

**Flora, fauna and Net Gain
assessment of the proposed New
Chiltern Quarry, Victoria**

September 2009

Biosis Research Pty. Ltd.

**Report to
CEMEX Australia Pty Ltd**

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assessment of the proposed New
Chiltern Quarry, Victoria**

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ABBREVIATIONS

AVW	Atlas of Victorian Wildlife (DSE 2005)
DBH	Diameter at breast height (130 cm above ground surface)
DEWHA	Department of the Environment, Water, Heritage and the Arts
DSE	Department of Sustainability & Environment
EVC	Ecological Vegetation Class
FIS	Flora Information System (DSE 2005)
sp.	Species (one species)
spp.	Species (more than one species)

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SUMMARY

Biosis Research Pty. Ltd. was commissioned by CEMEX Australia Pty Limited to undertake a flora, fauna and Net Gain assessment of its' proposed New Chiltern Quarry.

Ecological values

Although substantially modified through past clearing and grazing, much of the study area supports remnants of a threatened ecological community and Ecological Vegetation Classes (EVCs). The study area also supports populations or habitat for several plant and animal species that are significant at the national and state level. Values identified during the present assessment include:

- The presence of the EPBC-listed White Box – Yellow Box – Blakely's Red Gum grassy woodland and Derived Native Grassland community.
- The presence of the FFG listed Victorian Temperate Woodland Bird Community.
- Four EVCs listed as either endangered or vulnerable within the Northern Inland Slopes Bioregion and also, with the exception of Box Ironbark Forest, threatened at a state-wide level
- The proposed Work Authority contains over 100 hectares of modified native vegetation, which amounts to about 39 habitat hectares when assessed in accordance with Victoria's Native Vegetation Management Framework.
- Presence of three plant species of State significance and 49 species of regional conservation significance.
- Well-structured, remnant, woodland habitat, with multiple niches used by or likely to be used by a range of woodland dependent fauna including threatened species listed at the national (Swift Parrot, Regent Honeyeater) and state (Brush-tailed Phascogale, Squirrel Glider, Barking Owl, Grey-crowned Babbler) level.

On the basis of the available information, the larger block (6569/733) adjacent to the National Park and the road reserves contiguous with this block are of State conservation significance. Areas not supporting native vegetation (i.e. the western paddock and parts of the central ridgeline) are not considered significant for biodiversity conservation.

Government legislation and policy

The study area supports species and communities listed as threatened under the EPBC Act. The proposed new quarry could impact on these matters of national environmental significance. As such a referral under the EPBC Act (2009/4849) was prepared for a determination by the Australian Minister for Environment,

Water, Heritage and the Arts. The new quarry was determined to be a controlled action on 8 May 2009 to be evaluated by preliminary information.

The study area supports species and communities listed under the FFG Act. Most of the study area is private land where permit provisions of the FFG Act do not apply. However public land will be impacted by the proposal as at least some quarry infrastructure will intersect at least three road reserves. As such, an FFG permit is likely to be required for removal of protected flora.

The study area supports native vegetation that is subject to Victoria's Native Vegetation Management Framework. Native vegetation remnants within the study area meet the definition of High to Very High conservation value under the Framework, in which case clearing is generally not permitted unless exceptional circumstances apply, with ministerial approval in the case of Very High conservation value vegetation.

In total, the footprint of the proposed quarry and associated infrastructure would result in the loss of **15.91 ha** of modified native vegetation, amounting to **6.22 habitat hectares** of Very High conservation significance.

Mitigation

The primary mechanism for mitigating ecological impacts is through adherence to Net Gain policy. The 3-step process to achieving Net Gain has been followed during the design process to: (1) attempt to avoid any native vegetation loss, (2) minimise any unavoidable loss of native vegetation, and (3) identify offsets for any approved native vegetation losses.

The habitat hectare offsets to be achieved within the Northern Inland Slopes Bioregion are as follows:

- **1.96 hha** of VHCS Grassy Woodland;
- **7.61 hha** of VHCS open grassy woodland habitat for Diamond Firetail and Barking Owl;
- **1.07 hha** of VHCS Box Ironbark Forest; and
- **1.79 hha** of VHCS Valley Grassy Forest.

Additional offsets prescribed for the loss of Large Old Trees (LOTs) within patches (37) and one scattered LOT are as follows:

- protect **40** and recruit **200** in Valley Grassy Forest;
- protect **192** and recruit **960** within Grassy Woodland; and
- protect **64** and recruit **320** within the best 50% of habitat for Diamond Firetail or Barking Owl.
- Protect 2 and recruit 10 **or** recruit 100 in an area of Grassy Woodland.

Offsets can be achieved through the management of native vegetation retained within the paddock incorporating the extraction area and two other potential offset sites supporting Grassy Woodland available within the Eames property.

The propose New Chiltern quarry has identified potential habitat hectare offsets within the Eames property to generate a like-for-like Net Gain outcome for the habitat hectare component of the offset prescriptions for this project. The nominated offset site also generates an excess of **2.45 hha** of VHCS and **0.48 hha** of HCS.

Of the 528 mature trees (337 LOTs and 191 MOTs) identified within the leasehold area 177 LOTs can be utilised under the like-for-like requirements. This reduces the offset prescription to protect 296 LOTs to **119** Grassy Woodland LOTs, leaving **114 LOTs** and 121 MOTs within Valley Grassy Forest, 70 Grassy Woodland MOTs and 8 scattered LOTs (**122 LOTs** and **191 MOTs**) unallocated to any offsets. This provides about 60% of the prescribed like-for-like LOT offsets for the project. The remaining 40% of LOT offsets are yet to be identified.

A summary of the Net Gain offsets available within the Lease Area is as follows:

Habitat Hectares (all Very High conservation significance)

EVC	Prescribed Offset	Offset Identified	Compliance
Box Ironbark Forest	1.07 hha	2.01 hha	188%
Creepline Grassy Woodland	0 hha	0.02 hha	NA
Valley Grassy Forest	1.79 hha	2.07 hha	116%
Threatened Bird Habitat	7.61 hha	7.61 hha	100%
Grassy Woodland	1.96 hha	3.19 hha	163%
Totals	12.43 hha	14.90 hha	120%

Large Old Tree Protection

EVC	Prescribed Offset	Offset Available	Compliance
Box Ironbark Forest	0	45*	NA
Creepline Grassy Woodland	0	2*	NA
Valley Grassy Forest	40	154 [#] (+121 MOTs)	385%
Threatened Bird Habitat*	64	64	100%
Grassy Woodland	192	73 (+70 MOTs)	38%
Totals	296	291 (+191 MOTs)	(98.3%)

* used as Threatened Bird Habitat offsets,

17 were used as Threatened Bird Habitat offset

1.0 INTRODUCTION

1.1 Project Background

Biosis Research Pty. Ltd. was commissioned by CEMEX Australia Pty Ltd to undertake a flora, fauna and Net Gain assessment of their proposed New Chiltern Quarry. The proposal is a response to the planned closure of existing CEMEX quarry within the Chiltern - Mt. Pilot National Park and involves the replacement of this quarry with another on private property about 500 metres west-south west of the existing operation.

1.2 Objectives

The objectives of this investigation are to:

- Describe the vascular flora, terrestrial vertebrate fauna and habitat values of the proposed Work Authority and relevant leasehold lands.
- Evaluate the conservation significance of the land.
- Map any ecologically significant flora and fauna habitats.
- Assess any potential impacts of the proposed development.
- Assess the project against the Net Gain policy.
- Identify a program of potential mitigation measures.
- Recommend any further assessments of the site that may be required (such as targeted searches for significant species).

1.3 Study Area

The New Chiltern quarry is located approximately three kilometres southeast of Chiltern and approximately 230 km north-east of Melbourne (**Figure 1**).

The proposed Work Authority (WA) is bounded to the north by the Chiltern - Mt. Pilot National Park and Forrest Lane, to the east by the Chiltern - Mt. Pilot National Park and to the west and south by private farmland, Black Dog Creek Road and the Chiltern – Beechworth Road. It is irregular in shape and approximately 116 hectares in area. It consists of private land and undeveloped road reserves. Other areas of the Eames property are also leased by CEMEX and some of these areas were also examined as part of this assessment.

The study area is largely owned by the Eames family and it appears that the road reserves within their property are grazed under licence. The area has largely been cleared although there are remnant trees present as isolated individuals and as small clumps. The road reserves generally retain a relatively natural density of indigenous trees. The land is currently used for the grazing of domestic stock and does not appear to have been subject to pasture improvement or extensive fertiliser application.

The study area is within the Northern Inland Slopes Bioregion (Department of Sustainability and Environment: www.dse.vic.gov.au).

2.0 METHODS

2.1 Classification

Common and scientific names for flora and fauna follow the Flora Information System (FIS 2007 version) and the Atlas of Victorian Wildlife (AVW 2007 version) of the Department of Sustainability and Environment (DSE).

Classification of native vegetation in Victoria follows a typology in which ecological vegetation classes (EVCs) are the primary level of classification. An EVC contains one or more plant (floristic) communities, and represents a grouping of broadly similar environments. Vegetation community names follow the typology of vegetation in Victoria developed by DSE (<http://www.dse.vic.gov.au/>).

2.2 Literature and Database Review

Information in the FIS, AVW and Birds Australia databases was reviewed. The Department of the Environment, Water, Heritage and the Arts (DEWHA) online database for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act Protected Matters Search Tool, hereafter referred to as the DEWHA database) was also searched.

The current distribution and 1750 EVCs (DSE mapping of native vegetation present at these dates) present within the study area and their bioregional conservation status were reviewed (DSE web site: <http://www.dse.vic.gov.au/>). DSE flora and fauna officers, relevant experts and locals were also asked about the classification of the native vegetation present and records of threatened fauna from the study area and its surrounds.

2.3 Site Visit

2.3.1 Flora and fauna assessment

The initial field assessment took place on 7, 8 and 9 November 2007. A more intensive search for the threatened species Narrow Goodenia *Goodenia macbarronii* was conducted on 18 and 20 December 2007. Potential access road alignments were examined on 2 April 2008 and the western third of the proposed Work Authority was assessed on 3 December 2008. Other potential offset areas within the Eames property were also examined.

Targeted survey for EPBC Act listed threatened species was conducted on 26 September 2008. The focus for this survey included two threatened species recorded within the surrounding forest (National Park): Crimson Spider-

orchid *Caladenia concolor* and Mountain Swainson-pea *Swainsona recta*. Domestic stock was excluded from the study area for a period of approximately one month prior to this survey. Populations of these species in the Chiltern-Mt Pilot National Park were inspected before the site search commenced.

Assessment was concentrated in sections of the WA that support native vegetation remnants and with potential to support threatened species. Detailed assessment and data collection was generally not undertaken in highly altered sections of the study area that contain few native species. Plant species observed were recorded in five defined area species lists and stored electronically in the DSE Flora Information System (U40640-41, U40671-2 and U40724) (**Figure 2**).

General observations were made on the vegetation and fauna habitat of the study area. The overall site condition and conservation significance of the study area were also documented.

Fauna survey was conducted by two zoologists. Several fauna survey techniques were employed including spotlighting, small mammal trapping, Anabat bat detection, call playback and active searching. A description of each of these survey techniques is provided in Appendix 1. A summary of fauna survey effort is detailed in **Table 1** with the location of survey sites is presented in **Figure 2**.

Table 1: Fauna survey techniques and effort at Chiltern, November 2007 – January 2009.

Survey technique	Locations	Survey effort
Anabat bat detection, Nov 2007	3	6 Anabat-nights
Small mammal (large Elliot) trapping (Phascogales), Nov 2007	44	88 trap-nights
Spotlighting, Nov 2007	throughout	4 spotlight-hours
Nocturnal call playback, Nov 2007	3	2 playback-hours
Other active searching and incidental observations, Nov 2007	many	15 hours
Golden Sun Moth survey, Summer 2008	throughout	4 survey days
Pink-tailed Worm-lizard survey, Oct 2008	Rocky hill	3 days/2541 rocks 36 funnel trap nights
Striped Legless Lizard tile survey, Sept 2008-Jan 2009	3 grids	150 tiles/10 checks

Fauna records will be submitted to the Atlas of Victorian Wildlife (AVW).

2.3.2 Vegetation Quality Assessment for Net Gain

Vegetation quality is assessed using a standard method contained in a manual published by the Department of Sustainability and Environment (DSE 2004). A summary of this method is provided in Appendix 3. Vegetation quality

assessment contributes to the assessment of a development project in relation to the Net Gain policy as per Victoria's Native Vegetation Framework (NRE 2002).

A habitat hectare assessment was conducted and habitat score calculated for vegetation quality zones within the study area (**Figure 3**). Indigenous canopy trees were also assessed in accordance with the Native Vegetation Framework although data on the diameter at breast height (DBH) for trees within the study area was provided by local CEMEX staff.

2.3.3 Identifying Offsets for Net Gain

The offset potential of area of native vegetation proposed to provide any prescribed offsets associated with the proposed quarry were calculated using the DSE online net gain calculator (October 2008 version).

The 'like-for-like' criteria prescribed under the Framework to offset permitted clearing require the vegetation gains from an offset to be commensurate (or equal) to the vegetation loss in terms of habitat and vegetation type, landscape role and quality. In practical terms, this means that if the *highest* significance rating of the native vegetation being removed is triggered by the presence of habitat for a particular threatened species (or community), then the offset should provide habitat for the same threatened species (or community) (DSE 2007). Advice from DSE (Kim Lowe, Director Ecosystem Services 26/03/09) indicate that the same habitat type should only be considered as a like-for-like offset when habitat for a particular threatened species is driving the *highest* conservation significance rating for the loss. Otherwise, where offsets are sought for vegetation of Very High conservation significance, the offset must reflect the same EVC as the approved loss.

Where offsets are provided with a higher conservation significance than that of the vegetation approved for clearing, the offset does not have to be the same vegetation type and does not have to provide the same habitat for rare or threatened species. This is in accordance with Table 6 of the Framework.

2.4 Qualifications

The field surveys combined with information available from other sources is considered suitable to assess the existing ecological condition of the study area and identify relevant issues for the proposed quarry. However, the ecological surveys conducted provide a sampling of the flora and fauna at a series of given times. While a number of surveys were conducted, more species could be recorded with additional survey during different seasons.

Overall we consider that there are no significant limitations to the present study. However the following qualifications apply to the data collected from the study area:

- The assessment includes vascular flora (ferns, conifers, flowering plants) and terrestrial vertebrate fauna (birds, mammals, reptiles, frogs). Non-vascular flora (e.g. mosses, liverworts) were not sampled although their presence is noted as part of the cover of native species in the definition of a patch.
- The flora and fauna assessment was conducted over a range of seasonal conditions which included optimal times for survey. However, the survey within the corridor for the site access road (mid-autumn) and the western third of the WA (early summer) were completed during seasonal conditions which are sub-optimal times for such flora survey work. Some plant species are dormant and/or lack flowering or fruiting material in late spring/early summer but particularly mid-autumn, making detection and/or identification difficult. In addition, migratory fauna may be seasonally absent. Seasonal surveys for threatened flora species were conducted and although drought conditions prevailed, sterile material for target species was present in surrounding forest environments.
- Field mapping is conducted using hand-held (uncorrected) GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (manufacturer states +/- 15m but generally +/-2 to 5 metres) and dependent on the limitations of aerial photo resolution, rectification and registration. As such, these points should not be relied on for survey grade design purposes.
- For the purposes of this assessment the limit of the resolution for the habitat hectare assessment process is taken to be 0.01 habitat hectares. That is, if native vegetation is present with sufficient cover but its condition and extent would not result in the identification of at least 0.01 habitat hectares then that vegetation will be considered as part of the broader area of predominantly introduced vegetation in which it occurs.
- Agricultural areas are often heavily grazed making detection and/or identification of certain species, and estimation of life form cover difficult. This was not a constraint during spring as the site had only been lightly grazed following significant rainfall, however the site had been heavily grazed during the autumn inspection. Grazing had been removed for a period of approximately one month prior to targeted surveys for threatened species.

- Only a limited time was spent trapping for Phascogales. Regardless of whether animals were caught, the study area is considered to support suitable habitat for this species and given that it is contiguous with the Chiltern-Mt Pilot National Park, it is likely that this species uses the study area.
- Limited time was spent surveying for amphibians.

2.5 Defining Significant Species and Communities

A number of categories and criteria are applied to assess the ecological significance of flora and fauna and sites supporting flora and fauna. The definition and application of the criteria are detailed in Appendix 4.

Areas of endangered EVCs were defined during various stages of this assessment. Typically the extent of different EVCs is defined based on the characteristics of that EVC described by the relevant benchmark (<http://www.dse.vic.gov.au/dse/nrence.nsf/LinkView/43FE7DF24A1447D9CA256EE6007EA8788062D358172E420C4A256DEA0012F71C>) and the mapping of extant native vegetation provided by DSE (http://nremap-sc.nre.vic.gov.au/MapShare.v2/imf.jsp?site=bim_external).

In this instance the DSE mapping for the site was inaccurate and therefore a broader regional inspection was conducted to ensure the EVC mapping of the proposed work authority was consistent with the distribution of these EVCs within the broader landscape.

3.0 RESULTS

3.1 Flora

3.1.1 Species

Records during present assessment

A total of 224 vascular plant species (ferns, conifers and flowering plants) have been recorded for the study area (Appendix 5). Of these, 151 species (67%) are indigenous and three (1%) are rare or threatened.

Database records

There are no existing flora data for the study area in the FIS.

The FIS contains records of an additional 255 indigenous flora species from within 5 km of the study area, including 21 threatened species (Appendix 5).

The DEWHA database predicts the occurrence of, or suitable habitat for a single additional listed flora species, River Swamp Wallaby-grass *Amphibromus fluitans*, within 5 km of the study area (Appendix 5).

While there is potential habitat for some of these plants within the study area the likelihood of these occurring is relatively low given the relatively long agricultural history of the site. However, given the steep and rocky nature of parts of the site some of these could be present.

3.1.2 Ecological Vegetation Classes

DSE mapping of 1750 vegetation in this area models the study area as previously supporting the Ecological Vegetation Class (EVC) Heathy Dry Forest (EVC 20) on the upper slopes of the ridge with the mid and lower slopes dominated by Box Ironbark Forest (EVC 61). The relatively flat plains are modelled to support Valley Grassy Forest (EVC 47) with the larger drainage lines near Forrest Lane supporting Alluvial Terraces Herb-rich Woodland (EVC 67).

Observations within the study area and discussion with Sue Berwick (DSE North East Region) indicate that this modelling is inaccurate.

The northern lower slopes of the central ridge support remnant stands of Mugga *E. sideroxylon* and this is consistent with DSE mapping identifying this area as Box Ironbark Forest (**Figure 3**).

The well defined drainage lines descending from the central ridgeline also have a distinctive flora dominated by Tall Sedge *Carex appressa*, Weeping Grass *Microlaena stipoides* and Rushes *Juncus* spp. At the extremes of the study area these drainage lines occasionally support remnant River Red-gum. Given the relatively fine scale mapping for the study area these remnants are mapped as Creekline Grassy Woodland (EVC 68) (**Figure 3**).

The gentle slopes and undulating areas of low relief to the north west, west and south of the central ridge support outwash areas with a relatively high cover of Red Stringybark *E. macrorhyncha* and while Mugga is still present so are scattered occurrences of Yellow Box *E. melliodora*, Red Box and River Red-gum *E. camaldulensis*. This is more typical of Valley Grassy Forest (**Figure 3**).

The upper slopes are dominated by White box *Eucalyptus albens*, Red Box *E. polyanthemos* and Blakely's Red-gum *E. blakelyi*. This vegetation is therefore best classified as remnants of Rainshadow Grassy Woodland (EVC 175-62) (**Figure 3**). Other areas of this EVC were also identified towards the western end of the proposed work authority. These areas are dominated by Red Box but also support scattered Blakely's Red-gum. The grassy, relatively herb-rich ground cover typically supports an obvious cover of Dense Spear-grass *Austrostipa densiflora*, together with Cane Wire-grass *Aristida ramosa*, Wallaby-grasses *Austrodanthonia* spp., Weeping Grass *Microlaena stipoides* and Kangaroo Grass *Themeda triandra*. This area is ecotonal between Grassy Woodland and Valley Grassy Forest and much of the floristic differences between the two have also been blurred or dissolved by the current land use. However, using the benchmarks for these two communities and observations within the broader region based on DSE mapping suggest the vegetation on the slopes of these lower hills is also consistent with Grassy Woodland.

Areas which did not support the prescribed cover of indigenous flora to be defined as a patch of native vegetation were classified as predominantly introduced vegetation. This vegetation was typically dominated by a range of exotic flora and was restricted to the treeless areas of the ridgeline and the open areas of the western paddock within the study area (**Figure 3**). Common exotic species included Sweet Vernal-grass *Anthoxanthum odoratum*, Squirrel-tail Fescue *Vulpia bromoides*, Bulbous Meadow-grass *Poa bulbosa*, Wimmera Rye-grass *Lolium rigidum*, Barley-grass *Hordeum leporinum*, Clover *Trifolium* spp. Big Heron's-bill *Erodium botrys* and Cape Weed *Arctotheca calendula*.

3.1.3 Condition of Native Vegetation

Native vegetation over the majority of the study area has been substantially modified, although it remains dominated by unimproved native pasture. The ridge and its lower slopes support enough cover of remnant native plants to be

defined as a patch (DSE 2007). Much of the corridor for the site access road within the Eames property was also dominated by native vegetation.

Trees along the ridgeline are generally remnant large old trees. This upper ridgeline appears to be an area where domestic stock concentrate and the ground here was typically heavily disturbed. As a consequence the understorey is dominated by annual exotic flora although remnant populations of wattles and some native perennial grasses persist.

The areas of Box Ironbark Forest have also been grazed but the shaded environment and skeletal rocky soils do not support a significant cover of exotic species. Indigenous grasses and herbs are relatively common and steeper areas support an open cover of shrubs. The understorey is therefore relatively sparse but it remains predominantly indigenous and relatively species rich.

The mid to lower northern slopes and western areas of the WA are relatively rocky and generally support only skeletal soils. While exotic grasses and herbs are relatively common, the dominant flora of this environment is indigenous grasses with a scattered to locally high cover of ground ferns and herbs. Common species include Brush Wire-grass *Aristida behriana*, Cane Wire-grass *A. ramosa*, Hill Wallaby-grass *Austrodanthonia eriantha*, Bristly Wallaby-grass *A. setacea*, Dense Spear-grass *Austrostipa densiflora*, Rough Spear-grass *A. scabra*, Green Rock-fern *Cheilanthes austrotenuifolia*, Bristly Cloak-fern *C. distans*, Tall Raspwort *Gonocarpus elatus*, Wattle Mat-rush *Lomandra filiformis*, Many-flowered Mat-rush *L. multiflora* and Weeping Grass *Microlaena stipoides*.

The mid to lower southern slopes are more sheltered and rather than Wire-grass the most common species is Weeping Grass. Although the cover of exotic grasses such as Sweet Vernal-grass and Bulbous Meadow-grass is often visually dominant the cover of indigenous grasses is more than adequate to be defined as a patch. Other common grasses include Lobed Wallaby-grass *A. auriculata*, Velvet Wallaby-grass *A. pilosa*, Bristly Wallaby-grass *A. setacea*, Knotty Spear-grass *A. nodosa*, Common Wheat-grass *Elymus scaber*, Silvertop Wallaby-grass *Joycea pallida*, Grey Tussock-grass *Poa sieberiana* var. *hirtella* and Kangaroo Grass *Themeda triandra*.

The drainage lines flowing from the central ridgeline are recognisable as a narrow strip dominated by Tall Sedge *Carex appressa*. These drainage lines are obvious from about mid-slope but can also start from any of the numerous ephemeral springs which emerge this side of the ridge. Other common species found along these drainage lines include Rushes *Juncus* spp., Wattle Mat-rush, Common Love-grass *Eragrostis brownii* and Smooth Wallaby-grass *Austrodanthonia laevis*. Where these drainage lines traverse the more gentle lower slopes on the southern side of Skeleton Hill, the relatively broad and open

swampy areas provide habitat for the vulnerable Narrow Goodenia *Goodenia macbarronii* and the rare Dwarf Brooklime *Gratiola pumilo*.

3.2 Vegetation quality assessment for Net Gain

A brief explanation of Net Gain methodology is included in Appendix 3. The EVC Benchmarks for *Rainshadow* Grassy Woodland, Creekline Grassy Woodland, Valley Grassy Forest and Box Ironbark Forest are provided in Appendix 6.

3.2.1 Vegetation in Patches

The vegetation quality zones mapped are identified in **Figure 3**. The assessment criteria and scores are given in **Table 2**.

The WA contains over **100 hectares** of modified native vegetation, which amounts to **38.79 habitat hectares**. Area of native vegetation not required for quarry infrastructure but still within the Eames property was also assessed. These areas have the potential to function as an offset site for the protection of large old trees and to generate habitat hectare offsets.

The habitat score for the vegetation ranges from 0.29 to 0.65. The higher habitat scores represent the most intact areas of native vegetation.

Conservation significance

Conservation significance was assessed for the patches using criteria in the assessment manual (DSE 2004), and is given in **Table 2**.

The EVCs within the study area are considered by DSE to be either endangered or vulnerable within the bioregion. As a result, the indigenous vegetation is defined as either High or Very High conservation significance depending on the habitat hectare score (NRE 2002: Table 5). The vegetation also provides habitat for threatened flora and fauna, particularly arboreal fauna such as Brush-tailed Phascogale, birds such as the FFG listed Woodland Birds Community, Barking Owl and Diamond Firetail, and the vulnerable Narrow Goodenia *Goodenia macbarronii* which was recorded from a number of drainage lines on the southern side of the central ridge. Much of this vegetation therefore has been classified as the best 50% of habitat for threatened species (**Table 2**, NRE 2002: Table 5).

The response to applications to clear High conservation significance is ‘clearing generally not permitted’. In the case of vegetation of Very High conservation significance, ministerial approval is required (NRE 2002).

3.2.2 Large Old Trees

Locally indigenous trees located outside defined patches of native vegetation are defined as scattered trees. Therefore only one tree within the paddock supporting the extraction area would be classified as a scattered tree and this tree is proposed to be retained.

All but one of the 38 large old trees proposed for clearing to develop the quarry and its associated infrastructure are within vegetation patches and would be accounted for in terms of impacts on habitat hectares and the associated large old tree offsets. Note that these trees would not all be lost at one time, but progressively over the 50 to 80 year life of the quarry.

The distribution of trees measured within the study area is presented in **Figure 4** and the DBH data is presented in Appendix 7. A total of 509 large or medium old trees (337 LOTs and 172 MOTs) have been measured over the lease areas within the Eames property and within the road reserves south of Forrest Lane. More large old trees are present in other areas of the Eames property (including areas outside of the WA).

Table 2. Habitat scores for patches of native vegetation within the study area.

