

**Brookton Hwy Nature Reserve (R36742)
Environmental Assessment
2018**



Prepared for: Department of Biodiversity, Conservation and Attraction
(DBCA)
Perth Hills District
District Nature Conservation Program

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EXECUTIVE SUMMARY

This report has been prepared by Del Botanics on behalf of Department of Biodiversity, Conservation and Attractions (DBCA) to review remnant flora, fauna and vegetation on Brookton Highway Nature Reserve. A site survey was undertaken in October 2018 and March 2019. The site is approximately 114 kilometres south east of the Perth central area, in the Shire of Brookton.

Brookton Highway Nature Reserve (R36742) consists of approximately 424.5 hectares of Wandoo (*Eucalyptus wandoo*) Powderbark (*Eucalyptus accedens*) and Jarrah (*Eucalyptus marginata*)/ Marri (*Corymbia calophylla*) Woodland. The purpose of this reserve is to conserve the flora and fauna.

The soils found in Brookton Highway Nature Reserve can be referred to as the *Zone of Rejuvenated Drainage*. This zone is defined by the Meckering Line to the east and the Darling Range Zone to the west. It encompasses a major portion of the Shire of Beverley and about a third of the Shire of Brookton. It represents the 'Inner Wheatbelt' and the central portion of the Avon Valley.

A large portion of the vegetation within Brookton Highway Nature Reserve is in “Very Good” condition and provides a great example of the variety of vegetation communities which dominated the area prior to European settlement. During the site visits, vegetation communities were broadly mapped and described by recording the dominant tree species and upper level flora species. The vegetation described on site can be categorised into five broad vegetation communities.

Brookton Highway Nature Reserve is a conservation reserve for the protection of the flora, fauna and vegetation communities. The reserve is currently in very good condition and provides a valuable habitat for fauna with diverse habitats and an array of flora species.

STATEMENT OF LIMITATIONS

This environmental report has been prepared in accordance with the scope of services set out in the original quotation. In preparing the report, Del Botanics has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Del Botanics has not verified the accuracy or completeness of the data to the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Del Botanics will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed.

In accordance with the scope of services, Del Botanics has have relied on publically available data and information supplied by DBCA and have conducted environmental field monitoring in the preparation of the report. The nature and extent of monitoring conducted is described in the report. Within the limitations imposed by the scope of services, the monitoring and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care. No other warranty, express or implied, is made.

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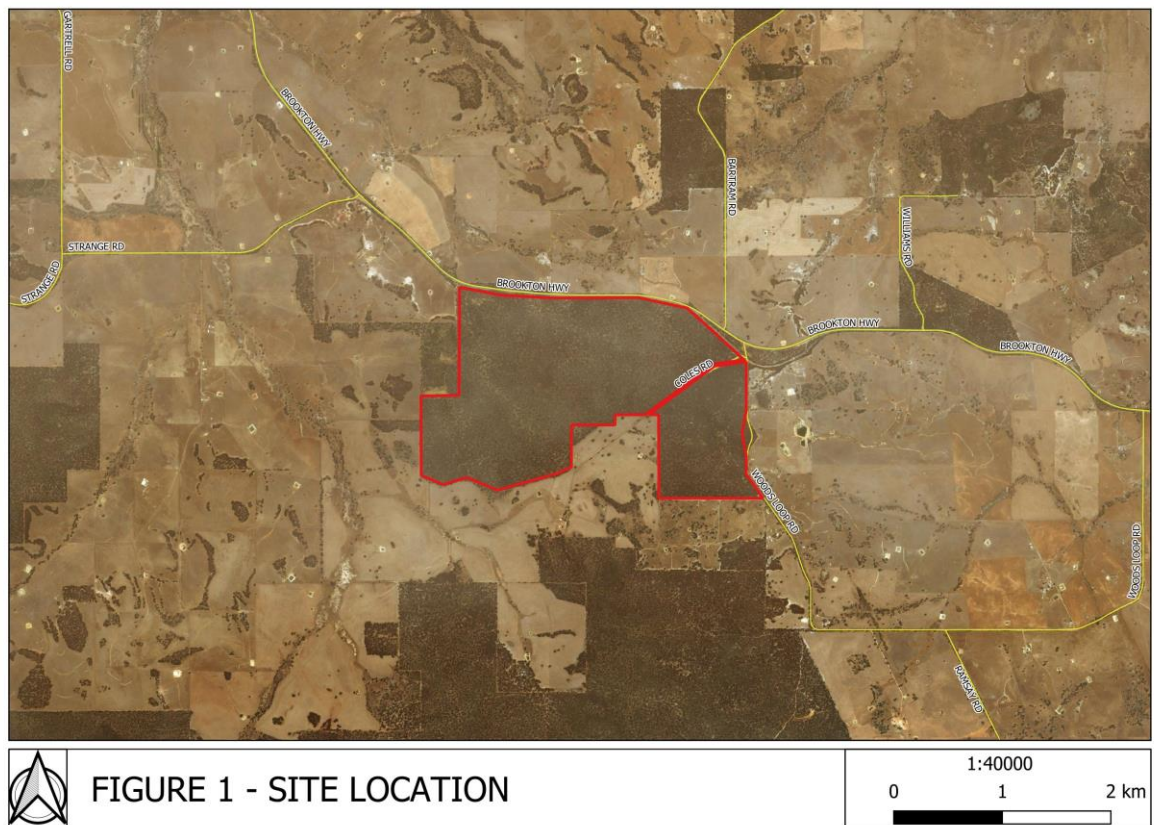
Appendix A	Flora Species Recorded
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1. INTRODUCTION

1.1 BROOKTON HIGHWAY NATURE RESERVE

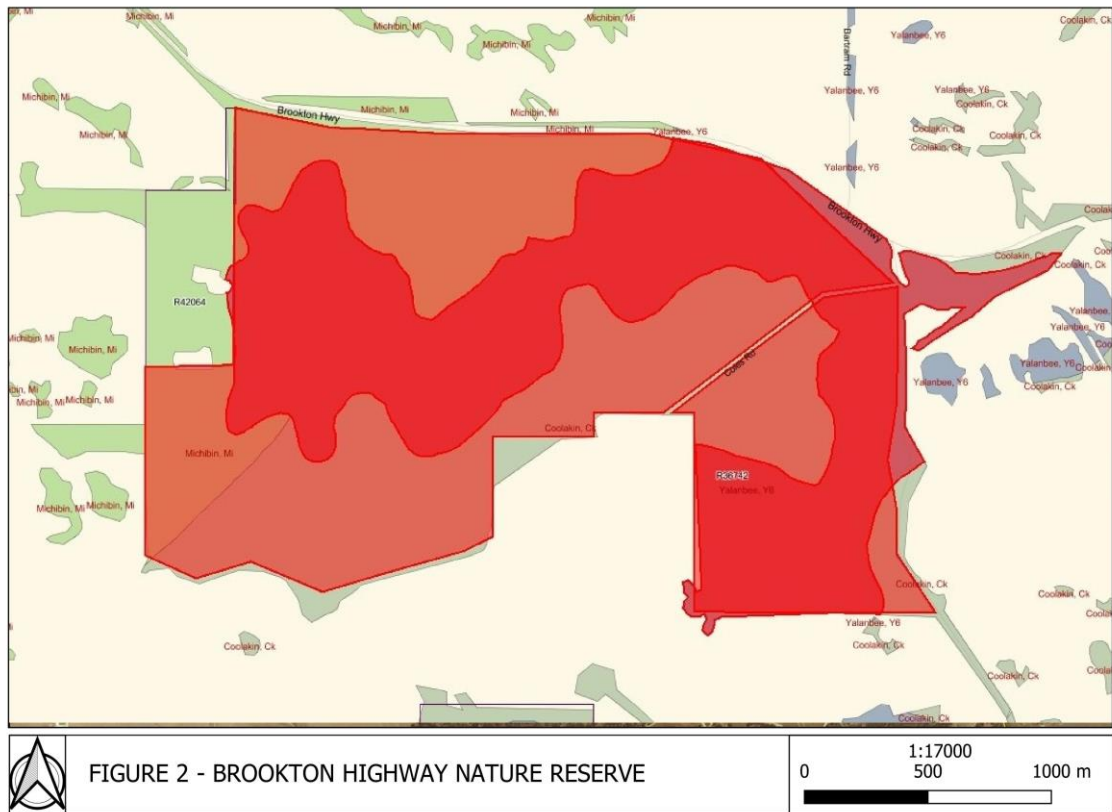
This report has been prepared by Del Botanics on behalf of Department of Biodiversity, Conservation and Attractions (DBCA) to review remnant flora, fauna and vegetation on Brookton Highway Nature Reserve. A site survey was undertaken in October 2018 and March 2019. The site is approximately 114 kilometres south east of the Perth central area, in the Shire of Brookton. The location of the site is shown on **Figure 1** below.

Figure 1: Brookton Hwy Nature Reserve Location



The Shire of Brookton covers an area of 161,283 hectares and is located in the Avon River Catchment. The Avon River flows through the eastern part of the shire. Brookton Highway Nature Reserve is approximately 28km west of the Brookton town site and is shown in red on **Figure 2** below. The purpose of this reserve is for the conservation of flora and fauna.

Figure 2: Brookton Highway Nature Reserve



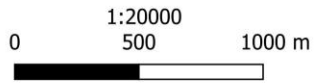
Brookton Highway Nature Reserve (R36742) is approximately 424.5 hectares. It contains a mixture of Wandoo (*Eucalyptus wandoo*) Powderbark (*Eucalyptus accedens*) Jarrah (*Eucalyptus marginata*) Marri (*Corymbia calophylla*) and Sheoak (*Allocasuarina huegeliana*) Vegetation Communities.

1.2 LOCAL GOVERNMENT AREA

The area shown below on **Figure 3**, Crown Reserve 42064, is currently vested with the Shire of Brookton and the commissioner of Main Roads and managed by Main Roads Western Australia. This areas current use is gravel extraction. This area is not part of the Brookton Highway Nature Reserve (NR).



