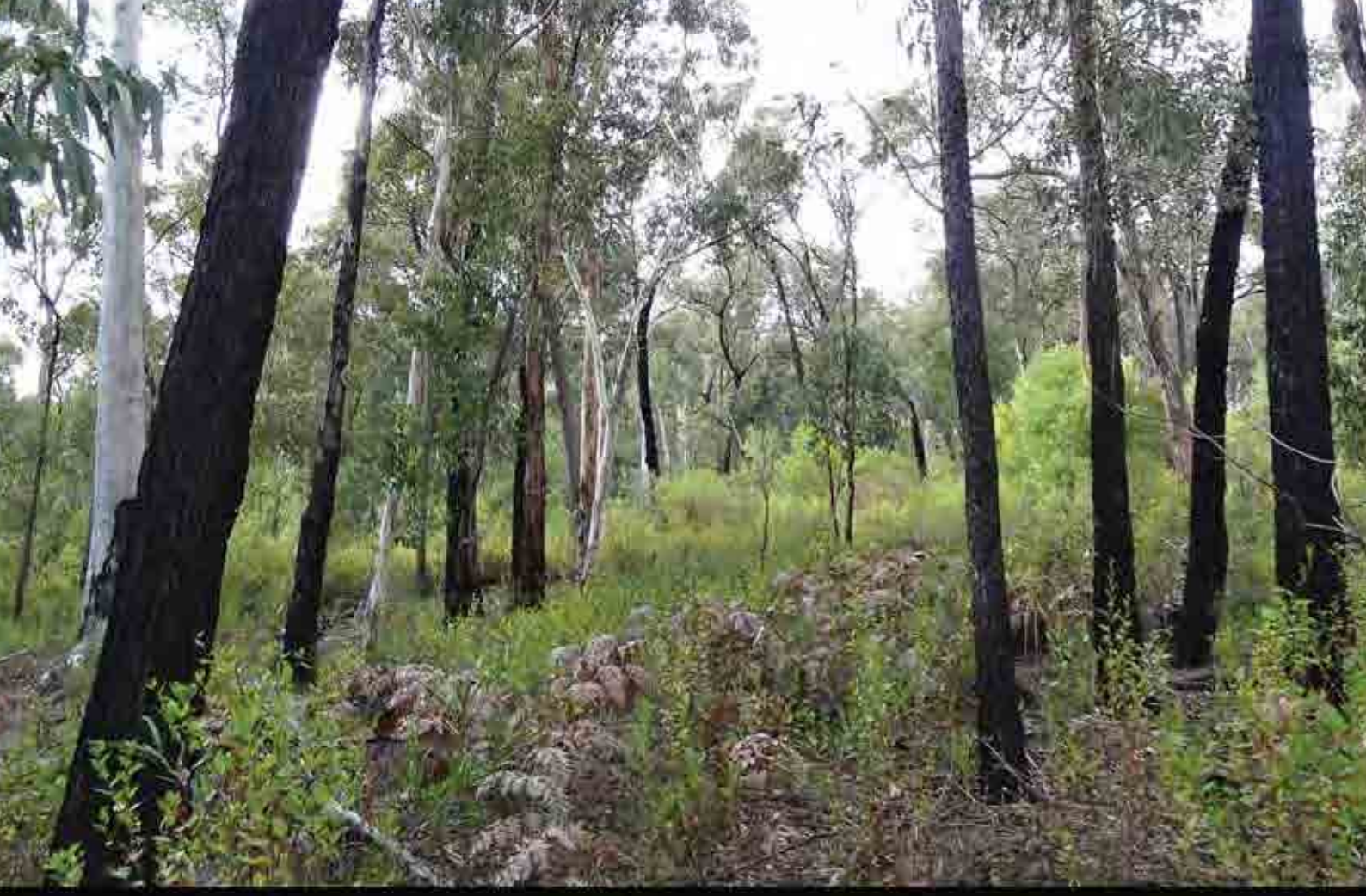

NOWA NOWA IRON PROJECT

ATTACHMENT 8 :

FLORA, FAUNA AND ECOLOGICAL CHARACTERISTICS AND ASSESSMENT

Prepared for Eastern Iron Limited by Earth Systems

REVISION 1

EARTH SYSTEMS
Environment | Water | Sustainability

EASTERN IRON LIMITED

October 2013

EARTH SYSTEMS
Environment | Water | Sustainability

DOCUMENT REVISION LIST

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Rev0	October 2013	Draft	Nigel Murphy
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Contents

Terminology

Term	Definition
ANOSIM	Analysis of Similarities: statistical modelling technique
BIM	Biodiversity Interactive Map
Biodiversity	All life-forms (organisms) including plants, animals and micro-organisms
Bioregion	A landscape based approach to classifying the land surface using a range of environmental attributes such as climate, geomorphology, lithology and vegetation
Bioregional Conservation Status	An assessment of the conservation status of the native vegetation type (EVC) in the context of a particular bioregion, taking account of how commonly it originally occurred, the current level of depletion and the level of degradation of condition typical of remaining stands
BOM	Bureau of Meteorology
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
CAMBA	China-Australia Migratory Bird Agreement
CMS	Convention of Migratory Species
DEPI	Department of Environment and Primary Industries
DEWHA	Department of Environment, Water, Heritage and the Arts
DPI	Department of Primary Industries (superseded by DEPI in April 2013)
DSE	Department of Sustainability and Environment (superseded by DEPI in April 2013)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
Ecological Vegetation Class (EVC)	Native vegetation classification system categorising a vegetation community based on a combination floristics, structure, life forms, ecological characteristics, and bioregions
EES	Environmental Effects Statement
EGL	East Gippsland Lowlands
EGFMP	East Gippsland Forest Management Plan
EGU	East Gippsland Uplands
EMP	Environment Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPHC	Environment Protection and Heritage Council
Exotic/introduced species	Any species that is not native to Australia or its States and Territories. This definition can sometimes include non-indigenous vegetation.
FFG Act	Flora and Fauna Guarantee Act1988
GMA	Groundwater Management Areas
JAMBA	Japan-Australia Migratory Bird Agreement
MDS	Multi-dimensional Scaling: analytical technique
MOMA	Masked Owl Management Area

Term	Definition
Native Vegetation	All vegetation that is native to Australia, and its States and Territories
Non-indigenous (Native) Species	Australian species that are found beyond their original range
POMA	Powerful Owl Management Area
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
Shannon's Index	Determines whether most individuals are from the same species (weighted) or evenly distributed among multiple species: $$H' = -\sum_{i=1}^{R} p_i ln\, p_i$$ Where p_i = the proportion of individuals belonging to the *ith* species, R = is the richness (number of species). When H' = 0 there is no uncertainty and there is only one species; H' between 1.5 and 3.5 represents that individuals are distributed evenly
Simpson's Index	The probability that two individuals taken at random from a population (with replacement) are from the same species: $$D = \sum_{i=1}^{R} p_i^2$$ Where p_i = the proportion of individuals belonging to the *i*th species, R = is the richness (number of species); D = 0 represents infinite diversity, D = 1 no diversity
SMZ	Special Management Zone
SOMA	Sooty Owl Management Area
SPZ	Special Protection Zone
TSSC	Threatened Species Scientific Committee
VBA	Victorian Biodiversity Atlas

Definitions of Conservation Status of Threatened Species

Conservation Status	Definition
Commonwealth (EPBC Act 1999)	
Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual of the taxon has died
Critically Endangered (CR)	A species is Critically Endangered if it is facing an extremely high risk of extinction in the wild in the immediate future
Endangered (EN)	A species is Endangered if it is facing a very high risk of extinction in the wild in the near future but is not critically endangered
Vulnerable (VU)	A species is Vulnerable if it is facing a high risk of extinction in the wild in the medium-term future but is not critically endangered or endangered
Conservation Dependent (CD)	A species is Conservation Dependent when it is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of five years
Migratory	Migratory species listed under the international conventions and agreements Australia is party to are protected under the *Environment Protection and Biodiversity Conservation Act 1999*
Marine	Marine species listed under the international conventions and agreements Australia is party to are protected under the *Environment Protection and Biodiversity Conservation Act 1999*
Cetacean	Whales, dolphins and porpoises that are protected within Australian waters
Victorian (FFG Act 1988)	
Listed	Listed as threatened
Nominated (N)	Nominated for listing as threatened but has not yet completed the listing process. In some cases, the taxon may have received a preliminary or final recommendation indicating that it is eligible or ineligible for listing. In other cases, the nomination might not yet have been considered
Potentially Threatening Process	Processes have been listed as potentially threatening processes in accordance with Section 10 of the FFG Act
Victorian (DEPI 2013) Advisory Lists	
Extinct (EX)	A species or community is Extinct when there is no reasonable doubt that the last individual has died. A species or community is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual
Regionally Extinct (RX)	As for Extinct but within a defined region (in this case the State of Victoria) that does not encompass the entire geographic range of the taxon. A species or community is presumed Regionally Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout the region have failed to record an individual
Critically Endangered (CR)	A species or community is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see IUCN Standards and Petitions Subcommittee 2010), and it is therefore considered to be facing an extremely high risk of extinction in the wild
Endangered (EN)	A species or community is Endangered when the best available evidence indicates

Conservation Status	Definition
	that it meets any of the criteria A to E or Endangered (see IUCN Standards and Petitions Subcommittee 2010), and it is therefore considered to be facing a very high risk of extinction in the wild
Vulnerable (VU)	A species or community is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see IUCN Standards and Petitions Subcommittee 2010), and it is therefore considered to be facing a high risk of extinction in the wild
Near-threatened (NT)	A species or community is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
Data Deficient (DD)	A species or community is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate
Victorian (DEPI 2013) BCS for EVCs	
Presumed Extinct (X)	Probably no longer present in the Bioregion
Endangered (E)	Contracted to less than 10% of former range; OR Less than 10% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • 10 to 30% pre-European extent remains and severely degraded over a majority of this area; or • Naturally restricted EVC reduced to 30% or less of former range and moderately degraded over a majority of this area; or • Rare EVC cleared and/or moderately degraded over a majority of former area
Vulnerable (V)	10 to 30% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • Greater than 30% and up to 50% pre-European extent remains and moderately degraded over a majority of this area; or • Greater than 50% pre-European extent remains and severely degraded over a majority of this area; or • Naturally restricted EVC where greater than 30% pre-European extent remains and moderately degraded over a majority of this area; or • Rare EVC cleared and/or moderately degraded over a minority of former area
Depleted (D)	Greater than 30% and up to 50% pre-European extent remains; OR Combination of depletion, degradation and current threats is comparable overall to

Conservation Status	Definition
	the above and: • Greater than 50% pre-European extent remains and moderately degraded over a majority of this area
Rare (R)	Greater than 30% and up to 50% pre-European extent remains; OR Combination of depletion, degradation and current threats is comparable overall to the above and: • Greater than 50% pre-European extent remains and moderately degraded over a majority of this area
Least Concern (LC)	Greater than 50% pre-European extent remains and subject to little to no degradation over a majority of this area

Executive Summary

Introduction

Eastern Iron Limited ('Eastern Iron'), through its wholly owned subsidiary Gippsland Iron Pty Ltd, proposes to develop the Nowa Nowa Iron Project (hereafter 'the Project'). The Project is a greenfield development of a high grade magnetite/hematite deposit generally referred to as '5 Mile'. It is located approximately 7 km north of the township of Nowa Nowa, which is situated on the Princes Highway between Bairnsdale and Orbost in East Gippsland, Victoria.

Earth Systems has been commissioned by Eastern Iron Limited to prepare this *Flora, Fauna and Ecological Characteristics and Assessment* to support a referral to the Minister for Planning for advice as to whether an Environment Effects Statement is required for the Project pursuant to the *Environment Effects Act* 1978 ('EES Referral').

There are spatial and landscape aspects that are relevant to the consideration of the Project. Firstly the mine site itself, which is where the mineral extraction and infrastructure associated with the Project will occur and secondly, the wider region surrounding the mine site which may be impacted by construction and operation. The ecological characteristics of the downstream catchment have been addressed separately; see ***Aquatic and Wetland Ecology Study*** (EES Referral Attachment 9).

The main aim of this *Flora, Fauna and Ecological Characteristics and Assessment* is to review, investigate and discuss the baseline ecological characteristics of the mine site, and recommend key management and mitigation measures to minimise potential adverse effects on species and communities. Specific objectives of this study were to:

- Identify and assess flora, fauna and ecological communities that may be present in, or near to, the mine site;
- Determine the likelihood that threatened species and communities may reside or temporarily use the mine site and greater region; and
- Briefly outline the current disturbance status of the mine site, and assess the potential impacts of the proposed Project on terrestrial ecology; and
- Outline mitigation and management measures that will minimise the potential for any significant impacts on flora, fauna and ecological communities.

Environmental Setting

The mine site is located approximately 7 km north of the township of Nowa Nowa, 18 km northeast of Lakes Entrance and 250 km east of Melbourne in East Gippsland, Victoria. The mine site (and greater region) intersects both the East Gippsland Lowlands (EGL) and East Gippsland Uplands (EGU) bioregions.

East Gippsland is a low-lying region with gently undulating hills flanked by coastal plains, dune fields and inlets. The hills rarely reach over 320 metres elevation. The climate of East Gippsland is temperate, with a mean annual rainfall of approximately 821 mm recorded at Mount Nowa Nowa, in close proximity to the mine site. Mean maximum temperatures recorded at Mount Nowa Nowa are highest in January (25ºC) and mean minimum temperatures are lowest in July (6ºC). Relative humidity levels range between 57% (in January) and 78% (in May).

The main land use activities within the East Gippsland region are forestry and agriculture, including dairy farming, wool production, cattle and sheep production and vegetable production. Tourism is a growing industry in East Gippsland, with the Ramsar listed wetlands, lakes, forests, rivers and the Victorian Alps key attractions. The mine site itself is entirely located within the Tara State Forest, which is primarily

managed for forestry activities. The site includes areas approved as timber coupes in VicForests' latest Timber Release Plan (2009-2014).

In terms of its hydrological setting, the mine site is primarily located within the Boggy Creek Sub-Catchment. A number of creeks, both permanent and ephemeral, are present within the mine site and form two main waterways to the ocean. The site is north of the Gippsland Lakes system including the Ramsar-listed lakes and wetlands.

Most of the East Gippsland region is composed of Neogene (late Tertiary) alluvial sediments. These alluvial sediments form terraces and fan out from the uplands. The lowlands are sandy loams overlying clays. There has been some structural movement with early deposits being dissected with sediment composed of organic matter and iron, and volcanic intrusions.

Methodology

A three-tiered approach was adopted to assess the ecological characteristics of the mine site and surrounds:

1. Literature and database searches to determine species previously recorded in the area;
2. An overview site visit of the mine site and broader region; and
3. Detailed flora and fauna field surveys of the mine site.

Regional biodiversity was assessed by examining literature and database records within a 10 km zone around coordinates centred at the mine site. The overview field study was conducted covering the same zone. The detailed fauna survey was undertaken by Earth Systems within a 1250 ha (12.5 km^2) ***Study Area*** encompassing the mine site, buffers and the immediate habitat surrounding the mine site (to account for highly mobile fauna).

Field flora surveys within a similar Study Area were conducted by Ethos NRM Pty Ltd. The assessment was undertaken to determine on-site vegetation quality and included a site description, Habitat Hectares Assessment and Ecological Vegetation Class mapping (Annex 1). Targeted surveys for the Colquhoun grevillea (*Grevillea celata;* EPBC Act listed) were conducted in October 2013 (flowering season) to determine presence of individual plants and potential habitat (Annex 2). Additional spring vegetation assessment and other threatened species surveys are currently underway. The field assessments were undertaken by a DEPI accredited Native Vegetation Assessor.

The fauna field study included a total of 127 hours of surveys. Fauna habitat was assessed to provide an indication of the distribution and quality of habitat within the Study Area. Detailed habitat assessment was primarily achieved by observations on foot (~550 ha), and supplemented by observations from a vehicle and satellite imagery. Systematic spatial sampling was used to survey the Study Area. The fauna field study included:

- Diurnal point counts of all vertebrate fauna observed (72 points arranged in a grid);
- Diurnal transect searches (vegetation, trees, under rocks/logs, leaf litter and bare ground were searched for evidence of vertebrate fauna);
- Nocturnal fauna surveys using call playback, call recognition, point spotlight search, transect spotlighting and dusk and dawn watches; and
- Incidental records of all vertebrate fauna seen or heard within the Study Area and not seen during formal diurnal or nocturnal fauna surveys.

Regional Biodiversity

Database and literature searches indicated that within a 10 km zone around the mine site:

- The EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland community (Critically Endangered) may occur in the region (although was not identified during field surveys of the Study Area);

- No EPBC Act threatened mammals have been recorded in the region;
- Four modelled FFG Act communities have been mapped within the region, all being listed as Rare communities and composed of Warm Temperate Rainforest;
- Eight Ecological Vegetation Classes (EVCs) have been mapped in the region;
- 1102 different species, sub-species, variants and hybrids of plant have been recorded, with 200 of these being introduced;
- 196 bird species have been recorded in the region; most are common and widespread except for:
  - Two EPBC Act threatened species were recorded in 1977 (Australian bittern *Botaurus poiciloptilus* and swift parrot *Lathamus discolor*);
- Three FFG Act listed species (masked, sooty and powerful owl, *Tyto novaehollandiae novaehollandiae, T. tenebricosa tenebricosa* and *Ninox strenua*);
- 25 mammalian species have previously been recorded, six of these are non-native;
- 12 species of reptile have been recorded in the past in the region but only one is recognised by the DEPI Advisory list (lace monitor *Varanus varius*);
- 14 species of the class Amphibia have been recorded in the region, only one being a nationally significant species; the EPBC Act Vulnerable green and golden bell frog (*Litoria aurea*); and
- No significant fish or invertebrates have been recorded in the region.

The overview field assessment found:

- Fifty-two species of bird and 16 mammal species were observed during the overview assessment of the region, and of these:
  - No EPBC or FFG Act listed species were observed at any time, however one DEPI-listed species was observed in forested areas within the region.
  - All other fauna species were common and/or widespread within Victoria and/or Australia.

Study Area Biodiversity

Databases and literature searches of the Study Area (encompassing the mine site and surrounding habitat) indicated:

- No EPBC Act listed species have been recorded within the mine site or Study Area;
- Four modelled Rare FFG Act communities have been mapped within the south-east corner of the Study Area. All of these four communities are within one remnant patch of Warm Temperate Rainforest. However, this patch is not located within the mine site;
- One FFG Act listed species (sooty owl) has been recorded within the Study Area, but not within the mine site;
- Two DEPI recognised species, the slender wire-lily (*Laxmannia gracilis*) and southern toadlet (*Pseudophyrne semimarmorata*), have been recorded within the Study Area, but only the wire-lily was recorded within the mine site (in 1980);
- It is unlikely that additional FFG or EPBC Act listed flora or fauna species inhabit the mine site due to previous logging, insufficient habitat characteristics and poor connectivity with source populations;
- Overall, it appears that the Study Area has few areas of vegetation that are reliant on subsurface or subterranean groundwater since groundwater depths range from 37 to 50 m. The most likely areas of GDEs are within and along the three main ephemeral creeks of the mine site and the greater Study Area. However, these GDEs are probably only reliant on surface expression of groundwater, rather than tapping deeper sources of water.

Field flora surveys of the Study Area indicated:

- No EPBC Act or FFG Act threatened flora species (or preferred habitat) were identified at any time during the survey;
- Colquhoun grevillea (or preferred habitat) was not found within the mine site during targeted spring surveys (Annex 2);
- Five Ecological Vegetation Classes (EVCs) were identified within the Study Area:
  - Lowland Forest (Least Concern);
  - Shrubby Dry Forest (Least Concern);
  - Damp Forest (Least Concern);
  - Riparian Forest (Depleted); and
  - Warm Temperate Rainforest (FFG Act modelled) – notably this community does not occur within the mine site.
- A total of 146 ha of vegetation equating to approximately 104 habitat hectares (HHa) is proposed for removal;
- Additional (flowering period) spring 2013 flora and vegetation surveys will determine vegetation loss and offset requirements and will search for other threatened flora.

Fauna surveys of the Study Area indicated:

- No EPBC Act species were observed (or evidence found) at any time during surveys;
- One FFG Act listed species, the masked owl, was observed 1.2 km east-north-east of the mine site;
- Despite extensive searches of the habitat, including the Warm Temperate Rainforest patch to the south-east of the mine site, evidence of owl nests or roosts was not found;
- It is likely that the three threatened owl species hunt in the Study Area, but do not nest or roost in the Study Area or nearby. Analyses indicates that surveys were sufficient to detect all three species, if they were present in areas searched;
- A DEPI-listed Near Threatened species, the brown treecreeper (*Climacteris picumnus victoriae*) was observed on numerous occasions;
- The DEPI-listed Endangered lace monitor was observed twice and scratched trees indicating its presence were found throughout the Study Area;
- The DEPI-listed Critically Endangered Martin's toadlet (*Uperoleia martini*) was heard on one occasion, during a particularly heavy rainfall event, on the southern boundary of the Study Area, along the Nowa Nowa-Buchan Road (outside mine site);
- Overall, 43 species of bird were seen using, flying over, or heard within, the Study Area;
- All mammals detected were common and widespread native species (i.e. not listed), in addition to three introduced species;
- In total, 571 individuals from 58 terrestrial fauna species were observed inhabiting or using the Study Area; and
- Most models estimated species richness to be between 58 (± 0.1) and 73 (± 9.1) with an upper outlying estimate of 90.1 (± 38.4).

Potential Impacts

Habitat fragmentation and degradation feature prominently in the current threats to the Study Area. Historical timber harvesting has probably altered the microclimate, hydrology, erosion patterns and the number of weeds and pests. It is unlikely that the vegetation of the Study Area resembles the pre-

European (harvesting) habitat. Similarly, fauna biodiversity is unlikely to resemble the original suite of species present on the site. Many species have become extinct from the Gippsland region and introduced species are now common and widespread.

Potential impacts on terrestrial ecology associated with the development of the Project at the mine site are expected to be moderate due to the significant historical disturbance of the area through timber harvesting and human use. The primary impact on fauna and flora is expected to be associated with the native vegetation clearance required for the Project components. Key potential direct and indirect impacts are summarised below.

Direct Impacts

Native Vegetation – key potential direct impacts include:

- The development of the mine site will require the removal of approximately 146 ha of native vegetation (equating to approximately 104 habitat hectares);
- No EPBC Act or FFG Act threatened species or ecological communities have currently been identified as potentially impacted;
- Vegetation removal may directly impact upon the following DEPI-listed Rare species:
  - Wallaby bush (*Beyeria lasiocarpa*);
  - Gippsland stringybark (*Eucalyptus mackintii*);
  - Forest red box (*Eucalyptus polyanthemos longior*);
  - Paperbark tea-tree (*Leptospermum trinervium*);
  - Austral tobacco (*Nicotiana suaveolens*); and
  - Smooth geebung (*Persoonia levis*).

Native Fauna – key potential direct impacts include:

- Accidental death and/or injury are likely to be the primary potential direct impact on native fauna.

Indirect Impacts

Native Vegetation – key potential indirect impacts include:

- Increased exposure of vegetation to light and altered microclimate on clearance edges;
- Vegetation exposed to increased weeds and parasites carried by wind and increased traffic;
- Dewatering may indirectly impact GDEs within the area of the cone of depression around the pit, however it is likely that these areas will already be cleared for mine components;
- The following species are unlikely to occur in the habitat of the mine site but nevertheless will be considered in regards of mitigation and management (in line with the precautionary principle):
  - Maroon leek-orchid (*Prasophyllum frenchii*);
  - Leafy nematolepis (*Nematolepis frondosa*);
  - Leafless tongue-orchid (*Cryptostylis hunteriana*);
  - Thick-lipped spider-orchid (*Caladenia tessellate*); and
  - Yellow-wood (*Acronychia oblongifolia*).
- Please note that Colquhoun grevillea was not found during targeted surveys and therefore there will be no impact on this species.

Native Fauna – key potential indirect impacts include:

- Removal of foraging and/or breeding fauna habitat;
- Fauna being disturbed by an increase in human activities;
- Increased competition for resources; and
- Increased competition and predation from increased number of introduced fauna species (including native).

Significant fauna species found in the Study Area that may be indirectly impacted by the development of the mine site include:

- Masked owl;
- Brown treecreeper;
- Lace monitor; and
- Martin's toadlet.

It is likely that foraging habitat will be removed, but these species are highly mobile, and are likely to find foraging grounds elsewhere. Removal of habitat for Project activities is not expected to significantly impact on the local or regional population. For example, the lace monitor occurs in relatively low population densities, being one to three individuals over 1000 to 3000 ha and their large territories typically cover highly degraded habitat. Brown treecreepers also occur in highly degraded and fragmented forest in East Gippsland, and elsewhere across Victoria (e.g. box iron-bark forests; see Kavanagh et al. 2007 for example). Removal of a small proportion of the foraging grounds for these two species is thus unlikely to significantly impact on their foraging activities. There may be temporary displacement, but these species are able to readily habituate to (human-caused) disturbance, since all species forage in highly disturbed/fragmented and degraded habitat. It is also possible that these species will habituate to the mining activities and take advantage of the cleared areas to hunt.

It is possible that other threatened species inhabit the mine site and surrounding habitat but have never been recorded in the area, particularly due to their cryptic nature. An assessment of threatened species habitat requirements and the likelihood of their presence within the mine site found that no (additional) threatened species were “likely” to inhabit the area. “Likely” is defined as a species having habitat requirements met, threatening processes are low and that it is likely that they are detected in the future. The habitat is too disturbed, structural components are absent (e.g. adequate shrub cover) and threatening processes are too frequent and/or in high numbers (e.g. introduced predators, logging activities) for many threatened species.

The following species have been identified as having the potential (categorised as “potential” or “occasional”) to occur in the Study Area based on habitat requirements and the potential presence of nearby populations, and may be indirectly impacted (if present):

- Black-faced monarch (*Monarcha melanopsis*);
- Greater glider (*Petauroides volans*);
- Long-nosed potoroo (*Potorous tridactylus tridactylus*);
- Powerful owl;
- Sooty owl;
- Southern brown bandicoot (*Isoodon obesulus obesulus*);
- Southern toadlet;
- Spot-tailed quoll (*Dasyurus maculatus maculatus*); and
- White-footed dunnart (*Sminthopsis leucopus*).

