ASSESSING THE NATURE CONSERVATION AND OTHER VALUES OF CROWN LANDS WITHIN THE SHIRE OF MOUNT MARSHALL

Prepared for:

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SUMMARY

The vegetation, weeds and land-use of 18 Crown Land Reserves within the Shire of Mount Marshall, Western Australia were surveyed to enable the assessment of conservation and other values of these Reserves. A total of 31 quadrats were established to undertake this assessment.

The survey was conducted over a three week period in May 2000, using the methods of McDonald *et al.* (1998). In particular, the following features were surveyed:

- Vegetation floristics;
- Vegetation structure;
- Vegetation cover;
- Weed cover;
- Soil and landform characteristics;
- Adjacent land use;
- Significant sites (indigenous and non-indigenous); and
- Reserve features (including natural resource use and man-made features).

A total of 49 vegetation associations were identified based on a combination of structural and floristic information. A total of 30 vascular plant Families and 104 plant species were recorded, of which 89 were identified to at least species level.

One species of Priority flora was identified. The rush *Schoenus calcatus* is a Priority 3 Flora, which means it is a taxon which is known from several populations, at least some of which are not believed to be under threat. Also of note was the presence of Sandalwood (*Santalum spicatum*) in Reserves 13509, 14642 and 20529.

A total of 23 fauna species were recorded during the survey period. Of these, the Mallee Fowl (*Leipoa ocellata*) is listed as being Vulnerable, that is it considered is rare or likely to become extinct.

The quadrats were relatively similar in landform type, with the majority being plains, pediments (gently inclined), hillslopes or footslopes. The soil types encountered were predominately sand based (sandy duplexes, shallow sands, deep sands, sandy earths) as well as some areas of loamy earths and non-cracking clays.

The extent of weed infestations was described for each Reserve. Reserves 17924 and the contiguous Vacant Crown Land, 39186, 16423, 13509, 25323, 22082 and contiguous Vacant Crown Lands had mostly low weed cover, Reserves 15437, 25217, 14642, 12690, 28120, 19513, 20529 had variable weed cover, and Reserves 28486 and 12689 had relatively high weed cover. In general, weed cover varied with the level of disturbance within Reserves, the size of the Reserve and proximity to roadsides and internal tracks.

Five non-indigenous cultural heritage sites were located during fieldwork. These consisted of one dam, one telegraph line, two wells and one tank with a constructed drainage on a granite outcrop.

SECTION ONE: SURVEY DESCRIPTION

1. INTRODUCTION

Ecoscape (Australia) Pty Ltd was commissioned by the Department of Conservation and Land Management (CALM) to undertake an assessment of the nature conservation and other values of selected Crown Lands in the Shire of Mount Marshall within the Wheatbelt Region of Western Australia. Information collected in this survey will assist CALM and other land management agencies to evaluate the relative values of the Crown lands assessed, and to make informed recommendations on future management options.

Over the next five years, a large number of Reserves in agricultural areas will be assessed for changes in purpose and vesting. This is for a range of reasons including:

- Rationalisation of estate by Water Corporation, Water and Rivers Commission, and Office of Water Regulation;
- Continuing work by Department of Land Administration to have all Reserves and unallocated land covered by management orders;
- Rationalisation of estate by agencies preparing for the asset charges that Treasury is intending to levy over Crown lands; and
- Private interest in specific Reserves.

The Reserves assessed in the Shire of Mount Marshall form part of this review of bushland Reserves in agricultural areas. CALM is generally asked for comments on land identified as belonging to one of the above four categories. The information gathered in this survey will assist CALM with these comments, and to decide on the best use for unallocated lands, unwanted bushland Reserves and proposed CALM Reserves.

1.1. The Study Area

The Shire of Mount Marshall covers an area of 1,013,400 ha in the north-eastern Wheatbelt region of Western Australia. Local industries in the Shire include the production of grains, pulses, sheep and cattle, with less than 7% of the land occupied by remnant vegetation Reserves. The principal towns of the Shire are Bencubbin and Beacon. A total of 18 parcels of Crown Land within the Shire of Mount Marshall were assessed, totalling 1,719 ha in area. The Reserves ranged in size between 2 ha and 547 ha. The Reserves surveyed and their current purposes are listed in Table 1.

1.2. Climate

This region displays an extra-dry Mediterranean climatic regime, with an average annual rainfall of 315mm (McArthur, 1991). Most of this rain falls in the winter months (June to August). Average July temperatures range from 4 to 16°C. During the dry summer months (December to March), relatively high temperatures (17 to 33°C) contribute to extreme evaporation rates of approximately 2,110mm per annum (McArthur, 1991).

Table 1: Crown Reserves surveyed in the Shire of Mount Marshall.

Reserve No.	Polygon ID No.	Purpose	Area (ha)
12689	741586	Conservation of Flora	73
13509	741479	Water & Camping	135
25323	738218	Water	178
28486	741333	Water	8
14642	741385	Water Supply	40
15437	741434	Water	20
16423	738583	Water	5
39186	738176, 989524	Water & Conservation of Flora & Fauna	103
25217	989519	Sheep Dip	2
20529	742131	Water & Conservation of Flora & Fauna	547
28120	1000851, 1072122	Water Supply Waddouring	178
12690	1000960, 742308	Water	62
22082	1000866, 1108391, 742318	Fauna	175
Vacant Crown Land	1000962		10
Vacant Crown Land	1000963		14
19513	742305	Water	2
17924	741180	Water	16
Vacant Crown Land	741143		151

1.3. Vegetation

The study area lies within the northern portion of the Avon Botanical District in the South West Botanical Province, bordering on the Coolgardie Botanical District within the South West Interzone (Beard, 1981). Typical vegetation of the Avon District comprises scrub heath on sandplain, *Acacia-Allocasuarina* thickets on ironstone gravels, woodlands of York gum (*Eucalyptus loxophleba*), Salmon gum (*E. salmonophloia*) and Wandoo (*E. wandoo*) on loams of the lower slopes and valleys, and halophytes on sandy soils.

Within the Avon District, the Shire of Mount Marshall straddles the boundary between the Jibberding Vegetation System in the west and the Moorine Rock Vegetation System in the east (Beard, 1981). The Jibberding System is broadly divided into sandplains on the interfluves and red loam soils in the valleys, and is characterised by the formation of intricate mosaics of soils and vegetation. Sandplain soils carry kwongan communities dominated by *Acacia*, *Allocasuarina* and *Melaleuca* on deep sand, gravelly sands and loamy sands. Mallee is limited to small patches, while woodlands are dominated by York gum, Yorrell (*E. gracilis*), Salmon gum and Gimlet. Salt lake areas in the broad valleys contain samphire communities, scrub of *Acacia* and *Hakea*, and woodland (Beard, 1981).

The landscape and vegetation of the Moorine Rock System is much the same, but there are sharper divisions between the sandplains and the valleys, with sandplains usually bordered by distinct breakaways (Beard, 1981). Wandoo can be found at the foot of breakaways. The sandplains of the Moorine Rock System contain a mixture of scrub thickets and kwongan communities, with the vegetation association varying with soil types. Granite outcrops are normally well covered by shrubs. Mallee species are typically Black marlock (*E. redunca*), York gum, *E. sheathiana* (Ribbonbarked Mallee) and Redwood (*E. transcontinentalis*). Principal woodland species are Salmon gum, Gimlet and Morrell (*E. longicornis*) (Beard, 1981).

Within the study area, Beard (1981) mapped the major plant communities as woodland of York gum, salmon gum and gimlet, thickets of *Acacia* species on sandplain, and scrub of

Allocasuarina campestris on granite outcrops. Succulent steppe is also present on salt flats in the south and west of the study area (Beard, 1981).

Areas of remnant vegetation within the study area are generally small and fragmented, with the largest Reserve having an area of 547 ha. The vegetation of several Reserves within the Shire of Mount Marshall has previously been assessed by Safstrom *et al*. (1996). Reserve 17924 was found to contain five vegetation types, consisting of grassland on shallow granite, shrubland, York gum woodland, thicket and *Acacia* sp. shrubland on granite. York gum woodland and grassland on granite were listed as priority vegetation associations due to their good condition and rarity in the Wheatbelt. Reserve 16423 contained one vegetation association of shrubland with emergent mallee. Reserve 12688, which was not surveyed in the present study, contained shrubland, woodland of Salmon gum and Gimlet and shrubland of *Acacia* and Jam (*Acacia acuminata*). The condition of these Reserves varied from poor to good, depending on the extent of weed invasion and tree decline.

1.4. Geomorphology and Soils

The Shire of Mount Marshall is situated in the northern part of the Yilgarn Plateau, a region that has shallow, wide valleys separated by very broad sandplain uplands, with generally sluggish surface drainage (Beard, 1981). The study area lies within the catchment of the Avon River, with very heavy rains required for the broad, shallow drainage systems of the area to actually flow into the Avon River (Blight *et al*., 1984). The major valleys of the Plateau naturally contain chains of salt lakes and pans (Beard, 1981). Rising water tables are responsible for water logging and secondary salinisation of many low-lying areas. The very low slope gradients result in low levels of sheet and gully erosion due to surface runoff of water. The landscape is gently undulating and generally featureless, except for laterite breakaways and a number of large granite monoliths, such as Mount Marshall itself, found occasionally on the higher parts of the divides (Beard, 1981; Blight *et al*., 1984).

The soils of the sandplains are a mosaic of sandy yellow earths and yellow earthy sands, containing or overlying ironstone gravels. Laterite outcrops or low breakaways normally marks the edge of the sandplains. On slopes below the sandplains, alkaline red and yellow-mottled duplex soils occur. On valley floors, the soils are alkaline yellow soils overlying acid lateritic clays. The salt-lake channels are mostly devoid of true soils, and are fringed by gypseous and saline loams (Beard, 1981).

2. OBJECTIVES

The general objective of this survey was to provide information on the nature conservation and other values (e.g. water catchment, resource extraction, recreational areas, and indigenous and non-indigenous cultural heritage sites) of Crown Lands within the Shire of Mount Marshall. The specific objectives of the study were to:

- Describe and characterise vegetation units, noting areas of degraded or modified vegetation and the likely cause(s), and map their occurrence at a scale of 1:5000;
- Describe and map the extent and severity of weed invasion within Reserves at a scale of 1:5000;
- Describe and map human influence and cultural features within Reserves, including internal vehicle tracks, boundary fence condition, artificial water features, constructed drainage, non-indigenous cultural heritage sites and Aboriginal sites at a scale of 1:5000;
- Assess land use within Reserves, including extractive industries, recreation, water resources and natural resources; and
- Gather detailed data on vegetation, soil and landform characteristics within survey sites (quadrats) considered to be representative of vegetation mapping units.

3. METHODS

3.1. Data Collection

All data collected followed the methods of McDonald *et al*. (1998) (soils and vegetation) and Safstrom (1995) (land use and other Reserve data). The use of these methods ensured that the data collected as part of this study is compatible with previous studies. Both these methods have been used to assess the nature conservation and other values of Reserves in other parts of Western Australia.

Data was collected through field assessment of 18 Reserves and recorded on standard data sheets (refer to Appendix 1). Data management is discussed below.

3.2. Data Storage and Database Structure

A Microsoft® Access 97® relational database was used as the prime means of storing all survey data and a single ESRI® ArcView® 3.2 project containing multiple themes was created as the main interface through which spatial data can be queried. Photos were stored digitally on Kodak® Photo CD®, and were hotlinked to relevant ESRI® ArcView® themes.

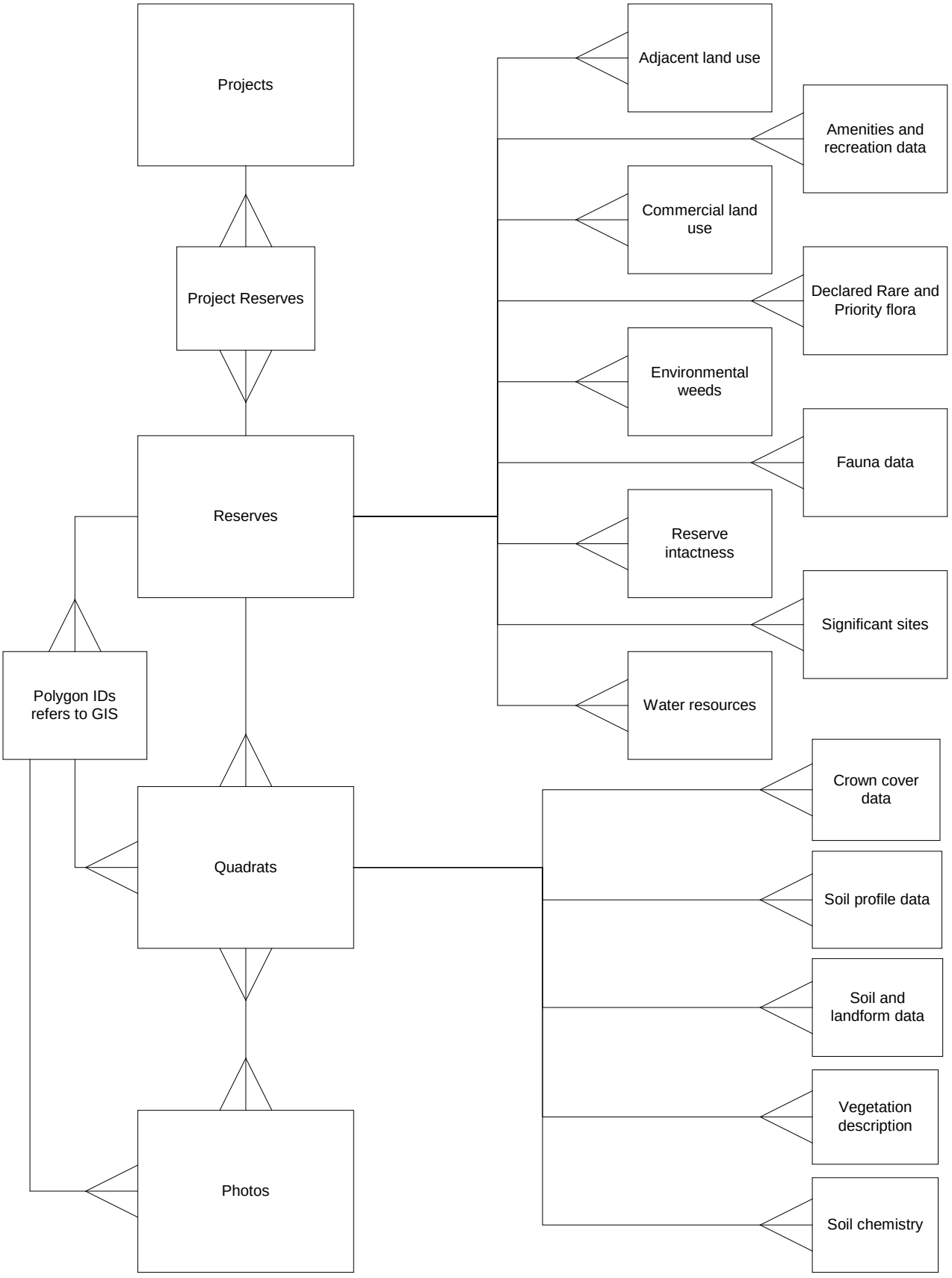
Survey data was entered into the database in the following tables:

- Projects (provides bibliographical information on this (and other) projects);
- Codes (provides the codes for all types of data recorded);
- Polygon Data (provides the corresponding Polygon Identification Numbers for each Reserve);
- Quadrat Descriptions (location and characteristics within Quadrats);
- Vegetation Descriptions (floristic and structural formation data within Quadrats);
- Crown Cover Data (data relating to vegetation cover within Quadrats);
- Soil Profile Data (data relating to soil horizons within Quadrats);
- Soils and Landform Data (data relating landform and soil surface conditions within Quadrats);
- Reserve Details (data on soils and geology within Reserves);
- Reserve Intactness (weeds and degradation within Reserves);
- Fauna Data (fauna data within Reserves);
- Amenity and Recreation Data (access and recreation within Reserves);
- Water Resources (natural and artificial within Reserves);
- Commercial Land Use (timber and wildflower harvesting and extractive industry within Reserves);
- Adjacent Land Use (cropping, grazing and bushland adjacent to Reserves and boundary fence condition);
- Significant Sites (Aboriginal and non-indigenous cultural; sites within Reserves); and
- DRF and Priority Flora (significant flora recorded within Reserves).

