THE MUIR RAPID HABITAT ASSESSMENT SYSTEM (MRHAS©)

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1.0 INTRODUCTION

1.1 THE ORIGIN OF MRADS AND MRHAS©

The Muir Rapid Assessment Data System (MRADS), the forerunner of the Muir Rapid Assessment System (MRHAS©), evolved from a research programme which was commenced Western Australian Museum (WA Museum) in 1971. At that time, under the guidance of D Kitchener, a survey of mammal, bird and reptile fauna began in the Western Australian wheatb agricultural area of about 22 million hectares of which all but about 5 million hectares ha cleared for grain growing. Uncleared land was held in road, town, railway, recreation, wat conservation reserves.

It had been noted that, following the clearing of land in the region, there had been a dramatic c in the mammals (Kitchener 1973), birds (Serventy and Whittell 1976), and reptiles (Storr 1964). probable that many other groups of animals had also been greatly affected by these extensive alterations to the environment. The only chance for future persistence of many species of vertebrates in the region depended on the haphazardly located conservation reserves and patches of remnant bushland in the area.

The field survey of wheatbelt reserves commenced with the aim of examining the remnant fauna populations. The general approach was to survey each reserve during autumn and spring. Mammal trap-lines were set to sample the major habitats on each of the selected reserves. In each of these habitats, birds were recorded by observation, and reptiles and frogs by opportunistic collection. Habitat descriptions of all traplines, and vegetation maps were prepared for each reserve.

At the outset of the survey, it became apparent to Kitchener that the systems of vegetation mapping available at that time were not suitable for describing vegetation of the wheatbelt in terms thought relevant to the fauna. This was primarily because the available vegetation classification systems did not differentiate clearly between vegetation that was structurally quite different, both in its overall physiognomy and internal stratification. It was decided, nevertheless, to proceed with the fauna

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survey until a suitable system of vegetation classification was developed, and then retrospectively annotate the vegetation at those localities where traps had been set and fauna observed or collected. Barry Muir, an Ecologist, was appointed by the Western Australian Museum in 1975 to develop a 'fine-tuned' system of vegetation classification and mapping that was more suitable for fauna studies.

The vegetation classification which resulted from those studies was published in 1977, and became known in Australia as the Muir Classification (Muir 1977). During further studies in the wheatbelt, from 1976 to 1979, the Muir Classification was further modified. It was adopted by various agencies and researchers throughout Australia and overseas.

Comments on the success and limitations of the classification were fed back to Barry Muir. In 1980, Muir commenced a process of examining fauna ecology data from any available source and comparing the findings with the Muir Classification. He also tested the Classification in any habitat type he encountered in Australia or overseas, and gathered input from zoologists whenever possible.

The result of these ongoing studies has been that the original Muir Vegetation Classification diverged into two other systems:

- the Muir Rapid Assessment Data System (MRADS) - which was intended to allow meaningful vegetation classification over large areas or when study time was limited; and

- the Muir Rapid Habitat Assessment System (MRHAS©) - which similarly was intended for large scale or rapid vegetation surveys, but provided additional information which allows it to be of particular value in describing fauna habitats.

The two systems have much in common and are, therefore, largely inseparable in the text of this document. In most in-field situations MRHAS© is used exclusively, as it provides the same data as MRADS but also adds habitat data with little extra effort.

1.2 THE DEVELOPMENT OF THE MUIR CLASSIFICATION

Two possible approaches to describing vegetation are most likely to distinguish the habitat preferences of vertebrate fauna. One of the earliest studies in Australia was that of Webb (1959; 1968) and Kikkawa and Webb (in Webb et al. 1973). These researchers selected a group of animals and recorded in great detail the characteristics of the environment in which they were found. They then analysed the resultant data, obtaining a set of parameters to produce a vegetation classification. This approach requires a computerised data processing system and results in a habitat classification relevant only to a particular animal group. It is too slow and complex for a rapid approach to fauna survey, or for large area mapping and classification of vegetation.

The alternative approach was to develop a simple vegetation classification, useful to botanists, but detailed enough to describe habitats of fauna, particularly vertebrates. Systems based on floristics were not considered in the original studies because there was not time to develop such a classification. Further, such classifications were generally more difficult to use. Structurally-based classifications were easy to use. Several structural classification systems were already widely used in Australia for botanical and fauna survey work and could form a basis for the new system. Floristic components were included as the method developed.

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The Muir (1977) Vegetation Classification was derived from the Beard and Webb (1974) classification, with modifications based on the needs of scientists specialising in mammal, bird, reptile, and amphibian studies. Consistent results have been obtained in its application, even from users with very little botanical background.

1.3 PHILOSOPHY OF MRADS

To undertake fauna surveys in the field requires detailed, lengthy (sometimes several years), and costly field work. Further, because of the mobility of fauna, there is a high level of uncertainty in evaluating data. Absence of a species may mean, for example, that it was simply not detected rather than being absent, or that the impacts of a project had destroyed or displaced it.

To some extent this may be true of plant species. Small, ephemeral or particularly inconspicuous species may be overlooked and considered rare or scarce when, in fact, they are simply hard to find. Larger species are usually perennial, easily measured or evaluated, and are the primary 'building blocks' on which the habitat is constructed.

Using the philosophy that if the habitat is complex, floristically rich and 'healthy', so will be the fauna populations which occupy it, it is possible to direct an examination at the vegetation and habitat rather than at the fauna.

Further to this philosophy, it is possible to adopt certain biological principles on which to evaluate the habitat. These are:

- the more structurally complex the habitat the more diverse will be the fauna;
- the more floristically rich the habitat the more diverse will be the fauna;
- the greater the level of protection from predators afforded by the habitat the more likely it is to be 'useful' to fauna; and
- some easily measured special habitat characteristics (e.g. numbers of trees with hollow limbs, length of tree trunks, distance between strata, etc.) are a useful evaluation of habitat availability.

Based on these philosophies, modified from long experience with habitat studies, the following methodology has been developed for assessing faunal habitat.

1.4 USE OF MRADS DATA FOR FAUNA HABITAT

As MRADS has been used more frequently to describe fauna habitat (ie. as it evolved into MRHAS©) a number of specific applications of its various components have also consolidated. Some of these are directly related to MRADS, e.g. the number of life-form/density classes (LFDCs) (originally proposed by Kitchener 1980a; 1980b; 1982). Others have arisen independently, e.g. the abundance of hollow logs, or in response to certain needs in habitat description, e.g. the presence of buttresses on rainforest trees.

Data collected using these parameters is weighted to reflect the significance of the parameter for fauna habitat description. The weightings are a subjective decision made by Muir and based on observation, literature review, and discussion with numerous other researchers.

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Weightings may vary slightly from one geographic location to another (wet tropics are clearly different to more temperate climates) and are not necessarily applied to all characteristics noted.

Because some of the data are subjective, e.g. abundance of food-generating plant species, while others may have actual numbers, e.g. numbers of plant species, the items with numbers are grouped and the groups scored. This is explained in further detail below. While this procedure tends to converge the end scores to a lowest common denominator, experience has shown that major differences in habitat are still detected and obvious. Grouping also reduces the error which results from using only approximate numbers, such as the number of species in an area.

A further advantage of MRADS and MRHAS© is that, because actual numbers are grouped, or ranges of numbers or characters clustered into categories, the minor errors which can creep into large, complex spreadsheets, or discrepancies between operators or measurements, are negated in the final scores. Absolute exactness in scoring or mathematical proceedings is not essential to generate meaningful conclusions.

The very high degree of structural homogeneity of vegetation and habitat in some locations, such as deserts, renders some of the MRHAS© rating parameters of limited value, ie. they give identical figures in all habitats. These parameters, once recognised, may be excluded from the analysis and only those which distinguish between habitats then used.

In tropical habitats this is much less of a problem because the vegetation and habitats are often very heterogeneous and there are more parameters to measure. Those used, or sometimes not used, are indicated in the descriptions of system components presented below.

Even those parameters not used are, however, frequently of considerable value in interpretation of the data.

2.0 MRHAS© SYSTEM COMPONENTS

2.1 BIOPHYSICAL COMPONENTS

2.1.1 Soil Drainage

Drainage is subjectively classified as very poor, poor, moderate, well drained and very well drained, and often closely correlates with topographic position as well as soil texture and pedality. This parameter may be of use in examining habitat of moisture-requiring species such as land snails, or may be important in estimating soil burrowability, e.g. for burrowing mammals or reptiles.

If used, the scoring procedure is: very poor = 1; poor = 2; moderate = 3; well drained = 2; and very well drained = 1. Weighting is 1.

These parameters are not generally used in the MRHAS© rating but may be useful in some circumstances.

...../5

2.1.2 Slope

This is determined by a clinometer and presented as degrees of slope. Steep slopes usually indicate better drainage on the crests and upper slopes, and greater availability of moisture at the slope toe.

If used, the score is: slopes > 40° = 1; slopes 18° - 40° = 2; slopes 5°-18° = 3; slopes < 5° = 2; flat = 1. Weighting is 1.

This parameter is generally not used in the MRHAS© rating, but may provide some insight into distribution of fauna. In addition, soil stability tends to decrease significantly on slopes greater than 18° and may affect the establishment of vegetation.

2.1.3 Aspect

Observation on dune slopes and other similar locations, such as in valleys, shows that the south and west sides in the southern hemisphere, and the north and west sides in the northern hemisphere receive less heat and retain moisture a little longer early in the day during the hot season than do the other slopes. Consequently, the vegetation is often different.

If used, the scores are as shown below. Weighting is 1.

	NORTH SIDE	EAST SIDE	SOUTH SIDE	WEST SIDE
Northern Hemisphere	2	2	1	1
Near the Equator	1	1	1	1
Southern Hemisphere	1	1	2	2

This parameter is not generally used in the MRHAS© rating but may be important in interpretation of differing habitat densities or floristic variations.

2.1.4 Soil Protection

Soil protection is a combination of rock cover, vegetation cover, and leaf litter depth and cover. It is a measure of the possible incidence of water or wind erosion when the soil is in an undisturbed condition. The degree of protection is expressed as a percentage of the protected soil surface. This parameter is difficult to interpret for fauna because it depends very much on what animal is being investigated. Thus, 100% cover of deep litter may totally protect the soil and provide a habitat for a small vertebrate, whereas 100% cover of rock may also protect the land surface from erosion but be unsuitable for most fauna.

This parameter is not used in the MRHAS© rating except for guidance.

2.1.5 Erosion

Erosion is a derivative of the soil protection classification but generally refers to the disturbed condition. Any evidence of runoff erosion or wind-blowing of the soil is evaluated.

Erosion is scored as: 5 = none (fully stable); 4 = minor; 3 = moderate; 2 = severe erosion; 1 = very severe and ongoing. Weighting is 1.

...../6

This parameter is not generally used in the MRHAS© rating but may be useful when comparing habitats in semi-stable environments.

2.1.6 Depth of Soil Loss

In many areas where sheet erosion has been significant, the loss of soil has exposed root systems of plants. By measuring the amount of soil loss from the roots an estimate can be made of the total loss of soil over the area and, from the age of the plants, over how long a period the loss has been occurring. The parameter has many sub-variables which may be difficult to interpret but may be of value in reference to ground-dwelling micro-fauna, or small reptiles, etc.

Scores are: no apparent soil loss = 5; minor soil loss (less than 1 - 2 cm) = 4; significant soil loss but basically stable = 3; significant soil loss and currently unstable = 2; severe soil loss (in excess of 10 cm) and destabilisation process ongoing = 1. Weighting = 1.

An extension of this parameter is soil-compacting or pugging of waterlogged soils caused by the activities of sheep, cattle or other stock. If compacting is to be evaluated, replace the word "loss" with "compacting" or "pugging", and score as above.

2.2 STRUCTURAL AND FLORISTIC COMPONENTS

2.2.1 Formations and Associations

Formations are defined as structural vegetation types where the dominant life-form defines the type. Thus, vegetation dominated by the tree life-form is referred to as woodland; shrub dominated vegetation greater than 2 m tall as shrubland; shrub dominated vegetation less than 2 m tall as heath; grass dominated vegetation as grassland; etc. The habitat complexity is increased if there is another formation adjacent to the one under review. Thus, a woodland adjacent to a heath provides opportunity for animal species to use both habitats. This opportunity is not available to species occupying the centre of an extensive single formation.

The number of formations is scored directly in the MRHAS©, with a weighting of 2.

An association is a formation defined by the dominant plant species. Differing formations are mostly dominated by different species, although a heath or shrubland formation may be dominated by tree species which have not yet reached maturity. Similarly, adjacent and contiguous woodlands may be dominated by different species.

The number of associations is scored in the MRHAS©, with a weighting of 2.

2.2.2 Width of Ecotone

Ecotones between adjacent formations or associations may be very narrow, such as in cleared land adjacent to uncleared land. These ecotones are of limited (but some) value to fauna and are scored as 1.
Where the ecotone is from 60 m to 120 m wide it creates, in effect, a third habitat type, and can support a unique fauna as well as extending habitat opportunities for fauna occupying the adjacent main associations or formations. These ecotones are scored as 3.

...../7

When the ecotone is detectable but wider than 120 m, it is scored as 2, as it is still a distinct habitat type, but is a lesser value because of its gradational similarity to the adjacent types.

Ecotones are given a weighting of 2.

2.2.3 Life-form

Many botanical studies only describe (and map) climax formations, sub-climax stages being interpreted on their probable nature when climax is reached. In contrast, habitat classification must describe vegetation seral stage in its existing form, regardless of its climax. Such an approach requires the resolution of questions such as when does a tree, regrowing after fire, cease to be a shrub and become a tree. Definitions of life-form that are fauna habitat-oriented hold the key to selection of terms in this situation. The problem then arises in habitat-oriented life-form classification that terms may vary when the vegetation is dominated by different species of plants, the fauna sometimes utilising each plant species in a particular way.

The Muir Vegetation Classification attempts to define life-forms in a manner which will produce consistent vegetation descriptions meaningful to fauna utilisation. The adaptation of these vegetation descriptions to describe habitat may depend upon the plant species involved, the researcher's purpose, and the group of animals being studied.

This parameter is not used in the MRHAS© rating *per se*, but in the general descriptions of vegetation necessary for interpretation.

The following dominant life-forms are recognised.

Trees

Trees are defined as woody, perennial plants, generally erect, of variable outline, but commonly with a spherical or ovoid canopy raised well above the ground. The presence of a canopy excludes cacti (for example) from this category. The major part of the canopy from bottom to top is less than, or equal to, two thirds of the total height of the tree (excluding suckers and basal shoots). Trees are generally single stemmed. However, if they are multi-stemmed they have fewer than five individual trunks that result from branching of a single trunk (which may be quite short). Trees do not usually arise from a fire-resistant lignotuber.

Tree height is variable but usually exceeds 2 m when the plant is mature. When dead, hollow tree limbs may be of sufficient size to provide habitats for vertebrates. Many trees in arid areas are less than 5 m tall. However, because of their life-form, they are used by animals differently from shrubs of similar height.

Shrubs

These are defined as woody, usually perennial plants, generally erect but may be procumbent or of weeping habit. Commonly, they are broadly conical in form with the foliage occupying all, or only part, of the total height of the plant. Multiple stems and branches arise from a rootstock or very short common trunk. Lignotubers are usually, but not always, absent.

...../8

Shrubs may be of any height but are generally less than 5 m tall. Dead, hollow branches rarely reach sufficient size to provide habitats for vertebrates. Enlarged rootstocks may be present in some species exposed to frequent fires. Height classes in the classification were selected in order to separate all strata in shrub-dominated formations. This is thought to be particularly important for bird utilisation of these formations.

Grasses

Grasses are herbaceous, or rarely woody, plants of the family Poaceae (Graminae). Perennial or annual, generally erect or spreading, they usually have distinct individual shoots (tillers) arising from a single root system.

Canopy density of grass is sometimes overestimated because dead stems and leaves are invariably present, and these may have flattened out. Height division is normally set at 0.5 m, with grasses and bamboo exceeding 2 m in height usually used the same way as much taller grasses (> 5 m) in these habitats. Bamboo may be separated out on floristic grounds.

Herbs

Herbs are soft plants which may be ephemeral or perennial. In environments many are creepers or small ground-cover species. In newly disturbed areas there may be a prolific carpet of seedling plants which are, effectively a herb-field.

2.2.4 Top and Bottom Height and Inter-stratal Distance

Top Height refers to the average and approximate height of the top of each stratum. This, and Bottom Height, are used as a measure of stratal organisation and spacing.

Bottom Height refers to the bottom of each stratum. The height of the bottom of Stratum 1, minus the height of the top of Stratum 2 (strata are numbered from the upper stratum down) gives an indication of the inter-canopy distance used by some predators. There are also several species, such as some birds and mammals, which use this open area between Strata 1 and 2.

This measurement is referred to in MRHAS© tables as Inter-stratal Distance and is given a weighting of 1.

Scoring is as follows:

- if the distance between the top of Stratum 2 and the bottom of Stratum 1 is more than twice the height of Stratum 2, score = 1;
- if the inter-stratal distance is equal to or up to twice the height of Stratum 2, score = 2; or
- if the inter-stratal distance is less than the height of the understorey, score = 3.

2.2.5 Trunk Length

Trunk length is the distance in metres between the ground and the bottom of Stratum 1 of the tree canopy. The trunk of some Eucalypt trees, in particular, is used almost exclusively by some insects and spiders, and by many birds and reptiles.

It is scored as 0-10 m = 1; 11-20 m = 2; 21-30 m = 3; 31-40 m = 4; 41 m and above = 5. Weighting is 1.

...../9

2.2.6 Canopy Cover

Canopy Cover is the total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or association area. The term is used in this study in preference to the commonly used term, 'Crown Cover', because it records the actual area of foliage more accurately. This is particularly so with some tree life-forms, such as Fabaceae, where the crown may be made up of several smaller foliage clumps. Visually estimated Canopy Cover divisions of 10% are used in the present study. A derivative of Canopy Cover, the Total Canopy Index (see below) is used in the MRHAS© rating.

A lower limit of 2% Canopy Cover has been set because experience has indicated that plants with less than 2% Canopy Cover are too widely spaced to be used as a stratum by fauna. They do not appear in descriptions as a stratum but may be Structure-modifying species (see below).

2.2.7 Average Foliage Density (AFD)

Average Foliage Density is measured with a Spherical Densiometer (Type A) as described in Lemmon (1956), or by using photographic or point-quadrat techniques. Foliage density is determined by five readings for each species in the association, or, when there are too many species or the strata is too complex, readings are taken from the dominants.

Figures are adjusted where necessary to give a more accurate representation of the foliage density of the stratum as a whole. Some formations (e.g. scrubland and heath) may have a similar foliage density for most of the plant species present. Other species may individually have almost 100% foliage density. If such a species comprises several percent of the whole stratum, the foliage density figure is adjusted accordingly.

This parameter is not directly used in the MRHAS© rating, but is used in calculating the Total Canopy Index.

2.2.8 Total Canopy Index

Both individually, and in combination, Canopy Cover and Average Foliage Density (AFD) provide an indication of the degree of protection offered by the vegetation to both arboreal and ground-dwelling fauna. Again, the cover provided will vary with vegetation health and thus, indirectly, may be related to moisture availability.

An artificial Total Canopy Index (TCI) provided by the taller strata (usually Strata 1, 2 and 3) can be generated by:

TCI = % Canopy Cover of Stratum 1 x % AFD of Stratum 1,
plus % Canopy Cover of Stratum 2 x % AFD of Stratum 2,
plus % Canopy Cover of Stratum 3 x % AFD of Stratum 3.

TCI is scored as 0-20 = 0; 21-50 = 1; 51-100 = 2; 101-150 = 3; 151-200 = 4. Weighting is given as 2.

2.2.9 Mean Vegetation Health

Vegetation health is estimated by a simple scoring procedure. Plants visually in excellent health are rated 5. Plants which are comparatively healthy but with some tip dieback or yellowing are rated 4. These features are more pronounced with a rating of 3. Plants with very sparse foliage, yellowing and curling of leaves and considered almost dead are rated 2, and very poor or apparently freshly dead a rating of 1. A rating of 0 is only given if the plant is undeniably dead.

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Stratum health is scored as: 0 = dead; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = very good. A large number of plants are evaluated and an average taken, or it can be an overall visual estimate. In most studies the health rating for Strata 1 and 2 are averaged. These are the strata believed to have the greatest influence on overall canopy health.

This parameter is given a weighting of 2 and is used in the MRHAS© rating.

2.2.10 Dominance

These are the species which are most abundant in each stratum and serve to identify it. In Stratum 1 the dominants lend their name to the formation and serve to identify the association.

This parameter is not directly used in the MRHAS© rating.

2.2.11 Life-form Density Classes (LFDCs)

Many botanical studies describe vegetation in terms of its character at climax; sub-stages after disturbance are interpreted on their probable nature when climax is eventually reached. In contrast, fauna habitat classification must describe vegetation in its existing form, regardless of its climax. Changes in vegetation structure will permit certain fauna species to take advantage of the newly-created ecological niche. Over time these niches will disappear and new ones will appear as the seedlings eventually grow to climax, or the vegetation recovers, e.g. from fire. Accompanying these changes will be an associated succession in fauna utilisation.

The use of LFDCs by Kitchener *et al.* (1982) has shown that there is a relationship, although imprecise, between the number of LFDCs and the abundance of certain passerine bird species. Work by Muir (1992) in rainforest in Asia has shown that the relationship still holds true.

Kitchener's habitat variable 'total number of Life-form Density Classes (LFDCs)' is generally considered to be the number of vegetation strata within each Canopy Cover class present in the sample area (ie. 2-10%, 10-30%, 30-70%, or 70-100% Canopy Cover). The overall total Canopy Cover is generally not sufficiently variable to make this of value. However, the number of strata present is variable, so the number of strata has been taken as equivalent to the number of LFDCs. As an example, if the vegetation consists of a tall woodland over a short woodland over tall shrubs over herbaceous ground stratum, there are four strata and the rating given is 4.

Weighting factor is 3 as this parameter appears to be of considerable significance to fauna. This parameter is always used in the MRHAS© rating.

2.2.12 Number of Plant Species

This is the total number of all perennial plant species actually recorded in a period of about 20 minutes observation. The method does not require taxonomic identification, only recognition of the number of species. Thus, detailed and lengthy taxonomic studies are not necessary to use the MRHAS©. This parameter is used in the MRHAS© rating to estimate floristic richness (below). Ephemeral species may be included if they are particularly abundant or relevant but their impermanence reduces their value for many fauna.

2.2.13 Floristic Richness

As an actual number of plant species is available, this can be directly applied as a measure of habitat floristic richness.

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Scoring proven to be reliable is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the MRHAS© rating.

2.2.14 Number of Structure-modifying Perennials

Structure-modifying Perennials (SMPs) is the number of perennials (ie. all year habitat) species which are so abundant as to significantly influence the structural makeup of the vegetation. If the number of SMPs is very similar to the total number of species in the sample, the vegetation may be considered to have very little internal heterogeneity in structure and it may even be un-stratified. If the number of SMPs is much lower than the total number of species present, but still visually modifying the appearance of the vegetation, then the SMPs may be considered to have a significant role to play in creating local structural variations. These variations may be specifically used by fauna.

The SMPs score is derived from two sources:

- the number of SMP classes represented ie. climbers, epiphytes, palm/cycads, grass-trees and others. These are scored as actual number of classes found. Weighting is 1. This parameter is used in the MRHAS© rating; and

- actual total number of SMPs of all classes. Scoring is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the MRHAS© rating.

2.2.15 Spatial Organisation

As with other fauna parameters examined, the principal philosophy is that floristic and structural diversity and canopy density are directly related to usefulness of the habitat to fauna. Therefore, the spatial relationships of the strata and between adjacent clumps of vegetation are relevant.

It is generally accepted that the usefulness of an area to support fauna species, or for fauna to use the vegetation as a corridor for movement, depends on the degree of cover offered by the habitat. The significance of roads and cleared land as barriers to fauna movement is well documented in temperate habitats (e.g. Barnett et al. 1978; Dames and Moore 1989; and Mader et al. 1990). This is partly due to the foreign nature of the cleared area, but is also to exposure of the small fauna to predators (especially raptors) while crossing the open areas.

Scoring process is as follows: vegetation continuous = 3; small gaps in taller vegetation = 4 (opportunity to use both habitats is high); gaps about one-third of the vegetation structure = 5; gaps about one half of the structure = 4; gaps about two-thirds of the structure = 3; scattered clumps of taller vegetation = 4. Weighting is 1.

2.2.16 Horizontal View Distance

This is the average distance an observer can see horizontally, with the eyes at approximately 1.5 m above the ground surface. It gives a measure of the lateral density of the vegetation. It is used as a guide to spatial organisation (see above), but is not always used in the MRHAS© rating. The measure is also useful to estimate visual screening effects of vegetation in development areas.

When used, Horizontal View Distance is scored as: 1-20 m = 5; 20-50 m = 4; 50-100 m = 3; 100-150 m = 2; >150 m = 1. Weighting is 1.

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2.2.17 Stratal Recovery

This is a measure of the seral stage of vegetation after fire, disturbance or clearing, using the observed structure and floristics of the vegetation plus the known history and/or fire age data.,

If the full mature structure is present (be it heath or woodland formation), the vegetation is given a rating of 4. If, in the opinion of the observer, it is three-quarters restored to pre-disturbance condition, a rating of 3 is given; if half restored, a rating of 2; and if only one-quarter restored, a rating of 1. The weighting is 3. This parameter is used in the MRHAS© rating.

2.2.18 Seedlings and Saplings

The presence of seedlings and saplings in the understorey of an association is an indication of the likely long-term regenerative/replacement capacity of the vegetation. If there are no young plants developing it is likely that, with time, the mature vegetation will begin to change in structure.

The abundance of seedlings and saplings of dominant species is scored as 1 = very few; 2 = moderately abundant; and 3 = abundant. Weighting is 1.

2.2.19 History of Disturbance

Logging and other human activities create a significant disturbance to the forest habitat. Fauna can take several years to recover after logging, and the degree of disturbance depends on the intensity of the logging and the period since the logging occurred.

It is scored as follows:

- heavily logged (or disturbed) long ago 3;
- heavily logged (or disturbed) recently 0;
- moderately logged (or disturbed) long ago 3;
- lightly logged (or disturbed) long ago 4;
- lightly logged (or disturbed) recently 2; and
- no evidence of logging (or disturbance - pristine) 5

Weighting is 1.

2.2.20 Weeds

The presence of weeds and pioneer species in an otherwise visually intact habitat can indicate past disturbance by human or stock activity, or natural disturbance such as storm damage or flooding. Weedy species can also add to floristic diversity by providing foliage, nectar, pollen, seeds, ground cover and other features which can be used by fauna.

Scores for weed abundance in habitats are: 5 = none; 4 = very few; 3 = moderately common; 2 = abundant; 1 = weeds dominant. Weighting is 1.

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2.2.21 Disease

Included in this category are fungal infections (rust, smuts, root-rot) and severe insect attack causing defoliation. It is distinguished from "health" where it is clear that the impacts are related to parasites or saprophytes rather than physiological stress caused by climatic or other pressures.

Scoring is: heavily diseased = 0; some evidence of disease = 1; no evidence of disease = 5. Weighting is 1.

2.3 MRHAS© RATING

As indicated previously, MRHAS© is mostly used where actual fauna data are not available. The summed MRHAS© scores (Appendix A) and fauna data (if it is available) are used to compare the "habitat value" of each study site. To simplify the results or to facilitate mapping (and to allow for variations and inaccuracies inherent in such data), the total MRHAS© scores may sometimes be clustered or grouped.

A suitable clustering for mapping has been found to be: total MRHAS© scores of 0-50 are clustered as 1; 51-100 as 2; 101-150 as 3; 151-200 as 4; and so on. If variation in scores is less than 50 results must be interpreted with caution but demonstrate a high level of structural homogeneity.

2.3.1 Structural Measurements Specifically for Fauna Evaluation

In order to apply MRHAS© more accurately to the description of fauna habitat, some additional vegetation structural definitions and observations on fauna use of the habitat may be applied.

The method is to score each parameter as indicated in the text, then to sum the scores and add the total to the MRHAS© rating determined from the vegetation study. This puts comparatively greater emphasis on the specific fauna evaluation components, but, considering the purpose of the evaluation is to examine the usefulness of the habitat for fauna, this is considered to be an advantage.

2.3.2 Hollow Limbs and Hollow Trunks (Senescence Index)

Many bird species and some mammals, reptiles and invertebrates are dependent on hollow limbs or trunks of plants (usually trees). Hollows can be used as refuges and breeding sites, and hollows high in trees as vantage points for predators to view the habitat. The abundance of such hollows in a given area can provide an indication of the area's usefulness to fauna which use these habitats.

The degree of usefulness can change over time. Young plants grow to maturity and senesce, thereby increasing the number of hollows. Similarly, mature trees may die from such effects as a change in water table. This may increase the abundance of hollows for a period until decay causes the loss of the dead trees. Dead standing trees may then decrease in number and the number of hollow logs increase.

Determination in the field of the actual number of hollows for fauna is a lengthy and tedious process. The index of abundance of hollow limbs and hollow trunks was developed to provide a speedy method of evaluating hollow abundance.

Abundance of hollows is scored as: 0 = none; 1 = very few; 2 = some present; 3 = many. Weighting is 2.

...../14

2.3.3 Buttresses

Buttress trunks occur in many tropical tree species and appear to be related to species rather than location of growth. Some reptiles, birds and insects are associated almost exclusively with the buttresses and so these create a distinct micro-habitat.

They are scored as: 0 = *none*; 1 = *a few*; 2 = *moderately common*; 3 = *abundant*; 4 = *abundant* and very large. Weighting is 1.

2.3.4 Litter Depth and Spacing

Average leaf litter depth in centimetres is recorded to indicate the availability of substantial cover for insects, reptiles and small mammals. Litter is rarely evenly distributed and occurs in clumps beneath bushes, or is blown into mounds by wind or washed into clumps by water. As well as the depth of available litter, the average distance between litter clumps is sometimes recorded because this may have a role for small animals in greater risk of predation.

Scores are litter depth 0-5 cm = 0; 6-10 cm = 1; 11-20 cm = 2; 21-50 cm = 3. Weighting is 1.

2.3.5 Abundance of Flowering and Seeding Species (Food Availability)

It is assumed that floristically rich areas are capable of supporting more fauna than areas which are floristically less rich. Similarly, plant species which produce abundant pollen (e.g. Myrtaceae), abundant nectar (some Proteaceae), or abundant large seeds (e.g. some Fabaceae), are probably significant species in a habitat in comparison to less productive plants. The numbers and types of productive food plants have, therefore, been considered.

Very low abundance scores 0; low abundance scores 1; moderate abundance scores 2; and high abundance scores 3. Weighting is 1.

2.3.6 Macrophylly

This is the abundance of very large leaves in the association and applies more to tropical habitats. Large leaves provide some additional cover (reflected, sometimes, but not always, in high AFD scores); but also an indication of light demands; the availability of large leaves as specific habitat, e.g. for some bats and geckoes; and some insight into the nutrient-recycling capacity of the vegetation.

Scores are 5 = almost entirely macrophyllous (leaves round and greater than 100 mm diameter); 4 = about three quarters of species macrophyllous; 3 = about one-half of species macrophyllous; 2 = about one-quarter of species macrophyllous; 1 = very few macrophyllous species present; 0 = none. Weighting is 2.

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APPENDIX E

INTENSITY OF DATA COLLECTING

APPENDIX E

KEMERTON BIOLOGICAL SURVEY PHASE 1

INTENSITY OF DATA COLLECTING

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
1		X						
2	X	X				X		
3		X						
4		X						
5		X						
6	X		X		X	X		
7	X					X		
8		X						
9		X						
10	X		X		X	X		
11		X						X
12	X		X		X	X		X
13	X		X	X	X	X		
14	X					X		
15		X						
16		X						
17		X						
18		X						
19		X						
20		X						
21		X						
22		X						
23		X						
24		X						
25	X					X		
26	X		X		X	X		
27	X					X		
28	X					X		
29	X					X		
30	X					X		
31	X		X	X	X	X		
32	X					X		
33		X						
34		X						
35	X					X		
36		X						
37	X					X		
38	X							
39		X						
40	X					X		
41		X						

Kemerton Data Collection - Page 2

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
42		X						
43	X		X		X	X		
44		X						
45		X						
46		X						
47		X						
48	X					X		
49		X						
50		X						
51		X						
52	X					X		
53		X						
54	X					X		
55	X					X		
56		X						
57	X		X		X	X		
58	X					X		
59	X					X		
60	X					X		
61		X						
62		X						
63		X						
64		X						
65		X						
66		X						
67	X		X		X	X		
68		X						
69		X						
70		X						
71		X						
72	X					X		
73		X						
74		X						
75		X						
76		X						
77	X		X		X	X		
78		X						
79		X						
80	X					X		
81	X					X		
82	X					X		
83	X					X		
84		X	X		X			
85		X						
86	X					X		
87	X					X		
88		X						
89	Data unreliable - requires checking							

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
90		X						
91	X		X		X	X		
92	X					X		
93	X					X		
94		X						
95		X						
96	X					X		
97	X		X		X	X	X	
98	X					X		
99		X						
100	X					X	X	
101	X		X		X	X		
102		X						
103	Data unreliable - requires checking							
104		X						
105		X						
106		X						
107		X						
108		X						
109	X					X		
110	X					X		
111	X					X		
112	X					X		
113	X					X		
114		X						
115		X						
116		X						
117	X					X		
118	X					X		
119	X					X		
120	X					X		
121		X						
122	X					X		
123	Data unreliable - requires checking							
124	Data unreliable - requires checking							
125		X						
126		X						
127		X						
128		X						
129		X						
130		X						
131		X						
132		X						
133		X						
134		X	X		X		X	
135		X					X	
136		X						
137		X						

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
138		X						
139		X				X		
140	X		X	X	X	X		
141	X		X		X	X		
142		X						
143		X				X		
144	X					X		
145		X						
146	X		X		X	X		
147	X					X		
148	X					X		
149	X					X		
150	X					X		
151	X		X		X	X		
152	X					X		
153	X					X		
154	X					X		
155	X		X		X	X		
156	X					X		
157	X					X		
158	Data unreliable - requires checking							
159	X					X		
160	X					X		
161	X					X		
162		X						
163		X						
164		X						
165	Data unreliable - requires checking							
166	X					X		
167		X						
168		X					X	
169		X						
170	X					X		
171	X					X		
172	X		X	X	X	X		
173	X		X		X	X		
174		X						
175	X		X	X	X	X		
176	X					X		
177	X					X		
178	X					X		
179	X					X		
180	X					X		
181		X						
182	X	X				X		
183	X		X		X	X		
184		X				X		
185		X						

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
186		X						
187		X						
188	X					X		
189		X						
190		X						
191	X					X		
192		X						
193		X						
194		X						
195		X						
196		X						
197	X					X		
198		X						
199		X						
200		X						
201	X		X		X	X		
202		X						
203		X						
204		X						
205		X						
206		X						
207	X		X		X	X		
208	X					X		X
209	X					X		
210	X					X		X
211		X						
212		X						
213		X						
214		X						
215		X						
216	X					X		
217		X						
218		X						
219		X						
220		X						
221		X						
222	X					X		
223		X						
224		X						
225	X					X		
226	X					X		
227		X						
228	X					X		
229		X						
230	X		X	X	X	X	X	
231		X						
232		X						
233		X						

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
234	Data unreliable - requires checking							
235	Data unreliable - requires checking							
236		X						
237	X					X		
238		X						
239		X						
240		X						
241	X					X		
242		X						
243		X						
244	X					X		
245		X						
246		X						
247	X		X	X	X	X		X
Below 247								X
248	X					X		
249	X					X		
250	X					X		
251	X					X		
252		X						
253	X					X		
254	X					X		
255	X					X		
256	X					X		
257		X						
258		X						
259		X						
260		X						
261		X						
262		X						
263		X						
264	X					X		
265		X						
266		X						
267	X					X		
268	X					X		
269		X						
270		X					X	
271		X						
272		X						
273		X						
274		X						
275		X						
276	X					X		
277		X						
278	X					X		
279		X						
280		X						

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
281	X					X		
282		X						
283		X						
284	X					X		
285		X						
286	X					X		
287		X						
288		X						
289		X						
290		X						
291	X					X		
292		X						
293		X						
294	X					X		
295	X					X		
296	X					X		
297		X						
298	X		X		X	X		
299		X						
300	X					X		
301	X		X		X	X		X
302	X		X		X	X		X
303	X		X	X	X	X		
304	X					X		
305	X					X		
306		X						
307	X					X		
308	X					X		
309	X					X		
310	X					X		
311		X						
312		X						
313	X					X		
314	X					X		
315		X						
316		X						
317		X						
318		X						
319		X						
320	X					X		
321		X						
322		X						
323	X					X		
324	X		X		X	X	X	
325		X						
326		X						
327	X	X				X		
328		X						

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
329		X						
330		X						
331		X						
332	X		X		X	X		
333	X					X		
334	X					X		
335	X					X		
336	X					X		
337		X						
338		X						
339	X					X		
340	X					X		
341	X		X		X	X		
342	X		X		X	X		
343		X						
344	X					X		
345	X					X		
346	X		X			X		
347	X		X		X	X		
348	X		X		X	X		X
349		X						
350		X						
351	X					X		
352		X						
353	X		X		X	X		
354		X						
355	X					X		
356	X		X		X	X		
357	X		X		X	X		
358	X					X		
359	X					X		
360	X					X		
361	X					X		
362	X					X		
363	X					X		
364		X						
365	X					X		
366		X						
367	X		X		X	X		
368	X					X		
369	X					X		
370	X		X		X	X		
371	X		X		X	X		
372		X						
373		X						
374		X						
375		X						
376	X					X		

LOC.No	DETAILED STRUCTURE	STRUC. OBSVNS	SPECIES LIST	GIBSON QUADRAT	SOIL PROFILE	SOIL STRU. OBSERV.	AQUATIC FAUNA	VERTEB. FAUNA
377		X						
378		X						
379		X						
380		X						

APPENDIX F

WETLANDS

APPENDIX F

KEMERTON BIOLOGICAL SURVEY PHASE 1

WETLANDS

For vegetation codes refer Appendix L

LOCN No.	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Cont. water Nov. '98	Surface water Temp. (deg.C)	Surface Water pH	Surface Water TDS	Secchi	Depth to WT Nov. '98	Rate of Infiltration	Ground Water Temp. (deg.C)	Ground Water pH	Ground Water TDS
2	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
3	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
6	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
15	D	Cleared	Palusplain	N/A	Cleared	??	M g	S	??	P g	S	N					> 1 m				
17	D	Cleared	Palusplain	N/A	Cleared	??	M g	S	??	P g	S	N					> 1 m				
18	D	Damaged	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
[illegible]	D	Damaged	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
20	D	Cleared	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
36	D	Cleared	Lenticular	Cleared	Melaprei	??	M g	SL	U	M g	SL	N					??				
41	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					> 1 m				
43	D		Lenticular	Maculiform	Kunzeric	WT	M g	S	U	M g	S	N					> 1 m				
45	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
46	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
47	D	Cleared	Lenticular	??	Cleared	WT	P g	S	U	P g	S	N					> 1 m				
48	D		Lenticular	Maculiform	Melaraph	WT	M g	S	U	M g	S	N					> 1 m				
56	D	Cleared	Lenticular	Cleared	Plantings	WT	P y-b	S	U	P y-b	S	N					> 1 m				
65	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.6	H	18.7	6.4	310
67	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N									
68	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.8 m	H	18.5	6.2	300
69	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.8 m	H	18.5	6.3	310
71	D		Lenticular	Maculiform	Kunzeric	WT	M g	S	U	M g	S	N					> 1 m				
72	D		Lenticular	Concentriform	Astafasc	WT	P g	SL	G	P p-g	SL	N					> 1 m				
8[illegible]	D		Lenticular	Maculiform	Beauarti	WT	D g	Peaty S	U	D g	S	N					0.5 m	H	16.8	3.9	120
86	D		Lenticular	Concentriform	Melatere	WT	M g	Peaty S	U	M g	S	N					> 1 m				
91	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
92	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
93	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
96	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
97	D		Lenticular	Zoniform	Melaraph	WT	VD g	Peaty S	G	P g	S	Y	21.4	6.6	1310	8 cm	Exposed	H	N/A	N/A	N/A
98	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
100	D		Lenticular	Zoniform	Melaraph	WT	VD g	Peaty S	G	P g	S	Y	22.1	6.6	1290	6 cm	Exposed	H	N/A	N/A	N/A
101	D		Lenticular	Concentriform	Eucarudi	WT	P g	SL	U	P g	SL	N					> 1 m				
113	D		Lenticular	Concentriform	Perielli	WT	P g	SL	U	P g	SL	N					> 1 m				
114	D		Lenticular	Maculiform	Perielli	WT	P g	SL	U	P g	SL	N					> 1 m				
115	D		Lenticular	Heteroform	Kunzeric	WT	D g	SL	U	P g	SL	N					> 1 m				
116	D		Lenticular	Latiform	Perielli	WT	P g	S	U	P g	S	N					> 1 m				
132	D		Lenticular	Concentriform	Melaprei	WT	P g	S	U	P g	S	N					> 1 m				
133	D	Cleared	Lenticular	Concentriform	Cleared	WT	M g	SL	U	P g	SL	N					> 1 m				
134	D	Cleared	Lenticular	Concentriform	Cleared	WT	D g	Peaty SL	G	M g	SL	Y	14	5.96	650	2 cm	Exposed	H	18.5	6.2	570
135	D	Cleared	Lenticular	Concentriform	Eucarudis	WT	M g	SL	U	P g	SL	Y	17.8	6.1	480	15 cm	Exposed	H	18.6	6.4	460

LOC.N	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Contains wate 28-29 Nov. '9	Surface water Temp. (deg.C)	urface Wat pH	Surface Water TDS	Secchi	Depth to WT 28-29 Nov. '98	Rate of Infiltration	Ground Water Temp. (deg.C)	Ground Water pH	Ground Water TDS
145	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	P g	S	N					> 1.0 m				
150	D		Lenticular	Latiform	Perielli	WT	M g	Peaty S	G	P g-b	S	N					> 1.3 m				
151	D		Lenticular	Latiform	Perielli	WT	M g	Peaty S	G	P g-b	S	N					> 1.3 m				
155	D		Lenticular	Latiform	Astafasc	WT	VD g	Peaty SL	G	VP g-b	S	N					0.6 m	H	18.5	6.1	120
156	D		Lenticular	Heteroform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
160	D		Lenticular	Heteroform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
161	D		Lenticular	Latiform	Astefasc	WT	P g	S	U	P g	S	N					> 1 m				
163	D	Damaged	Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
164	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
166	D		Lenticular	Maculiform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
168	D	Man-made	Linear	Drain	Eucarudi	WT	P g	S	U	P g	S	Y	17.3	6.4	1170	32 cm	Exposed	H	N/A	N/A	N/A
172	D		Lenticular	Concentriform	Melatere	WT	P y-g	Peaty CL	G	P y-g	SL	N					0.6 m	H	18.2	6.2	910
173	D		Lenticular	Concentriform	Melatere	WT	VD g	Peaty CL	G	P y-g	SL	N					0.6 m	H	18.2	6.1	920
17[illegible]	D	Damaged	Lenticular	Concentriform	Juncpall	WT	VD g	Peaty CL	G	P y-g	SL	Y	15.3	6.6	560	28	Exposed	H	18.3	6.2	840
187	D		Lenticular	Maculiform	Melaprei	WT	VD g	Peaty SL	G	VP g-b	SL	N					> 1 m				
189	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
191	D		Lenticular	Maculiform	Melaprei	WT	VD g	Peaty SL	G	VP g-b	SL	N					> 1 m				
201	D		Lenticular	Maculiform	Banklitt	WT	M g	S	U	M g	S	N					> 1 m				
202	D		Lenticular	Concentriform	Melaprei	WT	M g	SL	U	P g	SL	N					> 1 m				
214	D	Cleared	Lenticular	Concentriform	Melaprei	WT	M g	SL	U	Mg	SL	N					> 1 m				
223	D		Lenticular	Cleared	Melapreis	WT	P g	S	U	P G	S	Y	22	5.1	670	7	Exposed	H	17.8	6.3	340
229	D	Minor Dam	Lenticular	Maculiform	Melahamu	WT	P g	S	U	P g	S	N					> 1 m				
230(1)	D	Damaged	Lenticular	Maculiform	Hakevari	PER	VP g-b	S	G	P p-b	S (v fine)	N					0.6 m	L	17.7	6.2	4420
230(2)	D	Damaged	Lenticular	Maculiform	Melalate	PER	VP g-b	S	G	P p-b	S (v fine)	Y	23.4	5.6	440	12	Exposed	L	17.8	6.2	4410
230(3)	D	Damaged	Lenticular	Maculiform	Melaraph	PER	D g-b	S	G	P p-b	S (v fine)	Y	24.1	5.5	430	11	Exposed	N/A	N/A	N/A	N/A
232	D	Fire	Lenticular	Maculiform	Melaprei	PER	D g-b	SL	G	P g-b	S (v fine)	N					0.8 m	L	17.4	6.2	4390
237	D		Lenticular	Latiform	Melaraph	WT	M g	SL	G	M y-b	SL	N					0.4 m	H	18.2	7.1	1220
241	D		Lenticular	Maculiform	Banklitt	WT	M g	S	U	M g	S	N					> 1m				
243	D		Lenticular	Maculiform	Eucarudi	WT	P g	S	U	P g	S	N					> 1 m				
24[illegible]	D		Lenticular	Concentriform	Melaprei	WT	P g	SL	G	P g	S	N					> 1 m				
256	D	Cleared	Lenticular	??	Melaprei	WT	P g-b	SL	U	P g-b	SL	N					> 1 m				
258	D		Lenticular	Maculiform	Pelaprei	WT	P g	S	U	P g	S	N					> 1 m				
264	D	Damaged	Lenticular	Maculiform	Melahamu	PER	VP g-b	S	G	P p-b	S (v fine)	N					1 m	L	17.8	6.1	4430
269	D	Damaged	Lenticular	Maculiform	Kunzeric	PER??	P g	S	G	P p-b	S	N					> 1 m				
270	D	Damaged	Lenticular	Latiform	Melaraph	WT	P g-b	Peaty SL	G	M b	SL	Y	20.4	6.7	320	> 30 cm	Exposed	N/A	N/A	N/A	N/A
275	D	Cleared	Lenticular	??	Melaprei	WT	P g	SL	U	P g	S	N					> 1 m				
277	D		Lenticular	Concentriform	Melaprei	WT	P g	S	U	P g	S	N					> 1 m				
302	D		Lenticular	Concentiform	Eucarudi	WT	D g	Peaty SL	G	P g	SL	N					> 1 m				
303	D		Lenticular	Concentiform	Eucarudi	WT	D g	Peaty SL	G	P g	SL	Y	22.5	5.2	380		Exposed	L	18.2	6.2	170
310	D		Lenticular	Latiform	Melaprei	WT	M g	SL	G	P g	SL	N					> 1 m				
321	D	Cleared	Lenticular	Concentriform	Melaprei	WT	P g	SL	U	P g	SL	N					> 1 m				
324	D	Cleared	Lenticular	??	Melaraph	WT	M g	SL	U	P g	SL	Y	19.5	5.5	410	25 cm	Exposed	H	18.3	6.4	420
325	D	Cleared	Lenticular	??	Cleared	WT	P g	S	U	P g	S	N					> 1 m				
329	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
331	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
342	D		Lenticular	Heteroform	Eucarudi	??	VP g	S	U	Vp g	S	N					> 1 m				
346	D		Lenticular	Periform	Melahamu	WT	D g-b	SCL	G	M y-b	SL	Y	22.1	6.2	3200		Exposed	??	N/A	N/A	N/A

Kemerton Wetlands - Page 3

LOC.N	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Contains wate 28-29 Nov. '98	Surface water Temp. (deg.C)	urface Wat pH	Surface Water TDS	Secchi	Depth to WT 28-29 Nov. '98	Rate of Infiltration	Ground Water Temp. (deg.C)	Ground Water pH	Ground Water TDS
347	D		Lenticular	Zoniform	Eucarudi	WT	M g	SL	G	P g	SL	N					> 1 m				
349	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	17	6.2	4820		Exposed	N/A	N/A	N/A	N/A
350	D		Lenticular	Maculiform	Perialli	WT	M g	LS	U	M g	LS	N					> 1 m				
352	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
354	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
361	D		Lenticular	Concentiform	Melaprei	WT	D g	SL	G	M g	SL	N					> 1 m				
362	D		Lenticular	Concentiform	Melaprei	WT	D g	SL	G	M g	SL	N					> 1 m				
365	D	Cleared	Lenticular	Cleared	Melaprei	??	D g	SL	G	P g	SL	N					> 1 m				
371	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	P g	S	N					> 1 m				
372	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
373	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y									
374	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y									
375	V	Damaged	Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
376	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.2	6.1	4750		Exposed	N/A	N/A	N/A	N/A

STATUS	TAXON	CODE
	Stylidium caespitosum	*Stylcaes*
	Stylidium calcaratum	*Stylcalc*
	Stylidium despectum	*Styldesp*
	Stylidium divaricatum	*Styldiva*
	Stylidium diversifolium	*Styldive*
	Stylidium guttatum	*Stylgutt*
	Stylidium junceum	*Styljunc*
	Stylidium piliferum	*Stylpili*
	Stylidium repens	*Stylrepe*
	Stylidium schoenoides	*Stylschoe*
	Synaphea spinulosa	*Synaspin*
	Tetraria octandra	*Tetrocta*
	Tetratheca hirsuta	*Tetrhirs*
	Thelymitra ? *benthamiana*	*Thelbent*
	Thelymitra crinita	*Thelcrin*
	Thelymitra ? aff *holmesii*	*Thelholm*
	Thysanotus arbuscula	*Thysarbu*
	Thysanotus manglesianus	*Thysmang*
	Thysanotus multiflorus	*Thysmult*
	Trachymene cyanopetala	*Traccyan*
	Trachymene pilosa	*Tracpilo*
	Trichocline spathulata	*Tricspat*
	Tricoryne elatior	*Tricelat*
*	*Trifolium angustifolium*	*Trifangu*
*	*Trifolium campestre*	*Trifcamp*
*	*Trifolium dubium*	*Trifdubi*
*	*Trifolium fragiferum*	*Triffrag*
*	*Trifolium glomeratum*	*Trifglom*
*	*Trifolium hirtum*	*Trifhirt*
*	*Trifolium hybridum*	*Trifhybr*
*	*Trifolium repens*	*Trifrepe*
*	*Trifolium* sp	*Trifsp*
*	*Trifolium subterraneum*	*Trifsubt*
*	*Trifolium tomentosum*	*Triftome*

STATUS	TAXON	CODE
	Triglochin huegelii	*Trighueg*
	Triglochin lineare	*Trigline*
*	*Typha orientalis*	*Typhorie*
*	*Ursinia anthemoides*	*Ursiant*
	Verticordia nitens	*Vertnite*
	Villarsia albiflora	*Villalbi*
	Villarsia capitata	*Villcapi*
	Viminaria juncea	*Vimijunc*
*	*Vulpia* sp	*Vulpsp*
*	*Wahlenbergia capensis*	*Wahlcape*
	Wahlenbergia gracilenta	*Wahlgrac*
	Wahlenbergia preissii	*Wahlprei*
*	*Watsonia bulbillifera*	*Watsbulb*
	Xanthorrhoea brunonis	*Xantbrun*
	Xanthorrhoea preissii	*Xantprei*
	Xanthosia huegelii	*Xanthueg*
	Xylomelum occidentale	*Xyloocci*
*	*Zantedeschia aethiopica*	*Zantaeth*

* designates introduced species
P3 CALM Priority Code
DRF Declared Rare Flora

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*	*Variable 1*	
Mean	41.875	25.75	41.875	
Variance	504.982143	280.2143	504.982	
Observations	8	8	8	
Pearson Correlation	0.91286827		0.91287	
Hypothesized Mean Differen	0		16	Note the changed mean difference
df	7		7	
t Stat	4.59751892		0.03564	
P(T<=t) one-tail	0.00124574		0.48628	
t Critical one-tail	1.89457751		1.89458	
P(T<=t) two-tail	0.00249149		0.97256	
t Critical two-tail	2.36462256		2.36462	

Hence reject Ho - (p=0.12% or p=0.24%) indicating that there are significant differences beteen the paired samples (the difference is greater than 0) and no difference when the differences is set to 16 species.

Analysis of differences between the General area and Gibson Plots for species richness

Site No	226	31	172	175	247	303	230	13	
General area (approx 1ha)	66	63	13	44	55	6	34	54	335
Gibson Plots (100m2)	45	40	9	27	33	6	5	41	206

chi square 12.713
significance DF=7 0.079
Therefore accept Ho (p=7.9%) the techniques are independat of each other

Brown-Forsythe Test for Heterogeneity

median of general 54.000
median of Gibson 33.000

Transformed scored

General	12.000	9.000	41.000	10.000	1.000	48.000	20.000	0.000	281.000
Gibson	12.000	7.000	24.000	6.000	0.000	27.000	28.000	8.000	173.000

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Row 1	8	141	17.625	317.982
Row 2	8	112	14	116.286

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	52.5625	1	52.5625	0.24207	0.63034	4.60011
Within Groups	3039.875	14	217.134			
Total	3092.4375	15				

Hence accept Ho - (p=63%) their being no difference between the variance of the two sampling techniques.

Kemerton MRHAS Phase 1 - Page 2

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	WEIGHTING	26	26	27	27	28	28	29	29	30	30	31	31	32	32	35	35	37	37
Formations Adjacent (1)	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	3	4	12	4	12	4	12	3	9	3	9	3	9	3	9	4	12	3	9
Floristic Richness (3)	2	1	2	1	2	1	2	2	4	2	4	2	4	2	4	2	4	1	2
Food Potential (4)	1	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	2	2
Total Cover Index (2)	2	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	1	2
Mean Health (2)	2	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	4	8
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	5	5
Senescence Index (hollows, etc) (5)	2	2	4	2	4	2	4	2	4	2	4	2	4	2	4	3	6	1	2
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Abundance seedl./sapl. (5)	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
History of Disturbance (6)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
Freedom from Weeds (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Freedom from Disease (7)	1	2	2	2	2	2	2	5	5	5	5	5	5	5	5	4	4	5	5
Ecotonal complexity (5)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	3	6
TOTAL			68		68		68		71		75		75		75		87		76

Kemerton MRHAS Phase 1 - Page 3

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**38**	**38**	**40**	**40**	**43**	**43**	**48**	**48**	**52**	**52**	**54**	**54**	**55**	**55**	**57**	**57**	**58**	**58**
Formations Adjacent (1)	**2**	0	0	1	2	1	2	1	2	0	0	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	**3**	4	12	3	9	3	9	3	9	1	3	3	9	3	9	3	9	3	9
Floristic Richness (3)	**2**	1	2	1	2	2	4	2	4	1	2	2	4	2	4	2	4	2	4
Food Potential (4)	**1**	3	3	2	2	2	2	3	3	2	2	3	3	3	3	2	2	2	2
Total Cover Index (2)	**2**	2	4	1	2	2	4	1	2	1	2	2	4	2	4	1	2	1	2
Mean Health (2)	**2**	5	10	4	8	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	2	6	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	2	2	1	1	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	5	5	5	5	5	5	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	2	4	2	4	1	2	0	0	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	**1**	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2
Abundance seedl./sapl. (5)	**1**	1	1	3	3	2	2	1	1	2	2	2	2	2	2	3	3	3	3
History of Disturbance (6)	**1**	3	3	3	3	4	4	5	5	1	1	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	**1**	3	3	4	4	5	5	1	1	1	1	3	3	3	3	3	3	3	3
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	4	4	1	1	5	5	5	5	2	2	2	2
Freedom from Disease (7)	**1**	4	4	5	5	3	3	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	3	6	3	6	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			70		79		81		68		44		73		73		69		69

Kemerton MRHAS Phase 1 - Page 4

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	WEIGHTING	59	59	60	60	67	67	72	72	77	77	80	80	81	81	82	82	83	83
Formations Adjacent (1)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	3	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9
Floristic Richness (3)	2	2	4	2	4	1	2	1	2	2	4	2	4	2	4	2	4	2	4
Food Potential (4)	1	3	3	3	3	2	2	2	2	2	2	3	3	3	3	3	3	3	3
Total Cover Index (2)	2	2	4	2	4	0	0	1	2	1	2	2	4	2	4	2	4	2	4
Mean Health (2)	2	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	3	9	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	2	4	2	4	0	0	0	0	1	2	2	4	2	4	2	4	2	4
Trunk Length (2)	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	1	2	2	2	2	1	1	1	1	3	3	2	2	2	2	2	2	2	2
History of Disturbance (6)	1	3	3	3	3	5	5	5	5	3	3	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	3	3	5	5	3	3	3	3	3	3	3	3	3	3
Freedom from Weeds (7)	1	5	5	5	5	5	5	5	5	2	2	5	5	5	5	5	5	5	5
Freedom from Disease (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	2	0	0	0	0	3	6	3	6	0	0	0	0	0	0	0	0	0	0
TOTAL			75		75		72		72		69		75		75		75		75

Kemerton MRHAS Phase 1 - Page 5

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**84**	**84**	**86**	**86**	**87**	**87**	**91**	**91**	**92**	**92**	**93**	**93**	**96**	**96**	**97**	**97**	**98**	**98**
Formations Adjacent (1)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	1	2
Number of LFDC (2)	3	1	3	2	6	3	9	3	9	3	9	3	9	3	9	2	6	3	9
Floristic Richness (3)	2	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	1	1	1	2	2	3	3	2	2	2	2	2	2	2	2	3	3	2	2
Total Cover Index (2)	2	2	4	0	0	2	4	1	2	1	2	1	2	1	2	2	4	1	2
Mean Health (2)	2	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	0	0	1	2	2	4	0	0	0	0	0	0	0	0	1	2	0	0
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	1	1	1	1	1	2	2	3	3	3	3	3	3	3	3	2	2	3	3
History of Disturbance (6)	1	5	5	5	5	3	3	1	1	1	1	1	1	1	1	4	4	1	1
Horizontal View Distance (1.5 m) (6)	1	5	5	4	4	3	3	1	1	1	1	1	1	1	1	4	4	1	1
Freedom from Weeds (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5
Freedom from Disease (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	2	3	6	3	6	0	0	0	0	2	4	2	4	2	4	2	4	2	4
TOTAL			70		72		75		63		67		67		67		75		67

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**100**	**100**	**101**	**101**	**109**	**109**	**110**	**110**	**111**	**111**	**112**	**112**	**113**	**113**	**117**	**117**	**118**	**118**
Formations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2
Associations Adjacent (1)	**2**	2	4	3	6	0	0	0	0	0	0	1	2	1	2	0	0	1	2
Number of LFDC (2)	**3**	2	6	4	12	4	12	4	12	4	12	3	9	2	6	4	12	4	12
Floristic Richness (3)	**2**	1	2	1	2	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Food Potential (4)	**1**	2	2	2	2	2	2	2	2	2	2	3	3	1	1	3	3	3	3
Total Cover Index (2)	**2**	2	4	1	2	2	4	2	4	2	4	2	4	0	0	1	2	1	2
Mean Health (2)	**2**	5	10	4	8	4	8	4	8	4	8	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1
Senescence Index (hollows, etc) (5)	**2**	0	0	1	2	1	2	1	2	1	2	2	4	0	0	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	2	2	1	1	2	2	2	2	2	2	2	2	1	1	2	2	2	2
History of Disturbance (6)	**1**	5	5	5	5	3	3	3	3	3	3	3	3	5	5	3	3	0	0
Horizontal View Distance (1.5 m) (6)	**1**	4	4	3	3	3	3	3	3	3	3	3	3	1	1	3	3	1	1
Freedom from Weeds (7)	**1**	4	4	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Freedom from Disease (7)	**1**	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			73		75		68		68		68		75		59		68		65

Kemerton MRHAS Phase 1 - Page 7

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**119**	**119**	**120**	**120**	**122**	**122**	**134**	**134**	**140**	**140**	**141**	**141**	**144**	**144**	**146**	**146**	**147**	**147**
Formations Adjacent (1)	**2**	1	2	0	0	0	0	1	2	0	0	0	0	0	0	1	2	1	2
Associations Adjacent (1)	**2**	1	2	0	0	0	0	1	2	0	0	0	0	0	0	1	2	1	2
Number of LFDC (2)	**3**	4	12	4	12	4	12	2	6	4	12	3	9	4	12	3	9	3	9
Floristic Richness (3)	**2**	1	2	1	2	1	2	1	2	2	4	2	4	2	4	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	3	3	1	1	2	2	2	2	2	2	2	2	2	2
Total Cover Index (2)	**2**	1	2	1	2	1	2	0	0	2	4	2	4	2	4	2	4	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	4	8	5	10	4	8	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	1	3	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	1	1	3	3	2	2	3	3	1	1	1	1
Spatial Organisation (5)	**1**	1	1	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	1	2	0	0	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	2	2	2	2	2	2	1	1	2	2	3	3	2	2	3	3	3	3
History of Disturbance (6)	**1**	0	0	3	3	3	3	0	0	3	3	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	**1**	1	1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	1	1	5	5	4	4	5	5	4	4	4	4
Freedom from Disease (7)	**1**	5	5	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			65		68		68		40		68		66		68		68		68

LOCATION	WEIGHTING	RAW 148	CAL. 148	RAW 149	CAL. 149	RAW 150	CAL. 150	RAW 151	CAL. 151	RAW 152	CAL. 152	RAW 153	CAL. 153	RAW 154	CAL. 154	RAW 155	CAL. 155	RAW 156	CAL. 156
Formations Adjacent (1)	**2**	1	2	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	1	2	0	0	1	2	1	2	1	2	1	2	1	2	1	2	2	4
Number of LFDC (2)	**3**	4	12	4	12	2	6	2	6	4	12	4	12	4	12	2	6	2	6
Floristic Richness (3)	**2**	1	2	1	2	0	0	1	2	1	2	2	4	1	2	1	2	0	0
Food Potential (4)	**1**	3	3	2	2	2	2	3	3	3	3	3	3	3	3	1	1	2	2
Total Cover Index (2)	**2**	1	2	0	0	0	0	0	0	1	2	2	4	2	4	0	0	1	2
Mean Health (2)	**2**	5	10	4	8	5	10	5	10	5	10	5	10	5	10	3	6	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	1	2	0	0	0	0	1	2	1	2	1	2	1	2	0	0	0	0
Trunk Length (2)	**1**	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
History of Disturbance (6)	**1**	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Horizontal View Distance (1.5 m) (6)	**1**	3	3	3	3	1	1	1	1	1	1	3	3	1	1	1	1	1	1
Freedom from Weeds (7)	**1**	5	5	4	4	5	5	5	5	5	5	4	4	5	5	5	5	5	5
Freedom from Disease (7)	**1**	4	4	0	0	5	5	5	5	4	4	5	5	4	4	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6
TOTAL			70		57		58		63		70		76		72		55		68

Kemerton MRHAS Phase 1 - Page 9

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**157**	**157**	**159**	**159**	**160**	**160**	**161**	**161**	**166**	**166**	**170**	**170**	**171**	**171**	**172**	**172**	**173**	**173**
Formations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	2	4
Associations Adjacent (1)	**2**	1	2	1	2	2	4	1	2	1	2	1	2	1	2	2	4	2	4
Number of LFDC (2)	**3**	4	12	4	12	2	6	2	6	2	6	4	12	4	12	3	9	3	9
Floristic Richness (3)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	2	2	1	1	1	1	2	2	2	2	2	2	2	2
Total Cover Index (2)	**2**	1	2	1	2	0	0	0	0	1	2	2	4	2	4	2	4	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Spatial Organisation (5)	**1**	4	4	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	0	0	0	0	0	0	2	4	2	4	0	0	0	0
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1
Abundance seedl./sapl. (5)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
History of Disturbance (6)	**1**	3	3	5	5	5	5	5	5	5	5	2	2	2	2	1	1	1	1
Horizontal View Distance (1.5 m) (6)	**1**	3	3	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	5	5	1	1	1	1	2	2	2	2
Freedom from Disease (7)	**1**	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	3	6	3	6	3	6	0	0	0	0	3	6	3	6
TOTAL			71		70		68		65		67		68		68		75		75

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**175**	**175**	**176**	**176**	**177**	**177**	**178**	**178**	**179**	**179**	**180**	**180**	**182**	**182**	**183**	**183**	**188**	**188**
Formations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Associations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Number of LFDC (2)	**3**	3	9	3	9	4	12	4	12	4	12	4	12	3	9	4	12	4	12
Floristic Richness (3)	**2**	1	2	1	2	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	0	0	1	2	1	2
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	3	6	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
Senescence Index (hollows, etc) (5)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1
History of Disturbance (6)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	**1**	3	3	3	3	2	2	2	2	2	2	2	2	3	3	3	3	3	3
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	5	5	5	5	1	1	5	5	5	5
Freedom from Disease (7)	**1**	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ecotonal complexity (5)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		0	74		74		72		72		72		72		52		71		71

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**189**	**189**	**191**	**191**	**197**	**197**	**201**	**201**	**207**	**207**	**208**	**208**	**209**	**209**	**210**	**210**	**216**	**216**
Formations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	0	0	0	0	0	0	0	0	1	2
Associations Adjacent (1)	**2**	1	2	2	4	1	2	2	4	0	0	0	0	0	0	0	0	1	2
Number of LFDC (2)	**3**	2	6	2	6	3	9	3	9	4	12	4	12	4	12	4	12	1	3
Floristic Richness (3)	**2**	1	2	0	0	1	2	1	2	2	4	2	4	2	4	2	4	0	0
Food Potential (4)	**1**	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	1	1
Total Cover Index (2)	**2**	0	0	0	0	0	0	1	2	2	4	2	4	2	4	2	4	0	0
Mean Health (2)	**2**	5	10	5	10	4	8	3	6	5	10	5	10	5	10	5	10	1	2
Stratal Recovery (5)	**3**	4	12	4	12	2	6	4	12	4	12	4	12	4	12	4	12	0	0
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	0
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	0	0	0	0	2	4	0	0	2	4	2	4	2	4	2	4	0	0
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1
History of Disturbance (6)	**1**	5	5	5	5	3	3	5	5	3	3	3	3	3	3	3	3	0	0
Horizontal View Distance (1.5 m) (6)	**1**	1	1	1	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1
Freedom from Weeds (7)	**1**	5	5	5	5	2	2	2	2	5	5	5	5	5	5	5	5	1	1
Freedom from Disease (7)	**1**	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	5	5
Ecotonal complexity (5)	**2**	3	6	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			65		65		54		59		72		72		72		72		22

LOCATION	WEIGHTING	RAW 222	CAL. 222	RAW 225	CAL. 225	RAW 226	CAL. 226	RAW 228	CAL. 228	RAW 230	CAL. 230	RAW 237	CAL. 237	RAW 241	CAL. 241	RAW 244	CAL. 244	RAW 247	CAL. 247
Formations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	1	2	0	0	0	0
Associations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	2	4	0	0	0	0
Number of LFDC (2)	3	1	3	4	12	4	12	4	12	3	9	2	6	3	9	5	15	5	15
Floristic Richness (3)	2	0	0	2	4	2	4	2	4	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	1	1	1	3	3	3	3	3	3	2	2	1	1	1	1	2	2	2	2
Total Cover Index (2)	2	0	0	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Mean Health (2)	2	1	2	5	10	5	10	5	10	5	10	3	6	4	8	5	10	5	10
Stratal Recovery (5)	3	0	0	4	12	4	12	4	12	4	12	2	6	4	12	4	12	4	12
Interstratal Distance (4)	1	0	0	3	3	3	3	3	3	3	3	1	1	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	0	0	2	4	2	4	2	4	0	0	0	0	1	2	2	4	2	4
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3
History of Disturbance (6)	1	0	0	3	3	3	3	3	3	5	5	3	3	5	5	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3
Freedom from Weeds (7)	1	1	1	5	5	5	5	5	5	5	5	1	1	2	2	5	5	5	5
Freedom from Disease (7)	1	5	5	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			22		72		72		72		67		45		65		75		75

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**248**	**248**	**249**	**249**	**250**	**250**	**251**	**251**	**253**	**253**	**254**	**254**	**255**	**255**	**256**	**256**	**264**	**264**
Formations Adjacent (1)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2
Associations Adjacent (1)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2
Number of LFDC (2)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	2	6	3	9
Floristic Richness (3)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	2	4	0	0	1	2
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	0	1	1
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	2	4	0	0	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	5	10	2	4	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	1	3	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	0	0
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1
Abundance seedl./sapl. (5)	**1**	2	2	2	2	2	2	2	2	2	2	2	2	3	3	1	1	1	1
History of Disturbance (6)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	5	5
Horizontal View Distance (1.5 m) (6)	**1**	2	2	2	2	2	2	2	2	2	2	2	2	3	3	0	0	1	1
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	5	5
Freedom from Disease (7)	**1**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0	0
TOTAL			72		72		72		72		72		72		74	0	41		66

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**267**	**267**	**268**	**268**	**276**	**276**	**278**	**278**	**281**	**281**	**284**	**284**	**291**	**291**	**294**	**294**	**295**	**295**
Formations Adjacent (1)	2	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Associations Adjacent (1)	2	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Number of LFDC (2)	3	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	2	4	2	4	2	4	2	4	0	0	2	4	2	4
Food Potential (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	0	0	3	3	2	2
Total Cover Index (2)	2	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Mean Health (2)	2	5	10	5	10	5	10	5	10	5	10	5	10	3	6	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	0	0	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	2	4	2	4	2	4	2	4	0	0	2	4	1	2
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1	2	2	2	2
History of Disturbance (6)	1	3	3	3	3	3	3	3	3	3	3	3	3	0	0	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2
Freedom from Weeds (7)	1	4	4	4	4	5	5	5	5	5	5	5	5	1	1	4	4	4	4
Freedom from Disease (7)	1	5	5	5	5	4	4	4	4	4	4	4	4	5	5	4	4	4	4
Ecotonal complexity (5)	2	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			75		75		72		72		72		72		33	0	75		72

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	WEIGHTING	296	296	298	298	300	300	301	301	302	302	303	303	304	304	305	305	307	307
Formations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0
Associations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0
Number of LFDC (2)	3	4	12	4	12	4	12	4	12	3	9	3	9	4	12	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	1	2	1	2	1	2	0	0	1	2	1	2	1	2
Food Potential (4)	1	2	2	2	2	3	3	3	3	2	2	2	2	3	3	3	3	3	3
Total Cover Index (2)	2	2	4	1	2	3	6	3	6	4	8	4	8	3	6	3	6	3	6
Mean Health (2)	2	5	10	4	8	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	1	1	1	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
History of Disturbance (6)	1	2	2	3	3	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	3	3	4	4	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Freedom from Weeds (7)	1	4	4	1	1	4	4	4	4	4	4	5	5	4	4	4	4	4	4
Freedom from Disease (7)	1	4	4	5	5	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Ecotonal complexity (5)	2	2	4	0	0	2	4	2	4	2	4	2	4	2	4	2	4	2	4
TOTAL			73		66		73		73		81		80		73		73		73

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**308**	**308**	**309**	**309**	**310**	**310**	**313**	**313**	**314**	**314**	**320**	**320**	**323**	**323**	**324**	**324**	**327**	**327**
Formations Adjacent (1)	**2**	0	0	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	0	0	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	**3**	4	12	4	12	4	12	1	3	4	12	4	12	4	12	2	6	4	12
Floristic Richness (3)	**2**	1	2	1	2	2	4	0	0	1	2	2	4	2	4	0	0	2	4
Food Potential (4)	**1**	3	3	3	3	3	3	1	1	2	2	3	3	3	3	1	1	3	3
Total Cover Index (2)	**2**	3	6	3	6	3	6	0	0	2	4	1	2	1	2	0	0	1	2
Mean Health (2)	**2**	5	10	5	10	5	10	2	4	4	8	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	0	0	4	12	4	12	4	12	1	3	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	0	0	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
History of Disturbance (6)	**1**	3	3	3	3	3	3	0	0	3	3	3	3	3	3	0	0	3	3
Horizontal View Distance (1.5 m) (6)	**1**	3	3	3	3	3	3	1	1	3	3	3	3	3	3	1	1	3	3
Freedom from Weeds (7)	**1**	4	4	4	4	4	4	1	1	4	4	4	4	4	4	1	1	4	4
Freedom from Disease (7)	**1**	3	3	3	3	3	3	5	5	2	2	4	4	4	4	5	5	4	4
Ecotonal complexity (5)	**2**	0	0	0	0	3	6	0	0	2	4	2	4	2	4	0	0	2	4
TOTAL			68		68		81		29		70		75		75		38		75

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**332**	**332**	**333**	**333**	**334**	**334**	**335**	**335**	**336**	**336**	**339**	**339**	**340**	**340**	**341**	**341**	**342**	**342**
Formations Adjacent (1)	**2**	0	0	0	0	0	0	0	0	0	0	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	0	0	0	0	0	0	0	0	0	0	2	4	2	4	2	4	1	2
Number of LFDC (2)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	1	3
Floristic Richness (3)	**2**	2	4	2	4	2	4	2	4	1	2	1	2	1	2	1	2	2	4
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	3	6	1	2	1	2	1	2	1	2
Mean Health (2)	**2**	4	8	4	8	4	8	4	8	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1
Spatial Organisation (5)	**1**	4	4	4	4	4	4	4	4	3	3	4	4	4	4	4	4	3	3
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	1	2	1	2	0	0	1	2	1	2	1	2	2	4
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedl./sapl. (5)	**1**	3	3	3	3	3	3	3	3	1	1	2	2	2	2	2	2	2	2
History of Disturbance (6)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5
Horizontal View Distance (1.5 m) (6)	**1**	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5
Freedom from Disease (7)	**1**	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			71		71		71		71		67		74		74		74		65

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**344**	**344**	**345**	**345**	**346**	**346**	**347**	**347**	**348**	**348**	**351**	**351**	**353**	**353**	**355**	**355**	**356**	**356**
Formations Adjacent (1)	2	1	2	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	2	4	1	2	2	4	3	6	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	3	4	12	3	9	2	6	4	12	3	9	3	9	3	9	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	0	0	2	4	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	1	3	3	2	2	1	1	2	2	2	2	2	2	1	1	1	1	1	1
Total Cover Index (2)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	2	4
Mean Health (2)	2	5	10	4	8	5	10	4	8	4	8	4	8	5	10	3	6	3	6
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	1	3	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	4	4	3	3	4	4	3	3	5	5	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	1	1	2	2	1	1	1	1	2	2	2	2	1	1	2	2	2	2
Abundance seedl./sapl. (5)	1	2	2	3	3	1	1	2	2	3	3	3	3	1	1	1	1	1	1
History of Disturbance (6)	1	3	3	3	3	1	1	4	4	3	3	3	3	1	1	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	2	2	4	4	1	1	5	5	4	4	4	4	1	1	2	2	2	2
Freedom from Weeds (7)	1	5	5	5	5	1	1	4	4	5	5	5	5	1	1	2	2	2	2
Freedom from Disease (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2
Ecotonal complexity (5)	2	0	0	3	6	2	4	2	4	3	6	3	6	0	0	0	0	0	0
TOTAL			74		75		60		85		77		75		49		61		61

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	**WEIGHTING**	**357**	**357**	**358**	**358**	**359**	**359**	**360**	**360**	**361**	**361**	**362**	**362**	**363**	**363**	**365**	**365**	**367**	**367**
Formations Adjacent (1)	**2**	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2	0	0
Associations Adjacent (1)	**2**	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2	0	0
Number of LFDC (2)	**3**	3	9	4	12	4	12	4	12	3	9	3	9	4	12	2	6	4	12
Floristic Richness (3)	**2**	1	2	2	4	2	4	2	4	0	0	0	0	1	2	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	1	2	1	2	2	4	0	0	2	4
Mean Health (2)	**2**	5	10	4	8	4	8	4	8	5	10	5	10	4	8	5	10	4	8
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	1	1	1	1	3	3	1	1	3	3
Spatial Organisation (5)	**1**	5	5	4	4	4	4	4	4	3	3	3	3	4	4	3	3	4	4
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2
Abundance seedl./sapl. (5)	**1**	3	3	3	3	3	3	3	3	1	1	1	1	2	2	0	0	2	2
History of Disturbance (6)	**1**	5	5	3	3	3	3	3	3	5	5	5	5	3	3	0	0	3	3
Horizontal View Distance (1.5 m) (6)	**1**	5	5	3	3	3	3	3	3	1	1	1	1	3	3	1	1	3	3
Freedom from Weeds (7)	**1**	3	3	5	5	5	5	5	5	5	5	5	5	4	4	1	1	4	4
Freedom from Disease (7)	**1**	5	5	4	4	4	4	4	4	5	5	5	5	0	0	5	5	0	0
Ecotonal complexity (5)	**2**	2	4	0	0	0	0	0	0	2	4	2	4	1	2	1	2	1	2
TOTAL			80		71		71		71		68		68		64		45		64

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
LOCATION	WEIGHTING	368	368	369	369	370	370	371	371	376	376
Formations Adjacent (1)	2	0	0	0	0	0	0	1	2	2	4
Associations Adjacent (1)	2	0	0	0	0	0	0	1	2	2	4
Number of LFDC (2)	3	4	12	4	12	4	12	3	9	4	12
Floristic Richness (3)	2	1	2	1	2	2	4	2	4	2	4
Food Potential (4)	1	1	1	1	1	1	1	2	2	3	3
Total Cover Index (2)	2	2	4	2	4	2	4	1	2	2	4
Mean Health (2)	2	4	8	4	8	4	8	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	2	2	2	2	2	2	3	3	3	3
Spatial Organisation (5)	1	4	4	4	4	4	4	3	3	5	5
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	2	2	2	2	2	2	1	1	2	2
Abundance seedl./sapl. (5)	1	2	2	2	2	2	2	1	1	3	3
History of Disturbance (6)	1	3	3	3	3	3	3	5	5	4	4
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	3	3	1	1	2	2
Freedom from Weeds (7)	1	4	4	4	4	4	4	5	5	4	4
Freedom from Disease (7)	1	0	0	0	0	0	0	5	5	5	5
Ecotonal complexity (5)	2	1	2	1	2	1	2	2	4	2	4
TOTAL			63		63		65		73		87

NOTES:

Some data are taken from tables compiled for other purposes (and included in this report) and other data are extracted directly from the original field data sheets. These latter data do not necessarily appear elsewhere in this report.

1 = from map and direct from field observations
2 = from vegetation descriptions
3 = from species lists and direct from field data where species lists not made
4 = from vegetation descriptions
5 = direct from field observations
6 = from connectivity data
7 = from fire, weeds, etc. data

APPENDIX O

GIBSON STATUS (derived from Gibson et al 1994)

.APPENDIX O

KEMERTON BIOLOGICAL SURVEY PHASE 1

GIBSON STATUS (derived from Gibson et al (1994)

GIBSON NAME	GIBSON TYPE	RESERVATION STATUS (1994)	CONSERV-ATION STATUS (1994)
E haematoxylon, E marginata	1a	Unreserved	Susceptible
Southern E calophylla woodland on heavy soil	1b	Well	Vulnerable
Southern wet shrublands	2	Poor	Vulnerable
E calophylla, Kingia australis woodland on heavy soil	3a	Unreserved	Vulnerable
E calophylla, E marginata woodland on sandy clay soil	3b	Well	Vulnerable
E calophylla, Xanthorrhoea preissii woodland and shrubland	3c	Well	Vulnerable
Melaleuca preissiana dampland	4	Well	Low
Mixed shrub damplands	5	Well	Low
Weed dominated wetlands on heavy soils	6	Well	Low
Herb-rich saline shrublands in clay pans	7	Well	Vulnerable
Herb-rich shrublands in clay pans	8	Well	Vulnerable
Dense shrublands on clay flats	9	Well	Vulnerable
Shrublands on dry clay flats	10a	Well	Vulnerable
Shrublands on southern ironstone	10b	Unreserved	Critical
Wet forests and woodlands	11	Well	Low
Melaleuca teretifolia and/or Astartea fascicularis shrublands	12	Well	Low
Deeper wetlands on heavy soils	13	Well	Low
Deeper wetlands on sandy soils	14	Unreserved	Insufficiently known
Forests and woodlands on deep seasonal wetlands	15	Well	Vulnerable
Highly saline seasonal wetlands	16	Poor	Vulnerable
Melaleuca raphiophylla, Gahnia trifida seasonal wetlands	17	Well	Low
Shrublands on calcareous silts	18	Poor	Vulnerable
Sedgelands in Holocene dune swales	19	Unreserved	Vulnerable
Banksia attenuata woodland over species-rich dense shrubland	20a	Unreserved	Endangered
Eastern Banksia attenuata and/or E marginata woodlands	20b	Well	Vulnerable
Eastern shrublands and woodlands	20c	Well	Low
Central Banksia attenuata, E marginata woodlands	21a	Well	Low
Southern Banksia attenuata	21b	Well	Susceptible

GIBSON NAME	GIBSON TYPE	RESERVATION STATUS (1994)	CONSERV-ATION STATUS (1994)
Low lying Banksia attenuata woodlands and shrublands	21c	Well	Low
Banksia ilicifolia woodland	22	Poor	Low
Central Banks attenuata, B menziesii woodland	23a	Well	Low
Northern Banksia attenuata - B menziesii woodland	23b	Unreserved	Susceptible
Northern Spearwood shrublands and woodlands	24	Well	Susceptible
Southern E gomphocephala, Agonis flexuosa woodland	25	Poor	Susceptible
Melaleuca huegelii, M acerosa shrublands of limestone ridges	26a	Unreserved	Susceptible
Woodlands and mallees on limestone	26b	Well	Low
Species poor mallees and shrublands on limestone	27	Well	Low
Spearwood Banksia attenuata or B attenuata Eucalyptus woodlands	28	Well	Low
Coastal shrublands on shallow sands	29a	Poor	Susceptible
Acacia shrublands on taller dunes	29b	Poor	Susceptible
Callitris preissii (or Melaleuca lanceolata) forests and woodlands	30a	Poor	Vulnerable
Quindalup E gomphocephala and/or Agonis flexuosa woodland	30b	Well	Susceptible
Other mallees or scrubs	30c	Unreserved	Insufficiently known

APPENDIX P

PRINCIPLES FOR EVALUATION OF NATIVE VEGETATION

PRINCIPLES FOR EVALUATION OF NATIVE VEGETATION

The tables in this section provide a summary of principles to be considered when assessing priorities for retention of native vegetation. The third column can be used to note whether the principles apply to a particular piece of native vegetation. Criteria and justification for the principles are detailed in *Criteria for Evaluation Principles* on page 6.

1. REGIONAL PROCESSES

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
1.1 Water	the clearance of vegetation is likely to cause deterioration in surface and groundwater catchments which result in increases in salinity and eutrophication.	
1.2 Soil	the clearance of vegetation is likely to contribute to soil erosion, waterlogging or flooding	
1.3 Corridors and Buffers	the land provides a corridor or stepping stone between areas of conservation land or the land provides a buffer or is an inlier to areas reserved for conservation	
1.4 Aesthetics and Cultural	the land provides high landscape values, has special physiographic features, aboriginal sites or heritage value	

2. REPRESENTATION

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
2.1.1 Flora	it contains or is likely to contain threatened flora or flora of special interest.	
2.1.2 Plant communities	it contains or is likely to contain threatened plant communities	
2.1.3 Diversity	it contains areas of very high species richness	
2.1.4 Wetlands	it contains wetlands of significance	

2. REPRESENTATION (continued)

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
2.1.5 Local representation	within a 15 kilometre radius of the remnant there is less than 20% of the original cover of any plant community on the land represented by: (i) viable occurrences in NPNCA National Parks or Nature Reserves. (ii) viable occurrences in other Crown Land or Remnant Vegetation Protection Scheme covenants.	
2.1.6 Regional representation	it includes vegetation communities not well conserved in the region compared with the original cover as represented in the Interim Biographical Representation in Australia (IBRA)	
2.2.1 Wildlife	it contains or is likely to contain rare fauna	
2.2.2 Habitats	it has significance as habitat for wildlife or if a loss of diversity by clearing part of the land will adversely impact on fauna dependent on a mosaic of vegetation types.	

3. VIABILITY

Item	Principle - survival of natural values over the next 50 years.	Yes/No/ Partly
3.1 Area	Large areas have higher conservation values, the maximum possible area of a remnant should be retained. Groups of small remnants can support fauna able to move between remnants and threatened species.	
3.2 Shape	Very narrow areas of retained vegetation are less likely to be viable and of reduced value as corridors.	
3.3 Intactness	Remnants with little or no intact vegetation are unlikely to be viable.	
3.4 Diseases and Pests	The vegetation should be free of major diseases and pests such as Dieback. Disease free vegetation is more important for retention if similar vegetation communities in nearby reserves are diseased.	
3.5 Invasive plants	Presence of invasive plants capable of, or with potential to, disrupt ecosystem processes.	
3.6 Adjacent uses	Adjacent land uses impacting on the viability of the land must be considered.	