Management, Mitigation and Monitoring

Suitable measures to avoid, minimise, manage and monitor impacts to flora and fauna will be required for the Project and will include the development and implementation of:

- An Environmental Management Plan;
- General mitigation and management measures;
- Targeted Colquhoun grevillea surveys have identified no specimens or preferred habitat within the mine site, but additional (planned spring) vegetation quality surveys will establish the absence of other nationally and State threatened flora species through targeted surveying and will involve:
  - Conducted during species flowering period;
  - Transect and/or quadrat surveying within suitable habitat;
  - If specimens are detected:
    - Monitor population over life and upon closure of the mine (e.g. annual surveying).
    - Implement a monitoring and management plan including translocation, propagation and revegetation programs.
- It is likely that a pair of each FFG Act listed owl species (masked, powerful and sooty owls) intermittently use the habitat within and surrounding the Study Area, therefore management and conservation will follow current DEPI guidelines.

Where adverse impacts cannot be avoided, mitigated and/or managed (e.g. due to direct native vegetation loss required for the Project components), a *Biodiversity Offset Strategy* will need to be implemented to compensate for these impacts on native vegetation and biodiversity. The *Biodiversity Offset Strategy* should:

- Provide net gain in native vegetation area and biodiversity values;
- Ensure offsets are kept in perpetuity;
- Be enforceable; and
- Involve both on-site and off-site offsets.

Appropriate native vegetation offset sites will need to be identified and secured prior to Project commencement. Offset management plans will also be required covering each offset site which detail the specific works to be implemented.

Since no EPBC Act listed species were detected, specific offsets for these species are unlikely to be necessary. Native vegetation to be removed will require offsets to be set aside in accordance with *Victoria's Native Vegetation Framework* or *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (new reforms). These offsets will be calculated to take into account:

- Site based:
  - Area of native vegetation to be removed;
  - Condition of native vegetation;
  - Types and conservation status of Ecological Vegetation Classes (EVCs) to be removed; and
  - Presence of any threatened flora and fauna (of DEPI Rare status and above).
- Landscape level:
  - Importance of area for Victoria's biodiversity; and
  - Habitat importance.

Under the current Victorian Native Vegetation Framework, it is estimated that between 104.4 HHa (1.26 HHa of High and 103.14 HHa of Medium Conservation Significance) and 155.96 HHa of High Conservation Significance vegetation will need to be offset. Additionally, this would include an estimated Large Old Tree (LOT) protection target of between 890 and 1772 LOTs will be required to offset the loss of 443 LOTs.

Additional Habitat Hectare Assessments for the mine site are currently being undertaken and offsets will be calculated in accordance with the new DEPI requirements and will be used as the basis of the approvals process for the Project.

Summary and Conclusions

Potential impacts on terrestrial ecology associated with the development of the Project at the mine site are expected to be moderate due to the significant historical disturbance of the area through timber harvesting and human use. Direct impacts will result from the removal of native vegetation however, indirect impacts may also occur due to dewatering, removal of foraging habitat and general disturbance from increased human activity.

The most pertinent Commonwealth legislation for the Project is the EPBC Act. Under the Act, actions that are likely to have a significant impact upon matters of national environmental significance require approval from the Environment Minister. However, no EPBC Act threatened species, communities or critical habitats have been identified during the field surveys of the Study Area at the current stage. It appears the habitat condition within the Study Area is unsuitable, poor or there is little habitat connectivity to support EPBC Act species.

Suitable measures to avoid, minimise, manage and monitor impacts to flora and fauna will be required for the Project and should be included in an Environmental Management Plan where appropriate. Where adverse impacts cannot be avoided, mitigated and/or managed, a *Biodiversity Offset Strategy* will need to be developed and implemented to compensate for any impacts on native vegetation and biodiversity. Since no EPBC species were detected, specific offsets for these species are unlikely to be necessary at this stage. Native vegetation to be removed will require offsets to be set aside in accordance with *Permitted clearing of native vegetation – Biodiversity assessment guidelines.*

With progressive revegetation of disturbed areas over the mine life and the effective implementation of management measures and native vegetation offsets as outlined in this study, it is envisaged that the mine site can be developed with no long-term impact on regional or State biodiversity values.

1 Introduction

1.1 Background

Eastern Iron Limited ('Eastern Iron'), through its wholly owned subsidiary Gippsland Iron Pty Ltd, proposes to develop the Nowa Nowa Iron Project (hereafter 'the Project'). The Project is a greenfield development of a high grade magnetite/hematite deposit generally referred to as 'Five Mile'. It is located approximately 7 km north of the township of Nowa Nowa, which is situated on the Princes Highway between Bairnsdale and Orbost in East Gippsland, Victoria.

Earth Systems has been commissioned by Eastern Iron to prepare this *Flora, Fauna and Ecological Characteristics and Assessment* to support a referral to the Minister for Planning for advice as to whether an Environment Effects Statement is required for the Project pursuant to the *Environment Effects Act* 1978 ('EES Referral').

There are spatial and landscape aspects that are relevant to the consideration of the Project. Firstly the mine site itself, which is where the mineral extraction and infrastructure associated with the Project will occur and secondly, the wider region surrounding the mine site which may be indirectly impacted by construction and operation. In accordance with State and Commonwealth legislation, the Project will be required to achieve a net-gain benefit in the region's biodiversity. Project components will need to be designed and placed to avoid, minimize and mitigate impacts on ecological characteristics wherever possible. A comprehensive management and monitoring program for biodiversity values will also need to be implemented over the life of the Project.

1.2 Objectives and Scope

The main aim of this *Flora, Fauna and Ecological Characteristics and Assessment* is to review, investigate and discuss the baseline ecological characteristics of the mine site, and recommend key management and mitigation measures to minimise potential adverse effects on species and communities. Specific objectives of this study were to:

- Identify and assess flora, fauna and ecological communities that may be present in, or near to, the mine site;
- Determine the likelihood that threatened species and communities may reside or temporarily use the mine site and greater region; and
- Briefly outline the current disturbance status of the mine site, and assess the potential impacts of the proposed Project on terrestrial ecology; and
- Outline mitigation and management measures that will minimise the potential for any significant impacts on flora, fauna and ecological communities.

As discussed in the section above, the scope of this report is limited to an assessment of the ecological characteristics in the mine site and surrounds. The ecological characteristics of the downstream catchment have been addressed separately in the ***Aquatic and Wetland Ecology Study*** (EES Referral Attachment 9).

As the purpose of the current Study is to support the EES Referral, the focus of the report is on the components of the Project within Victoria. Project components at the South East Fibre Exports (SEFE) wharf in Edrom, NSW, will be subject to approval under State and local planning processes.

1.3 Project Description

The proposed Project is a greenfield development of a high grade magnetite/hematite deposit generally referred to as '5 Mile'. It is located approximately 7 km north of the township of Nowa Nowa, which is situated on the Princes Highway between Bairnsdale and Orbost in East Gippsland, Victoria. The site is wholly within the Tara State Forest (Figure 1-1).

The Project involves an open cut mining operation from a single pit with dry processing at the site to upgrade the material to a saleable product. It is anticipated that the Project will produce up to 1Mt of ore per annum, over an initial mine life of 8-10 years. The mine will be operated using a mining contractor and local employees (i.e. no on-site accommodation).

It is proposed to transport the processed ore by road to the existing South East Fibre Exports (SEFE) wharf at the Port of Eden in Edrom, NSW. The majority of the transport route between the mine and the Port is via the Princes Highway. The material will be temporarily stockpiled before being loaded onto 50-60,000t vessels and exported to international markets.

The main components of the Project at the mine site will include:

- Open Pit;
- Mine Infrastructure (includes the Run of Mine (ROM) pad, processing plant and Mine Operations Centre);
- Waste Rock Dump;
- Temporary Low Grade Ore Stockpile;
- Water Storage Infrastructure;
- Mine Access and Haul Roads; and
- Ancillary Infrastructure.

These components are depicted in Figure 1-2, whilst further details of the Project are provided in the ***Project Description and Proposed Mine Plan*** (EES Referral Attachment 1).

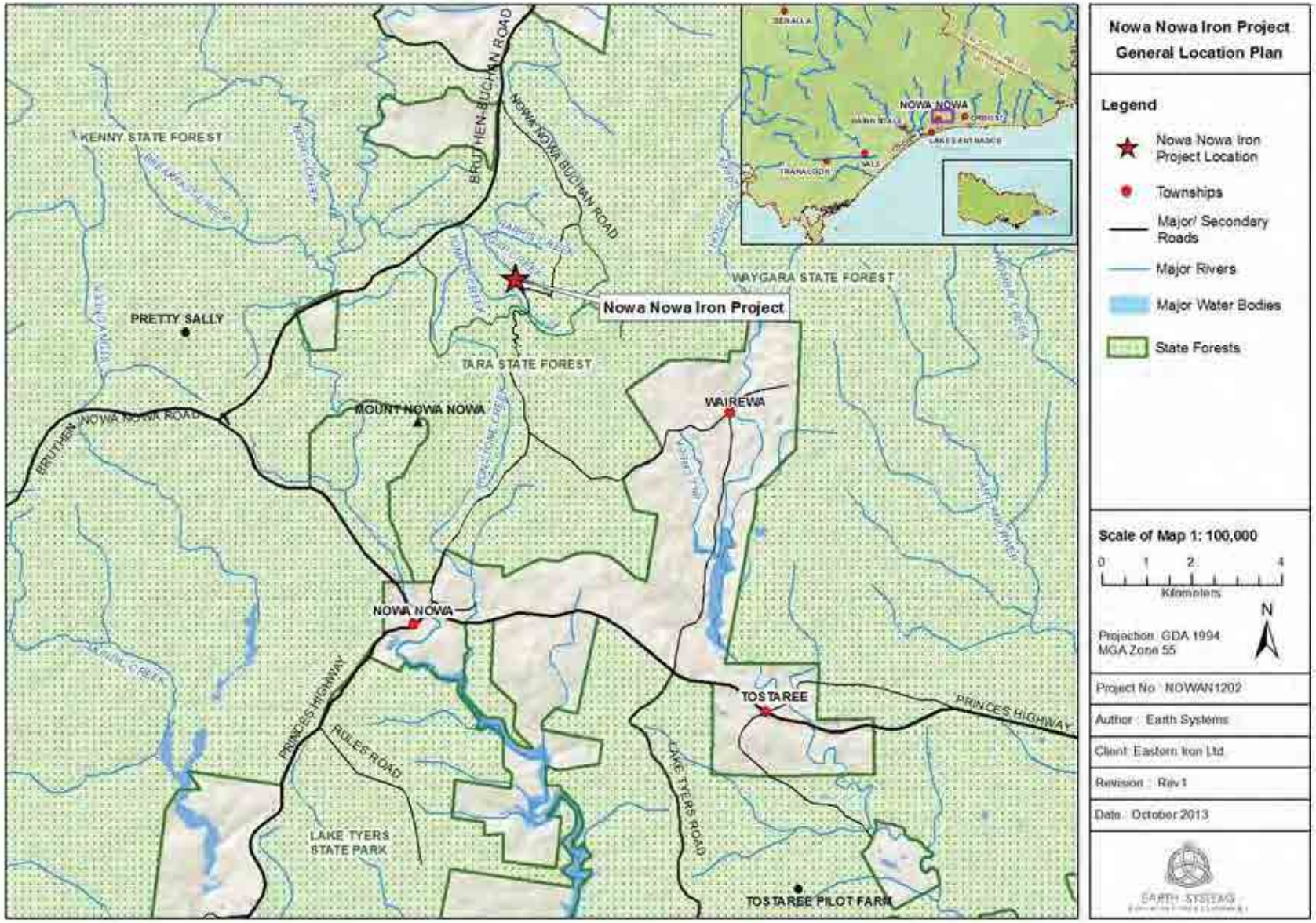

Figure 1-1 Project location

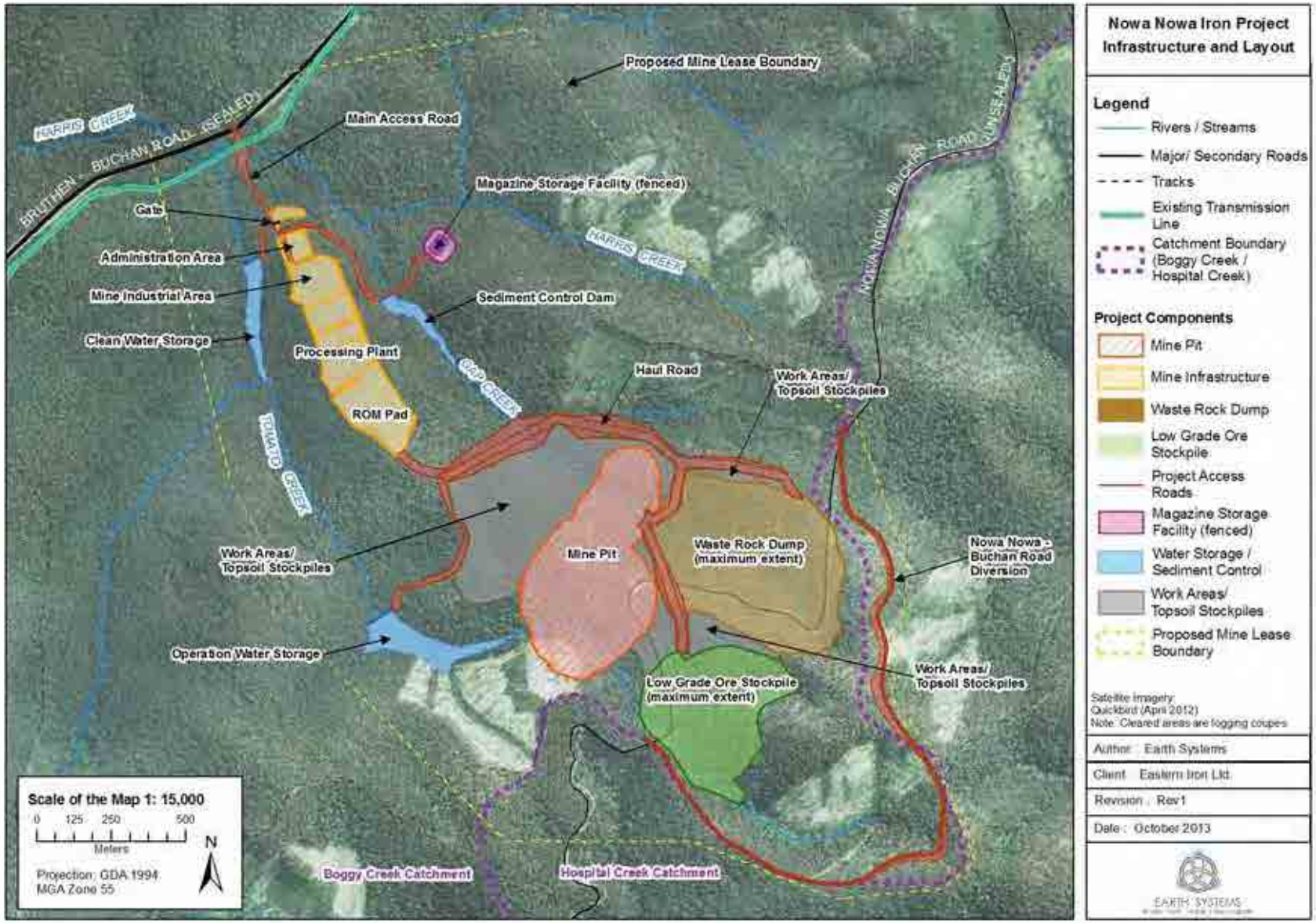

Figure 1-2 Mine site infrastructure and layout

2 Environmental Setting

2.1 Topography and Climate

The mine site is located approximately 7 km north of the township of Nowa Nowa, 18 km northeast of Lakes Entrance and 250 km east of Melbourne in East Gippsland, Victoria (37° 39' 45"S, 148° 6' 43"E; Figure 1-1). East Gippsland is a low-lying region with gently undulating hills flanked by coastal plains, dunefields and inlets. Drainage from the area of the mine site flows south to the estuaries on the coast which form part of the Gippsland Lakes.

The climate of East Gippsland is temperate, with a mean annual rainfall of approximately 821 mm recorded at Mount Nowa Nowa, in close proximity to the mine site (BOM 2013b). Mean maximum temperatures recorded at Mount Nowa Nowa are highest in January (25ºC) and mean minimum temperatures are lowest in July (6ºC). Relative humidity levels range between 57% (in January) and 78% (in May). Mean wind speeds recorded at Mount Nowa Nowa are approximately 12 km/hr. The prevailing wind direction is from the north-west in the morning and south-east in the afternoon.

2.2 Landuse, Geology and Soils

2.2.1 Landuse

The Project is located within the Tara State Forest. The Department of Environment and Primary Industries (DEPI) divides State Forests into three zones for management purposes, two of which occur within the mine site (the latter two):

1. General Management Zone (GMZ) - are managed for a range of uses and values, with human use and timber production given a high priority.
2. Special Management Zone (SMZ) - managed to conserve specific features, while catering for timber production under specific management conditions.
3. Special Protection Zone (SPZ) - managed for particular conservation values, forming a network designed to complement the formal reserve system. Timber harvesting and other disturbances are excluded from this zone.

The Tara State Forest is primarily managed for forestry activities and the mine site includes some areas approved as timber coupes in the VicForests' latest Timber release Plan (2009-2014).

The main land use activities within the broader East Gippsland region are forestry and agriculture, including dairy farming, wool production, cattle and sheep production and vegetable production. Tourism is a growing industry in East Gippsland, with the Ramsar listed wetlands, lakes, forests, rivers and the Victorian Alps key attractions (DSEWPaC 2010). Hikers and cyclists are attracted to the East Gippsland Rail Trail which follows the disused Bairnsdale-Orbost railway, crossing Boggy Creek and Ironstone Creek and passing through Nowa Nowa. The Lake Tyers Forest Park which extends to Mount Nowa Nowa is a destination for shore-based activities including bushwalking and camping. There are also several other national and State parks surrounding the area, particularly along the coast.

For a more detailed review of land and water use associated with the Project see **the *Land and Water Use Study*** (EES Referral Attachment 11).

2.2.2 Geology and Soils

Most of the region of the mine site is composed of Neogene (late Tertiary) alluvial sediments (DPI 2013). These alluvial sediments form terraces and fan out from the uplands. The lowlands are sandy loams overlying clays. There has been some structural movement with early deposits being dissected with sediment composed of organic matter and iron, and volcanic intrusions.

Surface soils are moderately to highly acidic, particularly along the coast (EPHC 2011). Soils range from sandy loams to dark grey brown loamy sands. Surface soils also have a low nutrient and water holding capacity, and are particularly prone to wind erosion (if exposed). Deeper layers of heavy clay can also be moderately to strongly acidic (DPI 2013).

The 5 Mile deposit area itself consists of a massive magnetite/haematite ore body within Silurian felsic volcanics (Thorkidaan Volcanics) and turbidites (Pinnak Sandstone). The style of mineralisation appears to be skarn-style or carbonate replacement. The mineralisation is characterised by massive magnetite-haematite with lesser chlorite, talc, pyrite and quartz with trace chalcopyrite. Magnetite appears to be late stage replacing specular haematite, but where extensive weathering is apparent haematite appears to occur after magnetite. For a more detailed review of the geology of the site refer to EES Referral Attachments 1 and 6.

2.3 Hydrology and Drainage

Surface water

The mine site occurs principally within the catchment of Boggy Creek, and is located adjacent to the boundary of the Hospital Creek Catchment. Several small creeks intersect the mine site area, which are ephemeral and dry for most of the year. These creeks are Harris Creek, Gap Creek, and Tomato Creek. Both Gap Creek and Tomato Creek are tributaries of Harris Creek, which flows into the Boggy Creek about 4 km downstream of the mine site. A further 11 km downstream, the Boggy Creek flows into the 'Nowa Nowa Wetlands' at the northern end of Lake Tyers, which is part of the broader Gippsland Lakes. Lake Tyers is an estuary covering approximately 25 km^2, with an average depth of 3-4 m. The Gippsland Lakes system, including Lake Tyers, is listed under the Convention on Wetlands of International Importance (i.e. Ramsar Convention). The main lakes of the Gippsland Lakes system are Lake Wellington, Victoria and King, which are linked to the sea by an artificial entrance at Lakes Entrance. Notably, Lake Tyers is situated to the east of the Lakes Entrance area and does not have connectivity to the other lakes in the Gippsland Lakes system.

While not directly downstream of the mine site, Ironstone Creek occurs south of the mine area and forms the second of two major tributaries draining directly into Lake Tyers. The source of Ironstone Creek is located south of Mount Nowa Nowa, approximately 2 km south of the mine site. Ironstone Creek is crossed by both Nowa Nowa – Buchan Road and the Princes Highway, flowing south to join the Nowa Nowa arm of Lake Tyers just south of Nowa Nowa township.

Groundwater

The catchment downstream of the Project is located within the Gippsland groundwater basin which underlies a significant proportion of the Gippsland region. There are no Groundwater Management Areas in the Nowa Nowa region (EGCMA 2006). Groundwater Management Areas cover areas where groundwater has been, or has the potential to be, intensively developed.

Further detail on the surface and groundwater setting of the Project is provided in the ***Surface and Ground Water Baseline and Assessment*** (EES Referral Attachment 5).

2.4 Bioregional Context

The mine site and greater region lies within the East Gippsland Lowlands and East Gippsland Uplands (DEPI 2013b). The mine site specifically lies within the two former bioregions. The **East Gippsland Lowlands** (EGL) is formed by gently undulating terraces flanked by coastal plains, dunefields and inlets. The vegetation is dominated by Lowland Forest with Damp Forest and Shrubby Dry Forest ecosystems interspersed throughout the foothills; Banksia Woodland and Riparian Scrub Complex are common along coastal areas. The **East Gippsland Uplands** (EGU) consists of tablelands and mountains up to 1400 metres elevation. The vegetation is dominated by Shrubby Dry Forest and Damp Forest on the upland slopes and Wet Forest ecosystems which are restricted to the higher altitudes; Grassy Woodland, Grassy Dry Forest and Valley Grassy Forest ecosystems are associated with major river valleys.

2.5 Legislative Context

The development of the Project at the mine site will need to be developed in accordance with several items of Commonwealth and Victorian legislation relevant to flora, fauna and ecological communities, as well as relevant international treaties and agreements.

2.5.1 Commonwealth

The Commonwealth Government regulates many aspects of the environment. Key Commonwealth legislation applicable to the flora, fauna and ecological aspects of the Project include:

- Environment Protection and Biodiversity Conservation *Act* 1999 (EPBC Act);
- International treaties that are governed under the EPBC Act (refer Section 2.5.3).

2.5.2 State

Key Victorian legislative items that may be applicable to the flora, fauna and ecological aspects of the Project include:

- Catchment and Land Protection Act 1994;
- Coastal and Management Act 1995;
- Crown Land (Reserves) Act 1978;
- Environmental Effects Act 1978;
- Environmental Protection Act 1970;
- Flora and Fauna Guarantee Act 1988 (FFG Act);
- Forest Management Zones;
- National Parks Act 1975;
- Planning and Environment Act 1987:
  - Currently including Victoria's Native Vegetation Framework;

- Victoria's Biodiversity Strategy;
- Water Act 1989;
- Wildlife Act 1975.

2.5.3 International Treaties

The Convention on Wetlands of International Importance (Ramsar Convention 2013) is an international treaty designed to conserve and manage the sustainable use of wetlands. Australia became a signatory in 1971 and protects its 64 Ramsar wetlands under Commonwealth Legislation, specifically the *EPBC Act* 1999 (DSEWPaC 2010). This Convention is of relevance to the Project as the Gippsland Lakes Ramsar site occurs approximately 15 km downstream of the mine site.

3 Methodology

A three-tiered approach was adopted to assess the ecological characteristics of the mine site and surrounds. Firstly, a search of the literature and available databases provided an indication of the species and communities recorded in the greater region and also the likelihood of these species inhabiting the mine site. Secondly, an overview site visit of the mine site and broader region was conducted to initially assess the ecological characteristics of the area. Thirdly, detailed field surveys were conducted including:

- Detailed flora field surveys to assess the quality and conservation status of habitat and vegetation and provide estimates of offsets for any vegetation that may be removed; and
- Diurnal and nocturnal fauna surveys to record the presence (and absence) of birds, mammals, reptiles and amphibians inhabiting the mine site.

3.1 Study Areas

For the purposes of this report, the ***mine site*** is defined as the area proposed to be directly cleared for the Project, including the open pit, mine infrastructure, waste rock dump, temporary low grade ore stockpile, mine access and haul roads, ancillary infrastructure, and buffer areas (Figure 1-2, see also EES Referral Attachment 1 for full description). This includes the proposed diversion of the existing Nowa Nowa-Buchan Road.

Regional biodiversity was assessed by examining literature and database records within a 10 km zone (hereafter 'the region') centred on coordinates at the mine site (37° 39' 45"S, 148° 6' 43"E). This zone was also visited to provide an overview field assessment of the region. The zone was chosen to allow for spatial error in species or ecological communities locations. It is possible that the location details from the various flora and fauna databases have been inexactly recorded or incorrectly entered into the databases. Additionally, many animals can move long distances and may be recorded elsewhere but still visit the region.

For the detailed fauna field surveys, the area assessed was at a much finer spatial scale. A ~1250 ha ***Study Area*** encompassed the mine site and surrounding habitat (to account for highly mobile fauna). Field flora surveys within and around the mine site were conducted by Ethos NRM within a similar area (referred to as the 'vegetation study area' (see Section 3.4, Annex 1 and Annex 2).

3.2 Literature and Database Review

This assessment also sought information for flora, fauna and ecological community records from the following main databases and literature sources:

- Victorian Biodiversity Atlas (VBA: DEPI 2013d);
- Biodiversity Interactive Map (BIM: DEPI 2013a);
- BOM Atlas of Groundwater Dependent Ecosystems (BOM 2013a);
- EPBC Act Protected Matters Search Tool (DSEWPaC 2013a);

- DEPI Threatened Species Advisory Lists (DEPI 2013c);
- Department of Sustainability, Environment, Water, Populations and Community Species Profile and Threats Database (DSEWPaC 2013b);
- Gippsland Lakes Ramsar site Ecological Character Description (DSEWPaC 2010); and
- Gippsland Lakes Ramsar site Strategic Management Plan (DSE 2003).