Each table was linked via common fields, and each field in each table was linked to a separate Access table in which data codes were defined. The relationship between each table is shown in Figure 1.

The database was constructed as a normalised database, using codes rather than English descriptions. Appendix 2 provides the code descriptions (also found in the database).

Figure 1: Relational Structure of Database.



3.3. Reserves

The 18 Reserves surveyed within the Shire of Mount Marshall are listed in Table 1. Figure 2 provides an overview of their location within the Shire of Mount Marshall. The following information provides a description of the Reserve-level data collected.

3.3.1. Reserve Details

Each Reserve was located using a combination of maps and cadastral information provided by CALM. The following information was recorded for each Reserve (where the information was available):

- Shire;
- Reserve number;
- Land district;
- Lot number;
- Location;
- CALM district name and district number;
- Locality or Reserve name;
- Survey date;
- Surveyor name;
- The appropriate 1:25 000 or 1:50 000 Topographic Survey mapsheet name and number;
- The appropriate 1:250 000 Geology mapsheet name and number;
- Underlying Reserve geology and approximate percentage of the Reserve occupied by each geological unit identified;
- The presence of any non-indigenous cultural heritage sites; and
- The presence of any Aboriginal sites.

3.3.2. Vegetation Associations

Vegetation associations within each Reserve were identified and mapped as a series of vegetation units at a scale of 1:5000 (Map 1). Each vegetation unit was depicted as one or more separate and numbered polygons within each Reserve. Preliminary mapping was based on vegetation structural boundaries interpreted from colour aerial photographs, which was further supplemented with information on topographic position and underlying geology. These boundaries were verified and refined in the field during site reconnaissance and weed mapping (see Section 3.3.4 below). Areas of granite outcrop were mapped as a separate vegetation unit. The locations of any new populations of Declared Rare or Priority Flora identified in the field were recorded using GPS, and a voucher specimen collected.

Areas where the original floristic composition or structure of vegetation was significantly degraded or modified were mapped. The map output for this study indicates all such degraded vegetation units as being "Degraded". However, information as to the likely original vegetation type, and the type(s) of degradation or modification visible have been recorded in the accompanying Access database and Arcview files (see Section 3.3.3 below).

3.3.3. Reserve Intactness

Reserve intactness was indicated by the extent of degraded vegetation units and the level of grazing within Reserves. Grazing pressure was estimated visually, based on damage to vegetation and soil disturbance.

For each area of degraded vegetation identified, the following information was recorded:

- The type of degradation or modification (presence of salt-tolerant species, salt scalds, bare ground, decline/stress and/or death/loss of overstorey vegetation, decline/stress and/or death/loss of understorey vegetation, all vegetation removed, regenerating vegetation, other)
- The likely cause of degradation or modification (dieback, waterlogging, salinity, clearing for roaded catchment, clearing for gravel/sand extraction, other clearing, fire)

Where the likely cause of degradation or modification was from waterlogging or salinity, it was noted whether the source was rising water tables, discharge from constructed drains or surface run-off.

Degraded vegetation units are shown on Map 1.

3.3.4. Environmental Weeds

Weed infestations within each Reserve was mapped at a scale of 1:5 000 based on the extent and severity of infestations of weeds and exotic grasses and forbs.

Weed cover maps (Map 2) were created by surveying each Reserve, paying particular attention to Reserve edges, drainage lines and sites which had undergone some form of disturbance. A series of cover classes were used (<20%, 20-50%, 50-80% or >80%) to describe the extent of weed cover in each Reserve. Reserves were accessed both by vehicle (where possible) and on foot, and weed assessments were made by walking through areas and mapping changes in weed cover.

The occurrence of any serious environmental weeds incidentally observed was noted. If the infestation was isolated (rather than widespread), the following information was recorded:

- Date observed;
- Location of the approximate centre of infestation using a GPS;
- Duration of GPS averaging;
- Species;
- Degree of infestation at that location; and
- A brief comment.

Where the infestation was widespread, the GPS location could not be sensibly recorded.

3.3.5. Social, Cultural and Economic Attributes

Information on a range of social, cultural and economic attributes were gathered for each Reserve, with selected features mapped at a scale of 1:5000 (Map 3). The features identified on these maps, from aerial photograph interpretation and field observation, were:

- Internal vehicle tracks;
- Artificial water features;
- The presence and condition of boundary fences;
- Constructed drains entering or draining into the Reserve; and
- Indigenous and Non-indigenous cultural heritage sites.

Any Aboriginal sites or non-indigenous cultural heritage sites that were incidentally encountered during fieldwork were recorded, photographed and the appropriate forms were completed. The GPS location of these sites and the duration of GPS averaging was also recorded.

Within each Reserve, the presence and attributes of the following uses and values were recorded, on the basis of aerial photo interpretation and field observation.

3.3.5.1 Recreation/Amenity/Tourism

The following information relating to Reserve amenity was recorded:

- Condition of external road access (2WD, 4WD or none) (Map 2);
- Condition of internal vehicle access (2WD, 4WD or none) (Map 2); and
- Current recreation activities

3.3.5.2 Water Resources

The following information relating to water resources was recorded:

- Natural surface water features; and
- Artificial water features (tanks, dams, wells) (Map 2).

3.3.5.3 Extractive Industries

The following information relating to extractive industry was recorded:

- Type of extractive industry;
- Area (ha) occupied by the extractive industry;
- Quantity of the resource remaining (ha), estimated from soil data and general observations

3.3.5.4 Direct Production

The following information relating to direct production was recorded:

- Presence of timber cutting, the intensity in relation to the extent of the desired species, and an estimate of the number of years since the most recent harvest;
- Presence of wildflower harvesting, the intensity in relation to the extent of the desired species, and an estimate of the number of years since the most recent cutting; and
- Sandalwood (*Santalum spicatum*) presence and abundance.

3.3.5.5 Adjacent Land Use

For land uses adjacent to Reserves, the following information was recorded:

- Types of land use (cropping/grazing, agroforestry/plantation, extractive, urban, industrial, remnant vegetation, revegetation, utility/transport (road, rail or easement), water production/conservation, other);
- The percentage of the total Reserve perimeter adjoining each land use identified above;
- The length of boundary fencing for each Reserve that fits into the quality classes of none, poor or good; and
- The presence/absence of any constructed drains that either enter, or terminate at and drain into, the Reserve.

3.3.6. Fauna

Evidence of native and introduced vertebrate fauna was recorded and the type of observation noted (e.g. sighting, hearing, animal remains, tracks, scats and diggings). Observations made were incidental and not the result of a systematic search of the area. Wherever, possible, fauna were identified to species level (see Appendix 3).

3.4. Quadrats

A total of 31 survey sites or plots were established on Reserves throughout Shire of Mount Marshall to enable detailed assessment of vegetation, soil and landform characteristics in areas representative of each vegetation unit identified. An additional quadrat was removed after undertaking vegetation and soil assessments, as it had been mistakenly placed within a privately owned vegetation remnant. Despite being removed, the data for this quadrat (MM0032) has been included in this report.

Survey sites consisted of two quadrats of $100m^2$ (10m x 10m) and $400m^2$ (20m x 20m), with the $100m^2$ quadrat nested within a corner of the $400m^2$ quadrat. Wherever possible, quadrats were aligned north-south and east-west, with the north west corner as the common corner between the two quadrats. Any variations from this orientation were noted. The common corner was marked with a galvanised steel star picket with a stamped aluminium plate to identify the site number. The corners of the $100m^2$ quadrat were marked with galvanised fence droppers. A transect was established that diagonally intersected both quadrats, with its origin in the north-west corner. The locations of survey quadrats were plotted onto the same map as vegetation associations (Map 1).

3.4.1. Quadrat Location

A quadrat was placed in representative vegetation units identified during preliminary and field mapping of vegetation associations. Sites were chosen within homogenous areas subjectively considered to be characteristic of the vegetation unit at the selected location. As far as possible, quadrat locations were chosen to avoid vegetation boundaries and areas of local disturbance, such as roads, tracks and gravel pits.

Although disturbed areas were generally avoided, some quadrats were placed in disturbed areas if the vegetation association was not better represented elsewhere. This was to ensure that the true diversity in vegetation associations within the Shire was adequately represented in the survey. Similarly, where vegetation communities had changed from one form to another as a result of some degradation process (e.g. salinisation), the "new" vegetation communities were regarded as a vegetation association in its own right, and not excluded from the survey.

3.4.2. Quadrat Description

Through a combination of office and field based assessments, the following information was recorded for each quadrat:

- Date;
- Surveyor name;
- Unique site identifier (Quadrat number);
- Reserve details as per Section 3.3.1;
- GPS location, including duration of GPS averaging (minutes);
- An air photo reference;
- Aspect (cardinal directions);

- Elevation;
- Disturbance of site, based on the degree of clearing, cultivation and soil disturbance;
- Abundance, size and lithology of surface coarse fragments;
- Abundance, nature, form and size of segregations of pedogenic orgin;
- Landform element, slope class and morphological type;
- Vegetation name (both full and brief descriptions);
- Evidence/no evidence of fire, and an estimate of the number of years since the most recent fire;
- Percentage cover of plant litter;
- Percentage cover of bare ground; and
- Any other features of ecological relevance.

The methods and coding of McDonald *et al.* (1998) were used to describe site disturbance, the abundance, size and lithology of surface coarse fragments the abundance, nature, form and size of segregations of pedogenic origin, landform element, slope class and morphological type; and vegetation name.

Evidence of fire was determined through observation of charred wood and vegetation. The period since the fire has occurred was estimated based on the degree of litter present, the degree of decomposition of fallen timber and the height of regrowth vegetation. The degree of litter present was not used as a sole indicator because of variable litter decomposition rates in different vegetation communities and climatic regimes.

A colour photograph was taken of the site from the north west corner of the quadrat looking in a south easterly direction (unless indicated otherwise). Each photograph shows the general appearance of the vegetation at the survey site.

3.4.3. Vegetation Description

Within each quadrat, the floristics, vertical structure and cover of the vegetation were recorded, following the minimum vegetation description guidelines provided in McDonald *et al.* (1998). This information was combined for all strata to give a detailed vegetation name. Vegetation name was determined using the vegetation structural formation, height class and floristic associations in each stratum present within a quadrat.

To determine vegetation floristics, the dominant/co-dominant vascular plant species in each strata within or overhanging the $100m^2$ quadrat, were identified to species and subspecies level (where possible). Additional dominant/co-dominant plant species in the tallest stratum within or overhanging the $400m^2$ quadrat were also identified. The stratum and quadrat in which each species occurred also were recorded.

The vertical structure of the vegetation was determined by recording the growth form, average height, height class and height class name for each of the dominant/co-dominant species in the tallest stratum within the $400m^2$ quadrat, following the method and descriptions of McDonald (1998).

The transect was used to assess the vegetation cover of the tallest strata using the method of McDonald *et al*. (1998). Crown width and the distance between plant crowns within each strata were measured along the transect. Twelve measurements

were taken where possible. For some sites, large distances between plants in some strata (e.g. very scattered mallee in heath formations or sparse middle storey under woodlands) meant that it was not possible to take 12 measurements along the transect before intercepting another vegetation type or disturbed area such as an access track.

For the tallest stratum, data gathered was used to calculate the following information using the method of McDonald *et al*. (1998):

- Average crown width and gap;
- Crown separation ratio;
- Percentage crown cover; and
- Crown cover class.

For the remaining strata, the crown cover class of dominant and co-dominant species was visually estimated according to the method of McDonald *et al*. (1998).

Plant nomenclature and taxon identification codes followed the MAX Collecting Book database produced by the Western Australian Herbarium. Duplicate voucher specimens were collected for all dominant/co-dominant species surveyed within quadrats. Voucher specimens were only collected if fertile material (buds, flowers and fruit) were available or if positive identification could be made without fertile material. These voucher specimens were mounted to Herbarium standards for lodgement at CALM Herbaria at Como and Merredin. In addition to the voucher specimens, plant specimens that did not have fertile material were collected for identification purposes. All specimens were identified at the WA Herbarium, with reference to collections and experts as required. A complete flora list is provided in Appendix 4.

Where populations of declared rare or priority flora were identified from voucher specimens and not in the field, their location was estimated using the GPS readings from the quadrat that the specimen originated from.

3.4.4. Soil Description

The A and B horizons of the soil profile were described from a soil pit, or auger hole adjacent to, but outside the common quadrat corner (north-west). Information recorded for each quadrat followed the methods and coding of McDonald (1998) and were as follows:

- Upper and lower depth of each horizon (distance from the soil surface);
- Moist soil colour (using a Munsell Soil Colour Chart);
- Field texture grade;
- Abundance, size and shape of coarse fragments. If segregations of pedogenic origin occurred, their abundance, nature, form and size were recorded;
- Structure (grade of pedality);
- Condition of surface soil when dry;
- Effervescence of carbonates (based on the reaction of HCl added to dry soil); and
- Soil pH.

Soil pH was measured using a portable pH meter. Two measurements were made – the first based on an extract of 5g of soil added to 25mL of pH neutral water, and the second based on the addition of 0.5 mL $CaCl_2$ to the original soil/water mixture. The

second measurement is preferable as it more accurately reflects the pH in soil solutions as the addition of $CaCl_2$ releases bound hydrogen in the soil.

Soil Supergroup and Soil Group classifications were identified and coded in accordance with Schoknecht (1999) for each quadrat.

3.5. Map Production and Arcview Themes

The following section describes the methods used in the preparation of the three maps outlined in Sections 3.3.2., 3.3.4. and 3.3.5.

3.5.1. Metadata

Each spatial dataset used information on the following core metadata elements provided. These follow the ANZLIC metadata guidelines:

- Title;
- Custodian;
- Description (abstract);
- Date currency;
- Access (stored data format);
- Projection;
- Datum;
- Data quality (lineage, positional accuracy, attribute accuracy, completeness); and
- Metadata date.

A brief written summary was provided for each dataset (refer to Section 3). The summary contained information about how it was created, any limitations, and any other information that will assist third parties to access the dataset.