APPENDIX Q

SAFSTROM AND CRAIG EVALUATION (modified)

APPENDIX Q

KEMERTON BIOLOGICAL SURVEY PHASE 1

SAFSTROM AND CRAIG EVALUATION (modified)

1.0 REGIONAL PROCESSES		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	A	B	C	D	E	F	G	H	I	J
1.1 Water	Is the clearance of vegetation likely to cause deterioration in surface and groundwater catchments which result in increases in salinity or eutrophication?	P	P	N	Y	N	N	Y	N	Y	N
1.2 Soil	Is the clearance of vegetation likely to contribute to soil erosion, waterlogging or flooding?	N	N	P	Y	N	N	Y	N	Y	N
1.3 Corridors and Buffers	Is the land providing a corridor or stepping stone between areas of conservation land or does the land provide a buffer to areas reserved for conservation?	N	N	N	N	N	N	N	N	Y	N

2.0 REPRESENTATION		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	A	B	C	D	E	F	G	H	I	J
2.1 Flora	Does it contain or is it likely to contain threatened or significant flora?	N	N	P	Y	N	Y	Y	N	Y	Y
2.2 Plant Communities	Does it contain or is it likely to contain threatened plant communities?	N	N	N	P	N	N	Y	N	Y	Y
2.3 Diversity	Does it contain areas of very high plant species richness?	N	N	Y	Y	N	Y	Y	N	N	Y
2.4 Wetlands	Does it contain wetlands of "significance"?	N	N	N	P	Y	N	Y	N	Y	N

ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	AREA A	B	C	D	E	F	G	H	I	J
2.5.1 Local representation	There are no conservation reserves or designated conservation areas within a 15 km radius	N	N	N	N	N	N	N	N	N	N
2.5.2 Local representation	There is less than 20% of the immediate regional vegetation left intact	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.6 Regional representation	The site includes vegetation communities not well conserved in the broader region	N	N	N	N	N	N	Y	N	Y	Y
2.7 Wildlife	Is the site likely to contain rare or significant vertebrate fauna?	N	N	P	P	N	P	Y	N	P	P
2.8 Habitats	Is the site a known significant habitat for wildlife, or will loss of the site adversely impact on vertebrate fauna	N	N	P	P	N	N	Y	N	P	P

3.0 VIABILITY

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA A	B	C	D	E	F	G	H	I	J
3.1 Area	Is the site large enough to be viable in the long-term, or is it part of a complex of fragments which may survive in the long-term?	N	N	P	Y	Y	Y	Y	N	Y	Y
3.2 Shape	Is the shape of the site conducive to long-term viability (ie square, rectangular) rather than prone to edge effects, eg linear?	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
3.3 Intactness	Is the vegetation of the site basically intact?	N	P	Y	Y	N	Y	Y	N	P	Y
3.4 Diseases and Pests	Is the site disease and pest free?	Y	Y	P	P	N	Y	Y	Y	Y	Y
3.5 Invasive Plants	Is the site largely free of invasive plants?	N	N	Y	Y	N	Y	Y	N	P	Y

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA A	B	C	D	E	F	G	H	I	J
3.6 Adjacent Land Uses	Adjacent land uses are unlikely to impact on the long-term viability of the land being considered	N	N	P	P	N	P	Y	N	Y	Y
	TOTAL Y	3	3	4	11	5	9	17	5	13	12
	TOTAL P	1	2	6	5	0	2	0	0	4	2
	SCORE	3.5	4	7	13.5	5	10	17	5	15	13

1.0 REGIONAL PROCESSES		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	K	L	M	N	O	P	Q	R	S	T
1.1 Water	Is the clearance of vegetation likely to cause deterioration in surface and groundwater catchments which result in increases in salinity or eutrophication?	N	Y	N	Y	N	N	Y	N	Y	Y
1.2 Soil	Is the clearance of vegetation likely to contribute to soil erosion, waterlogging or flooding?	P	Y	N	Y	N	P	Y	N	Y	Y
1.3 Corridors and Buffers	Is the land providing a corridor or stepping stone between areas of conservation land or does the land provide a buffer to areas reserved for conservation?	N	N	N	Y	N	N	N	N	Y	N
1.4 Aesthetics and Cultural	Does the land have high landscape values, special physiographic features, Aboriginal sites or known heritage values?	N	Y	Y	Y	Y	N	Y	P	Y	N

2.0 REPRESENTATION		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	K	L	M	N	O	P	Q	R	S	T
2.1 Flora	Does it contain or is it likely to contain threatened or significant flora?	Y	Y	N	Y	Y	Y	Y	Y	Y	N

APPENDIX Q
Kemerton Safstrom and Craig Phase 1 - Page 4

ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	AREA K	L	M	N	O	P	Q	R	S	T
2.2 Plant Communities	Does it contain or is it likely to contain threatened plant communities?	Y	Y	P	Y	N	Y	P	Y	Y	N
2.3 Diversity	Does it contain areas of very high plant species richness?	N	N	N	N	Y	N	N	Y	N	N
2.4 Wetlands	Does it contain wetlands of "significance"?	Y	Y	Y	Y	N	Y	Y	Y	Y	N
2.5.1 Local representation	There are no conservation reserves or designated conservation areas within a 15 km radius	N	N	N	N	N	N	N	N	N	N
2.5.2 Local representation	There is less than 20% of the immediate regional vegetation left intact	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.6 Regional representation	The site includes vegetation communities not well conserved in the broader region	N	Y	Y	Y	N	P	Y	P	Y	N
2.7 Wildlife	Is the site likely to contain rare or significant vertebrate fauna?	N	P	N	P	Y	N	P	P	Y	N
2.8 Habitats	Is the site a known significant habitat for wildlife, or will loss of the site adversely impact on vertebrate fauna	N	P	N	P	Y	N	P	P	Y	N

3.0 VIABILITY		AREA									
ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	K	L	M	N	O	P	Q	R	S	T
3.1 Area	Is the site large enough to be viable in the long-term, or is it part of a complex of fragments which may survive in the long-term?	N	Y	N	Y	Y	N	Y	Y	P	N
3.2 Shape	Is the shape of the site conducive to long-term viability (ie square, rectangular) rather than prone to edge effects, eg linear?	Y	Y	Y	Y	Y	Y	P	Y	P	Y

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA									
		K	L	M	N	O	P	Q	R	S	T
3.3 Intactness	Is the vegetation of the site basically intact?	N	Y	N	P	Y	N	Y	Y	Y	P
3.4 Diseases and Pests	Is the site disease and pest free?	P	P	N	Y	Y	N	P	P	Y	N
3.5 Invasive Plants	Is the site largely free of invasive plants?	N	Y	N	P	Y	N	P	Y	P	N
3.6 Adjacent Land Uses	Adjacent land uses are unlikely to impact on the long-term viability of the land being considered	Y	Y	N	Y	Y	Y	Y	P	Y	Y
	TOTAL Y	6	13	5	13	12	6	10	9	14	5
	TOTAL P	2	3	1	4	0	2	6	6	3	1
	SCORE	**8**	**14.5**	**5.5**	**15**	**12**	**7**	**13**	**12**	**15.5**	**5.5**

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
292		Pines									
293		Cleared farmland with some Juncpall									
294	J	G>I	1	N	N/A	N	N/A	60	HLLA	None	VF
295	J	G>I	1	N	N/A	N	N/A	60	HLLA	None	VF
296	D	G>I	1	Y	60-120	N	N/A	80	HLLA	MGR	VF
297	J	G>I	1	Y	60-120	N	N/A	120	HLLA	HGR	VF
298	T	G<I	0	N	N/A	N	N/A	50	HLLA	Lightly	VA
299	T	Parkland grazed Eucagomp over Agonflex									
300	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
301	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
302	D	C	1	Y	10 m	N	N/A	20	N/A	None	C
303	D	C	1	Y	10 m	N	N/A	20	N/A	None	C
304	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
305	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
306	J	Parkland cleared Eucamarg and Agonflex									
307	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
308	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
309	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
310	J	G<I	1	Complex	60-120	N	N/A	80	HLLA	Minor	C
311	J	Parkland cleared Eucamarg woodland with scattered Allofras, Nuytflor and Bankilic									
312	J	Intensively cleared Eucamarg woodland									
313	J	Intensively cleared Eucamarg woodland									
314	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Recent	VF
315	J	Intensively cleared Eucamarg woodland									
316		Pines									
317		Pines									
318		Pines									
319	J	Parkland cleared Eucamarg woodland									
320	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Recent	VF
321	D	Farmland with patches of Astafasc and Melaprei in a shallow dampland									

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
322		Cleared									
323	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Minor	VF
324	D	G<I	Cleared	N	N/A	N	N/A	N/A	HLR	HGR	None
325		Farmland with patches of Juncpall and Kunzeric									None
326	J	Parkland cleared and grazed Agonflex with most of the Eucamarg removed									
327	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Minor	VF
328		Farmland with a thin veneer of Bassendean sand over Guildford Clay									
329	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
330	J	Agonflex woodland with some Eucamarg and Bankilic and Melaprei in places									
331	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
332	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
333	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
334	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
335	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
336	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
337	J	Intensively cleared Eucamarg woodland									
338	J	Intensively cleared Eucamarg woodland									
339	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
340	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
341	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
342	D	G>I	1	N	N/A	N	N/A	150	N/A	Possibly	S
343	J	Intensively cleared Eucamarg woodland									
344	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
345	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
346	D	Open water with scattered Mela??hamu									
347	D	C	3	Y	20 m	N	N/A	15	N/A	Possibly	S
348	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
349	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
350	D	Perielli heath with Melaprei and Melahamu									
351	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
352	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
353	M	Parkland cleared Eucacalo over Melaprei over Xantbrun									
354	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
355	J	G>I	1	N	N/A	N	N/A	150	HLLA	Y	S
356	J	G>I	1	N	N/A	N	N/A	150	HLLA	Y	S
357	DEC	G<I	1	Y	>120 m	N	N/A	10	None	Y	VA
358	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
359	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
360	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
361	D	G>I	1	Y	<60 m	N	N/A	N/A	None	None	S
362	D	G>I	1	Y	<60 m	N	N/A	N/A	N/A	N/A	S
363	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
364	J	Parkland cleared Eucamarg with damp patches									
365	D	G>I	1	Y	60	N	N/A	120	HLR	HGR	None
366	M	Parkland cleared Eucacalo woodland									
367	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
368	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
369	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
370	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
371	D	G>I	1	Y	60-120 m	N	N/A	N/A	None	None	VF
372	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
373	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
374	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
375	RIV	Parkland cleared or grazed farmland with intact river margins with Eucarudi, Melaraph, Agonflex, Juncpall									
376	RIV	G<I	2	Y	<60 m	Y	VG	120	None	Y	VA
377		Heavily cleared farmland withn scattered trees									
378		Partly cleared or heavily grazed farmland withn scattered trees									
379	J	Farmland with regrowth of Xantbrun									
380		Parkland cleared or heavily grazed farmland with trees									

APPENDIX J

FLORA SPECIES LISTS FOR STANDARD STUDY SITES

APPENDIX J

KEMERTON BIOLOGICAL SURVEY PHASE 1

FLORA SPECIES LISTS FOR STANDARD STUDY SITES

Site 6

Acacia extensa
Astartea fascicularis
Asteridea pulverulenta
Banksia attenuata
Banksia ilicifolia
* *Briza maxima*
Caladenia flava
Dasypogon bromeliifolius
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata
Ixiolaena viscosa
Kunzea ericifolia
Lagenifera huegelii
Lepyrodia glauca
Macrozamia riedlei
Melaleuca preissiana
Melaleuca thymoides
Platysace compressa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii
Xanthosia huegelii

Site 10

* *Acacia pycnantha*
* *Acetosella vulgaris*
Agonis flexuosa
Asteridea pulverulenta
* *Avena fatua*
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Banksia littoralis
* *Briza maxima*
Burchardia umbellata
Cartonema philydroides
* *Chamaecytisus palmensis*
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Dianella revoluta
Drosera pallida
Drosera stolonifera
* *Ehrharta brevifolia*
* *Eragrostis curvula*
Eucalyptus calophylla
Eucalyptus marginata
Grevillea diversifolia subsp *diversifolia*
Hardenbergia comptoniana
Hibbertia cuneiformis
* *Hypochaeris glabra*
Isotropis cuneifolia
Jacksonia sternbergiana
Kennedia prostrata
Kunzea ericifolia
Lepidosperma longitudinale
Luzula meridionalis
Macrozamia riedlei
Melaleuca preissiana
Microtis media subsp *media*
Opercularia hispidula
* *Petrorhagia velutina*
Phlebocarya ciliata
Poranthera microphylla
* *Silene gallica*
* *Solanum nigrum*
* *Sonchus oleraceus*
Trachymene pilosa
Tricoryne elatior
* *Trifolium angustifolium*
* *Trifolium campestre*
* *Ursinia anthemoides*
* *Watsonia bulbillifera*
Xanthorrhoea preissii

Site 12

P3 *Acacia semitrullata*
Adenanthos meisneri
* *Aira caryophyllea*
* *Anagallis arvensis*
Aphelia cyperoides
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Banksia ilicifolia

Site 12 (continued)

Boronia dichotoma
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix fraseri
Conostephium pendulum
Dampiera linearis
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus marginata
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Ixiolaena viscosa
Kunzea ericifolia
Laxmannia squarrosa
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lyginia barbata
Melaleuca scabra group
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Platysace compressa
Pterostylis recurva
Rhodanthe cotula
Schoenus curvifolius
Stylidium brunonianum
Stylidium junceum
Stylidium piliferum
Thelymitra ? aff holmesii
Thelymitra ? benthamiana
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii
Xanthosia huegelii

Site 13

Acacia extensa
P3 *Acacia semitrullata*
Adenanthos meisneri
* *Aira caryophyllea*
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Banksia ilicifolia
Boronia dichotoma
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Eucalyptus marginata
Euchilopsis linearis
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
Hypocalymma angustifolium
* *Hypochaeris glabra*
Jacksonia furcellata
Kunzea ericifolia
Lepidosperma squamatum
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra purpurea
Lyginia barbata
Macrozamia riedlei
Melaleuca scabra group
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Petrophile linearis
Philotheca spicatus
Platysace compressa
Podotheca angustifolia
Rhodanthe cotula
Siloxerus filifolius
Stylidium brunonianum
Stylidium piliferum
Stylidium schoenoides
Thysanotus manglesianus
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthorrhoea preissii

Site 26

    Acacia extensa
* *Aira caryophyllea*
    Allocasuarina fraseriana
    Asteridea pulverulenta
    Austrodanthonia occidentalis
    Banksia attenuata
    Banksia grandis
    Banksia ilicifolia
    Bossiaea eriocarpa
* *Briza maxima*
* *Briza minor*
    Chamaescilla corymbosa
    Conostylis aculeata subsp *aculeata*
    Conostylis juncea
* *Crassula alata*
    Dasypogon bromeliifolius
    Eucalyptus marginata
    Gompholobium tomentosum
    Goodenia incana
    Hibbertia hypericoides
    Hibbertia subvaginata
* *Hypochaeris glabra*
    Isotoma hypocrateriformis
    Kennedia prostrata
    Lagenifera huegelii
    Laxmannia squarrosa
    Leucopogon racemulosus
    Lobelia tenuior
    Lomandra sonderi
    Lyginia barbata
    Macrozamia riedlei
    Melaleuca thymoides
    Nuytsia floribunda
    Persoonia saccata
    Petrophile linearis
    Platysace compressa
    Poranthera microphylla
    Rhodanthe cotula
    Siloxerus filifolius
    Stirlingia latifolia
    Stylidium brunonianum
    Stylidium piliferum
    Trachymene pilosa
* *Ursinia anthemoides*
    Xanthorrhoea brunonis
    Xanthosia huegelii

Site 31

    Acacia extensa
    Adenanthos meisneri
* *Aira caryophyllea*
    Asteridea pulverulenta
    Austrodanthonia occidentalis
    Banksia attenuata
    Bossiaea eriocarpa
    Brachyloma preissii
* *Briza maxima*
* *Briza minor*
    Burchardia umbellata
    Calytrix flavescens
    Calytrix fraseri
    Chamaescilla corymbosa
    Comesperma virgatum
    Conostephium pendulum
    Conostylis aculeata subsp *aculeata*
    Conostylis juncea
    Dampiera linearis
    Dasypogon bromeliifolius
    Daviesia physodes
    Drosera pallida
    Drosera stolonifera
    Eucalyptus calophylla
    Eucalyptus marginata
    Gompholobium polymorphum
    Gompholobium tomentosum
    Goodenia incana
    Hardenbergia comptoniana
    Hemiandra pungens
    Hibbertia hypericoides
    Hibbertia racemosa
    Hovea trisperma
* *Hypochaeris glabra*
    Hypolaena exsulca
    Isotropis cuneifolia
    Jacksonia sternbergiana
    Kennedia prostrata
    Kunzea ericifolia
    Lagenifera huegelii
    Lepidosperma squamatum
    Lepyrodia glauca
    Leucopogon polymorphus
    Leucopogon propinquus
    Leucopogon racemulosus
    Levenhookia stipitata
    Lobelia tenuior
    Lomandra ? caespitosa
    Lomandra sonderi
    Macrozamia riedlei
    Melaleuca thymoides
    Patersonia occidentalis
    Petrophile linearis
    Philotheca spicatus
    Phlebocarya ciliata
* *Pinus pinaster*
    Platysace compressa
    ? *Pronaya fraseri*

Site 31 (continued)

Rhodanthe cotula
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Thelymitra ? aff *holmesii*
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 43

P3 *Acacia semitrullata*
Adenanthos meisneri
Adenanthos obovatus
Aotus gracillima
Astartea fascicularis
Asteridea pulverulenta
Banksia attenuata
Banksia ilicifolia
Banksia littoralis
Boronia dichotoma
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calothamnus lateralis
Calytrix fraseri
Dampiera linearis
Dasypogon bromeliifolius
Drosera ? *pulchella*
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus marginata
Euchilopsis linearis
Eutaxia virgata
Gompholobium capitatum
Gompholobium polymorphum
Gompholobium tomentosum
Hibbertia racemosa
Hibbertia stellaris
Hibbertia vaginata
Hovea trisperma
Hypocalymma angustifolium
* *Hypochaeris glabra*
Jacksonia furcellata
Kunzea ericifolia
Lagenifera huegelii
Latrobea tenella
Leucopogon australis
Melaleuca preissiana
Melaleuca thymoides
Monotaxis occidentalis
Patersonia occidentalis
Pericalymma ellipticum
Phyllangium paradoxum
Poranthera microphylla
Pultenaea reticulata
Siloxerus filifolius
Stylidium brunonianum
Stylidium junceum
Stylidium schoenoides
Thysanotus manglesianus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii

Site 57

Acacia huegelii
Agonis flexuosa
Asteridea pulverulenta
Austrodanthonia occidentalis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Comesperma virgatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Dasypogon bromeliifolius
Daucus glochidiatus
Desmocladus flexuosa
Dianella revoluta
Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Isotropis cuneifolia
Jacksonia furcellata
Kennedia prostrata
Lagenifera huegelii
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon racemulosus
Lobelia tenuior
Lomandra ? *caespitosa*
Macrozamia riedlei

Site 57 (continued)

	Melaleuca thymoides
*	*Monadenia bracteata*
	Olearia axillaris
	Opercularia hispidula
	Patersonia occidentalis
	Persoonia saccata
	Petrophile linearis
*	*Petrorhagia velutina*
	Philotheca spicatus
	Pteridium esculentum
	Pyrorchis nigricans
	Rhodanthe cotula
	Stylidium brunonianum
	Stylidium schoenoides
	Thelymitra ? aff *holmesii*
	Trachymene pilosa
	Tricoryne elatior
*	*Trifolium angustifolium*
*	*Trifolium campestre*
*	*Ursinia anthemoides*
*	*Zantedeschia aethiopica*

Site 67

	Aotus gracillima
	Astartea fascicularis
P1	*Boronia juncea* subsp *juncea*
	Calothamnus lateralis
	Comesperma virgatum
	Crassula colorata
	Dampiera linearis
	Drosera nitidula subsp *nitidula*
	Epiblema grandiflorum subsp *grandiflorum*
	Goodenia filiformis
	Hibbertia stellaris
	Hibbertia vaginata
	Hypocalymma angustifolium
	Isolepis marginata
	Lepidosperma longitudinale
	Melaleuca incana subsp *incana*
	Melaleuca lateritia
	Melaleuca rhaphiophylla
	Microtis media subsp *media*
	Patersonia occidentalis
	Pericalymma ellipticum
	Pimelea lanata
	Siloxerus filifolius
	Stylidium despectum
	Stylidium divaricatum
	Stylidium junceum

Site 77

	Acacia huegelii
	Agonis flexuosa
	Asteridea pulverulenta
	Austrodanthonia occidentalis
	Banksia attenuata
	Banksia ilicifolia
	Bossiaea eriocarpa
*	*Briza maxima*
	Burchardia umbellata
	Calytrix flavescens
	Comesperma virgatum
	Conostephium pendulum
	Conostylis aculeata subsp *aculeata*
	Conostylis juncea
	Dasypogon bromeliifolius
	Daucus glochidiatus
	Desmoclaudus flexuosa
	Dianella revoluta
	Drosera stolonifera
	Eucalyptus calophylla
	Eucalyptus marginata
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Hibbertia racemosa
*	*Hypochaeris glabra*
	Isotropis cuneifolia
	Jacksonia furcellata
	Kennedia prostrata
	Lagenifera huegelii
P2	*Lasiopetalum membranaceum*
	Lepidosperma squamatum
	Leucopogon racemulosus
	Lobelia tenuior
	Lomandra ? *caespitosa*
	Macrozamia riedlei
	Melaleuca thymoides
*	*Monadenia bracteata*
	Olearia axillaris
	Opercularia hispidula
	Patersonia occidentalis
	Persoonia saccata
	Petrophile linearis
*	*Petrorhagia velutina*
	Philotheca spicatus
	Pteridium esculentum
	Pyrorchis nigricans
	Rhodanthe cotula
	Stylidium brunonianum
	Stylidium schoenoides
	Thelymitra ? aff *holmesii*
	Trachymene pilosa
	Tricoryne elatior
*	*Trifolium angustifolium*
*	*Trifolium campestre*

Site 77 (continued)

* *Ursinia anthemoides*
* *Zantedeschia aethiopica*

Site 84

* *Acetosella vulgaris*
Astartea fascicularis
Austrostipa compressa
Banksia littoralis
Baumea articulata
* *Briza maxima*
Calothamnus lateralis
Cynodon dactylon
Eucalyptus rudis
* *Hypochaeris glabra*
Juncus pallidus
Kunzea ericifolia
Lepidosperma effusum
Lepidosperma longitudinale
Leucopogon polymorphus
Melaleuca preissiana
Melaleuca rhaphiophylla
* *Monopsis debilis*
* *Orobanche minor*
Oxylobium lineare
* *Parentucellia viscosa*
Pericalymma ellipticum
Pimelea lanata
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
Villarsia albiflora
Villarsia capitata

Site 91

Acacia cyclops
Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
Adenanthos meisneri
Adenanthos obovatus
Aphelia cyperoides
Astartea fascicularis
Boronia dichotoma
P1 *Boronia juncea* subsp *juncea*
Bossiaea eriocarpa
* *Briza maxima*
Calothamnus lateralis
Calytrix angulata
Centrolepis aristata
Dampiera linearis
Dasypogon bromeliifolius
Drosera nitidula subsp *nitidula*
Eucalyptus marginata
Euchilopsis linearis
Evandra pauciflora
Gompholobium capitatum
Gonocarpus pithyoides
Hibbertia stellaris
Hovea trisperma
Hypocalymma angustifolium
Hypolaena exsulca
Kunzea ericifolia
Kunzea micrantha
Lechenaultia expansa
Lepyrodia glauca
Lysinema ciliatum
Melaleuca preissiana
Melaleuca thymoides
Pericalymma ellipticum
Pimelea lanata
Platysace compressa
Platytheca galioides
Stylidium brunonianum
Stylidium divaricatum
* *Ursinia anthemoides*
Xanthorrhoea brunonis

Site 97

* *Acetosella vulgaris*
* *Aira caryophyllea*
* *Anagallis arvensis*
Baumea articulata
* *Briza maxima*
* *Briza minor*
* *Callitriche stagnalis*
Cassytha racemosa
* *Centaurium pulchellum*
Crassula colorata
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
* *Hypochaeris glabra*
Isolepis marginata
Ixiolaena viscosa
Juncus pallidus
Lemna disperma
* *Lolium* sp
* *Lotus suaveolens*
* *Lythrum hyssopifolia*
Melaleuca rhaphiophylla
Melaleuca teretifolia
Pimelea lanata
* *Pseudognaphalium luteo-album*
* *Senecio vulgaris*
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium despectum

Site 97 (continued)

Stylidium divaricatum
* *Trifolium* sp
Villarsia albiflora

Site 101

Acacia pulchella
* *Acetosella vulgaris*
Agonis flexuosa
* *Aira caryophyllea*
Aotus gracillima
Astartea fascicularis
Austrostipa compressa
Cartonema philydroides
* *Centaurium pulchellum*
Crassula colorata
Cynodon dactylon
Dasypogon bromeliifolius
Dianella revoluta
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
Goodenia filiformis
Hardenbergia comptoniana
Hibbertia stellaris
Homalosciadium homalocarpum
Hypocalymma angustifolium
* *Hypochaeris glabra*
Isolepis marginata
Ixiolaena viscosa
Jacksonia furcellata
Lepidosperma longitudinale
Lobelia tenuior
* *Lolium* sp
* *Lotus suaveolens*
* *Lythrum hyssopifolia*
Melaleuca rhaphiophylla
Microtis media subsp *media*
* *Misopates orontium*
Opercularia hispidula
Patersonia occidentalis
Phyllangium paradoxum
Pteridium esculentum
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium brunonianum
Trachymene pilosa
* *Trifolium* sp
* *Ursinia anthemoides*
Viminaria juncea
Xanthorrhoea preissii

Site 134

* *Ammophila arenaria*
Baumea articulata
* *Bromus* sp
Caesia occidentalis
Centella asiatica
Cotula coronopifolia
Cynodon dactylon
Eucalyptus rudis
* *Isolepis prolifer*
Juncus pallidus
Lemna disperma
* *Lolium* sp
* *Lythrum hyssopifolia*
* *Medicago polymorpha*
Melaleuca rhaphiophylla
Myriophyllum crispatum
* *Pennisetum clandestinum*
* *Rumex pulcher* subsp *pulcher*
* *Trifolium dubium*
* *Trifolium fragiferum*
* *Trifolium tomentosum*
Triglochin huegelii

Site 140

Acacia huegelii
Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
* *Aira caryophyllea*
Allocasuarina humilis
Anigozanthos manglesii
Astroloma pallidum
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
* *Briza minor*
Burchardia umbellata
Calytrix flavescens
Comesperma virgatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
* *Crassula alata*
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata
Daviesia physodes
Desmocladus fasciculata
Dianella revoluta
Drosera pallida

Site 140 (continued)

Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium tomentosum
Goodenia incana
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia subvaginata
* *Hypochaeris glabra*
Isotoma hypocrateriformis
Isotropis cuneifolia
Jacksonia furcellata
Kennedia prostrata
Laxmannia squarrosa
Leucopogon polymorphus
Leucopogon propinquus
Levenhookia stipitata
Lobelia tenuior
Lomandra sonderi
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Nemcia capitatum
Olearia paucidentata
Opercularia hispidula
Patersonia occidentalis
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Podotheca angustifolia
? Pronaya fraseri
Rhodanthe cotula
Stirlingia latifolia
Stylidium brunonianum
Stylidium piliferum
Stylidium schoenoides
Tetratheca hirsuta
Thysanotus arbuscula
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 141

Agonis flexuosa
* *Aira caryophyllea*
Asteridea pulverulenta
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Banksia grandis
Bossiaea eriocarpa
* *Briza maxima*
Cartonema philydroides
Clematis pubescens
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Dasypogon bromeliifolius
Daviesia physodes
Desmocladus flexuosa
Drosera stolonifera
Eucalyptus marginata
Glischrocaryon flavescens
Gompholobium polymorphum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia subvaginata
Hovea trisperma
* *Hypochaeris glabra*
Isotropis cuneifolia
Jacksonia furcellata
Lagenifera huegelii
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra micrantha subsp *micrantha*
Macrozamia riedlei
Melaleuca thymoides
* *Monadenia bracteata*
Opercularia hispidula
* *Orobanche minor*
* *Pelargonium capitatum*
Pelargonium littorale
Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phyllanthus calycinus
? Pronaya fraseri
Rhodanthe cotula
Sowerbaea laxiflora
Stylidium piliferum
Stylidium schoenoides
Synaphea spinulosa
Thelymitra ? aff holmesii
Thysanotus manglesianus
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 146

	Acacia pulchella
P3	*Acacia semitrullata*
	Anigozanthos manglesii
	Astroloma pallidum
	Austrostipa compressa
	Banksia attenuata
	Bossiaea eriocarpa
*	*Briza maxima*
	Burchardia umbellata
	Conostylis aculeata subsp *aculeata*
	Dampiera linearis
	Dasypogon bromeliifolius
	Eucalyptus marginata
	Gompholobium confertum
	Gompholobium tomentosum
	Goodenia incana
	Hemiandra pungens
	Hibbertia hypericoides
	Hibbertia subvaginata
	Hibbertia vaginata
*	*Hypochaeris glabra*
	Jacksonia sternbergiana
	Kennedia prostrata
	Lagenifera huegelii
	Lepidosperma squamatum
	Leucopogon polymorphus
	Leucopogon propinquus
	Levenhookia stipitata
	Lyginia barbata
	Macrozamia riedlei
	Melaleuca thymoides
*	*Monadenia bracteata*
	Patersonia occidentalis
	Persoonia longifolia
	Petrophile linearis
	Philotheca spicatus
	Rhodanthe cotula
	Stirlingia latifolia
	Stylidium brunonianum
	Tetratheca hirsuta
*	*Ursinia anthemoides*
	Xanthorrhoea brunonis
	Xanthosia huegelii

Site 151

P3	*Acacia semitrullata*
	Adenanthos meisneri
	Adenanthos obovatus
	Astartea fascicularis
	Banksia ilicifolia
	Boronia ramosa subsp *anethifolia*
	Calothamnus lateralis
	Cassytha flava
	Comesperma flavum
	Dampiera linearis .
	Euchilopsis linearis
	Eutaxia virgata
	Hibbertia stellaris
	Hypocalymma angustifolium
	Lepyrodia glauca
	Meeboldina sp
	Melaleuca preissiana
	Pericalymma ellipticum
	Platytheca galioides
	Selaginella gracillima
	Stylidium calcaratum
	Stylidium guttatum
	Stylidium junceum
	Thysanotus multiflorus

Site 155

P3	*Acacia semitrullata*
	Adenanthos meisneri
	Astartea fascicularis
P1	*Boronia juncea* subsp *juncea*
	Calothamnus lateralis
	Cassytha racemosa
	Comesperma flavum
	Comesperma virgatum
	Dampiera linearis
	Euchilopsis linearis
	Eutaxia virgata
	Gompholobium tomentosum
	Hibbertia stellaris
	Hypocalymma angustifolium
	Kunzea ericifolia
	Lepyrodia glauca
	Melaleuca lateritia
	Melaleuca preissiana
	Melaleuca teretifolia
	Pericalymma ellipticum
	Stylidium brunonianum
	Stylidium caespitosum
	Stylidium calcaratum

Site 172

	Agrostis sp
*	*Aira* sp
*	*Anagallis arvensis*
	Austrodanthonia occidentalis
	Baumea articulata
	Baumea juncea
*	*Briza minor*
	Cassytha racemosa
*	*Centaurium pulchellum*

Site 172 (continued)

	Centella asiatica
*	*Cirsium vulgare*
	Comesperma virgatum
*	*Conyza* sp
*	*Cuscuta epithymum*
DRF	*Diuris drummondii*
*	*Hypochaeris glabra*
	Lobelia alata
*	*Lolium* sp
*	*Lotus suaveolens*
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
*	*Mentha X piperita*
	Microtis media subsp *media*
*	*Orobanche minor*
*	*Parentucellia viscosa*
*	*Sonchus hydrophilus*
*	*Trifolium dubium*
	Villarsia albiflora

Site 173

	Acacia saligna
	Agonis flexuosa
*	*Anagallis arvensis*
*	*Arctotheca calendula*
	Baumea articulata
	Baumea juncea
*	*Briza minor*
	Cassytha racemosa
	Centella asiatica
*	*Conyza* sp
*	*Cuscuta epithymum*
	Eucalyptus rudis
	Homalosciadium homalocarpum
*	*Hypochaeris glabra*
*	*Lotus suaveolens*
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca teretifolia
*	*Mentha X piperita*
	Microtis media subsp *media*
	Myoporum caprarioides
*	*Orobanche minor*
*	*Parentucellia viscosa*
*	*Sonchus asper*
	Villarsia albiflora
*	*Vulpia* sp

Site 175

	Agonis flexuosa
	Agrostocrinum scabrum
*	*Aira caryophyllea*
	Astartea fascicularis
	Banksia attenuata
	Banksia ilicifolia
	Bossiaea eriocarpa
*	*Briza maxima*
	Caesia occidentalis
	Caladenia sp (site 28m)
	Comesperma virgatum
	Dampiera linearis
	Dasypogon bromeliifolius
	Daviesia physodes
	Elythranthera emarginata
	Eucalyptus calophylla
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Hibbertia racemosa
*	*Hypochaeris glabra*
	Lagenifera huegelii
	Lepidosperma squamatum
	Leucopogon australis
	Leucopogon propinquus
	Lobelia tenuior
	Lomandra ? caespitosa
	Lomandra sonderi
	Macrozamia riedlei
	Melaleuca preissiana
	Melaleuca thymoides
	Microtis media subsp *media*
	Monotaxis occidentalis
	Opercularia hispidula
	Patersonia occidentalis
	Persoonia longifolia
	Philotheca spicatus
	Phyllanthus calycinus
	Platysace compressa
	Platytheca galioides
	? *Pronaya fraseri*
	Rhodanthe cotula
	Stylidium brunonianum
	Tetratheca hirsuta
	Thelymitra ? aff *holmesii*
	Trachymene pilosa
	Xanthorrhoea brunonis

Site 183

	Acacia pulchella
P3	*Acacia semitrullata*
	Adenanthos meisneri
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Bossiaea eriocarpa

Site 183 (continued

Caesia occidentalis
Caladenia flava
Calytrix fraseri
Conostylis juncea
Dampiera linearis
DRF *Drakaea micrantha*
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
Jacksonia sternbergiana
Kennedia prostrata
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Nuytsia floribunda
Paracaleana nigrita
Petrophile linearis
Phlebocarya ciliata
Platysace compressa
? Pronaya fraseri
Pterostylis recurva
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Stylidium piliferum
Tetratheca hirsuta
Thysanotus manglesianus
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 201

Adenanthos meisneri
* *Anagallis arvensis*
Banksia ilicifolia
Banksia littoralis
Baumea articulata
* *Briza maxima*
* *Briza minor*
Cassytha racemosa
* *Centaurium pulchellum*
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
* *Conyza* sp
* *Crassula alata*
Daucus glochidiatus
Eucalyptus rudis
* *Hypochaeris glabra*
Ixiolaena viscosa
Jacksonia furcellata
Lepidosperma longitudinale
Leucopogon australis
Levenhookia stipitata
Lobelia alata
Lobelia tenuior
Lyginia barbata
Melaleuca incana subsp *incana*
Melaleuca preissiana
Melaleuca teretifolia
Nuytsia floribunda
* *Orobanche minor*
* *Parentucellia viscosa*
* *Petrorhagia velutina*
Rhodanthe cotula
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
* *Sonchus oleraceus*
Stylidium junceum
Thelymitra ? aff holmesii
* *Ursinia anthemoides*
Villarsia albiflora

Site 207

Acacia extensa
Acacia pulchella
Agonis flexuosa
Astroloma pallidum
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Caesia occidentalis
Calytrix flavescens
Calytrix fraseri
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata
Desmocladus fasciculata
Desmocladus flexuosa
Eucalyptus marginata
Gompholobium confertum
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*

Site 207 (continued)

Isotoma hypocrateriformis
Kennedia prostrata
Lepidosperma squamatum
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra sonderi
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Opercularia hispidula
Patersonia occidentalis
Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Podotheca angustifolia
Rhodanthe cotula
Stirlingia latifolia
Stylidium brunonianum
Thysanotus manglesianus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 230

Alternanthera nodiflora
Aotus gracillima
Aphelia brizula
Astartea fascicularis
Baumea articulata
P1 *Boronia juncea* subsp *juncea*
* *Briza minor*
Calothamnus lateralis
Comesperma virgatum
Cotula coronopifolia
Cynodon dactylon
Dampiera linearis
Drosera nitidula subsp *nitidula*
Epiblema grandiflorum subsp *grandiflorum*
Goodenia filiformis
Goodenia incana
Haemodorum simplex
Hakea varia
Hibbertia stellaris
* *Hypochaeris glabra*
Isolepis marginata
Lepidosperma longitudinale
Lepyrodia glauca
* *Lotus suaveolens*
Melaleuca incana subsp *incana*
Melaleuca lateritia
Melaleuca rhaphiophylla
Microtis media subsp *media*
* *Monopsis debilis*
Oxylobium lineare
Pimelea lanata
Prasophyllum brownii
* *Pseudognaphalium luteo-album*
* *Rumex pulcher* subsp *pulcher*
* *Sonchus asper*
Stylidium brunonianum
Stylidium calcaratum
Stylidium despectum
Stylidium divaricatum
Triglochin lineare
Villarsia albiflora

Site 247

Acacia extensa
Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
Adenanthos meisneri
Agrostocrinum scabrum
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Caesia occidentalis
Caladenia cf *huegelii* but not *huegelii*
Calytrix fraseri
Conospermum capitatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Corynotheca micrantha
Cryptostylis ovata
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata
Desmocladus flexuosa
Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Goodenia incana
Hardenbergia comptoniana
Hibbertia hypericoides
Hovea trisperma
Jacksonia furcellata
Lepidosperma squamatum

Site 247 (continued)

Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Opercularia hispidula
Persoonia longifolia
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Stylidium brunonianum
Stylidium junceum
Stylidium piliferum
Stylidium schoenoides
Tetratheca hirsuta
Thelymitra ? aff *holmesii*
Thysanotus multiflorus
Trichocline spathulata
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 298

Acacia saligna
Acacia willdenowiana
Agonis flexuosa
Astroloma pallidum
* *Avena fatua*
Banksia attenuata
Banksia grandis
* *Briza maxima*
* *Briza minor*
Chamaescilla corymbosa
Conostylis aculeata subsp *aculeata*
Corynotheca micrantha
Daviesia divaricata
Desmocladus flexuosa
Dianella revoluta
Eryngium pinnatifidum subsp *pinnatifidum*
Eucalyptus gomphocephala
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Jacksonia furcellata
Kennedia prostrata
* *Lagurus ovatus*
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon propinquus
Lobelia tenuior
Lyginia barbata
Macrozamia riedlei
Persoonia saccata
Petrophile linearis
* *Petrorhagia velutina*
Phyllanthus calycinus
Podotheca angustifolia
Ptilotus stirlingii var stirlingii
Rhodanthe cotula
Sowerbaea laxiflora
Synaphea spinulosa
Tetraria octandra
Trachymene pilosa
* *Trifolium campestre*
* *Ursinia anthemoides*

Site 300

Acacia pulchella
Acacia willdenowiana
* *Aira caryophyllea*
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Chamaescilla corymbosa
Conostylis aculeata subsp *aculeata*
Dasypogon bromeliifolius
Daviesia divaricata
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus calophylla
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hovea trisperma
Isolepis marginata
Lepidosperma squamatum
Lepyrodia glauca
Leucopogon polymorphus
Leucopogon racemulosus
Levenhookia stipitata
Luzula meridionalis
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Nemcia capitatum
Patersonia occidentalis
Petrophile linearis
Philotheca spicatus
Phyllanthus calycinus

Site 300 (continued)

Podotheca angustifolia
Rhodanthe cotula
Stylidium brunonianum
Stylidium piliferum
Trachymene pilosa
Xanthorrhoea brunonis

Site 302

Acacia pulchella
Acacia saligna
P3 *Acacia semitrullata*
Adenanthos meisneri
Agonis flexuosa
* *Ammophila arenaria*
Aotus gracillima
Astartea fascicularis
Baumea articulata
Baumea juncea
Baumea vaginalis
* *Briza maxima*
* *Briza minor*
* *Bromus diandrus*
* *Conyza* sp
Hemiandra pungens
* *Hypochaeris glabra*
Jacksonia furcellata
Lobelia alata
Melaleuca preissiana
Melaleuca teretifolia
Microtis media subsp *media*
* *Monadenia bracteata*
Oxylobium lineare
Patersonia occidentalis
* *Petrorhagia velutina*
Platysace compressa
* *Romulea rosea*
* *Rubus* sp
* *Sonchus oleraceus*
Stylidium junceum
Thelymitra ? aff *holmesii*
Thelymitra crinita
Thysanotus multiflorus
* *Typha orientalis*
* *Ursinia anthemoides*

Site 303

Acacia saligna
Baumea articulata
Baumea vaginalis
Centella asiatica
Lobelia alata
Melaleuca preissiana

Site 324

* *Azolla pinnata*
Cotula coronopifolia
Cynodon dactylon
* *Hypochaeris glabra*
Juncus caespiticius
Juncus pallidus
Lemna disperma
Lepidosperma longitudinale
* *Lolium* sp
* *Lotus suaveolens*
Melaleuca lateritia
Melaleuca rhaphiophylla
* *Mentha X piperita*
* *Paspalum dilatatum*
* *Pennisetum clandestinum*
* *Rumex pulcher* subsp *pulcher*

Site 332

Acacia huegelii
Acacia pulchella
Acacia stenoptera
Adenanthos meisneri
Agonis flexuosa
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Calectasia cyanea
Chamaescilla corymbosa
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
Dasypogon bromeliifolius
Daviesia divaricata
Daviesia physodes
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Haemodorum spicatum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hyalosperma cotula
Hypolaena exsulca
Jacksonia furcellata
Lepidosperma effusum
Leucopogon propinquus
Levenhookia stipitata
Lobelia tenuior
Logania serpyllifolia

Site 332 (continued)

Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Patersonia occidentalis
Pelargonium littorale
Persoonia longifolia
Phlebocarya ciliata
Poranthera microphylla
Stylidium brunonianum
Stylidium diversifolium
Synaphea spinulosa
Tetratheca hirsuta
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 341

Acacia extensa
Adenanthos meisneri
Agrostis sp
Banksia attenuata
Banksia ilicifolia
Boronia dichotoma
Bossiaea eriocarpa
Burchardia umbellata
Calytrix flavescens
Conostylis juncea
Dasypogon bromeliifolius
Drosera stolonifera
Eucalyptus marginata
Gompholobium confertum
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata
Hovea trisperma
Leucopogon australis
Lomandra sonderi
Melaleuca thymoides
Monotaxis occidentalis
Nuytsia floribunda
Patersonia occidentalis
Persoonia longifolia
Persoonia saccata
Petrophile linearis
Platysace compressa
Stylidium brunonianum
Stylidium diversifolium
Stylidium piliferum
Tetratheca hirsuta
Thysanotus manglesianus
Xanthorrhoea brunonis
Xanthosia huegelii

Site 342

Adenanthos meisneri
Adenanthos obovatus
* *Aira caryophyllea*
? *Aotus* sp
* *Arctotheca calendula*
* *Asparagus asparagoides*
Astartea fascicularis
Banksia ilicifolia
Banksia littoralis
* *Briza minor*
* *Conyza* sp
* *Crassula alata*
Crassula colorata
Daucus glochidiatus
Drosera paleacea subsp *paleacea*
Eucalyptus calophylla
Eucalyptus rudis
Euchilopsis linearis
Gompholobium capitatum
Hibbertia stellaris
Hibbertia subvaginata
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Jacksonia furcellata
Leucopogon propinquus
Leucopogon racemulosus
* *Lotus suaveolens*
Melaleuca preissiana
* *Monadenia bracteata*
Nuytsia floribunda
Parietaria debilis
Patersonia occidentalis
Pericalymma ellipticum
Poranthera microphylla
* *Pseudognaphalium luteo-album*
Rhagodia baccata subsp *dioica*
* *Senecio vulgaris*
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium repens
Thysanotus multiflorus
* *Ursinia anthemoides*
Xanthorrhoea preissiana

Site 346

* *Anagallis arvensis*
Astartea fascicularis
* *Atriplex prostrata*

Site 346 (continued)

* *Briza maxima*
Cassytha racemosa
Cotula coronopifolia
* *Crassula natans* var *minus*
Cynodon dactylon
Eleocharis acuta
* *Epilobium tetragonum*
Eucalyptus rudis
Glycera declinata
Juncus pallidus
Lepilaena preissii
* *Lotus suaveolens*
Luzula meridionalis
Melaleuca rhaphiophylla
Melaleuca teretifolia
* *Parentucellia viscosa*
Phyllangium paradoxum
* *Pseudognaphalium luteo-album*
* *Ranunculus trilobus*
Rhagodia baccata subsp *dioica*
* *Rumex crispus*
* *Sonchus oleraceus*
* *Trifolium hirtum*
* *Trifolium repens*
Villarsia capitata

Site 347

Agonis linearifolia
* *Aira caryophyllea*
Alternanthera nodiflora
* *Ammophila arenaria*
* *Arctotheca calendula*
Astartea fascicularis
* *Briza maxima*
* *Briza minor*
Caladenia longicaudata subsp *longicaudata*
Caladenia paludosa
Cassytha racemosa
Cotula coronopifolia
* *Crassula natans var minus*
Cryptostylis ovata
Cynodon dactylon
Drosera glanduligera
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
Hardenbergia comptoniana
Homalosciadium homalocarpum
Hypocalymma angustifolium
* *Hypochaeris glabra*
Juncus pallidus
Kunzea ericifolia
* *Lotus suaveolens*
Luzula meridionalis
Melaleuca rhaphiophylla
Microtis media subsp media
* *Monadenia bracteata*
* *Monopsis debilis*
* *Ornithopus compressus*
* *Orobanche minor*
Oxylobium lineare
* *Parentucellia viscosa*
Pericalymma ellipticum
Phyllangium paradoxum
* *Pseudognaphalium luteo-album*
* *Ranunculus trilobus*
Senecio glomeratus
Siloxerus filifolius
* *Sonchus oleraceus*
* *Trifolium dubium*
* *Trifolium glomeratum*
* *Trifolium hirtum*
* *Trifolium hybridum*
* *Trifolium repens*
Villarsia capitata
Xanthorrhoea preissii

Site 348

Acacia extensa
Agonis flexuosa
* *Aira caryophyllea*
* *Ammophila arenaria*
Astartea fascicularis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Cryptostylis ovata
Dampiera linearis
Daucus glochidiatus
Daviesia physodes
DRF *Drakaea ? elastica*
Drosera ? menziesii
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium polymorphum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
Hypocalymma angustifolium
* *Hypochaeris glabra*
Kennedia prostrata
Kunzea ericifolia
Macrozamia riedlei

Site 348 (continued)

Melaleuca preissiana
Melaleuca thymoides
Opercularia hispidula
Paracaleana nigrita
Patersonia occidentalis
Platysace compressa
Siloxerus filifolius
Sowerbaea laxiflora
Stylidium brunonianum
Trichocline spathulata
* Ursinia anthemoides
Xanthorrhoea brunonis

Site 353

Agrostis sp
Banksia ilicifolia
Banksia littoralis
* Briza maxima
* Briza minor
Cynodon dactylon
Dasypogon bromeliifolius
Daucus glochidiatus
Drosera neesii
Drosera paleacea subsp paleacea
Elythranthera emarginata
Eucalyptus calophylla
Gompholobium tomentosum
Hibbertia vaginata
Hypocalymma angustifolium
* Hypochaeris glabra
Isolepis marginata
Juncus pallidus
Kunzea ericifolia
Lepidosperma longitudinale
Melaleuca preissiana
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Poranthera microphylla
Siloxerus filifolius
Stylidium diversifolium
Thelymitra ? benthamiana
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis

Site 356

Agonis flexuosa
* Aira caryophyllea
Astroloma pallidum
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
* Briza maxima
Burchardia umbellata
Cassytha racemosa
Daucus glochidiatus
Daviesia divaricata
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Hibbertia hypericoides
Hibbertia racemosa
* Hypochaeris glabra
Kennedia prostrata
Kunzea ericifolia
P2 Lasiopetalum membranaceum
Lechenaultia biloba
Leucopogon racemulosus
Levenhookia stipitata
Macrozamia riedlei
* Monadenia bracteata
Olearia axillaris
* Orobanche minor
Pelargonium littorale
Petrophile linearis
* Petrorhagia velutina
Phyllanthus calycinus
Podolepis lessonii
Poranthera microphylla
* Senecio vulgaris
Synaphea spinulosa
Trachymene cyanopetala
Trachymene pilosa
* Trifolium dubium
* Trifolium hirtum
* Ursinia anthemoides
Wahlenbergia gracilenta
Xanthorrhoea brunonis
Xylomelum occidentale

Site 357

Agonis flexuosa
* Anagallis arvensis
* Bellardia trixago
Brachyloma preissii
* Briza maxima
* Briza minor
Caladenia lobata
Clematis pubescens
* Conyza sp
Daucus glochidiatus
Daviesia divaricata
Eucalyptus calophylla

Site 357 (continued)

Eucalyptus decipiens
Hardenbergia comptoniana
Hibbertia hypericoides
* *Hypochaeris glabra*
Isotoma hypocrateriformis
P2 *Lasiopetalum membranaceum*
Levenhookia stipitata
Lobelia tenuior
Macrozamia riedlei
* *Medicago polymorpha*
Melaleuca acerosa
Olearia axillaris
* *Orobanche minor*
Pelargonium littorale
* *Petrorhagia velutina*
Phyllanthus calycinus
Poranthera microphylla
Rhagodia baccata subsp *dioica*
* *Senecio vulgaris*
* *Silene gallica*
* *Sonchus oleraceus*
Thelymitra ? benthamiana
Trachymene pilosa
* *Ursinia anthemoides*
Wahlenbergia preissii
Lobelia tenuior
Lomandra purpurea
Macrozamia riedlei
Melaleuca thymoides
Patersonia occidentalis
Pericalymma ellipticum
Persoonia longifolia
Petrophile linearis
Phlebocarya ciliata
Poranthera microphylla
Pterostylis recurva
Scaevola calliptera
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Thelymitra crinita
Thysanotus multiflorus
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xylomelum occidentale

Site 367

Acacia huegelii
Acacia pulchella
Acacia stenoptera
Adenanthos meisneri
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Conospermum capitatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Dampiera linearis
Dasypogon bromeliifolius
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hypolaena exsulca
Kunzea ericifolia
Lepidosperma squamatum
Levenhookia stipitata

Site 370

Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
Agonis flexuosa
Anigozanthos manglesii
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
Dampiera linearis
Dasypogon bromeliifolius
Daucus glochidiatus
Daviesia divaricata
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hovea trisperma
Hyalosperma cotula
Isotropis cuneifolia

Site 370 (continued)

Jacksonia furcellata
Kennedia prostrata
Lagenifera huegelii
Lepidosperma squamatum
Lobelia tenuior
Logania serpyllifolia
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Microtis media subsp *media*
Opercularia hispidula
Patersonia occidentalis
Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Phyllanthus calycinus
Platysace compressa
Podolepis lessonii
Pyrorchis nigricans
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Stylidium schoenoides
Tetratheca hirsuta
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 371

P3 *Acacia semitrullata*
Agonis flexuosa
* *Aira caryophyllea*
Aotus gracillima
Aphelia cyperoides
Astartea fascicularis
Banksia grandis
Boronia dichotoma
* *Briza maxima*
Calothamnus lateralis
Cartonema philydroides
Cassytha racemosa
Dampiera linearis
Dampiera trigona
Dasypogon bromeliifolius
Drosera nitidula subsp *nitidula*
Drosera paleacea subsp *paleacea*
Elythranthera emarginata
Eucalyptus calophylla
Eucalyptus marginata
? *Eutaxia* sp
Gompholobium capitatum
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Isolepis cernua
Kunzea ericifolia
Lechenaultia biloba
Lepidosperma longitudinale
Lobelia tenuior
* *Lotus suaveolens*
Melaleuca lateritia
Melaleuca preissiana
Melaleuca thymoides
Microtis media subsp *media*
* *Monopsis debilis*
Monotaxis occidentalis
Pericalymma ellipticum
Phyllangium paradoxum
Poranthera microphylla
Pteridium esculentum
Selaginella gracillima
Siloxerus filifolius
Stylidium brunonianum
Stylidium calcaratum
Stylidium junceum
Trachymene pilosa
* *Trifolium subterraneum*
* *Ursinia anthemoides*
Viminaria juncea
Xanthorrhoea brunonis

APPENDIX K

GIBSON PLOT FLORA LISTS

APPENDIX K

KEMERTON BIOLOGICAL SURVEY
PHASE 1
GIBSON PLOT FLORA LISTS

Site 13

P3 *Acacia semitrullata*
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
* *Hypochaeris glabra*
Kunzea ericifolia
Lepidosperma squamatum
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? *caespitosa*
Lomandra purpurea
Lyginia barbata
Macrozamia riedlei
Melaleuca scabra group
Melaleuca thymoides
Petrophile linearis
Philotheca spicatus
Platysace compressa
Rhodanthe cotula
Siloxerus filifolius
Stylidium brunonianum
Stylidium piliferum
Stylidium schoenoides
Thelymitra ? aff *holmesii*
Thysanotus manglesianus
Thysanotus multiflorus
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii

Site 31

* *Aira caryophyllea*
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
* *Briza minor*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Comesperma virgatum
Conostephium pendulum
Conostylis juncea
Dasypogon bromeliifolius
Daviesia physodes
Drosera pallida
Drosera stolonifera
Eucalyptus marginata
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Hypolaena exsulca
Lagenifera huegelii
Lepidosperma squamatum
Lepyrodia glauca
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? *caespitosa*
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
? *Pronaya fraseri*
Rhodanthe cotula
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Thelymitra ? aff *holmesii*
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii

Site 172

	Agrostis sp
*	*Aira* sp
	Austrodanthonia occidentalis
	Baumea articulata
	Baumea juncea
*	*Briza minor*
	Cassytha racemosa
*	*Centaurium pulchellum*
	Centella asiatica
*	*Cirsium vulgare*
*	*Conyza* sp
*	*Cuscuta epithymum*
*	*Hypochaeris glabra*
	Lobelia alata
*	*Lolium* sp
*	*Lotus suaveolens*
	Melaleuca teretifolia
*	*Mentha* X *piperita*
	Microtis media subsp *media*
*	*Orobanche minor*
*	*Sonchus hydrophilus*
*	*Trifolium dubium*
	Villarsia albiflora

Site 175

	Agonis flexuosa
	Banksia ilicifolia
	Bossiaea eriocarpa
*	*Briza maxima*
	Caesia occidentalis
	Caladenia sp (site 28m)
	Dampiera linearis
	Dasypogon bromeliifolius
	Eucalyptus calophylla
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Hibbertia racemosa
*	*Hypochaeris glabra*
	Lagenifera huegelii
	Lepidosperma squamatum
	Lomandra ? *caespitosa*
	Lomandra sonderi
	Macrozamia riedlei
	Melaleuca preissiana
	Melaleuca thymoides
	Opercularia hispidula
	Patersonia occidentalis
	Persoonia longifolia
	Philotheca spicatus
	Platysace compressa
	? *Pronaya fraseri*
	Thelymitra ? aff *holmesii*
	Trachymene pilosa
	Xanthorrhoea brunonis

Site 226

P3	*Acacia semitrullata*
	Acacia stenoptera
*	*Aira caryophyllea*
	Astroloma pallidum
	Austrodanthonia occidentalis
	Banksia attenuata
	Bossiaea eriocarpa
*	*Briza maxima*
*	*Briza minor*
	Burchardia umbellata
	Conostephium pendulum
	Conostylis juncea
	Dasypogon bromeliifolius
	Daviesia divaricata
	Desmocladus fasciculata
	Drosera pallida
	Drosera stolonifera
	Eucalyptus calophylla
	Eucalyptus marginata
	Gompholobium tomentosum
	Goodenia incana
	Hemiandra pungens
	Hibbertia hypericoides
	Hibbertia racemosa
	Hibbertia subvaginata
*	*Hypochaeris glabra*
	Isotoma hypocrateriformis
	Isotropis cuneifolia
	Leucopogon polymorphus
	Leucopogon propinquus
	Lobelia tenuior
	Lomandra sonderi
	Lyginia barbata
	Melaleuca thymoides
	Nemcia capitatum
	Olearia paucidentata
	Patersonia occidentalis
	Petrophile linearis
	Philotheca spicatus
	Platysace compressa
	Rhodanthe cotula
	Stirlingia latifolia
	Stylidium brunonianum
	Stylidium piliferum
	Tetratheca hirsuta

Site 226 (continued)

Thysanotus arbuscula
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii
Baumea vaginalis
Centella asiatica
Lobelia alata
Melaleuca preissiana

Site 230

Baumea articulata
Lepidosperma longitudinale
Lepyrodia glauca
Melaleuca lateritia
Villarsia albiflora

Site 247

Acacia pulchella
P3 *Acacia semitrullata*
Agrostocrinum scabrum
Banksia attenuata
Bossiaea eriocarpa
Caesia occidentalis
Conospermum capitatum
Conostephium pendulum
Dampiera linearis
Dasypogon bromeliifolius
Desmocladus flexuosa
Eucalyptus calophylla
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Hibbertia hypericoides
Hovea trisperma
Lepidosperma squamatum
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Opercularia hispidula
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Stylidium brunonianum
Stylidium schoenoides
Tetratheca hirsuta
Trichocline spathulata
Tricoryne elatior
Xanthosia huegelii
Xylomelum occidentale

Site 303

Acacia saligna
Baumea articulata

APPENDIX L

COMPILED SPECIES LIST (ALL SITES)

APPENDIX L

KEMERTON BIOLOGICAL SURVEY PHASE 1

COMPILED SPECIES LIST (ALL SITES) FOR KEMERTON INDUSTRIAL ESTATE

STATUS	TAXON	CODE
	Acacia cyclops	Acaccycl
	Acacia extensa	Acacexte
P4	Acacia flagelliformis	Acacflag
	Acacia huegelii	Acachueg
	Acacia pulchella	Acacpulc
*	Acacia pycnantha	Acacpycn
	Acacia saligna	Acacsali
P3	Acacia semitrullata	Acacsemi
	Acacia stenoptera	Acacsten
	Acacia willdenowiana	Acacwill
*	Acetosella vulgaris	Acetvulg
	Adenanthos meisneri	Adenmeis
	Adenanthos obovatus	Adenobov
	Agonis flexuosa	Agonflex
	Agonis linearifolia	Agonline
	Agrostis sp	Agrosp
	Agrostocrinum scabrum	Agroscab
*	Aira caryophyllea	Airacary
*	Aira sp	Airasp
	Allocasuarina fraseriana	Allofras
	Allocasuarina humilis	Allohumi
	Alternanthera nodiflora	Altenodi
*	Ammophila arenaria	Ammoaren
*	Anagallis arvensis	Anagarve
	Anigozanthos manglesii	Anigmang
	Aotus gracillima	Aotugrac
	? Aotus sp	Aotusp
	Aphelia brizula	Aphebriz
	Aphelia cyperoides	Aphecype
*	Arctotheca calendula	Arctcale
*	Asparagus asparagoides	Aspaaspa
	Astartea fascicularis	Astafasc
	Asteridea pulverulenta	Astepulv

STATUS	TAXON	CODE
	Astroloma pallidum	Astrpall
*	Atriplex prostrata	Atripros
	Austrodanthonia occidentalis	Austocci
	Austrostipa compressa	Austcomp
*	Avena fatua	Avenfatu
*	Azolla pinnata	Azolpinn
	Banksia attenuata	Bankatte
	Banksia grandis	Bankgran
	Banksia ilicifolia	Bankilic
	Banksia littoralis	Banklitt
	Baumea articulata	Baumarti
	Baumea juncea	Baumjunc
	Baumea vaginalis	Baumvagi
*	Bellardia trixago	Bellatrix
	Boronia dichotoma	Borodich
P1	Boronia juncea subsp juncea	Borojunc
	Boronia ramosa subsp anethifolia	Bororamo
	Bossiaea eriocarpa	Bosserio
	Brachyloma preissii	Brachprei
*	Briza maxima	Brizmaxi
*	Briza minor	Brizmino
*	Bromus diandrus	Bromdian
*	Bromus sp	Bromsp
	Burchardia umbellata	Burchumb
	Caesia occidentalis	Caesocci
	Caladenia cf huegelii but not huegelii	Calahueg
	Caladenia flava	Calaflav
	Caladenia lobata	Calaloba
	Caladenia longicaudata subspongicaudata	Calalong
	Caladenia paludosa	Calapalu
	Caladenia sp (site 28m)	Calasp
	Calectasia cyanea	Calecyan
*	Callitriche stagnalis	Callstag

STATUS	TAXON	CODE
	Calothamnus lateralis	Calolate
	Calytrix angulata	Calyangu
	Calytrix flavescens	Calyflav
	Calytrix fraseri	Calyfras
	Cartonema philydroides	Cartphil
	Cassytha flava	Cassflav
	Cassytha racemosa	Cassrace
*	*Centaurium pulchellum*	Centpulc
	Centella asiatica	Centasia
	Centrolepis aristata	Centaris
*	*Chamaecytisus palmensis*	Champalm
	Chamaescilla corymbosa	Chamcory
*	*Cirsium vulgare*	Cirsvulg
	Clematis pubescens	Clempube
	Comesperma flavum	Comeflav
	Comesperma virgatum	Comevirg
	Conospermum capitatum	Conocapi
	Conostephium pendulum	Conopend
	Conostylis aculeata subsp *aculeata*	Conoacul
	Conostylis juncea	Conojunc
*	*Conyza* sp	Conysp
	Corynotheca micrantha	Corymicr
	Cotula coronopifolia	Cotucoro
*	*Crassula alata*	Crasalat
	Crassula colorata	Crascolo
*	*Crassula natans* var *minus*	Crasnata
	Cryptostylis ovata	Crypovat
*	*Cuscuta epithymum*	Cuscepit
	Cynodon dactylon	Cynodact
	Dampiera linearis	Dampline
	Dampiera trigona	Damptrig
	Dasypogon bromeliifolius	Dasybrom
	Daucus glochidiatus	Daucgloc
	Daviesia divaricata	Davidiva
	Daviesia physodes	Daviphys
	Desmocladus fasciculata	Desmfasc

STATUS	TAXON	CODE
	Desmocladus flexuosa	Desmflex
	Dianella revoluta	Dianrevo
DRF	*Diuris drummondii*	Diurdrum
DRF	*Drakaea elastica*	Drakelas
DRF	*Drakaea ? elastica*	Drakelas
	Drakaea glyptodon	Drakglyp
	Drakaea jeanensis	Drakjean
DRF	*Drakaea micrantha*	Drakmicr
	Drosera glanduligera	Drosglan
	Drosera ? menziesii	Drosmenz
	Drosera neesii	Drosnees
	Drosera nitidula subsp *nitidula*	Drosniti
	Drosera paleacea subsp *paleacea*	Drospale
	Drosera pallida	Drospall
	Drosera ? pulchella	Drospulc
	Drosera stolonifera	Drosstol
*	*Ehrharta brevifolia*	Ehrhbrev
	Eleocharis acuta	Eleoacut
	Elythranthera emarginata	Elytemar
	Epiblema grandiflorum subsprandiflorum	Epibgran
*	*Epilobium tetragonum*	Epiltetr
*	*Eragrostis curvula*	Eragcurv
	Eryngium pinnatifidum subspinnatifidum	Erynpinn
	Eucalyptus calophylla	Eucacalo
	Eucalyptus decipiens	Eucadeci
	Eucalyptus gomphocephala	Eucagomp
	Eucalyptus marginata	Eucamarg
	Eucalyptus rudis	Eucarudi
	Euchilopsis linearis	Euchiline
	Eutaxia virgata	Eutavirg
	? *Eutaxia* sp	Eutasp
	Evandra pauciflora	Evanpauc
	Glischrocaryon flavescens	Glisflav
	Glyceria declinata	Glycdecl
	Gompholobium capitatum	Gompcapi
	Gompholobium confertum	Gompconf

STATUS	TAXON	CODE
	Gompholobium polymorphum	*Gomppoly*
	Gompholobium tomentosum	*Gomptome*
	Gonocarpus pithyoides	*Gonopithy*
	Goodenia filiformis	*Goodfili*
	Goodenia incana	*Goodinca*
	Grevillea diversifolia subspiversifolia	*Grevdive*
	Haemodorum simplex	*Haemsimp*
	Haemodorum spicatum	*Haemspic*
	Hakea varia	*Hakevari*
	Hardenbergia comptoniana	*Hardcomp*
	Hemiandra pungens	*Hemipung*
	Hibbertia cuneiformis	*Hibbcune*
	Hibbertia hypericoides	*Hibbhype*
	Hibbertia racemosa	*Hibbrace*
	Hibbertia stellaris	*Hibbstel*
	Hibbertia subvaginata	*Hibbsubv*
	Hibbertia vaginata	*Hibbvagi*
	Homalosciadium homalocarpum	*Homahoma*
	Hovea trisperma	*Hovetris*
	Hyalosperma cotula	*Hyalcotu*
	Hypocalymma angustifolium	*Hypoangu*
*	*Hypochaeris glabra*	*Hypoglab*
	Hypolaena exsulca	*Hypoexsu*
	Isolepis cernua	*Isolcern*
	Isolepis marginata	*Isolmarg*
*	*Isolepis prolifer*	*Isolprol*
	Isotoma hypocrateriformis	*Isothypo*
	Isotropis cuneifolia	*Isotcune*
	Ixiolaena viscosa	*Ixiovisc*
	Jacksonia furcellata	*Jackfurc*
	Jacksonia sternbergiana	*Jackster*
	Juncus caespiticius	*Junccaes*
	Juncus pallidus	*Juncpall*
	Kennedia prostrata	*Kennpros*
	Kunzea ericifolia	*Kunzeric*
	Kunzea micrantha	*Kunzmicr*
	Lagenifera huegelii	*Lagehueg*
*	*Lagurus ovatus*	*Laguovat*
P2	*Lasiopetalum membranaceum*	*Lasimemb*
	Latrobea tenella	*Latrtene*
	Laxmannia squarrosa	*Laxmsqua*
	Lechenaultia biloba	*Lechbilo*
	Lechenaultia expansa	*Lechexpa*
	Lemna disperma	*Lemndisp*
	Lepidosperma effusum	*Lepieffu*
	Lepidosperma longitudinale	*Lepilong*
	Lepidosperma squamatum	*Lepisqua*
	Lepilaena preissii	*Lepiprei*
	Lepyrodia glauca	*Lepyglau*
	Leucopogon australis	*Leucaust*
	Leucopogon polymorphus	*Leucpoly*
	Leucopogon propinquus	*Leucprop*
	Leucopogon racemulosus	*Leucrace*
	Levenhookia stipitata	*Levestip*
	Lobelia alata	*Lobealat*
	Lobelia tenuior	*Lobetenu*
	Logania serpyllifolia	*Logaserp*
*	*Lolium* sp	*Lolisp*
	Lomandra ? caespitosa	*Lomacaes*
	Lomandra micrantha subspicrantha	*Lomamicr*
	Lomandra purpurea	*Lomapurp*
	Lomandra sonderi	*Lomasond*
*	*Lotus suaveolens*	*Lotusuav*
	Luzula meridionalis	*Luzumeri*
	Lyginia barbata	*Lygibarb*
	Lysinema ciliatum	*Lysicili*
*	*Lythrum hyssopifolia*	*Lythhyss*
	Macrozamia riedlei	*Macrried*
*	*Medicago polymorpha*	*Medipoly*
	Meeboldina sp	*Meebsp*
	Melaleuca acerosa	*Melalacer*
	Melaleuca incana subsp *incana*	*Melainca*

STATUS	TAXON	CODE
	Melaleuca lateritia	*Melalate*
	Melaleuca preissiana	*Melaprei*
	Melaleuca rhaphiophylla	*Melarhap*
	Melaleuca scabra group	*Melascab*
	Melaleuca teretifolia	*Melatere*
	Melaleuca thymoides	*Melathym*
*	*Mentha X piperita*	*Mentpipe*
	Microtis media subsp *media*	*Micrmedi*
*	*Misopates orontium*	*Misooron*
*	*Monadenia bracteata*	*Monabrac*
*	*Monopsis debilis*	*Monodebi*
	Monotaxis occidentalis	*Monoocci*
	Myoporum caprarioides	*Myopcapr*
	Myriophyllum crispatum	*Myricris*
	Nemcia capitatum	*Nemccapi*
	Nuytsia floribunda	*Nuytflor*
	Olearia axillaris	*Oleaaxil*
	Olearia paucidentata	*Oleapauc*
	Opercularia hispidula	*Operhisp*
*	*Ornithopus compressus*	*Ornitcomp*
*	*Orobanche minor*	*Orobmino*
	Oxylobium lineare	*Oxylline*
	Paracaleana nigrita	*Paranigr*
*	*Parentucellia viscosa*	*Parevisc*
	Parietaria debilis	*Paridebi*
*	*Paspalum dilatatum*	*Paspdila*
	Patersonia occidentalis	*Pateocci*
*	*Pelargonium capitatum*	*Pelacapi*
	Pelargonium littorale	*Pelalitt*
*	*Pennisetum clandestinum*	*Pennclan*
	Pericalymma ellipticum	*Perielli*
	Persoonia longifolia	*Perslong*
	Persoonia saccata	*Perssacc*
	Petrophile linearis	*Petrline*
*	*Petrorhagia velutina*	*Petrvelu*
	Philotheca spicatus	*Philspic*
	Phlebocarya ciliata	*Phlecili*
	Phyllangium paradoxum	*Phylpara*

STATUS	TAXON	CODE
	Phyllanthus calycinus	*Phylcaly*
	Pimelea lanata	*Pimelana*
*	*Pinus pinaster*	*Pinupina*
	Platysace compressa	*Platcomp*
	Platytheca galioides	*Platgali*
	Podocarpus drouynianus	*Pododrou*
	Podolepis lessonii	*Podoless*
	Podotheca angustifolia	*Podoangu*
	Poranthera microphylla	*Poramicr*
	Prasophyllum brownii	*Prasbrow*
	? Pronaya fraseri	*Pronfras*
*	*Pseudognaphalium luteo-album*	*Pseulute*
	Pteridium esculentum	*Pterescu*
	Pterostylis recurva	*Pterrecu*
	Ptilotus stirlingii var *stirlingii*	*Ptilstir*
	Pultenaea reticulata	*Pultreti*
	Pyrorchis nigricans	*Pyronigr*
*	*Ranunculus trilobus*	*Ranutril*
	Rhagodia baccata subsp *dioica*	*Rhagbacc*
	Rhodanthe cotula	*Rhodcotu*
*	*Romulea rosea*	*Romurose*
*	*Rubus* sp	*Rubusp*
*	*Rumex crispus*	*Rumecrisp*
*	*Rumex pulcher* subsp *pulcher*	*Rumepulc*
	Scaevola calliptera	*Scaecall*
	Schoenus curvifolius	*Schocurv*
	Selaginella gracillima	*Selagrac*
	Senecio glomeratus	*Seneglom*
*	*Senecio vulgaris*	*Senevulg*
*	*Silene gallica*	*Silegall*
	Siloxerus filifolius	*Silofili*
*	*Solanum nigrum*	*Solanigr*
*	*Sonchus asper*	*Soncaspe*
*	*Sonchus hydrophilus*	*Sonchhydr*
	Sonchus oleraceus	*Soncoler*
	Sowerbaea laxiflora	*Sowelaxi*
	Stirlingia latifolia	*Stirlati*
	Stylidium brunonianum	*Stylbrun*

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
262	P		Pines								
263	P		Pines								
264	D	1	Hakevari	2	0.5	5	10	5			
		2	Astafasc, Calolate, sedges	1.5	0	95	60	5			
		3	Villaalbi	0.1	0	2	20	5	56	5	
265	P		Pines								
266	P		Pines								
267	J	1	Eucamarg	24	10	10	20	4			
		2	Bank ilic, Bankatte	8	3	60	60	5			
		3	Melathym	1	0.5	50	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	69	4.8	
268	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
269	D		Low-lying woodland dampland interface complex with Kunzeric and Eucamarg merging into Melaprei over Perielli. Refer to discussion of woodland and dampland catenary complexes								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
270	D		Parkland cleared and heavily grazed Melaraph wetland								
271	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
272	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
273	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
274	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
275	D		Parkland cleared wetland with Melaprei and Agonflex over grass and weeds								
276	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
277	D		Edge of a Melaprei dampland with Eucamarg and Bankilic								
278	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
279	J		Parkland cleared Eucamarg and Agonflex								
280	J		Parkland cleared Eucamarg and Agonflex								
281	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
282	J		Parkland cleared Eucamarg woodland with regrowth								
283	J		Parkland cleared Eucamarg woodland with regrowth								
284	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
285	J		Cleared Eucamarg woodland with some regrowth								
286	C		Data may be in error - check in Phase 2 - recorded as farmland with clumps of Juncpall and Kunzeric regrowth								
287	P		Pines								
288	P		Pines								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
289	P		Pines								
290	P		Pines								
291	P		Pines								
292	P		Pines								
293	C		Cleared farmland with some Juncpall								
294	J	1	Eucamarg	22	10	10	20	4			
		2	Bankatte, Kunseric	6	3	70	50	5			
		3	Melathym	1	0.5	60	20	5			
		4	Mixed shrubs	0.5	0	40	50	5	69	4.8	
295	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunseric, Bankilic	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
296	J	1	Eucamarg	22	10	10	20	4			
		2	Bankatte, Kunseric	6	3	80	50	5			
		3	Melathym	1	0.5	60	20	5			
		4	Mixed shrubs	0.5	0	40	50	5	74	4.8	
297	J		Parkland cleared Eucamarg woodland								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
298	T	1	Eucagomp	26	16	5	80	5			
		2	Agonflex	12	2	80	20	5			
		3	Macreid and mixed shrubs	1	0	5	50	5			
		4	Annual grasses	0.3	0	95	5	1	23	4	
299	T		Parkland grazed Eucagomp over Agonflex								
300	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
301	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
302	D	1	Eucarudi	16	8	10	30	5			
		2	Melaprei	12	4	90	60	5			
		3	Sedges	1	0	100	95	5	152	5	
303	D	1	Eucarudi	16	8	10	30	5			
		2	Melaprei	12	4	90	60	5			
		3	Sedges	1	0	100	95	5	152	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
304	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
305	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
306	J		Parkland cleared Eucamarg and Agonflex								
307	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
308	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
309	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
310	J	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
311	J		Parkland cleared Eucamarg woodland with scattered Allofras, Nuytflor and Bankilic								
312	J		Intensively cleared Eucamarg woodland								
313	J		Intensively cleared Eucamarg woodland								
314	J	1	Eucamarg	24	10	10	20	3			
		2	Bankatte, Bankilic	8	3	70	30	3			
		3	Melathym	1	0.5	80	20	5			
		4	Mixed shrubs	0.5	0	40	40	4	55	3.8	
315	J		Intensively cleared Eucamarg woodland								
316	P		Pines								
317	P		Pines								
318	P		Pines								
319	J		Parkland cleared Eucamarg woodland								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
320	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte Bankilic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	
321	D		Farmland with patches of Astafasc and Melaprei in a shallow dampland								
322	C		Cleared farmland								
323	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunzeric, Bankiic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	
324	D		Melaraph	8	3	20	60	5			
			Weeds and grasses	0.2	0	100	5	5	17	5	
325	D		Farmland with patches of Juncpal and Kunzeric								
326	J		Parkland cleared and grazed Agonflex with most of the Eucamarg removed								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
327	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunzeric, Bankiic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	
328	J		Cleared farmand. Situated on Bassendean Sand Guildford Clay interface								
329	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
330	J		Semicleared and grazed Agonflex woodland with some Eucamarg and Bankilic and patches of Melaprei in places								
331	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
332	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	
333	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
334	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	
335	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	
336	M	1	Eucacalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
337	J		Intensively cleared Eucamarg woodland								
338	J		Intensively cleared Eucamarg woodland								
339	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
340	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
341	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
342	D	1	Eucarudi, Melaprei	14	2	70	50	5	35	5	Scattered Melaprei less than 2% CC and Adenmeis less than 2% CC in understorey. Small numbers of very large and old Nuytfor, Bankiic and Xantprei, but none abundant enough to alter the overall structure
343	J		Intensively cleared Eucamarg woodland								
344	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
345	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	
346	D	1	Melahamu	5	1	80	30	5			Open water surrounded by grass and weeds in centre of wetland. Chara spp in water. Clumps of Beauarti and Juncpall
		2	Cotucoro & agricultural weeds and Cynodact	0.2	0	100	20	5	44	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
347	D	1	Eucarudi	12	4	70	30	4			Scattered Melaprei & Melatere
		2	Agonflex	8	2	20	20	5			This associationn is an 80 m wide zone
		3	Astaflex	3	0	70	10	5			behind Melahamu zone
		4	Weeds and sedges	0.3	0	5	80	0	32	3.5	
348	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	
349	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
350	D		Scattered Melaprei over a complex mosiac largely dominated by Perielli and Melahamu								
351	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	
352	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex & Juncpall. Trigproc aquatic in slow flowing areas								
353	M		Eucacalo	14	8	10	30	5			
			Melaprei	8	2	10	80	5			
			Xantbrun and weeds	0.3	0	80	20		27	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
354	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
355	J	1	Eucamarg, Eucacalo	25	12	10	40	4			
		2	Bankatte, Xyloocci, Bankilic	12	3	40	60	4			
		3	Hibbhype, Xantprei	1	0.5	20	80	4			
		4	Annuals and grasses	0.3	0	60	70	2	86	3.4	
356	J	1	Eucamarg, Eucacalo	25	12	10	40	4			
		2	Bankatte, Xyloocci, Bankilic	12	3	40	60	4			
		3	Hibbhype, Xantprei	1	0.5	20	80	4			
		4	Annuals and grasses	0.3	0	60	70	2	86	3.4	
357	DEC	1	Eucadeci, Agonflex	10	3	70	60	5			
		2	Melaacer	2	0.5	60	80	5			
		3	Phebcaly	0.5	0	5	20	5	91	5	
358	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	
359	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
360	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, PhleXXXX	0.3	0	50	60	4	70	3.8	
361	D	1	Melaprei	12	8	10	60	5			
		2	Perielli, Melahype	1.5	0	90	30	5			
		3	Mixed sedges	0.3	0	10	20	5	35	5	
362	D	1	Melaprei	12	5	10	60	5			Some Melapoly
		2	Perielli, Melahype	1.5	0	90	30	5			
		3	Mixed sedges	0.3	0	10	20	5	35	5	
363	J	1	Eucamarg	20	15	5	30	3			Kunzeric & Agonflex patchily
		2	Bankatte, Kunzeric	10	3	40	50	5			distributed
		3	Mela thymo	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
364	J		Parkland cleared Eucamarg with damp patches								
365	D	1	Melaprei			10		5			
		2	Weeds and grasses			N/A					Parkland cleared
366	M		Parkland cleared Eucacalo woodland								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
367	J	1	Eucamarg	26	15	2	20	3			Degraded
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5			
		4	Dasybrom	0.2	0	70	80	4	96	4	
368	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Mela thymo	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
369	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Mela thymo	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
370	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Mela thymo	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
371	D	1	Melaprei	3.5	1	10	80	5			
		2	Astafasc, Hypohype, AotuXXXX	1	0	90	20	5			
		3	Mixed sedges	0.2	0	20	5	5	27	5	
372	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
373	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
374	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow flowing areas								
375	RIV		Parkland cleared or grazed farmland with intact river margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall								
376	RIV		Eucarudi	22	16	40	30	4			Highly variable
			Melaraph Agonflex	8	6	80	60	5			Data provided is an average
			Agonline	2.5	1	20	10	5			
			Juncpall mixed sedges and shrubs	1	0	80	40	5	94	4.8	
377	C		Heavily cleared farmland with scattered trees								
378	C		Partly cleared or heavily grazed farmland with scattered trees								
379	J		Cleared farmland with Xantbrun regrowth to 70%								
380	C		Parkland cleared or heavily grazed farmland with scattered trees								

APPENDIX H

FIRE, INSECT ATTACK, WEEDS, AND DIEBACK

APPENDIX H

KEMERTON BIOLOGICAL SURVEY PHASE 1

FIRE, INSECT ATTACK, WEEDS AND DIEBACK

LOC.No	TYPE	Strata Recovery	Insect attack	Weeds and Grass	Dieback	Risk evaluation as Source	Risk evaluation as Target
2	D	4	5	5	5	L	M
6	D	4	5	4	0	VH	H
7	P	0	5	1	5	L	L
10	J	4	5	3	4	M	H
12	J	4	5	5	4	L	H
13	J	4	5	5	4	L	H
14	J	4	5	5	4	L	H
25	J	4	5	5	2	H	H
26	J	4	5	5	2	H	H
27	J	4	5	5	2	H	H
28	J	4	5	5	2	H	H
29	J	4	3	5	5	L	H
30	J	4	3	5	5	L	H
31	J	4	3	5	5	L	H
32	J	4	3	5	5	L	H
35	J	4	5	5	4	L	H
37	J	4	4	5	5	L	H
38	J	4	5	5	4	L	H
40	J	4	4	5	5	L	H
43	D	4	5	5	3	L	M
48	D	4	5	4	5	L	M
52	J	1	5	1	5	M	M
54	J	4	3	5	5	L	H
55	J	4	3	5	5	L	H
57	J	4	5	2	5	L	H
58	J	4	5	2	5	L	H
59	J	4	3	5	5	L	H
60	J	4	3	5	5	L	H
67	D	4	5	5	5	L	M
72	D	3	5	5	5	L	M
77	J	4	5	2	5	L	H
80	J	4	3	5	5	L	H
81	J	4	3	5	5	L	H
82	J	4	3	5	5	L	H
83	J	4	3	5	5	L	H
84	D	4	5	5	5	L	L
86	D	4	5	5	5	L	M
87	J	4	3	5	5	L	H
91	D	4	5	5	5	L	M
92	D	4	5	5	5	L	M

Kemerton Fire, Weeds and Disease Phase 1 - Page 2

LOC.No	TYPE	Strata Recovery	Insect attack	Weeds and Grass	Dieback	Risk evaluation as Source	Risk evaluation as Target
93	D	4	5	5	5	L	M
96	D	4	5	5	5	L	M
97	D	4	5	4	5	L	M
98	D	4	5	5	5	L	M
100	D	4	5	4	5	L	M
101	D	4	2	2	5	L	M
109	J	4	5	5	4	L	H
110	J	4	5	5	4	L	H
111	J	4	5	5	4	L	H
112	J	4	3	5	5	L	H
113	D	4	5	5	5	L	M
117	J	4	5	5	5	L	H
118	J	4	5	5	5	L	H
119	J	4	5	5	5	L	H
120	J	4	5	5	5	L	H
122	J	4	5	5	5	L	H
134	D	1	5	1	5	L	L
140	J	4	5	5	4	L	H
141	J	4	4	4	4	M	H
144	J	4	5	5	4	L	H
146	J	4	4	4	5	L	H
147	J	4	4	4	5	L	H
148	J	4	4	5	4	L	H
149	J	4	4	4	0	H	H
150	D	4	5	5	5	L	M
151	D	4	5	5	5	L	M
152	J	4	4	5	4	L	H
153	J	4	4	4	5	L	H
154	J	4	4	5	4	L	H
155	D	4	5	5	5	L	M
156	D	4	5	5	5	L	M
157	J	4	4	5	4	L	H
159	J	4	4	5	4	L	H
160	D	4	5	5	5	L	M
161	D	4	5	5	5	L	M
166	D	4	5	5	5	L	M
170	T	4	5	1	5	L	L
171	T	4	5	1	5	L	L
172	D	4	5	2	5	L	M
173	D	4	5	2	5	L	M
175	M	4	5	5	5	L	M
176	M	4	5	5	5	L	M
177	J	4	5	5	4	L	H
178	J	4	5	5	4	L	H
179	J	4	5	5	4	L	H
180	J	4	5	5	4	L	H

Kemerton Fire, Weeds and Disease Phase 1 - Page 3

LOC.No	TYPE	Strata Recovery	Insect attack	Weeds and Grass	Dieback	Risk evaluation as Source	Risk evaluation as Target
182	J	2	4	1	4	H	H
183	J	4	4	5	4	L	H
188	J	4	4	5	4	L	H
189	D	4	5	5	5	L	M
191	D	4	5	5	5	L	M
197	T	2	5	2	5	L	L
201	D	4	5	2	5	L	M
207	J	4	5	5	4	L	H
208	J	4	5	5	4	L	H
209	J	4	5	5	4	L	H
210	J	4	5	5	4	L	H
225	J	4	5	5	4	L	H
226	J	4	5	5	4	L	H
228	J	4	5	5	4	L	H
230	D	4	5	5	5	L	M
237	D	2	5	1	5	L	L
241	D	4	5	2	5	L	M
244	J	4	5	5	5	L	H
247	J	4	5	5	5	L	H
248	J	4	5	5	4	L	H
249	J	4	5	5	4	L	H
250	J	4	5	5	4	L	H
251	J	4	5	5	4	L	H
253	J	4	5	5	4	L	H
254	J	4	5	5	4	L	H
255	J	4	5	5	4	L	H
264	D	4	5	5	5	L	M
267	J	4	5	4	5	L	H
268	J	4	5	4	5	L	H
276	J	4	5	5	4	L	H
278	J	4	5	5	4	L	M
281	J	4	5	5	4	L	M
284	J	4	5	5	4	L	M
294	J	4	4	4	4	M	H
295	J	4	4	4	4	M	H
296	J	4	4	4	4	M	H
298	T	4	5	1	5	L	L
300	M	4	4	4	3	M	M
301	M	4	4	4	3	M	M
302	D	4	3	4	5	L	M
303	D	4	5	5	5	L	M
304	M	4	4	4	3	M	M
305	M	4	4	4	3	M	M
307	M	4	4	4	3	M	M
308	M	4	4	4	3	M	M
309	M	4	4	4	3	M	M

LOC.No	TYPE	Strata Recovery	Insect attack	Weeds and Grass	Dieback	Risk evaluation as Source	Risk evaluation as Target
310	M	4	4	4	3	M	M
314	J	4	4	4	2	M	H
320	J	4	4	4	4	M	H
323	J	4	4	4	4	M	H
324	D	1	5	1	5	L	L
327	J	4	4	4	4	M	H
332	J	4	4	5	4	H	H
333	J	4	4	5	4	H	H
334	J	4	4	5	4	H	H
335	J	4	4	5	4	H	H
336	M	4	4	4	4	M	M
339	J	4	5	5	5	L	H
340	J	4	5	5	5	L	H
341	J	4	5	5	5	L	H
342	D	4	4	5	5	L	M
344	J	4	5	5	5	L	H
345	J	4	4	5	5	L	H
346	D	4	5	1	5	L	L
347	D	4	3	4	5	L	M
348	J	4	4	5	5	L	H
351	J	4	4	5	5	L	H
355	J	4	4	2	2	H	H
356	J	4	4	2	2	H	H
357	DEC	4	5	3	5	L	L
358	J	4	4	5	4	H	H
359	J	4	4	5	4	H	H
360	J	4	4	5	4	H	H
361	D	4	5	5	5	L	M
362	D	4	5	5	5	L	M
363	J	4	1	4	0	H	H
365	D	2	5	1	5	L	L
367	J	4	1	4	0	H	H
368	J	4	1	4	0	H	H
369	J	4	1	4	0	H	H
370	J	4	1	4	0	H	H
371	D	4	5	5	5	L	M
376	RIV	4	4	4	5	L	L