Polygon number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	18	Totals
EVC name	RGW	RGW	RGW	VGF	VGF	BIB	BIB	CLGW	VGF	VGF	VGF	VGF	RGW	GLGW	VGF	RGW	RGW	
EVC number	175-62	175-62	175-62	47	47	61	61	68	47	47	47	47	175-62	68	47	175-62	175-62	
Site Condition	Large Old Trees	10	10	3	3	0	6	3	0	6	6	4	3	0	3	3	3	3
	Canopy Cover	5	5	0	0	3	0	0	5	5	0	5	0	0	0	5	0	0
	Lack of Weeds	15	6	6	6	13	13	6	6	6	6	6	6	6	9	13	9	9
	Understorey	25	5	5	5	15	15	5	5	5	5	5	5	5	5	5	5	5
	Recruitment	10	0	0	0	0	6	6	0	0	0	3	0	0	0	0	0	0
Landscape	Organic Matter	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Logs	5	3	3	0	0	2	0	3	5	0	2	2	0	0	0	0	0
	Patch Size	10	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Neighbourhood	10	4	4	5	5	5	5	3	3	3	1	5	5	3	4	4	4
	Distance to Core	5	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3
Site Condition Score	32	32	20	17	14	48	40	14	28	30	17	25	29	14	20	29	20	
Landscape Score	16	16	17	17	17	17	17	15	15	15	13	17	17	15	15	15	15	
HABITAT SCORE (/100)	48	48	37	34	31	65	57	29	43	45	30	42	46	29	35	44	35	
Area of the Quality Zone (Hectares)	1.71	1.42	25.66	14.10	3.49	4.29	2.97	1.65	5.07	1.35	0.87	0.15	0.27	0.22	21.34	3.08	13.81	101.44
HABITAT HECTARES	0.82	0.68	9.49	4.79	1.08	2.79	1.69	0.48	2.18	0.61	0.26	0.06	0.12	0.07	7.47	1.36	4.83	38.79
Bioregion	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	NIS	
EVC Conservation Status	End	End	End	End	End	Vuln	Vuln	End	End	End	End	End	End	End	End	End	End	
Conservation Significance	Conservation Status x Hab Score	VHigh	VHigh	High	High	VHigh	VHigh	High	VHigh	VHigh	High	High	VHigh	High	High	VHigh	VHigh	
	Threatened Species Rating	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	High	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	
	Other Site Attribute Rating	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	
Overall Conservation Significance	VHigh	VHigh	VHigh	VHigh	High	VHigh	VHigh	High	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	VHigh	
Net Outcome Ratio	2	2	2	2	1.5	2	2	1.5	2	2	2	2	2	2	2	2	2	
Area of loss (hectares)	1.71	0.04	10.28	0	0	0.26	0.64	0.004	0.09	0	0.26	0	0.03	0	2.21	0	0.37	15.91
Hab ha loss (habitat hectares)	0.82	0.02	3.80	0.00	0.00	0.17	0.36	0.00	0.04	0.00	0.08	0.00	0.01	0.00	0.77	0.00	0.13	6.22
Net Gain offset required (habitat hectares)	1.64	0.03	7.61	0.00	0.00	0.34	0.73	0.00	0.08	0.00	0.16	0.00	0.03	0.00	1.55	0.00	0.26	12.43
Area proposed for offset site	0.00	1.38	15.39	14.11	3.49	4.02	2.34	1.65	4.98	1.35	0.60	0.15	0.24	0.22	19.50	3.08	13.09	85.56
Potential Gains (173 Agreement)	20.55	20.55	18.3	14.7	14.1	33.35	28.8	13.7	19.55	21.55	14.2	18.35	21.5	10.6	19.4	21.25	19.4	
Potential Gains (Conservation Reserve)	34.95	34.95	29.4	24.9	23.4	52.85	45.9	22.4	32.45	35.05	23.2	30.95	35.3	19.3	29.9	34.45	29.9	
Habitat Hectare offset (173/Reserve)	0.0/0.0	0.3/0.5	2.8/4.5	2.1/3.5	0.5/0.8	1.3/2.1	0.7/1.1	0.2/0.4	1.0/1.6	0.3/0.5	0.1/0.2	0.0/0.1	0.1/0.1	0.02/0.04	3.8/5.8	0.7/1.1	2.5/3.9	16.3 / 26.1
Large Old Trees Retained	0	22	2	6	0	45	0	2	39	14	0	0	2	0	3	25	21	179
Large old Trees Lost	24	0	8	0	0	0	0	0	5	0	0	0	0	0	0	0	0	37

Notes to Table: NIS = Northern inland Slopes, VHigh = Very High, RGW = Rainshadow Grassy Woodland, VGF = Valley Grassy Forest
 BIB = Box Ironbark Forest, CLGW = Creek-line Grassy Woodland
 End = Endangered, Vuln = Vulnerable

3.3 Threatened Species Searches

Populations of Narrow Goodenia identified during this assessment are mapped in **Figure 4**. An estimated 2100 plants were observed in and around soaks and springs on the southern side of the central ridge.

No individuals of Crimson Spider-orchid or Mountain Swainson-pea were observed within the study area. While these species were not in flower within the national park, largely due to the ongoing drought, no similar leaves or other sterile material which could potentially be these species was observed.

Therefore, although the potential visibility of these species was relatively low due to poor seasonal conditions, it is considered unlikely that either species is present within the footprint of the proposed quarry.

3.4 Fauna

3.4.1 Species

Records during present assessment

A total of 88 indigenous fauna species (11 mammals, 63 birds, 11 reptiles, and three frogs) and two introduced mammal species were recorded from the study area (Appendix 8). The results of the Anabat analysis, undertaken by DSE, are shown in Appendix 2.

The AVW has records of seven 'sites' that appear to fall within the study area. Collectively these sites contain records of 45 species (Appendix 8). However, the mapping accuracy of this data extends beyond the study area and it is likely that most if not all of these sites are actually from Chiltern-Mt Pilot National Park and surrounds rather than the study area itself.

Database records

The AVW contains records of 266 terrestrial vertebrate fauna species from within 5 km of the study area: 215 birds (204 native), 28 mammals (22 native), 16 reptiles (all native) and seven frogs (all native).

The DEWHA database lists ten species whose geographic range is predicted to include the study area. Of these species, ten (one mammal, four birds, one reptile, one frog, two fishes and one insect) are listed as threatened and 11 bird species are listed under the migratory provisions of the EPBC Act, as discussed in Section 4.5.

3.4.2 Habitats

Fauna habitats vary in size and quality throughout the study area. A variety of fauna habitat types occur, including:

- Woodland (Box Ironbark Forest, Valley Grassy Forest, Grassy Woodland);
- Drainage lines (Creek-line Grassy Woodland)
- Dams
- Grassland (Native and exotic)

A description of the structural features and characteristic vertebrate fauna for each of these habitat types follows.

Woodland

Habitat features:

Woodland is the dominant habitat type in the study area and occurs in all parts of the study area except the cleared paddock that supports much of the quarry infrastructure, which supports Predominantly Introduced Vegetation. Due to past clearing, overstorey trees are generally sparse. However, a relatively intact overstorey occurs on the northern slopes of the central ridgeline, (Box Ironbark Forest) and within the road reserves (Valley Grassy Forest). There are also remnant patches of trees on the upper slopes of the central ridgeline (Grassy Woodland). Areas with remnant tree cover have the highest value for native fauna and the trees present are generally of a larger size than in the adjacent Chiltern-Mt Pilot National Park.

Areas supporting Box Ironbark Forest have a sparse, but substantially native ground layer of forbs and grasses and a sparse shrub layer. Coarse woody debris is common and this provides good cover for ground foraging birds. The soils are generally rocky, providing good habitat for reptiles.

The understorey vegetation within the road reserves is generally dominated by exotic grasses, but native grasses and herbs are present.

The ridgeline supports stands of mature White Box and Red Box over a substantially exotic ground layer with many logs and dead standing trees. The ground is rocky, providing good habitat for reptiles.

Other areas of forest and woodland lack an intact overstorey, but retain a substantially native ground layer of grasses and herbs. Fallen timber is common in this environment and there are scattered large trees and cut stumps.

Characteristic Vertebrate Fauna:

Species adapted to large, old trees: A large proportion of the wildlife in Box Ironbark ecosystems is dependent on large old eucalypts, particularly those that contain hollows. Large old trees were much more abundant prior to European settlement and many Box Ironbark species are adapted to living in forests dominated by large old trees. Large old trees have greater foraging potential than small trees – they have a larger, more complex canopy, flower more reliably, produce greater quantities of nectar and contain a greater number and variety of hollows. It is no surprise therefore, that large old trees are important to many Box Ironbark species including the threatened Brush-tailed Phascogale, Squirrel Glider, Swift Parrot, Regent Honeyeater and Barking Owl. The trees within the study area are relatively large compared to the adjacent national park and as such are important for hollow-dependant fauna.

Diurnal avian predators: Raptors such as Brown Goshawk, Wedge-tailed Eagle, Australian Hobby and Peregrine Falcon are all likely to forage within areas of woodland and over grasslands. Some species, such as Brown Goshawk and Wedge-tailed Eagle are likely to nest in larger trees. Several species of raptor were recorded during the current assessments.

Nocturnal avian predators: One nocturnal avian predator, Southern Boobook, was recorded during the present assessment. Barking Owl has also been recorded from the study area (N. Shedvin, Healesville Sanctuary, pers. comm.). A number of other nocturnal avian predators have been recorded from the local area in the past and could be expected to use the areas of forest and woodland at times (e.g. Powerful Owl, Tawny Frogmouth). Similar to the diurnal birds of prey, these nocturnal raptors could use the forest areas for perching, roosting and foraging activities. Hollows are a limiting resource for all these species except Tawny Frogmouth, which does not require hollows for nesting.

Woodland-dependent birds: A large proportion of Australia's bird species are confined to eucalypt forests and woodlands. Other birds, although not confined to these areas, will use forests and woodlands regularly or occasionally. Many of the bird species recorded during the present assessment were confined to the forest and woodland habitats (e.g. Hooded Robin, Painted Honeyeater, thornbills, whistlers).

Wooded habitats within the study area provide a diversity of niches for birds, more than any other habitat within the study area. Insectivorous birds can forage on the tree trunk and limbs, underneath the bark, on leaves, around flowers and in coarse woody debris and leaf litter at ground level. The tree branches can also be used as viewing perches and launching pads for birds capturing flying insects (e.g. Grey Fantail). Larger aggressive birds were also regularly observed (e.g. Kookaburra, Ravens)

Eucalypts in the Box Ironbark ecosystem provide an important source of food for nectar-feeding woodland birds (e.g. Swift Parrot, honeyeaters, lorikeets). Many nectar-feeding birds are nomadic. That is, large numbers of nectivores' could descend on the woodland when profusely flowering and then move elsewhere when flowering wanes. However, even when flowering is poor or absent within the woodland area, small numbers of honeyeaters and lorikeets will remain, foraging on insects and alternate carbohydrate sources such as lerps and honey.

Woodland Mammals: As mentioned before, the tree hollows within the Box Ironbark ecosystem are important nesting and denning sites for a range of hollow-dependent mammals. Squirrel Gliders, Brush-tailed Phascogale, Common Brushtail Possums and insectivorous bats and would be expected to be using hollows within or immediately adjacent to the study area.

Eastern Grey Kangaroos were commonly observed in the study area and Black Wallabies are likely to be present, although they were not recorded during the present assessment. Small and medium-sized ground-dwelling mammals are now rare in Box Ironbark ecosystems. Native species known to be present within the study area are Short-beaked Echidna and Yellow-footed Antechinus. Some species formerly occupying Box Ironbark Forest, such as Rufous Bettong, Eastern Hare-wallaby and Eastern Quoll are now extinct in Victoria. Others, such as Spot-tailed Quoll are probably regionally extinct. Introduced species now dominate the ground-dwelling mammal fauna and these include carnivores such as the Red Fox and Cat and herbivores such as European Rabbit, Brown Hare, Black Rat and House Mouse.

A number of the eucalypt species growing naturally within the study area are known food plants for Koala. The study area is likely to contribute to a larger home range for a small number of individuals.

Woodland reptiles: Ten species were recorded during the present assessment (Appendix 8) and a number of others are suspected to occur within the study area. The majority of reptiles known or likely to occur within the study area are terrestrial and are associated with ground cover such as leaf litter, rocks and coarse woody debris. The exception to this is Tree Goanna, was recorded from the site during this assessment.

Reptiles not recorded during the present survey, but considered likely to occur within the study area include Large Striped Skink, Rainbow Skink, Eastern Bearded Dragon and Common Bluetongue Lizard.

Much of the woodland area now consists only of a ground layer of grasses and herbs, together with fallen timber and cut stumps. The fauna present here is typified by species adapted to grassy environments with scattered trees. Such species include Red-rumped Parrot, Willie Wagtail, and Eastern Rosella.

Drainage lines

Several drainage lines occur within the study area, which have formed from run-off from the central ridgeline. These are dominated by Tall Sedge, but other indigenous rushes and herbs are also present. These drainage lines appear to be largely ephemeral although some springs appear to provide areas where the soil is more permanently saturated.

Characteristic Vertebrate Fauna:

Frogs are probably the most obvious terrestrial vertebrate group to use this habitat type and they may provide breeding habitat for the state significant Brown Toadlet.

Dams

Two dams occur in the study area. These artificial wetlands are relatively small in extent and do not provide significant habitat for aquatic fauna. Neither dam contains significant quantities of aquatic vegetation.

Groups of common ducks such as Pacific Black Duck and Chestnut Teal are most likely to use the dams. Common wading birds are also likely to use the dams (e.g. Masked Lapwing), although these birds will also forage in open grasslands. Insectivorous bats may forage for aerial insects over the dams.

Frogs such as Peron's Tree Frog and Plains Froglet were heard calling from the dams during the present assessment. The dams would provide suitable breeding habitats for these species.

Grassland (native/exotic)

The grassland habitat primarily comprised the paddocks in the west of the study area and understorey of portions of the woodland areas. The grasses are typically indigenous species and are regularly grazed. Some paddocks or parts thereof are dominated by exotic grass species.

A number of indigenous fauna species have been recorded in these grassland areas, and those species that are able to use resources within this landscape usually thrive. A moderate diversity of reptiles was found through the tile survey and active searching, with nine species detected on the site.

Native species that forage on the ground for insects and other invertebrates, such as Australian Magpie and Magpie-lark, were common as were parrots. Raptors also forage over these open areas and several species were commonly observed during surveys onsite.

There was also evidence of foraging by rabbits and fox scats were common.

3.4.3 Results of targeted fauna surveys

Golden Sun Moth *Synemon plana*

Survey for this species was undertaken in suitable conditions on four separate occasions on 2, 11 and 25 November 2008 and 1 December 2008. The survey methodology is described in Appendix 1. Survey concentrated on areas of suitable grassland habitat. No Golden Sun Moth were observed. The site is unlikely to support a population of this species.

Pink-tailed Worm Lizard *Aprasia parapulchela*

Rock rolling was carried out over three days from 7 – 9 October 2008 to target this species. Funnel traps were also used from 6 – 10 October 2008 to target this species and Figure 2 shows the location of trap lines. Survey methodology is described in Appendix 1. A number of reptile species were observed during the rock rolling survey (Appendix 8), however no Pink-tailed Worm Lizards were found. Where possible coarse woody debris was also examined either by observing into crevices with a torch or by lifting fallen timber and bark. Two species of the ant genus *Iridomyrmex* were found on the site, with two species recorded on the upper slopes and one species on the lower slopes of the main rocky hill. *Iridomyrmex* are known to be associated with the Pink-tailed Worm Lizard, on which the species feeds (Michael 2005). Pink-tailed Worm Lizard is often found under rocks in *Iridomyrmex* ant galleries (Michael 2005).

Striped Legless Lizard *Delma impar*

Three tiles grids were monitored from September 2008 – January 2009. This survey methodology is described in Appendix 1. No Striped Legless Lizards were found during these surveys. A number of other species including Olive Legless Lizard *Delma inornata* were observed under the tiles. Most of the reptile species listed in Appendix 8 were observed under tiles within the study area. Large numbers of Olive Legless Lizard rapidly colonised the tile grids, particularly Tile Grid no. 3, where up to nine individuals were found over the November/December 2008 monitoring period.

4.0 ECOLOGICAL SIGNIFICANCE

The following section discusses the ecological significance of the site and species within a local, regional, state and national context. The criteria for these significance levels are outlined in Appendix 4. Note that this assessment is independent from 'conservation significance' as defined in the Native Vegetation Management Framework (Section 3). The Framework assessment (Low, Medium, High and Very High) applies to the bioregional level only.

4.1 Significance of the study area

The majority (75%) of the proposed Work Authority supports remnant native vegetation with the main exceptions being the processing paddock and treeless sections of the central ridgeline. The scattered stands of mature trees, in combination with the grassy understorey dominated by indigenous species, provide a significant area of grassy open woodland habitat otherwise not present within the National Park. Much of the balance of the proposed Work Authority, which is traversed by the proposed access road alignment, also supports stands and scattered individuals of mature trees and large areas of native pasture. This grassy open woodland habitat type includes both Valley Grassy forest and Grassy Woodland EVCs and equates to the EPBC Act listed White Box – Yellow Box – Blakely's Red Gum grassy woodland and Derived Native Grassland community.

On the basis of the available information, the native vegetation and fauna habitats within the WA are of **State** conservation significance.

Reasons for this level of significance are as follows:

- The presence of the EPBC Act-listed White Box – Yellow Box – Blakely's Red Gum grassy woodland and Derived Native Grassland community.
- The four EVCs present are listed as either endangered or vulnerable within the Northern Inland Slopes Bioregion and with the exception of Box Ironbark Forest, are endangered at a state-wide level.
- Presence of three plant species of State significance and 49 species of regional conservation significance.
- Remnant, well-structured woodland habitat, with multiple niches used by or likely to be used by a range of woodland dependent fauna including threatened species listed at the national (Swift Parrot, Regent Honeyeater) and state (Brush-tailed Phascogale, Squirrel Glider, Barking Owl, Grey-crowned Babbler) level.
- The presence of the FFG listed Victorian Temperate Woodland Bird Community.

While areas of native pasture traversed by the proposed site access road also contribute to a broader area of **State** conservation significance, the impact of the proposed road would have a high local impact on the native vegetation present.

The ecological features of the study area are mapped in **Figures 3** and **4** and discussed further in the following section.

4.2 Previous assessments of significance

Biosis Research (2005) conducted a preliminary flora and fauna assessment of the study area in April 2005 to identify broad ecological issues relating to the study area. This assessment was largely based on a desktop assessment as the land was only viewed from publicly available access points (Biosis Research 2005). No conservation significance was attributed to the site although the presence of native ground cover vegetation was noted.

No other assessments apart from the DSE 2005 vegetation mapping are known for the study area.

4.3 Significant Flora Species

Significant flora species recorded during the present assessment, recorded in the local area (FIS) or predicted to occur in the local area (DEWHA database) are discussed in the following section and listed in Appendix 5. Significant species are defined in Appendix 4.

4.3.1 National significance

No species of national significance have been recorded from the study area.

Database records

The FIS database contains recent (in the last 20 years) records of four species of national conservation significance from within 5 km (Appendix 5).

The DEWHA database predicts the occurrence of, or suitable habitat for, one additional species listed under the EPBC Act. The likelihood for any of these species to occur in the study area is listed in Appendix 5. Large species such as Warby Range Swamp-gum *Eucalyptus cadens* would have been detected by the site survey and therefore do not occur within the study area.

Four other species are relatively small, cryptic and often are only detectable for short periods (i.e. during flowering). Such species are also generally vulnerable to the high grazing pressures from sheep and rabbits associated with agricultural land and are unlikely to persist in such environments. While the study area does

support environments that are less accessible to stock (i.e. steep rocky areas) and these cryptic species have some potential to persist in such environments, targeted surveys failed to detect these threatened species. As a result their presence within the study area is considered unlikely.

4.3.2 State significance

Three flora species of state conservation significance were recorded within the study area. One is rated as vulnerable while the other two are rare in Victoria.

Narrow Goodenia *Goodenia macbarronii*, is considered to be vulnerable in Victoria and is listed under the FFG Act. This small herb typically grows on the margins of drainage lines, swamps, soaks and artificial wetlands. Known locations and the areas searched for this species in and around the study area are mapped in **Figure 4**. An estimated 2100 individuals were observed from six general locations within the study area. No individuals were observed beyond the southern slopes of the central ridge within or immediately adjacent to the study area.

Mugga *Eucalyptus sideroxylon* is the dominant tree in areas of Box Ironbark around Chiltern. Within the study area this species occurs on the northern aspect and lower slopes of the central ridge. Few if any of this species would be impacted by the proposed extraction area but it is likely that some mature individuals would be impacted by the associated infrastructure.

Dwarf Brooklime *Gratiola pumilo* grows on the margins of drainage lines, swamps, soaks and artificial wetlands. While unlikely to be directly impacted by the proposed quarry, impact on the drainage lines flowing from the central ridge and the farm dam in the north western corner of the study area would have a negative impact on the populations and available habitat for this species.

Another vulnerable species, late-flower Flax-lily *Dianella tarda*, was observed within the flora reserve adjacent to the Beechworth Chiltern Road. This species was not observed within the study area and is unlikely to occur within the study area due to the grazing of domestic stock.

Database records

The FIS database contains recent records of an additional 19 species of state conservation significance from the local area (within 5 km – **Appendix 5.3**). Large species such as Deane's wattle *Acacia deanei*, Currawang *Acacia doratoxylon*, Spur-wing Wattle *Acacia triptera*, Cottony Cassinia *Cassinia ozothamnoides*, Beechworth Silver Stringybark *Eucalyptus* aff. *cinerea* (Beechworth), Western Golden-tip *Goodia medicaginea* and Indigo *Indigofera adesmiifolia* would have been detected by the site survey and therefore do not occur within the study area.

While there is potential habitat for the remaining nine species (Appendix 5.3), such species are also generally vulnerable to the high grazing pressures associated with agricultural land and are unlikely to persist in such environments. However, the study area does support environments that are less accessible to stock (i.e. steep rocky areas) and these cryptic species have some potential to persist in such environments. Despite this their presence within the study area is still considered unlikely as none were observed during spring searches conducted for other threatened species.

4.3.3 Regional significance

Forty nine of the species recorded have regional significance within the Northern Inland Slopes Bioregion (Appendix 5). However this bioregion has had relatively little survey and the significance of many wetland species may be overestimated.

4.4 Significant Vegetation Communities

Box Ironbark Forest EVC 61 is rated as vulnerable within the Northern Inland Slopes Bioregion while the other three EVCs present (*Rainshadow* Grassy Woodland EVC 175-62, Valley Grassy Forest EVC 47 and Creekline Grassy Woodland EVC 68, are rated as endangered. While Box Ironbark Forest is more generally rated as depleted within Victoria, the other three EVCs are all endangered on a state-wide basis.

High quality examples of all these EVCs except Box Ironbark Forest would have state significance for biodiversity conservation. Based on its condition, the relatively intact area of Box Ironbark Forest within the study area has regional conservation significance.

4.5 Significant Ecological Communities

4.5.1 White Box–Yellow Box–Blakely’s Red Gum Grassy Woodland and Derived Native Grassland

Areas of Grassy Woodland and Valley Grassy Forest within the study area generally fit the broad description available for White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands which is listed as a Critically Endangered community under the EPBC Act (EPBC Act policy statement available at <http://www.environment.gov.au/epbc/>). The ministerial advice for this critically endangered community, also available online, lists both EVCs (Grassy Woodland and Valley Grassy Forest of the Northern Inland slopes) as an equivalent to the listed community. The

treeless vegetation mapped as *Rainshadow* Grassy Woodland and Valley Grassy Forest within the study area readily satisfies the requirements defined within the descriptive policy statement defining an area as supporting the listed community. This vegetation is therefore of at least State conservation significance.

4.5.2 Victorian Temperate Woodland Bird Community

This community is listed as threatened on Schedule 2 of the *Flora and Fauna Guarantee Act 1988*. There is now a substantial body of evidence that indicates the presence of a unique assemblage of birds in the temperate woodlands region of Victoria. This assemblage or ‘community’ of birds is dependent on the characteristics of these temperate woodlands for their survival. This community is defined as “a group of bird species characteristically and commonly found within Box Ironbark, yellow box and other woodlands” (FFG Nomination 512). The geographic area that encompasses this bird community can be broadly defined as the country that lies in the south-east along the slopes and plains of the Great Dividing Range (FFG Nomination 512). These bird species are defined in the nomination and include 24 native woodland dependent bird species, nine of which are individually listed under Schedule 2 of the FFG Act.

Ongoing loss, fragmentation and degradation of suitable woodland habitat threaten this bird community. Many of the species that make up the community are in a demonstrable state of decline and have suffered local extinctions. This process of extinction is continuing.

The study area is within the geographic area of this threatened community and it contains the correct habitat and assemblage of birds that defines this community. Ten woodland dependent birds making up this community were recorded during the present assessment or have been recorded in the study area in relevant databases or by local naturalists: Barking Owl, Black-chinned Honeyeater, Brown Treecreeper (subspecies *victoriae*), Brown-headed Honeyeater, Fuscous Honeyeater, Hooded Robin, Jacky Winter, Painted Honeyeater, Speckled Warbler, Regent Honeyeater, Yellow tufted Honeyeater (subspecies *meltoni*) (Appendix 8). A further seven species have been previously recorded in the local area (AVW). Thus, on the basis of available information the study area supports the Victorian Temperate Woodland Bird Community as defined under Schedule 2 of the FFG Act.

4.6 Significant Fauna Species

Significant fauna species recorded during the present assessment, recorded in the local area (AVW) or predicted to occur in the local area (DEWHA database) are discussed in the following section and listed in Appendix 8. Species listed under migratory provisions of the EPBC Act are addressed in Section 5.

4.6.1 National significance

Species of national significance are defined in Appendix 4 and the relative status of all nationally significant species is indicated in **Table A.8.2** in Appendix 8.

Below is a summary of nationally significant fauna species recorded within the study area or in the local area. Further detail on the habitat requirements and likely occurrence of these species in the study area is provided in Appendix 8.

Records from the study area

No species of national significance were recorded from the study area during the present assessment.

There is a 1987 record of Regent Honeyeater *Xanthomyza phrygia* that appears to be from within the study area (AVW), although it is likely that this record is actually from the adjacent Chiltern-Mt Pilot National Park. Small numbers of this species are regularly recorded within Chiltern-Mt Pilot National Park and suitable woodland habitat for this species occurs within the study area. Small numbers may visit the site occasionally. The Chiltern area is the last stronghold for this species in Victoria. Captive bred and wild individuals were observed north of the Hume Highway within the adjacent Chiltern-Mt Pilot National Park during September 2008.

Database records

One additional fauna species of national significance has been recorded from within 5 km of the study area in the AVW and BA databases. There are recent (2006) records of Swift Parrot *Lathamus discolor* from Chiltern-Mt Pilot National Park. This species is likely to visit the study area on a seasonal basis over winter to exploit eucalypt nectar and pollen resources in the remnant woodland.

An additional eight threatened fauna species listed under the EPBC Act on the DEWHA database are predicted to occur, or their habitat is predicted to occur, within 5 km of the study area (Appendix 8). The study area contains potential habitat for one of these species:

- The study area broadly falls within the distributional range of the Golden Sun Moth *Synemon plana* and supports areas dominated by Wallaby-grass *Austrodanthonia* spp., the presumed food plant for the larvae of this species. Further targeted survey has been carried out to determine if the species is present in the study area. The species was not found within the study area. The results are discussed in chapter 3.

Additional species

- Pink-tailed Worm-lizard *Aprasia parapulchella*. The biology of the Pink-tailed Worm-lizard is poorly known. It is a burrowing species, living beneath rocks or within burrow systems made by ant colonies (Michael 2005). It presumably feeds upon ants and their larvae, although the diet of this species has not been documented. The species has a disjunct distribution, with two distinct populations recognised – one centred on the Australian Capital Territory and the other around Bendigo in central Victoria. The species is known to inhabit two distinct habitat types - native grasslands (Canberra region) and Box Ironbark woodlands (Bendigo Region). Another population has been discovered recently in Box-dominated woodland in Albury, NSW (Michael 2005). The consistent feature of occupied habitats is the presence of abundant surface and shallowly embedded rock associated with ant galleries. Pink-tailed Worm-lizard is detected more often in spring and early summer, after which time detectability of the species declines markedly (Osbourne and McKergow 1993, P. Robertson pers. comm.).

Although not recorded from the local area or listed as potentially occurring in the area on relevant biological databases, the species has some potential to occur in the study area. Targeted survey was carried out within the study area and the species was not found. The results are discussed in chapter 3.

Suitable habitat in the form of slightly embedded surface rock supporting ant galleries of the genus *Irydomyrmex* and other ant species was abundant on the rocky hill section of the study area. The focus of rock rolling and funnel trapping occurred within this area. The 2541 rocks turned during the three days of survey, combined with funnel trapping, is considered adequate to determine if the species occurs on the site.

- Striped Legless Lizard *Delma impar*, is predicted or has habitat predicted to occur in the local area. Michael (2004) comments that this species is likely to occur in the region surrounding Albury – Wodonga in relatively undisturbed grasslands. Our assessment was that the site is unlikely to support this species (Appendix 8) and that Olive Legless Lizard was more likely to be present. However, DEWHA required that targeted survey be undertaken for Striped Legless Lizard. Targeted survey was conducted within the relatively intact native grasslands of the WA. The species was not found within the study area. The results are discussed in Chapter 3. The relatively high number of observations of the closely related Olive Legless Lizard from the tile grids indicates that the tile survey effort was sufficient to detect *Delma* species present within the study area and that Striped Legless Lizard is unlikely to be present.

