



**THE VEGETATION AND FLORA OF BUSHLAND
ON THE
TONKINS' PROPERTY, 'BORONIA GULLY', COLLIE**

Shire of Collie



by

**Sandra Santich
and**

Volunteers of the Bushland Plant Survey Project

**Wildflower Society of Western Australia (Inc)
PO Box 64 Nedlands WA 6909**

581.
9
(9412)
COL

2002



This project was supported by funds from the Bushcare Program of the Natural Heritage Trust (2000-01). Additional support was also provided by the Western Australian Department of Conservation and Land Management.

TABLE OF CONTENTS

1. INTRODUCTION	2
2. THE STUDY AREA	3
2.1 Location	3
2.2 Climate	3
2.3 Geomorphology and Soils	3
2.4 Vegetation and Flora	4
3. SURVEY METHOD	6
4. VEGETATION: PLANT COMMUNITIES AND VEGETATION MAP	8
4.1 Vegetation	8
4.2 Flora	18
4.3 Declared Rare and Priority Flora	18
4.4 Significant Species	19
4.5 Other Significant Features	19
4.6 Vegetation Condition	19
5. DISCUSSION	22
5.1 Vegetation	22
5.2 Flora	22
5.3 Conservation Values	23
5.4 Management Issues	24
5.4.1 Weeds	24
5.4.2 Grazing	26
6. CONCLUSION	27
7. ACKNOWLEDGEMENTS	28
8. REFERENCES	29
APPENDIX 1 – VEGETATION STRUCTURE CLASSIFICATION SCHEME AND VEGETATION CONDITION SCALE	31
APPENDIX 2 – QUADRAT DESCRIPTIONS ARRANGED BY MAPPED PLANT COMMUNITY	33
APPENDIX 3 - SPECIES LIST FOR BORONIA GULLY BUSHLAND	39
APPENDIX 4 – ORCHID SPECIES RECORDED BY THE TONKIN FAMILY IN BORONIA GULLY	53

Front cover: The creekline at Boronia Gully, showing the sedges and other wetland species, including the spectacular Velvet Rush (*Meeboldina scariosa*) flowering in the foreground. (Photograph by Greg Keighery, October 2000)

This report is to be cited as follows:

Santich, S. and Volunteers from the Bushland Plant Survey Project (2002). The Vegetation and Flora of Bushland on the Tonkins' Property, 'Boronia Gully', Collie. Wildflower Society of Western Australia (Inc.), Nedlands

1. Introduction

Western Australia has unique vegetation (plant communities) and flora (individual species) with over 12,500 taxa (species, subspecies and varieties) having been recorded. The south west is especially diverse and is recognised as one of the world's 19 'megadiversity hotspots' (Shea 1998). Over 8,000 taxa occur in the south west with nearly three quarters of these being endemic, that is being found nowhere else. Knowledge of our vegetation and flora is still incomplete, and new taxa are constantly being discovered, while existing classifications are constantly being revised.

The Wildflower Society of Western Australia (Inc.) strongly believes that to protect and manage our vegetation and flora, we need to know what is present. Once it is known what is present conservation values can be determined and management priorities outlined. The Wildflower Society's Bushland Plants Survey Project is a community project that has been in existence since 1989. It has the combined objectives of learning through involvement and bushland conservation. It is based on the belief that by developing an understanding of our surroundings we are better able to value them. It aims to help community groups and individual landholders know and conserve their bushland by providing training and help to survey, document and monitor vegetation and flora. In particular it encourages the recognition of native plants and plant communities. This knowledge can then be utilised in the management and conservation of the bushland.

The subject of this report is a 60 hectare block of bushland on the property of 'Boronia Gully' owned by Colin and Margaret Tonkin. The area is within the Collie catchment in the Shire of Collie. Colin and Margaret applied on behalf of the Collie LCDC for a survey to be undertaken of the area to improve their personal and local knowledge of the area. A survey will also provide the Tonkins' with baseline data on vegetation composition and condition and establishes permanent monitoring sites for future reference.

The Tonkins' have already demonstrated that long term protection measures have been undertaken, particularly fencing and no grazing. 'Boronia Gully' is a 160 hectare property of which 60 hectares was fenced off between 15 and 20 years ago. The management of their bushland undertaken by the Tonkins' resulted in the awarding of the National Landcare Rivercare award in March 2000. Colin also encourages school groups to visit his bushland. The Tonkins' are hoping to covenant their bushland in the future.

The survey was conducted over a weekend in the spring of 2000. Wildflower Society volunteers and a coordinating botanist travelled to Collie to work alongside local community participants. As well as the benefit of on-ground survey experience for all involved, much value and enjoyment was gained in the social interactions. This report describes the flora, vegetation and conservation values of the bushland sites. It provides some baseline data for future management of the bushland and for revegetation in the area.

The project has been supported since its inception by a series of federal government grants. This survey was supported by funds from the Bushcare Program of the Natural Heritage Trust (1998-99). The Department of Conservation and Land Management and the Wildflower Society also provided support.

2. The Study Area

2.1 Location

The Tonkins' property is located immediately north east of the township of Collie, approximately 210 kilometres south of Perth (Figure 1). The bushland is just south of Harris River State Forest. Boronia Gully creek, a shallow, seasonal upper tributary of the Collie River, runs through the bushland on the property.

Collie has traditionally relied on the coal mining, power generation and bauxite refining industries to provide employment. While 75% of the Collie Basin is under State Forest, timber production is not a major activity, however timber plantations may become more important in the future. The recreation and nature conservation values of the forest are highly regarded along with the recreational opportunities provided by the Wellington Reservoir. These values have led to increased promotion of the area for tourism by the local business community and the Shire of Collie (Collie Water Advisory Group, 1996).

Approximately 10% of the total Shire area is utilised for agriculture which is a small proportion compared to most other Local Authorities in the South West Region. This is due to the large areas of State Forest including the water catchments of the Harris and Wellington Dams being located within the Shire. The main agricultural production is in beef and sheep production. Activities such as dairying and pig farming are also undertaken within the Shire. Apples are the most notable fruit crop grown in the Shire with other fruit including various citrus and stone fruit (Shire of Collie, 2001).

2.2 Climate

Collie has a Mediterranean climate with cool, wet winters and hot, dry summers. Rainfall in Collie averages 948 mm and falls all year round although primarily from late Autumn (May) through to early Spring (September). Average temperatures range from maxima of 30.5 C (January) to 15.5 C (July) (Bureau of Meteorology, 2001).

2.3 Geomorphology and Soils

The Tonkins' property is within the Darling Range Geomorphological region of south west Australia (Bell, 1997) and the geomorphological province of the Collie Basin. The Collie Basin is a small down faulted outlier of Permian and younger sedimentary rocks in the Precambrian rocks of the Darling Plateau (Churchward and McArthur, 1980). The occurrence of plant and animal communities in this region is closely related to the underlying geology, geomorphology and soil type, which have developed over millions of years.

Most of the Collie region consists of a hilly and steeply hilly dissected laterite-covered plateau 220m to 340m above sea level with occasional hills rising another 30 to 100 m. The Darling escarpment forms the western edge of the plateau (Smith, 1972).

The laterite landscapes in the Collie Basin have very low relief with the greater part ranging from 200 to 250m. In general it can be expected that lateritic duricrust will occur on the broad crests and upper slopes either outcropping or obscured by shallow gravelly sands. On the slopes, the soils are very gravelly, often 60 to 80% gravel, over a clay subsoil, changing downslope to become deeper, less gravelly with finer gravels and extending to the swampy valley floors. Slopes of the major valleys have mainly red or yellow earths or duplex soils (McArthur, 1991).

Deeply incised valleys, associated with major rivers, traverse the area from east to west. The Collie Basin is drained by the Collie River and its tributaries the East Collie, Bingham and

Harris Rivers. Boronia Gully Creek drains into the Collie River. These waters are collected in the Wellington Dam west of Collie, before passing through a deep gorge in the escarpment to flow across the coastal plain into Leschenault Inlet (Smith 1972).

2.4 Vegetation and Flora

The maps of Heddle *et al.* (1980) show the vegetation complexes of the Swan Coastal Plain and the Darling Range. Most of the Boronia Gully Bushland belongs to the Muja Complex, with the southern third of the bushland belonging to the Cardiff Complex.

In general terms the vegetation of the Muja Complex consists of an open-woodland of *Melaleuca preissiana*-*Banksia littoralis* with some admixture of yarri (*E. patens*) dominating the moister areas, and replaced by a woodland of *Banksia* species on the drier sites. The understorey species reflect the level of soil moisture. On the drier soils common plants include *Lepidosperma angustatum*, *Dasyogon bromeliifolius*, *Lyginia tenax*¹ and *Xylomelum occidentale*. Common plant species on the moister soils include *Hakea ceratophylla*, *Agonis linearifolia*, *Leptospermum ellipticum*², *Hypocalymma angustifolium*, *Adenanthos obovatus* and *Leptocarpus scariosus*³ (Heddle *et al.*, 1980).

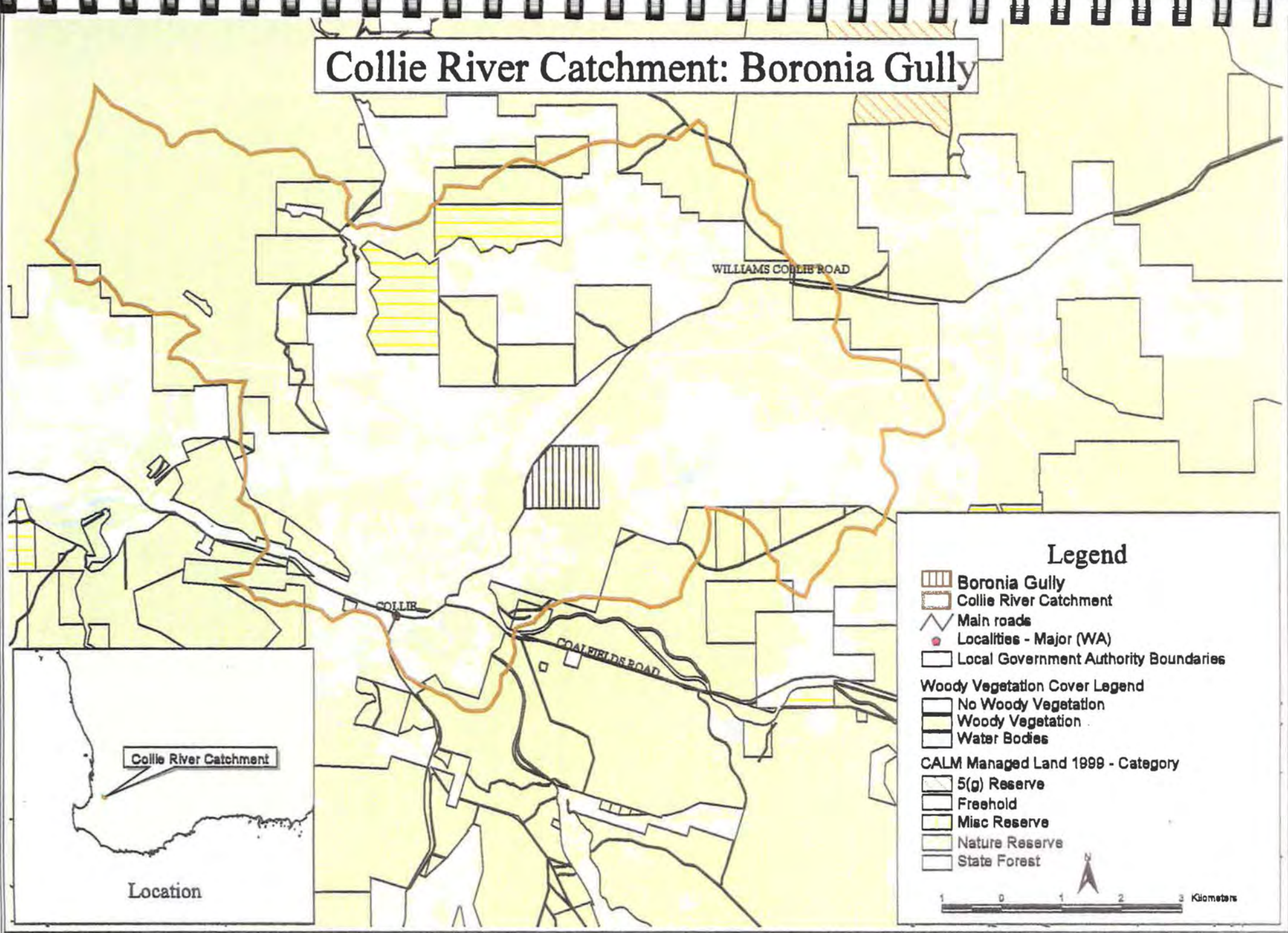
The Cardiff Complex consists of an open woodland of *Banksia attenuata* – *Banksia ilicifolia* and *Nuytsia floribunda* with a distinctive understorey with a range of species that reflects the levels of soil moisture. On the drier soils the understorey plant species include *Kunzea vestita*, *Banksia meisneri*, *Calothamnus* species, *Lepidosperma angustatum*, *Xylomelum occidentale*, *Leucopogon glabellus*, *Jacksonia furcellata*, *Bossiaea eriocarpa* and *Daviesia incrassata*. On the moister soils common understorey species include *Leptospermum ellipticum*, *Adenanthos obovatus*, *Hypocalymma angustifolium* and *Schoenus brevifolius* (Heddle *et al.*, 1980).

¹ *Lyginia tenax*: name now changed to *Lyginia barbata*

² *Leptospermum ellipticum*: name now changed to *Pericalymma ellipticum*

³ *Leptocarpus scariosus*: name now changed to *Meeboldina scariosa*

Collie River Catchment: Boronia Gully



Legend

- Boronia Gully
- Collie River Catchment
- Main roads
- Localities - Major (WA)
- Local Government Authority Boundaries

Woody Vegetation Cover Legend

- No Woody Vegetation
- Woody Vegetation
- Water Bodies

CALM Managed Land 1999 - Category

- 5(g) Reserve
- Freehold
- Misc Reserve
- Nature Reserve
- State Forest

1 0 1 2 3 Kilometers

Collie River Catchment

Location

Map 1: Locality map of the Tonkins' property "Boronia Gully"

5

3. Survey Method

The survey methods used are described in the publication "Bushland Plant Survey for the Community" by Keighery, BJ (1994). These methods were developed in conjunction with botanists and trialed successfully during the Moore River to Jurien Sandplain Survey (Griffin and Keighery 1989). They have proved successful for volunteer and community participation over a number of years. The use of quadrats (10 x 10m) and standardised data recording sheets allow the systematic collection of information and ensures that all species are recorded, not just common ones. The quadrats provide the baseline data required for the plant species list and descriptions of the plant communities. Metal fence droppers are used as quadrat markers in case of fire and are left in place (with the landowners' permission) to create permanent monitoring sites. At the end of the project copies of the photographs and field recording sheets are given to the community group for future reference.