APPENDIX I

CONNECTIVITY AND DISTURBANCE

APPENDIX I

KEMERTON BIOLOGICAL SURVEY PHASE 1

CONNECTIVITY AND DISTURBANCE

For vegetation codes refer Appendix L

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
1		Pines									
2	D	C	1	N	N/A	N	N/A	30	N/A	None	VF
3	J	Mosiac complex of Eucamarg with Melaprei dampland with very dense Kunzeric thickets									
4		Drain margin									
5		Pines									
6	D	C	1	Complex	Complex	N	N/A	40	HLLA	None	A
7		Mature pines									
8		Young pines									
9	J	Parkland cleared Agonflex, very weedy									
10	J	C	1	N	N/A	N	N/A	60	HLLA	LGLA	VA
11		Mature pines									
12	J	G=I	1	Complex	N/A	N	N/A	100	HLLA	None	A
13	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
14	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
15	D	Parkland cleared to totally cleared dampland and paluspIain with patches of Eucamarg									
16	J	Complex of sparse Eucamarg with scattered Eucacalo. Open areas with bare patches amongst Kunzeric thickets									
17	D	Parkland cleared to totally cleared dampland and palusplain with patches of Eucamarg									
18	D	Damaged but not cleared dampland and palusplain with patches of Eucamarg									
19	D	Disturbed and grazed wetland mosaic									
20	D	Parkland cleared to totally cleared dampland and palusplain with patches of Eucamarg									
21	J	Parkland cleared Eucamarg woodland									

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
22	J	Complex of sparse Eucamarg with scattered Eucacalo. Open areas with bare patches amongst Kunzeric thickets									
23		Under intensive agriculture/horticulture									
24		Under intensive agriculture/horticulture									
25	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
26	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
27	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
28	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
29	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
30	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
31	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
32	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
33		Cleared farmland with a few scattered Melaprei									
34		Cleared farmland with a few scattered Melaprei									
35	J	G=I	1	Complex	N/A	N	N/A	100	HLLA	None	A
36		Cleared farmland with a few scattered Melaprei and Eucarudi									
37	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
38	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
39		Cleared farmland with a few scattered Melaprei									
40	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
41	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
42		Pines									
43	D	G>I	1	Complex	N/A	N	N/A	15	Beanpoles	None	C
44	J	Complex of sparse Eucamarg with scattered Eucacalo. Open areas with bare patches amongst Kunzeric thickets									
45	D	Melaprei flats with patches of Eucamarg									
46	D	Parkland cleared and degraded dampland mosaic									
47	D	Cleared wetland with some regrowth									
48	D	Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points									
49	J	Parkland cleared and degraded Eucamarg woodland									
50		Under intensive agriculture/horticulture									
51		Under intensive agriculture/horticulture									

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
52	J	Dense parkland cleared and grazed Agonflex woodland									
53	J	Dense parkland cleared and grazed Agonflex woodland with Melaprei in low areas									
54	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
55	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
56	D	Cleared and partially regrowing wetland									
57	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
58	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
59	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
60	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
61		Cleared farmland with scattered Eucamarg and Agonflex trees									
62		Cleared farmland with scattered Eucamarg and Agonflex trees									
63	J	Complex Eucamarg, Agonflex, Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas									
64	J	Complex Eucamarg, Agonflex, Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas									
65	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
66		Pines									
67	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
68	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
69	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
70		Young pines									
71	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
72	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
73		Under intensive agriculture/horticulture									
74		Under intensive agriculture/horticulture									
75		Under intensive agriculture/horticulture									
76		Under intensive agriculture/horticulture - parts are seasonally flooded									
77	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
78	J	Parkland cleared Agonflex									
79	J	Parkland cleared Agonflex									
80	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
81	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C

Kemerton Connectivity Phase 1 - Page 4

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
82	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
83	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
84	D	C	1	Complex	Complex	N	N/A	N/A		N	VF
85	J	Low lying Bankilic regrowth - previously cleared and with piles of logs									
86	D	Kunzeric stand with Eucarudi on the edge and an internal complex of Banklitt, Melatere, Melaprei, Melainca and Melapoly									
87	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
88		Silica sand mine slurry pond									
89	D	Not examined - appears to be Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points									
90		Silica sand processing plant									
91	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
92	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
93	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
94	J	Parkland cleared Agonflex with a few Eucamarg and scattered Eucarudi									
95	J	Parkland cleared Agonflex									
96	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
97	D	C	2	Y	10 m	N	N/A	30	N/A	Probably	C
98	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
99		Silica sand mine dredge pond									
100	D	C	2	Y	10 m	N	N/A	30	N/A	Probably	C
101	D	C	3	Y	15 m	N	N/A	100	N/A	Probably	S
102	J	Parkland cleared Agoflex and Eucamarg									
103		Not examined - reported by B Keighery as Eucadeci on Muchea Limestone - examine in Phase 2									
104		Under intensive agriculture/horticulture									
105	J	Grazed Eucamarg woodland with a reduced understorey									
106		Under intensive agriculture/horticulture - wetland may be seasonally flooded									
107		Pines									
108	J	Parkland cleared Agonflex and scattered Eucamarg									
109	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
110	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
111	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
112	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
113	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
114	D	Complex Perielli, Astafasc Calolate dampland - scattered Melaprei									
115	D	Kunzeric shrubland with associated complex Perielli Astafasc Calolate dampland - scattered Melaprei									
116	D	Complex Perielli Astafasc Calolate dampland - scattered Melaprei									
117	J	Eucamarg woodland with Bankilic									
118	J	Eucamarg Bankatte remnant									
119	J	Low Jarrah Bankatte woodland remnant									
120	J	Eucamarg woodland with Vertnite									
121	J	Parkland cleared Eucamarg woodland with regrowth and remnants - much Bankilic									
122	J	Low Eucamarg Bankatte woodland									
123		Not examined - parkland cleared Agonflex and Eucamarg									
124		Not examined - possible site for Eucadeci on Muchea Limestone - examine in Phase 2									
125	J	Grazed Eucamarg woodland with reduced understorey									
126	J	Eucamarg Agonflex regrowth									
127	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
128	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
129	J	Parkland cleared Agonflex									
130	J	Parkland cleared Eucamarg Eucacalo regrowth									
131	T	Intensely parkland cleared Eucagomp Agonflex woodland									
132	D	Parkland cleared Eucarudi and Melaprei									
133	D	Cleared wetland									
134	D	Cleared	Cleared	N	N/A	N	N	N/A	HCR	HGR	None
135	D	Open water with scattered Eucarudi and Melaprei									
136	J	Parkland cleared Agonflex									
137	M	Grazed Eucacalo Agonflex woodland									
138		Sand pit									
139	T	Parkland cleared Eucagomp Eucacalo Agonflex									
140	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
141	J	C	0	N	N/A	N	N/A	80	HLLA	Minor recent	VA

Kemerton Connectivity Phase 1 - Page 6

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
142	J	Intensively cleared with scattered Agonflex									
143	DEC	Parkland cleared Eucadeci and Agonflex over Tamala limestone									
144	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
145	D	Edge of an Astafasc and Melaprei wetland complex									
146	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
147	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
148	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
149	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
150	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
151	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
152	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
153	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
154	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
155	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
156	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
157	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
158		Requires field check - data error?? - recorded as parkland cleared Eucamarg woodland with regrowth & remnants									
159	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
160	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
161	D	C	1	Complex	Complex	N	N/A	N/A	N/A	None	VF
162		Not examined - parkland cleared Agonflex									
163	D	Complex of heavily grazed low lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei									
164	D	Complex of low lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei									
165		Not examined - could contain Muchea limestone - to be examined in Phase 2									
166	D	C	1	Complex	Complex	N	N/A	N/A	N/A	None	VF
167	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
168	D	Eucarudi over weeds on drain which leads into Myalla Lagoon									
169	T	Sparse parkland cleared Agonflex with Eucagomp									
170	T	G>I	1	N	N/A	N	N/A	300	HLLA	Recent	VF
171	T	G>I	1	N	N/A	N	N/A	300	HLLA	Recent	VF

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
172	D	G<I	2	Complex	30 m	N	N/A	10	N/A	Moderate	S
173	D	G<I	2	Complex	30 m	N	N/A	10	N/A	Moderate	S
174	D	Open water with sedges on west side - reported as cleared in the 1960s									
175	M	C	1	N	N/A	N	N/A	80	HLLA	None	VA
176	M	C	1	N	N/A	N	N/A	80	HLLA	None	VA
177	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
178	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
179	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
180	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
181	DEC	Grazed sparse Eucadeci and dense Agonflex over Tamala limestone									
182	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
183	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
184	J	Eucamarg woodland with Bankilic									
185	J	Eucamarg woodland with Bankilic									
186	J	Parkland cleared Eucamarg with abundant Xantbrun regrowth									
187	D	Melaprei over Perielli with minor Banklitt									
188	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
189	D	C	1	Complex	Complex	N	N/A	N/A	N/A	N/A	VF
190	J	Eucamarg woodland complex merging into Bankilic and Kunzeric dampland									
191	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
192	J	Complex of low lying Eucamarg Bankilic woodland									
193		Tasmanian Blue Gum plantation to 7 m									
194		Tasmanian Blue Gum									
195		Tasmanian Blue Gum									
196	T	Sparse parkland cleared Agonflex with Eucagomp									
197	T	G>I	0	N	N/A	N	N/A	120	HLLA	HR	None
198	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
199	M	Heavily grazed Eucacalo with scattered Eucamarg									
200	M	Heavily grazed Eucacalo with scattered Eucamarg									
201	D	G>I	2	N	N/A	N	N/A	N/A	N/A	None	VF

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
202	D	Grazed Melaprei and Eucarudi, dead Perielli on north side and Eucagomp over Bankilic on south side									
203	J	Grazed Eucamarg, Agonflex, Bankilic									
204	T	Cleared with scattered Eucagomp and Agonflex									
205	T	Heavily grazed Eucagomp and Agonflex									
206	J	Eucamarg and Agonflex on edge of wetland with Eucagomp and Eucadeci, south side with grazed Agonflex over Pterescu									
207	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
208	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
209	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
210	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
211	J	Parkland cleared Agonflex on rural lots, many with houses									
212	J	Parkland cleared Agonflex									
213	J	Parkland cleared Agonflex with Xantbrun regrowth									
214	D	Parkland cleared Melaprei									
215	J	Parkland cleared Eucamarg									
216	J	Cleared Eucamarg woodland with some regrowth									
217		Tasmanian Blue Gum plantation to 7 m tall									
218		Totally cleared farmland									
219	J	Part cleared Eucamarg Bankatte - heavy Dieback									
220		Mature pines									
221	J	Cleared with some regrowth - previously Eucamarg woodland with some damp areas									
222	J	Cleared with some regrowth - previously Eucamarg woodland with some damp areas									
223	D	Small cleared swamp in paddock with Melaprei and a few Astafasc and a Lemnmino cover - polluted by cattle									
224	J	Eucamarg woodland with patches of Melaprei - heavy Dieback									
225	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
226	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
227	J	Eucamarg woodland remnant									
228	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
229	D	Complex mosaic of Melaprei and Mela??hamu thickets with Melapoly and Perielli									
230	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
231	J	Complex of Eucamarg woodland with Bankilic, Kunzeric and Xantbrun and heavy Dieback									

Kemerton Connectivity Phase 1 - Page 9

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
232	D	Complex of Melaprei Calolate, Hakevari post-fire regrowth									
233	J	Eucamarg and Bankatte with heavy Dieback									
234		Not examined - to be surveyed in Phase 2									
235		Not examined - to be surveyed in Phase 2									
236	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
237	D	G>I	1	N	N/A	N	N/A	N/A	HLLA	HGR	VF
238	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
239	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
240	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
241	D	G>I	2	N	N/A	N	N/A	N/A	N/A	None	VF
242	J	Cleared with scattered Eucamarg, Nuytflor, Agonflex, scattered Eucarudi on west side									
243	D	Damp patch of Eucarudi, Melaraph, Melaprei in Agonflex woodland with Xantprei, Banklitto and Eucacalo									
244	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
245	D	Wetland of Melaprei, Melaraph Agonflex on margins - in reasonable condition									
246		Cleared farmland with scattered trees and remnants									
247	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
248	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
249	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
250	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
251	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
252	J	Cleared Eucamarg woodland with some regrowth									
253	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
254	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
255	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
256	D	Scattered Melaprei wetland									
257		Pines									
258	D	Melaprei and Bankilic remnant									
259		Pines									
260		Pines									
261		Pines									

LOC. No.	TYPE	Internal Spatial Distribution	Nearby Veg.Types	Site is ecotonal	Width Ecotone	Site is Corridor	Condn of Corridor	Horiz.View Distance	Logging History	Grazing History	Abund. Sapling
262		Pines									
263		Pines									
264	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
265		Pines									
266		Pines									
267	J	G>I	1	Y	60-120	N	N/A	120	HLLA	Possibly	VF
268	J	G>I	1	Y	60-120	N	N/A	120	HLLA	Possibly	VF
269	D	Kunzeric, Melaprei and Perielli dampland									
270	D	Parkland cleared and heavily grazed Melaprei wetland									
271	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
272	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
273	T	Parkland cleared Eucagomp over Agonflex over grass and weeds									
274	T	Parkland cleared Agonflex over grass and weeds									
275	D	Parkland cleared wetland with Melaprei and Agonflex over grass and weeds									
276	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
277	D	Edge of a Melaprei dampland with Agonflex and Bankilic									
278	D	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
279	D	Parkland cleared Eucamarg and Agonflex									
280	D	Parkland cleared Eucamarg and Agonflex									
281	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
282	D	Parkland cleared Eucamarg woodland with regrowth									
283	D	Parkland cleared Eucamarg woodland with regrowth									
284	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
285	D	Cleared Eucamarg woodland with regrowth									
286		Data may be in error - check in Phase 2 - recorded as farmland with clumps of Juncpall and Kunzeric regrowth									
287		Pines									
288		Pines									
289		Pines									
290		Pines									
291		Pines									

APPENDIX G

VEGETATION OF KEY SITES

APPENDIX G

KEMERTON BIOLOGICAL SURVEY PHASE 1

VEGETATION OF KEY SITES

For plant species codes refer Appendix L

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
1	P		Pine plantation								
2	D	1	Melaprei	12	5	2	80	5			
		2	Kunzeric	5	2	80	60	5	48	5	
3	J		Mosiac complex of Eucamarg woodland with Melaprei dampland & with very dense Kunzeric thickets. Refer dampland complexes								
4	D		Drain margin with remnant Eucamarg trees								
5	P		Pines								
6	D	1	Kunxeric	6	2	80	30	4			Very complex mosaic of Melaprei
		2	Dasybrom	0.2	0	5	70	2	28	3	dampland with Eucamarg & Bankatte. Refer discussion of interface between woodland and dampland catenary complexes. Woodland component has been very heavily logged and is severely infected with Dieback Disease

Kemerton Vegetation Phase 1- Page 2

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
7	P	1	Pinus radiata	18	10	80	90	5			Pine plantation. This structure & density
		2	Weeds and grasses	0.3	0	90	20	1	90	3	is typical of the mature plantations
8	P		Young pines								
9	J		Parkland cleared Agonflex, very weedy, surrounding remnant of Melaprei and Kunzeric thickets								
10	J	1	Eucamarg, Eucacalo	18	9	10	20	3			Minor degradation and some
		2	Bankatte, Agonflex	9	4	70	50	4			weed invasion. Part is parkland
		3	Kunzeric	4	1	10	60	5			cleared with Agoneric remaining and
		4	Weeds, sedges, Conoacul	0.2	0	5	30	5	45	4	scattered Melaprei in low spots
11	P		Mature pines								
12	J	1	Eucamarg	20	8	5	70	5			Some thickets with no Eucamarg
		2	Bankatte, Bankilic	10	3	50	30	5			but St2 to 80% CC St3 Xantprei to
		3	Melathym, Xantprei	1	0	5	40	5			3% CC St4 Dasybrom 90%CC
		4	Dasybrom	0.5	0	80	90	5	93	5	
13	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	50	5			
		3	Mixed shrubs	1	0	5	30	5			
		4	Dasybrom	0.3	0	60	80	5	86	5	

Kemerton Vegetation Phase 1- Page 3

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
14	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	50	5			
		3	Mixed shrubs	1	0	5	30	5			
		4	Dasybrom	0.3	0	60	80	5	86	5	
15	D		Parkland cleared to totally cleared dampland & palusplain with patches of Eucamarg								
16	J		Complex of sparse Eucamarg with scattered Eucacalo. Open areas with bare patches amongst Kunzeric thickets								
17	D		Parkland cleared to totally cleared dampland and palusplain with patches of Eucamarg								
18	D		Damaged but not cleared dampland and palusplain with patches of Eucamarg								
19	D		Heavily disturbed and grazed wetland mosaic								
20	D		Parkland cleared palusplain with patches of Eucamarg								
21	J		Parkland cleared Eucamarg woodland								
22	J		Sparse Eucamarg & Eucacalo and open areas amongst Kunzeric thickets								
23	C		Under intensive agriculture/horticulture								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
24	C		Under intensive agriculture/horticulture								
25	J	1	Eucamarg	20	5	5	20	4			Appears to have been burned
		2	Bankatte	9	5	50	50	5			fairly regularly. Bankilic appears
		3	Mixed shrubs	0.75	0	70	60	5			anomalous - site might get
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	seepage from higher ground
26	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
27	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
28	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
29	J	1	Eucamarg	18	9	10	30	5			Scattered Macoreid
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
30	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
31	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
32	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
33	C		Cleared farmland with scattered Melaprei								
34			Cleared farmland with scattered Melaprei								
35	J	1	Eucamarg	20	8	5	70	5			Some thickets with no Eucamarg
		2	Bankatte, Bankilic	10	3	50	30	5			but St2 to 80% CC St3 Xantprei to
		3	Melathym, Xantprei	1	0	5	40	5			3% CC St4 Dasybrom 90%CC
		4	Dasybrom	0.5	0	80	90	5	93	5	
36	C		Cleared, few scattered Melaprei & Eucarudi								
37	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
38	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	60	5			
		3	Mixed shrubs	1	0	5	40	5			
		4	Dasybrom	0.3	0	60	70	5	86	5	
39	C		Cleared farmland with a few scattered Melaprei								
40	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	
41	D		Very complex dampland with indistinct stratification and no clear zonation. Consists of Melaprei scattered to up to 20% CC over sedges with varying amounts of Astafasc and Calolate with some Perielli over Hypoangu on slightly higher ground. Refer dampland complexes								
42	P		Pines								
43	D	1	Melaprei	8	2	2	60	5			Kunzeric variable from 20-50%CC
		2	Kunzeric	6	1	50	70	5			
		3	Perielli	0.5	0	5	20	5	58	5	
44	J		Complex of sparse grazed Eucamarg with scattered Eucacalo interspersed with open areas with bare patches amongst Kunzeric thickets								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
45	D		Cleared Melaprei flats with patches of Eucamarg								
46	D		Parkland cleared and degraded dampland mosaic								
47	D		Cleared wetland with some minor regrowth								
48	D	1	Melaprei	8	4	2	60	5			Scattered Kunzeric and Xantbrun on high points
		2	Perielli	1.5	0	60	20	5			
		3	Hypoangu	0.5	0	40	20	5	20	5	
49	J		Parkland cleared and degraded Eucamarg woodland								
50	C		Under intensive agriculture/horticulture								
51	C		Under intensive agriculture/horticulture								
52	J		Dense parkland cleared and grazed Agonflex woodland	18	3	80	30	5	24	5	
53	J		Dense parkland cleared and grazed Agonflex woodland with Melaprei in low areas								
54	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
55	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
56	D		Cleared and partially regrowing wetland								
57	J	1	Eucacalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings
		2	Bankatte, Agonflex	12	8	50	40	5			between Strata 2 and 3
		3	Hibbhype	0.3	0	20	60	5	34	5	
58	J	1	Eucacalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings
		2	Bankatte, Agonflex	12	8	50	40	5			between Strata 2 and 3
		3	Hibbhype	0.3	0	20	60	5	34	5	
59	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
60	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
61	C		Cleared farmland with scattered Eucamarg & Agonflex trees								
62	C		Cleared farmland with scattered Eucamarg & Agonflex trees								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
63	J		Complex Eucamarg Agonflex Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas. Refer to woodland catenary complexes								
64	J		Complex Eucamarg Agonflex Bankatte woodland mosaic with Bankgran, Bankilic & Kunzeric in lower areas. Heavily logged and grazed. Refer to woodland catenary complexes								
65	D		Very complex dampland with indistinct stratification and no clear zonation. Consists of Melaprei scattered to up to 20% CC over sedges with varying amounts of Astafasc and Calolate with some Perielli over Hypoangu on slightly higher ground. Refer dampland complexes								
66	P		Pines								
67	D		Very complex dampland comprising three associations in mosaic. Associations designated A, B and C						Mean about 11	5	Regrowth in disturbed area under power line is mainly Astafasc, Aotugrac, Perielli and Calolate
		A1	Melaraph	6	2	90	20	5			
		A2	Sedges	1	0	20	5	5	19	5	
		B1	Astafasc	3.5	2.5	90	5	5			
		B2	Sedges	1	0	30	5	5			
		B3	Villarsia albiflora	0.1	0	5	30	5	8	5	
		C1	Calolate	1.5	0	10	10	5			
		C2	Astfasc	2	0.5	60	10	5			
		C3	Sedges	1	0	5	5	5	7	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
68	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Location 67								
69	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Location 67								
70	P		Young pines								
71	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Location 67								
72	D	1	Perielli	1	0	90	20	5			May have been cleared at some time.
		2	Hypoangu	0.5	0	70	30	5			Many heaps of earth and logs.
		3	Sedges	0.2	0	30	1	5	39	5	Scattered Melaprei
73	C		Under intensive agriculture/horticulture								
74	C		Under intensive agriculture/horticulture								
75	C		Under intensive agriculture/horticulture								
76	C		Under intensive agriculture/horticulture - parts are seasonally flooded								

Kemerton Vegetation Phase 1- Page 11

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
77	J	1	Eucacalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings
		2	Bankatte, Agonflex	12	8	50	40	5			between Strata 2 and 3
		3	Hibbhype	0.3	0	20	60	5	34	5	
78	J		Parkland cleared Agonflex								
79	J		Parkland cleared Agonflex								
80	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
81	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
82	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
83	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
84	D	1	Beauarti	2	0	100	95	5	95	5	Scattered Astafasc (small area with Astafasc to 2 m tall and 95% CC) and some small low-lying depressions with Melaraph

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
85	J		low-lying Bankilic regrowth - previously cleared and with piles of logs								
86	D	1	Melaprei, Banklitt	7	3	10	60	5			Kunzeric stand with Eucarudi on the
		2	Melatere, Melainca, Melapoly	1.5	0	5	40	5	8	5	edge and an internal mosiac. Refer woodland dampland interfaces and catenary complexes
87	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
88	C		Silica sand mine slurry pond								
89	D		Not examined - appears to be Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points								
90	C		Silica sand processing plant								
91	D	1	Perielli	1	0	60	20	5			Clumps of earth and logs suggest
		2	Hypoangu	0.5	0	60	30	5			previously cleared. Scattered Melaprei
		3	Sedges	0.2	0	30	1	5	30	5	and Xantprei
92	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest
		2	Hypoangu	0.5	0	70	30	5			previously cleared
		3	Sedges	0.2	0	30	1	5	39	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
93	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest
		2	Hypoangu	0.5	0	70	30	5			previously cleared
		3	Sedges	0.2	0	30	1	5	39	5	
94	J		Parkland cleared Agonflex with a few Eucamarg and scattered Eucarudi								
95	J		Parkland cleared Agonflex with a few Eucamarg and scattered Eucarudi								
96	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest
		2	Hypoangu	0.5	0	70	30	5			previously cleared
		3	Sedges	0.2	0	30	1	5	39	5	
97	D	1	Melaraph	10	1.5	60	60	5			
		2	Melaraph	2	0.5	50	50	5	61	5	
98	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest
		2	Hypoangu	0.5	0	70	30	5			previously cleared
		3	Sedges	0.2	0	30	1	5	39	5	
99	C		Silica sand mine dredge pond								
100	D	1	Melaraph	10	1.5	60	60	5			
		2	Melaraph	2	0.5	50	50	5	61	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
101	D	1	Eucarudi	16	5	80	20	1			Ecotone to Locations 97 and 100
		2	Melaraph	5	2	10	40	4			Casspube common in in parts
		3	Astafasc	1.5	0	20	10	5			Patchy understorey of Pterescu
		4	Sedges	0.3	0	70	40	5	50	3.8	
102	J		Parkland cleared Agonflex and Eucamarg								
103			Not examined - reported by B Keighery as Eucadeci on Muchea Limestone - examine in Phase 2								
104	C		Under intensive agriculture/horticulture								
105	J		Grazed Jarrah woodland with a reduced understorey								
106	C		Under intensive agriculture/horticulture - wetland may be seasonally flooded								
107	P		Pines								
108	J		Parkland cleared Agonflex and scattered Eucamarg								
109	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying.
		2	Bankatte	10	3	30	50	5			Scattered Xanthprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
110	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying.
		2	Bankatte	10	3	30	50	5			Scattered Xanthprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
111	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying
		2	Bankatte	10	3	30	50	5			Scattered Xanthprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
112	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
113	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
114	D		Complex Kunzeeric over Hypoangu dampland with scattered Nuytflor. Refer dampland complex								
115	D		Kunzeric shrubland with associated complex of Perielli, Astafasc, Calolate dampland with scattered Melaprei. Refer Dampland Complex								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
116	D		Complex of Perielli, Astafasc, Calolate dampland with scattered Melaprei. Refer Dampland Complex								
117	J	1	Eucamarg	26	8	5	20	3			Scattered Perslong.
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			No Agonflex
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
118	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
119	J	1	Eucamarg	14	8	5	20	3			
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
120	J	1	Eucamarg	26	8	5	20	3			Scattered Perslong.
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			No Agonflex
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
121	J		Parkland cleared Eucamarg woodland with regrowth and remnants - much Bankilic								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
122	J	1	Eucamarg	18	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
123	C		Not examined - parkland cleared Agonflex and Eucamarg								
124			Not examined - possible site for Eucadeci on Muchea Limestone - examine in Phase 2								
125	J		Grazed Eucamarg woodland with reduced understorey								
126	J		Eucamarg Agonflex post-clearing regrowth								
127	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								
128	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								
129	J		Parkland cleared Agonflex								
130	J		Parkland cleared Eucamarg Eucacalo regrowth								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
131	T		Intensely parkland cleared Eucagomp Agonflex woodland								
132	D		Parkland cleared Eucarudi and Melaprei woodland								
133	D		Cleared wetland								
134	D		Melaprei	7	2	10	80	5			Typhorie on margin
			Juncpall	0.5	0	10	60	5	14	5	
135	D		Open water (28 November 1998) almost completely cleared but with scattered Eucarudi and Melaprei								
136	J		Parkland cleared Agonis								
137	M		Heavily grazed Eucamarg Eucacalo Agonflex woodland								
138	C		Sand pit								
139	T		Parkland cleared Eucagomp Eucacalo Agonflex woodland								

LQCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
140	J	1	Eucamarg Eucacalo	20	8	2	20	2			
		2	Bankatte	10	3	30	50	5			
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
141	J	1	Bankatte Eucamarg Agonflex	18	4	80	40	5			Emergent Eucamarg to 26 m less
		2	Agonflex	1.5	1	5	20	5			than 2% CC. Agonflex more tree-form
		3	Hibbhype Xantbrun	0.5	0	40	80	5	65	5	rather than usual coppice form
142	J		Intensively cleared with scattered Agonflex								
143	DEC		Parkland cleared Eucadeci and Agonflex over Tamala limestone								
144	J	1	Eucamarg Eucacalo	20	8	2	20	2			
		2	Bankatte	10	3	30	50	5			
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
145	D		Edge of Astafasc and Melaprei dampland complex in Location 150								
146	J	1	Eucamarg	18	5	40	50	5			Parkland cleared about 30 years ago
		2	Melathym, Jackster	1.5	0.5	2	30	5			
		3	Hibbhype, Stirlati, Xantbrun	0.5	0	90	70	5	83	5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
147	J	1	Eucamarg	18	5	40	50	5			Parkland cleared about 30 years ago
		2	Melathym, Jackster	1.5	0.5	2	30	5			
		3	Hibbhype, Stirlati, Xantbrun	0.5	0	90	70	5	83	5	
148	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg Bankgran Bankilic Bankatte	14	4	20	50	5			
		3	Jackster Melathym	1	0	80	20	5			
		4	Xantbrun Hibbhype	0.3	0	30	70	5	45	4.5	
149	J	1	Eucamarg	20	15	2	30	3			
		2	Bankilic, Bankatte	10	3	30	50	5			
		3	Calyfras	1	0.5	60	5	4			
		4	Dasybrom	0.3	0	2	80	4	20	4	
150	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
151	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
152	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
153	J	1	Eucamarg	22	8	5	20	3			
		2	Bankilic, Bankatte	14	4	30	50	5			
		3	Melathym	1	0	60	20	5			
		4	Hibbhype	0.3	0	40	60	5	52	5	
154	J	1	Eucamarg	22	8	5	20	3			
		2	Bankilic, Bankatte	14	4	30	50	5			
		3	Melathym	1	0	60	20	5			
		4	Hibbhype	0.3	0	40	60	5	52	5	
155	D	1	Astafasc	1.5	0	95	10	3			
		2	Sedges	1	0	10	5	2	10	2.5	
156	D	1	Perielli Astafasc	1.5	0	95	20	5			Scattered Melaprei
		2	Spiral leaf sedge	0.5	0	20	2	5	23	5	
157	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg,Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
158	C		Requires field check - data may be in error - recorded as parkland cleared Eucamarg woodland with regrowth and remnants - much Bankilic								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
159	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg,Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
160	D	1	Perielli Astafasc	1.5	0	10	20	5			Scattered Melaprei
		2	Calolate Hypoangu	0.5	0	20	40	5	10	5	
161	D	1	Astafasc	1.5	0	95	10	5			
		2	Mixed shrubs and sedges	0.5	0	10	30	5	13	5	
162	C		Not examined - parkland cleared Agonflex								
163	D		Complex of heavily grazed low-lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei								
164	D		Complex of heavily grazed low-lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei								
165			Not examined - could contain Muchea limestone - to be examined in Phase 2								
166	D	1	Perielli	1	0	80	30	5			Nuytflor on margin and scattered
		2	Sedge and scattered Hibbstel	0.3	0	< 2	10	5	24	5	Melaprei in patches on east side

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
167	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								
168	D		Eucarudi over weeds on drain which leads into Myalla Lagoon								
169	T		Sparse parkland cleared Agonflex with Eucagomp								
170	T	1	Eucagomp	26	12	3	80	5			No evidence of Eucadeci
		2	Agonflex, Bankatte	10	2.5	50	60	5			
		3	Hibbhype	0.5	0	5	60	5			
		4	Annual grasses	0.2	0	90	20	5	53	5	
171	T	1	Eucagomp	26	12	3	80	5			No evidence of Eucadeci
		2	Agonflex, Bankatte	10	2.5	50	60	5			Some minor Eucamarg, Bankgran
		3	Hibbhype	0.5	0	5	60	5			Xantprei
		4	Annual grasses	0.2	0	90	20	5	53	5	
172	D	1	Melatere	3	1	80	20	5			Cleared in 1960s. Acacsalig
		2	Sedges	0.5	0	60	80	5			is invading from margin plus a few
		3	Villalbi and weeds	0.1	0	50	60	5	94	5	young Eucarudi
173	D	1	Melatere	3	1	80	20	5			Cleared in 1960s. Acacsalig
		2	Sedges	0.5	0	60	80	5			is invading from margin plus a few
		3	Villalbi and weeds	0.1	0	50	60	5	94	5	young Eucarudi

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
174	D		Open water with Beauartic, Juncpall and Typhorie and rushes sedges on west side - reported as cleared in the 1960s								
175	M	1	Eucacalo	22	8	10	60	5			Scattered Eucamarg
		2	Bankilic, Eucacalo	14	6	60	70	5			
		3	Hibbhype	0.5	0	60	80	5	96	5	
176	M	1	Eucacalo	22	8	10	60	5			Scattered Eucamarg
		2	Bankilic, Eucacalo	14	6	60	70	5			
		3	Hibbhype	0.5	0	60	80	5	96	5	
177	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
178	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
179	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
180	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
181	DEC		Grazed sparse Eucadeci and dense Agonflex over Tamala limestone								
182	J	1	Eucamarg	26	8	3	20	3			Partly cleared and probably heavily grazed
		2	Bankilic, Bankatte, Xyloocci	12	4	10	50	5			
		3	Ephemeral weeds and grasses	0.3	0	60	20	2	18	3.3	
183	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
184	J		Semi-cleared and grazed Eucamarg woodland with Bankilic								
185	J		Semi-cleared and grazed Eucamarg woodland with Bankilic								
186	J		Parkland cleared Eucamarg with abundant Xantbrun regrowth								
187	D		Scattered Melaprei over Perieli with minor Banklitto								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
188	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
189	D	1	Melaprei	8	4	10	60	5			Refer dampland complex
		2	Perielli	1.5	0	10	20	5	8	5	descriptions
190	J		Eucamarg woodland complex merging on sightly lower ground into Bankilic and Kunzeric dampland. Refer discussions of woodland and dampand catenary complexes								
191	D	1	Perielli	1.5	0	30	30	5			Scattered Melaprei
		2	Sedge and scattered Hibbstel	0.3	0	2	10	5	9	5	
192	J		Complex of low-lying Eucamarg Bankilic woodland. Refer discussion of woodland catenary complexes								
193	P		Tasmanian Blue Gum								
194	P		Tasmanian Blue Gum								
195	P		Tasmanian Blue Gum								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
196	T		Sparse parkland cleared Agonflex with Eucagomp								
197	T	1	Eucagomp	24	10	3	80	5			Parkland cleared
		2	Agonflex	8	2	50	20	5			
		3	Grass, weeds and Lupins	0.3	0	70	5	1	16	3.7	
198	T		Sparse parkland cleared Agonflex with Eucagomp over grass and weeds								
199	M		Heavily grazed Eucacalo with scattered Eucamarg								
200	M		Heavily grazed Eucacalo with scattered Eucamarg								
201	D	1	Banklitt	6	1	5	40	5			Eucarudi on margins all very healthy.
		2	Melatere	1.5	0	90	40	2			Melatere dying
		3	Sedges (flat spiral) and grasses	0.3	0	10	5	2	39	3	
202	D		Heavily grazed Melaprei and Eucarudi over dead Perielli on north side of road and Eucagomp over Bankilic on south side								
203	J		Grazed Eucamarg, Agonflex and Bankilic								
204	T		Cleared with scattered Eucagomp and Agonflex								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
205	T		Heavily grazed Eucagomp and Agonflex								
206	J		Eucamarg and Agonflex on edge of wetland with Eucagomp and Eucadeci. South margin with grazed Agonflex over Pterescu								
207	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
208	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
209	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
210	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
211	J		Parkland cleared Agonflex on rural lots, many with houses								
212	J		Parkland cleared Agonflex								
213	J		Parkland cleared Agonflex with Xantbrun regrowth								
214	D		Parkland cleared Melaprei								
215	J		Parkland cleared Eucamarg								
216	J		Cleared Eucamarg woodland with some regrowth								
217	P		Tasmanian Blue Gum to 7 m tall								
218	C		Totally cleared farmland								
219	J		Part cleared Eucamarg and Bankatte - heavy infection of Dieback Disease								
220	P		Mature pines								
221	J		Cleared with some regrowth - previously Eucamarg woodland with some damp areas								
222	J		Cleared with some regrowth - previously Eucamarg woodland with some damp areas								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
223	D		Small cleared swamp in paddock with Melaprei and a few Astafasc and a Lemnmino cover - polluted by cattle								
224	J		Eucamarg woodland with patches of Melaprei - heavy infection of Dieback Disease								
225	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
226	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
227	J		Eucamarg woodland remnant								
228	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
229	D		Complex mosaic of Melaprei and Mela ??hamu thickets with Melapoly and Perielli. Refer wetland catenary complexes								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
230	D	1	Hakevari	2	0.5	5	10	5			Complex with Hakevari dominating in
		2	Astafasc, Calolate, sedges	1.5	0	95	60	5			centre, Lepoglau and Melalate in places
		3	Villaalbi	0.1	0	2	20	5	56	5	& Melaraph over wettest areas. Refer wetland catenary complexes
231	J		Complex of Eucamarg woodland with Bankilic, Kunzeric and Xantbrun and heavy infection of Dieback Disease. Refer woodland catenary complexes								
232	D		Complex of Melaprei, Calolate, Hakevari post-fire regrowth to 0.5 m tall								Some Melaprei to 8 m survived fire
233	J		Eucamarg and Bankatte with heavy infection of Dieback Disease								
234			Not examined - to be surveyed in Phase 2								
235			Not examined - to be surveyed in Phase 2								
236	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
237	D	1	Melaraph	8	1.5	95	60	5			Some Juncpall
		2	Grass and weeds	0.3	0	90	5	1	59	3	
238	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
239	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
240	T		Parkland cleared Eucagomp over Agonflex over grass and weeds								
241	D	1	Banklitt	6	1	5	40	5			
		2	Melatere	1.5	0	90	60	4			
		3	Sedges (flat spiral) and grasses	0.3	0	10	5	2	57	3.7	
242	J		Cleared with scattered Eucamarg, Nuytfloi, Agonfex, scattered Eucarudi on west side								
243	D		Damp patch of Eucarudi, Melaraph, Melaprei in Agonflex woodland with Xantprei, Banklitt and Eucacalo								
244	J	1	Eucamarg	24	8	3	20	5			Many dead staghead old Eucamarg
		2	Bankilic, Bankatte, Bankgran	11	3	30	60	5			probably killed by fire
		3	Xylo, Eucamarg	3	1	10	70	5			Some very large and old Eucacalo
		4	Melathym	1	0.5	10	10	5			and Bankilic
		5	Hibbhype	0.5	0	80	80	5	91	5	Long-unburned
245	D		Part cleared and cattle-damaged wetland of Meaprei, Melaraph with Agonflex on margins - in reasonable condition compared to other cattle-damaged wetlands in region								Some Astafasc, Melatere and Juncpall in places
246	C		Cleared farmland with scattered trees and remnants								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
247	J	1	Eucamarg	24	8	3	20	5			Many dead staghead old Eucamarg
		2	Bankilic, Bankatte, Bankgran	11	3	30	60	5			probably killed by fire. Some very large &
		3	Xylo, Eucamarg	3	1	10	70	5			old Eucacalo & Bankilic. Site backs onto
		4	Melathym	1	0.5	10	10	5			edge of Mialla Lagoon wetland complex
		5	Hibbhype	0.5	0	80	80	5	91	5	with Melaprei & Eucarudi. Long unburned
248	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
249	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
250	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
251	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
252	J		Cleared Eucamarg woodland with some regrowth								

LOCN No.	TYPE	Stratum	Dominants	Top ht	Bot ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
253	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
254	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
255	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
256	D		Cleared wetland with scattered Melaprei								
257	P		Pines								
258	D		Melaprei and Bankilic remnant								
259	P		Pines								
260	P		Pines								
261	P		Pines								

ENTERED ON GIS

Name: Kemerton Silica Sands Mining Proposal
Date: 28/04/2006
Capture Author: Thomas Leong / Ian Steward

Comments:
Polygon
Created to match documented study area with high level of accuracy

Accuracy Levels:

- High = Document contained visual and or described spatial references easily copied, resulting in little or no polygon boundary errors
- Acceptable = Document contained visual references with complex boundaries, resulting in minor boundary errors
- Low = Document contained little or no visual references, resulting in polygon boundary errors

Attributes
Report Info – Captured without problems
Custodial/Contact – Captured without problems
Content – Captured without problems

Kemerton silica sand mining proposal

Gwalia Consolidated Ltd

Report and recommendations of the Environmental Protection Authority

Full document available on request

Environmental Protection Authority
Perth, Western Australia
Bulletin 741
July 1994

(2)

REPORT

VERTEBRATE FAUNA ASSESSMENT OF THE KEMERTON SILICA SANDS PROJECT

Prepared for: John Consulting Services

By: Ninox Wildlife Consulting

January 1993

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REPORT SUMMARY

The report consists of an overview of the vertebrate fauna of the proposed Kemerton Silica Sands project. Two days in late December 1992, were spent assessing the fauna habitats of the initial mining area, infrastructure sites and service corridor. Effort was concentrated in sensitive habitats, particularly wetlands. Two experienced field workers assessed the site by means of a series of vehicle and foot transects throughout the major vegetation associations and soil types. A series of representative wetlands were individually assessed by means of foot-transects through fringing vegetation and along exposed shorelines. An actual and predicted species list was constructed for the area. Actual records were gathered during the field assessment and predicted records, i.e. species likely to be present but not recorded during the survey, were drawn from a variety of sources. Five major fauna habitats have been defined and described in the report.

Thirty-six species of bird, one native mammal, four introduced mammals, three frogs and two reptiles were recorded during the assessment. Given intensive field sampling over several seasons, a further 106 species of bird (including 55 potential wetland species), 23 native mammals, two introduced mammals, seven frogs and 33 reptiles are expected to occur. Based on the site assessment and data from reference sources, ten rare species are predicted. Five of these, if present, will be resident and the remainder will occur as migrants and nomads. Distribution patterns are mapped and details of each are given in text. Most of the rare species which could occur are relatively widespread in their distribution and are protected in reserved land elsewhere in the south-west of Western Australia. Migratory species covered by international treaties are discussed, as are fauna requiring special consideration due to their specialised needs. Wetland habitats are assessed in detail and their local significance is individually defined.

The regional and local conservation status of the proposed mining area is described and it is concluded that the area has no exceptional regional qualities or unusually distinctive suites of fauna. Two permanent wetlands, however, are considered to be locally significant within the confines of the project area rather than the wider locality. It is also recognised that the project area represents a relatively undisturbed isolate surrounded by farming land and, as such, provides refuge for a large range of vertebrates currently under pressure on the Swan Coastal Plain. While some strictly local impact on the fauna is inevitable through development of the proposed mine, this can be minimised if well-planned environmental management strategies are in place. A series of recommendations and preliminary guidelines are outlined in the report.

1.0 INTRODUCTION

This report is part of a feasibility study by Gwalia Consolidated Ltd and describes a vertebrate fauna assessment of the proposed Kemerton Silica Sand project area situated on Lot 32 Wellington Location 1, approximately 2 kilometres NNE of the Kemerton Industrial Park. The mineralised area includes a number of woodlands, swamps, sumplands and damplands whose current conservation status is assessed.

Initial mining operations will involve the use of conventional earthmoving equipment on elevated, consolidated dune areas. Subsequently, a dredge would be used to extract ore to a depth of up to 15 metres. Clay fines constituting 3-5% of the ore will be pumped from the processing plant to a settling pond and decant water returned to the dredging site and/or the processing plant. Dried clay from the settling pond will be incorporated into the sandy soils of the property as part of post-mining rehabilitation.

An overview of the project area focussing on the initial mining area and service corridor is given and the report provides actual and potential species lists, discusses the implications of rare species and defines locations of high conservation status. Preliminary fauna management and impact reduction strategies have also been provided.

1.1 Assessment Objectives

The objectives of this assessment were to:

- produce an inventory of the vertebrate fauna recorded during the field survey, recent published and unpublished species records and, provisional records of seasonal migrants or cryptic species likely to occur but not recorded during the study;
- review vertebrate fauna species considered to be rare or endangered, geographically restricted or occurring as an outlier population;
- provide a review of species not necessarily declared rare, but in need of special consideration;
- assess the status of introduced predators such as feral cats and foxes;
- assess the relationships between vertebrate fauna and the vegetation communities present in order to clearly identify any habitats of significance;
- review the zoogeographic region as a whole and assess the regional and local conservation status of the area; integrate all the above and assess the potential impact of the development on fauna;
- realistically assess methods whereby the effects of mining on fauna may be minimised, particularly in wetlands;
- prepare a detailed report summarising the findings, cross referenced to the flora and vegetation report.

2.0 METHODS

Two days, 21-22 December 1992, were spent assessing the fauna habitats of the initial mining area, infrastructure sites and service corridor. Effort was concentrated in sensitive habitats, particularly wetlands. Two Ninox principals assessed the site by means of a series of vehicle and foot transects throughout the major vegetation and soil types of the area. Wetlands representative of the area were individually assessed by means of foot-transects through fringing vegetation and along exposed shorelines.

Adequate numbers of terrestrial vertebrates such as small mammals and many reptiles are mainly recorded during intensive trapping surveys conducted over several seasons, therefore few were observed. Birds, however, are highly visible and, given reasonable weather conditions, it is likely that a two day, intensive site assessment will establish the presence of the majority of resident species. Based on this, all birds seen and heard were recorded in conjunction with accessory details such as the habitat utilised.

Mammals, reptiles and amphibians are more difficult to detect in the short-term, but were recorded opportunistically through signs of their presence such as scats, tracks and diggings. Intensive hand-foraging was used to maximise returns for effort. In the case of the rare Southern Brown Bandicoot, special attention was paid to assessing their potential presence and establishing some indication of population levels.

An appraisal of vertebrate micro-habitat quality and critical resources was also conducted. This latter aspect included an assessment of the number of tree-hollows, the frequency of logs on the ground, leaf litter depth and distribution, the capacity of the soil to support burrows and the density of flowering shrubs. This appraisal was conducted in order to facilitate the production of a list of species not recorded during the site assessment but which may be seasonally present or have cryptic behaviour. This has assisted in providing recommendations on the conservation status of specific locations and placing the area in a regional and local perspective.

An actual and provisional species list (Appendix 1) was constructed for the area. Actual records were gathered during the field assessment and provisional records i.e. species likely to be present but not recorded during the survey, were drawn from a variety of sources including: Bamford and Watkins (1983); Ninox Wildlife Consulting (1982, 1985, 1987); Sedgwick (1973, 1977). All of these documents assess and describe fauna habitats similar, or almost identical, to those within the project area. A computer search of Western Australian Museum records (mammals, amphibians and reptiles) from the Southern Swan Coastal Plain was also undertaken to assist in this construction of a list of species expected to occur .

2.1 Distribution, Nomenclature and Taxonomy

Geographic distribution patterns and taxonomy follow: Blakers *et al.* (1984) for birds; Strahan (1983) for mammals; Storr *et al.* (1981, 1983, 1986, 1990), Wilson and

Knowles 1988 for reptiles and Tyler *et al.* (1984) for amphibians. More recent taxonomic revisions have been used where applicable.

3.0 HABITAT DEFINITION

The series of plant communities described in Mattiske and Associates (1993) are on a finer scale than the opportunistic habitat usage shown by most terrestrial vertebrates, the exception being species exclusively associated with wetlands. Friend and Taylor (1985), in an analogous example in the Northern Territory, considered that:

> *"......the habitat types perceived by various species of small mammals usually overlapped several of the habitat types delineated on the basis of vegetation structure or floristics. It may be that the small mammal scale of perception is different from the human's scale as expressed on a vegetation map."*

For this reason, sub-sets of vegetation types have been amalgamated in this report to more accurately represent meaningful distinctions in fauna communities. Five composite fauna habitats have therefore been defined and described. In brief these are:

Habitat 1 - Woodland of Jarrah *Eucalyptus marginata*, Marri *E. calophylla*, over mixed Banksia species: Holly-leaved Banksia *Banksia ilicifolia*, Coastal Banksia *B. attenuata* and Firewood Banksia *B. menziesii* over mixed, dense Proteaceous and Myrtaceous shrubs on aeolian sands.

Habitat 2 - Woodland of Peppermint *Agonis flexuosa* over *Xanthorrhoea preissii*, *Hibbertia* species and *Leucopogon* species on aeolian/fluvial sands.

Habitat 3 - Permanent wetlands surrounded by low-closed forest of *Melaleuca preissiana*, *M. rhaphiophylla*, *Eucalyptus rudis* and a closed, tall heath of mixed shrubs.

Habitat 4 - Shallow ephemeral sumplands surrounded by the Paperbarks *Melaleuca preissiana*, *M. rhaphiophylla* and Flooded Gum *Eucalyptus rudis*.

Habitat 5 - Damplands supporting a low, closed heath dominated by of *Pericalymma ellipticum*, *Adenanthos obovata* and *Calothamnus lateralis*.

Full descriptions of plant community codings adopted for the Kemerton Silica Sand project area are given in Mattiske and Associates (1993).

4.0 RESULTS

4.1 Birds

One hundred and forty-two species of bird (92 Non-passerines and 50 Passerines) are expected to occur in the project area (Appendix 1). Of these, 36 species were recorded during the site assessment. No rare birds were located, but six may be present either as breeding residents, nomads or migrants. Details on rare birds are given in Section 5.0. Several Trans-equatorial migratory shorebirds potentially occurring in the project area and covered by the Japan/Australia or China/Australia treaties for the protection of migratory birds and their environment are listed and marked in Appendix 1.

4.2 Native Mammals

Twenty-four native and six introduced mammal species could occur in the habitats of the project area (Appendix 1). Many of these species are small and are rarely recorded without extensive seasonal trapping programmes. However, larger species such as kangaroos were either sighted or confirmed by the presence of scats or tracks. No rare mammals were recorded during the site assessment but details on three expected to occur are given in Section 5.0.

Nine of the native mammals listed in Appendix 1 are bats, animals with no specific habitat requirements with the exception of roosting sites in hollow tree limbs. These aerial species forage for food over all vegetation types, particularly over wetlands where large numbers of flying insects concentrate.

4.3 Introduced Mammals

Of the six introduced mammals recorded or expected, two are highly efficient predators: the fox *Vulpes vulpes* and the feral cat *Felis catus*. Tracks of both were noted in mud surrounding some wetlands. Much of the country surrounding the project area is farmland which makes control of introduced predators difficult, if not impossible, without the full cooperation of all local landholders and the Department of Conservation and Land Management. Interim recommendations are given in Section 8.1 on methods of discouraging recruitment of introduced mammals into the project area from adjacent land. Their presence can severely retard the return of native fauna to rehabilitation areas.

The rabbit *Oryctolagus cuniculus*, was recorded by the presence of scrapes and droppings, although no individuals were seen. This animal is an introduced herbivore which can severely damage rehabilitation areas. In keeping with foxes and cats, little can be done to control these animals, given the surrounding land use. None of these introduced animals is judged to be common in the project area, based on the evidence recorded.

4.4 Amphibians and Reptiles

Three species of frog and two reptiles were recorded during the site assessment. A further five amphibians and 33 reptiles are expected to be present within the project area and could only be detected after a detailed sampling exercise. One rare reptile, the Carpet Snake *Morelia spilota imbricata*, is expected to occur in the area and details on this animal are given in Section 5.0

5.0 RARE OR PROTECTED SPECIES

In Western Australia, rare or endangered species are covered by Schedules 1 and 2 of the Wildlife Conservation Act (1950 - amended November 1990).

Schedule 1 species are described as "fauna that is likely to become extinct, or is rare." Among other criteria, these can either represent animals which have not been seen in Western Australia for many years (Night Parrot *Geopsittacus occidentalis*), others which are known to be rare because specific searches have shown this to be so (Shark Bay Mouse *Pseudomys praeconis*), species whose distribution has contracted markedly since European settlement (Chuditch *Dasyurus geoffroii*), animals with a very limited distribution (Lancelin Island Skink *Ctenotus lancelini*) and fauna about which relatively little is known but are presumed to be under threat (Pebble-mound Mouse *Pseudomys chapmani*).

Schedule 2 species are described as "in need of special protection" and mainly include uncommon birds with a cosmopolitan distribution (Peregrine Falcon *Falco peregrinus*), species whose breeding areas are threatened (Carnaby's Black-Cockatoo *Calyptorhynchus funereus latirostris*) or previously exploited reptiles such as the Saltwater Crocodile *Crocodylus porosus*.

Prior to any discussion of rare or threatened species, two aspects require clarification:

- the concept of individual species rarity is a dynamic process strongly influenced by the level of survey work carried out in a particular location and an increased understanding of distribution patterns over time. For example, the November 1990 amendments to the Wildlife Conservation Act eliminated a relatively large number of previously listed fauna including two which occur in the project area. Other species were added to the list or re-assigned from Schedule 1 to Schedule 2 on the advice of the Threatened Species Committee which advises the Minister for the Environment. Listing of species, in many cases, tends to act as a temporary safeguard until a more complete understanding of population size, distribution and biology is obtained;
- not all rare species are residents or equally susceptible to disturbance. Many are passage migrants, nomads, cryptic species or naturally uncommon predators at the higher trophic level of the food chain such as birds of prey typified by the Peregrine Falcon. Resident rare species known to occur in a given site generally have a much wider distribution than their localised

records of occurrence suggest (Figures 1 and 2). Typical among these are the Southern Brown Bandicoot *Isoodon obesulus* and Carpet Python *Morelia spilota imbricata*, both of which potentially occur in the Kemerton Silica Sand project area.

Based on the site assessment and data from other sources, ten rare species may occur in the project area. Distribution patterns are shown in Figures 1 and 2, and details of each are given in text. It is stressed that the presence of these rare animals does not, in itself, automatically confer special status on the area. It is more a matter of being aware of them and taking appropriate steps to ensure that impact is minimised and structuring rehabilitation to advantage these species if possible (see Section 8.0). Most of the rare species expected to be present are relatively widespread in their distribution and also occur in reserved land elsewhere in the south-west of Western Australia.

5.1 Birds

Although no rare birds were recorded during this assessment, six species listed under the Wildlife Conservation Act (1950, amendment November 1990) could occur in the area. These are listed below with maps showing their current known distribution, comments on their status and habitat requirements.

Australasian Bittern *Botaurus poiciloptilus*

Status: Schedule 1 - likely to become extinct, or is rare. Nomadic.

Habitat: Dense, tall reedbeds (*Typha, Baumea*) and sedges surrounding freshwater swamps and lakes.

Comments: This bird was the best known of all the bitterns of the South-West swamps (Serventy and Whittell 1976) and was locally common on the Swan Coastal Plain until early this century (Storr 1991). The loss of wetlands and the change of vegetation structure surrounding swamps by stock trampling has affected the status of this bird. The secretive and nocturnal behaviour of the Australian Bittern makes its presence difficult to establish.

Freckled Duck *Stictonetta naevosa*

Status: Schedule 1 - likely to become extinct, or is rare. Nomadic.

Habitat: Heavily vegetated areas of fresh water, freshly flooded creeks.

Comments: This duck is basically sedentary but has the ability to move extensively to exploit newly formed habitat and to escape prolonged drought (Frith 1982). Breeding by this species is known from Benger Swamp, approximately 6 kilometres south-east of the study area. A few individuals may breed in the relatively small, permanent wetlands of the project area and some individuals could be affected if these are disturbed. However, sensitive re-vegetation of artificial wetlands could encourage more breeding in the area (see Section 8.2).

Peregrine Falcon Falco peregrinus

Status: Schedule 2 - in need of special protection. Passage migrant.

Habitat: All vegetation types.

Comments: A highly mobile bird with little apparent habitat specificity. While cosmopolitan in its distribution, Australia is a stronghold for this species (Blakers *et al.* 1984). Pesticide residue in food, which prevents successful breeding, is thought to be the main cause of decline throughout most of its worldwide range (Hoser 1991). The Peregrine Falcon is a seasonal passage migrant and could be expected to occur throughout the area, particularly wetlands where ducks would be the preferred food resource.

Long-Billed (Baudin's) Black-Cockatoo *Calyptorhynchus baudini*
Short-Billed (Carnaby's) Black Cockatoo *C. funereus latirostris*

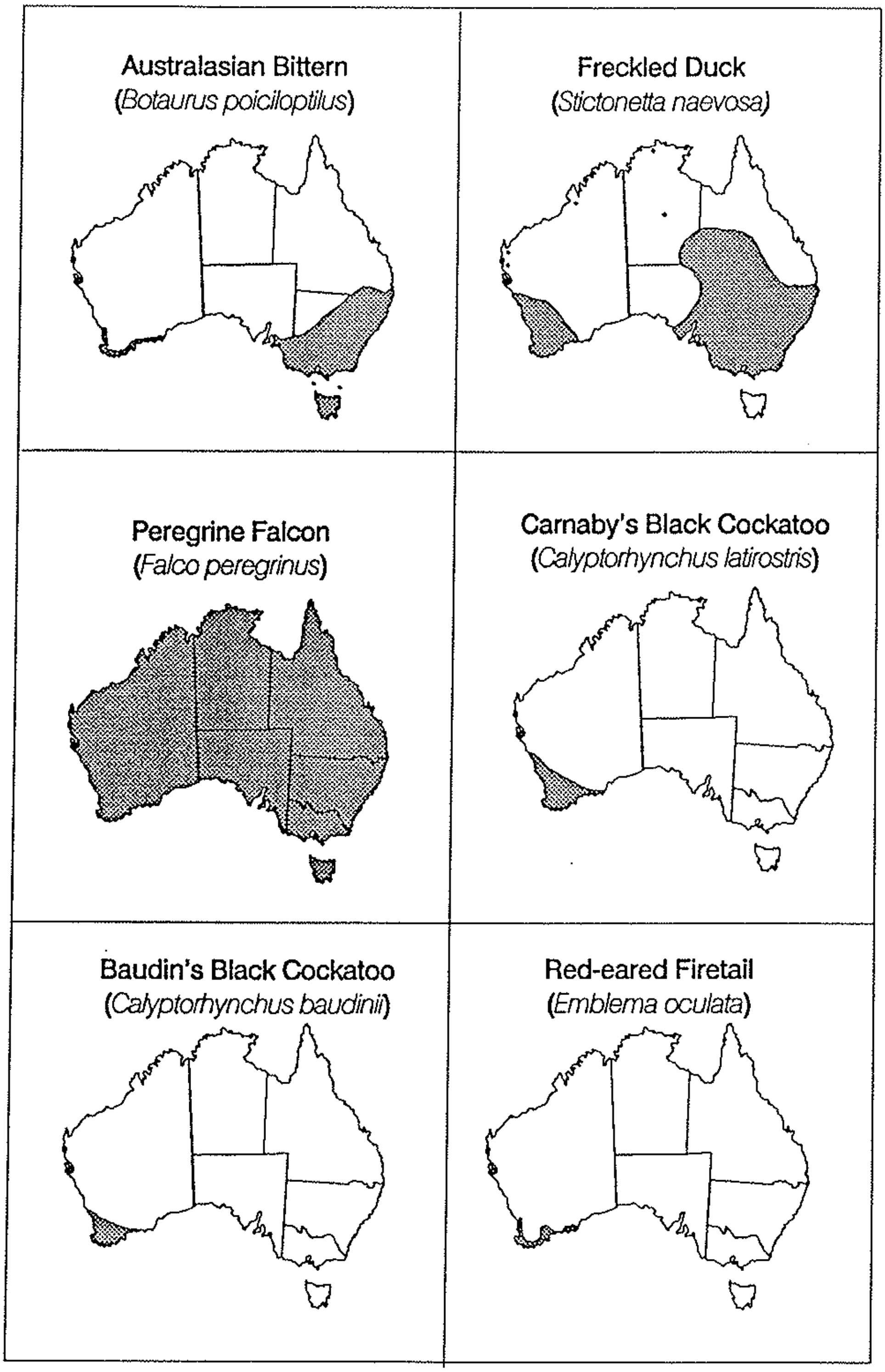
Status: Schedule 2 - in need of special protection. Nomadic.

Habitat: Woodlands, shrublands, heaths and pine plantations.

Comments: It has only recently been recognised that the common and widespread White-tailed Black-Cockatoo was divisible into two separate species and that one, Baudin's Cockatoo had declined in abundance. While Carnaby's Black-Cockatoo is more secure, the centre of distribution has shifted west and south due to clearing of Wheatbelt woodlands, the main breeding area of this species. The extreme difficulty in differentiating between the two in the field has led to both being listed on Schedule 2 and in this report.

The main food resource of the Baudin's Black Cockatoo is the seed of the Marri *Eucalyptus calophylla*, a widespread, common tree species as yet not exploited for timber or woodchips to the same degree as other Eucalypt species. Populations of the Long-billed Black-Cockatoo are thought to be relatively stable at present (Saunders *et al.* 1985). While difficult to distinguish, both species may be seasonally present in the study area. No breeding is likely to occur and any impact is considered to be negligible.

Figure 1 ***Diagrams showing the distribution of rare or protected birds expected to occur in the Kemerton Silica Sands project area.***



Red-eared Firetail *Emblema oculata*

Status: Schedule 2 - in need of special protection. Resident.

Habitat: Well vegetated stream zones and swamps with native sedges .

Comments: Populations of this species can be affected by clearing of feeding and breeding areas in or near stream zones or swamps, and while 20-30% of the Firetail's habitat in the Darling Range has been lost through water supply dams, associated habitat fragmentation has not put the species under additional pressure (Bamford 1989). Mining within the project area may result in a further, albeit minor, loss of habitat if it takes place within swamps or indirectly impacts these areas. This will ultimately reduce the total area of feeding and breeding sites for this species and will be cumulative upon the pre-existing loss of habitat within the birds' distribution. This, however, is unlikely to significantly impact the species as a whole. In addition, the project area is situated in less than prime habitat for this finch, mainly attracting sub-adult birds dispersing from adult territories (M. Bamford, pers. comm.).

5.2 Mammals

Although no rare mammals were recorded during this site assessment, three species could occur.

Chuditch *Dasyurus geoffroii*

Status: Schedule 1 - likely to become extinct, or is rare. Resident.

Habitat: All vegetation types, but more common in forests and woodlands.

Comments: Male Chuditch require 4-6 square kilometres and females 3-4 for their home range. Male territories appear to overlap with several females. Work by Conservation and Land Management is continuing into the requirements of this species which is generally uncommon on the Swan Coastal Plain. The adjacent Darling Range is more typical habitat.

Western Ringtail Possum *Pseudocheirus peregrinus occidentalis*

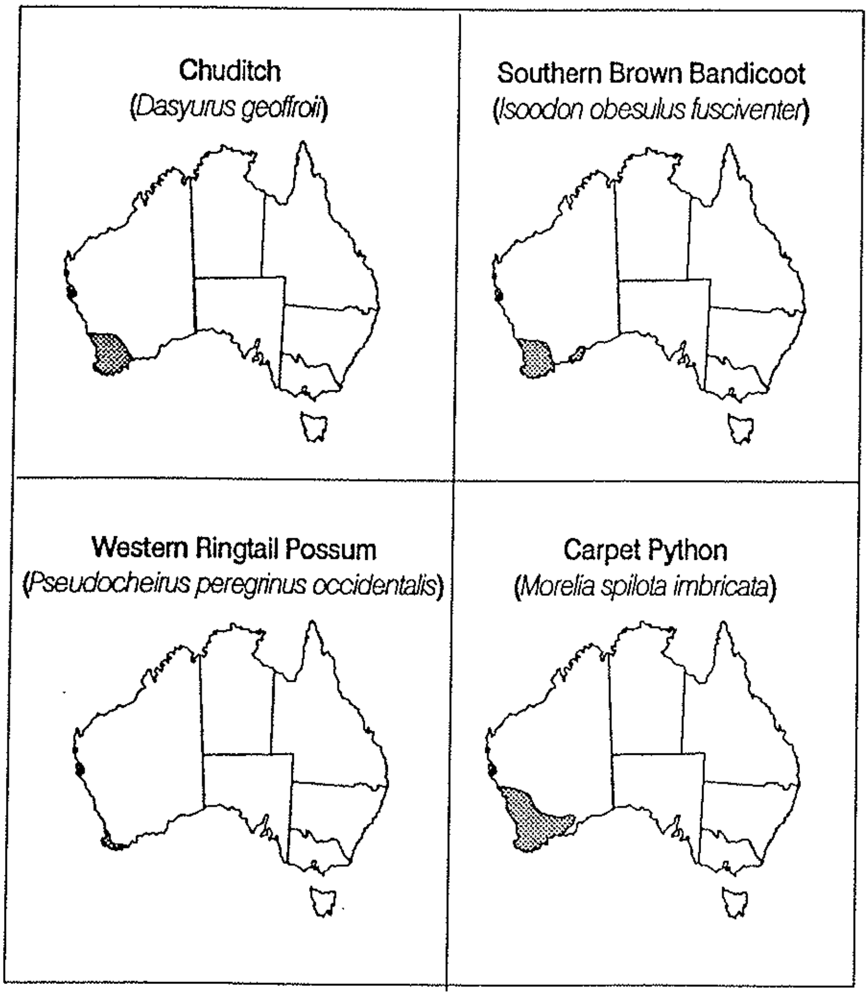
Status: Schedule 1 - likely to become extinct, or is rare. Resident.

Habitat: Peppermint *Agonis flexuosa* and Tuart *Eucalyptus gomphocephala* forests.

Comments: The abundance of this possum has declined drastically since European occupation. It was once common in Peppermint forest, particularly adjacent to rivers and around swamps (How *et al.* 1987). Small, isolated colonies of this animal may occur throughout its south-west distribution (Christensen *et al.* 1985). The Kemerton

Silica Sand project area is north of Capel, the generally accepted limits of this possum's coastal plain range. However, several abandoned nests were found at Melros, some 90 kilometres north of the project area (Ninox Wildlife Consulting 1987) and there is the possibility that this species may also occur in the study area. The presence of Ringtail Possums is often confirmed by sightings of its large stick/leaf dreys (nests) in Peppermint trees and a search of the Peppermint forest occurring on the study area was therefore made. No dreys were detected but this does not necessarily indicate that this rare possum is absent (see Section 8.3).

Figure 2 ***Diagrams showing the distribution of rare or protected mammals and reptiles expected to occur within the habitats of the Kemerton Silica Sand project area.***



5.3 Amphibians and Reptiles

No rare frogs are currently known to occur on the Swan Coastal Plain and no rare species of reptile were recorded in the study area. However one species, the Carpet Python *Morelia spilota imbricata* is a possibility based on known distribution patterns.

<u>Carpet Python *Morelia spilota imbricata*</u>

Status: Schedule 2 - in need of special protection. Resident.

Habitat: Most vegetation types with a preference for rocky ridges and heaths.

Comments: While uncommon throughout its range, intensive survey work in the Darling Range has shown this species to be relatively abundant in some areas.

5.4 Fauna Requiring Special Attention

5.4.1 Birds

Two international treaties, the Japan/Australia Agreement (JAMBA) and China/Australia Agreement (CAMBA) protect trans-equatorial migratory birds and their habitats. These treaties mainly cover wading or shorebirds but also include such migratory woodland birds as the Rainbow Bee-eater.

Twelve species of shorebird covered by these international treaties are predicted to occur in the wetland habitats of the project area (Appendix 1). These migratory birds arrive in the South-West during spring and depart in autumn for the northern hemisphere where they breed. The estuaries and wetlands of the South-West are feeding areas for these birds. Estuarine habitats are rich feeding resource areas and the relatively small wetlands within the project area are not prime habitat for shorebirds, although several may be present on occasions. The proximity of the project area to Benger Swamp, Lake Clifton and Leschenault Inlet would minimise the value of these small wetlands as major feeding areas.

The Rainbow Bee-eater arrives in the South-West in spring to breed, and construct their nests in sandy soils. They depart in summer but not all birds migrate from Western Australia, many remain in the north of the State. The Kemerton Silica Sands project is unlikely to adversely affect this migratory bird and, in fact may increase breeding frequency by providing vertical sand faces for burrows. This effect has been observed in sand pits and road cuttings in many parts of the South-West.

5.4.2 Mammals

The Department of Conservation and Land Management (CALM) considers the Brush or Black-gloved Wallaby *Macropus irma* to be under threat and it is likely that it will be placed on the rare species schedule in the near future. While no animals were seen during the site assessment, this species is almost certainly present in areas of dense vegetation.

The Honey Possum *Tarsipes rostratus* has attracted much publicity in recent years and is considered under pressure from loss of feeding resources due to fungal diseases, the best known being *Phytophthora cinnamomi* (Friend 1992). The Honey Possum is a highly specialised feeder on nectar and pollen and is common in floristically rich heaths and shrublands of the South-West. Adequate dieback disease management techniques applied during the life of the project (see Flora and Vegetation report) and a rehabilitation program using the Proteaceae and Myrtaceae species known from the locality would protect the habitats of this mammal.

5.4.3 Amphibians and Reptiles

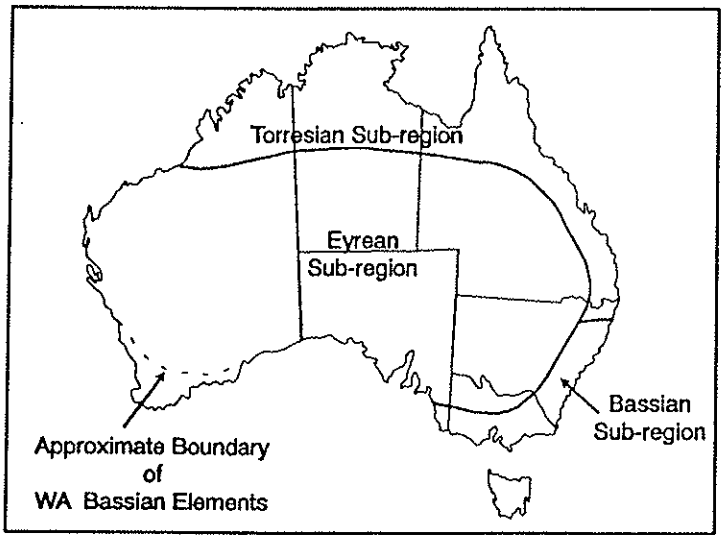
Apart from the previously mentioned Carpet Python, no amphibians or reptiles needing special attention are predicted or known from the project area.

6.0 THE EXISTING ENVIRONMENT

6.1 Regional Setting

In any assessment of the significance of an area to fauna it is important that zoogeographic considerations are reviewed. A pioneer in this field was Baldwin Spencer (1896) who recognised three major, distinct, zoogeographic sub-regions in Australia. His concept took into account broad faunal distribution patterns which aligned fairly well with the wetter south-eastern zone of Australia (Bassian Sub-region), the northern, hot, wet, coastal area (Torresian Sub-region), and inland, arid Australia (Eyrean Sub-region).

Figure 3 *Map showing the main areas of distribution for Australian vertebrate fauna. (Diagram after Serventy and Whittell 1976).*



Spencer's concept was carefully considered by Serventy and Whittell (1976) who examined bird distributions in Western Australia and concluded that there was a need to define a fourth, and much smaller sub-region: the south-western corner of Western Australia where an intermingling of two faunas, the Eyrean and Bassian, occurred (Figure 1). The Kemerton Silica Sands project area is situated within this small South-West sub-region. The South-West has several species identical to those found in southern Victoria but which no longer have a continuous distribution across the continent. More importantly, however, it supports several endemic species with no equivalent populations in Eastern Australia. Examples recognised by Serventy and Whittell as being of special significance are: Western Rosella *Platycercus icterotis*, Red-capped Parrot *Purpureicephalus spurius*, Baudin's Cockatoo *Calyptorhynchus baudinii*, White-breasted Robin *Eopsaltria georgiana*, Red-winged Fairy-wren *Malurus elegans*, Western Thornbill *Acanthiza inornata* and Western Spinebill *Acanthorhynchus superciliosus.* All of these endemics have been recorded or are likely to be present in the project area (Appendix 1).

Consideration has also been given to evaluating the importance of different regions for other faunal groups. Storr (1964) confirmed that the distinctness of the South-West for reptiles paralleled the situation previously indicated for birds and believed that geographical influences, especially the presence of a large belt of forest-covered laterite between the Wheatbelt and the Swan Coastal Plain, explained some of the speciation which had occurred in reptiles and frogs.

In examining the distribution patterns of south-western reptiles, Chapman and Dell (1985) concluded that a south-western sub-region encompassing the area south of a line from Shark Bay to Israelite Bay was not valid since many species with wide distributions in arid Australia extended well to the west and south of this line. They instead drew attention to a much smaller region within the South-West. This area has a number of mesio-temperate elements from south-eastern Australia as well as a significant number of endemic species. Examples of the latter are *Bassiana trilineata, Ctenotus labillardieri, C. delli, Diplodactylus polyophthalmus*, several snakes from the genera *Notechis* and *Rhinoplocephalus* and the frog genera *Crinia.* Many of these endemic reptiles are listed for the project area.

Several mammals are also endemic to the South-West. In many cases they do not fit into the South-Western sub-region outlined for reptiles but have a larger distribution defined by the line from Shark Bay to Israelite Bay. Examples of these are the Brush Wallaby *Macropus irma* and the Honey Possum *Tarsipes rostratus.* Others are restricted to the South-West sub-region either because of their specialised habitat requirements or because their geographic range has contracted since European settlement.

Heavier rainfall coupled with a higher clay content in the soil has resulted in denser understoreys in the southern portion of the Darling sub-region in the South-West Botanical Province (Beard 1977). This, and other influencing factors, has produced a fauna peculiarly adapted to an unique environment (Mulchahy 1980). The South-West of Western Australia, particularly the heavier forested portion, is therefore an area of great zoogeographical significance and a number of species have evolved in its mesio-temperate environment which provided refuge as the continent became increasingly arid. Its proximity to large centres of population, the presence of valuable mineral deposits and timber resources, however, has placed its very limited area under increasing development pressure.

The project area lies within the Swan Coastal Plain, an area extending from the Hill River Scarp in the north, to Cape Naturaliste in the south. The Swan Coastal Plain is bounded by the Indian Ocean to the west and the Darling Scarp to the east. Until

1977 no fauna surveys of any magnitude had been conducted in the Swan Coastal Plain and little was known of its conservation status or overall contribution to the fauna of the south-west of Western Australia. In 1977 the Western Australian Museum commenced a major vertebrate fauna survey of the northern portion of this area and published the results in the following year (Western Australian Museum 1978). While concentrating on the northern portion of the Swan Coastal Plain, the conclusions of the study are relevant to the project area which is situated in the southern portion.

In summarising the conclusions of contributing authors to the above report, How (1978) considered that major faunal changes had occurred since European settlement. Kitchener *et al.* (1978), for instance, considered that the native mammals originally numbered 33, of which only 12 were recorded during the intensive survey period, although Museum records (Kitchener and Vicker 1981) show that several other species still occur. Storr *et al* (1978a and b) believed that changes to the avifauna were less dramatic, although still significant, and that reptiles showed a marked decline in Perth and its suburbs. All these authors attribute this conspicuous faunal decline to environmental modification brought about by urban and agricultural development, increased fire frequency and intensity, introduction of exotic fauna species, disease and the modification of wetlands by drainage or landfill. Later studies of the vegetation of Western Australia showed that clearing in the Drummond botanical sub-district (Swan Coastal Plain and Dandaragan Plateau) had reached 78% (Beard and Sprenger 1984).

6.2 Local Setting

The project area has no exceptional habitat qualities or unusually distinctive suites of fauna. However, it represents a relatively undisturbed isolate surrounded by farming land and, as such, provides refuge for a large range of vertebrates. Within the southern portion of the Swan Coastal Plain, between Harvey and Dunsborough, 96% of wetlands have been lost through drainage and clearing, mainly for agriculture (Riggert 1966). Benger Swamp, a notable waterfowl refuge, feeding and breeding site close to the study area, was drained regularly each summer for potato, pumpkin and maize crops (Sedgwick 1973) but is now managed as waterfowl refuge. This historical pressure on wetlands of the Swan Coastal Plain has led to the current situation, where many wetlands are designated as high priority conservation areas (Environmental Protection Authority 1991). In this context, Individual wetlands of the project area are discussed in Section 6.3. 1.

The *Eucalyptus* and *Agonis* woodlands of the project area are typical habitats of the Southern Swan Coastal Plain although very few vertebrate fauna studies have been carried out in these habitats (Bamford and Watkins 1983, Ninox Wildlife Consulting 1985). These short term studies have resulted in incomplete species lists and include little information on population densities. However, based on the potential species richness, predicted rare fauna and representation of the habitats on a regional basis, locally significant habitats have been defined in the following Section.

6.3 Habitats of Significance

In identifying habitats significant to vertebrates, the following criteria were applied:

- habitat poorly represented regionally;
- habitat supports unusual or significant features;
- habitat has the capacity to support site-specific or rare fauna.

Based on these criteria, no vertebrate habitat in the project area is particularly significant regionally or encompasses unusual features. All are replicated elsewhere in this portion of the coastal plain. Some, however, have the potential to support habitat-specific or rare fauna, and a few operate as summer drought refuges for waterbirds. Wetlands of local significance within the confines of the project area are individually discussed. These wetlands are of minor significance in the wider region which is dominated by highly significant locations such as Benger Swamp and Leschenault Estuary.

6.3.1 Wetlands

The following wetland types occur in the project area: (1) small permanent lakes, (2) small seasonally inundated sumplands and, (3) large seasonally waterlogged damplands or palusplains. A range of representative wetlands occurring within the project area and nominated by the Environmental Protection Policy for Swan Coastal Plain Wetlands were assessed in the field; others were defined by aerial photograph interpretation. All assessed wetlands are described in Table 1 using the wetland vegetation classification system developed by Semeniuk (1987). EPA nominated wetlands are designated with the prefix EPP followed by a number.

Project Area Lakes: as a general rule, permanent lakes surrounded by vegetation are of high significance to fauna since they operate as year-round refuges for a wide range of animals. Three occur in the north-eastern periphery of the project area beyond the initial mining area. Two of these (Table 1) are judged to be locally significant to fauna.

Project Area Sumplands: these are ephemeral wetlands which normally dry out in summer. At the time of the survey (late December 1992) all of these wetlands in the project area had contracted to very shallow pools supporting little in the way of waterbird activity. These wetlands, however, fulfil an important function as refuge areas for waterbirds during the breeding season, and throughout the year support larger populations of vertebrates than the surrounding, drier country. They are also important to the rare Southern Brown Bandicoot *Isoodon obesulus* and almost certainly provide breeding refuges for the rare Freckled Duck *Stictonetta naevosa*. Relative to the permanent lakes of the project area, they are judged to be moderately significant to fauna in Table 1. Five occur close to the initial mining area.

Project Area Damplands: a large portion of the project area consists of seasonally waterlogged damplands supporting low, closed heaths and sedgelands with emergent trees. This mosaic of several structurally simple communities has a limited number of habitat niches, and previous intensive sampling programmes have shown very similar areas to be relatively poor in fauna (Ninox Wildlife Consulting 1992). Large areas of this habitat were traversed during the field assessment, with specific attention being paid to the proposed settling pond west of the initial mining area.

Table 1 ***List of wetland types, codes, vegetation classifications, local fauna conservation significance and grid references for the project area wetlands (* = in close proximity, or within the area of operations ; = ♦ assessed during survey). Wetland types based on Semeniuk (1987).***

Wetland Code		Vegetation Classification	Local Significance	Grid Reference	
		LAKES			
EPP-7	♦	meso zoniform low forest/shrubland	high	N12300	E12600
EPP-9	♦	micro zoniform low forest/shrubland	very high	N13050	E12000
12		micro (cleared, degraded by stock)	low	N13550	E12500
		SUMPLANDS			
EPP-1*	♦	micro heteroform low forest/tall scrub/sedgeland	moderate	N11300	E12300
EPP-2*	♦	micro heteroform low forest/tall scrub/sedgeland	moderate	N11600	E12350
EPP-3*		micro heteroform low forest/tall scrub/sedgeland	moderate	N12000	E12250
EPP-4*	♦	micro heteroform low forest/tall scrub/sedgeland	moderate	N12150	E10950
EPP-6*		micro heteroform low forest/tall scrub/sedgeland	moderate	N11500	E12600
EPP-8		micro heteroform low forest/tall scrub/sedgeland	moderate	N12700	E11950
10*	♦	micro heteroform low forest/tall scrub/sedgeland	moderate	N11700	E11650
		SUMPLAND / PALUSPLAIN			
EPP-5	♦	micro heteroform low forest/tall scrub/sedgeland	moderate	N10600	E12150
		DAMPLANDS			
11* (Settling Pond)	♦	meso maculiform open woodland/ closed heath/sedgeland	minor	N11800	E10250

6.3.2 Forests and Woodlands

Of the forest and woodland habitats present in the project area, the Peppermint *Agonis flexuosa* forest on the eastern boundary has the potential to be locally important because of the possibility that the rare Western Ringtail Possum may occur. This habitat is not well represented within the project area and has been disturbed by exploration grid lines. Further searches to establish the status of this possum within the project area are recommended in Section 8.2.

7.0 ASSESSMENT OF IMPACT

The impact of mining on fauna can be described as either primary or secondary. The primary impact of mining on fauna is the physical and permanent destruction of particular habitats through the development of the mine pit. Secondary impacts relate to activities with varying degrees of impact beyond the immediate point where mining is taking place.

7.1 Primary Impact - The Mining Area

Territorial Birds: this group of birds will absorb the main impact of the project because of the total area and range of habitats which will be cleared for mining. Most of the impact will be directed towards small, territorial residents typified by the various species of Fairy-wren which form cohesive family groups defending relatively large areas for feeding and breeding purposes. Although birds are highly mobile compared with other vertebrate groups, the forced movement of territorial species into the adjacent territories of other individuals will cause a "ripple-effect" of conflict well beyond the initial area of impact.

At this stage of disturbance to territorial boundaries, individuals are open to a greater level of predation, competition for food resources, shelter and breeding sites. This disturbance eventually reaches an equilibrium when the edges of cleared areas become new territorial boundaries. While this effect obviously occurs after fires, the mining area will represent a long-term feature.

Mammals: the larger mammals of the project area, such as kangaroos, are able to move away from the area of primary impact. This movement increases competition in adjacent areas. Competition eventually reaches a position of stability when territorial conflicts are resolved, although some deaths may take place in this process. Small territorial mammals, such as marsupial carnivores and small possums are not as mobile, with the result that the proportion of local populations occurring in the area of primary impact, that is the minesite itself, will be eliminated.

Amphibians and Reptiles: the comments made above for mammals equally apply to amphibians and reptiles. Larger reptiles such as monitor lizards (goannas) are capable of moving large distances away from disturbance but most small reptile and amphibian populations within the area of primary impact will be lost.

7.2 Secondary Impact - Support Facilities

Secondary impacts such as the construction of transport corridors, creation of borrow pits, laydown areas and other support facilities associated with mining are potentially more widespread in their effect and encompass many of the impacts described above. They require careful forward planning and the application of adequate environmental safeguards to minimise widespread disturbance to fauna or, more precisely, to the habitats which support them. Many of these safeguards are standard procedures in mining development projects such as this, and are implemented under the relevant statutory acts or in the maintenance of a safe working environment. Some examples are: dieback control, the minimisation of dust and noise levels; the reduction of spillage and/or the containment of hazardous chemicals; the monitoring of pollution levels or minimisation of excess drawdown in water supply areas; the suppression of wildfires and the careful placement of access roads and site works. All of these contribute to the maintenance of a healthy faunal environment by reducing the impact of secondary effects on vegetation.

Factors which particularly affect wildlife are:

- lowering of the water table or increased salinity potentially affecting susceptible vegetation communities at the lower levels of the landscape;
- the excessive clearing of vegetation for access roads, transport corridors, construction camps, working and storage areas. The first two aspects can create barriers to the free movement of terrestrial species and in combination with the latter, reduce the amount of habitat available. Features such as temporary construction camps and the mine usually require rubbish disposal sites and laydown areas, all of which can be either poorly situated, too large for the purpose required or abandoned without rehabilitation;
- the presence of a workforce. This aspect increases the risk of broadscale habitat destruction or modification through accidental wildfires and the uncontrolled use of four-wheel drive vehicles or trail bikes. Scenic areas such as permanent wetlands are under specific pressure since recreational activity beyond the mine site is usually focused here. A small minority of the work force also tends to see fauna as a recreational resource (indiscriminate hunting) or as an imagined threat (driving over snakes far from the mine site). Increased traffic also has a potentially detrimental effect on wildlife especially when speed is involved.
- the clearing of vegetation for grid lines and tracks creates barriers to the movement of small animals although larger, highly mobile animals such as kangaroos, monitor lizards and bats utilise tracks and grid lines. However, most species of small mammal and reptile are reluctant to cross areas of open ground because of their increased exposure to predators. Many are territorial and/or niche-specific and react adversely to habitat partitioning or clearing. Roads and other expanses of bare ground form barriers to the free movement of small mammals (Barnett *et al.* 1978), reduce the area of available habitat and can have a disruptive effect on populations of territorial birds such as Fairy-wrens.

8.0 RECOMMENDATIONS

8.1 Impact Reduction Strategies

In order to reduce the primary and secondary impacts of mining and support facilities on fauna, especially within or near previously defined significant habitats, it is recommended that :

- the topsoil, debris and leaf litter removed from all areas of operation should be stockpiled for use in rehabilitation programmes. The topsoil contains a seed store of native vegetation and the log and litter debris provide micro-habitat for vertebrate and invertebrate species, allowing early recruitment of fauna to rehabilitated areas;
- unnecessary clearing of vegetation, particularly trees, in all locations is avoided and that areas of natural vegetation adjacent to operations are left undisturbed where the risk of fire is low;
- rehabilitation of cleared areas which are no longer required and which can be practicably rehabilitated, commences as soon as possible and is structured to encourage fauna by providing micro-relief and dense vegetation cover;
- the increased run-off from mining areas and access roads is channeled and restricted in such a manner that siltation of swamps is minimised;
- off-road vehicles are restricted to main access roads. Disused tracks and grid lines should be blocked, and if compacted, deep ripped to encourage plant regrowth and the subsequent rehabilitation of faunal habitats;
- firearms and pets are excluded from the project area;
- all current and new exploration drill-holes are immediately capped or sealed to prevent small animals from being trapped and periodic checks are made on all caps to test their integrity;
- adequate rubbish disposal procedures are applied, especially for food refuse, in order to discourage scavenging by introduced foxes and feral cats.

Although many of the wetlands present in the project area will be left undisturbed, some have already been disturbed by exploration grid lines and may be further affected by mining operations. It is therefore recommended that:

- rehabilitation includes the construction of artificial wetlands to compensate for any loss of this specialised habitat within the project area. The satisfactory design of such wetlands is crucial if the many species of vertebrates that utilise this habitat are to be encouraged. Many studies of the requirements of native fauna have been completed, or are in progress, that will assist with this procedure. Preliminary notes on artificial wetlands are given in Section 8.2.