4.6.2 State significance

Species of State significance are defined in Appendix 4. The status of all state significant species is indicated in **Table A.8.2** in Appendix 8.

State significant fauna species recorded in the study area or from the local area are summarised below. The likelihood of occurrence within the study area is described in more detail in Appendix 8.

Records from the study area

Five state significant fauna species were recorded from the study area during the present assessment.

- Hooded Robin *Melanodryas cucullata* – a single bird was recorded in the Box Ironbark Forest remnant near the boundary with the Chiltern-Mt Pilot National Park.
- Speckled Warbler *Chthonicola sagittata* – two birds were observed within the Box Ironbark Forest on the northern slope of the central ridgeline where coarse woody debris and ground cover provided structural diversity at ground level.
- Brown Treecreeper *Climacteris picumnus victoriae* was recorded throughout wooded sections of the study area.
- A single Painted Honeyeater *Grantiella picta* was heard calling in the Box Ironbark Forest remnant near the interface with Chiltern-Mt Pilot National Park. The eucalypts with clumps of mistletoe within the study area provide food and nesting sites for this species.
- A single Black Falcon *Falco subniger* was observed flying over the study area and may be resident and/or forage within open areas of the study area.

The AVW has records of two state significant species that appear to be from within the study area, but are most likely from the adjacent Chiltern-Mt Pilot National Park.

- Turquoise Parrot *Neophema pulchella* was recorded from the study area in 1997 (AVW) and the study area supports good quality woodland habitat for this species including abundant potential breeding sites in the form of coppice stumps and good quality grassy foraging areas.

Two additional species have been recorded within the study area.

- Barking Owl *Ninox connivens* – the study area is known to form part of a home range for a resident pair of Barking Owls. Natasha Shedvin of Healesville Sanctuary has been studying this pair as part of her PhD

research on the species and has observed both birds foraging within the remnant woodland within the study area (N. Shedvin, Healesville Sanctuary, pers. comm.). The study area provides good foraging habitat for this species.

- Tree Goanna *Varanus varius* – this species was observed by CEMEX contractors during a routine site inspection and by Biosis Research during botanical surveys. The abundant hollow logs, large dead and live trees and provide suitable foraging and refuge habitat for this large lizard.

Database records

Sixteen species of state conservation significance have been recorded within 5 km of the study area in the AVW and BA databases (Appendix 8). Twenty-one of these species are considered to have some potential to occur within the study area:

- There is a 1998 AVW record of Red-chested Button Quail *Turnix pyrrhotorax* from Chiltern-Mt Pilot National Park. There is suitable woodland habitat for this species within the study area.
- Royal Spoonbill *Platalea regia*, Little Egret *Egretta garzetta*, Intermediate Egret *Ardea intermedia*, Great Egret *Ardea alba*, Australasian Shoveler *Anas rhynchos*, Freckled Duck *Stictonetta naevosa*, Hardhead *Aythya australis*, *Oxyura australis* and Musk Duck *Biziura lobat* may use the farm dams within the study area for foraging.
- Grey Goshawk *Accipiter novaehollandiae*. This species may occasionally forage within wooded areas within the study area.
- White-bellied Sea-Eagle *Haliaeetus leucogaster*. This species may forage around dams within the study area on rare occasions.
- Square-tailed Kite *Lophoictinia isura* may occasionally forage within wooded areas within the study area.
- Powerful Owl *Ninox strenua* is likely to forage within the wooded parts of the study area and is resident in the adjacent Chiltern-Mt Pilot National Park.
- Crested Bellbird *Oreoica gutturalis* could possibly forage within the wooded parts of the study area and is resident in the adjacent Chiltern-Mt Pilot National Park.
- Grey-crowned Babbler *Pomatostomus temporalis* could possibly forage within the wooded parts of the study area.
- Chestnut-rumped Heathwren *Hylacola pyrrhopygia* is likely to use the wooded parts of the study area, particularly the lower northern slopes of the central ridgeline.

- Diamond Firetail *Stagonopleura guttata* is likely to use the wooded parts of the study area, particularly the lower northern slopes of the central ridgeline. The study area provides high quality grassy woodland habitat for this species.
- Brush-tailed Phascogale *Phascogale tapoatafa*. A targeted trapping survey was conducted on site to detect this species. Forty-four Elliot traps were placed in suitable habitat throughout the study area over 2 nights (88 trap-nights). No individuals were trapped. However this trapping effort is not considered adequate and the species is likely to use the study area regularly as part of a broader home range for one or more individuals. The larger trees within the study area may provide den sites for this hollow-dependent species.
- Squirrel Glider *Petaurus norfolcensis*. This species has been recorded on several occasions in the local area and a resident population occurs in the Chiltern-Mt Pilot National Park. The species is likely to use the study area regularly as part of a broader home range for one or more individuals. The larger trees within the study area may provide den sites for this hollow-dependent species.
- Bandy Bandy *Vermicella annulata*. There is one, relatively old (1984) record of this species from Chiltern-Mt Pilot National Park. This species may occur in the remnant Box Ironbark Forest within the study area.
- Brown Toadlet *Pseudophryne bibronii*. This species has been recently recorded from Chiltern-Mt Pilot National Park and breeds in ephemeral drainage lines during autumn. The drainage lines within the study area are potential habitat for this species.

4.6.3 Regional Significance

Species of regional significance are defined in Appendix 4.

Records from the study area

No regionally significant fauna species were recorded from the study area during the present assessment. The AVW records one species from the study area (Black-chinned Honeyeater *Melithreptus gularis*). However, this record is more likely to be from the adjacent Chiltern-Mt Pilot National Park. Nevertheless, the species is likely to occur within the study area.

Database records

Twelve additional species of regional conservation significance have been recently recorded in the local area in the AVW and BA databases. These species and their likelihood of occurrence in the study area are shown in Appendix 8.

5.0 BIODIVERSITY LEGISLATION AND GOVERNMENT POLICY

Biodiversity legislation and government policy that is potentially relevant to the proposed New Chiltern Quarry is discussed below.

5.1 Commonwealth

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) applies to developments and associated activities that have the potential to significantly impact on matters protected under the Act.

Under the Act, unless exempt, actions require approval from the Australian Government Minister for Environment, Water, Heritage and the Arts if they are likely to significantly impact on a ‘matter of national environmental significance’. There are currently seven matters of national environmental significance (NES):

- World Heritage properties;
- National Heritage properties;
- nationally listed threatened species and ecological communities;
- listed migratory species;
- Ramsar wetlands of international significance;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The EPBC Act also applies to the environment in general if actions are taken on Commonwealth land, or if actions that are taken outside Commonwealth land will impact on the environment on Commonwealth land.

Any person proposing to take an action that may, or will, have a significant impact on a matter of national environmental significance must refer the action to the Australian Government Minister for Environment and Heritage for determination as to whether the action is a ‘controlled action’ or is not approved.

NES matters relevant to the proposal

There are two matters of national significance that are relevant to the proposed development, as summarised in the following section.

Listed threatened species and/or ecological communities

Ecological communities: One listed ecological community, White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands, occurs within the study area. This community varies in condition, however about 78 ha within the WA is considered to meet the description of this critically endangered community of which about 15 ha (19% of the community within the WA) is proposed to be impacted.

Listed flora species: Flora species listed under the Act are discussed in Section 4.3 and listed in Appendix 5. In summary, no listed species have been recorded from the study area. While there is potentially suitable habitat within the study area for four species, their presence within the study area is considered unlikely.

Listed fauna species: Fauna species listed under the Act are discussed in Section 4.5 and listed in Appendix 8. In summary, there is suitable habitat for Regent Honeyeater, Swift Parrot, Pink-tailed Worm-lizard and Golden Sun Moth. Both the honeyeater and the parrot are seasonal migrants to the Chiltern area and both are likely to use the study area occasionally. Targeted survey has been carried out for Pink-tailed Worm-lizard, Striped Legless Lizard and Golden Sun Moth. None of these species were recorded at the site.

Listed migratory species

The list of migratory species under the EPBC Act is a compilation of species listed under three international conventions: China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Species listed under the ‘migratory’ provisions of the EPBC Act are listed in Appendix 8 and summarised below:

- Fifteen species have been recorded from the local area (AVW, BA).
- One additional species are predicted, or its habitat is predicted, to occur within 5 km of the study area (DEWHA database).

While some of these species would be expected to use the study area on occasions, and some of them may do so regularly or may be resident, it does not provide important habitat for an ecologically significant proportion of any of these species.

Implications for the proposed New Chiltern Quarry

The quarry could significantly impact on these matters of national environmental significance. As such the EPBC Act is likely to be triggered and a referral was

prepared to seek a determination from DEWHA (Referral 2009/4849). As a consequence the project was determined to be a controlled action on 8 May 2009 to be assessed through preliminary information.

5.2 State

5.2.1 Flora and Fauna Guarantee Act 1988

In most circumstances, a permit is required from DSE to 'take' listed flora species, flora species that are members of listed communities or protected flora from public land. Most native vegetation contains some protected flora species.

One listed threatened plant species, Narrow Goodenia, has been recorded from the study area. The distribution of this species is presented in **Figure 4**.

Four listed fauna species were recorded during the present assessment or are recorded from the study area (Regent Honeyeater, Barking Owl, Hooded Robin, Specked Warbler and Painted Honeyeater). An additional 19 species recently recorded from the local area are listed under the FFG Act (Appendix 8). The study area provides habitat for many of these species.

One listed fauna community 'Victorian Temperate Woodland Bird Community' occurs within the study area.

Listed threatening processes relevant to the proposed quarry include:

- Habitat fragmentation as a threatening process for fauna in Victoria.
- Invasion of native vegetation by "environmental weeds".
- Loss of hollow-bearing trees from Victorian native forests.

Implications for the proposal

Most of the land is privately owned and is not declared 'critical habitat'. Therefore a permit to 'take' listed flora species is not required under the FFG Act. However, there may be impacts on road reserves adjacent to the parcel of land supporting the proposed extraction area. In this instance, an FFG permit is likely to be required to impact on these areas of public land unless they are purchased from the Crown.

FFG Act Action Statements relevant to the site are available for the following species:

- Narrow Goodenia Action Statement 72
- Swift Parrot Action Statement 169
- Regent Honeyeater Action Statement 41

- Intermediate Egret Action Statement 120
- Great Egret Action Statement 120
- Freckled Duck Action Statement 105
- Blue-billed Duck Action Statement 174
- Barking Owl Action Statement 116
- Powerful Owl Action Statement 92
- Grey-crowned Babbler Action Statement 34
- Painted Honeyeater Action Statement 193

5.2.2 Planning and Environment Act 1987

The primary legislation dealing with biodiversity conservation in Victoria is the *Planning and Environment Act 1987*. This legislation gives effect to local planning schemes which require a planning permit to clear native vegetation and require consideration of the Native Vegetation Framework (Net Gain) policy.

A planning permit is required under the *Planning and Environment Act 1987* to remove, destroy or lop native vegetation on a landholding of more than 0.4 hectares unless exemptions apply. The Department of Sustainability and Environment is a mandatory referral authority in some circumstances, such as where vegetation clearance is proposed on public land, or where vegetation clearance is proposed on private land beyond the thresholds identified within the relevant planning scheme. These thresholds include potential clearing of:

- More than 0.5 hectares of an EVC with a bioregional conservation status of endangered, vulnerable or rare;
- more than one hectare of an EVC with a bioregional conservation status of depleted or least concern;
- more than 15 trees with a diameter less than 40 cm at 1.3 metres above ground; or
- more than 5 trees more than 40 cm at 1.3 metres above ground.

Implications for the proposal

The proposed quarry is an extractive industry with a specific exemption under Clause 52:17 and is therefore does not require a planning permit under the *Planning and Environment Act 1987*. However the application to the Department of Primary Industries for a Work Authority will still need to be referred to DSE and this process will activate the prescriptions of Victoria's Native Vegetation Management Framework.

5.2.3 Native Vegetation Management Framework

The Native Vegetation Management Framework (NRE 2002) is State Government policy for the protection, enhancement and revegetation of native vegetation in Victoria. The primary goal of the Framework is:

a reversal, across the whole landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain (NRE 2002).

In association with the regional Native Vegetation Plans, when these are released, the Framework provides decision-making tools for native vegetation management.

Where an application is made to remove native vegetation, a proponent for a development must explain the steps that have been taken to:

- Avoid adverse impacts, particularly through vegetation clearance.
- Minimise impacts where impacts cannot be avoided.
- Identify appropriate offset options.

A proponent for a development must demonstrate that the option to avoid and minimise vegetation clearance has been fully explored before considering offsets.

An offset may be achieved by improvements in the quality or extent of native vegetation in a selected 'offset area', either within a project area or off-site. An area that is revegetated and protected or set aside for natural regeneration may provide some, or all, of the required offset. The conservation significance of vegetation to be removed is also taken into account when offsets are determined.

In the event that a permit were granted for removal of native vegetation, a multiplier of either 2 for vegetation of Very High or 1.5 times for vegetation of High conservation significance applies to the habitat hectare loss when calculating offset prescriptions. Offsets must be provided according to the Frameworks like-for-like criteria which sets condition criteria for offsets and typically requires the same vegetation or habitat type or other vegetation of higher conservation significance to provide the prescribed gains.

Managing an area of remnant vegetation on private land as an offset will generally yield a gain in habitat score of approximately 20 % over 10 years.

Implications for the proposal

A proponent must demonstrate that options to avoid vegetation clearance have been fully explored. Changes to the proposed design of the quarry footprint in response to the ecological information provided demonstrate that native vegetation removal has been avoided where possible. However, given the extent of native vegetation on the site, establishing a quarry on site cannot avoid clearing native vegetation.

Native vegetation remnants within the study area meet the definition of High to Very High conservation value under the Framework, in which case clearing is generally not permitted unless exceptional circumstances apply, with ministerial approval required in the case of Very High conservation value vegetation.

An assessment of the proposed development against the Net Gain 3-step process is discussed in Section 6.

5.2.4 North East Native Vegetation Plan

This document (North East Catchment Management Authority 2005) has been prepared to develop a strategic and co-ordinated approach to the problem of the continuing decline in quantity and quality of native vegetation throughout the North East Gippsland region.

This Native Vegetation Plan (NVP) describes the biodiversity values of the Region, and provides guidance to local government on how clearing applications should be assessed, based on regional priorities. The Northern Inland slopes Bioregion is classed as fragmented, raising targets for protection of remnant vegetation in this area.

Implications for the proposal

The NVP refers to the *Planning and Environment Act 1987* for the removal of native vegetation (see section 5.2). The objectives of the Native Vegetation Plan are similar to the objectives of the Native Vegetation Management Framework and should be met if the three step approach to achieving a net gain outcome is followed. Offsets for unavoidable tree losses that are not covered by the Framework have replacement ratios calculated using the North East Native Vegetation Plan (Table 8b on page 76 of the plan).

5.3 Local

5.3.1 Local Government Planning Scheme (Indigo Shire Council)

Information from Planning Schemes online (<http://www.dse.vic.gov.au/planningschemes/>) indicates the study area is zoned as Farming Zone. No Significant Landscape Overlays or Environmental Significance Overlays cover the study area.

Implications for the proposal

To establish the proposed quarry, a planning permit may be required under the Indigo planning scheme, as discussed.

6.0 POTENTIAL IMPACTS AND MITIGATION

6.1 Potential impacts

6.1.1 Extraction Area

The proposed development of the New Chiltern Quarry would require both habitat hectares and large old trees offsets. Other ecological impacts would occur as a result of the infrastructure, including processing and stockpile areas, the access road and water storages, required to service the extraction area.

A number of ecological impacts likely to result from any development of the site within areas of native vegetation are summarised below.

6.1.2 Direct Impacts

The revised quarry design, configured to avoid and minimise impacts on native vegetation, is provided in **Figure 5**. Current known direct impacts include the removal of vegetation and habitat from within the proposed extraction footprint (12.5 ha) and other quarry infrastructure including roads, stockpiles, plant, storage dams and bund walls. Note that some trees appear within the proposed footprint as displayed but this has been updated to protect additional trees including Trees 1, 68, 188 and 381. Proposed losses include the following:

- Thirty eight Large Old Trees (LOTs), 37 within patches and all except eight within areas of Grassy Woodland, much of which corresponds to the DEWHA listed vegetation community;
- The loss of areas of Grassy Woodland including all of Patch 1 (1.71 ha), 10.28 ha of Patch 3 and small parts of Patch 2 (0.04 ha), Patch 13 (0.03 ha) and Patch 16 (2.21 ha) and Patch 18 (0.37 ha) (22% of this EVC in the broader WA);
- The loss of 0.9 ha of Box Ironbark Forest (12% of this EVC in the WA); and
- The loss of 2.6 ha of Valley Grassy Forest (6% of this EVC in the WA).

Other potential direct impacts include:

- Loss of habitat for fauna species. The areas of native vegetation within the study area provide potential habitat for a range of fauna species considered significant at the state or regional level. Development would result in the reduction of habitat potentially used by local populations of these species.

- Increased human disturbance to areas of native vegetation.
- Increased disturbance to sensitive fauna species.
- Accidental loss of or damage to retained vegetation during the construction and operation of the quarry.
- Reductions in population size of some regionally significant flora species.
- Reduction in viability of retained vegetation as habitat.

6.1.3 Indirect Impacts

Indirect impacts of development typically involve the modification and degradation of adjacent vegetation and habitat (terrestrial and aquatic) not removed by the development footprint. Potential indirect impacts include the following:

- Weed-invasion, rubbish dumping or accidental damage during construction, and associated edge effects.
- Loss of any retained vegetation as a result of changed environmental conditions, particularly through weed invasion or altered hydrology.
- Altered fire or other disturbance regimes associated with increased human activity.
- Reduced viability of some fauna species on the site in the longer term due to reductions in population size and reduced habitat area.
- Degradation of habitat values in the local area due to incremental loss of remnant vegetation.

6.1.4 Assessment of the Three-step Process

The proposed extraction area is largely defined by the extent of the underlying geological resource. However, the extent of extraction has been limited by a number of factors including the need to minimise the impact on native vegetation.

During the design phase of the quarry and its associated infrastructure, CEMEX has considered the three step process for avoiding, minimising and offsetting native vegetation. The design of the extraction area and associated infrastructure has gone through a number of iterations in response to the presence of native vegetation. The design has been changed to avoid native vegetation by selecting

a relatively small extraction area and by concentrating the placement of infrastructure within areas which support predominantly introduced vegetation. Impacts would be minimised through the use of best practice construction works to avoid any potential impacts beyond the construction footprint. Otherwise the loss of native vegetation will be offset through the protection and management of remnant native vegetation on private land within the bioregion and as close as possible to the area of loss. Negotiations are in progress to secure sections of the Eames property as a net gain offset site but these are yet to be finalised. CEMEX will seek to acquire most if not all prescribed offsets (or their equivalent) within the Eames property.

6.2 Recommendations for mitigation

There may be further opportunities to reduce potential impacts through alterations to the design or management following review of this assessment. The vegetation indicated in the current survey has been considered during the detailed design phase of the project. Impacts on vegetation and habitats should be avoided and minimised, in accordance with Net Gain policy.

The project site layout provided in **Figure 5** reflects the outcomes from the vegetation map produced as part of this assessment and was developed to minimise the net gain offset requirements of this project.

6.2.1 Net Gain

The primary mechanism for mitigating ecological impacts is through adherence to Net Gain policy.

The 3-step process to achieving Net Gain should be followed: (1) to first attempt to avoid any native vegetation loss, (2) minimise any unavoidable loss of native vegetation, and (3) offset any native vegetation losses.

Step 1: Avoid

The proposed extraction area is based on the distribution of the underlying rock resource and in that context this resource cannot be extracted without the corresponding loss of native vegetation. Therefore, as the quarry would be established to extract the existing rock resource it is not possible to avoid some clearing of the native vegetation present.

The proposed infrastructure has been concentrated in the area of land south of Forrest Lane and otherwise surrounded by undeveloped road reserves as this area is dominated by Predominantly Introduced Vegetation and is largely down slope of existing stands of remnant trees. The selection of these areas for infrastructure

therefore avoids the clearing of patches of remnant native vegetation where possible.

The use of a conveyor system to transport materials minimises the extent of clearing required to achieve this task.

Road access between plant, the extraction area, stockpile areas and Black Dog Creek Road is restricted by the gradient over which trucks can travel and the suitability of the topography for road construction. As such the proposed network of roads is relatively fixed by the location of the quarry, it's infrastructure and the local topography. Sections of the road between the plant and Black Dog Creek Road avoid impacts on native vegetation but much of the farmland between the quarry and the established road network supports native pasture.

Step 2: Minimise

Native vegetation loss will be minimised through the restricted size of the quarry (the resource is more extensive and a larger quarry is plausible on the site) and the strategic placement of associated infrastructure to avoid the better quality areas of native vegetation.

The loss of native vegetation within the proposed extraction limit would occur progressively over the 50 to 80 year life of the quarry. All native vegetation/ fauna habitat would be protected from disturbance until the relevant stage for extraction is required. Many trees will therefore be retained for a number of decades.

Step 3: Offset

Any native vegetation losses will need to be offset in line with the like-for-like prescriptions outlined by Victoria's Native Vegetation Management – A Framework for Action (NRE 2002). Offsets will be provided as part of the approvals process. This will typically be well in advance of when the actual loss occurs, particularly for impacts on large old trees.

6.2.1.1 Vegetation Offset Prescription

Extraction Area

The extraction area covers approximately 12.5 hectares. Of this approximately 10.3 ha supports modified native vegetation including **3.89** habitat hectares of Very High conservation significance (VHCS) Grassy Woodland and **0.19** habitat hectares of VHCS Box Ironbark Forest. Therefore the habitat hectare offsets for the proposed extraction area totals **8.16** habitat hectares (hha).

Site Infrastructure

A network of roads (assumed to have a minimum 15 m wide construction footprint) connects areas of extraction, plant and stockpile with Black Dog Creek Road (**Figure 5**). Assumptions associated with the assessment of this infrastructure are outlined in Section 6.1.2.

Habitat Hectare Offset Target

The WA supports two dominant EVCs, Valley Grassy Forest and Grassy Woodland. These are aggregated into a single habitat type (open grassy woodland) as both provide equivalent resources for threatened fauna in this environment.

The prescribed habitat hectare offset for the proposed quarry and its associated infrastructure totals **12.43 hha** (**Table 2**). Under the like-for-like prescriptions EVC specific offsets are required for losses associated with Polygons 1, 2, 6, 7, 9, 13 and 18. Habitat specific offsets can be provided for Polygon 3 as the conservation significance of this vegetation is based on it providing the best 50% of habitat for woodland birds (i.e. Diamond Firetail, Barking Owl, the FFG Act listed community and Turquoise Parrot). The habitat hectare offsets to be achieved within the Northern Inland Slopes Bioregion are therefore described as follows:

- **1.96 hha** of VHCS Grassy Woodland;
- **7.61 hha** of VHCS open grassy woodland habitat for Diamond Firetail and Barking Owl;
- **1.07 hha** of VHCS Box Ironbark Forest; and
- **1.79 hha** of VHCS Valley Grassy Forest.

Large Old Trees

A total of 38 LOTs would be cleared during the life of the proposed quarry. This includes 32 LOTs within patches of Grassy Woodland, 5 within Valley Grassy Forest and one within areas of degraded treeless vegetation (predominantly introduced vegetation). However, the 8 LOTs associated with Patch 3 are rated to be of VHCS because of their fauna habitat values rather than the condition of the EVC in which they occur. Therefore these trees can be offset in suitable habitat for the relevant threatened species rather than requiring specific EVC offsets. All trees within patches are of VHCS while the three trees within degraded treeless vegetation (DTV) are of High conservation significance. The prescribed LOT offsets are therefore:

- Protect **296** and recruit **1480** for the loss of 37 LOTs in patches of VHCS; and
- Protect **2** and recruit **10** (protect and recruit option) or recruit **100** (recruit only option) for the loss of three **scattered** trees in DTV.

The like-for-like prescriptions for the loss of trees **within patches** break this up into:

- protect **40** and recruit **200** in Valley Grassy Forest;
- protect **192** and recruit **960** within Grassy Woodland; and
- protect **64** and recruit **320** within the best 50% of habitat for Diamond Firetail or Barking Owl.

Other Mitigation Measures

There are a number of options to further mitigate potential ecological impacts of the proposed development. Recommendations to minimise the potential ecological impact of development of the land are as follows:

- Water storage dams and sediment basins should be designed as fauna habitat. Suitable habitat features include provision of adequate shelter and basking sites (i.e. rocks and logs), fringing emergent aquatic vegetation in the forms of reeds and rushes and submerged aquatic vegetation.
- All areas of retained native vegetation including scattered trees should be protected during construction, and disturbance of native vegetation should be kept to a minimum.
- A Construction Environmental Management Plan (CEMP) should be developed prior to commencement of construction, and environmental management issues should be incorporated into the workforce induction program. Part of this CEMP will include a reptile salvage plan to be endorsed by DSE.
- Best practice sedimentation and drainage management should be adopted.
- Use of site indigenous native species for any landscape plantings will enhance the natural values of the study area. Plantings should contain species of local provenance and appropriate for the EVCs found within the study area.

6.2.2 Potential Offsets

Much of the Eames property supports remnant patches of native vegetation including open grassy woodland vegetation, broad areas of native grassy ground cover and both scattered individual and stands of LOTs with the potential to provide some or all of the prescribed offsets for the proposed quarry.

Some of the prescribed habitat hectare offsets could be generated from the balance of the native vegetation retained within the WA and particularly within the paddock supporting the proposed extraction area. The potential habitat hectare offsets which could be generated from retained EVC patches are documented in **Table 3**. Other patches of Grassy Woodland, Valley Grassy Forest and a substantial number of LOTs occur on the Eames property both in and out of the WA and could also contribute to the offset prescription. Proposed offset sites within the Eames property are identified in Figure 5. Note that native vegetation, including LOTs, within road reserves cannot provide offsets as these areas are public land.

Habitat Hectare Offsets

The proposed net gain offset sites protected by a 173 agreement would generate **2.01 hha** of VHCS Box Ironbark Forest, **10.8 hha** of VHCS Grassy Woodland plus **2.07** of VHCS and **0.48 hha** of HCS Valley Grassy Forest (Table 3). These offsets are in excess of the prescribed habitat hectare offset requirements for each EVC providing an additional **0.94 hha** of Box Ironbark Forest, **1.23 hha** of Grassy Woodland and **0.28hha** of Valley Grassy Forest, all of VHCS.

Therefore the propose New Chiltern quarry has identified potential habitat hectare offsets within the Eames property to generate a like-for-like Net Gain outcome for the habitat hectare component of the offset prescriptions for this project. The nominated offset site also generates an excess of **2.45 hha** of VHCS and **0.48 hha** of HCS.

Large Old Tree Offsets

The paddock surrounding the extraction area supports an additional **78 LOTs** within areas of Valley Grassy Forest (6), Grassy Woodland (25), Creekline Grassy Woodland (2) and Box Ironbark Forest (45). An additional **51 LOTs, 48** within areas of Grassy Woodland, and 70 Medium Old Trees occur within the offset sites proposed on the western edge of the Eames property (Figure 5).

CEMEX also proposes the acquisition of sections of road reserves within the area to be leased from Mr. Eames and which are otherwise not required for access to the surrounding titles (Figure 5). These sections of road reserve provide an additional **53 LOTs** within Valley Grassy Forest which provides the best 50% of habitat for both Barking Owl and Diamond Firetail. An additional **231 trees** (109 LOTs and 121 MOTs) within Valley Grassy Forest were identified as potential offset trees within the lease area to the east of the extraction paddock (Figure 5)

CEMEX will provide the offsets for the loss of the single LOT within DTV using the recruit only option (i.e. recruit 100 plants) within a yet to be defined area of the WA.

Table 3: The habitat hectare offset potential of patches of native vegetation within the study area.