The VBA provides information on species that have been recorded, for example seen, heard, or indirect evidence (e.g. tracks), in an area (DEPI 2013d). The records may be part of an official survey conducted by scientists or incidental observations by amateurs. The VBA data is much more detailed than what is provided publically by the DEPI on their BIM and therefore information sourced from the BIM supplemented data provided to us by the VBA rather than supplanting it. Although these databases were searched in 2013, data were limited to records up until 2011.

Information regarding threatened species was also sought from the DSE's Advisory Lists. These lists refer to rare and threatened species in Victoria only and are not to be confused with the species listed under the FFG Act. There are no legal requirements pertaining to species in these Advisory Lists. However, information was sourced from these lists to aid in detailed flora and fauna assessments of the study area.

Native vegetation has been classified according to Ecological Vegetation Classes (EVCs). These EVCs have been mapped using various sources (e.g. satellite, field) and are available through the BIM and VBA. The conservation status of EVCs is similar to the legal requirements of DEPI Advisory Lists. However, some EVCs have been encompassed under the FFG Act, either alone or in conjunction with other EVCs or communities (e.g. bird communities). The data pertaining to any FFG Act modelled communities in the region were obtained from DEPI (DEPI 2013d).

A thorough search of the literature and publically available documents was conducted to provide background information and to assess the likelihood of an impact on the ecological characteristics of the region (including significant species and communities). It was then possible to use expert knowledge and the literature to determine how likely these species and communities were to occur within the region in the future (if no records exist).

Species that are exclusively marine, particularly deep marine, have been excluded from this report as they are highly unlikely to occur in-shore and thus not be in any way impacted by the Project.

3.3 Regional Overview Field Assessment

Much of the region surrounding the mine site was traversed on foot and by vehicle to provide an overview assessment of the entire region. Species seen or heard and their rough location (e.g. study area) were noted. This did not include the area designated as the Study Area.

3.4 Vegetation and Flora

Field flora surveys within and around the mine site were conducted by Ethos NRM Pty Ltd. The methodology of the vegetation and flora assessment is described in detail in Annex 1 and Annex 2, and is summarised briefly below.

The vegetation and flora assessment was undertaken to determine on-site vegetation quality and included site description, Habitat Hectares Assessment and Ecological Vegetation Class mapping. All field assessments were undertaken by a DEPI accredited Native Vegetation Assessor.

Background information was sourced to aid in the identification of potential flora and fauna values associated with the proposed vegetation removal, as well as any other conditions that may be relevant to the quantification of vegetation loss and calculation of the Offset like-for-like conditions. These sources included:

- Atlas of Victorian Wildlife;
- Biodiversity Interactive Map (DEPI interactive maps);
- DSE Rare and Threatened species database;
- Ecological Vegetation Class Descriptions;
- EPBC on-line Protect Matters Search Tool; and
- Planning Maps Online.

Field surveys within a vegetation study area of approximately 1100 hectares surrounding the mine site were undertaken on the 26th and 27th of March and 5th of April, 2013. The assessment followed existing guidelines (see DSE 2004) to determine on-site vegetation quality and included:

- Site Description (location) and Site Specific Details;
- Ecological Vegetation Class (EVC) descriptions;
- Habitat Hectares Assessment of 17 sample sites and Tomato Track-Bruthen-Buchan Road intersection; and
- EVC mapping.

Targeted surveys for the Colquhoun grevillea (*Grevillea celata;* EPBC Act listed) were conducted in October 2013 (flowering season) to determine presence of individual plants and potential habitat. This involved vehicular and walking transects along tracks and roads (grevilleas seem to prefer disturbed sites) and also detailed searching within the mine footprint (see Annex 2 for details).

3.5 Fauna Habitat

Fauna habitat was assessed to provide an indication of the distribution and quality of habitat within the Study Area. Detailed habitat assessment was primarily achieved by observations on foot (~550 ha), and supplemented by observations from a vehicle and high resolution satellite imagery covering the remainder of the 1250 ha Study Area. Fauna habitat was broadly categorised into very low, low, moderate and high quality, with finer scale assessment based on aspects such as the number of trees per hectare, canopy cover and the presence of tree hollows. Fauna habitat was then classified based on the type and structure of vegetation, canopy presence and topography.

3.6 Diurnal Fauna Surveys

Diurnal fauna surveys were conducted between the 27th March and 29th May, 2013, with each survey session being separated by a two-week interval to obtain a representative sample over time, encompassing the end of warmer temperatures to the start of winter. All diurnal fauna surveys were

conducted in fine weather, that is, not in excessively wet or stormy conditions. Light, sporadic and short-lasting rain was considered acceptable. Animals are less active during wet and stormy weather and therefore detectability decreases. The aim was to detect all species present, rather than obtaining a representative (behavioural) activity level in different weather conditions. This did not include targeted surveys for frogs as they are more active in wet conditions; however, any frogs heard or seen during these surveys were recorded (see Section 3.7).

3.6.1 Point Counts

Systematic spatial sampling was used to survey the Study Area, as the site was too large (and logistically difficult) to survey by simple random or other randomised methods. The Study Area was divided into nine approximately 130 ha quadrats, and within these quadrats, eight survey points were located in a grid arrangement, following the borders of the quadrat (see Figure 3-1). These survey points (totalling 72), or replicates, aimed to cover all habitat types and provide a representative spatial sample of the Study Area's species assemblage. Quadrat surveying order was randomised and points were systematically visited in either a clockwise or anti-clockwise direction (logistically too difficult to randomise).

Diurnal surveys began 30 min after sunrise and finished within approximately 3 hrs. This restricted period of time was to reduce time-of-day effects (i.e. changes in faunal activity levels). At least two quadrats (16 points) were visited within one survey session, sampling the range of different habitats within the Study Area. A survey point was at least 250 m from another point to reduce the likelihood of resampling highly mobile fauna. Points were not revisited to avoid resampling individuals.

All vertebrate fauna seen during point counts were recorded within two radii of each point. The radius from each point was determined by the size of the animal. Larger animals (e.g. laughing kookaburra *Dacelo novaeguineae,* 340 g) could be identified within 50 m, smaller at approximately 15 m (e.g. striated thornbill *Acanthiza lineata,* 7 g). Each point was surveyed for 10 min to adequately search the radii but to avoid resampling individuals. Calls were only used to identify the location of animals; if the animal could not be seen and identified (with or without binoculars) an incidental record was taken (see Section 3.8). Birds flying overhead and not utilising some of the vegetation within the radii were not recorded within counts, but were included in incidental records (see Section 3.8). This methodology was adopted from (Loyn 1986) and (Watson 2003) (with modifications) to suit the biotic and abiotic characteristics of this Study Area.

3.6.2 Transect Searches

Searches were conducted of vegetation, trees, under rocks/logs, leaf litter and bare ground for evidence of vertebrate fauna (e.g. nests, scats, tracks, owl pellets) while walking to, from and in between survey points. Approximately 3 to 10 m either side of the path taken was surveyed and any potential evidence of threatened species was noted, photographed and spatial coordinates recorded (see Figure 3-1). Any evidence of non-threatened species was recorded within incidental records (see Incidental Surveys). These searches also included listening for any threatened owl or frog species. Owls will occasionally vocalise when roosting.

3.7 Nocturnal Fauna Surveys

Due to the steep terrain and dense vegetation, nocturnal surveys were restricted to roads, tracks and paths for personnel safety. Surveys were either conducted on foot or by vehicle. Due to the nature of the surveying methodology, a larger area than the Study Area was surveyed (see Figure 3-2). Depending on environmental conditions (e.g. wind, track condition), area covered and sites visited per night varied. All

tracks and roads within the Study Area were surveyed over four sessions, each session being separated by at least two weeks from 26th March to 28th May, 2013. Autumn is one of the best times of year to detect forest owls and arboreal marsupials (Wintle et al. 2005).

The interval between sessions was to allow for temporal and seasonal variation in nocturnal fauna occupancy (i.e. site use) and to avoid animals habituating or being overly disturbed by survey methods. Nocturnal fauna surveys began 30 min before sunset and continued for approximately 3 hours after sunset. All vertebrate fauna species detected during nocturnal surveys were recorded; however, certain techniques were used to target threatened species. The different techniques used were call playback, call recognition, point spotlight search, transect spotlighting and dusk and dawn watches. Call playback, call recognition and point spotlight search were combined within search and playback sites.

3.7.1 Search and Playback Sites

Fifteen sites were chosen at least 1 km apart along tracks and roads throughout the entire Study Area and within 2 km of surrounding region (see Figure 3-2). These sites targeted the sooty owl (*Tyto tenebricosa*), powerful owl (*Ninox strenua),* masked owl (*Tyto novaehollandiae*) and various frog species. These species and some other birds and mammals have distinctive vocalisations and call recognition is the best and primary mode of detection. Surveys (for birds and mammals) were halted if conditions became extreme (e.g. wind >25 km/h, heavy rain), as these conditions were unsuitable for call recognition or playback and animals were less likely to be active. However, these stormy conditions became more suitable for the detection of frogs (e.g. green and golden bell frog *Litoria aurea* and giant burrowing frog *Heleioporus australiacus*) and therefore focus was shifted to recognition of frog vocalisations.

Sites were at least 1 km apart as approximate audible vocalisation distance for owls is 1.5 km (Wintle et al. 2005), and therefore increased probability of detection. Although this may appear to potentially cause an over-estimation in the number of individuals, call recognition was only used as a method of initial detection and further searching was required to confirm presence. These three owl species occur in pairs and their territories range from 600 to 4300 ha (Loyn et al. 2001, Loyn et al. 2011) and therefore, if individuals were present in the approximate 1400 ha Study Area, they would be infrequent and/or in very low densities (at one site).

For the first 10 min at a search and playback site any vocalisations were identified along with estimated location and distance (i.e. call recognition). Owl vocalisations were then played using an mp3 player and either portable speakers or a car stereo. Playing order followed DEPI guidelines for these species (e.g. Loyn et al. 2011), for example, powerful owl was played first as this species is known to respond slowly to elicitation (Wintle et al. 2005), sooty and then masked owl vocalisations (i.e. territorial screams and trilling) were then played and all calls were followed by at least 2 min silence. All species heard were recorded as present, if any of the target species were heard, these were followed by further identification methods (see dusk/dawn watches). Any elicited vocalisations close to the site were followed up by a search with a spotlight (250 lumen portable spotlight). A point spotlight search was conducted upon completion of call playback, searching an approximately 30 m radius. If targeted species were heard or seen within a night, the playback of their call was discontinued to avoid distressing and disturbing the animals.

Call playback was not used for frogs as suitable habitat for FFG or EPBC Act species was absent and it was decided that call recognition (especially during and after rain) was sufficient to identify other threatened species. Surveys during stormy conditions also follow Commonwealth and State survey guidelines. Particular effort was made to listen for frog species (especially near known creeks) during and after rain, regardless of the time of day.

3.7.2 Transect Spotlighting

All paths, tracks and roads within the Study Area and some in the surrounding 2 km habitat (see Figure 3-2) were covered by foot or vehicle to detect any nocturnal vertebrate fauna. After the completion of call playback (see above), transect spotlighting was the primary method to detect all other nocturnal fauna, especially those that do not vocalise. However, if any vocalisations were heard, species and locations were recorded. Transects were traversed at approximately 4 to 5 km/h and roughly 20 m either side of the transects were searched with a spotlight. Nocturnal animals were predominantly located via eye-shine, with some species having very distinctive eye-shine. For example, greater gliders (*Petauroides volans*) have bright white eye-shine and tend to stare at intruders, making them easier to identify than shyer animals (Wintle et al. 2005). The location (i.e. GPS coordinates) of any species identified was recorded from the road or track to avoid any further disturbance to the animal. If any threatened species were detected, a photograph was taken (whenever possible).

3.7.3 Dusk/Dawn Watches

The Study Area was visited regularly during dusk and dawn (during the course of other formal surveys) and therefore every attempt was made to listen and/or detect the presence of threatened species. Some species are crepuscular (active at dusk/dawn) and nocturnal and diurnal species often vocalise at these times.

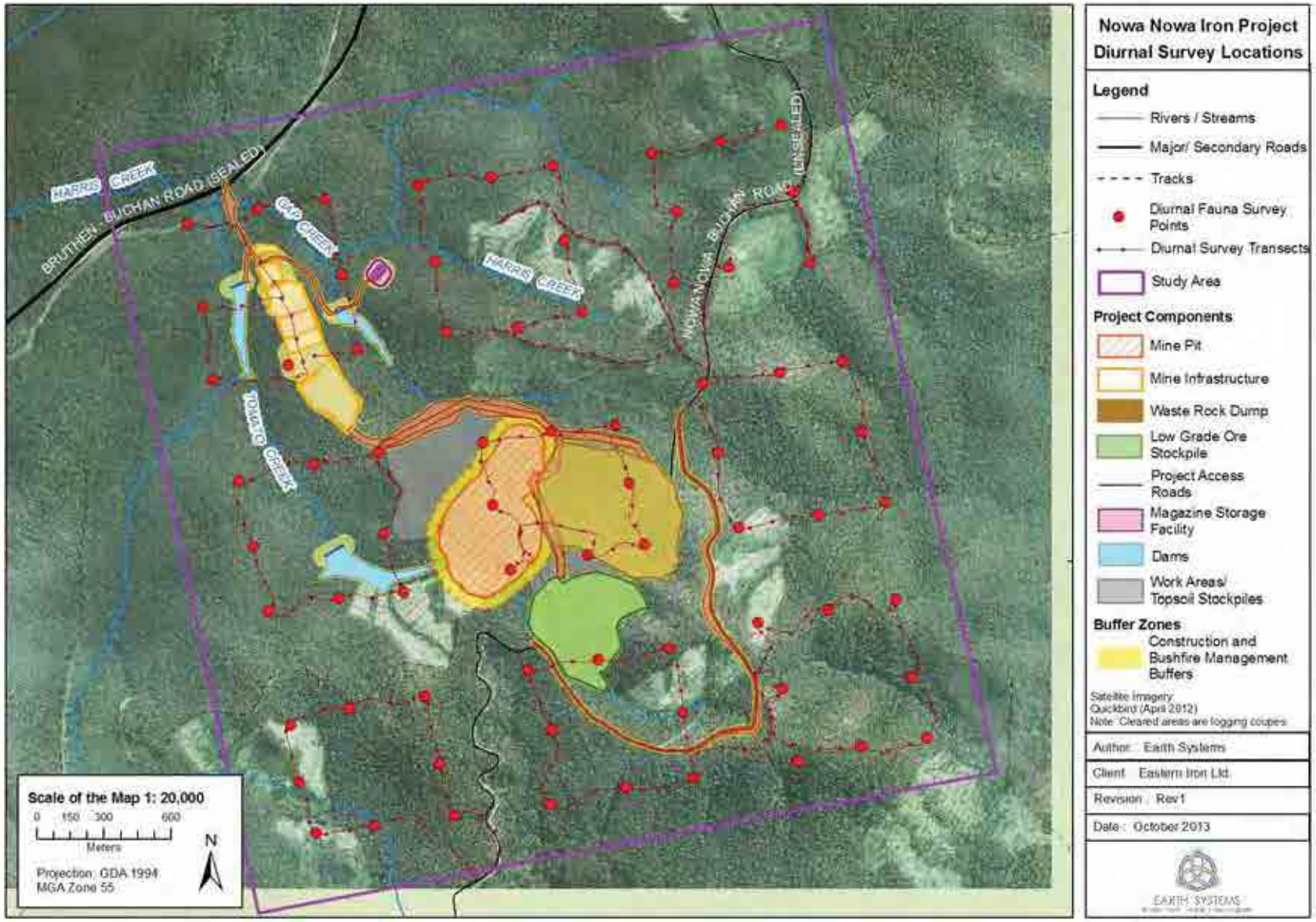

Figure 3-1 Diurnal fauna survey locations; point counts and transects walked within the Study Area

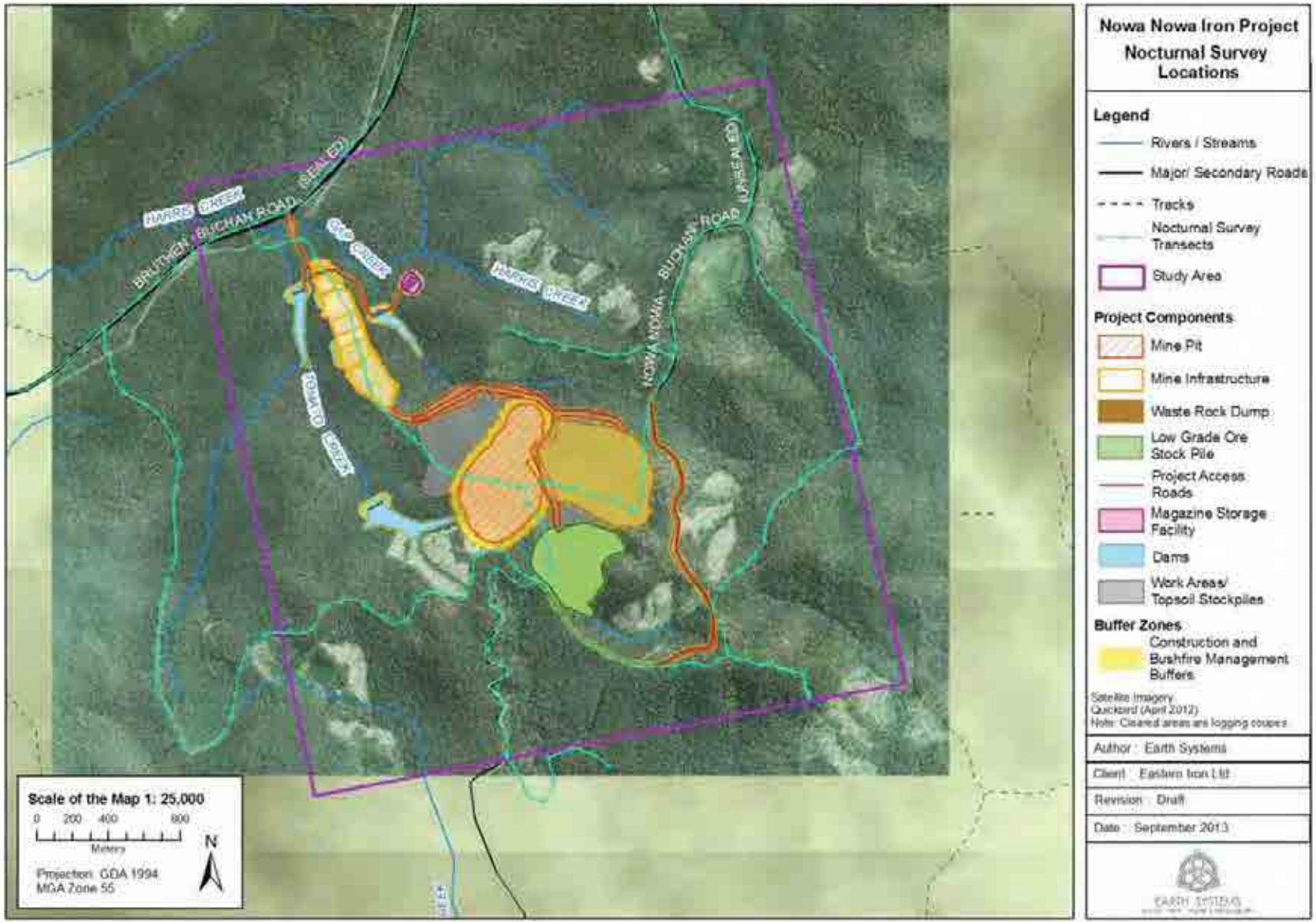

Figure 3-2 Nocturnal fauna survey locations; spotlighting transects, playback and call recognition locations and greater Study Area

3.7.4 Estimating Owl and Glider Detectability and Sufficient Survey Effort

Generally, it is assumed that if a species is not recorded within surveys it is absent. However it is possible the species was present and not detected. We estimated species richness (see Section 3.9) to account for these potential false absences, but this does not indicate which species were not detected. False absences in a fauna assessment (such as this) may result in inadequate conservation and management measures (Wintle et al. 2005), even if using the precautionary principle.

Since nocturnal animals are more difficult to detect than diurnal, it is important to be confident that an animal was not detected because it was absent (or uses the site very rarely) rather than being recorded as a false absence. This confidence is particularly important when assessing the use of an area by threatened species. The Study Area may be within the territorial home-ranges of several threatened species, but the sooty owl, powerful owl, masked owl and greater glider were most likely to occur due to records nearby and suitable habitat being present within the region.

Wintle et al. (2005) calculated single-visit detection and long-term occupancy probabilities for three of these species using a zero-inflated binomial model, given certain environmental variables. Single-visit detection probability (*d*) was the probability that a species will be detected within any one visit, whereas long-term occupancy (*p*) was the probability of sites being occupied over a long period. Wintle et al. (2005) produced detectability models for each of the species based on environmental conditions that most influenced detectability (Table 3-1). It was assumed that masked owl detectability would be similar to the sooty owl as they occupy similar ecological niches and are similar in appearance.

Table 3-1 Detectability models for three threatened nocturnal species potentially inhabiting the Study Area (Wintle et al. 2005). T = Ambient Temperature, H = Habitat Quality, MP = Moon Phase (%), Sol = Solar Radiation Index.

Species	Model: logit(*d*) =
Greater Glider	-1.85 + 0.08T + 3.74H
Powerful Owl	-1.31 – 1.03MP
Sooty Owl	-2.37 + 0.114T + 5.20Sol

Ambient temperature, habitat quality and solar radiation index were measured on site or derived from GIS models. Habitat quality was determined from an average of habitat hectare scores (converted to proportions) of different habitat types within the Study Area (see Annex 1). Moon phase was determined from a calendar and converted to proportions. These environmental parameters varied and therefore an average, maximum and minimum were calculated and used in the model.

Single-visit detectability (*d*) was then inputted into the following model to produce the probability that a species would be detected after *v* visits, given that it is present.

Pr (species detected at least once) =

$$\sum_{x=1}^{v} \binom{v}{x} d^s (1-d)^{v-x}$$

$$= 1 - (1-d)^v$$

Detectability curves were produced for each species using the above equation for *v* visits.

3.8 Incidental Surveys

All vertebrate fauna seen or heard within the Study Area and not seen during formal diurnal or nocturnal fauna surveys were recorded. If threatened species were detected, extra effort was made to locate and record the appropriate variables (e.g. GPS, habitat). Incidental surveys occurred whenever ecologists were traversing the Study Area and not conducting formal surveys.

3.9 Data Analysis

3.9.1 Bird Species Assemblage Differences

Generally, species richness is defined as the number of species, however we have recorded the number of species in an area with a known size and will therefore more accurately define species richness as species density. Bird species density and abundance data were compared between habitat types using semi-parametric analysis of variance statistical models (i.e. PERMANOVA see Anderson 2004, Anderson 2005). No other taxon was as well represented (i.e. large sample size) and therefore only bird density and abundance data were compared across habitats. Habitat types compared were open woodland, open shrubby forest, riparian/damp forest and logging regeneration since they were the main types present in the Study Area (see Section 5.4 for descriptions). Data were averaged over site points, transformed ln(x + 1) to reduce the zero inflated data set and α-priori was set at less than 0.05.

To compare the species diversity in the different fauna habitats, data was analysed using several standard techniques. Standard diversity indices were calculated for all habitat types, these were Simpson's Index and Shannon's Index (Krebs 2009). These indices essentially quantify the proportion or probability that individuals (will) belong to the same species (see Terminology for full description). For example, a low Simpson's Index equates to high diversity, when two individuals are chosen at random the Simpson's Index calculates the probability they belong to the same species.

Generalised Morisita similarity/dissimilarity indices were computed to compare observed species density and abundance data between habitat types (Chao & Shen 2010). These analyses were computed with PAST (Palaeontological Studies) and SPADE (Species Prediction and Diversity Estimation) software that used non-parametric similarity/dissimilarity statistical models (e.g. MDS, ANOSIM; Hammer et al. 2006, Chao & Shen 2010).

These analyses provided an indication of how habitats within the Study Area varied in their biodiversity and if any particular habitat was more diverse.

3.9.2 Estimated Species Richness and General Diversity

Measuring species richness is often used as a proxy of community structure but can neither be accurately measured nor directly estimated by observation (Gotelli & Colwell 2010). Study areas are often too large, they are not closed (i.e. species move in and out) and many species are difficult to detect. Therefore estimating species richness (i.e. undetected species) should be an essential step of an assessment, and in the management of biodiversity.

There are many classic statistical models to estimate species richness and often they over- or under-estimate species richness because they ignore some of the fundamental problems of biodiversity sampling. Often it is assumed that detectability of one species is the same as all other species. Detectability is the probability of detecting at least one individual of a given species in a particular sampling period, provided that it is present (Boulinier et al. 1998). Thus, rare species are likely to be

detected infrequently. Unlike classic estimators, non-parametric estimators/models use the number of rare or infrequent species to extrapolate the number of undetected species (Chao et al. 2009).

Species incidence (presence/absence) and abundance data was pooled from all sources (e.g. nocturnal and diurnal surveys) to estimate species richness for the entire Study Area. Additionally, the total number of species was pooled as mammal and herpetofauna numbers were not sufficient to run the model by themselves. All species data were analysed using several different types of non-parametric models to produce a range of estimates (Species Prediction and Diversity Estimation program; Chao & Shen 2010). Overall species diversity indices were also calculated for this pooled data.

3.10 Groundwater Dependent Ecosystems

Literature, databases and particularly the BOM Atlas of Groundwater Dependent Ecosystems (BOM 2013a) were searched for evidence of on-site verification and remote modelling of Groundwater Dependent Ecosystems (GDEs) within the Study Area.

Information on groundwater at the site was also sourced from the ***Surface and Ground Water Baseline and Assessment*** (EES Referral Attachment 5). Groundwater depth recorded in this study was used to infer whether vegetation within the Study Area would be likely to rely on surface expression, subsurface groundwater or caves and aquifers.

3.11 Limitations of Surveys

Limitations of the surveys conducted in the current study included the fact that some flora and fauna species are only identifiable or onsite during particular periods of the year (e.g. flowering/migratory seasons). Additionally, a few flora and reptile species could not be identified to species level. Animals can move and be absent during a single observation session, that is, the entire Study Area cannot be surveyed at the same time.

