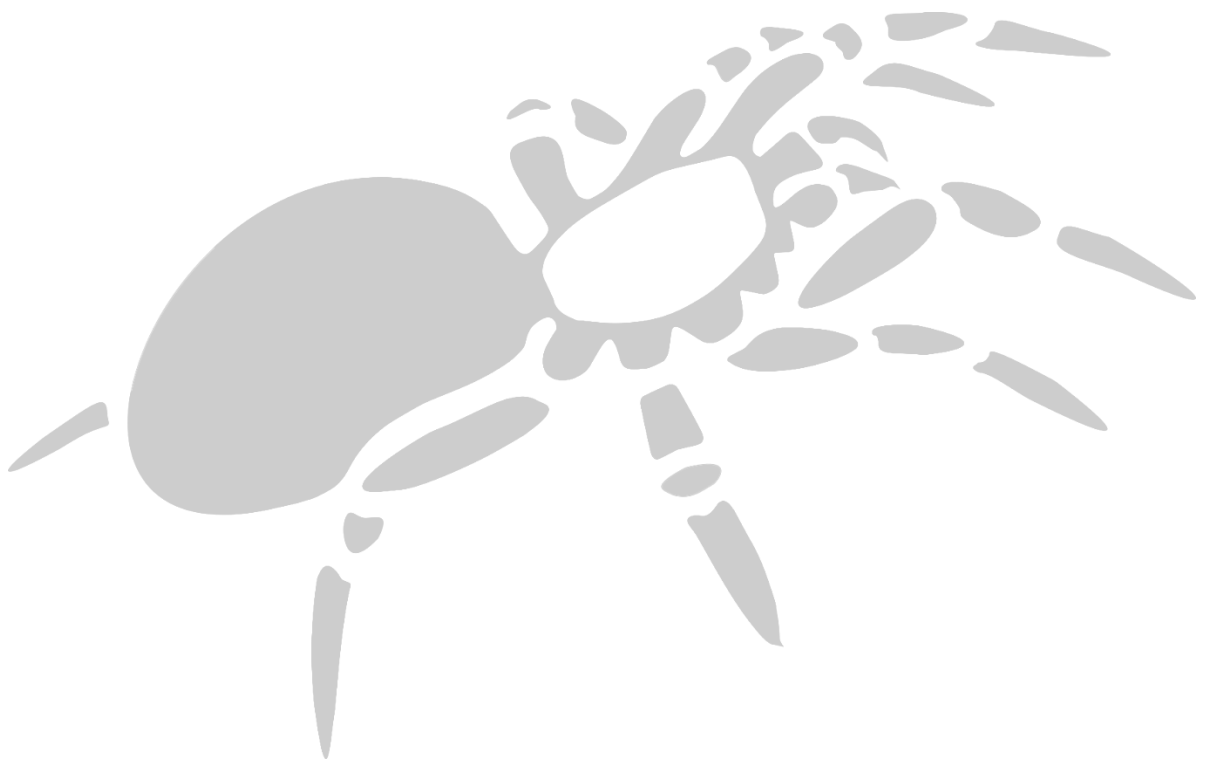
Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



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Moora Quartz Subterranean Fauna Baseline Survey Report

Prepared for:

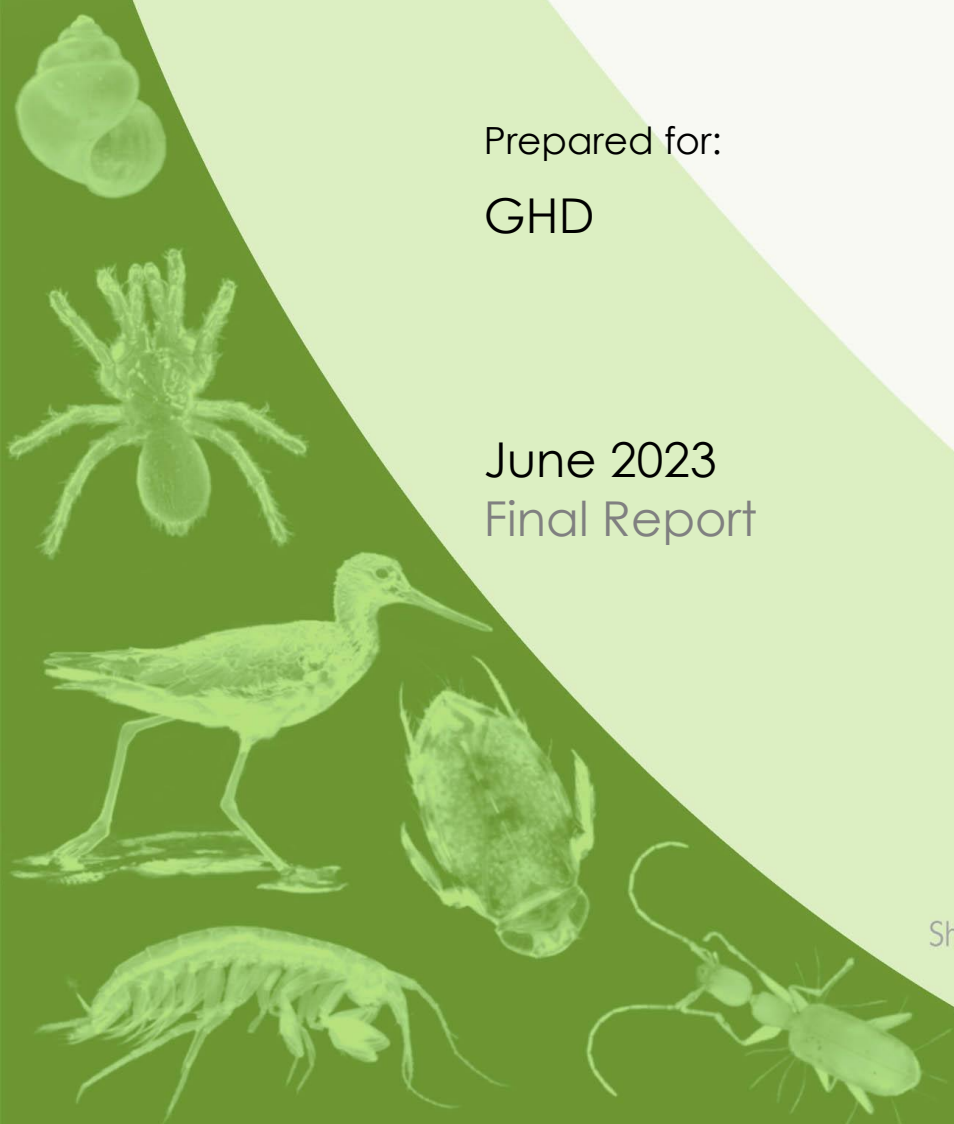
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June 2023

Final Report

Short-Range Endemics | Subterranean Fauna

Waterbirds | Wetlands



Moora Quartz Subterranean Fauna Baseline Survey Report

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EXECUTIVE SUMMARY

Simcoa Operations Pty Ltd proposes to extend quartzite mining operations below the water table at an existing site 15 km north of Moora, Western Australia (The Project). The Moora Quartz mine has been operating since 1989 on tenement M70/191 with two open pits 400 m apart currently being mined. GHD engaged Bennelongia Environmental Consultants to undertake baseline survey of subterranean fauna in the Project area. This report combines the findings of a desktop assessment conducted prior to fieldwork with the results of the field survey.

Groundwater in the Project area is fresh, with salinity between 656 and 850 mg/L; bicarbonates predominate. pH ranges from 6.9-9.4. Transmissivity between bores is high, approximately 1,020 to 1,549 m²/d. Groundwater appears to flow westward towards the Yarra Yarra Palaeovalley and Coonderoo River. Following several years of abstraction the groundwater level is currently about 211 mAHD; the minerals targeted by the Project would require dewatering to 202 mAHD in the main mine pit and 200 mAHD in the west mine pit.

Desktop assessment recovered no existing records of subterranean fauna in an area of 10,000 km² centred on the Project area. However, a survey carried out in the Project area in February 2005 recovered stygofauna from four out of 17 boreholes sampled. Among the stygofauna recovered, five species were identified: two syncarids, which the authors deemed zoologically significant; two oligochaetes; and one species of nematode. Troglifauna was not sampled. Overall, the desktop assessment found that the geology and hydrology of the Project area were conducive to hosting subterranean fauna, but that a historical lack of survey in the region precluded conclusive statements about the presence or absence of such fauna.

Bennelongia staff sampled stygofauna from seven boreholes and troglifauna from two drill holes on 18 January 2023. Despite the small number of holes sampled, the survey recovered 110 specimens identifiable to at least 15 distinct species-level taxa. Only one of the species was putatively troglifaunal; the rest were stygofaunal, with one amphibious taxon. Four of the species were collected for the first time during this survey.

The survey results suggest a substantial assemblage of stygofauna exists in the Project area, but the diversity and abundance and indeed presence of troglifauna remain unknown. The degree of dewatering proposed by the Project may impact upon the stygofauna present. However, given the minimal information available, it is not currently possible to estimate the likelihood or severity of potential impacts. Further survey is recommended to characterise more thoroughly the communities of stygofauna and troglifauna in the Project area, to establish whether the species collected occur outside the Project footprint, and to determine whether any of the species present are of conservation significance.

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1. INTRODUCTION

Simcoa Operations Pty Ltd (hereafter Simcoa) proposes to extend quartzite mining operations below the water table at an existing site 15 km north of Moora, Western Australia (Figure 1). The Moora Quartz mine has been operating since 1989 on tenement M70/191 with two open pits 400 m apart currently being mined. Approximately 160,000 tonnes (t) of lump quartz is excavated annually and transported to Bunbury for smelting. At least 2,000,000 t, and possibly up to 4,000,000 t more, of high purity quartzite is known to exist at the site.

The Moora Quartz mine site (hereafter the Project area) lies at the northern periphery of the Katanning subregion of the Avon Wheatbelt bioregion. The Dandaragan Plateau subregion, part of the Swan Coastal Plain region, begins 2 km to the west of the project area; the Lesueur Sandplain subregion, part of the Gerald Sandplains region, begins 14.4 km to the north.

The climate of the Project area is Mediterranean. Monthly mean maxima range from 17.3 °C in July to 34.4 °C in January; monthly mean minima range from 6.7 °C in August to 18.1 °C in February. Monthly mean rainfall ranges from 9.6 mm in December to 90.0 mm in June. The monthly mean number of days with rain ranges from 1.2 in January to 10.9 in July.

GHD engaged Bennelongia Environmental Consultants to undertake baseline survey of subterranean fauna in the Project area. This report combines the findings of a desktop assessment conducted prior to fieldwork with the results of the field survey. The objectives of this report are:

- To identify the likely extent of suitable habitat for subterranean fauna in the Project and surrounding areas;
- To collate records of subterranean animals from the Project area and surrounds to determine the types of subterranean fauna present;
- To identify and collate all records of subterranean animals collected during survey;
- To determine the conservation status of the subterranean species recorded and the known distribution of any conservation-significant species; and
- To estimate the likely impact of mining activities on subterranean fauna based on groundwater flow, direction, connectivity, and drawdown.



1.1. The Moora Quartz Project in Geological Context

The Project area lies in the Moora Group (Figure 2), a bedrock unit formed 1,000 million years ago comprising lithified sandstone, arkose, siltstone, and volcanic rocks. Within the Moora Group, the Project area lies in Noondine Chert unit, which comprises bedded chert, orthoquartzite, chert breccia, silicified limestone, and dolomite and contains significant siliceous sandstone and minor claystone. The chert is almost pure in silica, but includes contaminants such as iron oxides, clays, apatite, chlorite, pyrite, and remnant carbonates (Saprolite 2011). The Project area predominantly lies on exposed rock (Figure 3).

The quartzite targeted by the Project is exclusively associated with the Noondine Chert unit (formerly Coomberdale Chert). Outcrops of the unit stretch across 150 km from Moora to Three Springs in the form of north-northwest-trending parallel ridges peaking 75 m above adjacent valleys. Project activities are projected to affect <1% of the Noondine Chert formation.

Figure 1. Location of the Project area in relation to Moora.