Polygon	Patch 2			Patch 3			Patch 4			Patch 5			Patch 6			Patch 7			Patch 16			Patch 17			Patch 18			Total						
	EVC Number	EVC Name	Current Habitat Score (/100)	Conservation Significance	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components	Improvement	Current Site Condition	Maintenance Components		Improvement					
	175-62	R. Grassy Woodland	0.48	Very High	175-62	R. Grassy Woodland	0.37	Very High	47	Valley Grassy Forest	0.34	High	47	Valley Grassy Forest	0.65	Very High	61	Box Ironbark Forest	0.57	Very High	175-62	R. Grassy Woodland	0.44	Very High	175-62	R. Grassy Woodland	0.35	Very High	175-62	R. Grassy Woodland				
Site Condition	Large Old Trees	3	NA	NA	3	NA	NA	NA	3	NA	NA	NA	3	NA	NA	NA	3	NA	NA	3	NA	NA	NA	3	NA	NA	3	NA	NA	3	NA	NA		
	Canopy Cover	0	0.25	0	0	0.6	0	0.6	0	0	0.6	0	0.6	0	0.15	0.4	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0.6	0		
	Understorey	5	0.5	2.5	5	0.5	2.5	5	0.5	2.5	5	0.5	2.5	5	1.5	5	1.5	5	1.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5		
	Lack of Weeds	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2	6	NA	2
	Recruitment	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	4	0.6	4	0.6	4	0.6	4	0	0	0	0	0	0	0	0	0	0	0	
Organic Matter	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	3	0.3	2	
Logs	3	3.4	0	3	3	0	3	3	0	3	3	0	3	2.4	0	2.4	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0	0	0		
Subtotals of Maintenance & improvement columns			4.45	6.50	3.80	7.10	0.80	7.10	0.80	7.10	4.95	15.40	15.00	2.40	15.00	4.95	15.40	2.40	15.00	2.40	15.00	11.60	11.60	11.00	11.00	0.80	11.60	11.60	0.80	11.60	11.60	11.60		
Sum of Maintenance + Improvement Gain			10.95	10.90	7.90	7.90	20.35	17.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	
Adjusted sum of Maintenance + Improvement Gain			10.95	10.90	7.90	7.90	20.35	17.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	12.40	
Prior management Gain (10% current score)			4.80	3.70	3.40	3.10	6.50	5.70	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	
Security Gain (10% current score)			4.80	3.70	3.40	3.10	6.50	5.70	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Total gain in Habitat Points per hectare			20.55	18.30	14.70	14.10	33.35	28.80	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	19.40	
Convert gain points to habitat score gained per ha = gain points/100			0.21	0.18	0.15	0.14	0.33	0.29	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	
Area of the proposed offset (ha)			1.38	15.39	14.11	3.49	4.02	2.34	19.50	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	
Net Gain (habitat hectares)			0.28	2.82	2.07	0.49	1.34	0.67	3.78	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	

Note: Full numbers are used for calculations, however values shown are rounded for reporting purposes. Values for each quality zone are rounded to 2 decimal places and the final total is rounded to 1 decimal place.

These provide the prescribed LOT offsets for Valley Grassy Forest and the habitat for threatened birds. However an additional **119** LOTs within Grassy Woodland are required to be protected to provide like-for-like LOT offsets. Note that the excess 45 LOTs within Box Ironbark Forest, the 2 LOTs within Creek-line Grassy Woodland and 17 LOTs from Valley Grassy Forest are accounted for in the offset requirements for threatened species habitat.

Of the trees measured **114** LOTs and **121** MOTs within Valley Grassy Forest and **70** MOTs within areas of Grassy Woodland could be protected but do not satisfy the like-for-like requirements associated with the outstanding LOT offset prescription of **119** LOTs within Grassy Woodland. An additional **8** LOTs occur outside areas proposed to be protected as an offset site. These scattered trees are within areas of predominantly introduced vegetation, within areas that were once Valley Grassy Forest.

The proposed offset prescription to recruit 100 new trees under the recruit only prescription for the loss of one scattered LOT may require an area of land beyond the habitat hectare offset site. While DSE regard the protection of a LOT to provide the recruitment prescriptions, an offset for the protection of an additional **119** LOTs is yet to be defined under the strict like-for-like prescriptions. With the current level of protection achieved within the Eames property the outstanding recruitment prescription has been reduced to **595** new trees.

6.2.3 Further Work

The proposed quarry site has been subjected to a number of ecological surveys including targeted surveys for threatened flora and fauna and spring flora surveys to detect seasonally visible flowering plants. As such, it is considered that the only outstanding survey requirements associated with this quarry are associated with any defined external net gain offset site. If external offsets are required they should be located and subjected to ecological survey to define the offset potential of the vegetation present. This has been done for the offsets available within the study area. An offset management plan also needs to be prepared for any proposed offset site to document how vegetation gains will be generated and managed.

Mountain Swainson-pea Translocation

CEMEX has also proposed to target Mountain Swainson-pea as a species for reintroduction into suitable habitats within the WA. This endangered species is known from 18 sites in Victoria (FIS 2007) including one nearby within the Chiltern - Mt. Pilot National Park. This small population consists of less than 10 plants and includes some individuals propagated from seed. This population is closely monitored and remains subject to a number of threats including grazing by wallabies and kangaroos.

The habitat for this species is only described in general terms as grassland and open woodland, often on stony hillsides or low hill country in north east Victoria (Thompson and James 1991, Walsh and Entwisle 1996).

Examination of the WA with local naturalist Eileen Collins suggests that secondary grassland areas in close proximity to the springs and soaks on the southern side of Skeleton Hill would provide potential habitat for this species. The additional moisture provided in these areas would also assist any translocated population to survive. The utilisation of this area as a net gain offset site would also control the other threatening processes which currently constrain the local recovery of this species. If approved by DSE/DEWHA, CEMEX would prepare a translocation plan for approval by DSE to facilitate this translocation.

6.2.4 Quarry Rehabilitation

Rehabilitation of the exhausted quarry with suitable locally indigenous species would provide a level of longer term mitigation as this would eventually increase the area of native vegetation present. In general the exhausted quarry would be configured to maximise its potential value for fauna habitat.

The existing central ridgeline is relatively rocky and supports only skeletal soils. Topsoil salvage and stockpiling during quarry establishment is therefore unlikely to yield any significant volume of material able to be redistributed during the rehabilitation phase. A similar environment would be created within exhausted sections of the quarry although it may be necessary to provide some finely crushed material to accelerate some level of soil development. The rehabilitation process should involve the collection and dispersal of locally indigenous seed, the propagation and planting of tubestock and weed control works to control the colonisation of the site by exotic species.

Species suitable for planting within the exhausted quarry are included in Appendix 9.

6.2.5 Reptile Salvage

A protocol will be developed for the salvage for reptiles during the establishment of the pit and other site infrastructure. This plan will be completed to the satisfaction of DSE but would include the supervision of habitat destruction and the capture and translocation of reptiles before the existing soil/rock surface is destroyed.

The Bandy Bandy will be a particular focus of this salvage protocol and all suitable habitat for this species (i.e. hollow logs, stumps and under larger rocks) will be carefully removed from the construction footprint in order to minimise any potential impact on this species.

6.3 Conclusions

The majority of the study area supports native vegetation with enough cover and diversity for the area to be mapped as patches of native vegetation and for most areas of Grassy Woodland and Valley Grassy Forest to be classified as the critically endangered vegetation community White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and derived native grasslands.

This vegetation also provides habitat for a range of fauna of state and national conservation significance and provides the best 50% of habitat for a number of these species.

As such much of the study area is rated to be of **State** conservation significance and to have Very High conservation significance under the Framework, clearing of the vegetation within the proposed extraction limit may require Ministerial approval from both State and federal regulators.

The propose New Chiltern quarry has identified potential habitat hectare offsets within the Eames property to generate a like-for-like Net Gain outcome for the habitat hectare component of the offset prescriptions for this project.

Of the 528 mature trees (337 LOTs and 191 MOTs) identified within the leasehold area 177 LOTs can be utilised under the like-for-like requirements. This reduces the offset prescription to protect 296 LOTs to **119** Grassy Woodland LOTs, leaving 114 LOTs and 121 MOTs within Valley Grassy Forest, 70 Grassy Woodland MOTs and 8 scattered LOTs (**122 LOTs** and **191 MOTs**) unallocated to any offsets. This provides about 60% of the prescribed like-for-like LOT offsets for the project. The remaining 40% of LOT offsets are yet to be identified.

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APPENDICES

APPENDIX 1

Fauna Survey Methods

Fauna survey has been conducted under the terms of a research permit issued by the Department of Sustainability and Environment under the *Wildlife Act 1975* and *Flora and Fauna Guarantee Act 1988*. The research permit number is 10004009, expiry date 31 December 2009.

Standard fauna survey techniques are described below, along with an explanation of their applicability to the study.

Elliott and cage trapping

Elliott traps are designed to trap small mammals, while cage traps are designed trap medium-sized mammals such as bandicoots. Traps are baited with a mixture of peanut butter, honey and oats. Leaf litter and foliage or shredded paper is placed into traps to provide trapped animals with insulation from the weather. Animals trapped are identified and released. If identification is difficult, body measurements and hair samples will be taken for subsequent analysis. One 'trap-night' is equivalent to one trap left open for one night.

Applicability to the current study: Elliott traps were used that were modified for trapping Brush-tailed Phascogale, a species thought likely to occur on the subject land..

Bat call detecting (Echolocation analysis)

Anabat detectors (Titley Electronics) are used to record Microchiropteran bat calls. The technique relies on the capacity to identify bat species from their unique ultrasonic echolocatory sequences. This technique can be more effective than the use of harp traps, because some species usually forage above canopy height where they are less likely to be caught in harp traps. Stationary detecting involves placing an Anabat detector near a potential bat flight corridor and leaving it to record for a period of time. Mobile detecting involves carrying the Anabat detector while spotlighting and recording bats that are detected.

As with harp traps, bat detectors are placed along bat flight paths where bats fly regularly. Bat detectors are also useful for surveying for bats in more open areas, such as clearings and the space over water.

Call identification is based on a key developed from observed characteristics of search phase pulses within reference calls from known species. The files are viewed in Anabat software which provides a sonogram display of frequency versus time.

Many calls are specie-specific, however, there is also considerable overlap in the call characteristics. Some Victorian species and many calls are attributable only to species complexes and not particular species. Calls are more likely to be identified when longer pulse sequences are provided for analysis. Calls of less than three seconds duration are usually inadequate for analysis. Calls that are difficult to identify are typically those recorded in very large clearings, open paddocks or extremely closed forest.

Applicability to the current study: Three detectors were deployed in areas thought likely to be bat flight paths. The calls recorded have been analysed by DSE, using the computer program AnaScheme (see Appendix 2).

Active searching

Active searching involves diurnal investigation of a variety of habitats, including microenvironments in which animals may shelter during daylight hours. This technique involves actively searching for all fauna species, including rolling logs and any other

sources of refuge. Both direct and indirect evidence of fauna can be recorded and used to identify species present. Direct evidence includes actual sightings or identification of the species from distinct vocalisations or calls (e.g. birds, frogs, some nocturnal mammals). Indirect evidence includes remains (e.g. bones, skin, fur, feathers), tracks, diggings or burrows.

Applicability to the current study: Observations of fauna were noted throughout the duration of the survey. Three days were dedicated to rock rolling for Pink-tailed Worm-lizard from 7-9 October 2009. 2541 rocks were rolled across the site, with focus on the rocky hill.

Spotlighting

This technique involves active searching at night with the aid of spotlights. It is conducted to detect nocturnal mammals, birds and frogs. Tracks and roads are traversed on foot and in a vehicle during the night, and trees are searched for arboreal mammals and owls. Frogs and geckoes can also be detected at night with the aid of spotlights. During spotlighting, species are also recorded incidentally by identification of calls (e.g. owls, arboreal mammals, frogs). Spotlight surveys are timed and survey effort is expressed in spotlight-hours.

Applicability to the current study: Spotlighting was undertaken using two spotlights over two nights.

Call playback

Some species have large home ranges or are particularly secretive and, therefore, are difficult to locate when spotlighting or active searching. This technique relies on the fact that most species of animal are territorial and use calls as a method of defending their territory from individuals of their own species. Calls of vocal species are played through a loudspeaker to attract them closer to observers or to prompt a response call.

Applicability to the current study: Call playback was undertaken at several locations in an attempt to elicit a response by owls, frogmouths and nightjars.

Funnel traps

Funnel traps are constructed of shade cloth with an internal spring and wire frame which maintains the shape of the trap when open. They are approximately 750mm x 180mm x 180mm, with a circular opening of 40mm diameter. A zipper is located along the length of the trap and is opened to remove captured fauna.

Each funnel trap is used in conjunction with:

- a drift fence which extends 5 metres on either side of the trap. The traps are clipped onto the drift fence at the front and rear of the trap;
- a layer of soil/leaf litter inside the trap in order to maintain moisture levels; and
- an additional covering of 90% shade cloth.

The funnel traps are checked and cleared at least twice daily, once as early as possible in the morning and once in the late afternoon/evening. In extreme weather conditions, traps are removed from the drift fence and not used.

Applicability to the current study: Two sites were selected to funnel trap for Pink-tailed Worm-lizard from 6-10 October 2008. Both sites are depicted in figure 2. Nine funnel traps were located along each drift fence.

Tile survey

Roof tiles were placed flat in a grid pattern (typically a grid of 5 x 10 tiles with 5m spacing) and then routinely lifted at fortnightly intervals from late September 2008 to mid January 2009 (ten surveys) to check for fauna sheltering underneath. Once lifted,

tiles are replaced carefully in the same location. This is a detection technique, rather than a trapping technique.

Applicability to the current study: This survey technique was used to survey for Striped Legless Lizard. Three grids were placed in suitable grassland habitat across the site and their location is depicted in figure 2.

Golden Sun Moth survey

On four separate occasions the entire site was systematically surveyed by one zoologist walking a series of transects, spaced approximately 50m apart between the hours of 10am and 2pm. An observer carries a hand held GPS and a waypoint is taken where GSM are observed. The observer takes care to minimise double counting any individual moths. The number of male and/or female moths observed is recorded. To guide the timing of survey, weather information was obtained from BOM website www.bom.gov.au.

Applicability to the current study: Suitable grassland habitat exists on the site and was surveyed four times during suitable conditions on 2, 11 and 25 November 2008 and 1 December 2008.

APPENDIX 2

Anabat Results

APPENDIX 2

Anabat Results

Identification of Anabat calls for Biosis from Chiltern, November 2007

Lindy Lumsden
Arthur Rylah Institute

11 December 2007

Identification of calls

A total of 1274 Anabat files were provided for analysis from the Chiltern area, of which 1229 contained bat calls.

The files were first viewed in AnalookW software (Chris Corben, www.hoarybat.com) to remove files that did not contain bat calls. The calls were then analysed using the automated bat analysis program, AnaScheme. The following description of AnaScheme is taken largely from Lumsden and Bennett (2005).

Echolocation calls were identified by using AnaScheme software (Matt Gibson, Ballarat University, Ballarat, Victoria; Gibson and Lumsden, 2003) which automatically analyses Anabat files in a consistent, quantifiable way. An identification key has been developed specifically for the Northern Plains region of Victoria, which is the appropriate key for the Chiltern area. Reference calls were collected from all species known from the region by recording individuals as they were released at the sampling sites, either just prior to dusk or during the night with a light tag (Starlight Mini, NKH Luminous Arts Japan Ltd.) attached. Each call was examined and parameters extracted from search-phase pulses. Only search phase pulses were used for reference calls and during identification, as these are the most characteristic of all calls. A total of 3,311 pulses from 152 reference call sequences was included in this analysis. The Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris* was included in the key despite there being no confirmed records from the region, because it has a patchy distribution and uncertain status in Victoria (Lumsden and Menkhorst, 1995).

AnaScheme fits a modelled curve to each pulse and provides a range of parameters including various frequency and slope measures, duration and curvature of the pulse, and time between pulses. The key for the Northern Plains was developed by identifying mutually exclusive combinations of parameters to distinguish between species. Two approaches were used. First, the parameters from the pulses of all reference calls were sorted into frequency ranges. Sub-sets were then sorted using other variables until a combination of variables, each within a specific data range, revealed a single species. This was repeated until all possible species identifications were recognised.

The second approach used Discriminant Function Analysis. Eleven pulse parameters from each of the reference calls were incorporated, and raw coefficients for canonical variables were calculated. Discriminant function scores for the first two functions were plotted for all pulses. Clusters of pulses from a single species, with no overlap from another species, were used to

determine the limits of each species. Steps in the classification key were developed that incorporated the weightings for each of the variables, and the limits represented by each species.

The key was tested on reference calls of known species identity (both the calls used to develop the key, and an additional set of reference calls used specifically to test the key) and checked against unknown calls that had been manually identified. Many species overlap considerably in their echolocation call parameters and not all calls could be successfully identified. The key was refined until no reference call sequences were incorrectly identified and as many as possible were positively identified to a single species. The remainder were identified as species complexes or recorded as 'unknowns'. The proportion of reference calls that could be correctly identified varied between species depending on the extent of overlap in pulse parameters with other species. All reference call sequences could be identified for some species (e.g. White-striped Freetail Bat *Tadarida australis*, Eastern Freetail Bat *Mormopterus* sp.2), whereas identification rates were less than 40% for other species.

It was not possible to reliably distinguish the Lesser Long-eared Bat *Nyctophilus geoffroyi* and Gould's Long-eared Bat *N. gouldi* using AnaScheme (or manually). Therefore, for this genus identifications were made only to generic level. The form of *Vespadelus regulus* present in the Northern Plains has a higher echolocation call than in southern Victoria (characteristic frequency of 50-57 kHz, compared with 39-47 kHz in southern Victoria Duffy *et al.*, 2000; see also Law *et al.*, 2002).

A minimum of five good quality pulses were required from an unknown call sequence (i.e. a pass) for an identification to be attempted. Positive identifications were only made when more than 50% of the pulses were identified as a particular species. A subsample of calls were checked manually to verify the automated identifications. By undertaking the analysis using AnaScheme the identification process was considerably quicker.

The total number of calls and the number of calls that could be positively identified of each species from each site are recorded in the table below, with an example of an identified call of each of the seven species provided. The majority of files that could not be identified were relatively short and contained less than the required five good quality pulses for identification to be attempted. While this may mean that some short, but distinctive, calls may go unanalysed, this threshold is set to minimise the number of mis-identifications that may occur.

Identification of Anabat files from Chiltern area recorded on 7-8 November 2007.

Site		Anabat 1		Anabat 2		Anabat 3	
Date		7-Nov	8-Nov	7-Nov	8-Nov	7-Nov	8-Nov
White-striped Freetail Bat	<i>Tadarida australis</i>	1	1			1	
Southern Freetail Bat	<i>Mormopterus</i> sp.	7	20	17	25		9
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	2	1	1	3		2
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	9	3	1			4
Long-eared bats *	<i>Nyctophilus</i> sp.		2	1		1	6
Large Forest Bat	<i>Vespadelus darlingtoni</i>				2		1
Little Forest Bat	<i>Vespadelus vulturnus</i>	2	13	2	14	12	36
Chocolate Wattled Bat / Southern Forest Bat	<i>C. morio</i> / <i>V. regulus</i>						1
Little Forest Bat / Large Forest Bat	<i>Vespadelus vulturnus</i> / <i>V. darlingtoni</i>		2	8	6	1	2
Total files identified		21	42	30	50	21	61
Total files containing		129	208	102	197	221	372

bat calls						
% files identified	16.3	20.2	29.4	25.4	9.5	16.4

* Lesser Long-eared Bat and Gould's Long-eared Bats can not be distinguished on call and hence are always combined into a species complex. Other species can be reliably distinguished at least some of the time and are shown as a single species where this is possible, and as a species complex for calls where there is considerable overlap in call parameters.

Interpreting the numbers of calls for each species / species complex.

Note that recordings of microbat calls cannot be used to estimate absolute abundances. For example, ten calls recorded at a site could either be the result of ten individual flying past the detector once or one individual flying past ten times. However, it does provide a relative index of activity which can be used to compare between sites or time periods. This is a useful measure as it indicates that the site supported ten units of bat activity, irrespective of the number of individuals involved. Hence, comparisons of species between sites is valid.

In contrast, it is not valid to compare the relative activity levels of different species at the same site, because there are differences in both identifiability and detectability between species. For example, ten calls by species X might typically result in the recording of ten readily identifiable calls, but ten calls from species Y might result in only one or two of its calls being able to be identified to species level, due to the high level of overlap with other species. For example, the White-striped Freetail Bat has a very distinct call that does not overlap with any other species and hence if a clear call is recorded it can be identified every time. In contrast, a number of species call in the frequency range 40-50 kHz and overlap extensively. It is possible to identify some calls in this range using AnaScheme, but a large proportion of the time the calls are very similar and so we take the conservative approach of placing them into a species complex. For other species, like the long-eared bats it is not ever possible to distinguish their calls and hence we always lump these as a species complex of *Nyctophilus* sp. and treat it as if it was a species.

In addition, different species have differing levels of detectability. For example, the White-striped Freetail Bat has a strong call that may be detected from 30 m or more, whereas the long-eared bats have a quiet call that might only be detected less than 5 m from the microphone.

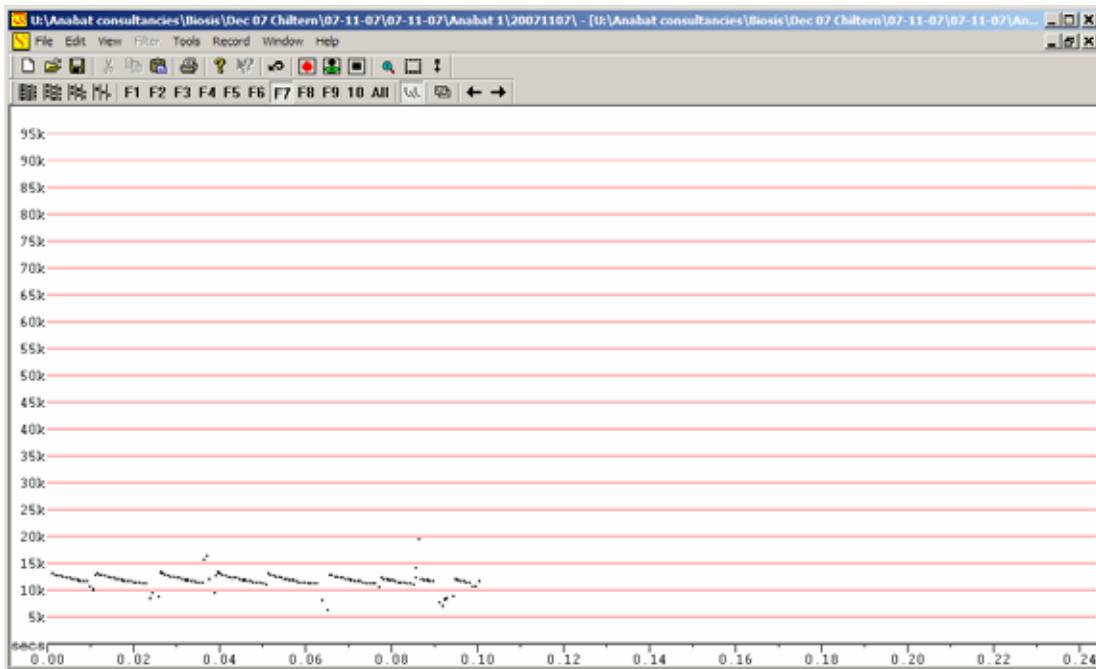
The ability to identify a call can also depend on the situation in which the call was recorded. The more 'clutter' at a site (i.e. denser vegetation), the steeper the call will be and the less diagnostic it is. Calls from more open areas tend to be more distinctive and identifiable. For example, calls recorded of bats flying along a track in forest will be easier to identify than calls recorded within the forest. Calls recorded in very open areas, such as an open paddock will look different to calls recorded within a forested situation.

There is also geographical variation in the calls of some species, where in different parts of Victoria species use different call frequencies, further complicating the call analysis process. This is one of the reasons why regional keys need to be developed and used when analysing calls in AnaScheme.

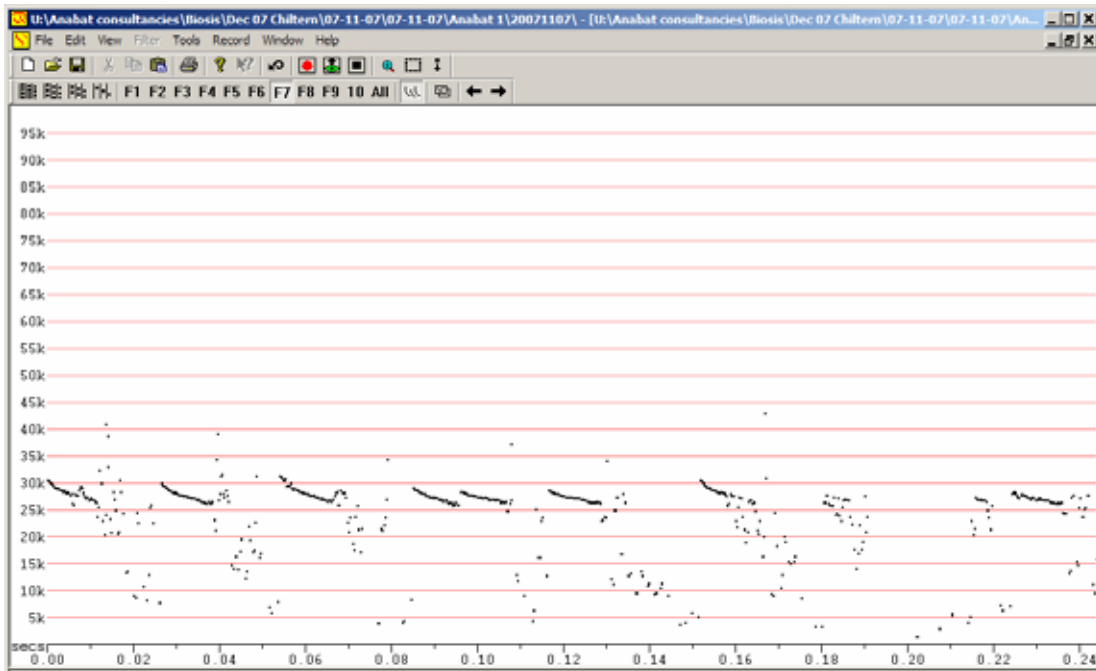
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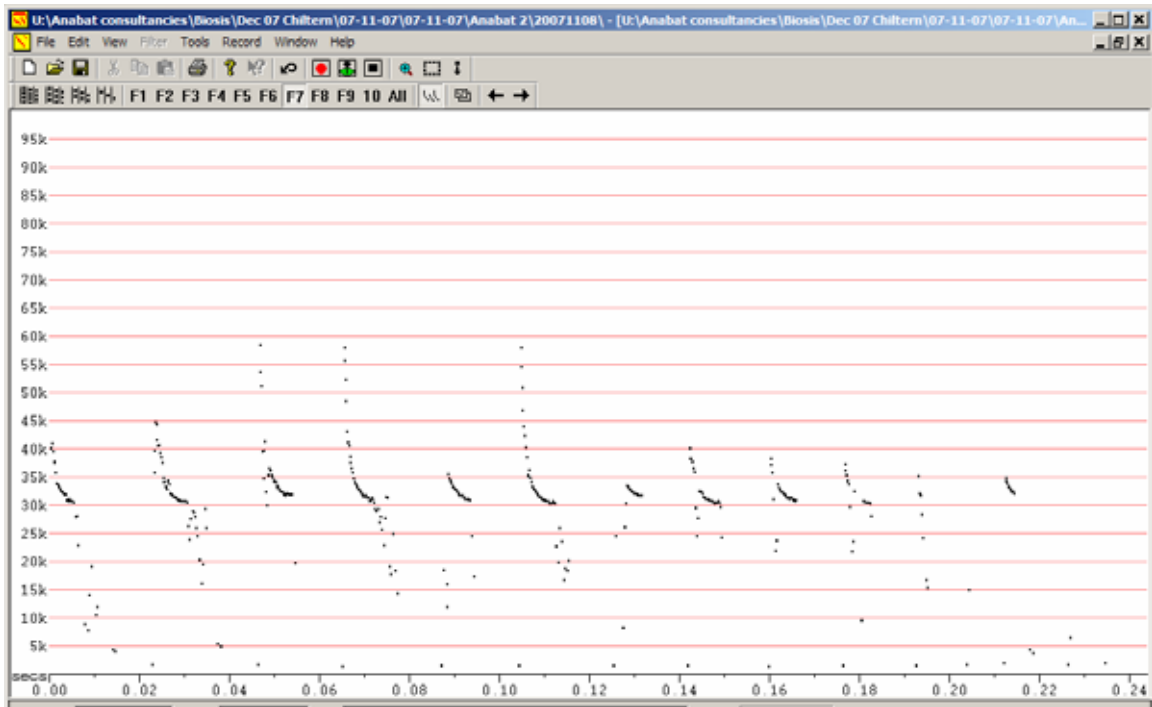
An example of a call of each species identified using AnaScheme from the Chiltern recordings.