3.5.2. Vegetation Associations Map

Vegetation associations (including degraded areas and granite outcrops) were provided as single ESRI® ArcView® 3.2 shapefiles (polygon themes). Each polygon was attributed with a unique polygon identifier, Reserve number, land district, lot number, class/type/value, area (ha) and perimeter (m) value. All themes were stored in decimal degrees (4 decimal places). Quadrat locations were also included with this map.

Each occurrence of the same vegetation unit within a Reserve was mapped as a separate polygon. However, as each not every vegetation unit was surveyed in each Reserve, each polygon was attributed with features that corresponded to that vegetation unit from elsewhere within the Shire. For each vegetation polygon mapped, the following information was recorded:

- Polygon Number;
- Reserve Number;
- Land District;
- Location Number;
- Lot Number;
- The area of the polygon (ha), and the percentage of the Reserve's area the polygon occupies;
- For degraded or modified vegetation polygons, a name describing the unit in terms of the likely original vegetation and type of degradation;
- For all remaining vegetation polygons, a site identifier (quadrat number) and a vegetation name; and

- A brief comment, where appropriate.

There were 17 vegetation units which were identified within the Shire but not found to contain quadrats. These vegetation units were included in the mapping and database, to ensure all vegetation types are adequately represented. However, these vegetation units do not have detailed vegetation or soil information associated with them. Instead, they were allocated a nominal quadrat number (non-existent).

3.5.3. Reserve Intactness Map

Weed cover classes were mapped as separate polygons, and each had the following information recorded:

- Reserve Number;
- Land District;
- Location Number;
- Lot Number;
- Weed cover class (<20%, 20-50%, 50-80% or >80%);
- The area of the polygon (ha);
- The percentage of the Reserve's area occupied by that polygon; and
- A brief comment, where appropriate.

3.5.4. Social, Cultural and Economic Attributes Map

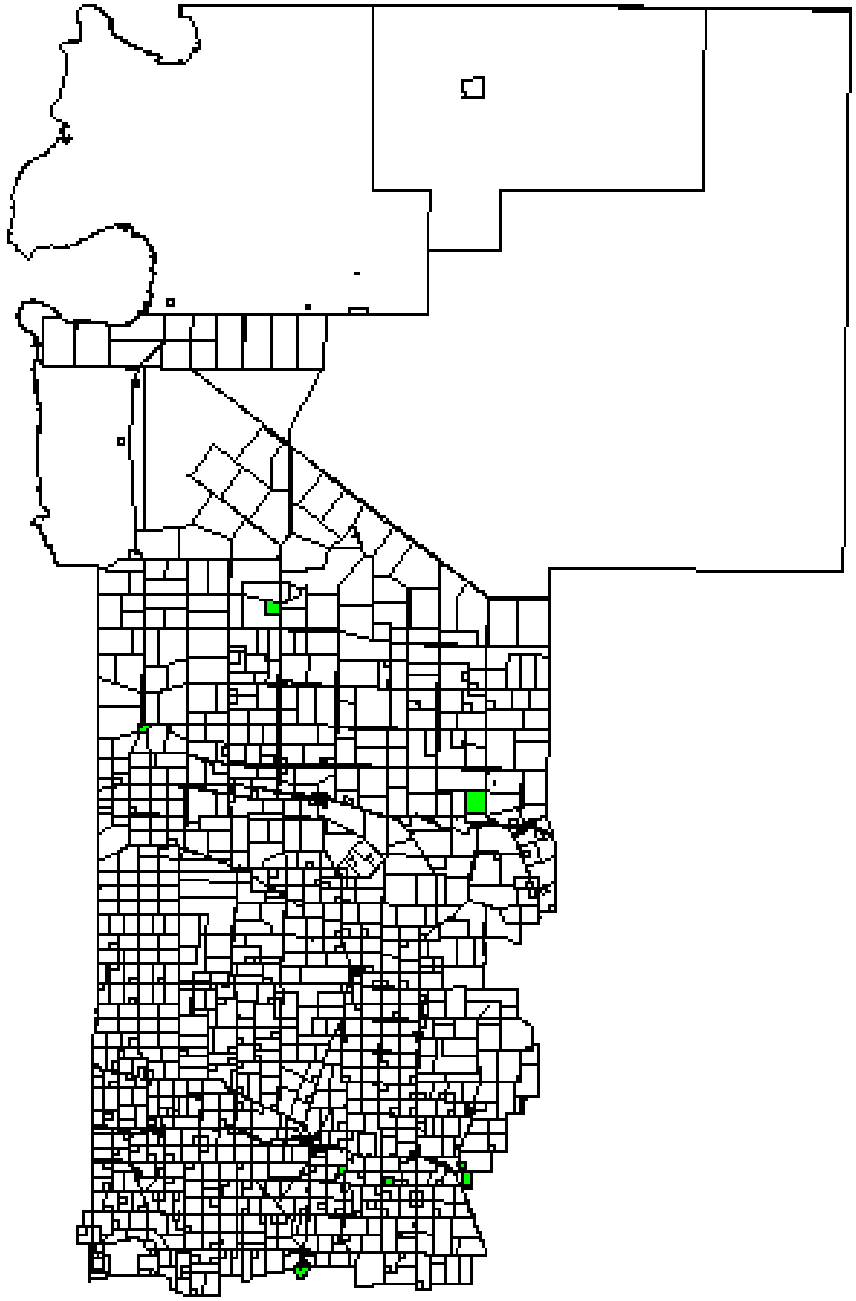
Reserve boundary fences, vehicular tracks and drains entering the Reserve or terminating at the boundary were mapped as separate ESRI® ArcView® 3.2 shapefiles (line themes). Each of the line feature themes were attributed with a unique line identifier, Reserve number, land district, lot number, class/type/value and length (m) values.

Water tanks, bores, dams and wells were mapped as single ESRI® ArcView® 3.2 shapefiles (point themes). Each point theme was attributed with a unique identifier, Reserve number, land district, lot number, class/type/value, latitude and longitude (decimal degrees to 4 decimal places). Large dams were mapped as polygons.

3.6. Timing of Survey

The field investigations were undertaken over a three week period, from the 1st May to the 17th May 2000, inclusive.

Figure 2: Location of Reserves Surveyed within the Shire of Mount Marshall



4. RESULTS

The following sections provide summary information for each Reserve surveyed within the Shire of Mount Marshall, as well as a Species by Site table, which lists the occurrence of species within each Quadrat surveyed.

Complete fauna and flora species lists are provided in Appendices 3 and 4 respectively.

4.1. Species by Site

The distribution of species across the survey quadrats is illustrated in Table 2.

4.2. Reserve and Quadrat Descriptions

The end of this report provides a summary description of the features of individual Reserves, along with the following maps:

- Map 1: Vegetation and Quadrat Locations
- Map 2: Weed Cover
- Map 3: Reserve Features

4.2.1. Vegetation Associations

A total of 49 vegetation associations (including degraded vegetation and lithic complexes) were identified based on a combination of structural and floristic information. Appendix 5 provides brief vegetation descriptions, and individual Reserve reports in Section 2 provide detailed vegetation descriptions.

4.2.2. Flora

A total of 30 vascular plant Families and 104 plant species were recorded, of which 89 were identified to at least species level.

One species of Priority flora was located, in Reserve 28120. The rush *Schoenus calcatus* is a Priority 3 Flora, which means it is a taxon which is known from several populations, at least some of which are not believed to be under threat. Also of note was the presence of Sandalwood (*Santalum spicatum*) in Reserves 13509, 14642 and 20529.

A total of 158 vouchers and duplicates were prepared for the WA Herbarium and the Katanning Regional Herbarium, respectively.

4.2.3. Fauna

A total of 23 fauna species were recorded during the survey period. Of these, the Mallee Fowl (*Leipoa ocellata*) is listed as being Vulnerable, that is it considered is rare or likely to become extinct.

4.2.4. Soils and Landforms

The quadrats were relatively similar in landform type, with the majority being plains, pediments (gently inclined), hillslopes or footslopes. The soil types encountered were predominately sand based (sandy duplexes, shallow sands, deep sands, sandy earths) as well as some areas of loamy earths and non-cracking clays.

4.2.5. Weed Cover

The extent of weed infestations is illustrated in Map 2 for each Reserve. Reserves 17924 and the contiguous Vacant Crown Land, 39186, 16423, 13509, 25323, 22082

and contiguous Vacant Crown Lands had mostly low weed cover, Reserves 15437, 25217, 14642, 12690, 28120, 19513, 20529 had variable weed cover, and Reserves 28486 and 12689 had relatively high weed cover. In general, weed cover varied with the level of disturbance within Reserves, the size of the Reserve and proximity to roadsides and internal tracks.

4.2.6. Heritage Sites

Five non-indigenous cultural heritage sites were located during fieldwork. These consisted of one dam, one telegraph line, two wells and one tank with a constructed drainage on a granite outcrop. The forms use to record information on these sites are shown in Appendix 6.

Table 2: Presence of Flora Species at Survey Quadrats

Species Name / Quadrat No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Grand Total
Acacia acuminata				1	1			1	1			1				1		1					1					1			1		**10**
Acacia coolgardiensis subsp. *coolgardiensis*					1												1																**2**
Acacia erinacea	1										1				1							1							1				**5**
Acacia hemiteles																								1					1		1		**3**
Acacia jibberdingensis										1															1	1	1						**4**
Acacia lasiocalyx												1																					**1**
Acacia mackeyana						1														1									1			1	**4**
Acacia resinomarginea		1																															**1**
Acacia sphacelata																														1			**1**
Acacia stereophylla subsp. *stereophylla*		1	1																							1	1					1	**5**
Acacia tetragonophylla	1															1							1										**3**
Allocasuarina acutivalvis			1					1																		1				1	1	1	**6**
Allocasuarina campestris				1	1					1				1			1		1		1			1	1		1			1	1		**12**
Allocasuarina corniculata							1																			1							**2**
Aristida contorta							1			2		1					1																**5**
Astroloma serratifolium					1																1						1			1			**4**
Austrodanthonia sp.1	1	1	1		1			1	1	1	1												1	1	1			1			1	1	**14**
Avena sp.1																1																	**1**
Baeckea crassifolia																										1							**1**
Baeckea muricata							1																										**1**
Baeckea sp.1			1																														**1**
Beyeria sp.1																								1									**1**
Borya constricta														1											1		1						**3**
Borya sphaerocephala				1				1		1							1	1			1			1									**7**
Callitris canescens																														1		1	**2**
Calothamnus asper																									1								**1**
Calothamnus gilesii					1												1																**2**
Calycopeplu pauciflorus				1													1				1												**3**
Calytrix brevifolia																		1			1												**2**
Calytrix leschenaultia																											1						**1**
Chamelaucium pauciflorum subsp. *thryptomeniodes*																										1							**1**
Chrysitrix distigmatosa														1																			**1**
Cryptandra minutifolia																															1		**1**
Cryptandra nutans														1																			**1**
Dianella revoluta					1						1	1				1							1	1									**6**
Dodonaea inaequifolia																												1	1				**2**
Ecdeiocelea monostachya		1	1					1		1				1					1					1		1	1						**9**
Eremophila deserti															1																		**1**
Eremophila drummondis											1																						**1**

Species Name	Quadrat No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Grand Total
Eremophila gilesii subsp. *variabilis*						1																												**1**
Eremophila sp.1																													1					**1**
Eucalyptus celastroides		1					1																											**2**
Eucalyptus hypochlamaedea subsp. *hypochlamaedea*																									1									**1**
Eucalyptus kochii subsp. *plenissima*										1																								**1**
Eucalyptus leptopoda subsp. *subulata*			1																															**1**
Eucalyptus loxophleba subsp. *supralaevis*		1								1		1		1		1			1				1						1	1				**9**
Eucalyptus oldfieldii			1																									1						**2**
Eucalyptus salmonophloia												1				1																		**2**
Eucalyptus sheathiana																					1													**1**
Eucalyptus sp.1																																	1	**1**
Eucalyptus subangusta subsp. *subangusta*								1																								1		**2**
Eucalyptus subangusta subsp. *virescens*																														1				**1**
Grevillea acuaria		1																																**1**
Grevillea paniculata											1									1														**2**
Grevillea paradoxa			1																			1									1			**3**
Grevillea yorkrakinensis							1	1		1																								**3**
Hakea erecta																									1									**1**
Hakea francisiana		1																										1						**2**
Hakea recurva																	1		1															**2**
Hakea scoparia			1				1	1																				1				1		**5**
Hibbertia arcuata		1	1				1							1														1					1	**6**
Hibbertia glomerosa																				1		1												**2**
Lepidobolus preissianus														1																				**1**
Mairearia triptera																					1													**1**
Melaleuca acuminata subsp. *acuminata*						1	1	1																						1				**4**
Melaleuca conothamnoides																				1														**1**
Melaleuca cordata														1													1	1						**3**
Melaleuca eleuterostachya																								1										**1**
Melaleuca laxiflora								1																										**1**
Melaleuca leptospermoides														1																				**1**
Melaleuca radula				1	1																								1					**3**
Melaleuca uncinata		1					1	1		1			1						1					1	1	1							1	**10**
Melalueca uncinata																															1			**1**
Mesomelaena preissii														1																				**1**
Micromyrtus racemosa																															1		1	**2**
Mirbelia trichocalyx											1																							**1**
Myrtaceous sp.1									1																									**1**
Olearia dampiera subsp eremicola										1				1																		1		**3**
Olearia muelleri		1																			1								1					**3**
Opercularia spermacacea					1																													**1**

Species Name	Quadrat No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	Grand Total
Petrophile incurvata								1																										**1**
Phebalium sp.1			1																												1	1	1	**4**
Pimelea sp.																1																		**1**
Pittosporum phylliraeoides																	1		1															**2**
Platysace trachymenoides								1							1													1						**3**
Poaceae sp.1													1																					**1**
Ptilotus obovatus		1								1																			1					**3**
Ptilotus polystachus																	1																	**1**
Rhagodia drummondii		1					1									1																		**3**
Santalum lanceolatum																			1															**1**
Santalum spicatum																								1										**1**
Schoenus calcatus															1																			**1**
Schoenus hexandrus																												1						**1**
Sclerolaena diacantha							1							1		1							1	1					1	1				**7**
Sclerolaena drummondii																							1												**1**
Scleroleana diacantha		1																																	**1**
Senna artemisioides										1																									**1**
Solanum oldfieldii					1								1																						**2**
Spartochloa scirpoidea																		1		1						1					1				**4**
Spartochloa scripoidea											1																								**1**
Stypandra glauca																										1									**1**
Unknown sp.4												1																							**1**
Unknown sp.5												1																							**1**
Unknown sp.6																																1			**1**
Xanthorrhoea nana													1																						**1**
Grand Total		**10**	**10**	**8**	**7**	**9**	**5**	**10**	**12**	**7**	**12**	**8**	**7**	**4**	**12**	**7**	**7**	**7**	**8**	**6**	**4**	**7**	**4**	**8**	**10**	**8**	**8**	**14**	**9**	**8**	**10**	**11**	**10**	**267**

5. DISCUSSION OF METHODS

Although the survey methods are well established and based on McDonald *et al*. (1998), there were some areas which could possibly be improved for future surveys. The following is a brief discussion of these areas.