The initial survey was conducted on the 7th and 8th of October 2000. Each quadrat was given a four letter code (COBG representing Collie (CO) and Boronia Gully (BG)) plus a sequential number. Quadrats were located away from tracks and areas of disturbance and placed in bushland considered typical of a given plant community. Fifteen quadrats were completed. Volunteers and community group members worked in groups of up to six, each including a volunteer experienced in survey techniques.

Vegetation structure was recorded using the classification system shown in Appendix 1 and dominant species in each layer were noted. A vegetation condition rating was assigned according to the scale in Appendix 1. Vegetation that did not fill one particular rating was given a graded rating between two conditions. For example, if the condition was almost excellent with the vegetation intact but still with obvious signs of disturbance the condition would be rated as Excellent to Very Good. This data was checked later for consistency by the project leader.

A list of all the species within the quadrat was then made with the specimens being collected where necessary to confirm identification and provide material for the field herbarium. Care was taken not to trample the bushland, especially within the quadrat. Additional species from the same plant community were recorded from just adjacent to each quadrat (adjacents). Records of species not found in or adjacent to the quadrats were also made across the whole site (opportunistics).

Each quadrat was revisited later in spring on 11 November 2000. Specimens were collected from later flowering species and annual plants were recorded, expanding the species list. Collections were also made at other times throughout the year by project leaders during the preliminary site assessments.

A plant identification workshop was held on the night of the 7th of October 2000 allowing some of the plant identification work to be carried out on fresh specimens. All specimens were pressed and then dried in low temperature ovens at the Western Australian Herbarium before freezing for one week to kill insect pests. Volunteers and the botanists leading the project then completed the identification work on the dried specimens at the Reference Herbarium of the WA Herbarium. A field herbarium was compiled by the volunteers for presentation to the Collie Landcare District Committee along with this report. Duplicates of as many species as possible, including any rare or priority species, will be lodged with the WA Herbarium following completion of this project.

It is estimated that this survey will have recorded approximately 75-80% of the plant species present at the site. No survey can claim to fully record the flora and vegetation present on any

given site. There are always limitations associated with the survey methods and the season and time period over which it is conducted.

The limitations of this study are as follows:

- It was conducted over only one flowering season (spring 2000). Collections need to be made over several flowering seasons and regularly at other times of the year, over several years to more fully document the flora and vegetation.
- Estimates of vegetation cover and assessments of vegetation condition are somewhat subjective as they are interpreted slightly differently between individuals. Vegetation condition is considered relative to what we would expect pristine bushland to be.
- No analysis of soil types were carried out, observations of colour and texture for surface soils were made and the sub-surface soil described by digging a pit approximately 0.15m deep with a trowel. If ant nests were present, the colour and texture of the soil brought to the surface were determined.
- Where suitable material is available after preparation of the field herbarium, duplicate voucher specimens will be lodged with the WA Herbarium as a lasting record of the species collected. Rare or priority species are always vouchered and most species from the survey will be vouchered. In the future, name changes to any of the vouchered specimens can be corrected with confidence as they will have been verified by the WA Herbarium. For other specimens the field herbarium may need to be taken to the WA Herbarium to ensure the specimen in the field herbarium is the species that has had its name changed. This is particularly necessary if a given species is divided up into several new species or subspecies. All of the species identified during the survey were verified against voucher specimens at the WA Herbarium to ensure accuracy of the identifications.
- Detailed floristic analysis of the data collected was not undertaken due to limited project resources and was not considered necessary for the project's objectives. All data collected by the Bushland Plant Survey Project is made available to the Department of Conservation and Land Management's (CALM) Biological Survey Unit for use in regional studies of vegetation and flora. The standardised collecting methods used in this survey are compatible with those used by CALM.

4. Vegetation: Plant Communities and Vegetation Map

4.1 Vegetation

The plant communities were determined by assessment of the vegetation structure, dominant species and species composition. Three broad community groups and eight distinct plant communities were identified from the quadrat data. Using aerial photo interpretation and on ground observations these have been mapped (Figure 2). Mapping was done from 1:25 000 aerial photographs flown in January 2000.

A further community (which was not fenced, so unsuitable to survey fully) was identified on a block south west of the main bush block. Specimens were collected from this community during the survey, as this community appeared to be quite distinct from the other communities surveyed.

Appendix 2 summarises the information collected for each quadrat according to mapped plant community.

The mapping units are:

1. Fringing Woodlands

- Flooded Gum (*Eucalyptus rudis*) over Swamp Peppermint (*Agonis linearifolia*) Fringing Woodland (Fw)
- Moonah (*Melaleuca preissiana*) / Flooded Gum Fringing Woodland (MFw)
- Moonah and Harsh Hakea (*Hakea prostrata*) Low Open Forest (MHf)

2. Heath - Shrubland Complexes

- Harsh Hakea Shrubland (Hs)
- *Kunzea recurva* and *Acacia extensa* Open Shrubland (KAs)

3. Eucalypt Woodlands

- Marri (*Eucalyptus calophylla*) – Balga (*Xanthorrhoea preissii*) Woodland (MBw)
- Marri – Jarrah (*Eucalyptus marginata*) Woodland (MJw)
- Jarrah Woodland (Jw)

- *Allocasuarina fraserana* Woodland (unsampled) (Aw)

The distribution of the mapping units over the site reflects variations in soil type, topography and drainage. The increase in distance from the drainage line is reflected in the changes in composition of vegetation communities' further upslope.

This is demonstrated with Fringing Woodland communities being adjacent to the drainage line, these species, particularly Flooded Gum and Moonah, able to tolerate long periods in saturated soil. The shrublands and heathlands were slightly higher up in the landscape, with species such as *Kunzea recurva* and *Boronia tenuis* (Blue Boronia) being able to tolerate periods of saturated soil, interspersed with drier periods. Within these communities some species are able grow in both types of drainage, *Boronia megastigma* (Scented Boronia) is

found both close to the drainage line and higher up in the Heath-Shrubland. Then finally in the upland, lateritic areas the communities changed to the Marri, Jarrah and Balga woodlands, where free draining soil is required for the species present.

The plant communities are described as follows:

1 Fringing Woodlands (Mw)

These woodlands are situated along the drainage line. The understorey differs with soil type with Balga forming the understorey in slightly upland ironstone areas, and Swamp Peppermint in areas immediately adjacent to the drainage line.

▪ Flooded Gum - Swamp Peppermint Fringing Woodland (Fw)

(Quadrat/s: COBG 10)

Figure 3

This community occurs along the creekline, in close association with the Moonah/Flooded Gum Woodlands. Large Flooded Gum trees grow with the understorey dominated in places by Swamp Peppermint. *Kunzea glabrescens* also dominates the understorey in places. The ground layer is dominated by sedge species such as *Lepidosperma tetraquetrum* and *Baumea rubiginosa*.

▪ Moonah - Flooded Gum Fringing Woodland (MFw)

(Quadrat/s: COBG 05, COBG 08, COBG 09 and COBG 14)

Figure 4

The distinctive Flooded Gum and Moonah Fringing Woodland grows in the transitional zone between the creekline and shrublands. Large Flooded Gum trees grow interspersed with the smaller Moonah. The understorey is dominated in places by Swamp Peppermint and *Aotus cordifolia*.

Sedges are common in among the perennial herbs, and this community type can be further divided according to presence or absence of sedges present on the basis of the soil type present. For instance quadrat COBG 09 is located on an ironstone outcrop, in this quadrat sedges such as *Meeboldina scariosa*, *Lepidosperma pubisquameum* and *Mesomelaena tetragona* are present. Whilst quadrat COBG 8, on more sandy soils, only had the sedge species *Hypolaena exsulca* present, and COBG 05 and COBG 14 had no sedges present, and contained a shrub understorey of *Kunzea recurva* and *Aotus cordifolia*.

▪ Moonah and Harsh Hakea Low Open Forest (MHf)

(Quadrat/s: COBG 1 and COBG 15)

Figures 5 and 6

There are two isolated pockets of this community, one close to the ironstone community and one to the north of the creekline immediately adjacent to the dam. The understorey between the two communities varies, most likely due to differences in topography, with one community being on ironstone higher up in the landscape and the other community close to the creekline.

The community adjacent to the ironstone community is quite disturbed with many annual weed species present in the understorey with open sparse White Myrtle (*Hypocalymma angustifolium*) and Balga. In many respects this community is similar to the upland areas of the Moonah Fringing Woodlands community, with the main difference being the dominance of the Harsh Hakea in the understorey.

The area north of the creekline has been subject to much less disturbance and is in very good condition. Very few weed species are present. This area has a sparser overstorey of Harsh Hakea with a dense understorey of heath species such as *Kunzea recurva* and *Andersonia involucrata*. Many sedge species were present, including annual sedge species *Aphelia cyperoides* and *Centrolepis aristata*.

2 Heath - Shrubland Complexes (Hs)

These communities occurred immediately adjacent to the riparian fringing communities and provided a transition to the Eucalypt Woodlands of the upland areas.

▪ Harsh Hakea shrubland (Hs)

(Quadrat/s: COBG 12)

Figure 7

This area is located on the ironstone, with a sparse overstorey of Harsh Hakea. Balga is dominant in the understorey. Other understorey species include Honey Bush (*Hakea lissocarpa*), *Boronia tenuis* and annual species such as *Trichocline spathulata* and *Poranthera microphylla*. Several of the species are not present in other communities, such as *Thomasia foliosa*, *Kennedia prostrata* and *Pimelea imbricata* variety *piligera*. This community has several invasive pasture weed species present (eg. **Trifolium subterraneum* and **Lotus angustissimus*), this is most likely due to the community being adjacent to pasture areas.

▪ *Kunzea recurva* - *Acacia extensa* Open Shrubland (KAs)

(Quadrat/s: COBG 7)

Figure 8

Kunzea recurva and *Acacia extensa* Open Shrubland grows slightly higher upslope of the Moonah Fringing Woodlands. This is a transition area where wetland species such as Swamp Peppermint and *Aotus cordifolia* occur, as well as woodland species such as *Leschenaultia biloba* and *Dampiera linearis*. In this community White Myrtle, *Boronia megastigma* and *Andersonia involucrata* form a Low Open Heath with the ground layer a closed *Schoenus foliolatus* and *Hypolaena exsulca* Sedgeland.

3 Eucalypt Woodlands (Ew)

These communities are situated in the upland areas and are characterised by an overstorey of Marri and/or Jarrah.

▪ Marri - Balga Woodland (MBw)

(Quadrat/s: COBG 2)

Figure 9

The Marri – Balga Woodland grows in the upland areas towards the south east areas of the block. Marri is the dominant overstorey species, with Jarrah also present. Balga grows extensively through the understorey in association with a number of annual herbs such as *Drosera stolonifera* subspecies *stonolifera*, *Stylidium brunonianum* subspecies *brunonianum* and *Pterostylis recurva*. This community is relatively undisturbed with **Briza maxima* being the only weed species recorded.

▪ Marri– Jarrah Woodland (MJw)

(Quadrat/s: COBG 3, COBG 11 and COBG 13)

Figure 10

The Marri – Jarrah Woodland occurs on the eastern slopes of the large block, and also occurs in the small block adjacent to the house. It is similar in species composition to the Marri-Balga woodlands but the canopy can be dominated by Jarrah in places. Honey Bush and various *Acacia* species are frequently present in the understorey. Sedges such as *Tetraria capillaris* and *Mesomeleana tetragona* are common among the perennial herbs *Hibbertia commutata*, *Dampiera linearis* and *Conostylis setigera*, with a wide variety of annual herbs blooming in spring each year.