One of the main areas of potential impact of a project is the devolution of environmental responsibility from the proponent to sub-contracting teams who may not have been adequately briefed on the constraints placed on the development and who unknowingly carry out environmentally unsound practices in good faith, or knowingly take short-cuts for reasons of economy. Impacts such as excessive clearing, rubbish dumping, casual disposal of waste lubricants, leaving drill holes uncapped or the accidental or purposeful lighting of bushfires are typical examples which have been recorded. In order to reduce these potential impacts and reinforce the proponent's commitment to and ultimate responsibility for environmental concerns, it is recommended that:

- all sub-contracting teams are adequately briefed by the proponents and made aware of the environmental constraints imposed on the project and themselves;
- in consideration of the fact that areas such as permanent and semi-permanent wetlands are a critical resource in south-west Western Australia, a penalty system for breaches of sound environmental practices is put in place by the proponents;
- the proponents give consideration to preparing a brief handout on sound environmental practices which could be given to, and signed by, all members of sub-contracting teams and permanent employees during site induction. The pamphlet should cover the aspects defined in previous sections of this report;
- the proponent ensures that regular spot-checks for breaches of sound environmental practises are carried out by delegated individuals so that problems can be anticipated or rectified at an early stage.

8.2 Wetland Rehabilitation

This section explores various methods of rehabilitating or creating waterbird habitat to replace that lost through development of traditional sites. The creation of a variety of wetland types to encourage waterbirds is assessed, as is planned re-vegetation and rehabilitation with the objective of raising the quality of the area for nomadic and resident birds.

Waterbirds have three major requirements - water, shelter and food. Each species has its own particular needs and niches so that the greater the variety of water depths and food sources available, the greater the diversity of species which will be attracted to the wetland.

Water: in the construction of an artificial wetland, a variety of water depths is most important with extensive areas of shallows and mudflats being the single greatest factor in attracting a range of waterbirds. Where water is less than 1 metre deep, adequate light reaches the bottom and encourages the growth of plant life. Aquatic plants and the invertebrates on or near them are eaten by waterbirds. Deeper areas are used by diving species which feed on fish or crustaceans but deep water is much less diverse than shallows.

In a natural wetland, seasonal variations in water levels allow access to new food sources and release soil-bound nutrients which increase productivity. Such variations should be allowed to occur naturally in artificial wetlands or should be accomplished by artificially raising and lowering of water levels; this aspect may eventuate in the project through normal drawdown/pumping regimes associated with the mine. The edges of the wetland should be as irregular as possible since this increases the area of available shallows and is more pleasing aesthetically.

Shelter: many waterbirds utilise reeds and sedges for shelter, protection from predators and in some cases nesting. Plantings of various species of sedges and reeds should be made in and around the shallow areas. Other birds require shrubs and trees set back from the water to provide roosting, refuge and, eventually, nesting sites when the trees are large enough. Shrubs and trees should not be planted too close together, since this may obstruct flight-paths to and from the water surface. Ideally, the plants should be species which are adapted to local conditions. A list of suitable species is provided in Appendix 2.

Islands are an extremely important factor in encouraging waterbirds to artificial wetlands. They increase the amount of shallow water available, provide shelter from the weather when vegetated and if constructed at a sufficient distance from the shore in deeper water, become predator-free refuges. Three types of island should be considered:

- higher relief vegetated islands with gently sloping access ramps;
- low relief, bare, sandy islets subject to partial seasonal inundation or temporarily exposed by drawdown;
- anchored log piles for use as roosts.

These islands can be constructed from rubble, bulldozer spoil and dead trees and set well back from the shorelines so that drawdown does not allow access to them by domestic pets, feral cats and foxes.

Food: if the conditions outlined in the previous section are fulfilled, an adequate food supply for waterbirds will naturally follow. There is usually no need to introduce aquatic vertebrates and invertebrates to the water as they will tend to colonise from other areas.

Anticipated Problems: local conditions such as the presence of superphosphate fertilisers, water turbidity, excess acidity or alkalinity, increased salinity and algal blooms can seriously effect the capacity of a wetland to support waterfowl and can seriously lower food supplies. Treatment to rectify these problems after the event can be time-consuming and expensive. However, valuable information for attempting to control, or forestall these effects is given in "Ducks, Ponds and People (Swift 1976). Design strategies are also provided in "Farm Dams for Wildlife and Stock" (NSW National Parks and Wildlife Service 1983). A profile of an 'ideal' wetland is described in "Wetlands of the south-west of Western Australia, with special reference to the Busselton area" (Dept. of Fisheries and Wildlife 1978).

8.3 Other Recommendations

In order to confirm the presence or absence of two potentially resident rare mammals, the Southern Brown Bandicoot *Isoodon obesulus* and Western Ringtail Possum *Pseudocheirus peregrinus occidentalis*, further specific field searches are recommended. While preliminary searches for these species were made, opportunistic site assessments do not allow for concentrated effort on individual species. These animals can be detected by the presence of their characteristic conical diggings (Southern Brown Bandicoot) and the presence of distinctive nests (Western Ringtail Possum).

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APPENDIX 1 List of vertebrate fauna species recorded or expected to occur in the habitats present in the proposed Kemerton Sands Project area.

KEY

♠ = Rare species
• = Migratory birds protected by international treaties
⊗ = Introduced species
R = Species recorded during the site assessment
X = Species recorded or predicted to occur (W.A. Museum records and literature review results) (Waterbirds and shorebirds - seasonally present in ephemeral swamps)
A = Predominantly aerial species

HABITAT TYPE

1 = Woodland of Jarrah *Eucalyptus marginata*, Marri *E. calophylla over* Holly-leaved Banksia *Banksia ilicifolia*, Coastal Banksia *B. attenuata* and Firewood Banksia *B. menzeisii* over mixed, dense Proteaceous and Myrtaceous shrubs on aeolian sands.

2 = Woodland of Peppermint *Agonis flexuosa* over *Xanthorrhoea preissii*, *Hibbertia* species and *Leucopogon* species on aeolian/fluvial sands.

3 = Relatively deep, permanent wetlands surrounded by low-closed forest of *Melaleuca preissiana*, *M. rhaphiophylla*, *Eucalyptus rudis* and a closed, tall heath of mixed shrubs.

4 = Shallow ephemeral sumplands surrounded by Paperbarks *M. preissiana*, *M. rhaphiophylla*, *Eucalyptus rudis.*

5 = Damplands supporting a low, closed heath of *Pericalymma elliptica*, *Adenanthos obovata* and *Calothamnus lateralis.*

Full descriptions of plant community codings adopted for the Kemerton Sand Project area are given in Mattiske and Associates (1993).

COMMUNITY		WOODLANDS		WETLANDS		
HABITAT TYPE		1	2	3	4	5
BIRD SPECIES						
DROMAIIDAE						
Dromaius novaehollandiae	Emu	R	R	X	R	X
PODICIPEDIDAE						
Podiceps cristatus	Great Crested Grebe	-	-	X	-	-
Poliocephalus poliocephalus	Hoary-headed Grebe	-	-	X	X	-
Tachybaptus novaehollandiae	Australasian Grebe	-	-	X	X	-
PELECANIDAE						
Pelecanus conspicillatus	Australian Pelican	-	-	X	-	-
ANHINGIDAE						
Anhinga melanogaster	Darter	-	-	X	-	-
PHALACROCORACIDAE						
Phalacrocorax carbo	Great Cormorant	-	-	X	X	-
P. sulcirostris	Little Black Cormorant	-	-	R	X	-
P. melanoleucos	Little Pied Cormorant			X	X	
ARDEIDAE						
Ardea pacifica	Pacific Heron	-	-	X	R	-
A. novaehollandiae	White-faced Heron	-	-	X	R	-
Ardeola ibis	Cattle Egret •	-	-	X	X	-
Egretta alba	Great Egret •	-	-	X	X	-
E. garzetta	Little Egret					
Nycticorax caledonicus	Rufous Night Heron	-	-	X	X	-

APPENDIX 1 Continued.

COMMUNITY / HABITAT TYPE			WOODLANDS 1	2	WETLANDS 3	4	5
Ixobrychus minutus	Little Bittern		-	-	X	X	-
Botaurus poiciloptilus	Australasian Bittern	♠	-	-	X	X	-
PLATALEIDAE							
Plegadis falcinellus	Glossy Ibis	•	-	-	X	X	-
Threskiornis aethiopica	Sacred Ibis		-	-	X	X	-
T. spinicollis	Straw-necked Ibis		-	-	X	X	-
Platalea regia	Royal Spoonbill		-	-	X	X	-
P. flavipes	Yellow-billed Spoonbill		-	-	X	X	-
ANATIDAE							
Cygnus atratus	Black Swan		-	-	X	X	-
Stictonetta naevosa	Freckled Duck	♠	-	-	X	X	-
Tadorna tadornoides	Australian Shelduck		-	-	R	X	-
Anas superciliosa	Pacific Black Duck		-	-	R	X	-
A. gibberfrons	Grey Teal		-	-	X	X	-
A. castanea	Chestnut Teal		-	-	X	X	-
A. rhynchotis	Australasian Shoveler		-	-	X	X	-
Malacorhynchus membranaceus	Pink-eared Duck		-	-	X	X	-
Aythya australis	Hardhead		-	-	X	X	-
Chenonetta jubata	Maned Duck		-	-	X	X	-
Oxyura australis	Blue-billed Duck		-	-	X	X	-
Biziura lobata	Musk Duck		-	-	X	X	-
ACCIPITRIDAE							
Elanus notatus	Black-shouldered Kite		A	A	A	A	A
Lophoictinia isura	Square-tailed Kite		A	A	A	A	A
Haliastur sphenurus	Whistling Kite		A	A	A	A	A
Accipiter fasciatus	Brown Goshawk		A	A	A	A	A
A. cirrhocephalus	Collared Sparrowhawk		A	A	A	A	A
Aquila audax	Wedge-tailed Eagle		A	A	A	A	A
Hieraaetus morphnoides	Little Eagle		A	A	A	A	A
Circus aeruginosus	Marsh Harrier		A	A	A	A	A
FALCONIDAE							
Falco peregrinus	Peregrine Falcon	♠	A	A	A	A	A
F. longipennis	Australian Hobby		A	A	A	A	A
F. berigora	Brown Falcon		A	A	A	A	A
F. cenchroides	Australian Kestrel		R	A	A	A	A
TURNICIDAE							
Coturnix novaezealandiae	Stubble Quail		X	X	-	-	-
C. australis	Brown Quail		-	-	X	X	X
Turnix varia	Painted Button-quail		X	X	-	-	-
RALLIDAE							
Rallus philippensis	Buff-banded Rail		-	-	X	X	-
Porzana pusilla	Baillon's Crake		-	-	X	X	-
P. fluminea	Australian Crake		-	-	X	X	-
P. tabuensis	Spotless Crake		-	-	X	X	-
Gallinula ventralis	Black-tailed Native-hen		-	-	X	X	-
G. tenebrosa	Dusky Moorhen		-	-	X	X	-
Porphyrio porphyrio	Purple Swamphen		-	-	X	X	-
Fulica atra	Eurasian Coot		-	-	X	X	-
CHARADRIIDAE							
Vanellus tricolor	Banded Lapwing		-	-	X	X	-
Charadrius ruficapillus	Red-capped Plover		-	-	X	X	-
C. melanops	Black-fronted Plover		-	-	X	X	-
RECURVIROSTRIDAE							
Himantopus himantopus	Black-winged Stilt		-	-	X	X	-
Recurvirostra novaehollandiae	Red-necked Avocet		-	-	X	X	-

APPENDIX 1 Continued.

COMMUNITY / HABITAT TYPE			WOODLANDS 1	WOODLANDS 2	WETLANDS 3	WETLANDS 4	WETLANDS 5
SCOLOPACIDAE							
Tringa glareola	Wood Sandpiper	•	-	-	X	X	-
T. hypoleucos	Common Sandpiper	•	-	-	X	X	-
T. nebularia	Greenshank	•	-	-	X	X	-
T. stagnatilis	Marsh Sandpiper	•	-	-	X	X	-
Limosa lapponica	Bar-tailed Godwit	•	-	-	X	X	-
Calidris acuminata	Sharp-tailed Sandpiper	•	-	-	X	X	-
C. ferruginea	Curlew Sandpiper	•	-	-	X	X	-
LARIDAE							
Larus novaehollandiae	Silver Gull		-	-	X	X	-
Chlidonias hybrida	Whiskered Tern		-	-	X	X	-
COLUMBIDAE							
Phaps chalcoptera	Common Bronzewing		R	X	X	R	-
CACATUIDAE							
Calyptorhynchus magnificus	Red-tailed Black-Cockatoo		X	X	X	X	-
C. baudinii	White-tailed Black-Cockatoo	♠	X	X	X	X	-
C. f. latirostris	White-tailed Black-Cockatoo	♠	X	X	X	X	-
LORIIDAE							
Glossopsitta porphyrocephala	Purple-crowned Lorikeet		X	X	X	X	-
PLATYCERCIDAE							
Purpureicephalus spurius	Red-capped Parrot		X	X	R	X	-
Platycercus icterotis	Western Rosella		X	X	X	X	-
Barnardius zonarius	Port Lincoln Ringneck		R	X	X	X	-
Neophema elegans	Elegant Parrot		R	X	X	X	R
CUCULIDAE							
Cuculus pallidus	Pallid Cuckoo		X	X	X	X	-
C. pyrrhophanus	Fan-tailed Cuckoo		X	X	X	X	-
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		X	X	X	X	-
C. lucidus	Shining Bronze-Cuckoo		X	X	X	X	-
STRIGIDAE							
Ninox novaeseelandiae	Southern Boobook		A	A	A	A	-
TYTONIDAE							
Tyto alba	Barn Owl		A	A	A	A	A
T. novaehollandiae	Masked Owl		A	A	A	A	A
PODARGIDAE							
Podargus strigoides	Tawny Frogmouth		A	A	A	A	A
AEGOTHELIDAE							
Aegotheles cristatus	Australian Owlet-nightjar		X	X	X	X	-
ALCEDINIDAE							
Dacelo novaeguineae	Laughing Kookaburra	⊗	X	R	R	R	-
Halcyon sancta	Sacred Kingfisher		R	R	X	R	-
MEROPIDAE							
Merops ornatus	Rainbow Bee-eater	•	A	A	A	A	A
HIRUNDINIDAE							
Hirundo neoxena	Welcome Swallow		-	-	A	A	A
Cecropis nigricans	Tree Martin		R	R	R	R	A
MOTACILLIDAE							
Anthus novaeseelandiae	Richard's Pipit		-	-	-	X	R
CAMPEPHAGIDAE							
Coracina novaehollandiae	Black-faced Cuckoo-shrike		R	X	X	R	-
Lalage sueurii	White-winged Triller		X	X	-	-	X

APPENDIX 1 Continued.

COMMUNITY		WOODLANDS		WETLANDS		
HABITAT TYPE		1	2	3	4	5
MUSCICAPIDAE						
Petroica multicolor	Scarlet Robin	X	X	X	X	-
P. goodenovii	Red-capped Robin	X	X	X	X	-
Eopsaltria georgiana	White-breasted Robin	X	X	X	X	-
E. griseogularis	Western Yellow Robin	X	X	X	X	-
Microeca leucophaea	Jacky Winter					
Pachycephala pectoralis	Golden Whistler	R	X	X	X	-
P. rufiventris	Rufous Whistler	X	R	R	R	-
Colluricincla harmonica	Grey Shrike-thrush	X	X	X	X	-
Rhipidura fuliginosa	Grey Fantail	X	R	R	R	-
R. leucophrys	Willie Wagtail	X	X	X	X	X
SYLVIIDAE						
Acrocephalus stentoreus	Clamorous Reed-Warbler	-	-	X	R	-
Megalurus gramineus	Little Grassbird	-	-	X	X	-
MALURIDAE						
Malurus splendens	Splendid Fairy-wren	X	R	R	R	X
M. elegans	Red-winged Fairy-wren	-	-	X	X	-
Stipiturus malachurus	Southern Emu-wren	-	-	-	-	X
ACANTHIZIDAE						
Sericornis frontalis	White-browed Scrubwren	X	X	R	R	X
Smicrornis brevirostris	Weebill	X	X	X	X	-
Gerygone fusca	Western Gerygone	R	R	X	R	-
Acanthiza apicalis	Inland Thornbill	X	X	X	R	X
A. inornata	Western Thornbill	X	X	X	X	X
A. chrysorrhoa	Yellow-rumped Thornbill	X	R	R	X	X
NEOSITTIDAE						
Daphoenositta chrysoptera	Varied Sittella	X	X	X	X	-
CLIMACTERIDAE						
Climacteris rufa	Rufous Treecreeper	X	X	X	X	-
MELIPHAGIDAE						
Anthochaera carunculata	Red Wattlebird	R	X	R	R	-
A. chrysoptera	Little Wattlebird	X	X	X	X	-
Lichenostomus virescens	Singing Honeyeater	X	X	X	X	X
Melithreptus lunatus	White-naped Honeyeater	X	X	X	X	-
Lichmera indistincta	Brown Honeyeater	R	X	R	R	X
Phylidonyris novaehollandiae	New Holland Honeyeater	R	X	X	X	X
P. nigra	White-cheeked Honeyeater	X	X	X	X	X
P. melanops	Tawny-crowned Honeyeater	R	-	-	-	X
Acanthorhynchus superciliosus	Western Spinebill	R	X	X	R	X
EPHTHIANURIDAE						
Ephthianura albifrons	White-fronted Chat	-	-	-	-	X
DICAEIDAE						
Dicaeum hirundinaceum	Mistletoebird	X	X	X	X	-
PARDALOTIDAE						
Pardalotus punctatus	Spotted Pardalote	X	X	X	X	-
P. striatus	Striated Pardalote	X	R	R	X	-
ZOSTEROPIDAE						
Zosterops lateralis	Silvereye	R	X	R	R	X

APPENDIX 1 Continued.

COMMUNITY	WOODLANDS		WETLANDS		
HABITAT TYPE	1	2	3	4	5
PLOCEIDAE					
Emblema oculata Red-eared Firetail ♠	-	-	X	X	X
GRALLINIDAE					
Grallina cyanoleuca Australian Magpie-lark	X	X	X	X	X
ARTAMIDAE					
Artamus cinereus Black-faced Woodswallow	A	A	A	A	A
A. cyanopterus Dusky Woodswallow	R	A	A	A	R
CRACTICIDAE					
Cracticus torquatus Grey Butcherbird	R	R	X	X	X
Gymnorhina tibicen Australian Magpie	R	X	X	X	X
Strepera versicolor Grey Currawong	X	X	X	X	-
CORVIDAE					
Corvus coronoides Australian Raven	R	R	R	X	X
MAMMAL SPECIES					
TACHYGLOSSIDAE					
Tachyglossus aculeatus Short-beaked Echidna	X	X	-	-	X
DASYURIDAE					
Dasyurus geoffroii Chuditch ♠	X	X	X	X	X
Phascogale tapoatafa Brush-tailed Phascogale	X	X	X	X	-
Antechinus flavipes Yellow-footed Antechinus	X	X	X	X	X
Sminthopsis gilberti Common Dunnart	X	X	X	X	X
S. griseoventer Common Dunnart	X	X	X	X	X
PERAMELIDAE					
Isoodon obesulus Southern Brown Bandicoot ♠	X	X	X	X	X
PETAURIDAE					
Pseudocheirus peregrinus occidentalis Western Ringtail Possum ♠	-	X	-	-	-
PHALANGERIDAE					
Trichosurus vulpecula Common Brushtail Possum	X	X	X	X	-
BURRAMYIDAE					
Cercartetus concinnus Western Pygmy-possum	X	X	X	X	-
TARSIPEDIDAE					
Tarsipes rostratus Honey-possum	X	-	X	X	X
MACROPODIDAE					
Macropus irma Western Brush Wallaby	X	X	X	X	X
M. fuliginosus Western Grey Kangaroo	X	R	R	R	R
MOLOSSIDAE					
Tadarida australis White-striped Mastiff-bat	A	A	A	A	A
Mormopterus planiceps Little Mastiff-bat	A	A	A	A	A
VESPERTILIONIDAE					
Nyctophilus major Greater Long-eared Bat	A	A	A	A	A
N. gouldi Gould's Long-eared Bat	A	A	A	A	A
N. geoffroyi Lesser Long-eared Bat	A	A	A	A	A
Chalinolobus gouldii Gould's Wattled Bat	A	A	A	A	A
C. morio Chocolate Wattled Bat	A	A	A	A	A
Falsistrellus mackenziei Great Pipistrelle	A	A	A	A	A
Eptesicus regulus King River Eptesicus	A	A	A	A	A

APPENDIX 1 Continued.

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
MURIDAE							
Hydromys chrysogaster	Water-rat		-	-	X	X	-
Rattus fuscipes	Bush Rat		X	X	X	X	X
R. rattus	Black Rat	⊗	X	X	X	X	X
Mus musculus	House Mouse	⊗	X	X	X	X	X
LEPORIDAE							
Oryctolagus cuniculus	Rabbit	⊗	R	R	R	R	X
CANIDAE							
Vulpes vulpes	Fox	⊗	X	X	X	R	X
FELIDAE							
Felis catus	Feral Cat	⊗	X	X	X	R	X
BOVIDAE							
Bos taurus	Cattle	⊗	X	X	X	R	X
AMPHIBIAN AND REPTILE SPECIES							
LEPTODACTYLIDAE - Frogs							
Crinia georgiana			-	-	R	R	X
C. insignifera			-	-	X	X	X
Heleioporus eyrei			X	X	X	X	X
H. psammophilus			X	X	X	X	X
Limnodynastes dorsalis			X	X	X	X	X
Myobatrachus gouldii			X	X	-	-	-
Pseudophryne guentheri			X	X	X	X	X
HYLIDAE - Frogs							
Litoria adelaidensis			-	-	R	R	X
L. moorei			-	-	X	X	-
CHELUIDAE - Side-necked Tortoises							
Chelodina oblonga			-	-	R	X	-
GEKKONIDAE - Geckos							
Phyllodactylus marmoratus			X	X	X	X	-
PYGOPODIDAE - Legless Lizards							
Aprasia repens			X	X	-	-	X
Lialis burtonis			X	X	-	-	X
Pygopus lepidopodus			X	X	-	-	X
AGAMIDAE - Dragon Lizards							
Pogona m. minor			X	X	X	X	X
SCINCIDAE - Skinks							
Bassiana trilineata			-	-	X	X	X
Cryptoblepharus plagiocephalus			X	X	X	X	-
Ctenotus impar			X	X	-	-	X
C. fallens			X	X	X	X	X
C. lesueurii			X	X	-	-	-
E. luctuosa			-	-	X	X	-
E. napoleonis			X	X	X	X	-
Hemiergis quadrilineata			X	X	X	X	X
Lerista distinguenda			X	X	-	-	-
L.. elegans			X	X	-	-	-
Menetia greyii			X	X	X	X	X
Morethia lineoocellata			X	X	-	-	X
Tiliqua r. rugosa			R	X	X	X	X
VARANIDAE - Monitors							
Varanus gouldii			X	X	X	X	X
V. rosenbergi			X	X	X	X	X
TYPHLOPIDAE - Blind Snakes							
Ramphotyphlops australis			X	X	-	-	-
R. pinguis			X	X	-	-	-
BOIDAE - Pythons							
Morelia spilota imbricata		♠	X	X	X	X	X
ELAPIDAE - Elapid Snakes							
Demansia psammophis reticulata			X	X	-	-	-
Drysdalia coronata			X	X	X	X	X
Echiopsis curta			X	X	-	-	-

APPENDIX 1 Continued.

COMMUNITY HABITAT TYPE	WOODLANDS 1	 2	 3	WETLANDS 4	 5
Neelaps bimaculata	X	X	-	-	-
Notechis scutatus occidentalis	X	X	X	X	X
Pseudonaja a. affinis	X	X	X	X	X
Rhinoplocephalus gouldii	X	X	X	X	X
R. nigriceps	X	X	X	X	X
Simoselaps bertholdi	X	X	-	-	-

Appendix 2 ***List of plant species suitable for revegetation and encouraging the return of fauna to modified or artificial wetlands. (after Department of Conservation and the Environment 1980.)***

KEY

H = Herb, grass or sedge
S = Shrub less than 1 metre
TS = Shrub greater than 1 metre
ST = Small trees
T = Tree

EMERGENT PLANTS IN WETLAND

Baumea articulata	H
Baumea juncea	H (brackish)
Scirpus validus	H
Scirpus subfascicularis	H
Typha orientalis	H
Polygonum minus	H
Juncus pallidus	H
Juncus polyanthemos	H
Juncus krausii	H
Melaleuca teretifolia	TS
Lepidosperma longitudinale	H
Triglochin procera	H

WETLAND EDGE - SEASONALLY INUNDATED

Melaleuca raphiophylla	TS
Melaleuca teretifolia	TS
Melaleuca uncinata	TS
Melaleuca lateritia	S
Cenetella orbifolia	H
Eucalyptus rudis	T
Polygonum minus	H
Epilobum junceum	H
Scirpus inundatus	H
Euchilopsis linearis	H
Eutaxia virgata	S
Myoprum gracilis	S
Agonis linearifloia	TS

Suitable for nutrient poor soils:

Melaleuca preissiana	TS
Melaleuca laterita	S
Viminaria juncea	TS
Aotus ericoides	S
Pultenea reticulata	S
Astartea fascicularis	S
Sphaerolobium vimineum	S
Cyatochoetae avenacea	H
Banksia littoralis	T
Deyeuxia quadriseta	H
Acacia saligna	TS
Leptospermum ellipticum	S
Kunzea vestita	TS
Hypocalymma angustifolia	S
Carex appressa	H

THE KEMERTON SILICA SANDS PROJECT AREA

VERTEBRATE FAUNA ASSESSMENTS DECEMBER 1992 - DECEMBER 1993

Prepared for: John Consulting Services

By: Ninox Wildlife Consulting

February 1994

SUMMARY

This report describes the final session in a series of five vertebrate fauna surveys of the Kemerton Silica Sands Project Area. Sampling was of longer duration than the earlier surveys, extended over six days and included trapping, intensive hand searching, mist netting and head torching for the first time. Detailed wetland sampling was also undertaken as were specific searches for rare fauna. A synthesis of all surveys undertaken between December 1992 and December 1993 forms the main portion of the report and places the Project Area in a local and regional perspective by comparing the results of the surveys with fauna lists from a series of other locations in the general area.

Five native mammals, 5 introduced mammals, 48 bushbirds, 17 waterbirds, 7 frogs and 10 reptiles were recorded between December 1992 and December 1993. The low number of native mammals, frogs and reptiles found in the Project Area is very similar to that from Reserves C12632 and C12049 in the Harvey district, showing that the area is not exceptionally rich in species. The nearby Kemerton Industrial Park is substantially richer in all these groups. The number of bushbirds recorded in the Project Area exceeds that found in the two reserves and compares well, not only with the nearby Kemerton Industrial Park, but also with the number of species known from the coastal plain.

Waterbirds are poorly represented. The maximum number of species in any one wetland was 11, as opposed to 27 from Darter Swamp in the Kemerton Industrial Park, 30 recorded from Mialla Lagoon and 59 from Benger Swamp. The combined total of waterbirds for the Project Area is 17 species and it is concluded that the Project Area lies at the lower end of the species richness scale and cannot be considered as particularly productive in terms of its waterbirds and its capacity to operate as a summer drought refuge for this group. Of the four EPA nominated wetlands in the vicinity of the initial mining area, Wetland #1 is the most productive (strictly within the local context of the Project Area and stressing that only eight species of waterbirds were recorded). Wetland #3 is moderately productive, (5 species) while Wetland #2 and Wetland #4 are depauperate (3 and 2 species respectively).

Several species of fauna recorded during the surveys are of interest. The captures of the Honey Possum and Pygmy Possum provide further data points for the distribution of these attractive and highly specialised marsupials on the coastal plain. The Western Brush Wallaby sightings are also of interest since this species appears to be under threat in the metropolitan and near metropolitan area. The Black-stripe Minnow is of particular note since the Project Area is about 165 kilometres north of its previously known distribution and its presence, along with several other native fish, suggests that the wetlands of the Project Area are in good condition and have not been colonised by the introduced Mosquito Fish.

Despite thorough searches in all surveys, no rare animals were recorded. The status of several species originally predicted has therefore been downgraded from probable to highly unlikely. Examples are the Western Ringtail Possum and the Chuditch. The apparent absence of the Southern Brown Bandicoot is inexplicable, given that its typical habitat is present. Others rare animals such as the Carpet Python and the two species of White-tailed Black Cockatoo have been retained on the predicted list because they may either be resident or visit the area from time to time.

A series of management and rehabilitation strategies are reproduced from the first report on the Project Area and several new recommendations specifically relating to the Black-stripe Minnow are also included.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PARTICIPANTS

K. Youngson & J. Henry	-	Planning, field sampling and reporting.
M. Bamford	-	Field sampling and reporting.
P. Curry	-	Field sampling.
J. Dell	-	Field sampling.
C. Welbon	-	Field sampling and data collation.

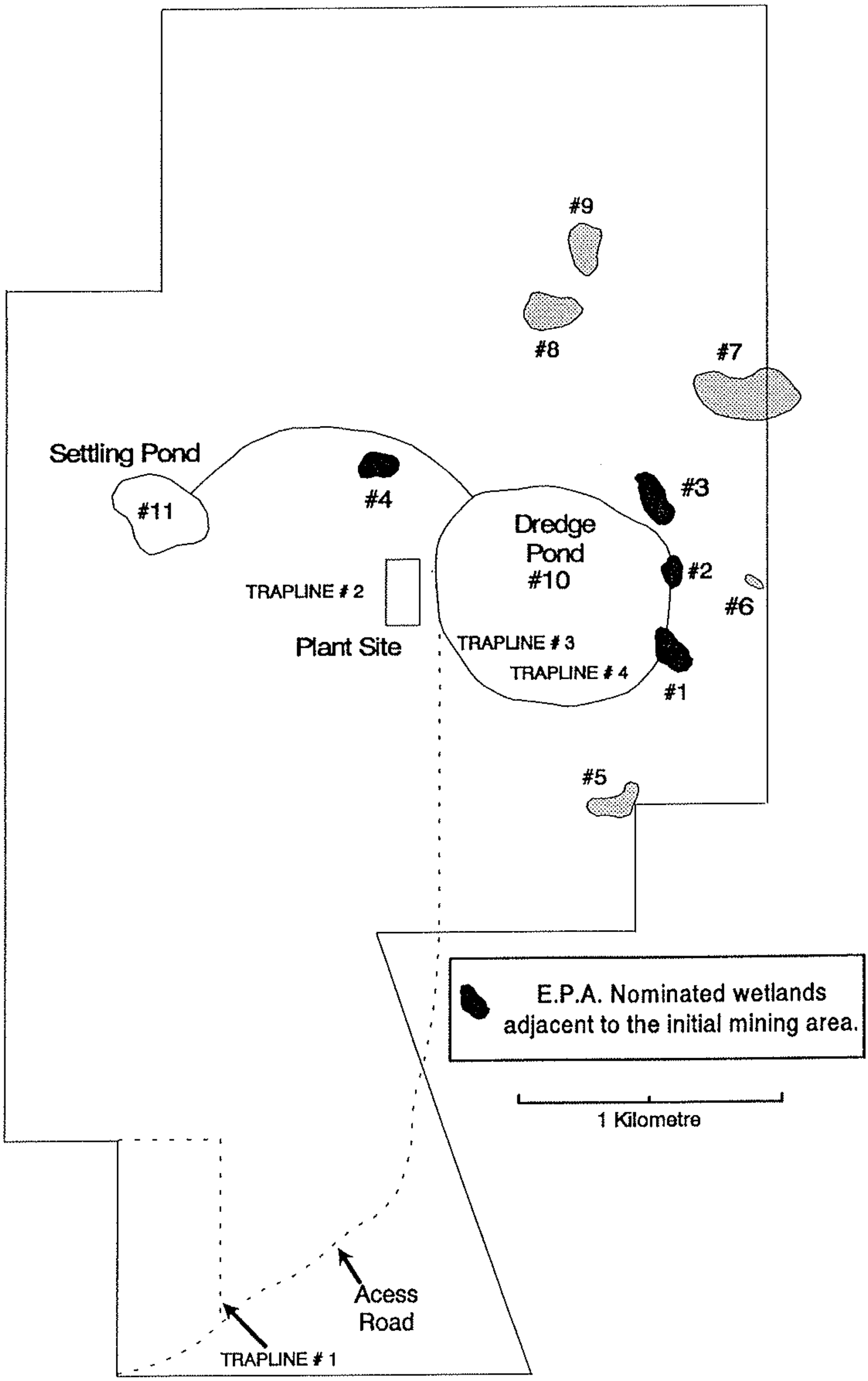

Figure 1 *Diagram showing the location of the wetlands and traplines sampled during the surveys of the Project Area between December 1992 and December 1993.*

1.0 INTRODUCTION

This report describes the final sampling session in a series of five vertebrate fauna surveys of the Kemerton Silica Sands Project Area. These surveys were commissioned by Gwalia Consolidated Limited and commenced in December 1992 as part of a continuing programme of fauna assessment. The first four surveys were of short duration and were structured to:

- opportunistically sample the fauna of the Project Area over a range of seasonal conditions;
- compile a comprehensive list of both resident and migratory species, based on actual records gathered during the surveys;
- list the species predicted to occur based on a thorough literature review;
- assess wetland dynamics and their significance to fauna;
- gain an overall familiarity with the Project Area prior to development and define locations of significance to fauna.

The final survey described in this report was of longer duration and included trapping, intensive hand searching, mist netting and head torching for the first time. Detailed wetland sampling was also undertaken. The results for all surveys, and a list of species predicted to occur, are presented in Appendix 1, which has been divided into wetland and woodland fauna habitats to give an overview of the Project Area.

1.1 Study Objectives

The main objectives of this final survey were to:

- undertake a detailed fauna sampling survey concentrating on species not normally recorded in short duration, opportunistic surveys;
- specifically target the series of rare species which could possibly occur and which were predicted in the first report. Special attention was to be paid to rare residents such as the Southern Brown Bandicoot and the Western Ringtail Possum;
- compare the wetlands of the Project Area with nearby locations; and,
- synthesise all information collected to date and place the Project Area in a local and regional perspective in terms of its fauna conservation significance.

2.0 METHODS - DECEMBER 1993

Sampling for this final survey took place between December 4 and December 9, 1993 (inclusive) and was undertaken by two experienced field personnel. The following techniques were used:

Trapping: this was carried out at four sites over a five day period. The layout at each site was based on a line transect consisting of seven 20 litre and seven 10 litre plastic drum pitfall traps, ten medium and three large Elliott box traps, plus two cage traps. All of these were placed at 20 metre intervals. Up to three of the large pitfalls were fenced when damage to vegetation could be minimised. Medium Elliott traps were baited with dog and cat pellets soaked in a mixture of peanut oil, honey, bacon paste and Vegemite. Large Elliott traps and wire cage traps were baited with universal bait, a mixture of peanut paste, oats and sardines. Every attempt was made to apply equal effort sampling to all sites but this was not possible in some locations, since several pitfall traps had to closed to avoid ants attacking and killing captured animals.

Table 1 ***Location, vegetation community and notes on the four sites trapped for five days in the Project Area during December 1993.***

Site	AMG Reference	Vegetation	Notes
1	8500 N 10500 E	Eucalyptus/Banksia woodland	Three large pitfall traps fenced, only one wire cage trap for first two nights.
2	11600 N 11200 E	Eucalyptus/Banksia woodland at proposed plant site	Three large pitfall traps fenced. One large, fenced pitfall trap closed for the first night (ants).
3	11400 N 11700 E	Low shrubland on palusplain	Only two large pitfalls fenced.
4	11300 N 12300E	Tall, dense shrubland around wetland	No fenced pitfalls because of dense vegetation. Four pitfalls closed on last two nights (ants).

Hand Foraging: approximately 1.5 hours of intensive hand foraging took place at each of the following locations: woodland near Trapping Site 1; damp shrubland margin at about 10500 N, 12000 E; woodland at about 12000 N, 11000 E. Activities at each site consisted of raking leaf litter, searching for burrow systems, turning over logs, digging in decaying stumps and inspecting hollows. Searches were also made for tracks, droppings and diggings.

Nocturnal Mist Netting: this took place at a small inundated test pit at about 8500 N, 10800 E. Conditions were ideal, being a mild evening after a warm day. Two 12 metre nets were placed around the pit to sample bats.

Head Torching: one hour was spent head torching in the vicinity of the bat mist netting site.

Wetland Sampling: most wetlands previously assessed (Figure 1) were reassessed. Sampling took place over a one-hour period. Two small wetlands not previously visited were also assessed and were situated at 12900 N, 11400 E (tall paperbarks with shallow water present - less than 50 m across) and 13000 N, 10800 E (tall paperbarks; recently dried out. Marked as "dense timber" on Project Area map).

Fish Sampling: this was accomplished by direct observation and identification of fish seen in the wetlands. One galaxid species which could not be identified was netted and submitted to the Western Australian Museum for confirmation.

Visit to Nearby Wetlands: several wetlands in the vicinity of the Project Area were sampled briefly for comparison. These were Benger Swamp (Melaleuca Road), a wetland on Swamp/Typha Road and a series of wetlands west of Benger Swamp and south of study area. These were situated on Mitchell Road, Campbell Road, Wellesley Road, Wellington Road and Heron Road.

3.0 SAMPLING RESULTS - DECEMBER 1993

3.1 Terrestrial Sampling

3.1.1 Mammals, Amphibians and Reptiles

Five species of native mammal, one introduced mammal, six frogs and 10 reptiles were recorded during sampling of the four representative trapline sites (Table 2). Despite thorough hand foraging in three other representative habitats, returns for effort were extremely poor. One *Hemiergis quadrilineata* skink was found under leaf litter in the woodland near Trapping Site 1. Nothing was recorded in the remaining two sampling sites. No bats were captured in the two 12 metre mist nets which were placed around an inundated test pit, despite the ideal conditions, although one, probably Gould's Wattled Bat *Chalinolobus gouldii*, was seen. Results were also poor for head torching with only the Moaning Frog *Heleioporus eyrei* found. A Boobook Owl and a Tawny Frogmouth were heard calling during the head torching period.

Table 2 ***Mammals, amphibians and reptiles recorded either by trapping or observation in the four sites established and monitored in the Kemerton Silica Sands Project Area during December 1993. (X = sightings or tracks, numbers not counted.)***

TRAP SITE NUMBER		1	2	3	4
NATIVE MAMMAL SPECIES					
BURRAMYIDAE					
Cercartetus concinnus	Western Pygmy-possum		1		
TARSIPEDIDAE					
Tarsipes rostratus	Honey Possum				1
MACROPODIDAE					
Macropus irma	Western Brush Wallaby	X	X		

M. fuliginosus	Western Grey Kangaroo	X	X	X	X
MURIDAE					
Hydromys chrysogaster	Water-rat				X
INTRODUCED MAMMAL SPECIES					
MURIDAE					
Mus musculus	House Mouse				1
AMPHIBIAN AND REPTILE SPECIES					
LEPTODACTYLIDAE - Frogs					
Crinia glauerti					X
C. insignifera		2	X	2	52
Heleioporus eyrei		4	2	10	11
Pseudophryne guentheri				1	
HYLIDAE - Frogs					
Litoria adelaidensis			5		X
L. moorei					X
PYGOPODIDAE - Legless Lizards					
Lialis burtonis		2	1		
AGAMIDAE - Dragon Lizards					
Pogona m. minor				1	
SCINCIDAE - Skinks					
Bassiana trilineata				2	
Cryptoblepharus plagiocephalus		X			
Egernia napoleonis				1	
Hemiergis quadrilineata		2			
Lerista distinguenda			1		1
Morethia lineoocellata		1			1
Tiliqua r. rugosa			3	3	2
VARANIDAE - Monitors					
Varanus gouldii		X			

The captures of the Honey Possum and Pygmy Possum (Table 2) are interesting and provide further data points for the distribution of these attractive and highly specialised marsupials on the coastal plain. The Western Brush Wallaby sightings are also of interest since this species appears to be under threat in the metropolitan and near metropolitan area. There is a strong possibility that this animal may be added to the rare species list when this is next reviewed.

The relatively large number of frogs reflects the domination of the area by wetlands; reptile results were surprisingly poor despite the warm conditions, which normally assist in raising the capture rate for this group. The range of species recorded represents a typical, if surprisingly depauperate, suite of coastal plain fauna.

3.2 Wetland Sampling

Wetland #1: up to 40 cm water and still an extensive area flooded. Bird species recorded were: Little Grassbird (1), Little Pied Cormorant (1), Sacred Ibis (5), Port Lincoln Ringneck, Inland Thornbill, Silvereye. This wetland was also observed for about 1 hour at dusk and an unidentified crake or rail was heard. The following frogs were recorded: *Litoria adelaidensis* tadpoles amongst reeds; recently metamorphosed *Crinia insignifera, Crinia glauerti* and

Litoria adelaidensis around the vegetated margin of the wetland. A small galaxid fish later identified by the Western Australian Museum as the Black-stripe Minnow *Galaxiella nigrostriata* was also present.

Wetland #2: water shallow (30 cm) and receding, with some bare areas of mud exposed. Bird species recorded were: Little Grassbird and a Splendid Fairy-wren with dependent young. The following frogs were recorded: unidentified tadpoles amongst reeds; recently metamorphosed *Crinia insignifera, Crinia glauerti* and *Litoria adelaidensis* on the wetland margin.

Wetland #3: water extensive and flooded into reeds, but mostly less than 25 cm deep. The only reptile recorded was the Long-necked Tortoise *Chelodina oblonga*.

Wetland #4: one area of water left, an open pool 50 m across and < 20 cm deep. Bird species recorded were: White-faced Heron (5) and Sacred Ibis (2). Unidentified tadpoles and many small Black-stripe Minnows were seen in the shallows. A Western Pygmy Perch *Edelia vittata* was also seen.

Wetland #5: water at southern end only, but up to 0.5 m deep. Bird species recorded were: Buff-banded Rail flushed from *Baumea* sedges. Unidentified tadpoles were seen, and recently metamorphosed *Crinia insignifera, Crinia glauerti* and *Litoria adelaidensis* were active on the wetland margin. A Black-stripe Minnow was also seen.

Wetland #6: up to 40 cm water in places. Bird species recorded were: Emu, Grey Fantail, Rufous Whistler, Willy Wagtail, Striated Pardalote, Shining Bronze-Cuckoo, Little Grassbird, Port Lincoln Ringneck, Sacred Kingfisher, Tree Martin, Red Wattlebird, Western Gerygone, Laughing Kookaburra, Australian Raven. The following frogs were recorded: assorted tadpoles and many recently metamorphosed *Crinia insignifera, Crinia glauerti, Litoria adelaidensis* and *Litoria moorei.* A Bobtail lizard *Tiliqua rugosa* was seen. The Black-stripe Minnow was also present here.

Wetland #7: water has receded little since the September visit. Bird species recorded were: Little Pied Cormorant (1), Pacific Black Duck (2), Maned Duck (8), Musk Duck (1), Grey Teal (25), White-faced Heron (1), Sacred Ibis (1), Marsh Harrier (1), Laughing Kookaburra, Elegant Parrot (with dependent young), Willie Wagtail, White-browed Scrubwren, Golden Whistler, Grey Fantail, Black-faced Woodswallow, Tree Martin, Rainbow Bee-eater, Striated Pardalote, Magpie Lark.

Wetland #8: water level up to 0.7 m. Bird species recorded were: Eight Little Pied Cormorants in a group with two nests about 50 m from these (one of the two separate nests was large and possibly represented another species); Reed Warbler, Sacred Ibis (1), White-faced Heron (1), Little Pied Cormorant (10, including several juveniles). Unidentified tadpoles were seen in the shallows. The Black-stripe Minnow was also present.

Wetland #9: water level up to 0.7 m in places. Bird species recorded were: Little Pied Cormorant (1), Pacific Black Duck (2), Grey Teal (1), Maned Duck (1), Golden Whistler, Tree Martin, Common Bronzewing (on nest in flooded paperbark), Scarlet Robin, Sacred Kingfisher, Grey Fantail, Australian Raven. Unidentified tadpoles were seen in the shallows. The Black-stripe Minnow was also present.

Wetland #10: very shallow (< 20 cm) but covers an area of almost a hectare. No open water. Complete groundcover of sedges, *Calothamnus lateralis* and *Melaleuca lateritia.* The following frogs were recorded: unidentified tadpoles; recently metamorphosed *Crinia insignifera, Crinia glauerti* and *Litoria adelaidensis.* The Black-stripe Minnow was also present.

Previously unsampled wetland at 12900 N 11400 E: tall paperbarks with shallow water (< 20 cm). Body of water < 50 m across. Unidentified tadpoles were seen in the shallows. The Black-stripe Minnow was also present.

Previously unsampled wetland at 13000 N, 10800 E: Tall paperbarks; recently dried out. Marked as "dense timber" on Project Area map. No species of fauna were seen at this site.

3.2.1 Fish Sampling

Details of the fish species recorded are included in the wetland notes above. The record of the Black-stripe Minnow *Galaxiellia nigrostriata* is the most interesting. During detailed fauna surveys there is always the likelihood that the range of an animal may be extended. An eventuality such as this needs to be viewed in context. The authors of this report, for example, have recorded many range extensions for a number of species in their survey work in Western Australia. During the most recent survey of the Kemerton Silica Sands Project Area, the range of the Black-stripe Minnow *Galaxiellia nigrostriata* was extended significantly. Until now, the northern limit of the poorly known Black-stripe Minnow was believed to be much further south of the Project Area. Allen (1982) defines the range of this species as:

> *"Known only from Western Australia in coastal streams, swamps and ponds, between Albany and Northcliffe."*

This represents a range extension for this poorly known species of some 165 kilometres northwards.

The Family Galaxiidae contains small, scaleless, minnow-like fishes which are common inhabitants of lakes, swamps and streams of New Zealand, Tasmania and the southern half of Australia. The life history of the Western Australian minnows is very poorly understood, but in keeping with other members of the Family, it is highly probable that the Black-stripe Minnow deals with drought conditions by aestivating, perhaps by burrowing into mud on the bottom of temporary pools. When conditions improve after rain these minnows reappear in previously dry swamps, ditches and pools. This adaptation appears likely in the case of the Black-stripe Minnow, since specimens were located in ephemeral swamps which were dry in previous surveys.

Dr Gerry Allen of the W. A. Museum identified a specimen from the Project Area and made the following comments on this native fish:

- the occurrence of this species well beyond its previously known range is scientifically important;
- it would be valuable to further define the range of this species by mounting specific searches beyond the Project Area;
- the presence of the Black-stripe Minnow suggests that the Project Area wetlands are in relatively good condition, have good quality water and have not been invaded by the introduced Mosquito Fish *Gambusia affinis* which tends to displace small, native species.

The Black-stripe Minnow was recorded in most of the wetlands of the Project Area which were sampled, including small, ephemeral examples. This included wetlands in, and well beyond, the initial mining area.

3.3 Visit to Nearby Wetlands

Benger Swamp (at Melaleuca Road): Australian Shelduck (100); Pacific Black Duck (20); Maned Duck (4); Yellow-billed Spoonbill (5); Little Pied Cormorant (2); Australian Pelican (3); Sacred Ibis (5); Black-winged Stilt (2); Marsh Harrier (2); Black Swan (9).

Swamp on Freckled Duck Drive: Pink-eared Duck (29); Eurasian Coot (80); Black Swan (11); Yellow-billed Spoonbill (7); Blue-billed Duck (10); Australian Shelduck (50); Pacific Black Duck (50); Australian Pelican (5); Great Egret (2); Hoary-headed Grebe (3).

Swamp adjacent to Swamp and Typha Roads: Hardhead (20); Blue-billed Duck (7); Musk Duck (2); Pacific Black Duck (10); Black Swan (8); Little Pied Cormorant (1); Sacred Ibis (1).

Several wetlands west of Benger Swamp and south of study area were also inspected. These were situated on Mitchell Road, Campbell Road, Wellesley Road, Wellington Road and Heron Road. Most of these wetlands were cleared or grazed and were unproductive.

4.0 DISCUSSION - ALL SURVEYS 1992-1993

4.1 Mammals, Amphibians and Reptiles

As discussed in the Results section, sampling returns from trapping, hand foraging, mist netting and head torching were extremely poor (Table 2). To place the Project Area in a local perspective, all mammal, amphibian and reptile records collected during the five surveys (Appendix 1) have been combined and compared to two similar surveys in the general area. These are: an assessment of the Kemerton Industrial Park commissioned by the Department of Conservation and Land Management (Ninox Wildlife Consulting 1985); an assessment of Reserves C12632 and C12049 in the Harvey district commissioned by the then Department of Conservation and the Environment (Ninox Wildlife Consulting 1982).

All these sites were sampled at a similar level of intensity to the Project Area. That is, several visits, five nights of trapping and intensive hand foraging. Figure 2 shows that the results of native mammal, frog and reptile sampling in the Project Area are very similar to those from Reserves C12632 and C12049 and that the area is not exceptionally rich in species. The nearby Kemerton Industrial Park is substantially richer, probably because of the wider range of habitats, including Tuart forest, that it supports.

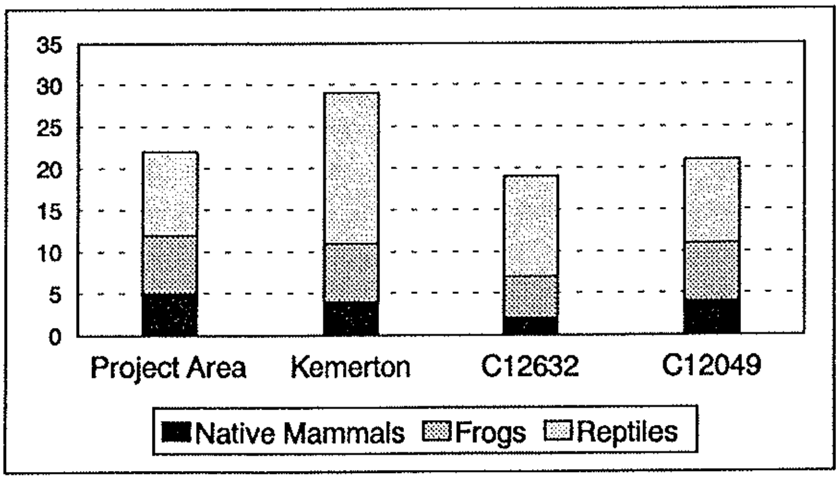

Figure 2 ***Diagram comparing the number of native mammals, frogs and reptiles recorded in the Project Area with three nearby locations where similar surveys have taken place.***

4.1.1 Rare Species

Three rare mammals, the Chuditch, Southern Brown Bandicoot, Western Ringtail Possum and one rare reptile, the Carpet Python, were listed in the first report on the area as possibly occurring. No rare species were recorded during the series of surveys undertaken since December 1992, despite specific searches and trapping for these animals. The following comments on each species can now be made with confidence.

Chuditch: ān unlikely possibility. There are no recent records on the coastal plain.

Southern Brown Bandicoot: possibly occurs but, if present, will be in extremely low numbers. The apparent absence of this species is one of the more unusual and surprising features of the Project Area since the site contains ideal habitat for the Southern Brown Bandicoot. All field workers participating in the series of five surveys were experienced in locating this species through tracks, scats, diggings and trapping, but no signs were found.

Western Ringtail Possum: an extremely unlikely possibility. The Peppermint woodlands of the Project Area were thoroughly searched on several occasions for the very obvious drays of this species but none was found.

Carpet Python: although no Carpet Pythons were found during the surveys, they almost certainly occur in low numbers, being a predator at the higher levels of the food chain.

4.2 Bushbirds

Thirty-eight species of birds other than waterbirds are listed in Table 4, additional species recorded from the woodlands of the Project Area are shown in Appendix 1. A total of 48 species was recorded over the five surveys throughout the area. As for mammals, amphibians and reptiles, species richness in the Project Area has been compared with Reserves C12632 and C12049 in the Harvey district and the Kemerton Industrial Park as shown in Figure 3.

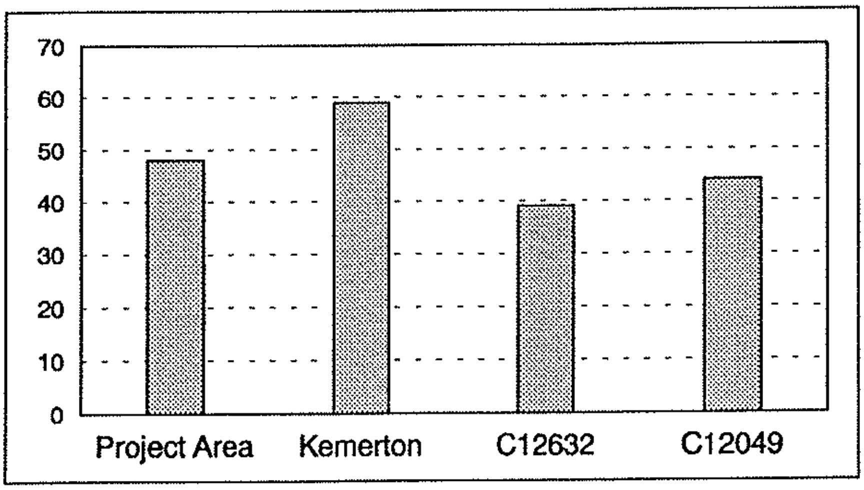

Figure 3 ***Diagram comparing the number of bushbirds recorded in the Project Area with three nearby locations where surveys of similar intensity have taken place.***

Figure 3 shows that the Project Area is richer in bushbird species than both the reserves on the Harvey Flats and compares well, not only with the nearby Kemerton Industrial Park, but with the number of species known from the coastal plain.

4.2.1 Rarē Species

The first report on the Project Area predicted that four rare species of bushbird were likely to occur: Peregrine Falcon; Baudin's Black Cockatoo; Carnaby's Black Cockatoo; Red-eared Firetail. These birds were not recorded during the five surveys, but the first three are wide-ranging or nomadic species and will almost certainly be present from time to time. The Red-eared Firetail, if it does occur in the Project Area, will be restricted to the occasional, young, non-resident bird dispersing from more typical habitat in the Darling Range.

4.3 Wetland Sampling

4.3.1 Waterbirds and Associated Species

A total of 17 species of waterbirds and associated species (Marsh Harrier, Magpie Lark etc.) were recorded during the five surveys of the Project Area (Table 3). Twelve species and 79 individuals were recorded during the five days of the final survey. This contrasts to the short, single visit paid to several adjacent wetlands in the vicinity of the Project Area during the same period: section of Benger Swamp (Melaleuca Road): 10 species, 152 individuals; Swamp on Freckled Duck Drive: 11 species, 247 individuals; Swamp adjacent to Swamp and Typha Roads: 7 species, 40 individuals. Given five days of sampling, these sites would self-evidently have shown more species and a far higher number of individuals than the Project Area.

Table 3 ***Number of waterbirds and associated species recorded during the five surveys of the Project Area.***

WETLAND NUMBER		1	2	3	4	5	6	7	8	9	10	11
WATERBIRD SPECIES												
PHALACROCORACIDAE												
Phalacrocorax sulcirostris	Little Black Cormorant									1		
P. melanoleucos	Little Pied Cormorant	2						14	12	3		
ARDEIDAE												
Ardea pacifica	Pacific Heron			1								
A. novaehollandiae	White-faced Heron	1			5	1		2	1			
PLATALEIDAE												
Threskiornis aethiopica	Sacred Ibis	1			2			9	7	6		
Platalea flavipes	Yellow-billed Spoonbill									1		
ANATIDAE												
Tadorna tadornoides	Australian Shelduck							6		2		
Anas superciliosa	Pacific Black Duck	5	1			1		13	2	7		
A. gibberfrons	Grey Teal					2		30		1		
Chenonetta jubata	Maned Duck							12	2	3		
Biziura lobata	Musk Duck							3				
ACCIPITRIDAE												
Circus aeruginosus	Marsh Harrier	1						1				
RALLIDAE												
Rallus philippensis	Buff-banded Rail					1						

Porzana sp.	Unidentified Crake	1	1	2								
SYLVIIDAE												
Acrocephalus stentoreus	Clamorous Reed-Warbler	1		1					2	1		
Megalurus gramineus	Little Grassbird	2	2	1			1	1				
GRALLINIDAE												
Grallina cyanoleuca	Australian Magpie-lark					1		1				
TOTAL NUMBER OF SPECIES (17)		**8**	**3**	**5**	**2**	**5**	**1**	**11**	**6**	**9**	**0**	**0**

Table 3 has been reproduced as a graph (Figure 4) with the wetland sites ranked in descending order of species richness. In assessing the significance of these wetlands it has to be stressed that the wetlands of the Project Area are not particularly productive sites in terms of their waterbird populations. The maximum number of species in any one wetland is 11 species, as opposed to 30 recorded from Mialla Lagoon and 59 from Benger Swamp. The combined total of waterbirds for the Project Area is 17 species.

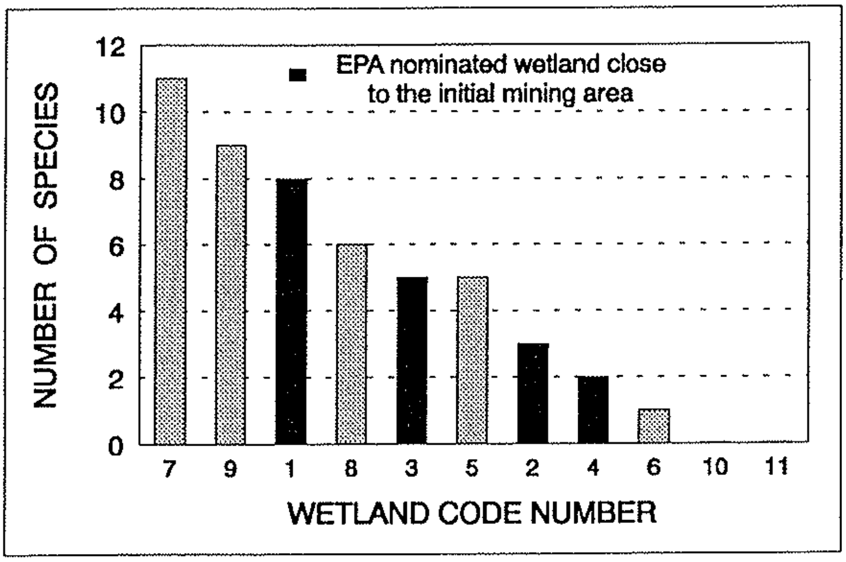

Figure 4 ***Wetlands of the Project Area ranked in descending order of waterbird species richness.***

Of the four EPA nominated wetlands in the vicinity of the initial mining area, Wetland #1 is the most significant (strictly within the local context of the Project Area and stressing that only eight species of waterbirds were recorded). Wetland #3 is of moderate, local significance to waterbirds (5 species) while Wetland #2 and Wetland #4 are of marginal, local significance (3 and 2 species respectively). No waterbirds were recorded in or near the proposed sites of the dredge pond or the settling pond. The settling pond is located in an area of periodically waterlogged heath which has been shown to be lacking in waterbirds and appears to be depauperate in all vertebrate fauna groups.

To bring the waterbirds of the Project Area into a more realistic, local context, the following diagram compares the total waterbird species richness of its wetlands with four other locations in the district: Harvey Flats wetlands (Reserves C12632 and C12049 - Ninox Wildlife Consulting 1982); Darter Swamp and an interconnected wetland - Ninox Wildlife Consulting (1985); Mialla Lagoon - Bamford and Watkins (1983); Benger Swamp -

Sedgwick (1973, 1977). The first two areas used for comparison in Figure 5 have strong similarities with the wetlands of the Project Area. Darter Swamp and Mialla Lagoon are substantially more productive. Benger Swamp, however, differs markedly but has been included as an example of an extremely productive, although highly modified wetland in the general vicinity.

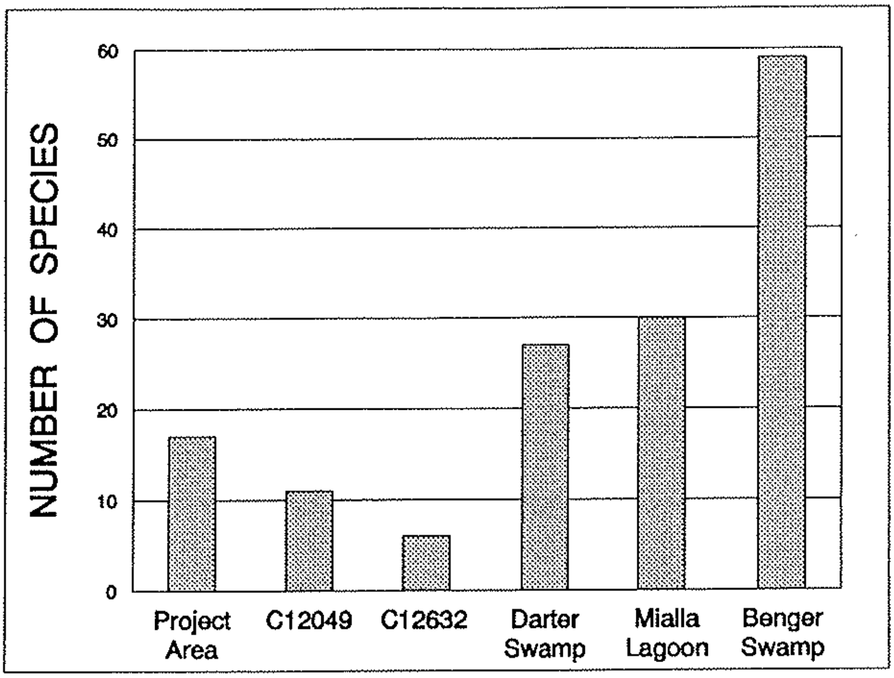

Figure 5 Diagram comparing waterbird species recorded in the Project Area with five other wetlands in the general area.

While the Project Area wetlands are somewhat more productive than those of the two reserves, it is evident from Figure 5 that it lies at the lower end of the species richness scale and cannot be considered as particularly productive in terms of its waterbirds or its capacity to operate as a summer drought refuge. This contrasts with the last three locations shown in Figure 5.

4.3.2 Rare Species

Two rare waterbirds, the Australasian Bittern and the Freckled Duck were listed in the first report on the Project Area as possibly occurring. No rare waterbirds were recorded during the series of surveys undertaken since December 1993 despite specific searches for them. Both species as originally predicted, however, are likely to occur occasionally in the Project Area.

4.3.3 Fish

Several species of fish were observed during the survey. Some of these were positively identified, while a tentative identification could only be made on others before they disappeared into deeper water.

Positive Identifications: Black-stripe Minnow *Galaxiella nigrostriata;* Western Pygmy Perch *Edelia vittata.*

Tentative Identifications: Hardyhead *Atherinosoma* sp.; Swan River goby *Pseudogobius olorum.*

The presence of these native fish in the Project Area wetlands strongly indicates that the site is relatively unpolluted and has not been colonised by the introduced Mosquito Fish.

4.3.4 Terrestrial Species in Wetlands

Wetlands do not only provide habitat for aquatic and semi-aquatic species. A large number of terrestrial species are attracted to the dense vegetation cover found in wetlands. These are listed in Table 4. A total species list for the Project Area is presented in Appendix 1 and is divided into wetland and woodland habitats.

Table 4 List of fauna other than waterbirds recorded in the Project Area wetlands between December 1992 and December 1993.

WETLAND NUMBER		1	2	3	4	5	6	7	8	9	10	11
BIRD SPECIES												
DROMAIIDAE												
Dromaius novaehollandiae	Emu	X		X	X	X	X					
FALCONIDAE												
Falco longipennis	Australian Hobby				X							
F. berigora	Brown Falcon				X							
COLUMBIDAE												
Phaps chalcoptera	Common Bronzewing					X		X		X		
LORIIDAE												
Glossopsitta porphyrocephala	Purple-crowned Lorikeet			X								
PLATYCERCIDAE												
Purpureicephalus spurius	Red-capped Parrot	X	X			X				X		
Barnardius zonarius	Port Lincoln Ringneck	X	X	X			X	X				
Neophema elegans	Elegant Parrot							X				
CUCULIDAE												
Cuculus pyrrhophanus	Fan-tailed Cuckoo			X								
Chrysococcyx lucidus	Shining Bronze-Cuckoo		X	X			X	X				
ALCEDINIDAE												
Dacelo novaeguineae	Laughing Kookaburra					X	X	X		X		
Halcyon sancta	Sacred Kingfisher					X	X			X		

WETLAND NUMBER		1	2	3	4	5	6	7	8	9	10	11
MEROPIDAE												
Merops ornatus	Rainbow Bee-eater							X				
HIRUNDINIDAE												
Hirundo neoxena	Welcome Swallow		X									
Cecropis nigricans	Tree Martin	X	X	X		X	X	X		X		
MOTACILLIDAE												
Anthus novaeseelandiae	Richard's Pipit											X
CAMPEPHAGIDAE												
Coracina novaehollandiae	Black-faced Cuckoo-shrike	X		X	X					X		
MUSCICAPIDAE												
Petroica multicolor	Scarlet Robin									X		
Pachycephala pectoralis	Golden Whistler	X	X					X		X		
P. rufiventris	Rufous Whistler			X	X	X	X			X		
Colluricincla harmonica	Grey Shrike-thrush							X				
Rhipidura fuliginosa	Grey Fantail	X	X	X	X	X	X	X	X	X		
R. leucophrys	Willie Wagtail						X	X				
MALURIDAE												
Malurus splendens	Splendid Fairy-wren	X	X	X	X	X		X		X		
ACANTHIZIDAE												
Sericornis frontalis	White-browed Scrubwren			X	X	X		X				
Gerygone fusca	Western Gerygone	X		X		X	X	X				
Acanthiza apicalis	Inland Thornbill	X	X	X	X	X		X	X	X		
A. chrysorrhoa	Yellow-rumped Thornbill					X				X		
MELIPHAGIDAE												
Anthochaera carunculata	Red Wattlebird	X		X		X	X	X		X		
Lichmera indistincta	Brown Honeyeater	X	X	X	X	X		X				
Phylidonyris novaehollandiae	New Holland Honeyeater	X		X								
P. melanops	Tawny-crowned Honeyeater				X							
Acanthorhynchus superciliosus	Western Spinebill					X						
PARDALOTIDAE												
Pardalotus striatus	Striated Pardalote	X		X			X	X		X		
ZOSTEROPIDAE												
Zosterops lateralis	Silvereye	X			X			X		X		
ARTAMIDAE												
Artamus cinereus	Black-faced Woodswallow							X				
CRACTICIDAE												
Cracticus torquatus	Grey Butcherbird			X		X		X				
CORVIDAE												
Corvus coronoides	Australian Raven	X	X	X			X	X		X		
TOTAL NUMBER OF SPECIES (38)		**16**	**11**	**19**	**12**	**17**	**13**	**22**	**2**	**17**	**-**	**1**
NATIVE MAMMAL SPECIES												
MACROPODIDAE												
Macropus fuliginosus	Western Grey Kangaroo	X		X	X	X		X		X		X
MURIDAE												
Hydromys chrysogaster	Water-rat							S				
TOTAL NUMBER OF SPECIES (2)		**1**	**-**	**1**	**1**	**1**	**-**	**2**	**-**	**1**	**-**	**1**
INTRODUCED MAMMAL SPECIES												
LEPORIDAE												
Oryctolagus cuniculus	Rabbit					S				S		
CANIDAE												
Vulpes vulpes	Fox					S						

WETLAND NUMBER		1	2	3	4	5	6	7	8	9	10	11
FELIDAE												
Felis catus	Feral Cat	1										
BOVIDAE												
Bos taurus	Cattle			S								
TOTAL NUMBER OF SPECIES (4)		1	-	1	-	2	-	-	-	1	-	-
AMPHIBIAN AND REPTILE SPECIES												
LEPTODACTYLIDAE - Frogs												
Crinia glauerti		X	X	X	X	X	X	X		X	X	
C. insignifera		X	X	X		X	X			X	X	
Geocrinia leai		X		X								
Heleioporus eyrei				X		X			X			
HYLIDAE - Frogs												
Litoria adelaidensis		X	X	X	X	X	X	X		X	X	
CHELUIDAE - Side-necked Tortoises												
Chelodina oblonga				X						X		
SCINCIDAE - Skinks												
Bassiana trilineata		X	X	X								
Egernia napoleonis			X									
Tiliqua r. rugosa							X					
ELAPIDAE - Elapid Snakes												
Notechis scutatus occidentalis		X										
TOTAL NUMBER OF SPECIES (10)		6	5	7	2	4	4	2	1	4	3	-

Thirty-eight species of bushbird were recorded in the vegetation communities surrounding the wetlands of the Project Area. The number of bird species typically reflects the structural complexity of the vegetation with the wide range of habitats in and around wetland #7, for example, showing a high species richness (22 species).

Native mammals were poorly represented in wetlands, with only Grey Kangaroos and signs of Water Rat being noted. Introduced mammals were more common, as is the case in many remnant areas of vegetation.

Amphibians were well represented in most wetlands but reptiles were very uncommon with only four species being recorded within wetland vegetation. The woodlands of the area are likely to support a greater range of reptiles, although trapping results during December 1994 were poor, with only 10 species being recorded.

5.0 CONCLUSIONS

Based on the series of surveys undertaken within the Project Area, the following conclusions can be made:

- there is no single habitat of special, local significance to fauna within the Project Area. However, its greatest conservation value flows from its status as a relatively undisturbed area of land representative of the original habitats of the highly modified southern coastal plain;
- the Project Area does not appear to be particularly rich in native mammals and reptiles but, in keeping with other uncleared and cleared wetlands in the district, supports an extensive range of frogs;
- introduced animals such as the fox, cat, House Mouse and Mosquito Fish appear to be relatively uncommon or, in the case of the Mosquito Fish, apparently absent;
- the presence of the Black-stripe Minnow in the Project Area is of particular note since this represents a significant range extension of some 165 kilometres northward of its known distribution. Its occurrence, along with several other native fish in the Project Area suggests that the wetlands are in good condition and are not seriously affected by pollutants or disturbance;
- the Project Area supports a wide, and fairly intact range of bushland birds (as opposed to waterbirds) and provides a valuable feeding, breeding and refuge area for this group;
- waterbirds are poorly represented in the Project Area, not only in terms of low species richness but also in low population levels;
- the ephemeral nature and small size of the areas of open water in most of the wetlands of the Project Area preclude it being considered as a significant waterbird drought refuge;
- the Project Area has the potential to support a relatively large number of rare species of fauna, but no more so than many other pristine or semi-pristine locations in the region where a similar or identical range of rare species are known or predicted to occur;

6.0 RECOMMENDATIONS

A series of recommendations and conservation strategies were given in the first survey report and are reproduced in Appendix 2 for ease of reference. The following additional recommendations refer specifically to the native Black-stripe Minnow, the only species of particular significance recorded to date in the Project Area.

1. Give a high priority to commissioning an outside party specialising in fish to assess whether the species occurs in locations north and south of the Project Area. Dr Gerry Allen of the W.A. Museum suggests that Professor Ian Potter of Murdoch University may be a likely candidate since he and his students have already worked on the species and may have more up to date information on its distribution.

2. Once the question of whether the species is an isolated, northern population restricted to the Project Area is resolved, a management plan should be developed using the species for water quality monitoring and as a measure of the success of modified or artificial wetlands.

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Appendix 1 ***List of vertebrate fauna species recorded or expected to occur in the habitats of the proposed Kemerton Silica Sands Project Area.***

KEY

♠ = Rare species
• = Migratory birds protected by international treaties
⊗ = Introduced species
R = Species recorded during the site assessments
X = Species predicted to occur (W.A. Museum records and literature review results)
(Waterbirds and shorebirds - seasonally present in ephemeral swamps)
A = Predominantly aerial species

HABITAT TYPE

1 = Woodland of Jarrah *Eucalyptus marginata*, Marri *E. calophylla over* Holly-leaved Banksia *Banksia ilicifolia,* Coastal Banksia *B. attenuata* and Firewood Banksia *B. menzeisii* over mixed, dense Proteaceous and Myrtaceous shrubs on aeolian sands.

2 = Woodland of Peppermint *Agonis flexuosa* over *Xanthorrhoea preissii, Hibbertia* species and *Leucopogon* species on aeolian/fluvial sands.

3 = Relatively deep, permanent wetlands surrounded by low-closed forest of *Melaleuca preissiana, M. rhaphiophylla, Eucalyptus rudis* and a closed, tall heath of mixed shrubs.

4 = Shallow ephemeral sumplands surrounded by Paperbarks *M. preissiana, M. rhaphiophylla, Eucalyptus rudis.*

5 = Damplands supporting a low, closed heath of *Pericalymma elliptica, Adenanthos obovata* and *Calothamnus lateralis.*

Full descriptions of plant community codings adopted for the Kemerton Sand Project Area are given in Mattiske and Associates (1993).

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
BIRD SPECIES							
DROMAIIDAE							
Dromaius novaehollandiae	Emu		R	R	X	R	X
PODICIPEDIDAE							
Podiceps cristatus	Great Crested Grebe		-	-	X	-	-
Poliocephalus poliocephalus	Hoary-headed Grebe		-	-	X	X	-
Tachybaptus novaehollandiae	Australasian Grebe		-	-	X	X	-
PELECANIDAE							
Pelecanus conspicillatus	Australian Pelican		-	-	X	-	-
ANHINGIDAE							
Anhinga melanogaster	Darter		-	-	X	-	-
PHALACROCORACIDAE							
Phalacrocorax carbo	Great Cormorant		-	-	X	X	-
P. sulcirostris	Little Black Cormorant		-	-	R	X	-
P. melanoleucos	Little Pied Cormorant				R	R	
ARDEIDAE							
Ardea pacifica	Pacific Heron		-	-	X	R	-
A. novaehollandiae	White-faced Heron		-	-	R	R	-
Ardeola ibis	Cattle Egret	•	-	-	X	X	-
Egretta alba	Great Egret	•	-	-	X	X	-
E. garzetta	Little Egret						
Nycticorax caledonicus	Rufous Night Heron		-	-	X	X	-
Ixobrychus minutus	Little Bittern		-	-	X	X	-
Botaurus poiciloptilus	Australasian Bittern	♠	-	-	X	X	-

Appendix 1 Continued.

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
PLATALEIDAE							
Plegadis falcinellus	Glossy Ibis	•	-	-	X	X	-
Threskiornis aethiopica	Sacred Ibis		-	-	R	X	-
T. spinicollis	Straw-necked Ibis		-	-	X	R	-
Platalea regia	Royal Spoonbill		-	-	X	X	-
P. flavipes	Yellow-billed Spoonbill		-	-	R	X	-
ANATIDAE							
Cygnus atratus	Black Swan		-	-	X	X	-
Stictonetta naevosa	Freckled Duck	♠	-	-	X	X	-
Tadorna tadornoides	Australian Shelduck		-	-	R	R	-
Anas superciliosa	Pacific Black Duck		-	-	R	R	-
A. gibberfrons	Grey Teal		-	-	R	R	-
A. castanea	Chestnut Teal		-	-	X	X	-
A. rhynchotis	Australasian Shoveler		-	-	X	X	-
Malacorhynchus membranaceus	Pink-eared Duck		-	-	X	X	-
Aythya australis	Hardhead		-	-	X	X	-
Chenonetta jubata	Maned Duck		-	-	R	X	-
Oxyura australis	Blue-billed Duck		-	-	X	X	-
Biziura lobata	Musk Duck		-	-	R	X	-
ACCIPITRIDAE							
Elanus notatus	Black-shouldered Kite		A	A	A	A	A
Lophoictinia isura	Square-tailed Kite		A	A	A	A	A
Haliastur sphenurus	Whistling Kite		A	A	A	A	A
Accipiter fasciatus	Brown Goshawk		A	A	A	A	A
A. cirrhocephalus	Collared Sparrowhawk		A	A	A	A	A
Aquila audax	Wedge-tailed Eagle		A	A	A	A	A
Hieraaetus morphnoides	Little Eagle		A	A	A	A	A
Circus aeruginosus	Marsh Harrier		A	A	R	R	A
FALCONIDAE							
Falco peregrinus	Peregrine Falcon	♠	A	A	A	A	A
F. longipennis	Australian Hobby		A	A	A	R	A
F. berigora	Brown Falcon		A	A	A	A	A
F. cenchroides	Australian Kestrel		R	A	A	A	A
TURNICIDAE							
Coturnix novaezealandiae	Stubble Quail		X	X	-	-	-
C. australis	Brown Quail		-	-	X	X	X
Turnix varia	Painted Button-quail		X	X	-	-	-
RALLIDAE							
Rallus philippensis	Buff-banded Rail		-	-	X	R	-
Porzana pusilla	Baillon's Crake		-	-	X	X	-
P. fluminea	Australian Crake		-	-	X	X	-
P. tabuensis	Spotless Crake		-	-	X	X	-
Porzana sp.	Unidentified Crake		-	-	-	R	-
Gallinula ventralis	Black-tailed Native-hen		-	-	X	X	-
G. tenebrosa	Dusky Moorhen		-	-	X	X	-
Porphyrio porphyrio	Purple Swamphen		-	-	X	X	-
Fulica atra	Eurasian Coot		-	-	X	X	-
CHARADRIIDAE							
Vanellus tricolor	Banded Lapwing		-	-	X	X	-
Charadrius ruficapillus	Red-capped Plover		-	-	X	X	-
C. melanops	Black-fronted Plover		-	-	X	X	-
RECURVIROSTRIDAE							
Himantopus himantopus	Black-winged Stilt		-	-	X	X	-
Recurvirostra novaehollandiae	Red-necked Avocet		-	-	X	X	-
SCOLOPACIDAE							
Tringa glareola	Wood Sandpiper	•	-	-	X	X	-
T. hypoleucos	Common Sandpiper	•	-	-	X	X	-
T. nebularia	Greenshank	•	-	-	X	X	-
T. stagnatilis	Marsh Sandpiper	•	-	-	X	X	-
Limosa lapponica	Bar-tailed Godwit	•	-	-	X	X	-
Calidris acuminata	Sharp-tailed Sandpiper	•	-	-	X	X	-
C. ferruginea	Curlew Sandpiper	•	-	-	X	X	-
LARIDAE							
Larus novaehollandiae	Silver Gull		-	-	X	X	-

Appendix 1 Continued.

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
Chlidonias hybrida	Whiskered Tern		-	-	X	X	-
COLUMBIDAE							
Phaps chalcoptera	Common Bronzewing		R	X	R	R	-
CACATUIDAE							
Calyptorhynchus magnificus	Red-tailed Black-Cockatoo		X	X	X	X	-
C. baudinii	Baudin's Black-Cockatoo	♠	X	X	X	X	-
C. f. latirostris	Carnaby's Black-Cockatoo	♠	X	X	X	X	-
LORIIDAE							
Glossopsitta porphyrocephala	Purple-crowned Lorikeet		X	X	X	R	-
PLATYCERCIDAE							
Purpureicephalus spurius	Red-capped Parrot		R	X	R	R	-
Platycercus icterotis	Western Rosella		X	X	X	X	-
Barnardius zonarius	Port Lincoln Ringneck		R	X	R	R	-
Neophema elegans	Elegant Parrot		R	X	R	X	R
CUCULIDAE							
Cuculus pallidus	Pallid Cuckoo		X	X	X	X	-
C. pyrrhophanus	Fan-tailed Cuckoo		X	X	X	R	-
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		X	X	X	R	-
C. lucidus	Shining Bronze-Cuckoo		X	X	R	R	-
STRIGIDAE							
Ninox novaeseelandiae	Southern Boobook		X	X	X	X	-
TYTONIDAE							
Tyto alba	Barn Owl		X	X	X	X	X
T. novaehollandiae	Masked Owl		X	X	X	X	X
PODARGIDAE							
Podargus strigoides	Tawny Frogmouth		R	X	X	X	X
AEGOTHELIDAE							
Aegotheles cristatus	Australian Owlet-nightjar		X	X	X	X	-
ALCEDINIDAE							
Dacelo novaeguineae	Laughing Kookaburra	⊗	R	R	R	R	-
Halcyon sancta	Sacred Kingfisher		R	R	R	R	-
MEROPIDAE							
Merops ornatus	Rainbow Bee-eater	•	A	A	R	A	A
HIRUNDINIDAE							
Hirundo neoxena	Welcome Swallow		-	-	A	R	A
Cecropis nigricans	Tree Martin		R	R	R	R	A
MOTACILLIDAE							
Anthus novaeseelandiae	Richard's Pipit		-	-	-	X	R
CAMPEPHAGIDAE							
Coracina novaehollandiae	Black-faced Cuckoo-shrike		R	X	R	R	-
Lalage sueurii	White-winged Triller		X	X	-	-	X
MUSCICAPIDAE							
Petroica multicolor	Scarlet Robin		R	X	R	X	-
P. goodenovii	Red-capped Robin		X	X	X	X	-
Eopsaltria georgiana	White-breasted Robin		X	X	X	X	-
E. griseogularis	Western Yellow Robin		X	X	X	X	-
Microeca leucophaea	Jacky Winter						
Pachycephala pectoralis	Golden Whistler		R	X	R	R	-
P. rufiventris	Rufous Whistler		R	R	R	R	-
Colluricincla harmonica	Grey Shrike-thrush		X	X	R	X	-
Rhipidura fuliginosa	Grey Fantail		R	R	R	R	-
R. leucophrys	Willie Wagtail		X	R	R	R	X
SYLVIIDAE							
Acrocephalus stentoreus	Clamorous Reed-Warbler		-	-	R	R	-
Megalurus gramineus	Little Grassbird		-	-	R	R	-
MALURIDAE							
Malurus splendens	Splendid Fairy-wren		R	R	R	R	X
M. elegans	Red-winged Fairy-wren		-	-	X	X	-
Stipiturus malachurus	Southern Emu-wren		R	-	-	-	X
ACANTHIZIDAE							
Sericornis frontalis	White-browed Scrubwren		R	X	R	R	X
Smicrornis brevirostris	Weebill		X	X	X	X	-
Gerygone fusca	Western Gerygone		R	R	R	R	-

Appendix 1 Continued.

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
Acanthiza apicalis	Inland Thornbill		R	X	R	R	X
A. inornata	Western Thornbill		X	X	X	R	X
A. chrysorrhoa	Yellow-rumped Thornbill		X	R	R	R	X
NEOSITTIDAE							
Daphoenositta chrysoptera	Varied Sittella		X	X	X	X	-
CLIMACTERIDAE							
Climacteris rufa	Rufous Treecreeper		X	X	X	X	-
MELIPHAGIDAE							
Anthochaera carunculata	Red Wattlebird		R	R	R	R	-
A. chrysoptera	Little Wattlebird		X	X	X	X	-
Lichenostomus virescens	Singing Honeyeater		X	X	X	X	X
Melithreptus lunatus	White-naped Honeyeater		X	X	X	X	-
Lichmera indistincta	Brown Honeyeater		R	X	R	R	X
Phylidonyris novaehollandiae	New Holland Honeyeater		R	X	X	R	X
P. nigra	White-cheeked Honeyeater		X	X	X	R	X
P. melanops	Tawny-crowned Honeyeater		R	-	-	R	X
Acanthorhynchus superciliosus	Western Spinebill		R	X	X	R	X
EPHTHIANURIDAE							
Ephthianura albifrons	White-fronted Chat		-	-	-	-	X
DICAEIDAE							
Dicaeum hirundinaceum	Mistletoebird		X	X	X	X	-
PARDALOTIDAE							
Pardalotus punctatus	Spotted Pardalote		X	X	X	X	-
P. striatus	Striated Pardalote		X	R	R	R	-
ZOSTEROPIDAE							
Zosterops lateralis	Silvereye		R	X	R	R	X
PLOCEIDAE							
Emblema oculata	Red-eared Firetail	♠	-	-	X	X	X
GRALLINIDAE							
Grallina cyanoleuca	Australian Magpie-lark		X	X	R	R	X
ARTAMIDAE							
Artamus cinereus	Black-faced Woodswallow		R	A	R	R	A
A. cyanopterus	Dusky Woodswallow		R	A	A	A	R
CRACTICIDAE							
Cracticus torquatus	Grey Butcherbird		R	R	R	R	X
Gymnorhina tibicen	Australian Magpie		R	R	X	R	X
Strepera versicolor	Grey Currawong		R	X	X	X	-
CORVIDAE							
Corvus coronoides	Australian Raven		R	R	R	R	X
MAMMAL SPECIES							
TACHYGLOSSIDAE							
Tachyglossus aculeatus	Short-beaked Echidna		X	X	-	-	X
DASYURIDAE							
Dasyurus geoffroii	Chuditch	♠	X	X	X	X	X
Phascogale tapoatafa	Brush-tailed Phascogale		X	X	X	X	-
Antechinus flavipes	Yellow-footed Antechinus		X	X	X	X	X
Sminthopsis gilberti	Common Dunnart		X	X	X	X	X
S. griseoventer	Common Dunnart		X	X	X	X	X
PERAMELIDAE							
Isoodon obesulus	Southern Brown Bandicoot	♠	X	X	X	X	X
PETAURIDAE							
Pseudocheirus peregrinus occidentalis	Western Ringtail Possum	♠	-	X	-	-	-
PHALANGERIDAE							
Trichosurus vulpecula	Common Brushtail Possum		X	X	X	X	-
BURRAMYIDAE							
Cercartetus concinnus	Western Pygmy-possum		R	X	X	X	-
TARSIPEDIDAE							
Tarsipes rostratus	Honey-possum		X	-	X	X	X
MACROPODIDAE							
Macropus irma	Western Brush Wallaby		R	X	X	X	X

Appendix 1 Continued.

