

**3. Attachment C – Ecological Assessment for a Proposed
Quarry on Sanders Road, Garfield, Victoria**

Final Report

Ecological Assessment for a Proposed Quarry on Sanders Road, Garfield, Victoria

Prepared for

Hanson Construction Materials Pty Ltd

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Ecology and Heritage Partners Pty Ltd

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GLOSSARY

Acronym	Description
AVW	Atlas of Victorian Wildlife
CaLP	<i>Catchment and Land Protection Act 1994</i>
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CMP	Conservation Management Plan
DBH	Diameter at Breast Height
DEPI	Victorian Department of Environment and Primary Industries
DoE	Federal Department of the Environment
DTPLI	Victorian Department of Transport, Planning and Local Infrastructure
EES	Environment Effects Statement
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVC	Ecological Vegetation Class
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
FIS	Flora Information System
HabHa	Habitat Hectare
LOT	Large Old Tree
NES	National Environmental Significance
NVIM Tool	Native Vegetation Information Management Tool (DEPI)
PMST	Protected Matters Search Tool (DoE)
TRZ	Tree Retention Zone
VBA	Victorian Biodiversity Atlas (DEPI)

SUMMARY

Introduction

Ecology and Heritage Partners Pty Ltd was commissioned by Hanson Construction Materials Pty Ltd to conduct an Ecological Assessment at a Proposed Quarry on Sanders Road, Garfield, Victoria. This assessment was undertaken to identify and characterise the vegetation and habitats on-site, to determine the presence (or likelihood thereof) of any significant flora and fauna species and/or ecological communities, and to address any implications under Commonwealth and State environmental legislation.

Methods

A field assessment was undertaken on 27 October and 3 November 2014 to obtain information on terrestrial flora and fauna values within the study area. A habitat hectare assessment was undertaken in conjunction with the flora survey. Vegetation within the study area was assessed in accordance with the habitat hectare methodology, which is described in the Vegetation Quality Assessment Manual.

Results

Flora

A total of 145 flora species (94 indigenous and 51 non-indigenous) were recorded within the study area during the field assessment. No significant flora species were recorded during the site assessment; however there is suitable habitat within the study area for flora species of national (Green-striped Greenhood and Strzelecki Gum) and State (Green Scentbark, Long Pink-bells, Marsh Sun-orchid, and Swamp Bush-pea) conservation significance.

Fauna

Eighty-one fauna species were recorded within the study area during the field assessment, including: seven mammals (five native, two introduced), 71 birds (64 native, seven introduced) and three native frogs. There is suitable habitat within the study area for fauna species of national (Southern Brown Bandicoot, Australasian Bittern, Growling Grass Frog and Dwarf Galaxias,), State (White-footed Dunnart, Greater Glider, Black Bittern, Lewin's Rail, Baillon's Crake, Masked Owl, Powerful Owl, Barking Owl, Sooty Owl, Southern Toadlet and Swamp Skink) and regional (Latham's Snipe) conservation significance.

Communities

Vegetation within the study area did not meet the condition thresholds that define any significant ecological communities.

Permitted Clearing Assessment (the Guidelines)

Based on DEPI's NVIM Tool (DEPI 2014b) and BIOR report (Appendix 4), the study area is situated in Location A with 46.378 hectares (comprising 44.337 hectares of remnant patch vegetation, and 29 scattered trees) of native vegetation proposed to be impacted as part of the proposed quarry development (Appendix 4). As such, the permit application falls under **the Moderate Risk-based** pathway. The offset requirement for native vegetation removal is 0.009 General Biodiversity Equivalence Units (BEU) and 33.712 specific BEUs for Spotted Gum, 37.491 specific BEUs for Cobra Greenhood, and 37.347 specific BEUs for Green Scentbark.

Legislative and Policy Implications

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act - Federal)

There is suitable habitat within the study area for two flora species (Green-striped Greenhood, Strzelecki Gum) and five fauna species (Southern Brown Bandicoot, Australasian Bittern, Latham's Snipe, Growling Grass Frog and Dwarf Galaxias,) listed under the EPBC Act. Based on likely impacts to Dwarf Galaxias, potential impacts to Australasian Bittern, Latham's Snipe (and Green-striped Greenhood, Southern Brown Bandicoot and Growling Grass Frog pending the results of targeted surveys), a referral to the Commonwealth Environment Minister will be required.

Flora and Fauna Guarantee Act 1988 (FFG Act - Victoria)

There is suitable habitat within the study area for several species listed or protected under the FFG Act. However, the study area is privately owned, as such a permit under the FFG Act is not required.