5.1. Crown Cover Measurements

The method of McDonald *et al*. (1998) treats all plants within a stratum as a single species for the measurement of Crown Cover. This method posed some problems for the field staff. The method failed if the overstorey was sparse as there were large distances between trees.

The method also may provide overestimates of crown cover. This is particularly so for the large variety of Western Australian plants with mallee growth forms which have a sparse but wide canopy. We suggest that an alternative method of measuring crown cover be used for future surveys.

5.2. Survey Timing

The survey was carried out in late May, and so there were a number of species which were not yet in flower, making field identification of flora more difficult. Caution must be applied if undertaking analysis of data at a later date. This is because the annual species recorded would represent a very small subset of the true annual species diversity, and so any data analyses will exhibit a large amount of "noise".

Similarly, the estimation of weed cover classes may be significantly different if undertaken during spring.

5.3. Vegetation Surveys

Not all of the vegetation associations identified during the mapping of Reserves were able to have a quadrat placed within them. Two factors contributed to this result:

- The relatively short time-frame over which this project was to be carried out precluded a greater number of quadrats being established and surveyed; and
- Although the aerial photographs for this study were relatively recent, it was not possible to discern the subtle shifts in community composition which are readily discernible in the field. Therefore, what may appear as a single vegetation association on an aerial photograph may in reality encompass several quite different (floristically and structurally) associations.

However, we have created "Nominal Quadrats" in the database for these vegetation associations, which could be used as a starting point for future surveys.

Similarly, it may be helpful to define the level detail required in the survey of vegetation associations. Although the vegetation maps have been produced at a scale of 1:5,000, the scale of data capture from aerial photographs is 1:25,000. Field verification was successful in providing a finer level of detail except in the case of large Reserves which were not readily accessible.

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APPENDIX ONE: EXAMPLE DATA SHEETS

Insert Quadrat Vegetation data sheet

Insert Quadrat Soils data sheet

Insert Reserve data sheet

APPENDIX TWO: DATABASE CODE DESCRIPTIONS

Database Table	Field	Code	Description
Adjacent Land Use	Adjacent Land Use	1	cropping/grazing
Adjacent Land Use	Adjacent Land Use	2	agroforestry/plantation
Adjacent Land Use	Adjacent Land Use	3	extractive
Adjacent Land Use	Adjacent Land Use	4	urban
Adjacent Land Use	Adjacent Land Use	5	industrial
Adjacent Land Use	Adjacent Land Use	6	remnant vegetation
Adjacent Land Use	Adjacent Land Use	7	revegtation
Adjacent Land Use	Adjacent Land Use	8	utility/ transport
Adjacent Land Use	Adjacent Land Use	9	water conservation
Adjacent Land Use	Adjacent Land Use	10	other
Adjacent Land Use	Fence Condition	G	good
Adjacent Land Use	Fence Condition	N	none
Adjacent Land Use	Fence Condition	P	poor
Commercial Land Use	Extent Cut	H	High
Commercial Land Use	Extent Cut	L	Low
Commercial Land Use	Extent Cut	M	Moderate
Commercial Land Use	Extractive Industry	1	gravel
Commercial Land Use	Extractive Industry	2	sand
Commercial Land Use	Extractive Industry	3	gypsum
Commercial Land Use	Extractive Industry	4	other
Commercial Land Use	Sandalwood Abundance	1	isolated
Commercial Land Use	Sandalwood Abundance	2	scattered
Commercial Land Use	Sandalwood Abundance	3	moderately abundant
Commercial Land Use	Sandalwood Abundance	4	abundant
Commercial Land Use	Years Since Cut	1	<1 year
Commercial Land Use	Years Since Cut	3	1-5 years
Commercial Land Use	Years Since Cut	5	>5 years
Cover	Cover Class	D	closed or dense (crowns touching/overlapping)
Cover	Cover Class	I	isolated plants (trees>100m apart, shrubs 25m apart)
Cover	Cover Class	L	isolated clumps (clump of 2-4 plants >200m apart)
Cover	Cover Class	M	mid-dense (crowns touching/slightly separated)
Cover	Cover Class	S	sparse (crowns clearly separated)
Cover	Cover Class	V	very sparse (crowns well separated)
Fauna	Fauna Observation Type	B	bones
Fauna	Fauna Observation Type	D	digging
Fauna	Fauna Observation Type	H	hearing
Fauna	Fauna Observation Type	S	scats
Fauna	Fauna Observation Type	T	tracks
Fauna	Fauna Observation Type	V	visual sighting
Intactness	Degradation Cause	1	dieback
Intactness	Degradation Cause	2	clearing-roaded catchement
Intactness	Degradation Cause	3	clearing-gravel/sand extraction
Intactness	Degradation Cause	4	other clearing
Intactness	Degradation Cause	5	fire
Intactness	Degradation Cause	6	waterlogging
Intactness	Degradation Cause	7	salinity
Intactness	Degradation Cause	8	other
Intactness	Degraded Vegetation	1	salt-tolerant plants
Intactness	Degraded Vegetation	2	salt scalds
Intactness	Degraded Vegetation	3	bare ground
Intactness	Degraded Vegetation	4	decline/stress overstorey

Database Table	Field	Code	Description
Intactness	Degraded Vegetation	5	death/loss overstorey
Intactness	Degraded Vegetation	6	decline/loss understorey
Intactness	Degraded Vegetation	7	death/loss understorey
Intactness	Degraded Vegetation	8	all removed
Intactness	Degraded Vegetation	9	regenerating vegetation
Intactness	Degraded Vegetation	10	other
Intactness	Grazing Pressure	1	light
Intactness	Grazing Pressure	2	moderate
Intactness	Grazing Pressure	3	severe
Intactness	Waterlogging/Salinity	1	rising water-table
Intactness	Waterlogging/Salinity	2	drain discharge
Intactness	Waterlogging/Salinity	3	surface run=off
Intactness	Waterlogging/Salinity	4	other
Intactness	Weed Infestation	1	one/few
Intactness	Weed Infestation	2	scattered
Intactness	Weed Infestation	3	moderate density
Intactness	Weed Infestation	4	dense
Project	Project Code	465 6/00	Conservation and Other Values of Crown lands within the Shire of Mt Marshall
Quadrat	Collector	WEGJ	Juliet Wege
Quadrat	Disturbance	0	none
Quadrat	Disturbance	1	grazing
Quadrat	Disturbance	2	limited clearing
Quadrat	Disturbance	3	extensive clearing
Quadrat	Disturbance	4	complete clearing, not cultivated
Quadrat	Disturbance	5	complete clearing, cultivated
Quadrat	Disturbance	6	cultivation, rain-fed
Quadrat	Disturbance	7	cultivation, irrigated
Quadrat	Disturbance	8	highly disturbed
Quadrat	Geology	Agb	Biotite adamellite & granite; medium & coarse-grained, equigranular, allotriomorphic
Quadrat	Geology	Agg	Adamellite & granodiorite - granoblastic texture, strongly foliated; foliation defined by entrainment & alignment of biotite (rarely hornblende)
Quadrat	Geology	Agv	Variable textured adamellite; medium & coarse-grained, commonly seriate, microcline phenocrysts up to 60 mm
Quadrat	Geology	Amf	Metamorphosed agmatite - granoblastic or gneissic palaeosome consisting of Agg, minor paragneiss &/or amphibolite, enclosed by granoblastic leucocrativ granite & adamallite Anf (granoblastic gneiss or granofels)
Quadrat	Geology	Cza	Alluvium - silt & sand in broad valley flats; extensively reworked by present drainage
Quadrat	Geology	Czb	Silcrete - subvitreous siliceous rock with angular quartz grains
Quadrat	Geology	Czg	Reworked sandplain with undulating surface - contains yellow to white sand and clay, gravel and minor laterite outcrop
Quadrat	Geology	Czk	Calcrete in layers or nodules, adjacent to playa lakes
Quadrat	Geology	Czl	Laterite - limonite nodules in cemented matrix; grades into Czb & Czs (sandplain) & downwards into weathered bedrock
Quadrat	Geology	Czo	Deeply weathered rock - kaolinised, subsequently ferruginised and silicified

Database Table	Field	Code	Description
Quadrat	Geology	Czs	Reworked sandplain - yellow and white sand; contains locally abundant limonite pebbles
Quadrat	Geology	Qa	Alluvium - silt, sand and gravel in stream channels
Quadrat	Geology	Qc	Colluvium and minor alluvium - Derived mainly from Czs (sandplain) and Czg
Quadrat	Geology	Qd	Gypsiferous sand and silt in dunes adjacent to playa lakes; ancient drainage flats; commonly contain calcrete nodules
Quadrat	Geology	Ql	Saline and gypsiferous clay and silt in playa lake deposits
Quadrat	Geology	Qz	Mixed sheetwash deposit, colluvium and alluvium - red-brown sandy and clayey loam on valley slopes
Quadrat	Geology	Tl	Laterite and silcrete - grades upwards into Ts and downward into weathered bedrock
Quadrat	Geology	Ts	Sand, yellow-white - commonly contains limonite nodules. Remnant of Tertiary sandplain
Quadrat	Vegetation Condition	1	near natural, minor weed invasion
Quadrat	Vegetation Condition	2	slightly disturbed
Quadrat	Vegetation Condition	3	moderately disturbed
Quadrat	Vegetation Condition	4	very disturbed
Quadrat	Vegetation Condition	5	highly disturbed, signif. weed invasion
Recreation-Amenity-Tourism	External Access	0	None
Recreation-Amenity-Tourism	External Access	1	Unsealed
Recreation-Amenity-Tourism	External Access	2	Sealed
Recreation-Amenity-Tourism	External Access	3	Sealed and unsealed
Recreation-Amenity-Tourism	Internal Access	0	None
Recreation-Amenity-Tourism	Internal Access	2	2 WD
Recreation-Amenity-Tourism	Internal Access	4	4 WD
Recreation-Amenity-Tourism	Internal Access	5	Both 2WD and 4WD
Recreation-Amenity-Tourism	Recreation Activity	B	bird watching
Recreation-Amenity-Tourism	Recreation Activity	C	camp site
Recreation-Amenity-Tourism	Recreation Activity	F	fishing
Recreation-Amenity-Tourism	Recreation Activity	P	picnic area
Recreation-Amenity-Tourism	Recreation Activity	S	swimming
Recreation-Amenity-Tourism	Recreation Activity	W	walk trail
Soil Landforms	Landform Element	BEA	beach
Soil Landforms	Landform Element	BER	berm
Soil Landforms	Landform Element	BKP	backplain
Soil Landforms	Landform Element	DDE	drainage depression
Soil Landforms	Landform Element	DUC	dunecrest
Soil Landforms	Landform Element	FOO	footslope
Soil Landforms	Landform Element	HCR	hillcrest
Soil Landforms	Landform Element	HSL	hillslope
Soil Landforms	Landform Element	LUN	lunette
Soil Landforms	Landform Element	PED	pediment
Soil Landforms	Landform Element	PLA	plain
Soil Landforms	Landform Element	PLY	playa
Soil Landforms	Landform Element	S	simple slope
Soil Landforms	Landform Element	VLF	valley flat
Soil Landforms	Landform Modal Slope	CL	cliffed
Soil Landforms	Landform Modal Slope	GE	gently inclined
Soil Landforms	Landform Modal Slope	LE	level
Soil Landforms	Landform Modal Slope	MO	moderately inclined
Soil Landforms	Landform Modal Slope	PR	precipitous

Database Table	Field	Code	Description
Soil Landforms	Landform Modal Slope	ST	steep
Soil Landforms	Landform Modal Slope	VG	very gently inclined
Soil Landforms	Landform Modal Slope	VS	very steep
Soil Landforms	Landform Morphology	C	crest
Soil Landforms	Landform Morphology	D	closed depression
Soil Landforms	Landform Morphology	F	flat
Soil Landforms	Landform Morphology	H	hillock
Soil Landforms	Landform Morphology	L	lower slope
Soil Landforms	Landform Morphology	M	mid-slope
Soil Landforms	Landform Morphology	R	ridge
Soil Landforms	Landform Morphology	S	simple slope
Soil Landforms	Landform Morphology	U	upper slope
Soil Landforms	Landform Morphology	V	open depression (vale)
Soil Landforms	Soil Supergroup	100	wet or water logged soils
Soil Landforms	Soil Supergroup	200	rocky or stony soils
Soil Landforms	Soil Supergroup	300	ironstone gravelly soils
Soil Landforms	Soil Supergroup	400	sandy duplexes
Soil Landforms	Soil Supergroup	420	shallow sands
Soil Landforms	Soil Supergroup	440	deep sands
Soil Landforms	Soil Supergroup	460	sandy earths
Soil Landforms	Soil Supergroup	500	loamy duplexes
Soil Landforms	Soil Supergroup	520	shallow loams
Soil Landforms	Soil Supergroup	540	loamy earths
Soil Landforms	Soil Supergroup	600	cracking clays
Soil Landforms	Soil Supergroup	620	non-cracking clays
Soil Landforms	Surface Boulder Abundance	A	abundant, 50-90%
Soil Landforms	Surface Boulder Abundance	C	common, 10-20%
Soil Landforms	Surface Boulder Abundance	F	few, 2-10%
Soil Landforms	Surface Boulder Abundance	M	many, 20-50%
Soil Landforms	Surface Boulder Abundance	N	no coarse fragments, 0%
Soil Landforms	Surface Boulder Abundance	T	very abundant, >90%
Soil Landforms	Surface Boulder Abundance	V	very few, <2%
Soil Landforms	Surface Condition	C	surface crust
Soil Landforms	Surface Condition	F	firm
Soil Landforms	Surface Condition	G	cracking
Soil Landforms	Surface Condition	H	hard setting
Soil Landforms	Surface Condition	L	loose
Soil Landforms	Surface Condition	M	self-mulching
Soil Landforms	Surface Condition	S	soft
Soil Landforms	Surface Condition	X	surface flake
Soil Landforms	Surface Gravel Abundance	A	abundant, 50-90%
Soil Landforms	Surface Gravel Abundance	C	common, 10-20%
Soil Landforms	Surface Gravel Abundance	F	few, 2-10%
Soil Landforms	Surface Gravel Abundance	M	many, 20-50%
Soil Landforms	Surface Gravel Abundance	N	no coarse fragments, 0%
Soil Landforms	Surface Gravel Abundance	T	very abundant, >90%
Soil Landforms	Surface Gravel Abundance	V	very few, <2%
Soil Landforms	Surface Segregation Abundance	A	abundant, >50%
Soil Landforms	Surface Segregation Abundance	C	common, 10-20%
Soil Landforms	Surface Segregation Abundance	F	few, 2-10%
Soil Landforms	Surface Segregation Abundance	M	many, 20-50%
Soil Landforms	Surface Segregation Abundance	N	no segregations
Soil Landforms	Surface Segregation Abundance	V	very few, <2%
Soil Landforms	Surface Segregation Form	C	concretions
Soil Landforms	Surface Segregation Form	F	fragments
Soil Landforms	Surface Segregation Form	L	laminae
Soil Landforms	Surface Segregation Form	N	nodules