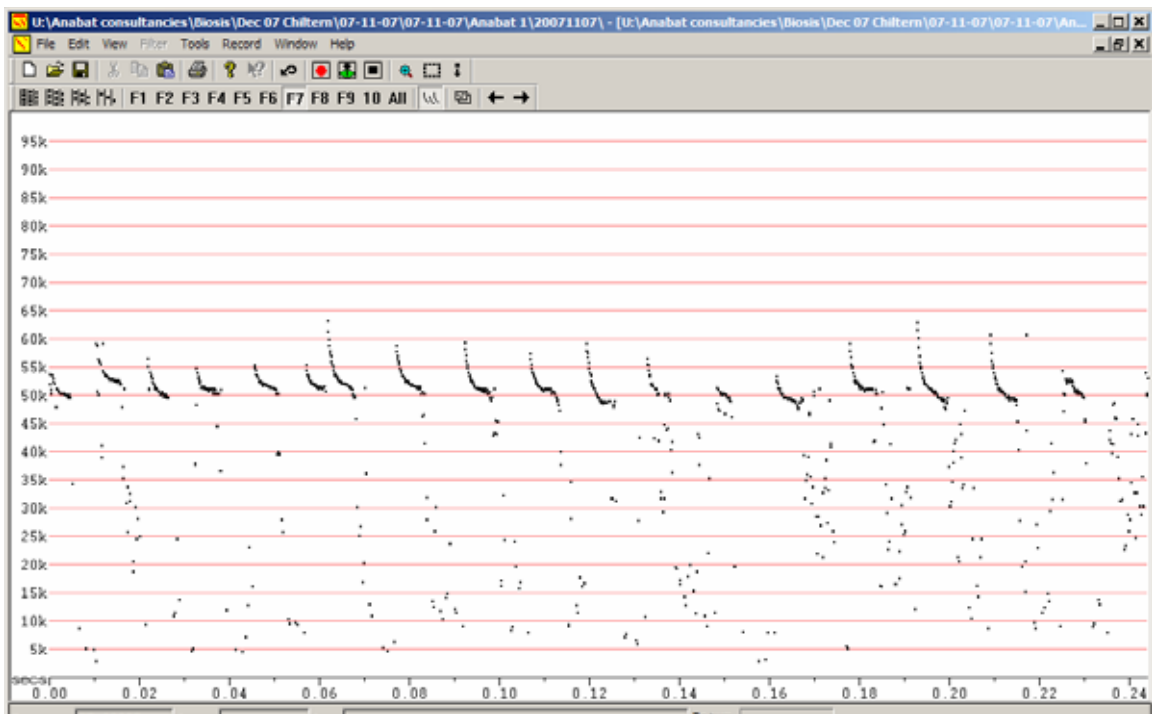
Call identified as White-striped Freetail Bat *Tadarida australis* from Anabat 1 on 7 Nov 2007.



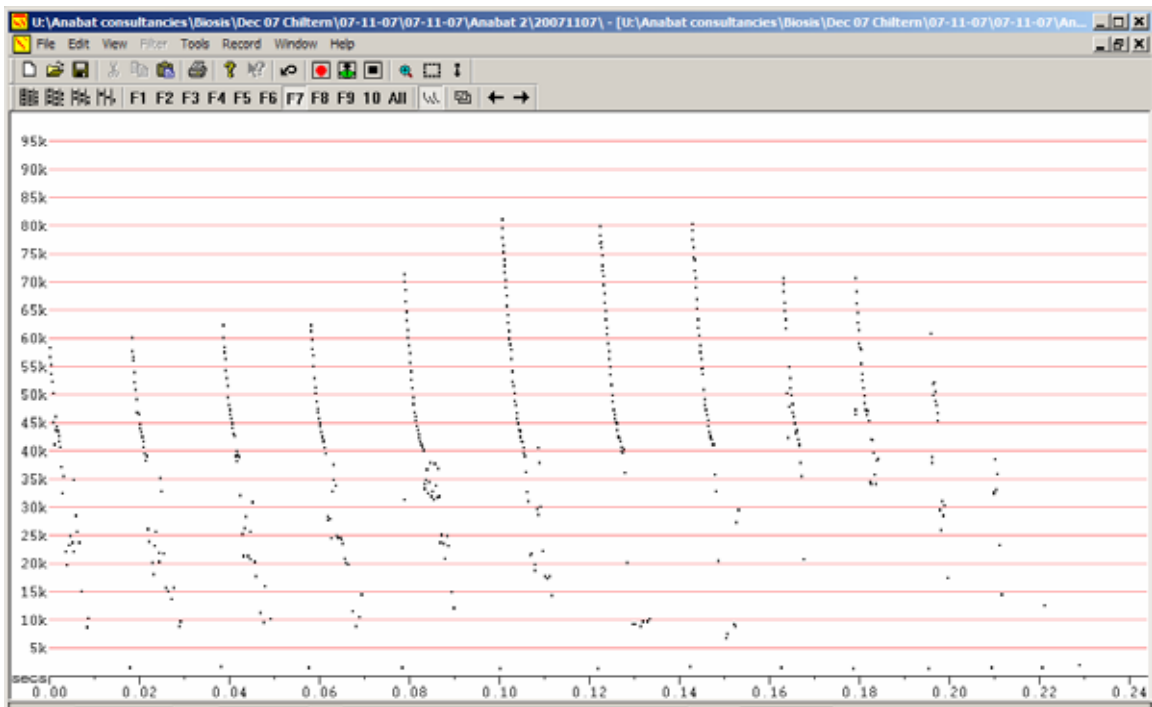
Call identified as Southern Freetail Bat *Mormopterus* sp. (long penis form) from Anabat 1 on 7 November 2007.



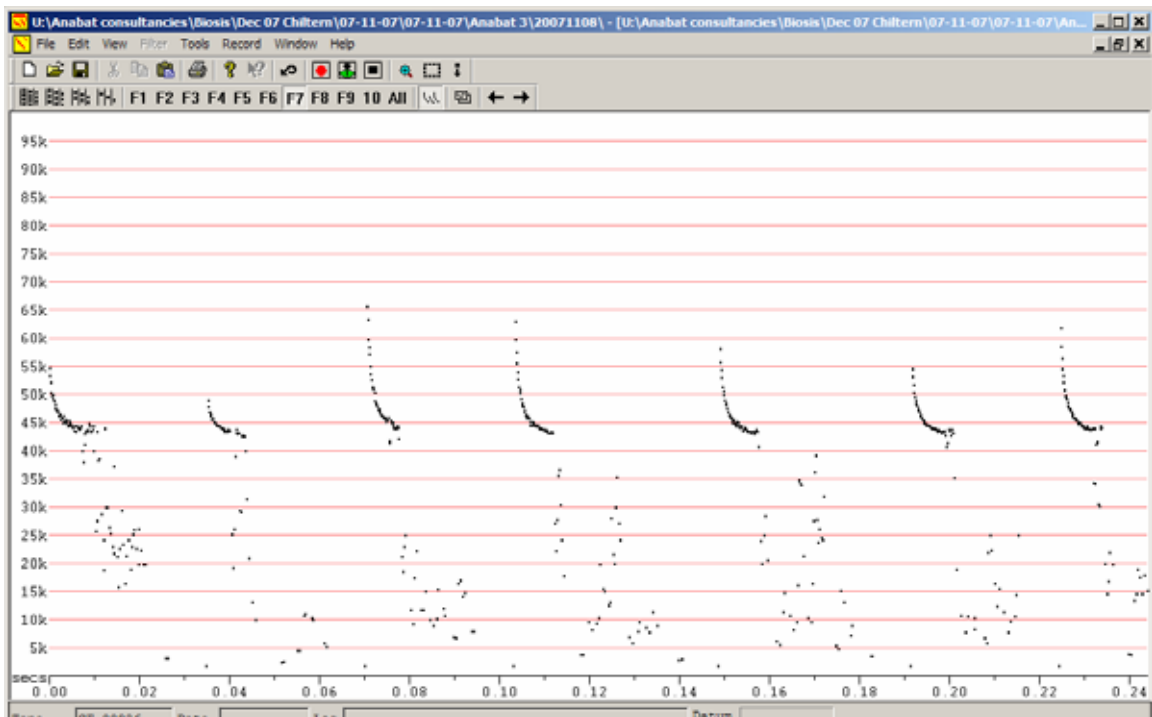
Call identified as Gould's Wattled Bat *Chalinolobus gouldii* from Anabat 2 on 8 November 2007.



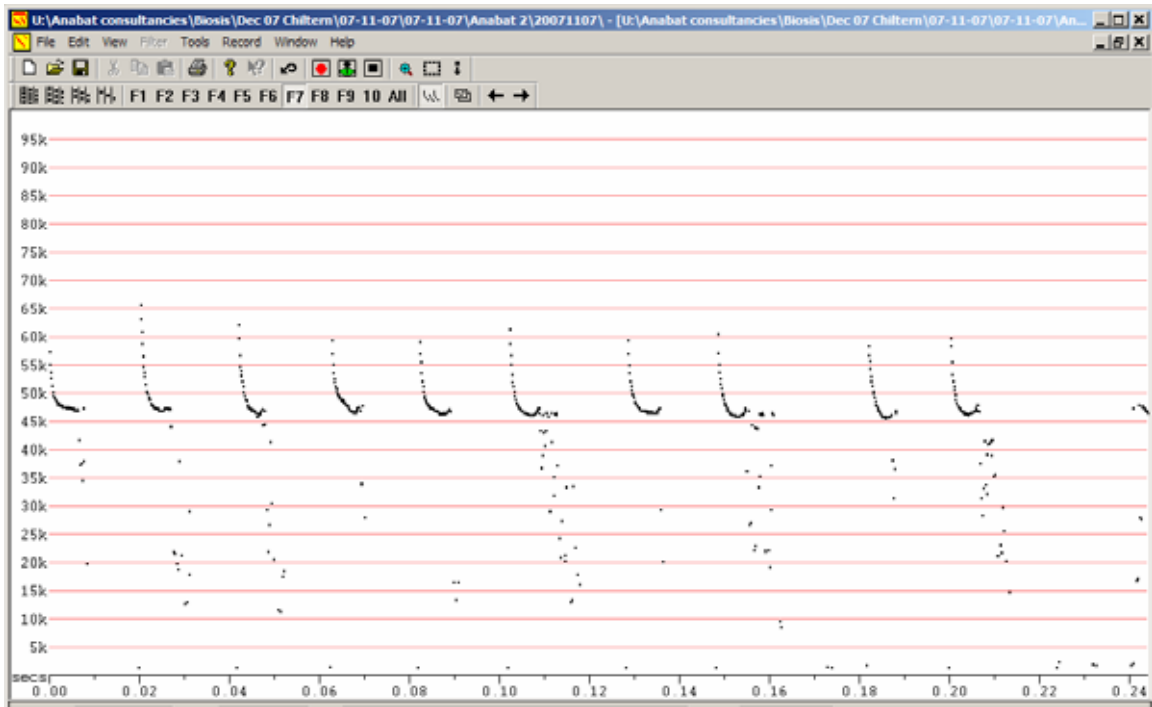
Call identified as Chocolate Wattled Bat *Chalinolobus morio* from Anabat 1 on 7 November 2007.



Call identified as a long-eared bat *Nyctophilus* sp from Anabat 2 on 7 November 2007. The two species of long-eared bats in this area (Lesser Long-eared Bat *Nyctophilus geoffroyi* and Gould's Long-eared Bat *N. gouldi*) can not be distinguished on call.



Call identified as Large Forest Bat *Vespadelus darlingtoni* from Anabat 3 on 8 November 2007.



Call identified as Little Forest Bat *Vespadelus vulturnus* from Anabat 2 on 7 November 2007.

APPENDIX 3

DSE Vegetation Assessment Methodology

A3.1 Habitat hectares

Habitat hectares are calculated where at least 25 % of the understorey cover is native or a group (i.e. at least 3) of trees where the tree canopy cover is at least 20% (DSE 2007). Such sites are termed 'patches' of native vegetation.

Each vegetation patch has one or more habitat quality zones. Each habitat zone consists of one ecological vegetation class (EVC) and has uniform quality within limits.

The assessment process compares the vegetation of the habitat zone against a DSE 'benchmark' description of the EVC, using methods described in the DSE assessment manual (DSE 2004). A habitat score for the habitat zone is calculated by this method.

Each habitat zone has a habitat score of between 0 and 100, with extensive intact vegetation having a theoretical score of 100. Habitat score is calculated using ten components: large trees, tree canopy cover, understorey, weediness, recruitment, organic litter, logs, patch size, neighbourhood context and distance to core area. In naturally treeless vegetation, or vegetation that can exist in different structural forms, the score is standardised to account for the absence of some or all 'woody' criteria.

The habitat hectare value of a habitat zone is given by its habitat score (expressed as a decimal between 0 and 1) multiplied by its land area in hectares. For example, 4 hectares of vegetation with a habitat score of 50 contain 2.0 habitat hectares.

Habitat hectares are used to measure losses arising from clearing, and also gains obtained through protection measures and active management of existing vegetation.

A3.2 Indigenous canopy trees

The following information on indigenous canopy trees does not apply if the subject land contains only treeless vegetation types.

Large Old Trees within patches

'Large Old Trees' within native vegetation patches are subject to offset requirements, as outlined in the Native Vegetation Management Framework (NRE 2002: Table 6, p 55). Trees smaller than benchmark size within patches are not included in this assessment, as they are addressed in the habitat hectare analysis.

Scattered trees outside patches

Trees over predominantly introduced understoreys are offset through tree protection/replacement ratios.

Trees in areas where less than 25 % of the understorey cover is native are assessed as 'scattered old trees'. Trees are offset by the protection of other old trees and/or recruitment of new trees.

For land parcels (usually a title boundary) where tree density is greater than eight per hectare, the offset ratios are outlined in the Native Vegetation Management Framework (NRE 2002, p 55). For areas where tree density is less, the offset ratios are specified in the Regional Native Vegetation Plan. Offsets for small trees are also included in the Native Vegetation Plan.

APPENDIX 4

Significance Assessment

The common language meaning of significance is ‘importance; consequence’ (Macquarie Dictionary). While the general meaning of this is clear, in natural resource assessment and management this meaning needs to be defined in scientific terms.

A4.1 Significant Species and Communities

Species and community conservation significance is defined as follows:

A taxon or community is significant at a particular geographic level (national, state, regional, local) when it is considered to be rare or threatened at that level.

A taxon is an officially recognised species, subspecies or variety of a species. The significance of a taxon or community is a function of its rarity within a specified geographic context: nation, state, region, local area. In each context a taxon or community has a conservation status: not rare, rare, vulnerable, endangered, extinct. ‘Threatened’ is a combination of the ‘vulnerable’ and ‘endangered’ categories.

The significance of the taxon or community is the largest geographic context in which it is at least rare. For example, if a species is uncommon in a state and rare within a region of that state, it has regional significance within that region.

Species listed as ‘poorly known’ are not considered rare or threatened at present and are assigned an intermediate rating. For example, a species listed as poorly known in a state list has potential state significance and is assigned ‘regional/state’ significance.

A4.2 Sites

Site conservation significance is defined as follows:

A site is significant at a particular geographic level (national, state, regional, local) when it is considered to make a substantial contribution to biodiversity at that level.

As a guideline, one per cent of the total extant population of a significant species within a specified geographic area or of the total extant area of a significant ecological community within a specified geographic area is a threshold for ‘substantial contribution’. Comprehensive data are not always available for such assessments and interpretation of available data and information is usually required.

In some cases a site may be small when viewed in isolation but it forms an integral and functional part of a larger site of significance. If there is no ecological reason to divide the larger site, then the rating that applies to the larger site applies to the smaller site.

Sites with a particularly high level of local or regional significance are assigned ‘high local’ or ‘high regional’ significance, respectively. These terms are not applied to state and national levels of significance or to species and communities.

To determine whether a site makes a ‘substantial contribution’ to biological conservation, it is assessed against the following criteria:

- Size – overall size of site or habitats/vegetation communities within the site.
- Significant species and populations – number of significant species or populations known or likely to occur on the site.
- Significant habitat or vegetation communities – presence and extensiveness of significant habitats and vegetation communities on the site.
- Ecological integrity – degree of intactness, level of past disturbance (such as weed invasion) and overall condition of vegetation communities on the site.
- Richness and diversity – quantity of species, vegetation communities and habitats.
- Connectivity – Quality and quantity of linkages between site and adjacent areas of native vegetation/habitat (wildlife corridor value).
- Viability – level of existing and/or future disturbances, degree of existing and/or future fragmentation.
- Distribution – proximity of the site to known distribution limits for significant species, populations, habitats and/or vegetation communities.
- Level of conservation – representation of site attributes in conservation reserves.

As a guideline, *one per cent* of the total extant population of a significant species within a specified geographic area or of the total extant area of a significant ecological community within a specified geographic area is a threshold for ‘substantial contribution’. Comprehensive data are seldom available and interpretation of limited available data and information is usually required.

A4.3 Scale: Geographic Context

Significance is determined within specified geographic contexts:

- Australia
- State Victoria
- Region Northern Inland Slopes Bioregion (DSE Flora Information System)
- Local area Chiltern area (within 5 km of the study area)

A4.4 Conservation Status: Degree of Threat

Official government lists define species and communities that are rare or threatened (and thus significant) at *national* and/or *state* levels. Most of these lists appear as schedules under legislation and are followed unless further evidence is available.

Species and communities that are rare or threatened at *regional* and *local* levels are determined from the available literature, data and information, and consultation with relevant individuals where relevant reports and government listings are not available.

National Significance

Species

Species of national significance are either:

- Flora or fauna listed as extinct, extinct in the wild, critically endangered, endangered or vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*.

- Flora listed as rare in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- Fauna listed as extinct, endangered or vulnerable in Australia in an Action Plan published by Environment Australia.

Communities

Ecological communities of national significance are either:

- Listed as critically endangered, endangered or vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Considered to be rare or threatened in Australia by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Ecological communities include flora and/or fauna communities.

State Significance

Species

Species of state significance in Victoria are either:

- Flora or fauna listed as threatened under the *Flora and Fauna Guarantee Act 1988*.
- Flora listed as extinct, endangered, vulnerable or rare in Victoria in the DSE Flora Information System 2006 Version.
- Flora listed as poorly known in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- Fauna listed as extinct, critically endangered, endangered or vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria, 2003* (DSE 2003) or fauna listed as conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Fauna listed as rare/near-threatened in Australia in an Action Plan published by Environment Australia.

Communities

Ecological communities of state significance in Victoria are either:

- Listed as threatened under the *Flora and Fauna Guarantee Act 1988*.
- Considered to be rare or threatened in Victoria by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Regional Significance

Species

Species of regional significance are:

- Flora recorded from less than 5% of documented sites (quadrats/defined area lists) from the Northern Inland slopes Bioregion in the DSE Flora Information System unless there is reason to believe they are undersampled in the available data.
- Fauna considered to be rare or threatened at the bioregional level by Biosis Research using IUCN criteria where applicable (IUCN 2000) or fauna considered to be near-threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria, 2003* (DSE 2003).

Communities

Ecological communities of regional significance in Victoria are:

- Listed as an endangered, vulnerable or depleted ecological vegetation class within a

- particular bioregion in a Native Vegetation Plan.
- Considered to be rare or threatened at the bioregional level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Local Significance

Species

Species of local significance are:

- Flora or fauna considered to be rare or threatened at the local level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Communities

Ecological communities of local significance are:

- Considered to be rare or threatened at the local level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

No Significance

Species and ecological communities are not significant when they are considered not to be rare or threatened at any geographic level by Biosis Research using IUCN criteria where applicable (IUCN 2000). Species that are not indigenous to a given study area are not significant. Plantings are generally not significant.

APPENDIX 5

Flora Results

A5.1 Flora species recorded within the study area

Table A5.1. Flora species (151 native and 73 weeds) recorded from the study area

Significance of species (Source: DSE Flora Information System)

Status (Australia/Victoria):

V/v Listed under EPBC Act as vulnerable / vulnerable in Victoria
R/r Rare (Briggs & Leigh 1996) / rare in Victoria

Species of regional significance (**49**) are highlighted in **bold**

All indigenous species have at least local significance.

Species	Common Name
Rare or Threatened Native Species	
r <i>Eucalyptus sideroxylon</i>	Mugga
v <i>Goodenia macbarronii</i>	Narrow Goodenia
r <i>Gratiola pumilo</i>	Dwarf Brooklime
Native Species	
<i>Acacia dealbata</i>	Silver Wattle
<i>Acacia gunnii</i>	Ploughshare Wattle
<i>Acacia implexa</i>	Lightwood
<i>Acacia paradoxa</i>	Hedge Wattle
<i>Acacia pycnantha</i>	Golden Wattle
<i>Acacia verniciflua</i>	Varnish Wattle
<i>Acaena echinata</i>	Sheep's Burr
<i>Acaena ovina</i>	Australian Sheep's Burr
<i>Allocasuarina verticillata</i>	Drooping Sheoak
<i>Alternanthera denticulata</i>	Lesser Joyweed
<i>Amphibromus nervosus</i>	Common Swamp Wallaby-grass
<i>Amyema miquelii</i>	Box Mistletoe
<i>Amyema miraculosa</i> subsp. <i>boormanii</i>	Fleshy Mistletoe
<i>Aphanes australiana</i>	Australian Piert
<i>Aristida behriana</i>	Brush Wire-grass
<i>Aristida ramosa</i>	Cane Wire-grass
<i>Arthropodium fimbriatum</i>	Nodding Chocolate-lily
<i>Arthropodium strictum</i>	Chocolate Lily
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass
<i>Austrodanthonia bipartita</i>	Leafy Wallaby-grass
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass
<i>Austrodanthonia duttoniana</i>	Brown-back Wallaby-grass
<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass
<i>Austrodanthonia fulva</i>	Copper-awned Wallaby-grass
<i>Austrodanthonia geniculata</i>	Kneed Wallaby-grass
<i>Austrodanthonia laevis</i>	Smooth Wallaby-grass
<i>Austrodanthonia pilosa</i>	Velvet Wallaby-grass
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Slender Wallaby-grass
<i>Austrodanthonia setacea</i> var. <i>setacea</i>	Bristly Wallaby-grass
<i>Austrostipa densiflora</i>	Dense Spear-grass

Species	Common Name
Native Species (cont.)	
<i>Austrostipa nodosa</i>	Knotty Spear-grass
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Rough Spear-grass
<i>Brachyloma daphnoides</i>	Daphne Heath
<i>Brunonia australis</i>	Blue Pincushion
<i>Bulbine bulbosa</i>	Bulbine Lily
<i>Burchardia umbellata</i>	Milkmaids
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria
<i>Caladenia carnea</i>	Pink Fingers
<i>Callitris glaucophylla</i>	White Cypress-pine
<i>Carex appressa</i>	Tall Sedge
<i>Carex inversa</i>	Knob Sedge
<i>Centipeda elatinoides</i>	Elatine Sneezeweed
<i>Centipeda minima</i> subsp. <i>minima</i>	Spreading Sneezeweed
<i>Centrolepis strigosa</i> subsp. <i>strigosa</i>	Hairy Centrolepis
<i>Chamaesyce drummondii</i>	Flat Spurge
<i>Cheilanthes austrotenuifolia</i>	Green Rock-fern
<i>Cheilanthes distans</i>	Bristly Cloak-fern
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Narrow Rock-fern
<i>Cheiranthra cyanea</i> var. <i>cyanea</i>	Blue Finger-flower
<i>Chenopodium pumilio</i>	Clammy Goosefoot
<i>Chloris truncata</i>	Windmill Grass
<i>Cotula australis</i>	Common Cotula
<i>Crassula decumbens</i> var. <i>decumbens</i>	Spreading Crassula
<i>Crassula sieberiana</i>	Sieber Crassula
<i>Cynoglossum suaveolens</i>	Sweet Hound's-tongue
<i>Cyperus gunnii</i> subsp. <i>gunnii</i>	Flecked Flat-sedge
<i>Cyperus sanguinolentus</i>	Dark Flat-sedge
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea
<i>Desmodium varians</i>	Slender Tick-trefoil
<i>Dianella revoluta</i> var. <i>revoluta</i>	Black-anther Flax-lily
<i>Dillwynia phyllicoides</i>	Small-leaf Parrot-pea
<i>Dillwynia sericea</i>	Showy Parrot-pea
<i>Diuris</i> spp.	Diuris
<i>Drosera glanduligera</i>	Scarlet Sundew
<i>Drosera peltata</i> subsp. <i>auriculata</i>	Tall Sundew
<i>Drosera peltata</i> subsp. <i>peltata</i>	Pale SunDEWHA
<i>Eleocharis acuta</i>	Common Spike-sedge
<i>Eleocharis atricha</i>	Tuber Spike-sedge
<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
<i>Eragrostis brownii</i>	Common Love-grass
<i>Eragrostis diandra</i>	Close-headed Love-grass
<i>Eucalyptus albens</i>	White Box
<i>Eucalyptus blakelyi</i>	Blakely's Red-gum
<i>Eucalyptus camaldulensis</i>	River Red-gum
<i>Eucalyptus macrorhyncha</i>	Red Stringybark
<i>Eucalyptus melliodora</i>	Yellow Box
<i>Eucalyptus nortonii</i>	Silver Bundy
<i>Eucalyptus polyanthemus</i> subsp. <i>vestita</i>	Red Box
<i>Galium gaudichaudii</i>	Rough Bedstraw
<i>Geranium potentilloides</i>	Cinquefoil Cranesbill
<i>Geranium retrorsum</i>	Grassland Cranesbill
<i>Geranium</i> sp. 2	Variable Cranesbill

Species	Common Name
Native Species (cont.)	
<i>Glycine clandestina</i>	Twining Glycine
<i>Glycine tabacina</i>	Variable Glycine
<i>Gompholobium huegelii</i>	Common Wedge-pea
<i>Gonocarpus elatus</i>	Tall Raspwort
<i>Gonocarpus tetragynus</i>	Common Raspwort
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy Goodenia
<i>Goodenia lanata</i>	Trailing Goodenia
<i>Grevillea alpina</i>	Cat's Claw Grevillea
<i>Hibbertia riparia</i>	Erect Guinea-flower
<i>Hovea heterophylla</i>	Common Hovea
<i>Hyalosperma demissum</i>	Moss Sunray
<i>Hydrocotyle callicarpa</i>	Small Pennywort
<i>Hypericum gramineum</i>	Small St John's Wort
<i>Hypoxis vaginata</i> var. <i>vaginata</i>	Yellow Star
<i>Isolepis cernua</i> var. <i>cernua</i>	Nodding Club-sedge
<i>Isolepis hookeriana</i>	Grassy Club-sedge
<i>Isolepis inundata</i>	Swamp Club-sedge
<i>Isotoma fluviatilis</i> ssp. <i>australis</i>	Swamp Isotome
<i>Joycea pallida</i>	Silvertop Wallaby-grass
<i>Juncus amabilis</i>	Hollow Rush
<i>Juncus australis</i>	Austral Rush
<i>Juncus bufonius</i>	Toad Rush
<i>Juncus homalocaulis</i>	Wiry Rush
<i>Juncus planifolius</i>	Broad-leaf Rush
<i>Juncus remotiflorus</i>	Diffuse Rush
<i>Juncus semisolidus</i>	Plains Rush
<i>Juncus subsecundus</i>	Finger Rush
<i>Lachnagrostis filiformis</i>	Common Blown-grass
<i>Lepidosperma laterale</i>	Variable Sword-sedge
<i>Leptorhynchos squamatus</i>	Scaly Buttons
<i>Levenhookia dubia</i>	Hairy Stylewort
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
<i>Luzula meridionalis</i> var. <i>densiflora</i>	Common Woodrush
<i>Lythrum hyssopifolia</i>	Small Loosestrife
<i>Melichrus urceolatus</i>	Urn Heath
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Microseris</i> sp. 3	Yam Daisy
<i>Microtis unifolia</i>	Common Onion-orchid
<i>Myriophyllum</i> spp.	Water-milfoil
<i>Opercularia hispida</i>	Hairy Stinkweed
<i>Ophioglossum lusitanicum</i>	Austral Adder's-tongue
<i>Oxalis chnoodes</i>	Plains Wood-sorrel
<i>Oxalis exilis</i>	Shady Wood-sorrel
<i>Oxalis perennans</i>	Grassland Wood-sorrel
<i>Panicum effusum</i>	Hairy Panic
<i>Persicaria hydropiper</i>	Water Pepper
<i>Persicaria prostrata</i>	Creeping Knotweed
<i>Phragmites australis</i>	Common Reed
<i>Pleurosorus rutifolius</i>	Blanket Fern
<i>Poa sieberiana</i> var. <i>hirtella</i>	Grey Tussock-grass
<i>Poa tenera</i>	Slender Tussock-grass