Environment Effects Act 1978 (Victoria)

Based on the current development plan, vegetation proposed to be removed and other associated impacts, the development may trigger the requirement for an Environment Effects Statement (EES). A referral under the *Environment Effects Act 1978* should be considered to ensure that all environmental impacts are considered and mitigated in an appropriate manner prior to development.

Mineral Resources (Sustainable Development) Act 1990 (MRSD Act)

A work plan will need to be prepared as the proposed development does not meet any of the exemptions listed under the Act. In order for a Work Plan to be approved by DEPI, the Department must be satisfied of "all necessary planning consents and approvals" including where Victoria's native vegetation policy requires action has been addressed.

Planning and Environment Act 1987

The clearing of native vegetation for extractive industries is exempt from the requirement for a planning permit subject to an assessment as part of the work plan approval process (MRSD Act). The removal of native vegetation for the Earth Resources Industry (ERI) is regulated through the Mining and Extractive Industry Work Approvals Process. A Memorandum of Understanding (MoU) between the former DSE and DPI recognises that native vegetation should be offset in accordance with the relevant State policy (i.e. the Guidelines).

Other Legislation and Policy

Implications relating to other State Government policy (e.g. *Wildlife Act 1975*, *Catchment and Land Protection Act 1994*) along with additional assessments or reporting that may be required (e.g. targeted surveys, Conservation Management Plan, Weed Management Plan, Construction Environment Management Plan) are provided in Section 8.

Additional Surveys

Given the presence of potentially suitable habitat for nationally significant species (i.e. EPBC Act-listed species), targeted surveys are required to determine the presence or absence of these species within the study area. If one or more of these species are present an assessment of the species' likely use of the study area (extent or distribution across, and/or adjacent to the study area), the abundance and importance of the

habitats within the study area for the species, and the likely or potential impacts to the species associated with the proposed development is required.

Although surveys for State and regionally significant species are not a legislative requirement, there is a requirement for DEPI to consider all state matters listed under the FFG Act as part of the planning and assessment approval process. There is also a possibility that the project will trigger the Environment Effects Act and be assessed under an EES, in which case such surveys are likely to be required. As such, targeted surveys for significant flora and fauna species that have the potential to use habitat resources within the study area, either as residents or visitors on a regular, occasional or rare basis is recommended. Targeted surveys should be undertaken as part of the planning and assessment of the proposed development for the following species:

- Nationally significant flora species (Green-striped Greenhood and Strzelecki Gum) and fauna (Southern Brown Bandicoot, Australasian Bittern, Growling Grass Frog and Dwarf Galaxias).
- State-significant flora (Green Scentbark, Long Pink-bells, Marsh Sun-orchid and Swamp Bush-pea) and fauna species (i.e. White-footed Dunnart, Greater Glider, Black Bittern, Lewin's Rail, Baillon's Crake, Masked Owl, Powerful Owl, Barking Owl, Sooty Owl, Southern Toadlet and Swamp Skink); and,
- Regionally significant fauna species (Latham's Snipe) and microbats.

Table S1. Application requirements for a permit to remove native vegetation (*Victoria Planning Provisions Clause 52.17 -3; DEPI 2013a*)

No.	Application Requirement	Response
Application requirements for <u>Moderate risk</u> pathway applications:		
1	The location of the site of native vegetation to be removed.	Refer to Section 1.3.
2	A description of the native vegetation to be removed, including the area of the patch of native vegetation and/or the number of any scattered trees to be removed.	Refer to Section 3.2.
3	Maps or plans containing information set out in the Guidelines, (Department of Environment and Primary Industries, September 2013)	Refer to Figures and BIOR report (Appendix 4.1).
4	Recent dated photographs of the native vegetation to be removed.	Refer to Section 3.
-	Topographic information, highlighting ridges, crests and hilltops, streams and waterways, slopes of more than 20 percent, drainage lines, low lying areas, saline discharge areas, and areas of existing erosion.	Refer to Section 1.3, Figure 2.
5	The risk-based pathway of the application to remove native vegetation.	Refer to Section 4.
6	Where the purpose of removal, destruction or lopping of native vegetation is to create defensible space, a statement is required that explains why removal, destruction or lopping of native vegetation is necessary. The statement must have regard to other available bushfire risk mitigation measures. This requirement does not apply to the creation of defensible space in conjunction with an application under the Bushfire Management Overlay.	Not applicable.
7	A copy of any property vegetation plan that applies to the site.	Not applicable.
8	Details of any other native vegetation that was permitted to be removed on the same property with the same ownership as the native vegetation to be removed, where the removal occurred in the five year period before the application to remove native vegetation is lodged.	Not applicable.
9	The strategic biodiversity score of the native vegetation to be removed.	Refer to Section 4 and BIOR report (Appendix 4.1).
10	The offset requirements should a permit be granted to remove native vegetation.	Refer to Section 4.2 and BIOR report (Appendix 4.1).
11	A habitat hectare assessment of the native vegetation to be removed.	Refer to Section 4 and BIOR report (Appendix 4.1).
12	A statement outlining what steps have been taken to minimise the impacts of the removal of native vegetation on biodiversity.	Refer to Section 7.1.
13	An assessment of whether the proposed removal of native vegetation will have a significant impact on Victoria's biodiversity, with specific regard to the proportional impact on habitat for any rare or threatened species.	Refer to Section 7.1.
14	An offset strategy that details how a compliant offset will be secured to offset the biodiversity impacts of the removal of native vegetation.	Refer to Section 7.2.1.1.