Since the Study Area is a large area, only a portion could be ground-truthed for EVC distribution. This is a common problem/limitation for any flora and fauna study of a large area, it is impossible to survey a large area in detail. The extent of EVC mapping and flora sampling effort was designed to provide a preliminary indication of vegetation quality and diversity in the area. Further vegetation (habitat hectare) assessments are underway for Spring 2013, when cryptic species are likely to be flowering. The current habitat hectare estimates prepared by Ethos NRM (Annex 1) will be updated as part of this process.

Furthermore, preliminary estimates of vegetation offsets have been calculated using the current Native Vegetation Framework. This framework is set to be superseded by new guidelines for calculating offsets, but the full workings of these new regulations have not been released (refer Section 8.3.1). The limitations of the flora study are also outlined in Annex 1.

4 Regional Biodiversity

4.1 Significant Ecological Communities

4.1.1 Listed EPBC Act Significant Communities

The EPBC Act Protected Matters Search Tool identified that there may be one nationally significant ecological community in the region (within a 10 km zone around the mine site). The search identified White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland community, which is listed as Critically Endangered under the Act as there are few remnant areas remaining. The community is patchy and has been under threat because the historic range included high quality soils that were cleared for agriculture. The remaining patches are so fragmented and degraded that a true representation of the original matrix probably does not exist (Thiele & Prober 2000).

This community can be either woodland or derived grassland (grassy woodland where the trees have been removed). The ground layer can be composed of a sparse, patchy shrub layer, native tussock grasses and herbs and a tree canopy usually of white box (*Eucalyptus albens*), yellow-box (*E. melliodora*) and Blakely's red gum (*E. blakeli*) (Yates & Hobbs 1997). The tree canopy dominates this ecological community and the three main species can be interspersed with other tree species (Thiele & Prober 2000). The dominant life forms in the original community ground layer were herb and grasses, particularly kangaroo grass (*Themeda triandra*) and snow grass (*Poa sieberiana*). Consequently, it is possible for the community to exist without the tree canopy. Of 473 native species that may exist within the community, 167 plant species have been recorded in the region. This does not include the key species listed above.

Notably, this community was not identified in vegetation and flora surveys of the mine site (see Annex 1). The community might exist elsewhere in the East Gippsland region, though is likely to occur in areas with significantly less disturbance than the State Forests surrounding the mine site, which have been managed for timber harvesting.

4.1.2 FFG Act Modelled Communities

Four modelled FFG Act communities have been mapped within the region, all being listed as Rare. These communities are composed of the same EVC (Warm Temperate Rainforest EVC 32) but are listed separately as the patches differ in vegetative structure (listed under no. 274, 362, 363, 364). The EVC is generally described as being dominated by a range of non-eucalypt canopy species above an understorey of smaller trees and shrubs and usually visually dominated by ferns and climbers. It is a closed forest, with trees 20 to 25 m tall occurring along gullies and river flats. None of these small remnant patches of the Rare EVC are within the mine site. However, the closest patch is located approximately 600 m from the mine site (see Annex 1). The patch consists of the Coastal East Gippsland (362), East Gippsland Alluvial Terraces (274) and the Far East Gippsland (364) types.

4.2 Vegetation and Flora

4.2.1 Ecological Vegetation Classes

Two Bioregions exist within the region, the East Gippsland Uplands and the East Gippsland Lowlands. The BIM indicates eight Ecological Vegetation Classes (EVC's) have been mapped within the region (Table 4-1). Apart from native vegetation, other land cover types are common in the region such as agricultural land (Plate 4-1).

Table 4-1 Descriptions of the main Ecological Vegetation Classes within the region (DEPI 2013b), in order of estimated percentage cover

EVC Name	EVC No.	Conservation Status	EVC Benchmark
Lowland Forest	16	Least Concern	A very widespread dry forest vegetation type that is found in the foothills of the Great Dividing Range from East Gippsland to the western edge of the Study Area as well as the foothills of the Strzelecki ranges and Wilsons Promontory National Park. The understorey varies from shrubby to heathy to sedgy and may even be grassy as fertility increases.
Shrubby Dry Forest	21	Least Concern	Occurs on a range of rock types in the foothills associated with shallow rocky sites on exposed aspects such as ridges and medium to steep upper slopes on shallow soils. The overstorey is a low, open forest consisting of a range of eucalypts. The understorey lacks a secondary tree layer but a well-developed medium to low shrub layer is present. The ground layer is often very sparse with tussock-forming graminoids being the dominant life form.
Damp Forest	29	Least Concern	Damp Forest grows on a wide range of fertile parent rock types on a variety of aspects, from sea level to submontane elevations. It is dominated by a tall eucalypt layer over a shrub layer of broad-leaved species typical of wet forest mixed with elements from dry forest types such as prickly or small-leaved shrubs. The ground layer includes forbs and grasses as well as moisture-dependent ferns.
Blackthorn Scrub	27	Rare	Found on northerly and westerly slopes of mountains and gullies. Trees are sparse, often present only as a mid-canopy or forming a very open woodland. Dominated by a small tree or tall shrub layer to 6 m tall, the ground layer is generally sparse and species-poor due to low site quality and the density of the overstorey. Vines can be conspicuous in the understorey.
Clay Heathland	7	Vulnerable	Occurs on sites with poor drainage, often on duplex soils. Dominated by heathy shrub species with or without an eucalypt overstorey. The ground layer is dense and diverse with a variety of species.
Riparian Scrub/Swampy Riparian Woodland Complex	17	Least Concern	Can be either areas of shrubland or open forest. Occurs along broad, gently sloping drainage lines where stream alluvium is present. The understorey is dominated by large sedges and amphibious herbs although species diversity is generally low due to the dense cover of shrubs.
Limestone Box Forest	15	Vulnerable	Occurs on generally well developed soils derived from Tertiary limestone that outcrop around coastal streams, gullies and lakes. Open eucalypt forest to 20 m tall with a tall shrub layer understorey and a grass and herb-rich ground layer on sheltered aspects but may be almost completely bare on drier aspects.

EVC Name	EVC No.	Conservation Status	EVC Benchmark
Warm Temperate Rainforest	32	Rare	Generally occupies gullies and slopes where mean annual rainfall is >700 mm. Closed forest along small streams and dominated by non-eucalypt canopy, with understorey of trees and shrubs and a matrix of ferns.

4.2.2 Flora

A list of all flora recorded in the region was sourced from the VBA provided by DEPI. There were 1102 different species, sub-species, variants and hybrids of plant (referred to hereafter as "species"), with 200 of these being introduced (not native)[1]. Of the 902 native species three species are listed as Vulnerable under the EPBC Act, the Colquhoun grevillea, limestone blue wattle (*Acacia caerulescens*) and leafy nematolepis (*Nematolepis frondosa*) (see Annex 3). These species are also listed under the FFG Act and considered Vulnerable by the DEPI Advisory List. There were four species listed under the FFG Act but not nationally recognised (i.e. EPBC Act). Another 73 species that are recognised as being significant solely on State (DEPI) advisory lists have been recorded in the region (see Annex 3).

A total of 89 State and nationally threatened species may reside in the region based on available habitat (EVC's) and ecosystem modelling (including nine species not recorded previously; see Annex 3).

4.3 Fauna

4.3.1 Birds Recorded During Overview Assessment

Fifty-two species of bird were observed during the overview assessment, six of which were not native to Australia (Table 4-2). No EPBC or FFG Act listed species were observed at any time, however one DEPI-listed species was observed in forested areas within the region. All other species were common and/or widespread within Victoria and/or Australia.

4.3.2 Birds Previously Recorded In, and May Use, the Region

Databases indicated that 196 bird species have been recorded within the region between 1954 and 2009 (DEPI 2013d)[2]. Eight of these species of bird were not native to Australia. Two EPBC Act threatened species were recorded in the region in 1977 (Australian bittern *Botaurus poiciloptilus,* swift parrot *Lathamus discolor*).

Nineteen species recorded in the region are recognised by the FFG Act as being threatened, five also being listed under the EPBC Act. All 19 are also recognised by the DEPI Advisory Lists. A further seven species are recognised by the DEPI but no other legislation. Three of the FFG Act listed species (masked, sooty and powerful owl, *Tyto novaehollandiae novaehollandiae, T. tenebricosa tenebricosa* and *Ninox strenua*) have been recorded several times over many years.

In total, 46 significant bird species have the potential to reside in the region in the future, 33 being previously sighted in the area (Annex 4). Of these 46, 19 are recognised by the EPBC Act, but most of

[1] A full list of species recorded in the region can be provided on request.

[2] A full list of species recorded in the region can be provided on request.

these are Migratory or Marine significant species, generally associated with Lake Tyers (see ***Aquatic and Wetland Ecology Study*** – EES Referral Attachment 9).

One species that is of particular conservation interest is the Critically Endangered orange-bellied parrot (*Neophema chrysogaster*), a small parrot of south-east Australia. There are only approximately 50 individuals still living in the wild and the species prefers open heathland and grassland (BirdLife Australia 2013). It is highly unlikely that the species uses the disturbed habitat of the region and the species has never been recorded within the region in previous years.

Table 4-2 Birds directly and indirectly observed within the region; with conservation status or introduced origin

Order	Family	Common Name	Scientific Name	EPBC Act	FFG Act	DEPI
Accipitriformes	Accipitridae	Black-shouldered kite	*Elanus axillaris*			
Anseriformes	Anatidae	Australian wood duck	*Chenonetta jubata*			
Charadriiformes	Charadriidae	Masked lapwing	*Vanellus miles*			
Columbiformes	Columbidae	Brush bronzewing	*Phaps elegans*			
		Common bronzewing	*Phaps chalcoptera*			
		Rock dove	*Columba livia*	Introduced		
		Spotted turtle-dove	*Streptopelia chinensis*	Introduced		
Coraciiformes	Halcyonidae	Laughing kookaburra	*Dacelo novaeguineae*			
Falconiformes	Accipitridae	Wedge-tailed eagle	*Aquila audax*			
	Falconidae	Brown falcon	*Falco berigora*			
Gruiformes	Rallidae	Dusky moorhen	*Gallinula tenebrosa*			
Passeriformes	Acanthizidae	Brown thornbill	*Acanthiza pusilla*			
		Weebill	*Smicrornis brevirostris*			
		White-browed scrubwren	*Sericornis frontalis*			
	Artamidae	Dusky woodswallow	*Artamus cyanopterus*			
		Grey butcherbird	*Cracticus torquatus*			
		Pied currawong	*Strepera graculina*			
	Campephagidae	Black-faced cuckoo-shrike	*Coracina novaehollandiae*			
	Climacteridae	Brown treecreeper	*Climacteris picumnus victoriae*			NT
	Corvidae	Australian raven	*Corvus coronoides*			
		Little raven	*Corvus mellori*			

Order	Family	Common Name	Scientific Name	EPBC Act	FFG Act	DEPI
	Cracticidae	Australian magpie	*Gymnorhina tibicen*			
	Hirundinidae	Welcome swallow	*Petrochelidon neoxena*			
	Locustellidae	Rufous songlark	*Cincloramphus mathewsi*			
	Maluridae	Superb fairy-wren	*Malurus cyaneus*			
	Meliphagidae	Bell miner	*Manorina melanophrys*			
		Eastern spinebill	*Acanthorhynchus tenuirostris*			
		Little wattlebird	*Anthochaera chrysoptera*			
		Noisy miner	*Manorina melanocephala*			
		Red wattlebird	*Anthochaera carunculata*			
		White-eared honeyeater	*Lichenostomus leucotis*			
		White-plumed Honeyeater	*Lichenostomus penicillatus*			
	Menuridae	Superb lyrebird	*Menura novaehollandiae*			
	Monarchidae	Magpie-lark	*Grallina cyanoleuca*			
	Pachycephalidae	Grey shrike-thrush	*Colluricincla harmonica*			
		Rufous whistler	*Pachycephala rufiventris*			
	Passeridae	House sparrow	*Passer domesticus*	Introduced		
	Petroicidae	Eastern yellow robin	*Eopsaltria australis*			
	Ptilonorhynchidae	Satin bowerbird	*Ptilonorhynchus violaceus*			
	Rhipiduridae	Willie wagtail	*Rhipidura leucophrys*			
	Sturnidae	Common myna	*Acridotheres tristis*	Introduced		
		Common starling	*Sturnus vulgaris*	Introduced		

Order	Family	Common Name	Scientific Name	EPBC Act	FFG Act	DEPI
	Turdidae	Common blackbird	*Turdus merula*	Introduced		
Psittaciformes	Cacatuidae	Galah	*Eolophus roseicapilla*			
		Gang-gang cockatoo	*Callocephalon fimbriatum*			
		Sulphur-crested cockatoo	*Cacatua galerita*			
		Yellow-tailed black-cockatoo	*Calyptorhynchus funereus*			
	Psittaculidae	Australian king parrot	*Alisterus scapularis*			
		Crimson rosella	*Platycercus elegans*			
		Eastern rosella	*Platycercus eximius*			
		Musk lorikeet	*Glossopsitta concinna*			
		Rainbow lorikeet	*Trichoglossus haematodus*			

4.3.3 Mammals Recorded During Overview Assessment

Sixteen mammal species were seen inhabiting, or dead (e.g. roadkill), within the region (Table 4-3). Only seven of these are native to Australia and none are threatened or of conservation significance. Many of the introduced species seen are considered amongst Victoria's threatening processes (see Section 6.1). One of the most common and widespread introduced mammal's is the European rabbit (*Oryctolagus cuniculus*; Plate 4-2).

4.3.4 Mammals Previously Recorded and Significant Species that May Reside in the Region

Twenty-five mammalian species have previously been recorded in the region, six of which are non-native. No EPBC Act threatened species have been recorded within the region (Annex 5). Four FFG Act listed species were recorded over 30 years ago in the region.

Literature and data sources indicated that 13 threatened mammalian species may reside within the region. Three of these are Endangered and four are Vulnerable under the EPBC Act (Annex 5). However, it is unlikely that these species are abundant or widespread if they are present.

Table 4-3 Mammals directly and indirectly observed in the region, with conservation status or introduced origin

Order	Family	Common Name	Scientific Name	EPBC Act	FFG Act	DEPI
Artiodactyla	Bovidae	Cattle	*Bos taurus*	Introduced		
		Goat	*Capra hircus*	Introduced		
		Sheep	*Ovis aries*	Introduced		
	Cervidae	Sambar deer	*Cervus unicolor*	Introduced		
Carnivora	Canidae	Dog	*Canis lupus familiaris*	Introduced		
		Red fox	*Vulpes vulpes*	Introduced		
	Felidae	Cat	*Felis catus*	Introduced		
Chiroptera	Molossidae	White-striped freetail bat	*Tadarida australis*			
Diprotodontia	Macropodidae	Black wallaby	*Wallabia bicolor*			
	Macropodidae	Eastern grey kangaroo	*Macropus giganteus*			
	Phalangeridae	Mountain brushtail possum	*Trichosurus cunninghami*			
	Pseudocheiridae	Common ringtail possum	*Pseudocheirus peregrinus*			
	Vombatidae	Common wombat	*Vombatus ursinus*			
Lagomorpha	Leporidae	European rabbit	*Oryctolagus cuniculus*	Introduced		
Monotremata	Tachyglossidae	Short-beaked echidna	*Tachyglossus aculeatus*			
Perissodactyla	Equidae	Horse	*Equus caballus*	Introduced		

4.3.5 Herpetofauna Recorded and may Reside in Region

No reptiles or amphibians were recorded during the overview assessment.

Twelve species of reptile have been recorded in the past in the region but only one is recognised by the DEPI Advisory list (lace monitor *Varanus varius*; Annex 6). No other reptiles were recorded in the region and it is unlikely that EPBC/FFG Act reptile species would occur with any regularity in the future.

Fourteen species of the class Amphibia have been sighted or heard within the region, only one being a nationally significant species; the Vulnerable green and golden bell frog (*Litoria aurea*). This species is listed as Vulnerable under both Commonwealth and State legislation. The green and golden bell frog was recorded once in Hospital Creek in March 1993, 4.5 km from the mine site. Mean rainfall (mm) was higher in March 1993 than the mean rainfall for 1981 to 2010 (BOM 2013b) and therefore water may have been higher in Hospital Creek than normal/mean levels. Additionally, the current condition of Hospital Creek is not conducive to providing habitat for this frog (e.g. polluted stormwater).

Two other DEPI listed species have been recorded in the region (see Annex 6).

4.3.6 Other fauna

No significant fish or invertebrates have been recorded in the region.

Plate 4-1 Agricultural land (beef cattle) within the region

Plate 4-2 European rabbit (*Oryctolagus cuniculus*), a common and widespread animal in the region

4.4 Limitations of the Data Sources

Spatial and count data was sourced from the Victorian Biodiversity Atlas (VBA) courtesy of the DEPI (2013a). This data is collected by scientists and amateurs and therefore may not necessarily be accurate or correct. The DEPI make every effort to check the authenticity of the data, but they cannot ensure data collection method or species identification in the field is rigorous. For example, the same individual bird may be counted more than once or similar species may be misidentified. Many animals are cryptic and or nocturnal and therefore difficult even for trained personnel to correctly identify.

The number of bird species sightings is always considerably higher than any other taxon. It is not necessarily an indication that bird diversity is greater than other groups, but it may simply be an artefact of birds being more conspicuous. There are also many amateur bird observation groups that contribute to the database, much more than any other taxon (recreational-watching) group. Additionally, most of

Australia's mammals and frogs are nocturnal and therefore hard to observe, and reptiles are difficult to survey without the use of trapping techniques.

There is little to no information/data regarding fish and invertebrates within the Study Area and this is probably due to insufficient sampling and little available water in the area. There appears to be little previous flora and fauna data for the mine site. This is unsurprising as it has little to attract recreational flora and fauna groups, as the site has been extensively harvested.

Plants are known to hybridise with similar species and this makes identification very difficult. The accuracy of location data is probably improving with more people using GPS units or GPS applications on their mobile phones. However, older location records may not be as accurate.

Much of the information on vegetation communities in Victoria is sourced from satellite imagery and general mapping. Vegetation is generally modelled on what should, and may, be there, since it would be impossible to survey all of Victoria's vegetation. Additionally, the list of EVCs did not include mosaics and may not be completely exhaustive, as some patches of EVCs are so small they may have been missed (by this review).

Finally, these data sources and literature have been used to provide a preliminary assessment of what may be in the area and does not necessarily reflect what is or will be within the region or the mine site in the future. Therefore all information presented from the literature is used as background and a guide for the more detailed assessments conducted.

5 Study Area Biodiversity

5.1 Literature and Database Results and Discussion

5.1.1 Vegetation and Flora

Recorded in Study Area and Mine Site

Four modelled Rare FFG Act communities have been mapped within the south-east corner of the Study Area. All of these four communities are within one remnant patch of Warm Temperate Rainforest. Notably, this patch is not located within the mine site.

Within the mine site, only one DEPI listed flora species has been recorded previously. The slender wire-lily (*Laxmannia gracilis*) was recorded once in 1980 near the junction of Tomato Track and Nowa Nowa-Buchan Road. No other threatened flora (EPBC/FFG Act, DEPI) species have been recorded within the mine site.

With Potential to Inhabit the Mine Site

No threatened ecological communities have been modelled within the mine site. Additionally, due to previous timber harvesting activities it is unlikely that threatened communities would inhabit/re-establish within the mine site in the future.

Of the 89 State and nationally threatened species that may reside in the region, there is potential habitat for 34 DEPI recognised species in the mine site (see Annex 3). However, it is unlikely that any FFG or EPBC Act listed species occur within the mine site due to previous logging, insufficient habitat characteristics and poor connectivity with source populations (see Section 4.2.2). Targeted surveys for the Colquhoun Grevillea (*Grevillea celata*) were undertaken in October 2013 in accordance with the methodology prescribed by the DEPI. No evidence of the Colquhoun Grevillea was found at or near the mine site (refer Annex 2). Additional Spring (2013) vegetation surveys are underway and will be undertaken by Ethos NRM which will include additional targeted surveys where required.

5.1.2 Fauna

Birds

No bird species have been previously recorded within the mine site and only one threatened species has been recorded in the Study Area (sooty owl).

Only one EPBC Act Migratory listed species (black-faced monarch, *Monarcha melanopsis*) may use the habitat of the mine site due to habitat characteristic requirements. However, it has never been recorded on site and is considered unlikely to rely upon habitat within the mine site.

There are several State (i.e. FFG Act, DEPI-listed) significant species that may occasionally visit or use the mine site as part of their much larger territory range (defined as Occasional visitor Annex 4). For example, the three territorial owl species (masked, sooty and powerful owl) have been recorded several times within 10 km of the mine site. Although there have been approximately 5 separate recordings of each species, it is extremely unlikely there is more than one pair of each species. These species are highly territorial and long-lived, and are unlikely to fledge more than one offspring per year (Silveira et al.

2003, Webster et al. 2004). The sooty owl's territory can range between 10-30 km^2 (Bilney et al. 2011) and therefore there are probably only a maximum of three individuals (pair plus one offspring) of each species hunting in the habitat of the mine site. It is unlikely that the three owl species nest or roost within the mine site, due to a lack of large, hollow-bearing trees.

Mammals

No significant mammals have been recorded within the mine site or the broader Study Area.

Of the seven EPBC Act species previously recorded or potentially occurring in the broader region (Annex 5), there may be sufficient habitat for two of these species to visit or reside in the mine site; the long-nosed potoroo (*Potorous tridactylus tridactylus*) and southern brown bandicoot (*Isoodon obesulus obesulus*), but it is likely that their presence would be more influenced by other threatening processes (e.g. predators).

A spot-tailed quoll (*Dasyurus maculatus maculatus*) was recently captured via a camera trap in the Nowa Nowa region (Powell pers. comm. 2013), however the exact details have not been verified by DEPI (including location). Spot-tail quolls have been recorded outside of the region (>10 km from the mine site) over the last 50 years. Habitat is probably not suitable for quolls within the Study Area.

It is also questionable whether the habitat is of sufficient quality for any FFG Act listed species (e.g. common bent-wing bat *Minopterus schreibersii* GROUP, eastern pygmy possum *Cercartetus nanus*, white-footed dunnart *Sminthopsis leucopus*). The listed bat species is a cave roosting species and is thus more likely to be found to the north, possibly in the Buchan Caves, or in the Victorian Alps. Similar to EPBC Act listed species, there is likely to be a myriad of factors limiting their presence at the mine site.

Herpetofauna

No significant reptiles have been recorded in the Study Area or the mine site. One DEPI listed (Vulnerable) amphibian species (southern toadlet *Pseudophyrne semimarmorata*) has been recorded a few times north of Harris Creek within the Study Area but not within the mine site.

It is likely that the highly mobile and territorial lace monitor uses the mine site.

Nationally and State significant amphibian species are unlikely to inhabit or breed within the Study Area due to the seasonality of water availability. If rainfall is high for several months and there are substantial flows or standing water within the creeks, some species may move into the area. Most species breed during the peak of summer when water is lowest (absent) within the mine site.

5.1.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that are partially or completely dependent on underground water for their survival and health. Groundwater can provide a reliable water supply when it is close to the surface and when rainfall is infrequent or low. Groundwater can provide water to plants, wetlands, streams and some animals. The main types of GDEs are:

- Terrestrial vegetation;
- Wetlands;
- Coastal estuarine and near shore marine systems;
- River base flow systems;
- Aquifer and cave ecosystems; and
- Terrestrial fauna (direct drinking source).

These GDEs may be reliant on surface expression of groundwater, subsurface groundwater and/or subterranean groundwater.

The GDE most relevant to the proposed Project is terrestrial vegetation. The other five are unlikely to occur within or nearby the mine site. Terrestrial vegetation GDEs can be defined as '*vegetation communities that do not rely on expressions of surface water for survival, but which have seasonal or episodic dependence on groundwater*' (Dresel et al. 2010). However, it is difficult to determine dependency, as a species may use groundwater once every decade and thus be technically defined as groundwater dependent. Additionally, GDEs may be located in areas with little proximal surface water and be located in riparian zones in ephemeral streams (Dresel et al. 2010).

Current groundwater levels (see *Surface and Ground Water Baseline and Assessment,* EES Referral Attachment 5) are estimated to be too deep (~37-50 m) below the surface to provide even a partial water source to most of the species and EVCs within the Study Area. The groundwater depth varies between 50 m within most of the area to 37 m below the creek and drainage lines.

It is assumed that only trees (woody plants) could tap the groundwater, particularly large Eucalypts. Trees typically establish roots within the top 2 m of soil, but have been observed at depths of 10 or more metres (Stone & Kalisz 1991). One of the species that can be found within the EVCs of the Study Area (*Eucalyptus viminalis*) has been observed to grow roots up to 18 m (Johnson et al. 1968).

No on-site assessment of GDEs appears to have been conducted within the Study Area (by the BOM or other agency). Victorian and Commonwealth agencies are currently undertaking remote and composite modelling of GDEs across the country.

Reliance on Surface Expression of Groundwater

The BOM Atlas of Groundwater Dependent Ecosystems indicates that the three creeks (i.e. Gap, Harris, Tomato) intersected by the mine site have high potential for groundwater interaction (BOM 2013a). Where the three creeks intersect (near Buchan-Bruthen Road) has been modelled as having moderate potential for reliance on surface expression of groundwater. The remaining area within the mine site and larger Study Area has no potential for surface groundwater expression.

Reliance on Subsurface Groundwater

According to the BOM Atlas, most of the Study Area is not reliant on subsurface groundwater. The area around the intersection of the three creeks on-site (and just north of this point) has been identified as having low potential for reliance on subsurface groundwater. Considering the depth of the groundwater table, this result is unsurprising.

Reliance on Subterranean Groundwater

The Study Area has not been assessed by the BOM Atlas for reliance on subterranean groundwater, including caves and aquifers. However, the geology of this area precludes the likelihood of caves.

Study Area GDEs

Overall, it appears that the Study Area has few areas of vegetation that are potentially reliant on subsurface or subterranean groundwater. The most likely areas of GDEs are within and along the three main ephemeral creeks within the Study Area. However, due to the depth of the water table in the area, it is therefore highly unlikely that groundwater dependent ecosystems (GDE) occur in the direct vicinity of the mine site (refer Section 6.2.3).

5.2 Vegetation and Flora Field Assessment

A full account of the results of the vegetation and flora assessment is provided in Annex 1 and the key results are summarised below.