FIGURE 3 - CROWN RESERVE (R42064)



1.3 HISTORY

The first European farmers settled in the Avon Valley in 1831 and established themselves as pastoralists, grazing sheep on native herbage and cropping small areas of the better soil types. In 1880 the railway came to the Avon Valley and large advances to agriculture were made in the early 1900's.

Native vegetation in the Shire of Brookton has been significantly cleared for agricultural purposes. The district was first settled in the mid 1800's and the best country for agriculture, the woodlands on heavy soils in the valleys were cleared by hand. Much of the sandplain areas were cleared post 1950's with bulldozers. Remnant vegetation areas were often cleared in the early days as they were seen to harbour rabbits. The remaining areas of native vegetation are mostly the areas unsuitable for agriculture, such as granite outcrops, breakaway country and saline areas. Woodland and sandplain country are very poorly represented in reserves and much of the woodlands that do remain on private land have been degraded by grazing, weed invasion and inappropriate fire regimes (Safstrom, 1997).



Photo 1: Lookout from Brookton Hwy NR

2. EXISTING ENVIRONMENT

2.1 SOILS AND LANDFORMS

Brookton is underlain by Archaean rocks of the Yilgarn Block which has been a relatively stable part of the earth's crust for 2400 million years. The Great Plateau of Western Australia, referred to locally as the Darling Plateau, is the surface expression of the Yilgarn Block. The ancient 'basement' rocks of the Darling Plateau are composed of predominantly granite and metamorphics with localised intrusions of narrow quartz or dolerite dykes. (Beecham, 2001).

The surface of the Darling Plateau was once extensively mantled by Tertiary (Cainozoic) laterite and associated weathering products. Although the plateau is now substantially dissected by major drainage systems, remnants of the lateritised surface occur in upper parts of the landscape and along drainage divides.

2.1.1 Localised soils

The soils found in Brookton Hwy Nature Reserve can be referred to as the *Zone of Rejuvenated Drainage*. This zone is defined by the Meckering Line to the east and the Darling Range Zone to the west. It encompasses the major portion of the Shire of Beverley and about a third of the Shire of Brookton. It represents the 'Inner Wheatbelt' and the central portion of the Avon Valley. The Zone of Rejuvenated Drainage is characterised by a greater degree of dissection of the landscape than in the Zone of Ancient Drainage to the east. Thus steeper, narrower valleys are formed which contain rivers and creeks that flow every winter. Large areas of yellow duplex soils have formed here from the dissection of the lateritic profile. In areas where the lateritic profile has been completely removed there are extensive areas of rocky, red and greyish soils developed from fresh rock. The valley floors contain alluvial clays, loams and sands (Beecham, 2001).

2.2 VEGETATION

A large portion of the vegetation within Brookton Highway Nature Reserve is in very good condition and provides a great example of the variety of vegetation communities which dominated the area prior to European settlement. The vegetation is dominated with Powderbark woodland, which transitions into Mixed Eucalypt woodland and Wandoo woodland. There are pockets of *Allocasuarina huegeliana* woodland and Jarrah Woodland.

The southwest of Western Australia has been divided into districts, known as Natural Resource Zones, which are determined by their vegetation type, drainage/catchment system and rainfall. The Shire of

Brookton contains parts of two Natural Resource Zones, the Swan/Avon catchment zone, which includes the Northern Jarrah Forrest and the Wheatbelt Vegetation District zone, which includes the Darling and Avon Districts.



Photo 2: Powderbark (*Eucalyptus accedens*) Woodland with sparse understorey



Photo 3: Powderbark (*Eucalyptus accedens*) and Wandoo (*Eucalyptus wandoo*) Woodland with King Dryandra (*Banksia proteoides*)



Photo 4: Sheak (*Allocasuarina huegeliana*) and Wandoo (*Eucalyptus wandoo*) Woodland.

2.3 CLIMATE

The Shire's climate consists of a warm Mediterranean climate with hot dry summers and mild wet winters. Brookton receives, on average 430mm rainfall per annum. Average maximum temperatures range from 30°C in January and 17.1°C in July, while average minimum temperatures range from 16.1°C in February to 4.6°C in August.

3. FLORA, FAUNA AND VEGETATION

The survey area lies in the Drummond Botanical Subdistrict within the Southwest Botanical Province as described by Beard (1990). Flora composition has been described by Beard (1990) as predominantly consisting of *Banksia* Low Woodlands on leached sands with *Melaleuca* swamps where ill drained and Woodlands of *Eucalyptus* spp. on less leached soils. This area has been described by Beard (1990) as the Avon Botanical District.

The updated mapping system IBRA (*Interim Biogeographic Regionalisation for Australia*) was developed in 1993-94 and is endorsed by all levels of government as a key tool for identifying land for conservation under *Australia's Strategy for the National Reserve System 2009-2030*.

The nationally agreed regionalisation was published in Thackway and Cresswell (1995), *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves*.

The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The IBRA description of vegetation for this area is best categorised as the Avon Wheatbelt Region.

3.1 FLORA

The site is dominated by Powderbark woodland with variations including Jarrah with Powderbark Wandoo a distinctive Powderbark Wandoo/ Wandoo woodland, mixed Eucalypt woodland and Sheoak woodlands. There is a diverse number of understorey species and low densities and number of weed species, which are predominantly along the fence line boundaries of the site. A species list is available in **Appendix A**, this provides a list of flora species identified during the field survey and those recorded as occurring on the site from the DBCA NatureMap search results.



Photo 5: *Verticordia sp*



Photo 6: *Xanthorrhoea preissii*

3.1.1 Threatened flora

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database identified one Threatened (T), three Priority 4 (P4), four Priority 3 (P3), and one Priority 2 (P2) species within a 10 km radius, that are likely to occur within the area. These species are listed in **Table 1** below.

Table 1: NatureMap listed flora species

Species Name	Common Name	Conservation Code
<i>Acacia alata</i> var. <i>platyptera</i>		P4
<i>Darwinia thymoides</i> subsp. <i>St Ronans</i>		P4
<i>Gastrolobium ovalifolium</i>	Runner Poison	P4
<i>Grevillea crowleyae</i>		P2
<i>Hibbertia glomerata</i> subsp. <i>wandoo</i>		P3
<i>Pultenaea pauciflora</i>	Narrogin Pea	T
<i>Synaphea pandurata</i>		P3
<i>Thelymitra antennifera</i>	Vanilla Orchid	P3
<i>Xanthosia tomentosa</i>	Lesueur Southern Cross	P3

A search of the Department of Environment and Energy (DEE) Protected Matters database identified seven flora species of significance within a 10 km radius, which are likely to occur within the area.

Two flora species have been listed as Vulnerable and five species are listed as Endangered. These species are listed in **Table 2** below.

Table 2: DEE Protected Matters listed flora species

Species Name	Common Name	Conservation Code
<i>Acacia cochlocarpa</i> subsp. <i>cochlocarpa</i>	Spiral-fruited Wattle	Endangered
<i>Banksia oligantha</i>	Wagin Banksia	Endangered
<i>Boronia capitata</i> subsp. <i>capitata</i>		Endangered
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Vulnerable
<i>Pultenaea pauciflora</i>	Narrogen Pea	Vulnerable
<i>Thelymitra dedmaniarum</i>	Cinnamon Sun Orchid	Endangered
<i>Verticordia fimbrialepis</i> subsp. <i>fimbrialepis</i>	Shy Featherflower	Endangered

3.1.2 Weeds

Invasive plants are widespread in fragmented landscapes that have been highly modified, and where nutrient enrichment of soils and frequent disturbance encourages the establishment of weeds over native vegetation. Established weeds compete with native plants, affecting their recruitment and survival, therefore reducing the habitat quality for native fauna. Grassy weeds can also increase the flammability of the vegetation, increasing fire frequency and intensity. Once established, weeds become a long-term and potentially costly management issue.

There are a low number of weed species and densities on average across the site. Weeds are dominant along the edges of the reserve, adjacent to firebreaks and private properties. Weed control may be applied to the areas along the boundary fence lines, however due to the adjacent farming properties weeds may continue to present an issue along the fence lines. It is important to minimise the encroachment of weeds into bushland areas. There is a large patch of Bridal Creeper along the southern border; this area is shown on **Figure 6**. The majority of the dominant weeds are grasses.



Photo 7: Bridal Creeper, along the southern boundary



Photo 8: Weeds along the fence line of the South East Section of the reserve

3.2 FAUNA

Due to the location of the reserve and the reduced areas of other natural bushland in the area, this reserve is an important refuge for native animals and is a valuable stepping stone of native vegetation in this landscape. A species list is available in **Appendix B**, this provides a list of fauna species identified during the field survey and those recorded as occurring on the site from the DBCA NatureMap search results.



Photo 9: *Tiliqua rugosa* (Bobtail lizard)

3.2.1 Threatened Fauna

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database identified eight priority species within a 10 km radius, which are likely to occur within the area. Of these, six are listed as Threatened (T) and two as Priority 4 (P4) species. The list is provided in **Table 3** below.

Table 3: NatureMap listed fauna species

Species Name	Common Name	Conservation Code
<i>Calyptorhynchus banksii subsp. naso</i>	Forest Red-tailed Black Cockatoo	T
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo	T
<i>Calyptorhynchus sp.</i>	white-tailed black cockatoo	T
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	T
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider	T
<i>Macropus irma</i>	Western Brush Wallaby	P4
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	T
<i>Notamacropus irma</i>	Western Brush Wallaby	P4

A search of the Department of Environment and Energy (DEE) Protected Matters database identified eight fauna species of significance likely to occur within a 10km radius of the reserve. One fauna species is listed as Critically Endangered, two species have been listed as Endangered and five species are listed as Vulnerable. These species are listed in **Table 4** below.