Legend

-  Project area
-  Rivers

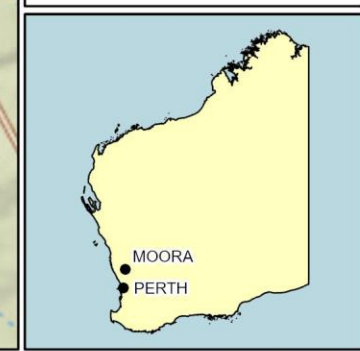
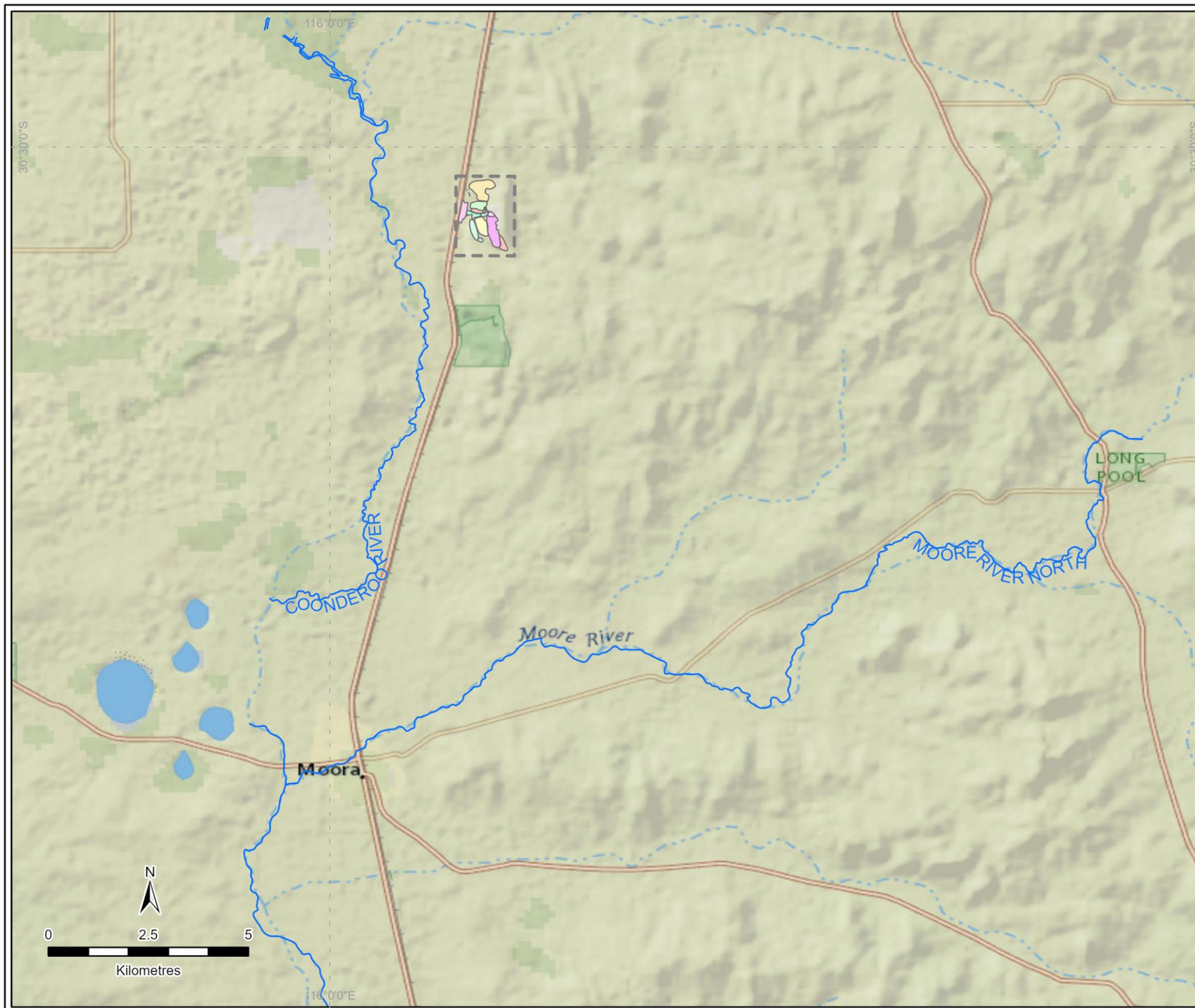





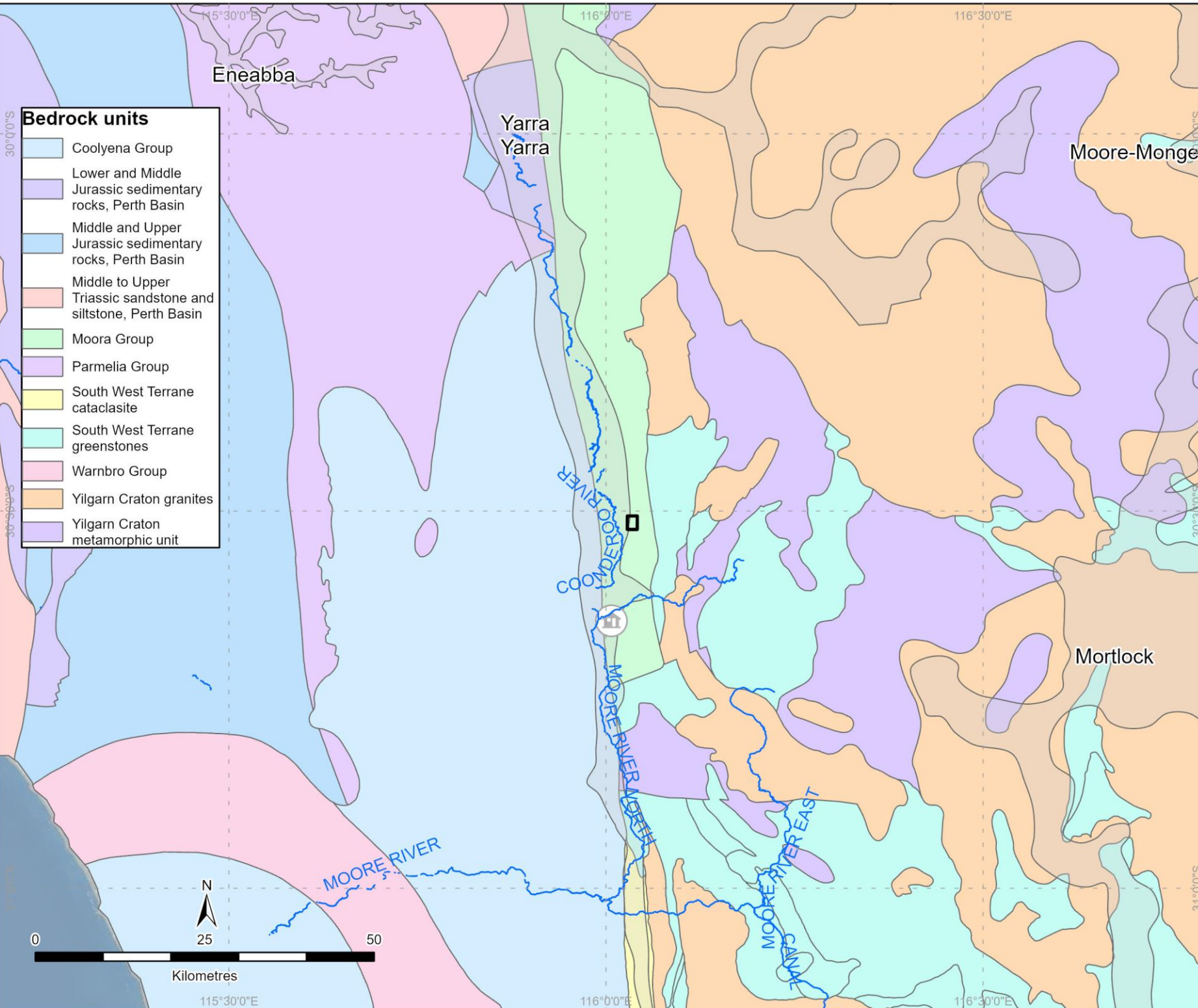













Figure 2. Bedrock geology around the Project area.

Legend

-  Moora
-  Project area
-  Desktop study area
-  Rivers
-  Palaeovalleys



- Bedrock units**
-  Coolyena Group
 -  Lower and Middle Jurassic sedimentary rocks, Perth Basin
 -  Middle and Upper Jurassic sedimentary rocks, Perth Basin
 -  Middle to Upper Triassic sandstone and siltstone, Perth Basin
 -  Moora Group
 -  Parmelia Group
 -  South West Terrane cataclasite
 -  South West Terrane greenstones
 -  Warnbro Group
 -  Yilgarn Craton granites
 -  Yilgarn Craton metamorphic unit

Eneabba

Yarra Yarra

Moore-Monger

Mortlock



Kilometres

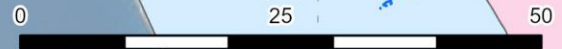















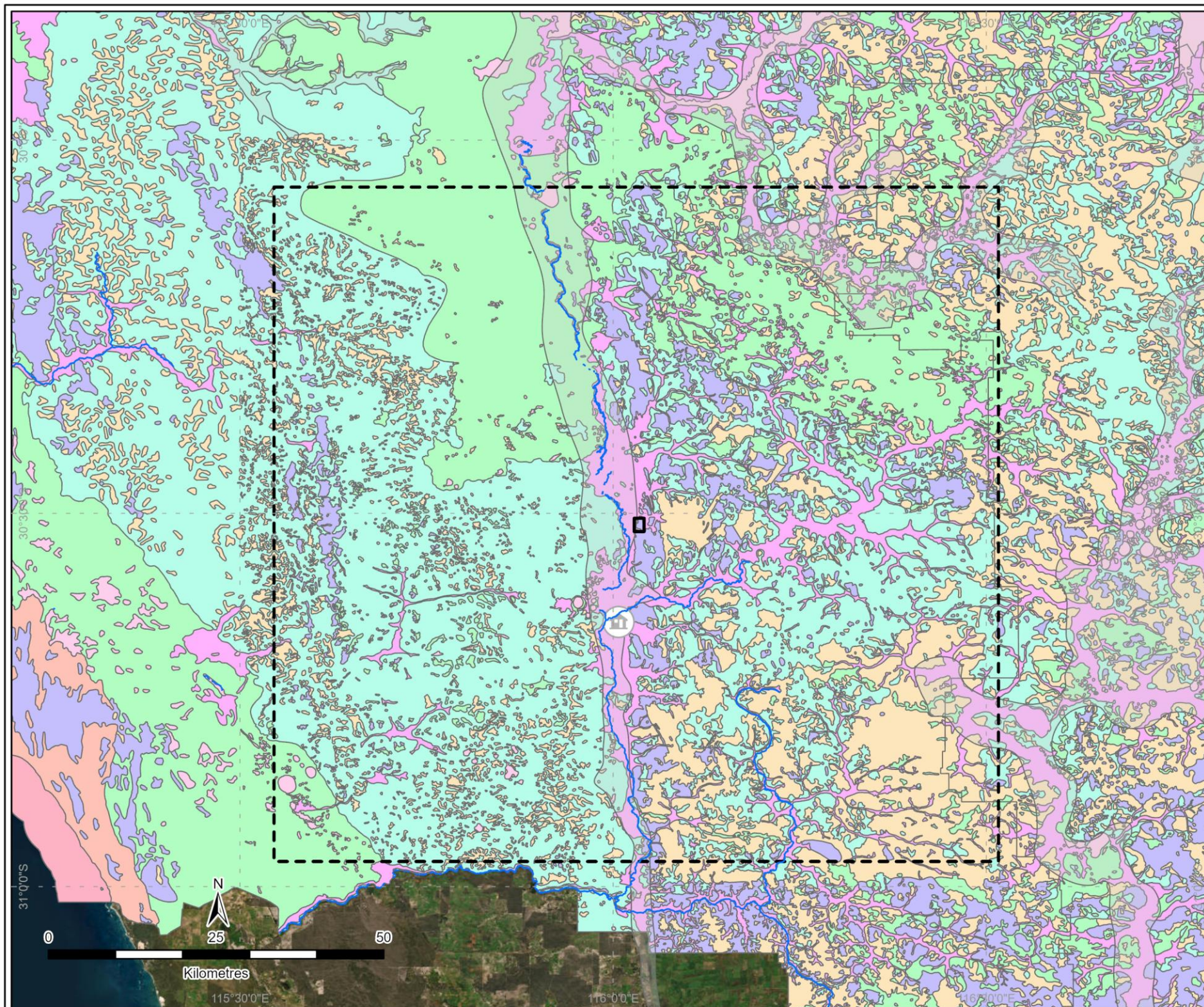
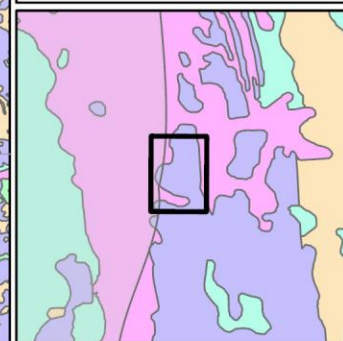


Figure 3. Regolith geology around the Project area. Inset: close view of the Project area.

Legend

-  Moora
-  Project area
-  Desktop study area
-  Palaeovalley
-  Alluvium
-  Calcrete
-  Coastal
-  Colluvium
-  Exposed
-  Lacustrine
-  Residual
-  Sandplain
-  Tidal
-  Water
-  Rivers



Regional surficial aquifers occur in alluvium and colluvium, with interbedded sand, silt, clay, and shale, and water is essentially fresh (GHD 2023). Underlying fractured rock aquifers occurring in Noondine Chert range from brackish to saline, with recharge limited to rainwater infiltration. Groundwater in the Project area is fresh, with salinity between 656 and 850 mg/L (GHD 2021, 2022); bicarbonate dominates the anions (Saprolite 2011). pH ranges from 6.9-9.4 (Saprolite 2022).

Transmissivity between bores is high, approximately 1,020 to 1,549 m²/d (Saprolite 2011). Groundwater appears to flow westward towards the Yarra Yarra Palaeovalley and Coonderoo River, the latter of which is saline to hypersaline (GHD 2022, 2023).