▪ **Jarrah Woodland (Jw)**

(Quadrat/s: COBG 4, COBG 6)

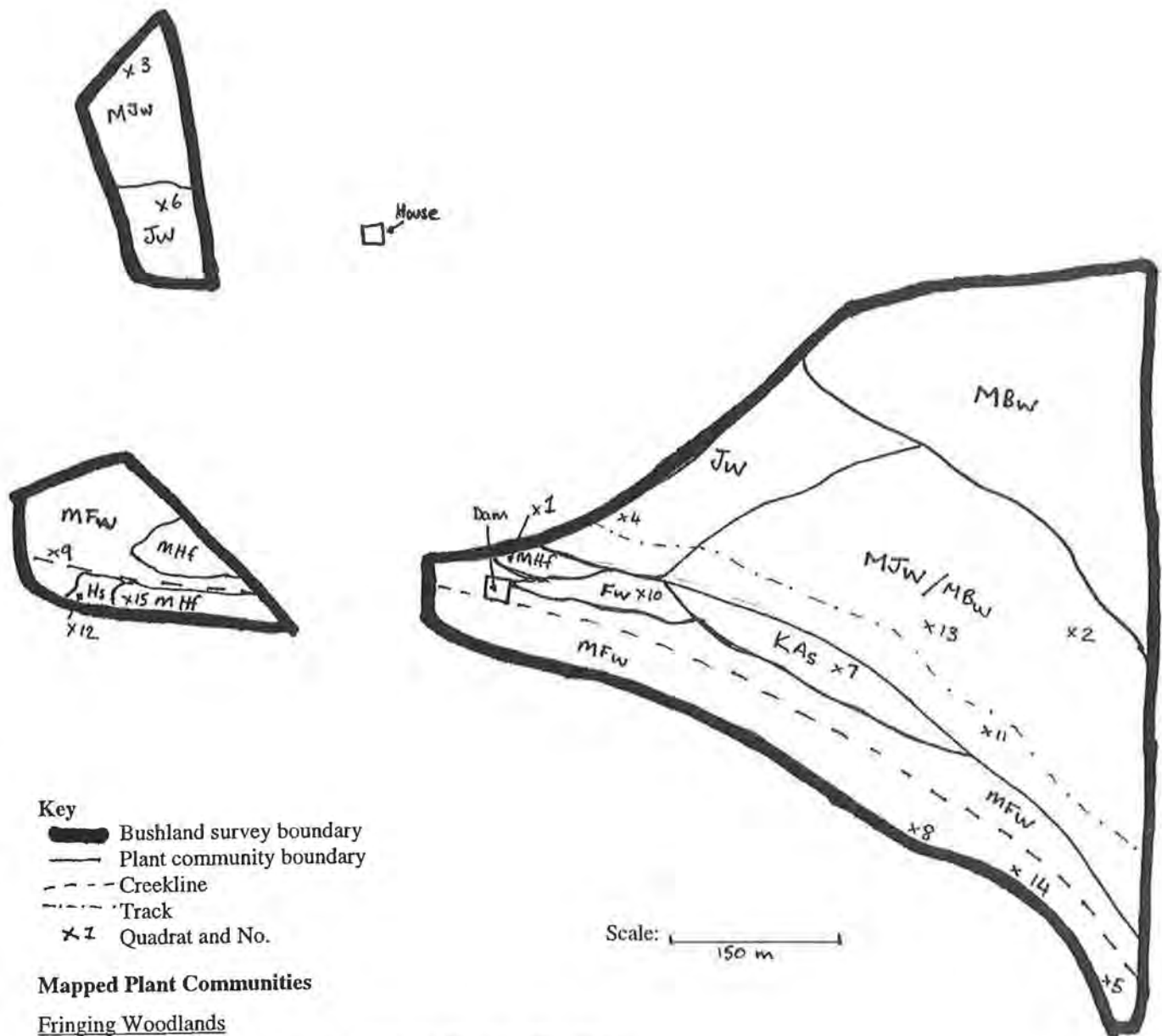
Figure 11

Jarrah woodland occurs on the north eastern corner of the large block. The species composition is similar to the other upland Eucalypt Woodland except Marri is absent and White Myrtle and *Conostylis aculeata* dominate the understorey in patches.

▪ ***Allocasuarina fraserana* Woodland (unsampled) (Aw)**

The *Allocasuarina* woodland was not sampled in detail. *Allocasuarina fraserana* forms an almost pure Open Woodland, with occasional Jarrah. The understorey consists of a very open Herbland. Most of the species collected opportunistically were not found in any other community. Species not found in other communities included *Petrophile linearis*, *Gompholobium polymorphum*, *Conostylis setosa*, *Hibbertia spicata* variety *spicata* and *Actinotus glomeratus*.

Figure 2: Plant Communities of the Boronia Gully Bushland



- Key**
- Bushland survey boundary
 - Plant community boundary
 - Creekline
 - Track
 - Quadrat and No.

Scale: 150 m

Mapped Plant Communities

Fringing Woodlands

- Fw Flooded Gum - Swamp Peppermint Fringing Woodland
- MFw Moonah - Flooded Gum Fringing Woodland
- MHf Moonah - Harsh Hakea Low Open Forest

Heath - Shrubland Complexes

- Hs Harsh Hakea Shrubland
- KAs *Kunzea recurva* - *Acacia extensa* Open Shrubland

Eucalypt Woodlands

- MBw Marri - Balga Woodland
- MJw Marri - Jarrah Woodland
- Jw Jarrah Woodland
- Aw *Allocasuarina fraserana* Woodland (unsampled)

Fringing Woodlands



Figure 3 - Flooded Gum - Swamp Peppermint Fringing Woodland

This community occurs along the creekline, in close association with the Moonah/Flooded Gum Woodlands. Large Flooded Gum trees grow with the understorey dominated in places by Swamp Peppermint. *Kunzea ericifolia* also dominates the understorey in places. Quadrat COBG 10, 7 October 2000 with 38 native species and 1 weed species.



Figure 4 - Moonah - Flooded Gum Fringing Woodland

The distinctive Flooded Gum and Moonah Fringing Woodland grows in the transitional zone between the creekline and shrublands. Large Flooded Gum trees grow interspersed with the smaller Moonah. The understorey is dominated in places by Swamp Peppermint and *Aotus cordifolia*. Quadrat COBG9, 7 October 2000 with 47 native species and 7 weed species.



Figure 5 - Moonah and Harsh Hakea Low Open Forest (Ironstone)

There are two isolated pockets of this community, one close to the ironstone community and one to the north of the creekline immediately adjacent to the dam. The community adjacent to the ironstone community is quite disturbed with many annual weed species present in the understorey with open sparse White Myrtle (*Hypocalymma angustifolium*) and Balga. Quadrat COBG15, 8 October 2000 with 35 native species and 17 weed species.

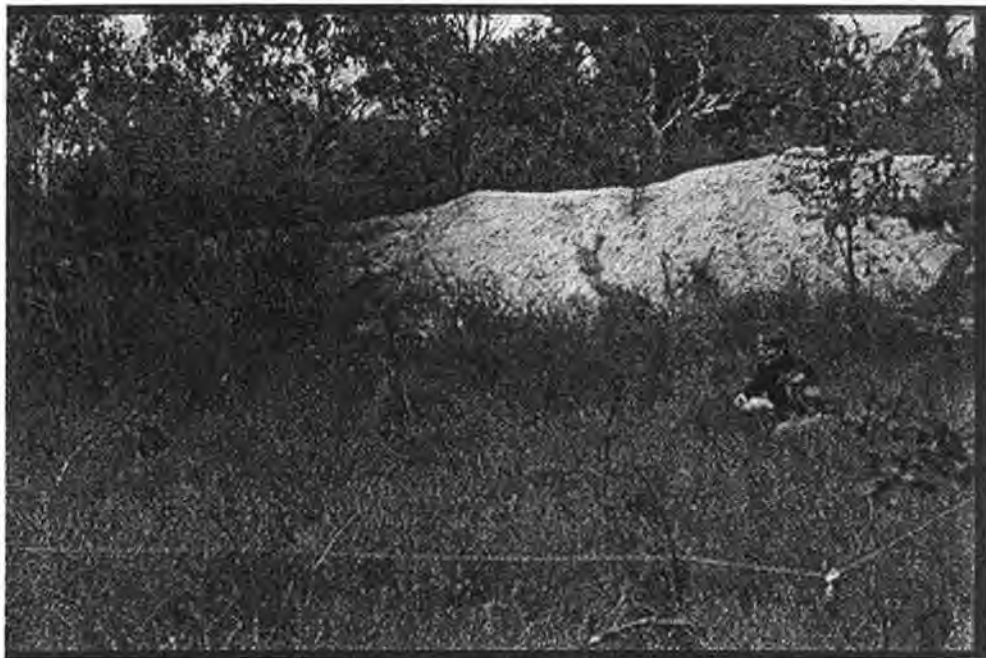


Figure 6 - Moonah and Harsh Hakea Low Open Forest (Creekline)

The area north of the creekline is in very good condition. Very few weed species are present. This area has a sparser overstorey of Harsh Hakea with a dense understorey of heath species such as *Kunzea recurva* and *Andersonia involucrata*. Many sedge species are present, including annual sedge species *Aphelia cyperoides* and *Centrolepis aristata*. Quadrat COBG1, 7 October 2000 with 47 native species and 5 weed species.

Heath - Shrubland Complexes



Figure 7 - Harsh Hakea shrubland

This area is located on the ironstone, with a sparse overstorey of Harsh Hakea. Balga is dominant in understorey. Other understorey species include Honey Bush (*Hakea lissocarpha*), *Boronia tenuis*, and annual species such as *Trichocline spathulata*, and *Poranthera microphylla*. COBG 12, October 8 2000 with 43 native species and 10 weed species.



Figure 8 - *Kunzea recurva* - *Acacia extensa* Open Shrubland (KAs)

Kunzea recurva and *Acacia extensa* Open Shrubland grows slightly higher upslope of the Moonah Fringing Woodlands. This is a transition area where wetland species such as Swamp Peppermint and *Aotus cordifolia* occur, as well as woodland species such as *Leschenaultia biloba* and *Dampiera linearis*. COBG7, 7 October 2000 with 48 native species and 3 weed species.

Eucalypt Woodlands



Figure 9 - Marri - Balga Woodland

The Marri – Balga Woodland grows in the upland areas towards so the south east areas of the block. Marri is the dominant overstorey species, with Jarrah also present. Balga grows extensively through the understorey in association with a number of annual herbs. COBG2, 7 October 2000 with 54 native species and 1 weed species.



Figure 10 - Marri – Jarrah Woodland

The Marri – Jarrah Woodland occurs on the eastern slopes of the large block, and also occurs in the small block adjacent to the house. It is similar in species composition to the Marri-Balga woodlands but the canopy can be dominated by Jarrah trees. COBG11, 7 October 2000 with 57 native species and 2 weed species.



Figure 11 - Jarrah Woodland

Jarrah woodland occurs on the north eastern corner of the large block. The species composition is similar to the other upland Eucalypt Woodlands except Marri is absent, and White Myrtle and *Conostylis aculeata* dominate the understorey in patches. COBG4, October 8 2000 with 65 native species and 5 weed species.

4.2 Flora

278 vascular plant taxa (species, subspecies and varieties) were recorded from 51 different plant families. These consisted of 236 perennials (85% of the flora) and 42 annuals or annually renewed plants. Weed species made up 11% of the flora at 31 species.

In the current survey the Pea family (Papilionaceae) were the largest group of plants with 30 taxa (6 weed taxa), being a mixture of perennial and annual species. Other families that are particularly well represented on the site were:

Family	No. Natives	No. Weeds	Total
Myrtaceae (Myrtle Family)	20	0	20
Orchidaceae (Orchids)	19	1	20
Poaceae (Grasses)	9	10	19
Asteraceae (Daisies)	10	7	17
Stylidiaceae (Trigger Plants)	12	0	12
Anthericaceae (eg. Fringe lily)	9	0	9

These 7 families together represent 45% of the flora. The number of species found in the 10 x 10 m quadrats varied from 70 species found in COBG 4 to 21 species in COBG 14.

A list of species found across the site and their occurrence is presented alphabetically by family in Appendix 3. Weed species are included in this list and are discussed in detail in Section 5.4.1.

4.3 Declared Rare and Priority Flora

The definitions for the declared rare and priority flora classifications are given in Appendix 3 and descriptions of relevant species are given below.

Four species on the Priority Flora List (Atkins, 2001) were recorded during the survey, *Millotia tenuifolia* variety *laevis* (Priority 2), *Aotus cordifolia* (Priority 3), *Boronia tenuis* (Priority 4) and *Calothamnus pallidifolius* (Priority 4).

Millotia tenuifolia variety *laevis* (Asteraceae) Priority 2

A member of the Daisy family *Millotia tenuifolia* variety *laevis* is a small ascending to erect herb growing from 0.02 – 0.1m high. The flowers are yellow and occur between September and October. *Millotia tenuifolia* variety *laevis* occurred in the Marri – Balga Woodland. It is a species which grows on granite or lateritic soils between Red Hill and Dunsborough.

Aotus cordifolia (Papilionaceae) Priority 3

An erect or straggling shrub, *Aotus cordifolia* is a member of the Pea family and grows from 0.3 to 1.5 high. It has yellow flowers, which occur between August and January. *Aotus cordifolia* grows in peaty soils and swamps between Upper Swan and Margaret River. At this site it was common along most of the creekline areas including Flooded Gum – Swamp Peppermint Fringing Woodlands, Moonah – Flooded Gum Fringing Woodlands and *Kunzea recurva* and *Acacia extensa* Open Shrublands.

Boronia tenuis (Rutaceae) Priority 4

Commonly known as Blue Boronia, *Boronia tenuis* is a procumbent or erect and slender shrub, which grows to from 0.1 to 0.5m high in Eucalypt woodlands. The flowers are blue,

pink and white and occur from August to November. At this site *Boronia tenuis* occurs in Harsh Hakea Shrubland and Marri – Jarrah Woodland. It is usually found on laterite, stony soils and granite. Its distribution is from Kalamunda to Dunsborough.

***Calothamnus pallidifolius* (Myrtaceae) Priority 4**

Commonly known as Hawkeswood, *Calothamnus pallidifolius* is an erect, straggly shrub, growing between 0.5 – 0.7m high. The flowers are green, yellow, red or pink. At Boronia Gully the flowers are green. It was found in Jarrah Woodland. It usually grows on lateritic soils and on hillsides on loam/sand over laterite. This species was considered restricted to the Whicher Ranges, south-east of Busselton, this collection is outside its known distribution.

4.4 Significant Species.

***Adiantum aethiopicum* (Adiantaceae)**

A perennial fern, which grows to 0.35m high, this species grows in lateritic clay gravel, sandy clay or loam in the south west. Despite it's common name of 'Common Maidenhair' this species is quite uncommon in it's natural habitat, and is considered a significant species in this location (B Keighery, pers. comm, 2002).

***Pentapeltis silvatica* (Apiaceae)**

A prostrate, perennial herb, which has white or pink flowers between December and April this species grows in gravelly lateritic soils. This species is at the northern limit of its range in this location (G. Keighery, pers. comm., 2002).

4.5 Other Significant Features

Numerous *Lomandra* species (Dasyopogonaceae)

Commonly referred to as mat rushes, *Lomandra* are tufted, strappy species, often mistaken for sedges or grasses. They are commonly known as mat rushes, and the species this site grow up to 0.6m high. They are dioecious (having separate male and female plants), rhizomatous, caespitose perennial herbs. During the survey nine species were recorded, with 5 species in one vegetation community (COBG 2: Marri-Banksia woodland). Whilst numerous *Lomandra* species are a feature of Jarrah forests it is unusual to have this many species in the woodlands present at this site (G Keighery, pers. comm., 2002)

***Xanthosia atkinsonia/ X. candida/ X. huegelii* (Apiaceae)**

This number of *Xanthosia* species in one location is considered unusual (G Keighery, pers comm., 2002).