Table 4: DEE Protected Matters listed fauna species

Species Name	Common Name	Conservation Code
<i>Bettongia penicillata</i>	Brush-tailed Bettong, Woylie	Endangered
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo, Karrak	Vulnerable
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo, Long-billed Black-Cockatoo	Vulnerable
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Endangered
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	Vulnerable
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable
<i>Phascogale calura</i>	Red-tailed Phascogale, Red-tailed Wambenger, Kenngoos	Vulnerable

3.2.2 Feral Animals

Several species of invasive animals have established in the Wheatbelt region which have impacted upon native vegetation and fauna. Feral cats (*Felis catus*) and the European fox (*Vulpes vulpes*) are key predators that prey upon ground-dwelling native fauna. The European rabbit (*Oryctolagus cuniculus*) causes direct loss of plant species, and indirect loss of native plant and animal species through changes to soil structure and nutrient dynamics by their digging, burrowing and grazing activities. There is evidence within the reserve of the presence rabbits.

3.2.3 Local Habitat Condition

Brookton Highway Nature Reserve has potential habitat for ground dwelling fauna. The site contains fallen logs and leaf litter. The site also has hollows both on the ground and in trees, which would provide suitable habitat for a range of fauna including ground dwelling species. Further investigations will determine the habitat suitability for specific fauna, including numbats.



Photo 10: Woodland with logs and hollows



Photo 11: Powderbark Wandoo/Wandoo Woodland with logs and hollows



Photo 12: Tree hollows

3.3 VEGETATION

The original vegetation of the region has been mapped and described by Beard (1979, 1980). The major parts of the Shires of Beverley and Brookton fall into the Avon Botanical District, although a small area along the western boundary of both Shires is part of the Darling District (Dale Subdistrict). The Shire of Brookton includes Jarrah Forrest on its western margin with a mix of cleared farming land and forested country with wandoo (*Eucalyptus wandoo*) and areas of Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) towards the east of their range. (Safstrom, 1997). Brookton Hwy NR original vegetation (described by Beard (1979, 1980)) falls within the Northern Jarrah Forrest.

Jarrah and Marri Forest: The Jarrah and Marri forest occurs in the higher rainfall western areas on the lateritic plateau (Darling District). Jarrah (*Eucalyptus marginata*) is the dominant tree, and is normally accompanied by Marri (*Corymbia calophylla*). On some sites it will also be associated with Blackbutt (*E. patens*), Wandoo (*E. wandoo*) and Powderbark Wandoo (*E. accedens*). There is also often a lower layer of small trees, including *Banksia grandis*, *Allocasuarina fraseriana* and *Persoonia longifolia*.

Jarrah - Marri - Wandoo - Powderbark - Brown Mallet Woodlands: On the eastern edge of the lateritic plateau (Darling grading into Avon District), woodland replaces the Jarrah forest, due to the declining rainfall.

The principal components are Jarrah, Wandoo and Powderbark Wandoo. Jam (*Acacia accuminata*) and Rock sheoak (*Allocasuarina huegeliana*) are common associated species in most areas, but land clearing has eliminated most of the smaller species once present. On the dissected slopes below the plateau, a mixture of Marri - Wandoo woodland occurs. Further east, the plant communities are comprised of scattered shrubs and rock sheoak. There are woodlands of Powderbark Wandoo and brown mallet (*E. astringens*) on lateritic plateau remnants, woodlands of Wandoo and Powderbark on upperslopes, Marri and Wandoo on middle slopes, and York gum on lower slopes close to drainage lines.

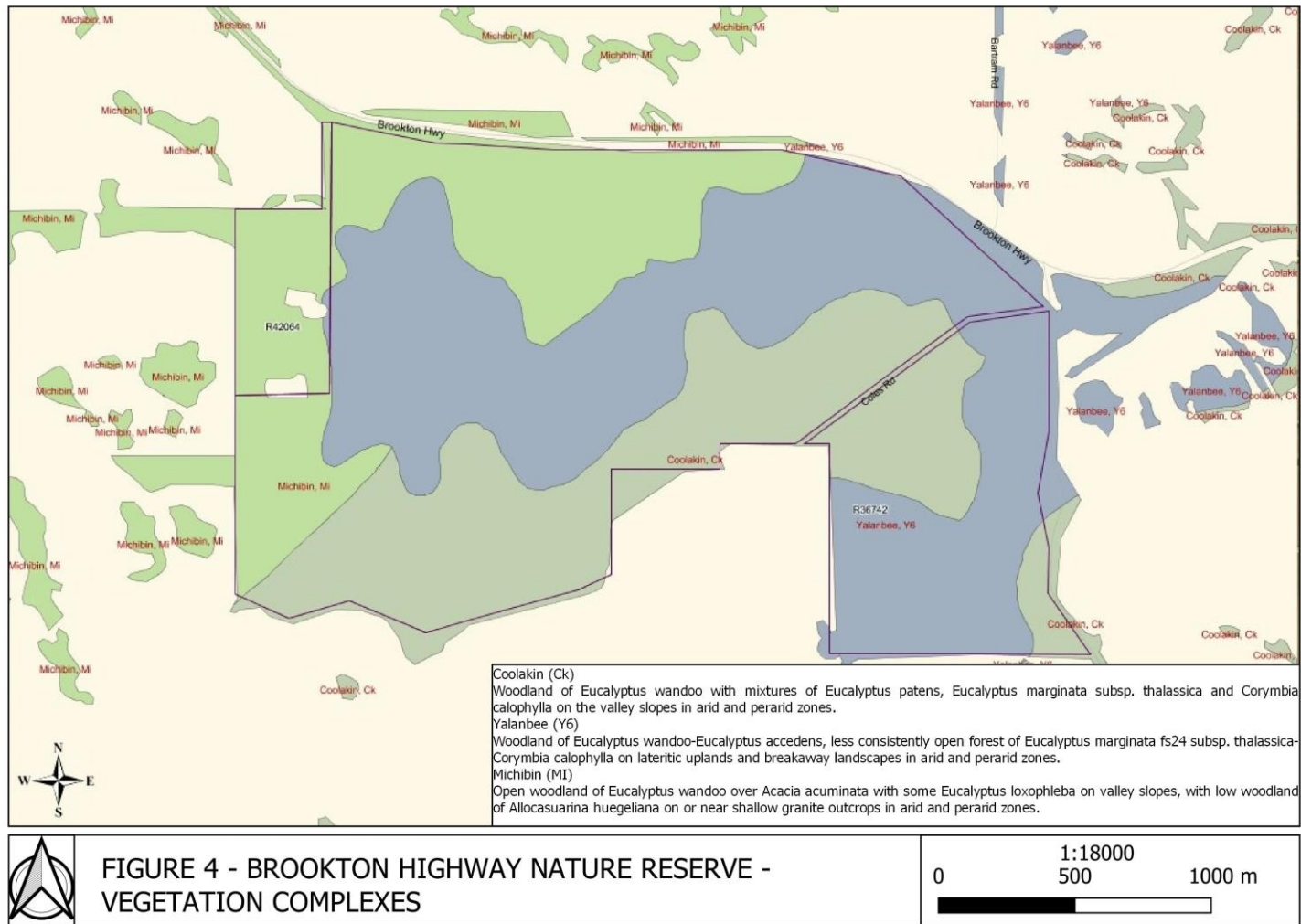
3.3.1 Vegetation Complexes

Vegetation complexes are based on the pattern of vegetation at a regional scale as they reflect the underlying key determining factors of landforms, soils and climate. The Perth and Peel Regions are spread over two IBRA regions, the Swan Coastal Plain and Jarrah Forest. The Jarrah Forest IBRA region can be divided into two sub-regions, the Northern Jarrah Forest, and the Southern Jarrah Forest. The Perth and Peel Region extends only to the Northern Jarrah Forest IBRA sub-region.

The following inputs were used to create a data layer of remnant vegetation extent by vegetation complexes for the Swan Coastal Plain and the Jarrah Forest IBRA, including the Perth and Peel Region Scheme areas:

- DAFWA (2014) - Current extent of native vegetation (Remnant vegetation)
- Heddle et al (1980) - Vegetation of the Darling System, Department of Environment and Conservation (south of Moore River)
- Mattiske & Havel (2000) - Vegetation complex mapping for the South West Forest Region and for the Swan Coastal Plain in the Busselton area.

There are 27 vegetation complexes represented within the Swan Coastal Plain and 18 vegetation complexes represented within the Jarrah Forest portions of the Perth and Peel Scheme Regions. Native vegetation complexes occurring at Brookton Highway Nature Reserve are shown below on **Figure 4:**



3.3.2 *Vegetation complexes found within Brookton Hwy Nature Reserve*

Coolakin

Woodland of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones.

Yalanbee (Y6)

Woodland of *Eucalyptus wandoo*-*Eucalyptus accedens*, less consistently open forest of *Eucalyptus marginata* fs24 subsp. *thalassica*-*Corymbia calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones.

Michibin

Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones (WALGA, 2018).



Photo 12: Powderbark Woodland found within the reserve



Photo 13: Laterite outcrop located in the centre of the reserve

3.3.3 Local Vegetation Communities

During the site visits, vegetation communities were broadly mapped and described by recording the dominant tree species and upper level flora species. The vegetation described on site can be categorised into five broad vegetation communities. These communities are described in **Table 5** and shown on **Figure 5**.