Species	Common Name
Native Species (cont.)	
<i>Poranthera microphylla</i>	Small Poranthera
<i>Ranunculus sessiliflorus</i>	Annual Buttercup
<i>Rumex brownii</i>	Slender Dock
<i>Schoenus apogon</i>	Common Bog-sedge
<i>Siloxerus multiflorus</i>	Small Wrinklewort
<i>Thelymitra peniculata</i>	Trim Sun-orchid
<i>Thelymitra</i> spp.	Sun Orchid
<i>Themeda triandra</i>	Kangaroo Grass
<i>Thysanotus patersonii</i>	Twining Fringe-lily
<i>Tricoryne elatior</i>	Yellow Rush-lily
<i>Triptilodiscus pygmaeus</i>	Common Sunray
<i>Wurmbea dioica</i>	Common Early Nancy
<i>Xerochrysum viscosum</i>	Shiny Everlasting
Introduced Species	
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Agrostis capillaris</i>	Brown-top Bent
<i>Aira caryophyllea</i>	Silvery Hair-grass
<i>Aira cupaniana</i>	Quicksilver Grass
<i>Aira elegantissima</i>	Delicate Hair-grass
<i>Anagallis arvensis</i>	Pimpernel
<i>Anagallis minima</i>	Chaffweed
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Aphanes microcarpa</i>	Small Piert
<i>Arctotheca calendula</i>	Cape Weed
<i>Avena fatua</i>	Wild Oat
<i>Briza maxima</i>	Large Quaking-grass
<i>Briza minor</i>	Lesser Quaking-grass
<i>Bromus diandrus</i>	Great Brome
<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome
<i>Bromus lanceolatus</i>	Mediterranean Brome
<i>Bromus madritensis</i>	Madrid Brome
<i>Carduus pycnocephalus</i>	Slender Thistle
<i>Centaureum tenuiflorum</i>	Slender Centaury
<i>Cerastium glomeratum</i>	Sticky Mouse-ear Chickweed
<i>Chondrilla juncea</i>	Skeleton Weed
<i>Cirsium vulgare</i>	Spear Thistle
<i>Citrullus lanatus</i>	Camel Melon
<i>Cucumis myriocarpus</i> subsp. <i>leptodermis</i>	Paddy Melon
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
<i>Echium plantagineum</i>	Paterson's Curse
<i>Erodium botrys</i>	Big Heron's-bill
<i>Erodium moschatum</i>	Musky Heron's-bill
<i>Galium aparine</i>	Cleavers
<i>Genista monspessulana</i>	Montpellier Broom
<i>Geranium molle</i> var. <i>molle</i>	Dove's Foot
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hordeum leporinum</i>	Barley-grass
<i>Hypericum perforatum</i> subsp. <i>veronense</i>	St John's Wort
<i>Hypochoeris glabra</i>	Smooth Cat's-ear
<i>Hypochoeris radicata</i>	Cat's Ear
<i>Isolepis hystrix</i>	Awned Club-sedge

Species	Common Name
Introduced Species (cont.)	
<i>Isolepis levynsiana</i>	Tiny Flat-sedge
<i>Juncus capitatus</i>	Capitate Rush
<i>Lactuca serriola</i>	Prickly Lettuce
<i>Lolium rigidum</i>	Wimmera Rye-grass
<i>Malva</i> spp.	Mallow
<i>Medicago polymorpha</i>	Burr Medic
<i>Moenchia erecta</i>	Erect Chickweed
<i>Myosotis discolor</i>	Yellow-and-blue Forget-me-not
<i>Parentucellia latifolia</i>	Red Bartsia
<i>Paspalum dilatatum</i>	Paspalum
<i>Pentaschistis airoides</i> subsp. <i>airoides</i>	False Hair-grass
<i>Petrorhagia dubia</i>	Velvety Pink
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Phytolacca octandra</i>	Red-ink Weed
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa bulbosa</i> var. <i>bulbosa</i>	Bulbous Meadow-grass
<i>Polypogon monspeliensis</i>	Annual Beard-grass
<i>Romulea rosea</i>	Onion Grass
<i>Rosa rubiginosa</i>	Sweet Briar
<i>Setaria parviflora</i>	Slender Pigeon Grass
<i>Sherardia arvensis</i>	Field Madder
<i>Silybum marianum</i>	Variegated Thistle
<i>Solanum nigrum</i>	Black Nightshade
<i>Soliva sessilis</i>	Jo Jo
<i>Sonchus asper</i>	Rough Sow-thistle
<i>Sonchus oleraceus</i>	Common Sow-thistle
<i>Stellaria media</i>	Chickweed
<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover
<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover
<i>Trifolium campestre</i> var. <i>campestre</i>	Hop Clover
<i>Trifolium dubium</i>	Suckling Clover
<i>Trifolium fragiferum</i> var. <i>fragiferum</i>	Strawberry Clover
<i>Trifolium glomeratum</i>	Cluster Clover
<i>Trifolium subterraneum</i>	Subterranean Clover
<i>Vulpia bromoides</i>	Squirrel-tail Fescue
<i>Vulpia myuros</i>	Rat's-tail Fescue

A5.2 Flora species recorded along potential road alignments

Table A5.2. Flora species recorded along potential road alignments within the Eames property

U4067100 (Proposed Road alignment)

Recs 44 (28 native, 16 weeds) Date : 02 Apr 2008 Location : 146°36'44" 36°10'36" Altitude : 220 Collector : SGM Vegetation : Valley Grassy Forest

Species	Common Name
Rare or Threatened Native Species	
r <i>Eucalyptus sideroxylon</i>	Mugga
Native Species	
<i>Amyema miquelii</i>	Box Mistletoe
<i>Aristida behriana</i>	Brush Wire-grass
<i>Aristida ramosa</i>	Cane Wire-grass
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Slender Wallaby-grass
<i>Austrodanthonia setacea</i> var. <i>setacea</i>	Bristly Wallaby-grass
<i>Austrostipa densiflora</i>	Dense Spear-grass
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Rough Spear-grass
<i>Carex appressa</i>	Tall Sedge
<i>Carex inversa</i>	Knob Sedge
<i>Chamaesyce drummondii</i>	Flat Spurge
<i>Chenopodium pumilio</i>	Clammy Goosefoot
<i>Chloris truncata</i>	Windmill Grass
<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
<i>Eragrostis brownii</i>	Common Love-grass
<i>Eragrostis diandra</i>	Close-headed Love-grass
<i>Eucalyptus camaldulensis</i>	River Red-gum
<i>Eucalyptus melliodora</i>	Yellow Box
<i>Eucalyptus polyanthemus</i> subsp. <i>vestita</i>	Red Box
<i>Juncus remotiflorus</i>	Diffuse Rush
<i>Juncus subsecundus</i>	Finger Rush
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Oxalis perennans</i>	Grassland Wood-sorrel
<i>Panicum effusum</i>	Hairy Panic
<i>Poa sieberiana</i> var. <i>hirtella</i>	Grey Tussock-grass
<i>Rumex brownii</i>	Slender Dock
Introduced Species	
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Arctotheca calendula</i>	Cape Weed
<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome
<i>Citrullus lanatus</i>	Camel Melon
<i>Cucumis myriocarpus</i> subsp. <i>leptodermis</i>	Paddy Melon
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
<i>Erodium botrys</i>	Big Heron's-bill
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hypochoeris radicata</i>	Flatweed
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Poa bulbosa</i> var. <i>bulbosa</i>	Bulbous Meadow-grass
<i>Romulea rosea</i>	Onion Grass

<i>Setaria parviflora</i>	Slender Pigeon Grass
<i>Solanum nigrum</i>	Black Nightshade
<i>Trifolium subterraneum</i>	Subterranean Clover
<i>Vulpia bromoides</i>	Squirrel-tail Fescue

U4067200 (potential alternative road alignment)

Recs 28 (12 native, 16 weeds) Date : 02 Apr 2008 Location : 146°36'38" 36°10'42" Altitude : 210 Collector : SGM Vegetation : PIV

Species	Common Name
Native Species	
<i>Austrodanthonia bipartita</i>	Leafy Wallaby-grass
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Slender Wallaby-grass
<i>Carex inversa</i>	Knob Sedge
<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
<i>Eragrostis brownii</i>	Common Love-grass
<i>Eucalyptus blakelyi</i>	Blakely's Red-gum
<i>Eucalyptus camaldulensis</i>	River Red-gum
<i>Juncus subsecundus</i>	Finger Rush
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Rumex brownii</i>	Slender Dock
Introduced Species	
<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Agrostis capillaris</i>	Brown-top Bent
<i>Citrullus lanatus</i>	Camel Melon
<i>Cucumis myriocarpus</i> subsp. <i>leptodermis</i>	Paddy Melon
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hypericum perforatum</i> subsp. <i>veronense</i>	St John's Wort
<i>Hypochoeris radicata</i>	Flatweed
<i>Lolium rigidum</i>	Wimmera Rye-grass
<i>Paspalum dilatatum</i>	Paspalum
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Poa bulbosa</i> var. <i>bulbosa</i>	Bulbous Meadow-grass
<i>Rosa rubiginosa</i>	Sweet Briar
<i>Setaria parviflora</i>	Slender Pigeon Grass
<i>Solanum nigrum</i>	Black Nightshade
<i>Trifolium subterraneum</i>	Subterranean Clover

A5.3 Significant flora species

Table A5.3: Flora of national or state significance recorded or predicted to occur within 5 km of the study area

Source: DSE Flora Information System, DEWHA database

Status (Australia/Victoria):

E/e Listed under EPBC Act as endangered / endangered in Victoria

V/v Listed under EPBC Act as vulnerable / vulnerable in Victoria

R/r Rare (Briggs & Leigh 1996) / rare in Victoria

Source of record:

FIS: Recorded within 5 km of centre of study area, DSE Flora Information System

DEWHA: Species predicted to occur in local area, EPBC Act Protected Matters Search Tool

Scientific name	Common name	Aust. status	Vic. status	Source of record	Likelihood of occurrence
National significance:					
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	V		DEH	Potential habitat present
<i>Caladenia concolor</i>	Crimson Spider-orchid	V	e	FIS	Potential habitat but unlikely
<i>Eucalyptus cadens</i>	Warby Range Swamp-gum	V	v	FIS	Not present
<i>Goodenia macbarronii</i>	Narrow Goodenia	V	v	FIS	Recorded from site
<i>Senecio garlandii</i>	Woolly Ragwort	V	e	FIS	Potential habitat but unlikely
<i>Swainsona recta</i>	Mountain Swainson-pea	E	e	FIS	Potential habitat but unlikely
State significance:					
<i>Acacia deanei</i> subsp. <i>deanei</i>	Deane's wattle		e	FIS	Large species, not seen
<i>Acacia deanei</i> subsp. <i>pauci</i> .	Deane's Wattle		r	FIS	Large species, not seen
<i>Acacia doratoxylon</i>	Currawang		r	FIS	Large species, not seen
<i>Acacia triptera</i>	Spur-wing Wattle		r	FIS	Large species, not seen
<i>Brachyscome gracilis</i>	Dookie Daisy		v	FIS	Potential habitat but unlikely
<i>Calochilus imberbis</i>	Naked Beard-orchid		r	FIS	Potential habitat but unlikely
<i>Calotis cuneifolia</i>	Blue Burr-daisy		r	FIS	Potential habitat but unlikely
<i>Cassinia ozothamnoides</i>	Cottony Cassinia		r	FIS	Large species, not seen
<i>Centipeda nidiformis</i>	Cotton Sneezeweed		r	FIS	Potential habitat but unlikely
<i>Dianella tarda</i>	Late-flower Flax-lily		v	Pers. Obs.	Potential habitat but unlikely
<i>Dipodium hamiltonianum</i>	Yellow Hyacinth-orchid		e	FIS	Potential habitat but unlikely
<i>Diuris punctata</i> var. <i>punct.</i>	Purple Diuris		v	FIS	Potential habitat but unlikely
<i>Eucalyptus</i> aff. <i>cinerea</i> (Be)	Beechworth Silver Stringybark		v	FIS	Large species, not seen
<i>Eucalyptus sideroxylon</i>	Mugga		r	FIS	Recorded from site
<i>Fimbristylis velata</i>	Veiled Fringe-sedge		r	FIS	Potential habitat but unlikely
<i>Goodia medicaginea</i>	Western Golden-tip		r	FIS	Large species, not seen
<i>Indigofera adesmiifolia</i>	Tick Indigo		v	FIS	Large species, not seen
<i>Isoetes pusilla</i>	Small Quillwort		e	FIS	Potential habitat but unlikely
<i>Pultenaea foliolosa</i>	Small-leaf Bush-pea		r	FIS	Large species, not seen
<i>Swainsona galegifolia</i>	Smooth Darling-pea		e	FIS	No suitable habitat present

APPENDIX 6

EVC Benchmarks

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Northern Inland Slopes bioregion

EVC 47: Valley Grassy Forest

Description:

Valley Grassy Forest occurs under moderate rainfall regimes of 700-800 mm per annum on fertile well-drained colluvial or alluvial soils on gently undulating lower slopes and valley floors. Open forest to 20 m tall that may contain a variety of eucalypts, usually species which prefer more moist or more fertile conditions over a sparse shrub cover. In season, a rich array of herbs, lilies, grasses and sedges dominate the ground layer but at the drier end of the spectrum the ground layer may be sparse and slightly less diverse, but with the moisture-loving species still remaining.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	<i>Eucalyptus blakelyi</i>	Blakely's Red-gum
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
	<i>Eucalyptus melliodora</i>	Yellow Box
	<i>Eucalyptus albens</i>	White Box
	<i>Eucalyptus rubida</i>	Candlebark
	<i>Eucalyptus bridgesiana</i>	But But
	<i>Eucalyptus polyanthemus</i>	Red Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	3	10%	T
Medium Shrub	3	10%	MS
Small Shrub	3	5%	SS
Large Herb	1	1%	LH
Medium Herb	8	20%	MH
Small or Prostrate Herb	3	1%	SH
Large Tufted Graminoid	1	1%	LTG
Medium to Small Tufted Graminoid	12	25%	MTG
Medium to Tiny Non-tufted Graminoid	1	5%	MNG
Bryophytes/Lichens	na	20%	BL

EVC 47: Valley Grassy Forest - Northern Inland Slopes bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia dealbata</i>	Silver Wattle
T	<i>Acacia melanoxylon</i>	Blackwood
T	<i>Exocarpos cupressiformis</i>	Cherry Ballart
MS	<i>Cassinia aculeata</i>	Dogwood
MS	<i>Dodonaea viscosa</i> ssp. <i>angustissima</i>	Narrow-leaf Hop-bush
MS	<i>Indigofera australis</i>	Austral Indigo
SS	<i>Hibbertia riparia</i>	Erect Guinea-flower
SS	<i>Hibbertia obtusifolia</i>	Grey Guinea-flower
SS	<i>Platylobium formosum</i>	Handsome Flat-pea
LH	<i>Senecio quadridentatus</i>	Cotton Fireweed
LH	<i>Wahlenbergia stricta</i>	Tall Bluebell
MH	<i>Gonocarpus tetragynus</i>	Common Raspwort
MH	<i>Hypericum gramineum</i>	Small St John's Wort
MH	<i>Geranium solanderi</i> s.l.	Austral Cranesbill
SH	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
SH	<i>Desmodium varians</i>	Slender Tick-trfoil
MTG	<i>Lomandra filiformis</i>	Wattle Mat-rush
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
MTG	<i>Schoenus apogon</i>	Common Bog-sedge
MTG	<i>Arthropodium strictum</i> s.l.	Chocolate Lily
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
GF	<i>Cheilanthes austrotenuifolia</i>	Green Rock-fern
SC	<i>Hardenbergia violacea</i>	Purple Coral-pea
SC	<i>Glycine clandestina</i>	Twining Glycine

Recruitment:
Continuous

Organic Litter:
20 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Hypericum perforatum</i>	St John's Wort	high	high
LH	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	high	low
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	low
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Anagallis arvensis</i>	Pimpernel	high	low
MH	<i>Hypochoeris glabra</i>	Smooth Cat's-ear	high	low
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Briza minor</i>	Lesser Quaking-grass	high	low
MTG	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	Soft Brome	high	low
MTG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Northern Inland Slopes bioregion

EVC 61: Box Ironbark Forest

Description:

Occurs in low rainfall areas on gently undulating rises, low hills and penepains on infertile, often stony soils derived from a range of geologies. Open eucalypt forest to 20 m tall, often including one of the Ironbark species. The mid storey often forms a dense to open small tree or shrub layer over an open ground layer ranging from a sparse to well-developed suite of herbs and grasses.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	<i>Eucalyptus sideroxylon</i> s.s.	Mugga
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
	<i>Eucalyptus polyanthemus</i>	Red Box
	<i>Eucalyptus microcarpa</i>	Grey Box

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	5	10%	MS
Small Shrub	5	15%	SS
Prostrate Shrub	1	1%	PS
Large Herb	2	5%	LH
Medium Herb	6	15%	MH
Small or Prostrate Herb	1	1%	SH
Large Tufted Graminoid	1	5%	LTG
Medium to Small Tufted Graminoid	8	20%	MTG
Scrambler or Climber	1	1%	SC
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C
Total understorey projective foliage cover		85%	

LF Code	Species typical of at least part of EVC range	Common Name
MS	<i>Acacia pycnantha</i>	Golden Wattle
MS	<i>Grevillea alpina</i>	Cat's Claw Grevillea
MS	<i>Cassinia arcuata</i>	Drooping Cassinia
MS	<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea
SS	<i>Hibbertia riparia</i>	Erect Guinea-flower
SS	<i>Hibbertia obtusifolia</i>	Grey Guinea-flower
SS	<i>Dillwynia sericea</i> s.l.	Showy Parrot-pea
PS	<i>Acrotriche serrulata</i>	Honey-pots
PS	<i>Astroloma humifusum</i>	Cranberry Heath
LH	<i>Xerochrysum bracteatum</i>	Golden Everlasting
LH	<i>Senecio tenuiflorus</i>	Slender Fireweed
MH	<i>Gonocarpus tetragynus</i>	Common Raspwort
MH	<i>Goodenia hederacea</i>	Ivy Goodenia
MH	<i>Drosera peltata</i> ssp. <i>auriculata</i>	Tall Sundew
SH	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
MTG	<i>Lomandra filiformis</i>	Wattle Mat-rush
MTG	<i>Poa sieberiana</i>	Grey Tussock-grass
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
MTG	<i>Austrostipa scabra</i>	Rough Spear-grass
EP	<i>Amyema miquelii</i>	Box Mistletoe
SC	<i>Hardenbergia violacea</i>	Purple Coral-pea

EVC 61: Box Ironbark Forest - Northern Inland Slopes bioregion

Recruitment:

Continuous

Organic Litter:

20 % cover

Logs:

20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Hypochoeris glabra</i>	Smooth Cat's-ear	high	low
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Northern Inland Slopes bioregion

EVC 68: Creekline Grassy Woodland

Description:

Eucalypt-dominated woodland to 15 m tall with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. Occurs on low-gradient ephemeral to intermittent drainage lines, typically on fertile colluvial/alluvial soils, on a wide range of suitably fertile geological substrates. These minor drainage lines can include a range of graminoid and herbaceous species tolerant of waterlogged soils, and are presumed to have sometimes resembled a linear wetland or system of interconnected small ponds.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	<i>Eucalyptus camaldulensis</i>	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	4	10%	MS
Small Shrub	3	5%	SS
Large Herb	2	5%	LH
Medium Herb	9	15%	MH
Small Herb*	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	16	35%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia dealbata</i>	Silver Wattle
T	<i>Acacia melanoxylon</i>	Blackwood
MS	<i>Acacia pycnantha</i>	Golden Wattle
MS	<i>Melaleuca parvistaminea</i>	Rough-barked Haoney-myrtle
MS	<i>Acacia retinodes</i> var. <i>retinodes</i>	Wilrilda
SS	<i>Pimelea humilis</i>	Common Rice-flower
PS	<i>Astroloma humifusum</i>	Cranberry Heath
LH	<i>Senecio tenuiflorus</i>	Slender Fireweed
LH	<i>Senecio quadridentatus</i>	Cottony Fireweed
MH	<i>Centipeda cunninghamii</i>	Common Sneezeweed
MH	<i>Hypericum gramineum</i>	Small St John's Wort
SH	<i>Dichondra repens</i>	Kidneyweed
LTG	<i>Carex appressa</i>	Tall Sedge
LNG	<i>Phragmites australis</i>	Common Reed
MTG	<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass
MTG	<i>Poa labillardierei</i>	Common Tussock-grass
MTG	<i>Juncus</i> spp.	Rush
MTG	<i>Cyperus</i> spp.	Flat-sedge
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass

EVC 68: Creekline Grassy Woodland - Northern Inland Slopes bioregion

Recruitment:

Continuous

Organic Litter:

40 % cover

Logs:

30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	<i>Cirsium vulgare</i>	Spear Thistle	high	high
LH	<i>Sonchus oleraceus</i>	Common Sow-thistle	high	low
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Anagallis arvensis</i>	Pimpernel	high	low
MH	<i>Hypochoeris glabra</i>	Smooth Cat's-ear	high	low
MH	<i>Galium murale</i>	Small Goosegrass	high	low
MH	<i>Oxalis pes-caprae</i>	Soursob	high	high
LTG	<i>Juncus acutus</i>	Spiny Rush	high	high
LTG	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	high	high
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MTG	<i>Briza minor</i>	Lesser Quaking-grass	high	low
MTG	<i>Romulea rosea</i>	Onion Grass	high	low
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	Soft Brome	high	low
MNG	<i>Aira elegantissima</i>	Delicate Hair-grass	high	low
MNG	<i>Vulpia muralis</i>	Wall Fescue	high	low
MNG	<i>Bromus madritensis</i>	Madrid Brome	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Northern Inland Slopes bioregion

EVC 175_62: Rainshadow Grassy Woodland

Description:

A variable open eucalypt woodland to 15 m tall over a diverse ground layer of grasses and herbs. The shrub component is usually sparse. It occurs on sites with moderate fertility on gentle slopes or undulating hills on a range of geologies.

Large trees:

Species	DBH(cm)	#/ha
<i>Eucalyptus</i> spp.	70 cm	15 / ha
<i>Brachychiton</i> spp.	50 cm	

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	<i>Eucalyptus albens</i>	White Box
	<i>Eucalyptus polyanthemus</i>	Red Box
	<i>Eucalyptus melliodora</i>	Yellow Box
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
	<i>Brachychiton populneus</i> ssp. <i>populneus</i>	Kurrajong

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	1	5%	MS
Small Shrub	1	1%	SS
Prostrate Shrub	2	5%	PS
Large Herb	2	5%	LH
Medium Herb	13	20%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	1	1%	LTG
Medium to Small Tufted Graminoid	15	40%	MTG
Medium to Tiny Non-tufted Graminoid	3	5%	MNG
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	<i>Acacia implexa</i>	Lightwood
MS	<i>Acacia verniciflua</i>	Varnish Wattle
MS	<i>Acacia rubida</i>	Red-stem Wattle
SS	<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea
SS	<i>Cheiranthra cyanea</i> var. <i>cyanea</i>	Blue Finger-flower
PS	<i>Astroloma humifusum</i>	Cranberry Heath
LH	<i>Wahlenbergia stricta</i>	Tall Bluebell
LH	<i>Wahlenbergia luteola</i>	Bronze Bluebell
MH	<i>Gonocarpus tetragynus</i>	Common Raspwort
MH	<i>Geranium solanderi</i> s.l.	Austral Cranesbill
SH	<i>Cymbonotus preissianus</i>	Austral Bear's-ear
SH	<i>Solenogyne dominii</i>	Smooth Solenogyne
SH	k <i>Desmodium varians</i>	Slender Tick-trefoil
LTG	<i>Juncus flavidus</i>	Gold Rush
LTG	<i>Austrostipa densiflora</i>	Dense Spear-grass
MTG	<i>Bothriochloa macra</i>	Red-leg Grass
MTG	<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily
MTG	<i>Poa sieberiana</i>	Grey Tussock-grass
MTG	<i>Themeda triandra</i>	Kangaroo Grass
MNG	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
TTG	<i>Isolepis marginata</i>	Little Club-sedge
GF	<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>	Narrow Rock-fern
SC	<i>Glycine clandestina</i>	Twining Glycine
SC	<i>Convolvulus erubescens</i> spp. agg.	Pink Bindweed

EVC 175_62: Rainshadow Grassy Woodland - Northern Inland Slopes bioregion

Recruitment:

Continuous

Organic Litter:

20 % cover

Logs:

10 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	<i>Hypochoeris radicata</i>	Cat's Ear	high	low
MH	<i>Cicendia quadrangularis</i>	Square Cicendia	high	low
MH	<i>Hypochoeris glabra</i>	Smooth Cat's-ear	high	low
MH	<i>Trifolium dubium</i>	Suckling Clover	high	low
MH	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	high	low
MH	<i>Petrorhagia velutina</i>	Velvety Pink	high	low
MH	<i>Trifolium subterraneum</i>	Subterranean Clover	high	low
MH	<i>Centaureum erythraea</i>	Common Centaury	high	low
MH	<i>Parentucellia latifolia</i>	Red Bartsia	high	low
MH	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover	high	low
MH	<i>Moenchia erecta</i>	Erect Chickweed	high	low
MH	<i>Galium divaricatum</i>	Slender Bedstraw	high	low
MH	<i>Arctotheca calendula</i>	Cape Weed	high	low
LNG	<i>Holcus lanatus</i>	Yorkshire Fog	high	high
MTG	<i>Romulea rosea</i>	Onion Grass	high	low
MTG	<i>Vulpia bromoides</i>	Squirrel-tail Fescue	high	low
MTG	<i>Briza minor</i>	Lesser Quaking-grass	high	low
MTG	<i>Briza maxima</i>	Large Quaking-grass	high	low
MNG	<i>Juncus capitatus</i>	Capitate Rush	high	low
MNG	<i>Holcus setosus</i>	Annual Fog	high	low
MNG	<i>Avena barbata</i>	Bearded Oat	high	low
MNG	<i>Aira cupaniana</i>	Quicksilver Grass	high	low
MNG	<i>Aira elegantissima</i>	Delicate Hair-grass	high	low
MNG	<i>Aira caryophyllea</i>	Silvery Hair-grass	high	low
TTG	<i>Cyperus tenellus</i>	Tiny Flat-sedge	high	low