Field assessment results:

- No EPBC Act or FFG Act threatened flora species (or their preferred habitat) were identified during the survey;
- Two bioregions intersect the vegetation study area; East Gippsland Uplands (EGU) covers the majority of the Study Area, with a smaller area occurring within the East Gippsland Lowlands (EGL);
- Five EVCs were identified during the field survey. Shrubby Dry Forest is the dominant EVC covering almost 75% of the mine site, with Lowland Forest comprising almost 20%, Riparian Forest 4% and Damp Forest 3%. Warm Temperate Rainforest was recorded within the Study Area but will not be impacted by the mine footprint or other Project components at the mine site.
- Warm Temperate Rainforest has a Bioregional Conservation Status (BCS) of Rare in both bioregions; Riparian Forest has a BCS of Depleted in the EGL and Least Concern in the EGU, and the remaining EVCs have a BCS of Least Concern in both bioregions;
- Vegetation quality recorded at the sample sites ranged between 60 and 70, with some higher scores recorded within the vicinity of Tomato Track;
- Vegetation across the sites surveyed was floristically diverse;
- Low density of large trees, particularly in areas previously impacted by timber harvesting (approximately 50% of the site since the 1960s), was also recorded;
- 141 terrestrial flora species, including 4 weed species and 6 rare species, were recorded during surveys; and
- Colquhoun grevillea (or preferred habitat) was not found within the mine site during targeted spring surveys (see Annex 2 for details).

Additional vegetation quality and other targeted flora surveys will be undertaken in spring 2013. These surveys will be used in conjunction with autumn assessments to determine vegetation loss and offset requirements. The surveys will be conducted during the flowering period for threatened species to determine their presence, suitable habitat or absence.

Plate 5-1 Open woodland with mostly Eucalypt trees and no understorey

Plate 5-2 Logging regeneration habitat with dense ground cover

Plate 5-3 Open shrubby forest, with mostly Eucalypt trees and a shrubby understorey

5.3 Fauna Field Assessment Survey Effort

The Study Area was traversed and surveyed between February and May 2013, with detailed on foot surveying of approximately 500 ha (Table 5-1). Call playback and recognition surveys covered a much more extensive area because owl calls could potentially be heard over 1.5 km from their source. Areas of the 1250 ha Study Area not surveyed on foot were assessed by vehicle with habitat also assessed remotely by high resolution satellite imagery.

Table 5-1 Area covered and time taken to complete habitat, diurnal, nocturnal and incidental surveys within the Study Area

Survey method		Area covered (ha)	Time taken (hh:mm)
Fauna habitat assessment (detailed on foot)		371	N/A
Diurnal point counts and transects (detailed on foot)		131	46:23
Nocturnal searching and dusk/dawn watches	Call playback and recognition	3550	37:40
	Transect spotlighting	200	
Incidental searches		N/A	43:00
Total			127:03

5.4 Fauna Habitat

Several different fauna habitat types were identified within the Study Area, and most habitats were differentiated based on the time since logging. The lowest quality habitats were post-logging regrowth, having been logged within the last 5 to 10 years. Large old trees were generally from the genus *Eucalyptus* and had diameter at breast (1.3 m) height (DBH) of greater than 70 cm. But these large old trees were rare and restricted to riparian and rainforest habitats.

No 'critical habitat' was identified during field surveys or from a search of the literature (EPBC or FFG Acts).

5.4.1 Logging Regeneration Habitat

Sparse Regrowth (Very low quality)

This very low quality habitat had no canopy or sub-canopy with sparse post-logging regrowth (~1-5 years). Vegetation was mostly small shrubs and ground cover from 0.5 to 1.5 m, often with substantial patches of bare ground. One large old seed tree (often dead) per 1 to 2 hectares provided seed propagation for new vegetation, sometimes these trees provided perches for raptors and large parrots. However, the lack of sub-canopy and canopy provides poor connectivity/cover between adjacent patches for animals moving through this area.

Dense Regrowth (Low quality)

One to five years post-logging regrowth with no canopy or sub-canopy, fallen logs present but covered by dense undergrowth (Plate 5-2). Few large old seed trees (often dead), these provided resting perches for raptors and large parrots. Shrub layer provided habitat for small birds and some leaf litter for frogs and small reptiles. This habitat probably provides poor to moderate connectivity between adjacent patches for animals moving through this area.

5.4.2 Open Woodland

Open Forest/woodland (Moderate quality)

Few (~1 per ha) large old trees, with a very sparse to moderate canopy dominated by medium eucalypt trees to a height of 20 to 30m (Plate 5-1). This tree canopy provides ample hollows and several fallen logs for nesting and roosting, although not suitable for larger species such as owls and raptors. Hollows were suitable for possums, mid-sized parrots and nocturnal birds. There was a very sparse or absent shrub and ground layer and no sub-canopy. Fallen logs highly suitable for small mammals and reptiles, leaf litter present for some frog species. Several termite/ant hills present and are probably used by short-beaked echidnas (*Tachyglossus aculeatus*). Common wombat (*Vombatus ursinus*) burrows and scats frequently encountered in this habitat. Scratching on trees and at the base of trees suggests use of the habitat by the lace monitor (*Varanus varius*). There was moderate cover and connectivity for highly mobile species; inadequate/poor ground-cover for small to mid-sized arboreal mammals. Most of this habitat had probably been logged over 50 years ago.

5.4.3 Open Shrubby Forest

Shrubby Open Forest/woodland (Moderate Quality)

Few to several (1-3) large old trees with sparse to moderately dense canopy, dominated by medium to large eucalypt trees of heights between 30 to 40m (Plate 5-3). Moderate shrub and ground layer but sub-canopy was absent or very sparse. Ground layer was moderately to highly dense, in places dominated by Austral bracken (*Pteridium esculentum*), with tufted grasses and smaller flowering shrubs. Tree hollows and fallen logs in abundance, providing ample habitat for nesting and roosting species. However, these hollows and logs were probably not suitable for larger species such as owls and raptors whereas they were suitable for possums, mid-sized parrots and nocturnal birds. Fallen logs were probably inhabited by small mammals and reptiles and leaf litter was present for some frog species to reside within. Large reptiles are probably common and often move through this habitat. For example, scratchings on trees and at the base of trees suggested use by the lace monitor. Several termite/ant hills were present and common wombat burrows and scats were frequently encountered. There was moderate cover and connectivity for highly mobile species and moderate ground cover for small to mid-sized arboreal mammals. Most of this habitat had probably been logged over 50 years ago. There was habitat available for gliders and potential perching and hunting habitat for owls.

5.4.4 Riparian/damp Forest

Riparian and Warm Temperate Rain Forest (Moderate to High Quality)

The riparian forest was limited to small patches along Harris, Gap and Tomato intermittent creeks. The warm temperate rainforest was restricted to a gully in the far south-east corner of the Study Area. Few to several (1-5 per ha) large old trees with sparse to moderate canopy dominated by large eucalypt trees to a height of up to 40 m. Occasional or sparse mid-canopy of eucalypts and other native trees. Shrub layer moderate to dense, often composed of Myrtacae species. Ferns abundant in the shrub and ground layer,

high cover of leaf litter and decomposing matter for ground dwelling fauna (e.g. reptiles, frogs). We frequently encountered superb lyrebird (*Menura novaehollandiae*) ground scratchings. Fallen logs and hollow-bearing large old trees were common, but no evidence of forest owl use. If owls were to nest or roost in the Study Area, they would more likely use the trees within the warm temperate rainforest. Moderate to good connectivity and cover, but due to low to moderate quality of surrounding areas unlikely to be home to many threatened species. There was habitat available for gliders and potential perching and hunting habitat for owls. The wetter areas at the creek-line (especially during heavy downpours) may experience increased activity of awakening frogs.

Damp/gully Forest (Moderate to High Quality)

This damp forest was present along all other intermittent creeks or deep gullies. Few (1-2 per ha) large old trees, sparse to moderate canopy dominated by eucalypt trees to a height of 40 m. Very sparse mid-canopy of medium eucalypts and other native trees. The shrub layer was sparse, with few areas of leaf litter and decomposing matter for ground dwelling fauna (e.g. reptiles, frogs). There were several hollow-bearing medium-large trees and fallen logs. Moderate connectivity and cover, but due to low to moderate quality of surrounding areas unlikely to be home to many threatened species. There was also habitat available for gliders and potential perching and hunting habitat for owls. The wetter areas at the creek-line (especially during heavy downpours) may experience increased activity of awakening frogs.

5.5 Birds

No EPBC Act bird species were observed during any of the surveys of the Study Area. Overall, 43 species of bird (26 Families) were seen using, heard or flying over the Study Area (Table 5-2). The most abundant species were the striated thornbill (*Acanthiza lineata*) and the white-eared honeyeater (*Lichenostomus leucotis*), both with 72 individuals recorded. The most commonly encountered species (based on number of sites they were present) were the white-eared honeyeater and the white-throated treecreeper (*Cormobates leucophaea*). Both species were most often observed singly or in pairs, with the honeyeater being present at 28 survey points and the treecreeper at 22 points. A few very distinctive birds were observed, including the superb fairy-wren (*Malurus cyaneus* Plate 5-5). Most birds seen or heard are common and widespread species in Victoria.

A State significant DEPI-listed Near Threatened species, the brown treecreeper (*Climacteris picumnus victoriae*), was observed within four survey points in the Study Area. Four individuals of the Victorian sub-species were seen foraging on the various eucalypt trunks. Despite being sighted only a few times, the species was heard frequently within the Study Area and seems to be able to habituate to living in the highly disturbed habitat. It is expected that the brown treecreeper breeds within the Study Area, but no nests were observed.

One FFG Act listed species, the masked owl, was observed sitting on a branch (presumably) during its nocturnal hunt (19:41 AEST), 1.2 km east-north-east of the mine site (Figure 5-1 and Plate 5-6). The call of this species had been heard on two consecutive nights during call playback and recognition surveys, but its presence was not confirmed until observed during spotlighting transects (see Annex 7). The calls had been estimated being approximately 1 to 2 km south east of the Study Area, and despite surveying these areas (e.g. dusk/dawn, playback) the calls were not heard again. No other threatened owl species calls were heard during any of the surveying periods (Plate 5-7).

Despite extensive searches of the habitat, including the Warm Temperate Rainforest patch to the south-east of the mine site, no evidence of owl nests or roosts was found. It is suspected that all three threatened owl species hunt in the Study Area, but do not nest or roost in the Study Area or nearby.

These species may nest and/or roost to the south-east, closer to Nowa Nowa and Lake Tyers Park where there are older and larger trees when compared with the Study Area.

Table 5-2 Number of birds and survey points (or sites) where the species were observed within the Study Area, including their national (EPBC Act) and State (FFG Act, DEPI) conservation status

Order	Family	Common Name	Scientific Name	No. of birds	No. of survey points	EPBC Act	FFG Act	DEPI
Strigiformes	Tytonidae	Masked owl	*Tyto novaehollandiae novaehollandiae*	1	1		L	EN
Passeriformes	Climacteridae	Brown treecreeper	*Climacteris picumnus victoriae*	4	4			NT
Caprimulgiformes	Aegothelidae	Australian owlet-nightjar	*Aegotheles cristatus*	H	1			
	Podargidae	Tawny frogmouth	*Podargus strigoides*	H	1			
Columbiformes	Columbidae	Brush bronzewing	*Phaps elegans*	1	1			
		Common bronzewing	*Phaps chalcoptera*	1	1			
Coraciiformes	Halcyonidae	Laughing kookaburra	*Dacelo novaeguineae*	6	4			
Falconiformes	Accipitridae	Wedge-tailed eagle	*Aquila audax*	2	2			
	Falconidae	Peregrine falcon	*Falco peregrinus*	1	1			
Passeriformes	Acanthizidae	Brown thornbill	*Acanthiza pusilla*	6	1			
		Yellow thornbill	*Acanthiza nana*	36	6			
		Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	52	8			
		Striated Thornbill	*Acanthiza lineata*	72	13			
		Weebill	*Smicrornis brevirostris*	H	1			
	Artamidae	Pied butcherbird	*Cracticus nigrogularis*	2	2			
		Pied currawong	*Strepera graculina*	6	3			
		Dusky woodswallow	*Artamus cyanopterus*	S	1			
		Grey butcherbird	*Cracticus torquatus*	S	1			
	Cinclosomatidae	Eastern whipbird	*Psophodes olivaceus*	2	1			
	Climacteridae	White-throated treecreeper	*Cormobates leucophaea*	26	22			

Order	Family	Common Name	Scientific Name	No. of birds	No. of survey points	EPBC Act	FFG Act	DEPI
	Corvidae	Australian raven	*Corvus coronoides*	H	1			
	Locustellidae	Rufous songlark	*Cincloramphus mathewsi*	1	1			
	Maluridae	Superb fairy-wren	*Malurus cyaneus*	12	6			
	Meliphagidae	Bell miner	*Manorina melanophrys*	1	1			
		Eastern spinebill	*Acanthorhynchus tenuirostris*	3	1			
		White-naped honeyeater	*Melithreptus lunatus*	6	1			
		Red wattlebird	*Anthochaera carunculata*	26	15			
		Yellow-plumed honeyeater	*Lichenostomus ornatus*	32	6			
		White-eared honeyeater	*Lichenostomus leucotis*	72	28			
	Menuridae	Superb lyrebird	*Menura novaehollandiae*	1	1			
	Neosittidae	Varied sittella	*Daphoenositta chrysoptera*	10	2			
	Pachycephalidae	Grey shrike-thrush	*Colluricincla harmonica*	2	1			
		Golden whistler	*Pachycephala pectoralis*	14	9			
	Pardalotidae	Spotted pardalote	*Pardalotus punctatus*	7	4			
	Petroicidae	Southern scrub robin	*Drymodes brunneopygia*	2	2			
		Jacky winter	*Microeca fascinans*	8	5			
		Eastern yellow robin	*Eopsaltria australis*	9	6			
	Rhipiduridae	Grey fantail	*Rhipidura albiscapa*	13	12			
	Zosteropidae	Silvereye	*Zosterops lateralis*	18	2			
Psittaciformes	Cacatuidae	Gang-gang cockatoo	*Callocephalon fimbriatum*	13	4			
		Sulphur-crested cockatoo	*Cacatua galerita*	S	1			

Order	Family	Common Name	Scientific Name	No. of birds	No. of survey points	EPBC Act	FFG Act	DEPI
	Psittaculidae	Crimson rosella	*Platycercus elegans*	13	5			
Strigiformes	Strigidae	Southern boobook	*Ninox novaeseelandiae*	H	1			

Key: L – Listed, EN – Endangered, NT – Near Threatened; H – Heard; S – Seen outside of counts.

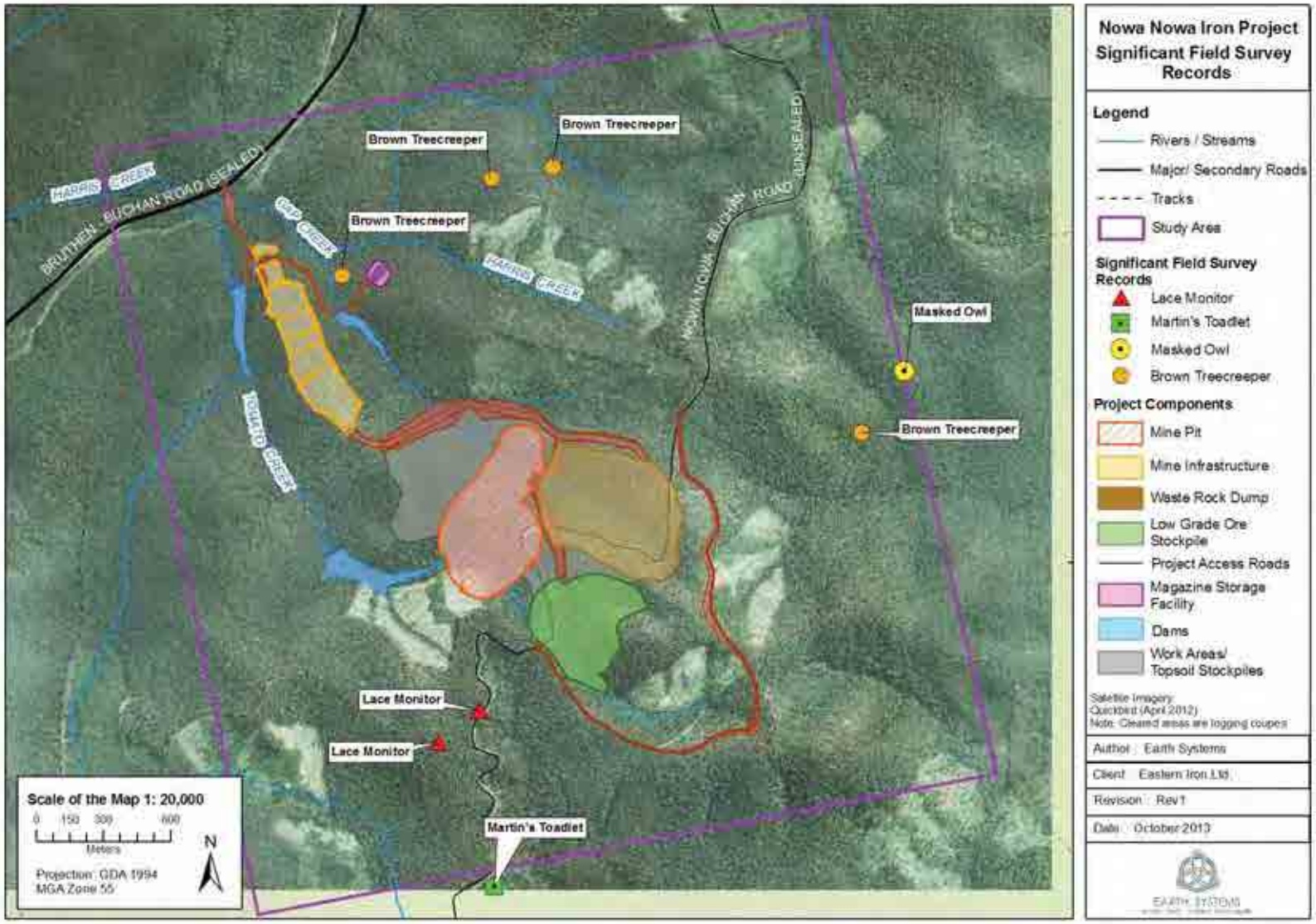

Figure 5-1 Significant fauna species recorded within during the field survey of the Study Area

5.6 Mammals

No EPBC Act, FFG Act or DEPI listed mammal species were indirectly or directly detected during surveys. All mammals detected were common and widespread native species (i.e. not listed, black wallaby *Wallabia bicolor* Plate 5-4), in addition to three introduced species (Table 5-3). The most commonly (indirectly) sighted species was the common wombat (*Vomatus ursinus*), with fresh and recent scats and burrows frequent throughout the Study Area and in all habitat types. Other than carcasses by the side of the road, no common wombats were actually seen within the Study Area.

The white-striped freetail bat (*Tadarida australis*) was often observed during nocturnal surveys. The species was identified by its call, as it is the only bat in East Gippsland that can be heard by humans (0.2 – 20 kHz). The white-striped freetail bat's echolocation call ranges between 10.5 and 15.5 kHz (de Oliveira 1998). All other bats that may use the Study Area call at frequencies beyond 29 kHz (Herr 1998, Adams 2012), however, this does not exclude these species from being present onsite.

Table 5-3 Mammals indirectly or directly observed within the Study Area; their abundance or method of detection, number of survey points heard or seen and their conservation status.

Order	Family	Common Name	Scientific Name	Abundance	No. of survey points
Artiodactyla	Cervidae	Sambar deer (intro.)	*Cervus unicolor*	1	1
Carnivora	Canidae	Red fox (intro.)	*Vulpes vulpes*	S	F
Chiroptera	Molossidae	White-striped freetail bat	*Tadarida australis*	>10	F
Diprotodontia	Macropodidae	Black wallaby	*Wallabia bicolor*	9	6
	Petauridae	Yellow-bellied glider	*Petaurus australis*	4	3
		Sugar glider	*Petaurus breviceps*	H	>1
	Phalangeridae	Mountain brushtail possum	*Trichosurus cunninghami*	3	3
	Vombatidae	Common wombat	*Vombatus ursinus*	S, B, C	F
Lagomorpha	Leporidae	European rabbit (intro.)	*Oryctolagus cuniculus*	> 2	F
Monotremata	Tachyglossidae	Short-beaked echidna	*Tachyglossus aculeatus*	B	F

Key: B – Burrow; C – Carcass; H – Heard; S – Scat; F – Frequently observed throughout the site.

Plate 5-4 Black wallaby *Wallabia bicolor*

Plate 5-5 Superb fairy-wren *Malurus cyaneus*

Plate 5-6 Masked owl (*Tyto novaehollandiae novaehollandiae*) observed during nocturnal surveys

Plate 5-7 Open canopy observed during nocturnal surveys

5.7 Reptiles and Amphibians

No EPBC or FFG Act amphibians or reptiles were detected within the Study Area. Only two frogs and three reptiles were directly or indirectly observed within the Study Area (Table 5-4). The DEPI-listed Critically Endangered Martin's toadlet (*Uperoleia martini*) was heard on one occasion, during a particularly heavy downpour, on the southern boundary of the Study Area, along the Nowa Nowa-Buchan Road (Figure 5-1).

The DEPI-listed Endangered lace monitor was observed twice and scratched trees were found throughout the Study Area (Figure 5-1; Plate 5-8). The first lace monitor was seen 200 m west of the Nowa Nowa-Buchan Road, approximately 800 m south of the intersection with Five Mile Track. The second was observed on the Nowa Nowa-Buchan Road, about 350 m north of the first observation.

Table 5-4 Frogs and reptiles indirectly or directly observed within the Study Area; their abundance or method of detection, number of survey points heard or seen and their conservation status

Class	Family	Common Name	Scientific Name	No. of obs.	No. of survey points	EPBC Act	FFG Act	DEPI
Amphibia	Myobatrachidae	Victorian smooth toadlet	*Geocrinia victoriana*	H	5			
		Martin's toadlet	*Uperoleia martini*	H	1			CR
Reptilia	Agamidae	Tree dragon	*Amphibolurus muricatus*	1	1			
	Scincidae	Delicate or garden skink	*Lampropholis spp.*	1	1			

Class	Family	Common Name	Scientific Name	No. of obs.	No. of survey points	EPBC Act	FFG Act	DEPI
	Varanidae	Lace monitor	*Varanus varius*	2	2			EN

Key: H – Heard; CR – Critically Endangered; EN – Endangered

Plate 5-8 Lace monitor *Varanus varius*

5.8 Owl and Glider Detectability

The Study Area was visited 36 times during the survey period. One masked owl was detected and therefore the number of visits and survey effort was sufficient to detect this species.

Powerful owl probability of detection approaches 1.0 between 15 and 25 visits (Figure 5-2). Considering the Study Area was visited 36 times, we can be relatively confident that we would have detected powerful owls using the areas that were surveyed. Greater gliders should have been detected after the first 4 visits if they were present within the areas surveyed (Figure 5-4). However, no greater gliders were seen and hence it is most likely that the species is absent from the areas surveyed. Sooty owl detection probability also reaches 1 after only 6 or 7 visits (Figure 5-3).

The detection probabilities indicate that powerful and sooty owls as well as greater gliders are most likely absent from the areas that were surveyed within the Study Area. However, this does not preclude them from being elsewhere in the region (e.g. the owls have very large territories).

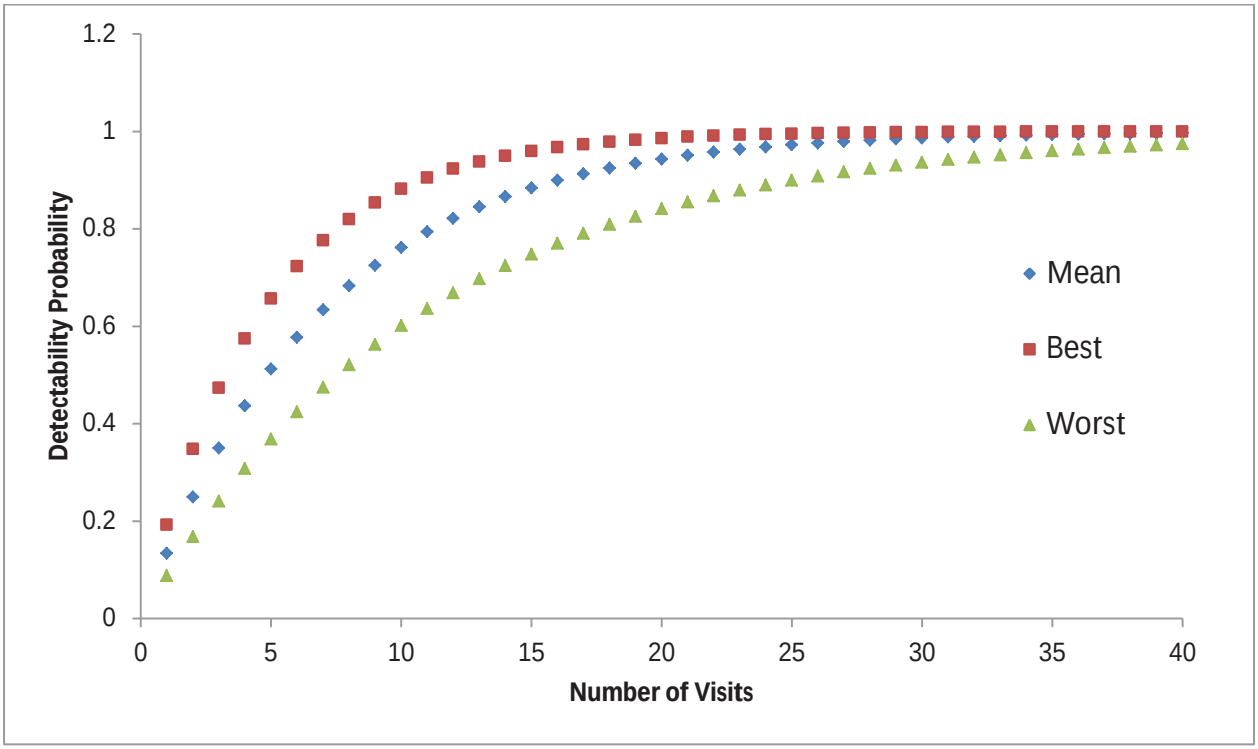

Figure 5-2 Powerful owl probability of detection over a number of visits, with mean and best and worst environmental conditions.