Table 5: Vegetation Communities

Mapping Code	Community Descriptions
Vegetation Community 1 – Rock Sheoak (<i>Allocasuarina huegeliana</i>) Woodland	
1	Low woodland of <i>Allocasuarina huegeliana</i> , over shrubland of <i>Acacia pulchella</i> and <i>Acacia accuminata</i> , over grassland of <i>Austrostipa elegantissima</i> , <i>Dedsmocladus flexuosa</i> , and <i>Neurachne alopecuroide</i>
Mapping Code	Community Descriptions
Vegetation Community 2 – Jarrah Woodland	
2	Open forest of <i>Eucalyptus marginata</i> with scattered <i>Corymbia calophylla</i> over open shrubland of <i>Macrozamia riedlei</i> , <i>Leptospermum erubescens</i> , <i>Banksia sessilis</i> , and <i>Xanthorrhoea acanthostachya</i>
Mapping Code	Community Descriptions
Vegetation Community 3 – Mixed Eucalypt Woodland	
3	Open forest of <i>Eucalyptus wandoo</i> , <i>Eucalyptus marginata</i> , <i>Eucalyptus accedens</i> and <i>Corymbia calophylla</i> over open shrubland of <i>Allocasuarina huegeliana</i> , <i>Banksia squarrosa subsp squarrosa</i> , <i>Hakea undulata</i> , <i>Hakea prostrata</i> , <i>Hypocalymma angustifolium</i> , <i>Xanthorrhoea preissii</i> , <i>Xanthorrhoea acanthostachya</i> over open herbland of <i>Dampiera alata</i> and <i>Kennedia prostrata</i> .
Mapping Code	Community Descriptions
Vegetation Community 4 – Powderbark Wandoo Woodland	
4	Open forest of <i>Eucalyptus accedens</i> and <i>Eucalyptus wandoo</i> , over open shrubland of <i>Allocasuarina humilis</i> , <i>Banksia proteoides</i> , <i>Macrozamia reideli</i> , <i>Neurachne alopecuroidea</i> and <i>Austrostipa flavescens</i>
Mapping Code	Community Descriptions
Vegetation Community 5 –Wandoo Woodland	
5	Open forest of <i>Eucalyptus accedens</i> and <i>Eucalyptus wandoo</i> , over open shrubland of <i>Allocasuarina humilis</i> , <i>Banksia nivea</i> , <i>Acacia pulchella</i> , and <i>Austrostipa elegantissima</i>



Photo 14: Rock Sheoak (*Allocasuarina huegeliana*) Woodland



Photo 15: Jarrah Woodland



Photo 16: Mixed Eucalypt Woodland



Photo 17: Powderbark Wandoo Woodland



Photo 18: Wandoo Woodland

3.3.4 *Threatened Ecological Communities*

The EPBC Act provides for the strong protection of TEC's, which are listed under section 181 of the Act and are described as 'Critically Endangered', 'Endangered' or 'Vulnerable' under section 182. Schedules of protected TECs maintained pursuant to the EPBC Act are based on the same Floristic Community Type's (FCT's) as adopted by DBCA, however not all TEC's listed by the DBCA are scheduled under the EPBC Act.

A DEE Protected Matters Report indicated there is one known Threatened Ecological Community (TEC) likely to occur in the area, this is listed in **Table 6**.

Table 6: EPBC listed Threatened Ecological Communities

Threatened Ecological Community	Conservation Code	Comments
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur in the area

After visiting the site, Del Botanics is of the opinion that a large portion of Brookton Highway Nature Reserve contains eucalypt woodlands that would fit this critically endangered community type; however further surveying would be required to confirm the presence and extent of the community.

3.3.5 *Vegetation Condition*

Many bushland remnants have been historically subject to ongoing degradation and are especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation and edge effects, weed invasion, plant diseases, changes in fire frequency and behaviour, landscape fragmentation, illegal firewood cutting, rubbish/refuse dumping, off-road motorbikes and 4WD's, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function. These issues can affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

The Vegetation Condition was rated according to the Vegetation Condition Scale commonly used in the Perth Metropolitan Region (Government of WA 2000). The definitions are described in **Table 7**.

Table 7: Vegetation Condition Scale (Taken from Bush Forever (Government of WA 2000))

Vegetation Condition	Definition
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	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 (4)	Vegetation structure significantly altered by very obvious 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 (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	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 comprising weed or crop species with isolated native trees or shrubs.

In general, the vegetation condition ranged from “Degraded” to “Very Good” in the study area. Vegetation condition mapping is provided on **Figure 6**.

The Jarrah (shown on **Figure 5** as Jarrah Woodland) recorded on site appears to be under stress with a large number of trees showing signs of crown decline.



Photo 19: Jarrah trees under stress

4. TRACK CONDITIONS, SIGNAGE AND ILLEGAL ACTIVITY

4.1 TRACKS AND FIREBREAKS CONDITION

Brookton Hwy NR is accessible from Brookton Highway along the northern boundary and Woods Loop on the eastern boundary. There are firebreaks around the southern and western perimeter of the reserve. Fleay Road is a gravel road, which runs through the middle of the eastern side of the reserve.

The fire break along the southern boundary is easy accessible and is in good condition. There is a section that requires maintenance near Fleay Rd, along the southern boundary. The western firebreak is in good condition except for a section towards the northern boundary, where there is a fire break along the Main Roads WA boundary but not the reserve boundary; this is shown on **Figure 6**, marked as Firebreak Maintenance. The firebreaks for the northern and eastern boundary are the existing roads, Brookton Highway and Woods Loop. There is a gravel road (Coles Rd) through the centre of the eastern portion of the reserve. There are no tracks through the western portion of the reserve. Areas requiring track maintenance are marked on **Figure 6**.

4.2 FENCING

The overall condition of the boundary fencing is good, with only small sections in need of repair, as shown on **Figure 6**. Ongoing maintenance is important as the reserve is bounded by working farms with livestock. There is no fencing along Brookton Hwy and Woods Loop.



Photo 20: Fence in good condition along the southern boundary



Photo 21: Fence line needing repairs along eastern boundary

4.3 SIGNAGE

During the site visit, three nature reserve signs were observed; one along Brookton Hwy, one on the corner of Coles Rd and Woods Loop and one at the end of the reserve on Woods Loop. Reserve sign locations are shown on **Figure 6**.



Photo 25: Signage at Brookton Hwy Nature Reserve

4.4 ILLEGAL ACTIVITY

There are no current signs of motorbikes or 4WD's accessing the reserve. There appears to be limited activity in this area. There are historic signs of wood cutting and rubbish dumping, including garden waste, however these areas are limited. Most of the rubbish is present along the Brookton Highway and around the camping/rest area adjacent to the reserve. There are signs of old firewood collection and historic logging.



Photo 26: Rubbish dumping on the eastern side of the reserve



Photo 27: Camping area in the northern section of the reserve

5. PHYTOPHTHORA DIEBACK

Dieback disease caused by the pathogen *Phytophthora cinnamomi* is a major threat to the biodiversity of south-western Australia. The spread of this water mould is facilitated by the movement of soil, water or plant material infested with spores, particularly under warm, moist conditions. Dieback affects a wide range of plant species and about 40% of native plants in the south west of Western Australia are considered potentially susceptible to the disease, the plant groups most affected are the banksia family (Proteaceae), heath family (Epacridaceae) and pea family (Fabaceae), all of which have species present in the WA Wheatbelt Woodlands. Jarrah trees are one of the few eucalypt species known to be susceptible to the disease (DBCA. 2019).

It generally occurs in areas that receive 400 mm or more annual rainfall, and especially the high rainfall zone that gets >800 mm annual rainfall. The vegetation most affected includes the Jarrah forests of the Darling Ranges, the taller forests of the far south-west and the kwongan and *Banksia* shrublands of the Swan Coastal Plain and Esperance Sandplains. Given the relationship of dieback to moisture and rainfall, its threat to the WA Wheatbelt Woodlands is largely potential, as this area receives over 400mm- 500mm annually.

There are signs that dieback may occur within the reserve, as a number of Jarrah deaths were observed during site visits. Further testing in this area will be required to confirm or otherwise the presence of dieback. **Figure 5** shows the locations of Jarrah Woodlands.

6. FIRE

Prior to European settlement, fires occurred through lightning strikes and Indigenous burning of the landscape. Indigenous burning practices had been adopted for up to 60 000 years and likely comprised a mosaic of frequent, small-scale fires, often during summer months in the more mesic woodlands of the western Wheatbelt. Since European settlement, fires still occur through lightning strikes. However, they now also originate from prescribed burning operations (including escapes from planned fires), arson or accidental ignition due to a range of sources. The nature and impacts of fire is influenced by other threats in the landscape. Fragmentation into small remnants and the surrounding modified land use can affect the intensity and impact of fires across a patch. The type of understorey may promote or suppress fire spread. Frequency of fire is one important consideration in addition to fire intensity and season. Too frequent fires may eliminate sensitive species. For example: obligate seeder species that require fire to stimulate seed germination may die out if recurring fires kill plants before they have a chance to mature and develop new seeds; and fauna may decline due to the loss of food and shelter resources after frequent fires.

The main concern for natural remnants in the Wheatbelt is a lack of fire or much longer intervals between fire events. The lack of fire limits recruitment of plant species, especially those that require heat, smoke or other features of a fire to stimulate germination and establishment of seedlings. It also impacts on fauna by limiting the development of habitat diversity, especially opportunities for new tree hollows and logs, or not allowing the regeneration of dense thickets of trees and shrubs, that give shelter to many kinds of fauna. It is important to develop appropriate fire management with the use of mosaic burning to maintain the diversity of habitats for flora and fauna.

There are no immediate signs of recent fire activity. Evidence on the vegetation suggests the last fire may have been more than 10 years ago. There is a firebreak around the entire perimeter of the reserve and there is a gravel road (Coles Rd) through the centre of the eastern portion of the reserve. There are no tracks or fire breaks through the western portion of the reserve which is the larger section of the reserve. Some areas of firebreaks will require maintenance. These areas are shown on **Figure 6**. For fire protection it is suggested that a firebreak is added through the centre of the large western portion of the reserve.

7. POTENTIAL THREATS

Nationally-listed key threatening processes

The following are EPBC-listed key threatening processes, current as at February 2015, that are relevant to the WA Wheatbelt Woodland ecological community:

- Competition and land degradation by rabbits
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Novel biota and their impact on biodiversity
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

The threats listed above should be considered when implementing future plans for the conservation and protection of the reserve.