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APPENDIX 7

Location and DBH data for Large Old Trees

Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch	Impact (Y/N)	Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch	Impact (Y/N)
1	466751	5996400	939	15	Y	170	466092	5996736	560		
2	466662	5996328	1108	1	Y	171	466087	5996721	688		
3	466632	5996315	1000	1	Y	172	466084	5996720	550		
4	466630	5996300	701	1	Y	173	466082	5996714	568		
5	466608	5996333	827	1	Y	174	466142	5996655	1142		
6	466614	5996348	898	1	Y	175	466173	5996712	830		
7	466613	5996354	769	1	Y	176	466260	5996594	571		
8	466621	5996368	855	1	Y	177	466261	5996550	1043		
9	466613	5996385	895	1	Y	178	466288	5996547	703		
10	466580	5996389	790	1	Y	179	466325	5996517	1090		
11	466580	5996392	842	1	Y	180	466354	5996501	982		
12	466597	5996374	790	1	Y	181	466333	5996497	990		
13	466590	5996350	785	1	Y	182	466324	5996493	753		
14	466591	5996341	671			183	466318	5996491	720		
15	466584	5996328	613			184	466277	5996454	1076		
16	466575	5996328	836			185	466268	5996445	895		
17	466546	5996361	781			186	466267	5996428	906		N
18	466513	5996337	859			187	466266	5996423	691		
19	466503	5996338	1150			188	466260	5996417	1171		
20	466462	5996351	778			189	466255	5996424	658		
21	466462	5996351	549			190	466273	5996460	1095		
22	466456	5996327	741			191	466237	5996434	894		
23	466461	5996325	709			192	466246	5996461	757		
24	466462	5996318	889			193	466240	5996474	1050		
25	466459	5996316	633			194	466240	5996508	554		
26	466459	5996316	676			195	466238	5996515	522		
27	466429	5996286	796			196	466219	5996511	834		
28	466389	5996286	839			197	466292	5996524	1030		
29	466373	5996262	860			198	466297	5996523	669		
30	466356	5996277	853			199	466295	5996524	621		
31	466380	5996321	715			200	466484	5996503	728		
32	466416	5996333	677			201	466496	5996505	766		
33	466358	5996406	888			202	466490	5996529	591		
34	466451	5996451	1073			203	466506	5996536	654		
35	466320	5996282	667			204	466511	5996536	593		
36	466274	5996243	820			205	466514	5996544	752		
37	466250	5996249	735			206	466491	5996545	990		
38	466248	5996245	947			207	466482	5996544	644		
39	466233	5996238	674			208	466476	5996544	916		
40	466223	5996228	559			209	466473	5996545	526		
41	466205	5996215	822			210	466473	5996547	660		
42	466209	5996208	578			211	466455	5996556	912		
43	466200	5996208	656			212	466467	5996560	644		
44	466202	5996200	691			213	466469	5996558	664		
45	466176	5996224	888			214	466479	5996566	698		
46	466166	5996241	814			215	466515	5996590	712		
47	466151	5996272	1165			216	466527	5996592	527		
48	466130	5996226	749			217	466533	5996605	752		
49	466103	5996217	1134			218	466529	5996618	771		

Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)	Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)
50	466090	5996191	1017		219	466516	5996632	735	
51	466082	5996191	946		220	466509	5996629	790	
52	466081	5996185	841		221	466508	5996616	781	
53	466085	5996163	679		222	466505	5996608	577	
54	466094	5996163	629		223	466506	5996607	593	
55	466090	5996176	765		224	466491	5996597	610	
56	466097	5996178	636		225	466482	5996618	842	
57	466102	5996161	709		226	466479	5996623	600	
58	466112	5996167	749		227	466470	5996616	708	
59	466115	5996191	737		228	466460	5996617	528	
60	466119	5996195	628		229	466463	5996619	601	
61	466148	5996180	860		230	466446	5996625	773	
62	466149	5996191	719		231	466443	5996616	595	
63	466149	5996195	591		232	466448	5996612	548	
64	466019	5996163	1079		233	466448	5996608	549	
65	466012	5996150	793		234	466451	5996601	641	
66	466003	5996170	1033		235	466454	5996582	745	
67	465997	5996179	1356	N	236	466452	5996580	577	
68	465976	5996207	1392		237	466446	5996573	650	
69	465948	5996233	881		238	466428	5996577	1030	
70	465929	5996281	683		239	466427	5996591	720	
71	465828	5996299	681		240	466424	5996593	582	
72	465830	5996295	727		241	466403	5996580	796	
73	465831	5996293	695		242	466401	5996584	743	
74	465833	5996291	651		243	466400	5996632	648	
75	465828	5996279	766		244	466329	5996600	746	
76	465831	5996271	754		245	465804	5996125	695	
77	465833	5996258	756		246	465814	5996129	519	
78	465848	5996251	796		247	465819	5996123	507	
79	465821	5996253	968		248	465819	5996121	712	
80	465826	5996245	680		249	465864	5996098	1425	
81	465826	5996245	594		250	465903	5996046	581	
82	465826	5996245	530		251	465906	5996042	760	
83	465817	5996240	541		252	466546	5996644	541	
84	465817	5996234	526		253	466552	5996634	502	
85	465814	5996227	1111		254	466552	5996631	500	
86	465809	5996216	521		255	466561	5996638	504	
87	465821	5996210	529		256	466566	5996640	751	
88	465821	5996212	542		257	466569	5996631	576	
89	465821	5996199	675		258	466602	5996592	517	
90	465820	5996195	717		259	466608	5996592	828	
91	465809	5996205	509		260	466614	5996588	771	
92	465811	5996197	828		261	466616	5996583	511	
93	465803	5996201	509		262	466614	5996566	757	
94	465815	5996175	983		263	466655	5996546	855	N
95	465811	5996169	519		264	466703	5996567	665	
96	465794	5996184	659		265	466653	5996611	777	
97	465793	5996180	806		266	466636	5996607	696	
98	465793	5996175	708		267	466634	5996605	738	
99	465808	5996158	750		268	466644	5996585	710	

Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)	Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)
100	465837	5996303	529		269	466652	5996583	720	
101	465842	5996308	545		270	466656	5996589	719	
102	465845	5996310	656		271	466633	5996620	533	
103	465846	5996316	566		272	466630	5996629	589	
104	465846	5996319	671		273	466609	5996627	596	
105	465851	5996319	570		274	466608	5996631	640	
106	465842	5996327	553		275	466606	5996635	508	
107	465846	5996330	922		276	466051	5996019	735	
108	465849	5996332	539		277	466111	5996002	742	
109	465860	5996332	582		278	466185	5996038	805	
110	465852	5996340	739		279	466240	5995994	632	
111	465861	5996353	558		280	466278	5995997	948	
112	465860	5996356	626		281	466303	5996003	723	
113	465869	5996366	501		282	466308	5995998	583	
114	465867	5996367	610		283	466308	5995994	637	
115	465869	5996369	647		284	466311	5995999	706	
116	465869	5996371	622		285	466323	5995998	634	
117	465858	5996373	800		286	466326	5996003	1031	
118	465861	5996390	509		287	466294	5996010	1050	
119	465858	5996395	536		288	466363	5996003	695	
120	465870	5996393	524		289	466387	5996000	1087	
121	465871	5996403	797		290	466392	5996007	672	
122	465871	5996408	702		291	466400	5996009	773	
123	465870	5996423	553		292	466411	5996007	568	
124	465862	5996425	507		293	466411	5996005	552	
125	465862	5996427	584		294	466415	5996013	558	
126	465862	5996430	725		295	466432	5996013	562	
127	465864	5996432	580		296	466444	5996013	539	
128	465877	5996436	688		297	466448	5996009	766	
129	465879	5996440	717		298	466457	5996007	880	
130	465874	5996441	563		299	466462	5996015	551	
131	465867	5996445	575		300	466466	5996017	511	
132	465868	5996449	585		301	466468	5996024	532	
133	465868	5996458	747		302	466495	5996026	916	
134	465879	5996456	643		303	466505	5996030	566	
135	465879	5996465	678		304	466505	5996028	776	
136	465862	5996484	823		305	466514	5996021	657	
137	465864	5996489	510		306	466523	5996019	693	
138	465864	5996493	577		307	466525	5996022	505	
139	465870	5996495	703		308	466562	5996034	751	
140	465876	5996488	583		309	466571	5996028	600	
141	465877	5996486	626		310	466582	5996024	1083	
142	465934	5996432	1395		311	466613	5996034	565	
143	465928	5996375	683		312	466616	5996041	649	
144	465881	5996521	777		313	466631	5996038	525	
145	465896	5996547	711		314	466633	5996038	570	
146	465910	5996569	750		315	466633	5996041	503	
147	465940	5996599	578		316	466642	5996045	636	
148	465954	5996617	750		317	466649	5996038	515	
149	465968	5996612	507		318	466654	5996036	655	

Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)	Tree #	Easting MGA Zone 55 (GDA94)	Northing MGA Zone 55 (GDA94)	Diameter of tree (mm)	Patch Impact (Y/N)
150	465969	5996617	504		319	466654	5996043	632	
151	465978	5996632	561		320	466673	5996051	673	
152	465978	5996634	507		321	466675	5996056	506	
153	465987	5996653	509		322	466678	5996053	744	
154	465998	5996653	673		323	466684	5996051	680	
155	466002	5996664	565		324	466681	5996045	660	
156	466008	5996660	548		325	466684	5996045	590	
157	466017	5996675	502		326	466684	5996042	570	
158	466025	5996680	675		327	466706	5996055	599	
159	466029	5996679	1000		328	466708	5996056	817	
160	466035	5996688	512		329	466709	5996055	676	
161	466035	5996692	581		330	466740	5996245	625	
162	466035	5996695	672		331	466756	5996288	641	
163	466034	5996693	521		332	466650	5996252	850	
164	466046	5996688	798		333	466623	5996211	680	
165	466064	5996701	504		334	466559	5996194	506	
166	466067	5996705	539		335	466501	5996223	1140	
167	466062	5996718	541		336	466413	5996218	989	
168	466069	5996729	654		337	466428	5996200	680	
169	466089	5996738	507		338	466419	5996198	763	

Additional trees measured to the east of the Work Authority (additional offsets)

Lat(WGS84)	Long(WGS84)	ID#	Dia	Lat(WGS84)	Long(WGS84)	ID#	Dia
3610.55	14636.58	601	920	3610.803	14636.87	654	950
3610.556	14636.58	602	840	3610.793	14636.88	655	720
3610.562	14636.59	603	910	3610.809	14636.89	656	800
3610.569	14636.57	604	500	3610.802	14636.9	657	740
3610.57	14636.57	605	500	3610.801	14636.9	658	630
3610.571	14636.56	606	520	3610.8	14636.9	659	720
3610.557	14636.56	607	840	3610.814	14636.9	660	1480
3610.552	14636.56	608	700	3610.827	14636.88	661	660
3610.567	14636.56	609	650	3610.826	14636.87	662	790
3610.574	14636.56	610	550	3610.834	14636.89	663	930
3610.565	14636.55	611	500	3610.84	14636.88	664	650
3610.57	14636.55	612	530	3610.844	14636.86	665	1090
3610.571	14636.54	613	630	3610.861	14636.83	666	930
3610.567	14636.54	614	730	3610.867	14636.81	667	610
3610.564	14636.54	615	840	3610.858	14636.82	668	610
3610.561	14636.53	616	720	3610.857	14636.82	669	580
3610.554	14636.53	617	710	3610.855	14636.81	670	580
3610.547	14636.53	618	650	3610.86	14636.81	671	600
3610.543	14636.53	619	500	3610.86	14636.81	672	600
3610.538	14636.54	620	620	3610.853	14636.8	673	850
3610.543	14636.55	621	610	3610.855	14636.8	674	550
3610.599	14636.56	622	590	3610.859	14636.79	675	510
3610.598	14636.56	623	620	3610.842	14636.8	676	630
3610.599	14636.55	624	1070	3610.842	14636.8	677	890
3610.655	14636.62	625	830	3610.847	14636.79	678	560
3610.656	14636.61	626	1010	3610.862	14636.78	679	1020

Lat(WGS84)	Long(WGS84)	ID#	Dia	Lat(WGS84)	Long(WGS84)	ID#	Dia
3610.533	14636.62	627	980	3610.855	14636.77	680	610
3610.73	14636.87	628	760	3610.854	14636.75	681	775
3610.723	14636.87	629	530	3610.848	14636.75	682	1130
3610.721	14636.87	630	720	3610.871	14636.72	683	720
3610.728	14636.87	631	730	3610.871	14636.72	684	520
3610.733	14636.86	632	570	3610.872	14636.73	685	530
3610.73	14636.84	633	770	3610.875	14636.72	686	530
3610.734	14636.85	634	530	3610.874	14636.72	687	600
3610.739	14636.85	635	500	3610.899	14636.73	688	930
3610.743	14636.85	636	530	3610.829	14636.7	689	600
3610.744	14636.85	637	510	3610.829	14636.69	690	720
3610.744	14636.85	638	620	3610.829	14636.69	691	740
3610.741	14636.86	639	610	3610.826	14636.69	692	690
3610.742	14636.87	640	670	3610.805	14636.71	693	1110
3610.757	14636.84	641	1060	3610.805	14636.73	694	900
3610.769	14636.86	642	660	3610.839	14636.73	695	1040
3610.769	14636.86	643	630	3610.832	14636.75	696	670
3610.774	14636.86	644	550	3610.826	14636.75	697	550
3610.777	14636.87	645	530	3610.825	14636.75	698	550
3610.79	14636.85	646	570	3610.822	14636.75	699	610
3610.793	14636.85	647	500	3610.82	14636.75	700	550
3610.792	14636.86	648	540	3610.827	14636.78	701	605
3610.803	14636.84	649	710	3610.825	14636.79	702	590
3610.81	14636.84	650	660	3610.824	14636.79	703	640
3610.804	14636.85	651	570	3610.824	14636.79	704	670
3610.815	14636.85	652	520	3610.818	14636.8	705	700
3610.816	14636.87	653	1010	3610.833	14636.82	706	520
				3610.831	14636.81	708	510
				3610.829	14636.81	709	505
				3610.827	14636.82	710	860
				3610.817	14636.82	711	610
				3610.809	14636.82	712	1220
				3610.761	14636.78	713	1230
				3610.755	14636.74	716	650
				3610.706	14636.78	717	1010
				3610.693	14636.78	718	650
				3610.691	14636.79	719	770
				3610.704	14636.81	720	920
				3610.911	14636.88	721	1310
				3610.912	14636.88	722	600
				3610.914	14636.86	723	1100

APPENDIX 8

Fauna Results

A8.1 Fauna species recorded within the study area

Table A8.1. Terrestrial vertebrate fauna recorded from the study area

Key:

- # recorded within the study area by N. Shedvin, Healesville Sanctuary
* introduced species

Common Name	Scientific Name	Record from AVW database	Recorded during present assessment
Birds			
Brown Quail	<i>Coturnix ypsilophora</i>	•	
Peaceful Dove	<i>Geopelia striata</i>	•	•
Crested Pigeon	<i>Ocyphaps lophotes</i>		•
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	•	
Masked Lapwing	<i>Vanellus miles</i>		•
Black-fronted Dotterel	<i>Elseyornis melanops</i>		•
Straw-necked Ibis	<i>Threskiornis spinicollis</i>		•
Pacific Black Duck	<i>Anas superciliosa</i>		•
White-faced Heron	<i>Egretta novaehollandiae</i>	•	•
Brown Goshawk	<i>Accipiter fasciatus</i>		•
Wedge-tailed Eagle	<i>Aquila audax</i>		•
Black-shouldered Kite	<i>Elanus axillaris</i>		•
Brown Falcon	<i>Falco berigora</i>	•	•
Black Falcon	<i>Falco subniger</i>		•
Nankeen Kestrel	<i>Falco cenchroides</i>		•
Peregrine Falcon	<i>Falco peregrinus</i>		•
Southern Boobook	<i>Ninox novaeseelandiae</i>		•
Barking Owl#	<i>Ninox connivens</i>	•	
Galah	<i>Cacatua roseicapilla</i>	•	•
Eastern Rosella	<i>Platycercus eximius</i>		•
Red-rumped Parrot	<i>Psephotus haematonotus</i>		•
Turquoise Parrot	<i>Neophema pulchella</i>	•	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	•	•
Sacred Kingfisher	<i>Todiramphus sanctus</i>		•
Rainbow Bee-eater	<i>Merops ornatus</i>		•
Pallid Cuckoo	<i>Cuculus pallidus</i>		•
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	•	
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	•	
Welcome Swallow	<i>Hirundo neoxena</i>		•
Grey Fantail	<i>Rhipidura albiscarpa</i>	•	•
Willie Wagtail	<i>Rhipidura leucophrys</i>	•	•
Leaden Flycatcher	<i>Myiagra rubecula</i>		•
Restless Flycatcher	<i>Myiagra inquieta</i>	•	•
Jacky Winter	<i>Microeca fascinans</i>	•	•
Hooded Robin	<i>Melanodryas cucullata</i>	•	•
Eastern Yellow Robin	<i>Eopsaltria australis</i>	•	
Rufous Whistler	<i>Pachycephala rufiventris</i>	•	•

Common Name	Scientific Name	Record from AVW database	Recorded during present assessment
Gilbert's Whistler	<i>Pachycephala inornata</i>	●	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	●	●
Magpie-lark	<i>Grallina cyanoleuca</i>	●	●
Crested Shrike-tit	<i>Falcunculus frontatus</i>	●	●
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	●	●
White-winged Triller	<i>Lalage sueurii</i>		●
White-browed Babbler	<i>Pomatostomus superciliosus</i>		●
White-throated Gerygone	<i>Gerygone olivacea</i>	●	●
Weebill	<i>Smicrornis brevirostris</i>		●
Southern Whiteface	<i>Aphelocephala leucopsis</i>	●	●
Yellow Thornbill	<i>Acanthiza nana</i>		●
Brown Thornbill	<i>Acanthiza pusilla</i>	●	
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	●	●
Speckled Warbler	<i>Chthonicola sagittata</i>	●	●
Rufous Songlark	<i>Cincloramphus mathewsi</i>		●
Superb Fairy-wren	<i>Malurus cyaneus</i>		●
White-browed Woodswallow	<i>Atramus superciliosus</i>	●	●
Dusky Woodswallow	<i>Artamus cyanopterus</i>		●
Varied Sittella	<i>Daphoenositta chrysoptera</i>	●	
Brown Treecreeper	<i>Climacteris picumna victoriae</i>		●
White-throated Treecreeper	<i>Cormobates leucophaeus</i>	●	●
Mistletoebird	<i>Dicaeum hirundinaceum</i>	●	●
Spotted Pardalote	<i>Pardalotus punctatus</i>	●	●
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	●	
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	●	●
Painted Honeyeater	<i>Grantiella picta</i>	●	●
Regent Honeyeater	<i>Xanthomyza phrygia</i>	●	
Fuscous Honeyeater	<i>Lichenostomus fuscus</i>		●
Yellow-tufted Honeyeater	<i>Lichenostomus melanops</i>		●
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	●	●
Noisy Miner	<i>Manorina melanocephala</i>		●
Red Wattlebird	<i>Anthochaera carunculata</i>	●	●
Richard's Pipit	<i>Anthus novaeseelandiae</i>		●
Red-browed Finch	<i>Neochmia temporalis</i>	●	
Olive-backed Oriole	<i>Oriolus sagittatus</i>		●
White-winged Chough	<i>Corcorax melanorhamphos</i>	●	●
Grey Butcherbird	<i>Cracticus torquatus</i>		●
Australian Magpie	<i>Gymnorhina tibicen</i>	●	●
Australian Raven	<i>Corvus coronoides</i>	●	●
Striated Pardalote	<i>Pardalotus striatus</i>	●	
Mammals			
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		●
Yellow-footed Antechinus	<i>Antechinus flavipes</i>		●
Common Brushtail Possum	<i>Trichosurus vulpecula</i>		●
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		●
White-striped Freetail Bat	<i>Tadarida australis</i>		●
Gould's Wattleed Bat	<i>Chalinolobus gouldii</i>		●
Chocolate Wattleed Bat	<i>Chalinolobus morio</i>		●
Little Forest Bat	<i>Vespadelus vulturinus</i>		●
Large Forest Bat	<i>Vespadelus darlingtoni</i>		●
European Rabbit*	<i>Oryctolagus cuniculus</i>	●	●

Common Name	Scientific Name	Record from AVW database	Recorded during present assessment
Red Fox*	<i>Canis vulpes</i>	●	●
Southern Freetail Bat (long penis)	<i>Mormopterus sp.</i>		●
Long-eared Bat	<i>Nyctophilus spp.</i>		●
Reptiles			
Tree Goanna	<i>Varanus varius</i>	●	●
Large Striped Skink	<i>Ctenotus robustus</i>	●	●
Three-toed Skink	<i>Hemiergus decresiensis</i>		●
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		●
Eastern Brown Snake	<i>Pseudonaja textilis</i>		●
Olive Legless Lizard	<i>Delma inornata</i>		●
Carnaby's Wall Skink	<i>Cryptoblepharus carnabyi</i>		●
Boulenger's Skink	<i>Morthia boulengeri</i>		●
Garden Skink	<i>Lampropholis guichenoti</i>		●
Rainbow Skink	<i>Carlia tetradactyla</i>		●
Eastern Stone Gecko	<i>Diplodactylus vittatus</i>		●
Amphibians			
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>		●
Plains Froglet	<i>Crinia parinsignifera</i>		●
Peron's Tree Frog	<i>Litoria peronii</i>		●

A8.2 Significant fauna species

Table A8.2. Fauna of national, state and regional significance recorded, or predicted to occur, within the local area

Source: DSE Atlas of Victorian Wildlife, BA database, DEWHA database

- All database searches encompassed a 5 km radius of study area

Status of species:

CR	critically endangered
EN	endangered
VU	vulnerable
NT	near threatened
DD	data deficient (insufficient known)
R	rare or insufficient known
L	listed under Flora and Fauna Guarantee Act

Sources used to derive species status:

EPBC *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)

DSE Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2003)

FFG *Flora and Fauna Guarantee Act 1988* (Vic.)

Action Plans: Maxwell et al. (1996) for marsupials and monotremes, Duncan et al. (1999) for bats, Lee (1995) for rodents, Garnett and Crowley (2000) for birds, Cogger et al. (1993) for reptiles, Tyler (1997) for amphibians.

denotes species predicted to occur or with habitat predicted to occur in the local area (DEWHA database)

Common Name	Scientific Name	Last Record	EPBC Act	DSE 2003	FFG Act	Action Plan	Likelihood of Occurrence
National significance							
Australian Painted Snipe	<i>Rostratula australis</i>	#	VU	CR	L	VU	Unlikely. Sub-optimal wetland habitat.
Superb Parrot	<i>Polytelis swainsonii</i>	#	VU	EN	L	VU	Unlikely. Study area outside normal range.
Swift Parrot	<i>Lathamus discolor</i>	2006/#	EN	EN	L	EN	Likely seasonal visitor to woodland.
Regent Honeyeater	<i>Xanthomyza phrygia</i>	2004/#	EN	CR	L	EN	Possible visitor to woodland
Spot-tailed Quoll	<i>Dasyurus maculatus maculatus</i> (SE mainland population)	#	EN	EN	L	VU	Unlikely. Vagrant.
Pink-tailed Worm-lizard	<i>Aprasia parapulchella</i>	-	VU	EN	L		Unlikely. Species not detected by targeted survey.
Striped Legless Lizard	<i>Delma impar</i>	#	VU	EN	L	VU	Unlikely. No records from local area. Species not detected by targeted survey.

Common Name	Scientific Name	Last Record	EPBC Act	DSE 2003	FFG Act	Action Plan	Likelihood of Occurrence
Growling Grass Frog	<i>Litoria raniformis</i>	#	VU	EN	L	VU	Unlikely. No recent records from Chiltern area.
Murray Cod	<i>Maccullochella peelii peelii</i>	#	VU	EN	L		Unlikely. No suitable habitat.
Macquarie Perch	<i>Macquaria australasica</i>	#	EN	EN	L	EN	Unlikely. No suitable habitat.
Golden Sun Moth	<i>Synemon plana</i>	#	CR		L		Unlikely. Species not detected by targeted survey.
State significance							
Red-chested Button-quail	<i>Turnix pyrrhorothonax</i>	1998		VU	L		Possible in woodland.
Royal Spoonbill	<i>Platalea regia</i>	2007		VU			Possible visitor to dams.
Little Egret	<i>Egretta garzetta</i>	2000		EN	L		Possible visitor to dams.
Intermediate Egret	<i>Ardea intermedia</i>	2004		CR	L		Possible visitor to dams.
Great Egret	<i>Ardea alba</i>	2003/#		VU	L		Possible visitor to dams and drainage lines.
Australasian Shoveler	<i>Anas rhynchos</i>	2006		VU			Possible visitor to dams.
Freckled Duck	<i>Stictonetta naevosa</i>	2007		EN	L		Possible visitor to dams.
Hardhead	<i>Aythya australis</i>	2006		VU			Possible visitor to dams.
Blue-billed Duck	<i>Oxyura australis</i>	1997		EN	L		Possible visitor to dams.
Musk Duck	<i>Biziura lobata</i>	2006		VU			Possible visitor to dams.
Grey Goshawk	<i>Accipiter novaehollandiae</i>	2003		VU	L		Likely regular visitor.
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	2005/#		VU	L		Occasional visitor.
Square-tailed Kite	<i>Lophoictinia isura</i>	2004		VU	L		Occasional visitor.
Black Falcon	<i>Falco subniger</i>	1982		VU			Occasional visitor.
Barking Owl	<i>Ninox connivens</i>	2005		EN	L	NT	Recorded from study area.

Common Name	Scientific Name	Last Record	EPBC Act	DSE 2003	FFG Act	Action Plan	Likelihood of Occurrence
Powerful Owl	<i>Ninox strenua</i>	1998		VU	L		Likely visitor to study area.
Turquoise Parrot	<i>Neophema pulchella</i>	2006		NT	L	NT	Likely breeding resident in study area.
Hooded Robin	<i>Melanodryas cucullata</i>	2006		NT	L	NT	Recorded from study area.
Crested Bellbird	<i>Oreoica gutturalis</i>	2001		NT	L	NT	Possible visitor to woodland areas.
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	2005		EN	L	NT	Possible visitor to woodland areas.
Chestnut-rumped Heathwren	<i>Hylacola pyrrhopygia</i>	2001		VU			Likely visitor to areas of woodland.
Speckled Warbler	<i>Chthonicola sagittata</i>	2003		VU	L	NT	Recorded from study area.
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	2006		NT		NT	Recorded from study area.
Painted Honeyeater	<i>Grantiella picta</i>	2006		VU	L	NT	Recorded from study area.
Diamond Firetail	<i>Stagonopleura guttata</i>	2006		VU	L	NT	Likely resident in areas of woodland.
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	2005		VU	L	NT	Likely resident in areas of woodland.
Squirrel Glider	<i>Petaurus norfolcensis</i>	2004		EN	L	NT	Likely resident in areas of woodland.
Tree Goanna	<i>Varanus varius</i>	2006		VU			Recorded from study area.
Bandy Bandy	<i>Vermicella annulata</i>	1987		NT	L		Possible resident in areas of woodland.
Brown Toadlet	<i>Pseudophryne bibronii</i>	2005		EN	L	DD	Possible breeding resident in drainage lines.
Regional significance							
Brown Quail	<i>Coturnix ypsilophora</i>	2006		NT			Likely resident.
Pied Cormorant	<i>Phalacrocorax varius</i>	2004		NT			Unlikely visitor to farm dams.
Whiskered Tern	<i>Chlidonias hybridus</i>	2001		NT			Uncommon visitor.
Latham's Snipe	<i>Gallinago hardwickii</i>	2006/#		NT			Likely seasonal visitor to drainage lines.

Common Name	Scientific Name	Last Record	EPBC Act	DSE 2003	FFG Act	Action Plan	Likelihood of Occurrence
Glossy Ibis	<i>Plegadis falcinellus</i>	2000		NT			Possible rare visitor to dams and drainage lines.
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	2004		NT			Possible rare visitor to dams and drainage lines.
Spotted Harrier	<i>Circus assimilis</i>	1985		NT			Possible uncommon visitor.
Azure Kingfisher	<i>Alcedo azurea</i>	1993		NT			Possible uncommon visitor.
Red-backed Kingfisher	<i>Todiramphus pyrrhopygia</i>	1990		NT			Possible uncommon visitor.
Black-eared Cuckoo	<i>Chrysococcyx osculans</i>	2000		NT			Likely seasonal visitor to woodland.
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	2007		NT			Likely resident in woodland.
Pectoral Sandpiper	<i>Calidris melanotos</i>	2000		NT			Unlikely visitor to farms dams
Woodland Blind Snake	<i>Ramphotyphlops proximus</i>	1995		NT			Possible resident in woodland.