Database Table	Field	Code	Description
Soil Landforms	Surface Segregation Form	R	root linings
Soil Landforms	Surface Segregation Form	S	soft segregations
Soil Landforms	Surface Segregation Form	T	tubules
Soil Landforms	Surface Segregation Form	V	veins
Soil Landforms	Surface Segregation Form	X	crystals
Soil Landforms	Surface Segregation Nature	E	earthy
Soil Landforms	Surface Segregation Nature	F	ferruginous
Soil Landforms	Surface Segregation Nature	G	ferruginous- organic
Soil Landforms	Surface Segregation Nature	H	organic (Humified)
Soil Landforms	Surface Segregation Nature	K	calcerous
Soil Landforms	Surface Segregation Nature	L	argillaceous
Soil Landforms	Surface Segregation Nature	M	manganiferous
Soil Landforms	Surface Segregation Nature	N	ferromanganiferous
Soil Landforms	Surface Segregation Nature	O	other
Soil Landforms	Surface Segregation Nature	S	sulphurous
Soil Landforms	Surface Segregation Nature	U	unidentified
Soil Landforms	Surface Segregation Nature	Y	gypseous
Soil Landforms	Surface Segregation Nature	Z	saline (visible salt)
Soil Landforms	Surface Segregation Size	C	Coarse (6-20mm)
Soil Landforms	Surface Segregation Size	E	Extremely coarse (>60mm)
Soil Landforms	Surface Segregation Size	F	Fine (<2mm)
Soil Landforms	Surface Segregation Size	L	Very coarse, large (20-60mm)
Soil Landforms	Surface Segregation Size	M	Medium (2-6mm)
Soil Landforms	Surface Stone Abundance	A	abundant, 50-90%
Soil Landforms	Surface Stone Abundance	C	common, 10-20%
Soil Landforms	Surface Stone Abundance	F	few, 2-10%
Soil Landforms	Surface Stone Abundance	M	many, 20-50%
Soil Landforms	Surface Stone Abundance	N	no coarse fragments, 0%
Soil Landforms	Surface Stone Abundance	T	very abundant, >90%
Soil Landforms	Surface Stone Abundance	V	very few, <2%
Soil Profile	Carbonates	H	highly calcareous, moderately visible
Soil Profile	Carbonates	M	moderately calcareous, audible and slightly visible
Soil Profile	Carbonates	N	non-calcareous, no fizz
Soil Profile	Carbonates	S	slightly calcareous, lightly audible but not visible
Soil Profile	Carbonates	V	very highly calcareous, strong visible fizz
Soil Profile	Coarse Fragments Abundance	A	abundant, 50-90%
Soil Profile	Coarse Fragments Abundance	C	common, 10-20%
Soil Profile	Coarse Fragments Abundance	F	few, 2-10%
Soil Profile	Coarse Fragments Abundance	M	many, 20-50%
Soil Profile	Coarse Fragments Abundance	N	no coarse fragments, 0%
Soil Profile	Coarse Fragments Abundance	T	very abundant, >90%
Soil Profile	Coarse Fragments Abundance	V	very few, <2%
Soil Profile	Coarse Fragments Size	1	2-6mm
Soil Profile	Coarse Fragments Size	2	6-20mm
Soil Profile	Coarse Fragments Size	3	20-60mm
Soil Profile	Coarse Fragments Size	4	60-200mm
Soil Profile	Coarse Fragments Size	5	200-600mm
Soil Profile	Coarse Fragments Size	6	600mm-2m
Soil Profile	Coarse Fragments Size	7	>2m
Soil Profile	Field Texture Grade	CL	Clay loam
Soil Profile	Field Texture Grade	CS	Clayey sand, ribbon 5-15mm
Soil Profile	Field Texture Grade	HC	Heavy clay
Soil Profile	Field Texture Grade	L	Loam
Soil Profile	Field Texture Grade	LC	Light clay
Soil Profile	Field Texture Grade	LMC	Light medium clay

Database Table	Field	Code	Description
Soil Profile	Field Texture Grade	LS	Loamy sand, ribbon 5mm
Soil Profile	Field Texture Grade	MC	Medium clay
Soil Profile	Field Texture Grade	S	Sand, no ribbon
Soil Profile	Field Texture Grade	SC	Sandy clay
Soil Profile	Field Texture Grade	SCL	Sandy clay loam
Soil Profile	Field Texture Grade	SCL	Sandy clay loam
Soil Profile	Field Texture Grade	SL	Sandy loam, ribbon 15-25mm
Soil Profile	Field Texture Grade	ZC	Silty clay
Soil Profile	Field Texture Grade	ZCL	Silty clay loam
Soil Profile	Field Texture Grade	ZL	Silt loam
Soil Profile	Horizon	A	First horizon
Soil Profile	Horizon	B	Second horizon
Soil Profile	Horizon	C	Third horizon
Soil Profile	Horizon	D	Fourth horizon
Soil Profile	Horizon Boundary Distinctness	A	abrupt (5-20mm
Soil Profile	Horizon Boundary Distinctness	C	clear (20-50mm)
Soil Profile	Horizon Boundary Distinctness	D	diffuse (>100m)
Soil Profile	Horizon Boundary Distinctness	G	gradual (50-100mm)
Soil Profile	Horizon Boundary Distinctness	S	sharp (<5mm)
Soil Profile	Horizon Boundary Shape	B	broken
Soil Profile	Horizon Boundary Shape	I	irregular
Soil Profile	Horizon Boundary Shape	S	smooth
Soil Profile	Horizon Boundary Shape	T	tongued
Soil Profile	Horizon Boundary Shape	W	wavy
Soil Profile	Layer	1	Layer One
Soil Profile	Layer	2	Layer Two
Soil Profile	Layer	3	Layer Three
Soil Profile	Layer	4	Layer Four
Soil Profile	Layer	5	Layer Five
Soil Profile	Segregation Abundance	A	abundant, >50%
Soil Profile	Segregation Abundance	C	common, 10-20%
Soil Profile	Segregation Abundance	F	few, 2-10%
Soil Profile	Segregation Abundance	M	many, 20-50%
Soil Profile	Segregation Abundance	N	no segregations
Soil Profile	Segregation Abundance	V	very few, <2%
Soil Profile	Segregation Form	C	concretions
Soil Profile	Segregation Form	F	fragments
Soil Profile	Segregation Form	L	laminae
Soil Profile	Segregation Form	N	nodules
Soil Profile	Segregation Form	R	root linings
Soil Profile	Segregation Form	S	soft segregations
Soil Profile	Segregation Form	T	tubules
Soil Profile	Segregation Form	V	veins
Soil Profile	Segregation Form	X	crystals
Soil Profile	Segregation Nature	A	aluminuos
Soil Profile	Segregation Nature	E	earthy
Soil Profile	Segregation Nature	F	ferruginous
Soil Profile	Segregation Nature	G	ferruginous- organic
Soil Profile	Segregation Nature	H	organic (Humified)
Soil Profile	Segregation Nature	K	calcerous
Soil Profile	Segregation Nature	L	argillaceous
Soil Profile	Segregation Nature	M	manganiferous
Soil Profile	Segregation Nature	N	ferromanganiferous
Soil Profile	Segregation Nature	O	other
Soil Profile	Segregation Nature	S	sulphurous
Soil Profile	Segregation Nature	U	unidentified
Soil Profile	Segregation Nature	Y	gypseous

Database Table	Field	Code	Description
Soil Profile	Segregation Nature	Z	saline (visible salt)
Soil Profile	Segregation Size	C	Coarse (6-20mm)
Soil Profile	Segregation Size	E	Extremely coarse (>60mm)
Soil Profile	Segregation Size	F	Fine (<2mm)
Soil Profile	Segregation Size	L	Very coarse, large (20-60mm)
Soil Profile	Segregation Size	M	Medium (2-6mm)
Soil Profile	Structure	G	single grain (apedal)
Soil Profile	Structure	M	moderately pedal
Soil Profile	Structure	S	strongly pedal
Soil Profile	Structure	V	massive (apedal)
Soil Profile	Structure	W	weakly pedal
Soil Profile	Type of Soil Observation	A	auger boring
Soil Profile	Type of Soil Observation	C	relatively undisturbed soil core
Soil Profile	Type of Soil Observation	D	dual auger and pit
Soil Profile	Type of Soil Observation	E	existing vertical exposure
Soil Profile	Type of Soil Observation	P	soil pit
Vegetation	Growth Form	A	cycad
Vegetation	Growth Form	C	chenopod shrub
Vegetation	Growth Form	D	sod grass
Vegetation	Growth Form	E	fern
Vegetation	Growth Form	F	forb
Vegetation	Growth Form	G	tussock grass
Vegetation	Growth Form	H	hummock grass
Vegetation	Growth Form	L	vine
Vegetation	Growth Form	M	tree mallee
Vegetation	Growth Form	N	lichen
Vegetation	Growth Form	O	moss
Vegetation	Growth Form	P	palm
Vegetation	Growth Form	R	rush
Vegetation	Growth Form	S	shrub
Vegetation	Growth Form	T	tree
Vegetation	Growth Form	V	sedge
Vegetation	Growth Form	W	liverwort
Vegetation	Growth Form	X	Xanthorrhoea
Vegetation	Growth Form	Y	mallee shrub
Vegetation	Growth Form	Z	heath shrub
Vegetation	Height Class	1	<0.25m
Vegetation	Height Class	2	0.26-0.5m
Vegetation	Height Class	3	0.51-1m
Vegetation	Height Class	4	1.01-3m
Vegetation	Height Class	5	3.01-6m
Vegetation	Height Class	6	6.01-12m
Vegetation	Height Class	7	12.01-20m
Vegetation	Height Class	8	20.01-35m
Vegetation	Height Class	9	>35.01m
Vegetation	Height Class Name	Dwarf	T4, M1, S1, Y1, Z1, C1
Vegetation	Height Class Name	Extremely tall	T9, M6, S6, Y6, Z6, C6, H5, G5, F5, R5, V5, E5, D3, X3, N3, W3
Vegetation	Height Class Name	Low	T5, M2, S2, Y2, Z2, C2, H1, G1, F1, R1, V1, E1, D1, X1, N1, W1
Vegetation	Height Class Name	Mid-high	T6, M3, S3, Y3, Z3, C3, H2, G2, F2, R2, V2, E2
Vegetation	Height Class Name	Tall	T7, M4, S4, Y4, Z4, C4, H3, G3, F3, R3, V3, E3, D2, X2, N2, W2
Vegetation	Height Class Name	Very tall	T8, M5, S5, Y5, Z5, C5, H4, G4, F4, R4, V4, E4

Database Table	Field	Code	Description
Vegetation	Stratum	0	emergent, trees above tallest dominant stratum, up to 5% of total crown cover
Vegetation	Stratum	1	upper, tallest dominant statum, av. distance between crowns overlapping to 20 times crown size
Vegetation	Stratum	2	middle, all layers between upper layer & 1m in height
Vegetation	Stratum	3	lower stratum, all vegetation up to 1m tall
Vegetation	Stratum	4	non-woody ground stratum
Vegetation	Stratum	2A	middle (upper)
Vegetation	Stratum	2B	middle (lower)
Water Resources	Art Water Features	1	constructed drainage
Water Resources	Art Water Features	2	dam
Water Resources	Art Water Features	3	tank
Water Resources	Art Water Features	4	roaded catchment
Water Resources	Art Water Features	5	bore/well
Water Resources	Art Water Features	6	other
Water Resources	Natural Water Features	1	natural drainage line
Water Resources	Natural Water Features	2	wetland
Water Resources	Natural Water Features	3	seeps/soaks
Water Resources	Natural Water Features	4	saltpan
Water Resources	Natural Water Features	5	other

APPENDIX THREE: FAUNA LIST

COMMON NAME	TAXONOMIC NAME	STATUS
Birds		
Australian Raven	*Corvus coronoides*	
Australian Ringneck	*Barnardius zonarius*	
Brown Falcon	*Falco berigora*	
Crested Pigeon	*Ocyphaps lophotes*	
Emu	*Dromaius novaehollandiae*	
Galah	*Cacatua roseicapilla*	
Magpie Larks	*Grallina cyanoleuca*	
Mallee Fowl	*Leipoa ocellata*	Vulnerable
Pied Butcher Bird	*Cracticus nigrogularis*	
Striated Pardalote	*Pardalotus striatus*	
Wedge-tailed Eagle	*Aquila audax*	
Willy-wagtails	*Rhipidura leucaphrys*	
Yellow-throated Miner	*Manorina flavigula*	
Mammals and Monotremes		
Domestic Cat	*Felis cattus*	Introduced
Domestic Dog	*Canis familiaris*	Introduced
European Rabbit	*Oryctolagus cuniculus*	Introduced
European Red Fox	*Vulpes vulpes*	Introduced
Short-beaked Echidna	*Tachyglossus aculeatus*	
Western Grey Kangaroo	*Macropus fuliginosus*	
Reptiles and Amphibians		
Dugite	*Pseudonaja affinis*	
Frogs	*Unidentified species*	
Ornate Dragon	*Ctenophorus ornatus*	
Western Bearded Dragon	*Pogona minor*	

APPENDIX FOUR: FLORA LIST

Family	Species Name
Amaranthaceae	*Ptilotus obovatus*
	Ptilotus polystachyus
Apiaceae	*Platysace trachymenoides*
Asteraceae	*Olearia dampiera* subsp. *eremicola*
	Olearia muelleri
Boryaceae	*Borya constricta*
	Borya sphaerocephala
Caesalpiniaceae	*Senna artemisioides*
Casuarinaceae	*Allocasuarina acutivalvis*
	Allocasuarina campestris
	Allocasuarina corniculata
Chenopodiaceae	*Maireana triptera*
	Rhagodia drummondii
	Sclerolaena diacantha
	Sclerolaena drummondii
Cupressaceae	*Callitris canescens*
Cyperaceae	*Chrysitrix distigmatosa*
	Lepidosperma sp.1
	Mesomelaena preissii
	Schoenus calcatus
	Schoenus hexandrus
Dilleniaceae	*Hibbertia arcuata*
	Hibbertia glomerosa
Ecdeiocoleaceae	*Ecdeiocelea monostachya*
Epacridaceae	*Astroloma serratifolium*
Euphorbiaceae	*Beyeria* sp.1
	Calycopeplus pauciflorus
Mimosaceae	*Acacia acuminata*
	Acacia coolgardiensis subsp. *coolgardiensis*
	Acacia erinacea
	Acacia hemiteles
	Acacia jibberdingensis
	Acacia lasiocalyx
	Acacia mackeyana
	Acacia resinomarginea
	Acacia sphacelata
	Acacia stereophylla subsp. *stereophylla*
	Acacia tetragonophylla
Myoporaceae	*Eremophila deserti*
	Eremophila drummondii
	Eremophila gilesii subsp. *variabilis*
	Eremophila sp.1
Myrtaceae	*Baeckea crassifolia*
	Baeckea muricata
	Baeckea sp.1
	Calothamnus asper
	Calothamnus gilesii
	Calytrix brevifolia