COMMUNITY			WOODLANDS		WETLANDS		
HABITAT TYPE			1	2	3	4	5
M. fuliginosus	Western Grey Kangaroo		R	R	R	R	R
MOLOSSIDAE							
Tadarida australis	White-striped Mastiff-bat		A	A	A	A	A
Mormopterus planiceps	Little Mastiff-bat		A	A	A	A	A
VESPERTILIONIDAE							
Nyctophilus major	Greater Long-eared Bat		A	A	A	A	A
N. gouldi	Gould's Long-eared Bat		A	A	A	A	A
N. geoffroyi	Lesser Long-eared Bat		A	A	A	A	A
Chalinolobus gouldii	Gould's Wattled Bat		A	A	A	A	A
C. morio	Chocolate Wattled Bat		A	A	A	A	A
Falsistrellus mackenziei	Great Pipistrelle		A	A	A	A	A
Eptesicus regulus	King River Eptesicus		A	A	A	A	A
MURIDAE							
Hydromys chrysogaster	Water-rat		-	-	R	R	-
Rattus fuscipes	Bush Rat		X	X	X	X	X
R. rattus	Black Rat	⊗	X	X	X	X	X
Mus musculus	House Mouse	⊗	X	X	X	R	X
LEPORIDAE							
Oryctolagus cuniculus	Rabbit	⊗	R	R	R	R	X
CANIDAE							
Vulpes vulpes	Fox	⊗	X	X	X	R	X
FELIDAE							
Felis catus	Feral Cat	⊗	X	X	X	R	X
BOVIDAE							
Bos taurus	Cattle	⊗	X	X	X	R	X

AMPHIBIAN AND REPTILE SPECIES

LEPTODACTYLIDAE - Frogs					
Crinia georgiana	-	-	R	R	X
C. glauerti	-	-	R	R	-
C. insignifera	-	-	R	R	R
Geocrinia leai	-	-	-	R	-
Heleioporus eyrei	R	X	R	R	R
H. psammophilus	X	X	X	X	X
Limnodynastes dorsalis	X	X	X	X	X
Myobatrachus gouldii	X	X	-	-	-
Pseudophryne guentheri	X	X	X	R	R
HYLIDAE - Frogs					
Litoria adelaidensis	-	-	R	R	X
L. moorei	-	-	X	R	-
CHELUIDAE - Side-necked Tortoises					
Chelodina oblonga	-	-	R	R	-
GEKKONIDAE - Geckos					
Phyllodactylus marmoratus	X	X	X	X	-
PYGOPODIDAE - Legless Lizards					
Aprasia repens	X	X	-	-	X
Lialis burtonis	X	X	-	-	R
Pygopus lepidopodus	X	X	-	-	X
AGAMIDAE - Dragon Lizards					
Pogona m. minor	X	X	X	R	X
SCINCIDAE - Skinks					
Bassiana trilineata	-	-	X	R	X
Cryptoblepharus plagiocephalus	R	X	X	X	-
Ctenotus impar	X	X	-	-	X
C. fallens	X	X	X	X	X
C. lesueurii	X	X	-	-	-
Egernia luctuosa	-	-	X	X	-
E. napoleonis	R	X	R	R	-
Hemiergis quadrilineata	R	X	X	X	X
Lerista distinguenda	X	X	-	R	-
L.. elegans	X	X	-	-	-
Menetia greyii	X	X	X	X	X

Appendix 1 Continued.

COMMUNITY		**WOODLANDS**		**WETLANDS**		
HABITAT TYPE		**1**	**2**	**3**	**4**	**5**
Morethia lineoocellata		X	X	-	-	X
Tiliqua r. rugosa		R	X	X	R	X
VARANIDAE - Monitors						
Varanus gouldii		R	X	X	X	X
V. rosenbergi		X	X	X	X	X
TYPHLOPIDAE - Blind Snakes						
Ramphotyphlops australis		X	X	-	-	-
R. pinguis		X	X	-	-	-
BOIDAE - Pythons						
Morelia spilota imbricata	♠	X	X	X	X	X
ELAPIDAE - Elapid Snakes						
Demansia psammophis reticulata		X	X	-	-	-
Drysdalia coronata		X	X	X	X	X
Echiopsis curta		X	X	-	-	-
Neelaps bimaculata		X	X	-	-	-
Notechis scutatus occidentalis		X	X	X	R	X
Pseudonaja a. affinis		X	X	X	X	X
Rhinoplocephalus gouldii		X	X	X	X	X
R. nigriceps		X	X	X	X	X
Simoselaps bertholdi		X	X	-	-	-

Appendix 2 Impact management and rehabilitation strategies reproduced from the first report on the Project Area.

In order to reduce the impactsof mining and support facilities on fauna it is recommended that :

- the topsoil, debris and leaf litter removed from all areas of operation should be stockpiled for use in rehabilitation programmes. The topsoil contains a seed store of native vegetation and the log and litter debris provide micro-habitat for vertebrate and invertebrate species, allowing early recruitment of fauna to rehabilitated areas;
- unnecessary clearing of vegetation, particularly trees, in all locations is avoided and that areas of natural vegetation adjacent to operations are left undisturbed where the risk of fire is low;
- rehabilitation of cleared areas which are no longer required and which can be practicably rehabilitated, commences as soon as possible and is structured to encourage fauna by providing micro-relief and dense vegetation cover;
- the increased run-off from mining areas and access roads is channeled and restricted in such a manner that siltation of swamps is minimised;
- off-road vehicles are restricted to main access roads. Disused tracks and grid lines should be blocked, and if compacted, deep ripped to encourage plant regrowth and the subsequent rehabilitation of faunal habitats;
- firearms and pets are excluded from the project area;
- all current and new exploration drill-holes are immediately capped or sealed to prevent small animals from being trapped and periodic checks are made on all caps to test their integrity;
- adequate rubbish disposal procedures are applied, especially for food refuse, in order to discourage scavenging by introduced foxes and feral cats.

Although many of the wetlands present in the project area will be left undisturbed, some have already been disturbed by exploration grid lines and may be further affected by mining operations. It is therefore recommended that:

- rehabilitation includes the construction of artificial wetlands to compensate for any loss of this specialised habitat within the project area. The satisfactory design of such wetlands is crucial if the many species of vertebrates that utilise this habitat are to be encouraged. Many studies of the requirements of native fauna have been completed, or are in progress, that will assist with this procedure. Preliminary notes on artificial wetlands are given at the end of this appendix.

One of the main areas of potential impact of a project is the devolution of environmental responsibility from the proponent to sub-contracting teams who may not have been adequately briefed on the constraints placed on the development and who unknowingly carry out environmentally unsound practices in good faith, or knowingly take short-cuts for reasons of economy. Impacts such as excessive clearing, rubbish dumping, casual disposal of waste lubricants, leaving drill holes uncapped or the accidental or purposeful lighting of bushfires are typical examples which have been recorded. In order to reduce these potential impacts and reinforce the proponent's commitment to and ultimate responsibility for environmental concerns, it is recommended that:

- all sub-contracting teams are adequately briefed by the proponents and made aware of the environmental constraints imposed on the project and themselves;
- in consideration of the fact that areas such as permanent and semi-permanent wetlands are a critical resource in south-west Western Australia, a penalty system for breaches of sound environmental practices is put in place by the proponents;
- the proponents give consideration to preparing a brief handout on sound environmental practices which could be given to, and signed by, all members of sub-contracting teams and permanent employees during site induction. The pamphlet should cover the aspects defined in previous sections of this report;
- the proponent ensures that regular spot-checks for breaches of sound environmental practises are carried out by delegated individuals so that problems can be anticipated or rectified at an early stage.

Wetland Rehabilitation

This review explores various methods of rehabilitating or creating waterbird habitat to replace that lost through development of traditional sites. The creation of a variety of wetland types to encourage waterbirds is assessed, as is planned re-vegetation and rehabilitation with the objective of raising the quality of the area for nomadic and resident birds.

Waterbirds have three major requirements - water, shelter and food. Each species has its own particular needs and niches so that the greater the variety of water depths and food sources available, the greater the diversity of species which will be attracted to the wetland.

Water: in the construction of an artificial wetland, a variety of water depths is most important with extensive areas of shallows and mudflats being the single greatest factor in attracting a range of waterbirds. Where water is less than 1 metre deep, adequate light reaches the bottom and encourages the growth of plant life. Aquatic plants and the invertebrates on or near them are eaten by waterbirds. Deeper areas are used by diving species which feed on fish or crustaceans but deep water is much less diverse than shallows.

In a natural wetland, seasonal variations in water levels allow access to new food sources and release soil-bound nutrients which increase productivity. Such variations should be allowed to occur naturally in artificial wetlands or should be accomplished by artificially raising and lowering of water levels; this aspect may eventuate in the project through normal drawdown/pumping regimes associated with the mine. The edges of the wetland should be as irregular as possible since this increases the area of available shallows and is more pleasing aesthetically.

Shelter: many waterbirds utilise reeds and sedges for shelter, protection from predators and in some cases nesting. Plantings of various species of sedges and reeds should be made in and around the shallow areas. Other birds require shrubs and trees set back from the water to provide roosting, refuge and, eventually, nesting sites when the trees are large enough. Shrubs and trees should not be planted too close together, since this may obstruct flight-paths to and from the water surface. Ideally, the plants should be species which are adapted to local conditions. A list of suitable species is provided at the end of this review.

Islands are an extremely important factor in encouraging waterbirds to artificial wetlands. They increase the amount of shallow water available, provide shelter from the weather when vegetated and if constructed at a sufficient distance from the shore in deeper water, become predator-free refuges. Three types of island should be considered:

- higher relief vegetated islands with gently sloping access ramps;
- low relief, bare, sandy islets subject to partial seasonal inundation or temporarily exposed by drawdown;
- anchored log piles for use as roosts.

These islands can be constructed from rubble, bulldozer spoil and dead trees and set well back from the shorelines so that drawdown does not allow access to them by domestic pets, feral cats and foxes.

Food: if the conditions outlined in the previous section are fulfilled, an adequate food supply for waterbirds will naturally follow. There is usually no need to introduce aquatic vertebrates and invertebrates to the water as they will tend to colonise from other areas.

Anticipated Problems: local conditions such as the presence of superphosphate fertilisers, water turbidity, excess acidity or alkalinity, increased salinity and algal blooms can seriously effect the capacity of a wetland to support waterfowl and can seriously lower food supplies. Treatment to rectify these problems after the event can be time-consuming and expensive. However, valuable information for attempting to control, or forestall these effects is given in "Ducks, Ponds and People (Swift 1976). Design strategies are also provided in "Farm Dams for Wildlife and Stock" (NSW National Parks and Wildlife Service 1983). A profile of an 'ideal' wetland is described in "Wetlands of the south-west of Western Australia, with special reference to the Busselton area" (Fisheries and Wildlife 1978).

KEMERTON SANDS AREA

ENTERED ON GIS

Name: Report of Biological Survey – Phase 1: Kemerton Industrial Estate Volume 2 - Appendices
Date: 28/04/2006
Capture Author: Thomas Leong / Ian Steward

Comments:
Polygon
Created to match documented study area with high level of accuracy

Accuracy Levels:
- High = Document contained visual and or described spatial references easily copied, resulting in little or no polygon boundary errors
- Acceptable = Document contained visual references with complex boundaries, resulting in minor boundary errors
- Low = Document contained little or no visual references, resulting in polygon boundary errors

Attributes
Report Info – Captured without problems
Custodial/Contact – Captured without problems
Content – Captured without problems

REPORT OF BIOLOGICAL SURVEY - PHASE 1: KEMERTON INDUSTRIAL ESTATE

VOLUME 2 - APPENDICES

for

LandCorp

ME98-002-006 25 February 1999

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LIST OF APPENDICES

APPENDIX A

REQUIREMENTS FOR BIOLOGICAL SURVEY OF KEMERTON INDUSTRIAL ESTATE

APPENDIX A

KEMERTON BIOLOGICAL SURVEY PHASE 1

REQUIREMENTS FOR BIOLOGICAL SURVEY OF KEMERTON INDUSTRIAL ESTATE

DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) REQUIREMENT (extracted from DEP letter)	WORK UNDERTAKEN IN PHASE 1	WORK TO BE UNDERTAKEN IN PHASE 2
a. Review of Existing Relevant Data and Information		
Review relevant information on flora, vegetation, vertebrate fauna and invertebrate groups from other environmental studies and publications in the project area	Some information incorporated or referenced in this report	Further information will be included in the Phase 2 report
Access current information on declared rare and priority flora species known from, or likely to occur in, the project area on the basis of the consultants' experience, and the databases held by Department of Conservation and Land Management (CALM) prior to field work	Included in this report	To be updated in Phase 2
Access current information on rare and endangered fauna species known from, or likely to occur in, the project area on the basis of the consultants' experience, and the databases held by the Western Australian Museum (WA Museum) and CALM prior to fieldwork	Included in this report	To be updated in Phase 2
Review relevant studies of the wetlands, damplands, and sumplands of the project area	Discussed briefly in this report	Further detail to be included in Phase 2 after dry-season and wet-season field work
Review land tenure and remnant native vegetation areas to delineate potential study focus areas	Discussed in this report	May require refinement in Phase 2
b. Survey Work		
Survey the flora of the project area, focussing mainly on the areas defined as less disturbed in the initial review of remnant native vegetation	Included in this report	Follow-up flora surveys to be carried out in Phase 2 in winter and spring
Carry out specific searches for declared rare flora and priority flora known from, or likely to occur in, the project area	Included in this report	Follow-up flora surveys to be carried out in Phase 2 in winter and spring

APPENDIX A - *Page 2*

DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) REQUIREMENT (extracted from DEP letter)	WORK UNDERTAKEN IN PHASE 1	WORK TO BE UNDERTAKEN IN PHASE 2
Define and map the native vegetation on a scale suitable for an assessment at the local scale	Included in this report	
Define and map the condition of the vegetation of the project area, using the condition scale used by the DEP (Keighery 1994) and Ministry for Planning	Discussed, and results included in this report	May be modified if required
Record sufficient vegetation plots in representative sites (10 m x 10 m, to be consistent with the minimum standards set by the CALM - Salinity Action Plan data collection methods, e.g. as used by Gibson et al. (1994), to enable statistical analyses of the data)	Included in this report	Further quadrats to be installed in February and follow-up checking of all quadrats in winter and spring 1999
Survey the vertebrate fauna (birds, mammals, reptiles, fish, amphibians) of the project area through trapping at representative sites which preferably should overlap with the vegetation plots and other appropriate searches	Included in this report	Follow-up surveys in autumn 1999
Make specific searches for rare and endangered vertebrate fauna species known from, or likely to occur in, the project area	Included in this report	Ongoing in Phase 2
Survey selected invertebrate groups (crustaceans, spiders, scorpions, and centipedes) using techniques consistent with those used by WA Museum and CALM		Field work in February 1999 and will be discussed in Phase 2 report
Survey wetlands using techniques consistent with those used by CALM and academic specialists	Some preliminary data on wet-ands in this report	Mostly undertaken in Phase 2
c. Report writing and analysis (including maps, etc. from above as appropriate)		
Review the conservation status of all flora species recorded for the project area, specifically commenting on Declared Rafe Flora (DRF), Priority Flora, and other significant flora (species at the ends of their range, previously unknown, disjunct populations, etc.)	Preliminary in this report	Expanded in Phase 2 after spring 1999 survey
Indicate the location of populations of DRF, Priority Flora and other species of conservation significance on a map	Preliminary in this report	Expanded in Phase 2 after spring 1999 survey
Indicate the occurrence of the flora species recorded in the vegetation mapping units defined	Preliminary in this report	Expanded in Phase 2 after spring 1999 survey

APPENDIX A - *Page 3*

DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) REQUIREMENT (extracted from DEP letter)	WORK UNDERTAKEN IN PHASE 1	WORK TO BE UNDERTAKEN IN PHASE 2
Describe the vegetation mapping units, including general descriptions, and descriptions of representative stands and key site parameters (soils, landforms, etc.)	Provided in this report	Modifications expected in Phase 2
Review the conservation status of all vertebrate fauna species recorded for the project area, specifically commenting on rare and endangered species, and other significant species (species at the ends of their range, disjunct populations, etc.)	Preliminary in this report	Expanded in Phase 2 after autumn 1999 survey
Assess the biological values of the flora, vegetation, vertebrate fauna, invertebrate fauna, wetlands, damplands, and sumplands areas in the local and regional context by reference to other data and published material: including particular attention to rare and endangered flora and fauna species, restricted plant communities, threatened ecological communities, land tenure, clearing activities, linkages and corridor values, and threatening processes	Preliminary in this report	Expanded in Phase 2
Assess the relative biological values of the areas within and near the project area in the context of assisting in reviewing potential options or alternatives for industrial and conservation areas	Presented in this report	Minor modifications expected in Phase 2

LANDCORP AND DRD REQUIREMENTS IN ADDITION TO THE ABOVE (extracted from Project Brief)	WORK UNDERTAKEN IN PHASE 1	WORK TO BE UNDERTAKEN IN PHASE 2
Linkages and corridors to be addressed	Presented in this report	Expanded in Phase 2 report
Landscape values	Presented in this report	Expanded in Phase 2 report
Research and education values	Presented in this report	Expanded in Phase 2 report
Evaluation of possible approaches for long-term air quality monitoring	Preliminary vegetation assessment in this report	Expanded in Phase 2 report

APPENDIX B

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
VEGETATION CLASSIFICATION
(derived from Muir 1992)

LIFE FORM/ HEIGHT CLASS	CANOPY COVER AND % SURFACE COVER			
	DENSE d 100-70%	MODERATE c 70-30%	SPARSE i 30-10%	VERY SPARSE r 10-2%
TZ Trees over 60m	Dense V. Tall Forest	Very Tall Forest	Very Tall Woodland	Open Very Tall Woodland
T Trees 30m - 60m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees 5m or less	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
FZ Palms over 60m	Dense V. Tall Palms	Very Tall Palms	Sparse V. Tall Palms	Open Very Tall Palms
F Palms 30-60m	Dense Tall Palms	Tall Palms	Sparse Tall Palms	Open Tall Palms
FA Palms 15-30m	Dense Palms	Palms	Sparse Palms	Open Palms
FB Palms 5-15m	Dense Medium Palms	Low Palms A	Sparse Low Palms A	Open Low Palms A
FC Palms under 5m	Dense Low Palms	Low Palms B	Sparse Low Palms B	Open Low Palms B
KT Mallee Tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee Shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
SZ Shrubs 5-10m	Dense V. Tall Thicket	Very Tall Thicket	Very Tall Scrub	Open Very Tall Scrub
S Shrubs 2-5m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
R Cycads (Zamias)	Dense Cycads	Cycads	Open Cycads	Very Open Cycads
P Mat Plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass (Spinifex)	Dense Hum. Grass	Mid-Dense Hum.Grass	Hummock Grass	Open Hummock Grass
GZ Bunch Grass over 2m	Dense V. Tall Grass	Very Tall Grass	Open Very Tall Grass	Very Open Very Tall Grass
GT Bunch Grass 0.5m -2m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch Grass under 0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
EZ Bamboo over 5m	Dense V Tall Bamboo	Very Tall Bamboo	Open V. Tall Bamboo	Very Open V. Tall Bamboo
ET Bamboo 2-5m	Dense Tall Bamboo	Tall Bamboo	Open Tall Bamboo	Very Open Tall Bamboo
EL Bamboo under 2m	Dense Low Bamboo	Low Bamboo	Open Low Bamboo	Very Open Low Bamboo
J Herbaceous	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VZ Sedges over 2m	Dense V. Tall Sedges	Very Tall Sedges	Open V. Tall Sedges	Very Open V. Tall Sedges
VT Sedges 0.5m - 2m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges less than 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
XF Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
STRUCTURE MODIFYING PERENNIALS				
SMP (Vines, Creepers, epiphytes)	Dense vines/epiphyte	vines / epiphytes	Open Vines /epiphyte	Very Open Vines / epiphytes
AQUATIC COVERAGE				
A Aquatics	Dense Aquatics	Aquatics	Open Aquatics	Very Open Aquatics
CRYPTOGAMIC SURFACE COVERAGE				
XM Mosses	Dense Mosses	Mosses	Open Mosses	Very Open Mosses
BS Lichens (Soil)	Dense Soil Lichens	Soil Lichens	Open Soil Lichens	Very Open Soil Lichens
BF Lichens (Bark or Wood)	Dense Plant Lichens	Plant Lichens	Open Plant Lichens	Very Open Plant Lichens
BR Lichens (Rock)	Dense Rock Lichens	Rock Lichens	Open Rock Lichens	Very Open Rock Lichens
BL Liverworts	Dense Liverworts	Liverworts	Open Liverworts	Very Open Liverworts

APPENDIX C

FAUNA STUDY AND REVIEW
M.J. AND A.R. BAMFORD CONSULTING ECOLOGISTS

KEMERTON FAUNA STUDY AND REVIEW

1998

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28/01/'99

EXECUTIVE SUMMARY

The vertebrate fauna of the Kemerton Industrial Area and nearby regions has been studied on a number of occasions. Surveys were carried out around several wetlands for Alcoa in 1982, surveys have been conducted as part of environmental assessment and monitoring for the Gwalia Silica Sands Mine in the period 1993-1998, and studies were carried out over the whole area in 1998 to determine the conservation value of the Buffer Zone.

The Alcoa site is in the west buffer zone and consists of a chain of wetlands, some partly cleared and permanent, others undisturbed and seasonal. The study consisted of a week's intensive field work in summer, involving trapping and daily observations of waterbirds. Some observations were also made in adjacent eucalypt/banksia woodland, but the focus of the study was upon wetlands. The Gwalia studies have focussed upon a large area on the north-east buffer zone. Much of this area consists of low-lying land which is seasonally damp or inundated, and supports dense heathland or shrubland. There are also some areas of eucalypt/banksia woodland, and some discrete, seasonal wetlands.

The current study involved visiting as much of the buffer zone as possible, with trapping carried out at nine sites. These sites were spread from the southern edge to just beyond the northern end of the buffer zone, and in most cases sampled areas and vegetation types that had not been sampled for Alcoa or Gwalia. Some sites were close to wetlands, with other sites located in upland vegetation.

In all studies, the trapping was designed to catch frog, reptile and mammal species, and trapping results were supplemented with searching and opportunistic observations on all fauna, including freshwater fish. In 1998, systematic observations on birds were made in conjunction with site visits to check traps.

The Alcoa and Gwalia projects provided detailed data on two small areas within the Kemerton region, while the purpose of the current study was to review existing data and to carry out supplementary sampling to add to this information. In particular, the aim of the current study was to assess the value for fauna of the buffer zone and of areas currently outside the buffer zone. Because the buffer zone is required around the Industrial Area as part of the management of industry on the site, bringing together and supplementing information on fauna of the region makes it possible to maximise the conservation value of this zone.

During surveys of vertebrate fauna, it is normal practice to prepare a list of species expected to occur at a site on the basis of location and habitats present. It is also normal practice to prepare a list of species which may have occurred at the site but which are known to have become extinct in the region. Following detailed field work, it is then possible to prepare a list of the species actually recorded on the site. Despite intensive field work, there will always be some expected species which are either too cryptic or too vagrant to be recorded, but the field studies can provide important information on levels of abundance and local patterns of distribution of the majority of species.

These species are not of the same level of significance. For example, the Peregrine Falcon, Black-striped Minnow and Square-tailed Kite are classed as Priority species by the WA Department of Conservation and Land Management. These are species which have declined, are not considered to be threatened but are of concern and need to be monitored. The Falcon and the Kite may visit the site infrequently, but the Minnow is a special case, as it occurs in only a few wetlands at Kemerton, and this population is a relict, with the nearest known population being near Margaret River.

In contrast, the Chuditch and the Short-billed Black-Cockatoo are Schedule 1 species (rare and likely to become extinct) under the WA Wildlife Conservation Act. Any site which these species use regularly is therefore important. At Kemerton, the Short-billed Black-Cockatoos were observed in pine plantations north of the buffer zone, although they almost certainly forage in native vegetation as well. The record of the Chuditch was based upon a road-killed specimen found in 1997, and this cannot be taken to indicate that the species is resident on the site.

Although the Kemerton region supports a rich fauna because it contains a large area of remnant native vegetation, some differences across the region were found. For example, the Black-striped Minnow was only found in a group of interconnected wetlands in the north-west of the region. These wetlands lie on the Gwalia lease, but part of the wetland area has recently been handed to the Department of Conservation and Land Management. The Quenda also appeared to have a restricted local distribution, with most evidence of the species found around a wetland just south of Treasure Road. Trapping results and bird observations suggested that the upland vegetation in the vicinity of Treasure Road, east of Mialla Lagoon and the chain of wetlands south of the Lagoon, is particularly rich in fauna, including a number of species of local significance. This situation may exist because a range of vegetation types can be found across a short distance from the wetlands in the valley to eucalypt/banksia woodland on the sandy uplands. In contrast, eucalypt/banksia woodland in the northern buffer zone appeared to have lower levels of abundance of fauna species.

The sites located to the north of and outside the buffer zone differed in vegetation type from other sites, supporting lowland banksia woodland rather than eucalypt/banksia woodland in the uplands. This difference may have affected the fauna species present, as some of the more conspicuous species of local conservation significance, such as the Golden Whistler and Grey Currawong, were either scarce or absent in the lowland banksia woodland. It should be stressed, however, that the level of sampling carried out cannot generate sample sizes which support detailed statistical analyses.

In conclusion, the vertebrate fauna of the Kemerton region is rich and distinctive. This distinctiveness comes from the number of species present which have declined elsewhere on the Swan Coastal Plain between Perth and Bunbury, and the number of species that are of national conservation significance. In a sense, the region supports a relictual assemblage of Swan Coastal Plain fauna. The most important areas within this region are the shallow, seasonal wetlands around the Gwalia Silica Sands Mine, and the forests and wetlands of the western sector of the region, from Mialla Lagoon to the southern edge of the buffer zone.

Combining the results of all studies, the vertebrate fauna of the Kemerton region has the following numbers of species in the major taxonomic groups:

	Expected	Observed	Locally extinct
freshwater fish	4	3	?1
amphibians	9	8	?
reptiles	31	21	0
birds	125	98	4
mammals	25	18	5

The Kemerton region supports a rich fauna, principally because it includes a large area of remnant native vegetation, whereas much of the surrounding coastal plain has been developed for agriculture. This fauna includes species which are of regional conservation significance and species which are of national conservation significance.

If a species is still common throughout much of its range but has declined in some regions, its persistence at a few locations within that part of its range where it has declined can be said to be of regional conservation significance. At Kemerton, a number of species were recorded which have declined or disappeared from the coastal plain between Perth and Bunbury. These include the Western Pygmy Perch *Edelia vittata*, Red-legged Skink *Ctenotus labillardieri*, Mourning Skink *Egernia luctuosa*, Golden Whistler *Pachycephala pectoralis*, Grey Currawong *Strepera versicolor*, Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*, Western Rosella *Platycercus icterotis*, Honey Possum *Tarsipes rostratus*, Western Pygmy Possum *Cercartetus concinnus* and Brush-tailed Possum *Trichosurus vulpecula*. Several of these species are still common in the jarrah forest of the nearby Darling Scarp. Individuals of some of these species may travel between Kemerton and large areas of native vegetation on the Darling Scarp, but others are probably isolated populations in the Kemerton area.

Another form of regional conservation significance rests with bird species which breed colonially, as all the birds which may forage over a large area return to only a few locations to breed. The wetlands on the Alcoa site support large breeding colonies of the Darter *Anhinga melanogaster*, Little Pied Cormorant *Phalacrocorax melanoleucos* and Nankeen Night Heron *Nycticorax caledonicus*, while a small wetland on the Gwalia site supports a small breeding colony of the Little Pied Cormorant.

Species are considered to be of national conservation significance if they have declined in abundance and are listed as threatened species using categories recognised by the state or federal government, or the IUCN. At Kemerton, species recorded which fall into this category include: the Black-striped Minnow *Galaxiella nigrostriata*, Short-billed Black-Cockatoo *Calyptorhynchus latirostris*, Chuditch *Dasyurus geoffroyi*, Quenda or Southern Brown Bandicoot *Isoodon obesulus* and Rakali or Water Rat *Hydromys chrysogaster*. Species of national conservation significance expected to use the site but not observed include the South-West Carpet Python *Morelia spilota imbricata*, Freckled Duck *Stictonetta naevosa*, Square-tailed Kite, Peregrine Falcon *Falco peregrinus* and the Masked Owl *Tyto novaehollandiae*. In addition, the undescribed skink *Glaphyromorphus* sp., which has not been assigned a conservation status and could be extinct, may be present.

CONTENTS

INTRODUCTION

An overall environmental investigation of the Kemerton Industrial Estate and nearby areas was undertaken to guide future expansion of industry in the area, whilst retaining environmental values. As part of these investigations, we reviewed existing information on vertebrate fauna and carried out additional field work to supplement these data. The fauna study had the following aims:

- To investigate the conservation value of the total area in a regional (Southern Swan Coastal Plain) context. This conservation value includes the fauna species present, fauna habitats (including wetlands), endangered fauna; wildlife linkage/corridors and research/educational values.
- To compare the relative values of different sectors of the area, with expansion of industry in mind.
- To generate baseline data from standardised fauna sampling, so that these data can be used for monitoring of future impacts.

Prior to the 1998 field programme carried out as part of this project, major fauna studies had taken place at specific localities within the Kemerton region in 1982 for Alcoa (Bamford and Watkins 1983), and for Gwalia in 1993 (Ninox Wildlife Consulting 1994) and 1996-1998 (Bamford & Bamford 1998, 1999). The aim of this report is to combine the data collected in these two studies with information collected over a large area in 1998.

METHODS

Previous studies

All three studies used similar techniques to determine the vertebrate fauna, and details of sampling techniques used for the Alcoa and Gwalia studies can be found in the relevant reports. Study areas for these two projects are indicated on Figure One.

The Alcoa study focussed upon a series of wetlands, both permanent and seasonal, located close to the Old Coast Road. These wetlands are located in a swale between distinct stabilised dunes. Sampling took place in December 1982 and activities included pitfall-trapping for frogs, reptiles and small mammals, mist-netting for bats, counts of waterbirds and opportunistic observations on all fauna. These observations extended into eucalypt/banksia woodland of uplands adjacent to the wetlands.

The Gwalia study examined a larger area in the north-east of the Kemerton region. This site has a distinct topography, consisting largely of seasonally damp or inundated palusplain vegetated with a low, dense shrubland. There are a number of well-defined but seasonal wetlands located in this region. Slightly higher ground supports eucalypt/banksia woodland, often mixed with *Kunzea* tall shrubland on the margins of the palusplain. Some parts of the woodland in the northern sector of the Gwalia study area had been replaced by pine plantations which were harvested in the early 1990s.

Sampling of the Gwalia study area involved seasonal visits to monitor waterbird numbers on the seasonal wetlands, and a trapping programme which took place during the last of these visits, in November 1993. Activities included pitfall-trapping for frogs, reptiles and small mammals, Elliott and cage trapping for small and medium-sized mammals, mist-netting for bats, counts of waterbirds and opportunistic observations on all fauna. Activities took place throughout the Gwalia area, around wetlands, in shrublands on the palusplain and in woodland on slightly higher ground.

Following beginning of operations at the Gwalia Silica Sands Mine, fauna studies were undertaken to monitor waterbird numbers and to study aspects of the biology of a rare freshwater fish that had been found on the site in 1993. These monitoring studies began in 1997 and are ongoing.

The 1998 studies

Field work for the 1998 studies consisted of a site visit on 19th November, followed by detailed sampling over the period 10th-15th December. Sampling was carried out at nine sites spread from south of Marriot Road to nearly as far north as the Harvey-Myalup Road. Trapping and bird surveys were carried out at these nine sites, with opportunistic observations being made both at and between sites. The layout of sites was designed to sample habitats and locations that had not been surveyed as part of previous studies, although site 173(pt) was close to a site which had proven interesting in 1982. Most of the sites were within the proposed buffer zone, but some were in the proposed industrial core while two were located just north of the proposed buffer zone. Field work was carried out by Dr M. Bamford and Mr P. Smith of Bamford Consulting Ecologists, under Licence No, SF002686 issued by the WA Department of Conservation and Land Management.

Trapping

At each sampling site, the layout consisted of 8 trapping points aligned in a transect at 20 m intervals, with a pitfall trap and either an Elliott trap or a cage trap set with universal bait (peanut paste, rolled oats and sardines) at each point. There were therefore 8 pitfall traps (each consisting of a 20 litre bucket, 40 cm deep and 28 cm diameter, with every second bucket assisted by a 7 m fly-wire driftfence), 4 Elliott traps and 4 cage traps at each trapping site. Traps were checked in the morning and sometimes in the afternoon and animals caught were identified and some were measured before release.

The suite of 9 sites included 3 sites close to wetlands within the buffer zone (sites 348, 302 and 173(pt)), and 3 pairs of sites in upland vegetation. These 3 pairs of sites were: sites 210 & 208 (eucalypt/banksia woodland in the industrial core); sites 301 & 30 (eucalypt/banksia woodland within the buffer zone); and sites 7 and 8 (banksia woodland outside the buffer zone). Locations of these sites are indicated on Figure One and they are described below. Note that the site numbers are taken from vegetation sampling points.

Site 348. 33° 05.5'S, 115° 46.6'E. Woodland on sandplain adjacent to a wetland. Woodland consists of eucalypts, *Banksia*, *Agonis* and thickets of *Kunzea*. Within buffer zone. Sampled for 5 nights.

Site 302. 33° 09.8'S, 115° 44.0'E. Phraetophytic vegetation around a seasonal wetland in a dune swale. Within buffer zone. Sampled for 6 nights.

Site 173(pt). 33° 11.0'S, 115° 44.3'E. Phraetophytic vegetation around a seasonal wetland in a broad, low dune swale just south of Mialla Lagoon. Close to a site sampled in 1982, but the area had been recently burnt then. Within buffer zone. Sampled for 5 nights.

Site 210. 33° 10.8'S, 115° 44.7'E. Woodland of eucalypts, *Banksia* and *Agonis* on dune system in industrial core. Up-slope from wetland at site 173(pt). Sampled for 5 nights.

Site 208. 33° 'S, 115° 'E. Woodland of eucalypts, *Banksia* and *Agonis* on dune system in Industrial Core. Up-slope from Mialla Lagoon. Sampled for 5 nights.

Site 301. 33° 09.8'S, 115° 43.9'E. Eucalypt/*Banksia* woodland on dune system adjacent to site 302. Within buffer zone. Sampled for 6 nights.

Site 30. 33° 06.6'S, 115° 44.8'E. Woodland of eucalypts and *Banksia* on high dune system in buffer zone. *Banksia grandis* notably abundant at this site. No wetlands nearby. Sampled for 5 nights.

Site 12. 33° 05.5'S, 115° 46.4'E. Banksia woodland (few eucalypts) on sandplain outside buffer zone. Sampled for 4 nights.

Site 13. 33° 05.5'S, 115° 46.6'E. Banksia woodland (few eucalypts) on sandplain outside buffer zone. Sampled for 4 nights.

<u>Other fauna sampling</u>

Sampling took place over 4 to 6 nights at each site. On each occasion when traps were checked at a site, a bird list was made. Bird lists were also kept when sites were visited for searching, re-baiting and so on. Therefore, an index of abundance for each bird species at each site was obtained, based upon the percentage frequency at which each species was observed.

Mist-netting for bats was carried out at site 302 on one night only. This sort of sampling is only effective on warm to hot nights in summer, as it is at such times that bats come in to waterholes to drink, making them fairly easy to catch in a mist-net. During the sampling week, heavy rain and thunderstorms were experienced, and the night of 13th December was the only occasion when conditions appeared suitable for the capture of bats.

Opportunistic searching was carried out at sampling sites and in other areas within the region to supplement the species list and to search for particular species. A dip-net was used to search permanent and seasonal wetlands throughout the area in an attempt to locate new populations of the Black-striped Minnow *Galaxiella nigrostriata*, a rare species located by Ninox Wildlife consulting (1994) in the Gwalia project area. Other species of interest for which searches were carried out included the Quenda or Southern Brown Bandicoot *Isoodon obesulus*, and the skinks *Ctenotus labillardieri* and *Glaphyromorphus* sp.

Approach to analyses

Despite intensive field work, there will always be some species present at a site that do not get recorded. Therefore, during surveys of vertebrate fauna, it is normal practice to prepare a list of species expected to occur at a site on the basis of site location and habitats present. It is also normal practice to prepare a list of species which may have occurred at the site but which are known to have become extinct in the region. Field studies make it possible to confirm the presence of the majority of species, which is especially important for species of conservation significance, and can also reveal the presence of species that might not have been expected. Field studies also provide important information on levels of abundance and local patterns of distribution.

Lists of vertebrate fauna likely to occur in the Kemerton region were developed on the basis of published and unpublished records and personal experience. The main source of information was a printout from the WA Museum for specimen records of frogs, reptiles and mammals from the region bounded by 32° 00'S to 33° 00'S, and 115° 30'E to 116°00' E. Information on birds likely to occur in the area was obtained from Blakers *et al.* (1984).

Standardised results from sampling in 1998 are presented, including trapping and bird censussing results. Although numbers of captures were not high enough for valid statistical analyses to be undertaken, the results are presented as they form a baseline for future reference and monitoring.

Taxonomic orders and names used in this report generally follow Tyler *et al.* (1984) for amphibians, Storr *et al.* (1981, 1983, 1986 and 1990) for reptiles, Strahan (1983) for mammals and Christidis and Boles (1994) for birds. Where recent taxonomic revisions have occurred, earlier names are given in parenthesis. This is particularly the case with reptiles, for which several recent revisions have been carried out but some new names have not been widely published or accepted. Species are considered to be of national conservation significance if they are listed under the WA Wildlife Protection Act, in Cogger *et al.* (1993), Kennedy (1992) or in Garnett (1992). Levels of conservation significance used in these sources are given on Appendix One. Species are considered to be of regional conservation significance if they are poorly represented in the general area, are present as an isolated population, or are at the limit of the species distribution in the region, but are not listed as being of national conservation significance.

RESULTS

All vertebrate species recorded or expected in the Kemerton region are listed in Tables One to Three. Species which may have disappeared from the site during the period since European settlement of the South-West are listed in Table Four, but it should be stressed that this list is almost certainly incomplete.

The vertebrate fauna of Kemerton includes two native and one introduced freshwater fish, 9 expected frog species (8 recorded), 31 reptile species (21 recorded), 125 bird species (98 recorded, including one introduced), 19 native mammal species (13 recorded) and six introduced mammal species (5 recorded). Two freshwater fish, four bird and at least six native mammal species may have become extinct on the site.

Freshwater fish

The South-West region in general supports very few species of freshwater fish, so the presence of one introduced and at least two native species is of interest. The introduced Mosquitofish was found only in the Myalup Drain but is probably present in all drains in the Kemerton region. It cannot survive in seasonal wetlands, but would probably thrive in the permanent wetlands of the Alcoa site if introduced.

The Westralian Pygmy-perch is widespread in the South-West and requires permanent water. Surprisingly, therefore, it was recorded only in a seasonal wetland in the Gwalia study area in November 1993. Large numbers of juvenile fish were present at a time when much of the study area was flooded, so presumably these had dispersed from a population living in a permanent wetland nearby. This site has not been located in subsequent studies and Westralian Pygmy-perch have not been found again.

The Black-striped Jollytail was an unexpected find, as the species was previously thought to be confined to wetlands on the south coast between Northcliffe and near Albany. Because of its limited range, it is classed as Priority 4 by the WA Department of Conservation and Land Management (CALM), although the Kemerton population is of special significance because it is presumably a relict from when the species was more widespread.

The Black-striped Jollytail can survive in seasonal wetlands, possibly by sheltering in burrows of freshwater crayfish which contain water throughout the year. Studies at the Gwalia site have found that the species disperses widely over winter, but is restricted to about six wetland refuges over summer. These refuges are the last points to dry out and in some cases are only a few metres across. One of the six refuges contains water throughout most or all summers and in one year, the fish in this wetland grew larger than fish that were forced to shelter in burrows for several months (Bamford and Bamford 1998). In the summer of 1997/'98, however, this population died out, possibly because the water level dropped especially low and the shallow pool that remained was in full sun, resulting in lethally high water temperatures. The other summer refuge sites are shaded by paperbark trees *Melaleuca rhaphiophylla*, whereas the trees from the centre of the semi-permanent wetland appear to have been cleared during the construction of a powerline. This wetland was not recolonised in 1998 due to poor winter rains. It has also been found that the Silica Sands Mine now restricts the winter dispersal of the Jollytails to some degree (Bamford and Bamford 1999).

Despite intensive searching as part of the 1998 study, no new sites supporting the Jollytail were located. Some apparently suitable sites were found in similar landforms both directly north and south of the Gwalia project area, but these wetlands had been modified by grazing livestock, and their water levels may have been altered by clearing and draining.

Frogs

The frog species recorded (Table One) are all widespread in the South-West, while the one species which was expected but not found has a patchy distribution on the Swan Coastal Plain. The Green-bellied Froglet is also reported to be patchily distributed on the Swan Coastal Plain (Bush *et al.* 1995), but there is nothing to suggest that its presence in the Kemerton area is of regional significance. All of the frogs require water to breed, but several of the species, particularly the Moaning Frog and the Pobblebonk, spend much of their adult lives in upland habitat several kilometres from the nearest wetland. These two species are probably present throughout the region, with the remaining species tending to be concentrated around wetlands.

The 1998 sampling provided some information on the pattern of distribution of frogs in relation to habitat (Table 5a). The Moaning Frog and the Pobblebonk were the only species recorded in upland habitats, while additional species such as the Sandplain Froglet, Green-bellied Froglet and Motorbike Frog were recorded at the wetland sites. The Slender Tree Frog was seen at these wetland sites, but was not trapped. Site 348 appeared exceptional because of the abundance of the Sandplain Froglet, and this is consistent with observations made by Bamford and Watkins (1983). They found that the Sandplain Froglet favoured disturbed areas where there was little ground cover, including the flooded edges of paddocks, Glauert's Froglet favoured similarly disturbed areas but where vegetation cover was dense, while the Green-bellied Froglet was most abundant where there was a dense cover of trees. Site 348 consisted of low-lying land adjacent to a shallow, open wetland, and little understorey was present in the vegetation. At all other sites, wetlands supported dense vegetation and a dense understorey was present around the traps.

During the Alcoa and Gwalia studies, the three froglet species in particular were found to be extremely widespread around seasonal and permanent wetlands. Given the low numbers of captures of most frog species in 1998, the absence of species recorded during the Alcoa and Gwalia studies is probably not significant. The only species which may be of interest in this respect is Guenther's Toadlet, which was only recorded during the Gwalia surveys. It may be confined to the seasonally inundated palusplain areas in the east of the Kemerton region.

Reptiles

Nearly a third of the reptile species expected for the Kemerton region were not recorded, but most of these species are very cryptic and/or occur at low population densities, so they may be present (see Table One). The majority of the species recorded are typical of the southern Swan Coastal Plain, but the presence of several species was of interest. During the Alcoa study, the Red-legged and Mourning Skinks were definitely recorded, while a skink which may have been the Western Ctenotus was seen but not caught. While none of these species is rare, their presence on the southern Swan Coastal Plain is unusual. The Red-legged Skink is primarily a species of the lateritic soils of the Darling Scarp, and there are only a few Coastal Plain records (Ford 1968, bush *et al.* 1995). Two specimens were caught in 1982 close to the location of the 1998 site 173(pt), and the species is presumably still present. This Coastal Plain population can be considered an outlier of the main Darling Scarp population, and is thus of regional conservation significance.

The Mourning Skink is also a species which occurs mainly on the Darling Scarp, where it is associated with dense vegetation along streams. Several specimens were caught in vegetation around wetlands on the Alcoa site in 1982, and the particular area where they were caught was not sampled in 1998. Although known from scattered localities on the Coastal Plain as far north as Herdsman Lake in Perth (Bush *et al.* 1995), the Kemerton population can still be considered of regional conservation significance.

The Western Ctenotus is listed as of regional conservation significance as it is not known to occur in the Kemerton region, with the nearest locality being Mandurah. The species was listed as possibly *Ctenotus lesueurii* by Bamford and Watkins (1983), but could also have been *Ctenotus fallens*. The nearest locality for this species is also Mandurah. Both of these are large species, not likely to be confused with the small, boldly-striped *Ctenotus impar* that was recorded at several sites in 1998.

Two reptile species listed as expected but which were not recorded are of national conservation significance. The Lined Lerista is included for the area on the basis of a report from Yalgorup National Park (Youngson and Harold 1989) and an old WA Museum record from West Busselton. It is classed as Rare or Insufficiently Known by Cogger *et al.* (1993) but is not recognised by CALM. The South-West Carpet Python is classed as Vulnerable by Cogger *et al.* (1993) and is listed in the "Other Specially Protected Fauna" category of the WA Wildlife Conservation Act. The Lerista occurs in sandy soils of upland areas, while the Python could occur in almost any habitat, but particularly favours areas where it can shelter in fallen timber or similar.

There is a possibility that an undescribed and possibly extinct species of skink, *Glaphyromorphus* sp., may be present in the Kemerton region, but it has not been included as expected as the only known specimens came from salt marsh habitat on the edge of the Leschenault Inlet. The original specimens were found under timber, and some effort was spent searching under logs near wetlands to explore the possibility that this species might be present.

Numbers of captures made on the sites sampled during the 1998 study reveal few differences between sites close to wetlands, sites in eucalypt/banksia woodland and sites in banksia woodland (Table 5b). This is contributed to by the small sample sizes obtained, which make it unrealistic to carry out statistical analyses. One notable feature, however, is the small number of captures made on site 30, which may have resulted from this site being at least a kilometre from the nearest wetland. Much higher numbers of captures were made on sites 301 and 208, which were very similar eucalypt/banksia woodland sites to site 30, but were close to wetlands. Site 210, however, which was also a eucalypt/banksia woodland close to a wetland, had only a small number of captures.

The majority of reptile species expected or recorded in the Kemerton region probably have broad habitat preferences, which may be why there were few distinct differences in numbers of captures across the sites sampled in 1998. The only aquatic reptile in the region is the Long-necked Tortoise, which was recorded in the Alcoa wetlands in 1982, was found in the wetlands of the Gwalia project area, and was found in the wetland at site 302 in 1998. *Bassiana trilineata*, the Mourning Skink and the Tiger Snake are closely associated with wetland habitats, with both the Mourning Skink and the Tiger Snake swimming on occasions. All other reptile species are probably widespread from wetland margins to upland areas, although Bamford and Watkins (1983) suggested that the Red-legged Skink was probably confined to dense vegetation around wetlands.

A few reptile species have very specific habitat requirements which might not be reflected by the vegetation type or position in the landscape. For example, the Salmon-bellied Skink tends to shelter in crevices and under loose bark of large logs.

Birds

A high proportion of the birds expected in the Kemerton region has been recorded, while a number of the species that have not been recorded would probably only ever be present as vagrants. It should also be noted that there are potentially vagrant species which have not been listed at all. A number of the species either expected or recorded are of conservation significance.

Species of regional conservation significance include the Australian Owlet Nightjar, Spotted Pardalote, Golden Whistler and Grey Currawong. These are all widespread species which are uncommon on the Coastal Plain but are still well represented in the eucalypt forests of the nearby Darling Scarp. Significantly, three of the five bird species listed as extinct in the region (Table Four) are still common on the Darling Scarp, but formerly occurred on the Coastal Plain.

Other species of regional conservation significance are waterbirds which have breeding colonies in the Kemerton region. Waterbird colonies found at the Alcoa wetlands in 1982 (Bamford and Watkins 1983) included the Darter (25 active nests) Little Pied Cormorant (*ca.* 70 nests probably used the previous winter) and Nankeen Night Heron (*ca.* 100 nests, at least some recently used). In addition, the wetlands were used as a night-roost by Straw-necked and Australian White Ibis, and it is possible that these species also bred there. At least five Darter nests with chicks were present during the 1998 survey. A small colony (6 nests) of Little Pied Cormorants was also found in a wetland in the Gwalia Project area, and this colony was active in all years when it was visited (1993, 1997 and 1998). These colonies probably account for most breeding birds of these species between Mandurah and Bunbury.

The only bird species of national conservation significance which have been recorded in the Kemerton region are the Forest Red-tailed Black-Cockatoo (Priority 4 according to CALM and classed as Insufficiently Known by Garnett 1992) and the Short-billed Black-Cockatoo (Schedule 1 (Endangered) of the WA Wildlife Conservation Act and Vulnerable according to Garnett 1992). The record of the Red-tailed Black-Cockatoo is interesting, as this is the forest sub-species normally confined to the Darling Scarp and rarely encountered on the Coastal Plain. Both species are probably regular, non-breeding visitors to the region.

Other species of national conservation significance which may use the Kemerton region are: the Freckled Duck (Priority 4 and Rare), Little Bittern (Priority 4), Black Bittern (South-West population, Priority 2), Australasian Bittern (Schedule 1 (Vulnerable) and Insufficiently Known (Garnett 1992)), Square-tailed Kite (Priority 4 and Rare (Garnett 1992)), Peregrine Falcon (Schedule 4), Long-billed Black-Cockatoo (Schedule 1 (Vulnerable) and Insufficiently Known (Garnett 1992)) and Masked Owl (Priority 4 and Rare (Garnett 1992)). The Duck and three bittern species are all waterbirds that need permanent or semi-permanent wetlands with paperbark trees *Melaleuca* spp. (Freckled Duck and Black Bittern), or with extensive beds of rushes (Little and Australasian Bitterns). The Alcoa wetlands and Mialla Lagoon are most likely to support these species. The Kite, Falcon, Black-Cockatoo and Owl are forest or woodland species, most likely to use areas with tall eucalypts, which occur mainly in the western part of the Kemerton region, particularly in the vicinity of the Alcoa Wetlands and south-west of Marriot Road. All of these species of national conservation significance could be present as occasional visitors or in low numbers.

Bird census data collected during the 1998 survey reveal something of the habitat preferences of the birds recorded in the Kemerton region (Table 6). In this table, all bird species are also classed into at least one of several main habitat types. Some of the habitat associations are very predictable, such as the link between ducks and wetlands, but there are some associations among other habitats that are noteworthy. Importantly, in the classification of species into main habitats, a total of 11 species were considered to be largely confined to the eucalypt/banksia woodland, and 8 of these were of regional or national conservation significance. In comparison, it was estimated that only one and four species would be largely confined to the banksia woodland and wetland fringe respectively. The survey data supported this. For example, the only records of the Grey Currawong were in eucalypt/banksia woodland, while the Golden Whistler occurred principally in eucalypt/banksia woodland and in the sites around wetlands. The few species observed only or principally in the banksia woodland sites (sites 12 and 13) included the Rainbow Bee-eater and Tree Martin, which were attracted to specific features of the sites that were not related to the vegetation type. The Bee-eaters were nesting on the side of a limestone track while the Tree Martins were nesting in a single dead eucalypt nearby.

The bird species which are believed to have become extinct in the Kemerton region (Table 4) include three which are associated with dense vegetation around wetlands and damplands, while a fourth species was probably associated with eucalypt/banksia woodland.

Mammals

The Kemerton region supports a rich mammal fauna by the standards of the Swan Coastal Plain, where a number of species have become extinct. Furthermore, the successful trapping of bats in 1982 contributed a number of species from a group which is known to be present but is rarely surveyed. Unfortunately, the lack of survey data for bats for the whole South-West makes it difficult to determine if the presence of several bat species is of regional significance. It may be significant, however, that during surveys of bats of the Darling Scarp from Dwellingup to Jarrahdale, all species except *Falsistrellus mackenziei* were recorded (M. Bamford, unpub. records).

The recorded mammal fauna includes two species of regional conservation significance and four species of national conservation significance. The Honey Possum and Pygmy Possum are both common in some parts of the South-West, but have declined on the Swan Coastal Plain in settled areas; especially between Mandurah and Busselton. While detailed surveys have not been carried out in areas such as Yalgorup National Park, the presence of these two species at Kemerton should be considered highly significant on a regional basis. The Honey Possum was trapped during all three studies and always in dense vegetation on the fringe of a wetland area, but individuals probably move widely as seasonal sources of nectar vary. A single Pygmy Possum was recorded on the Gwalia site in eucalypt/banksia woodland, and the species is commonly associated with eucalypt woodlands elsewhere in its range. The Brush-tailed Possum is also of some regional conservation significance, but it is common in the nearby Yalgorup National Park.

The Chuditch is classed as Schedule 1 (Vulnerable) of the Wildlife Conservation Act, and the Kemerton record is very unusual for the Coastal Plain. The record is for a specimen killed on the northern end of the Australind Bypass Road, within 100 m of the Old Coastal Road and therefore just outside the south-western corner of the buffer zone. It was found in October 1997. The presence of this specimen cannot be taken to indicate that the species is resident in the region, but this is possible.

The Quenda was until recently classed as Schedule 1, but is now listed only as Priority 4. It is still common in some parts of the South-West, but its status in the Kemerton region is puzzling. It is commonly associated with dense vegetation around wetlands and there are large areas of apparently suitable habitat around the Alcoa wetlands, including Mialla Lagoon, and in the Gwalia project area. Despite this, the species was not located in the 1982 study of the Alcoa site, nor during the intensive trapping of the Gwalia site in 1993. Fresh diggings (characteristic of the species) made by a single animal were found beside a wetland at Gwalia in 1998, and there were diggings around the wetland at site 173 of the 1998 surveys. This wetland was surveyed thoroughly in 1982, so it appears that the Quenda has colonised the area. This may be related to the control of Foxes in Yalgorup National Park and on the Leschenault Peninsula.

The Brush Wallaby and the Rakali are also classed as Priority 4. The Wallaby is seen occasionally in dense shrubland of the Gwalia project area, and a specimen was seen at site 12 during the 1998 study. Studies currently under way in Whiteman Park, outside Perth, suggest that the Brush Wallaby forages in banksia woodland at night and shelters in dense vegetation close to wetlands during the day (M. Bamford, unpub. data). The Rakali has been seen around semi-permanent wetlands of the Gwalia study area, and is probably present at most permanent or semi-permanent wetlands in the Kemerton Region.

Few mammal species were trapped in any of the studies, and the 1998 trapping results are of limited value in determining any associations with habitat (Table 5c). The eucalypt/banksia woodland and wetland areas are probably especially important for native mammals, but the banksia woodlands around sites 12 and 13 may be seasonally important for species such as the Honey Possum. The habitat preferences of bats are very poorly known. The Western Grey Kangaroo and some of the introduced species, such as the Rabbit, Fox and Cat, may make considerable use of agricultural areas.

At least six mammal species may have become extinct in the Kemerton region during the period of European settlement (Table 4). Most of these species are believed to have declined as a result of predation by the introduced Fox (Burbidge and McKenzie 1989). Partial clearing and alterations to the natural regime of bushfires may also have been significant factors in their decline. These factors may interact, as Johnson and Morris (1999) suggest that Foxes invade native vegetation from nearby agricultural areas, and are aided by disturbance of bushland.

DISCUSSION

The Kemerton region supports a rich vertebrate fauna with the following numbers of species expected (number of species recorded in parenthesis): freshwater fish 4 (3); frogs 9 (8), reptiles 31 (21), birds 125 (98) and mammals 25 (18). This fauna is rich by the standards of the southern Swan Coastal Plain because the Kemerton region has a variety of habitats and because it contains large areas of uncleared native vegetation, whereas much of the surrounding Coastal Plain has been developed for agriculture.

The variety of habitats present in the Kemerton region includes: permanent wetlands, mainly in the west of the buffer zone; seasonal wetlands, both in the west and east of the buffer zone; palusplain damplands that support a dense heathland mainly in the north-east of the buffer zone; eucalypt/banksia woodlands on sandy upland soils mainly in the west; and banksia woodlands on sandy upland soils mainly in the north.

The fauna is unusual in a regional context because it includes a number of species which are uncommon on the southern Swan Coastal Plain, or have declined or disappeared from the general region. These include freshwater fish such as the Black-striped Jollytail and Westralian Pygmy-perch, reptiles such as the Red-legged and Mourning Skinks, birds such as the Golden Whistler, Grey Currawong, Forest Red-tailed Black-Cockatoo, Australian Owlet-nightjar and Western Rosella, and mammals such as the Honey Possum, Pygmy Possum, Brush-tailed Possum, Quenda and Chuditch. Some of these species are more typical of the eucalypt forests of the Darling

Scarp than the woodlands of the Coastal Plain, and probably owe their persistence in the Kemerton region to the large tracts of undisturbed habitats, including eucalypt/banksia woodlands. The fauna is also notable in that it includes breeding colonies of the Darter, Nankeen Night-Heron and Little Pied Cormorant.

The presence of these species is of regional conservation significance, and some are of national conservation in that they are recognised under CALM and/or International Union for the Conservation of Nature guidelines. There are also species which may be present and which are of national conservation significance. The majority of these are forest-dwelling species that would utilise the eucalypt/banksia woodland.

Probably the most unexpected species to have been recorded is the Black-striped Jollytail, which seems to occur only in a series of seasonal wetlands in the Gwalia Silica Sands Mine project area. The persistence of the Jollytail in this area is probably due to the presence of a number of seasonally linked refuges, whereas possibly suitable wetlands nearby tended to be single sites, where one dry year or one disturbance event would be sufficient to wipe out the species.

The survival of the Westralian Pygmy Perch is also unusual, and at present this species is known only from a seasonal wetland, where it could not persist. Therefore, the species must survive in a permanent wetland somewhere nearby, but this has not been located. This may be important, as if the Pygmy Perch can survive and colonise the wetlands where the Jollytail occurs, then the introduced Mosquitofish may be able to do the same. The impact of the Mosquitofish upon aquatic wildlife, including invertebrates, frogs and native fish, has been poorly assessed, although one study found that it was a significant predator of tadpoles (Blyth 1994). Thee may be the potential for the Mosquitofish to colonise the wetland system and adversely affect the Jollytail.

All the habitat types present in the Kemerton region are important for fauna, with the presence of so many different habitats in one region being especially significant. Within the region, the eucalypt/banksia woodland with adjacent wetlands in the west, and the palusplain and wetland systems in the north east, are probably the most significant areas. The eucalypt/banksia woodlands with adjacent wetlands are especially important for some of the species more typical of eucalypt forests of the Darling Scarp. The banksia woodlands north of the proposed buffer zone, in the area of sites 12 and 13, did not appear to support some of these species and therefore do not have the same conservation value. However, the banksia woodlands may be of seasonal value for nectar-feeding species such as honeyeaters and the Honey Possum.

The Kemerton region is not only important for fauna because of the species it supports, but because of its position. It provides a corridor or at least a stepping stone for wildlife dispersing across the southern Coastal Plain between areas such as the Leschenault Peninsula, Yalgorup National Park and State Forest of the Darling Scarp. The strip of eucalypt/banksia woodland in the west of the buffer zone also has the potential to allow for the movement of fauna north and south. This linkage may prove to be increasingly important as Fox control allows the populations of some species to increase. The capture of two Brush-tailed Possums and the appearance of Quendas in

1998 may reflect an increase in the populations of these species as a result of Fox control in Yalgorup and on the Leschenault Peninsula.

In conclusion, the vertebrate fauna of the Kemerton region is rich and distinctive. This distinctiveness comes from the number of species present which have declined elsewhere on the Swan Coastal Plain between Perth and Bunbury, and the number of species that are of national conservation significance. In a sense, the region supports a relictual assemblage of Swan Coastal Plain fauna. The most important areas within this region are the shallow, seasonal wetlands around the Gwalia Silica Sands Mine, and the forests and wetlands of the western sector of the region, from Mialla Lagoon to the southern edge of the buffer zone. Because of the significance of fauna in the Kemerton region, the buffer zone for the industrial area has potential as a conservation zone of some importance.

Table One. Fish, frog and reptile species expected at Kemerton, indicating those species recorded during surveys conducted in the region. Uncon. indicates an unconfirmed record, while Binn. indicates recorded in Binningup only. The Status column indicates taxa of regional or national conservation significance (RCS and NCS), and introduced species (intro.).

Species		Alcoa	Gwalia	1998	Status
FISH					
Galaxiidae (jollytails or native minnows)					
Black-striped Jollytail	*Galaxiella nigrostriata*		+		**NCS**
Kuhliidae (pygmy-perch)					
Westralian Pygmy-perch	*Edelia vittata*		+		
Poeciliidae (live-bearers)					
Mosquitofish	*Gambusia holbrooki*			+	Intro.
Gobiidae (gobies)					
Swan River Goby	*Pseudogobius olorum*				
FROGS					
Myobatrachidae (ground frogs)					
Quacking Froglet	*Crinia georgiana*				
Glauert's Froglet	*Crinia (Ranidella) glauerti*	+	+		
Sandplain Froglet	*Crinia (Ranidella) insignifera*	+	+	+	
Green-bellied Froglet	*Geocrinia leai*	+	+	+	
Moaning Frog	*Heleioporus eyrei*	+	+	+	
Pobblebonk	*Limnodynastes dorsalis*	+		+	
Guenther's Toadlet	*Pseudophryne guentheri*		+		
Hylidae (tree frogs)					
Slender Tree Frog	*Litoria adelaidensis*	+	+	+	
Motorbike Frog	*Litoria moorei*	+	+	+	
REPTILES					
Chelidae (side-neck tortoises)					
Long-necked Tortoise	*Chelodina oblonga*	+	+	+	
Gekkonidae (geckoes)					
Marbled Gecko	*Phyllodactylus marmoratus*			+	
Pygopodidae (legless lizards)					
Sandplain Worm Lizard	*Aprasia repens*			+	
Burton's Legless Lizard	*Lialis burtonis*		+		
Common Scaleyfoot	*Pygopus lepidopodus*				
Agamidae (dragon lizards)					
Western Bearded Dragon	*Pogona minor*		+	+	
Varanidae (monitors or goannas)					
Gould's Sand Goanna	*Varanus gouldii*	+	+	+	
Rosenberg's Goanna	*Varanus rosenbergi*		+		

Table 1 (cont.)

Species		Alcoa	Gwalia	1998	Status
Scincidae (skink lizards)					
	Bassiana (Leiolopisma) trilineata	+	+	+	
Fence Skink	*Cryptoblepharus plagiocephalus*	+	+	+	
	Ctenotus impar			+	
Red-legged Skink	*Ctenotus labillardieri*	+			RCS
Western Ctenotus	*Ctenotus lesueurii*	Uncon.			RCS
King's Skink	*Egernia kingii*				
Mourning Skink	*Egernia luctuosa*	+			RCS
Salmon-bellied Skink	*Egernia napoleonis*	+	+	+	
	Hemiergis quadrilineata	+	+	+	
	Lerista distinguenda	+	+	+	
Lined Lerista	*Lerista lineata*				NCS
Dwarf Skink	*Menetia greyii*			+	
	Morethia lineoocellata	+	+	+	
Bobtail	*Tiliqua rugosa*		+	+	
Typhlopidae (blind snakes)					
	Ramphotyphlops australis	+		+	
Boidae (pythons)					
South-West Carpet Python	*Morelia spilota imbricata*				NCS
Elapidae (front-fanged snakes)					
Crowned Snake	*Notechis coronatus*				
Bardick	*Notechis curtus*				
Tiger Snake	*Notechis scutatus*	+	+	+	
Dugite	*Pseudonaja affinis*	+		+	
Gould's Snake	*Rhinoplocephalus gouldii*				
Black-backed Snake	*Rhinoplocephalus nigriceps*				
Jan's Bandy-Bandy	*Vermicella bertholdi*			Binn.	
Black-naped Snake	*Vermicella bimaculata*				
Number of fish species expected (recorded):	4 (3)				
Number of frog species expected (recorded):	9 (8)				
Number of reptile species expected (recorded):	31 (21)				

Table 2. Bird species expected at Kemerton, indicating those species recorded during surveys conducted in the region. Binn. indicates recorded in Binningup only. The Status column indicates taxa of regional or national conservation significance (RCS and NCS); introduced (intro.) species and species represented by breeding colonies (colony) are also indicated in this column.

Species		Alcoa	Gwalia	1998	Status
Casuariidae (emus and cassowaries)					
Emu	*Dromaius novaehollandiae*	+	+	+	
Phasianidae (pheasants and quails)					
Brown Quail	*Coturnix ypsilophora*				
Stubble Quail	*Coturnix pectoralis*				
Anatidae (ducks, geese and swans)					
Black Swan	*Cygnus atratus*	+	+		
Freckled Duck	*Stictonetta naevosa*				NCS
Australian Shelduck	*Tadorna tadornoides*	+	+		
Pacific Black Duck	*Anas superciliosus*	+	+	+	
Grey Teal	*Anas gibberifrons*	+	+	+	
Chestnut Teal	*Anas castanea*				
Australasian Shoveler	*Anas rhynchotis*				
Pink-eared Duck	*Malacorhynchus membranaceus*				
Hardhead (White-eyed Duck)	*Aythya australis*	+			
Australian Wood Duck	*Chenonetta jubata*	+	+	+	
Musk Duck	*Biziura lobata*	+	+	+	
Blue-billed Duck	*Oxyura australis*	+			
Podicepididae (grebes)					
Great Crested Grebe	*Podiceps cristatus*				
Hoary-headed Grebe	*Poliocephalus poliocephalus*	+			
Australasian Grebe	*Tachybaptus novaehollandiae*	+			
Anhingidae (darters)					
Darter	*Anhinga melanogaster*	+		+	colony
Phalacrocoracidae (cormorants)					
Great Cormorant	*Phalacrocorax carbo*	+			
Pied Cormorant	*Phalacrocorax varius*	+			
Little Black Cormorant	*Phalacrocorax sulcirostris*	+	+		colony
Little Pied Cormorant	*Phalacrocorax melanoleucos*	+	+	+	
Ardeidae (herons and egrets)					
White-faced Heron	*Egretta novaehollandiae*	+	+	+	
Little Egret	*Egretta garzetta*				
White-necked Heron	*Ardea pacifica*	+	+		
Great Egret	*Egretta alba*			+	
Cattle Egret	*Ardeola ibis*				
Nankeen Night Heron	*Nycticorax caledonicus*	+			colony
Little Bittern	*Ixobrychus minutus*				NCS
Black Bittern	*Ixobrychus flavicollis*				NCS
Australasian Bittern	*Botaurus poiciloptilus*				NCS

Table 2 (cont.).

Species		Alcoa	Gwalia	1998	Status
Plataleidae (ibis and spoonbills)					
Glossy Ibis	*Plegadis falcinellus*				
Australian White Ibis	*Threskiornis molucca*	+	+	+	
Straw-necked Ibis	*Threskiornis spinicollis*	+	+		
Yellow-billed Spoonbill	*Platalea flavipes*	+	+	+	
Accipitridae (kites, hawks and eagles)					
Black-shouldered Kite	*Elanus notatus*			+	
Square-tailed Kite	*Lophoictinia isura*				NCS
Whistling Kite	*Haliastur sphenurus*	+		+	
Swamp Harrier	*Circus approximans*	+	+	+	
Brown Goshawk	*Accipiter fasciatus*	+			
Collared Sparrowhawk	*Accipiter cirrhocephalus*	+			
Wedge-tailed Eagle	*Aquila audax*			+	
Little Eagle	*Hieraaetus morphnoides*			+	
Falconidae (falcons)					
Peregrine Falcon	*Falco peregrinus*				NCS
Australian Hobby	*Falco longipennis*	+	+		
Brown Falcon	*Falco berigora*		+		
Nankeen Kestrel	*Falco cenchroides*	+	+	+	
Turnicidae (button-quails)					
Painted Button-quail	*Turnix varia*		+	+	
Rallidae (crakes and rails)					
Buff-banded Rail	*Rallus philippensis*	+	+		
Baillon's Crake	*Porzana pusilla*	+			
Spotless Crake	*Porzana tabuensis*	+			
Australian Crake	*Porzana fluminea*				
Black-tailed Native-hen	*Gallinula ventralis*	+			
Dusky Moorhen	*Gallinula tenebrosa*	+			
Purple Swamphen	*Porphyrio porphyrio*	+		+	
Eurasian Coot	*Fulica atra*	+		+	
Scolopacidae (sandpipers)					
Common Sandpiper	*Tringa hypoleucos*		+		
Recurvirostridae (stilts and avocets)					
Black-winged Stilt	*Himantopus himantopus*				
Charadriidae (lapwings and plovers)					
Red-capped Plover	*Charadrius ruficapillus*				
Black-fronted Dotterel	*Elseyornis melanops*				
Red-kneed Dotterel	*Erythrogonys cinctus*				
Columbidae (pigeons and doves)					
Laughing Turtle-Dove	*Streptopelia senegalensis*				Intro.
Common Bronzewing	*Phaps chalcoptera*	+	+	+	
Crested Pigeon	*Ocyphaps lophotes*			+	
Cacatuidae (cockatoos)					
Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*			+	NCS
Short-billed Black-Cockatoo	*Calyptorhynchus latirostris*	+		+	NCS
Long-billed Black-Cockatoo	*Calyptorhynchus baudinii*				NCS

Table 2 (cont.)

Species		Alcoa	Gwalia	1998	Status
Psittacidae (lorikeets and parrots)					
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*		+		
Regent Parrot	*Polytelis anthopeplus*			+	
Red-capped Parrot	*Purpureicephalus spurius*	+	+	+	
Western Rosella	*Platycercus icterotis*	+		Binn	
Australian Ringneck (twenty-eight)	*Barnardius zonarius*	+	+	+	
Elegant Parrot	*Neophema elegans*	+	+	+	
Cuculidae (cuckoos)					
Pallid Cuckoo	*Cuculus pallidus*			+	
Fan-tailed Cuckoo	*Cuculus pyrrhophanus*		+		
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*		+		
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	+	+	+	
Strigidae (hawk-owls)					
Southern Boobook Owl	*Ninox novaeseelandiae*	+			
Tytonidae (barn owls)					
Masked Owl	*Tyto novaehollandiae*				NCS
Barn Owl	*Tyto alba*				
Podargidae (frogmouths)					
Tawny Frogmouth	*Podargus strigoides*		+	+	
Aegothelidae (owlet-nightjars)					
Australian Owlet-nightjar	*Aegotheles cristatus*	+			RCS
Halcyonidae (forest kingfishers)					
Laughing Kookaburra	*Dacelo novaeguineae*	+	+	+	Intro.
Sacred Kingfisher	*Todiramphus sanctus*	+	+	+	
Meropidae (bee-eaters)					
Rainbow Bee-eater	*Merops ornatus*	+	+	+	
Maluridae (fairy-wrens)					
Southern Emu-wren	*Stipiturus malachurus*				
Splendid Fairy-wren	*Malurus splendens*	+	+	+	
Pardalotidae (pardalotes)					
Spotted Pardalote	*Pardalotus punctatus*			+	RCS
Striated Pardalote	*Pardalotus striatus*	+	+	+	
White-browed Scrubwren	*Sericornis frontalis*	+	+	+	
Western Gerygone	*Gerygone fusca*	+	+	+	
Weebill	*Smicrornis brevirostris*			+	
Inland Thornbill	*Acanthiza apicalis*	+	+	+	
Western Thornbill	*Acanthiza inornata*		+	+	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	+	+	+	
Meliphagidae (honeyeaters)					
Red Wattlebird	*Anthochaera carunculata*	+	+	+	
Little Wattlebird	*Anthochaera chrysoptera*				
Singing Honeyeater	*Lichenostomus virescens*	+			
White-naped Honeyeater	*Melithreptus lunatus*				
Brown Honeyeater	*Lichmera indistincta*	+	+	+	
New Holland Honeyeater	*Phylidonyris novaehollandiae*		+	+	
Tawny-crowned Honeyeater	*Phylidonyris melanops*		+		
Western Spinebill	*Acanthorhynchus superciliosus*	+	+	+	
White-fronted Chat	*Epthianura albifrons*				

Table 2 (cont.)

Species		Alcoa	Gwalia	1998	Status
Petroicidae (Australian robins)					
Scarlet Robin	*Petroica multicolor*	+	+	+	
Neosittidae (sittellas)					
Varied Sittella	*Daphoenositta chrysoptera*			+	
Pachycephalidae (whistlers)					
Golden Whistler	*Pachycephala pectoralis*	+	+	+	RCS
Rufous Whistler	*Pachycephala rufiventris*	+	+	+	
Grey Shrike-thrush	*Colluricincla harmonica*	+	+	+	
Dicruridae (flycatchers)					
Magpie-lark	*Grallina cyanoleuca*	+	+	+	
Grey Fantail	*Rhipidura fuliginosa*	+	+	+	
Willie Wagtail	*Rhipidura leucophrys*	+	+	+	
Campephagidae (cuckoo-shrikes)					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	+	+	+	
Artamidae (woodswallows)					
Black-faced Woodswallow	*Artamus cinereus*	+	+	+	
Dusky Woodswallow	*Artamus cyanopterus*		+		
Grey Butcherbird	*Cracticus torquatus*	+	+	+	
Australian Magpie	*Gymnorhina tibicen*	+	+	+	
Corvidae (ravens and crows)					
Grey Currawong	*Strepera versicolor*	+		+	RCS
Australian Raven	*Corvus coronoides*	+	+	+	
Motacillidae (pipits and true wagtails)					
Richard's Pipit	*Anthus novaeseelandiae*	+	+		
Hirundinidae (swallows)					
Welcome Swallow	*Hirundo neoxena*	+	+	+	
Tree Martin	*Hirundo nigricans*	+	+	+	
Sylviidae (old world warblers)					
Clamorous Reed-Warbler	*Acrocephalus stentoreus*	+	+		
Little Grassbird	*Megalurus gramineus*	+	+		
Zosteropidae (white-eyes)					
Silvereye	*Zosterops lateralis*	+	+	+	
Number of bird species expected:	125				
Number of bird species observed:	98				

Table Three. Mammal species expected at Kemerton, indicating those species recorded during surveys conducted in the region. The Status column indicates taxa of regional or national conservation significance (RCS and NCS); introduced (intro.) species are also indicated in this column. Species known to be extinct in the region appear on Table 4.

Species		Alcoa	Gwalia	1998	Status
Tachyglossidae (echidnas)					
Echidna	*Tachyglossus aculeatus*				
Dasyuridae					
Chuditch	*Dasyurus geoffroii*			+	NCS
Peramelidae (bandicoots)					
Quenda or Southern Brown Bandicoot	*Isoodon obesulus*		+	+	NCS
Tarsipedidae (honey possum)					
Honey Possum	*Tarsipes rostratus*	+	+	+	
Phalangeridae (possums)					
Brush-tailed Possum	*Trichosurus vulpecula*			+	
Burramyidae (pygmy possums)					
Western Pygmy Possum	*Cercartetus concinnus*		+		
Macropodidae (kangaroos and wallabies)					
Western Grey Kangaroo	*Macropus fuliginosus*	+	+	+	
Brush or Black-gloved Wallaby	*Macropus irma*	+	+	+	NCS
Mollosidae (mastiff bats)					
White-striped Bat	*Tadarida australis*				
	Mormopterus planiceps				
Vespertilionidae (vesper bats)					
Gould's Wattled Bat	*Chalinolobus gouldii*	+			
Chocolate Wattled Bat	*Chalinolobus morio*				
	Falsistrellus mackenziei	+			
	Vespedalus (Eptesicus) regulus	+			
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	+			
Gould's Long-eared Bat	*Nyctophilus gouldii*				
Greater Long-eared Bat	*Nyctophilus major*	+			
Muridae (rats and mice)					
Rakali or water rat	*Hydromys chrysogaster*		+	+	NCS
Moodit or Southern Bush Rat	*Rattus fuscipes*				
House Mouse	*Mus musculus*	+			Intro
Brown Rat	*Rattus norvegicus*				Intro
Black Rat	*Rattus rattus*	+		+	Intro
Leporidae (rabbits and hares)					
Rabbit	*Oryctolagus cuniculus*	+	+	+	Intro
Canidae (foxes and dogs)					
European Red Fox	*Vulpes vulpes*	+	+	+	Intro
Felidae (cats)					
Feral Cat	*Felis catus*	+	+	+	Intro
Number of mammal species expected:	25				
Number of mammal species recorded:	18				

Table Four. Vertebrate species which are known or believed to have become extinct in the Kemerton region since European settlement, indicating the main habitat types where they may have occurred. These are: Eucalypt/Banksia - eucalypt/banksia woodland of uplands; Banksia woodland - banksia woodland of uplands; and Wetland heath - dense, low vegetation fringing wetlands, including on seasonally damp palusplain. Note that this list is not complete, and that a number of other mammal and bird species known to have declined or disappeared in the South-West may have been present in the Kemerton region.

		Eucalypt Banksia	Banksia Woodland	Wetland Heath
Pardalotidae (pardalotes and allies)				
Western Bristlebird	*Dasyornis longirostris*			+
Petroicidae (Australian robins)				
White-breasted Robin	*Eopsaltria georgiana*			+
Western Yellow Robin	*Eopsaltria griseogularis*	+		
Passeridae (finches)				
Red-eared Firetail	*Stagonopleura oculata*			+
Dasyuridae				
Brush-tailed Phascogale	*Phascogale tapoatafa*	+	+	+
Pseudocheiridae (ring-tailed possums)				
Western Ring-tailed Possum	*Pseudochierus occidentalis*	+		
Potoroidae (potoroos)				
Woylie	*Bettongia penicillata*	+	+	+
Boodie	*Bettongia lesueur*	+	+	+
Macropodidae (kangaroos and wallabies)				
Quokka	*Setonix brachyurus*			+
Muridae (rats and mice)				
Noodji	*Pseudomys albocinereus*		+	

Table Five. The distribution of frog, reptile and mammal captures during trapping carried out for the 1998 sampling. See methods for site descriptions. Note that numbers of captures have been standardised to allow comparisons between sites to be made, as sampling efforts varied slightly.

Table 5a.

Habitat of site:	Wetland			Eucalypt/banksia				Banksia	
Site Number:	348	302	173	301	208	210	30	12	13
Sandplain Froglet	29	-	-	-		-	-	-	-
Green-bellied Froglet	-	1	-	-	-	-	-	-	-
Moaning Frog	7	3	1	7	-	3	3	3	6
Pobblebonk	1	2	2	1	-	-	-	-	-
Motorbike Frog	2	-		-	-	-	-		-
Number of species:	4	3	2	2	0	1	1	1	1
Total captures:	39	6	3	8	0	3	3	3	6

Table 5b.

Habitat of site:	Wetland			Eucalypt/banksia				Banksia	
Site Number:	348	302	173	301	208	210	30	12	13
Long-necked Tortoise	-	+	-	-	-	-	-	-	-
Sandplain Worm Lizard	-	-	+	-	-	-	-	-	-
Western Bearded Dragon	1	1	-	-	-	-	-	-	2
Gould's Sand Goanna	-	-	-	-	-	+	-	-	-
Bassiana (Leiolopisma) trilineata	-	1	-	-	-	-	-	-	-
Fence Skink	-	-	-	1	-	-	-	1	1
Ctenotus impar	-	-	-	3	-	1	-	-	1
Salmon-bellied Skink	-	-	1	-	-	-	-	1	-
Hemiergis quadrilineata	-	-	1	1	1	-	1	-	-
Lerista distinguenda	1	1	1	-	3	-	1	-	-
Dwarf Skink	-	-	+	-	-	-	-	-	-
Morethia lineoocellata	7	3	-	4	7	4	1	2	7
Bobtail	3	1	5	6	5	3	1	5	1
Ramphotyphlops australis	-	-	-	-	1	-	-	-	-
Dugite	-	+	-	-	-	-	-	-	-
Number of species:	4	5	4	5	5	3	4	4	5
Number of captures:	12	7	8	15	17	8	4	9	12

Table 5c.

Habitat of site:	Wetland			Eucalypt/banksia				Banksia	
Site Number:	348	302	173	301	208	210	30	12	13
Honey Possum	-	1	-	-	-	-	-	-	-
Brush-tailed Possum	2	-	-	-	-	-	-	-	-
House Mouse	-	2	-	-	-	-	-	1	1
Black Rat	-	3	-	2	3	3	-	3	-
Number of species:	1	3	0	1	1	1	0	2	1
Number of captures:	2	6	0	2	3	3	0	4	1

Table Six. The distribution of bird observations during 1998 sampling, indicating the percentage of visits to each site on which each species was recorded. See methods for site descriptions. Each species is assigned to at least one of four habitat classes to indicate its main habitat preference. These classes are: W - wetland; Wf - wetland fringe (including damp heath of palusplain); EB - eucalypt/banksia woodland; B - banksia woodland; and Ag - agricultural land. Species marked as Ge are generalists, including aerial feeders over any habitat.

Habitat of site:	Wetland			Eucalypt/banksia				Banksia		Habitat class
Site Number:	348	302	173	301	208	210	30	12	13	
Number of site visits:	8	8	7	8	7	7	6	7	6	
Emu										EB,B
Brown Quail										Wf
Stubble Quail										Wf,Ag
Black Swan										W
Freckled Duck										W
Australian Shelduck										W
Pacific Black Duck										W
Grey Teal										W
Chestnut Teal										W
Australasian Shoveler										W
Pink-eared Duck										W
Hardhead (White-eyed Duck)										W
Australian Wood Duck										W
Musk Duck										W
Blue-billed Duck										W
Great Crested Grebe										W
Hoary-headed Grebe										W
Australasian Grebe										W
Darter										W
Great Cormorant										W
Pied Cormorant										W
Little Black Cormorant										W
Little Pied Cormorant										W
White-faced Heron										W
Little Egret										W
White-necked Heron										W
Great Egret										W
Cattle Egret										W,Ag
Nankeen Night Heron										W
Little Bittern										W
Black Bittern										W
Australasian Bittern										W
Glossy Ibis										W,Ag
Australian White Ibis										W,Ag
Straw-necked Ibis										W,Ag
Yellow-billed Spoonbill										W,Ag
Black-shouldered Kite										Ge
Square-tailed Kite										Ge
Whistling Kite			14							Ge

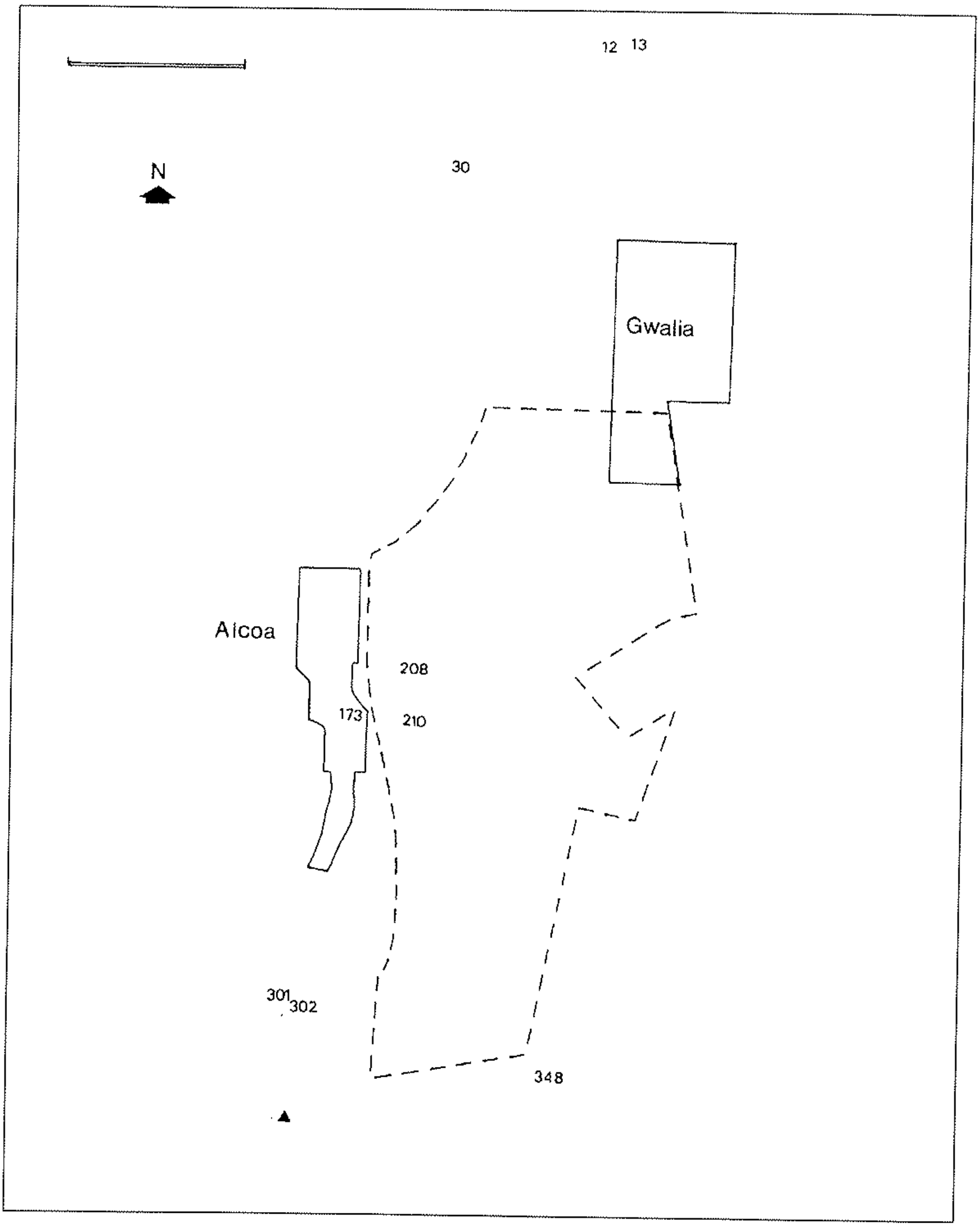
Table 6 (cont.)

Species	348	302	173	301	208	210	30	12	13	Habitat
Swamp Harrier										W
Brown Goshawk										EB,B
Collared Sparrowhawk										EB,B
Wedge-tailed Eagle									17	Ge
Little Eagle				12						Ge
Peregrine Falcon										EB,B
Australian Hobby										EB,B
Brown Falcon										Ge
Nankeen Kestrel										Ge
Painted Button-quail					14			14		EB,B
Buff-banded Rail										W,Wf
Baillon's Crake										W,Wf
Spotless Crake										W,Wf
Australian Crake										W,Wf
Black-tailed Native-hen										W,Wf
Dusky Moorhen										W,Wf
Purple Swamphen										W,Wf
Eurasian Coot										W,Wf
Common Sandpiper										W
Black-winged Stilt										W
Red-capped Plover										W
Black-fronted Dotterel										W
Red-kneed Dotterel										W
Laughing Turtle-Dove										Ag
Common Bronzewing							17			EB,B
Crested Pigeon										Ag
Red-tailed Black Cockatoo				12						EB
Short-billed Black-Cockatoo			14							EB,B
Long-billed Black-Cockatoo										EB
Purple-crowned Lorikeet										EB,B
Regent Parrot										Ge
Red-capped Parrot	38	25		12	14					EB
Western Rosella										EB
Australian Ringneck	88	25	14	25	57		17	14		Ge
Elegant Parrot										Ge
Pallid Cuckoo					14					EB,B
Fan-tailed Cuckoo										EB,B
Horsfield's Bronze-Cuckoo										EB,B
Shining Bronze-Cuckoo		25			14	14				EB,B
Southern Boobook Owl										Ge
Masked Owl										EB
Barn Owl										EB,Ag
Tawny Frogmouth										EB,B
Australian Owlet-nightjar										EB
Laughing Kookaburra	25	12			14			14		EB,Ag
Sacred Kingfisher	12				29			14		Ge
Rainbow Bee-eater						14		86	17	Ge
Southern Emu-wren										Wf
Splendid Fairy-wren		50				14		14	33	Wf,B

Table 6 (cont.)