8. CONCLUSION AND RECOMMENDATIONS

Brookton Highway Nature Reserve is a conservation reserve for the protection of vegetation, flora and fauna. The reserve is currently in very good condition and provides valuable habitat for fauna with a diverse number of flora species.

Based on the results of this assessment, Del Botanics proposes the following reserve management recommendations:

- Implement a dieback and hygiene management plan, including periodic dieback survey and treatment;
- Implement a weed management plan;
- Undertake fire break maintenance, as detailed on **Figure 6**;
- Undertake a Level two flora survey;
- Undertake a Threatened Ecological Community Assessment for *Eucalypt Woodlands of the Western Australian Wheatbelt*;
- Undertake a targeted Declared Rare Flora Search for the species listed below. These species have been selected as a result of a background search of the site; however the search should not be limited to these species but should also include any DRF found within the reserve.
- Undertake a Targeted Fauna Search for the species listed below. These species have been selected as a result of a background search of the site; however the search should not be limited to these species but should also include any Threatened fauna found within the reserve.

Targeted Flora Search List species

Species Name	Common Name	Conservation Code
<i>Acacia alata</i> var. <i>platyptera</i>		P4
<i>Acacia cochlocarpa</i> subsp. <i>cochlocarpa</i>	Spiral-fruited Wattle	Endangered
<i>Banksia oligantha</i>	Wagin Banksia	Endangered
<i>Boronia capitata</i> subsp. <i>capitata</i>		Endangered
<i>Darwinia thymoides</i> subsp. <i>St Ronans</i>		P4
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Vulnerable
<i>Gastrolobium ovalifolium</i>	Runner Poison	P4
<i>Grevillea crowleyae</i>		P2
<i>Hibbertia glomerata</i> subsp. <i>wandoo</i>		P3
<i>Pultenaea pauciflora</i>	Narrogin Pea	T
<i>Synaphea pandurata</i>		P3
<i>Thelymitra antennifera</i>	Vanilla Orchid	P3
<i>Thelymitra dedmaniarum</i>	Cinnamon Sun Orchid	Endangered
<i>Verticordia fimbrialepis</i> subsp. <i>fimbrialepis</i>	Shy Featherflower	Endangered
<i>Xanthosia tomentosa</i>	Lesueur Southern Cross	P3

Targeted Fauna Search List species

Species Name	Common Name	Conservation Code
<i>Calyptorhynchus banksii</i> subsp. <i>naso</i>	Forest Red-tailed Black Cockatoo	T
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo	T
<i>Calyptorhynchus</i> sp.	White-tailed black cockatoo	T
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	T
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider	T
<i>Macropus irma</i>	Western Brush Wallaby	P4
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	T
<i>Notamacropus irma</i>	Western Brush Wallaby	P4
<i>Bettongia penicillata</i>	Brush-tailed Bettong, Woylie	Endangered
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo, Long-billed Black-Cockatoo	Vulnerable
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable
<i>Phascogale calura</i>	Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor	Vulnerable

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FIGURES

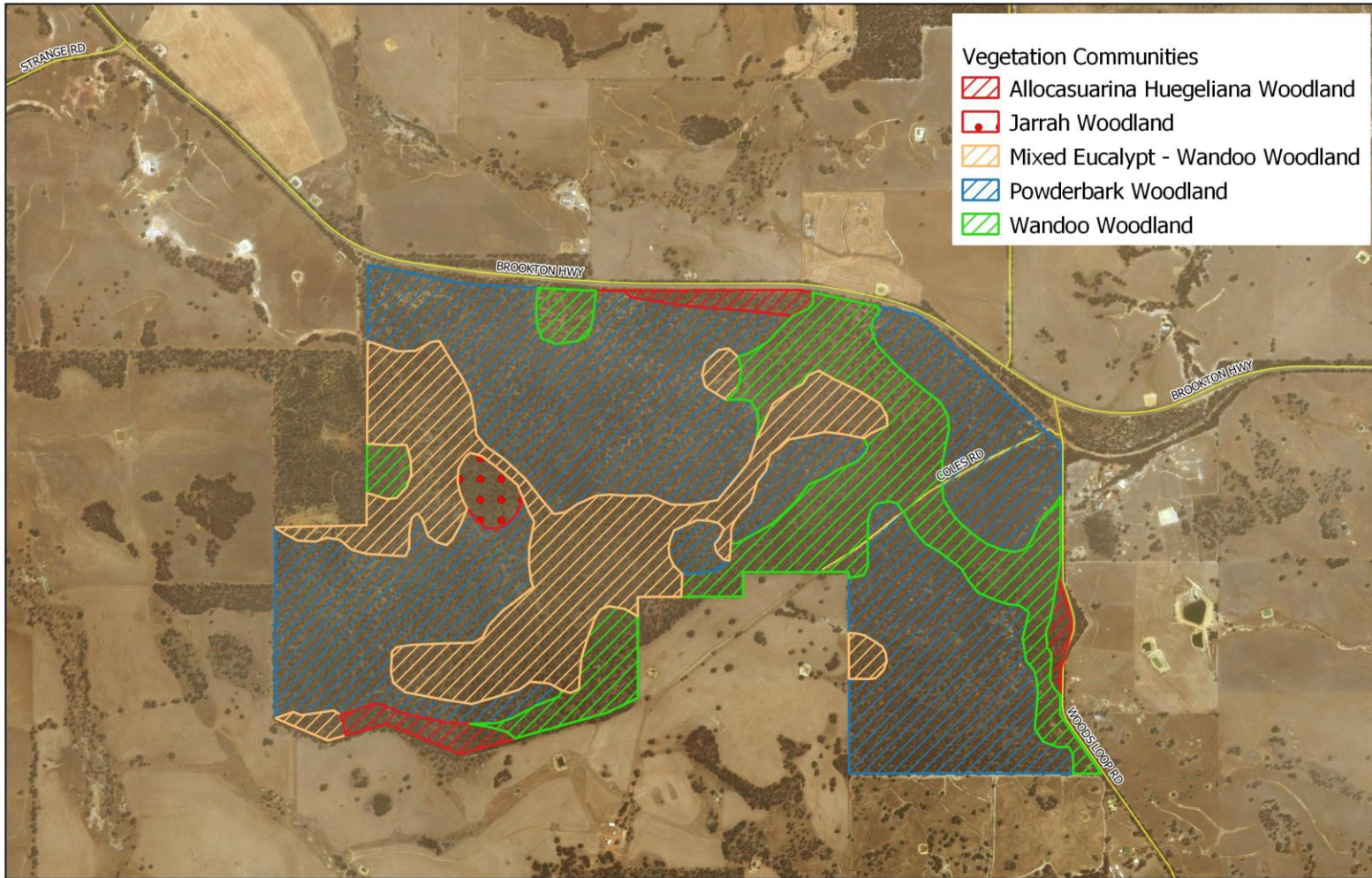
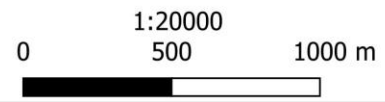


FIGURE 5 - LOCAL VEGETATION COMMUNITIES



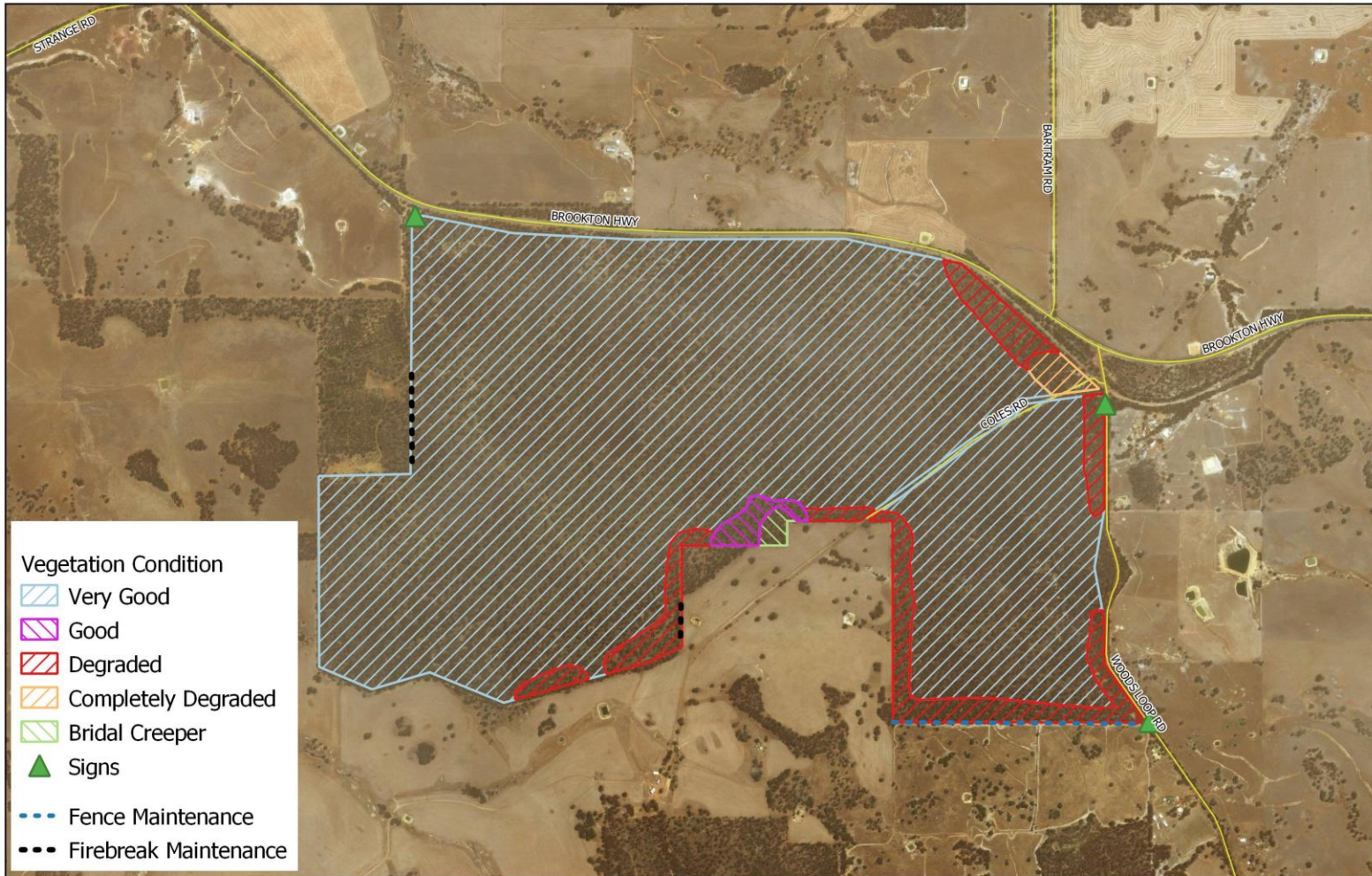
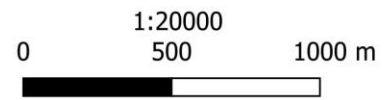


FIGURE 6 - LOCAL VEGETATION CONDITION



APPENDIX A
FLORA SPECIES RECORDED

Appendix A: Flora species recorded at Brookton Highway Nature Reserve in October 2018 and March 2019.