4.6 Vegetation Condition

The condition of the vegetation throughout the study area varied from Excellent to Good with the lowest condition areas occurring west of the streamline, where the vegetation is adjacent to paddocks. Overall the vegetation was in Excellent to Very Good condition.

The **Flooded Gum over *Agonis linearifolia* Fringing Woodland** was in Excellent condition, with an intact ground layer of rush and sedge species. Non -aggressive weed species, such as **Hypochaeris glabra*, were present in small numbers.

The **Moonah/ Flooded Gum Fringing Woodland** was in Good to Excellent condition. Two areas contained more aggressive weed species. For example, in the two southern sites toward the eastern boundary, west of the streamline, **Holcus lanatus* dominated the understorey in patches, and replaced native species, lowering the vegetation condition rating to a Good to Very Good condition. Two other areas were in Excellent condition. These areas had a more

intact rush and sedge layer which tended to inhibit the introduction of aggressive weed species in these areas.

The **Moonah and Harsh Hakea Low Open Forest** east of the streamline was in Excellent condition, with only a few non-aggressive weed species present. On the western side of the streamline the vegetation was in Good to Very Good condition. Weed species present dominated the open patches, especially close to the boundaries of the paddocks. This plant community contained the highest proportion of weed species, with over a third of all species recorded. Dead Harsh Hakea specimens were present in this area.

The **Harsh Hakea Shrubland** was in Very Good condition. Much of this area was weedy, especially in open patches. There were several dead Harsh Hakea specimens.

The **Kunzea recurva and Acacia extensa Open Shrubland** was in Excellent condition with the intact sedgeland providing little opportunity for weed invasion. Only non-aggressive weed species were present in low numbers. There were several dead *Jacksonia furcellata* shrubs.

The **Marri - Balga Woodland** was in Excellent condition. *Briza maxima* were the only weed species present. The **Marri - Jarrah Woodland** was in Very Good to Excellent condition, with the Very Good area occurring in the area of bushland surveyed adjacent to the house. Increased access to this area compared to the other areas in the main block of bushland, and its comparatively smaller area-edge ratio increasing the risk of weed invasion, could be a source of the lower condition compared to the main block.

The **Jarrah Woodland** in the main bush block was in excellent condition with minimal weed invasion. The vegetation adjacent to the house was in Good to Very Good condition with some invasive weeds present, for similar reasons as the adjacent Marri-Jarrah Woodland.

With areas that were considered less than in Excellent condition the main disturbance factors were tracks, although the impact was usually minimal, except for the bushland adjacent to the house where tracks are causing a greater impact. This allows for the invasion of aggressive weed species such as *Avena barbata* and *Holcus lanatus*. Evidence of selective logging was present in some of the Eucalypt Woodland area.

5. Discussion

5.1 Vegetation

This site has provided a unique opportunity to observe and document an area of riparian and adjacent upland vegetation, which is no longer common along the streams of the south west.

The changes in the type of plant communities that occur across the site are primarily determined by the changes in topography and subsequent moisture availability throughout the year. The mapping of Heddlé *et al.* (1980) suggests that changes should also occur due to basic geology and soil type. This mapping shows the Muja Vegetation Complex on the two smaller blocks and the western half of the main bush block, with Cardiff Vegetation complex occurring on the eastern half of the main bush block.

Much of the main bush block and the smaller ironstone area is dominated by the streamline, and hence riparian vegetation communities, where the variations in moisture availability and topography result in a change of plant community. The vegetation present ranges from the Flooded Gum Fringing Woodlands along the creekline, through a small band of Heath and Shrublands, to the Marri and Jarrah woodlands on the higher areas.

Most of the bushland of the study site was in Excellent condition, with the condition of the fifteen quadrats ranging from Good to Excellent. Areas of lower condition ratings tended to be in the two smaller blocks of bushland surveyed and in areas of bushland west of the streamline that were adjacent to a paddock. In these areas aggressive weed species (eg. *Holcus lanatus*) were displacing native ground layer species, there were also deaths of some mature shrub species (eg Harsh Hakea on the ironstone areas).

The only disturbance factors were:

- weed intrusion along the boundaries of the paddocks
- uncontrolled access to the bushland adjacent to the house
- the access track traversing the major block of bushland
- some evidence of Jarrah being cut in the past

The lack of any activities through the major block of bushland for much of the year is probably largely responsible for it being in Excellent condition with minimal weed invasion. Bushland sites like this one on private property can be in better condition than those on public lands, where the pressures from public use and public utilities are greater. The privately owned remnants are therefore extremely valuable and important for preserving Western Australia's biodiversity.

5.2 Flora

This survey has provided baseline data for an area not previously surveyed, and has provided knowledge of significant species presently known to occur on the site. The survey found 247 native species to be present, with further surveying likely to find more species present.

The significant species occur in a range of habitats, from the *Aotus cordifolia* (P3) occurring along the edges of the streamline, to the *Boronia tenuis* (P4) occurring in the heathlands, to the *Millotia tenuifolia* variety *laevis* (P2) and *Calothamnus pallidifolius* (P4) occurring in the Eucalypt Woodlands. As this is a baseline study, further surveying may uncover other significant species not found during this study.

In addition to the flora recorded during this survey, the Tonkins have a keen interest in the orchids of their bushland and have been recording, and taking photos (Appendix 4) of the

many orchid species that flower during the year in Boronia Gully. An orchid specialist (M. Brundrett pers. comm) confirmed the identifications of the orchids made by the Tonkins. Many of these were not recorded during the survey, demonstrating that further survey work could uncover many species that were not collected during the current survey simply because they were not flowering at the time, further increasing the already high conservation value of the bushland.

The main outcomes of a survey such as this are that it contributes towards an assessment of the conservation values of the bushland and provides information that can be used to implement appropriate management strategies.

5.3 Conservation Values

Conservation value is assessed at a range of levels according to international, national, regional and local communities. It is important to know the conservation value of an area so that land owners can make decisions about the sites' values relative to other land uses. All remnant vegetation in the south west of Western Australia has conservation value due to the high rate of clearing that has occurred since European settlement.

There are several factors that contribute to the conservation value of bushland remnants. Looking briefly at these in relation to the Tonkins' bushland helps to provide an understanding of the attributes of the site, which make it a valuable piece of natural heritage of highly significant nature conservation value.

Larger areas free of weeds or other significant disturbances (intactness)

Weed invasion is a key indicator of bushland degradation. Weeds were a minor component of the species composition and cover on the site and there were no seriously aggressive species, particularly in the large block. The site was free of any significant disturbances and was largely intact particularly in the Eucalypt woodland areas.

Diversity of vegetation communities or flora

An area with a diverse flora and range of vegetation communities is considered to have more value than an area with fewer taxa or vegetation communities. As discussed earlier in this report, this site exhibited a rich diversity in both these attributes, 278 species in eight different vegetation communities, which is of high significance given the relatively small size of the bushland remnant compared to other areas with comparable number of species.

Value as a buffer

The study site is 25 hectares, immediately adjacent to a streamline. The size of this remnant buffers the streamline; therefore the streamline is less vulnerable to degrading processes such as erosion when compared to other streamlines with no buffer vegetation.

The site also represents riparian vegetation in very good condition. In the Collie region, stands of fringing vegetation (including forest) that contain an intact native understorey are considered of exceptional importance, and are often relic communities of vegetation that were once established all along the waterways (Waterways Commission, 1993).

Perimeter to area ratio

The lower the ratio the greater the conservation value because of the influence of edge effects is minimised. Long narrow blocks, for example, are subject to greater edge disturbance than a larger rectangular block. The largest remnant east of the streamline fares well on this score. From a management viewpoint, the less the perimeter in relation to the core area, the lower the cost of fencing.

Proximity, connectivity and size of other remnants

This is a two sided coin in that areas with habitat not already conserved in the area have a high value, but replication of habitats is also important to ensure conservation of the dynamic and variable gene pools. Large and close reserves and greater connectivity are considered to increase the value (for flora and fauna) and viability of a site.

The vegetation is also part of connected corridor of vegetation that joins the upper reaches of Boronia Gully Creek with the Collie River, providing important fauna habitat. The upland areas in the main bush block also provide a vegetated link to the bushland north-east of the site. The transition from riparian to upland areas provides a variety of habitat for fauna present, encouraging a wide range of fauna to the bushland.

Presence of rare, threatened or significant species or communities.

The presence of four priority flora and the significant fauna species, the Quenda (Southern Brown Bandicoot), greatly increases the conservation value of the site.

The Muja vegetation complex (Hedde *et al.*, 1980) is the major vegetation type surveyed on Boronia Gully, and although 71% of the original extent of this vegetation complex remains in the south west, none of it is protected in secure reserves (DEP, 1998). This would be a result of much of this vegetation complex being set aside for future mining. This makes the conservation value of any remnants protected on private property particularly important.

The Cardiff vegetation complex (Hedde *et al.*, 1980) is the other vegetation complex vegetation complex that was surveyed. This vegetation complex has a high conservation value as well because, although 75% of it's original extent is still present, none of it remains in secure reserves.

Other uses of the remnant that do not degrade its nature conservation value

The bushland is an ideal place for non-destructive recreation, enjoying the wildflowers and the landscape. It is valuable fauna for habitat. It offers a sense of place and value to its owners.

5.4 Management Issues

The site is in Excellent condition with weed invasion around the edge posing the greatest potential problem, especially along the western edges of the bushland. Overall little management is required except to maintain fencing, maintain some weed control and avoid disturbances. Exotic fauna such as rabbits and foxes should be controlled. It is also recommended spray drift of fertilisers and pesticides in to the bushland be avoided.

5.4.1 Weeds

The National Weed Strategy defines a weed as: 'a plant that has, or has the potential to have, a detrimental effect on economic, social or conservation values' (NWS Executive, 1997). In terms of bushland, weeds have the potential to have an affect on conservation values as they compete with native species, prevent recruitment, alter fire regimes and increase the risk of erosion. Weeds commonly invade areas of native vegetation following disturbances such as flooding, grazing, fire, soil disturbance.

Preventing the introduction and spread of weeds is far easier than removing them. As Boronia Gully bushland is in Excellent condition with weed invasion in most area, prevention is the key. The main ways of preventing the introduction of more weeds is to prevent grazing through maintenance of fencing of areas already fenced and to fence any areas where the conservation value is to be managed, for instance the area of Sheoaks at Boronia Gully. It is

also important to limit uncontrolled access, with walk trails used whenever possible if groups of people enter the bushland.

In areas where weeds have already invaded the bushland, and where time and resources are limited, priorities for weed control need to be established. The first step is to know what weeds are present and observe how they are affecting the ecosystem, those causing significant impacts need to be dealt with as a priority.

Dixon and Keighery (1995) provides a ranking for weeds based on their distribution and invasiveness which can be used as a guide to establish priorities for weed control. To assist in management of the area we have classified the weeds present in the Boronia Gully bushland (Table 5.4.1) into the following categories on the basis of our observations and information in Dixon and Keighery (1995):

Category 1: significant weed species present in particular areas that appear to be displacing native species but for which control is feasible.

Category 2: species present in low numbers but with the potential to become significant weeds in the future and for which control is feasible.

Category 3: species not likely to become significant weeds or for which control is not feasible at present, these species need to be reviewed regularly and new control methods considered as they become available.

The category 1 and 2 weeds are listed in Table 5.4.1. This list is not definitive and given primarily as a basis for discussion. The placing of weed species in these categories is a management tool that needs to be reviewed regularly as the vegetation changes in response to control procedure and new control methods become available.

Table 5.4.1: Weeds believed to be a significant or potentially significant problem in the Boronia Gully bushland.

Botanical Name	Family	Common Name	Category
* <i>Avena barbata</i>	Poaceae	Bearded Oat	1
* <i>Briza minor</i>	Poaceae	Shivery Grass	2
* <i>Briza maxima</i>	Poaceae	Blowfly Grass	2

Only one category 1 species (see Appendix 4), **Avena barbata*, is a problem and needs priority control. This species is present in COBG 6 (Jarrah Open Woodland over Honey Bush) and COBG 15 (Harsh Hakea and Moonah Low Open Woodland). Using the principles of bush regeneration, work on degraded areas should be a low priority, as the best quality bushland should be focused on first to ensure it maintains its condition. Therefore the presence of **Avena barbata* throughout the very good quality Jarrah over Honey Bush Woodland (COBG 6) would be the highest priority for treatment.

5.4.1.1 Riparian weeds

The Boronia Gully bushland has a significant riparian area in excellent condition. Therefore the potential impact of weeds in the riparian areas should be a management consideration, as aggressive weeds entering these areas could potentially degrade them by out competing native species.

At Boronia Gully currently the biggest risk to the riparian vegetation is from pasture species (particularly Yorkshire Fog (**Holcus lanatus*)).

5.4.2 Grazing

Preventing grazing in bushland is an important consideration. In the vegetation around Collie grazing in bushland has been shown to decrease the number of perennial herbs and shrubs, and increase weed invasion (Pettit, *et al.*, 1995).

Eliminating grazing will allow vegetation to recover and increase the conservation value of areas where grazing is currently being undertaken, for example the *Allocasuarina fraserana* Open Woodland, currently has a very sparse herb layer, but could quite likely regenerate once fenced off.

The riparian zone is currently in a state that would be the envied by many others who have highly invasive weeds in their riparian zones. The Tonkins' bushland is essentially weed free in many places, particularly the riparian zone, therefore it is extremely important grazing isn't allowed in these areas.

6. Conclusion

It is encouraging to find landholders with the enthusiasm and insight to undertake and value the outcomes of surveys of the flora and vegetation of their bushland. This survey has confirmed that Boronia Gully bushland has high conservation value. It is one of the few intact areas of riparian areas on private property fenced off in the Collie Shire, containing both intact riparian and adjacent upland vegetation. The following attributes of the site combine to give this site its unique character and significant conservation value:

The Boronia Gully Bushland is of important conservation value because it contains:

- several types of Eucalypt woodlands and a range of riparian plant communities in Excellent condition
- a transect from creekline to upland with the associated communities
- a total of 247 native plant taxa (species, subspecies and varieties)
- Four species of significant flora of which are currently listed as priority species
- the significant fauna species *Isoodon obesulus fusciventer*, Quenda or Southern Brown Bandicoot, and
- a variety of habitats for fauna.