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1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by Hanson Construction Materials Pty Ltd (Hanson) to conduct a Ecological Assessment at Proposed Quarry on Sanders Road, Garfield, Victoria. The study area is proposed to be developed as a hard rock extractive quarry, with production anticipated to reach approximately two million tonnes of hard rock per annum. .

Previous flora assessment and fauna assessments have been undertaken across the proposed quarry site (Ecology Australia Pty Ltd 2009; Ecology Partners Pty Ltd 2008). However, a planning permit application to develop the site has not been prepared, and given the time that has passed since the previous assessments (i.e. nearly 5 years), it was considered prudent to undertake an additional assessment to obtain up to date information on the extent and significance of ecological values within the study area as part of the proposed development.

The purpose of this assessment was to identify the current extent and type of remnant native vegetation and fauna habitat present within the study area, and to determine the likely or potential presence of significant flora and fauna species and/or ecological communities. The following presents the results of the assessment and discusses the likely or potential ecological and legislative implications associated with the proposed development. Recommendations to avoid and minimise direct and indirect impacts to ecological values, along with the requirement for further targeted surveys for significant species are also provided.

1.2 Scope and Objectives

The objectives of the ecological assessment were to:

- Review the previous ecological assessments;
- Review the relevant flora and fauna databases and available literature;
- Conduct a detailed site assessment to identify flora and fauna values within the study area;
- Provide figures showing areas of remnant native vegetation and locations of any significant flora and fauna species, and/or fauna habitat;
- Classify any flora and fauna species and vegetation communities identified or considered likely to occur within the study area in accordance with Commonwealth and State legislation;
- Provide information with respect to environmental legislation and policy that is relevant to the proposed development;
- Document any opportunities and constraints associated with the proposed development; and,
- Advise whether any additional flora and/or fauna surveys are required as part of the planning and approval of the proposed quarry (e.g. targeted surveys for significant flora and fauna species).

Where areas of remnant native vegetation are present within the study area, the following was undertaken to address requirements under the 'Permitted clearing of native vegetation - Biodiversity Assessment Guidelines' (the Guidelines) (DEPI 2013a):

- A habitat hectare assessment of any areas of remnant native vegetation within the study area;
- Recommendations to address requirements under the Guidelines (DEPI 2013a) to avoid and/or minimise impacts to remnant vegetation; and,
- Provision of offset targets for any native vegetation, scattered trees and habitat for significant species proposed to be impacted as a result of the proposed development.

1.3 Study Area

The study area is located on the southern side of Sanders Road between Wallaby Court and Tonimbuk Road, approximately 80 kilometres east of Melbourne's CBD (Figure 1). The site covers approximately 157 hectares and is bound by Sanders Road to the north, private agricultural land to the south and east, and partially bound by private property and Wallaby Court to the west. Adjoining the western boundary of the study area is approximately 120 hectares of remnant vegetation comprising privately owned land, and the Mt Cannibal Flora and Fauna Reserve.

The study area is privately-owned and has previously been subject to extensive vegetation clearance in the northern half for farming and grazing purposes. The majority of the land to the north and south of the study area is also predominantly used for farming and/or grazing purposes. Land to the east and west are forested private properties with a pine plantation along part of the eastern boundary. There are 12 artificial wetlands/dams scattered throughout the study area, with a large wetland existing directly south of the southern study area boundary (Figure 2).