Standing water levels at another site managed by Simcoa, 2.5 km north of the Project area, range from 210 -215 mAHD or 10-20 m below ground level (GHD 2023). The northern site also borders the Yarra Yarra Palaeovalley, and surficial aquifer also occurs there. At the Moora Quartz Project, surficial aquifer probably overlies the target minerals.

Following several years of abstraction, groundwater level in the Project area is currently about 211 mAHD; the minerals targeted by the Project would require dewatering to 202 mAHD in the main mine pit and 200 mAHD in the west mine pit (GHD 2021; Saprolite 2022).

1.2. Subterranean Fauna Framework

The term subterranean fauna refers to animals living essentially full-time underground. Subterranean taxa are divided into two main groups: stygofauna comprises aquatic animals that live below ground in water, while troglifauna is made up of terrestrial animals that live underground and breathe air but require very high humidity (Gibson *et al.* 2019). Stygofauna inhabit vugs, fissures, and interstitial spaces in groundwater aquifers, especially those in alluvium and calcretes. Troglifauna inhabit similar spaces above the water table but with more emphasis on vugs, fissures, and relatively large interstitial spaces.

Subterranean species share several convergent adaptations to life underground where it is dark and resources are limited. These include worm-shaped bodies, elongated chemosensory apparatus, and the loss of skin colouration and eyes. Western Australia supports a particularly rich subterranean fauna outside caves (Humphreys 2000; UNESCO World Heritage Centre 2022), with estimates of over 4,000 species, 90% of which remain to be described (Guzik *et al.* 2011; Halse 2018a). Almost all subterranean animals in Western Australia are invertebrates, but fishes (Whitely 1945) and one snake (Aplin 1998) have also been recorded.

The distribution of subterranean animals is largely determined by prevailing lithology. In Western Australia, subterranean animals probably mostly occupy spaces only a few millimetres in width (Halse 2018a, b; Halse *et al.* 2018) but the key characteristics of their habitat(s) is that it is rich in such spaces and that the spaces are well connected laterally and vertically. Lateral connectivity facilitates dispersal of animals, while vertical connectivity ultimately to the surface is crucial for delivering carbon and other nutrients to subterranean ecosystems (Korbel and Hose 2011). Connectivity may be disrupted by a range of factors, including dykes, major landscape features, and chemical barriers.

Subterranean animals tend to have limited distributions. Most stygofauna species exhibit short range endemism (SRE), having substantially smaller ranges than Harvey's (2002) SRE criterion of 10,000 km² (Cooper *et al.* 2007; Cooper *et al.* 2002; Eberhard *et al.* 2009). The ranges of troglifauna have yet to be investigated in detail but are mostly even more restricted than those of stygofauna, with many species having linear ranges less than 10 km (Halse and Pearson 2014; Lamoreux 2004).

1.2.1. Stygofauna

Most stygofauna species in Western Australia are crustaceans, particularly ostracods and copepods, although other groups such as worms and beetles are sometimes abundant (DEC 2009; DPAW 2022; Matthews *et al.* 2019). Stygofauna typically inhabits aquifers in alluvium and colluvium and karstic limestones (Halse 2018b; Hyde *et al.* 2018) and is rarely abundant where depth to the water table is more than 30 m below ground level (Halse 2018a; Halse and Pearson 2014). Aquifers with higher transmissivity are more likely to host stygofauna than aquifers with lower transmissivity (Maurice and Bloomfield 2012). Stygofauna mostly occurs in fresh to hyposaline water (Halse *et al.* 2014; Humphreys *et al.* 2009), but can occur in higher salinities.

1.2.2. Troglifauna

Western Australia appears to be almost unique for its diverse and widespread troglifauna inhabiting small spaces in the vadose zone (Halse and Pearson 2014). The Western Australian troglifauna comprises mostly arthropods, with a variety of isopods, insects, spiders, pseudoscorpions, and millipedes, centipedes, and their allies represented. Troglifauna are particularly likely to occur in weathered or mineralised iron formations, alluvium or colluvium in valley-fill areas (including areas of karstic calcrete), and fractured sandstone (Halse 2018a).

1.3. Threatened and Priority Ecological Communities (TECs and PECs)

An ecological community can be defined in several ways but, for the purposes of environmental impact assessment in Western Australia, it is a naturally occurring group of plants, animals, and other organisms interacting in unique habitat (with the unique habitat created by the combination of the species and their landscape setting; DEC 2013). Communities occupying a small or threatened habitat are classified as threatened ecological communities (TECs) under the Western Australian *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Currently, 69 TECs are listed in Western Australia under the BC Act, of which 25 are also listed under the EPBC Act. Other potentially at-risk communities in Western Australia that do not meet the criteria for TEC listing may be informally listed by the Department of Biodiversity, Conservation and Attractions (DBCA) as priority ecological communities (PECs). Currently, 390 PECs are listed.

2. DESKTOP SURVEY

2.1. Methods

A survey carried out in the Project area by UWA staff in February 2005 targeted 26 bores (Knott and Goater 2005). Of these bores, 20 fell within the predicted dewatering zone; the remainder comprised control samples. Each bore was sampled three times by bailing (lowering a bailer just beneath the water surface) and once by netting (lowering a net to agitate bottom sediment). Water retrieved from both techniques was sieved and animals retained for sorting in the laboratory.

A further search of databases and literature was undertaken to find out what subterranean fauna records were available from the area surrounding the Project, as well as whether any TECs or PECs featuring subterranean fauna occurred nearby. The search covered an area of approximately 10,000 km² centred on the Project area (30.054°S, 115.546°E to 30.958°S, 116.517°E; Figures 2 and 3). Analysis and mapping were undertaken using ArcGIS Pro v2.9.

The search used three sources of information. These were:

- The Western Australia Museum and Bennelongia databases, as well as relevant consulting reports, were interrogated for information about subterranean species. For each identifiable species, the number of records (i.e. the number of times the species was found) and the total

number of individuals collected from these sources were collated. Distribution patterns of identifiable species were cross-referenced with the Atlas of Living Australia.

- Proposed development and mine boundary information and descriptions were supplied by GHD.
- Boundaries of TECs and PECs were sourced from relevant government databases.

2.2. Results

2.2.1. Species Records

Results of previous survey

The survey carried out in the Project area in February 2005 recovered stygofauna from at least three out of 17 boreholes sampled (Knott and Goater 2005; nine of the targeted bores proved inadequate for sampling). Among the stygofauna recovered, five discrete morphospecies were identified: two syncarids, which the authors deemed zoologically significant; two oligochaetes; and one species of nematode. Among the syncarids, three specimens belonging to a species of Parabathynellidae were found from a single bore, and two of a species of Bathynellidae in a different bore. Among the oligochaetes, 23 specimens of one nauid species and one specimen from an unknown group were found, all from a single bore that had no other specimens. The nematode was a singleton. Troglifauna was not sampled.

Desktop search results

Of 1,102 records of invertebrates in the search area, none are known from subterranean habitats.

2.2.2. Potential Subterranean Fauna Habitat Within the Project Area

Several factors indicate the Project area is conducive to stygofauna occurrence, as was shown at least to some extent by the records of syncarids and worms. The water table lies less than 30 m below ground level; salinity is fresh to brackish, with high bicarbonate load; and alluvium associated with a palaeochannel occurs immediately west of the Project area. Typically, where suitable habitat for stygofauna is present, suitable habitat for troglifauna will also be present above the water table. No TECs or PECs are listed near the Project area.

2.3. Discussion

Few records, and no described species, were recovered from the Project area or vicinity in the desktop assessment. On one hand, the Wheatbelt is in general less rich in subterranean fauna than other regions such as the Yilgarn or Pilbara. On the other hand, the Project area and surrounds have not been sampled with the frequency or rigour of those other regions.

Knott and Goater (2005) identified five stygofaunal morphospecies from within the Project area, including two syncarids that they suggested may have ranges restricted to the Project area. Additional survey may reveal more species occurring in the Project area, as well as in its surrounds. Moreover, additional survey may uncover whether the stygofauna recovered by Knott and Goater (2005) inhabit a single connected aquifer or whether the aquifer is subdivided.

The depth to the water table, groundwater salinity, and underlying geology are all conducive to stygofaunal habitation. This is particularly true in the western extremity of the Project area, where alluvium occurs over a palaeovalley. The extensive and continuous nature of this association suggests substantial prospective habitat for stygofauna immediately west of the mine pits and running north-south for many kilometres.

Nevertheless, stygofaunal populations in the Project area are unlikely to be recharged by these hypothetical populations to the west. The direction of groundwater flow is westerly and transmissivity is

high, increasing the difficulty of small animals dispersing east to replenish decreased stocks. Thus, any stygofaunal populations present are probably susceptible to impacts of mining activity, depending on the depth to which suitable habitats occur and the degree of interconnectedness among habitats, both of which remain unknown.

Unlike with stygofauna, there is no evidence of troglifauna being present in the Project area. While troglifauna may historically have occupied dry spaces beneath ground level, it is unlikely that any persist following the long-term extraction activities in the Project area.

2.4. Conclusion

The evidence recovered in the desktop assessment is inconclusive. While stygofauna certainly exist in the Project area, sampling effort and rigour have historically been low in the area, preventing discussion of the conservation status or distribution of taxa present. Stygofauna in the Project area will almost certainly be affected by the proposed dewatering, but the extent of the impact depends on the connectivity and distribution of existing populations, which remain unknown.

3. FIELD SURVEY

3.1. Methods

3.1.1. Stygofauna Sampling

A baseline stygofauna sampling program was undertaken at seven bores in the Project area (Appendix 1), including two bores sampled by Knott and Goater (2005), M1099 and M1961 (Figures 5-6). Sampling occurred on 18 January 2023 and was carried out according to the methods specified by the EPA (2016a, 2016b, 2021). Six hauls using weighted plankton nets were taken at each bore, three using a 50- μ m mesh net and three using a 150- μ m mesh net. During each haul, the net was lowered to the bottom of the hole and oscillated vertically to agitate the benthos, increasing the likelihood of collecting benthic species, and then slowly retrieved. Contents of the net were transferred to a 125-ml polycarbonate vial after each haul, flushed with bore water to reduce fine sediment content, preserved in 100% ethanol, and refrigerated at a constant 4 °C. Nets were washed between holes to minimise site-to-site contamination.

In situ water quality parameters (temperature, electrical conductivity, and pH) were measured in each bore using a WP 81 field meter. Standing water level and total depth of hole were also measured using a Solinst water level meter. Contents of the net hauls were preserved in cold ethanol and returned to the laboratory in Perth for processing.

3.1.2. Troglifauna Sampling

A baseline troglifauna sampling program was undertaken at two drill holes at the Project site and surrounds (Appendix 1). Sampling typically uses two complementary techniques: scraping and trapping (Halse and Pearson 2014). In this case, only scraping was possible. When calculating troglifauna sampling effort, scraping and trapping each represent 0.5 samples, irrespective of the number of traps used. The reason for treating scraping and trapping as sub-samples is that troglifauna yields are low and diverse methods are required to collect a moderately comprehensive sample (Halse and Pearson 2014).

Scraping uses a weighted net of 150- μ m mesh and an upper diameter approximately 60% of that of the drill hole to scrape troglifaunal off the wall of the drill hole. To collect the animals, the net is carefully lowered to the bottom of the hole or to the water table and then scraped back to the surface at least

four times. In each of these scrapes, where possible, a different section of the wall of the hole is targeted (e.g., north, south) to maximise the number of animals collected. After each haul, net contents are transferred to a 125-ml vial with 100% ethanol for preservation of the sample and its DNA, and refrigerated at a constant 4 °C. Samples are then returned to the laboratory in Perth for processing.

3.1.3. Laboratory Processing

In the laboratory, samples were elutriated to separate out heavy sediment particles and sieved into size fractions using 250-, 90-, and 53- μ m screens. Samples were sorted under a dissecting microscope and, where necessary, dissected and examined under a differential interference contrast compound microscope. Specimens were identified to described species where possible using available keys and species descriptions. In many cases among subterranean fauna, species descriptions and taxonomic frameworks are lacking. In these cases, specimens may be identified morphologically and/or genomically as belonging to discrete putative species that await formal description; such species are usually assigned placeholder codes (e.g. 'B01'). In other cases, when the taxonomic framework is exceptionally poor and/or the specimen in question is damaged, juvenile, or of the nondiagnostic sex, the specimen is classified to the lowest level possible. These specimens often carry the miscellaneous designation "sp."

3.1.4. Personnel

Field work, including netting and scraping, were carried out by Ella Carstens and Jaxon Haines. Samples were sorted in the laboratory by Megan Lewis and Jaxon Haines. Identifications were carried out by Jane McRae, Megan Lewis, and Jaxon Haines.

3.1.5. Survey Limitations

The primary limitation to the information provided by survey results was the relatively small scale of the survey. It is difficult to extrapolate from small sample numbers to general patterns; an animal with a wide distribution may by chance only be found in one or two holes, whereas an animal with high endemism might be found in all holes within a small area. Either pattern would be misleading, but may be mitigated by sampling more holes across a broader area.