It is now well understood, accepted and promoted that the retention of existing remnant vegetation is of vital importance in supporting public and private efforts to reverse land degradation and biodiversity loss, and to prevent these problems worsening while solutions are found and implemented. All remaining remnants are valuable resources for the maintenance of biodiversity and command a high priority for conservation.

This site is an important area of conservation value along the Collie River. The variation and condition of the plant communities, with the limited disturbance factors and relative absence of weeds in the majority of the bushland adds to its value. The challenge is to maintain this site's condition. Key factors presently affecting the condition of the vegetation and flora are discussed in this report.

The survey has helped achieve the purposes of educating the community about bushland and fostering city-country link. Eighteen Wildflower Society volunteers, including 4 botanists participated, giving their time and expertise as well as learning about some vegetation in the Collie Shire, an area which is currently not well known botanically (G. Keighery, pers. comm.). Members of the local community, along with the Tonkin family, were participants in the project.

The resulting information and field herbarium will be available as resources to the community and it is hoped that the interest and awareness of the vegetation and flora of the local area will continue to grow.

7. Acknowledgements

Colin Tonkin submitted the application for this survey on behalf of the Collie Landcare District Committee and the following local community members took part and made valuable contributions to the survey: Jeremy Case, Tristan Case, Cathy Dixon, Leanne Ledbetter, Ross Mandry, Ken Whitehouse, Margaret Tonkin.

The survey was made possible through the continued involvement and enthusiasm of the following Wildflower Society volunteers: Jennifer Bell, Alan Bellman, Anne Bellman, Mary Bremner, Jeff Faulkner, Shirley Fisher, Graham Fisher, Elizabeth George, Jennifer Hawkes, Colma Keating, Greg Keighery, Amanda Malone, Margaret Phillips, Alice Stubber, Carolyn Switzer, Sylvia Tetlow, Sherry Thomas and Andrew Thomson.

In addition to helping with the field survey work Anne Bellman, Sylvia Garlick, Elizabeth George, Brian Moyle, Dorothy Perret, and Andrew Thomson assisted with the large volume of follow up work at the Reference Herbarium, sorting and identifying specimens and preparing the Field Herbarium.

Thank you also to Brian Moyle for help with conducting the second previsit, and to Karen Clarke for conducting the initial previsit and continuing support throughout the project. Thank you to Greg Keighery for the supply of slides used produce the photographs in the report and for helping with updating species names. Thank you to Mark Brundrett for confirming orchid identifications.

The project was greatly supported by the use of the West Australian Herbarium, particularly the Reference Herbarium facilities and this is gratefully acknowledged. The assistance of Mike Hislop with confirmation of numerous identifications is particularly appreciated. Thank you also to Greg Keighery and Neil Gibson for assistance with difficult plant identifications.

Acknowledgment is also due to the Department of Environmental Protection for producing the locality map (Figure 1).

The Bushland Plant Survey Project is a community volunteer program. The project was supported by funding from the Bushcare Program of the Natural Heritage Trust (1999-2000), a Federal Government initiative and by the Department of Conservation and Land Management and the Department of Environmental Protection Ecoplan Program.

8. References

- Aplin, T.E.H. (1979). The Flora. In: O'Brien, B.J. (Ed.) *Environment and Science*. University of Western Australia Press, Nedlands, Western Australia.
- Atkins, K (2001). *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Como, Western Australia.
- Bell, R.W. (1997). Geomorphology and Soils with particular reference to Southwest Australia. In: N310 Land Management Unit Reader Volume 1. Murdoch University, Perth, Western Australia.
- Bennett, E.M. (1993). *Common and Aboriginal Names of Western Australian Plant Species*. 2nd Edition. Eastern Hills Branch of the Wildflower Society of WA (Inc.), Glen Forrest, Western Australia.
- Brown, A., Coates, D. and Hopper, S. (1998). Why are there so many threatened plants in WA? In: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds.) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Perth, Western Australia.
- Bureau of Meteorology (2001). URL: http://www.bom.gov.au/climate/averages/tables/cw_009628.shtml. Accessed on 17th September, 2001
- Churchward, H.M and McArthur, W.M. (1980). Landforms and soils of the Darling System of Western Australia. In: *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia.
- Collie Water Advisory Group (1996). Strategies for Water Resource Management in the Collie Basin. Department of Resources Development, Perth Western Australia.
- Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.
- DEP (1998). Unpublished GIS database output.
- Dixon, B. and Keighery, G.J. (1995). "Weeds and their control", "Suggested methods to control weeds" and "Recommended methods to control specific weed species". In: *Managing Perth's Bushlands*. pp 26-144. Greening Western Australia, Perth, Western Australia.
- Griffin, E.A. and Keighery, B.J. (1989). *Moore River to Jurien Sandplain Survey*. Wildflower Society of WA (Inc.), Nedlands, Western Australia.
- Hedde, E.M, Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Perth, Western Australia.
- Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds. A Guide to the Weeds of Western Australia*. The Plant Protection Society of Western Australia (Inc.), Victoria Park, Western Australia.
- Keighery, B.J. (1994). *Bushland Plant Survey. A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.), Nedlands, Western Australia.
- McArthur, W.M. (1991). The Darling Plateau and Narrogin. In: *Reference Soils of South-Western Australia*. Dept of Agriculture, Western Australia and Australian Society of Soil Science.

Muir, B.G. (1997). Biological Survey of the Western Australian Wheatbelt. Part II Vegetation and habitat of Bendering Reserve. *Records of the Western Australian Museum*, Supplement No. 3.

NWS Executive (1997). *The National Weeds Strategy: A strategic approach to weed problems of national significance*. Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council and Forestry Ministers Australia. Canberra: Commonwealth of Australia.

Paczkowska, G. and Chapman, A.R. (2000). *The Western Australia Flora. A Descriptive Catalogue*. Wildflower Society of Western Australia (Inc.), Western Australian Herbarium, CALM and the Botanic Gardens and Parks Authority, Perth, Western Australia.

Pettit, N. E., Froend, R. H. and Ladd, P. G. (1995). Grazing in remnant woodland vegetation: changes in species composition and life form groups. *Journal of Vegetation Science* 6: 121-130.

Safstrom, R. (1995). Conservation values of small reserves in the Central Wheatbelt of Western Australia: A framework for evaluating the conservation values of small reserves. Unpublished report for the Department of Conservation and Land Management, Perth, Western Australia.

Shea, S. (1998). A vision for the future. In: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds.) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Perth, Western Australia.

Shire of Collie (2001). Economic Profile and Demographics. URL: <http://www.collie.wa.gov.au/economy.html> Accessed on the 17th September 2001.

Smith, F.G. (1972). *Vegetation Map: Collie*. West Australian Department of Agriculture, Perth, Western Australia.

Waterways Commission (1993). *Collie and Brunswick Rivers Foreshore Reserves Study Draft Report*. Prepared for the Leschenault Inlet Management Authority by the Waterways Commission.

Appendix 1 –Vegetation Structure Classification Scheme and Vegetation Condition Scale

Classification system used to describe Vegetation Structure (Keighery, B.J. (1994), as adapted from Muir (1977) and Aplin (1979)).

Life Form/ Height Class	Canopy Cover			
	100-70%	70-30%	30-10%	10-2%
Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrub over 2m	Closed Scrub	Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Very Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Vegetation Condition Scale (Keighery, B.J. (1994), as adapted from Trudgen (1991)).

Condition	Description
'Pristine'	Pristine or nearly so, no obvious signs of disturbance
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example, damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by various signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

Appendix 2 – Quadrat Descriptions Arranged by Mapped Plant Community

Fringing Woodlands

Flooded Gum – Swamp Peppermint Fringing Woodlands

COBG 10

Eucalyptus rudis (Flooded Gum) Open Woodland over *Agonis linearifolia* (Swamp Peppermint) and *Kunzea ericifolia* (Spearwood) Tall Shrubland over *Kunzea recurva* Shrubland over *Hypocalymma angustifolium* Low Shrubland over Mixed Very Open Grassland over *Lepidosperma tetraquetrum* and *Schoenus efolius* Open Sedgeland.

Condition rating: Excellent

Latitude: 33^o 20. 17.3' Longitude: 116^o 11. 33.8'

Topographic position: seasonal wetland

Slope: gentle

Aspect: SW

Soil: light grey sand over light grey sand

Drainage: poor

Litter: 2-10%, 1 cm

Bare Ground: 0-2%

Number of Species: 39 (38 natives,1 weed)

Moonah – Flooded Gum Fringing Woodlands

COBG 5

Eucalyptus rudis (Flooded Gum) Open Woodland over *Melaleuca preissiana* (Moonah) over *Agonis linearifolia* (Swamp Peppermint) Open Heath over *Aotus cordifolia* and *Hypocalymma angustifolium* (White Myrtle) Low Open Shrubland over **Holcus lanatus* Very Open Grassland over Mixed Very Open Herbland over *Lepidosperma tetraquetrum* Very Open Sedgeland.

Condition rating: Good

Latitude: 33^o 29. 8' Longitude: 116^o 115. 6'

Topographic position: wet flat

Slope: gentle

Aspect: W

Soil: sandy loam over white sand

Drainage: moderate

Litter: 2-10%, 1cm

Bare Ground: 1-2%

Number of Species: 34 (25 natives, 9 weeds)

COBG 8

Melaleuca preissiana (Moonah) Tall Open Woodland over *Agonis linearifolia* (Swamp Peppermint) and *Acacia divergens* Closed Scrub over *Hypocalymma angustifolium*, *Boronia megastigma* and *Aotus cordifolia* Open Shrubland over *Gahnia decomposita* Very Open Tall Sedgeland over Mixed Closed Low Sedgeland

Condition rating: Excellent

Latitude: 33^o 20. 22.4' Longitude: 116^o 11. 41.5'

Topographic position: seasonal wetland
Slope: flat
Aspect: -
Soil: black peaty sand over black sand, ironstone at 10-20 cm
Drainage: poor
Litter: 15%, 5 cm
Bare Ground: 0%
Number of Species: 29 (27 natives, 2 weeds)

COBG 9

Eucalyptus rudis (Flooded Gum) and *Melaleuca preissiana* (Moonah) Low Open Woodland over *Viminea juncea* Shrubland over *Astartea* species, *Agonis linearifolia* (Swamp Peppermint) and *Melaleuca incana* subspecies *incana* Open Heath over *Hypocalymma angustifolium* Low Shrubland over Mixed Closed Sedgeland.

Condition rating: Excellent

Latitude: 33^o 20. 16.6' Longitude: 116^o 11. 11.2'
Topographic position: seasonal wetland
Slope: gentle
Aspect: N
Soil: black clay over black clay and laterite
Drainage: mod
Litter: 10%, 1 cm
Bare Ground: 10%
Number of Species: 54 (47 natives, 7 weed)

COBG 14

Eucalyptus rudis (Flooded Gum) Open Woodland over *Agonis linearifolia*, *Melaleuca preissiana* and *Astartea fascicularis* Open Scrub over *Acacia divergens* and *Aotus cordifolia* Shrubland over **Holcus lanatus* Open Grassland over *Juncus pallidus* and *Gahnia decomposita* Sedgeland.

Condition rating: Very Good to Good

Latitude: 33^o 20. 27.7' Longitude: 116^o 11. 50.4'
Topographic position: seasonal wetland
Slope: flat to gentle
Aspect: E
Soil: dark brown peaty clay over grey sand
Drainage: poor
Litter: 40%, 5 cm
Bare Ground: 5%
Number of Species: 21 (12 natives, 9 weeds)

Moonah and Harsh Hakea Low Open Forest

COBG 1

Melaleuca preissiana (Moonah) Low Open Woodland over *Hakea prostrata* Tall Open Shrubland over *Acacia extensa* and *Kunzea recurva* Open Shrubland over *Hypocalymma angustifolium* Open Low Heath over Mixed Sedgeland.

Condition rating: Excellent

Latitude: 33^o 20. 17.0' Longitude: 116^o 11. 33.1'

Topographic position: seasonal wetland
Slope: gentle
Aspect: NW
Soil: black sand over light brown sandy clay
Drainage: poor
Litter: 1%, <1cm deep
Bare Ground: <1%
Number of Species: 52 (47 natives, 5 weeds)

COBG 15

Hakea prostrata (Harsh Hakea) and *Melaleuca preissiana* (Moonah) Low Open Woodland over *Hypocalymma angustifolium* (White Myrtle) Low Open Shrubland over **Briza maxima* (Blowfly Grass) Very Open Grassland over *Xanthorrhoea preissii* (Balga) Very Open Herbland.

Condition rating: Good to Very Good

Latitude: 33^o 28. 22.5' Longitude: 116^o 11. 29.7'
Topographic position: dune slope
Slope: gentle
Aspect: N
Soil: redly brown laterite over orange brown laterite
Drainage: well
Litter: 60%, 0-4 cm
Bare Ground: 25%
Number of Species: 52 (35 natives, 17 weeds)

Heath – Shrubland Complexes

Harsh Hakea Shrubland

COBG 12

Hakea prostrata (Harsh Hakea) Tall Open Shrubland over *Xanthorrhoea preissii* (Balga) Low Shrubland over *Neurachne alopecuroidea* (Foxtail Mulga Grass) Very Open Grassland over *Burchardia umbellata* Very Open Herbland.

Condition rating: Very Good

Latitude: 33^o 20. 21.3' Longitude: 116^o 11. 28.2'
Topographic position: seasonal wetland
Slope: gentle
Aspect: NW
Soil: brown laterite over brown laterite
Drainage: well
Litter: 30%, 1 cm
Bare Ground: 10%
Number of Species: 53 (43 natives, 10 weeds)

***Kunzea recurva* and *Acacia extensa* Open Shrubland**

COBG 7

Kunzea recurva and *Acacia extensa* Open Shrubland over *Hypocalymma angustifolium* (White Myrtle), *Boronia megastigma* and *Andersonia involucrata* Low Open Heath over *Schoenus efolius* and *Hypolaena exsulca* Closed Sedgeland.