Flora Species	Sighted
* <i>Aira caryophylla</i> (<i>Silvery Hairgrass</i>)	X
* <i>Arctotheca calendula</i>	X
* <i>Asparagus asparagoides</i>	X
* <i>Avena barbata</i>	X
* <i>Briza maxima</i>	X
* <i>Ehrharta longiflora</i>	X
* <i>Hypochaeris glabra</i> (<i>Smooth Catsear</i>)	
* <i>Sonchus oleraceus</i>	X
* <i>Ursinia anthemoides</i> (<i>Ursinia</i>)	X
<i>Acacia ?alata</i>	X
<i>Acacia acuminata</i>	X
<i>Acacia alata</i> var. <i>platyptera</i>	
<i>Acacia applanata</i>	
<i>Acacia celastrifolia</i> (<i>Glowing Wattle</i>)	
<i>Acacia drummondii</i> (<i>Drummond's Wattle</i>)	
<i>Acacia drummondii</i> subsp. <i>drummondii</i>	
<i>Acacia microbotrya</i> (<i>Manna Wattle, Kalyang</i>)	X
<i>Acacia nervosa</i> (<i>Rib Wattle</i>)	
<i>Acacia pulchella</i> (<i>Prickly Moses</i>)	X
<i>Acacia saligna</i> subsp. <i>lindleyi</i>	
<i>Acacia</i> sp	X
<i>Acacia willdenowiana</i> (<i>Grass Wattle</i>)	
<i>Adenanthos cygnorum</i> (<i>Common Woollybush</i>)	
<i>Allocasuarina huegeliana</i> (<i>Rock Sheoak, Kwoowl</i>)	X
<i>Amphipogon laguroides</i> subsp. <i>havelii</i>	
<i>Anarthria gracilis</i>	
<i>Andersonia caerulea</i> (<i>Foxtails</i>)	
<i>Aphelia brizula</i>	
<i>Aphelia cyperoides</i>	
<i>Aphelia drummondii</i>	
<i>Astroloma acervatum</i>	
<i>Astroloma compactum</i>	
<i>Astroloma epacridis</i>	
<i>Astroloma</i> sp	X
<i>Astroloma pallidum</i> (<i>Kick Bush</i>)	
<i>Austrostipa elegantissima</i>	X
<i>Austrostipa hemipogon</i>	X
<i>Austrostipa plumigera</i>	
<i>Austrostipa trichophylla</i>	
<i>Banksia armata</i> var. <i>armata</i>	
<i>Banksia attenuata</i> (<i>Slender Banksia, Piara</i>)	
<i>Banksia drummondii</i> subsp. <i>hiemalis</i>	
<i>Banksia grandis</i> (<i>Bull Banksia, Pulgarla</i>)	
<i>Banksia littoralis</i> (<i>Swamp Banksia, Pungura</i>)	
<i>Banksia nivea</i>	X

<i>Banksia nobilis</i> subsp. <i>nobilis</i>	
<i>Banksia proteoides</i> (King <i>Dryandra</i>)	X
<i>Banksia sessilis</i> var. <i>sessilis</i>	X
<i>Banksia squarrosa</i> (Pingle)	X
<i>Beaufortia incana</i> (Grey-leaved <i>Beaufortia</i>)	
<i>Billardiera fraserii</i>	X
<i>Billardiera revoluta</i>	X
<i>Blennospora drummondii</i>	
<i>Boronia ramosa</i>	
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	
<i>Boronia scabra</i> subsp. <i>scabra</i>	
<i>Borya laciniata</i>	
<i>Bossiaea eriocarpa</i> (Common Brown Pea)	X
<i>Bossiaea ornata</i> (Broad Leaved Brown Pea)	X
<i>Brassica x napus</i>	
<i>Caesia micrantha</i> (Pale Grass Lily)	
<i>Caladenia barbarossa</i> (Dragon Orchid)	
<i>Caladenia discoidea</i> (Dancing Orchid)	
<i>Caladenia falcata</i>	
<i>Caladenia flava</i> (Cowslip Orchid)	
<i>Caladenia flava</i> subsp. <i>flava</i>	
<i>Caladenia flava</i> subsp. <i>late red</i> (G. Brockman GBB 2381)	
<i>Caladenia hirta</i> subsp. <i>rosea</i>	
<i>Caladenia longicauda</i> subsp. <i>eminens</i>	
<i>Caladenia longiclavata</i> (Clubbed Spider Orchid)	
<i>Caladenia macrostylis</i> (Leaping Spider Orchid)	
<i>Caladenia reptans</i> subsp. <i>reptans</i>	
<i>Caladenia uliginosa</i> subsp. <i>candicans</i>	
<i>Calochilus stramenicola</i>	
<i>Centrolepis drummondiana</i>	
<i>Cercophonium granulatus</i>	
<i>Cercophonium sulcatus</i>	
<i>Chamaescilla corymbosa</i> (Blue Squill)	
<i>Chamaescilla versicolor</i>	
<i>Chamaexeros serra</i> (Little Fringe-leaf)	
<i>Chordifex isomorphus</i>	
<i>Chorizema dicksonii</i> (Yellow-eyed Flame Pea)	
<i>Chrysothrix occidentalis</i>	
<i>Cladia ferdinandii</i>	
<i>Conostylis caricina</i> subsp. <i>caricina</i>	
<i>Conostylis pusilla</i>	
<i>Conostylis setigera</i> (Bristly Cottonhead)	
<i>Corymbia calophylla</i> (Marri)	X
<i>Cotula coronopifolia</i> (Waterbuttons)	
<i>Craspedia variabilis</i>	
<i>Cyanicula sericea</i>	
<i>Dampiera alata</i> (Winged-stem <i>Dampiera</i>)	X
<i>Dampiera eriocephala</i> (Woolly-headed <i>Dampiera</i>)	

<i>Dampiera juncea</i> (Rush-like Dampiera)	
<i>Dampiera lavandulacea</i>	
<i>Dampiera linearis</i> (Common Dampiera)	
<i>Dampiera obliqua</i>	
<i>Dampiera</i> sp	X
<i>Darwinia thymoides</i> subsp. <i>St Ronans</i> (J.J. Alford & G.J. Keighery 64)	
<i>Daucus glochidiatus</i> (Australian Carrot)	
<i>Daviesia cordata</i> (Bookleaf)	
<i>Daviesia costata</i>	
<i>Daviesia decipiens</i>	
<i>Daviesia decurrens</i> (Prickly Bitter-pea)	
<i>Daviesia preissii</i>	
<i>Daviesia rhombifolia</i>	
<i>Daviesia uniflora</i>	
<i>Delma grayii</i>	
<i>Desmocladius asper</i>	
<i>Desmocladius fasciculatus</i>	X
<i>Deyeuxia quadriseta</i> (Reed Bentgrass)	
<i>Dianella revoluta</i> (Blueberry Lily)	X
<i>Dillwynia laxiflora</i>	
<i>Dingosa simsoni</i>	
<i>Diploaena</i> sp	X
<i>Diplodactylus granariensis</i>	
<i>Diplolaena graniticola</i>	
<i>Diploschistes thunbergianus</i>	
<i>Diuris brachyscapa</i>	
<i>Diuris brumalis</i>	
<i>Diuris corymbosa</i>	
<i>Diuris longifolia</i> (Common Donkey Orchid)	
<i>Diuris porrifolia</i>	
<i>Drosera glanduligera</i> (Pimpernel Sundew)	
<i>Drosera leucoblasta</i> (Wheel Sundew)	
<i>Drosera macrantha</i> (Bridal Rainbow)	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	
<i>Drosera macrophylla</i> (Showy Sundew)	
<i>Drosera menziesii</i> (Pink Rainbow)	
<i>Drosera porrecta</i>	
<i>Drosera stricticaulis</i> (Erect Sundew)	
<i>Elanus axillaris</i>	
<i>Elythranthera emarginata</i> (Pink Enamel Orchid)	
<i>Eucalyptus accedens</i> (Powderbark Wandoo)	X
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	
<i>Eucalyptus decurva</i> (Slender Mallee)	
<i>Eucalyptus falcata</i> (Silver Mallet, Dulyumuk)	
<i>Eucalyptus gomphocephala</i> (Tuart, Duart)	
<i>Eucalyptus marginata</i> (Jarrah, Djara)	X
<i>Eucalyptus marginata</i> subsp. <i>thalassica</i> (Blue-leaved Jarrah)	