A8.3. Migratory species

Table A8.3. Migratory fauna species recorded, or predicted to occur, within 5 kilometres of the study area

Source: AVW, BA and DEWHA databases

Note:

denotes species predicted to occur or with habitat predicted to occur in the local area (DEWHA database)

Common name	Scientific name	Last Record
Australian Painted Snipe	<i>Rostratula australis</i>	#
Cattle Egret	<i>Ardea ibis</i>	2000/#
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	2005
Common Greenshank	<i>Tringa nebularia</i>	1998
Fork-tailed Swift	<i>Apus pacificus</i>	2005/#
Glossy Ibis	<i>Plegadis falcinellus</i>	2000
Great Egret	<i>Ardea alba</i>	2003/#
Latham's Snipe	<i>Gallinago hardwickii</i>	2006/#
Pectoral Sandpiper	<i>Calidris melanotos</i>	2000
Rainbow Bee-eater	<i>Merops ornatus</i>	2007/#
Regent Honeyeater	<i>Xanthomyza phrygia</i>	2004/#
Rufous Fantail	<i>Rhipidura rufifrons</i>	#/1982
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	2002/#
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	1982
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	2005/#
White-throated Needletail	<i>Hirundapus caudacutus</i>	2007/#

APPENDIX 9

Species suitable for rehabilitation works

Table A9.1. Flora species suitable for revegetation works in the exhausted quarry

Species	Common Name	Seed/plant
Trees		
<i>Eucalyptus sideroxylon</i>	Mugga	
<i>Allocasuarina verticillata</i>	Drooping Sheoak	
<i>Callitris glaucophylla</i>	White Cypress-pine	
<i>Eucalyptus albens</i>	White Box	
<i>Eucalyptus blakelyi</i>	Blakely's Red-gum	
<i>Eucalyptus macrorhyncha</i>	Red Stringybark	
<i>Eucalyptus nortonii</i>	Silver Bundy	
<i>Eucalyptus polyanthemos</i> subsp. <i>vestita</i>	Red Box	
Shrubs		
<i>Acacia dealbata</i>	Silver Wattle	
<i>Acacia gunnii</i>	Ploughshare Wattle	
<i>Acacia implexa</i>	Lightwood	
<i>Acacia paradoxa</i>	Hedge Wattle	
<i>Acacia pycnantha</i>	Golden Wattle	
<i>Acacia verniciflua</i>	Varnish Wattle	
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria	
<i>Brachyloma daphnoides</i>	Daphne Heath	
<i>Dillwynia phyllicoides</i>	Small-leaf Parrot-pea	
<i>Dillwynia sericea</i>	Showy Parrot-pea	
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea	
<i>Gompholobium huegelii</i>	Common Wedge-pea	
<i>Grevillea alpina</i>	Cat's Claw Grevillea	
<i>Hibbertia riparia</i>	Erect Guinea-flower	
<i>Melichrus urceolatus</i>	Urn Heath	
Grasses		
<i>Aristida behriana</i>	Brush Wire-grass	
<i>Aristida ramosa</i>	Cane Wire-grass	
<i>Austrodanthonia auriculata</i>	Lobed Wallaby-grass	
<i>Austrodanthonia caespitosa</i>	Common Wallaby-grass	
<i>Austrodanthonia eriantha</i>	Hill Wallaby-grass	
<i>Austrodanthonia fulva</i>	Copper-awned Wallaby-grass	
<i>Austrodanthonia geniculata</i>	Kneed Wallaby-grass	
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Slender Wallaby-grass	
<i>Austrodanthonia setacea</i> var. <i>setacea</i>	Bristly Wallaby-grass	
<i>Austrostipa densiflora</i>	Dense Spear-grass	
<i>Austrostipa nodosa</i>	Knotty Spear-grass	
<i>Austrostipa scabra</i> subsp. <i>falcata</i>	Rough Spear-grass	
<i>Chloris truncata</i>	Windmill Grass	
<i>Elymus scaber</i> var. <i>scaber</i>	Common Wheat-grass	
<i>Joycea pallida</i>	Silvertop Wallaby-grass	
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	
<i>Poa sieberiana</i> var. <i>hirtella</i>	Grey Tussock-grass	
<i>Themeda triandra</i>	Kangaroo Grass	

Table A9.1 (cont). **Flora species suitable for revegetation works in the exhausted quarry**

Herbs

Acaena echinata

Dianella revoluta var. *revoluta*

Geranium retrorsum

Geranium sp. 2

Glycine tabacina

Gonocarpus elatus

Gonocarpus tetragynus

Hovea heterophylla

Lepidosperma laterale

Leptorhynchus squamatus

Lomandra filiformis subsp. *filiformis*

Lomandra multiflora subsp. *multiflora*

Opercularia hispida

Rumex brownii

Tricoryne elatior

Xerochrysum viscosum

Sheep's Burr

Black-anther Flax-lily

Grassland Cranesbill

Variable Cranesbill

Variable Glycine

Tall Raspwort

Common Raspwort

Common Hovea

Variable Sword-sedge

Scaly Buttons

Wattle Mat-rush

Many-flowered Mat-rush

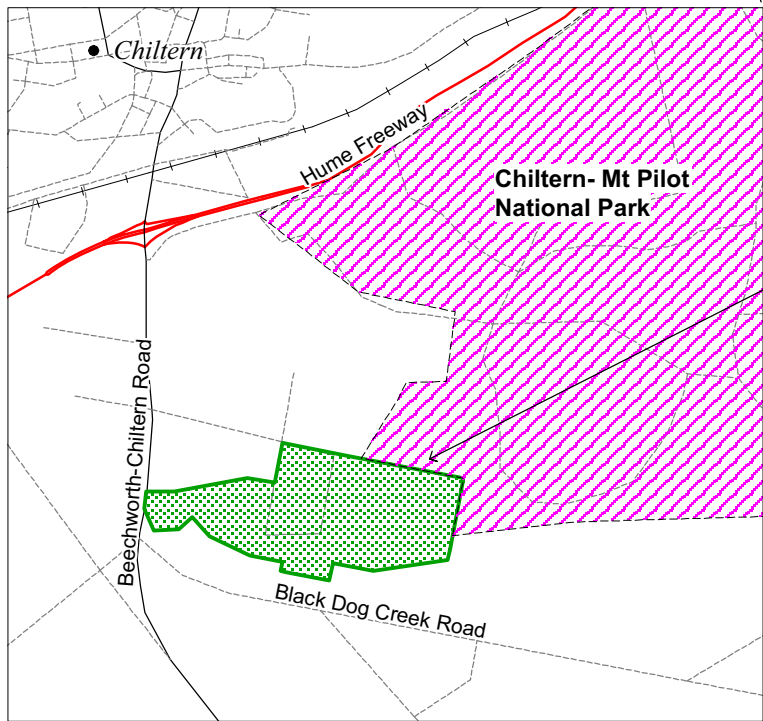
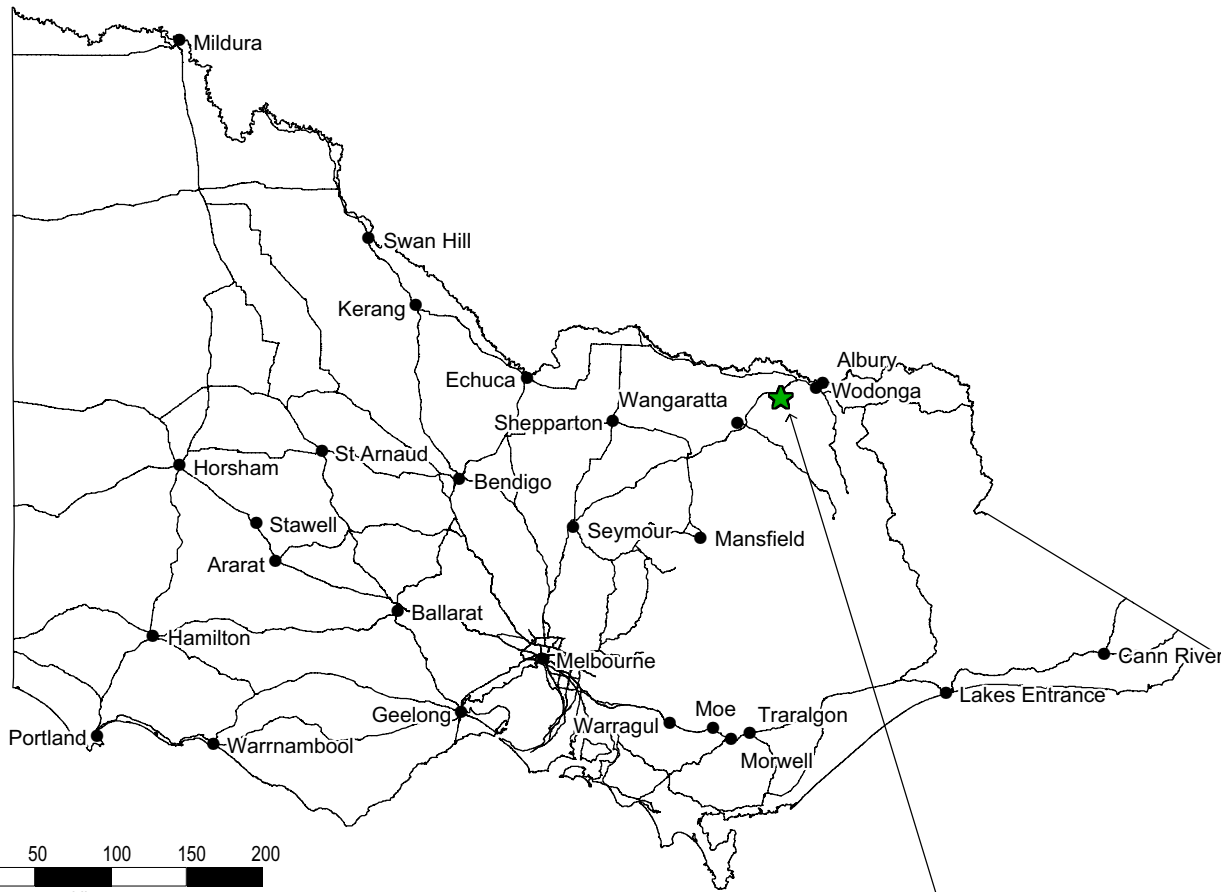
Hairy Stinkweed

Slender Dock

Yellow Rush-lily

Shiny Everlasting

FIGURES



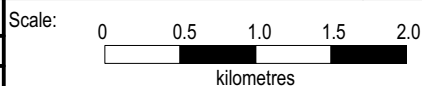
Acknowledgement: VicRoads



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Figure 1: Location of the study area, Chiltern, Victoria.

DATE: 2 January 2009
 Checked by: SGM Drawn by: RMF File number: 7594
 Location: ...:7594\Mapping\7594 Figure 1.WOR



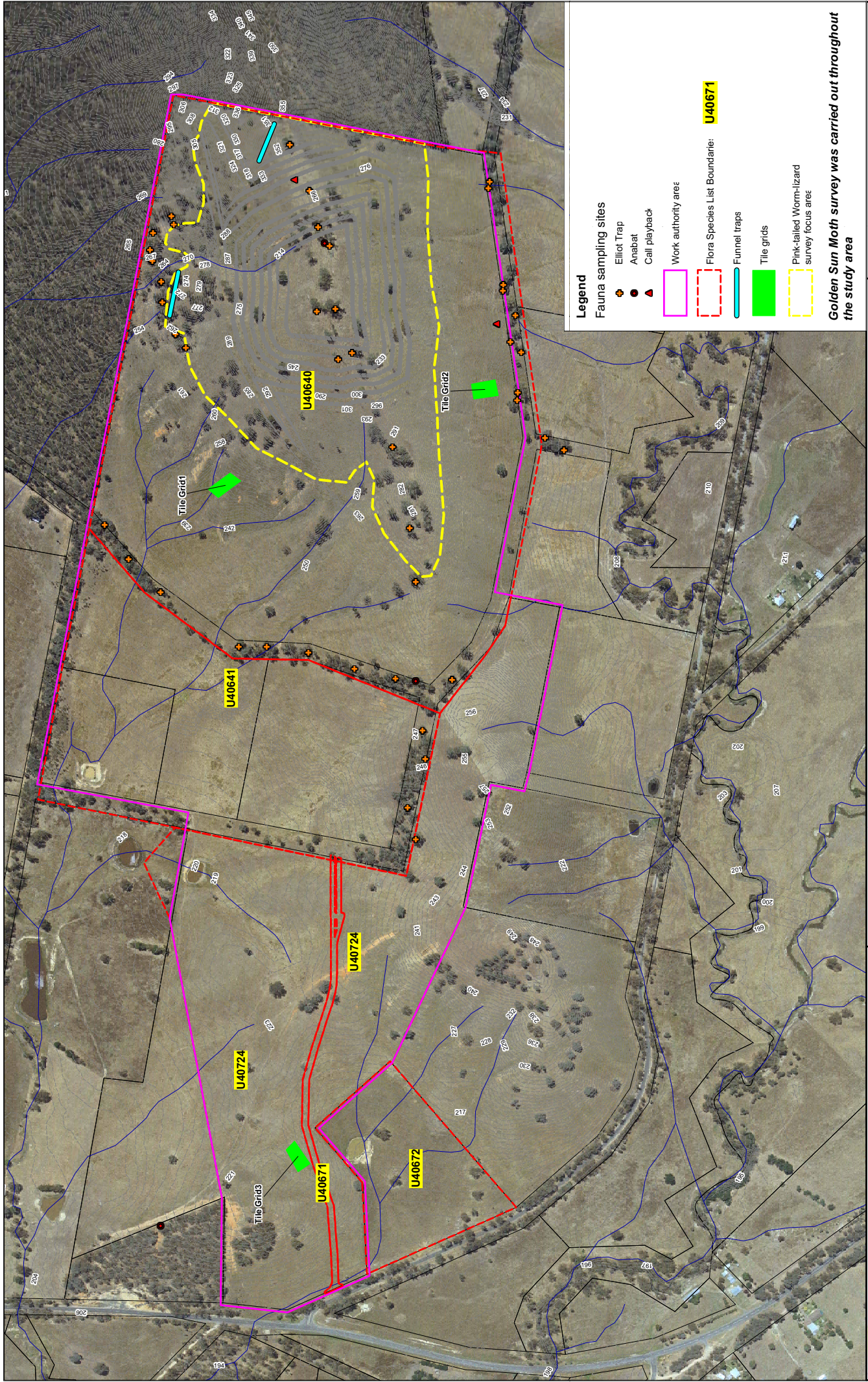


Figure 2: Flora and fauna survey locations within the study area, Chiltern.

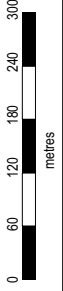


Figure 2: Flora and fauna survey locations within the study area, Chiltern.



Golden Sun Moth survey was carried out throughout the study area

- Legend**
- Fauna sampling sites**
- ⊕ Elliott Trap
 - Anabat
 - ▲ Call playback
- Work authority area
- Flora Species List Boundary: **U40671**
- Funnel traps
- Tile grids
- Pink-tailed Worm-lizard survey focus area

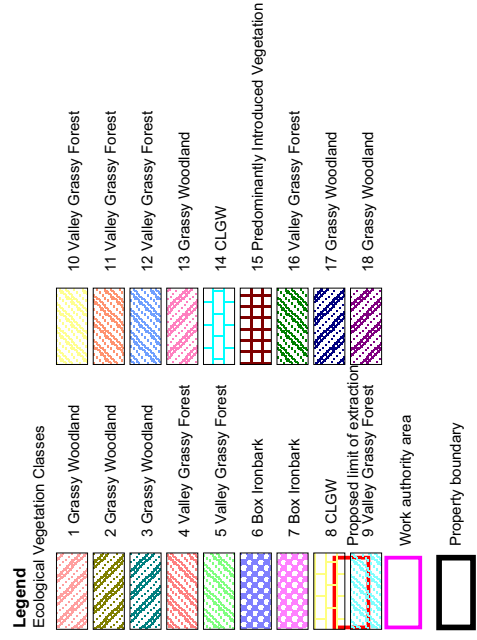
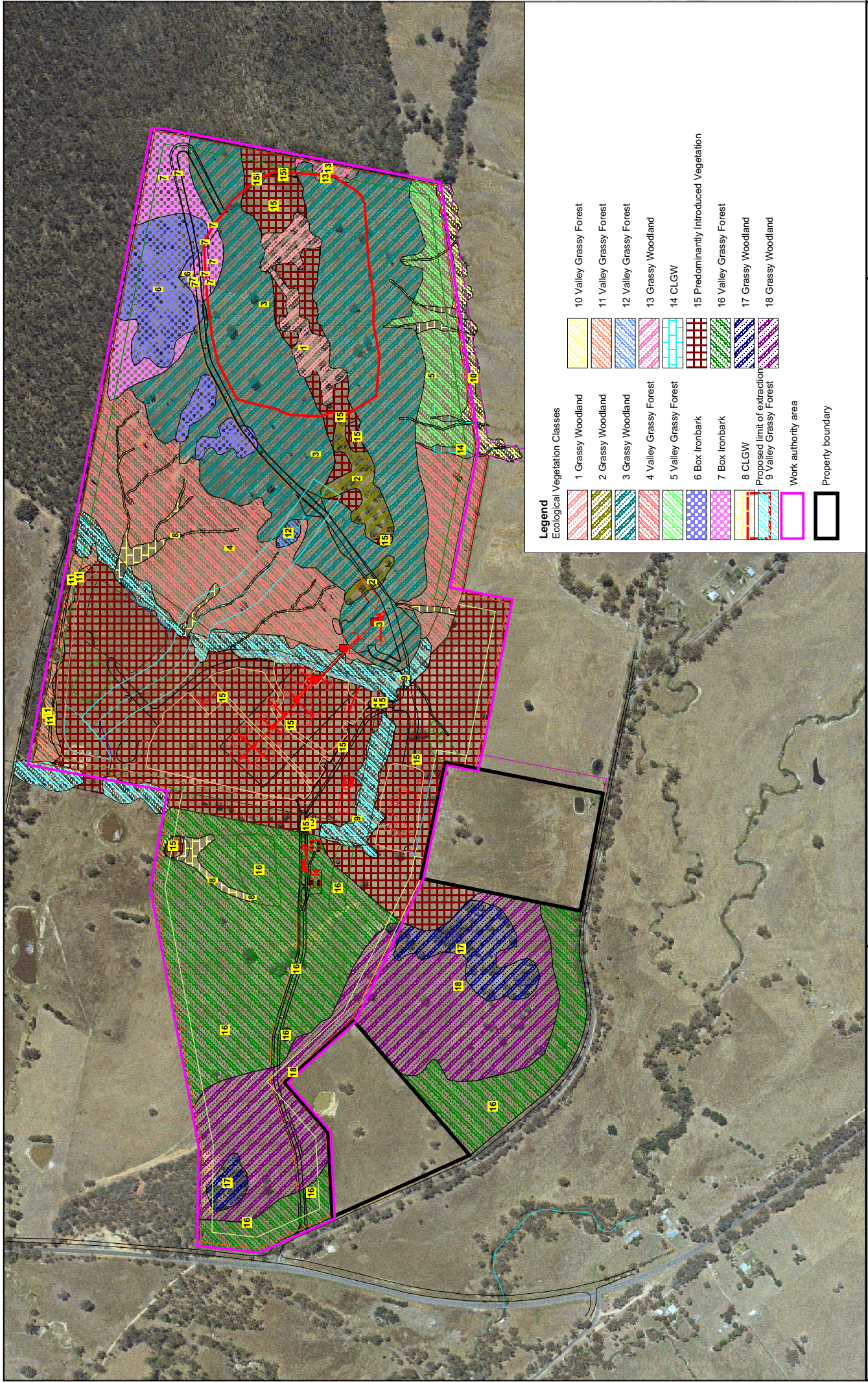
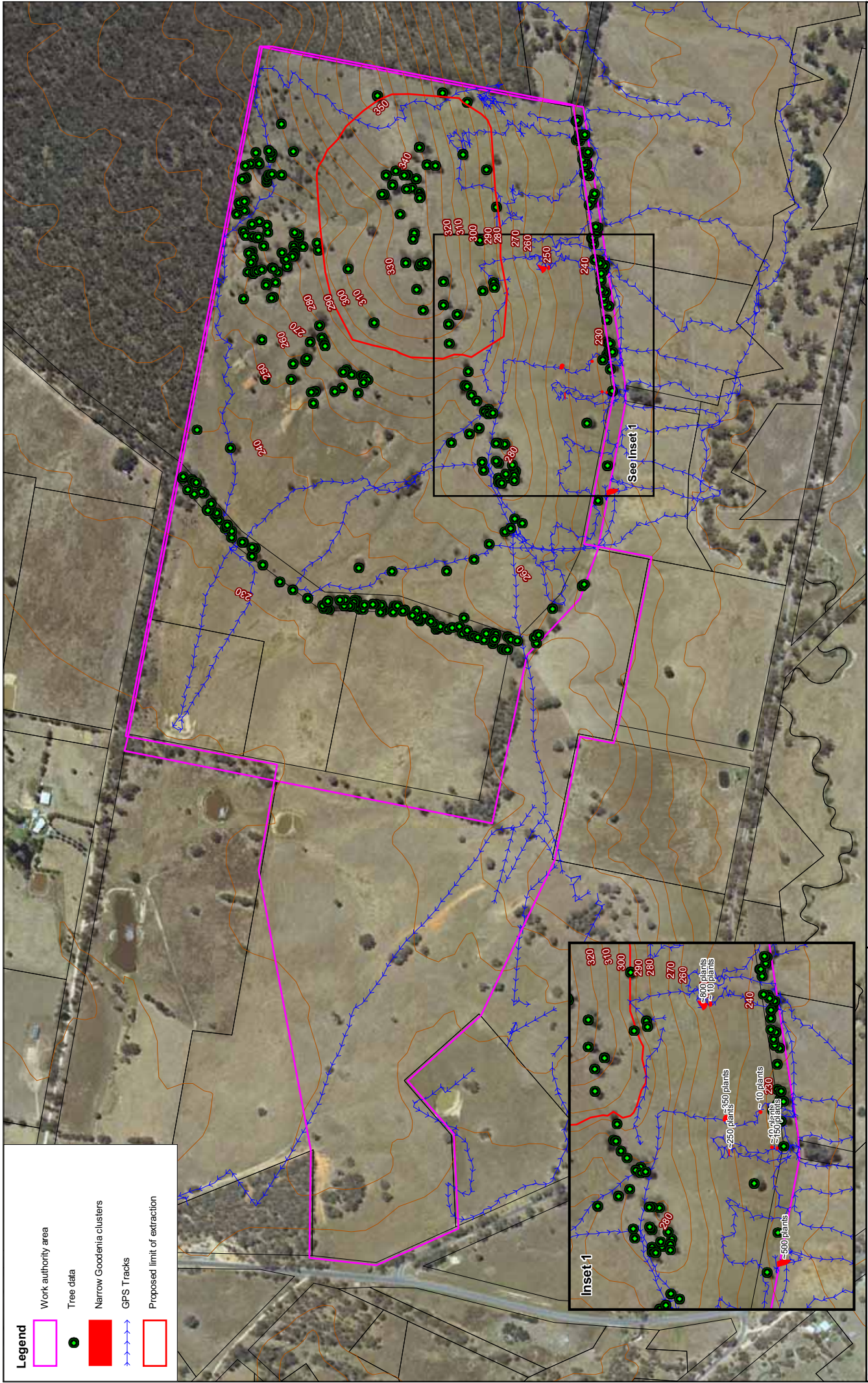


Figure 3 : The distribution of EVCs and patches of native vegetation.

Figure 3 : The distribution of EVCs and patches of native vegetation.



Legend




- Work authority area
- Tree data
- Narrow Goodenia clusters
- +—+—+— GPS Tracks
- Proposed limit of extraction

Figure 4: The distribution of Large Old Trees and Narrow Goodenia in the study area. (also showing SGM waypoints from Unit 16)




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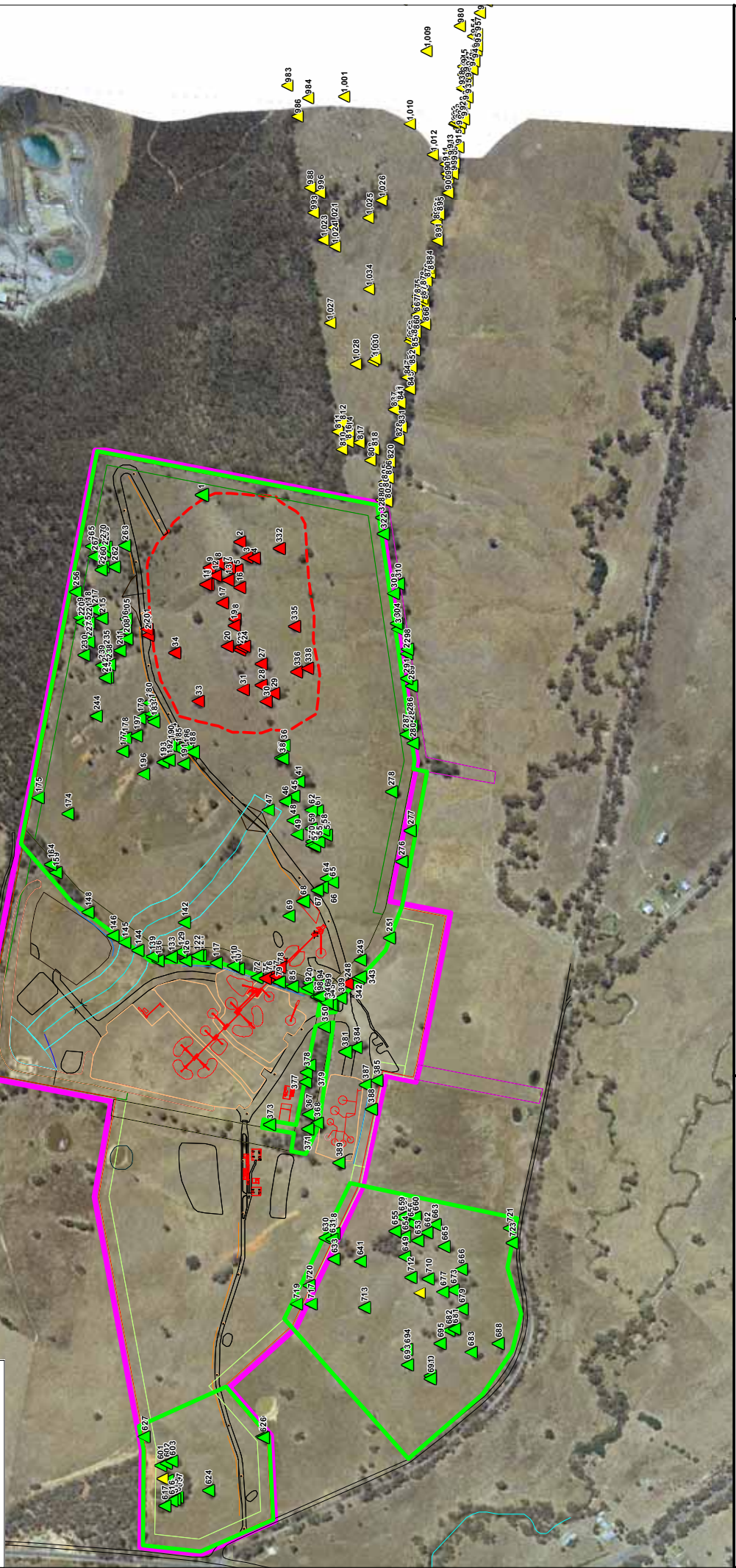
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Legend

-  Work authority area
-  Proposed habitat hectare offset site
-  Proposed limit of mining

Tree data

-  Tree to be removed
-  Tree to be retained
-  Tree to be retained




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Figure 5: Draft design for the proposed quarry and associated infrastructure

DATE: 12 August 2009
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 Location: P:\MRC\7500s\7594\Mapping\7594 Figure 5 w tree data.MXD

Drawn by: RMF / PLY
 File number: 7594

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Figure 5: Draft design for the proposed quarry and associated infrastructure