Condition rating: Excellent

Latitude: 33^o 20. 19.1' Longitude: 116^o 11. 40.9'

Topographic position: seasonal wetland

Slope: gentle

Aspect: SW

Soil: grey sand over white sand

Drainage: mod

Litter: 60%, 1-2 cm

Bare Ground: 0%

Number of Species: 51 (48 natives, 3 weeds)

Eucalyptus Woodlands

Marri - Balga Woodland

COBG 2

Eucalyptus calophylla (Marri) Woodland over *Xanthorrhoea preisii* (Balga) Shrubland over Mixed Open Herbland.

Vegetation condition: Excellent

Latitude: 33^o 20. 20.5' Longitude: 116^o 11. 52.1'

Topographic position: Dune slope

Slope: gentle to steep

Aspect: S

Soil: grey sand over grey loamy sand

Drainage: well

Litter: 85%, 1-2 cm

Bare Ground: 7-10%

Number of Species: 55 (54 natives, 1 weeds)

Marri - Jarrah Woodland

COBG 3

Eucalyptus marginata (Jarrah) and *Eucalyptus calophylla* (Marri) Open Woodland over *Acacia extensa* Open Shrubland over *Acacia pulchella*, *Leucopogon propinquus* and *Phyllanthus calycinus* Open Low Heath over *Tetraria capillaris* and *Lepidosperma pubisquameum* Open Sedgeland.

Condition: Very Good to Excellent

Latitude: 33^o 20. 006' Longitude: 116^o 11. 336'

Topographic position: Upland
Slope: gentle
Aspect: SW
Soil: brown laterite over orange brown laterite
Drainage: well
Litter: 80 - 90%, 1cm
Bare Ground: < 2%
Number of Species: 53 (50 natives, 3 weeds)

COBG 11

Eucalyptus calophylla (Marri) and *Eucalyptus marginata* (Jarrah) Low Open Woodland over *Hakea lissocarpa* (Honey Bush) and *Xanthorrhoea preissii* (Balga) Open Shrubland over Mixed Open Low Heath over Mixed Very Open Grassland over Mixed Very Open Sedgeland.

Condition rating: Excellent

Latitude: 33^o 20. 21.1' Longitude: 116^o 11. 49.0'
Topographic position: dune slope
Slope: gentle
Aspect: SWW
Soil: light grey sand over grey and brown sand
Drainage: well
Litter: 30%, 1 cm
Bare Ground: 2%
Number of Species: 59 (57 natives, 2 weeds)

COBG 13

Eucalyptus calophylla (Marri) and *Eucalyptus marginata* (Jarrah) Woodland over *Hakea prostrata* (Harsh Hakea), *Hakea lissocarpa* (Honey Bush) and *Acacia extensa* Open Shrubland over *Neurachne alopecuroidea* Very Open Grassland over *Mesomeleana tetragona* Very Open Sedgeland.

Condition rating: Very Good

Latitude: 33^o 20. 19.1' Longitude: 116^o 11. 43.2'
Topographic position: seasonal wetland
Slope: gentle
Aspect: S
Soil: brown sandy loam over brown sandy loam
Drainage: well
Litter: 80%, 1.5 cm
Bare Ground: 0%
Number of Species: 51 (48 natives, 3 weeds)

Jarrah Woodland

COBG 4

Eucalyptus marginata (Jarrah) Woodland over *Hakea prostrata* (Harsh Hakea) Low Woodland over *Xanthorrhoea preissii* (Balga) Open Shrubland over *Hakea lissocarpa* (Honey Bush) and *Hypocalymma angustifolium* (White Myrtle) Low Open Shrubland over *Austrostipa* sp Very Open Grassland over *Conostylis aculeata* Open Herbland over *Tetraria* species Open Sedgeland.

Condition: Excellent

Latitude: 33^o 20. 15.9' Longitude: 116^o 11. 36.3'
Topographic position: upland
Slope: gentle
Aspect: W
Soil: brown-black sandy loam over beige sandy loam
Drainage: well
Litter: 40- 45 %, 2 cm
Bare Ground: < 2%
Number of Species: 70 (65 natives, 5 weeds)

COBG 6

Eucalyptus marginata (Jarrah) Open Woodland over *Hakea lissocarpa* (Honey Bush) Open Shrubland over *Acacia pulchella* (Prickly Moses) Open Low Heath over Mixed Very Open Grassland over Mixed Very Open Herbland over *Lepidosperma leptostachyum* Very Open Sedgeland.

Condition rating: Good to Very Good

Latitude: 33^o 20. 029' Longitude: 116^o 11. 349'
Topographic position: upland
Slope: gentle
Aspect: W
Soil: brown sandy loam with laterite over brown laterite
Drainage: well
Litter: 45-50%, 3-4 cm
Bare Ground: <2%
Number of Species: 61 (57 natives, 4 weeds)

Appendix 3 - Species List for Boronia Gully Bushland

All taxa (species, subspecies and varieties) recorded in the quadrats or adjacent to them as well as taxa recorded opportunistically from elsewhere within the site are listed in the following table. The taxa are listed alphabetically by family, and within families alphabetically by genera.

Key:

Column 1 – Botanical Name

* indicates a weed species (“a plant growing where it is not wanted” Hussey et al. 1997).

Column 2 – Plant Family

According to the classification scheme of Cronquist (1981)

Column 3 – Common Name

The common name given in Paczkowska and Chapman (2000) or the Preferred Vernacular Name listed in Bennett (1993) has been used for each taxa where a common name exists.

Column 4 – Life Form

a Annual – a plant which completes its life cycle in less than 1 year, germinates and flowers, sets seed and dies all in the same year.

p Perennial – a plant that lives 3 or more years/growing seasons.

Column 5 – Growth Form

The plants have been divided according to the following growth forms adapted from Keighery, BJ (1994):

Tree: woody plant with a trunk and canopy, the canopy is less than or equal to 2/3 of the height of the trunk, no lignotuber apparent.

Shrub: woody plant with one or more woody stems, foliage all or part of the total height of the plant.

Grass: non-woody plants that have conspicuous individual flowers that are pollinated by wind.

Sedge: non-woody, tufted or spreading plant that comes from the plant family Cyperaceae, most have inconspicuous flowers that are pollinated by wind.

Herb: non-woody plant with stems, generally under 0.5m tall and that is not a grass, sedge or rush.

Column 6 – Conservation Status (Rare/Priority)

The Department of Conservation and Land Management publish a ‘Declared Rare Flora and Priority Flora List’ (Atkins, 2001) each year which places taxa that are under threat into various categories according to the threatening processes affecting them. The categories are:

Declared Rare Flora (DRF) – taxa afforded special protection under the Wildlife Conservation Act 1950 making it illegal for any person to take declared rare flora on any land throughout the State without the consent in writing of the Minister for the Environment. These taxa are also listed each year in a notice published in the Government Gazette. The current knowledge about and threats to DRF are continually assessed. Each taxon is assigned to one of

5 categories, critically endangered, endangered, vulnerable, data deficient or presumed extinct (Brown *et al.*, 1998). Resources are allocated to recover these rare species according to their category, with those critically endangered receiving the highest priority.

Priority Flora are of uncertain conservation status and annually reassessed as new information becomes available. They are also divided into categories according to the degree of threat (Atkins, 2001).

Priority 1 (P1) – poorly known taxa - taxa which are known from one or a few (generally < 5) populations which are under threat, either due to small population size or being on lands under immediate threat, eg. road verges, urban areas, farmland, mineral leases. Many include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

Priority 2 (P2) – poorly known taxa – taxa which are known from one or a few (generally < 5) populations, at least some of which are not considered to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

Priority 3 (P3) – poorly known taxa – taxa which are known from several populations, at least some of which are not believed to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

Priority 4 (P4) –rare taxa – taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

The current status of the flora recorded in the Boronia Gully bushland as listed in Atkins (2001), is given in Column 6.

Appendix 3 - Species List for Boronia Gully Bushland

Botanical Name	Family	Common Name	Life Form	Growth Form	Rare/ Priority	Occurrence in Mapped Plant Communities in Quadrats														
						MHf	M Bw	MJw		Jw	MfW			K As	Fw	Hs	Af	Op		
<i>Adiantum aethiopicum</i>	Adiantaceae	Common Maidenhair	p	Herb													7			
<i>Ptilotus manglesii</i>	Amaranthaceae	Poms	p	Herb								4								
<i>Agrostocrinum scabrum</i>	Anthericaceae	Blue Grass Lily	p	Herb		1		2				4	6				7			
<i>Caesia micrantha</i>	Anthericaceae	Pale Grass-lily	p	Herb				2	3	11	13 a		6		8				12	
<i>Chamaescilla corymbosa</i> variety <i>corymbosa</i>	Anthericaceae	Blue Squill	p	Herb				15							8				12	
<i>Dichopogon capillipes</i>	Anthericaceae	-	p	Herb				15							9				12	
<i>Sowerbaea laxiflora</i>	Anthericaceae	Purple Tassles	p	Herb		1		2							9					
<i>Thysanotus multiflorus</i>	Anthericaceae	Many-flowered Fringe Lily	p	Herb									6							
<i>Thysanotus patersonii</i>	Anthericaceae	Twining Fringe Lily	p	Herb						11			6		9				12	
<i>Thysanotus species</i>	Anthericaceae	Fringed Lily	p	Herb								4								
<i>Tricoryne humilis</i>	Anthericaceae	-	p	Herb				2		11	13	4		5					12	
<i>Actinotus glomeratus</i>	Apiaceae	Flannel Flowers	p/a	Herb																Af
<i>Centella asiatica</i>	Apiaceae	-	p	Herb									6		9					
<i>Hydrocotyle callicarpa</i>	Apiaceae	Small Pennywort	a	Herb				2												
<i>Pentapeltis silvatica</i>	Apiaceae	Southern Pentapeltis	p	Herb					3											
<i>Trachymene pilosa</i>	Apiaceae	Native Parsnip	a	Herb				15	2	3			4							
<i>Xanthosia atkinsonia</i>	Apiaceae	-	p	Herb						3			6							
<i>Xanthosia candida</i>	Apiaceae	-	p	Herb								4			9					
<i>Xanthosia huegelii</i>	Apiaceae	-	p	Herb				2				4					7			
* <i>Arctotheca calendula</i>	Asteraceae	Capeweed	a	Herb				15											12	

<i>*Cirsium vulgare</i>	Asteraceae	Spear thistle	a	Herb			15													
<i>*Hypochaeris glabra</i>	Asteraceae	Smooth catsear	a	Herb		1	15		3		7			5			14		10	
<i>*Hypochaeris radicata</i>	Asteraceae	Flat Weed	a	Herb												9				12
<i>*Sonchus asper</i>	Asteraceae	Prickly Sowthistle	a	Herb			15													
<i>*Sonchus oleraceus</i>	Asteraceae	Common Sowthistle	a	Herb										8			14			
<i>*Ursinia anthemoides</i>	Asteraceae	Ursinia	a	Herb		15				11			6		9					12
<i>Craspedia variabilis</i>	Asteraceae	-	a/p	Herb		1			2	11	13	4	6a						7	
<i>Hyalosperma cotula</i>	Asteraceae	-	a	Herb						11										
<i>Lagenophora huegelii</i>	Asteraceae	-	p	Herb					2	3	11	13	4	6					7	
<i>Millotia tenuifolia</i> variety <i>laevis</i>	Asteraceae	Soft Millotia	a	Herb	P2				2											
<i>Olearia paucidentata</i>	Asteraceae	Autumn Scrub Daisy	p	Shrub									4							
<i>Podolepis gracilis</i>	Asteraceae	Slender Podolepis	a	Herb																Af
<i>Pterochaeta paniculata</i>	Asteraceae	Wooly 'waitzia'	a	Herb																Af op
<i>Quinetia urvillei</i>	Asteraceae	Quinetia	a	Herb		1a														
<i>Trichocline spathulata</i>	Asteraceae	Native Gerbera	p	Herb																12
<i>Labichea punctata</i>	Caesalpinoideae	Lance-leaved Cassia	p	Shrub			15		3	11			6							12
<i>Wahlenbergia multicaulis</i>	Campanulaceae	-	p	Herb									6a							
<i>*Petrorhagia velutina</i>	Carophyllaceae	Velvet Pink	a	Herb																12
<i>Aphelia cyperoides</i>	Centrolepidaceae	-	a	Sedge		1								5						12
<i>Centrolepis aristata</i>	Centrolepidaceae	Pointed Centrolepis	a	Sedge		1														
<i>Centrolepis pilosa</i>	Centrolepidaceae	-	a	Sedge										5						
<i>Burchardia congesta</i>	Colchicaceae	Milkmaids	p	Herb			15	2	3	11	13	4	6a		9					12
<i>Baumea acuta</i>	Cyperaceae	Pale Twig Rush	p	Sedge										5	8					
<i>Baumea rubiginosa</i>	Cyperaceae	-	p	Sedge											8					10
<i>Baumea vaginalis</i>	Cyperaceae	Sheath Twig Rush	p	Sedge													14			

<i>Cyathochaeta avenacea</i>	Cyperaceae	-	p	Sedge									13				8	9		7				
<i>Cyathochaeta equitans</i>	Cyperaceae	-	p	Sedge													8							
<i>Gahnia decomposita</i>	Cyperaceae	Sawsedge	p	Sedge													8		14					
<i>Isolepis cyperoides</i>	Cyperaceae	-	a/p	Sedge																				op
<i>Lepidosperma leptostachyum</i>	Cyperaceae	-	p	Sedge			15									6								
<i>Lepidosperma pubisquameum</i>	Cyperaceae	-	p	Sedge		1	15	2		11	13	4					8	9			10	12		
<i>Lepidosperma squamatum</i>	Cyperaceae	-	p	Sedge																	7			
<i>Lepidosperma tetraquetrum</i>	Cyperaceae	-	p	Sedge												5						10		
<i>Mesomelaena tetragona</i>	Cyperaceae	Semaphore Sedge	p	Sedge				2		11	13	4						9			7			
<i>Schoenus curvifolius</i>	Cyperaceae	-	p	Sedge		1																		
<i>Schoenus discifer</i>	Cyperaceae	-	a	Sedge														9						
<i>Schoenus foliatus</i>	Cyperaceae	-	p	Sedge		1															7	10		
<i>Schoenus variicellae</i>	Cyperaceae	-	a	Sedge			15a																	
<i>Tetraria capillaris</i>	Cyperaceae	Hair Sedge	p	Sedge			15	2	3	11		4											12	
<i>Tetraria octandra</i>	Cyperaceae	-	p	Sedge			15		3	11	13	4									7			
<i>Dasypogon bromeliifolius</i>	Dasypogonaceae	Pineapple Bush	p	Herb		1															7	10		
<i>Lomandra brittanii</i>	Dasypogonaceae	-	p	Herb		1			3						6									
<i>Lomandra caespitosa</i>	Dasypogonaceae	Tufted Mat Rush	p	Herb																	7			
<i>Lomandra hermaphrodita</i>	Dasypogonaceae	-	p	Herb				2		11											7			
<i>Lomandra integra</i>	Dasypogonaceae	-	p	Herb				2							6			9						
<i>Lomandra nigricans</i>	Dasypogonaceae	-	p	Herb																	7			
<i>Lomandra preisii</i>	Dasypogonaceae	-	p	Herb			15a	2	3			4	6	5a										
<i>Lomandra purpurea</i>	Dasypogonaceae	Purple Mat Rush	p	Herb									6											
<i>Lomandra sericea</i>	Dasypogonaceae	Silky Mat Rush	p	Herb				2	3			4	6								7			
<i>Lomandra suaveolens</i>	Dasypogonaceae	-	p	Herb				2		11		4												