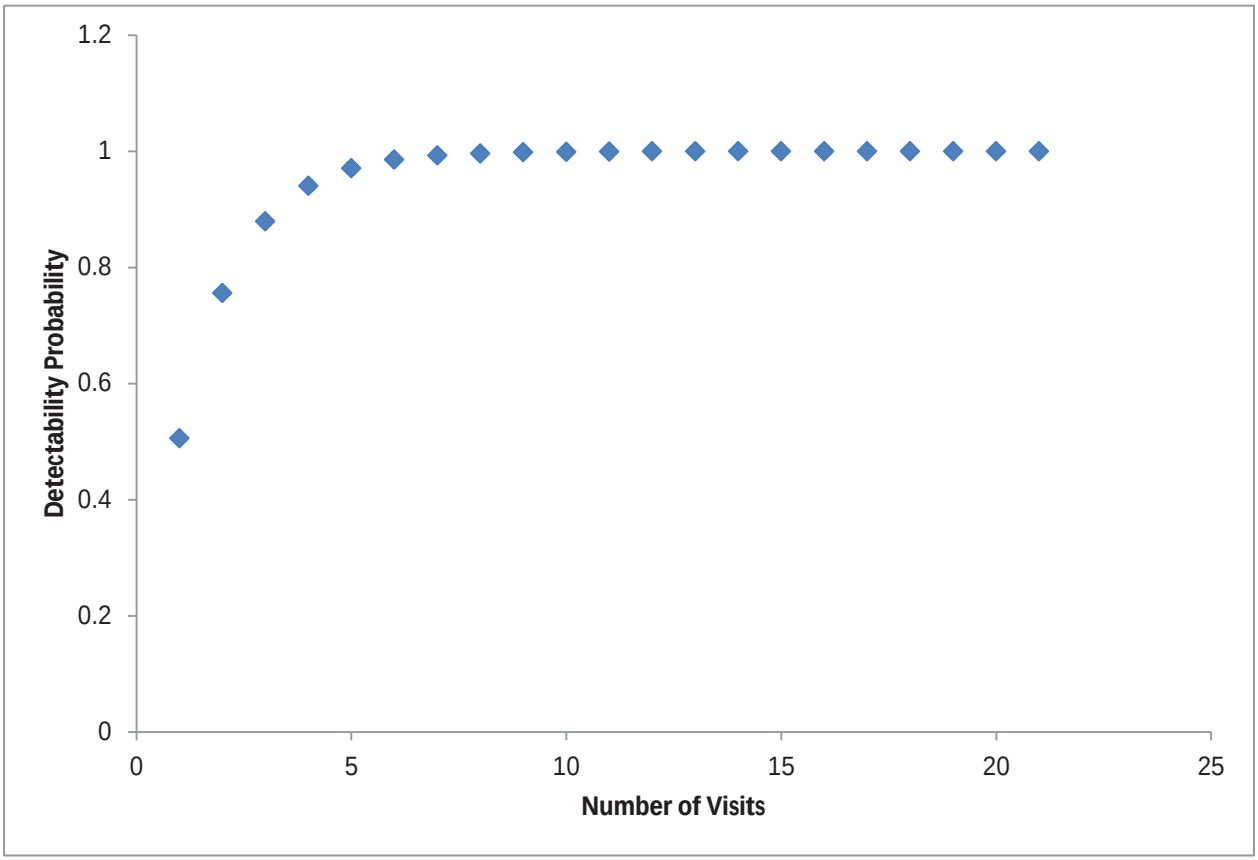

Figure 5-3 Sooty owl probability of detection over a number of visits, with mean and best and worst environmental conditions.

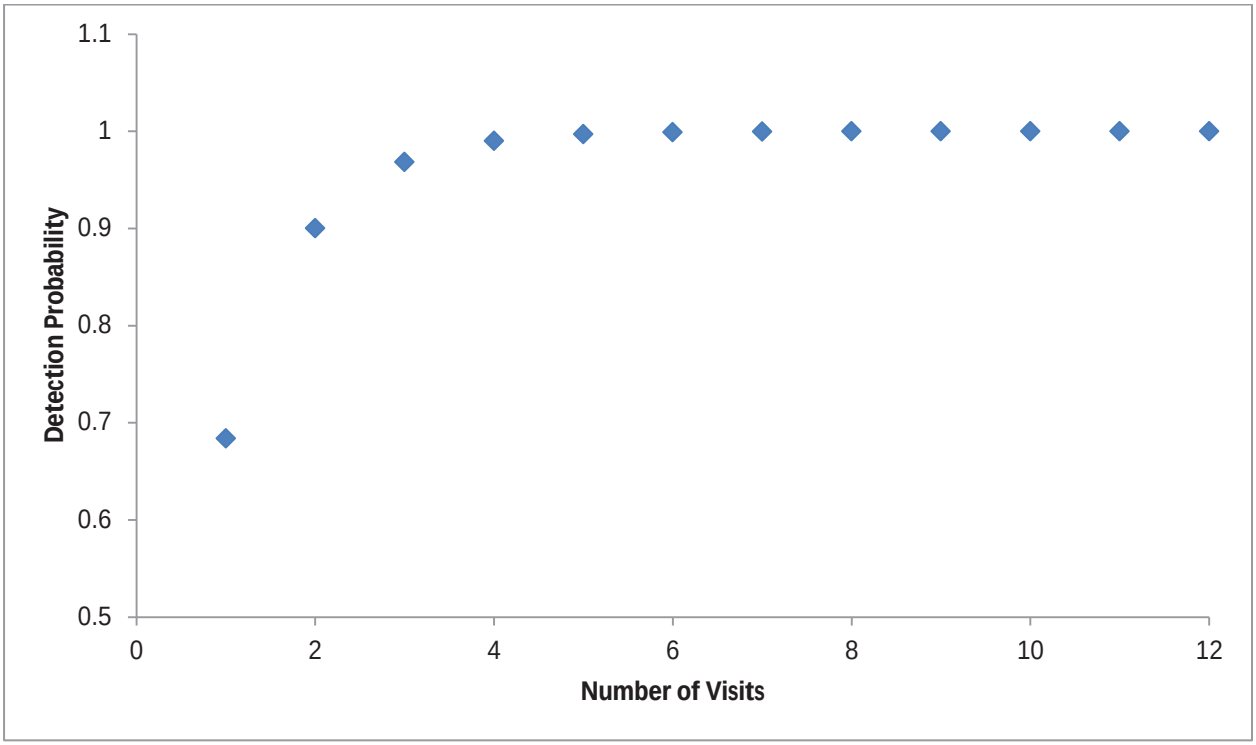

Figure 5-4 Greater glider probability of detection over a number of visits, best and worst scenarios are not illustrated as they mirrored the mean (note: x-axis begins at 0.5 probability).

5.9 Bird Species Assemblage Differences

Overall, bird species density and abundance significantly differed between habitat types ($F_{3, 116} = 5.24$, $P < 0.001$). The two forest types (i.e. open woodland, shrubby forest) were relatively similar in floristic composition and structure and therefore it was not surprising that species and abundance were not different (

Table 5-5). Similarly, it was not surprising that density and abundance in the two forest types were significantly different from logging regeneration and riparian/damp forest. Logging regeneration areas were devoid of a canopy and often lacked any or extensive vegetation cover. Whereas, riparian and damp forest had a denser canopy, often with a mid-canopy but lacking much ground or shrub layer due to less light availability and would therefore differ to the open forest types.

Interestingly, riparian/damp forest and logging regeneration did not differ regarding bird species density and abundance (

Table 5-5). This result is unexpected, as it would be assumed that riparian and damp forests would have higher density and abundance due to seemingly higher quality habitat. It may be correct or an artefact of the few sample points located in riparian/damp forest (due to this habitat being rare). The number of sampling points was corrected for by averaging abundances and also by using much more powerful semi-parametric analyses.

Table 5-5 Comparison of bird species density, abundance and diversity between different habitat types (i.e. pairwise PERMANOVA tests; note: there are repeated values within table).

Habitat One (H1)	Habitat Two (H2)	t value	*P* (Monte Carlo)	Simpson's Index		Shannon's Index	
				H1	H2	H1	H2
Open woodland	X Open shrubby forest	0.76	0.570	0.09	0.07	2.72	2.88
Open woodland	X Riparian/damp forest	*2.67*	*0.003**	*0.09*	*0.16*	*2.72*	*2.04*
Open woodland	X Logging regeneration	*2.50*	*0.006**	*0.09*	*0.17*	*2.72*	*2.00*
Open shrubby forest	X Riparian/damp forest	*2.96*	*0.002**	*0.07*	*0.16*	2.88	*2.04*
Open shrubby forest	X Logging regeneration	*2.90*	*0.001**	*0.07*	*0.17*	*2.88*	*2.00*
Riparian/damp forest	X Logging regeneration	0.69	0.547	*0.16*	*0.17*	*2.04*	*2.00*

**Statistically different: <0.05*

5.10Estimated Species Richness and General Diversity

In total, 571 individuals from 58 terrestrial fauna species were observed inhabiting or using the Study Area. Forty-three species were classified as rare as they had less than 10 individuals recorded. However, these numbers are an indication of the species assemblage for the habitat surveyed and not for the entire Study Area. Therefore extrapolation of estimated species richness indices provides an indication of the potential number of species that could inhabit the Study Area under different conditions (and models). The various models use the number of rare and abundant species to extrapolate the number of total species expected in a system.

Most models estimated species richness to be between 58 (± 0.1) and 73 (± 9.1) with an upper outlying estimate of 90.1 (± 38.4). It is expected that many of these species would be much more cryptic than the species observed during surveys. These estimates are probably conservative for all terrestrial fauna species, considering that herpetofauna were not extensively sampled for and there could be a few more smaller and cryptic mammal species.

Based on these estimates, literature and database results (see Section 4.3) as well as habitat requirements, it is estimated there is approximately six species of frog (all common except Martin's toadlet), 55 birds, 16 mammals and 12 reptiles present in the Study Area (total 89 species). However, it is highly unlikely that any nationally threatened species number in this 89. As stated previously, the habitat is too poor and the presence of many threatening processes makes conditions unsuitable for nationally threatened species. There is some habitat for State threatened species and their potential presence has been discussed in earlier sections.

Species diversity indices indicate that the species assemblage is generally diverse (Simpson's Index

Table 5-6) and is not dominated by one or two species (Shannon's index between 1.5 and 3.5).

Table 5-6 Species diversity indices for the assemblage within the Study Area

Diversity Index Name	Description	Diversity Index	Standard Error
Shannon's index	Distribution of individuals among species. Individuals distributed evenly as value approaches 4	3.29	0.05
Simpson's index	Ranges between 0 and 1, 0 represents infinite diversity	0.06	<0.01

6 Potential Impacts

6.1 Current Key Threatening Processes

Habitat fragmentation and degradation feature prominently in the current threats to the Study Area (Table 6-1). All habitats within the Study Area have been harvested and/or degraded by logging or associated activities. There are several stages of succession present in the area from recent logging regeneration to older higher quality habitat (see Section 5.4). Harvesting has probably altered the microclimate, hydrology, erosion and the number of weeds and pests. Harvesting would have also led to an increase in vehicular traffic. It is unlikely that the vegetation of the Study Area resembles the pre-European (harvesting) habitat.

It is likely that the Critically Endangered White Box - Yellow Box - Blakely's Red Gum grassy woodlands and derived native grasslands community was historically common in the Study Area. However, the large trees that characterise this community would have been highly sought after for timber and more disturbance-tolerant and quickly regenerating tree species have grown in their place. The Rare Warm Temperate Rainforest was also historically more widespread in the region but has been reduced to only one patch within the Study Area.

Similarly, fauna biodiversity probably does not resemble the original suite of species present on the site. Many species have become extinct from the Gippsland region and introduced species are now common and widespread. In particular, sambar deer, red foxes, feral cats, European rabbits are either abundant or expected to be common within the Study Area. It is also highly likely that feral pigs (*Sus scrofa*) and goats (*Capra hircus*) also use the Study Area. The presence of these species has caused a reduction in biomass and biodiversity of native vegetation and fauna has been listed as threatening processes under the FFG Act (except pigs; Table 6-1).

As the waterways within the Study Area are at the headwaters of the creeks intersecting the area, significant alterations to water flow are not listed as a current threatening process at the site.

Table 6-1 Threatening processes occurring, or have the potential to occur, in the Study Area that have been considered sufficiently severe to warrant listing under the Victorian Flora and Fauna (FFG) Act

Threatening Process	System/s Affected	Impact Outcomes and Listed Under the FFG Act as…
Degradation and fragmentation of native vegetation	All habitat, including waterways and catchments	Degradation of native riparian vegetation along Victorian rivers and streams Habitat fragmentation as a threatening process for fauna in Victoria Loss of hollow-bearing trees from Victorian native forests Loss of coarse woody debris from Victorian native forests and woodlands Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
Degradation of waterways and catchments	Waterways (including ephemeral)	Alteration to the natural temperature regimes of rivers and streams Removal of wood debris from Victorian streams
Collection of native orchids	Orchid biodiversity, conservation and management	Collection of native orchids
High frequency fire and inappropriate fire regimes	All native vegetation	High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity
Introduction of non-native animals	All habitats	Degradation and loss of habitats caused by feral horses (*Equus caballus*) Reduction in biodiversity of native vegetation by sambar deer (*Cervus unicolor*) Reduction in biomass and biodiversity of native vegetation through grazing by the rabbit *Oryctolagus cuniculus* Soil degradation and reduction of biodiversity through browsing and competition by feral goats (*Capra hircus*) Predation of native wildlife by the cat, *Felis catus* Predation of native wildlife by the red fox *Vulpes vulpes*
Introduction of 'environmental weeds'	All habitats	Invasion of native vegetation by 'environmental weeds' Invasion of native vegetation by blackberry *Rubus fruticosus* L. agg
Introduction or altered distribution of native animals and plants beyond their normal range (non-indigenous)	All habitats	Reduction in biodiversity resulting from noisy miner (*Manorina melanocephala*) populations in Victoria Spread of *Pittosporum undulatum* in areas outside its natural distribution

Threatening Process	System/s Affected	Impact Outcomes and Listed Under the FFG Act as…
Introduction and spread of non-native insects	Native flora and fauna	The introduction and spread of the large earth bumblebee *Bombus terrestris* into Victorian terrestrial environments Threats to native flora and fauna arising from the use by the feral honeybee *Apis mellifera* of nesting hollows and floral resources Loss of biodiversity in native ant populations and potential ecosystem integrity following invasion by Argentine ants (*Linepithema humile*)
Introduction and spread of plant and animal pathogens	Flora and fauna	Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a State or local government authority Use of *Phytophthora*-infected gravel in construction of roads, bridges and reservoirs

6.2 Potential Project Impacts

Potential impacts on terrestrial ecology associated with the development of the Project at the mine site are expected to be moderate due to the significant historical disturbance of the area through timber harvesting and human use. Nonetheless there is the potential for flora, fauna and ecological communities within (or close to) the mine site to be impacted by the Project. The primary impact on these aspects is expected to be associated with the native vegetation clearance required for the Project components.

6.2.1 Native Ecological Communities and Flora

Potential Direct Impacts

Potential impacts of the Project footprint on existing vegetation and flora will result from removal and/or pruning. Therefore, this will only impact upon the vegetation within the proposed Project footprint and buffers. This vegetation is regrowth from previous harvesting. No EPBC Act or FFG Act threatened vegetation, threatened species preferred habitat or ecological communities have been identified as potentially being directly impacted by the Project.

Preliminary calculations of native vegetation loss conducted by Ethos NRM (Annex 1) indicate that:

- The development of the mine site will require the removal of approximately 146 ha of native vegetation (equating to approximately 104 habitat hectares);
- Calculations estimate that the mine site (excluding roads) will require the removal of:
  - 138.42 ha of Shrubby Dry Forest, Lowland Forest, Damp Forest and Riparian Forest (in descending order of ha; i.e. Riparian Forest least ha);
  - Habitat hectares estimated to be 98.73;
  - 433 Large Old Trees;
  - In total, 140.56 ha to be removed.
- The diversion of the Nowa Nowa-Buchan Road will require the removal of 7.94 ha, including Shrubby Dry Forest, Lowland Forest and 9 Large Old Trees; and
- The mine access road to the Bruthen-Buchan Road will require the removal of 0.15 ha of Shrubby Dry Forest.

Notably, the single patch of Warm Temperate Rainforest identified in the Study Area will not be directly impacted, as this patch is at least 600 m away from the mine site.

For the purposes of this Study, it has been assumed that 100% of vegetation within the mine site will be effectively removed, including buffer areas. However, some vegetation components (e.g. grassland/shrubs) may be able to be retained in small parts of the buffer areas classified as the ‘outer’ bushfire management zones around buildings.

Additional vegetation quality and targeted flora surveys will be undertaken in spring 2013. These surveys will be used in conjunction with autumn assessments to determine vegetation loss and offset requirements. The surveys will be conducted during the flowering period for threatened species to determine their presence, suitable habitat or absence. Please note that Colquhoun grevillea was determined as being absent during October surveys of the mine site (see Annex 2).

Potential Indirect Impacts

Vegetation may be indirectly impacted by one or a combination of: increased exposure to light and altered microclimate on clearance edges, increased exposure to weeds and parasites carried by wind and increased traffic, increased erosion and sediment transport, increased dust pre- and post-construction and/or increased risk of fire.

Increased edge effects are created by the remaining fragments (after clearing) having a larger edge than the previous contiguous forest. In this system, the fragments will generally be surrounded by areas of low biodiversity and simple structure (e.g. roads, buildings). This will result in the edge being exposed to increased light (solar radiation), different temperatures, wind and generally a different climate to previous (Murcia 1995). Altered microclimate can encourage or decrease plant growth and consequently can change floristic structure.

The edges may also be exposed to more weed/pest invasion and erosion and sediment transport. It is likely that the area has a high weed and pest load already, however the edges may be invaded by more introduced grasses. The edges, especially along the roads, will erode more quickly without vegetation and any rain will erode this further. Any changes to the sediment loads after heavy rainfall may also alter nutrient cycling.

Construction activities and mine operations are likely to increase the concentration of particulate matter in the air. There is the possibility that the build-up of dust on plants can decrease exposure to light and consequently reduce photosynthesis.

The area is probably already fire prone, but the presence of the Project at the mine site may result in an increased risk of human-induced fire (e.g. cigarettes, arson), if not effectively managed.

It is highly likely that the vegetation is already, or has been, exposed to most (if not all) of these indirect impacts during historical timber harvesting activities. Therefore it is unlikely that these impacts will have a dramatic effect on existing disturbance patterns in the State Forest.

6.2.2 Native Fauna

Potential Direct Impacts

Direct impacts associated with the Project are likely to be limited to accidental death and injury of any native fauna. Similar to other human-based activities, native fauna may be accidentally killed or injured by vehicular traffic, electrocuted by transmission lines or other live structures, inadvertently fly into human-made structures (e.g. windows, power lines) or become trapped in buildings. This does not include the management of introduced species.

Potential Indirect Impacts

Native fauna may be indirectly impacted by the Project by one or a combination of: removal of foraging and/or breeding habitat, intolerance of human activities, increased competition for resources, increased exposure to introduced species (including native) and/or increased predation.

Removal of foraging and/or breeding habitat is more likely to impact upon specialist species that require specific habitat characteristics. Removal of breeding habitat is also more likely to impact upon species than foraging habitat. Nest building is energetically costly and time consuming and nest hollows are often a rare commodity. Nests are also generally at the centre of a species' home range (territory) and for highly territorial species, removal of part or all of their territory may result in conflict with individuals in unaffected territories. This may also result in local or large scale displacement of individuals. However, no specialist species were observed within the Study Area and, therefore, it is unlikely that they breed in the area.

Many native species are intolerant of human activities, and some species are even intolerant of the mere presence of humans (e.g. Beale & Monaghan 2004, Price & Lill 2009). Increased human presence and activity may force some species to leave the area entirely or leave temporarily. Some species may remain but increase their vigilance around people, thereby increasing their stress levels and reducing time for other activities. The mine is expected to operate 24 hours a day and emit noise above current background levels. This may disrupt behaviour and interfere with animal communications. For example, micro-bats rely on sound for navigating and foraging. It is likely that most animals are accustomed to a certain amount of human disturbance due to logging activities in the surrounding State Forest, but noise from pre- and post-construction activities may be more extensive and of a different nature to that of previous disturbances.

Increased competition for resources, exposure to introduced species and predation are likely consequences of reduced habitat and increased fragmentation of vegetation (edge effects). If individuals are not displaced by removal of habitat, these individuals will move into remaining fragments, increasing competition for remaining resources. An area has a limited carrying capacity (number of individuals per area/resources). Although it is highly likely that the number of introduced animals is already high, a few more individuals may immigrate. Additionally, some introduced and native species are disturbance-tolerant or thrive in disturbed areas. The number of these disturbance-tolerant species may increase. Many introduced species are efficient predators (e.g. cats and foxes) and if there is an increase in their number, predation pressure on native species may be greater.

Finally, native fauna have been exposed to many of these indirect impacts by previous disturbance regimes in the Tara State Forest and surrounds. Since fauna have already experienced high levels of disturbance, it is likely they will have an increased tolerance for the additional disturbances caused by the Project.

6.2.3 Groundwater Dependent Ecosystems

The BOMs Atlas of GDEs has estimated that the vegetation along the three creeks intersecting the mine site may be reliant on surface expression of groundwater.

Piezometric levels in the Project area range from approximately 37 to 50 m below ground level. Groundwater discharge / contribution to local streamflows appears not to occur in the Project area. Regionally, discharge of aquifer units closer to the surface may occur as baseflow in the lower reaches of the rivers and smaller creeks flowing over the coastal plains (e.g. potentially Boggy Creek) (DSE, 2010). Additional groundwater discharge may also occur to the Gippsland Lakes and other estuarine bodies (e.g. Lake Tyers) (DSE, 2010). However, such areas do not occur in the direct vicinity of the mine site.

It is therefore highly unlikely that groundwater dependent ecosystems (GDE) occur in the Project area. Some vegetation in the lower reaches of Boggy Creek and around Lake Tyers may use groundwater. However, this is approximately 15 km downstream of the Project area and groundwater levels are unlikely to be impacted by the proposed Project in this area.

Potential impacts on groundwater resources are further described in the ***Surface and Ground Water Baseline and Assessment*** (EES Referral Attachment 5).

6.3 National and State Threatened Species with Potential to be Impacted

6.3.1 Potential Direct Impacts to Flora and Communities

No EPBC Act or FFG Act species or communities will be directly impacted by the mine site as they have not been recorded in the Study Area or surrounding habitat to date. Additional surveys will need to be undertaken during the flowering period for threatened species to confirm that EPBC and FFG Act listed species are not present within the mine site.

The Project proposes to remove approximately 146 ha of native vegetation at the mine site, and this may directly impact upon the following DEPI-listed Rare flora species (i.e. identified during surveys either in footprint or in Study Area):

- Wallaby bush (*Beyeria lasiocarpa*);
- Gippsland stringybark (*Eucalyptus mackintii*);
- Forest red box (*Eucalyptus polyanthemos longior*);
- Paperbark tea-tree (*Leptospermum trinervium*);
- Austral tobacco (*Nicotiana suaveolens*); and
- Smooth geebung (*Persoonia levis*).

Individuals of some or all of these species will be removed and therefore these impacts will need to be offset as part of the Biodiversity Offset Strategy (see Section 8.3). Generally, these species' populations are stable elsewhere in Victoria and/or Australia and the removal of a few specimens (short-term) is unlikely to impact upon the conservation of these species.

6.3.2 Potential Indirect Impacts to Flora and Communities

Please note that only species and communities listed under EPBC Act, FFG Act and DEPI Vulnerable or of higher conservation significance are considered within this section. Many flora species of DEPI Rare status may be indirectly impacted and therefore to see a full list see Annex 3, however, impacts would be similar to those discussed below.

Many of the threatened species discussed in assessments (see Section 4 and 5) will not be subject to significant indirect impacts because they:

1. Have never been recorded in the mine site or greater region;
2. May be locally or regionally extinct as they have not been recorded in the area for over 20 years;
3. Are unlikely or highly unlikely to reside within the habitat of the mine site (see Section 4 and 5 and Annex 3 for likelihood assessments) due to insufficient habitat/local conditions.

FFG Act Modelled Communities

The closest patch of Warm Temperate Rainforest is at least 600 m away from the mine site. The Project will not remove or lop any of the vegetation within or surrounding these communities. However potential indirect impacts from Project activities may include:

- Increased fire risk;

- Increased erosion and sediment transport during heavy rainfall (from land disturbance associated with the diversion of the Nowa Nowa-Buchan Road); and
- Increased exposure to weeds and parasites carried by wind and increased traffic.

EPBC Act and FFG Act Flora Species "Unlikely" to Occur

The following species are considered unlikely[1] to occur in the habitat of the mine site but nevertheless can be considered in regards of mitigation and management (i.e. precautionary principle):

- Maroon leek-orchid (*Prasophyllum frenchii*, EPBC Act EN, FFG Act L, DEPI EN);
  - Grassland and grassy woodland habitats that are generally damp but well drained
  - Never recorded in the region
  - Most susceptible to (if present):
    - Exposure to light and altered microclimate on clearance edges
    - Exposure to weeds and parasites carried by wind and increased traffic
    - Erosion and sediment transport
    - Risk of fire
- Colquhoun grevillea (*Grevillea celata*, EPBC Act VU, FFG Act L, DEPI VU);
  - Terrain tends to be flat or with a slight northerly aspect. Populations occur from c. 140–300 m above sea level
  - Last recorded in region in 2008
  - Current study did not identify any specimens or suitable habitat (see Annex 2)
  - Most susceptible to (if present):
    - Erosion and sediment transport
    - Risk of fire
- Leafy nematolepis (*Nematolepis frondosa*, EPBC Act VU, FFG Act L, DEPI VU);
  - Varied habitat ranging from low rock outcrop scrub to tall open forest dominated by *Eucalyptus regnans*
  - Last recorded in region in 2002
  - Most susceptible to (if present):
    - Exposure to light and altered microclimate on clearance edges
    - Exposure to weeds and parasites carried by wind and increased traffic
    - Erosion and sediment transport
    - Risk of fire
- Leafless tongue-orchid (*Cryptostylis hunteriana*, EPBC Act VU, FFG Act L, DEPI EN);
  - Reported to occur in a wide variety of habitats including heathlands, dry sclerophyll forests, forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests
  - Never recorded in the region
  - Most susceptible to (if present):

[1] Species "highly unlikely" to occur are not discussed here (see Annex 3).