<i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)	
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	
<i>Eucalyptus wandoo</i> (Wandoo, Wondoo)	X
<i>Gahnia australis</i>	
<i>Galium murale</i> (Small Goosegrass)	
<i>Gallirallus philippensis</i> subsp. <i>mellori</i> (Buff-banded Rail)	
<i>Gastrolobium calycinum</i> (York Road Poison)	
<i>Gastrolobium hookeri</i>	
<i>Gastrolobium obovatum</i> (Boat-leaved Poison)	
<i>Gastrolobium ovalifolium</i> (Runner Poison)	
<i>Gastrolobium parviflorum</i>	
<i>Gastrolobium parvifolium</i> (Berry Poison)	
<i>Gastrolobium praemorsum</i>	
<i>Gastrolobium</i> sp	X
<i>Gastrolobium</i> sp (Spiky)	X
<i>Gastrolobium spinosum</i> (Prickly Poison)	X
<i>Gehyra variegata</i>	
<i>Geranium retrorsum</i>	
<i>Glischrocaryon aureum</i> (Common Popflower)	X
<i>Gompholobium capitatum</i>	
<i>Gompholobium marginatum</i>	
<i>Goodenia drummondii</i> subsp. <i>megaphylla</i>	
<i>Goodenia scapigera</i> subsp. <i>scapigera</i>	
<i>Goodenia watsonii</i> subsp. <i>glandulosa</i>	
<i>Grevillea crowleyae</i>	
<i>Grevillea hookeriana</i> (Red Tooth Brushes)	
<i>Grevillea hookeriana</i> subsp. <i>hookeriana</i>	
<i>Grevillea leptobotrys</i>	
<i>Grevillea monticola</i>	
<i>Grevillea quercifolia</i> (Oak-leaf Grevillea)	X
<i>Grevillea tenuiflora</i> (Tassel Grevillea)	
<i>Haemodorum simplex</i>	
<i>Hakea anadenia</i>	
<i>Hakea lissocarpha</i> (Honey Bush)	X
<i>Hakea prostrata</i> (Harsh Hakea)	X
<i>Hakea undulata</i> (Wavy-leaved Hakea)	X
<i>Helichrysum leucopsidium</i>	
<i>Hibbertia</i> ? <i>microphylla</i>	X
<i>Hibbertia commutata</i>	X
<i>Hibbertia diamesogenos</i>	
<i>Hibbertia exasperata</i>	
<i>Hibbertia glomerata</i> subsp. <i>wandoo</i>	
<i>Hibbertia hemignosta</i>	
<i>Hibbertia huegelii</i>	
<i>Hibbertia microphylla</i>	
<i>Hibbertia</i> sp	X
<i>Homalosciadium homalocarpum</i>	
<i>Hovea chorizemifolia</i> (Holly-leaved Hovea)	

<i>Hovea elliptica</i> (Tree Hovea)	
<i>Hyalosperma cotula</i>	X
<i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)	X
<i>Idiommata blackwalli</i>	
<i>Isopedella cana</i>	
<i>Isopogon crithmifolius</i>	
<i>Isopogon dubius</i> (Pincushion Coneflower)	
<i>Isopogon teretifolius</i> (Nodding Coneflower)	
<i>Jacksonia epiphyllum</i>	
<i>Jacksonia floribunda</i> (Holly Pea)	
<i>Jacksonia restioides</i>	
<i>Johnsonia</i> sp	X
<i>Kennedia prostrata</i> (Scarlet Runner)	X
<i>Kennedia</i> sp	X
<i>Labichea punctata</i> (Lance-leaved Cassia)	
<i>Lagenophora huegelii</i>	
<i>Lasiopetalum glabratum</i>	
<i>Lechenaultia biloba</i> (Blue Leschenaultia)	X
<i>Lechenaultia formosa</i> subsp. <i>Wheatbelt</i> (R.J. Cranfield 4718)	
<i>Lepidobolus preissianus</i>	
<i>Lepidosperma asperatum</i>	
<i>Lepidosperma gracile</i> (Slender Sword Sedge)	
<i>Lepidosperma leptostachyum</i>	
<i>Lepidosperma obtusum</i>	
<i>Lepidosperma pubisquameum</i>	
<i>Lepidosperma squamatatum</i>	
<i>Lepidosperma tenue</i>	X
<i>Leptoceras menziesii</i>	
<i>Leptomeria ellytes</i>	
<i>Leptospermum erubescens</i> (Roadside Teatree)	X
<i>Lerista distinguenda</i>	
<i>Leucopogon darlingensis</i>	
<i>Leucopogon darlingensis</i> subsp. <i>darlingensis</i>	
<i>Leucopogon fimbriatus</i>	
<i>Leucopogon nutans</i>	X
<i>Leucopogon obtusatus</i>	
<i>Leucopogon pubescens</i>	
<i>Leucopogon</i> sp	X
<i>Leucopogon</i> sp. <i>Boddington</i> (D. Halford 80746)	
<i>Leucopogon</i> sp. <i>Wandering</i> (F. Hort 419)	
<i>Levenhookia pusilla</i> (Midget Stylewort)	
<i>Levenhookia stipitata</i> (Common Stylewort)	
<i>Linum marginale</i> (Wild Flax)	
<i>Logania micrantha</i>	
<i>Lomandra brittanii</i>	
<i>Lomandra hermaphrodita</i>	
<i>Lomandra integra</i>	
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	

<i>Lomandra mucronata</i>	
<i>Lomandra nutans</i>	
<i>Lomandra spartea</i>	
<i>Lysinema elegans</i>	
<i>Macrozamia riedlei</i> (<i>Zamia</i> , <i>Djiridji</i>)	X
<i>Melaleuca aspalathoides</i>	
<i>Melaleuca pungens</i>	
<i>Melaleuca tuberculata</i>	
<i>Melaleuca tuberculata</i> var. <i>tuberculata</i>	
<i>Microcorys capitata</i>	
<i>Microeca fascinans</i> (<i>Jacky Winter</i>)	
<i>Millotia tenuifolia</i> (<i>Soft Millotia</i>)	
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i> (<i>Soft Millotia</i>)	
<i>Mirbelia floribunda</i> (<i>Purple Mirbelia</i>)	
<i>Molyceria quadricauda</i>	
<i>Monotaxis grandiflora</i> (<i>Diamond of the Desert</i>)	
<i>Muehlenbeckia</i> sp	X
<i>Myiagra inquieta</i> (<i>Restless Flycatcher</i>)	
<i>Neurachne alopecuroidea</i> (<i>Foxtail Mulga Grass</i>)	X
* <i>Oenothera stricta</i> subsp. <i>stricta</i>	
<i>Olearia rudis</i> (<i>Rough Daisybush</i>)	
<i>Opercularia vaginata</i> (<i>Dog Weed</i>)	X
<i>Ophioglossum lusitanicum</i> (<i>Adders Tongue</i>)	
<i>Pardalotus punctatus</i> (<i>Spotted Pardalote</i>)	
<i>Pardalotus striatus</i> (<i>Striated Pardalote</i>)	
<i>Parentucellia latifolia</i> (<i>Common Bartsia</i>)	
<i>Persoonia quinquenervis</i>	
<i>Persoonia trinervis</i>	
<i>Pertusaria georgeana</i> var. <i>occidentalis</i>	
<i>Petrochelidon nigricans</i> (<i>Tree Martin</i>)	
<i>Petrophile divaricata</i>	
<i>Petrophile serruriae</i>	
<i>Petrophile squamata</i> subsp. <i>northern</i> (<i>J. Monks 40</i>)	
<i>Petrophile striata</i>	
<i>Petrophile</i> sp (<i>Fine Petrophile</i>)	X
<i>Petrophile</i> sp	X
<i>Phaeotrametes decipiens</i>	
<i>Pheladenia deformis</i>	
<i>Philothea nodiflora</i> subsp. <i>latericola</i>	
<i>Phyllanthus calycinus</i> (<i>False Boronia</i>)	X
<i>Pimelea graniticola</i>	
<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>	
<i>Podolepis lessonii</i>	
<i>Podolepis</i> sp	X
<i>Polypogon monspeliensis</i> (<i>Annual Beardgrass</i>)	
<i>Polytelis anthopeplus</i> (<i>Regent Parrot</i>)	
<i>Poranthera microphylla</i> (<i>Small Poranthera</i>)	
<i>Prasophyllum gracile</i>	

<i>Protoparmelia nebulosa</i>	
<i>Pseudophryne guentheri</i> (Crawling Toadlet)	
<i>Pterochaeta paniculata</i>	
<i>Pterostylis concava</i>	
<i>Pterostylis hamiltonii</i> (Red-veined Shell Orchid)	
<i>Pterostylis recurva</i> (Jug Orchid)	
<i>Pterostylis sanguinea</i>	
<i>Pterostylis sargentii</i> (Frog Greenhood)	
<i>Pterostylis sp. inland</i> (A.C. Beaglehole 11880)	
<i>Pterostylis vittata</i> (Banded Greenhood)	
<i>Ptilotus declinatus</i> (Curved Mulla Mulla)	
<i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)	X
<i>Ptilotus manglesii</i> (Pom Poms, Mulamula)	
<i>Ptilotus sp</i>	X
<i>Pultenaea pauciflora</i> (Narrogen Pea)	
<i>Purpureicephalus spurius</i>	
<i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)	
<i>Quinetia urvillei</i>	
<i>Rhodanthe citrina</i>	
<i>Rhodanthe laevis</i>	
<i>Scaevola sp</i>	X
<i>Schoenus armeria</i>	
<i>Schoenus clandestinus</i>	
<i>Schoenus nanus</i> (Tiny Bog Rush)	
<i>Schoenus unispiculatus</i>	
<i>Senecio pinnatifolius</i> var. <i>pinnatifolius</i>	
<i>Sericornis frontalis</i> (White-browed Scrubwren)	
<i>Siloxerus filifolius</i>	
<i>Siloxerus multiflorus</i>	
<i>Sowerbaea laxiflora</i> (Purple Tassels)	
<i>Sphaerolobium medium</i>	
<i>Stackhousia monogyna</i>	
<i>Stackhousia pubescens</i> (Downy Stackhousia)	
<i>Stenanthemum pumilum</i> subsp. <i>majus</i>	
<i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)	
<i>Stylidium calcaratatum</i> (Book Triggerplant)	
<i>Stylidium caricifolium</i> (Milkmaids)	
<i>Stylidium ciliatum</i> (Golden Triggerplant)	
<i>Stylidium hispidum</i>	X
<i>Stylidium hortiorum</i>	
<i>Stylidium lateriticola</i>	
<i>Stylidium paulineae</i>	
<i>Stylidium piliferum</i> (Common Butterfly Triggerplant)	
<i>Stylidium schoenoides</i> (Cow Kicks)	
<i>Stylidium tenue</i> subsp. <i>majusculum</i> (Showy Fountain Triggerplant)	
<i>Stylidium uniflorum</i>	
<i>Stylidium uniflorum</i> subsp. <i>uniflorum</i> (Pincushion Triggerplant)	
<i>Styphelia tenuiflora</i> (Common Pinheath)	