Family	**Species Name**
Myrtaceae (cont.)	*Calytrix leschenaultii*
	Chamelaucium pauciflorum subsp. *thryptomeniodes*
	Eucalyptus celastroides
	Eucalyptus hypochlamydea subsp. *hypochlamydea*
	Eucalyptus kochii subsp. *plenissima*
	Eucalyptus leptopoda subsp. *subulata*
	Eucalyptus loxophleba subsp. *supralaevis*
	Eucalyptus oldfieldii
	Eucalyptus salmonophloia
	Eucalyptus sheathiana
	Eucalyptus sp.1
	Eucalyptus subangusta subsp. *subangusta*
	Eucalyptus subangusta subsp. *virescens*
	Melaleuca acuminata subsp. *acuminata*
	Melaleuca conothamnoides
	Melaleuca cordata
	Melaleuca eleuterostachya
	Melaleuca laxiflora
	Melaleuca leptospermoides
	Melaleuca radula
	Melaleuca uncinata
	Micromyrtus racemosa
	Myrtaceous sp.1
Papilionaceae	*Mirbelia trichocalyx*
Phormiaceae	*Dianella revoluta*
	Stypandra glauca
Pittosporaceae	*Pittosporum phylliraeoides*
Poaceae	*Aristida contorta*
	Austrodanthonia sp.1
	Avena sp.1
	Poaceae sp.1
	Spartochloa scirpoidea
Proteaceae	*Grevillea acuaria*
	Grevillea paniculata
	Grevillea paradoxa
	Grevillea yorkrakinensis
	Hakea erecta
	Hakea francisiana
	Hakea recurva
	Hakea scoparia
	Petrophile incurvata
Restionaceae	*Lepidobolus preissianus*
Rhamnaceae	*Cryptandra minutifolia*
	Cryptandra nutans
Rubiaceae	*Opercularia spermacocea*
Rutaceae	*Phebalium* sp.1
Santalaceae	*Santalum lanceolatum*
	Santalum spicatum
Sapindaceae	*Dodonaea inaequifolia*
Solanaceae	*Solanum oldfieldii*

Family	**Species Name**
Thymelaeaceae	*Pimelea* sp.1
Xanthorrhoeaceae	*Xanthorrhoea nana*
Unknown	Unknown sp.4 –6

APPENDIX FIVE: VEGETATION ASSOCIATIONS

Quadrat	Brief Vegetation Description
MM0001	Extremely tall mallee woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0002	Mallee woodland of *Eucalyptus oldfieldii*
MM0003	Very tall mallee shrubland of *Allocasuarina acutivalvis, Acacia stereophylla* subsp. *stereophylla* and *Hakea scoparia*
MM0004	Tall open shrubland of *Calcyopeplus pauciflorus, Allocasuarina campestris* and *Grevillea paradoxa*
MM0005	Low open forest of *Allocasuarina campestris, Acacia coolgardiensis* susbp. *coolgardiensis* and *Acacia acuminata* with emergent *Eucalyptus loxophleba* subsp. *supralaevis*
MM0006	Very tall open mallee forest of *Eucalyptus celastroides*
MM0007	Tall open shrubland dominated by *Allocasuarina corniculata* with *Melaleuca uncinata, Hakea scoparia* and *Melaleuca acuminata* subsp. *acuminata*
MM0008	Tall open shrubland of *Melaleuca acuminata* subsp. *acuminata, M. uncinata, Acacia acuminata, Hakea scoparia, Allocasuarina campestris* and *Allocasuarina acutivalvis* with emergent low trees of *Allocasuarina acutivalvis* and emergent very tall mallee trees of *Eucalyptus subangusta* subsp. *subangusta*
MM0009	Extremely tall open mallee forest of *Eucalyptus subangusta* subsp. *subangusta, E. loxophleba* subsp. *supralaevis* and *E. kochii* subsp. *plenissima*
MM0010	Tall open shrubland of *Allocasuarina campestris, Calothamnus asper, Melaleuca uncinata* and *Acacia jibberdingensis*
MM0011	Tall open forest of *Eucalyptus salmonophloia* over extremely tall mallee woodland of *E. loxophleba* subsp. *supralaevis*
MM0012	Very tall open shrubland of *Acacia acuminata* and *Acacia lasiocalyx* over low open shrubland of *Xanthorrhoea nana*
MM0013	Mid-high woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0014	Tall sparse shrubland of *Allocasuarina campestris, Acacia hemiteles, Melaleuca uncinata and Hakea erecta* with very sparse emergent mallee *Eucalyptus hypochlamaedea* subsp. *hypochlamaedea*
MM0015	Tall woodland of *Eucalyptus salmonophloia, E. salubris, E. loxophleba* subsp.*supralaevis* and *E. longicornis*
MM0016	Low woodland of *Acacia acuminata* with very sparse emergent *Pittosporum phylliraeoides*
MM0017	Tall open shrubland of *Acacia coolgardiensis* subsp. *coolgardiensis, Calothamnus gilesii, Calycopeplus pauciflorus, Allocasuarina campestris, Grevillea paniculata* and *Melaleuca conothamnoides*
MM0018	Extremely tall mallee woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0019	Tall open shrubland of *Acacia coolgardiensis* subsp. *coolgardiensis, Calothamnus gilesii, Calycopeplus pauciflorus, Allocasuarina campestris, Grevillea paniculata* and *Melaleuca conothamnoides*
MM0020	Extremely tall closed mallee forest of *Eucalyptus sheathiana*
MM0021	Tall open shrubland of *Calcyopeplus pauciflorus, Allocasuarina campestris* and *Grevillea paradoxa*
MM0022	Mid-high woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0023	Tall open shrubland of *Melaleuca eleuterostachya, Santalum spicatum, Acacia acuminata, M. uncinata* and *A. tetragonophylla*
MM0024	Tall sparse shrubland of *Allocasuarina campestris, Acacia hemiteles, Melaleuca uncinata and Hakea erecta* with very sparse emergent mallee *Eucalyptus hypochlamaedea* subsp. *hypochlamaedea*
MM0025	Tall open shrubland of *Allocasuarina campestris, Calothamnus asper, Melaleuca uncinata* and *Acacia jibberdingensis*
MM0026	Tall shrubland dominated by *Allocasuarina corniculata* and *Acacia stereophylla* subsp. *stereophylla*
MM0027	Mallee woodland of *Eucalyptus oldfieldii*
MM0028	Extremely tall mallee woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0029	Extremely tall open mallee forest of *Eucalyptus subangusta* subsp. *subangusta, E. loxophleba* subsp. *supralaevis* and *E. kochii* subsp. *plenissima*
MM0030	Very tall open shrubland dominated by *Callitris canscens* and *Allocasuarina acutivalvis* with *Allocasuarina campestris* over tall shrubland of *Melaleuca uncinata, Phebalium* sp., *Grevillea paradoxa, Acacia sphacelata, Mycromyrtus racemosa* and *Astroloma serratifolium*
MM0031	Extremely tall open mallee forest of *Eucalyptus subangusta* subsp. *subangusta, E. loxophleba* subsp. *supralaevis* and *E. kochii* subsp. *plenissima*
MM0032	Very tall open shrubland dominated by *Callitris canscens* and *Allocasuarina acutivalvis* with *Allocasuarina campestris* over tall shrubland of *Melaleuca uncinata, Phebalium* sp., *Grevillea paradoxa, Acacia sphacelata, Mycromyrtus racemosa* and *Astroloma serratifolium.*
MM0033#	Degraded vegetation

Quadrat	Brief Vegetation Description
MM0034#	Chenopod shrubland of *Halosarcia pergranulata* subsp. *pergranulata*, *Halosarcia halocnemoides* subsp *halocnemoides* and *Maireana* sp.
MM0035#	Tall shrubland of *Melaleuca acuminata* subsp. *acuminata*, *M. uncinata*, Mrytaceae sp., *Acacia* sp. and *Acacia acuminata* shrubland
MM0036#	Closed shrubland of *Melaleuca* species and *Acacia* species.
MM0037#	Open shrubland of *Acacia* species
MM0038#	Shrubland of *Allocasuarina campestris*, *Calothamnus asper*, *Allocasuarina acutivalvis*, and *Acacia acuminata* with scattered emergent *Eucalyptus loxophleba* subsp. *supralaevis*
MM0039#	Woodland of *Eucalyptus calycogona* subsp. *calycogona*, *E. kochii* subsp. *plenissima*, *E. loxophleba* subsp. *supralaevis*, *E. myriadena*, *E. salubris* and *Eucalyptus* sp.
MM0040#	Open woodland of *Eucalyptus transcontinentalis*
MM0041#	Low woodland of *Allocasuarina acutivalvis*
MM0042#	Low woodland of *Callitris canescens*.
MM0043#	Woodland of *Eucalyptus subangusta* subsp. *subangusta* and *E. eremophila* subsp. *eremophila*
MM0044#	Open woodland *Eucalyptus capillosa* subsp. *capillosa*
MM0045#	Tall open forest of *Eucalyptus loxophleba* subsp. *supralaevis* and *E. salubris*.
MM0046#	Open woodland of *Eucalyptus loxophleba* subsp. *supralaevis*
MM0047#	Open woodland of *Eucalyptus loxophleba* subsp. *supralaevis*, *E. kochii* subsp. *plenissima* and *Eualyptus* sp.
MM0048#	Open woodland of *Eucalyptus loxophleba* subsp. *supralaevis*, *E. transcontinentalis* and *Eucalyptus* sp.
MM0049#	Lithic Complex

Note: # = nominal quadrat (not surveyed)

APPENDIX SIX: HERITAGE SITE ASSESSMENT SHEETS

Sheet 1

sheet 2

sheet 3

sheet 4

sheet 5

SECTION TWO: RESERVE AND QUADRAT DESCRIPTIONS

Reserve Name:	Waircubbing Nature Reserve	**Purpose:**	Conservation of Flora	
Reserve #:	12689	**Area:** 73 ha	**Perimeter:** 3,408 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741586
Location:	14805	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 52.8% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 47.2%

Fauna: Australian Ringneck, Galah

Water Resources: Natural drainage line, dam

Weed Cover:

Area <20%:	0.0%	**Area 50-80%:**	15.8%
Area 20-50%:	0.0%	**Area >80%:**	84.2%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 77.7% **Utility/transport:** 22.3%

Grazing Pressure: Severe

Access: Unsealed external, no internal

Degraded Vegetation:
Decline/stress of overstorey due to unknown factors, bare ground due to fire, death/loss of overstorey and understorey due to salinity related to rising watertable.

Comments:
No quadrats in this Reserve.

Map 1: Reserve 12689

Map 2: Reserve 12689

Map 3: Reserve 12689

Reserve Name:		**Purpose:**	Water	
Reserve #:	12690	**Area:** 62 ha	**Perimeter:** 4,113 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		1000960 & 742308
Location:	14814	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 47.2% **Fence in Poor Condition:** 16.9% **Fence in Good Condition:** 36.0%

Fauna: European Rabbit, Australian Ringneck, Galah, Western Bearded Dragon

Water Resources: Natural drainage line

Weed Cover:

Area <20%:	26.8%	**Area 50-80%:**	15.4%
Area 20-50%:	37.6%	**Area >80%:**	20.3%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 6.1% **Utility/transport:** 32.4%

Remnant Vegetation: 61.5%

Grazing Pressure: Light

Access: Unsealed external, no internal

Degraded Vegetation:
Unknown factors contributing to degraded vegetation.

Comments:
Nearby to Reserves 19513 and 22082 and Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963).
One quadrat in this Reserve

Reserve 12690

Quadrat MM0021

Tall shrubland of *Calcyopeplus pauciflorus* and *Allocasuarina campestris* over tall shrubland of *Grevillea paradoxa* and tall heathland of *Astroloma serratifolium*, over open heathland of low *Calytrix brevifolia* and dwarf *Borya sphaeorocephala* and low open shrubland of *Hibbertia glomerosa*, on red brown non-cracking clay.

Map 1: Reserve 12690

Map 2: Reserve 12690

Map 3: Reserve 12690

Reserve Name:		**Purpose:**	Water	
Reserve #:	19513	**Area:** 2 ha	**Perimeter:** 606 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		742305
Location:	14386	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 100.0% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 0.0%				
Fauna: Galah, Crested Pigeon, European Rabbit, Australian Ringneck, unidentified frogs.				
Water Resources: Natural drainage line				
Weed Cover: **Area <20%:** 0.0% **Area 50-80%:** 0.0% **Area 20-50%:** 88.9% **Area >80%:** 11.1%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 85.0% **Utility/transport:** 15.0%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation: Not degraded				
Comments: Nearby to Reserves 12690 and 22082 and Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963). No quadrats in this Reserve.				

Reserve Name:		**Purpose:**	Water & Fauna	
Reserve #:	22082, Vacant Crown Land 2 and Vacant Crown Land 3	**Area:** 263 ha	**Perimeter:** 6,625 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**	1000866, 1108391, 742318, 1000962 & 1000963	
Location:	14386,	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 65% **Fence in Poor Condition:** 0% **Fence in Good Condition:** 35%

Fauna: Crested Pigeon, European Rabbit, Australian Ringneck, Galah, Western Bearded Dragon, unidentified frogs

Water Resources: Natural drainage line

Weed Cover:

Area <20%:	3.4%	**Area 50-80%:**	0%
Area 20-50%:	95.7%	**Area >80%:**	0.9%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 57% **Utility/transport:** 41.7%
Remnant Vegetation: 3.7%

Grazing Pressure: None to Light to Moderate

Access: Unsealed external, some 4WD internal

Degraded Vegetation:
Some areas, not degraded, other areas unknown factors contributing to degraded vegetation, other areas death/loss of overstorey due to salinity related to drain discharge, and other degradation from unknown causes,

Comments:
Four quadrats in Reserve 22082

Reserve Name:		**Purpose:**	Fauna	
Reserve #:	22082	**Area:** 175 ha	**Perimeter:** 8,648.4 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		1000866, 1108391 & 742318
Location:	14386	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 62.3% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 37.7%				
Fauna: Galah, Crested Pigeon, European Rabbit, Australian Ringneck, unidentified frogs.				
Water Resources: Natural drainage line				
Weed Cover: **Area <20%:** 63.0% **Area 50-80%:** 0.0% **Area 20-50%:** 35.4% **Area >80%:** 1.5%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 22.3% **Utility/transport:** 55.9% **Remnant Vegetation:** 21.8%				
Grazing Pressure: Moderate				
Access: Unsealed external, 4WD internal				
Degraded Vegetation: Death/loss of overstorey due to salinity related to drain discharge, and other degradation from unknown causes.				
Comments: Contiguous with Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963). 4 quadrats in this Reserve.				

Reserve 22082

Quadrat MM0017

Open shrubland of very tall *Calothamnus gilesii* and *Allocasuarina campestris* and tall *Acacia coolgardiensis* subsp. *coolgardiensis* and *Calycopeplu pauciflorus*, over dwarf heathland of *Borya sphaerocephala*, over tall open sedgeland of *Lepidosperma* sp.1 and tall open grassland of *Spartochloa scirpoidea*, on yellow brown shallow sand.

Quadrat MM0018

Extremely tall mallee woodland of *Eucalyptus loxophleba* subsp. *supralaevis* over very tall open mallee forest of *Santalum lanceolatum* and low open forest of *Acacia acuminata* and shrubland of very tall *Hakea recurva* and *Melaleuca uncinata*, and tall *Pittosporum phylliraeoides*, over heathland of low *Calytrix brevifolia* and dwarf *Borya sphaerocephala*, on brown sandy earth.