- Exposure to light and altered microclimate on clearance edges
- Increased dust pre- and post-construction
- Exposure to weeds and parasites carried by wind and increased traffic
- Erosion and sediment transport
- Risk of fire

- Thick-lipped spider-orchid (*Caladenia tessellata EPBC Act* VU);
  - Heathland, heathy or grassy woodland, and grassy or sedgy open forests in well drained sand and clay loams
  - Never recorded in the region
  - Most susceptible to (if present):
    - Exposure to light and altered microclimate on clearance edges;
    - Exposure to weeds and parasites carried by wind and increased traffic
    - Erosion and sediment transport
    - Risk of fire
- Yellow-wood (*Acronychia oblongifolia*, FFG Act L, DEPI R);
  - Warmer rainforest and on their margins, also in regrowth rainforest, widespread in coastal districts
  - Last recorded in region in 2000
  - Most susceptible to (if present):
    - Erosion and sediment transport
    - Risk of fire

Flora Species with Potential to Reside in Mine Site (Vulnerable DEPI)

These flora species have never been recorded within the mine site and were not recorded during field surveys, but have potential to occur within the site due to habitat requirements.

- Showy boronia (*Boronia ledifolia*);
  - Last recorded in region in 2004
  - Heath and dry sclerophyll forest on sandstone and granite
  - Most susceptible to (if present):
    - Exposure to weeds and parasites carried by wind and increased traffic
    - Erosion and sediment transport
    - Risk of fire
- Spotted gum (*Corymbia maculata*);
  - Last recorded in region in 1980
  - Community dominant, in open forest on somewhat infertile and drier sites on shales and slates
  - Most susceptible to (if present):
    - Erosion and sediment transport

- Risk of fire

- Wild sorghum (*Sarga leiocladum*);
  - Last recorded in region in 1999
  - In woodland on poorer soils
  - Most susceptible to (if present):
    - Exposure to light and altered microclimate on clearance edges
    - Increased dust pre- and post-construction
    - Exposure to weeds and parasites carried by wind and increased traffic
    - Erosion and sediment transport
    - Risk of fire

6.3.3 Potential Indirect Impacts to Fauna

Fauna Detected Within or Nearby Mine Site

These species were observed using habitat within and/or surrounding the mine site. As these species are typically highly mobile, some with very large territorial ranges, it is unlikely they will be subject to significant indirect impact by Project activities. However, a brief discussion of impacts is included below to guide mitigation and management. Impacts are restricted to those that are most likely to occur or increase due to the Project activities. There are other indirect impacts (e.g. introduced animals) that are already currently occurring within the area and are unlikely to increase significantly due to the Project.

- Masked owl (*Tyto novaehollandiae novaehollandiae*, FFG Act L, DEPI EN);
  - Inhabits forests, woodlands, caves; roosts in tree hollows, dense foliage, out-buildings, caves
  - Last recorded in the region in 2007
  - Probably only an occasional visitor as habitat present for hunting, unlikely to roost on site
  - No evidence of breeding or roosting found within Study Area, species more likely to breed and roost further east and south east
  - One individual seen, presumably hunting, on Telephone Road
  - Current (high urgency) impacts to masked owls include timber harvesting (Schedvin et al. 2003), which has occurred and will continue to occur within the Study Area
  - Most susceptible to:
    - Removal of hunting grounds
    - Increased human activity, territorial pair likely to flee and avoid area (but may habituate)
    - May avoid artificial lighting, but may also use it to hunt animals attracted by the light
- Brown treecreeper (*Climacteris picumnus victoriae*, DEPI NT);
  - Mostly lives in temperate or dry forests, can inhabit disturbed forests
  - Never recorded in region
  - Observed on four occasions
  - No evidence of nests, but suspected to breed in or nearby mine site
  - Most susceptible to:

- Removal of breeding and/or foraging habitat
- Increased human activity, individuals likely to temporarily flee and avoid area (but may habituate as they are often found in disturbed habitat)

- Lace monitor (*Varanus varius*, DEPI EN);
  - Common; semi-arboreal, forested areas
  - Presence dependent on prey; large home ranges and can travel several km a day
  - Last recorded in region in 2002
  - Observed on two occasions
  - No evidence of breeding, but territories very large
  - Most susceptible to:
    - Removal of breeding and/or foraging habitat
    - Increased human activity, individuals likely to temporarily flee and avoid area (but may habituate)
- Martin's toadlet (*Uperoleia martini,* DEPI CR);
  - Adults are found in dry forest, shrublands, grasslands, and open and disturbed areas. Mostly near water, but also in dry depressions that flood in winter or spring
  - Never recorded in region
  - Heard on one occasion, during a particularly heavy rainfall event, on the southern boundary of the Study Area, approximately 1-2 km south of Project components
  - No removal of habitat in area near where individuals heard, so no impact on foraging or breeding habitat, also not downstream
  - Most susceptible to:
    - Increased human activity, individuals may move further south-east (but may habituate)

It is likely that foraging habitat will be removed, but both species are highly mobile, and are likely to find foraging grounds elsewhere. Removal of habitat for Project activities is not expected to significantly impact on the local or regional population. For example, the lace monitor occurs in relatively low population densities, being one to three individuals over 1000 to 3000 ha and their large territories typically cover highly degraded habitat. Brown treecreepers also occur in highly degraded and fragmented forest in East Gippsland, and elsewhere across Victoria (e.g. box iron-bark forests; see Kavanagh et al. 2007 for example). Removal of a small proportion of the foraging grounds for these two species is thus unlikely to significantly impact on their foraging activities. There may be temporary displacement, but these species are able to readily habituate to (human-caused) disturbance, since all species forage in highly disturbed/fragmented and degraded habitat. It is also possible that these species will habituate to the mining activities and take advantage of the cleared areas to hunt.

Significant Fauna Species with Potential to Occur

It is possible that other threatened species inhabit the mine site and surrounding habitat but have never been recorded in the area, particularly due to their cryptic nature. An assessment of threatened species habitat requirements and the likelihood of their presence within the mine site found that no (additional) threatened species were “likely” to inhabit the area. “Likely” is defined as a species having habitat requirements met, threatening processes are low and that it is likely that they are detected in the future.

The habitat is too disturbed, structural components are absent (e.g. adequate shrub cover) and threatening processes are too frequent and/or in high numbers (e.g. introduced predators, logging activities) for many threatened species.

These species have been identified as having the potential (categorised as “potential” or “occasional”) to occur based on habitat requirements and the potential presence of nearby populations (Annex 4 to Annex 6). Only species with “Vulnerable” classifications and above have been included. Please also note that green and golden bell frog and giant burrowing frog are not discussed here as habitat is unsuitable, mine site is too far from permanent water sources and neither was detected during current surveys.

- Black-faced monarch (*Monarcha melanopsis, EPBC Act* Migratory/Marine-Bonn);
  - Last recorded in region in 1993
  - Habitat present but species is less common in southern section of range and not detected within Study Area
  - Inhabits east coast forests, rainforests, eucalypt woodlands, coastal scrub and damp gullies
  - Most susceptible to (if present):
    - Increased human activity, individuals likely to flee and avoid area (but may habituate)
- Greater glider (*Petauroides volans*, DEPI VU);
  - Last recorded in region in 2000
  - Inhabits wet sclerophyll forest, needs large tree hollows for shelter
  - Habitat present; may breed in Study Area but no individuals detected
  - Most susceptible to (if present):
    - Removal of breeding and/or foraging habitat
    - Increased human activity, individuals may temporarily flee (but may habituate as often found in disturbed habitat)
- Long-nosed potoroo (*Potorous tridactylus tridactylus*, EPBC Act VU, FFG Act L, DEPI NT);
  - Never recorded in region
  - Inhabits open forest and woodland and the ecotone in-between
  - Rare species, habitat probably of insufficient quality to permit constant/resident populations, very susceptible to introduced predators
  - Most susceptible to (if present):
    - Removal of breeding and/or foraging habitat
    - Increased competition for limited resources
    - Increased human activity, individuals likely to flee and avoid area
- Powerful owl (*Ninox strenua*, FFG Act L DEPI VU);
  - Occasional visitor
  - Last recorded in region in 2009
  - Tall open forests, woodlands, roost in large trees in gullies
  - Habitat probably of insufficient quality to nest or roost, but may forage
  - Most susceptible to (if present):

        - Removal of hunting grounds
        - Increased human activity, territorial pair may flee and avoid area (but may habituate)
        - May avoid artificial lighting, but may also use it to hunt animals attracted by the light
- Sooty owl (*Tyto tenebricosa tenebricosa* FFG Act L, DEPI VU);
    - Occasional visitor
    - Last recorded in region in 2008
    - Closed and tall forests, especially in gullies; roost in tree hollows, caves by day; active in canopy at night
    - Habitat probably of insufficient quality to nest or roost, but may forage
    - Most susceptible to (if present):
        - Removal of hunting grounds
        - Increased human activity, territorial pair may flee and avoid area (but may habituate)
        - May avoid artificial lighting, but may also use it to hunt animals attracted by the light
- Southern brown bandicoot (*Isoodon obesulus obesulus*, EPBC Act EN, FFG Act L, DEPI NT);
    - Never recorded in region
    - Inhabits variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland
    - Some habitat may be present, local populations known in greater Gippsland area
    - Not seen during nocturnal surveys but cryptic and shy
    - Most susceptible to (if present):
        - Removal of breeding and/or foraging habitat
        - Increased competition for limited resources
        - Increased human activity, individuals may flee and avoid area (but may habituate)
- Southern toadlet (*Pseudophryne semimarmorata*, DEPI VU);
    - Last recorded ~700 m north of Harris Creek in 1969
    - Adults inhabit in dry forest, shrubland, grassland, and heaths; under leaf litter and other debris in moist soaks
    - Some habitat may be present; if creeks flood
    - Most susceptible to (if present):
        - Removal of breeding and/or foraging habitat
        - Increased competition for limited resources
        - Increased human activity, individuals may flee and avoid area (but may habituate)
- Spot-tailed quoll (*Dasyurus maculatus maculatus* EPBC Act EN, FFG Act L, DEPI EN);
    - Possible visitor, but at least one individual was found near Bruthen (dead on road) in 2010 and Nowa Nowa region 2013
    - Never recorded in region (within 10 km of mine site)
    - Temperate and subtropical rainforests in mountain areas, wet schlerophyll forest, lowland forests, open and closed eucalypt woodlands

- Habitat of the Study Area is probably unsuitable
- Most susceptible to (if present):
  - Removal of foraging habitat
  - Increased competition for limited resources
  - May be hit by vehicles while feeding on road kill (from increased mining traffic)
  - Increased human activity, individuals likely to flee and avoid area (but may habituate)

- White-footed dunnart (*Sminthopsis leucopus*, FFG Act L DEPI NT);
  - Last recorded in region in 1978
  - Occurs in forests and woodlands with an open understorey of low density vegetation; also in grassy fore-dune complexes
  - Habitat may be present, may be of insufficient quality to sustain population
  - Most susceptible to (if present):
    - Removal of breeding and/or foraging habitat
    - Increased human activity, individuals may flee and avoid area (but may habituate)

7 Legislation and Policy Implications

7.1 Commonwealth Government and International Treaties

The most pertinent commonwealth and international legislation for the Project are the EPBC Act and several international treaties relating to migratory and marine species. International treaties are governed under the EPBC Act.

7.1.1 Environmental Protection and Biodiversity Conservation Act 1999

One of the primary aims of the EPBC Act 1999 is to provide for the conservation of biodiversity and the protection of the environment. The Act outlines several matters of national environmental significance (MNES), including:

- Wetlands of International Importance (Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements; and
- Commonwealth marine areas.

Under the Act, actions that are likely to have a significant impact upon MNES require approval from the Environment Minister.

No EPBC Act threatened flora species or critical habitats were identified during the field survey of the Study Area. Of the 902 native flora species that have been recorded in the region, there were only three species listed as Vulnerable under the EPBC Act (i.e. Colquhoun grevillea, limestone blue wattle, leafy nematolepis). The Colquhoun grevillea was not found within the mine site (see Annex 2). It is unlikely that the latter two (or maroon leek-orchid, leafless tongue-orchid, thick-lipped spider-orchid) occur within the Study Area as most habitat is too disturbed, being logged recently. Further surveys are being undertaken as part of the approvals process for the Project (spring 2013).

No EPBC Act fauna species were observed during any of the surveys of the Study Area. Databases indicated that two EPBC Act threatened bird species were recorded in the region in 1977 (Australian bittern, swift parrot). It is highly unlikely that either of these inhabit or use the area of the mine site or even the region with any regularity. The literature also indicated that ten Migratory/Marine bird species have been recorded at one time within the region (but not within the Study Area). Similarly, these species habitat requirements preclude them from using the habitat of the Study Area. Black-faced monarchs (Migratory/Marine) have the potential to move through the habitat of the Study Area, but have not been detected in the region since 1993. These birds are very distinctive and are unlikely to be missed during surveys.

No EPBC Act threatened mammal, fish or invertebrate species have ever been recorded within the region. One nationally significant species; the Vulnerable green and golden bell frog (*Litoria aurea*) was recorded once in Hospital Creek in March 1993 during a seemingly higher rainfall period. It is likely that this species has become locally extinct as there is little habitat (foraging or breeding) within the region. The habitat within the Study Area is too poor, there is little habitat connectivity and there are no

populations nearby to source new individuals. Similarly, the giant burrowing frog (*Heleioporus australiacus*) may be found in the surrounding area (>10 km radius), but due to the distance of the mine site from known populations and a more reliable water source, it is unlikely this species is present within the mine site. Additionally, the species was not heard or seen during nocturnal or diurnal surveys. Commonwealth survey requirements include surveys during and after heavy downpours, and these survey conditions were met during the current diurnal and nocturnal surveys.

Southern brown bandicoots and spot-tailed quolls have been recorded elsewhere outside of the region (except for unverified-DEPI quoll sighting 2013). These records range in dates from recent (2010) to old (1978) and therefore it is difficult to determine whether there are sustainable populations nearby for individuals to move into the Study Area. Both species are nocturnal, shy and cryptic and therefore it is difficult to determine their presence or absence. It is possible that the habitat within the mine site is too disturbed for individuals to establish local territories. Habitat structure within the mine site and greater Study Area appears to be too open and simple, with little undergrowth to attract either species (or long-nosed potoroos). The structural diversity of a habitat and high density of undergrowth is particularly important for southern brown bandicoots and spot-tailed quolls (Backhouse 2003, DSE 2009b). Additionally, introduced predators have severely impacted on these species populations, distribution and abundances.

If these species were detected then typically this would involve inclusion of habitat to be protected that includes the detection site. This would also involve overlaying of Special Protection Zones (SPZs) or Special Management Zones (SMZs), however the entire Study Area is already protected under these zones.

7.2 Victorian State Government

7.2.1 Environment Effects Act 1978

The Environment Effects Act *1978* provides for assessment of projects that are capable of having a significant effect on the environment. If it is deemed that the Project may have a significant effect on the environment, the Minister responsible for administering the *Environment Effects Act 1978* may ask the Proponent to prepare an *Environmental Effects Statement* (EES).

The EES process provides for the analysis of potential effects on environmental characteristics and the means of avoiding, minimising and managing adverse impacts. It also includes public involvement and the opportunity for an integrated response to a proposal. Additionally, the *Environment Effects Act* 1978 works in conjunction with the Commonwealth EPBC Act to allow for a bilateral agreement between the State and Commonwealth governments regarding awarding accreditation for the proposed Project, where an EES is required.

7.2.2 Flora and Fauna Guarantee Act 1988

The Victorian Flora and Fauna Guarantee Act 1988 (FFG Act) was established to provide a legal framework for enabling and promoting the conservation of Victoria's native flora and fauna, and to enable management of potentially threatening processes. One of the main features of the Act is the listing process, whereby native species, communities and potentially threatening process are listed in the schedules of the Act. Permits are required from the DEPI if the Project is likely to impact on FFG Act listed threatened species and communities on public land.

The four modelled FFG Act communities within the patch south-east of Five Mile Track are at least 600 m from the mine site. Thus these communities will not be directly impacted by Project activities and mitigation and management measures will need to be implemented to minimise potential indirect impacts. This patch is already located close to an occasionally used track.

No FFG Act flora species were identified during surveys. Yellow-wood is unlikely to grow within the Study Area, but if it were to occur, may grow within the remnant patch of Warm Temperate Rainforest over 600m from the mine site. Yellow-wood is a characteristic canopy species of two of the four modelled communities (DSE 2009a).

One FFG Act listed species, the masked owl, was observed sitting on a branch (presumably) during its nocturnal hunt, 1.2 km east-north-east of the mine site. Despite extensive searches of the habitat, including the Warm Temperate Rainforest patch to the south-east of the mine site, evidence of owl nests or roosts was not found. It is suspected that all three threatened owl species (sooty, masked and powerful) hunt in the Study Area, but do not nest or roost nearby. Owl detectability calculations suggest that the survey effort was sufficient to detect all three owl species, but mitigation and management measures will be designed to minimise impacts on all three species.

The masked owl was detected within a Powerful Owl Management Area (POMA) and therefore this may be redefined to include a Masked Owl Management Area (MOMA). However, this would not change the current management practices of the area as these two management area types are almost identical.

7.2.3 Catchment and Land Protection Act 1994

The Catchment and Land Protection Act 1994 (CaLP Act) is a key piece of legislation governing the management of pest plants and animals in Victoria. More specifically, landowners are responsible for avoid causing and/or minimising land degradation, including taking all reasonable steps to prevent soil erosion, protect water resources, eradicate regionally prohibited weeds, prevent the growth and spread of regionally controlled weeds and where possible, eradicate established pest animals, as declared under the Act.

Pest animals are common throughout the Study Area and therefore a pest animal strategy will be required to manage and prevent future spread and introductions. The Project will need to work in conjunction and consultation with the DEPI to control pest animals. A few noxious weeds (i.e. not including non-indigenous flora) are present in and around the Study Area. It is likely that weeds will be removed as part of vegetation clearance activities for the Project components and therefore mitigation and management of preventing the spread of seeds will be necessary. A weed management strategy will also involve the eradication and control of weeds on site where feasible to prevent them from re-establishing.

7.2.4 Wildlife Act 1975

The Wildlife Act 1975 provides the administrative and logistic framework for the protection and conservation of native wildlife within Victoria. The Act often works in combination with, or reference to, other acts (e.g. FFG Act) and governs most Victorian wildlife permit / licensing requirements. A permit is required to research, capture, translocate or kill any native wildlife in Victoria, regardless of its conservation status.

If native wildlife is found within vegetation required to be for cleared or lopped for the Project, the wildlife will be encouraged to leave (e.g. creating noise). If wildlife cannot or will not leave, salvage and translocation of such wildlife may be needed. Potential salvage and translocation operations need to be investigated for their efficacy and potential negative impacts (i.e. including consultation with experts and

DEPI) prior to consideration as a mitigation option for protected wildlife. These operations would require permits from the DEPI.

7.2.5 Planning and Environment Act 1987

The Planning and Environment Act 1987 establishes the objectives for planning in Victorian and provides the legislative framework for assessment of potential environmental impacts associated with the Project.

The Act is 'enabling' legislation and does not precisely define the scope of planning. The East Gippsland Planning Scheme is the relevant subordinate instrument for the assessment of the Project. The East Gippsland Shire Council is the responsible authority for administering the Planning Scheme.

The State and local planning policy frameworks of the East Gippsland Planning Scheme establish strategic land use and development policies and practices which promote environmental protection and sustainable development.

Relevantly, clause 52.17 outlines permit requirements regarding removal and lopping of native vegetation in order to protect and conserve native vegetation to reduce the impact of land and water degradation and provide habitat for plants and animals.

Victoria's recent native vegetation policy reforms may have a bearing on the Project regarding the calculation of vegetation loss and offset requirements (refer Section 8.3.1).

7.2.6 Victoria's Biodiversity Strategy

Victoria's Biodiversity Strategy complements the National Strategy for the Conservation of Australia's Biological Diversity and the FFG Act. It provides the overarching direction for biodiversity conservation and management in Victoria. The Biodiversity Strategy is coordinated with other natural resources management mechanisms such as Regional Catchment Strategies, Regional Forest Agreements, and National Parks and Reserve planning.

7.2.7 Forest Management Areas

The East Gippsland Forest Management Plan (EGFMP) covers 1.2 million ha of forest within the region (DSE 1995). The plan has been developed to address the requirements of the above legislation and strategies and incorporate DEPI Forest Management Zones.

Conservation guidelines outlined within the EGFMP state:

- Known populations of nationally and Victorian threatened flora (DEPI Vulnerable and of higher conservation significance) be included within Special Protection Zones (SPZs) or Special Management Zones (SMZs);
- Substantial representative populations of Victorian Rare flora, are poorly known, have few records or are at the edge of their range in East Gippsland to be included in a SPZ or SMZ;
- SPZs and SMZs to include:
  - Greater glider and common brushtail possum (<2 individuals per ha, >10 per km, or >15 per hour of spotlighting)
  - Yellow-bellied glider (>0.2 per ha, >5 per km, or >7 per hour of spotlighting)
  - Masked, powerful and sooty owl habitat

8 Management, Mitigation and Monitoring

8.1 General Mitigation and Management

Suitable measures to avoid, minimise and manage impacts to flora and fauna will be required for the Project, which should be outlined in an *Environmental Management Plan* (EMP). These measures will need to be continuously monitored for their efficiency and effectiveness, and improved if necessary.

All management measures will be conducted in consultation and in conjunction with DEPI, as they have several regional and area-specific management plans governing the site. General mitigation and management measures applicable to the development of the mine site are outlined in the following sections.

- Vegetation Removal and Fragmentation:
  - Minimise area required for the mine site;
  - Optimise use of already disturbed or cleared areas;
  - Avoid areas of ecological significance where possible;
  - Implement a vegetation management plan in conjunction and consultation with DEPI and their existing management plans for the area;
  - Offset the loss of quality native vegetation by the protection or improvement/revegetation of native vegetation elsewhere in consultation with the DEPI (and in accordance with Victorian offsetting calculation guidelines).
- Weed and Introduced Animal Control:
  - Ensure that vehicles and equipment arrive and leave free of vegetation and mud;
  - Provide identification keys for feral animals and noxious weeds to mine personnel (to prevent confusion);
  - Cooperate with DEPI regarding weed and introduced animal control measures (e.g. euthanasia procedures);
  - Discourage introduced animals, e.g. food waste should not be left exposed.
- Injured Wildlife Protocol:
  - As part of the EMP, develop an injured wildlife protocol in consultation with the DEPI and ensure that all personnel working with and for the Project are aware of protocol should they find or injure wildlife. The injured wildlife protocol should include:
    - Identification keys of native wildlife that may be present within the mine site (e.g. feral animals to be euthanized in accordance with control procedures above);
    - Contact names and numbers of wildlife carers, veterinarians, ecologists (with wildlife handling experience);
    - Immediate first aid procedures (e.g. keep in dark, warm place).

- Erosion and Sediment Transport:
  - Ensure appropriate measures to minimise erosion and sediment transport are included in the EMP;
  - Ensure monitoring of turbidity is conducted in local waterways downstream of the mine site.
- Minimisation of Project Disturbance:
  - Minimising noise, light and vibration emissions wherever possible, including in frequencies beyond human hearing;
  - Ensure mine site access and haul roads are well maintained to minimise noise and dust.
- Bushfire and General Fire Management:
  - No open flames and abiding by local fire restrictions (as issued by the CFA);
  - Flammable substances should be kept according to their Material Data Safety sheet;
  - Diesel vehicles should be used where possible.
- Closure and Rehabilitation:
  - Develop and implement a rehabilitation and closure plan that allows for the progressive rehabilitation of disturbed habitat over the Project life;
  - Monitor and assess the success of the plan against predefined criteria;
  - Offset native vegetation loss in consultation with DEPI.

8.2 Specific Management, Further Surveying and Monitoring

8.2.1 Warm Temperate Rainforest Community

This community will not be directly impacted by the Project. The patch is south-east of Five Mile Track and at least 600 m from the mine site. This patch is already located close to an occasionally used track. Its presence was confirmed by botanists from Ethos NRM (see Annex 1). The community is well documented (by DEPI) and therefore further surveying to establish its layout is probably not necessary. General mitigation and management measures will reduce indirect impacts from affecting this patch.

Current conservation measures for this community in State Forests focus on timber harvesting, altered fire regimes, tourism development and the spread of environmental weeds (DSE 2009a). The East Gippsland Forest Management Plan conservation actions and guidelines state that rainforest patches be surrounded by buffers of 20 to 40 m (DSE 1995). No further management or monitoring measures are expected to be required for this community in addition to the general measures specified in Section 8.1.

8.2.2 Threatened Flora Species

It is not expected that any EPBC and FFG Act threatened flora species occur within the mine site given the results of the field surveys and the substantial historical disturbance that has occurred in the area from timber harvesting and other activities. Regardless, planned surveys are to be undertaken to confirm (or falsify) the absence of Commonwealth and State threatened species. Consultation with authorities determined that spring surveys should target Colquhoun grevillea and these October surveys identified no individual plants or suitable habitat within the mine site (Annex 2; Carter & Walsh 2006). Although

consultations determined that other threatened flora are unlikely to occur within the mine site, upcoming surveys will also pay particular attention to identifying the following species or their preferred habitat:

- Maroon leek-orchid (Duncan 2010);
- Leafless tongue-orchid (DSEWPaC 2013b);
- Thick-lipped spider-orchid (DSEWPaC 2013b); and
- Leafy nematolepis (DSEWPaC 2013b).

In general, surveying will involve:

- Conducted during spring 2013, the species' flowering period;
- Transect and/or quadrat surveying within suitable habitat;
- If specimens are detected:
  - Monitor population over life and upon closure of the mine (e.g. annual surveying)
  - Implement a monitoring and management plan including translocation, propagation and revegetation programs

8.2.3 Forest Owls

The management and conservation of masked, powerful and sooty owl populations are governed by the DEPI and they have published documents and guidelines regarding owl conservation (e.g. Schedvin et al. 2003, Loyn et al. 2011). These guidelines were followed in the current study and were extended to include more surveying and detectability analyses (see Sections 5.5 and 5.8). Considering the results of surveys, it is highly likely that no owls roost or nest within the Study Area. However, it is suspected that the Study Area forms part of each species' hunting territory. It is likely that there is a pair of each species intermittently hunting the habitat within and surrounding the Study Area. Therefore seasonal or annual monitoring of these owls' presence and habitat use can be implemented.