A tributary of Two Mile Creek runs to the north of Sanders Road and south of the study area (Figure 2). A tributary of Cannibal Creek extends through the south-western portion of the study area, and joins Cannibal Creek approximately one kilometre to the south of the site. Two Mile Creek and Cannibal Creek join the Bunyip River to the east of the study area.

The property varies topographically from a height of 150 metres above sea level (a.s.l) along a ridge in the north-central portion of the study area, down to 90 metres a.s.l in the south-west, and far north of the study area, and 80 metres to the far east.

According to the Department of Environment and Primary Industries (DEPI) Biodiversity Interactive Map (DEPI 2014a), the study area occurs within the Highlands – Southern Fall bioregion. It is located within the jurisdiction of the Port Phillip and Westernport Catchment Management Authority (CMA) and the Cardinia Shire Council municipality. The planning scheme zoning and overlays relevant to the study area are provided below (Section 6.5.1).

2 METHODS

2.1 Nomenclature

Common and scientific names of vascular plants follow the Victorian Biodiversity Atlas (VBA) (DEPI 2014b) and the Census of Vascular Plants of Victoria (Walsh and Stajsic 2007). Vegetation community names follow DEPI's Ecological Vegetation Classes (EVC) benchmarks (DEPI 2014c). The names of aquatic and terrestrial vertebrate and invertebrate fauna follow the VBA (DEPI 2014b).

2.2 Desktop Assessment

Relevant literature, online-resources and numerous databases were reviewed to provide an assessment of flora and fauna values associated with the study area. The following information sources were reviewed:

- The DEPI Biodiversity Interactive Map (DEPI 2014a) for:
 - modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species;
 - the extent of historic and current EVCs; and,
 - the location of sites of biological significance (BioSites) within the region.
- The VBA (DEPI 2014b), Flora Information System (FIS) (Viridans 2013a) and Atlas of Victorian Wildlife (AVW) (Viridans 2013b) for previously documented flora and fauna records within the project locality;
- The Federal Department of the Environment (DoE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DoE 2014);
- The Victorian Department of Transport, Planning and Linear Infrastructure Planning Maps Online to ascertain current zoning and environmental overlays (DTPLI 2014);
- Aerial photography of the study area;
- Relevant environmental legislation and policies; and,
- Previous ecological assessments within the study area:
 - Ecology Australia Pty Ltd 2009; and,
 - Ecology Partners Pty Ltd 2008.

2.3 Ecological Assessment

An ecological assessment comprising a total of four person days was undertaken by two qualified ecologists on 27 October and 3 November 2014 to obtain information on ecological values within the study area. The study area was assessed, with all observed flora species recorded, any significant records mapped and the overall condition of vegetation noted. Remnant vegetation in the local area was also investigated to assist in

determining the pre-European vegetation within the study area. EVCs were determined with reference to DEPI pre-1750 and extant EVC mapping and their published descriptions (DEPI 2014c).

The study area was visually assessed for fauna and active searching under and around ground debris for reptiles, frogs and small mammals was undertaken. Binoculars were also used to scan the area for birds, and observers listened for calls and searched for other signs of fauna such as nests, remains of dead animals, droppings and footprints. Potential habitat for fauna was assessed, with a particular emphasis on habitats that may provide shelter, food or other resources for significant species.

The significance assessment criteria of taxa and vegetation communities are presented in Appendix 1.

2.4 Permitted Clearing Assessment (the Guidelines)

2.4.1 Risk-based Pathway

The planning system manages the impacts on biodiversity from native vegetation removal using a risk-based approach. Two factors – extent risk and location risk – are used to determine the risk associated with an application for a permit to remove native vegetation (Table 1). The extent risk is determined by the extent of native vegetation (in hectares) or the number of scattered trees that are proposed to be removed. The location risk (A, B or C) has been determined for all areas in Victoria and is available on DEPI's Native Vegetation Information Management (NVIM) Tool (DEPI 2014d). The risk-based pathway is determined by combining the extent risk and the location risk of the vegetation to be removed (Table 1). If the risk-based pathway for vegetation differs to that for scattered trees, the higher of the two must be applied.

Table 1. Risk-based pathways for applications to remove native vegetation (DEPI 2013a)

Extent*		Location		
		A	B	C
Native Vegetation	< 0.5 hectares	Low	Low	High
	≥ 0.5 hectares and < 1 hectare	Low	Moderate	High
	≥ 1 hectare	Moderate	High	High
Scattered Trees	< 15 scattered trees	Low	Moderate	High
	≥ 15 scattered trees	Moderate	High	High

* For the purpose of determining the risk-based pathway of an application to remove native vegetation the extent includes any other native vegetation that was permitted to be removed on the same contiguous parcel of land with the same ownership as the native vegetation to be removed, where the removal occurred in the five year period before an application to remove native vegetation is lodged.