Reserve 22082 (cont.)

Quadrat MM0019

Very tall shrubland of *Allocasuarina campestris*, over tall open shrubland of *Grevillea paniculata* and *Calothamnus gilesii* and *Melaleuca conothamnoides*, over low open shrubland of *Hibbertia glomerosa*, over tall rushland of *Ecdeiocelea monostachya* and of tall grassland of *Spartochloa scirpoidea*, on brown deep sand.

Quadrat MM0020

Extremely tall closed mallee forest of *Eucalyptus sheathiana* over open shrubland of mid-high *Acacia mackeyana* and low *Olearia muelleria* and dwarf open chenopod shrubland *of Mairearia triptera*, on yellow brown shallow sandy duplex.

Reserve Name:		**Purpose:**		
Reserve #:	Vacant Crown Land 2	**Area:** 10 ha	**Perimeter:** 1,623 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		1000962
Location:		**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 41.8% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 58.2%				
Fauna: Galah, Crested Pigeon, European Rabbit, Australian Ringneck, unidentified frogs.				
Water Resources:				
Weed Cover: **Area <20%:** 0.0% **Area 50-80%:** 0.0% **Area 20-50%:** 100.0% **Area >80%:** 0.0%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 58.3% **Utility/transport:** 41.7%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation:				
Comments: Contiguous with Reserve 22082 and Vacant Crown Land 3 (PIN: 1000963). No quadrats in this Reserve.				

Reserve Name:		**Purpose:**		
Reserve #:	Vacant Crown Land 3	**Area:** 14 ha	**Perimeter:** 1,714 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		1000963
Location:		**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 100.0% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 0.0%				
Fauna: Galah, Crested Pigeon, European Rabbit, Australian Ringneck, unidentified frogs.				
Water Resources:				
Weed Cover: **Area <20%:** 28.8% **Area 50-80%:** 0.0% **Area 20-50%:** 71.2% **Area >80%:** 0.0%				
Adjacent Land Use (% of Reserve Perimeter): **Remnant Vegetation:** 29.5% **Utility/transport:** 70.5%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation:				
Comments: Contiguous with Reserve 22082 and Vacant Crown Land 2 (PIN: 1000962). No quadrats in this Reserve.				

Map 1: Reserves 22082 and 19513 and Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963).

Map 2: Reserves 22082 and 19513 and Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963).

Map 3: Reserves 22082 and 19513 and Vacant Crown Lands 2 (PIN: 1000962) and 3 (PIN: 1000963).

Reserve Name:		**Purpose:**	Water
Reserve #:	17924 & Vacant Crown Land 1	**Area:** 167 ha	**Perimeter:** 5,188 m
Shire:	Mount Marshall	**Polygon Identification Number(s):**	741180 & 741143
Location:	4303 & 3405	**CALM District:** Merredin	**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 44.9% **Fence in Poor Condition:** 27.7% **Fence in Good Condition:** 27.4%

Fauna: Western Bearded Dragon, European Red Fox, Australian Raven, Pied Butcherbird, European Rabbit, Australian Ringneck, Mallee Fowl, unidentified frogs.

Water Resources: Natural drainage line, dam

Weed Cover:

Area <20%:	60.0%	**Area 50-80%:**	11.0%
Area 20-50%:	27.3%	**Area >80%:**	1.7%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 54.1% **Utility/transport:** 17.6%
Remnant Vegetation: 28.3%

Grazing Pressure: None

Access: Unsealed external, no internal

Degraded Vegetation:

Comments:
Contiguous with Vacant Crown Land 1 (PIN: 741143).
4 quadrats in Reserve Vacant Crown Land 1

Reserve Name:		**Purpose:**	Water	
Reserve #:	17924	**Area:** 16 ha	**Perimeter:** 1,602 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741180
Location:	4303	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 75.9% **Fence in Poor Condition:** 24.1% **Fence in Good Condition:** 0.0%				
Fauna: Western Bearded Dragon, European Red Fox, Australian Raven, Pied Butcherbird, European Rabbit, Australian Ringneck, unidentified frogs.				
Water Resources: Natural drainage line, dam				
Weed Cover: See weed cover classes for Vacant Crown Land 1 (PIN: 741143) – contiguous with this Reserve.				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 24.3% **Remnant Vegetation:** 75.7%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation:				
Comments: Contiguous with Vacant Crown Land 1 (PIN: 741143). No quadrats in this Reserve.				

Reserve Name:		**Purpose:**		
Reserve #:	Vacant Crown Land 1	**Area:** 151 ha	**Perimeter:** 5,185 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741143
Location:	3405	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 32.1% **Fence in Poor Condition:** 34.1% **Fence in Good Condition:** 33.9%				
Fauna: Western Bearded Dragon, European Red Fox, Australian Raven, Pied Butcherbird, European Rabbit, Australian Ringneck, Mallee Fowl, unidentified frogs.				
Water Resources: Natural drainage line				
Weed Cover: Note that weed cover areas are for the combined areas of Reserves 17294 and Vacant Crown Land 1 (PIN 741143). **Area <20%:** 60.0% **Area 50-80%:** 11.0% **Area 20-50%:** 27.3% **Area >80%:** 1.7%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 63.2% **Utility/transport:** 23.0% **Remnant Vegetation:** 13.7%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation:				
Comments: Contiguous with Reserve 17924. 4 quadrats in this Reserve.				

Reserve Vacant Crown Land 1 (PIN: 741143)

Quadrat MM0007

Tall shrubland dominated by *Allocasuarina corniculata* with *Melaleuca uncinata*, *Hakea scoparia* and *Melaleuca acuminata* subsp. *acuminata* over low sparse shrubland of *Petrophile incurvata*, over shrubland of low *Baeckea muricata*, *Grevillea yorkrakinensis* and *Hibbertia arcuata* and dwarf *Platysace trachymenoides*, over mid-high sedgeland of *Lepidosperma* sp.1, on yellow deep sand.

Quadrat MM0008

Low open forest of *Acacia acuminata* and shrubland of tall *Melaleuca acuminata* subsp. *acuminata*, *Melaleuca uncinata*, *Hakea scoparia* and very tall Myrtaceous sp.1, with emergent very tall mallee trees of *Eucalyptus subangusta* subsp. *subangusta* and low trees of *Allocasuarina acutivalvis*, over tall sparse shrubland of Myrtaceous sp.2, over tall open shrubland of *Grevillea yorkrakinensis* and dwarf open heath of *Borya sphaerocephala*, over mid-high grassland of *Austrodanthonia* sp. and tall rushland *Ecdeiocolea monostachya*, on yellow deep sand.

Reserve Vacant Crown Land 1 (PIN: 741143) (cont.)

Quadrat MM0009

Extremely tall open mallee forest of *Eucalyptus loxophleba* subsp. *supralaevis* and *E. kochii* subsp. *plenissima* and low open forest of *Acacia acuminata*, over open shrubland of tall *Senna artemisioides* and mid-high *Olearia dampieri* subsp. *eremicola*, over dwarf open shrubland of *Ptilotus obovatus* over mid-high grassland of *Austrodanthonia* sp.1, on brown deep sand.

Quadrat MM0010

Tall open shrubland of *Allocasuarina campestris*, *Melaleuca uncinata* and *Acacia jibberdingensis* over mid-high shrubland of *Grevillea paniculata*, and low shrubland of *Mirbelia trichocalyx* and *Lepidosperma* sp. and dwarf open shrubland of *Grevillea yorkrakinensis* and dwarf heathland of *Borya sphaerocephala*, over tall rushland of *Ecdeiocolea monostachya* and mid-high sedge of *Lepidosperma* sp. and grassland of tall *Spartochloa scirpoidea* and mid-high *Austrodanthia* sp.1, on yellow deep sand.

Map 1: Reserve 17924 and Vacant Crown Land 1 (PIN: 1000962).

Map 2: Reserve 17924 and Vacant Crown Land 1 (PIN: 1000962).

Map 3: Reserve 17924 and Vacant Crown Land 1 (PIN: 1000962).

Reserve Name:		**Purpose:**	Water & Conservation of Fauna and Flora, & Sheep Dip	
Reserve #:	39186 & 25217	**Area:** 105 ha	**Perimeter:** 4,230 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		738176, 989524 & 989519
Location:	3000 & 4048	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 35.4% **Fence in Poor Condition:** 2.2% **Fence in Good Condition:** 62.4%

Fauna: Willie Wagtail, Galah, unidentified frogs.

Water Resources: Natural drainage line, constructed drainage, tank

Weed Cover:

Area <20%:	75.8%	**Area 50-80%:**	8.3%
Area 20-50%:	15.1%	**Area >80%:**	0.9%

Adjacent Land Use (% of Reserve Perimeter):
Utility/transport: 75.3% **Remnant Vegetation:** 24.7%

Grazing Pressure: None

Access: Unsealed external, 4WD internal

Degraded Vegetation: None

Comments:
Heritage site – constructed catchment on granite outcrop, leading to tank, in Reserve 39186
2 quadrats in Reserve 39186

Reserve Name:		**Purpose:**	Water & Conservation of Fauna and Flora	
Reserve #:	39186	**Area:** 103 ha	**Perimeter:** 5,274 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		738176 & 989524
Location:	3000	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 49.4% **Fence in Poor Condition:** 1.6% **Fence in Good Condition:** 49.0%				
Fauna: Willie Wagtail, Galah, unidentified frogs.				
Water Resources: Natural drainage line, constructed drainage, tank				
Weed Cover: Note that weed cover areas are for the combined areas of Reserves 25217 and 39186. **Area <20%:** 75.8% **Area 50-80%:** 8.3% **Area 20-50%:** 15.1% **Area >80%:** 0.9%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 59.4% **Utility/transport:** 31.8% **Remnant Vegetation:** 8.8%				
Grazing Pressure: None				
Access: Unsealed external, 4WD internal				
Degraded Vegetation:				
Comments: Heritage site – constructed catchment on granite outcrop, leading to tank. Contiguous with Reserve 25217. 2 quadrats in this Reserve.				

Reserve 39186

Quadrat MM0005

Low closed forest of *Allocasuarina campestris, Acacia coolgardiensis* susbp. *coolgardiensis* and *Acacia acuminata,* over tall shrubland of *Calothamnus gilesii, Eremophila gilesii* subsp. *variabilis* and *Melaleuca radula,* over mid-high open heath of *Astroloma serratifolium,* over grassland of tall *Dianella revoluta* and mid-high *Austrodanthonia* sp.1, on brown sandy earth.

Quadrat MM0006

Very tall open mallee forest of *Eucalyptus celastroides* and tall shrubland of *Melaleuca acuminata* subsp. *acuminata,* over tall shrubland of *Acacia mackeyana,* over open chenopod shrubland of tall *Rhagodia drummondii* and low *Sclerolaena diacantha,* on red shallow sand.

Reserve Name:		**Purpose:**	Sheep Dip	
Reserve #:	25217	**Area:** 2 ha	**Perimeter:** 611 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		989519
Location:	4048	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 100.0% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 0.0%				
Fauna: Willy Wagtail, Galah, unidentified frogs.				
Water Resources: Tank				
Weed Cover: See weed cover classes for Reserve 39186 – contiguous with this Reserve.				
Adjacent Land Use (% of Reserve Perimeter): **Remnant Vegetation:** 82.7% **Utility/transport:** 17.3%				
Grazing Pressure: None				
Access: Unsealed external, 4WD internal				
Degraded Vegetation: None				
Comments: Contiguous with Reserve 39186. No quadrats in this Reserve.				

Map 1: Reserves 39186 and 25217.

Map 2: Reserves 39186 and 25217.

Map 3: Reserves 39186 and 25217.

Reserve Name:		**Purpose:**	Water	
Reserve #:	28486	**Area:** 8 ha	**Perimeter:** 5,274 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741333
Location:	4174	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 100.0% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 0.0%				
Fauna: European Rabbit				
Water Resources: Natural drainage line, natural seeps/soaks				
Weed Cover: **Area <20%:** 0.0% **Area 50-80%:** 0.0% **Area 20-50%:** 0.0% **Area >80%:** 100.0%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 92.6% **Remnant Vegetation:** 7.4%				
Grazing Pressure: None				
Access: No external, No internal				
Degraded Vegetation: Death/loss of understorey due to clearing.				
Comments: Reserve partially cleared and incorporated into adjacent farm land. 1 quadrat outside of this Reserve, later removed when Reserve boundaries identified.				

Reserve 28486

Quadrat MM0032

Low open forest of *Callitris canescens* and *Allocasuarina acutivalvis* and tall shrubland of *Acacia stereophylla* subsp. *stereophylla* and *Melaleuca uncinata* with isolated emergent trees of *Eucalyptus* sp.1 over tall shrubland of *Micromyrtus racemosa* and mid-high shrubland of *Acacia mackeyana* and *Phebalium* sp.1 over mid-high open shrubland of *Hibbertia arcuata* over mid-high open grassland of *Austrodanthonia* sp.1, on red brown non-cracking clay.

Map 1: Reserve 28486.

Map 2: Reserve 28486.

Map 3: Reserve 28486.

Reserve Name:		**Purpose:**	Water Supply Waddouring	
Reserve #:	28120	**Area:** 178 ha	**Perimeter:** 7,005 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		100851 & 1072122
Location:	28286	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 26.2% **Fence in Poor Condition:** 13.6% **Fence in Good Condition:** 60.2%

Fauna: Dugite, Ornate Dragon, Australian Ringneck, Western Grey Kangaroo, Domestic Dog, European Rabbit, European Red Fox

Water Resources: Dam, constructed drainage

Weed Cover:

Area <20%:	16.3%	**Area 50-80%:**	0.0%
Area 20-50%:	78.9%	**Area >80%:**	4.8%

Adjacent Land Use (% of Reserve Perimeter):

Cropping/grazing: 29.9%	**Revegetation:** 1.2%
Remnant Vegetation: 23.7%	**Utility/transport:** 45.2%

Grazing Pressure: None

Access: Sealed and unsealed external, 4WD internal

Degraded Vegetation:

Comments:
Priority 3 species *Schoenus calcatus* present within the Reserve.
3 quadrats in this Reserve.

Reserve 28120

Quadrat MM0013

Mid-high open forest of *Eucalyptus loxophleba* subsp. *supralaevis* over tall mallee shrubland of *Melaleuca uncinata* and tall shrubland of *Olearia dampieri* subsp. *eremicola*, over dwarf open chenopod shrubland of *Sclerolaena diacantha*, on yellow deep sand.

Quadrat MM0014

Tall sparse shrubland of *Allocasuarina campestris* over sparse shrubland of tall *Melaleuca cordata* and mid-high *Melaleuca leptospermoides*, over low shrubland of *Hibbertia arcuata* and heathland of mid-high *Cryptandra nutans*, low *Platysace trachymenoides*, and dwarf *Schoenus calcatus* and *Borya constricta*, over rushland of tall *Ecdeicolea monostachya* and low *Lepidobolus pressianus* and *Chrysitrix distigmatosa* and mid-high rushland of *Mesmolaena preissii*, on yellow deep sand.

Reserve 28120 (cont.)