<i>Pteridium esculentum</i>	Dennistaediaceae	Bracken Fern	p	Herb														10			
<i>Hibbertia amplexicaulis</i>	Dilleniaceae	-	p	Shrub								4a	6								
<i>Hibbertia commutata</i>	Dilleniaceae	-	p	Shrub				3	11	13	4	6									
<i>Hibbertia enervia</i>	Dilleniaceae	-	p	Shrub				2													
<i>Hibbertia hypericoides</i>	Dilleniaceae	Yellow Buttercups	p	Shrub						11	13		6								
<i>Hibbertia racemosa</i>	Dilleniaceae	Stalked Guinea Flower	p	Shrub			15			11	13	4				9				12	
<i>Hibbertia</i> species aff <i>inconspicua</i>	Dilleniaceae	-	p	Shrub				3													
<i>Hibbertia spicata</i> variety <i>spicata</i>	Dilleniaceae	-	p	Shrub																Af	
<i>Drosera bulbosa</i> subspecies <i>bulbosa</i>	Droseraceae	Red-leaved Sundew	p	Herb												9a					
<i>Drosera erythrorhiza</i> subspecies <i>collina</i>	Droseraceae	-	p	Herb						3a											
<i>Drosera glanduligera</i>	Droseraceae	Pimpernel Sundew	a	Herb		1a							5								
<i>Drosera huegelii</i>	Droseraceae	Bold Sundew	p	Herb				3	11	13	4	6			9					10	
<i>Drosera macrantha</i> subspecies <i>macrantha</i>	Droseraceae	Bridal Rainbow	p	Herb			15														
<i>Drosera menziesii</i> subspecies <i>menziesii</i>	Droseraceae	Pink Rainbow	p	Herb																op	
<i>Drosera myriantha</i>	Droseraceae	Star Rainbow	p	Herb								6									
<i>Drosera pallida</i>	Droseraceae	Pale Rainbow	p	Herb		1		2	3			6									
<i>Drosera pulchella</i>	Droseraceae	Pretty Sundew	p/a	Herb											9						
<i>Drosera</i> species	Droseraceae		p	Herb																12	
<i>Drosera stonolifera</i> subspecies <i>stonolifera</i>	Droseraceae	Leafy Sundew	p	Herb				2													
<i>Andersonia involucreta</i>	Epacridaceae	-	p	Shrub		1														7	
<i>Astroloma ciliatum</i>	Epacridaceae	Candle Cranberry	p	Shrub					3		13	6								10	12
<i>Astroloma drummondii</i>	Epacridaceae	-	p	Shrub								6									
<i>Astroloma pallidum</i>	Epacridaceae	Kick Bush	p	Shrub					3a	11		6								12	
<i>Leucopogon australis</i>	Epacridaceae	Spiked Beard-heath	p	Shrub		1a									8a					10	
<i>Leucopogon propinquus</i>	Epacridaceae	-	p	Shrub					3			6									

<i>Monotaxis occidentalis</i>	Euphorbiaceae	-	p	Shrub				2											
<i>Phyllanthus calycinus</i>	Euphorbiaceae	False Boronia	p	Shrub		15	3		4	6		9				12			
<i>Poranthera heugelii</i>	Euphorbiaceae	-	p	Shrub															op
<i>Poranthera microphylla</i>	Euphorbiaceae	Small Poranthera	p	Herb												12			
* <i>Erodium botrys</i>	Geraniaceae	Corkscrews	a	Herb		15													
<i>Dampiera alata</i>	Goodeniaceae	Winged-stem Dampiera	p	Herb		15a	3a		13	4									
<i>Dampiera linearis</i>	Goodeniaceae	Common Dampiera	p	Herb	1		2		13	4	6		8	9		7	10	12	
<i>Goodenia caerulea</i>	Goodeniaceae	-	p	Herb		15													
<i>Lechenaultia biloba</i>	Goodeniaceae	Blue Leschenaultia	p	Shrub		15	2		11	13	4	6				7		12	
<i>Scaevola calliptera</i>	Goodeniaceae	Royal Robe	p	Herb	1	15	2	3	11	13	4	6				7	10		16
<i>Velleia trinervis</i>	Goodeniaceae	-	p	Herb						4									
<i>Anigozanthus bicolor</i>	Haemodoraceae	Little Kangaroo Paw	p	Herb										9					
<i>Anigozanthus manglesii</i>	Haemodoraceae	Mangles Kangaroo Paw	p	Herb					11a	13a									
<i>Conostylis aculeata</i>	Haemodoraceae	Prickly Conostylis	p	Herb	1		2		11	13	4			9		7			
<i>Conostylis laxiflora</i>	Haemodoraceae	-	p	Herb															Af
<i>Conostylis setigera</i>	Haemodoraceae	Bristly Cottonhead	p	Herb		15			11	13	4			9				12	
<i>Conostylis setosa</i>	Haemodoraceae	White Cottonhead	p	Herb															Af
<i>Haemodorum parviflorum</i>	Haemodoraceae	-	p	Herb															op
<i>Haemodorum species</i>	Haemodoraceae	Blood Root	p	Herb														12	
<i>Phlebocarya ciliata</i>	Haemodoraceae	-	p	Herb	1		2												
<i>Glischrocaryon areum</i> variety <i>areum</i>	Haloragaceae	Common Popflower	p	Herb					11	4a									
<i>Hypoxis occidentalis</i>	Hypoxidaceae	-	p	Herb	1									9					
* <i>Romulea rosea</i>	Iridaceae	Guildford Grass	p	Herb		15									14			12	
<i>Patersonia juncea</i>	Iridaceae	Rush Leaved Patersonia	p	Herb					13	4									

<i>Patersonia occidentalis</i>	Iridaceae	Purple Flag	p	Herb		1		2	11			5a		9		10		
* <i>Juncus capitatus</i>	Juncaceae	Capitate Rush	a	Grass like Herb								5						
<i>Juncus caespiticius</i>	Juncaceae	Grassy Rush	p	Rush								8						
<i>Juncus holoschoenus</i>	Juncaceae	Jointleaf Rush	p	Rush								8a						
<i>Juncus pallidus</i>	Juncaceae	Pale Rush	p	Rush								5		14				
<i>Hemiandra pungens</i>	Lamiaceae	Snakebush	p	Shrub			2		11	13	4			9a			12	
<i>Hemigenia species</i>	Lamiaceae	-	p	Shrub													12	
<i>Cassytha glabella</i> forma <i>casuarinae</i>	Lauraceae	Tangled Dodder Laurel	p	Climber (Parasitic)								5						
<i>Cassytha species</i>	Lauraceae	-	p	Climber (Parasitic)					11				8					
<i>Isotoma hypocrateriformis</i>	Lobeliaceae	Woodbridge Poison	a	Herb														op
<i>Lobelia alata</i>	Lobeliaceae	Ribbed Lobelia	p	Herb								5	8a					
<i>Logania serpyllifolia</i> subspecies. <i>angustifolia</i>	Loganiaceae	-	p	Herb			2	3		13		6				7		Af
<i>Villarsia parnassifolia</i>	Menyanthaceae	-	p	Herb														op
<i>Acacia applanata</i>	Mimosaceae	-	p	Shrub					11	13	4	6				7		
<i>Acacia divergens</i>	Mimosaceae	-	p	Shrub									8	9	14	7	10	
<i>Acacia extensa</i>	Mimosaceae	Wiry Wattle	p	Shrub		1		2	3		13	4	6	5		7	10	a
<i>Acacia insolita</i> subspecies. <i>insolita</i>	Mimosaceae	-	p	Shrub			15			11								
<i>Acacia nervosa</i>	Mimosaceae	Rib Wattle	p	Shrub					3			6					12	
<i>Acacia pulchella</i> variety <i>pulchella</i>	Mimosaceae	Prickly Moses	p	Shrub					3			4a	6		9	7	12	
<i>Acacia stenoptera</i>	Mimosaceae	Narrow Winged Wattle	p	Shrub						11	13	4						
<i>Agonis linearifolia</i>	Myrtaceae	Swamp Peppermint	p	Shrub		1							5	8	9	14	7	10
<i>Astartea fascicularis</i>	Myrtaceae	-	p	Shrub		1a							5	8		14	10	
<i>Astartea species</i>	Myrtaceae	-	p	Shrub										9				
<i>Baeckea camphorosmae</i>	Myrtaceae	Camphor Myrtle	p	Shrub			15	2		11								

<i>Callistemon glaucus</i>	Myrtaceae	-	p	Shrub									5						
<i>Calothamnus lehmannii</i>	Myrtaceae	-	p	Shrub		1a													10
<i>Calothamnus pallidifolius</i>	Myrtaceae	Hawkeswood	p	Shrub	P4								6						
<i>Calothamnus species</i>	Myrtaceae	-	p	Shrub															10
<i>Eucalyptus calophylla</i>	Myrtaceae	Marri	p	Tree				2	3	11	13	4							
<i>Eucalyptus drummondii</i>	Myrtaceae	Drummond's Gum	p	Tree															op
<i>Eucalyptus marginata</i>	Myrtaceae	Jarrah	p	Tree				2	3	11	13		6						7
<i>Eucalyptus rudis</i>	Myrtaceae	Flooded Gum	p	Tree		1a							5	8	9				14
<i>Hypocalymna angustifolium</i>	Myrtaceae	White Myrtle	p	Shrub		1	15	2		11	13	4		5	8	9			14
<i>Kunzea glabrescens</i>	Myrtaceae	Spearwood	p	Shrub															10
<i>Kunzea recurva</i>	Myrtaceae	Mountain Kunzea	p	Shrub		1								5					7
<i>Kunzea species</i>	Myrtaceae	-	p	Shrub															10
<i>Melaleuca incana</i> subspecies <i>incana</i>	Myrtaceae	-	p	Shrub															9
<i>Melaleuca preissiana</i>	Myrtaceae	Moonah	p	Tree		1	15					4a		5	8	9		14a	10
<i>Pericalymma ellipticum</i> variety <i>floridum</i>	Myrtaceae	Swamp Teatree	p	Shrub															7
<i>Olex benthamiana</i>	Olacaceae	-	p	Shrub					2a										
<i>Epilobium ?hirtigerum</i>	Onograceae	Hairy Willow Herb	p	Herb															14
* <i>Monadenia bracteata</i>	Orchidaceae	South African Orchid	p	Herb									4		5				7
<i>Caladenia flava</i>	Orchidaceae	Cowslip Orchid	p	Herb								3a		4a	6				
<i>Caladenia longicauda</i>	Orchidaceae	Common White Spider Orchid	p	Herb				2											
<i>Caladenia longicauda</i> subspecies <i>eminens</i>	Orchidaceae	Stark White Spider Orchid	p	Herb								11a							
<i>Caladenia longiclavata</i>	Orchidaceae	Clubbed Spider Orchid	p	Herb								11a							
<i>Caladenia species 1</i>	Orchidaceae	-	p	Herb				2											

<i>Caladenia</i> species 2	Orchidaceae	-	p	Herb		1													10		
<i>Cyanicula sericea</i>	Orchidaceae	Silky Blue Orchid	p	Herb									6								
<i>Cyrtostylis robusta</i>	Orchidaceae	Large Gnat Orchid	p	Herb		1a															
<i>Diuris laxiflora</i>	Orchidaceae	Bee Orchid	p	Herb								4a									
<i>Elythranthera brunonis</i>	Orchidaceae	Purple Enamel Orchid	p	Herb		1				11 a	13								7		
<i>Prasophyllum</i> species	Orchidaceae	Leek Orchid	p	Herb															7		
<i>Pterostylis recurva</i>	Orchidaceae	Jug Orchid	p	Herb					2												
<i>Pterostylis vittata</i>	Orchidaceae	Banded Greenhood	p	Herb						3											
<i>Pyrochis ?nigricans</i>	Orchidaceae	Red Beak Orchid	p	Herb					2												
<i>Thelymitra benthamiana</i>	Orchidaceae	Cinnamon Sun Orchid	p	Herb																	op
<i>Thelymitra crinita</i>	Orchidaceae	Blue Lady Orchid	p	Herb					2	3a											
<i>Thelymitra flexuosa</i>	Orchidaceae	Twisted Sun Orchid	p	Herb																	op
<i>Thelymitra</i> species	Orchidaceae	Sun Orchid	p	Herb					2	3											
<i>Thelymitra</i> species, aff. <i>macrophylla</i>	Orchidaceae	Scented Sun Orchid	p	Herb								4							7a	10	
<i>Aotus cordifolia</i>	Papilionaceae	-	p	Shrub	P3									5	8		14	7	10		
<i>Bossiaea eriocarpa</i>	Papilionaceae	Common Brown Pea	p	Shrub				2		11											12
<i>Bossiaea ornata</i>	Papilionaceae	Broad Leaved Brown Pea	p	Shrub		1a		2	3	11	13	4	6		9			7		12	
<i>Bossiaea rufa</i>	Papilionaceae	-	p	Shrub															7	10	
<i>Chorizema aciculare</i> subspecies. <i>aciculare</i>	Papilionaceae	Needle-leaved Chorizema	p	Shrub								4a									
<i>Chorizema cordatum</i>	Papilionaceae	Flame Pea	p	Shrub											9						
<i>Daviesia angulata</i>	Papilionaceae	-	p	Shrub									6								
<i>Daviesia cordata</i>	Papilionaceae	Bookleaf	p	Shrub						3											
<i>Daviesia incrassata</i>	Papilionaceae	-	p	Shrub			15	2		11 a											12
<i>Gompholobium capitatum</i>	Papilionaceae	Yellow Pea	p	Shrub				2													