3.2. Results

The survey collected 110 specimens identifiable to at least 15 distinct species-level taxa (Table 1). Almost all the species identified were stygofaunal, with the exception of the troglifaunal symphylan *Hanseniella* sp. and some probably amphibious enchytraeids. Four of the species-level identifications constitute new species, i.e. they are not known to have been collected prior to this survey (highlighted blue in Table 1). Statistical estimates suggest a minimum species richness of at least 30-40 (Figure 4). Stygofauna were collected from every hole sampled by netting (Figures 5-7). Stygofauna were collected from M1099 in 2005 and in 2023 (Figures 5-6).

In addition to the nine holes sampled in the survey, five were visited but were not suitable for sampling (Figures 5-6). The monitoring bore MB01 was found to be blocked and dry; the uncased exploration hole M1961 was damaged and sampling equipment could not be lowered; the production bore BH1 could not be located at the supplied coordinates; and two monitoring bores south of the Project area, CHW1 and CHW2, were blocked respectively by rocks at 1 m and by coils of thick wire at 2 m.

Table 1. Subterranean fauna collected during the field survey in January 2023.

Fauna type: S = stygofauna; T = troglafauna. Novel morphospecies highlighted in blue.

Lowest identification	Fauna type	No. individuals	Hole(s)	Comments
Annelida		11		
Clitellata		11		
Enchytraeidae		11		
Enchytraeidae `2 bundle` s.l. (short sclero 4 per seg)	S/T	11	M1735	Widespread
Arthropoda		87		
Crustacea		86		
Malacostraca		24		
Syncarida		24		
Bathynellidae		9		
Bathynellidae sp.	S	9	MB03, MB05, MB06	Juvenile and/or incomplete specimens
Parabathynellidae		15		
<i>Atopobathynella</i> `BSY242`	S	13	M1099, MB02	New species; distribution unknown
<i>Atopobathynella</i> sp.	S	2	MB03	Juvenile and/or incomplete specimens; may belong to <i>Atopobathynella</i> `BSY242`
Maxillopoda		41		
Cyclopoida		37		
Cyclopidae		37		
Cyclopidae sp.	S	3	BH2	Juvenile and/or incomplete specimens. May belong to one of the cyclopids below
<i>Diacyclops</i> `BCY097`	S	32	BH2, MB02, MB05	New species; distribution unknown
<i>Mesocyclops brooksi</i>	S	1	BH2	Widespread (Atlas of Living Australia 2023)
<i>Paracyclops chiltoni</i>	S	1	BH2	Widespread (Atlas of Living Australia 2023)
Harpacticoida		4		

Lowest identification	Fauna type	No. individuals	Hole(s)	Comments
Ameiridae		3		
nr <i>Nitokra</i> `BHA351`	S	3	BH2	New species; might constitute novel genus; distribution unknown
Canthocamptidae		1		
Canthocamptidae sp.	S	1	MB02	Incomplete specimen
Ostracoda		21		
		21		
		21		
<i>Diacypris</i> sp.	S	10	BH2	Valves only; unable to be identified further
<i>Reticypris</i> sp.	S	10	BH2	Valves only; unable to be identified precisely, but probably the same species as <i>Reticypris</i> `BOS1087`, known from the Gascoyne region
Candonidae sp. (BOS1721)	S	1	MB04	New species; distribution unknown
Myriapoda		1		
Symphyla		1		
Cephalostigmata		1		
Scutigerellidae		1		
<i>Hanseniella</i> sp.	T	1	MB04	Poor taxonomic framework for the genus
Nematoda		2		
Nematoda spp.	S	2	M1099	No conservation significance
Rotifera		10		
Eurotatoria		10		
Bdelloidea		10		
Bdelloidea sp. 2:2	S	10	M1099	No conservation significance
Grand Total		110		

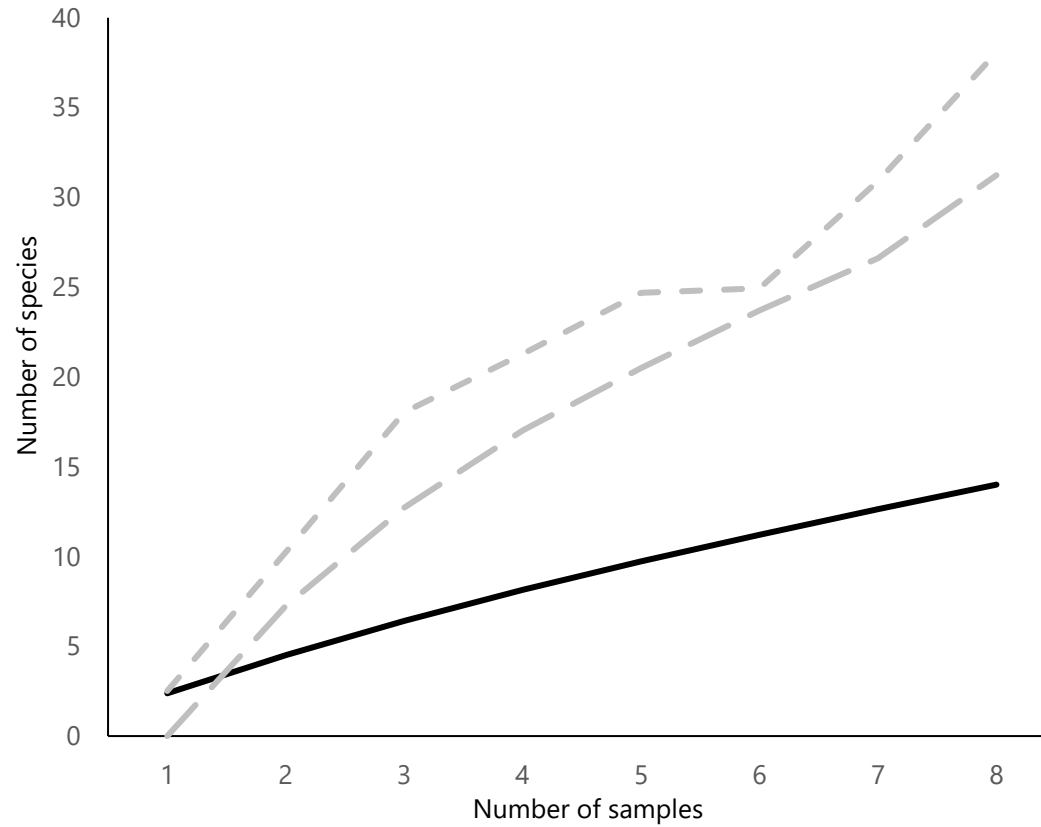


Figure 4. Species accumulation curves from the survey conducted in January 2023. Black solid line: actual number of species collected (smoothed). Long grey dashes: Jackknife 2 estimates of total species richness. Short grey dashes: Chao 2 estimates of total species richness. Estimates calculated using EstimateS (Colwell 2013).

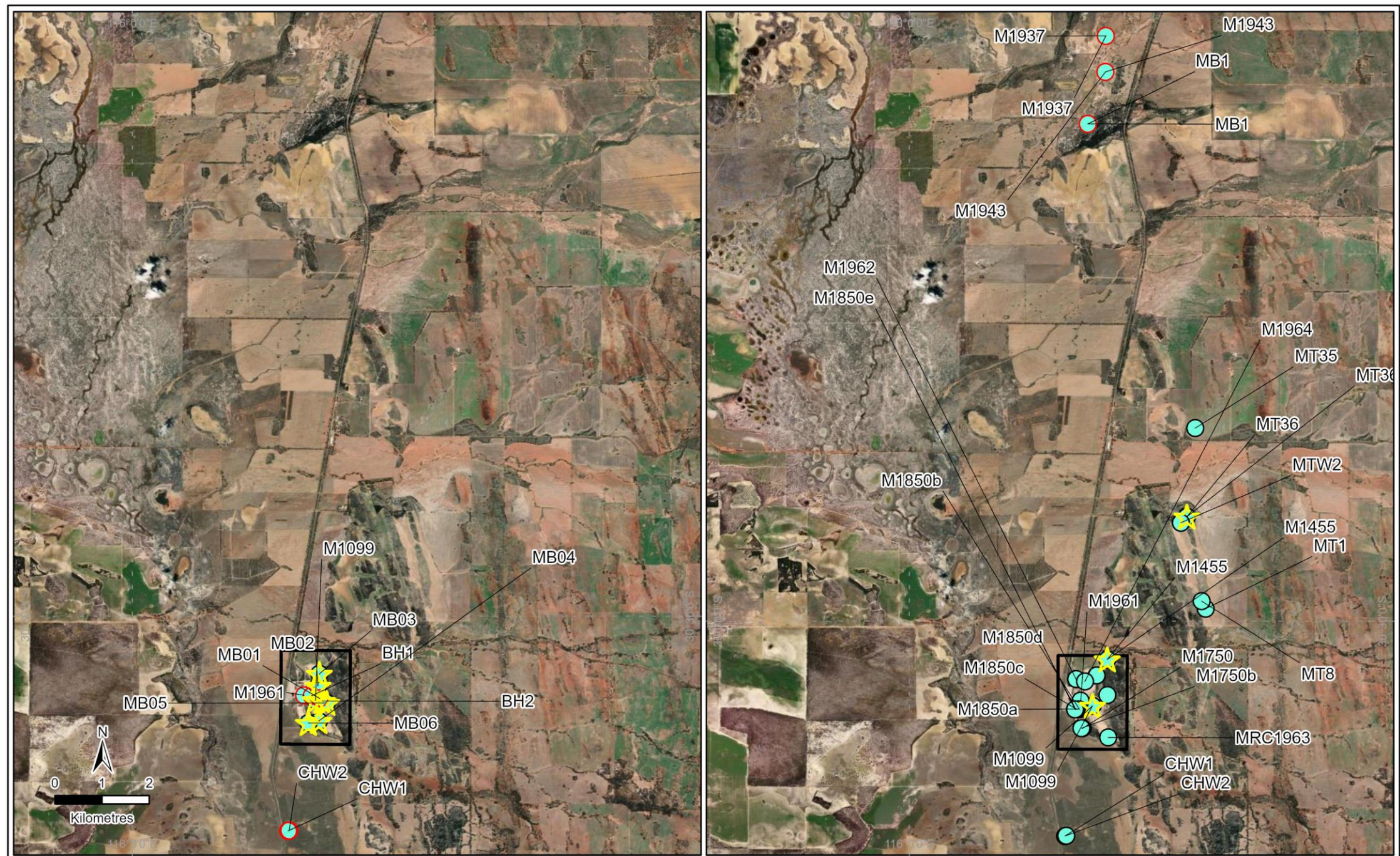
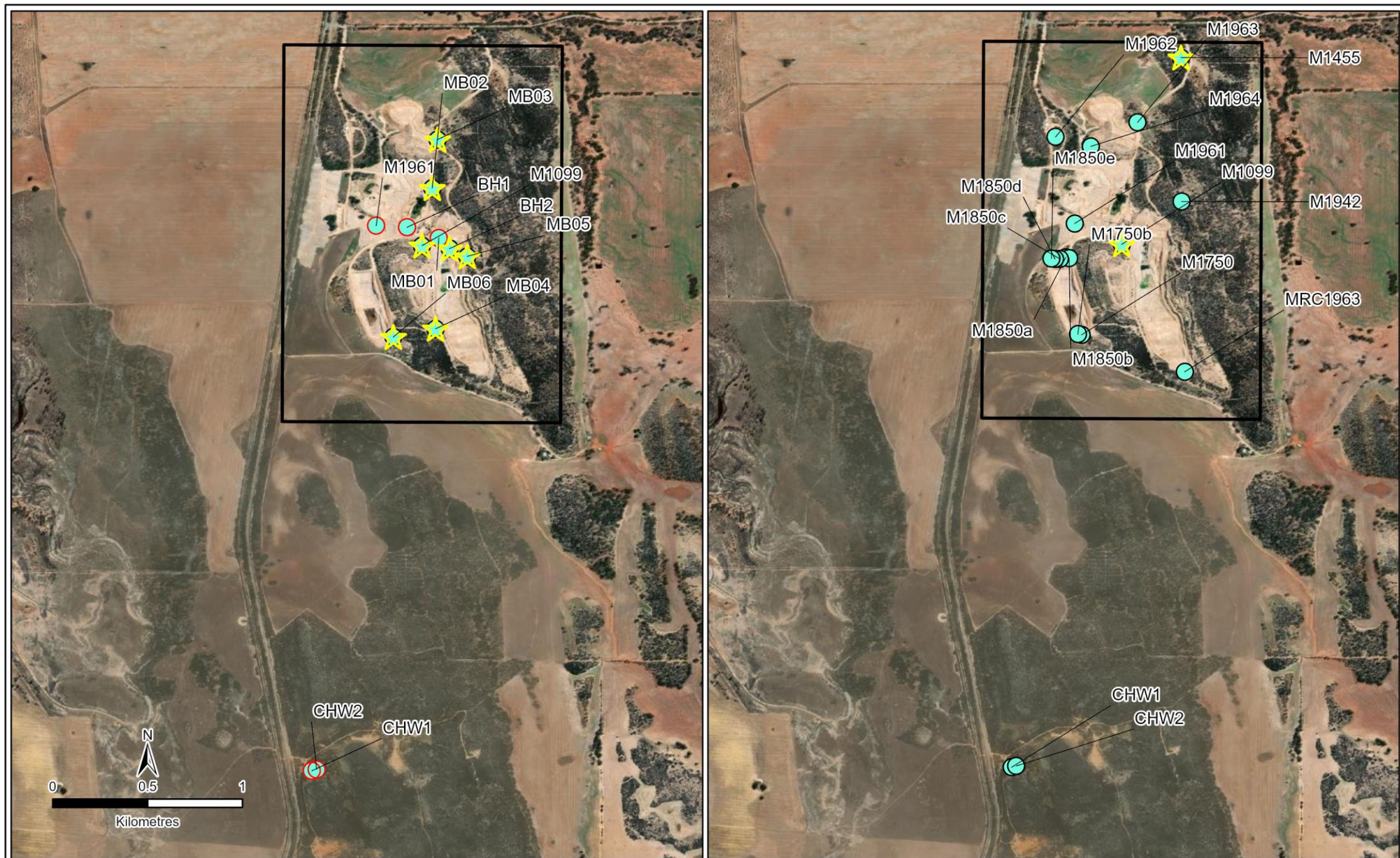


Figure 5. Bores sampled in 2023 (left) and 2005 (right), broad view.