Species	348	302	173	301	208	210	30	12	13	Habitat
Spotted Pardalote						14				EB
Striated Pardalote	25	38	29	75	86	71	83	29		EB,B
White-browed Scrubwren		50	43							Wf
Western Gerygone	62	25	29	50	86	14	100	100		EB,B
Weebill						57	17			EB
Inland Thornbill	12	50	57	12	29					Wf
Western Thornbill	12	12		12		14		14	17	EB,B
Yellow-rumped Thornbill										Ge
Red Wattlebird	50	38	29		14					EB,B
Little Wattlebird										EB,B
Singing Honeyeater										B
White-naped Honeyeater										EB
Brown Honeyeater	25	50		25				100	100	Ge
New Holland Honeyeater		38								Ge
Tawny-crowned Honeyeater										EB,B
Western Spinebill	12	62		38				58		EB,B
White-fronted Chat										Wf
Scarlet Robin				12	29	14				EB,B
Varied Sittella						14				EB,B
Golden Whistler	62	75	100	62	86	57	83		17	EB
Rufous Whistler	37	12	14	12	57		50	86	50	EB,B
Grey Shrike-thrush		38		12	14	14	50	14	17	EB,B
Magpie-lark										Ag
Grey Fantail	50	75	86	25	57	86	50			Ge
Willie Wagtail										Ag
Black-faced Cuckoo-shrike	25	25		38	29	29			17	Ge
Black-faced Woodswallow										Ge
Dusky Woodswallow										Ge
Grey Butcherbird	25				14	14				EB,B
Australian Magpie	12			50			17	14		Ge
Grey Currawong					71	14				EB
Australian Raven	25		29	12	43	14		28	29	Ge
Richard's Pipit										Ag
Welcome Swallow										Ge
Tree Martin								86	33	Ge
Clamorous Reed-Warbler										W
Little Grassbird										W
Silvereye		12		12	14			71		Ge
Number of species recorded:	18	20	12	19	21	17	10	17	12	
Number of species per visit:	6.0	7.5	4.6	5.1	7.9	4.6	5.2	7.7	3.1	

Figure One. Schematic diagram of the Kemerton region, showing the boundary of the industrial zone (broken line), and the locations of the Gwalia and Alcoa study areas and the 1998 study sites. The solid triangle indicates the location of the road-killed Chuditch discussed in the text. The scale bar is 1 km.



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APPENDIX ONE. Categories used in the recognition of conservation significance.

WA Wildlife Conservation Act.

Schedule 1. Fauna which is rare or likely to become extinct

Schedule 2. Fauna presumed to be extinct

Schedule 3. Birds protected under an international agreement

Schedule 4. Other specially protected fauna.

WA Department of Conservation and Land Management (species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring.

International Union for the Conservation of Nature and Natural Resources (IUCN)
These categories are used by Garnett (1992), Kennedy (1992) and Cogger *et al.* (1993). Note that the IUCN categories were refined in 1994 (Mace and Stuart 1994) but that the following categories are still applicable.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Endangered. Taxa in danger of extinction and whose survival is unlikely if the causal factors continue to operate.

Vulnerable. Taxa believed likely to become Endangered in the near future if the causal factors continue to operate.

Rare. Taxa with small populations that are not considered Endangered or Vulnerable, but which are threatened (if only by virtue of their small population size).

Insufficiently Known. Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

APPENDIX D

THE MUIR RAPID HABITAT ASSESSMENT SYSTEM (MRHAS©)

THE MUIR RAPID HABITAT ASSESSMENT SYSTEM (MRHAS©)

Barry G Muir

The MRHAS© system is a method developed by Barry Muir of Muir Environmental to facilitate fauna habitat evaluations. The material and methodology is proprietary and copyright and is not available to be applied or used for any purpose without express written permission of the author. Use of this methodology must be acknowledged. Reference sources and details of procedures are available upon request.

1.0 INTRODUCTION

1.1 THE ORIGIN OF MRADS AND MRHAS©

The Muir Rapid Assessment Data System (MRADS), the forerunner of the Muir Rapid Habitat Assessment System (MRHAS©), evolved from a research programme which was commenced by the Western Australian Museum (WA Museum) in 1971. At that time, under the guidance of Dr D.J. Kitchener, a survey of mammal, bird and reptile fauna began in the Western Australian wheatbelt, an agricultural area of about 22 million hectares of which all but about 5 million hectares had been cleared for grain growing. Uncleared land was held in road, town, railway, recreation, water, and conservation reserves.

It had been noted that, following the clearing of land in the region, there had been a dramatic change in the mammals (Kitchener 1973), birds (Serventy and Whittell 1976), and reptiles (Storr 1964). It is probable that many other groups of animals had also been greatly affected by these extensive alterations to the environment. The only chance for future persistence of many species of vertebrates in the region depended on the haphazardly located conservation reserves and patches of remnant bushland in the area.

The field survey of wheatbelt reserves commenced with the aim of examining the remnant fauna populations. The general approach was to survey each reserve during autumn and spring. Mammal trap-lines were set to sample the major habitats on each of the selected reserves. In each of these habitats, birds were recorded by observation, and reptiles and frogs by opportunistic collection. Habitat descriptions of all traplines, and vegetation maps were prepared for each reserve.

At the outset of the survey, it became apparent to Kitchener that the systems of vegetation mapping available at that time were not suitable for describing vegetation of the wheatbelt in terms thought relevant to the fauna. This was primarily because the available vegetation classification systems did not differentiate clearly between vegetation that was structurally quite different, both in its overall physiognomy and internal stratification. It was decided, nevertheless, to proceed with the fauna

...../2

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survey until a suitable system of vegetation classification was developed, and then retrospectively annotate the vegetation at those localities where traps had been set and fauna observed or collected. Barry Muir, an Ecologist, was appointed by the Western Australian Museum in 1975 to develop a 'fine-tuned' system of vegetation classification and mapping that was more suitable for fauna studies.

The vegetation classification which resulted from those studies was published in 1977, and became known in Australia as the Muir Classification (Muir 1977). During further studies in the wheatbelt, from 1976 to 1979, the Muir Classification was further modified. It was adopted by various agencies and researchers throughout Australia and overseas.

Comments on the success and limitations of the classification were fed back to Barry Muir. In 1980, Muir commenced a process of examining fauna ecology data from any available source and comparing the findings with the Muir Classification. He also tested the Classification in any habitat type he encountered in Australia or overseas, and gathered input from zoologists whenever possible.

The result of these ongoing studies has been that the original Muir Vegetation Classification diverged into two other systems:

- the Muir Rapid Assessment Data System (MRADS) - which was intended to allow meaningful vegetation classification over large areas or when study time was limited; and

- the Muir Rapid Habitat Assessment System (MRHAS©) - which similarly was intended for large scale or rapid vegetation surveys, but provided additional information which allows it to be of particular value in describing fauna habitats.

The two systems have much in common and are, therefore, largely inseparable in the text of this document. In most in-field situations MRHAS© is used exclusively, as it provides the same data as MRADS but also adds habitat data with little extra effort.

1.2 THE DEVELOPMENT OF THE MUIR CLASSIFICATION

Two possible approaches to describing vegetation are most likely to distinguish the habitat preferences of vertebrate fauna. One of the earliest studies in Australia was that of Webb (1959; 1968) and Kikkawa and Webb (in Webb et al. 1973). These researchers selected a group of animals and recorded in great detail the characteristics of the environment in which they were found. They then analysed the resultant data, obtaining a set of parameters to produce a vegetation classification. This approach requires a computerised data processing system and results in a habitat classification relevant only to a particular animal group. It is too slow and complex for a rapid approach to fauna survey, or for large area mapping and classification of vegetation.

The alternative approach was to develop a simple vegetation classification, useful to botanists, but detailed enough to describe habitats of fauna, particularly vertebrates. Systems based on floristics were not considered in the original studies because there was not time to develop such a classification. Further, such classifications were generally more difficult to use. Structurally-based classifications were easy to use. Several structural classification systems were already widely used in Australia for botanical and fauna survey work and could form a basis for the new system. Floristic components were included as the method developed.

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The Muir (1977) Vegetation Classification was derived from the Beard and Webb (1974) classification, with modifications based on the needs of scientists specialising in mammal, bird, reptile, and amphibian studies. Consistent results have been obtained in its application, even from users with very little botanical background.

1.3 PHILOSOPHY OF MRADS

To undertake fauna surveys in the field requires detailed, lengthy (sometimes several years), and costly field work. Further, because of the mobility of fauna, there is a high level of uncertainty in evaluating data. Absence of a species may mean, for example, that it was simply not detected rather than being absent, or that the impacts of a project had destroyed or displaced it.

To some extent this may be true of plant species. Small, ephemeral or particularly inconspicuous species may be overlooked and considered rare or scarce when, in fact, they are simply hard to find. Larger species are usually perennial, easily measured or evaluated, and are the primary 'building blocks' on which the habitat is constructed.

Using the philosophy that if the habitat is complex, floristically rich and 'healthy', so will be the fauna populations which occupy it, it is possible to direct an examination at the vegetation and habitat rather than at the fauna.

Further to this philosophy, it is possible to adopt certain biological principles on which to evaluate the habitat. These are:

- the more structurally complex the habitat the more diverse will be the fauna;
- the more floristically rich the habitat the more diverse will be the fauna;
- the greater the level of protection from predators afforded by the habitat the more likely it is to be 'useful' to fauna; and
- some easily measured special habitat characteristics (e.g. numbers of trees with hollow limbs, length of tree trunks, distance between strata, etc.) are a useful evaluation of habitat availability.

Based on these philosophies, modified from long experience with habitat studies, the following methodology has been developed for assessing faunal habitat.

1.4 USE OF MRADS DATA FOR FAUNA HABITAT

As MRADS has been used more frequently to describe fauna habitat (ie. as it evolved into MRHAS©) a number of specific applications of its various components have also consolidated. Some of these are directly related to MRADS, e.g. the number of life-form/density classes (LFDCs) (originally proposed by Kitchener 1980a; 1980b; 1982). Others have arisen independently, e.g. the abundance of hollow logs, or in response to certain needs in habitat description, e.g. the presence of buttresses on rainforest trees.

Data collected using these parameters is weighted to reflect the significance of the parameter for fauna habitat description. The weightings are a subjective decision made by Muir and based on observation, literature review, and discussion with numerous other researchers.

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Weightings may vary slightly from one geographic location to another (wet tropics are clearly different to more temperate climates) and are not necessarily applied to all characteristics noted.

Because some of the data are subjective, e.g. abundance of food-generating plant species, while others may have actual numbers, e.g. numbers of plant species, the items with numbers are grouped and the groups scored. This is explained in further detail below. While this procedure tends to converge the end scores to a lowest common denominator, experience has shown that major differences in habitat are still detected and obvious. Grouping also reduces the error which results from using only approximate numbers, such as the number of species in an area.

A further advantage of MRADS and MRHAS© is that, because actual numbers are grouped, or ranges of numbers or characters clustered into categories, the minor errors which can creep into large, complex spreadsheets, or discrepancies between operators or measurements, are negated in the final scores. Absolute exactness in scoring or mathematical proceedings is not essential to generate meaningful conclusions.

The very high degree of structural homogeneity of vegetation and habitat in some locations, such as deserts, renders some of the MRHAS© rating parameters of limited value, ie. they give identical figures in all habitats. These parameters, once recognised, may be excluded from the analysis and only those which distinguish between habitats then used.

In tropical habitats this is much less of a problem because the vegetation and habitats are often very heterogeneous and there are more parameters to measure. Those used, or sometimes not used, are indicated in the descriptions of system components presented below.

Even those parameters not used are, however, frequently of considerable value in interpretation of the data.

2.0 MRHAS© SYSTEM COMPONENTS

2.1 BIOPHYSICAL COMPONENTS

2.1.1 Soil Drainage

Drainage is subjectively classified as very poor, poor, moderate, well drained and very well drained, and often closely correlates with topographic position as well as soil texture and pedality. This parameter may be of use in examining habitat of moisture-requiring species such as land snails, or may be important in estimating soil burrowability, e.g. for burrowing mammals or reptiles.

If used, the scoring procedure is: very poor = 1; poor = 2; moderate = 3; well drained = 2; and very well drained = 1. Weighting is 1.

These parameters are not generally used in the MRHAS© rating but may be useful in some circumstances.

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2.1.2 Slope

This is determined by a clinometer and presented as degrees of slope. Steep slopes usually indicate better drainage on the crests and upper slopes, and greater availability of moisture at the slope toe.

If used, the score is: slopes > 40° = 1; slopes 18° - 40° = 2; slopes 5°-18° = 3; slopes < 5° = 2; flat = 1. Weighting is 1.

This parameter is generally not used in the MRHAS© rating, but may provide some insight into distribution of fauna. In addition, soil stability tends to decrease significantly on slopes greater than 18° and may affect the establishment of vegetation.

2.1.3 Aspect

Observation on dune slopes and other similar locations, such as in valleys, shows that the south and west sides in the southern hemisphere, and the north and west sides in the northern hemisphere receive less heat and retain moisture a little longer early in the day during the hot season than do the other slopes. Consequently, the vegetation is often different.

If used, the scores are as shown below. Weighting is 1.

	NORTH SIDE	EAST SIDE	SOUTH SIDE	WEST SIDE
Northern Hemisphere	2	2	1	1
Near the Equator	1	1	1	1
Southern Hemisphere	1	1	2	2

This parameter is not generally used in the MRHAS© rating but may be important in interpretation of differing habitat densities or floristic variations.

2.1.4 Soil Protection

Soil protection is a combination of rock cover, vegetation cover, and leaf litter depth and cover. It is a measure of the possible incidence of water or wind erosion when the soil is in an undisturbed condition. The degree of protection is expressed as a percentage of the protected soil surface. This parameter is difficult to interpret for fauna because it depends very much on what animal is being investigated. Thus, 100% cover of deep litter may totally protect the soil and provide a habitat for a small vertebrate, whereas 100% cover of rock may also protect the land surface from erosion but be unsuitable for most fauna.

This parameter is not used in the MRHAS© rating except for guidance.

2.1.5 Erosion

Erosion is a derivative of the soil protection classification but generally refers to the disturbed condition. Any evidence of runoff erosion or wind-blowing of the soil is evaluated.

Erosion is scored as: 5 = none (fully stable); 4 = minor; 3 = moderate; 2 = severe erosion; 1 = very severe and ongoing. Weighting is 1.

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This parameter is not generally used in the MRHAS© rating but may be useful when comparing habitats in semi-stable environments.

2.1.6 Depth of Soil Loss

In many areas where sheet erosion has been significant, the loss of soil has exposed root systems of plants. By measuring the amount of soil loss from the roots an estimate can be made of the total loss of soil over the area and, from the age of the plants, over how long a period the loss has been occurring. The parameter has many sub-variables which may be difficult to interpret but may be of value in reference to ground-dwelling micro-fauna, or small reptiles, etc.

Scores are: no apparent soil loss = 5; minor soil loss (less than 1 - 2 cm) = 4; significant soil loss but basically stable = 3; significant soil loss and currently unstable = 2; severe soil loss (in excess of 10 cm) and destabilisation process ongoing = 1. Weighting = 1.

An extension of this parameter is soil-compacting or pugging of waterlogged soils caused by the activities of sheep, cattle or other stock. If compacting is to be evaluated, replace the word "loss" with "compacting" or "pugging", and score as above.

2.2 STRUCTURAL AND FLORISTIC COMPONENTS

2.2.1 Formations and Associations

Formations are defined as structural vegetation types where the dominant life-form defines the type. Thus, vegetation dominated by the tree life-form is referred to as woodland; shrub dominated vegetation greater than 2 m tall as shrubland; shrub dominated vegetation less than 2 m tall as heath; grass dominated vegetation as grassland; etc. The habitat complexity is increased if there is another formation adjacent to the one under review. Thus, a woodland adjacent to a heath provides opportunity for animal species to use both habitats. This opportunity is not available to species occupying the centre of an extensive single formation.

The number of formations is scored directly in the MRHAS©, with a weighting of 2.

An association is a formation defined by the dominant plant species. Differing formations are mostly dominated by different species, although a heath or shrubland formation may be dominated by tree species which have not yet reached maturity. Similarly, adjacent and contiguous woodlands may be dominated by different species.

The number of associations is scored in the MRHAS©, with a weighting of 2.

2.2.2 Width of Ecotone

Ecotones between adjacent formations or associations may be very narrow, such as in cleared land adjacent to uncleared land. These ecotones are of limited (but some) value to fauna and are scored as 1.
Where the ecotone is from 60 m to 120 m wide it creates, in effect, a third habitat type, and can support a unique fauna as well as extending habitat opportunities for fauna occupying the adjacent main associations or formations. These ecotones are scored as 3.

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When the ecotone is detectable but wider than 120 m, it is scored as 2, as it is still a distinct habitat type, but is a lesser value because of its gradational similarity to the adjacent types.

Ecotones are given a weighting of 2.

2.2.3 Life-form

Many botanical studies only describe (and map) climax formations, sub-climax stages being interpreted on their probable nature when climax is reached. In contrast, habitat classification must describe vegetation seral stage in its existing form, regardless of its climax. Such an approach requires the resolution of questions such as when does a tree, regrowing after fire, cease to be a shrub and become a tree. Definitions of life-form that are fauna habitat-oriented hold the key to selection of terms in this situation. The problem then arises in habitat-oriented life-form classification that terms may vary when the vegetation is dominated by different species of plants, the fauna sometimes utilising each plant species in a particular way.

The Muir Vegetation Classification attempts to define life-forms in a manner which will produce consistent vegetation descriptions meaningful to fauna utilisation. The adaptation of these vegetation descriptions to describe habitat may depend upon the plant species involved, the researcher's purpose, and the group of animals being studied.

This parameter is not used in the MRHAS© rating *per se*, but in the general descriptions of vegetation necessary for interpretation.

The following dominant life-forms are recognised.

Trees

Trees are defined as woody, perennial plants, generally erect, of variable outline, but commonly with a spherical or ovoid canopy raised well above the ground. The presence of a canopy excludes cacti (for example) from this category. The major part of the canopy from bottom to top is less than, or equal to, two thirds of the total height of the tree (excluding suckers and basal shoots). Trees are generally single stemmed. However, if they are multi-stemmed they have fewer than five individual trunks that result from branching of a single trunk (which may be quite short). Trees do not usually arise from a fire-resistant lignotuber.

Tree height is variable but usually exceeds 2 m when the plant is mature. When dead, hollow tree limbs may be of sufficient size to provide habitats for vertebrates. Many trees in arid areas are less than 5 m tall. However, because of their life-form, they are used by animals differently from shrubs of similar height.

Shrubs

These are defined as woody, usually perennial plants, generally erect but may be procumbent or of weeping habit. Commonly, they are broadly conical in form with the foliage occupying all, or only part, of the total height of the plant. Multiple stems and branches arise from a rootstock or very short common trunk. Lignotubers are usually, but not always, absent.

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Shrubs may be of any height but are generally less than 5 m tall. Dead, hollow branches rarely reach sufficient size to provide habitats for vertebrates. Enlarged rootstocks may be present in some species exposed to frequent fires. Height classes in the classification were selected in order to separate all strata in shrub-dominated formations. This is thought to be particularly important for bird utilisation of these formations.

Grasses

Grasses are herbaceous, or rarely woody, plants of the family Poaceae (Graminae). Perennial or annual, generally erect or spreading, they usually have distinct individual shoots (tillers) arising from a single root system.

Canopy density of grass is sometimes overestimated because dead stems and leaves are invariably present, and these may have flattened out. Height division is normally set at 0.5 m, with grasses and bamboo exceeding 2 m in height usually used the same way as much taller grasses (> 5 m) in these habitats. Bamboo may be separated out on floristic grounds.

Herbs

Herbs are soft plants which may be ephemeral or perennial. In environments many are creepers or small ground-cover species. In newly disturbed areas there may be a prolific carpet of seedling plants which are, effectively a herb-field.

2.2.4 Top and Bottom Height and Inter-stratal Distance

Top Height refers to the average and approximate height of the top of each stratum. This, and Bottom Height, are used as a measure of stratal organisation and spacing.

Bottom Height refers to the bottom of each stratum. The height of the bottom of Stratum 1, minus the height of the top of Stratum 2 (strata are numbered from the upper stratum down) gives an indication of the inter-canopy distance used by some predators. There are also several species, such as some birds and mammals, which use this open area between Strata 1 and 2.

This measurement is referred to in MRHAS© tables as Inter-stratal Distance and is given a weighting of 1.

Scoring is as follows:

- if the distance between the top of Stratum 2 and the bottom of Stratum 1 is more than twice the height of Stratum 2, score = 1;
- if the inter-stratal distance is equal to or up to twice the height of Stratum 2, score = 2; or
- if the inter-stratal distance is less than the height of the understorey, score = 3.

2.2.5 Trunk Length

Trunk length is the distance in metres between the ground and the bottom of Stratum 1 of the tree canopy. The trunk of some Eucalypt trees, in particular, is used almost exclusively by some insects and spiders, and by many birds and reptiles.

It is scored as 0-10 m = 1; 11-20 m = 2; 21-30 m = 3; 31-40 m = 4; 41 m and above = 5. Weighting is 1.

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2.2.6 Canopy Cover

Canopy Cover is the total area encompassed within the circumference of individual foliage clumps, and expressed as a percentage of a given area, e.g. quadrat or association area. The term is used in this study in preference to the commonly used term, 'Crown Cover', because it records the actual area of foliage more accurately. This is particularly so with some tree life-forms, such as Fabaceae, where the crown may be made up of several smaller foliage clumps. Visually estimated Canopy Cover divisions of 10% are used in the present study. A derivative of Canopy Cover, the Total Canopy Index (see below) is used in the MRHAS® rating.

(1) A lower limit of 2% Canopy Cover has been set because experience has indicated that plants with less than 2% Canopy Cover are too widely spaced to be used as a stratum by fauna. They do not appear in descriptions as a stratum but may be Structure-modifying species (see below).

2.2.7 Average Foliage Density (AFD)

Average Foliage Density is measured with a Spherical Densiometer (Type A) as described in Lemmon (1956), or by using photographic or point-quadrat techniques. Foliage density is determined by five readings for each species in the association, or, when there are too many species or the strata is too complex, readings are taken from the dominants.

Figures are adjusted where necessary to give a more accurate representation of the foliage density of the stratum as a whole. Some formations (e.g. scrubland and heath) may have a similar foliage density for most of the plant species present. Other species may individually have almost 100% foliage density. If such a species comprises several percent of the whole stratum, the foliage density figure is adjusted accordingly.

This parameter is not directly used in the MRHAS® rating, but is used in calculating the Total Canopy Index.

2.2.8 Total Canopy Index

Both individually, and in combination, Canopy Cover and Average Foliage Density (AFD) provide an indication of the degree of protection offered by the vegetation to both arboreal and ground-dwelling fauna. Again, the cover provided will vary with vegetation health and thus, indirectly, may be related to moisture availability.

An artificial Total Canopy Index (TCI) provided by the taller strata (usually Strata 1, 2 and 3) can be generated by:

TCI = % Canopy Cover of Stratum 1 x % AFD of Stratum 1,
plus % Canopy Cover of Stratum 2 x % AFD of Stratum 2,
plus % Canopy Cover of Stratum 3 x % AFD of Stratum 3.

TCI is scored as 0-20 = 0; 21-50 = 1; 51-100 = 2; 101-150 = 3; 151-200 = 4. Weighting is given as 2.

2.2.9 Mean Vegetation Health

Vegetation health is estimated by a simple scoring procedure. Plants visually in excellent health are rated 5. Plants which are comparatively healthy but with some tip dieback or yellowing are rated 4. These features are more pronounced with a rating of 3. Plants with very sparse foliage, yellowing and curling of leaves and considered almost dead are rated 2, and very poor or apparently freshly dead a rating of 1. A rating of 0 is only given if the plant is undeniably dead.

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Stratum health is scored as: 0 = dead; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = very good. A large number of plants are evaluated and an average taken, or it can be an overall visual estimate. In most studies the health rating for Strata 1 and 2 are averaged. These are the strata believed to have the greatest influence on overall canopy health.

This parameter is given a weighting of 2 and is used in the MRHAS© rating.

2.2.10 Dominance

These are the species which are most abundant in each stratum and serve to identify it. In Stratum 1 the dominants lend their name to the formation and serve to identify the association.

This parameter is not directly used in the MRHAS© rating.

2.2.11 Life-form Density Classes (LFDCs)

Many botanical studies describe vegetation in terms of its character at climax; sub-stages after disturbance are interpreted on their probable nature when climax is eventually reached. In contrast, fauna habitat classification must describe vegetation in its existing form, regardless of its climax. Changes in vegetation structure will permit certain fauna species to take advantage of the newly-created ecological niche. Over time these niches will disappear and new ones will appear as the seedlings eventually grow to climax, or the vegetation recovers, e.g. from fire. Accompanying these changes will be an associated succession in fauna utilisation.

The use of LFDCs by Kitchener *et al.* (1982) has shown that there is a relationship, although imprecise, between the number of LFDCs and the abundance of certain passerine bird species. Work by Muir (1992) in rainforest in Asia has shown that the relationship still holds true.

Kitchener's habitat variable 'total number of Life-form Density Classes (LFDCs)' is generally considered to be the number of vegetation strata within each Canopy Cover class present in the sample area (ie. 2-10%, 10-30%, 30-70%, or 70-100% Canopy Cover). The overall total Canopy Cover is generally not sufficiently variable to make this of value. However, the number of strata present is variable, so the number of strata has been taken as equivalent to the number of LFDCs. As an example, if the vegetation consists of a tall woodland over a short woodland over tall shrubs over herbaceous ground stratum, there are four strata and the rating given is 4.

Weighting factor is 3 as this parameter appears to be of considerable significance to fauna. This parameter is always used in the MRHAS© rating.

2.2.12 Number of Plant Species

This is the total number of all perennial plant species actually recorded in a period of about 20 minutes observation. The method does not require taxonomic identification, only recognition of the number of species. Thus, detailed and lengthy taxonomic studies are not necessary to use the MRHAS©. This parameter is used in the MRHAS© rating to estimate floristic richness (below). Ephemeral species may be included if they are particularly abundant or relevant but their impermanence reduces their value for many fauna.

2.2.13 Floristic Richness

As an actual number of plant species is available, this can be directly applied as a measure of habitat floristic richness.

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Scoring proven to be reliable is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the MRHAS© rating.

2.2.14 Number of Structure-modifying Perennials

Structure-modifying Perennials (SMPs) is the number of perennials (ie. all year habitat) species which are so abundant as to significantly influence the structural makeup of the vegetation. If the number of SMPs is very similar to the total number of species in the sample, the vegetation may be considered to have very little internal heterogeneity in structure and it may even be un-stratified. If the number of SMPs is much lower than the total number of species present, but still visually modifying the appearance of the vegetation, then the SMPs may be considered to have a significant role to play in creating local structural variations. These variations may be specifically used by fauna.

The SMPs score is derived from two sources:

- the number of SMP classes represented ie. climbers, epiphytes, palm/cycads, grass-trees and others. These are scored as actual number of classes found. Weighting is 1. This parameter is used in the MRHAS© rating; and

- actual total number of SMPs of all classes. Scoring is: 0-20 species scores 0; 21-50 species scores 1; and 51-100 species scores 2. Weighting is 2. This parameter is used in the MRHAS© rating.

2.2.15 Spatial Organisation

As with other fauna parameters examined, the principal philosophy is that floristic and structural diversity and canopy density are directly related to usefulness of the habitat to fauna. Therefore, the spatial relationships of the strata and between adjacent clumps of vegetation are relevant.

It is generally accepted that the usefulness of an area to support fauna species, or for fauna to use the vegetation as a corridor for movement, depends on the degree of cover offered by the habitat. The significance of roads and cleared land as barriers to fauna movement is well documented in temperate habitats (e.g. Barnett et al. 1978; Dames and Moore 1989; and Mader et al. 1990). This is partly due to the foreign nature of the cleared area, but is also to exposure of the small fauna to predators (especially raptors) while crossing the open areas.

Scoring process is as follows: vegetation continuous = 3; small gaps in taller vegetation = 4 (opportunity to use both habitats is high); gaps about one-third of the vegetation structure = 5; gaps about one half of the structure = 4; gaps about two-thirds of the structure = 3; scattered clumps of taller vegetation = 4. Weighting is 1.

2.2.16 Horizontal View Distance

This is the average distance an observer can see horizontally, with the eyes at approximately 1.5 m above the ground surface. It gives a measure of the lateral density of the vegetation. It is used as a guide to spatial organisation (see above), but is not always used in the MRHAS© rating. The measure is also useful to estimate visual screening effects of vegetation in development areas.

When used, Horizontal View Distance is scored as: 1-20 m = 5; 20-50 m = 4; 50-100 m = 3; 100-150 m = 2; >150 m = 1. Weighting is 1.

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2.2.17 Strata| Recovery

This is a measure of the seral stage of vegetation after fire, disturbance or clearing, using the observed structure and floristics of the vegetation plus the known history and/or fire age data.

If the full mature structure is present (be it heath or woodland formation), the vegetation is given a rating of 4. If, in the opinion of the observer, it is three-quarters restored to pre-disturbance condition, a rating of 3 is given; if half restored, a rating of 2; and if only one-quarter restored, a rating of 1. The weighting is 3. This parameter is used in the MRHAS© rating.

2.2.18 Seedlings and Saplings

The presence of seedlings and saplings in the understorey of an association is an indication of the likely long-term regenerative/replacement capacity of the vegetation. If there are no young plants developing it is likely that, with time, the mature vegetation will begin to change in structure.

The abundance of seedlings and saplings of dominant species is scored as 1 = very few; 2 = moderately abundant; and 3 = abundant. Weighting is 1.

2.2.19 History of Disturbance

Logging and other human activities create a significant disturbance to the forest habitat. Fauna can take several years to recover after logging, and the degree of disturbance depends on the intensity of the logging and the period since the logging occurred.

It is scored as follows:

- heavily logged (or disturbed) long ago 3;
- heavily logged (or disturbed) recently 0;
- moderately logged (or disturbed) long ago 3;
- lightly logged (or disturbed) long ago 4;
- lightly logged (or disturbed) recently 2; and
- no evidence of logging (or disturbance - pristine) 5

Weighting is 1.

2.2.20 Weeds

The presence of weeds and pioneer species in an otherwise visually intact habitat can indicate past disturbance by human or stock activity, or natural disturbance such as storm damage or flooding. Weedy species can also add to floristic diversity by providing foliage, nectar, pollen, seeds, ground cover and other features which can be used by fauna.

Scores for weed abundance in habitats are: 5 = none; 4 = very few; 3 = moderately common; 2 = abundant; 1 = weeds dominant. Weighting is 1.

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2.2.21 Disease

Included in this category are fungal infections (rust, smuts, root-rot) and severe insect attack causing defoliation. It is distinguished from "health" where it is clear that the impacts are related to parasites or saprophytes rather than physiological stress caused by climatic or other pressures.

Scoring is: heavily diseased = 0; some evidence of disease = 1; no evidence of disease = 5. Weighting is 1.

2.3 MRHAS© RATING

As indicated previously, MRHAS© is mostly used where actual fauna data are not available. The summed MRHAS© scores (Appendix A) and fauna data (if it is available) are used to compare the "habitat value" of each study site. To simplify the results or to facilitate mapping (and to allow for variations and inaccuracies inherent in such data), the total MRHAS© scores may sometimes be clustered or grouped.

A suitable clustering for mapping has been found to be: total MRHAS© scores of 0-50 are clustered as 1; 51-100 as 2; 101-150 as 3; 151-200 as 4; and so on. If variation in scores is less than 50 results must be interpreted with caution but demonstrate a high level of structural homogeneity.

2.3.1 Structural Measurements Specifically for Fauna Evaluation

In order to apply MRHAS© more accurately to the description of fauna habitat, some additional vegetation structural definitions and observations on fauna use of the habitat may be applied.

The method is to score each parameter as indicated in the text, then to sum the scores and add the total to the MRHAS© rating determined from the vegetation study. This puts comparatively greater emphasis on the specific fauna evaluation components, but, considering the purpose of the evaluation is to examine the usefulness of the habitat for fauna, this is considered to be an advantage.

2.3.2 Hollow Limbs and Hollow Trunks (Senescence Index)

Many bird species and some mammals, reptiles and invertebrates are dependent on hollow limbs or trunks of plants (usually trees). Hollows can be used as refuges and breeding sites, and hollows high in trees as vantage points for predators to view the habitat. The abundance of such hollows in a given area can provide an indication of the area's usefulness to fauna which use these habitats.

The degree of usefulness can change over time. Young plants grow to maturity and senesce, thereby increasing the number of hollows. Similarly, mature trees may die from such effects as a change in water table. This may increase the abundance of hollows for a period until decay causes the loss of the dead trees. Dead standing trees may then decrease in number and the number of hollow logs increase.

Determination in the field of the actual number of hollows for fauna is a lengthy and tedious process. The index of abundance of hollow limbs and hollow trunks was developed to provide a speedy method of evaluating hollow abundance.

Abundance of hollows is scored as: 0 = none; 1 = very few; 2 = some present; 3 = many. Weighting is 2.

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2.3.3 Buttresses

Buttress trunks occur in many tropical tree species and appear to be related to species rather than location of growth. Some reptiles, birds and insects are associated almost exclusively with the buttresses and so these create a distinct micro-habitat.

They are scored as: 0 = none; 1 = a few; 2 = moderately common; 3 = abundant; 4 = abundant and very large. Weighting is 1.

2.3.4 Litter Depth and Spacing

Average leaf litter depth in centimetres is recorded to indicate the availability of substantial cover for insects, reptiles and small mammals. Litter is rarely evenly distributed and occurs in clumps beneath bushes, or is blown into mounds by wind or washed into clumps by water. As well as the depth of available litter, the average distance between litter clumps is sometimes recorded because this may have a role for small animals in greater risk of predation.

Scores are litter depth 0-5 cm = 0; 6-10 cm = 1; 11-20 cm = 2; 21-50 cm = 3. Weighting is 1.

2.3.5 Abundance of Flowering and Seeding Species (Food Availability)

It is assumed that floristically rich areas are capable of supporting more fauna than areas which are floristically less rich. Similarly, plant species which produce abundant pollen (e.g. Myrtaceae), abundant nectar (some Proteaceae), or abundant large seeds (e.g. some Fabaceae), are probably significant species in a habitat in comparison to less productive plants. The numbers and types of productive food plants have, therefore, been considered.

Very low abundance scores 0; low abundance scores 1; moderate abundance scores 2; and high abundance scores 3. Weighting is 1.

2.3.6 Macrophylly

This is the abundance of very large leaves in the association and applies more to tropical habitats. Large leaves provide some additional cover (reflected, sometimes, but not always, in high AFD scores); but also an indication of light demands; the availability of large leaves as specific habitat, e.g. for some bats and geckoes; and some insight into the nutrient-recycling capacity of the vegetation.

Scores are 5 = almost entirely macrophyllous (leaves round and greater than 100 mm diameter); 4 = about three quarters of species macrophyllous; 3 = about one-half of species macrophyllous; 2 = about one-quarter of species macrophyllous; 1 = very few macrophyllous species present; 0 = none. Weighting is 2.

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APPENDIX E

INTENSITY OF DATA COLLECTING

APPENDIX E

KEMERTON BIOLOGICAL SURVEY PHASE 1

INTENSITY OF DATA COLLECTING

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
1		X						
2	X	X				X		
3		X						
4		X						
5		X						
6	X		X		X	X		
7	X					X		
8		X						
9		X						
10	X		X		X	X		
11		X						X
12	X		X		X	X		X
13	X		X	X	X	X		
14	X					X		
15		X						
16		X						
17		X						
18		X						
19		X						
20		X						
21		X						
22		X						
23		X						
24		X						
25	X					X		
26	X		X		X	X		
27	X					X		
28	X					X		
29	X					X		
30	X					X		
31	X		X	X	X	X		
32	X					X		
33		X						
34		X						
35	X					X		
36		X						
37	X					X		
38	X							
39		X						
40	X					X		
41		X						

Kemerton Data Collection - Page 2

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
42		X						
43	X		X		X	X		
44		X						
45		X						
46		X						
47		X						
48	X					X		
49		X						
50		X						
51		X						
52	X					X		
53		X						
54	X					X		
55	X					X		
56		X						
57	X		X		X	X		
58	X					X		
59	X					X		
60	X					X		
61		X						
62		X						
63		X						
64		X						
65		X						
66		X						
67	X		X		X	X		
68		X						
69		X						
70		X						
71		X						
72	X					X		
73		X						
74		X						
75		X						
76		X						
77	X		X		X	X		
78		X						
79		X						
80	X					X		
81	X					X		
82	X					X		
83	X					X		
84		X	X		X			
85		X						
86	X					X		
87	X					X		
88		X						
89	Data unreliable - requires checking							

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
90		X						
91	X		X		X	X		
92	X					X		
93	X					X		
94		X						
95		X						
96	X					X		
97	X		X		X	X	X	
98	X					X		
99		X						
100	X					X	X	
101	X		X		X	X		
102		X						
103	Data unreliable - requires checking							
104		X						
105		X						
106		X						
107		X						
108		X						
109	X					X		
110	X					X		
111	X					X		
112	X					X		
113	X					X		
114		X						
115		X						
116		X						
117	X					X		
118	X					X		
119	X					X		
120	X					X		
121		X						
122	X					X		
123	Data unreliable - requires checking							
124	Data unreliable - requires checking							
125		X						
126		X						
127		X						
128		X						
129		X						
130		X						
131		X						
132		X						
133		X						
134		X	X		X		X	
135		X					X	
136		X						
137		X						

Kemerton Data Collection - Page 4

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
138		X						
139		X				X		
140	X		X	X	X	X		
141	X		X		X	X		
142		X						
143		X				X		
144	X					X		
145		X						
146	X		X		X	X		
147	X					X		
148	X					X		
149	X					X		
150	X					X		
151	X		X		X	X		
152	X					X		
153	X					X		
154	X					X		
155	X		X		X	X		
156	X					X		
157	X					X		
158	Data unreliable - requires checking							
159	X					X		
160	X					X		
161	X					X		
162		X						
163		X						
164		X						
165	Data unreliable - requires checking							
166	X					X		
167		X						
168		X					X	
169		X						
170	X					X		
171	X					X		
172	X		X	X	X	X		
173	X		X		X	X		
174		X						
175	X		X	X	X	X		
176	X					X		
177	X					X		
178	X					X		
179	X					X		
180	X					X		
181		X						
182	X	X				X		
183	X		X		X	X		
184		X				X		
185		X						

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
186		X						
187		X						
188	X					X		
189		X						
190		X						
191	X					X		
192		X						
193		X						
194		X						
195		X						
196		X						
197	X					X		
198		X						
199		X						
200		X						
201	X		X		X	X		
202		X						
203		X						
204		X						
205		X						
206		X						
207	X		X		X	X		
208	X					X		X
209	X					X		
210	X					X		X
211		X						
212		X						
213		X						
214		X						
215		X						
216	X					X		
217		X						
218		X						
219		X						
220		X						
221		X						
222	X					X		
223		X						
224		X						
225	X					X		
226	X					X		
227		X						
228	X					X		
229		X						
230	X		X	X	X	X	X	
231		X						
232		X						
233		X						

Kemerton Data Collection - Page 6

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
234	Data unreliable - requires checking							
235	Data unreliable - requires checking							
236		X						
237	X					X		
238		X						
239		X						
240		X						
241	X					X		
242		X						
243		X						
244	X					X		
245		X						
246		X						
247	X		X	X	X	X		X
Below 247								X
248	X					X		
249	X					X		
250	X					X		
251	X					X		
252		X						
253	X					X		
254	X					X		
255	X					X		
256	X					X		
257		X						
258		X						
259		X						
260		X						
261		X						
262		X						
263		X						
264	X					X		
265		X						
266		X						
267	X					X		
268	X					X		
269		X						
270		X					X	
271		X						
272		X						
273		X						
274		X						
275		X						
276	X					X		
277		X						
278	X					X		
279		X						
280		X						

Kemerton Data Collection - Page 7

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
281	X					X		
282		X						
283		X						
284	X					X		
285		X						
286	X					X		
287		X						
288		X						
289		X						
290		X						
291	X					X		
292		X						
293		X						
294	X					X		
295	X					X		
296	X					X		
297		X						
298	X		X		X	X		
299		X						
300	X					X		
301	X		X		X	X		X
302	X		X		X	X		X
303	X		X	X	X	X		
304	X					X		
305	X					X		
306		X						
307	X					X		
308	X					X		
309	X					X		
310	X					X		
311		X						
312		X						
313	X					X		
314	X					X		
315		X						
316		X						
317		X						
318		X						
319		X						
320	X					X		
321		X						
322		X						
323	X					X		
324	X		X		X	X	X	
325		X						
326		X						
327	X	X				X		
328		X						

SITE No.	Detailed Structure	Structural Observations	Species List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
329		X						
330		X						
331		X						
332	X		X		X	X		
333	X					X		
334	X					X		
335	X					X		
336	X					X		
337		X						
338		X						
339	X					X		
340	X					X		
341	X		X		X	X		
342	X		X		X	X		
343		X						
344	X					X		
345	X					X		
346	X		X			X		
347	X		X		X	X		
348	X		X		X	X		X
349		X						
350		X						
351	X					X		
352		X						
353	X		X		X	X		
354		X						
355	X					X		
356	X		X		X	X		
357	X		X		X	X		
358	X					X		
359	X					X		
360	X					X		
361	X					X		
362	X					X		
363	X					X		
364		X						
365	X					X		
366		X						
367	X		X		X	X		
368	X					X		
369	X					X		
370	X		X		X	X		
371	X		X		X	X		
372		X						
373		X						
374		X						
375		X						
376	X					X		

Keme 9

Detailed Structure

SITE No.			ecies List	Gibson Quadrat	Soil Profile	Soil Structure Observed	Aquatic Fauna	Vertebrate Fauna
377		X						
378		X						
379		X						
380		X						

Site No. is the study site number shown on Figures 5 and 6 of the main report

* Detailed Structure includes stratification, stratum top height, stratum bottom height, Canopy Cover, Average Foliage Density, health, and the other factors discussed in Appendix D

Structural observations refers to some but not all of the above

Species list is a list of all species recorded in a randomly selected standard plot (1 ha) and, where applicable, a Gibson quadrat

Gibson Quadrats are fixed quadrats installed and recorded according to the methods of Gibson et al. (1994)

Soil profile refers to a 1 m deep profile described using Munsell (1954) and Northcote (1971)

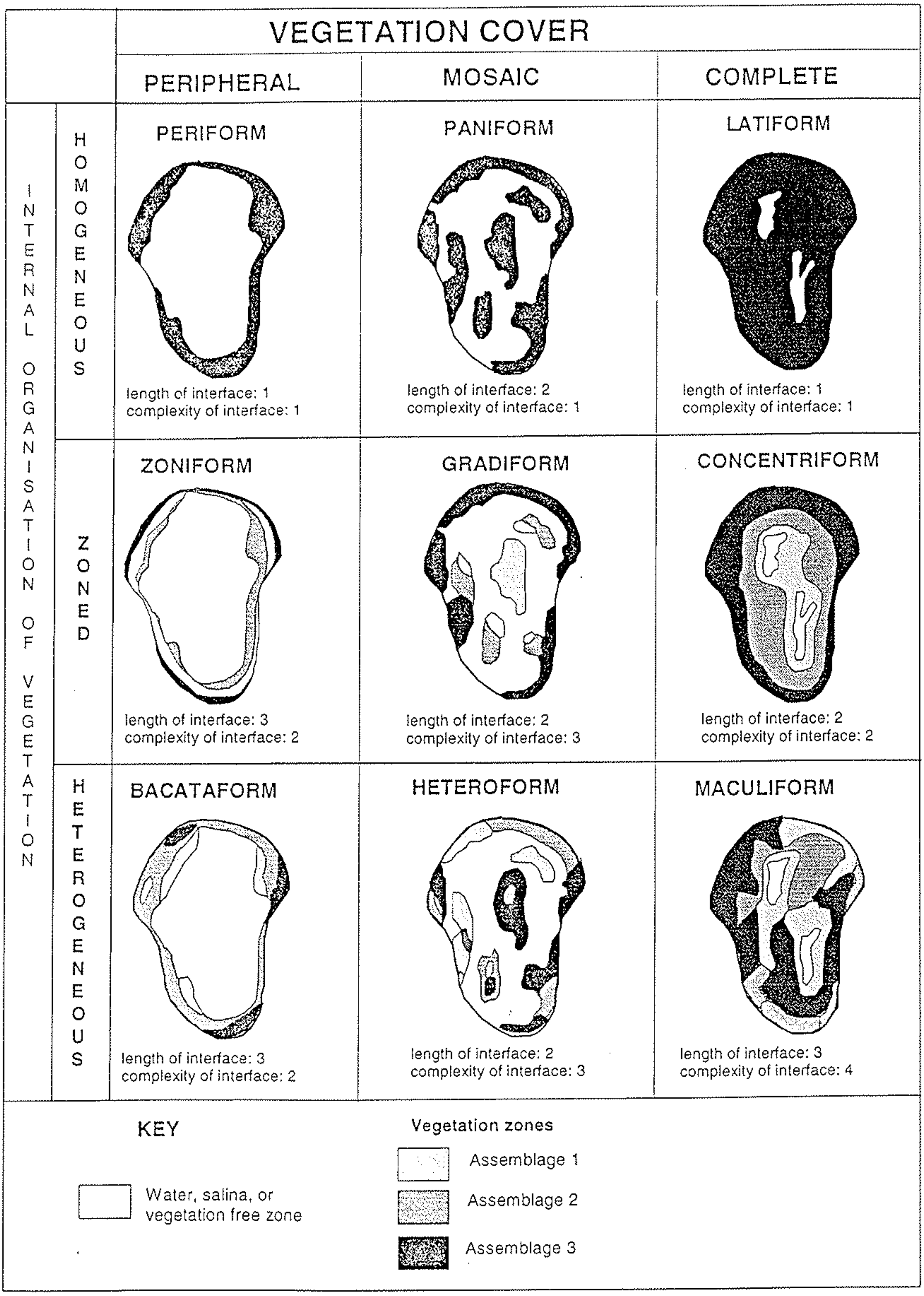
Soil structural observations are observations on structure, colour, and other features without digging a soil profile

Aquatic invertebrates - sites where aquatic invertebrates were collected

Vertebrate fauna - sites were collections or observations were made on vertebrate fauna

APPENDIX F

WETLANDS



Relative length and complexity of wetland vegetation community interface based on wetland classification system of Semeniuk *et al* (1990)

APPENDIX F

KEMERTON BIOLOGICAL SURVEY PHASE 1

WETLANDS

For vegetation codes refer Appendix L - other codes see end of Table

SITE No.	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege.	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Cont. water Nov. '98	Surface water Temp. (deg.C)	Surface Water pH	Surface Water TDS	Secchi	Depth to WT Nov. '98	Rate of Infiltration	Groundwater Temp. (deg.C)	Ground-water pH	Ground-water TDS
2	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
3	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
6	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
15	D	Cleared	Palusplain	N/A	Cleared	??	M g	S	??	P g	S	N					> 1 m				
17	D	Cleared	Palusplain	N/A	Cleared	??	M g	S	??	P g	S	N					> 1 m				
18	D	Damaged	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
19	D	Damaged	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
20	D	Cleared	Palusplain	N/A	Melaprei	??	M g	S	??	P g	S	N					> 1 m				
36	D	Cleared	Lenticular	Cleared	Melaprei	??	M g	SL	U	M g	SL	N					> 1 m				
41	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					??				
43	D		Lenticular	Maculiform	Kunzeric	WT	M g	S	U	M g	S	N					> 1 m				
45	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
46	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
47	D	Cleared	Lenticular	??	Cleared	WT	P g	S	U	P g	S	N					> 1 m				
48	D		Lenticular	Maculiform	Melaraph	WT	M g	S	U	M g	S	N					> 1 m				
56	D	Cleared	Lenticular	Cleared	Plantings	WT	P y-b	S	U	P y-b	S	N					> 1 m				
65	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.6	H	18.7	6.4	310
67	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N									
68	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.8 m	H	18.5	6.2	300
69	D		Lenticular	Concentriform	Melaraph	WT	D g	Peaty S	G	M g	S	N					0.8 m	H	18.5	6.3	310
71	D		Lenticular	Maculiform	Kunzeric	WT	M g	S	U	M g	S	N					> 1 m				
72	D		Lenticular	Concentriform	Astafasc	WT	P g	SL	G	P p-g	SL	N					> 1 m				
84	D		Lenticular	Maculiform	Beauarti	WT	D g	Peaty S	U	D g	S	N					0.5 m	H	16.8	3.9	120
86	D		Lenticular	Concentriform	Melatere	WT	M g	Peaty S	U	M g	S	N					> 1 m				
91	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
92	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
93	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
96	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
97	D		Lenticular	Zoniform	Melaraph	WT	VD g	Peaty S	G	P g	S	Y	21.4	6.6	1310	8 cm	Exposed	H	N/A	N/A	N/A
98	D		Lenticular	Concentriform	Perielli	WT	P g	SL	G	P p-g	SL	N					> 1 m				
100	D		Lenticular	Zoniform	Melaraph	WT	VD g	Peaty S	G	P g	S	Y	22.1	6.6	1290	6 cm	Exposed	H	N/A	N/A	N/A
101	D		Lenticular	Concentriform	Eucarudi	WT	P g	SL	U	P g	SL	N					> 1 m				
113	D		Lenticular	Concentriform	Perielli	WT	P g	SL	U	P g	SL	N					> 1 m				
114	D		Lenticular	Maculiform	Perielli	WT	P g	SL	U	P g	SL	N					> 1 m				
115	D		Lenticular	Heteroform	Kunzeric	WT	D g	SL	U	P g	SL	N					> 1 m				
116	D		Lenticular	Latiform	Perielli	WT	P g	S	U	P g	S	N					> 1 m				
132	D		Lenticular	Concentriform	Melaprei	WT	P g	S	U	P g	S	N					> 1 m				
133	D	Cleared	Lenticular	Concentriform	Cleared	WT	M g	SL	U	P g	SL	N					> 1 m				
134	D	Cleared	Lenticular	Concentriform	Cleared	WT	D g	Peaty SL	G	M g	SL	Y	14	5.96	650	2 cm	Exposed	H	18.5	6.2	570
135	D	Cleared	Lenticular	Concentriform	Eucarudis	WT	M g	SL	U	P g	SL	Y	17.8	6.1	480	15 cm	Exposed	H	18.6	6.4	460

SITE No.	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege.	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Cont. water Nov. '98	Surface water Temp. (deg.C)	Surface Water pH	Surface Water TDS	Secchi	Depth to WT Nov. '98	Rate of Infiltration	Groundwater Temp. (deg.C)	Ground-water pH	Ground-water TDS
145	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	P g	S	N					> 1.0 m				
150	D		Lenticular	Latiform	Perielli	WT	M g	Peaty S	G	P g-b	S	N					> 1.3 m				
151	D		Lenticular	Latiform	Perielli	WT	M g	Peaty S	G	P g-b	S	N					> 1.3 m				
155	D		Lenticular	Latiform	Astafasc	WT	VD g	Peaty SL	G	VP g-b	S	N					0.6 m	H	18.5	6.1	120
156	D		Lenticular	Heteroform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
160	D		Lenticular	Heteroform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
161	D		Lenticular	Latiform	Astefasc	WT	P g	S	U	P g	S	N					> 1 m				
163	D	Damaged	Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
164	D		Lenticular	Maculiform	Kunzeric	WT	P g	S	U	P g	S	N					> 1 m				
166	D		Lenticular	Maculiform	Perielli	WT	D g	SL	G	P g-b	SL	N					> 1m				
168	D	Man-made	Linear	Drain	Eucarudi	WT	P g	S	U	P g	S	Y	17.3	6.4	1170	32 cm	Exposed	H	N/A	N/A	N/A
172	D		Lenticular	Concentriform	Melatere	WT	P y-g	Peaty CL	G	P y-g	SL	N					0.6 m	H	18.2	6.2	910
173	D		Lenticular	Concentriform	Melatere	WT	VD g	Peaty CL	G	P y-g	SL	N					0.6 m	H	18.2	6.1	920
174	D	Damaged	Lenticular	Concentriform	Juncpall	WT	VD g	Peaty CL	G	P y-g	SL	Y	15.3	6.6	560	28	Exposed	H	18.3	6.2	840
187	D		Lenticular	Maculiform	Melaprei	WT	VD g	Peaty SL	G	VP g-b	SL	N					> 1 m				
189	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	M g	S	N					> 1 m				
191	D		Lenticular	Maculiform	Melaprei	WT	VD g	Peaty SL	G	VP g-b	SL	N					> 1 m				
201	D		Lenticular	Maculiform	Banklitt	WT	M g	S	U	M g	S	N					> 1 m				
202	D		Lenticular	Concentriform	Melaprei	WT	M g	SL	U	P g	SL	N					> 1 m				
214	D	Cleared	Lenticular	Concentriform	Melaprei	WT	M g	SL	U	Mg	SL	N					> 1 m				
223	D		Lenticular	Cleared	Melapreis	WT	P g	S	U	P G	S	Y	22	5.1	670	7	Exposed	H	17.8	6.3	340
229	D	Minor Dam	Lenticular	Maculiform	Melahamu	WT	P g	S	U	P g	S	N					> 1 m				
230(1)	D	Damaged	Lenticular	Maculiform	Hakevari	PER	VP g-b	S	G	P p-b	S (v fine)	N					0.6 m	L	17.7	6.2	4420
230(2)	D	Damaged	Lenticular	Maculiform	Melalate	PER	VP g-b	S	G	P p-b	S (v fine)	Y	23.4	5.6	440	12	Exposed	L	17.8	6.2	4410
230(3)	D	Damaged	Lenticular	Maculiform	Melaraph	PER	D g-b	S	G	P p-b	S (v fine)	Y	24.1	5.5	430	11	Exposed	N/A	N/A	N/A	N/A
232	D	Fire	Lenticular	Maculiform	Melaprei	PER	D g-b	SL	G	P g-b	S (v fine)	N					0.8 m	L	17.4	6.2	4390
237	D		Lenticular	Latiform	Melaraph	WT	M g	SL	G	M y-b	SL	N					0.4 m	H	18.2	7.1	1220
241	D		Lenticular	Maculiform	Banklitt	WT	M g	S	U	M g	S	N					> 1m				
243	D		Lenticular	Maculiform	Eucarudi	WT	P g	S	U	P g	S	N					> 1 m				
245	D		Lenticular	Concentriform	Melaprei	WT	P g	SL	G	P g	S	N					> 1 m				
256	D	Cleared	Lenticular	??	Melaprei	WT	P g-b	SL	U	P g-b	SL	N					> 1 m				
258	D		Lenticular	Maculiform	Pelaprei	WT	P g	S	U	P g	S	N					> 1 m				
264	D	Damaged	Lenticular	Maculiform	Melahamu	PER	VP g-b	S	G	P p-b	S (v fine)	N					1 m	L	17.8	6.1	4430
269	D	Damaged	Lenticular	Maculiform	Kunzeric	PER??	P g	S	G	P p-b	S	N					> 1 m				
270	D	Damaged	Lenticular	Latiform	Melaraph	WT	P g-b	Peaty SL	G	M b	SL	Y	20.4	6.7	320	> 30 cm	Exposed	N/A	N/A	N/A	N/A
275	D	Cleared	Lenticular	??	Melaprei	WT	P g	SL	U	P g	S	N					> 1 m				
277	D		Lenticular	Concentriform	Melaprei	WT	P g	S	U	P g	S	N					> 1 m				
302	D		Lenticular	Concentiform	Eucarudi	WT	D g	Peaty SL	G	P g	SL	N					> 1 m				
303	D		Lenticular	Concentiform	Eucarudi	WT	D g	Peaty SL	G	P g	SL	Y	22.5	5.2	380		Exposed	L	18.2	6.2	170
310	D		Lenticular	Latiform	Melaprei	WT	M g	SL	G	P g	SL	N					> 1 m				
321	D	Cleared	Lenticular	Concentriform	Melaprei	WT	P g	SL	U	P g	SL	N					> 1 m				
324	D	Cleared	Lenticular	??	Melaraph	WT	M g	SL	U	P g	SL	Y	19.5	5.5	410	25 cm	Exposed	H	18.3	6.4	420
325	D	Cleared	Lenticular	??	Cleared	WT	P g	S	U	P g	S	N					> 1 m				
329	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
331	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
342	D		Lenticular	Heteroform	Eucarudi	??	VP g	S	U	Vp g	S	N					> 1 m				
346	D		Lenticular	Periform	Melahamu	WT	D g-b	SCL	G	M y-b	SL	Y	22.1	6.2	3200		Exposed	??	N/A	N/A	N/A

SITE No.	TYPE	CONDN	Shape	Semeniuk Type	Dominant Vege.	Perched or WT Expos.	Surface Soil Colour	Surface Soil Texture	Soil Profile	Deep Soil Colour	Deep Soil Text.	Cont. water Nov. '98	Surface water Temp. (deg.C)	Surface Water pH	Surface Water TDS	Secchi	Depth to WT Nov. '98	Rate of Infiltration	Groundwater Temp. (deg.C)	Ground-water pH	Ground-water TDS
347	D		Lenticular	Zoniform	Eucarudi	WT	M g	SL	G	P g	SL	N					> 1 m				
349	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	17	6.2	4820		Exposed	N/A	N/A	N/A	N/A
350	D		Lenticular	Maculiform	Perialli	WT	M g	LS	U	M g	LS	N					> 1 m				
352	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
354	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
361	D		Lenticular	Concentiform	Melaprei	WT	D g	SL	G	M g	SL	N					> 1 m				
362	D		Lenticular	Concentiform	Melaprei	WT	D g	SL	G	M g	SL	N					> 1 m				
365	D	Cleared	Lenticular	Cleared	Melaprei	??	D g	SL	G	P g	SL	N					> 1 m				
371	D		Lenticular	Maculiform	Melaprei	WT	M g	S	U	P g	S	N					> 1 m				
372	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
373	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y									
374	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y									
375	RIV	Damaged	Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.3	6.2	4870	34 cm	Exposed		N/A	N/A	N/A
376	RIV		Linear	N/A	Eucarudi	River	D g-b	SL	Variab.	D g-b	SL	Y	18.2	6.1	4750		Exposed	N/A	N/A	N/A	N/A

Site No. is the location or study site number in accordance with Figures 5 and 6
Type - D = dampland/wetland, RIV = riverine
Condn (Condition) - overall condition of the site
Shape - whether lenticular (circular) or linear
Semeniuk Type - refer attached explanatory illustration
Dominant Vege (Dominant Vegetation) - for explanation of codes refer Appendix L (2) - (first four letters of genus and first four letters of species)
Perched or WT Expos. (Water Table Exposure)
Surface Soil Colour - approximately follows Munsell (1954) - VP = very pale, P = pale, M = mid, D = dark,
VD = very dark, g = grey, b = brown, p = pink, y = yellow, intermediate colours shown hyphenated
Surface Soil Texture - determined from bolus method (refer Northcote 1971) - S = sand, Sl = sandy loam,
CL = clay loam, SCL = sandy clay loam, LS = loamy sand
Soil Profile - G = gradational, U = uniform (refer Northcote 1971), variab. = variable
Deep Soil Colour - colour at 1 m depth or near the water table surface if this was less than 1 m deep
Deep Soil Text. (Deep Soil Texture) - texture at 1 m depth or near the water table surface if this was less than 1 m deep
Cont. Water Nov. 98 - contained surface water at time of survey (9, 10, 26, 27, 28, 29 November 1998) - N = no, Y = yes
Surface Water Temp. (Temperature) (degrees centigrade) as averaged from several readings with a HP81T TPS meter
Surface Water pH as averaged from several readings with a HP81T TPS meter
Surface Water TDS(Total Dissolved Salts) - total dissolved salts in mg/L as averaged from several readings with a HP81T TPS meter
Secchi - water colour extinction depth (in centimetres) using a standard Secchi disk or a colorimeter
Depth to WT (Water Table) (if known) at time of survey
Rate of Infiltration - a qualitative observation on the rate at which water seeped into a hole dug to below the water table - H = High; L = Low
Groundwater Temp. (Temperature) (degrees centigrade) from a reading with a HP81T TPS meter
Groundwater pH from a reading with a HP81T TPS meter
Groundwater TDS (Total Dissolved Salts) (in mg/L) from a reading with a HP81T TPS meter
N/A = not applicable

APPENDIX G

VEGETATION OF KEY SITES

APPENDIX G

KEMERTON BIOLOGICAL SURVEY PHASE 1

See end of appendix for [illegible]

VEGETATION OF KEY SITES

For plant species codes refer Appendix L

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
1	P		Pine plantation								
2	D	1	Melaprei	12	5	2	80	5			
		2	Kunzeric	5	2	80	60	5	48	5	
3	J		Mosiac complex of Eucamarg woodland with Melaprei dampland and with very dense Kunzeric thickets. Refer dampland complexes								
4	D		Drain margin with remnant Eucamarg trees								
5	P		Pines								
6	D	1	Kunxeric	6	2	80	30	4			Very complex mosaic of Melaprei dampland with Eucamarg and Bankatte. Refer discussion of interface between woodland and dampland catenary complexes. Woodland component has been very heavily logged and is severely infected with Dieback Disease
		2	Dasybrom	0.2	0	5	70	2	28	3	
7	P	1	Pinus radiata	18	10	80	90	5			Pine plantation. This structure and density is typical of the mature plantations
		2	Weeds and grasses	0.3	0	90	20	1	90	3	

Kemerton Vegetation Phase 1- Page 2

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
7	P	1	Pinus radiata	18	10	80	90	5			Pine plantation. This structure and density is
		2	Weeds and grasses	0.3	0	90	20	1	90	3	typical of the mature plantations
8	P		Young pines								
9	J		Parkland-cleared Agonflex, very weedy, surrounding remnant of Melaprei and Kunzeric thickets								
10	J	1	Eucamarg, Corycalo	18	9	10	20	3			Minor degradation and some weed invasion.
		2	Bankatte, Agonflex	9	4	70	50	4			Part is parkland-cleared with Agoneric
		3	Kunzeric	4	1	10	60	5			remaining and scattered Melaprei in low spots
		4	Weeds, sedges, Conoacul	0.2	0	5	30	5	45	4	
11	P		Mature pines								
12	J	1	Eucamarg	20	8	5	70	5			Some thickets with no Eucamarg but St2 to
		2	Bankatte, Bankilic	10	3	50	30	5			80% CC St3 Xantprei to 3% CC St4
		3	Melathym, Xantprei	1	0	5	40	5			Dasybrom 90%CC
		4	Dasybrom	0.5	0	80	90	5	93	5	
13	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	50	5			
		3	Mixed shrubs	1	0	5	30	5			
		4	Dasybrom	0.3	0	60	80	5	86	5	

Kemerton Vegetation Phase 1- Page 3

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
14	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	50	5			
		3	Mixed shrubs	1	0	5	30	5			
		4	Dasybrom	0.3	0	60	80	5	86	5	
15	D		Parkland-cleared to totally cleared dampland and palusplain with patches of Eucamarg								
16	J		Complex of sparse Eucamarg with scattered Corycalo. Open areas with bare patches amongst Kunzeric thickets								
17	D		Parkland-cleared to totally cleared dampland and palusplain with patches of Eucamarg								
18	D		Damaged but not cleared dampland and palusplain with patches of Eucamarg								
19	D		Heavily disturbed and grazed wetland mosaic								
20	D		Parkland-cleared palusplain with patches of Eucamarg								
21	J		Parkland-cleared Eucamarg woodland								
22	J		Sparse Eucamarg and Corycalo and open areas amongst Kunzeric thickets								
23	C		Under intensive agriculture/horticulture								

Kemerton Vegetation Phase 1- Page 4

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
24	C		Under intensive agriculture/horticulture								
25	J	1	Eucamarg	20	5	5	20	4			Appears to have been burned fairly regularly.
		2	Bankatte	9	5	50	50	5			Bankilic appears anomalous - site might get
		3	Mixed shrubs	0.75	0	70	60	5			seepage from higher ground
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
26	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
27	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
28	J	1	Eucamarg	20	5	5	20	4			Frequently burned
		2	Bankatte	9	5	50	50	5			
		3	Mixed shrubs	0.75	0	70	60	5			
		4	Dasybrom, herbs, sedges	0.2	0	20	80	5	84	5	
29	J	1	Eucamarg	18	9	10	30	5			Scattered Macoreid
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	

Kemerton Vegetation Phase 1- Page 5

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
30	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
31	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
32	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
33	C		Cleared farmland with scattered Melaprei								
34			Cleared farmland with scattered Melaprei								
35	J	1	Eucamarg	20	8	5	70	5			Some thickets with no Eucamarg, but St2 to 80% CC St3 Xantprei to 3% CC St4 Dasybrom 90%CC
		2	Bankatte, Bankilic	10	3	50	30	5			
		3	Melathym, Xantprei	1	0	5	40	5			
		4	Dasybrom	0.5	0	80	90	5	93	5	
36	C		Cleared, few scattered Melaprei and Eucarudi								
37	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs and sedges	0.5	0	20	20	5	40	4	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
38	J	1	Eucamarg	14	8	2	20	5			
		2	Bankatte, Bankilic	8	3	70	60	5			
		3	Mixed shrubs	1	0	5	40	5			
		4	Dasybrom	0.3	0	60	70	5	86	5	
39	C		Cleared farmland with a few scattered Melaprei								
40	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs & sedges	0.5	0	20	20	5	40	4	
41	D		Very complex dampland with indistinct stratification and no clear zonation. Consists of Melaprei scattered to up to 20% CC over sedges with varying amounts of Astafasc and Calolate with some Perielli over Hypoangu on slightly higher ground. Refer dampland complexes								
42	P		Pines								
43	D	1	Melaprei	8	2	2	60	5			Kunzeric variable from 20-50%CC
		2	Kunzeric	6	1	50	70	5			
		3	Perielli	0.5	0	5	20	5	58	5	
44	J		Complex of sparse grazed Eucamarg with scattered Corycalo interspersed with open areas with bare patches amongst Kunzeric thickets								
45	D		Cleared Melaprei flats with patches of Eucamarg								

Kemerton Vegetation Phase 1- Page 7

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
46	D		Parkland-cleared and degraded dampland mosaic								
47	D		Cleared wetland with some minor regrowth								
48	D	1	Melaprei	8	4	2	60	5			Scattered Kunzeric and Xantbrun on high points
		2	Perielli	1.5	0	60	20	5			
		3	Hypoangu	0.5	0	40	20	5	20	5	
49	J		Parkland-cleared and degraded Eucamarg wood-land								
50	C		Under intensive agriculture/horticulture								
51	C		Under intensive agriculture/horticulture								
52	J		Dense parkland-cleared and grazed Agonflex woodland	18	3	80	30	5	24	5	
53	J		Dense parkland-cleared and grazed Agonflex woodland with Melaprei in low areas								
54	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
55	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
56	D		Cleared and partially regrowing wetland								
57	J	1	Corycalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings between Strata 2 and 3
		2	Bankatte, Agonflex	12	8	50	40	5			
		3	Hibbhype	0.3	0	20	60	5	34	5	
58	J	1	Corycalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings between Strata 2 and 3
		2	Bankatte, Agonflex	12	8	50	40	5			
		3	Hibbhype	0.3	0	20	60	5	34	5	
59	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
60	J	1	Eucamarg	18	9	10	20	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
61	C		Cleared farmland with scattered Eucamarg and Agonflex trees								
62	C		Cleared farmland with scattered Eucamarg and Agonflex trees								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
63	J		Complex Eucamarg Agonflex Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas. Refer to woodland catenary complexes								
64	J		Complex Eucamarg Agonflex Bankatte woodland mosaic with Bankgran, Bankilic and Kunzeric in lower areas. Heavily logged and grazed. Refer to woodland catenary complexes								
65	D		Very complex dampland with indistinct stratification and no clear zonation. Consists of Melaprei scattered to up to 20% CC over sedges with varying amounts of Astafasc and Calolate with some Perielli over Hypoangu on slightly higher ground. Refer dampland complexes								
66	P		Pines								
67	D		Very complex dampland comprising three associations in mosaic. Associations designated A, B and C						Mean about 11	5	Regrowth in disturbed area under power-line is mainly Astafasc, Aotugrac, Perielli and Calolate
		A1	Melaraph	6	2	90	20	5			
		A2	Sedges	1	0	20	5	5	19	5	
		B1	Astafasc	3.5	2.5	90	5	5			
		B2	Sedges	1	0	30	5	5			
		B3	Villarsia albiflora	0.1	0	5	30	5	8	5	
		C1	Calolate	1.5	0	10	10	5			
		C2	Astfasc	2	0.5	60	10	5			
		C3	Sedges	1	0	5	5	5	7	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
68	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Site 67								
69	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Site 67								
70	P		Young pines								
71	D		Complex wetland of very dense Kunzeric with scattered Melaraph and components of shrubland similar to those described for Site 67								
72	D	1	Perielli	1	0	90	20	5			May have been cleared at some time.
		2	Hypoangu	0.5	0	70	30	5			Many heaps of earth and logs.
		3	Sedges	0.2	0	30	1	5	39	5	Scattered Melaprei
73	C		Under intensive agriculture/horticulture								
74	C		Under intensive agriculture/horticulture								
75	C		Under intensive agriculture/horticulture								
76	C		Under intensive agriculture/horticulture - parts are seasonally flooded								
77	J	1	Corycalo, Eucamarg	22	12	5	30	4			Poorly structured, with many saplings between
		2	Bankatte, Agonflex	12	8	50	40	5			Strata 2 and 3
		3	Hibbhype	0.3	0	20	60	5	34	5	

Kemerton Vegetation Phase 1- Page 11

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
78	J		Parkland-cleared Agonflex								
79	J		Parkland-cleared Agonflex								
80	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
81	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
82	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
83	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
84	D	1	Beauarti	2	0	100	95	5	95	5	Scattered Astafasc (small area with Astafasc to 2 m tall and 95% CC) and some small low-lying depressions with Melaraph
85	J		Low-lying Bankilic regrowth - previously cleared and with piles of logs								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
86	D	1	Melaprei, Banklitt	7	3	10	60	5			Kunzeric stand with Eucarudi on the edge and an internal mosaic. Refer woodland dampland interfaces and catenary complexes
		2	Melatere, Melainca, Melapoly	1.5	0	5	40	5	8	5	
87	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
88	C		Silica sand mine slurry pond								
89	D		Not examined - appears to be Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points								
90	C		Silica sand processing plant								
91	D	1	Perielli	1	0	60	20	5			Clumps of earth and logs suggest previously cleared. Scattered Melaprei and Xantprei
		2	Hypoangu	0.5	0	60	30	5			
		3	Sedges	0.2	0	30	1	5	30	5	
92	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest previously cleared
		2	Hypoangu	0.5	0	70	30	5			
		3	Sedges	0.2	0	30	1	5	39	5	
93	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest previously cleared
		2	Hypoangu	0.5	0	70	30	5			
		3	Sedges	0.2	0	30	1	5	39	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
94	J		Parkland-cleared Agonflex with a few Eucamarg and scattered Eucarudi								
95	J		Parkland-cleared Agonflex with a few Eucamarg and scattered Eucarudi								
96	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest previously cleared
		2	Hypoangu	0.5	0	70	30	5			
		3	Sedges	0.2	0	30	1	5	39	5	
97	D	1	Melaraph	10	1.5	60	60	5			
		2	Melaraph	2	0.5	50	50	5	61	5	
98	D	1	Perielli	1	0	90	20	5			Clumps of earth and logs suggest previously cleared
		2	Hypoangu	0.5	0	70	30	5			
		3	Sedges	0.2	0	30	1	5	39	5	
99	C		Silica sand mine dredge pond								
100	D	1	Melaraph	10	1.5	60	60	5			
		2	Melaraph	2	0.5	50	50	5	61	5	
101	D	1	Eucarudi	16	5	80	20	1			Ecotone to Sites 97 and 100 Casspube common in parts.
		2	Melaraph	5	2	10	40	4			Patchy understorey of Pterescu
		3	Astafasc	1.5	0	20	10	5			
		4	Sedges	0.3	0	70	40	5	50	3.8	
102	J		Parkland-cleared Agonflex and Eucamarg								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
103			Not examined - reported by B Keighery as Eucadeci on Muchea Limestone - examine in Phase 2								
104	C		Under intensive agriculture/horticulture								
105	J		Grazed Jarrah woodland with a reduced understorey								
106	C		Under intensive agriculture/horticulture - wetland may be seasonally flooded								
107	P		Pines								
108	J		Parkland-cleared Agonflex and scattered Eucamarg								
109	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying.
		2	Bankatte	10	3	30	50	5			Scattered Xantprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
110	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying.
		2	Bankatte	10	3	30	50	5			Scattered Xantprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
111	J	1	Eucamarg	20	8	2	20	2			Platvagi dead and dying.
		2	Bankatte	10	3	30	50	5			Scattered Xantprei
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
112	J	1	Eucamarg	18	9	10	30	5			
		2	Bankatte	10	2	50	50	5			
		3	Mixed shrubs	0.5	0	80	50	5	68	5	
113	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
114	D		Complex Kunzeeric over Hypoangu dampland with scattered Nuytflor. Refer dampland complex								
115	D		Kunzeric shrubland with associated complex of Perielli, Astafasc, Calolate dampland with scattered Melaprei. Refer dampland complex								
116	D		Complex of Perielli, Astafasc, Calolate dampland with scattered Melaprei. Refer dampland complex								
117	J	1	Eucamarg	26	8	5	20	3			Scattered Persiong.
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			No Agonflex
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
118	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
119	J	1	Eucamarg	14	8	5	20	3			
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
120	J	1	Eucamarg	26	8	5	20	3			Scattered Perslong.
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			No Agonflex
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
121	J		Parkland-cleared Eucamarg woodland with regrowth and remnants - much Bankilic								
122	J	1	Eucamarg	18	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
123	C		Not examined - parkland-cleared Agonflex and Eucamarg								
124			Not examined - possible site for Eucadeci on Muchea Limestone - examine in Phase 2								
125	J		Grazed Eucamarg woodland with reduced under-storey								
126	J		Eucamarg Agonflex post-clearing regrowth								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
127	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								
128	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								
129	J		Parkland-cleared Agonflex								
130	J		Parkland-cleared Eucamarg Corycalo regrowth								
131	T		Intensely parkland-cleared Eucagomp Agonflex woodland								
132	D		Parkland-cleared Eucarudi and Melaprei woodland								
133	D		Cleared wetland								
134	D		Melaprei	7	2	10	80	5			Typhorie on margin
			Juncpall	0.5	0	10	60	5	14	5	
135	D		Open water (28 November 1998) almost completely cleared but with scattered Eucarudi and Melaprei								
136	J		Parkland-cleared Agonis								
137	M		Heavily grazed Eucamarg Corycalo Agonflex wood-land								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
138	C		Sand pit								
139	T		Parkland-cleared Eucagomp Corycalo Agonflex woodland								
140	J	1	Eucamarg Corycalo	20	8	2	20	2			
		2	Bankatte	10	3	30	50	5			
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
141	J	1	Bankatte Eucamarg Agonflex	18	4	80	40	5			Emergent Eucamarg to 26 m less than 2% CC.
		2	Agonflex	1.5	1	5	20	5			Agonflex more tree-form rather than usual
		3	Hibbhype Xantbrun	0.5	0	40	80	5	65	5	coppice form
142	J		Intensively cleared with scattered Agonflex								
143	DEC		Parkland-cleared Eucadeci and Agonflex over Tamala limestone								
144	J	1	Eucamarg Corycalo	20	8	2	20	2			
		2	Bankatte	10	3	30	50	5			
		3	Melathym	1	0	10	20	5			
		4	Hibbhype	0.5	0	70	80	5	73	4.3	
145	D		Edge of Astafasc and Melaprei dampland complex in Location 150								

Kemerton Vegetation Phase 1- Page 19

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
146	J	1	Eucamarg	18	5	40	50	5			Parkland-cleared about 30 years ago
		2	Melathym, Jackster	1.5	0.5	2	30	5			
		3	Hibbhype, Stirlati, Xantbrun	0.5	0	90	70	5	83	5	
147	J	1	Eucamarg	18	5	40	50	5			Parkland-cleared about 30 years ago
		2	Melathym, Jackster	1.5	0.5	2	30	5			
		3	Hibbhype, Stirlati, Xantbrun	0.5	0	90	70	5	83	5	
148	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg Bankgran Bankilic Bankatte	14	4	20	50	5			
		3	Jackster Melathym	1	0	80	20	5			
		4	Xantbrun Hibbhype	0.3	0	30	70	5	45	4.5	
149	J	1	Eucamarg	20	15	2	30	3			
		2	Bankilic, Bankatte	10	3	30	50	5			
		3	Calyfras	1	0.5	60	5	4			
		4	Dasybrom	0.3	0	2	80	4	20	4	
150	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
151	D	1	Perielli	1	0	95	10	5			
		2	Mixed shrubs	0.3	0	20	30	5	16	5	
152	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankgran, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
153	J	1	Eucamarg	22	8	5	20	3			
		2	Bankilic, Bankatte	14	4	30	50	5			
		3	Melathym	1	0	60	20	5			
		4	Hibbhype	0.3	0	40	60	5	52	5	
154	J	1	Eucamarg	22	8	5	20	3			
		2	Bankilic, Bankatte	14	4	30	50	5			
		3	Melathym	1	0	60	20	5			
		4	Hibbhype	0.3	0	40	60	5	52	5	
155	D	1	Astafasc	1.5	0	95	10	3			
		2	Sedges	1	0	10	5	2	10	2.5	
156	D	1	Perielli Astafasc	1.5	0	95	20	5			Scattered Melaprei
		2	Spiral leaf sedge	0.5	0	20	2	5	23	5	
157	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
158	C		Requires field check - data may be in error - recorded as parkland-cleared Eucamarg woodland with regrowth and remnants - much Bankilic								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
159	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Melathym	1	0	80	20	5			
		4	Hibbhype	0.3	0	30	60	5	45	4.5	
160	D	1	Perielli Astafasc	1.5	0	10	20	5			Scattered Melaprei
		2	Calolate Hypoangu	0.5	0	20	40	5	10	5	
161	D	1	Astafasc	1.5	0	95	10	5			
		2	Mixed shrubs and sedges	0.5	0	10	30	5	13	5	
162	C		Not examined - parkland cleared Agonflex								
163	D		Complex of heavily grazed low-lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei								
164	D		Complex of heavily grazed low-lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei								
165			Not examined - could contain Muchea Limestone - to be examined in Phase 2								
166	D	1	Perielli	1	0	80	30	5			Nuytflor on margin and scattered Melaprei in patches on east side
		2	Sedge and scattered Hibbstel	0.3	0	< 2	10	5	24	5	
167	J		Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
168	D		Eucarudi over weeds on drain which leads into Myalla Lagoon								
169	T		Sparse parkland-cleared Agonflex with Eucagomp								
170	T	1	Eucagomp	26	12	3	80	5			No evidence of Eucadeci
		2	Agonflex, Bankatte	10	2.5	50	60	5			
		3	Hibbhype	0.5	0	5	60	5			
		4	Annual grasses	0.2	0	90	20	5	53	5	
171	T	1	Eucagomp	26	12	3	80	5			No evidence of Eucadeci.
		2	Agonflex, Bankatte	10	2.5	50	60	5			Some minor Eucamarg, Bankgran Xantprei
		3	Hibbhype	0.5	0	5	60	5			
		4	Annual grasses	0.2	0	90	20	5	53	5	
172	D	1	Melatere	3	1	80	20	5			Cleared in 1960s. Acacsalig is invading from
		2	Sedges	0.5	0	60	80	5			margin plus a few young Eucarudi
		3	Villalbi and weeds	0.1	0	50	60	5	94	5	
173	D	1	Melatere	3	1	80	20	5			Cleared in 1960s. Acacsalig is invading from
		2	Sedges	0.5	0	60	80	5			margin plus a few young Eucarudi
		3	Villalbi and weeds	0.1	0	50	60	5	94	5	
174	D		Open water with Beauartic, Juncpall and Typhorie and rushes sedges on west side - reported as cleared in the 1960s								