<i>Gompholobium marginatum</i>	Papilionaceae	-	p	Shrub			15		3	11		4			9a				
<i>Gompholobium ovatum</i>	Papilionaceae	-	p	Shrub					3				6						
<i>Gompholobium polymorphum</i>	Papilionaceae	-	p	Shrub/Twiner															Af
<i>Gompholobium preissii</i>	Papilionaceae	-	p	Shrub								4							
<i>Hovea chorizemifolia</i>	Papilionaceae	Holly-leaved Hovea	p	Shrub				2	3	11			6						12
<i>Isotropis cuneifolia</i>	Papilionaceae	Common Lamb Poison	p	Shrub															10
<i>Jacksonia furcellata</i>	Papilionaceae	Grey Stinkwood	p	Shrub									5					7	10
<i>Jacksonia hakeoides</i>	Papilionaceae	-	p	Shrub		1						13							
<i>Kennedia coccinea</i>	Papilionaceae	Coral Vine	p	Twining Shrub	1a				3	11	13	4	6						
<i>Kennedia prostrata</i>	Papilionaceae	Scarlet Runner	p	Twining Shrub		15													12
* <i>Lotus angustissimus</i>	Papilionaceae	Narrowleaf Trefoil	a/p	Herb															12
* <i>Lotus suaveolens</i>	Papilionaceae	Hairy Birdsfoot Trefoil	a/p	Herb															14
<i>Sphaerolobium medium</i>	Papilionaceae	-	p	Shrub					3			4	6a						
<i>Sphaerolobium scabriusculum</i>	Papilionaceae	-	p	Shrub															
<i>Sphaerolobium vimineum</i>	Papilionaceae	Leafless Globe Pea	p	Shrub										8					
* <i>Trifolium dubium</i>	Papilionaceae	Yellow Sucking Clover	a	Herb	1		15					4	5						14
							a												
* <i>Trifolium fragiferum</i>	Papilionaceae	Strawberry Clover	p	Herb															14
* <i>Trifolium hybridum</i> variety <i>hybridum</i>	Papilionaceae		p	Herb			15												
* <i>Trifolium subterraneum</i>	Papilionaceae	Subterranean Clover	a	Herb			15												14
																			12
<i>Viminaria juncea</i>	Papilionaceae	Swishbush	p	Shrub										9					
* <i>Pinus radiata</i>	Pinaceae	Radiata Pine	p	Tree									5						
<i>Billardiera variifolia</i>	Pittosporaceae	-	p	Climber					3										12
<i>Marianthus candidus</i>	Pittosporaceae	White Marianthus	p	Climber															7
<i>Sollya heterophylla</i>	Pittosporaceae	Australian Bluebell	p	Climber									6	5	8				

<i>*Aira caryophyllaea</i>	Poaceae	Silvery Hairgrass	a	Grass			15						5						
<i>Amphipogon amphipogonoides</i>	Poaceae	-	p	Grass									9		7	10			
<i>Austrodanthonia caespitosa</i>	Poaceae	Common Wallaby Grass	p	Grass			2	3		4								12	
<i>Austrodanthonia setacea</i> variety <i>brevisetata</i>	Poaceae	Smallflower Wallaby Grass	p	Grass															Af
<i>Austrostipa flavescens</i>	Poaceae	-	p	Grass						4									
<i>Austrostipa pycnostachya</i>	Poaceae	-	p	Grass				3		13	4	6							
<i>*Avena barbata</i>	Poaceae	Bearded Oat	a	Grass			15					6							
<i>*Briza maxima</i>	Poaceae	Blowfly Grass	a	Grass		1	15	2	3	11	13	4	6	5		9		7	12
<i>*Briza minor</i>	Poaceae	Shivery Grass	a	Grass		1	15				4								12
<i>Deyeuxia quadriseta</i> variety <i>cylindrica</i>	Poaceae	Reed Bentgrass	p	Grass									5						
<i>*Holcus lanatus</i>	Poaceae	Yorkshire Fog	p	Grass					3		13	4	6	5	8		14		
<i>*Lolium perenne</i>	Poaceae	Perennial Ryegrass	p	Grass			15												
<i>*Lolium rigidum</i>	Poaceae	Wimmera Ryegrass	a	Grass			15								9				
<i>Neurachne alopecuroidea</i>	Poaceae	Foxtail Mulga Grass	p	Grass			15			11	13	4			9				12
<i>*Poa annua</i>	Poaceae	Winter Grass	a	Grass										9					
<i>Poa porphyroclados</i>	Poaceae	-	p	Grass		1												7a	
<i>Tetrarrhena laevis</i>	Poaceae	Forest Ricegrass	p	Grass					3										
<i>*Vulpia muralis</i>	Poaceae	Wall Fescue	a	Grass		1							5	9					
<i>*Vulpia myuros</i>	Poaceae	Rat's Tail Fescue	a	Grass			15												12
<i>Comesperma calymega</i>	Polygalaceae	Blue-spike Milkwort	p	Herb								6	8	9				10	12
<i>*Rumex</i> species	Polygonaceae	-	a	Herb											14				
<i>Adenanthos obovatus</i>	Proteaceae	Basket Flower	p	Shrub		1												7	
<i>Conospermum capitatum</i> subspecies <i>glabratum</i>	Proteaceae	-	p	Shrub														7	
<i>Dryandra bipinnatifida</i> subspecies <i>bipinnatifida</i>	Proteaceae	-	p	Shrub				2		11									

<i>bipinnatifida</i>																						
<i>Dryandra lindleyana</i> subspecies. <i>sylvestris</i>	Proteaceae	-	p	Shrub		1a					13	4	6a						7		12	
<i>Dryandra lindleyana</i> variety <i>mellicula</i>	Proteaceae	-	p	Shrub			15															
<i>Hakea erinacea</i>	Proteaceae	Hedge-hog Hakea	p	Shrub			15															
<i>Hakea lissocarpa</i>	Proteaceae	Honey Bush	p	Shrub				2	3	11	13	4	6			9a				10	12	
<i>Hakea prostrata</i>	Proteaceae	Harsh Hakea	p	Shrub		1	15			11	13	4			9a	14					12	
<i>Petrophile linearis</i>	Proteaceae	Pixie Mops	p	Shrub																		Af
<i>Xylomelum occidentale</i>	Proteaceae	Woody Pear	p	Tree		1a					13											
<i>Desmocladus fasciculatus</i>	Restionaceae	-	p	Sedge-like herb	1	15	2	3	11	13	4	6		8	9						10	12
<i>Empodisma gracillimum</i>	Restionaceae	-	p	Sedge-like herb																		op
<i>Hypolaena exsulca</i>	Restionaceae	-	p	Sedge-like herb	1					13				8						7	10	
<i>Lepyrodia hermaphrodita</i>	Restionaceae	-	p	Sedge-like herb											9a					7		
<i>Lyginia imberbis</i>	Restionaceae	-	p	Sedge-like herb	1																	
<i>Meeboldina scariosa</i>	Restionaceae	Velvet Rush	p	Sedge-like herb											9							
<i>Cryptandra arbutiflora</i> variety <i>arbutiflora</i>	Rhamnaceae	Waxy Cryptandra	p	Shrub		15				11 a					9							
<i>Opercularia apiciflora</i>	Rubiaceae	-	p	Herb		1																
<i>Boronia megastigma</i>	Rutaceae	Scented Boronia	p	Shrub		1								8						7	10	
<i>Boronia tenuis</i>	Rutaceae	Blue Boronia	p	Shrub	P4						13										12	
<i>Leptomeria cunninghamii</i>	Santalaceae	-	p	Shrub										5								
* <i>Parentucellia latifolia</i>	Scrophulariaceae	Sticky Bartsia	a	Herb											9							
<i>Stackhousia scoparia</i>	Stackhousiaceae	-	p	Herb						11												
<i>Thomasia foliosa</i>	Sterculiaceae	-	p	Shrub																	12	
<i>Thomasia pauciflora</i>	Sterculiaceae	Few-Flowered Thomasia	p	Shrub																		op
<i>Stylidium amoenum</i> variety <i>amoenum</i>	Stylidiaceae	-	p	Herb									6									

<i>Stylidium brunonianum</i>	Stylidiaceae	Pink Fountain Triggerplant	p	Herb									4							
<i>Stylidium brunonianum</i> subspecies <i>brunonianum</i>	Stylidiaceae	Pink Fountain Triggerplant	p	Herb				3							9					
<i>Stylidium brunonianum</i> subspecies <i>minor</i>	Stylidiaceae	-	p	Herb					11	13	4					7a				
<i>Stylidium calcaratum</i>	Stylidiaceae	Book Triggerplant	a	Herb																op
<i>Stylidium ciliatum</i>	Stylidiaceae	Golden Triggerplant	p	Herb																op
<i>Stylidium piliferum</i>	Stylidiaceae	Common Butterfly Triggerplant	p	Herb					11											
<i>Stylidium pubigerum</i>	Stylidiaceae	Yellow Butterfly Triggerplant	p	Herb																op
<i>Stylidium rhynchocarpum</i>	Stylidiaceae	Black-beaked Triggerplant	p	Herb									6							
<i>Stylidium schoenoides</i>	Stylidiaceae	Cow Kicks	p	Herb				2	11 a	13										
<i>Stylidium spathulatum</i> subspecies <i>spathulatum</i>	Stylidiaceae	Creamy Triggerplant	p	Herb											9					
<i>Stylidium uniflorum</i>	Stylidiaceae	Pincushion Triggerplant	p	Herb			15						4a							
<i>Pimelea imbicata</i> variety <i>piligera</i>	Thymalaceae	-	p	Shrub			15													12
<i>Pimelea suaveolens</i> variety <i>suaveolens</i>	Thymalaceae	Scented Banjine	p	Shrub					3a	11	13	4	6			7				
<i>Tetradlea hirsuta</i>	Tremandraceae	Black Eyed Susan	p	Shrub					3			4a	6							
<i>Xanthorrhoea gracilis</i>	Xanthorrhoeaceae	Slender Grasstree	p	Shrub		1	15	2	3			4								
<i>Xanthorrhoea preissii</i>	Xanthorrhoeaceae	Balga	p	Shrub						11	13	4			9	7	10 a	12		
<i>Macrozamia reidleyi</i>	Zamiaceae	Western Zamia	p	Shrub		1				11	13	4a	6							

Appendix 4 – Orchid species recorded by the Tonkin family in Boronia Gully

Botanical Name	Common Name
<i>Caladenia cairnscarna</i>	Zebra Orchid
<i>Caladenia discondea</i>	Dancing Spider Orchid
<i>Caladenia ferrugina</i>	Rusty Spider Orchid
<i>Caladenia flava</i> subspecies <i>flava</i>	Cowslip Orchid
<i>Caladenia flava</i> subspecies <i>sylvestris</i>	
<i>Caladenia flava</i> x ???	
<i>Caladenia lobata</i> (? <i>attingens</i>)	Butterfly Orchid
<i>Caladenia longicauda</i> subspecies ? <i>redacta</i>	
<i>Caladenia longicauda</i> subspecies. <i>longicauda</i>	White Spider Orchid
<i>Caladenia macrostyla</i>	Leaping Spider Orchid
<i>Caladenia macrostylis</i>	Leaping Spider Orchid
<i>Caladenia reptans</i> (? <i>Thelymitra benthamiana</i>)	Little Pink Fairy Orchid
<i>Caladenia</i> species (? <i>chapmanii</i>)	
<i>Caladenia</i> species. (? <i>eusata</i>)	
<i>Caladenia</i> species (? <i>varians</i> subspecies <i>varians</i>)	
<i>Caladenia</i> species. (Albino form)	
<i>Calochilus aff robertsonii</i>	Swamp Beard Orchid
<i>Cryptostylis ovata</i>	Slipper Orchid
<i>Cyanicula sericea</i>	Silky Blue Orchid
<i>Diuris aff. corymbosa</i>	Slender Donkey Orchid
<i>Diuris corymbosa</i>	Common Donkey Orchid
<i>Diuris longifolia</i>	Purple Pansy Orchid
<i>Diuris micrantha</i>	Dwarf Bee Orchid
<i>Drakaea elastica</i>	Hammer Orchid
<i>Drakaea livida</i>	Warty Hammer Orchid
<i>Elythranthera marginata</i>	Pink Enamel Orchid
<i>Leptoceras manglesii</i>	Rabbit Orchid
<i>Lyperanthus serratus</i>	Rattle Beak
<i>Microtis aff. alba</i>	Scented Mignonette Orchid
<i>Microtis atrata</i>	Swamp Mignonette Orchid
<i>Microtis medis</i> subspecies <i>media</i>	Common Mignonette Orchid
<i>Microtis obicularis</i>	Dark Mignonette Orchid
<i>Paracaleana nigrita</i>	Flying Duck Orchid
<i>Prasophyllum brownii</i>	Christmas Leek Orchid
<i>Prasophyllum cyphochilum</i>	Pouched Leek Orchid
<i>Prasophyllum drummondii</i>	Swamp Leek Orchid
<i>Prasophyllum giganteum</i>	Bronze Leek Orchid
<i>Prasophyllum parvifolium</i>	Autumn Leek Orchid

<i>Prasophyllum parvifolium</i>	Scented Autumn Leek Orchid
<i>Prasophyllum ringens</i>	Little Laughing Leek Orchid
<i>Pterostylis barbata</i>	Bird Orchid
<i>Pterostylis dilatata</i>	Robust Snail Orchid
<i>Pterostylis recurva</i>	Jug Orchid
<i>Pterostylis vittata</i>	Banded Greenhood
<i>Thelymitra antennifera</i>	Vanilla Orchid
<i>Thelymitra macrophylla</i>	Scented Sun Orchid