Legend

- Bores
- Bores that could not be sampled
- ★ Bores yielding samples
- Proposal area

Figure 6. Bores sampled in 2023 (left) and 2005 (right), detail view.

3.3. Discussion

The desktop assessment indicated that habitat suitable for stygofauna and possibly troglifauna was present in the Project area, but that sampling in the region has historically been absent. The subsequent field survey indicates a moderately significant assemblage of stygofauna occurs in the Project area, expanding substantially on the results of the survey conducted by Knott and Goater (2005). Only two of the boreholes sampled in 2023 had also been sampled in 2005; of these, one (M1099) yielded stygofauna in both collection periods.

Over one third of the stygofauna species (6/14) in the present survey were collected from a single borehole, but each of the seven boreholes sampled contained multiple stygofauna individuals. Connectivity is difficult to assess with a relatively small number of samples, but appears to be low to moderate; some taxa are known from only one borehole, while others are known from two.

Four new species were collected during the field survey and were assigned unique codes internally (prefixed with `B`); one of the four new species, nr *Nitokra* `BHA351`, may represent a new genus, as it does not fully match the *Nitokra* diagnosis (reflected in the prefix 'nr'). As these species were collected for the first time during this field survey, it is not possible to determine their distribution. The distributions of stygofaunal copepods, syncarids, and ostracods (the groups to which the three morphospecies belong) vary substantially within Western Australia depending on the biology of the animals as well as the abiotic parameters of their environments.

The presence of four new species from only seven sampled boreholes indicates that a substantial but unknown stygofauna community exists in the Project area. It is possible that some or all of the new species detected, or other species as yet undetected, may be endemic to groundwater systems in and around the Project area, in which case they may be vulnerable to significant impacts as a result of dewatering. This possibility remains speculative given the absence of sampling effort in the region to date and the lack of biological information about species potentially present.

By contrast, several of the species recovered in the field survey are widespread, and thus will not be significantly affected by Project activities. The cyclopoid copepods *Mesocyclops brooksi* and *Paracyclops chiltoni* are both distributed widely across Western Australia (Atlas of Living Australia 2023). The ostracods referred to *Reticypris* were identified on the basis of valves alone (ostracods are crustaceans that live within a bivalved shell; the shells of deceased individuals often persist much longer than the other body parts). However, these specimens most likely belong to the known species *Reticypris* `BOS1087` from hundreds of kilometres north in the Gascoyne region, indicating the species from this survey probably has a widespread distribution. The species complex of enchytraeids recovered in the field survey is likewise widespread. Rotifers and nematodes are not considered in assessments of environmental impact partly because they tend to be widespread.

The specimen of *Hanseniella* recovered belongs to a group (Symphyla) with relatively poorly resolved taxonomy in Western Australia. This makes it difficult to compare the Project animals with those collected elsewhere and determine a species range. It is also possible that the *Hanseniella* collected during stygofauna is a surface species that dropped into the net when falling from the surface. Given these uncertainties, it is not possible to predict the effects of Project activities on this species.

The remainder of species recovered in the field survey could not be identified to a sufficiently low level to estimate distribution. Many specimens were incomplete and/or were juveniles, conditions which prevent species-level determinations.

While nine holes were successfully sampled, five could not be accessed and/or were damaged or blocked. Two of these holes occur a sufficient distance from the Project area to provide a reference

sample to shed light on the interconnectivity of subterranean populations. For example, the southern bores may have yielded additional species, or may have yielded species already collected elsewhere in the Project area. Without further sampling, it is not possible to speculate further.

For a baseline survey to clarify the results of desktop assessment, the number of holes sampled was adequate. However, given that the diversity and abundance of stygofauna were higher than expected, the number of holes sampled is overall not sufficient to provide a clear picture of the stygofauna community in the Project area.

While the specimens collected constitute a relatively substantial assemblage of stygofauna given the low number of holes sampled, the results for troglifauna are less clear. The absence of definitive troglifauna in the field survey does not necessarily indicate troglifauna do not occur in the area. Rather, the small number of holes sampled (two) restricts conclusions about the diversity and abundance of any troglifauna present.

3.4. Conclusion

The survey results suggest a moderately rich but poorly characterised assemblage of stygofauna exists in the Project area. The diversity and abundance of troglifauna remain unknown but information to date, including geology, suggest that the troglifaunal community is likely to be depauperate. Dewatering at the Project may potentially impact upon the stygofauna present. Therefore, further stygofauna survey is recommended to characterise more thoroughly the community in the Project area, and to determine whether any of the species present are of conservation significance.

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Appendix 1: Drill Holes Sampled during the Field Survey

SWL: standing water level (m). EOH: end of hole (m). Temp: temperature (° C). EC: electrical conductivity (µS/cm). Stygofauna were sampled using net hauls. Troglifauna were sampled using scrapes.

Hole ID	Latitude	Longitude	Sample Type	Date Visited	SWL	EOH	Temp	EC	pH
BH2	-30.51613	116.03619	Stygofauna	18/1/23	5.63	25	24.8	986	6.8
M1099	-30.51599	116.03488	Stygofauna	18/1/23	17.93	28	23.9	241	6.08
MB02	-30.51327	116.03537	Stygofauna	18/1/23	11.78	28	30.7	686	5.18
MB03	-30.51097	116.03562	Stygofauna	18/1/23	21.71	35	29.3	1654	4.38
MB04	-30.52012	116.03544	Stygofauna	18/1/23	26	52	23.9	726	5.99
MB05	-30.51652	116.037	Stygofauna	18/1/23	17.9	53	23.6	681	4.4
MB06	-30.52037	116.03349	Stygofauna	18/1/23	8.5	NA	23.6	580	4.59
M1735	-30.51669	116.03228	Troglifauna	18/1/23					
M1838	-30.5165	116.03218	Troglifauna	18/1/23					

Appendix O

**Mine Development Plan for the North
Kiaka Project (Snowden 2012)**

SNOWDEN

Final

Simcoa: Moora Quartz District
Project No. 3545

Kiaka Hills Mine Development Plan
30 November 2012

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This report has been prepared by Snowden Mining Industry Consultants ('Snowden') on behalf of Simcoa.

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1 Summary

Simcoa Operations Pty Ltd (“Simcoa”) requested Snowden Mining Industry Consultants Pty Ltd (“Snowden”) to update the quartz Mineral Resources and Ore Reserves at the two farms (owned by A Tonkin and J Tonkin) in the area north of Kiaka Road near Moora, WA, referred to as Kiaka Hills. The Project was designed in three phases.

Phase 1 and Phase 2 of the Project included resource interpretation and preparation of 3D orebody models. This final report covers Phase 3 of the Project which included the preparation of pit and waste dump designs and the estimation of Mineral Inventory (Mineral Resources and Ore Reserves) within the pit designs. This work has included:

- Pit optimisation using Whittle software.
- Open pit designs, including haul ramps.
- Estimation of the Mineral Inventory (Mineral Resources and Ore Reserves) within the open pit designs.
- Mine layout and haul road designs.
- Waste dump designs.

Table 1.1 shows the Mineral Resources at Kiaka Hills based on a total Mineral Inventory of 8.98 million tonnes (Mt) within seven open pit designs.

Table 1.1 Kiaka Hills, Resources based on Mineral Inventory in open pits

Farm Area	Indicated Resources Mt	Inferred Resources Mt	Total Resources Mt
A Tonkin (total) (25% Indicated)	1.05	3.14	4.19
J Tonkin North (50% Indicated)	1.72	1.72	3.48
J Tonkin South (50% Indicated)	0.65	0.65	1.31
Total	3.42	5.51	8.98

Snowden has applied a mining recovery factor of 90% to the Mineral Inventory (Mineral Resources) in pit to estimate the Ore Reserves.

Assuming that mining is approved then Snowden considers that approximately 38% of the Mineral Inventory can be classified as Probable Ore Reserves with 62% classified as Inferred Resources in pit. Table 1.2 shows the breakdown of the Mineral Inventory of Probable Reserves and Inferred Resources in pit.

Table 1.2 Mineral Inventory (Ore Reserves and Inferred Resources) in pits

Reserves/Resources	Mt	Fe2O3 %	Al2O3 %	TiO2 %	P2O5 %
Probable Ore Reserves	3.08	0.093	0.23	0.022	0.004
Inferred Resource in pits	5.00	0.093	0.23	0.022	0.004
Total Mining Inventory	8.08	0.093	0.23	0.022	0.004

Additional closer spaced drilling is required to convert the Inferred Resources to Indicated Resources, which can then be converted to Probable Reserves. This should be followed by more detailed resource estimation and revised pit designs.

This final report can be submitted to the Department of Mines and Petroleum (“DMP”) regarding the development of future silica mining at Kiaka Hills and obtaining approval for mining at Lease M70/1292.

2 Introduction

2.1 Scope of Report

Simcoa Operations Pty Ltd ("Simcoa") requested Snowden Mining Industry Consultants Pty Ltd ("Snowden") to update the quartz Mineral Resources and Ore Reserves at the two farms (owned by J Tonkin and A Tonkin) in the area north of Kiaka Road near Moora, WA, referred to by Simcoa as "Kiaka Hills". The Resource and Reserve Update Project ("Project") was designed in three phases.

Phase 1 and Phase 2 of the Project included resource interpretation and preparation of 3D orebody models. This final report covers Phase 3 of the Project which included the preparation of pit and waste dump designs and the estimation of Mineral Inventory (Mineral Resources and Ore Reserves) within the pit designs.

2.2 Work completed

2.2.1 Phase 1 and 2

The work completed during Phase 1 and 2 included:

- Interpretation of silica ore grade intersections (Phase 1).
- Wireframing of silica orebodies and creation of 3D models (Phase 2).

2.2.2 Phase 3

This work completed during Phase 3 has included:

- Pit optimisation using Whittle software.
- Open pit designs, including haul ramps.
- Estimation of the Mineral Inventory (Mineral Resources and Ore Reserves) within the open pit designs.
- Mine layout and haul road designs.
- Waste dump designs.
- A statement in line with the Australasian Code for the reporting of Mineral Resources and Ore Reserves, 2004 edition (the JORC Code).

This final report can be submitted to the Department of Mines and Petroleum ("DMP") regarding the development of future silica mining at Kiaka Hills and obtaining approval for mining at Lease M70/1292.

2.3 Personnel

The interpretation of the silica mineral resource was undertaken by Mr Terry Parker (Principal Consultant- Corporate) based on current grade specification at the Moora Quartz Mine. The ore grade intercepts were wire-framed by Mr Lindsay Farley (Senior Consultant Applied Geosciences) to produce three dimensional (3D) resource models. Simcoa provided topographic survey data which was converted to 1 m contours.

Whittle pit optimisation and pit design supervision was undertaken by Mr Stuart Pederick. The pit, waste dumps and road designs were undertaken by Ms Paula Constain (Mining Consultant). The estimation and classification of the quartz Mineral Resources was undertaken by Mr Terry Parker.

Mr Parker was Mine Manager and Geologist at the Moora Quartz Mine from 1990 to 1994 and from 2002 to 2008. He has also consulted to Simcoa since 1995 and is familiar with the style of mineralisation and mining operation. He is regarded as a Competent Person (CP) in terms of the JORC Code for the reporting of Mineral Resources and Ore Reserves of silica (chert) deposits used to produce silicon metal. Mr Parker is a Fellow of the AusIMM and a Chartered Professional. Mr Parker consents to the inclusion of this report in the form and context in which it appears.

The report was reviewed by Mr Frank Blanchfield, Divisional Manager Mining, a Fellow of the AusIMM.

3 Mineral Resources

3.1 Drilling and sampling

Holes have been drilled at Kiaka Hills using a blast hole percussion rig (Tamrock 1000) with open holes. Samples were collected every 2 m vertical depth. Target depth was 40 m, but many holes stopped short due to cavities and or blockages.