Kemerton Vegetation Phase 1- Page 23

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
175	M	1	Corycalo	22	8	10	60	5			Scattered Eucamarg
		2	Bankilic, Corycalo	14	6	60	70	5			
		3	Hibbhype	0.5	0	60	80	5	96	5	
176	M	1	Corycalo	22	8	10	60	5			Scattered Eucamarg
		2	Bankilic, Corycalo	14	6	60	70	5			
		3	Hibbhype	0.5	0	60	80	5	96	5	
177	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
178	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
179	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
180	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
181	DEC		Grazed sparse Eucadeci and dense Agonflex over Tamala limestone								
182	J	1	Eucamarg	26	8	3	20	3			Partly cleared and probably heavily grazed
		2	Bankilic, Bankatte, Xyloocci	12	4	10	50	5			
		3	Ephemeral weeds and grasses	0.3	0	60	20	2	18	3.3	
183	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
184	J		Semi-cleared and grazed Eucamarg woodland with Bankilic								
185	J		Semi-cleared and grazed Eucamarg woodland with Bankilic								
186	J		Parkland-cleared Eucamarg with abundant Xantbrun regrowth								
187	D		Scattered Melaprei over Perieli with minor Banklitto								
188	J	1	Eucamarg	26	8	5	20	3			
		2	Eucamarg, Bankilic, Bankatte	14	4	20	50	5			
		3	Jackster, Melathym	1	0	80	20	5			
		4	Xantbrun, Hibbhype	0.3	0	30	60	5	45	4.5	
189	D	1	Melaprei	8	4	10	60	5			Refer dampland complex descriptions
		2	Perielli	1.5	0	10	20	5	8	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
190	J		Eucamarg woodland complex merging on sightly lower ground into Bankilic and Kunzeric dampland. Refer discussions of woodland and dampland catenary complexes								
191	D	1	Perielli	1.5	0	30	30	5			Scattered Melaprei
		2	Sedge and scattered Hibbstel	0.3	0	2	10	5	9	5	
192	J		Complex of low-lying Eucamarg Bankilic woodland. Refer discussion of woodland catenary complexes								
193	P		Tasmanian Blue Gum								
194	P		Tasmanian Blue Gum								
195	P		Tasmanian Blue Gum								
196	T		Sparse parkland-cleared Agonflex with Eucagomp								
197	T	1	Eucagomp	24	10	3	80	5			Parkland-cleared
		2	Agonflex	8	2	50	20	5			
		3	Grass, weeds and Lupins	0.3	0	70	5	1	16	3.7	
198	T		Sparse parkland-cleared Agonflex with Eucagomp over grass and weeds								
199	M		Heavily grazed Corycalo with scattered Eucamarg								
200	M		Heavily grazed Corycalo with scattered Eucamarg								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
201	D	1	Banklitt	6	1	5	40	5			Eucarudi on margins all very healthy.
		2	Melatere	1.5	0	90	40	2			Melatere dying
		3	Sedges (flat spiral) and grasses	0.3	0	10	5	2	39	3	
202	D		Heavily grazed Melaprei and Eucarudi over dead Perielli on north side of road, and Eucagomp over Bankilic on south side								
203	J		Grazed Eucamarg, Agonflex and Bankilic								
204	T		Cleared with scattered Eucagomp and Agonflex								
205	T		Heavily grazed Eucagomp and Agonflex								
206	J		Eucamarg and Agonflex on edge of wetland with Eucagomp and Eucadeci. South margin with grazed Agonflex over Pterescu								
207	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
208	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
209	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
210	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
211	J		Parkland-cleared Agonflex on rural lots, many with houses								
212	J		Parkland-cleared Agonflex								
213	J		Parkland-cleared Agonflex with Xantbrun regrowth								
214	D		Parkland cleared Melaprei								
215	J		Parkland-cleared Eucamarg								
216	J		Cleared Eucamarg woodland with some regrowth								
217	P		Tasmanian Blue Gum to 7 m tall								
218	C		Totally cleared farmland								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
219	J		Part cleared Eucamarg and Bankatte - heavy infection of Dieback Disease								
220	P		Mature pines								
221	J		Cleared with some regrowth - previously Eucamarg woodland with some damp areas								
222	J		Cleared with some regrowth - previously Eucamarg woodland with some damp areas								
223	D		Small cleared swamp in paddock with Melaprei and a few Astafasc and a Lemnmino cover - polluted by cattle								
224	J		Eucamarg woodland with patches of Melaprei - heavy infection of Dieback Disease								
225	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
226	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
227	J		Eucamarg woodland remnant								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
228	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
229	D		Complex mosaic of Melaprei and Melaraph thickets with Melapoly and Perielli. Refer wetland catenary complexes								
230	D	1	Hakevari	2	0.5	5	10	5			Complex with Hakevari dominating in centre,
		2	Astafasc, Calolate, sedges	1.5	0	95	60	5			Lepoglau and Melalate in places, and Melaraph
		3	Villaalbi	0.1	0	2	20	5	56	5	over wettest areas. Refer wetland catenary complexes
231	J		Complex of Eucamarg woodland with Bankilic, Kunzeric and Xantbrun and heavy infection of Die-back Disease. Refer woodland catenary complexes								
232	D		Complex of Melaprei, Calolate, Hakevari post-fire regrowth to 0.5 m tall								Some Melaprei to 8 m survived fire
233	J		Eucamarg and Bankatte with heavy infection of Dieback Disease								
234			Not examined - to be surveyed in Phase 2								
235			Not examined - to be surveyed in Phase 2								
236	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
237	D	1	Melaraph	8	1.5	95	60	5			Some Juncpall
		2	Grass and weeds	0.3	0	90	5	1	59	3	
238	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
239	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
240	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
241	D	1	Banklitt	6	1	5	40	5			
		2	Melatere	1.5	0	90	60	4			
		3	Sedges (flat spiral) and grasses	0.3	0	10	5	2	57	3.7	
242	J		Cleared, with scattered Eucamarg, Nuytfloi, Agonfex, scattered Eucarudi on west side								
243	D		Damp patch of Eucarudi, Melaraph, Melaprei in Agonflex woodland with Xantprei, Banklitt and Corycalo								
244	J	1	Eucamarg	24	8	3	20	5			Many dead staghead old Eucamarg probably killed by fire.
		2	Bankilic, Bankatte, Bankgran	11	3	30	60	5			Some very large and old Corycalo and Bankilic.
		3	Xylo, Eucamarg	3	1	10	70	5			Long unburned
		4	Melathym	1	0.5	10	10	5			
		5	Hibbhype	0.5	0	80	80	5	91	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
245	D		Part cleared and cattle-damaged wetland of Meaprei, Melaraph with Agonflex on margins - in reasonable condition compared to other cattle-damaged wetlands in region								Some Astafasc, Melatere and Juncpall in places
246	C		Cleared farmland with scattered trees and remnants								
247	J	1	Eucamarg	24	8	3	20	5			Many dead staghead old Eucamarg probably killed by fire. Some very large and old Corycalo and Bankilic. Site backs onto edge of Mialla Lagoon wetland complex with Melaprei and Eucarudi. Long unburned
		2	Bankilic, Bankatte, Bankgran	11	3	30	60	5			
		3	Xylo, Eucamarg	3	1	10	70	5			
		4	Melathym	1	0.5	10	10	5			
		5	Hibbhype	0.5	0	80	80	5	91	5	
248	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
249	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
250	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
251	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
252	J		Cleared Eucamarg woodland with some regrowth								
253	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
254	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
255	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
256	D		Cleared wetland with scattered Melaprei								
257	P		Pines								
258	D		Melaprei and Bankilic remnant								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
259	P		Pines								
260	P		Pines								
261	P		Pines								
262	P		Pines								
263	P		Pines								
264	D	1	Hakevari	2	0.5	5	10	5			
		2	Astafasc, Calolate, sedges	1.5	0	95	60	5			
		3	Villaalbi	0.1	0	2	20	5	56	5	
265	P		Pines								
266	P		Pines								
267	J	1	Eucamarg	24	10	10	20	4			
		2	Bankilic, Bankatte	8	3	60	60	5			
		3	Melathym	1	0.5	50	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	69	4.8	
268	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
269	D		Low-lying woodland dampland interface complex with Kunzeric and Eucamarg merging into Melaprei over Perielli. Refer to discussion of woodland and dampland catenary complexes								
270	D		Parkland-cleared and heavily grazed Melaraph wetland								
271	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
272	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
273	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
274	T		Parkland-cleared Eucagomp over Agonflex over grass and weeds								
275	D		Parkland-cleared wetland with Melaprei and Agonflex over grass and weeds								
276	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
277	D		Edge of a Melaprei dampland with Eucamarg and Bankilic								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
278	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
279	J		Parkland-cleared Eucamarg and Agonflex								
280	J		Parkland-cleared Eucamarg and Agonflex								
281	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
282	J		Parkland-cleared Eucamarg woodland with regrowth								
283	J		Parkland-cleared Eucamarg woodland with regrowth								
284	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
285	J		Cleared Eucamarg woodland with some regrowth								
286	C		Data may be in error - check in Phase 2 - recorded as farmland with clumps of Juncpall and Kunzeric regrowth								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
287	P		Pines								
288	P		Pines								
289	P		Pines								
290	P		Pines								
291	P		Pines								
292	P		Pines								
293	C		Cleared farmland with some Juncpall								
294	J	1	Eucamarg	22	10	10	20	4			
		2	Bankatte, Kunseric	6	3	70	50	5			
		3	Melathym	1	0.5	60	20	5			
		4	Mixed shrubs	0.5	0	40	50	5	69	4.8	
295	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunseric, Bankilic	8	3	70	50	5			
		3	Melathym	1	0.5	80	30	5			
		4	Mixed shrubs	0.5	0	40	40	5	77	4.8	
296	J	1	Eucamarg	22	10	10	20	4			
		2	Bankatte, Kunseric	6	3	80	50	5			
		3	Melathym	1	0.5	60	20	5			
		4	Mixed shrubs	0.5	0	40	50	5	74	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
297	J		Parkland-cleared Eucamarg woodland								
298	T	1	Eucagomp	26	16	5	80	5			
		2	Agonflex	12	2	80	20	5			
		3	Macrreid and mixed shrubs	1	0	5	50	5			
		4	Annual grasses	0.3	0	95	5	1	23	4	
299	T		Parkland-grazed Eucagomp over Agonflex								
300	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
301	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
302	D	1	Eucarudi	16	8	10	30	5			
		2	Melaprei	12	4	90	60	5			
		3	Sedges	1	0	100	95	5	152	5	
303	D	1	Eucarudi	16	8	10	30	5			
		2	Melaprei	12	4	90	60	5			
		3	Sedges	1	0	100	95	5	152	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
304	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
305	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
306	J		Parkland-cleared Eucamarg and Agonflex								
307	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
308	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
309	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
310	J	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
311	J		Parkland-cleared Eucamarg woodland with scattered Allofras, Nuytflor and Bankilic								
312	J		Intensively cleared Eucamarg woodland								
313	J		Intensively cleared Eucamarg woodland								
314	J	1	Eucamarg	24	10	10	20	3			
		2	Bankatte, Bankilic	8	3	70	30	3			
		3	Melathym	1	0.5	80	20	5			
		4	Mixed shrubs	0.5	0	40	40	4	55	3.8	
315	J		Intensively cleared Eucamarg woodland								
316	P		Pines								
317	P		Pines								
318	P		Pines								
319	J		Parkland-cleared Eucamarg woodland								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
320	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte Bankilic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	
321	D		Farmland with patches of Astafasc and Melaprei in a shallow dampland								
322	C		Cleared farmland								
323	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunzeric, Bankiic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	
324	D		Melaraph	8	3	20	60	5			
			Weeds and grasses	0.2	0	100	5	5	17	5	
325	D		Farmland with patches of Juncpal and Kunzeric								
326	J		Parkland-cleared and grazed Agonflex with most of the Eucamarg removed								
327	J	1	Eucamarg	24	10	10	20	4			
		2	Bankatte, Kunzeric, Bankiic	8	3	80	30	5			
		3	Melathym	1	0.5	60	10	5			
		4	Mixed shrubs	0.5	0	40	30	5	44	4.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
328	J		Cleared farmland. Situated on Bassendean Sand Guildford Clay interface								
329	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
330	J		Semi-cleared and grazed Agonflex woodland with some Eucamarg and Bankilic and patches of Melaprei in places								
331	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
332	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
333	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
334	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
335	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
336	M	1	Corycalo, Eucamarg	22	8	40	40	5			
		2	Bankatte, Agonflex	8	1.5	70	40	5			
		3	Melathym	1	0	60	30	5			
		4	Hibbhype, sedges	0.5	0	70	80	5	118	5	
337	J		Intensively cleared Eucamarg woodland								
338	J		Intensively cleared Eucamarg woodland								
339	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
340	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
341	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
342	D	1	Eucarudi, Melaprei	14	2	70	50	5	35	5	Scattered Melaprei less than 2% CC and Adenmeis less than 2% CC in understorey. Small numbers of very large and old Nuytfor, Bankiic and Xantprei, but none abundant enough to alter the overall structure
343	J		Intensively cleared Eucamarg woodland								
344	J	1	Eucamarg	16	8	10	20	5			
		2	Bankatte, Bankilic	10	3	70	50	5			
		3	Melathym	1	0.5	2	30	5			
		4	Hibbhype	0.3	0	80	60	5	45	5	
345	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs and sedges	0.5	0	20	20	5	40	4	
346	D	1	Melahamu	5	1	80	30	5			Open water surrounded by grass and weeds in
		2	Cotucoro and agricultural weeds and Cynodact	0.2	0	100	20	5	44	5	centre of wetland. Chara spp in water. Clumps of Beauarti and Juncpall
347	D	1	Eucarudi	12	4	70	30	4			Scattered Melaprei and Melatere.
		2	Agonflex	8	2	20	20	5			This association is an 80 m wide zone behind
		3	Astaflex	3	0	70	10	5			Melahamu zone
		4	Weeds and sedges	0.3	0	5	80	0	32	3.5	
348	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs and sedges	0.5	0	20	20	5	40	4	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
349	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
350	D		Scattered Melaprei over a complex mosaic largely dominated by Perielli and Melahamu								
351	J	1	Eucamarg	26	15	2	20	3			
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs and sedges	0.5	0	20	20	5	40	4	
352	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
353	M		Corycalo	14	8	10	30	5			
			Melaprei	8	2	10	80	5			
			Xantbrun and weeds	0.3	0	80	20		27	5	
354	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
355	J	1	Eucamarg, Corycalo	25	12	10	40	4			
		2	Bankatte, Xyloocci, Bankilic	12	3	40	60	4			
		3	Hibbhype, Xantprei	1	0.5	20	80	4			
		4	Annuals and grasses	0.3	0	60	70	2	86	3.4	

Kemerton Vegetation Phase 1- Page 45

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
356	J	1	Eucamarg, Corycalo	25	12	10	40	4			
		2	Bankatte, Xyloocci, Bankilic	12	3	40	60	4			
		3	Hibbhype, Xantprei	1	0.5	20	80	4			
		4	Annuals and grasses	0.3	0	60	70	2	86	3.4	
357	DEC	1	Eucadeci, Agonflex	10	3	70	60	5			
		2	Melaacer	2	0.5	60	80	5			
		3	Phebcaly	0.5	0	5	20	5	91	5	
358	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
359	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
360	J	1	Eucamarg	25	10	5	30	3			
		2	Bankatte, Xyloocci	10	4	40	60	4			
		3	Melathym, Xantprei	1	0.5	20	70	4			
		4	Hibbhype, Phlecili	0.3	0	50	60	4	70	3.8	
361	D	1	Melaprei	12	8	10	60	5			
		2	Perielli, Melahype	1.5	0	90	30	5			
		3	Mixed sedges	0.3	0	10	20	5	35	5	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
362	D	1	Melaprei	12	5	10	60	5			Some Melapoly
		2	Perielli, Melahype	1.5	0	90	30	5			
		3	Mixed sedges	0.3	0	10	20	5	35	5	
363	J	1	Eucamarg	20	15	5	30	3			Kunzeric and Agonflex patchily distributed
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Melathym	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
364	J		Parkland-cleared Eucamarg with damp patches								
365	D	1	Melaprei			10		5			
		2	Weeds and grasses			N/A					Parkland-cleared
366	M		Parkland-cleared Corycalo woodland								
367	J	1	Eucamarg	26	15	2	20	3			Degraded
		2	Agonflex, Bankilic	11	3	90	40	5			
		3	Xantbrun, mixed shrubs and sedges	0.5	0	20	20	5			
		4	Dasybrom	0.2	0	70	80	4	96	4	
368	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Melathym	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
369	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Melathym	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
370	J	1	Eucamarg	20	15	5	30	3			
		2	Bankatte, Kunzeric	10	3	40	50	5			
		3	Melathym	1	0.5	30	30	4			
		4	Dasybrom	0.2	0	70	80	4	87	4	
371	D	1	Melaprei	3.5	1	10	80	5			
		2	Astafasc, Hypohype, Aotugrac	1	0	90	20	5			
		3	Mixed sedges	0.2	0	20	5	5	27	5	
372	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
373	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
374	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								

SITE No.	TYPE	Stratum	Dominants	Top Ht	Bot. Ht	CC	AFD	Hlth	TCI	Mean Hlth	Comments
375	RIV		Wellesley River margins with variable heights, densities and mixtures of Eucarudi, Melaraph, Agonflex and Juncpall. Trigproc aquatic in slow-flowing areas								
376	RIV		Eucarudi	22	16	40	30	4			Highly variable.
			Melaraph Agonflex	8	6	80	60	5			Data provided is an average
			Agonline	2.5	1	20	10	5			
			Juncpall mixed sedges and shrubs	1	0	80	40	5	94	4.8	
377	C		Heavily cleared farmland with scattered trees								
378	C		Partly cleared or heavily grazed farmland with scattered trees								
379	J		Cleared farmland with Xantbrun regrowth to 70%								
380	C		Parkland-cleared or heavily grazed farmland with scattered trees								

Site No. = study site number as shown on Figures 5 and 6

Type - C = cleared, D = dampland, DEC = Eucalyptus decipiens, J = Jarrah woodland, M = Marri, P = pines, T = Tuart, RIV = riverine

Stratum - numbered from the top down

Dominants (Dominant species) - as listed and coded in Appendix L

Top ht = the average height of the top of the stratum

Bot. ht (Bottom height) = the average height of the bottom of the stratum

CC (Canopy Cover) (%) - refer Appendix D for definition

AFD (Average Foliage Density) (%) - refer Appendix D for definition

Hlth (average vegetation health) - 0 = dead; 1 = very poor health; 2 = poor health; 3 = moderate health; 4 = good health; 5 = very good health - refer Appendix D

TCI (Total Canopy Index) - refer Appendix D

Mean Hlth (Health) - mean health of all strata

APPENDIX H

FIRE, INSECT ATTACK, WEEDS AND DIEBACK

APPENDIX H

KEMERTON BIOLOGICAL SURVEY PHASE 1

FIRE, INSECT ATTACK, WEEDS AND DIEBACK

SITE No.	TYPE	Strata Recovery	Insect Attack	Weeds and Grass	Dieback	Risk Evaluation as Source	Risk Evaluation as Target
2	D	4	5	5	5	L	M
6	D	4	5	4	0	VH	H
7	P	0	5	1	5	L	L
10	J	4	5	3	4	M	H
12	J	4	5	5	4	L	H
13	J	4	5	5	4	L	H
14	J	4	5	5	4	L	H
25	J	4	5	5	2	H	H
26	J	4	5	5	2	H	H
27	J	4	5	5	2	H	H
28	J	4	5	5	2	H	H
29	J	4	3	5	5	L	H
30	J	4	3	5	5	L	H
31	J	4	3	5	5	L	H
32	J	4	3	5	5	L	H
35	J	4	5	5	4	L	H
37	J	4	4	5	5	L	H
38	J	4	5	5	4	L	H
40	J	4	4	5	5	L	H
43	D	4	5	5	3	L	M
48	D	4	5	4	5	L	M
52	J	1	5	1	5	M	M
54	J	4	3	5	5	L	H
55	J	4	3	5	5	L	H
57	J	4	5	2	5	L	H
58	J	4	5	2	5	L	H
59	J	4	3	5	5	L	H
60	J	4	3	5	5	L	H
67	D	4	5	5	5	L	M
72	D	3	5	5	5	L	M
77	J	4	5	2	5	L	H
80	J	4	3	5	5	L	H
81	J	4	3	5	5	L	H
82	J	4	3	5	5	L	H
83	J	4	3	5	5	L	H
84	D	4	5	5	5	L	L
86	D	4	5	5	5	L	M
87	J	4	3	5	5	L	H
91	D	4	5	5	5	L	M
92	D	4	5	5	5	L	M

Kemerton Fire, Weeds and Disease Phase 1 - Page 2

SITE No.	TYPE	Strata Recovery	Insect Attack	Weeds and Grass	Dieback	Risk Evaluation as Source	Risk Evaluation as Target
93	D	4	5	5	5	L	M
96	D	4	5	5	5	L	M
97	D	4	5	4	5	L	M
98	D	4	5	5	5	L	M
100	D	4	5	4	5	L	M
101	D	4	2	2	5	L	M
109	J	4	5	5	4	L	H
110	J	4	5	5	4	L	H
111	J	4	5	5	4	L	H
112	J	4	3	5	5	L	H
113	D	4	5	5	5	L	M
117	J	4	5	5	5	L	H
118	J	4	5	5	5	L	H
119	J	4	5	5	5	L	H
120	J	4	5	5	5	L	H
122	J	4	5	5	5	L	H
134	D	1	5	1	5	L	L
140	J	4	5	5	4	L	H
141	J	4	4	4	4	M	H
144	J	4	5	5	4	L	H
146	J	4	4	4	5	L	H
147	J	4	4	4	5	L	H
148	J	4	4	5	4	L	H
149	J	4	4	4	0	H	H
150	D	4	5	5	5	L	M
151	D	4	5	5	5	L	M
152	J	4	4	5	4	L	H
153	J	4	4	4	5	L	H
154	J	4	4	5	4	L	H
155	D	4	5	5	5	L	M
156	D	4	5	5	5	L	M
157	J	4	4	5	4	L	H
159	J	4	4	5	4	L	H
160	D	4	5	5	5	L	M
161	D	4	5	5	5	L	M
166	D	4	5	5	5	L	M
170	T	4	5	1	5	L	L
171	T	4	5	1	5	L	L
172	D	4	5	2	5	L	M
173	D	4	5	2	5	L	M
175	M	4	5	5	5	L	M
176	M	4	5	5	5	L	M
177	J	4	5	5	4	L	H
178	J	4	5	5	4	L	H
179	J	4	5	5	4	L	H
180	J	4	5	5	4	L	H

Kemerton Fire, Weeds and Disease Phase 1 - Page 3

SITE No.	TYPE	Strata Recovery	Insect Attack	Weeds and Grass	Dieback	Risk Evaluation as Source	Risk Evaluation as Target
182	J	2	4	1	4	H	H
183	J	4	4	5	4	L	H
188	J	4	4	5	4	L	H
189	D	4	5	5	5	L	M
191	D	4	5	5	5	L	M
197	T	2	5	2	5	L	L
201	D	4	5	2	5	L	M
207	J	4	5	5	4	L	H
208	J	4	5	5	4	L	H
209	J	4	5	5	4	L	H
210	J	4	5	5	4	L	H
225	J	4	5	5	4	L	H
226	J	4	5	5	4	L	H
228	J	4	5	5	4	L	H
230	D	4	5	5	5	L	M
237	D	2	5	1	5	L	L
241	D	4	5	2	5	L	M
244	J	4	5	5	5	L	H
247	J	4	5	5	5	L	H
248	J	4	5	5	4	L	H
249	J	4	5	5	4	L	H
250	J	4	5	5	4	L	H
251	J	4	5	5	4	L	H
253	J	4	5	5	4	L	H
254	J	4	5	5	4	L	H
255	J	4	5	5	4	L	H
264	D	4	5	5	5	L	M
267	J	4	5	4	5	L	H
268	J	4	5	4	5	L	H
276	J	4	5	5	4	L	H
278	J	4	5	5	4	L	M
281	J	4	5	5	4	L	M
284	J	4	5	5	4	L	M
294	J	4	4	4	4	M	H
295	J	4	4	4	4	M	H
296	J	4	4	4	4	M	H
298	T	4	5	1	5	L	L
300	M	4	4	4	3	M	M
301	M	4	4	4	3	M	M
302	D	4	3	4	5	L	M
303	D	4	5	5	5	L	M
304	M	4	4	4	3	M	M
305	M	4	4	4	3	M	M
307	M	4	4	4	3	M	M
308	M	4	4	4	3	M	M
309	M	4	4	4	3	M	M

SITE No.	TYPE	Strata Recovery	Insect Attack	Weeds and Grass	Dieback	Risk Evaluation as Source	Risk Evaluation as Target
310	M	4	4	4	3	M	M
314	J	4	4	4	2	M	H
320	J	4	4	4	4	M	H
323	J	4	4	4	4	M	H
324	D	1	5	1	5	L	L
327	J	4	4	4	4	M	H
332	J	4	4	5	4	H	H
333	J	4	4	5	4	H	H
334	J	4	4	5	4	H	H
335	J	4	4	5	4	H	H
336	M	4	4	4	4	M	M
339	J	4	5	5	5	L	H
340	J	4	5	5	5	L	H
341	J	4	5	5	5	L	H
342	D	4	4	5	5	L	M
344	J	4	5	5	5	L	H
345	J	4	4	5	5	L	H
346	D	4	5	1	5	L	L
347	D	4	3	4	5	L	M
348	J	4	4	5	5	L	H
351	J	4	4	5	5	L	H
355	J	4	4	2	2	H	H
356	J	4	4	2	2	H	H
357	DEC	4	5	3	5	L	L
358	J	4	4	5	4	H	H
359	J	4	4	5	4	H	H
360	J	4	4	5	4	H	H
361	D	4	5	5	5	L	M
362	D	4	5	5	5	L	M
363	J	4	1	4	0	H	H
365	D	2	5	1	5	L	L
367	J	4	1	4	0	H	H
368	J	4	1	4	0	H	H
369	J	4	1	4	0	H	H
370	J	4	1	4	0	H	H
371	D	4	5	5	5	L	M
376	RIV	4	4	4	5	L	L

Site No. = study site number as shown on Figures 5 and 6

Type - C = cleared; D = dampland; DEC = Eucalyptus decipiens; J = Jarrah woodland; M = Marri; P = pines; T = Tuart; RIV = riverine

Strata Recovery - 0 = freshly cleared or burned; 1 = one-quarter restored to its pre-disturbance structure - 2 = half-restored; 3 = three-quarters restored; 4 = intact

Insect Attack - 0 = plant killed; 1 = very heavily infested and dying; 2 = heavily infested; 3 = moderately infested; 4 = infested but healthy; 5 = minor or no evidence of insect attack

Weeds and Grass - 0 = totally dominated by non-indigenous weeds or grass, 1= very abundant
2 = abundant, 3 = moderate, 4 = common but not abundant, 5 = absent or none
Dieback - 0 = dead, apparently as a result of Dieback, 1= very unhealthy apparently as a result of Dieb
2 = unhealthy, 3 = moderate infection, 4 = present but not severe or widespread, 5 = no evide
Risk Evaluation as Source - VH = very high, H = high, M = moderate, L = low, VL = very low
Risk Evaluation as Target - VH = very high, H = high, M = moderate, L = low, VL = very low

APPENDIX I

CONNECTIVITY AND DISTURBANCE

APPENDIX I

KEMERTON BIOLOGICAL SURVEY PHASE 1

CONNECTIVITY AND DISTURBANCE

For vegetation codes refer Appendix L (2)

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
1		Pines									
2	D	C	1	N	N/A	N	N/A	30	N/A	None	VF
3	J	Mosiac complex of Eucamarg with Melaprei dampland with very dense Kunzeric thickets									
4		Drain margin									
5		Pines									
6	D	C	1	Complex	Complex	N	N/A	40	HLLA	None	A
7		Mature pines									
8		Young pines									
9	J	Parkland-cleared Agonflex, very weedy									
10	J	C	1	N	N/A	N	N/A	60	HLLA	LGLA	VA
11		Mature pines									
12	J	G=I	1	Complex	N/A	N	N/A	100	HLLA	None	A
13	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
14	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
15	D	Parkland-cleared to totally cleared dampland and palusplain with patches of Eucamarg									
16	J	Complex of sparse Eucamarg with scattered Corycalo. Open areas with bare patches amongst Kunzeric thickets									
17	D	Parkland-cleared to totally cleared dampland and palusplain with patches of Eucamarg									
18	D	Damaged but not cleared dampland and palusplain with patches of Eucamarg									
19	D	Disturbed and grazed wetland mosaic									
20	D	Parkland-cleared to totally cleared dampland and palusplain with patches of Eucamarg									
21	J	Parkland-cleared Eucamarg woodland									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
22	J	Complex of sparse Eucamarg with scattered Corycalo. Open areas with bare patches amongst Kunzeric thickets									
23		Under intensive agriculture/horticulture									
24		Under intensive agriculture/horticulture									
25	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
26	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
27	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
28	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	S
29	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
30	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
31	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
32	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
33		Cleared farmland with a few scattered Melaprei									
34		Cleared farmland with a few scattered Melaprei									
35	J	G=I	1	Complex	N/A	N	N/A	100	HLLA	None	A
36		Cleared farmland with a few scattered Melaprei and Eucarudi									
37	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
38	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VF
39		Cleared farmland with a few scattered Melaprei									
40	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
41	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
42		Pines									
43	D	G>I	1	Complex	N/A	N	N/A	15	Beanpoles	None	C
44	J	Complex of sparse Eucamarg with scattered Corycalo. Open areas with bare patches amongst Kunzeric thickets									
45	D	Melaprei flats with patches of Eucamarg									
46	D	Parkland-cleared and degraded dampland mosaic									
47	D	Cleared wetland with some regrowth									
48	D	Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points									
49	J	Parkland-cleared and degraded Eucamarg woodland									
50		Under intensive agriculture/horticulture									
51		Under intensive agriculture/horticulture									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
52	J	Dense parkland-cleared and grazed Agonflex woodland									
53	J	Dense parkland-cleared and grazed Agonflex woodland with Melaprei in low areas									
54	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
55	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
56	D	Cleared and partially regrowing wetland									
57	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
58	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
59	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
60	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
61		Cleared farmland with scattered Eucamarg and Agonflex trees									
62		Cleared farmland with scattered Eucamarg and Agonflex trees									
63	J	Complex Eucamarg, Agonflex, Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas									
64	J	Complex Eucamarg, Agonflex, Bankatte woodland mosaic with Bankilic and Kunzeric in lower areas									
65	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
66		Pines									
67	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
68	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
69	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
70		Young pines									
71	D	Complex wetland of very dense Kunzeric with scattered Melaraph									
72	D	Very complex dampland of Melaprei over sedges with Astafasc and Calolate with some Perielli over Hypoangu									
73		Under intensive agriculture/horticulture									
74		Under intensive agriculture/horticulture									
75		Under intensive agriculture/horticulture									
76		Under intensive agriculture/horticulture - parts are seasonally flooded									
77	J	C	1	N	N/A	N	N/A	80	HLLA	Light	VA
78	J	Parkland-cleared Agonflex									
79	J	Parkland-cleared Agonflex									
80	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
81	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
82	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
83	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
84	D	C	1	Complex	Complex	N	N/A	N/A		N	VF
85	J	Low lying Bankilic regrowth - previously cleared and with piles of logs									
86	D	Kunzeric stand with Eucarudi on the edge and an internal complex of Banklitt, Melatere, Melaprei, Melainca and Melapoly									
87	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
88		Silica sand mine slurry pond									
89	D	Not examined - appears to be Perielli with Melaprei over Hypoangu. Scattered Xantprei and Kunzeric on high points									
90		Silica sand processing plant									
91	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
92	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
93	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
94	J	Parkland-cleared Agonflex with a few Eucamarg and scattered Eucarudi									
95	J	Parkland-cleared Agonflex									
96	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
97	D	C	2	Y	10 m	N	N/A	30	N/A	Probably	C
98	D	C	1	Zoned	<60	N	N/A	N/A	Regrowth	None	VF
99		Silica sand mine dredge pond									
100	D	C	2	Y	10 m	N	N/A	30	N/A	Probably	C
101	D	C	3	Y	15 m	N	N/A	100	N/A	Probably	S
102	J	Parkland-cleared Agoflex and Eucamarg									
103		Not examined - reported by B Keighery as Eucadeci on Muchea Limestone - examine in Phase 2									
104		Under intensive agriculture/horticulture									
105	J	Grazed Eucamarg woodland with a reduced understorey									
106		Under intensive agriculture/horticulture - wetland may be seasonally flooded									
107		Pines									
108	J	Parkland-cleared Agonflex and scattered Eucamarg									
109	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
110	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
111	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
112	J	G>I	1	N	N/A	N	N/A	100	HLLA	N	C
113	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
114	D	Complex Perielli, Astafasc Calolate dampland - scattered Melaprei									
115	D	Kunzeric shrubland with associated complex Perielli Astafasc Calolate dampland - scattered Melaprei									
116	D	Complex Perielli Astafasc Calolate dampland - scattered Melaprei									
117	J	Eucamarg woodland with Bankilic									
118	J	Eucamarg Bankatte remnant									
119	J	Low Jarrah Bankatte woodland remnant									
120	J	Eucamarg woodland with Vertnite									
121	J	Parkland-cleared Eucamarg woodland with regrowth and remnants - much Bankilic									
122	J	Low Eucamarg Bankatte woodland									
123		Not examined - parkland-cleared Agonflex and Eucamarg									
124		Not examined - possible site for Eucadeci on Muchea Limestone - examine in Phase 2									
125	J	Grazed Eucamarg woodland with reduced understorey									
126	J	Eucamarg Agonflex regrowth									
127	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
128	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
129	J	Parkland-cleared Agonflex									
130	J	Parkland-cleared Eucamarg Corycalo regrowth									
131	T	Intensely parkland-cleared Eucagomp Agonflex woodland									
132	D	Parkland-cleared Eucarudi and Melaprei									
133	D	Cleared wetland									
134	D	Cleared	Cleared	N	N/A	N	N	N/A	HCR	HGR	None
135	D	Open water with scattered Eucarudi and Melaprei									
136	J	Parkland-cleared Agonflex									
137	M	Grazed Corycalo Agonflex woodland									
138		Sand pit									
139	T	Parkland-cleared Eucagomp Corycalo Agonflex									
140	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
141	J	C	0	N	N/A	N	N/A	80	HLLA	Minor recent	VA

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
142	J	Intensively cleared with scattered Agonflex									
143	DEC	Parkland-cleared Eucadeci and Agonflex over Tamala limestone									
144	J	C	0	N	N/A	N	N/A	80	HLLA	LG	C
145	D	Edge of an Astafasc and Melaprei wetland complex									
146	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
147	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
148	J	G>I	1	N	N/A	N	N/A	100	HLLA	Minor	VF
149	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
150	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
151	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
152	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
153	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
154	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
155	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
156	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
157	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
158		Requires field check - data error?? - recorded as parkland-cleared Eucamarg woodland with regrowth and remnants									
159	J	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
160	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
161	D	C	1	Complex	Complex	N	N/A	N/A	N/A	None	VF
162		Not examined - parkland-cleared Agonflex									
163	D	Complex of heavily grazed low lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei									
164	D	Complex of low lying Eucamarg and Bankilic Kunzeric mosaic with Perielli and Melaprei									
165		Not examined - could contain Muchea limestone - to be examined in Phase 2									
166	D	C	1	Complex	Complex	N	N/A	N/A	N/A	None	VF
167	J	Bankatte and Agonflex woodland with scattered Eucamarg and Eucagomp and a heavily grazed understorey									
168	D	Eucarudi over weeds on drain which leads into Myalla Lagoon									
169	T	Sparse parkland-cleared Agonflex with Eucagomp									
170	T	G>I	1	N	N/A	N	N/A	300	HLLA	Recent	VF
171	T	G>I	1	N	N/A	N	N/A	300	HLLA	Recent	VF

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
172	D	G<I	2	Complex	30 m	N	N/A	10	N/A	Moderate	S
173	D	G<I	2	Complex	30 m	N	N/A	10	N/A	Moderate	S
174	D	Open water with sedges on west side - reported as cleared in the 1960s									
175	M	C	1	N	N/A	N	N/A	80	HLLA	None	VA
176	M	C	1	N	N/A	N	N/A	80	HLLA	None	VA
177	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
178	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
179	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
180	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
181	DEC	Grazed sparse Eucadeci and dense Agonflex over Tamala limestone									
182	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
183	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
184	J	Eucamarg woodland with Bankilic									
185	J	Eucamarg woodland with Bankilic									
186	J	Parkland-cleared Eucamarg with abundant Xantbrun regrowth									
187	D	Melaprei over Periellі with minor Banklitt									
188	J	G=I	1	N	N/A	N	N/A	80	HLLA	Minor	VF
189	D	C	1	Complex	Complex	N	N/A	N/A	N/A	N/A	VF
190	J	Eucamarg woodland complex merging into Bankilic and Kunzeric dampland									
191	D	C	2	Complex	Complex	N	N/A	N/A	N/A	None	VF
192	J	Complex of low lying Eucamarg Bankilic woodland									
193		Tasmanian Blue Gum plantation to 7 m									
194		Tasmanian Blue Gum									
195		Tasmanian Blue Gum									
196	T	Sparse parkland-cleared Agonflex with Eucagomp									
197	T	G>I	0	N	N/A	N	N/A	120	HLLA	HR	None
198	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
199	M	Heavily grazed Corycalo with scattered Eucamarg									
200	M	Heavily grazed Corycalo with scattered Eucamarg									
201	D	G>I	2	N	N/A	N	N/A	N/A	N/A	None	VF

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
202	D	Grazed Melaprei and Eucarudi, dead Perielli on north side and Eucagomp over Bankilic on south side									
203	J	Grazed Eucamarg, Agonflex, Bankilic									
204	T	Cleared with scattered Eucagomp and Agonflex									
205	T	Heavily grazed Eucagomp and Agonflex									
206	J	Eucamarg and Agonflex on edge of wetland with Eucagomp and Eucadeci, south side with grazed Agonflex over Pterescu									
207	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
208	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
209	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
210	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
211	J	Parkland-cleared Agonflex on rural lots, many with houses									
212	J	Parkland-cleared Agonflex									
213	J	Parkland-cleared Agonflex with Xantbrun regrowth									
214	D	Parkland-cleared Melaprei									
215	J	Parkland-cleared Eucamarg									
216	J	Cleared Eucamarg woodland with some regrowth									
217		Tasmanian Blue Gum plantation to 7 m tall									
218		Totally cleared farmland									
219	J	Part cleared Eucamarg Bankatte - heavy Dieback									
220		Mature pines									
221	J	Cleared with some regrowth - previously Eucamarg woodland with some damp areas									
222	J	Cleared with some regrowth - previously Eucamarg woodland with some damp areas									
223	D	Small cleared swamp in paddock with Melaprei and a few Astafasc and a Lemnmino cover - polluted by cattle									
224	J	Eucamarg woodland with patches of Melaprei - heavy Dieback									
225	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
226	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
227	J	Eucamarg woodland remnant									
228	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
229	D	Complex mosaic of Melaprei and Mela??hamu thickets with Melapoly and Perielli									
230	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
231	J	Complex of Eucamarg woodland with Bankilic, Kunzeric and Xantbrun and heavy Dieback									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
232	D	Complex of Melaprei Calolate, Hakevari post-fire regrowth									
233	J	Eucamarg and Bankatte with heavy Dieback									
234		Not examined - to be surveyed in Phase 2									
235		Not examined - to be surveyed in Phase 2									
236	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
237	D	G>I	1	N	N/A	N	N/A	N/A	HLLA	HGR	VF
238	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
239	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
240	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
241	D	G>I	2	N	N/A	N	N/A	N/A	N/A	None	VF
242	J	Cleared with scattered Eucamarg, Nuytflor, Agonflex, scattered Eucarudi on west side									
243	D	Damp patch of Eucarudi, Melaraph, Melaprei in Agonflex woodland with Xantprei, Banklitto and Corycalo									
244	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
245	D	Wetland of Melaprei, Melaraph Agonflex on margins - in reasonable condition									
246		Cleared famland with scattered trees and remnants									
247	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
248	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
249	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
250	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
251	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
252	J	Cleared Eucamarg woodland with some regrowth									
253	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
254	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
255	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
256	D	Scattered Melaprei wetland									
257		Pines									
258	D	Melaprei and Bankilic remnant									
259		Pines									
260		Pines									
261		Pines									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
262		Pines									
263		Pines									
264	D	C	1	N	N/A	N	N/A	N/A	N/A	None	VF
265		Pines									
266		Pines									
267	J	G>I	1	Y	60-120	N	N/A	120	HLLA	Possibly	VF
268	J	G>I	1	Y	60-120	N	N/A	120	HLLA	Possibly	VF
269	D	Kunzeric, Melaprei and Perielli dampland									
270	D	Parkland-cleared and heavily grazed Melaprei wetland									
271	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
272	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
273	T	Parkland-cleared Eucagomp over Agonflex over grass and weeds									
274	T	Parkland-cleared Agonflex over grass and weeds									
275	D	Parkland-cleared wetland with Melaprei and Agonflex over grass and weeds									
276	J	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
277	D	Edge of a Melaprei dampland with Agonflex and Bankilic									
278	D	G>I	0	N	N/A	N	N/A	150	HLLA	Possibly	C
279	D	Parkland-cleared Eucamarg and Agonflex									
280	D	Parkland-cleared Eucamarg and Agonflex									
281	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
282	D	Parkland-cleared Eucamarg woodland with regrowth									
283	D	Parkland-cleared Eucamarg woodland with regrowth									
284	J	G>I	0	N	N/A	N	N/A	80	HLLA	None	VA
285	D	Cleared Eucamarg woodland with regrowth									
286		Data may be in error - check in Phase 2 - recorded as farmland with clumps of Juncpall and Kunzeric regrowth									
287		Pines									
288		Pines									
289		Pines									
290		Pines									
291		Pines									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
292		Pines									
293		Cleared farmland with some Juncpall									
294	J	G>I	1	N	N/A	N	N/A	60	HLLA	None	VF
295	J	G>I	1	N	N/A	N	N/A	60	HLLA	None	VF
296	D	G>I	1	Y	60-120	N	N/A	80	HLLA	MGR	VF
297	J	G>I	1	Y	60-120	N	N/A	120	HLLA	HGR	VF
298	T	G<I	0	N	N/A	N	N/A	50	HLLA	Lightly	VA
299	T	Parkland-grazed Eucagomp over Agonflex									
300	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
301	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
302	D	C	1	Y	10 m	N	N/A	20	N/A	None	C
303	D	C	1	Y	10 m	N	N/A	20	N/A	None	C
304	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
305	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
306	J	Parkland-cleared Eucamarg and Agonflex									
307	M	C	0	Continuum	>120 m	N	N/A	60	HLLA	Minimal	C
308	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
309	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
310	J	G<I	1	Complex	60-120	N	N/A	80	HLLA	Minor	C
311	J	Parkland-cleared Eucamarg woodland with scattered Allofras, Nuytflor and Bankilic									
312	J	Intensively cleared Eucamarg woodland									
313	J	Intensively cleared Eucamarg woodland									
314	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Recent	VF
315	J	Intensively cleared Eucamarg woodland									
316		Pines									
317		Pines									
318		Pines									
319	J	Parkland-cleared Eucamarg woodland									
320	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Recent	VF
321	D	Farmland with patches of Astafasc and Melaprei in a shallow dampland									

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
322		Cleared									
323	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Minor	VF
324	D	G<I	Cleared	N	N/A	N	N/A	N/A	HLR	HGR	None
325		Farmland with patches of Juncpall and Kunzeric									None
326	J	Parkland-cleared and grazed Agonflex with most of the Eucamarg removed									
327	J	G>I	1	Y	60-120	N	N/A	100	HLLA	Minor	VF
328		Farmland with a thin veneer of Bassendean sand over Guildford Clay									
329	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
330	J	Agonflex woodland with some Eucamarg and Bankilic and Melaprei in places									
331	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
332	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
333	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
334	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
335	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
336	M	C	0	N	N/A	N	N/A	80	HLLA	Minor	S
337	J	Intensively cleared Eucamarg woodland									
338	J	Intensively cleared Eucamarg woodland									
339	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
340	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
341	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
342	D	G>I	1	N	N/A	N	N/A	150	N/A	Possibly	S
343	J	Intensively cleared Eucamarg woodland									
344	J	G=I	2	N	N/A	N	N/A	150	HLLA	None	S
345	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
346	D	Open water with scattered Mela??hamu									
347	D	C	3	Y	20 m	N	N/A	15	N/A	Possibly	S
348	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA
349	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
350	D	Perielli heath with Melaprei and Melahamu									
351	J	G<I	1	Complex	Complex	N	N/A	30	HLLA	Y	VA

SITE No.	TYPE	Internal Spatial Distribution	Nearby Veg. Types	Site is Ecotonal	Width of Ecotone	Site is Corridor	Condition of Corridor	Horiz. View Distance	Logging History	Grazing History	Abund. Sapling
352	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
353	M	Parkland-cleared Corycalo over Melaprei over Xantbrun									
354	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
355	J	G>I	1	N	N/A	N	N/A	150	HLLA	Y	S
356	J	G>I	1	N	N/A	N	N/A	150	HLLA	Y	S
357	DEC	G<I	1	Y	>120 m	N	N/A	10	None	Y	VA
358	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
359	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
360	J	G=I	0	N	N/A	N	N/A	100	HLLA	None	VA
361	D	G>I	1	Y	<60 m	N	N/A	N/A	None	None	S
362	D	G>I	1	Y	<60 m	N	N/A	N/A	N/A	N/A	S
363	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
364	J	Parkland-cleared Eucamarg with damp patches									
365	D	G>I	1	Y	60	N	N/A	120	HLR	HGR	None
366	M	Parkland-cleared Corycalo woodland									
367	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
368	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
369	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
370	J	G=I	0	Continuum	>120 m	N	N/A	80	HLLA	None	C
371	D	G>I	1	Y	60-120 m	N	N/A	N/A	None	None	VF
372	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
373	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
374	RIV	Wellesley River margins with Eucarudi, Melaraph, Agonflex, Juncpall									
375	RIV	Parkland-cleared or grazed farmland with intact river margins with Eucarudi, Melaraph, Agonflex, Juncpall									
376	RIV	G<I	2	Y	<60 m	Y	VG	120	None	Y	VA
377		Heavily cleared farmland within scattered trees									
378		Partly cleared or heavily grazed farmland within scattered trees									
379	J	Farmland with regrowth of Xantbrun									
380		Parkland-cleared or heavily grazed farmland with trees									

Site No. = study site number as shown on Figures 5 and 6
Type - C = cleared, D = dampland, DEC = Eucalyptus decipiens, J = Jarrah woodland,
M = Marri, P = pines, T = Tuart, RIV = riverine
Internal Spatial Distribution - refer Appendix D - C = continuum; G>I = gaps larger than intergaps; G=I gaps about the same size as intergaps; G<I = gaps mostly smaller than intergaps
Nearby Veg. (Vegetation) Types - the number of different vegetation types within 100 m of the study site. 0 indicates the site is part of a larger area of the same vegetation type
Site is Ecotonal - site is part of a continuum between adjacent vegetation types
Width of Ecotone - if site is ecotonal, the average (visually estimated) width of the ecotone is stated
Site is Corridor - this only applies to narrow strips of bushland connecting larger areas at either end
Condition of Corridor - intactness and health of a corridor
Horiz. (Horizontal) View Distance - the average distance (m) it is possible to see horizontally with the eyes 1.5 m above the ground
Logging History - HCR = heavily cleared recently; HLLA = heavily logged long ago; HLR = heavily logged recently;
LLR = lightly logged recently
Grazing History - any evidence the land had been, or is being, grazed by stock
Abund. (Abundance) of Saplings - VF = very few; S = some; C = common; A = abundant; VA = very abundant

APPENDIX J

FLORA SPECIES LISTS FOR STANDARD STUDY SITES

APPENDIX J

KEMERTON BIOLOGICAL SURVEY PHASE 1

FLORA SPECIES LISTS FOR STANDARD STUDY SITES

Site 6

	Acacia extensa
	Astartea fascicularis
	Asteridea pulverulenta
	Banksia attenuata
	Banksia ilicifolia
*	*Briza maxima*
	Caladenia flava
	Dasypogon bromeliifolius
	Drosera stolonifera
	Eucalyptus marginata
	Gompholobium tomentosum
	Hibbertia hypericoides
	Hibbertia racemosa
	Hibbertia vaginata
	Ixiolaena viscosa
	Kunzea ericifolia
	Lagenifera huegelii
	Lepyrodia glauca
	Macrozamia riedlei
	Melaleuca preissiana
	Melaleuca thymoides
	Platysace compressa
	Tricoryne elatior
*	*Ursinia anthemoides*
	Xanthorrhoea preissii
	Xanthosia huegelii

Site 10

*	*Acacia pycnantha*
*	*Acetosella vulgaris*
	Agonis flexuosa
	Asteridea pulverulenta
*	*Avena fatua*
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Banksia littoralis
*	*Briza maxima*
	Burchardia umbellata
	Cartonema philydroides
*	*Chamaecytisus palmensis*
	Conostylis aculeata subsp *aculeata*
	Conostylis juncea
	Corymbia calophylla

Site 10 (continued)

	Dianella revoluta
	Drosera pallida
	Drosera stolonifera
*	*Ehrharta brevifolia*
*	*Eragrostis curvula*
	Eucalyptus marginata
	Grevillea diversifolia subsp *diversifolia*
	Hardenbergia comptoniana
	Hibbertia cuneiformis
*	*Hypochaeris glabra*
	Isotropis cuneifolia
	Jacksonia sternbergiana
	Kennedia prostrata
	Kunzea ericifolia
	Lepidosperma longitudinale
	Luzula meridionalis
	Macrozamia riedlei
	Melaleuca preissiana
	Microtis media subsp *media*
	Opercularia hispidula
*	*Petrorhagia velutina*
	Phlebocarya ciliata
	Poranthera microphylla
*	*Silene gallica*
*	*Solanum nigrum*
*	*Sonchus oleraceus*
	Trachymene pilosa
	Tricoryne elatior
*	*Trifolium angustifolium*
*	*Trifolium campestre*
*	*Ursinia anthemoides*
*	*Watsonia bulbillifera*
	Xanthorrhoea preissii

Site 12

P3	*Acacia semitrullata*
	Adenanthos meisneri
*	*Aira caryophyllea*
*	*Anagallis arvensis*
	Aphelia cyperoides
	Asteridea pulverulenta
	Austrostipa compressa
	Banksia attenuata
	Banksia ilicifolia

Site 12 (continued)

Boronia dichotoma
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix fraseri
Conostephium pendulum
Dampiera linearis
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus marginata
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Ixiolaena viscosa
Kunzea ericifolia
Laxmannia squarrosa
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lyginia barbata
Melaleuca scabra group
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Platysace compressa
Pterostylis recurva
Rhodanthe cotula
Schoenus curvifolius
Stylidium brunonianum
Stylidium junceum
Stylidium piliferum
Thelymitra ? aff *holmesii*
Thelymitra ? *benthamiana*
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii
Xanthosia huegelii

Site 13

Acacia extensa
P3 *Acacia semitrullata*
Adenanthos meisneri

Site 13 (continued)

* *Aira caryophyllea*
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Banksia ilicifolia
Boronia dichotoma
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Eucalyptus marginata
Euchilopsis linearis
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
Hypocalymma angustifolium
* *Hypochaeris glabra*
Jacksonia furcellata
Kunzea ericifolia
Lepidosperma squamatum
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? *caespitosa*
Lomandra purpurea
Lyginia barbata
Macrozamia riedlei
Melaleuca scabra group
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Petrophile linearis
Philotheca spicatus
Platysace compressa
Podotheca angustifolia
Rhodanthe cotula
Siloxerus filifolius
Stylidium brunonianum
Stylidium piliferum
Stylidium schoenoides
Thysanotus manglesianus
Thysanotus multiflorus
Trachymene pilosa

Site 13 (continued)

Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthorrhoea preissii

Site 26

Acacia extensa
* *Aira caryophyllea*
Allocasuarina fraseriana
Asteridea pulverulenta
Austrodanthonia occidentalis
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
* *Briza minor*
Chamaescilla corymbosa
Conostylis aculeata subsp *aculeata*
Conostylis juncea
* *Crassula alata*
Dasypogon bromeliifolius
Eucalyptus marginata
Gompholobium tomentosum
Goodenia incana
Hibbertia hypericoides
Hibbertia subvaginata
* *Hypochaeris glabra*
Isotoma hypocrateriformis
Kennedia prostrata
Lagenifera huegelii
Laxmannia squarrosa
Leucopogon racemulosus
Lobelia tenuior
Lomandra sonderi
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Nuytsia floribunda
Persoonia saccata
Petrophile linearis
Platysace compressa
Poranthera microphylla
Rhodanthe cotula
Siloxerus filifolius
Stirlingia latifolia
Stylidium brunonianum
Stylidium piliferum
Trachymene pilosa
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 31

Acacia extensa
Adenanthos meisneri
* *Aira caryophyllea*
Asteridea pulverulenta
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
* *Briza minor*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Comesperma virgatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Corymbia calophylla
Dampiera linearis
Dasypogon bromeliifolius
Daviesia physodes
Drosera pallida
Drosera stolonifera
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Goodenia incana
Hardenbergia comptoniana
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hovea trisperma
* *Hypochaeris glabra*
Hypolaena exsulca
Isotropis cuneifolia
Jacksonia sternbergiana
Kennedia prostrata
Kunzea ericifolia
Lagenifera huegelii
Lepidosperma squamatum
Lepyrodia glauca
Leucopogon polymorphus
Leucopogon propinquus
Leucopogon racemulosus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Patersonia occidentalis

Site 31 (continued)

Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
* *Pinus pinaster*
Platysace compressa
? *Pronaya fraseri*
Rhodanthe cotula
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Thelymitra ? aff *holmesii*
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 43

P3 *Acacia semitrullata*
Adenanthos meisneri
Adenanthos obovatus
Aotus gracillima
Astartea fascicularis
Asteridea pulverulenta
Banksia attenuata
Banksia ilicifolia
Banksia littoralis
Boronia dichotoma
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calothamnus lateralis
Calytrix fraseri
Dampiera linearis
Dasypogon bromeliifolius
Drosera ? *pulchella*
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus marginata
Euchilopsis linearis
Eutaxia virgata
Gompholobium capitatum
Gompholobium polymorphum
Gompholobium tomentosum
Hibbertia racemosa
Hibbertia stellaris
Hibbertia vaginata
Hovea trisperma
Hypocalymma angustifolium

Site 43 (continued)

* *Hypochaeris glabra*
Jacksonia furcellata
Kunzea ericifolia
Lagenifera huegelii
Latrobea tenella
Leucopogon australis
Melaleuca preissiana
Melaleuca thymoides
Monotaxis occidentalis
Patersonia occidentalis
Pericalymma ellipticum
Phyllangium paradoxum
Poranthera microphylla
Pultenaea reticulata
Siloxerus filifolius
Stylidium brunonianum
Stylidium junceum
Stylidium schoenoides
Thysanotus manglesianus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii

Site 57

Acacia huegelii
Agonis flexuosa
Asteridea pulverulenta
Austrodanthonia occidentalis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Comesperma virgatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Corymbia calophylla
Dasypogon bromeliifolius
Daucus glochidiatus
Desmocladus flexuosa
Dianella revoluta
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*

Site 57 (continued)

Isotropis cuneifolia
Jacksonia furcellata
Kennedia prostrata
Lagenifera huegelii
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon racemulosus
Lobelia tenuior
Lomandra ? caespitosa
Macrozamia riedlei
Melaleuca thymoides
* *Monadenia bracteata*
Olearia axillaris
Opercularia hispidula
Patersonia occidentalis
Persoonia saccata
Petrophile linearis
* *Petrorhagia velutina*
Philotheca spicatus
Pteridium esculentum
Pyrorchis nigricans
Rhodanthe cotula
Stylidium brunonianum
Stylidium schoenoides
Thelymitra ? aff *holmesii*
Trachymene pilosa
Tricoryne elatior
* *Trifolium angustifolium*
* *Trifolium campestre*
* *Ursinia anthemoides*
* *Zantedeschia aethiopica*

Site 67

Aotus gracillima
Astartea fascicularis
P1 *Boronia juncea* subsp *juncea*
Calothamnus lateralis
Comesperma virgatum
Crassula colorata
Dampiera linearis
Drosera nitidula subsp *nitidula*
Epiblema grandiflorum subsp *grandiflorum*
Goodenia filiformis
Hibbertia stellaris
Hibbertia vaginata
Hypocalymma angustifolium
Isolepis marginata
Lepidosperma longitudinale
Melaleuca incana subsp *incana*
Melaleuca lateritia
Melaleuca rhaphiophylla

Site 67 (continued)

Microtis media subsp *media*
Patersonia occidentalis
Pericalymma ellipticum
Pimelea lanata
Siloxerus filifolius
Stylidium despectum
Stylidium divaricatum
Stylidium junceum

Site 77

Acacia huegelii
Agonis flexuosa
Asteridea pulverulenta
Austrodanthonia occidentalis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Comesperma virgatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Corymbia calophylla
Dasypogon bromeliifolius
Daucus glochidiatus
Desmocladus flexuosa
Dianella revoluta
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Isotropis cuneifolia
Jacksonia furcellata
Kennedia prostrata
Lagenifera huegelii
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon racemulosus
Lobelia tenuior
Lomandra ? caespitosa
Macrozamia riedlei
Melaleuca thymoides
* *Monadenia bracteata*
Olearia axillaris
Opercularia hispidula
Patersonia occidentalis

Site 77 (continued)

Persoonia saccata
Petrophile linearis
* *Petrorhagia velutina*
Philotheca spicatus
Pteridium esculentum
Pyrorchis nigricans
Rhodanthe cotula
Stylidium brunonianum
Stylidium schoenoides
Thelymitra ? aff *holmesii*
Trachymene pilosa
Tricoryne elatior
* *Trifolium angustifolium*
* *Trifolium campestre*
* *Ursinia anthemoides*
* *Zantedeschia aethiopica*

Site 84

* *Acetosella vulgaris*
Astartea fascicularis
Austrostipa compressa
Banksia littoralis
Baumea articulata
* *Briza maxima*
Calothamnus lateralis
Cynodon dactylon
Eucalyptus rudis
* *Hypochaeris glabra*
Juncus pallidus
Kunzea ericifolia
Lepidosperma effusum
Lepidosperma longitudinale
Leucopogon polymorphus
Melaleuca preissiana
Melaleuca rhaphiophylla
* *Monopsis debilis*
* *Orobanche minor*
Oxylobium lineare
* *Parentucellia viscosa*
Pericalymma ellipticum
Pimelea lanata
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
Villarsia albiflora
Villarsia capitata

Site 91

Acacia cyclops
Acacia pulchella
P3 *Acacia semitrullata*

Site 91 (continued)

Acacia stenoptera
Adenanthos meisneri
Adenanthos obovatus
Aphelia cyperoides
Astartea fascicularis
Boronia dichotoma
P1 *Boronia juncea* subsp *juncea*
Bossiaea eriocarpa
* *Briza maxima*
Calothamnus lateralis
Calytrix angulata
Centrolepis aristata
Dampiera linearis
Dasypogon bromeliifolius
Drosera nitidula subsp *nitidula*
Eucalyptus marginata
Euchilopsis linearis
Evandra pauciflora
Gompholobium capitatum
Gonocarpus pithyoides
Hibbertia stellaris
Hovea trisperma
Hypocalymma angustifolium
Hypolaena exsulca
Kunzea ericifolia
Kunzea micrantha
Lechenaultia expansa
Lepyrodia glauca
Lysinema ciliatum
Melaleuca preissiana
Melaleuca thymoides
Pericalymma ellipticum
Pimelea lanata
Platysace compressa
Platytheca galioides
Stylidium brunonianum
Stylidium divaricatum
* *Ursinia anthemoides*
Xanthorrhoea brunonis

Site 97

* *Acetosella vulgaris*
* *Aira caryophyllea*
* *Anagallis arvensis*
Baumea articulata
* *Briza maxima*
* *Briza minor*
* *Callitriche stagnalis*
Cassytha racemosa
* *Centaurium pulchellum*
Crassula colorata

Site 97 (continued)

Drosera paleacea subsp *paleacea*
Eucalyptus rudis
* *Hypochaeris glabra*
Isolepis marginata
Ixiolaena viscosa
Juncus pallidus
Lemna disperma
* *Lolium* sp
* *Lotus suaveolens*
* *Lythrum hyssopifolia*
Melaleuca rhaphiophylla
Melaleuca teretifolia
Pimelea lanata
* *Pseudognaphalium luteo-album*
* *Senecio vulgaris*
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium despectum
Stylidium divaricatum
* *Trifolium* sp
Villarsia albiflora

Site 101

Acacia pulchella
* *Acetosella vulgaris*
Agonis flexuosa
* *Aira caryophyllea*
Aotus gracillima
Astartea fascicularis
Austrostipa compressa
Cartonema philydroides
* *Centaurium pulchellum*
Crassula colorata
Cynodon dactylon
Dasypogon bromeliifolius
Dianella revoluta
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
Goodenia filiformis
Hardenbergia comptoniana
Hibbertia stellaris
Homalosciadium homalocarpum
Hypocalymma angustifolium
* *Hypochaeris glabra*
Isolepis marginata
Ixiolaena viscosa
Jacksonia furcellata
Lepidosperma longitudinale
Lobelia tenuior
* *Lolium* sp
* *Lotus suaveolens*

Site 101 (continued)

* *Lythrum hyssopifolia*
Melaleuca rhaphiophylla
Microtis media subsp *media*
* *Misopates orontium*
Opercularia hispidula
Patersonia occidentalis
Phyllangium paradoxum
Pteridium esculentum
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium brunonianum
Trachymene pilosa
* *Trifolium* sp
* *Ursinia anthemoides*
Viminaria juncea
Xanthorrhoea preissii

Site 134

* *Ammophila arenaria*
Baumea articulata
* *Bromus* sp
Caesia occidentalis
Centella asiatica
Cotula coronopifolia
Cynodon dactylon
Eucalyptus rudis
* *Isolepis prolifer*
Juncus pallidus
Lemna disperma
* *Lolium* sp
* *Lythrum hyssopifolia*
* *Medicago polymorpha*
Melaleuca rhaphiophylla
Myriophyllum crispatum
* *Pennisetum clandestinum*
* *Rumex pulcher* subsp *pulcher*
* *Trifolium dubium*
* *Trifolium fragiferum*
* *Trifolium tomentosum*
Triglochin huegelii

Site 140

Acacia huegelii
Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
* *Aira caryophyllea*
Allocasuarina humilis

Site 140 (continued)

- *Anigozanthos manglesii*
- *Astroloma pallidum*
- *Austrodanthonia occidentalis*
- *Banksia attenuata*
- *Bossiaea eriocarpa*
- * *Briza maxima*
- * *Briza minor*
- *Burchardia umbellata*
- *Calytrix flavescens*
- *Comesperma virgatum*
- *Conostephium pendulum*
- *Conostylis aculeata* subsp *aculeata*
- *Conostylis juncea*
- *Corymbia calophylla*
- * *Crassula alata*
- *Dampiera linearis*
- *Dasypogon bromeliifolius*
- *Daviesia divaricata*
- *Daviesia physodes*
- *Desmocladus fasciculata*
- *Dianella revoluta*
- *Drosera pallida*
- *Drosera stolonifera*
- *Eucalyptus marginata*
- *Gompholobium tomentosum*
- *Goodenia incana*
- *Hemiandra pungens*
- *Hibbertia hypericoides*
- *Hibbertia racemosa*
- *Hibbertia subvaginata*
- * *Hypochaeris glabra*
- *Isotoma hypocrateriformis*
- *Isotropis cuneifolia*
- *Jacksonia furcellata*
- *Kennedia prostrata*
- *Laxmannia squarrosa*
- *Leucopogon polymorphus*
- *Leucopogon propinquus*
- *Levenhookia stipitata*
- *Lobelia tenuior*
- *Lomandra sonderi*
- *Lyginia barbata*
- *Macrozamia riedlei*
- *Melaleuca thymoides*
- *Nemcia capitatum*
- *Olearia paucidentata*
- *Opercularia hispidula*
- *Patersonia occidentalis*
- *Petrophile linearis*
- *Philotheca spicatus*
- *Phlebocarya ciliata*

Site 140 (continued)

- *Platysace compressa*
- *Podotheca angustifolia*
- ? *Pronaya fraseri*
- *Rhodanthe cotula*
- *Stirlingia latifolia*
- *Stylidium brunonianum*
- *Stylidium piliferum*
- *Stylidium schoenoides*
- *Tetratheca hirsuta*
- *Thysanotus arbuscula*
- *Trachymene pilosa*
- *Tricoryne elatior*
- * *Ursinia anthemoides*
- *Xanthorrhoea brunonis*
- *Xanthosia huegelii*

Site 141

- *Agonis flexuosa*
- * *Aira caryophyllea*
- *Asteridea pulverulenta*
- *Astroloma pallidum*
- *Austrostipa compressa*
- *Banksia attenuata*
- *Banksia grandis*
- *Bossiaea eriocarpa*
- * *Briza maxima*
- *Cartonema philydroides*
- *Clematis pubescens*
- *Conostylis aculeata* subsp *aculeata*
- *Conostylis juncea*
- *Dasypogon bromeliifolius*
- *Daviesia physodes*
- *Desmocladus flexuosa*
- *Drosera stolonifera*
- *Eucalyptus marginata*
- *Glischrocaryon flavescens*
- *Gompholobium polymorphum*
- *Hemiandra pungens*
- *Hibbertia hypericoides*
- *Hibbertia subvaginata*
- *Hovea trisperma*
- * *Hypochaeris glabra*
- *Isotropis cuneifolia*
- *Jacksonia furcellata*
- *Lagenifera huegelii*
- P2 *Lasiopetalum membranaceum*
- *Lepidosperma squamatum*
- *Leucopogon polymorphus*
- *Levenhookia stipitata*
- *Lobelia tenuior*
- *Lomandra micrantha* subsp *micrantha*

Site 141 (continued)

Macrozamia riedlei
Melaleuca thymoides
* *Monadenia bracteata*
Opercularia hispidula
* *Orobanche minor*
* *Pelargonium capitatum*
Pelargonium littorale
Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phyllanthus calycinus
? *Pronaya fraseri*
Rhodanthe cotula
Sowerbaea laxiflora
Stylidium piliferum
Stylidium schoenoides
Synaphea spinulosa
Thelymitra ? aff *holmesii*
Thysanotus manglesianus
Thysanotus multiflorus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 146

Acacia pulchella
P3 *Acacia semitrullata*
Anigozanthos manglesii
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Conostylis aculeata subsp *aculeata*
Dampiera linearis
Dasypogon bromeliifolius
Eucalyptus marginata
Gompholobium confertum
Gompholobium tomentosum
Goodenia incana
Hemiandra pungens
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
* *Hypochaeris glabra*
Jacksonia sternbergiana
Kennedia prostrata
Lagenifera huegelii

Site 146 (continued)

Lepidosperma squamatum
Leucopogon polymorphus
Leucopogon propinquus
Levenhookia stipitata
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
* *Monadenia bracteata*
Patersonia occidentalis
Persoonia longifolia
Petrophile linearis
Philotheca spicatus
Rhodanthe cotula
Stirlingia latifolia
Stylidium brunonianum
Tetratheca hirsuta
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 151

P3 *Acacia semitrullata*
Adenanthos meisneri
Adenanthos obovatus
Astartea fascicularis
Banksia ilicifolia
Boronia ramosa subsp *anethifolia*
Calothamnus lateralis
Cassytha flava
Comesperma flavum
Dampiera linearis
Euchilopsis linearis
Eutaxia virgata
Hibbertia stellaris
Hypocalymma angustifolium
Lepyrodia glauca
Meeboldina sp
Melaleuca preissiana
Pericalymma ellipticum
Platytheca galioides
Selaginella gracillima
Stylidium calcaratum
Stylidium guttatum
Stylidium junceum
Thysanotus multiflorus

Site 155

P3 *Acacia semitrullata*
Adenanthos meisneri
Astartea fascicularis
P1 *Boronia juncea* subsp *juncea*

Site 155 (continued)

Calothamnus lateralis
Cassytha racemosa
Comesperma flavum
Comesperma virgatum
Dampiera linearis
Euchilopsis linearis
Eutaxia virgata
Gompholobium tomentosum
Hibbertia stellaris
Hypocalymma angustifolium
Kunzea ericifolia
Lepyrodia glauca
Melaleuca lateritia
Melaleuca preissiana
Melaleuca teretifolia
Pericalymma ellipticum
Stylidium brunonianum
Stylidium caespitosum
Stylidium calcaratum

Site 172

Agrostis sp
* *Aira* sp
* *Anagallis arvensis*
Austrodanthonia occidentalis
Baumea articulata
Baumea juncea
* *Briza minor*
Cassytha racemosa
* *Centaurium pulchellum*
Centella asiatica
* *Cirsium vulgare*
Comesperma virgatum
* *Conyza* sp
* *Cuscuta epithymum*
DRF *Diuris drummondii*
* *Hypochaeris glabra*
Lobelia alata
* *Lolium* sp
* *Lotus suaveolens*
Melaleuca rhaphiophylla
Melaleuca teretifolia
* *Mentha* X *piperita*
Microtis media subsp *media*
* *Orobanche minor*
* *Parentucellia viscosa*
* *Sonchus hydrophilus*
* *Trifolium dubium*
Villarsia albiflora

Site 173

Acacia saligna
Agonis flexuosa
* *Anagallis arvensis*
* *Arctotheca calendula*
Baumea articulata
Baumea juncea
* *Briza minor*
Cassytha racemosa
Centella asiatica
* *Conyza* sp
* *Cuscuta epithymum*
Eucalyptus rudis
Homalosciadium homalocarpum
* *Hypochaeris glabra*
* *Lotus suaveolens*
Melaleuca preissiana
Melaleuca rhaphiophylla
Melaleuca teretifolia
* *Mentha* X *piperita*
Microtis media subsp *media*
Myoporum caprarioides
* *Orobanche minor*
* *Parentucellia viscosa*
* *Sonchus asper*
Villarsia albiflora
* *Vulpia* sp

Site 175

Agonis flexuosa
Agrostocrinum scabrum
* *Aira caryophyllea*
Astartea fascicularis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Caesia occidentalis
Caladenia sp
Comesperma virgatum
Corymbia calophylla
Dampiera linearis
Dasypogon bromeliifolius
Daviesia physodes
Elythranthera emarginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*

Site 175 (continued)
Lagenifera huegelii
Lepidosperma squamatum
Leucopogon australis
Leucopogon propinquus
Lobelia tenuior
Lomandra ? caespitosa
Lomandra sonderi
Macrozamia riedlei
Melaleuca preissiana
Melaleuca thymoides
Microtis media subsp *media*
Monotaxis occidentalis
Opercularia hispidula
Patersonia occidentalis
Persoonia longifolia
Philotheca spicatus
Phyllanthus calycinus
Platysace compressa
Platytheca galioides
? Pronaya fraseri
Rhodanthe cotula
Stylidium brunonianum
Tetratheca hirsuta
Thelymitra ? aff *holmesii*
Trachymene pilosa
Xanthorrhoea brunonis

Site 183
Acacia pulchella
P3 *Acacia semitrullata*
Adenanthos meisneri
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
Caesia occidentalis
Caladenia flava
Calytrix fraseri
Conostylis juncea
Dampiera linearis
DRF *Drakaea micrantha*
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
Jacksonia sternbergiana
Kennedia prostrata
Lyginia barbata

Site 183 (continued)
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Nuytsia floribunda
Paracaleana nigrita
Petrophile linearis
Phlebocarya ciliata
Platysace compressa
? Pronaya fraseri
Pterostylis recurva
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Stylidium piliferum
Tetratheca hirsuta
Thysanotus manglesianus
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 201
Adenanthos meisneri
* *Anagallis arvensis*
Banksia ilicifolia
Banksia littoralis
Baumea articulata
* *Briza maxima*
* *Briza minor*
Cassytha racemosa
* *Centaurium pulchellum*
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
* *Conyza* sp
* *Crassula alata*
Daucus glochidiatus
Eucalyptus rudis
* *Hypochaeris glabra*
Ixiolaena viscosa
Jacksonia furcellata
Lepidosperma longitudinale
Leucopogon australis
Levenhookia stipitata
Lobelia alata
Lobelia tenuior
Lyginia barbata
Melaleuca incana subsp *incana*
Melaleuca preissiana
Melaleuca teretifolia
Nuytsia floribunda
* *Orobanche minor*

Site 201 (continued)

* *Parentucellia viscosa*
* *Petrorhagia velutina*
Rhodanthe cotula
* *Senecio vulgaris*
* *Silene gallica*
Siloxerus filifolius
* *Sonchus oleraceus*
Stylidium junceum
Thelymitra ? aff holmesii
* *Ursinia anthemoides*
Villarsia albiflora

Site 207

Acacia extensa
Acacia pulchella
Agonis flexuosa
Astroloma pallidum
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Caesia occidentalis
Calytrix flavescens
Calytrix fraseri
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata
Desmocladus fasciculata
Desmocladus flexuosa
Eucalyptus marginata
Gompholobium confertum
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Isotoma hypocrateriformis
Kennedia prostrata
Lepidosperma squamatum
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra sonderi
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Opercularia hispidula
Patersonia occidentalis

Site 207 (continued)

Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Podotheca angustifolia
Rhodanthe cotula
Stirlingia latifolia
Stylidium brunonianum
Thysanotus manglesianus
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii

Site 230

Alternanthera nodiflora
Aotus gracillima
Aphelia brizula
Astartea fascicularis
Baumea articulata
P1 *Boronia juncea* subsp *juncea*
* *Briza minor*
Calothamnus lateralis
Comesperma virgatum
Cotula coronopifolia
Cynodon dactylon
Dampiera linearis
Drosera nitidula subsp *nitidula*
Epiblema grandiflorum subsp *grandiflorum*
Goodenia filiformis
Goodenia incana
Haemodorum simplex
Hakea varia
Hibbertia stellaris
* *Hypochaeris glabra*
Isolepis marginata
Lepidosperma longitudinale
Lepyrodia glauca
* *Lotus suaveolens*
Melaleuca incana subsp *incana*
Melaleuca lateritia
Melaleuca rhaphiophylla
Microtis media subsp *media*
* *Monopsis debilis*
Oxylobium lineare
Pimelea lanata
Prasophyllum brownii
* *Pseudognaphalium luteo-album*
* *Rumex pulcher* subsp *pulcher*

Site 230 (continued)

* *Sonchus asper*
Stylidium brunonianum
Stylidium calcaratum
Stylidium despectum
Stylidium divaricatum
Triglochin lineare
Villarsia albiflora

Site 247

Acacia extensa
Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
Adenanthos meisneri
Agrostocrinum scabrum
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Caesia occidentalis
Caladenia cf *huegelii* but not *huegelii*
Calytrix fraseri
Conospermum capitatum
Conostephium pendulum
Conostylis aculeata subsp *aculeata*
Corymbia calophylla
Corynotheca micrantha
Cryptostylis ovata
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata
Desmocladus flexuosa
Drosera stolonifera
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Goodenia incana
Hardenbergia comptoniana
Hibbertia hypericoides
Hovea trisperma
Jacksonia furcellata
Lepidosperma squamatum
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Opercularia hispidula
Persoonia longifolia
Petrophile linearis
Philotheca spicatus

Site 247 (continued)

Phlebocarya ciliata
Platysace compressa
Stylidium brunonianum
Stylidium junceum
Stylidium piliferum
Stylidium schoenoides
Tetratheca hirsuta
Thelymitra ? aff *holmesii*
Thysanotus multiflorus
Trichocline spathulata
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 298

Acacia saligna
Acacia willdenowiana
Agonis flexuosa
Astroloma pallidum
* *Avena fatua*
Banksia attenuata
Banksia grandis
* *Briza maxima*
* *Briza minor*
Chamaescilla corymbosa
Conostylis aculeata subsp *aculeata*
Corynotheca micrantha
Daviesia divaricata
Desmocladus flexuosa
Dianella revoluta
Eryngium pinnatifidum subsp *pinnatifidum*
Eucalyptus gomphocephala
Gompholobium tomentosum
Hardenbergia comptoniana
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Jacksonia furcellata
Kennedia prostrata
* *Lagurus ovatus*
P2 *Lasiopetalum membranaceum*
Lepidosperma squamatum
Leucopogon propinquus
Lobelia tenuior
Lyginia barbata
Macrozamia riedlei
Persoonia saccata
Petrophile linearis
* *Petrorhagia velutina*
Phyllanthus calycinus

Site 298 (continued)

Podotheca angustifolia
Ptilotus stirlingii var *stirlingii*
Rhodanthe cotula
Sowerbaea laxiflora
Synaphea spinulosa
Tetraria octandra
Trachymene pilosa
* *Trifolium campestre*
* *Ursinia anthemoides*

Site 300

Acacia pulchella
Acacia willdenowiana
* *Aira caryophyllea*
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Chamaescilla corymbosa
Conostylis aculeata subsp *aculeata*
Corymbia calophylla
Dasypogon bromeliifolius
Daviesia divaricata
Desmoclaudus fasciculata
Drosera stolonifera
Gompholobium tomentosum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hovea trisperma
Isolepis marginata
Lepidosperma squamatum
Lepyrodia glauca
Leucopogon polymorphus
Leucopogon racemulosus
Levenhookia stipitata
Luzula meridionalis
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Nemcia capitatum
Patersonia occidentalis
Petrophile linearis
Philotheca spicatus
Phyllanthus calycinus
Podotheca angustifolia
Rhodanthe cotula
Stylidium brunonianum

Site 300 (continued)

Stylidium piliferum
Trachymene pilosa
Xanthorrhoea brunonis

Site 302

Acacia pulchella
Acacia saligna
P3 *Acacia semitrullata*
Adenanthos meisneri
Agonis flexuosa
* *Ammophila arenaria*
Aotus gracillima
Astartea fascicularis
Baumea articulata
Baumea juncea
Baumea vaginalis
* *Briza maxima*
* *Briza minor*
* *Bromus diandrus*
* *Conyza* sp
Hemiandra pungens
* *Hypochaeris glabra*
Jacksonia furcellata
Lobelia alata
Melaleuca preissiana
Melaleuca teretifolia
Microtis media subsp *media*
* *Monadenia bracteata*
Oxylobium lineare
Patersonia occidentalis
* *Petrorhagia velutina*
Platysace compressa
* *Romulea rosea*
* *Rubus* sp
* *Sonchus oleraceus*
Stylidium junceum
Thelymitra ? aff *holmesii*
Thelymitra crinita
Thysanotus multiflorus
* *Typha orientalis*
* *Ursinia anthemoides*

Site 303

Acacia saligna
Baumea articulata
Baumea vaginalis
Centella asiatica
Lobelia alata
Melaleuca preissiana

Site 324

* *Azolla pinnata*
Cotula coronopifolia
Cynodon dactylon
* *Hypochaeris glabra*
Juncus caespiticius
Juncus pallidus
Lemna disperma
Lepidosperma longitudinale
* *Lolium* sp
* *Lotus suaveolens*
Melaleuca lateritia
Melaleuca rhaphiophylla
* *Mentha* X *piperita*
* *Paspalum dilatatum*
* *Pennisetum clandestinum*
* *Rumex pulcher* subsp *pulcher*

Site 332

Acacia huegelii
Acacia pulchella
Acacia stenoptera
Adenanthos meisneri
Agonis flexuosa
Astroloma pallidum
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
Burchardia umbellata
Calectasia cyanea
Chamaescilla corymbosa
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
Corymbia calophylla
Dasypogon bromeliifolius
Daviesia divaricata
Daviesia physodes
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Haemodorum spicatum
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hyalosperma cotula
Hypolaena exsulca
Jacksonia furcellata
Lepidosperma effusum
Leucopogon propinquus
Levenhookia stipitata
Lobelia tenuior

Site 332 (continued)

Logania serpyllifolia
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Patersonia occidentalis
Pelargonium littorale
Persoonia longifolia
Phlebocarya ciliata
Poranthera microphylla
Stylidium brunonianum
Stylidium diversifolium
Synaphea spinulosa
Tetratheca hirsuta
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 341

Acacia extensa
Adenanthos meisneri
Agrostis sp
Banksia attenuata
Banksia ilicifolia
Boronia dichotoma
Bossiaea eriocarpa
Burchardia umbellata
Calytrix flavescens
Conostylis juncea
Dasypogon bromeliifolius
Drosera stolonifera
Eucalyptus marginata
Gompholobium confertum
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia vaginata
Hovea trisperma
Leucopogon australis
Lomandra sonderi
Melaleuca thymoides
Monotaxis occidentalis
Nuytsia floribunda
Patersonia occidentalis
Persoonia longifolia
Persoonia saccata
Petrophile linearis
Platysace compressa
Stylidium brunonianum
Stylidium diversifolium

Site 341 (continued)

Stylidium piliferum
Tetratheca hirsuta
Thysanotus manglesianus
Xanthorrhoea brunonis
Xanthosia huegelii

Site 342

Adenanthos meisneri
Adenanthos obovatus
* *Aira caryophyllea*
? *Aotus* sp
* *Arctotheca calendula*
* *Asparagus asparagoides*
Astartea fascicularis
Banksia ilicifolia
Banksia littoralis
* *Briza minor*
* *Conyza* sp
Corymbia calophylla
* *Crassula alata*
Crassula colorata
Daucus glochidiatus
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
Euchilopsis linearis
Gompholobium capitatum
Hibbertia stellaris
Hibbertia subvaginata
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Jacksonia furcellata
Leucopogon propinquus
Leucopogon racemulosus
* *Lotus suaveolens*
Melaleuca preissiana
* *Monadenia bracteata*
Nuytsia floribunda
Parietaria debilis
Patersonia occidentalis
Pericalymma ellipticum
Poranthera microphylla
* *Pseudognaphalium luteo-album*
Rhagodia baccata subsp *dioica*
* *Senecio vulgaris*
* *Solanum nigrum*
* *Sonchus oleraceus*
Stylidium repens
Thysanotus multiflorus
* *Ursinia anthemoides*
Xanthorrhoea preissiana

Site 346

* *Anagallis arvensis*
Astartea fascicularis
* *Atriplex prostrata*
* *Briza maxima*
Cassytha racemosa
Cotula coronopifolia
* *Crassula natans* var *minus*
Cynodon dactylon
Eleocharis acuta
* *Epilobium tetragonum*
Eucalyptus rudis
Glycera declinata
Juncus pallidus
Lepilaena preissii
* *Lotus suaveolens*
Luzula meridionalis
Melaleuca rhaphiophylla
Melaleuca teretifolia
* *Parentucellia viscosa*
Phyllangium paradoxum
* *Pseudognaphalium luteo-album*
* *Ranunculus trilobus*
Rhagodia baccata subsp *dioica*
* *Rumex crispus*
* *Sonchus oleraceus*
* *Trifolium hirtum*
* *Trifolium repens*
Villarsia capitata

Site 347

Agonis linearifolia
* *Aira caryophyllea*
Alternanthera nodiflora
* *Ammophila arenaria*
* *Arctotheca calendula*
Astartea fascicularis
* *Briza maxima*
* *Briza minor*
Caladenia longicaudata subsp *longicaudata*
Caladenia paludosa
Cassytha racemosa
Cotula coronopifolia
* *Crassula natans* var *minus*
Cryptostylis ovata
Cynodon dactylon
Drosera glanduligera
Drosera paleacea subsp *paleacea*
Eucalyptus rudis
Hardenbergia comptoniana
Homalosciadium homalocarpum
Hypocalymma angustifolium

Site 347 (continued)

* *Hypochaeris glabra*
Juncus pallidus
Kunzea ericifolia
* *Lotus suaveolens*
Luzula meridionalis
Melaleuca rhaphiophylla
Microtis media subsp *media*
* *Monadenia bracteata*
* *Monopsis debilis*
* *Ornithopus compressus*
* *Orobanche minor*
Oxylobium lineare
* *Parentucellia viscosa*
Pericalymma ellipticum
Phyllangium paradoxum
* *Pseudognaphalium luteo-album*
* *Ranunculus trilobus*
Senecio glomeratus
Siloxerus filifolius
* *Sonchus oleraceus*
* *Trifolium dubium*
* *Trifolium glomeratum*
* *Trifolium hirtum*
* *Trifolium hybridum*
* *Trifolium repens*
Villarsia capitata
Xanthorrhoea preissii

Site 348

Acacia extensa
Agonis flexuosa
* *Aira caryophyllea*
* *Ammophila arenaria*
Astartea fascicularis
Banksia attenuata
Banksia ilicifolia
Bossiaea eriocarpa
* *Briza maxima*
Cryptostylis ovata
Corymbia calophylla
Dampiera linearis
Daucus glochidiatus
Daviesia physodes
DRF *Drakaea ? elastica*
Drosera ? menziesii
Drosera paleacea subsp *paleacea*
Drosera stolonifera
Elythranthera emarginata
Eucalyptus marginata
Gompholobium polymorphum
Hardenbergia comptoniana

Site 348 (continued)

Hibbertia hypericoides
Hibbertia racemosa
Hypocalymma angustifolium
* *Hypochaeris glabra*
Kennedia prostrata
Kunzea ericifolia
Macrozamia riedlei
Melaleuca preissiana
Melaleuca thymoides
Opercularia hispidula
Paracaleana nigrita
Patersonia occidentalis
Platysace compressa
Siloxerus filifolius
Sowerbaea laxiflora
Stylidium brunonianum
Trichocline spathulata
* *Ursinia anthemoides*
Xanthorrhoea brunonis

Site 353

Agrostis sp
Banksia ilicifolia
Banksia littoralis
* *Briza maxima*
* *Briza minor*
Cynodon dactylon
Corymbia calophylla
Dasypogon bromeliifolius
Daucus glochidiatus
Drosera neesii
Drosera paleacea subsp *paleacea*
Elythranthera emarginata
Gompholobium tomentosum
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Isolepis marginata
Juncus pallidus
Kunzea ericifolia
Lepidosperma longitudinale
Melaleuca preissiana
Melaleuca thymoides
Nuytsia floribunda
Pericalymma ellipticum
Poranthera microphylla
Siloxerus filifolius
Stylidium diversifolium
Thelymitra ? benthamiana
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis

Site 356

- *Agonis flexuosa*
- * *Aira caryophyllea*
- *Astroloma pallidum*
- *Banksia attenuata*
- *Banksia grandis*
- *Banksia ilicifolia*
- *Bossiaea eriocarpa*
- * *Briza maxima*
- *Burchardia umbellata*
- *Cassytha racemosa*
- *Corymbia calophylla*
- *Daucus glochidiatus*
- *Daviesia divaricata*
- *Desmocladus fasciculata*
- *Drosera stolonifera*
- *Eucalyptus marginata*
- *Hibbertia hypericoides*
- *Hibbertia racemosa*
- * *Hypochaeris glabra*
- *Kennedia prostrata*
- *Kunzea ericifolia*
- P2 *Lasiopetalum membranaceum*
- *Lechenaultia biloba*
- *Leucopogon racemulosus*
- *Levenhookia stipitata*
- *Macrozamia riedlei*
- * *Monadenia bracteata*
- *Olearia axillaris*
- * *Orobanche minor*
- *Pelargonium littorale*
- *Petrophile linearis*
- * *Petrorhagia velutina*
- *Phyllanthus calycinus*
- *Podolepis lessonii*
- *Poranthera microphylla*
- * *Senecio vulgaris*
- *Synaphea spinulosa*
- *Trachymene cyanopetala*
- *Trachymene pilosa*
- * *Trifolium dubium*
- * *Trifolium hirtum*
- * *Ursinia anthemoides*
- *Wahlenbergia gracilenta*
- *Xanthorrhoea brunonis*
- *Xylomelum occidentale*

Site 357

- *Agonis flexuosa*
- * *Anagallis arvensis*
- * *Bellardia trixago*
- *Brachyloma preissii*

Site 357 (continued)

- * *Briza maxima*
- * *Briza minor*
- *Caladenia lobata*
- *Clematis pubescens*
- * *Conyza* sp
- *Corymbia calophylla*
- *Daucus glochidiatus*
- *Daviesia divaricata*
- *Eucalyptus decipiens*
- *Hardenbergia comptoniana*
- *Hibbertia hypericoides*
- * *Hypochaeris glabra*
- *Isotoma hypocrateriformis*
- P2 *Lasiopetalum membranaceum*
- *Levenhookia stipitata*
- *Lobelia tenuior*
- *Macrozamia riedlei*
- * *Medicago polymorpha*
- *Melaleuca acerosa*
- *Olearia axillaris*
- * *Orobanche minor*
- *Pelargonium littorale*
- * *Petrorhagia velutina*
- *Phyllanthus calycinus*
- *Poranthera microphylla*
- *Rhagodia baccata* subsp *dioica*
- * *Senecio vulgaris*
- * *Silene gallica*
- * *Sonchus oleraceus*
- *Thelymitra ? benthamiana*
- *Trachymene pilosa*
- * *Ursinia anthemoides*
- *Wahlenbergia preissii*

Site 367

- *Acacia huegelii*
- *Acacia pulchella*
- *Acacia stenoptera*
- *Adenanthos meisneri*
- *Astroloma pallidum*
- *Austrostipa compressa*
- *Banksia attenuata*
- *Banksia grandis*
- *Banksia ilicifolia*
- *Bossiaea eriocarpa*
- * *Briza maxima*
- *Conospermum capitatum*
- *Conostephium pendulum*
- *Conostylis aculeata* subsp *aculeata*
- *Corymbia calophylla*
- *Dampiera linearis*

Site 367 (continued)

Dasypogon bromeliifolius
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hypolaena exsulca
Kunzea ericifolia
Lepidosperma squamatum
Levenhookia stipitata
Lobelia tenuior
Lomandra purpurea
Macrozamia riedlei
Melaleuca thymoides
Patersonia occidentalis
Pericalymma ellipticum
Persoonia longifolia
Petrophile linearis
Phlebocarya ciliata
Poranthera microphylla
Pterostylis recurva
Scaevola calliptera
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Thelymitra crinita
Thysanotus multiflorus
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xylomelum occidentale

Site 370

Acacia pulchella
P3 *Acacia semitrullata*
Acacia stenoptera
Agonis flexuosa
Anigozanthos manglesii
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Comesperma virgatum
Conostylis aculeata subsp *aculeata*
Corymbia calophylla
Dampiera linearis
Dasypogon bromeliifolius
Daucus glochidiatus

Site 370 (continued)

Daviesia divaricata
Desmocladus fasciculata
Drosera stolonifera
Eucalyptus marginata
Gompholobium tomentosum
Hardenbergia comptoniana
Hemiandra pungens
Hibbertia hypericoides
Hibbertia racemosa
Hovea trisperma
Hyalosperma cotula
Isotropis cuneifolia
Jacksonia furcellata
Kennedia prostrata
Lagenifera huegelii
Lepidosperma squamatum
Lobelia tenuior
Logania serpyllifolia
Lyginia barbata
Macrozamia riedlei
Melaleuca thymoides
Microtis media subsp *media*
Opercularia hispidula
Patersonia occidentalis
Persoonia saccata
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Phyllanthus calycinus
Platysace compressa
Podolepis lessonii
Pyrorchis nigricans
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Stylidium diversifolium
Stylidium schoenoides
Tetratheca hirsuta
Trachymene pilosa
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea brunonis
Xanthosia huegelii
Xylomelum occidentale

Site 371

P3 *Acacia semitrullata*
Agonis flexuosa
* *Aira caryophyllea*
Aotus gracillima
Aphelia cyperoides

Site 371 (continued)