2.4.2 Vegetation Assessment

The 'habitat hectare' is a unit of measurement which combines the condition and extent of native vegetation. The methodology for undertaking a habitat hectare assessment is described in the Vegetation Quality Assessment Manual (DSE 2004) and summarised in Table 2. Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. Under the Biodiversity Assessment Guidelines, native vegetation is classified into two categories, remnant patches of native vegetation and scattered trees (Table 2).

For Moderate and High Risk-based pathways the extent (in hectares) and condition score are calculated based on a detailed habitat hectare assessment conducted by a qualified ecologist.

Table 2. Assessment of remnant native vegetation under Moderate and High Risk-based pathways (DEPI 2013a)

Category	Definition	Extent	Condition
Remnant patch of native vegetation	An area of native vegetation where at least 25 per cent of the total perennial understorey plant cover is native plants. OR An area with three or more native canopy trees where the canopy foliage cover is at least 20 per cent of the area.	Measured in hectares. Based on hectare area of the remnant patch.	Vegetation Quality Assessment Manual (DSE 2004).
Scattered tree	A native canopy tree that does not form part of a patch.	Measured in hectares. Each scattered tree is assigned an extent of 0.071 hectares (30m diameter).	Scattered trees are assigned a default condition score of 0.2.

2.4.3 Avoid and Minimise

Avoid and minimise requirements are summarised in Table 3. The impact avoidance and minimisation measures are discussed in Section 7.

Table 3. Avoid, minimise and offset requirements

Risk-based Pathway	Avoid	Minimise	Offset
Low	X	X	✓
Moderate	X	✓	✓
High	✓ *	✓	✓

*Where native vegetation makes a significant contribution to Victoria's biodiversity

2.4.4 Offset

When the removal of native vegetation has a significant impact on habitat for a rare or threatened species¹, the offset must compensate for the removal of that species' habitat. Offsets are divided into two categories: General and Specific. General offsets are based on the contribution a site makes to biodiversity overall, while Specific offsets consider the contribution a site makes to the persistence of rare or threatened species.

General offsets require an offset multiplier (Risk Factor) of 1.5 with restrictions on location (same Catchment Management Authority boundary or municipal district) and biodiversity value (strategic biodiversity score at least 80% that of the vegetation to be removed). A Specific offset requires an offset multiplier of 2, with no location or biodiversity value restrictions, and must support habitat for each rare or threatened species for which an offset is required (currently designated by DEPI).

The tools used to determine offset obligations are summarised in Appendix 1.5.1, and offset site criteria are summarised in Appendix 1.5.2.

¹ Only species listed as 'critically endangered', 'endangered', 'vulnerable' or 'rare' on DEPI's advisory lists (DEPI 2014e; DSE 2013) for flora and fauna are considered a rare or threatened species.

2.4.5 Biodiversity Impact and Offset Requirements (BIOR) Report

The offset requirements for native vegetation removal are calculated by DEPI, based on the vegetation condition scores determined during the biodiversity assessment. The resulting Biodiversity Impact and Offset Requirements report (BIOR) produced by DEPI is presented in Appendix 4.

2.5 Assessment Qualifications and Limitations

Data and information held within the ecological databases and mapping programs reviewed in the desktop assessment (e.g. VBA, PMST, Biodiversity Interactive Maps etc.) are unlikely to represent all flora and fauna observations within, and surrounding, the study area. It is therefore important to acknowledge that a lack of documented records does not necessarily indicate that a species or community is absent, but instead may reflect a lack of survey effort.

The 'snap shot' nature of a standard ecological assessment reduces the likelihood of mobile, migratory, seasonal, cryptic, nocturnal or uncommon species being detected. Generally, targeted or repeated surveys, at specific times of the year, are required to detect such species, and to assess the relative use and importance of habitats within the study area.

Notwithstanding the above, terrestrial ecological data collected during the current and previous (Ecology Australia Pty Ltd 2009; Ecology Partners Pty Ltd 2008) field assessments, and information obtained from relevant sources (e.g. biological databases and relevant literature) are considered suitable to provide an accurate assessment of the preliminary ecological values within the study area.

3 RESULTS

3.1 Flora and Fauna

A total of 145 flora species (94 indigenous and 51 non-indigenous) were recorded within the study area during the field assessment. A consolidated list of flora species recorded is provided below (Appendix 2.1). Planted trees and shrubs were not recorded unless they were seen to be naturally spreading on site.