Drill spacing commenced at 40 m (along strike) by 40 m across strike. In the J Tonkin farm resource area this was reduced to 20 m across strike.

Samples were riffle split down to about 2 kg into calico bags and transported to the Moora sample preparation laboratory. The samples were wet-screened through 1mm aperture sieves to remove unwanted clays and soil. Samples were dried in an oven at 100°C for several hours, roll crushed to -1mm, riffle split to about 50g and pulverised in a ring mill. Approximately 10g was packaged and transported to Simcoa's laboratory at Kemerton for analysis by XRF. Duplicate samples were included at approximately 1 in 20 samples.

It is noted that the drilling and sampling method is far from ideal, but is very cheap compared to diamond drilling and reverse circulation drilling and can give reliable results if ground conditions are good. If the rock is badly faulted then this can cause downhole contamination (by clays) and even prevent further drilling.

Although it is not normal to accept mineral resource estimation based on open hole drilling, this method has proved reasonably reliable in resource estimation at the Moora Quartz Mine, which has been operating since 1989.

The sample results obtained tend to be conservative as contaminated samples are rejected from mineral intercepts and not included in resource estimation. The drill hole samples are washed to remove unwanted contamination (clays), similar to the process at the crushing and wet screening plant and represent a "beneficiated" sample.

The grades are based on samples that have been washed and screened at 1 mm to try and replicate the estimated quartz product grades (after washing and screening at -75 mm +25 mm). This has been shown to provide more reliable grade results although the relationship is not 100%.

3.2 Quartz product chemical grade specifications

Table 3.1 shows the quartz grade specifications and targets for 2012 that apply at the Moora Quartz Mine. Recently the specification for iron has been relaxed to 0.30% Fe₂O₃ in the quartz product, which has allowed an increase in the resource base of the silica deposits.

Table 3.1 Quartz product chemical grade specifications and targets, 2012

Grade	Target	%Fe ₂ O ₃	%Al ₂ O ₃	%TiO ₂	%CaCO ₃	%MgO	%P ₂ O ₅
A	12,000	0.07	0.15	0.020	0.050	0.050	0.003
ALP	34,000	0.07	0.20	0.012	0.050	0.050	0.010
B	10,000	0.07	0.20	0.015	0.050	0.050	0.025
C	4,000	0.10	0.20	0.030	0.050	0.050	0.010
D	0	0.05	0.20	0.030	0.050	0.050	0.003
E	14,000	0.19	0.30	0.015	0.050	0.050	0.010
HT	6,000	0.08	0.20	0.050	0.050	0.050	0.003

Table 3.2 shows the cut-off quartz grade specifications for the Mineral Resources at Kiaka Hills. They are based on the lowest quality mineral grade (E grade) which is high in iron and alumina. Approximately 50% of the drill hole samples were below (better than) these grade specifications and form the mineral resource base. No attempt has been made to subdivide the Mineral Resources into different grades as the drill holes are not close enough to ensure continuity of grade.

The resource base cut-off grade specification allows for the combination of high and low grade material to be mined and blended during mining, and for a degree of beneficiation at the plant to produce quartz product. The concept is similar in principle to normal cut-off grades but in reverse due to the unwanted contaminants. It is similar to iron ore resource estimation regarding contaminants, although with iron ore the iron content is analysed.

Table 3.2 Kiaka Hills, quartz resource base cut-off grade specifications

% Fe ₂ O ₃	% Al ₂ O ₃	% TiO ₂	% CaO	% MgO	% P ₂ O ₅
0.30	0.40	0.10	na	na	0.05

Following blast hole and grade control drilling, different ore grades are subdivided from the resource base and mined separately according to the silica mineralisation and contaminants. The ratio or balance of the different ore grades varies with each deposit.

The different ore grades are transported to Simcoa’s smelter operations at Kemerton, where they are blended according to silicon customer’s specifications and requirements, which can change from year to year.

3.3 Resource classification

At the Moora Quartz Mine the resources are classified based on drill spacing for practical and simplistic purposes. In reality the ranges of influence of the six important chemical (contaminant) elements, vary significantly but are generally in the range of 10 m to 20 m. The grade of the contaminants is critical to the interpretation of quartz resources. The range of influence of phosphorus (P₂O₅), related primarily to the apatite mineral, is much shorter than the range of influence of other contaminants such as alumina (Al₂O₃), but this is considered too complex for resource classification. Table 3.3 shows the typical resource classification criteria at the Moora Quartz Mine.

Table 3.3 Resource classifications

Resource category	Drill spacing.
Measured	10 m x 10 m
Indicated	20 m x 20 m
Inferred	40 m x 40 m

Some of the Main Pit at the Moora Quartz Mine has been drilled at 10 m by 10 m spacing, which has since proved unnecessary as blast hole drilling is based on staggered 3 m x 3 m spaced drilling. Grade control sampling is based on 3 m holes across strike and 6 m spaced lines along strike, equivalent to 50% of all blast holes. This has been shown to be sufficient for fairly reliable ore type grade and waste prediction.

Based on this (simple) classification half of the resources at J Tonkin farm were classified as Indicated and the other half as Inferred. At A Tonkin farm 25% of the resource was classified as Indicated and the remainder as Inferred.

3.4 Preliminary Mineral Resource estimation

Snowden (T Parker) estimated the mineral resources at the two Kiaka Hills farms in July 2012, based on the drillhole samples and spacing. Within each drillhole a minimum of two (2 m vertical) adjacent samples that satisfied the base resource grade cut-offs were combined to form a mineral intercept. The mineral intercepts were averaged to estimate the tonnes and grades of the resource. The total estimate by this method was 12.0 Mt which was discounted by 50% to account for uncertainties in the continuity of mineralisation between drill holes and allow for the exclusion of small isolated zones.

Table 3.4 shows the Mineral Resources estimated at Kiaka Hills (July, 2012).

Table 3.4 Kiaka Hills, Mineral Resources (July, 2012)

Farm Area	Indicated 000 tonnes	Inferred 000 tonnes	Total 000 tonnes
J Tonkin North	871	871	1,742
J Tonkin South	667	667	1,334
A Tonkin	733	2,199	2,932
Total	2,271	3,737	6,008

Note: Resources reported to the nearest 1,000 tonnes

Table 3.5 shows the July 2007 estimated Mineral Resources with average “in-situ” beneficiated grades.

Table 3.5 Kiaka Hills, Mineral Resources (July 2012)

	M tonnes	% Fe ₂ O ₃	% Al ₂ O ₃	% TiO ₂	% CaO	% MgO	% P ₂ O ₅
J Tonkin N	1.74	0.082	0.237	0.017	0.027	0.025	0.003
J Tonkin S	1.33	0.079	0.263	0.022	0.028	0.026	0.005
A Tonkin	2.93	0.107	0.229	0.025	0.025	0.023	0.005
Total	6.01	0.087	0.222	0.020	0.024	0.023	0.004

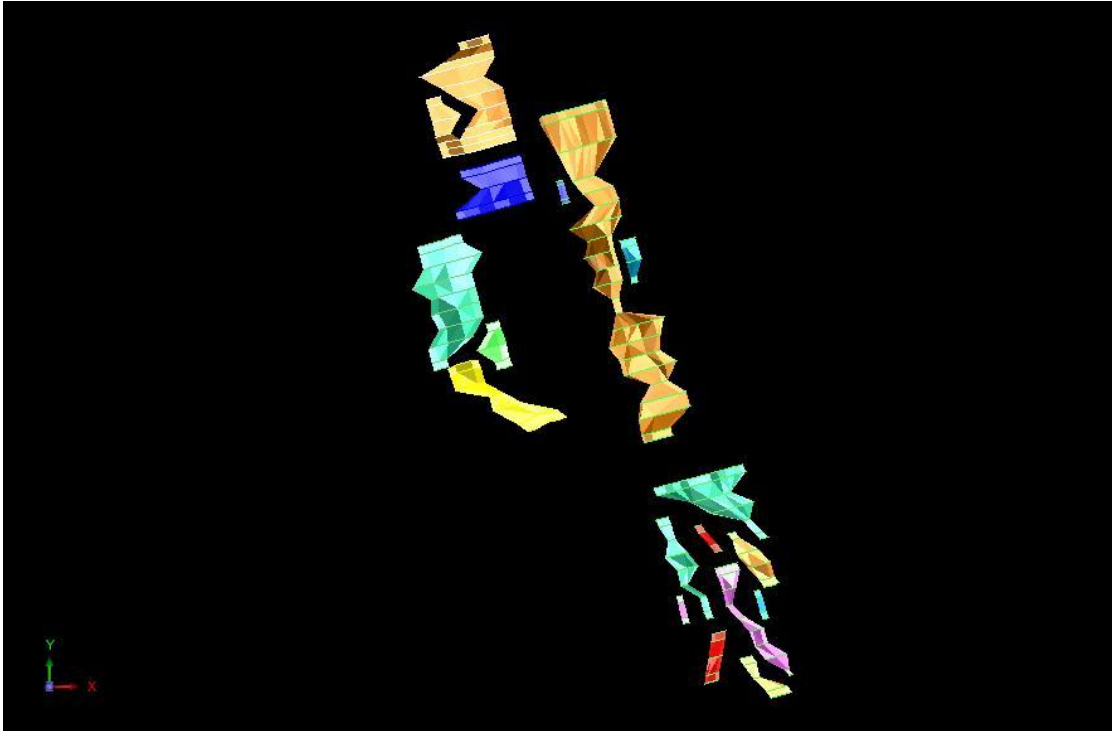
Quartz mineralisation is also known to exist in a quartz ridge to the east of J Tonkin North Ridge (referred to as the East Ridge). The farm owners (J Tonkin) have expressed the wish to exclude this area from future mining. These potential resources have been excluded from this study.

3.1 Revised Mineral Resource estimation (3D resource models)

To provide a more accurate estimation of the volume and tonnes of the quartz resource the mineral intercepts for each hole were combined into 3D resource models. Generally, there was at least one mineral intercept per hole. The resources are based on a minimum of 4 m (2 x 2 m) vertical intersections which have been extrapolated from hole to hole. Figure 3.1 shows a plan view of the resource models.

Snowden estimated the volume within these 3D models at 4.77 million cubic metres (Mm³), equivalent to 11.92 Mt at a bulk density of 2.5 tonnes/m³, which is similar to the July 2012 estimate of 12.0 Mt. Snowden notes that about a quarter of the volume within the resource models (about 3 Mt) occurs in isolated small pockets, which will be impractical to mine, particularly in the J Tonkin South area, shown at the bottom of the diagram.

Figure 3.1 Kiaka Hills 3D resource models



The 3D resource models were used as the basis for open pit and waste dump designs.

4 Mine Development Plan

4.1 Open Pit Optimisation

Snowden prepared a block model at 50 m x 50 m x 4 m, which incorporated the resource model. Snowden applied a Whittle pit optimisation programme in order to minimise the waste removal to an acceptable waste:ore ratio of 1:1. This reduces the cost of mining silica and reduces the waste and environmental footprint. The pit optimisation included all the available resources. The block model was optimised to generate open pit shells to be used for pit designs.

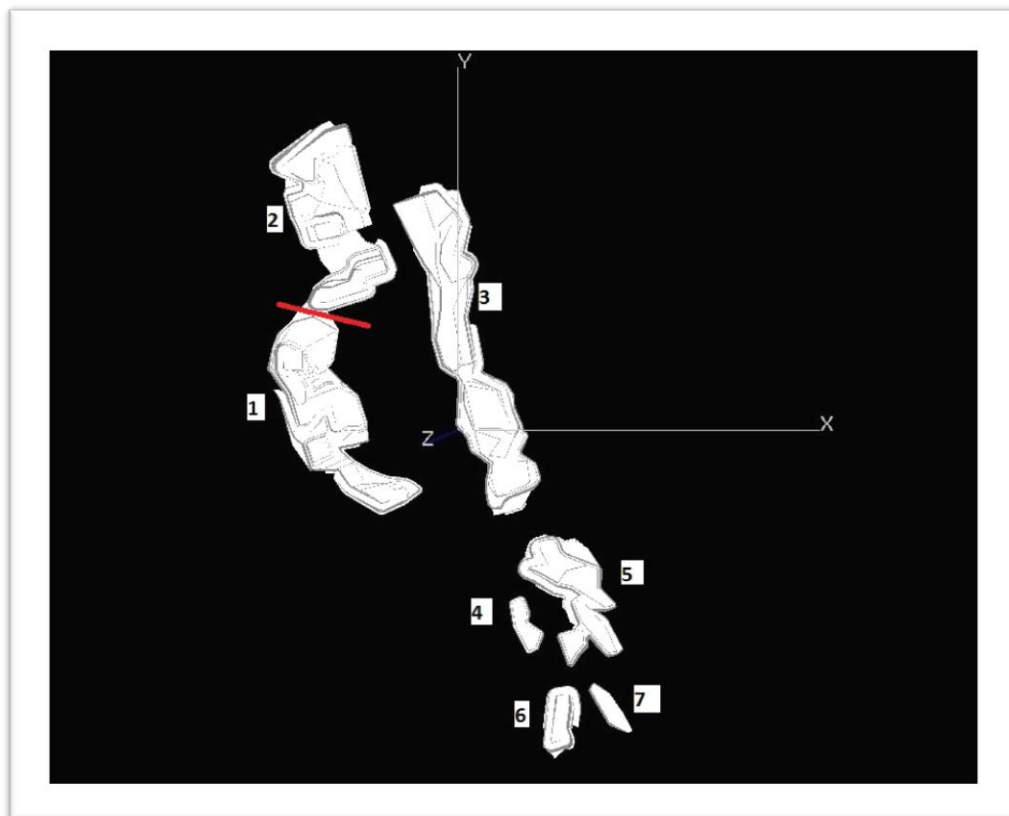
4.2 Open Pit designs

The open pits at Kiaka Hills were designed using the following parameters, which are applied at the Moora Quartz Mine:

- 70 degree pit wall batter angle,
- 4m safety berms at 20 m vertical depth
- 16 m wide haul ramps at a gradient of 1 in 10.