<i>Synaphea cuneata</i>	
<i>Synaphea decorticans</i>	
<i>Synaphea pandurata</i>	
<i>Tasmanicosa leuckartii</i>	
<i>Tetraria octandra</i>	
<i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391)	
<i>Tetralochea hirsuta</i> subsp. <i>hirsuta</i>	
<i>Tetralochea similis</i>	
<i>Thelymitra antennifera</i> (Vanilla Orchid)	
<i>Thelymitra graminea</i>	
<i>Thelymitra latiloba</i>	
<i>Thomasia foliosa</i>	
<i>Thysanotus patersonii</i>	
<i>Thysanotus tenellus</i>	
<i>Thysanotus teretifolius</i>	
<i>Trachymene cyanopetala</i>	
<i>Trachymene pilosa</i> (Native Parsnip)	
<i>Tribonanthes longipetala</i>	
<i>Tricoryne elatior</i> (Yellow Autumn Lily)	X
<i>Velleia trinervis</i>	
<i>Venator immansueta</i>	
<i>Venatrix pullastra</i>	
<i>Wahlenbergia gracilentia</i> (Annual Bluebell)	
<i>Waitzia suaveolens</i> (Fragrant Waitzia)	
<i>Xanthorrhoea acanthostachya</i>	X
<i>Xanthorrhoea preissii</i> (Grass tree, Palga)	X
<i>Xanthosia tomentosa</i> (Lesueur Southern Cross)	
<i>Xylographa isidiosa</i>	

APPENDIX B
FAUNA SPECIES RECORDED

Appendix B: fauna species recorded at Brookton Highway Nature Reserve in October 2018 and March 2019.

Fauna Species	Sighted	Evidence Onsite
<i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)		
<i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)		
<i>Acanthiza inornata</i> (Western Thornbill)		
<i>Acanthorhynchus superciliosus</i> (Western Spinebill)		
<i>Accipiter fasciatus</i> (Brown Goshawk)		
<i>Anthochaera carunculata</i> (Red Wattlebird)		
<i>Anthochaera lunulata</i> (Western Little Wattlebird)		
<i>Anthus australis</i> (Australian Pipit)		
<i>Aphelia brizula</i>		
<i>Aphelia cyperoides</i>		
<i>Aphelia drummondii</i>		
<i>Aquila audax</i> (Wedge-tailed Eagle)	X	
<i>Artamus cyanopterus</i> (Dusky Woodswallow)		
<i>Asterolasia squamuligera</i>		
<i>Barnardius zonarius</i>	X	
<i>Blennospora drummondii</i>		
<i>Brassica x napus</i>		
<i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)		
<i>Cacomantis pallidus</i> (Pallid Cuckoo)		
<i>Calochilus stramenicola</i>		
<i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)	X	
<i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		
<i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)	X	
<i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)		
<i>Cercophonium granulatus</i>		
<i>Cercophonium sulcatus</i>		
<i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)		
<i>Chordifex isomorphus</i>		
<i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)		
<i>Chrysothrix occidentalis</i>		
<i>Cladia ferdinandii</i>		
<i>Climacteris rufus</i> (Rufus treecreeper)	X	
<i>Colluricincla harmonica</i> (Grey Shrike-thrush)		
<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)		
<i>Corvus coronoides</i> (Australian Raven)	X	
<i>Cracticus tibicen</i> (Australian Magpie)	X	
<i>Cracticus tibicen</i> subsp. <i>dorsalis</i> (White-backed Magpie)		
<i>Craspedia variabilis</i>		
<i>Crinia pseudinsignifera</i> (Bleating Froglet)		
<i>Cyanicula sericea</i>		
<i>Dacelo novaeguineae</i> (Laughing Kookaburra)	X	
<i>Daphoenositta chrysoptera</i> (Varied Sittella)		
<i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		
<i>Delma grayii</i>		

<i>Dingosa simsoni</i>		
<i>Diplodactylus granariensis</i>		
<i>Dromaius novaehollandiae</i> (Emu)		
<i>Elanus axillaris</i>		
<i>Eolophus roseicapilla</i> (Pink and Grey Cockatoo)	X	
<i>Falco berigora</i> (Brown Falcon)		
<i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)		
<i>Falco peregrinus</i> (Peregrine Falcon)		
<i>Gallirallus philippensis subsp. mellori</i> (Buff-banded Rail)		
<i>Gavialis vireescens</i> (Singing Honeyeater)		
<i>Gehyra variegata</i>		
<i>Geopelia cuneata</i> (Diamond Dove)		
<i>Geranium retrorsum</i>		
<i>Gerygone fusca</i> (Western Gerygone)		
<i>Grallina cyanoleuca</i> (Magpie-lark)	X	
<i>Heleioporus albopunctatus</i> (Western Spotted Frog)		
<i>Hieraaetus morphnoides</i> (Little Eagle)		
<i>Hirundo neoxena</i> (Welcome Swallow)		
<i>Homalosciadium homalocarpum</i>		
<i>Idiommatata blackwalli</i>		
<i>Idiosoma nigrum</i> (Shield-backed Trapdoor Spider)		
<i>Isopedella cana</i>		
<i>Lalage tricolor</i> (White-winged Triller)		
<i>Leptoceras menziesii</i>		
<i>Leptomeria ellytes</i>		
<i>Lerista distinguenda</i>		
<i>Lichenostomus leucotis</i> (White-eared Honeyeater)		
<i>Lichmera indistincta</i> (Brown Honeyeater)		
<i>Lichmera indistincta subsp. indistincta</i> (Brown Honeyeater)		
<i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)		
<i>Malurus splendens</i> (Splendid Fairy-wren)		
<i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)		
<i>Melithreptus brevirostris subsp. leucogenys</i> (Brown-headed Honeyeater)		
<i>Merops ornatus</i> (Rainbow Bee-eater)		
Microbats	X	
<i>Microcorys capitata</i>		
<i>Microeca fascinans</i> (Jacky Winter)		
<i>Millotia tenuifolia</i> (Soft Millotia)		
<i>Millotia tenuifolia var. tenuifolia</i> (Soft Millotia)		
<i>Myiagra inquieta</i> (Restless Flycatcher)		
<i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		
<i>Neophema elegans</i> (Elegant Parrot)		
<i>Notamacropus irma</i> (Western Brush Wallaby)		
<i>Ocyphaps lophotes</i> (Crested Pigeon)		
<i>Oenothera stricta subsp. stricta</i>		
<i>Oryctolagus cuniculus</i> (European Rabbit)		X
<i>Pachycephala rufiventris</i> (Rufous Whistler)		
<i>Pardalotus punctatus</i> (Spotted Pardalote)		

<i>Pardalotus striatus</i> (Striated Pardalote)	X	
<i>Parentucellia latifolia</i> (Common Bartsia)		
<i>Pertusaria georgeana</i> var. <i>occidentalis</i>		
<i>Petrochelidon nigricans</i> (Tree Martin)		
<i>Petroica boodang</i> (Scarlet Robin)		
<i>Petroica goodenovii</i> (Red-capped Robin)		
<i>Phaeotrametes decipiens</i>		
<i>Phaps chalcoptera</i> (Common Bronzewing)	X	
<i>Phaps elegans</i> (Brush Bronzewing)		
<i>Pheladenia deformis</i>		
<i>Phylidonyris niger</i> (White-cheeked Honeyeater)		
<i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)		
<i>Platycercus icterotis</i> (Western Rosella)		
<i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)	X	
<i>Podargus strigoides</i> (Tawny Frogmouth)		
<i>Polytelis anthopeplus</i> (Regent Parrot)		
<i>Poranthera microphylla</i> (Small Poranthera)		
<i>Protoparmelia nebulosa</i>		
<i>Pseudonaja mengdeni</i> (Western Brown Snake)		
<i>Pseudophryne guentheri</i> (Crawling Toadlet)		
<i>Purpureicephalus spurius</i> (Red capped Parrot)	X	
<i>Quinetia urvillei</i>		
<i>Rhipidura albiscapa</i> (Grey Fantail)		
<i>Rhipidura leucophrys</i> (Willie Wagtail)	X	
<i>Sericornis frontalis</i> (White-browed Scrubwren)		
<i>Smicrornis brevirostris</i> (Weebill)		
<i>Sminthopsis gilberti</i> (Gilbert's Dunnart)		
<i>Stenanthemum pumilum</i> subsp. <i>majus</i>		
<i>Strepera versicolor</i> (Grey Currawong)		
<i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)		
<i>Tachyglossus aculeatus</i> (short-beaked echidna)		X
<i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)		
<i>Tasmanicosa leuckartii</i>		
<i>Tiliqua rugosa</i> (Bobtail lizard)	X	
<i>Tribonanthes longipetala</i>		
<i>Turnix varius</i> (Painted Button-quail)		
<i>Underwoodisaurus milii</i> (Barking Gecko)		
<i>Urodacus novaehollandiae</i>		
<i>Venator immansueta</i>		
<i>Venatrix pullastra</i>		
<i>Vulpia</i> sp.		