Eighty-one fauna species were recorded within the study area during the field assessment, including: seven mammals (five native, two introduced), 71 birds (64 native, seven introduced) and three native frogs. A consolidated list of fauna species recorded is provided below (Appendix 3.1).

3.2 Existing Conditions

The assessment recorded three remnant EVCs within the study area: Riparian Scrub (EVC 191), Herb-rich Foothill Forest (EVC 23), and Lowland Forest (EVC 16). This assessment is broadly consistent the previous flora assessment (Ecology Partners Pty Ltd 2008) and with extant (2005) DEPI mapping that shows these areas contain Riparian Scrub (EVC 191), Herb-rich Foothill Forest (EVC 23), Lowland Forest (EVC 16), and Damp Heathy Woodland (EVC 793) (DEPI 2014a).

The study area supports five broad vegetation and habitat types: Forest, shrubland, scattered trees, artificial dams and introduced grassland. These are discussed in further detail below.

3.2.1 Forest

3.2.1.1 Vegetation Condition

Much of the remnant native vegetation within the study area is dominated by forest, located throughout the western and southern portions of the property (Figure 2; Plate 1 - 2). Based on the field assessment, forest vegetation within the study area is consistent with Herb-rich Foothill Forest and Lowland Forest EVCs.

Herb-rich Foothill Forest

Herb-rich Foothill Forest is typically an open forest with an understorey supporting shrubs and bracken with a diversity of grasses and herbs (Oates and Taranto 2001). The overstorey is typically dominated by Messmate Stringybark *Eucalyptus obliqua* and Narrow-leaf Peppermint *Eucalyptus radiata*, however several other eucalypt species can also occur (Oates and Taranto 2001). It generally occurs on relatively fertile, well-drained soils in foothill areas with moderate rainfall (Oates and Taranto 2001).

Herb-rich Foothill Forest is the dominant EVC within the study area and generally occurs south of the ridge line on the south-facing slopes (Figure 2). Although Messmate Stringybark and Narrow-leaf Peppermint are present, the dominant overstorey species is Mountain Grey-gum *E. cypellocarpa*. The understorey component ranges from dominance by shrubs, herbs and native grasses to introduced pasture grasses (Plate 1). Typical native species present in the understory include Austral Bracken *Pteridium esculentum*, Hop Goodenia *Goodenia ovata*, Prickly Moses *Acacia verticillata*, Weeping Grass *Microlaena stipoides* var. *stipoides*, Wattle Mat Rush *Lomandra filiformis*, Common Heath *Epacris impressa*, Bog Sedge *Schoenus apogon*, and Dusty Miller *Spyridium parvifolium*.

A small thin strip running north-south in the central part of the area (HrFF h – Figure 2) comprises a planted overstorey component (as evidenced by the straight row of trees and established irrigation line). Therefore, the overstorey component of this patch was discounted as part of the habitat hectare assessment.

Lowland Forest

Lowland Forest is typically an open forest dominated by Messmate Stringybark and Narrow-leaf Peppermint with an understorey of shrubby ericoid species, saw-sedges and wire-grasses (Oates and Taranto 2001). It generally occurs within lowland plains and lower foothill slopes on moderately fertile soils (Oates and Taranto 2001).

Lowland Forest generally occurs within the drier areas on north and east-facing slopes within the far eastern and far western portion of the study area (Figure 2). It is generally dominated by Messmate Stringybark and Narrow-leaf Peppermint however Lowland Forest areas to the west of the property also support Mountain Grey-gum and Manna Gum *E. viminalis* subsp. *viminalis* (Plate 2). In most cases, areas containing Lowland Forest vegetation are contiguous with remnant vegetation in adjoining properties to the east and west of the study area (Figure 2).

The understorey within Lowland Forest is generally of high quality, supporting a high cover of indigenous shrubs, sedges, herbs and grasses including Trailing Ground-berry *Acrotriche prostrate*, Clustered Everlasting *Chrysocephalum semipapposum*, Austral Bear's-ear *Cymbonotus preissianus*, Pale Sundew *Drosera peltata* subsp. *peltata*, Common Raspwort *Gonocarpus tetragynus*, Hairy Pennywort *Hydrocotyle hirta*, Common Rice-flower *Pimelea humilis*, Ivy-leaf Violet *Viola hederacea*, Kangaroo Grass *Themeda triandra* and Weeping Grass.