Figure 4.1 shows the open pit designs numbered from 1 to 7. The designs have been created to minimise waste mining and aiming to achieve a strip ratio (waste:ore) of approximately 1:1. As a result the pit outlines appear irregular. Following further drilling it is likely that the pit designs will be modified to a more regular outline.

Figure 4.1 Kiaka Hills Open Pit designs



4.3 Mining Inventory

Table 4.1 shows a summary of the open pit Mining Inventory. It is noted that Pit 6 has a high stripping ratio, but by eliminating this pit the waste to ore ratio reduces to 1.03. Details of the Mining Inventory by pit and by 4 m bench are shown in Appendix A.

Table 4.1 Kiaka Hills open pit Mining Inventory

Pit	Ore Volume	Ore Tonnes	Waste Volume	Waste tonnes	Total Volume	Total tonnes	Strip ratio
1	883,868	2,209,670	847,678	2,119,196	1,731,546	4,328,866	0.96
2	792,649	1,981,622	702,137	1,755,343	1,494,786	3,736,965	0.89
3	1,390,392	3,475,980	1,489,179	3,722,948	2,879,571	7,198,928	1.07
4	65,176	162,941	34,525	86,314	99,702	249,255	0.53
5	367,576	918,941	542,762	1,356,905	910,339	2,275,847	1.48
6	52,403	131,007	193,010	482,524	245,412	613,531	3.68
7	40,697	101,743	28,328	70,821	69,026	172,564	0.70
All	3,592,762	8,981,905	3,837,620	9,594,051	7,430,382	18,575,956	1.07

Table 4.2 shows a summary of the open pit Mining Inventory based on pit designs (shown in Figure 4.1). The four small pits at J Tonkin South have been combined into Pit 4.

Table 4.2 Kiaka Hills openpit Mining Inventory

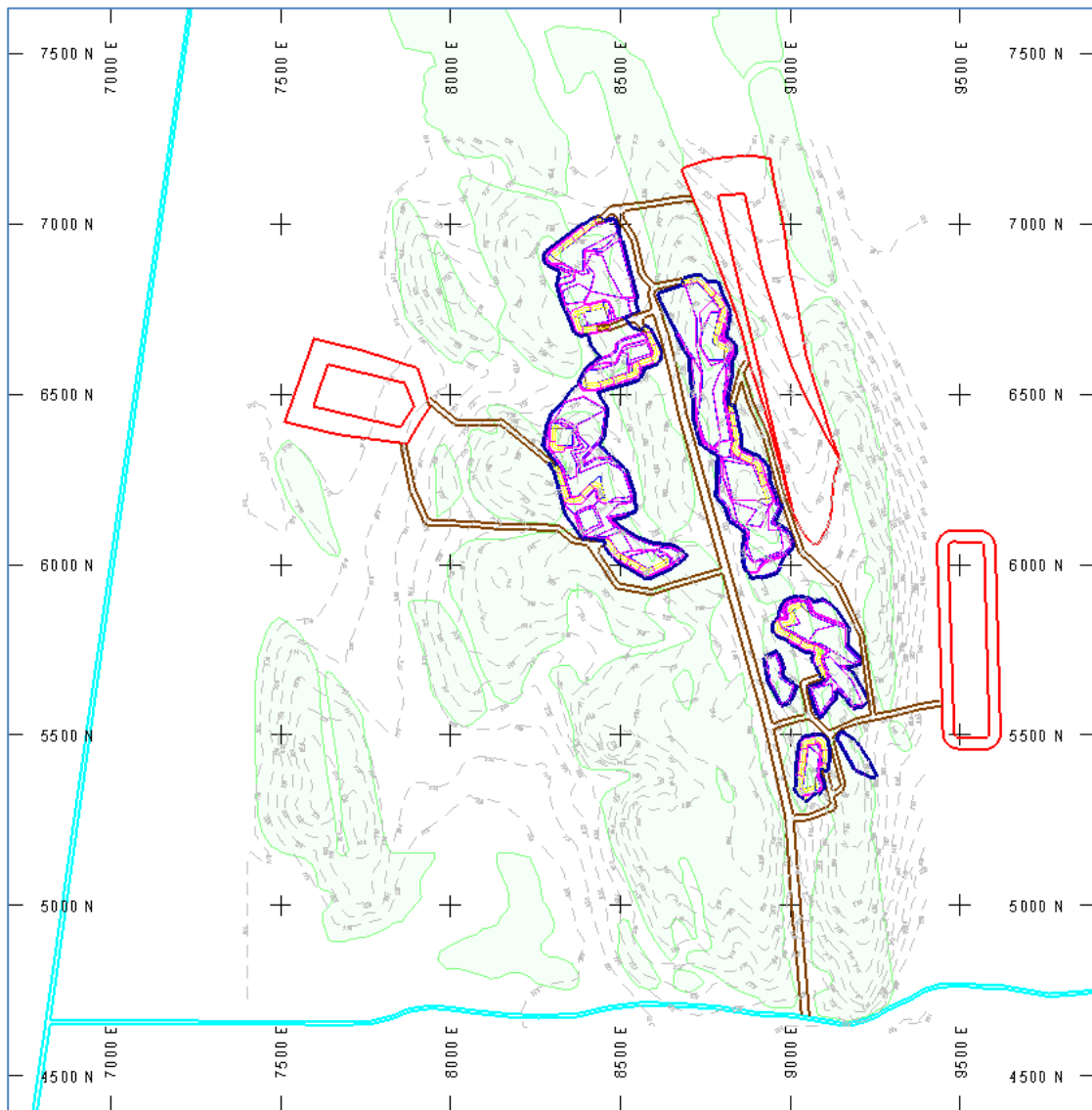
Pit	Ore Volume	Ore Tonnes	Waste Volume	Waste tonnes	Total Volume	Total tonnes	Strip ratio
1	883,868	2,209,670	847,678	2,119,196	1,731,546	4,328,866	0.96
2	792,649	1,981,622	702,137	1,755,343	1,494,786	3,736,965	0.89
3	1,390,392	3,475,980	1,489,179	3,722,948	2,879,571	7,198,928	1.07
4 (5,6,7)	525,853	131,4633	798,626	1,996,565	1,324,479	3,311,198	1.52
All	3,592,762	8,981,905	3,837,620	9,594,051	7,430,382	18,575,956	1.07

Table 4.2 shows there are approximately 8.98 Mt of Mineral Resources that can be effectively mined from the open pits, within a realistic mine design. A proportion of the Mineral Resources can be converted to probable Ore Reserves.

4.4 Mine design

Figure 4.2 shows a plan view of the Kiaka Hills preliminary conceptual mine design showing the open pit design outline (dark blue), waste dump design (red), haul roads (brown), pit ramps (yellow) and sealed roads (light blue). The uncleared native vegetation areas are coloured green. Some of the native vegetation area contains declared rare flora (DRF) and threatened ecological community (TEC) plants. The plan also shows contours at 1 m intervals.

Figure 4.2 Kiaka Hills, preliminary conceptual mine design



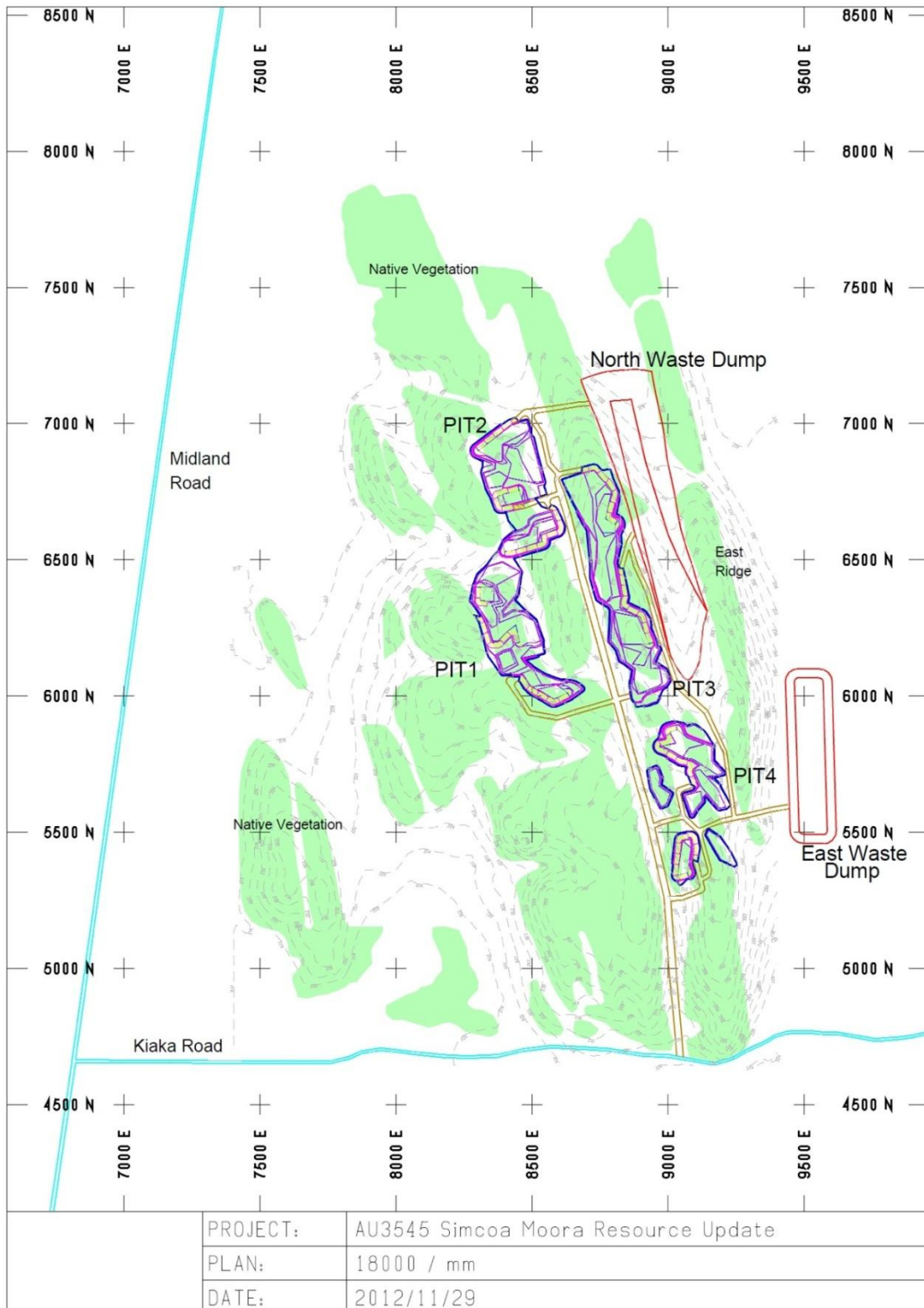
The map is based on the Moora Quartz Mine grid (modified AMG).

4.5 Revised Mine design

Following further discussions with Simcoa, a revised mine design was prepared to exclude the western waste dump and revise the mine plan to include backfilling of completed open pits. Snowden was informed that the owners of A Tonkin farm do not wish to have a waste dump on their property.

Figure 4.3 shows the revised mine design which includes roads to back fill Pit 3. This design slightly reduces the flexibility of blending ore from different pits, but is considered to be environmentally and economically more acceptable.

Figure 4.3 Kiaka Hills revised mine design



4.6 Haul Roads

Snowden has designed the haul roads based on hauling waste to two waste dumps and backfilling a completed open pit. The road design is also based on transporting ore to Kiaka Road by a wider (24 m wide) haul road. It may be necessary to crush the mined ore (using mobile crushers) to a size suitable for transporting by on-road trucks (road trains) to the Moora Quartz Mine crusher. Alternatively, a tunnel, bridge or cross roads could be built at Kiaka Road to allow off road haul trucks to transport ore to the current plant. Eventually, the crushing plant may be relocated north of Kiaka Road in an area of Kiaka Hills.

4.7 Waste dump designs

Snowden has prepared conceptual waste dump designs based on slope angles of 20 degrees. Two waste dumps have been designed, one in the valley to the north between J Tonkin North Pit (Pit 3) and the East Ridge, and the other in the cleared area east of the J Tonkin South open pits (Pits 4, 5, 6 and 7). Both areas have been cleared of native vegetation for agriculture in the past. The North Waste Dump has been designed 20 m high to a height of 264 mean relative level (mRL) and cut into the topography (valley sides).