Astartea fascicularis
Banksia grandis
Boronia dichotoma
* *Briza maxima*
Calothamnus lateralis
Cartonema philydroides
Cassytha racemosa
Corymbia calophylla
Dampiera linearis
Dampiera trigona
Dasypogon bromeliifolius
Drosera nitidula subsp *nitidula*
Drosera paleacea subsp *paleacea*
Elythranthera emarginata
Eucalyptus marginata
? *Eutaxia* sp
Gompholobium capitatum
Hibbertia vaginata
Hypocalymma angustifolium
* *Hypochaeris glabra*
Isolepis cernua
Kunzea ericifolia
Lechenaultia biloba
Lepidosperma longitudinale
Lobelia tenuior
* *Lotus suaveolens*
Melaleuca lateritia
Melaleuca preissiana
Melaleuca thymoides
Microtis media subsp *media*
* *Monopsis debilis*
Monotaxis occidentalis
Pericalymma ellipticum
Phyllangium paradoxum
Poranthera microphylla
Pteridium esculentum
Selaginella gracillima
Siloxerus filifolius
Stylidium brunonianum
Stylidium calcaratum
Stylidium junceum
Trachymene pilosa
* *Trifolium subterraneum*
* *Ursinia anthemoides*
Viminaria juncea
Xanthorrhoea brunonis

Notes:
* designates introduced species
P1; P2; P3 CALM Priority Codes
DRF Declared Rare Flora

APPENDIX K

GIBSON PLOT FLORA LISTS

APPENDIX K

KEMERTON BIOLOGICAL SURVEY PHASE 1

GIBSON PLOT FLORA LISTS

Site 13

P3 *Acacia semitrullata*
Asteridea pulverulenta
Austrostipa compressa
Banksia attenuata
Bossiaea eriocarpa
Brachyloma preissii
* *Briza maxima*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Dasypogon bromeliifolius
Drosera paleacea subsp *paleacea*
Eucalyptus marginata
Gompholobium tomentosum
Hibbertia hypericoides
Hibbertia subvaginata
Hibbertia vaginata
Hovea trisperma
* *Hypochaeris glabra*
Kunzea ericifolia
Lepidosperma squamatum
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra purpurea
Lyginia barbata
Macrozamia riedlei
Melaleuca scabra group
Melaleuca thymoides
Petrophile linearis
Philotheca spicatus
Platysace compressa
Rhodanthe cotula
Siloxerus filifolius
Stylidium brunonianum
Stylidium piliferum
Stylidium schoenoides
Thelymitra ? aff *holmesii*
Thysanotus manglesianus
Thysanotus multiflorus
Tricoryne elatior
* *Ursinia anthemoides*
Xanthorrhoea preissii

Site 31

* *Aira caryophyllea*
Austrodanthonia occidentalis
Banksia attenuata
Bossiaea eriocarpa
* *Briza maxima*
* *Briza minor*
Burchardia umbellata
Calytrix flavescens
Calytrix fraseri
Chamaescilla corymbosa
Comesperma virgatum
Conostephium pendulum
Conostylis juncea
Dasypogon bromeliifolius
Daviesia physodes
Drosera pallida
Drosera stolonifera
Eucalyptus marginata
Hibbertia hypericoides
Hibbertia racemosa
* *Hypochaeris glabra*
Hypolaena exsulca
Lagenifera huegelii
Lepidosperma squamatum
Lepyrodia glauca
Leucopogon polymorphus
Levenhookia stipitata
Lobelia tenuior
Lomandra ? caespitosa
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
? Pronaya fraseri
Rhodanthe cotula
Sowerbaea laxiflora
Stirlingia latifolia
Stylidium brunonianum
Thelymitra ? aff *holmesii*
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii

APPENDIX K - *Page 2*

Site 172

	Agrostis sp
*	*Aira* sp
	Austrodanthonia occidentalis
	Baumea articulata
	Baumea juncea
*	*Briza minor*
	Cassytha racemosa
*	*Centaurium pulchellum*
	Centella asiatica
*	*Cirsium vulgare*
*	*Conyza* sp
*	*Cuscuta epithymum*
*	*Hypochaeris glabra*
	Lobelia alata
*	*Lolium* sp
*	*Lotus suaveolens*
	Melaleuca teretifolia
*	*Mentha* X *piperita*
	Microtis media subsp *media*
*	*Orobanche minor*
*	*Sonchus hydrophilus*
*	*Trifolium dubium*
	Villarsia albiflora

Site 175

	Agonis flexuosa
	Banksia ilicifolia
	Bossiaea eriocarpa
*	*Briza maxima*
	Caesia occidentalis
	Caladenia sp
	Corymbia calophylla
	Dampiera linearis
	Dasypogon bromeliifolius
	Hardenbergia comptoniana
	Hibbertia hypericoides
	Hibbertia racemosa
*	*Hypochaeris glabra*
	Lagenifera huegelii
	Lepidosperma squamatum
	Lomandra ? *caespitosa*
	Lomandra sonderi
	Macrozamia riedlei
	Melaleuca preissiana
	Melaleuca thymoides
	Opercularia hispidula
	Patersonia occidentalis
	Persoonia longifolia
	Philotheca spicatus
	Platysace compressa

Site 175 (continued)

	? *Pronaya fraseri*
	Thelymitra ? aff *holmesii*
	Trachymene pilosa
	Xanthorrhoea brunonis

Site 226

P3	*Acacia semitrullata*
	Acacia stenoptera
*	*Aira caryophyllea*
	Astroloma pallidum
	Austrodanthonia occidentalis
	Banksia attenuata
	Bossiaea eriocarpa
*	*Briza maxima*
*	*Briza minor*
	Burchardia umbellata
	Conostephium pendulum
	Conostylis juncea
	Corymbia calophylla
	Dasypogon bromeliifolius
	Daviesia divaricata
	Desmoclaudus fasciculata
	Drosera pallida
	Drosera stolonifera
	Eucalyptus marginata
	Gompholobium tomentosum
	Goodenia incana
	Hemiandra pungens
	Hibbertia hypericoides
	Hibbertia racemosa
	Hibbertia subvaginata
*	*Hypochaeris glabra*
	Isotoma hypocrateriformis
	Isotropis cuneifolia
	Leucopogon polymorphus
	Leucopogon propinquus
	Lobelia tenuior
	Lomandra sonderi
	Lyginia barbata
	Melaleuca thymoides
	Nemcia capitatum
	Olearia paucidentata
	Patersonia occidentalis
	Petrophile linearis
	Philotheca spicatus
	Platysace compressa
	Rhodanthe cotula
	Stirlingia latifolia
	Stylidium brunonianum
	Stylidium piliferum

Site 226 (continued)

Tetratheca hirsuta
Thysanotus arbuscula
Trachymene pilosa
Tricoryne elatior
Xanthorrhoea brunonis
Xanthosia huegelii

Site 230

Baumea articulata
Lepidosperma longitudinale
Lepyrodia glauca
Melaleuca lateritia
Villarsia albiflora

Site 247

Acacia pulchella
P3 *Acacia semitrullata*
Agrostocrinum scabrum
Banksia attenuata
Bossiaea eriocarpa
Caesia occidentalis
Conospermum capitatum
Conostephium pendulum
Corymbia calophylla
Dampiera linearis
Dasypogon bromeliifolius
Desmocladus flexuosa
Eucalyptus marginata
Gompholobium polymorphum
Gompholobium tomentosum
Hibbertia hypericoides
Hovea trisperma
Lepidosperma squamatum
Lomandra sonderi
Macrozamia riedlei
Melaleuca thymoides
Monotaxis occidentalis
Opercularia hispidula
Petrophile linearis
Philotheca spicatus
Phlebocarya ciliata
Platysace compressa
Stylidium brunonianum
Stylidium schoenoides
Tetratheca hirsuta
Trichocline spathulata
Tricoryne elatior
Xanthosia huegelii
Xylomelum occidentale

Site 303

Acacia saligna
Baumea articulata
Baumea vaginalis
Centella asiatica
Lobelia alata
Melaleuca preissiana

Notes:
* designates introduced species
P3 CALM Priority Code
DRF Declared Rare Flora

APPENDIX L

L (1) - COMPILED SPECIES LIST (ALL SITES) -
IN FAMILY ORDER;

L (2) - COMPILED SPECIES LIST (ALL SITES) -
ALPHABETICAL ORDER; AND CODES USED IN THIS REPORT

APPENDIX L (1)

KEMERTON BIOLOGICAL SURVEY PHASE 1

COMPILED SPECIES LIST (ALL SITES) - IN FAMILY ORDER
(List in alphabetical order with codes follows)

SELAGINELLACEAE
Selaginella gracillima

DENNSTAEDTIACEAE
Pteridium esculentum

AZOLLACEAE
* *Azolla pinnata*

ZAMIACEAE
Macrozamia riedlei

PODOCARPACEAE
Podocarpus drouynianus

PINACEAE
* *Pinus pinaster*

TYPHACEAE
* *Typha orientalis*

ZANNICHELLIACEAE
Lepilaena preissii

JUNCAGINACEAE
Triglochin huegelii
Triglochin lineare

POACEAE
Agrostis sp
* *Aira caryophyllea*
* *Aira* sp
* *Ammophila arenaria*
Austrodanthonia occidentalis
Austrostipa compressa
* *Avena fatua*
* *Briza maxima*
* *Briza minor*
* *Bromus diandrus*
* *Bromus* sp
Cynodon dactylon
* *Ehrharta brevifolia*
* *Eragrostis curvula*
Glycera declinata
* *Lagurus ovatus*
* *Lolium* sp
* *Paspalum dilatatum*
* *Pennisetum clandestinum*
* *Vulpia* sp

CYPERACEAE
Baumea articulata
Baumea juncea
Baumea vaginalis
Eleocharis acuta
Evandra pauciflora
Isolepis cernua
Isolepis marginata
* *Isolepis prolifer*
Lepidosperma effusum
Lepidosperma longitudinale
Lepidosperma squamatum
Schoenus curvifolius
Tetraria octandra

ARACEAE
* *Zantedeschia aethiopica*

LEMNACEAE
Lemna disperma

RESTIONACEAE
Desmocladus fasciculata
Desmocladus flexuosa
Hypolaena exsulca
Lepyrodia glauca
Lyginia barbata
Meeboldina sp

CENTROLEPIDACEAE
Aphelia brizula
Aphelia cyperoides
Centrolepis aristata

COMMELINACEAE
Cartonema philydroides

JUNCACEAE
Juncus caespiticius
Juncus pallidus
Luzula meridionalis

ASPARAGACEAE
* *Asparagus asparagoides*

DASYPOGONACEAE
Calectasia cyanea
Dasypogon bromeliifolius
Lomandra ? caespitosa

APPENDIX L (1) - *Page 2*

DASYPOGONACEAE (continued)
Lomandra micrantha subsp *micrantha*
Lomandra purpurea
Lomandra sonderi

XANTHORRHOEACEAE
Xanthorrhoea brunonis
Xanthorrhoea preissii

PHORMIACEAE
Dianella revoluta

ANTHERICACEAE
Agrostocrinum scabrum
Caesia occidentalis
Chamaescilla corymbosa
Corynotheca micrantha
Laxmannia squarrosa
Sowerbaea laxiflora
Thysanotus arbuscula
Thysanotus manglesianus
Thysanotus multiflorus
Tricoryne elatior

COLCHICACEAE
Burchardia umbellata

HAEMODORACEAE
Anigozanthos manglesii
Conostylis aculeata subsp *aculeata*
Conostylis juncea
Haemodorum simplex
Haemodorum spicatum
Phlebocarya ciliata

IRIDACEAE
Patersonia occidentalis
* *Romulea rosea*
* *Watsonia bulbillifera*

ORCHADACEAE
Caladenia cf *huegelii* (but not *huegelii*)
Caladenia flava
Caladenia lobata
Caladenia longicaudata subsp *longicaudata*
Caladenia paludosa
Caladenia sp
Cryptostylis ovata
DRF *Diuris drummondii*
DRF *Drakaea ? elastica*
DRF *Drakaea elastica*
Drakaea glyptodon
Drakaea jeanensis
DRF *Drakaea micrantha*
Elythranthera emarginata
Epiblema grandiflorum subsp *grandiflorum*
Microtis media subsp *media*

ORCHADACEAE (continued)
* *Monadenia bracteata*
Paracaleana nigrita
Prasophyllum brownii
Pterostylis recurva
Pyrorchis nigricans
Thelymitra ? aff holmesii
Thelymitra ? benthamiana
Thelymitra crinita

CASUARINACEAE
Allocasuarina fraseriana
Allocasuarina humilis

URTICACEAE
Parietaria debilis

PROTEACEAE
Adenanthos meisneri
Adenanthos obovatus
Banksia attenuata
Banksia grandis
Banksia ilicifolia
Banksia littoralis
Conospermum capitatum
Grevillea diversifolia subsp *diversifolia*
Hakea varia
Persoonia longifolia
Persoonia saccata
Petrophile linearis
Stirlingia latifolia
Synaphea spinulosa
Xylomelum occidentale

LORANTHACEAE
Nuytsia floribunda

POLYGONACEAE
* *Acetosella vulgaris*
* *Rumex crispus*
* *Rumex pulcher* subsp *pulcher*

CHENOPODIACEAE
* *Atriplex prostrata*
Rhagodia baccata subsp *dioica*

AMARANTHACEAE
Alternanthera nodiflora
Ptilotus stirlingii var *stirlingii*

CARYOPHYLLACEAE
* *Petrorhagia velutina*
* *Silene gallica*

RANUNCULACEAE
Clematis pubescens
* *Ranunculus trilobus*

LAURACEAE
Cassytha flava
Cassytha racemosa

DROSERACEAE
Drosera ? menziesii
Drosera ? pulchella
Drosera glanduligera
Drosera neesii
Drosera nitidula subsp *nitidula*
Drosera paleacea subsp *paleacea*
Drosera pallida
Drosera stolonifera

CRASSULACEAE
* *Crassula alata*
Crassula colorata
* *Crassula natans* var *minus*

PITTOSPORACEAE
? *Pronaya fraseri*

ROSACEAE
* *Rubus* sp

MIMOSACEAE
Acacia cyclops
Acacia extensa
P4 *Acacia flagelliformis*
Acacia huegelii
Acacia pulchella
* *Acacia pycnantha*
Acacia saligna
P3 *Acacia semitrullata*
Acacia stenoptera
Acacia willdenowiana

PAPILIONACEAE
? *Aotis* sp
? *Eutaxia* sp
Aotus gracillima
Bossiaea eriocarpa
* *Chamaecytisus palmensis*
Daviesia divaricata
Daviesia physodes
Euchilopsis linearis
Eutaxia virgata
Gompholobium capitatum
Gompholobium confertum
Gompholobium polymorphum
Gompholobium tomentosum
Hardenbergia comptoniana
Hovea trisperma
Isotropis cuneifolia
Jacksonia furcellata
Jacksonia sternbergiana
Kennedia prostrata

PAPILIONACEAE (continued)
Latrobea tenella
* *Lotus suaveolens*
* *Medicago polymorpha*
Nemcia capitatum
* *Ornithopus compressus*
Oxylobium lineare
Pultenaea reticulata
* *Trifolium angustifolium*
* *Trifolium campestre*
* *Trifolium dubium*
* *Trifolium fragiferum*
* *Trifolium glomeratum*
* *Trifolium hirtum*
* *Trifolium hybridum*
* *Trifolium repens*
* *Trifolium* sp
* *Trifolium subterraneum*
* *Trifolium tomentosum*
Viminaria juncea

GERANIACEAE
* *Pelargonium capitatum*
Pelargonium littorale

RUTACEAE
Boronia dichotoma
P1 *Boronia juncea* subsp *juncea*
Boronia ramosa subsp *anethifolia*
Philopheca spicatus

TREMANDRACEAE
Platytheca galioides
Tetratheca hirsuta

POLYGALACEAE
Comesperma flavum
Comesperma virgatum

EUPHORBIACEAE
Monotaxis occidentalis
Phyllanthus calycinus
Poranthera microphylla

CALLITRICHACEAE
* *Callitriche stagnalis*

STERCULIACEAE
P2 *Lasiopetalum membranaceum*

DILLENIACEAE
Hibbertia cuneiformis
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia stellaris
Hibbertia subvaginata
Hibbertia vaginata

THYMELAEACEAE
Pimelea lanata

LYTHRACEAE
* *Lythrum hyssopifolia*

MYRTACEAE
Agonis flexuosa
Agonis linearifolia
Astartea fascicularis
Calothamnus lateralis
Calytrix angulata
Calytrix flavescens
Calytrix fraseri
Eucalyptus calophylla
Eucalyptus decipiens

MYRTACEAE (continued)
Eucalyptus gomphocephala
Eucalyptus marginata
Eucalyptus rudis
Hypocalymma angustifolium
Kunzea ericifolia
Kunzea micrantha
Melaleuca acerosa
Melaleuca incana subsp *incana*
Melaleuca lateritia
Melaleuca preissiana
Melaleuca rhaphiophylla
Melaleuca scabra group
Melaleuca teretifolia
Melaleuca thymoides
Pericalymma ellipticum
Verticordia nitens

ONAGRACEAE
* *Epilobium tetragonum*

HALORAGACEAE
Glischrocaryon flavescens
Gonocarpus pithyoides
Myriophyllum crispatum

APIACEAE
Centella asiatica
Daucus glochidiatus
Eryngium pinnatifidum subsp *pinnatifidum*
Homalosciadium homalocarpum
Platysace compressa
Trachymene cyanopetala
Trachymene pilosa
Xanthosia huegelii

EPACRIDACEAE
Astroloma pallidum
Brachyloma preissii

EPACRIDACEAE (continued)
Conostephium pendulum
Leucopogon australis
Leucopogon polymorphus
Leucopogon propinquus
Leucopogon racemulosus
Lysinema ciliatum

PRIMULACEAE
* *Anagallis arvensis*

LOGANIACEAE
Logania serpyllifolia
Phyllangium paradoxum

GENTIANACEAE
* *Centaurium pulchellum*

MENYANTHACEAE
Villarsia albiflora
Villarsia capitata

CUSCUTACEAE
* *Cuscuta epithymum*

LAMIACEAE
Hemiandra pungens
* *Mentha X piperita*

SOLANACEAE
* *Solanum nigrum*

SCROPHULARIACEAE
* *Bellardia trixago*
* *Misopates orontium*
* *Parentucellia viscosa*

OROBANCHACEAE
* *Orobanche minor*

MYOPORACEAE
Myoporum caprarioides

RUBIACEAE
Opercularia hispidula

CAMPANULACEAE
* *Wahlenbergia capensis*
Wahlenbergia gracilenta
Wahlenbergia preissii

LOBELIACEAE
Isotoma hypocrateriformis
Lobelia alata
Lobelia tenuior
* *Monopsis debilis*

GOODENIACEAE

Dampiera linearis
Dampiera trigona
Goodenia filiformis
Goodenia incana
Lechenaultia biloba
Lechenaultia expansa
Scaevola calliptera

STYLIDIACEAE

Levenhookia stipitata
Stylidium brunonianum
Stylidium caespitosum
Stylidium calcaratum
Stylidium despectum
Stylidium divaricatum
Stylidium diversifolium
Stylidium guttatum
Stylidium junceum
Stylidium piliferum
Stylidium repens
Stylidium schoenoides

ASTERACEAE

* *Arctotheca calendula*
Asteridea pulverulenta
* *Cirsium vulgare*
* *Conyza* sp
Cotula coronopifolia
Hyalosperma cotula
* *Hypochaeris glabra*
Ixiolaena viscosa
Lagenifera huegelii
Olearia axillaris
Olearia paucidentata
Podolepis lessonii
Podotheca angustifolia
* *Pseudognaphalium luteo-album*
Rhodanthe cotula
Senecio glomeratus
* *Senecio vulgaris*
Siloxerus filifolius
* *Sonchus asper*
* *Sonchus hydrophilus*
* *Sonchus oleraceus*
Trichocline spathulata
* *Ursinia anthemoides*

Notes:
* designates introduced species
P1; P2; P3 CALM Priority Codes
DRF Declared Rare Flora

APPENDIX L (2)

KEMERTON BIOLOGICAL SURVEY PHASE 1

COMPILED SPECIES LIST (ALL SITES) - ALPHABETICAL ORDER; AND CODES USED IN THIS REPORT

STATUS	TAXON	CODE
	Acacia cyclops	Acaccycl
	Acacia extensa	Acacexte
P4	*Acacia flagelliformis*	Acacflag
	Acacia huegelii	Acachueg
	Acacia pulchella	Acacpulc
*	*Acacia pycnantha*	Acacpycn
	Acacia saligna	Acacsali
P3	*Acacia semitrullata*	Acacsemi
	Acacia stenoptera	Acacsten
	Acacia willdenowiana	Acacwill
*	*Acetosella vulgaris*	Acetvulg
	Adenanthos meisneri	Adenmeis
	Adenanthos obovatus	Adenobov
	Agonis flexuosa	Agonflex
	Agonis linearifolia	Agonline
	Agrostis sp	Agrosp
	Agrostocrinum scabrum	Agroscab
*	*Aira caryophyllea*	Airacary
*	*Aira* sp	Airasp
	Allocasuarina fraseriana	Allofras
	Allocasuarina humilis	Allohumi
	Alternanthera nodiflora	Altenodi
*	*Ammophila arenaria*	Ammoaren
*	*Anagallis arvensis*	Anagarve
	Anigozanthos manglesii	Anigmang
	Aotus gracillima	Aotugrac
	? Aotus sp	Aotusp
	Aphelia brizula	Aphebriz
	Aphelia cyperoides	Aphecype
*	*Arctotheca calendula*	Arctcale
*	*Asparagus asparagoides*	Aspaaspa
	Astartea fascicularis	Astafasc
	Astroloma pallidum	Astrpall
*	*Atriplex prostrata*	Atripros
	Austrodanthonia occidentalis	Austocci
	Austrostipa compressa	Austcomp
*	*Avena fatua*	Avenfatu
*	*Azolla pinnata*	Azolpinn
	Banksia attenuata	Bankatte
	Banksia grandis	Bankgran
	Banksia ilicifolia	Bankilic
	Banksia littoralis	Banklitt
	Baumea articulata	Baumarti
	Baumea juncea	Baumjunc
	Baumea vaginalis	Baumvagi
*	*Bellardia trixago*	Bellatrix
	Boronia dichotoma	Borodich
P1	*Boronia juncea* subsp *juncea*	Borojunc
	Boronia ramosa subsp *anethifolia*	Bororamo
	Bossiaea eriocarpa	Bosserio
	Brachyloma preissii	Brachprei
*	*Briza maxima*	Brizmaxi
*	*Briza minor*	Brizmino
*	*Bromus diandrus*	Bromdian
*	*Bromus* sp	Bromsp
	Burchardia umbellata	Burchumb
	Caesia occidentalis	Caesocci
	Caladenia cf *huegelii* but not *huegelii*	Calahueg
	Caladenia flava	Calaflav
	Caladenia lobata	Calaloba
	Caladenia longicaudata subspongicaudata	Calalong
	Caladenia paludosa	Calapalu
	Caladenia sp	Calasp
	Calectasia cyanea	Calecyan

APPENDIX L (2) - *Page 2*

STATUS	TAXON	CODE
	Asteridea pulverulenta	Astepulv
	Asteridea pulverulenta	Astepulv
	Calothamnus lateralis	Calolate
	Calytrix angulata	Calyangu
	Calytrix flavescens	Calyflav
	Calytrix fraseri	Calyfras
	Cartonema philydroides	Cartphil
	Cassytha flava	Cassflav
	Cassytha racemosa	Cassrace
*	*Centaurium pulchellum*	Centpulc
	Centella asiatica	Centasia
	Centrolepis aristata	Centaris
*	*Chamaecytisus palmensis*	Champalm
	Chamaescilla corymbosa	Chamcory
*	*Cirsium vulgare*	Cirsvulg
	Clematis pubescens	Clempube
	Comesperma flavum	Comeflav
	Comesperma virgatum	Comevirg
	Conospermum capitatum	Conocapi
	Conostephium pendulum	Conopend
	Conostylis aculeata subsp *aculeata*	Conoacul
	Conostylis juncea	Conojunc
*	*Conyza* sp	Conysp
	Corymbia calophylla	Corycalo
	Corynotheca micrantha	Corymicr
	Cotula coronopifolia	Cotucoro
*	*Crassula alata*	Crasalat
	Crassula colorata	Crascolo
*	*Crassula natans var minus*	Crasnata
	Cryptostylis ovata	Crypovat
*	*Cuscuta epithymum*	Cuscepit
	Cynodon dactylon	Cynodact
	Dampiera linearis	Dampline
	Dampiera trigona	Damptrig
	Dasypogon bromeliifolius	Dasybrom
	Daucus glochidiatus	Daucgloc
*	*Callitriche stagnalis*	Callstag
*	*Callitriche stagnalis*	Callstag
	Desmocladus fasciculata	Desmfasc
	Desmocladus flexuosa	Desmflex
	Dianella revoluta	Dianrevo
DRF	*Diuris drummondii*	Diurdrum
DRF	*Drakaea elastica*	Drakelas
DRF	*Drakaea ? elastica*	Drakelas
	Drakaea glyptodon	Drakglyp
	Drakaea jeanensis	Drakjean
DRF	*Drakaea micrantha*	Drakmicr
	Drosera glanduligera	Drosglan
	Drosera ? menziesii	Drosmenz
	Drosera neesii	Drosnees
	Drosera nitidula subsp *nitidula*	Drosniti
	Drosera paleacea subsp *paleacea*	Drospale
	Drosera pallida	Drospall
	Drosera ? pulchella	Drospulc
	Drosera stolonifera	Drosstol
*	*Ehrharta brevifolia*	Ehrhbrev
	Eleocharis acuta	Eleoacut
	Elythranthera emarginata	Elytemar
	Epiblema grandiflorum subsprandiflorum	Epibgran
*	*Epilobium tetragonum*	Epiltetr
*	*Eragrostis curvula*	Eragcurv
	Eryngium pinnatifidum subspinnatifidum	Erynpinn
	Eucalyptus decipiens	Eucadeci
	Eucalyptus gomphocephala	Eucagomp
	Eucalyptus marginata	Eucamarg
	Eucalyptus rudis	Eucarudi
	Euchilopsis linearis	Euchiline
	Eutaxia virgata	Eutavirg
	? *Eutaxia* sp	Eutasp
	Evandra pauciflora	Evanpauc
	Glischrocaryon flavescens	Glisflav
	Glyceria declinata	Glycdecl

APPENDIX L (2) - *Page 3*

STATUS	TAXON	CODE	STATUS	TAXON	CODE
	Daviesia divaricata	Davidiva		*Gompholobium capitatum*	Gompcapi
	Daviesia physodes	Daviphys			
	Gompholobium polymorphum	Gomppoly		*Lagenifera huegelii*	Lagehueg
	Gompholobium tomentosum	Gomptome	*	*Lagurus ovatus*	Laguovat
	Gonocarpus pithyoides	Gonopithy	P2	*Lasiopetalum membranaceum*	Lasimemb
	Goodenia filiformis	Goodfili		*Latrobea tenella*	Latrtene
	Goodenia incana	Goodinca		*Laxmannia squarrosa*	Laxmsqua
	Grevillea diversifolia subspiversifolia	Grevdive		*Lechenaultia biloba*	Lechbilo
	Haemodorum simplex	Haemsimp		*Lechenaultia expansa*	Lechexpa
	Haemodorum spicatum	Haemspic		*Lemna disperma*	Lemndisp
	Hakea varia	Hakevari		*Lepidosperma effusum*	Lepieffu
	Hardenbergia comptoniana	Hardcomp		*Lepidosperma longitudinale*	Lepilong
	Hemiandra pungens	Hemipung		*Lepidosperma squamatum*	Lepisqua
	Hibbertia cuneiformis	Hibbcune		*Lepilaena preissii*	Lepiprei
	Hibbertia hypericoides	Hibbhype		*Lepyrodia glauca*	Lepyglau
	Hibbertia racemosa	Hibbrace		*Leucopogon australis*	Leucaust
	Hibbertia stellaris	Hibbstel		*Leucopogon polymorphus*	Leucpoly
	Hibbertia subvaginata	Hibbsubv		*Leucopogon propinquus*	Leucprop
	Hibbertia vaginata	Hibbvagi		*Leucopogon racemulosus*	Leucrace
	Homalosciadium homalocarpum	Homahoma		*Levenhookia stipitata*	Levestip
	Hovea trisperma	Hovetris		*Lobelia alata*	Lobealat
	Hyalosperma cotula	Hyalcotu		*Lobelia tenuior*	Lobetenu
	Hypocalymma angustifolium	Hypoangu		*Logania serpyllifolia*	Logaserp
*	*Hypochaeris glabra*	Hypoglab	*	*Lolium* sp	Lolisp
	Hypolaena exsulca	Hypoexsu		*Lomandra ? caespitosa*	Lomacaes
	Isolepis cernua	Isolcern		*Lomandra micrantha subspicrantha*	Lomamicr
	Isolepis marginata	Isolmarg		*Lomandra purpurea*	Lomapurp
*	*Isolepis prolifer*	Isolprol		*Lomandra sonderi*	Lomasond
	Isotoma hypocrateriformis	Isothypo	*	*Lotus suaveolens*	Lotusuav
	Isotropis cuneifolia	Isotcune		*Luzula meridionalis*	Luzumeri
	Ixiolaena viscosa	Ixiovisc		*Lyginia barbata*	Lygibarb
	Jacksonia furcellata	Jackfurc		*Lysinema ciliatum*	Lysicili
	Jacksonia sternbergiana	Jackster	*	*Lythrum hyssopifolia*	Lythhyss
	Juncus caespiticius	Junccaes		*Macrozamia riedlei*	Macrried
	Juncus pallidus	Juncpall	*	*Medicago polymorpha*	Medipoly
	Kennedia prostrata	Kennpros		*Meeboldina* sp	Meebsp
	Kunzea ericifolia	Kunzeric		*Melaleuca acerosa*	Melalacer

APPENDIX L (2) - *Page 4*

STATUS	TAXON	CODE
	Kunzea micrantha	Kunzmicr
	Melaleuca lateritia	Melalate
	Melaleuca preissiana	Melaprei
	Melaleuca rhaphiophylla	Melarhap
	Melaleuca scabra group	Melascab
	Melaleuca teretifolia	Melatere
	Melaleuca thymoides	Melathym
*	*Mentha* X *piperita*	Mentpipe
	Microtis media subsp *media*	Micrmedi
*	*Misopates orontium*	Misooron
*	*Monadenia bracteata*	Monabrac
*	*Monopsis debilis*	Monodebi
	Monotaxis occidentalis	Monoocci
	Myoporum caprarioides	Myopcapr
	Myriophyllum crispatum	Myricris
	Nemcia capitatum	Nemccapi
	Nuytsia floribunda	Nuytflor
	Olearia axillaris	Oleaaxil
	Olearia paucidentata	Oleapauc
	Opercularia hispidula	Operhisp
*	*Ornithopus compressus*	Ornitcomp
*	*Orobanche minor*	Orobmino
	Oxylobium lineare	Oxylline
	Paracaleana nigrita	Paranigr
*	*Parentucellia viscosa*	Parevisc
	Parietaria debilis	Paridebi
*	*Paspalum dilatatum*	Paspdila
	Patersonia occidentalis	Pateocci
*	*Pelargonium capitatum*	Pelacapi
	Pelargonium littorale	Pelalitt
*	*Pennisetum clandestinum*	Pennclan
	Pericalymma ellipticum	Perielli
	Persoonia longifolia	Perslong
	Persoonia saccata	Perssacc
	Petrophile linearis	Petrline
*	*Petrorhagia velutina*	Petrvelu
	Philotheca spicatus	Philspic
	Phlebocarya ciliata	Phlecili

STATUS	TAXON	CODE
	Melaleuca incana subsp *incana*	Melainca
	Phyllanthus calycinus	Phylcaly
	Pimelea lanata	Pimelana
*	*Pinus pinaster*	Pinupina
	Platysace compressa	Platcomp
	Platytheca galioides	Platgali
	Podocarpus drouynianus	Pododrou
	Podolepis lessonii	Podoless
	Podotheca angustifolia	Podoangu
	Poranthera microphylla	Poramicr
	Prasophyllum brownii	Prasbrow
	? Pronaya fraseri	Pronfras
*	*Pseudognaphalium luteo-album*	Pseulute
	Pteridium esculentum	Pterescu
	Pterostylis recurva	Pterrecu
	Ptilotus stirlingii var *stirlingii*	Ptilstir
	Pultenaea reticulata	Pultreti
	Pyrorchis nigricans	Pyronigr
*	*Ranunculus trilobus*	Ranutril
	Rhagodia baccata subsp *dioica*	Rhagbacc
	Rhodanthe cotula	Rhodcotu
*	*Romulea rosea*	Romurose
*	*Rubus* sp	Rubusp
*	*Rumex crispus*	Rumecrisp
*	*Rumex pulcher* subsp *pulcher*	Rumepulc
	Scaevola calliptera	Scaecall
	Schoenus curvifolius	Schocurv
	Selaginella gracillima	Selagrac
	Senecio glomeratus	Seneglom
*	*Senecio vulgaris*	Senevulg
*	*Silene gallica*	Silegall
	Siloxerus filifolius	Silofili
*	*Solanum nigrum*	Solanigr
*	*Sonchus asper*	Soncaspe
*	*Sonchus hydrophilus*	Sonchhydr
	Sonchus oleraceus	Soncoler
	Sowerbaea laxiflora	Sowelaxi
	Stirlingia latifolia	Stirlati

APPENDIX L (2) - *Page 5*

STATUS	TAXON	CODE
	Phyllangium paradoxum	Phylpara
	Stylidium caespitosum	Stylcaes
	Stylidium calcaratum	Stylcalc
	Stylidium despectum	Styldesp
	Stylidium divaricatum	Styldiva
	Stylidium diversifolium	Styldive
	Stylidium guttatum	Stylgutt
	Stylidium junceum	Styljunc
	Stylidium piliferum	Stylpili
	Stylidium repens	Stylrepe
	Stylidium schoenoides	Stylschoe
	Synaphea spinulosa	Synaspin
	Tetraria octandra	Tetrocta
	Tetratheca hirsuta	Tetrhirs
	Thelymitra ? *benthamiana*	Thelbent
	Thelymitra crinita	Thelcrin
	Thelymitra ? aff *holmesii*	Thelholm
	Thysanotus arbuscula	Thysarbu
	Thysanotus manglesianus	Thysmang
	Thysanotus multiflorus	Thysmult
	Trachymene cyanopetala	Traccyan
	Trachymene pilosa	Tracpilo
	Trichocline spathulata	Tricspat
	Tricoryne elatior	Tricelat
*	*Trifolium angustifolium*	Trifangu
*	*Trifolium campestre*	Trifcamp
*	*Trifolium dubium*	Trifdubi
*	*Trifolium fragiferum*	Triffrag
*	*Trifolium glomeratum*	Trifglom
*	*Trifolium hirtum*	Trifhirt
*	*Trifolium hybridum*	Trifhybr
*	*Trifolium repens*	Trifrepe
*	*Trifolium* sp	Trifsp
*	*Trifolium subterraneum*	Trifsubt
*	*Trifolium tomentosum*	Triftome

STATUS	TAXON	CODE
	Stylidium brunonianum	Stylbrun
	Triglochin huegelii	Trighueg
	Triglochin lineare	Trigline
*	*Typha orientalis*	Typhorie
*	*Ursinia anthemoides*	Ursiant
	Verticordia nitens	Vertnite
	Villarsia albiflora	Villalbi
	Villarsia capitata	Villcapi
	Viminaria juncea	Vimijunc
*	*Vulpia* sp	Vulpsp
*	*Wahlenbergia capensis*	Wahlcape
	Wahlenbergia gracilenta	Wahlgrac
	Wahlenbergia preissii	Wahlprei
*	*Watsonia bulbillifera*	Watsbulb
	Xanthorrhoea brunonis	Xantbrun
	Xanthorrhoea preissii	Xantprei
	Xanthosia huegelii	Xanthueg
	Xylomelum occidentale	Xyloocci
*	*Zantedeschia aethiopica*	Zantaeth

Notes:
* designates introduced species
P1; P2; P3; P4 CALM Priority Codes
DRF Declared Rare Flora

APPENDIX M

ANALYSIS OF DIFFERENCES BETWEEN THE GENERAL AREA AND GIBSON PLOTS FOR SPECIES RICHNESS

t-Test: Paired Two Sample for Means

	Variable 1	Variable 2	Variable 1	
Mean	41.875	25.75	41.875	
Variance	504.982143	280.2143	504.982	
Observations	8	8	8	
Pearson Correlation	0.91286827		0.91287	
Hypothesized Mean Differen	0		16	Note the changed mean difference
df	7		7	
t Stat	4.59751892		0.03564	
P(T<=t) one-tail	0.00124574		0.48628	
t Critical one-tail	1.89457751		1.89458	
P(T<=t) two-tail	0.00249149		0.97256	
t Critical two-tail	2.36462256		2.36462	

Hence reject Ho - (p=0.12% or p=0.24%) indicating that there are significant differences beteen the paired samples (the difference is greater than 0) and no difference when the differences is set to 16 species.

Analysis of differences between the General area and Gibson Plots for species richness

Site No	226	31	172	175	247	303	230	13	
General area (approx 1ha)	66	63	13	44	55	6	34	54	335
Gibson Plots (100m2)	45	40	9	27	33	6	5	41	206

chi square	12.713
significance DF=7	0.079

Therefore accept Ho (p=7.9%) the techniques are independat of each other

Brown-Forsythe Test for Heterogeneity

median of general	54.000
median of Gibson	33.000

Transformed scored

General	12.000	9.000	41.000	10.000	1.000	48.000	20.000	0.000	281.000
Gibson	12.000	7.000	24.000	6.000	0.000	27.000	28.000	8.000	173.000

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Row 1	8	141	17.625	317.982
Row 2	8	112	14	116.286

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	52.5625	1	52.5625	0.24207	0.63034	4.60011
Within Groups	3039.875	14	217.134			
Total	3092.4375	15				

Hence accept Ho - (p=63%) their being no difference between the variance of the two sampling techniques.

APPENDIX N

MRHAS® CALCULATIONS FOR KEY SITES

APPENDIX N

KEMERTON BIOLOGICAL SURVEY PHASE 1

MRHAS CALCULATIONS FOR KEY SITES

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	2	**2**	6	**6**	7	**7**	10	**10**	11	**11**	12	**12**	13	**13**	14	**14**	25	**25**
Formations Adjacent (1)	**2**	1	**2**	1	**2**	1	**2**	2	**4**	1	**2**	1	**2**	0	**0**	0	**0**	0	**0**
Associations Adjacent (1)	**2**	1	**2**	2	**4**	1	**2**	2	**4**	1	**2**	1	**2**	0	**0**	0	**0**	0	**0**
Number of LFDC (2)	**3**	2	**6**	2	**6**	2	**6**	4	**12**	2	**6**	4	**12**	4	**12**	4	**12**	4	**12**
Floristic Richness (3)	**2**	1	**2**	1	**2**	0	**0**	1	**2**	0	**0**	2	**4**	2	**4**	1	**2**	1	**2**
Food Potential (4)	**1**	2	**2**	2	**2**	1	**1**	3	**3**	1	**1**	3	**3**	3	**3**	3	**3**	2	**2**
Total Cover Index (2)	**2**	1	**2**	1	**2**	2	**4**	1	**2**	2	**4**	2	**4**	2	**4**	3	**6**	2	**4**
Mean Health (2)	**2**	5	**10**	3	**6**	3	**6**	4	**8**	3	**6**	5	**10**	5	**10**	5	**10**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	1	**3**	4	**12**	1	**3**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	1	**1**	1	**1**	3	**3**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**
Spatial Organisation (5)	**1**	3	**3**	4	**4**	3	**3**	3	**3**	3	**3**	4	**4**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	0	**0**	0	**0**	0	**0**	2	**4**	0	**0**	4	**8**	3	**6**	3	**6**	2	**4**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
Abundance seedlings/saplings (5)	**1**	1	**1**	1	**1**	1	**1**	3	**3**	1	**1**	3	**3**	1	**1**	1	**1**	2	**2**
History of Disturbance (6)	**1**	5	**5**	4	**4**	0	**0**	3	**3**	0	**0**	3	**3**	3	**3**	3	**3**	3	**3**
Horizontal View Distance (1.5 m) (6)	**1**	4	**4**	4	**4**	1	**1**	3	**3**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**
Freedom from Weeds (7)	**1**	5	**5**	4	**4**	1	**1**	3	**3**	1	**1**	5	**5**	5	**5**	5	**5**	5	**5**
Freedom from Disease (7)	**1**	5	**5**	0	**0**	5	**5**	4	**4**	5	**5**	4	**4**	4	**4**	4	**4**	2	**2**
Ecotonal complexity (5)	**2**	0	**0**	3	**6**	0	**0**	0	**0**	0	**0**	3	**6**	0	**0**	0	**0**	0	**0**
TOTAL			**65**		**61**		**37**		**74**		**37**		**89**		**74**		**74**		**68**

Kemerton MRHAS Phase 1 - Page 2

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**26**	**26**	**27**	**27**	**28**	**28**	**29**	**29**	**30**	**30**	**31**	**31**	**32**	**32**	**35**	**35**	**37**	**37**
Formations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Number of LFDC (2)	**3**	4	**12**	4	**12**	4	**12**	3	**9**	3	**9**	3	**9**	3	**9**	4	**12**	3	**9**
Floristic Richness (3)	**2**	1	**2**	1	**2**	1	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	1	**2**
Food Potential (4)	**1**	2	**2**	2	**2**	2	**2**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	2	**2**
Total Cover Index (2)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	1	**2**
Mean Health (2)	**2**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	4	**8**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Spatial Organisation (5)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	4	**4**	5	**5**
Senescence Index (hollows, etc) (5)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	3	**6**	1	**2**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	2	**2**
Abundance seedlings/saplings (5)	**1**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	3	**3**	3	**3**
History of Disturbance (6)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	2	**2**
Horizontal View Distance (1.5 m) (6)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	4	**4**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**
Freedom from Disease (7)	**1**	2	**2**	2	**2**	2	**2**	5	**5**	5	**5**	5	**5**	5	**5**	4	**4**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	3	**6**	3	**6**
TOTAL			**68**		**68**		**68**		**71**		**75**		**75**		**75**		**87**		**76**

Kemerton MRHAS Phase 1 - Page 3

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**38**	**38**	**40**	**40**	**43**	**43**	**48**	**48**	**52**	**52**	**54**	**54**	**55**	**55**	**57**	**57**	**58**	**58**
Formations Adjacent (1)	**2**	0	**0**	1	**2**	1	**2**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Number of LFDC (2)	**3**	4	**12**	3	**9**	3	**9**	3	**9**	1	**3**	3	**9**	3	**9**	3	**9**	3	**9**
Floristic Richness (3)	**2**	1	**2**	1	**2**	2	**4**	2	**4**	1	**2**	2	**4**	2	**4**	2	**4**	2	**4**
Food Potential (4)	**1**	3	**3**	2	**2**	2	**2**	3	**3**	2	**2**	3	**3**	3	**3**	2	**2**	2	**2**
Total Cover Index (2)	**2**	2	**4**	1	**2**	2	**4**	1	**2**	1	**2**	2	**4**	2	**4**	1	**2**	1	**2**
Mean Health (2)	**2**	5	**10**	4	**8**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	2	**6**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	2	**2**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**
Spatial Organisation (5)	**1**	3	**3**	5	**5**	5	**5**	5	**5**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	2	**4**	2	**4**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Trunk Length (2)	**1**	1	**1**	2	**2**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	2	**2**	2	**2**
Abundance seedlings/saplings (5)	**1**	1	**1**	3	**3**	2	**2**	1	**1**	2	**2**	2	**2**	2	**2**	3	**3**	3	**3**
History of Disturbance (6)	**1**	3	**3**	3	**3**	4	**4**	5	**5**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**
Horizontal View Distance (1.5 m) (6)	**1**	3	**3**	4	**4**	5	**5**	1	**1**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	5	**5**	4	**4**	1	**1**	5	**5**	5	**5**	2	**2**	2	**2**
Freedom from Disease (7)	**1**	4	**4**	5	**5**	3	**3**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	3	**6**	3	**6**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
TOTAL			**70**		**79**		**81**		**68**		**44**		**73**		**73**		**69**		**69**

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**59**	**59**	**60**	**60**	**67**	**67**	**72**	**72**	**77**	**77**	**80**	**80**	**81**	**81**	**82**	**82**	**83**	**83**
Formations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	**3**	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9
Floristic Richness (3)	**2**	2	4	2	4	1	2	1	2	2	4	2	4	2	4	2	4	2	4
Food Potential (4)	**1**	3	3	3	3	2	2	2	2	2	2	3	3	3	3	3	3	3	3
Total Cover Index (2)	**2**	2	4	2	4	0	0	1	2	1	2	2	4	2	4	2	4	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	3	9	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	2	4	2	4	0	0	0	0	1	2	2	4	2	4	2	4	2	4
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	**1**	2	2	2	2	1	1	1	1	3	3	2	2	2	2	2	2	2	2
History of Disturbance (6)	**1**	3	3	3	3	5	5	5	5	3	3	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	**1**	3	3	3	3	3	3	5	5	3	3	3	3	3	3	3	3	3	3
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	2	2	5	5	5	5	5	5	5	5
Freedom from Disease (7)	**1**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	3	6	3	6	0	0	0	0	0	0	0	0	0	0
TOTAL			75		75		72		72		69		75		75		75		75

Kemerton MRHAS Phase 1 - Page 5

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**84**	**84**	**86**	**86**	**87**	**87**	**91**	**91**	**92**	**92**	**93**	**93**	**96**	**96**	**97**	**97**	**98**	**98**
Formations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	1	2
Number of LFDC (2)	**3**	1	3	2	6	3	9	3	9	3	9	3	9	3	9	2	6	3	9
Floristic Richness (3)	**2**	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	**1**	1	1	2	2	3	3	2	2	2	2	2	2	2	2	3	3	2	2
Total Cover Index (2)	**2**	2	4	0	0	2	4	1	2	1	2	1	2	1	2	2	4	1	2
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	0	0	1	2	2	4	0	0	0	0	0	0	0	0	1	2	0	0
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	**1**	1	1	1	1	2	2	3	3	3	3	3	3	3	3	2	2	3	3
History of Disturbance (6)	**1**	5	5	5	5	3	3	1	1	1	1	1	1	1	1	4	4	1	1
Horizontal View Distance (1.5 m) (6)	**1**	5	5	4	4	3	3	1	1	1	1	1	1	1	1	4	4	1	1
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5
Freedom from Disease (7)	**1**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	3	6	3	6	0	0	0	0	2	4	2	4	2	4	2	4	2	4
TOTAL			70		72		75		63		67		67		67		75		67

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**100**	**100**	**101**	**101**	**109**	**109**	**110**	**110**	**111**	**111**	**112**	**112**	**113**	**113**	**117**	**117**	**118**	**118**
Formations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2
Associations Adjacent (1)	**2**	2	4	3	6	0	0	0	0	0	0	1	2	1	2	0	0	1	2
Number of LFDC (2)	**3**	2	6	4	12	4	12	4	12	4	12	3	9	2	6	4	12	4	12
Floristic Richness (3)	**2**	1	2	1	2	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Food Potential (4)	**1**	2	2	2	2	2	2	2	2	2	2	3	3	1	1	3	3	3	3
Total Cover Index (2)	**2**	2	4	1	2	2	4	2	4	2	4	2	4	0	0	1	2	1	2
Mean Health (2)	**2**	5	10	4	8	4	8	4	8	4	8	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1
Senescence Index (hollows, etc) (5)	**2**	0	0	1	2	1	2	1	2	1	2	2	4	0	0	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	**1**	2	2	1	1	2	2	2	2	2	2	2	2	1	1	2	2	2	2
History of Disturbance (6)	**1**	5	5	5	5	3	3	3	3	3	3	3	3	5	5	3	3	0	0
Horizontal View Distance (1.5 m) (6)	**1**	4	4	3	3	3	3	3	3	3	3	3	3	1	1	3	3	1	1
Freedom from Weeds (7)	**1**	4	4	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Freedom from Disease (7)	**1**	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			73		75		68		68		68		75		59		68		65

Kemerton MRHAS Phase 1 - Page 7

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**119**	**119**	**120**	**120**	**122**	**122**	**134**	**134**	**140**	**140**	**141**	**141**	**144**	**144**	**146**	**146**	**147**	**147**
Formations Adjacent (1)	**2**	1	**2**	0	**0**	0	**0**	1	**2**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	1	**2**	0	**0**	0	**0**	1	**2**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**
Number of LFDC (2)	**3**	4	**12**	4	**12**	4	**12**	2	**6**	4	**12**	3	**9**	4	**12**	3	**9**	3	**9**
Floristic Richness (3)	**2**	1	**2**	1	**2**	1	**2**	1	**2**	2	**4**	2	**4**	2	**4**	1	**2**	1	**2**
Food Potential (4)	**1**	3	**3**	3	**3**	3	**3**	1	**1**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**
Total Cover Index (2)	**2**	1	**2**	1	**2**	1	**2**	0	**0**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**
Mean Health (2)	**2**	5	**10**	5	**10**	5	**10**	5	**10**	4	**8**	5	**10**	4	**8**	5	**10**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	1	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	1	**1**	3	**3**	2	**2**	3	**3**	1	**1**	1	**1**
Spatial Organisation (5)	**1**	1	**1**	3	**3**	3	**3**	4	**4**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	1	**2**	1	**2**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
Abundance seedlings/saplings (5)	**1**	2	**2**	2	**2**	2	**2**	1	**1**	2	**2**	3	**3**	2	**2**	3	**3**	3	**3**
History of Disturbance (6)	**1**	0	**0**	3	**3**	3	**3**	0	**0**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Horizontal View Distance (1.5 m) (6)	**1**	1	**1**	3	**3**	3	**3**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	5	**5**	1	**1**	5	**5**	4	**4**	5	**5**	4	**4**	4	**4**
Freedom from Disease (7)	**1**	5	**5**	5	**5**	5	**5**	5	**5**	4	**4**	4	**4**	4	**4**	5	**5**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
TOTAL			**65**		**68**		**68**		**40**		**68**		**66**		**68**		**68**		**68**

Kemerton MRHAS Phase 1 - Page 8

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**148**	**148**	**149**	**149**	**150**	**150**	**151**	**151**	**152**	**152**	**153**	**153**	**154**	**154**	**155**	**155**	**156**	**156**
Formations Adjacent (1)	**2**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	1	**2**	2	**4**
Number of LFDC (2)	**3**	4	**12**	4	**12**	2	**6**	2	**6**	4	**12**	4	**12**	4	**12**	2	**6**	2	**6**
Floristic Richness (3)	**2**	1	**2**	1	**2**	0	**0**	1	**2**	1	**2**	2	**4**	1	**2**	1	**2**	0	**0**
Food Potential (4)	**1**	3	**3**	2	**2**	2	**2**	3	**3**	3	**3**	3	**3**	3	**3**	1	**1**	2	**2**
Total Cover Index (2)	**2**	1	**2**	0	**0**	0	**0**	0	**0**	1	**2**	2	**4**	2	**4**	0	**0**	1	**2**
Mean Health (2)	**2**	5	**10**	4	**8**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	3	**6**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Spatial Organisation (5)	**1**	3	**3**	4	**4**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	1	**2**	0	**0**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**	0	**0**	0	**0**
Trunk Length (2)	**1**	1	**1**	2	**2**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
Abundance seedlings/saplings (5)	**1**	1	**1**	2	**2**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
History of Disturbance (6)	**1**	3	**3**	3	**3**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**
Horizontal View Distance (1.5 m) (6)	**1**	3	**3**	3	**3**	1	**1**	1	**1**	1	**1**	3	**3**	1	**1**	1	**1**	1	**1**
Freedom from Weeds (7)	**1**	5	**5**	4	**4**	5	**5**	5	**5**	5	**5**	4	**4**	5	**5**	5	**5**	5	**5**
Freedom from Disease (7)	**1**	4	**4**	0	**0**	5	**5**	5	**5**	4	**4**	5	**5**	4	**4**	5	**5**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	3	**6**
TOTAL			70		57		58		63		70		76		72		55		68

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**157**	**157**	**159**	**159**	**160**	**160**	**161**	**161**	**166**	**166**	**170**	**170**	**171**	**171**	**172**	**172**	**173**	**173**
Formations Adjacent (1)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	2	4
Associations Adjacent (1)	**2**	1	2	1	2	2	4	1	2	1	2	1	2	1	2	2	4	2	4
Number of LFDC (2)	**3**	4	12	4	12	2	6	2	6	2	6	4	12	4	12	3	9	3	9
Floristic Richness (3)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	2	2	1	1	1	1	2	2	2	2	2	2	2	2
Total Cover Index (2)	**2**	1	2	1	2	0	0	0	0	1	2	2	4	2	4	2	4	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
Spatial Organisation (5)	**1**	4	4	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	0	0	0	0	0	0	2	4	2	4	0	0	0	0
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1
Abundance seedlings/saplings (5)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
History of Disturbance (6)	**1**	3	3	5	5	5	5	5	5	5	5	2	2	2	2	1	1	1	1
Horizontal View Distance (1.5 m) (6)	**1**	3	3	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
Freedom from Weeds (7)	**1**	5	5	5	5	5	5	5	5	5	5	1	1	1	1	2	2	2	2
Freedom from Disease (7)	**1**	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	**2**	0	0	0	0	3	6	3	6	3	6	0	0	0	0	3	6	3	6
TOTAL			71		70		68		65		67		68		68		75		75

PARAMETER	WEIGHTING	RAW 175	CAL. 175	RAW 176	CAL. 176	RAW 177	CAL. 177	RAW 178	CAL. 178	RAW 179	CAL. 179	RAW 180	CAL. 180	RAW 182	CAL. 182	RAW 183	CAL. 183	RAW 188	CAL. 188
Formations Adjacent (1)	2	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Associations Adjacent (1)	2	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Number of LFDC (2)	3	3	9	3	9	4	12	4	12	4	12	4	12	3	9	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Food Potential (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total Cover Index (2)	2	2	4	2	4	2	4	2	4	2	4	2	4	0	0	1	2	1	2
Mean Health (2)	2	5	10	5	10	5	10	5	10	5	10	5	10	3	6	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
Senescence Index (hollows, etc) (5)	2	2	4	2	4	2	4	2	4	2	4	2	4	1	2	1	2	1	2
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	1	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1
History of Disturbance (6)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	2	2	2	2	2	2	2	2	3	3	3	3	3	3
Freedom from Weeds (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	1	1	5	5	5	5
Freedom from Disease (7)	1	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ecotonal complexity (5)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		0	74		74		72		72		72		72		52		71		71

Kemerton MRHAS Phase 1 - Page 11

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**189**	**189**	**191**	**191**	**197**	**197**	**201**	**201**	**207**	**207**	**208**	**208**	**209**	**209**	**210**	**210**	**216**	**216**
Formations Adjacent (1)	**2**	1	**2**	1	**2**	1	**2**	1	**2**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**
Associations Adjacent (1)	**2**	1	**2**	2	**4**	1	**2**	2	**4**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**
Number of LFDC (2)	**3**	2	**6**	2	**6**	3	**9**	3	**9**	4	**12**	4	**12**	4	**12**	4	**12**	1	**3**
Floristic Richness (3)	**2**	1	**2**	0	**0**	1	**2**	1	**2**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**
Food Potential (4)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	3	**3**	3	**3**	3	**3**	3	**3**	1	**1**
Total Cover Index (2)	**2**	0	**0**	0	**0**	0	**0**	1	**2**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**
Mean Health (2)	**2**	5	**10**	5	**10**	4	**8**	3	**6**	5	**10**	5	**10**	5	**10**	5	**10**	1	**2**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	2	**6**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	0	**0**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	0	**0**
Spatial Organisation (5)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	0	**0**	0	**0**	2	**4**	0	**0**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
Abundance seedlings/saplings (5)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	2	**2**	2	**2**	2	**2**	2	**2**	1	**1**
History of Disturbance (6)	**1**	5	**5**	5	**5**	3	**3**	5	**5**	3	**3**	3	**3**	3	**3**	3	**3**	0	**0**
Horizontal View Distance (1.5 m) (6)	**1**	1	**1**	1	**1**	2	**2**	1	**1**	2	**2**	2	**2**	2	**2**	2	**2**	1	**1**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	2	**2**	2	**2**	5	**5**	5	**5**	5	**5**	5	**5**	1	**1**
Freedom from Disease (7)	**1**	5	**5**	5	**5**	5	**5**	5	**5**	4	**4**	4	**4**	4	**4**	4	**4**	5	**5**
Ecotonal complexity (5)	**2**	3	**6**	3	**6**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
TOTAL			**65**		**65**		**54**		**59**		**72**		**72**		**72**		**72**		**22**

PARAMETER	WEIGHTING	RAW 222	CAL. 222	RAW 225	CAL. 225	RAW 226	CAL. 226	RAW 228	CAL. 228	RAW 230	CAL. 230	RAW 237	CAL. 237	RAW 241	CAL. 241	RAW 244	CAL. 244	RAW 247	CAL. 247
Formations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	1	2	0	0	0	0
Associations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	2	4	0	0	0	0
Number of LFDC (2)	3	1	3	4	12	4	12	4	12	3	9	2	6	3	9	5	15	5	15
Floristic Richness (3)	2	0	0	2	4	2	4	2	4	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	1	1	1	3	3	3	3	3	3	2	2	1	1	1	1	2	2	2	2
Total Cover Index (2)	2	0	0	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Mean Health (2)	2	1	2	5	10	5	10	5	10	5	10	3	6	4	8	5	10	5	10
Stratal Recovery (5)	3	0	0	4	12	4	12	4	12	4	12	2	6	4	12	4	12	4	12
Interstratal Distance (4)	1	0	0	3	3	3	3	3	3	3	3	1	1	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	0	0	2	4	2	4	2	4	0	0	0	0	1	2	2	4	2	4
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3
History of Disturbance (6)	1	0	0	3	3	3	3	3	3	5	5	3	3	5	5	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3
Freedom from Weeds (7)	1	1	1	5	5	5	5	5	5	5	5	1	1	2	2	5	5	5	5
Freedom from Disease (7)	1	5	5	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
Ecotonal complexity (5)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			22		72		72		72		67		45		65		75		75

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	248	**248**	249	**249**	250	**250**	251	**251**	253	**253**	254	**254**	255	**255**	256	**256**	264	**264**
Formations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**
Number of LFDC (2)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	2	**6**	3	**9**
Floristic Richness (3)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**	1	**2**
Food Potential (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	0	**0**	1	**1**
Total Cover Index (2)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**	2	**4**
Mean Health (2)	**2**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**	2	**4**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	1	**3**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Spatial Organisation (5)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	2	**4**	0	**0**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	0	**0**	1	**1**
Abundance seedlings/saplings (5)	**1**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	3	**3**	1	**1**	1	**1**
History of Disturbance (6)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	1	**1**	5	**5**
Horizontal View Distance (1.5 m) (6)	**1**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	2	**2**	3	**3**	0	**0**	1	**1**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	1	**1**	5	**5**
Freedom from Disease (7)	**1**	4	**4**	4	**4**	4	**4**	4	**4**	4	**4**	4	**4**	4	**4**	1	**1**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	5	**10**	0	**0**
TOTAL			72		72		72		72		72		72		74	0	41		66

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**267**	**267**	**268**	**268**	**276**	**276**	**278**	**278**	**281**	**281**	**284**	**284**	**291**	**291**	**294**	**294**	**295**	**295**
Formations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Associations Adjacent (1)	**2**	1	2	1	2	0	0	0	0	0	0	0	0	1	2	1	2	1	2
Number of LFDC (2)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12	4	12
Floristic Richness (3)	**2**	1	2	1	2	2	4	2	4	2	4	2	4	0	0	2	4	2	4
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	0	0	3	3	2	2
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Mean Health (2)	**2**	5	10	5	10	5	10	5	10	5	10	5	10	3	6	5	10	5	10
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	0	0	4	12	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	3
Spatial Organisation (5)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	2	4	2	4	2	4	2	4	0	0	2	4	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	**1**	1	1	1	1	2	2	2	2	2	2	2	2	1	1	2	2	2	2
History of Disturbance (6)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	0	0	3	3	3	3
Horizontal View Distance (1.5 m) (6)	**1**	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2
Freedom from Weeds (7)	**1**	4	4	4	4	5	5	5	5	5	5	5	5	1	1	4	4	4	4
Freedom from Disease (7)	**1**	5	5	5	5	4	4	4	4	4	4	4	4	5	5	4	4	4	4
Ecotonal complexity (5)	**2**	2	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			75		75		72		72		72		72		33	0	75		72

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	296	296	298	298	300	300	301	301	302	302	303	303	304	304	305	305	307	307
Formations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0
Associations Adjacent (1)	2	1	2	0	0	0	0	0	0	1	2	1	2	0	0	0	0	0	0
Number of LFDC (2)	3	4	12	4	12	4	12	4	12	3	9	3	9	4	12	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	1	2	1	2	1	2	0	0	1	2	1	2	1	2
Food Potential (4)	1	2	2	2	2	3	3	3	3	2	2	2	2	3	3	3	3	3	3
Total Cover Index (2)	2	2	4	1	2	3	6	3	6	4	8	4	8	3	6	3	6	3	6
Mean Health (2)	2	5	10	4	8	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	3	3	5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	1	1	1	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
History of Disturbance (6)	1	2	2	3	3	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	3	3	4	4	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Freedom from Weeds (7)	1	4	4	1	1	4	4	4	4	4	4	5	5	4	4	4	4	4	4
Freedom from Disease (7)	1	4	4	5	5	3	3	3	3	5	5	5	5	3	3	3	3	3	3
Ecotonal complexity (5)	2	2	4	0	0	2	4	2	4	2	4	2	4	2	4	2	4	2	4
TOTAL			73		66		73		73		81		80		73		73		73

PARAMETER	WEIGHTING	RAW 308	CAL. 308	RAW 309	CAL. 309	RAW 310	CAL. 310	RAW 313	CAL. 313	RAW 314	CAL. 314	RAW 320	CAL. 320	RAW 323	CAL. 323	RAW 324	CAL. 324	RAW 327	CAL. 327
Formations Adjacent (1)	2	0	0	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	0	0	0	0	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	3	4	12	4	12	4	12	1	3	4	12	4	12	4	12	2	6	4	12
Floristic Richness (3)	2	1	2	1	2	2	4	0	0	1	2	2	4	2	4	0	0	2	4
Food Potential (4)	1	3	3	3	3	3	3	1	1	2	2	3	3	3	3	1	1	3	3
Total Cover Index (2)	2	3	6	3	6	3	6	0	0	2	4	1	2	1	2	0	0	1	2
Mean Health (2)	2	5	10	5	10	5	10	2	4	4	8	5	10	5	10	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	0	0	4	12	4	12	4	12	1	3	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3
Spatial Organisation (5)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	0	0	1	2
Trunk Length (2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Abundance seedlings/saplings (5)	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
History of Disturbance (6)	1	3	3	3	3	3	3	0	0	3	3	3	3	3	3	0	0	3	3
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	3	3	1	1	3	3	3	3	3	3	1	1	3	3
Freedom from Weeds (7)	1	4	4	4	4	4	4	1	1	4	4	4	4	4	4	1	1	4	4
Freedom from Disease (7)	1	3	3	3	3	3	3	5	5	2	2	4	4	4	4	5	5	4	4
Ecotonal complexity (5)	2	0	0	0	0	3	6	0	0	2	4	2	4	2	4	0	0	2	4
TOTAL			68		68		81		29		70		75		75		38		75

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	332	**332**	333	**333**	334	**334**	335	**335**	336	**336**	339	**339**	340	**340**	341	**341**	342	**342**
Formations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1	**2**	1	**2**	1	**2**	1	**2**
Associations Adjacent (1)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	2	**4**	2	**4**	2	**4**	1	**2**
Number of LFDC (2)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	1	**3**
Floristic Richness (3)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	1	**2**	1	**2**	1	**2**	1	**2**	2	**4**
Food Potential (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	2	**2**
Total Cover Index (2)	**2**	2	**4**	2	**4**	2	**4**	2	**4**	3	**6**	1	**2**	1	**2**	1	**2**	1	**2**
Mean Health (2)	**2**	4	**8**	4	**8**	4	**8**	4	**8**	5	**10**	5	**10**	5	**10**	5	**10**	5	**10**
Stratal Recovery (5)	**3**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**	4	**12**
Interstratal Distance (4)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	1	**1**
Spatial Organisation (5)	**1**	4	**4**	4	**4**	4	**4**	4	**4**	3	**3**	4	**4**	4	**4**	4	**4**	3	**3**
Senescence Index (hollows, etc) (5)	**2**	1	**2**	1	**2**	1	**2**	1	**2**	0	**0**	1	**2**	1	**2**	1	**2**	2	**4**
Trunk Length (2)	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**	1	**1**
Abundance seedlings/saplings (5)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	1	**1**	2	**2**	2	**2**	2	**2**	2	**2**
History of Disturbance (6)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	5	**5**
Horizontal View Distance (1.5 m) (6)	**1**	3	**3**	3	**3**	3	**3**	3	**3**	3	**3**	2	**2**	2	**2**	2	**2**	2	**2**
Freedom from Weeds (7)	**1**	5	**5**	5	**5**	5	**5**	5	**5**	4	**4**	5	**5**	5	**5**	5	**5**	5	**5**
Freedom from Disease (7)	**1**	4	**4**	4	**4**	4	**4**	4	**4**	4	**4**	5	**5**	5	**5**	5	**5**	5	**5**
Ecotonal complexity (5)	**2**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
TOTAL			71		71		71		71		67		74		74		74		65

Kemerton MRHAS Phase 1 - Page 18

PARAMETER	WEIGHTING	RAW 344	CAL. 344	RAW 345	CAL. 345	RAW 346	CAL. 346	RAW 347	CAL. 347	RAW 348	CAL. 348	RAW 351	CAL. 351	RAW 353	CAL. 353	RAW 355	CAL. 355	RAW 356	CAL. 356
Formations Adjacent (1)	2	1	2	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2
Associations Adjacent (1)	2	2	4	1	2	2	4	3	6	1	2	1	2	1	2	1	2	1	2
Number of LFDC (2)	3	4	12	3	9	2	6	4	12	3	9	3	9	3	9	4	12	4	12
Floristic Richness (3)	2	1	2	1	2	0	0	2	4	1	2	1	2	1	2	1	2	1	2
Food Potential (4)	1	3	3	2	2	1	1	2	2	2	2	2	2	1	1	1	1	1	1
Total Cover Index (2)	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	4	2	4
Mean Health (2)	2	5	10	4	8	5	10	4	8	4	8	4	8	5	10	3	6	3	6
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12	4	12	1	3	4	12	4	12
Interstratal Distance (4)	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatial Organisation (5)	1	4	4	3	3	4	4	3	3	5	5	3	3	3	3	3	3	3	3
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	2	4	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	1	1	2	2	1	1	1	1	2	2	2	2	1	1	2	2	2	2
Abundance seedlings/saplings (5)	1	2	2	3	3	1	1	2	2	3	3	3	3	1	1	1	1	1	1
History of Disturbance (6)	1	3	3	3	3	1	1	4	4	3	3	3	3	1	1	3	3	3	3
Horizontal View Distance (1.5 m) (6)	1	2	2	4	4	1	1	5	5	4	4	4	4	1	1	2	2	2	2
Freedom from Weeds (7)	1	5	5	5	5	1	1	4	4	5	5	5	5	1	1	2	2	2	2
Freedom from Disease (7)	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2
Ecotonal complexity (5)	2	0	0	3	6	2	4	2	4	3	6	3	6	0	0	0	0	0	0
TOTAL			74		75		60		85		77		75		49		61		61

Kemerton MRHAS Phase 1 - Page 19

		RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.	RAW	CAL.
PARAMETER	**WEIGHTING**	**357**	**357**	**358**	**358**	**359**	**359**	**360**	**360**	**361**	**361**	**362**	**362**	**363**	**363**	**365**	**365**	**367**	**367**
Formations Adjacent (1)	**2**	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2	0	0
Associations Adjacent (1)	**2**	1	2	0	0	0	0	0	0	1	2	1	2	0	0	1	2	0	0
Number of LFDC (2)	**3**	3	9	4	12	4	12	4	12	3	9	3	9	4	12	2	6	4	12
Floristic Richness (3)	**2**	1	2	2	4	2	4	2	4	0	0	0	0	1	2	1	2	1	2
Food Potential (4)	**1**	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1
Total Cover Index (2)	**2**	2	4	2	4	2	4	2	4	1	2	1	2	2	4	0	0	2	4
Mean Health (2)	**2**	5	10	4	8	4	8	4	8	5	10	5	10	4	8	5	10	4	8
Stratal Recovery (5)	**3**	4	12	4	12	4	12	4	12	4	12	4	12	4	12	2	6	4	12
Interstratal Distance (4)	**1**	3	3	3	3	3	3	3	3	1	1	1	1	3	3	1	1	3	3
Spatial Organisation (5)	**1**	5	5	4	4	4	4	4	4	3	3	3	3	4	4	3	3	4	4
Senescence Index (hollows, etc) (5)	**2**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	**1**	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2
Abundance seedlings/saplings (5)	**1**	3	3	3	3	3	3	3	3	1	1	1	1	2	2	0	0	2	2
History of Disturbance (6)	**1**	5	5	3	3	3	3	3	3	5	5	5	5	3	3	0	0	3	3
Horizontal View Distance (1.5 m) (6)	**1**	5	5	3	3	3	3	3	3	1	1	1	1	3	3	1	1	3	3
Freedom from Weeds (7)	**1**	3	3	5	5	5	5	5	5	5	5	5	5	4	4	1	1	4	4
Freedom from Disease (7)	**1**	5	5	4	4	4	4	4	4	5	5	5	5	0	0	5	5	0	0
Ecotonal complexity (5)	**2**	2	4	0	0	0	0	0	0	2	4	2	4	1	2	1	2	1	2
TOTAL			80		71		71		71		68		68		64		45		64

PARAMETER	WEIGHTING	RAW 368	CAL. 368	RAW 369	CAL. 369	RAW 370	CAL. 370	RAW 371	CAL. 371	RAW 376	CAL. 376
Formations Adjacent (1)	2	0	0	0	0	0	0	1	2	2	4
Associations Adjacent (1)	2	0	0	0	0	0	0	1	2	2	4
Number of LFDC (2)	3	4	12	4	12	4	12	3	9	4	12
Floristic Richness (3)	2	1	2	1	2	2	4	2	4	2	4
Food Potential (4)	1	1	1	1	1	1	1	2	2	3	3
Total Cover Index (2)	2	2	4	2	4	2	4	1	2	2	4
Mean Health (2)	2	4	8	4	8	4	8	5	10	5	10
Stratal Recovery (5)	3	4	12	4	12	4	12	4	12	4	12
Interstratal Distance (4)	1	2	2	2	2	2	2	3	3	3	3
Spatial Organisation (5)	1	4	4	4	4	4	4	3	3	5	5
Senescence Index (hollows, etc) (5)	2	1	2	1	2	1	2	1	2	1	2
Trunk Length (2)	1	2	2	2	2	2	2	1	1	2	2
Abundance seedlings/saplings (5)	1	2	2	2	2	2	2	1	1	3	3
History of Disturbance (6)	1	3	3	3	3	3	3	5	5	4	4
Horizontal View Distance (1.5 m) (6)	1	3	3	3	3	3	3	1	1	2	2
Freedom from Weeds (7)	1	4	4	4	4	4	4	5	5	4	4
Freedom from Disease (7)	1	0	0	0	0	0	0	5	5	5	5
Ecotonal complexity (5)	2	1	2	1	2	1	2	2	4	2	4
TOTAL			63		63		65		73		87

NOTES:

LFDC = Life Form Density Class (refer Appendix D); RAW = raw data (see below); CAL = calculated from the raw data multiplied by the weighting.
Some data are taken from tables compiled for other purposes (and included in this report), and other data are extracted directly from the original field data sheets. These latter data do not necessarily appear elsewhere in this report.

1 = from map and direct from field observations
2 = from vegetation descriptions
3 = from species lists and direct from field data where species lists not made
4 = from vegetation descriptions
5 = direct from field observations
6 = from connectivity data
7 = from fire, weeds, etc. data

APPENDIX O

GIBSON STATUS (derived from Gibson et al 1994)

APPENDIX O

KEMERTON BIOLOGICAL SURVEY PHASE 1

GIBSON STATUS (derived from Gibson et al 1994)

GIBSON NAME	GIBSON TYPE	RESERVATION STATUS (1994)	CONSERVATION STATUS (1994)
Eucalyptus haematoxylon, E. marginata	1a	Unreserved	Susceptible
Southern *Eucalyptus calophylla** woodland on heavy soil	1b	Well	Vulnerable
Southern wet shrublands	2	Poor	Vulnerable
*Eucalyptus calophylla**, *Kingia australis* woodland on heavy soil	3a	Unreserved	Vulnerable
*Eucalyptus calophylla**, *E. marginata* woodland on sandy clay soil	3b	Well	Vulnerable
*Eucalyptus calophylla**, *Xanthorrhoea preissii* woodland and shrubland	3c	Well	Vulnerable
Melaleuca preissiana dampland	4	Well	Low
Mixed shrub damplands	5	Well	Low
Weed dominated wetlands on heavy soils	6	Well	Low
Herb-rich saline shrublands in clay pans	7	Well	Vulnerable
Herb-rich shrublands in clay pans	8	Well	Vulnerable
Dense shrublands on clay flats	9	Well	Vulnerable
Shrublands on dry clay flats	10a	Well	Vulnerable
Shrublands on southern ironstone	10b	Unreserved	Critical
Wet forests and woodlands	11	Well	Low
Melaleuca teretifolia and/or *Astartea fascicularis* shrub-lands	12	Well	Low
Deeper wetlands on heavy soils	13	Well	Low
Deeper wetlands on sandy soils	14	Unreserved	Insufficiently known
Forests and woodlands on deep seasonal wetlands	15	Well	Vulnerable
Highly saline seasonal wetlands	16	Poor	Vulnerable
Melaleuca raphiophylla, Gahnia trifida seasonal wetlands	17	Well	Low
Shrublands on calcareous silts	18	Poor	Vulnerable
Sedgelands in Holocene dune swales	19	Unreserved	Vulnerable
Banksia attenuata woodland over species-rich dense shrubland	20a	Unreserved	Endangered
Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands	20b	Well	Vulnerable
Eastern shrublands and woodlands	20c	Well	Low
Central *Banksia attenuata*, *Eucalyptus marginata* woodlands	21a	Well	Low
Southern *Banksia attenuata*	21b	Well	Susceptible
Low lying *Banksia attenuata* woodlands and shrublands	21c	Well	Low

APPENDIX O - *Page 2*

GIBSON NAME	GIBSON TYPE	RESERVATION STATUS (1994)	CONSERVATION STATUS (1994)
Banksia ilicifolia woodland	22	Poor	Low
Central *Banksia attenuata, B. menziesii* woodland	23a	Well	Low
Northern *Banksia attenuata - B. menziesii* woodland	23b	Unreserved	Susceptible
Northern Spearwood shrublands and woodlands	24	Well	Susceptible
Southern *Eucalyptus gomphocephala*, *Agonis flexuosa* woodland	25	Poor	Susceptible
Melaleuca huegelii, M. acerosa shrublands of limestone ridges	26a	Unreserved	Susceptible
Woodlands and mallees on limestone	26b	Well	Low
Species poor mallees and shrublands on limestone	27	Well	Low
Spearwood *Banksia attenuata* or *B. attenuata* Eucalyptus woodlands	28	Well	Low
Coastal shrublands on shallow sands	29a	Poor	Susceptible
Acacia shrublands on taller dunes	29b	Poor	Susceptible
Callitris preissii (or *Melaleuca lanceolata*) forests and woodlands	30a	Poor	Vulnerable
Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodland	30b	Well	Susceptible
Other mallees or scrubs	30c	Unreserved	Insufficiently known

Notes:
* name changed to *Corymbia calophylla*

APPENDIX P

PRINCIPLES FOR EVALUATION OF NATIVE VEGETATION
(from Safstrom and Craig 1996)

PRINCIPLES FOR EVALUATION OF NATIVE VEGETATION

The tables in this section provide a summary of principles to be considered when assessing priorities for retention of native vegetation. The third column can be used to note whether the principles apply to a particular piece of native vegetation. Criteria and justification for the principles are detailed in *Criteria for Evaluation Principles* on page 6.

1. REGIONAL PROCESSES

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
1.1 Water	the clearance of vegetation is likely to cause deterioration in surface and groundwater catchments which result in increases in salinity and eutrophication.	
1.2 Soil	the clearance of vegetation is likely to contribute to soil erosion, waterlogging or flooding	
1.3 Corridors and Buffers	the land provides a corridor or stepping stone between areas of conservation land or the land provides a buffer or is an inlier to areas reserved for conservation	
1.4 Aesthetics and Cultural	the land provides high landscape values, has special physiographic features, aboriginal sites or heritage value	

2. REPRESENTATION

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
2.1.1 Flora	it contains or is likely to contain threatened flora or flora of special interest.	
2.1.2 Plant communities	it contains or is likely to contain threatened plant communities	
2.1.3 Diversity	it contains areas of very high species richness	
2.1.4 Wetlands	it contains wetlands of significance	

2. REPRESENTATION (continued)

Item	Principle - native vegetation should be retained if:	Yes/No/ Partly
2.1.5 Local representation	within a 15 kilometre radius of the remnant there is less than 20% of the original cover of any plant community on the land represented by: (i) viable occurrences in NPNCA National Parks or Nature Reserves. (ii) viable occurrences in other Crown Land or Remnant Vegetation Protection Scheme covenants.	
2.1.6 Regional representation	it includes vegetation communities not well conserved in the region compared with the original cover as represented in the Interim Biographical Representation in Australia (IBRA).	
2.2.1 Wildlife	it contains or is likely to contain rare fauna	
2.2.2 Habitats	it has significance as habitat for wildlife or if a loss of diversity by clearing part of the land will adversely impact on fauna dependent on a mosaic of vegetation types.	

3. VIABILITY

Item	Principle - survival of natural values over the next 50 years.	Yes/No/ Partly
3.1 Area	Large areas have higher conservation values, the maximum possible area of a remnant should be retained. Groups of small remnants can support fauna able to move between remnants and threatened species.	
3.2 Shape	Very narrow areas of retained vegetation are less likely to be viable and of reduced value as corridors.	
3.3 Intactness	Remnants with little or no intact vegetation are unlikely to be viable.	
3.4 Diseases and Pests	The vegetation should be free of major diseases and pests such as Dieback. Disease free vegetation is more important for retention if similar vegetation communities in nearby reserves are diseased.	
3.5 Invasive plants	Presence of invasive plants capable of, or with potential to, disrupt ecosystem processes.	
3.6 Adjacent uses	Adjacent land uses impacting on the viability of the land must be considered.	

APPENDIX Q

SAFSTROM AND CRAIG EVALUATION (modified)

APPENDIX Q

KEMERTON BIOLOGICAL SURVEY PHASE 1

SAFSTROM AND CRAIG EVALUATION (modified)

1.0 REGIONAL PROCESSES		AREA									
ITEM	**PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
1.1 Water	Is the clearance of vegetation likely to cause deterioration in surface and groundwater catchments which results in increases in salinity or eutrophication?	P	P	N	Y	N	N	Y	N	Y	N
1.2 Soil	Is the clearance of vegetation likely to contribute to soil erosion, waterlogging or flooding?	N	N	P	Y	N	N	Y	N	Y	N
1.3 Corridors and Buffers	Is the land providing a corridor or stepping stone between areas of conservation land, or does the land provide a buffer to areas reserved for conservation?	N	N	N	N	N	N	N	N	Y	N

2.0 REPRESENTATION		AREA									
ITEM	**PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
2.1 Flora	Does it contain, or is it likely to contain, threatened or significant flora?	N	N	P	Y	N	Y	Y	N	Y	Y
2.2 Plant Communities	Does it contain, or is it likely to contain, threatened plant communities?	N	N	N	P	N	N	Y	N	Y	Y
2.3 Diversity	Does it contain areas of very high plant species richness?	N	N	Y	Y	N	Y	Y	N	N	Y
2.4 Wetlands	Does it contain wetlands of "significance"?	N	N	N	P	Y	N	Y	N	Y	N
2.5.1 Local representation	There are no conservation reserves or designated conservation areas within a 15 km radius	N	N	N	N	N	N	N	N	N	N

APPENDIX Q - *Page 2*

ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	AREA A	B	C	D	E	F	G	H	I	J
2.5.2 Local representation	There is less than 20% of the immediate regional vegetation left intact	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.6 Regional representation	The site includes vegetation communities not well conserved in the broader region	N	N	N	N	N	N	Y	N	Y	Y
2.7 Wildlife	Is the site likely to contain rare or significant vertebrate fauna?	N	N	P	P	N	P	Y	N	P	P
2.8 Habitats	Is the site a known significant habitat for wildlife, or will loss of the site adversely impact on vertebrate fauna	N	N	P	P	N	N	Y	N	P	P

3.0 VIABILITY

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA A	B	C	D	E	F	G	H	I	J
3.1 Area	Is the site large enough to be viable in the long-term, or is it part of a complex of fragments which may survive in the long-term?	N	N	P	Y	Y	Y	Y	N	Y	Y
3.2 Shape	Is the shape of the site conducive to long-term viability (i.e. square, rectangular) rather than prone to edge effects, e.g. linear?	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
3.3 Intactness	Is the vegetation of the site basically intact?	N	P	Y	Y	N	Y	Y	N	P	Y
3.4 Diseases and Pests	Is the site disease and pest free?	Y	Y	P	P	N	Y	Y	Y	Y	Y
3.5 Invasive Plants	Is the site largely free of invasive plants?	N	N	Y	Y	N	Y	Y	N	P	Y

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	A	B	C	D	E	F	G	H	I	J
3.6 Adjacent Land Uses	Adjacent land uses are unlikely to impact on the long-term viability of the land being considered	N	N	P	P	N	P	Y	N	Y	Y
	TOTAL Y	3	3	4	11	5	9	17	5	13	12
	TOTAL P	1	2	6	5	0	2	0	0	4	2
	SCORE	**3.5**	**4**	**7**	**13.5**	**5**	**10**	**17**	**5**	**15**	**13**

1.0 REGIONAL PROCESSES		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	K	L	M	N	O	P	Q	R	S	T
1.1 Water	Is the clearance of vegetation likely to cause deterioration in surface and groundwater catchments which result in increases in salinity or eutrophication?	N	Y	N	Y	N	N	Y	N	Y	Y
1.2 Soil	Is the clearance of vegetation likely to contribute to soil erosion, waterlogging or flooding?	P	Y	N	Y	N	P	Y	N	Y	Y
1.3 Corridors and Buffers	Is the land providing a corridor or stepping stone between areas of conservation land, or does the land provide a buffer to areas reserved for conservation?	N	N	N	Y	N	N	N	N	Y	N
1.4 Aesthetics and Cultural	Does the land have high landscape values, special physiographic features, Aboriginal sites, or known heritage values?	N	Y	Y	Y	Y	N	Y	P	Y	N

2.0 REPRESENTATION		AREA									
ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	K	L	M	N	O	P	Q	R	S	T
2.1 Flora	Does it contain, or is it likely to contain, threatened or significant flora?	Y	Y	N	Y	Y	Y	Y	Y	Y	N

APPENDIX Q - *Page 4*

ITEM	PRINCIPLE - NATIVE VEGETATION SHOULD BE RETAINED IF THE ANSWER TO ANY OF THE FOLLOWING CRITERIA IS "YES"	AREA									
		K	L	M	N	O	P	Q	R	S	T
2.2 Plant Communities	Does it contain, or is it likely to contain, threatened plant communities?	Y	Y	P	Y	N	Y	P	Y	Y	N
2.3 Diversity	Does it contain areas of very high plant species richness?	N	N	N	N	Y	N	N	Y	N	N
2.4 Wetlands	Does it contain wetlands of "significance"?	Y	Y	Y	Y	N	Y	Y	Y	Y	N
2.5.1 Local representation	There are no conservation reserves or designated conservation areas within a 15 km radius	N	N	N	N	N	N	N	N	N	N
2.5.2 Local representation	There is less than 20% of the immediate regional vegetation left intact	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.6 Regional representation	The site includes vegetation communities not well conserved in the broader region	N	Y	Y	Y	N	P	Y	P	Y	N
2.7 Wildlife	Is the site likely to contain rare or significant vertebrate fauna?	N	P	N	P	Y	N	P	P	Y	N
2.8 Habitats	Is the site a known significant habitat for wildlife, or will loss of the site adversely impact on vertebrate fauna	N	P	N	P	Y	N	P	P	Y	N

3.0 VIABILITY

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA									
		K	L	M	N	O	P	Q	R	S	T
3.1 Area	Is the site large enough to be viable in the long-term, or is it part of a complex of fragments which may survive in the long-term?	N	Y	N	Y	Y	N	Y	Y	P	N
3.2 Shape	Is the shape of the site conducive to long-term viability (i.e. square, rectangular) rather than prone to edge effects, e.g. linear?	Y	Y	Y	Y	Y	Y	P	Y	P	Y

APPENDIX Q - *Page 5*

ITEM	PRINCIPLE - WILL THE NATURAL VALUES OF THE SITE SURVIVE OVER THE NEXT 50 YEARS?	AREA									
		K	L	M	N	O	P	Q	R	S	T
3.3 Intactness	Is the vegetation of the site basically intact?	N	Y	N	P	Y	N	Y	Y	Y	P
3.4 Diseases and Pests	Is the site disease and pest free?	P	P	N	Y	Y	N	P	P	Y	N
3.5 Invasive Plants	Is the site largely free of invasive plants?	N	Y	N	P	Y	N	P	Y	P	N
3.6 Adjacent Land Uses	Adjacent land uses are unlikely to impact on the long-term viability of the land being considered	Y	Y	N	Y	Y	Y	Y	P	Y	Y
	TOTAL Y	6	13	5	13	12	6	10	9	14	5
	TOTAL P	2	3	1	4	0	2	6	6	3	1
	SCORE	**8**	**14.5**	**5.5**	**15**	**12**	**7**	**13**	**12**	**15.5**	**5.5**

Notes:
Y (yes) is scored as 1; N (no) as zero; and P (Partly or perhaps) as 0.5