A small area on the western boundary of the study area (LF c and LF d – Figure 2) comprises a modified patch of Lowland Forest with all overstorey species removed. A high cover of Kangaroo Grass and Weeping Grass is present in the understory, along with a high diversity of groundcovers including Trailing Ground-berry, Early Nancy *Wurmbea dioica*, Common Onion-orchid *Microtis unifolia*, Chocolate Lily *Arthropodium strictum* s.l., Blue Pincushion *Brunonia australis*, Clustered Everlasting, Pale Sundew, Common Raspwort, Hairy Pennywort, Common Rice-flower, Ivy-leaf Violet, Kangaroo Grass and Weeping Grass.



Plate 1. Herb-rich Foothills Forest within the study area



Plate 2. Lowland Forest within the study area

3.2.1.2 Fauna Habitat

Forested areas provide moderate to high quality habitat for a variety of fauna including arboreal mammals, ground dwelling mammals, microbats, birds and reptiles. During the current survey a variety of birds were observed foraging within the canopy, including Rainbow Lorikeet *Trichoglossus haematodus*, Musk Lorikeet *Glossopsitta concinna*, White-plumed Honeyeater *Lichenostomus penicillatus*, Brown Thornbill *Acanthiza pusilla*, Spotted Pardalote *Pardalotus punctatus*, Striated Pardalote *Pardalotus striatus* and Eastern Spinebill *Acanthorhynchus tenuirostris*.

These trees provide suitable breeding, shelter and foraging habitat for a range of arboreal mammals. Many of the trees had signs of use by arboreal mammals such as possums and gliders, with numerous scratches present on the trunks, hollows with marks around the entrances and scats found in these areas. Common Brushtail Possum *Trichosurus vulpecula*, Common Ringtail Possum *Pseudocheirus peregrinus* and Sugar Glider *Petaurus breviceps* are all likely to be present, while habitat is also suitable for the State significant Greater Glider *Petauroides volans*.

A range of microbats are likely to forage for insects around the trees and roost within hollows and fissures, while hollows are also likely to be used by arboreal mammals and nocturnal raptors such as Southern Boobook *Ninox novaeseelandiae*, and the State significant Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens connivens*, Sooty Owl *Tyto tenebricosa tenebricosa* and Masked Owl *Tyto novaehollandiae novaehollandiae*.

Ground cover provides suitable habitat for ground-dwelling mammals such as Common Wombat *Vombatus ursinus* and Short-beaked Echidna *Tachyglossus aculeatus*, along with a diversity of small mammals and reptiles.

3.2.2 Shrubland

3.2.2.1 Vegetation Condition

Riparian Scrub

Riparian Scrub is typically a closed scrub dominated by Scented Paperbark *Melaleuca squarrosa* or Swamp Paperbark *M. ericifolia* but can also be dominated by Wattle *Acacia* spp. and Tea-tree *Leptospermum* spp. (Oates and Taranto 2001). Emergent eucalypts can be present and the ground cover is typically comprised of shrubs, sedges, rushes and ferns (Oates and Taranto 2001). Riparian Scrub occurs in areas of relatively high rainfall on infertile waterlogged soils near creeks and tributaries (Oates and Taranto 2001).

A high quality remnant of Riparian Scrub occurs in the south-western portion of the study area (Figure 2). Although Scented Paperbark is not present, the patch is dominated by a dense cover of Prickly Tea-tree *Leptospermum continentale*. Burgan *Kunzea ericoides* and Prickly Moses *Acacia verticillata* and Swamp Paperbark are also present. The northern portion of the Riparian Scrub patch (Figure 2) is dominated by Swamp Paperbark and Burgan further upslope. The ground layer is dominated by mosses together with indigenous rushes and sedges such as Variable Sword-sedge *Lepidosperma laterale* and Thatch Saw-sedge *Gahnia radula* (Plate 3).

Introduced species such as Gorse *Ulex europaeus* and Spanish Heath *Erica lusitanica* are also scattered throughout the Riparian Scrub.

3.2.2.2 Fauna Habitat

The areas of riparian scrub are likely to provide suitable refuge, foraging and nesting habitat for a diversity of small birds such as Superb Fairy-wren *Malurus cyaneus*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa* and White-browed Scrubwren *Sericornis frontalis*, small mammals such as Agile Antechinus *Antechinus agilis*, Swamp Antechinus *Antechinus minimus maritimus* and Dusky Antechinus *Antechinus swainsonii* are also likely to be present, potentially along with the nationally significant Southern Brown Bandicoot *Isodon obesulus obesulus*. Common reptiles, potentially including the State significant Swamp Skink *Egernia coventryi* may reside within these areas.