The East Waste Dump has been designed as a stand-alone dump 12 m high, to a height of 240 mRL. Following further studies it might be preferable to merge the dump with the southern end of the East Ridge, which will appear more aesthetically and environmentally pleasing. Snowden notes that the topographic data for this dump does not extend into the eastern valley and has assumed the area to be relatively flat.

The waste volumes are based on a swell factor of 30% assuming an increase in volume due to blasting of the rock. The waste dumps have been designed to accommodate waste from the different pits and to allow backfilling of completed pits. If back filling of waste into completed pits becomes a main priority, then the waste dumps may need to be redesigned.

4.8 Ore and Waste Mining Schedule

4.8.1 Mine Schedule

Simcoa currently has no immediate plans to commence mining at Kiaka Hills. This will depend on the development of the Main Pit and West Pits at the Moora Quartz Mine, and the need or ability to blend higher alumina silica ore from Kiaka Hills at the Mine.

Snowden has based the mining of ore and waste on the following schedule:

1. Mine Pit 3 (J Tonkin N), waste to Waste Dump North
2. Mine Pits 4, 5, 6 and 7 (J Tonkin S), waste to Waste Dump East
3. Mine Pits 1 and 2 (A Tonkin), waste to backfill Pit 3 (J Tonkin N)

4.8.2 Waste Mining

Table 4.3 shows the estimated volume of waste including the swell volume (30% increase) from the four main pit areas. The estimated volume of the waste (swelled) from Pit 1 and Pit 2 (2,014,761 m³) will readily fit within Pit 3 which has a design volume of 2,879,571 m³. It may be possible to further rationalise the movement of waste to the waste dumps and backfill pits. The exact quantities of ore and waste have yet to be finalised and await further close spaced drilling.

Table 4.3 Waste Mining Schedule

Pit	Waste Volume m ³	Swell Waste Volume m ³	Destination
1	847,678	1,101,982	Back Fill Pit 3
2	702,137	912,779	Back Fill Pit 3
Total	1,549,815	2,014,761	Backfill
3	1,489,179	1,935,933	North Waste Dump
4 (5,6,7)	798,626	1,038,214	East Waste Dump
Total	2,287,805	2,974,147	Waste Dumps
Total	3,837,621	4,988,907	

4.1 Revised Mineral Resource estimation (Nov 2012)

Table 4.4 shows the Mineral Resource Inventory within open pit designs and classifications based on drill spacing. The table shows about approximately 38% of the Mineral Resources can be classified as Indicated Resources and 62% as Inferred Resources.

Table 4.4 Mineral Resource Inventory in open pits (November, 2011)

Farm Area	Indicated Resources Mt	Inferred Resources Mt	Total Resources Mt
A Tonkin (total) (25% Indicated)	1.05	3.14	4.19
J Tonkin North (50% Indicated)	1.72	1.72	3.48
J Tonkin South (50% Indicated)	0.65	0.65	1.31
Total	3.42	5.51	8.98

Table 4.5 shows the comparison between the preliminary resource estimate (12 Mt discounted by 50%) and the revised Mineral Resource estimate based on the 3D models. The table shows an increase of 50% in the revised Mineral Resources, which is considered to be a more reliable estimate.

Table 4.5 Kiaka Hills, Mine Preliminary Resources versus Revised Resources

Farm Area	Indicated Resources Mt	Inferred Resources Mt	Total Resources Mt	Revised Resource Mt
A Tonkin (total) (25% Indicated)	0.73	2.20	2.93	4.19
J Tonkin North (50% Indicated)	0.87	0.87	1.74	3.48
J Tonkin South (50% Indicated)	0.67	0.67	1.33	1.31
Total	2.27	3.74	6.01	8.98

Further detailed drilling is required to be confident of the Mineral Resource outlines and estimation.

5 Ore Reserve Estimation

5.1 Mining Inventory

Table 5.1 shows the Kiaka Hills open pit Mining Inventory within the seven open pit designs, and the total Mineral Resources of 8.98 Mt.

Table 5.1 Kiaka Hills, open pit Mining Inventory

Pit	Farm	Resources Mt	Waste Mt	Total Mt	Strip ratio
1	A Tonkin	2.21	2.12	4.33	0.96
2	A Tonkin	1.98	1.76	3.74	0.89
3	J Tonkin North	3.48	3.72	7.20	1.07
4	J Tonkin South	0.16	0.09	0.25	0.53
5	J Tonkin South	0.92	1.36	2.28	1.48
6	J Tonkin South	0.13	0.48	0.61	3.68
7	J Tonkin South	0.10	0.07	0.17	0.70
Total		8.98	9.60	18.58	1.07

5.2 Modifying factors

The Mineral Resource Inventory is the current theoretically interpreted mineralisation that could be mined from the open pits. The mineral ore grade intercepts are based on a minimum of 4 m vertical intersection (two adjacent 2 m samples). The 3D resource models are not based on the practicalities of mining, which are currently 4 m high benches. Accordingly, a proportion of the mineral inventory will not be recovered during mining as it occurs above or below the 4 m benches. This has not been accurately quantified but Snowden consider that about 10% of this Mineral Inventory will not be recovered and has assumed the mining recovery of this Mineral Inventory to be in the order of 90%.

Snowden has applied a 90% mining recovery at zero dilution to the mineral inventory to estimate the Ore Reserves within the pit designs.

Table 5.2 shows the Mining Inventory based on a mining recovery of 90% giving a total of 8.08 Mt of quartz "ore" and a total of 10.50 Mt of waste at a strip ratio of 1.30. Snowden considers that further work is required to provide more detailed estimates of the Ore Reserves when mining has been approved.

Table 5.2 Modifying factor (mining recovery)

Pit	Mine recovery	Ore Mt	Waste Mt	Total Mt	Strip ratio
Total	100%	8.98	9.60	18.58	1.07
Total	90%	8.08	10.50	18.58	1.30

5.3 Ore Reserves

Snowden understands that the mining lease M70/1292 was approved by the DMP in early 2012 and approval to mine is awaiting the outcome of proposed mine development plans, including this report. When mining is approved, Snowden and Simcoa can report the Ore Reserves according to the JORC Code for the reporting of exploration results, Mineral Resources and Ore Reserves, subject to meeting all other criteria, including quality control procedures.

Assuming that mining is approved then Snowden considers that the approximately 38% of the Mining Inventory can be classified as Probable Ore Reserves with 62% classified as Inferred Resources in pit. Table 5.3 shows the breakdown of the Mining Inventory of Probable Reserves and Inferred Resources in pit.

Table 5.3 Mining Inventory (Ore Reserves and Inferred Resources) in pits

Reserves/Resources	Mt	Fe2O3 %	Al2O3 %	TiO2 %	P2O5 %
Probable Ore Reserves	3.08	0.093	0.23	0.022	0.004
Inferred Resource in pits	5.00	0.093	0.23	0.022	0.004
Total Mining Inventory	8.08	0.093	0.23	0.022	0.004

Additional closer spaced drilling is required to convert the Inferred Resources to Indicated Resources, which can then be converted to Probable Reserves. This should be followed by more detailed resource estimation, revised pit designs and a more definitive Mine Plan.

Appendix A Open pit bench summary

Pit	Bench	Ore Volume	Ore tonnes	Waste Volume	Waste tonnes	Total Volume	Total tonnes	Strip Ratio
1	264	-	-	121	303	121	303	-
1	260	3,365	8,412	17,492	43,731	20,857	52,143	5.20
1	256	23,478	58,694	84,970	212,426	108,448	271,120	3.62
1	252	42,490	106,224	99,634	249,084	142,123	355,308	2.34
1	248	117,299	293,247	188,576	471,440	305,875	764,687	1.61
1	244	87,353	218,382	104,408	261,019	191,760	479,401	1.20
1	240	152,152	380,380	153,902	384,754	306,054	765,134	1.01
1	236	168,673	421,682	109,239	273,098	277,912	694,781	0.65
1	232	105,356	263,390	39,278	98,195	144,634	361,585	0.37
1	228	124,487	311,217	36,800	91,999	161,286	403,215	0.30
1	224	28,905	72,262	5,691	14,227	34,595	86,488	0.20
1	220	20,660	51,651	3,349	8,372	24,009	60,023	0.16
1	216	9,652	24,130	4,219	10,547	13,871	34,677	0.44
1	Total	883,868	2,209,670	847,678	2,119,196	1,731,546	4,328,866	0.96
2	248	380	950	16,189	40,471	16,569	41,422	42.58
2	244	23,905	59,762	47,771	119,427	71,675	179,188	2.00
2	240	122,846	307,115	157,775	394,438	280,621	701,553	1.28
2	236	182,455	456,138	154,209	385,522	336,664	841,660	0.85
2	232	125,198	312,996	88,248	220,620	213,446	533,615	0.70
2	228	159,585	398,962	108,039	270,098	267,624	669,061	0.68
2	224	79,816	199,540	42,516	106,290	122,332	305,830	0.53
2	220	66,250	165,625	52,050	130,125	118,300	295,750	0.79
2	216	32,214	80,534	35,341	88,352	67,555	168,886	1.10
2	Total	792,649	1,981,622	702,137	1,755,343	1,494,786	3,736,965	0.89
3	276	1,433	3,583	10,353	25,884	11,787	29,466	7.22
3	272	6,742	16,854	104,451	261,127	111,193	277,981	15.49
3	268	23,348	58,369	252,532	631,330	275,880	689,699	10.82
3	264	42,689	106,723	157,904	394,759	200,593	501,483	3.70
3	260	110,589	276,471	304,805	762,012	415,393	1,038,483	2.76
3	256	197,641	494,102	250,525	626,312	448,166	1,120,414	1.27
3	252	197,505	493,763	100,745	251,864	298,251	745,626	0.51
3	248	310,492	776,231	126,853	317,133	437,346	1,093,364	0.41
3	244	162,970	407,426	52,860	132,150	215,831	539,577	0.32
3	240	200,694	501,736	75,459	188,648	276,153	690,384	0.38
3	236	94,246	235,616	33,240	83,099	127,486	318,716	0.35
3	232	22,372	55,930	7,935	19,837	30,307	75,767	0.35
3	228	19,670	49,176	11,517	28,793	31,187	77,969	0.59
3	Total	1,390,392	3,475,980	1,489,179	3,722,948	2,879,571	7,198,928	1.07

Pit	Bench	Ore Volume	Ore tonnes	Waste Volume	Waste tonnes	Total Volume	Total tonnes	Strip Ratio
4	272	31	77	2	5	33	83	0.07
4	268	3,063	7,657	4,337	10,842	7,400	18,500	1.42
4	264	7,708	19,270	7,105	17,762	14,813	37,032	0.92
4	260	17,228	43,071	12,397	30,993	29,625	74,063	0.72
4	256	21,581	53,953	7,854	19,635	29,435	73,588	0.36
4	252	15,565	38,913	2,831	7,076	18,396	45,989	0.18
4	Total	65,176	162,941	34,525	86,314	99,702	249,255	0.53
5	276	6,289	15,722	61,056	152,641	67,345	168,363	9.71
5	272	20,565	51,412	81,897	204,743	102,462	256,155	3.98
5	268	38,736	96,841	149,166	372,914	187,902	469,755	3.85
5	264	40,611	101,528	74,039	185,098	114,650	286,626	1.82
5	260	76,481	191,202	95,464	238,660	171,945	429,862	1.25
5	256	94,996	237,491	56,016	140,041	151,013	377,531	0.59
5	252	63,578	158,946	20,152	50,380	83,730	209,326	0.32
5	248	26,320	65,800	4,972	12,430	31,292	78,230	0.19
5	Total	367,576	918,941	542,762	1,356,905	910,339	2,275,847	1.48
6	268	-	-	2,490	6,225	2,490	6,225	-
6	264	-	-	13,077	32,693	13,077	32,693	-
6	260	129	322	36,975	92,436	37,103	92,759	286.91
6	256	1,252	3,130	45,167	112,918	46,419	116,048	36.08
6	252	2,918	7,295	25,453	63,633	28,371	70,929	8.72
6	248	9,004	22,509	34,913	87,284	43,917	109,793	3.88
6	244	8,810	22,026	15,090	37,726	23,901	59,752	1.71
6	240	15,027	37,567	14,833	37,084	29,860	74,651	0.99
6	236	15,263	38,159	5,010	12,525	20,273	50,683	0.33
6	Total	52,403	131,007	193,010	482,524	245,412	613,531	3.68
7	268	2,277	5,691	8,187	20,468	10,464	26,159	3.60
7	264	7,110	17,774	7,524	18,809	14,633	36,583	1.06
7	260	14,128	35,321	8,151	20,377	22,279	55,698	0.58
7	256	17,183	42,957	4,467	11,167	21,649	54,123	0.26
7	Total	40,697	101,743	28,328	70,821	69,026	172,564	0.70
Grand	Total	3,592,762	8,981,905	3,837,620	9,594,051	7,430,382	18,575,956	1.07