Quadrat MM0027

Low open forest of *Hakea francisiana* and very tall open mallee forest of *Eucalyptus oldfieldii* and shrubland of very tall *Acacia jibberdingensis* and tall *Acacia stereophylla* subsp. *stereophylla*, over tall open shrubland of *Allocasuarina campestris* and *Hakea scoparia*, over mid-high shrubland of *Melaleuca cordata* and *Platysace trachymenoides* and heathland of mid-high *Astroloma serratifolium*, low *Calytrix leschenaultii*, and dwarf *Hibbertia arcuata* and *Borya constricta*, over rushland of tall *Ecdeiocola monostachya* and low *Schoenus hexandrus*, on yellow deep sand.

Map 1: Reserve 28120.

Map 2: Reserve 28120.

Map 3: Reserve 28120.

Reserve Name:		**Purpose:**	Water	
Reserve #:	25323	**Area:**178 ha	**Perimeter:** 5,368 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		738218
Location:	3241	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 26.6% **Fence in Poor Condition:** 20.6% **Fence in Good Condition:** 52.8%

Fauna: Wedge-tailed Eagle, Willy Wagtail, Crested Pigeon, Galah, unidentified frogs

Water Resources: Constructed drainage

Weed Cover:

Area <20%:	85.0%	**Area 50-80%:**	13.1%
Area 20-50%:	0.4%	**Area >80%:**	1.4%

Adjacent Land Use (% of Reserve Perimeter):

Cropping/grazing: 29.3%	**Revegetation:** 47.3%
Remnant Vegetation: 11.8%	**Utility/transport:** 11.6%

Grazing Pressure: None

Access: Unsealed external, 2WD internal

Degraded Vegetation: Unknown factors contributing to degraded vegetation.

Comments:
Heritage site – telegraph line.
Gravel extraction occurring within Reserve.
6 quadrats in this Reserve.

Reserve 25323

Quadrat MM0001

Extremely tall open mallee forest of *Eucalyptus loxophleba* subsp. *supralaevis* and *E. celastroides* over tall shrubland of *Acacia tetragonophylla* over mid-high shrubland of *Acacia erinacea* and low open shrubland of *Grevillea acuaria*, *Olearia muelleri*, *Ptilotus obovatus* and chenopod shrubland of low *Rhagodia drummondii* and dwarf *Scleroleana diacantha*, over sparse grassland of *Austrodanthonia* sp.1, on red brown non-cracking clay.

Quadrat MM0002

Very tall mallee woodland of *Eucalyptus oldfieldii* and *Eucalyptus leptopoda* subsp. *subulata* and low open forest of *Acacia resinomarginea*, *Acacia stereophylla* subsp *stereophylla* and *Hakea francisiana* and very tall mallee shrubland of *Melaleuca uncinata*, over tall open heath of *Hibbertia arcuata* and *Phebalium* sp.1, over tall rushland of *Ecdeiocelea monostachya*, on yellow deep sand.

Reserve 25323 (cont.)

Quadrat MM0003

Very tall mallee shrubland of *Allocasuarina acutivalvis, Acacia stereophylla* subsp. *stereophylla* and *Hakea scoparia* over tall malleee shrubland of *Baeckea* sp.1 and tall shrubland of *Grevillea paradoxa,* over tall heathland of *Hibbertia arcuata,* over tall rushland of *Ecdeiocelea monostachya* and mid-high grassland of *Austrodanthonia* sp.1, on yellow brown shallow sand.

Quadrat MM0004

Open mallee forest of very tall *Acacia acuminata* and tall *Calycopeplus paucifolius, Allocasuarina campestris* and *Melaleuca radula,* over dwarf open heath of *Borya sphaerocephala* and *Solanum oldfieldii* over tall forbland of *Opercularia spermacacea,* on yellow brown shallow sand.

Reserve 25323 (cont.)

Quadrat MM0026

Open shrubland dominated by very tall *Allocasuarina acutivalvis* with tall *Acacia stereophylla* subsp. *stereophylla* and *Acacia jibberdingensis*, over tall shrubland of *Allocasuarina corniculata* and *Chamelaucium pauciflorum* subsp. *thryptomenioides*, over tall shrubland of *Melaleuca cordata*, over low open heath of *Baeckea crassifolia*, over very tall sparse rushland of *Ecdeiocelea monostachya*, on red shallow sand.

Quadrat MM0028

Extremely tall mallee woodland of *Eucalyptus loxophleba* subsp. *supralaevis* and low open forest of *Acacia acuminata*, over tall shrubland of *Dodonaea inaequifolia* and *Melaleuca radula*, over tall shrubland of *Eremophila* sp.1, over open shrubland of mid-high *Olearia muelleri* and low *Ptilotus obovatus* and dwarf open chenopod shrubland of *Sclerolaena diacantha*, over sparse mid-high grassland of *Austrodanthonia* sp.1, on yellow deep sand.

Map 1: Reserve 25323.

Map 2: Reserve 25323.

Map 3: Reserve 25323.

Reserve Name:		**Purpose:**	Water and Camping	
Reserve #:	13509	**Area:** 135 ha	**Perimeter:** 3,874 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741479
Location:	14281	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 100.0% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 0.0%

Fauna: Western Grey Kangaroo, Australian Raven, Crested Pigeon, European Rabbit.

Water Resources: Dam

Weed Cover:

Area <20%:	87.1%	**Area 50-80%:**	0.0%
Area 20-50%:	12.9%	**Area >80%:**	0.0%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 66.0% **Utility/transport:** 27.1%
Remnant Vegetation: 7.0%

Grazing Pressure: None

Access: Unsealed external, 2WD & 4WD internal

Degraded Vegetation: None

Comments:
Camping and fishing activities noted within Reserve.
Isolated trees of Sandalwood in this Reserve
2 quadrats in this Reserve.

Reserve 13509

Quadrat MM0015

Tall open woodland of *Eucalyptus salmonophloia* over mid-high open forest of *E. loxophleba* subsp. *supralaevis*, over tall open shrubland of unknown sp.2, over mid-high shrubland of *Acacia erinaceae* and unknown sp.1 and chenopod shrubland of low *Rhagodia drummondii* and dwarf *Sclerolaena diacantha*, on red brown non-cracking clay.

Quadrat MM0016

Low woodland of *Acacia acuminata* and open shrubland of very tall *Hakea recurva* and tall *Acacia tetragonophylla* with tall isolated emergent trees of *Pittosporum phylliraeoides*, over grassland of very tall *Dianella revoluta* and mid-high *Avena* sp. and mid-high forbland of *Ptilotus polystachus*, on brown loamy earth.

Map 1: Reserve 13509.

Map 2: Reserve 13509.

Map 3: Reserve 13509.

Reserve Name:		**Purpose:**	Water Supply	
Reserve #:	14642	**Area:** 40 ha	**Perimeter:** 2537 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741385
Location:	1353	**CALM District:** Merredin		**#:** 33

Fence Condition (% of Reserve Perimeter):
No Fence: 19.4% **Fence in Poor Condition:** 30.5% **Fence in Good Condition:** 50.1%

Fauna: Australian Ringneck, Galah, Striated Pardalote, Brown Falcon, Western Grey Kangaroo, Domestic Cat, European Red Fox, European Rabbit, Crested Pigeon, unidentified frogs.

Water Resources: Natural drainage line, dam

Weed Cover:

Area <20%:	20.3%	**Area 50-80%:**	12.2%
Area 20-50%:	54.4%	**Area >80%:**	13.1%

Adjacent Land Use (% of Reserve Perimeter):
Cropping/grazing: 66.6% **Utility/transport:** 19.5%
Remnant Vegetation: 13.9%

Grazing Pressure: Moderate

Access: Unsealed external, no internal

Degraded Vegetation: Unknown factors contributing to death/loss of overstorey

Comments:
Heritage site - dam.
Scattered Sandalwood in this Reserve.
2 quadrats in this Reserve.

Reserve 14642

Quadrat MM0022

Mid-high open forest of *Eucalyptus loxophleba* subsp. *supralaevis* over mid-high sparse shrubland of *Acacia erinaceae*, over dwarf open chenopod shrubland of *Scleroleana diacantha* and *Scleroleana drummondii*, on red brown non-cracking clay.

Quadrat MM0023

Tall open forest of *Acacia acuminata* and shrubland of very tall *Melaleuca eleuterostachya* and tall *Santalum spicatum*, over tall shrubalnd of *Melaleuca uncinata* and *Acacia tetragonophylla*, over dwarf open chenopod shrubland of *Scleroleana diacantha*, over grassland of tall *Dianella revoluta* and mid-high *Austrodanthonia* sp.1, on red brown non-cracking clay.

Map 1: Reserve 14642.

Map 2: Reserve 14642.

Map 3: Reserve 14642.

Reserve Name:		**Purpose:**	Water	
Reserve #:	15437	**Area:** 20 ha	**Perimeter:** 1850 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		741434
Location:	1596	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 50.1% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 49.9%				
Fauna: Australian Ringneck, European Rabbit, Australian Raven, Galah, Yellow-throated Miner				
Water Resources: Natural drainage line, tank				
Weed Cover: **Area <20%:** 8.5% **Area 50-80%:** 0.0% **Area 20-50%:** 59.0% **Area >80%:** 32.5%				
Adjacent Land Use (% of Reserve Perimeter): **Remnant Vegetation:** 77.7% **Utility/transport:** 22.3%				
Grazing Pressure: Severe				
Access: Unsealed external, 2WD internal				
Degraded Vegetation: Death/loss of overstorey due to clearing				
Comments: No quadrats in this Reserve.				

Map 1: Reserve 15437.

Map 2: Reserve 15437.

Map 3: Reserve 15437.

Reserve Name:		**Purpose:**	Water	
Reserve #:	16423	**Area:** 5 ha	**Perimeter:** 1131 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		738583
Location:	20430	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 0.0% **Fence in Poor Condition:** 28.2% **Fence in Good Condition:** 71.8%				
Fauna: Australian Ringneck, Galah, European Rabbit				
Water Resources: Bore/well				
Weed Cover: **Area <20%:** 78.8% **Area 50-80%:** 20.7% **Area 20-50%:** 0.0% **Area >80%:** 0.4%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 78.2% **Utility/transport:** 21.8%				
Grazing Pressure: None				
Access: Unsealed external, no internal				
Degraded Vegetation: Unknown factors contributing to degradation of vegetation.				
Comments: Heritage site – well. 1 quadrat in this Reserve.				

Reserve 16423

Quadrat MM0024

Open shrubland of very tall *Allocasuarina campestris* and tall *Acacia hemiteles* and *Melaleuca uncinata* with very isolated emergent mallee trees of *Eucalyptus hypochlamaedea* subsp. *hypochlamaedea*, over tall open shrubland of *Hakea erecta* and unknown sp.3, over dwarf open heath of *Borya sphaerocephala*, over tall rushland of *Ecdeiocelea monostachya* and grassland of tall *Dianella revoluta* and mid-high *Austrodanthonia* sp.1, on yellow brown deep sandy duplex.

Map 1: Reserve 16423.

Map 2: Reserve 16423.

Map 3: Reserve 16423.

Reserve Name:		**Purpose:**	Water and Conservation of Flora & Fauna	
Reserve #:	20529	**Area:** 547 ha	**Perimeter:** 9,338 m	
Shire:	Mount Marshall	**Polygon Identification Number(s):**		742131
Location:	4255	**CALM District:** Merredin		**#:** 33
Fence Condition (% of Reserve Perimeter): **No Fence:** 49.7% **Fence in Poor Condition:** 0.0% **Fence in Good Condition:** 50.3%				
Fauna: Emu, European Rabbit, Galah, Australian Raven, Crested Pigeon, Magpie Lark, Wedge-tailed Eagle, Short-beaked Echidna				
Water Resources: Natural drainage line, bore/well				
Weed Cover: **Area <20%:** 46.0% **Area 50-80%:** 5.0% **Area 20-50%:** 49.0% **Area >80%:** 0.0%				
Adjacent Land Use (% of Reserve Perimeter): **Cropping/grazing:** 24.2% **Utility/transport:** 44.3% **Remnant Vegetation:** 31.5%				
Grazing Pressure: None				
Access: Sealed and unsealed external, 4WD internal				
Degraded Vegetation: Unknown factors contributing to degradation of vegetation.				
Comments: Isolated sandalwood present within the Reserve. Camping activities noted within the Reserve. Heritage site – well. 6 quadrats in this Reserve.				

Reserve 20529

Quadrat MM0011

Tall open forest of *Eucalyptus salmonophloia* and extremely open mallee forest of *E. loxophleba* subsp. *supralaevis*, over tall sparse shrubland of unknown sp. 5, over open shrubland of mid-high *Acacia erinaceae* and low *Eremophila drummondii* and unknown sp.4, over sparse grassland of tall *Dianella revoluta* and low *Austrodanthonia* sp.1, on brown sandy earth.

Quadrat MM0012

Low open forest of *Acacia acuminata* and very tall shrubland of *A. lasiocalyx*, over low open shrubland of *Solanum oldfieldii* and extremely tall plants of *Xanthorrhoea nana*, over very tall sedgeland of *Lepidosperma* sp.1 and grassland of tall *Dianella revoluta* and low Poaceae sp.1, on brown sandy earth.

Reserve 20529 (cont.)

Quadrat MM0025

Tall open shrubland of *Allocasuarina campestris, Calothamnus asper* and *Melaleuca uncinata*, over tall open shrubland of *Acacia jibberdingensis* and mid-high open heathland of *Acanthocarpus* sp.1, over dwarf open heath of *Borya constricta*, over open grassland of very tall *Spartochloa scirpoidea* and mid-high *Austrodanthonia* sp.1, on yellow brown shallow sand.

Quadrat MM0029

Extremely tall closed mallee forest of *Eucalyptus subangusta* subsp. *subangusta* and *E. loxophleba* subsp. *supralaevis*, over tall shrubland of *Dodonaea inaequifolia*, *Acacia mackeyana* and *Acacia hemiteles* and sparse *Melaleuca acuminata* subsp. *acuminata*, over mid-high open shrubland of *Acacia erinaceae*, over dwarf open chenopod shrubland of *Sclerolaena diacantha*, on red brown non-cracking clay.

Reserve 20529 (cont.)

Quadrat MM0030

Low open forest of *Callitris canscens* and *Allocasuarina acutivalvis* and dwarf *Allocasuarina campestris*, over tall mallee shrubland of *Melaleuca uncinata* and shrubland of *Mycromyrtus racemosa*, over tall shrubland of *Phebalium* sp.1, *Grevillea paradoxa* and *Acacia sphacelata*, over low open shrubland of *Astroloma serratifolium* over mid-high open grassland of *Spartochloa scirpoidea*, on grey non-cracking clay.

Quadrat MM0031

Very tall mallee forest of *Eucalyptus subangusta* subsp. *subangusta* and low open forest of *Acacia acuminata* and *Allocasuarina acutivalvis*, over tall open shrubland of *Allocasuarina campestris*, over tall open shrubland of *Hakea scoparia*, *Olearia dampieri* subsp. *eremicola*, *Acacia hemiteles* and unknown sp.6, over mid-high open shrubland of *Cryptandra minutifolia* and *Phebalium* sp.1, over mid-high grassland of *Austrodanthonia* sp.1, on red deep sand.

Map 1: Reserve 20529.

Map 2: Reserve 20529.

Map 3: Reserve 20529.