3.2.3 Scattered Trees

3.2.3.1 Vegetation Condition

The area north of the ridge line sloping down towards Sanders Road (Figure 2) supports several native scattered trees that are generally Mountain Grey-gum closer towards the ridge line and Silver-leaf Stringybark *E. cephalocarpa* further north towards Sanders Road.

3.2.3.2 Fauna Habitat

Scattered remnant trees occur throughout the study area and provide an important resource for more mobile tree-dependent fauna. The majority of the scattered eucalypts are mature, providing an array of small, medium, large and very large hollows, bark fissures and crevices. These are likely to be used for shelter and nesting by a range of hollow-dependent fauna including parrots, microbats, possums, gliders and potentially owls. Scattered trees provide foraging habitat for insectivorous and nectivorous birds as well as vantage points and nesting areas for diurnal and nocturnal raptors. These trees also provide stepping stones for more mobile fauna moving through the study area, enhancing landscape permeability for native fauna.

Many of the scattered trees are likely to be over 300 years of age. Due to the paucity of woodland and forest habitat in the local area and across the landscape, tree hollows are important in the life history of many woodland and forest-dependent birds and mammals as they are likely to be scarce.



Plate 3. Riparian Scrub within the study area



Plate 4. Native Grassland within the study area

3.2.4 Artificial Dams

3.2.4.1 Vegetation Condition

Tall Spike-sedge *Eleocharis sphacelata* is present within most of the waterbodies within the study area. Other tall aquatic species present in low densities include Broad-leaf Cumbungi *Typha orientalis* and Tall Rush *Juncus procerus*. Submerged and floating aquatic species include Blunt Pondweed *Potamogeton ochreatus*, Swamp Lily *Ottelia ovalifolia* subsp. *ovalifolia*, Amphibious Water-milfoil *Myriophyllum simulans*, Ferny Azolla *Azolla pinnata*, Round Water-starwort *Callitriche muelleri* and Slender Knotweed *Persicaria decipiens*. Species present along the fringes of the waterbodies include Common Spike-sedge *Eleocharis acuta*, Swamp Club-sedge *Isolepis inundata* and Billabong Rush *Juncus usitatus* (Plate 5).

3.2.4.2 Fauna Habitat

Wetlands throughout the study area have been created by either being dug out or by damming a section of the catchment. The majority of dams provide moderate to high quality habitat to a diversity of aquatic fauna. Species recorded within the wetlands during the current assessment include Purple Swampphen *Porphyrio porphyrio*, Dusky Moorhen *Gallinula tenebrosa*, Eurasian Coot *Fulica atra*, White-necked Heron *Ardea pacifica*, Eastern Great Egret *Ardea modesta* and White-faced Heron *Egretta novaehollandiae*.

Eastern Great Egret, recorded in the wetland on the southern boundary of the study area (Site 14), is a State significant species, listed under the FFG Act. A previous fauna study (Ecology Australia Pty Ltd 2009) recorded several species of significance in wetland habitats in and around the study area, including:

- Dwarf Galaxias (nationally significant, listed as Vulnerable under the EPBC Act) was recorded at Site 14, and in Cannibal Creek, approximately one kilometre south of the study area, in January 2009;
- Australasian Bittern (nationally significant, listed as Endangered under the EPBC Act) was recorded at Site 14 in January 2009; and,
- Latham's Snipe (regionally significant, listed as Near Threatened under the DEPI Advisory List) was recorded at Site 14 in January 2009.

A wide range of additional species are likely to use these areas, potentially including the State significant Black Bittern *Ixobrychus flavicollis australis*, Lewin's Rail *Rallus pectoralis* and Baillon's Crake *Porzana pusilla*.

3.2.5 Introduced Grassland

3.2.5.1 Vegetation Condition

The majority of the area north of the ridge line sloping down towards Sanders Road (Figure 2) supports little indigenous vegetation, aside from several native scattered trees that are generally Mountain Grey-gum closer towards the ridge line, and Silver-leaf Stringybark *E. cephalocarpa* further north towards Sanders Road (Plate 4). Introduced pasture grasses are dominant and include Kikuyu *Pennisetum clandestinum*, Sweet Vernal-grass *Anthoxanthum odoratum* and Brown-top Bent *Agrostis capillaris* (Plate 6)

3.2.5.2 Fauna Habitat

Areas of introduced grassland are considered to be of low habitat value for fauna, likely to be utilised by locally common birds and mammals adapted to open areas, such as Australian Magpie *Gymnorhina tibicen*,