Approximately a third of the Study Area is set aside as Special Protection Zones, predominantly for the protection and management of the three owl species (i.e. Sooty Owl Management Area – SOMA; Powerful Owl Management Area – POMA; Masked Owl Management Area – MOMA). These zones overlap particularly within the south-west corner of the Study Area. These areas (POMA, MOMA, SOMA) are managed for the protection of owl species and their prey but also for sustainable timber harvesting.

In the East Gippsland Forest Management Area the regional target populations range from 100 to 150 pairs over 500 to 800 ha (Schedvin et al. 2003, Silveira et al. 2003, Webster et al. 2004). The masked owl sighted (within a POMA) was presumably part of the known pair within the larger region and the presence of this pair resulted in the designation of the nearby MOMA. Our finding may result in the redefinition of the POMA to include a MOMA. The most important habitat to be protected within these management areas is breeding and/or roosting sites, neither of which is likely to occur in the Study Area.

8.2.4 Nocturnal and Cryptic Mammals and Frogs

The habitat within the Study Area is not of a sufficiently high quality to attract a high diversity of mammals. Habitat structure within the mine site and broader Study Area appears to be too open and simple, with little undergrowth to attract either species. The structural diversity of a habitat and high density of undergrowth is particularly important for many threatened mammals (Backhouse 2003, DSE 2009b). The habitat is also too disturbed and largely too dry for EPBC Act frog species, particularly the giant burrowing frog and green and golden bell frog, neither being detected during the extensive nocturnal spotlighting and call recognition surveys.

Further consultation has been, and will be, undertaken with the Commonwealth and State government regarding the requirement for any further mammal surveys (if required).

8.2.5 Other Fauna

It has already been established that brown treecreepers and lace monitors use some of the habitat of the Study Area and as they are capable of moving long distances, they are likely to move into adjacent habitat for the duration of the Project. If the Project commences, increased human activity in the mine site is likely to encourage many animals to move out of the area.

Although there may be some increase competition within surrounding habitat, these species were not abundant and it is likely they will adapt to the change. This is particularly relevant to the extent that large areas of the Study Area have historically been cleared for timber harvesting. However, the presence of these species will also be included in the Biodiversity Offset Strategy (refer Section 8.3).

8.3 Biodiversity Offset Strategy

Where adverse impacts cannot be avoided, mitigated and/or managed (e.g. direct vegetation loss within Project components), a *Biodiversity Offset Strategy* will need to be developed and implemented to compensate for these direct and indirect impacts on native vegetation and biodiversity. The *Biodiversity Offset Strategy* may involve protecting land, improving land tenure security, scientific research and/or financial investment in biodiversity programs. The *Biodiversity Offset Strategy* should:

- Provide net gain in native vegetation area and biodiversity values;
- Ensure offsets are kept in perpetuity;
- Be enforceable; and
- Involve both on-site and off-site offsets.

Appropriate native vegetation offset sites will need to be identified and secured prior to Project commencement. Offset management plans will also be required covering each offset site which detail the specific works to be implemented.

Since no EPBC Act listed species were detected, specific offsets for these species are unlikely to be necessary. Native vegetation to be removed will require offsets to be set aside in accordance with the *Native Vegetation* Framework and/or *Permitted clearing of native vegetation – Biodiversity assessment guidelines.* These offsets will be calculated to take into account:

- Site based:
  - Area of native vegetation to be removed;
  - Condition of native vegetation;
  - Types and conservation status of Ecological Vegetation Classes (EVCs) to be removed; and
  - Presence of any threatened flora and fauna (of DEPI Rare status and above).
- Landscape level:
  - Importance of area for Victoria's biodiversity; and
  - Habitat importance.

As per Annex 1, Ethos NRM report that most of the vegetation within the mine site is likely to have a conservation significance of Medium. A small area of Riparian Forest to be removed has a High conservation significance. Possible increases in conservation significance may occur due to presence of the best 50% or remaining 50% of habitat for rare or threatened flora and fauna. The *Biodiversity Offset Strategy* developed will need to include detailed net gain calculations for proposed vegetation loss, after additional flora surveys are completed. Calculations based on the current legislation estimate that the required native vegetation offsets for vegetation loss associated with the mine site will range from:

- MINIMUM - 104.4 HHa (1.26 HHa of High Conservation Significance and 103.14 HHa of Medium Conservation Significance vegetation), to
- MAXIMUM - 155.96 HHa of High Conservation Significance vegetation.

An estimated Large Old Tree (LOT) protection target of between 890 and 1772 LOTs will also be required to offset the loss of 443 LOTs.

8.3.1 Reforms to Victoria's native vegetation permitted clearing regulations

Victoria's recent native vegetation policy reforms may have a bearing on the Project regarding the calculation of vegetation loss and offset requirements. The full extent of these implications is not yet known, as the government is still in the process of releasing guidance documents and have not enacted the policy changes at the time of writing.

As indicated by Ethos NRM (Annex 1) the native vegetation Reforms determine assessment requirements for applications to remove vegetation through determination of risk-based pathways, as defined in the *Permitted Clearing of Native Vegetation Biodiversity Assessment Guidelines* (DEPI, 2013). The risk-based pathway is determined by the Location Risk Map available from DEPI Biodiversity Interactive Maps, combined with the extent of proposed native vegetation removal.

Examination of the DEPI Location Risk Map shows that the majority of the main components of the mine site to be within Location A, with the proposed Buchan-Nowa Nowa Road diversion in Location C. Accordingly, the Project would be determined to require the High-risk pathway to be followed. The requirements are detailed in Chapter 7 of the *Guidelines*, which for moderate and high-risk pathways include:

- A habitat hectares assessment report;
- A statement of how impacts on biodiversity from the removal of native vegetation have been minimised;
- The Habitat Importance scores of the native vegetation to be removed; and
- An offset strategy that details how a compliant offset will be secured.

These major steps do not differ greatly from those required by the existing *Native Vegetation* Framework. However, the mechanisms for quantification of offset requirements have been changed. For a more detailed review of the implications of the native vegetation reforms see Section 5.4 of Annex 1.

9 References

Adams, M. D. (2012). *Vertical stratification of insectivorous bats (Microchiroptera) in harvested forests: assessing the role of structural clutter in shaping patterns of flight activity*. PhD, University of Woolongong.

Anderson, M. J. (2004). *DISTLM v.5: a FORTRAN computer program to calculate a distance-based multivariate analysis for a linear model*. New Zealand, Department of Statistics, University of Aukland.

Anderson, M. J. (2005). *PERMANOVA: a FORTRAN computer program for permutational multivariate analysis of variance*. New Zealand, Department of Statistics, University of Auckland.

Backhouse, G. N. (2003). *Spot-tailed Quoll Dasyurus maculatus; Action Statement FFG Act No. 15*. Melbourne, Department of Sustainability and Environment.

Beale, C. M. & P. Monaghan (2004). Human disturbance: people as predation-free predators? *Journal of Applied Ecology* 41: 335–343.

Bell, G. (1959). *The Iron Ore Deposits of Nowa Nowa, Eastern Gippsland*. Victoria, Department of Mines.

Bilney, R. J., J. G. White, F. A. L'Hotellier & R. Cooke (2011). Spatial ecology of Sooty Owls in south-eastern Australian coastal forests: implications for forest management and reserve design. *Emu* 111(1): 92-99.

BirdLife Australia (2013). *Orange-bellied Parrot Recovery Project*. Melbourne, BirdLife Australia.

BOM. (2013a). *Atlas of Groundwater Dependent Ecosystems*. Canberra, Bureau of Meteorology; Australian Government, from http://www.bom.gov.au/water/groundwater/gde/map.shtml.

BOM. (2013b). *Climate Data Online*. Melbourne, Bureau of Meteorology, from http://www.bom.gov.au/climate/data/index.shtml.

Boulinier, T., J. D. Nichols, J. R. Sauer, J. E. Hines & K. H. Pollock (1998). Estimating species richness: the importance of heterogeneity in species detectability. *Ecology* 79(3): 1018-1028.

Carter, O. & N. G. Walsh (2006). *National Recovery Plan for the Colquhoun Grevillea Grevillea celata*. Melbourne, Department of Sustainability and Environment.

Chao, A., R. K. Colwell, C.-W. Lin & N. J. Gotelli (2009). Sufficient sampling for asymptotic minimum species richness estimators. *Ecology* 90(4): 1125-1133.

Chao, A. & T.-J. Shen (2010). *Program SPADE (Species Prediction and Diversity Estimation)*. http://chao.stat.nthu.edu.tw.

Costermans, L. (2009). *Native Trees and Shrubs of South-Eastern Australia*. Sydney, New Holland Publishers.

de Oliveira, M. C. (1998). Towards standardized descriptions of the echolocation calls of microchiropteran bats: pulse design terminology for seventeen species from Queensland. *Australian Zoologist* 30(4): 405-411.

Department of Health (2008). *Annual Report on Drinking Water Quality in Victoria 2007-08*. Victoria, Victorian Department of Health.

DEPI. (2013a). *Biodiversity Interactive Map*. Melbourne, Department of Sustainability and Environment, Victorian Government, from http://www.dse.vic.gov.au/about-dse/interactive-maps.

DEPI. (2013b). *Ecological Vegetation Class (EVC) Benchmarks for each Bioregion*. Melbourne, Department of Sustainability and Environment, Victorian Government, from http://www.dse.vic.gov.au/conservation-and-environment/native-vegetation-groups-for-victoria/ecological-vegetation-class-evc-benchmarks-by-bioregion.

DEPI. (2013c). *Threatened Species and Communities Advisory Lists*. Melbourne, Department of Sustainability and Environment, from http://www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/threatened-species-and-communities/threatened-species-advisory-lists.

DEPI (2013d). *Victorian Biodiversity Atlas*. Department of Sustainability and Environment. Melbourne, Victorian Government.

DPI (2007). *Lake Tyers Fisheries Reserve Management Plan 2007*. Fisheries Victoria Management Report Series No. 43. Melbourne, Department of Primary Industries.

DPI (2012). *East Gippsland Fishery Management Plan*. Fisheries

Victoria Management Report Series No. 84. Melbourne, Department of Primary Industries, Victorian Government.

DPI. (2013). *Soils/landforms of East Gippsland*. Victoria, Department of Primary Industries, from http://vro.dpi.vic.gov.au/dpi/vro/egregn.nsf/pages/eg_soil_landform_units_waygara.

Dresel, P. E., R. Clark, X. Cheng, M. Reid, A. Terry, J. Fawcett & D. Cochrane (2010). *Mapping Terrestrial Groundwater Dependent Ecosystems: Method Development and Example Output*. Melbourne, Victoria Department of Primary Industries.

DSE (1995). *East Gippsland Forest Management Plan*. Melbourne, Department of Sustainability and Environment.

DSE (2003). *Gippsland Lakes Ramsar Site Strategic Management Plan*. Victoria, Department of Sustainability and Environment.

DSE (2004). *Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectares scoring method. Version 1.3.* . Melbourne, Victorian Government Department of Sustainability and Environment.

DSE (2008). *Colquhoun Grevillea Grevillea celata; Action Statement FFG Act No. 211*. Melbourne, Department of Sustainability and Environment.

DSE (2009a). *Rainforests and Myrtle Wilt; Flora and Fauna Guarantee Act Action Statement No. 238*. Melbourne, Department of Sustainability and Environment.

DSE (2009b). *Southern Brown Bandicoot Isoodon obesulus obesulus*. Melbourne, Department of Sustainability and Environment.

DSEWPaC (2010). *Gippsland Lakes Ramsar site Ecological Character Description*. Canberra, Department of Sustainability, Environment, Water, Population and Communities; Commonwealth of Australia.

DSEWPaC (2011). *Survey guidelines for Australia's threatened mammals*. Canberra, Department of Sustainability, Environment, Water, Population and Communities; Australian Government.

DSEWPaC. (2013a). *EPBC Act Protected Matters Search Tool*. Canberra, Department of Sustainability, Environment, Water, Population and Communities; Commonwealth of Australia, from http://www.environment.gov.au/epbc/pmst/index.html.

DSEWPaC. (2013b). *EPBC Act Species Profile and Threats Database*. Canberra, Department of Sustainability, Environment, Water, Population and Communities; Commonwealth of Australia, from http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

Duncan, M. (2010). *National Recovery Plan for the Maroon Leek-orchid Prasophyllum frechii*. Melbourne, Department of Sustainability and Environment.

East Gippsland Shire Council (2012). *Nowa Nowa, Wairewa and Lake Tyers Aboriginal Trust Community Plan 2012-2016: Draft*. Victoria, East Gippsland Shire Council.

EGCMA (2005). *East Gippsland Regional Catchment Strategy 2005-2010*. Victoria, East Gippsland Catchment Management Authority.

EGCMA (2006). *East Gippsland: Our Region*. Victoria, East Gippsland Catchment Management Authority.

EPHC (2011). *National guidance for the management of acid sulfate soils in inland aquatic ecosystems*. Canberra, Environment Protection and Heritage Council; Natural Resource Managment Ministerial Council.

Gotelli, N. J. & R. K. Colwell (2010). Estimating species richness. *Biological Diversity: Frontiers in Measurement and Assessment*. Oxford, UK, Oxford University Press.

Greig, D. (1999). *Field Guide to Australian Wildflowers*. Sydney, New Holland Publishers.

Hammer, Ø., D. A. T. Harper & P. D. Ryan (2006). *PAST - Palaeontological Statistics*. Oslo.

Herr, A. (1998). *Aspects of the ecology of insectivorous forest-dwelling bats (Microchiroptera) in the western slopes of the Australian alps*. PhD, Charles Sturt University.

Johnson, K. L., G. M. Wright & D. H. Ashton (1968). Ecological studies of Tunnel Cave, Mt. Eccles. *Victorian Naturalist* 85: 350-356.

Krebs, C. J. (2009). *Ecology: the experimental analysis of distribution and abundance*. USA, Pearson Benjamin Cummings.

Loyn, R. (1986). The 20 minute search: A simple method for counting forest birds. *Corella* 10: 58–60.

Loyn, R., E. McNabb & J. MacHunter (2011). *Approved Survey Standards: Sooty Owl Tyto tenebricosa*. Melbourne, Department of Sustainability and Environment.

Loyn, R. H., E. G. McNabb, L. Volodina & R. Willig (2001). Modelling landscape distributions of large forest owls as applied to managing forests in north-east Victoria, Australia. *Biological Conservation* 97(3): 361-376.

Menkhorst, P. W., Ed. (1995). *Mammals of Victoria*. Melbourne, Oxford University Press.

Murcia, C. (1995). Edge effects in fragmented forests: implications for conservation. *TREE* 10(2): 58-62.

Orchard, A. E. & A. J. G. Wilson, Eds. (2001). *Flora of Australia, Volume 11A; Mimosaceae, Acacia Part 1*. Melbourne, Inkata Press.

Price, M. & A. Lill (2009). Visual contact with humans and condition in domesticated budgerigars. *Avian Biology Research* 2(4): 221-228.

Russell, L. D. (1983). *A Report on Three Water Supply Catchments in East Gippsland*. Victoria, Soil Conservation Authority.

Schedvin, N. K., N. Clemann, R. Loyn & E. McNabb (2003). *Masked owl Tyto novaehollandiae novaehollandiae Action Statement*. Flora and Fauna Guarantee Act 1988. Victoria, Arthur Rylah Institute, Department of Sustainability and Environment.

Silveira, C. E., N. Clemann & R. Loyn (2003). *Sooty Owl Tyto tenebricosa Action Statement*. Flora and Fauna Guarantee Act 1988. Melbourne, Arthur Rylah Institute, Department of Sustainability and Environment.

Simpson, K. & N. Day (1999). *Field Guide to the Birds of Australia*. Melbourne, Viking.

Stone, E. L. & P. J. Kalisz (1991). On the maximum extent of tree roots. *Forest Ecology and Management* 46(1–2): 59-102.

Swanson, S. (2007). *Field Guide to Australian Reptiles*. Melbourne, CSIRO Publishing.

Tyler, M. J. & F. Knight (2011). *Field Guide to the Frogs of Australia*. Victoria, CSIRO Publishing.

Walsh, N. G. & T. J. Entwisle, Eds. (1996). *Dicotyledons: Winteraceae to Myrtaceae*. Flora of Victoria. Melbourne, Inkata Press.

Watson, D. M. (2003). The 'standardised search': An improved way to conduct bid surveys. *Austral Ecology* 28: 515–525.

Webster, A., R. Humphries & K. Lowe (2004). *Powerful Owl Ninox strenua Action Statement No. 92*. Flora and Fauna Guarantee Act 1998. Melbourne, Department of Sustainability and Environment.

Wintle, B. A., R. R. Kavanagh, M. A. McCarthy & M. A. Burgman (2005). Estimating and dealing with detectability in occupancy surveys for forest owls and arboreal marsupials. *Journal of Wildlife Management* 69(3): 905-917.

10 Annexes

Annex 1 Preliminary Vegetation Assessment and Ecological Vegetation Class Mapping (Ethos NRM)

Preliminary Vegetation Quality Assessment and Ecological Vegetation Class Mapping:

Nowa Nowa Iron Project

Prepared For:

Earth Systems

October 2013

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Ethos NRM Pty Ltd				
Document Control				
Client	Earth Systems			
Title	Preliminary VQA & EVC Mapping – Nowa Nowa Iron Project			
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EXECUTIVE SUMMARY

Ethos NRM Pty Ltd has been engaged by Earth Systems to undertake broad-scale Ecological Vegetation Class (EVC) mapping and Vegetation Quality Assessment (VQA; Habitat Hectares) sampling across an 1100 hectare Vegetation Study Area for the Nowa Nowa Iron Project. The Vegetation Study Area covers the proposed mine and associated components and is located in the Tara State Forest approximately 7km north of Nowa Nowa in the vicinity of Tomato Track, Five Mile Road and Nowa Nowa-Buchan Road.

The Tara State Forest is Crown land managed by the Department of Environment and Primary Industries and has been largely disturbed by historical timber harvesting activities.

This study was undertaken based on information and survey sites specified by Earth Systems to provide an overview of potential vegetation loss and implications of the mine on flora and vegetation values.

Habitat Hectare assessment was undertaken to determine the type and quality of vegetation at 17 survey sites, as a representative sample of the different EVCs and bioregions mapped by DSE across the site. Field survey data was used to verify and modify EVC mapping at a broad scale across the Vegetation Study Area, in combination with aerial imagery interpretation and local topography.

The Vegetation Study Area was confirmed as occurring across two bioregions; East Gippsland Uplands (EGU) covers the majority of the Vegetation Study Area and mine Project area, with a smaller area occurring within the East Gippsland Lowlands (EGL).

Five EVCs were identified during the field survey. The Vegetation Study Area consists predominantly of Lowland Forest and Shrubby Dry Forest, with Damp Forest, Riparian Forest and Warm Temperate Rainforest occurring along the creeks and drainage lines. Warm Temperate Rainforest has a Bioregional Conservation Status (BCS) of Rare in both bioregions, Riparian Forest has a BCS of Depleted in the EGL and Least Concern in the EGU, and the remaining EVCs have a BCS of Least Concern in both bioregions.

Vegetation quality recorded at the sample sites was consistent with the DSE modelled quality scores, as most habitat scores ranged between 60 and 70, with some higher scores recorded within the vicinity of Tomato Track. Vegetation across the sites surveyed was floristically diverse. A low density of large trees, particularly in areas previously impacted by timber harvesting (approximately 50% of the site since the 1960s), was also recorded. Old growth forest was not observed during field surveys.

Ethos NRM recorded 141 terrestrial flora species during the field survey, including 4 weed species and 6 rare species. No flora species or communities listed as threatened on the *Flora and Fauna Guarantee* (FFG) *Act 1988* or the *Environment Protection and Biodiversity* (EPBC) *Act 1999* were identified during the survey.

It is recommended that further flora surveys are conducted in Spring to provide a more comprehensive inventory of herbaceous and cryptic species, and to identify if suitable habitat is present for some rare and threatened species to warrant more detailed and targeted species surveys. If required, targeted surveys should be undertaken during the appropriate season. Flora which should be considered for targeted surveys include Slender Wire-lily (*Laxmannia gracilis*), orchids including the EPBC listed Leafless Tongue-orchid (*Cryptostylis hunteriana*) and Maroon Leek-orchid (*Prasophyllum frenchii*), and Colquhoun Grevillea (*Grevillea celata*).

The components of the Nowa Nowa Iron Project which will incur native vegetation impacts include the mine footprint (including open pit, waste rock dump, infrastructure and access/haul roads), the proposed diversion of the Nowa Nowa-Buchan Road, and the proposed mine access track intersection with the Bruthen-Buchan Road. Total native

vegetation loss has been assumed within the mine impact areas, including buffers, totalling 146 hectares (ha). This loss area has been used for the calculation of an indicative loss of native vegetation in Habitat Hectares (HHa) and the minimum likely net gain (offset) requirements.

It is estimated that a total of **146 ha** of vegetation equating to approximately **104 Habitat Hectares (HHa)** is proposed for removal as part of the Nowa Nowa Iron Project, comprising of:

- Mine Footprint, estimated loss of 138.42 ha equating to 98.72 HHa;
- Nowa Nowa-Buchan Road diversion, estimated loss of 7.24 ha equating to 5.16 HHa; and
- Bruthen-Buchan Road Access, estimated loss of 0.13 ha equating to 0.10 HHa.

Large Old Trees (LOTs) must also be accounted for when removing native vegetation, and within the Project Areas an estimated 443 LOTs will be removed comprising of:

- Mine Footprint, estimated loss of 433 LOTs;
- Buchan-Nowa Nowa Road diversion, estimated loss of 9 LOTs; and
- Bruthen-Buchan Road Access intersection, estimated loss of 1 LOT.

EVCs which are expected to be impacted within the Project Area footprints and road intersection are predominantly Shrubby Dry Forest, Lowland Forest, and small areas of Damp Forest and Riparian Forest. Most of the vegetation was estimated to have Conservation Significance of Medium based on habitat scores and Bioregional Conservation Status (BCS), except for Riparian Forest which was High, due to a habitat score greater than 0.6 and a BCS of Depleted.

The Project site does not impact on the rare EVC Warm Temperate Rainforest which is located in the south-east corner of the Vegetation Study Area. This Warm Temperate Rainforest vegetation has a Conservation Significance of Very High which requires Ministerial approval for removal, and therefore it is recommended that any impacts on this area be avoided.

There is potential for impacts on several rare flora species recorded by Ethos NRM including Forest Red Box *(Eucalyptus polyanthemos* subsp. *longior),* Gippsland Stringybark *(Eucalyptus mackintii),* Smooth Geebung (*Persoonia levis*), Wallaby-bush (*Beyeria lasiocarpa*) and Paperbark Tea-tree (*Leptospermum trinervium*).

An indicative combined net gain target to offset the loss of 146 hectares (equating to 104 HHa) of vegetation removal associated with the proposed Nowa Nowa Iron Project mine site, is estimated to range from:

- MINIMUM - **104.4 HHa (1.26 HHa** of **High Conservation Significance** and **103.14 HHa** of **Medium Conservation Significance** vegetation), to
- MAXIMUM - **155.96 HHa** of **High Conservation Significance** vegetation.

An **estimated** Large Old Tree (LOT) protection target of between **890** and **1772 LOTs** will be required to offset the loss of 443 LOTs.

In order to meet DEPI's regulatory requirements, further investigation will be required prior to Project commencement. This will enable accurate quantification of the loss of vegetation within the footprint, assessment of the presence of habitat for rare and threatened species, and calculation of offset requirements. Consultation with DEPI will be required to confirm the further survey requirements of the Project.

This assessment has been prepared using Victoria's Native Vegetation Framework. Potential implications of the Reforms to Victoria's native vegetation policy are discussed throughout the document.

1 INTRODUCTION

The Nowa Nowa Iron Project (the Project) proposed by Eastern Iron Limited, operating through their wholly owned subsidiary Gippsland Iron Pty Ltd, is a greenfield development of a high grade magnetite/hematite deposit generally referred to as 'Five Mile' and within EL4509.

The Project involves an open cut mining operation from a single pit with dry processing at the site to upgrade the material to a saleable product. It is anticipated that the Project will produce up to 1Mt of ore per annum, over an initial mine life of 8-10 years.

The Nowa Nowa Iron Project is located approximately 7 km north of the township of Nowa Nowa, which is situated on the Princes Highway between Bairnsdale and Orbost in East Gippsland, Victoria. The site is wholly within the Tara State Forest (Crown land) which is primarily managed for forestry activities in the vicinity of the proposed works.

It is proposed to transport the ore product from the mine site by road to the existing South East Fibre Exports (SEFE) wharf at the Port of Eden in Edrom, NSW.

The Nowa Nowa Iron Project will have impacts on native vegetation at the mine site, for the proposed diversion of the Nowa Nowa-Buchan Road and for works to upgrade the intersection of the mine access road at the Bruthen-Buchan Road. No additional vegetation loss is expected along the proposed Project transportation route within Victoria.

Ethos NRM Pty Ltd has been engaged by Earth Systems to undertake a preliminary vegetation assessment related to potential vegetation loss associated with the Project to support an Environmental Effects Statement (EES) Referral. Assessment of vegetation type and condition has been undertaken within a broad area, referred to in this report as the 'Vegetation Study Area', which contains the proposed mine site and associated infrastructure.

1.1 Objectives

The purposes of this survey and report are to:

1. Undertake Vegetation Quality Assessment (VQA) and calculate habitat scores for 15 predetermined survey sample points and 2 additional sample points;
2. Undertake broad-scale mapping of EVCs across the Vegetation Study Area polygon based on field observations, DSE EVC mapping and aerial imagery interpretation;
3. Provide preliminary indication of the potential vegetation loss (in Habitat Hectares) within:
    - the mine footprint (including all infrastructure except those listed below),
    - the diversion of the Nowa Nowa – Buchan Road, and
    - the Bruthen – Buchan Road/mine access road intersection.
4. Provide advice on legislative obligations, potential impacts of the proposed mine on flora and vegetation values, and further information/survey requirements

This report provides preliminary information on the type and condition of vegetation across the Vegetation Study Area and the likely impact within the proposed mine site footprint on flora and vegetation values.

1.2 Site Location and Description

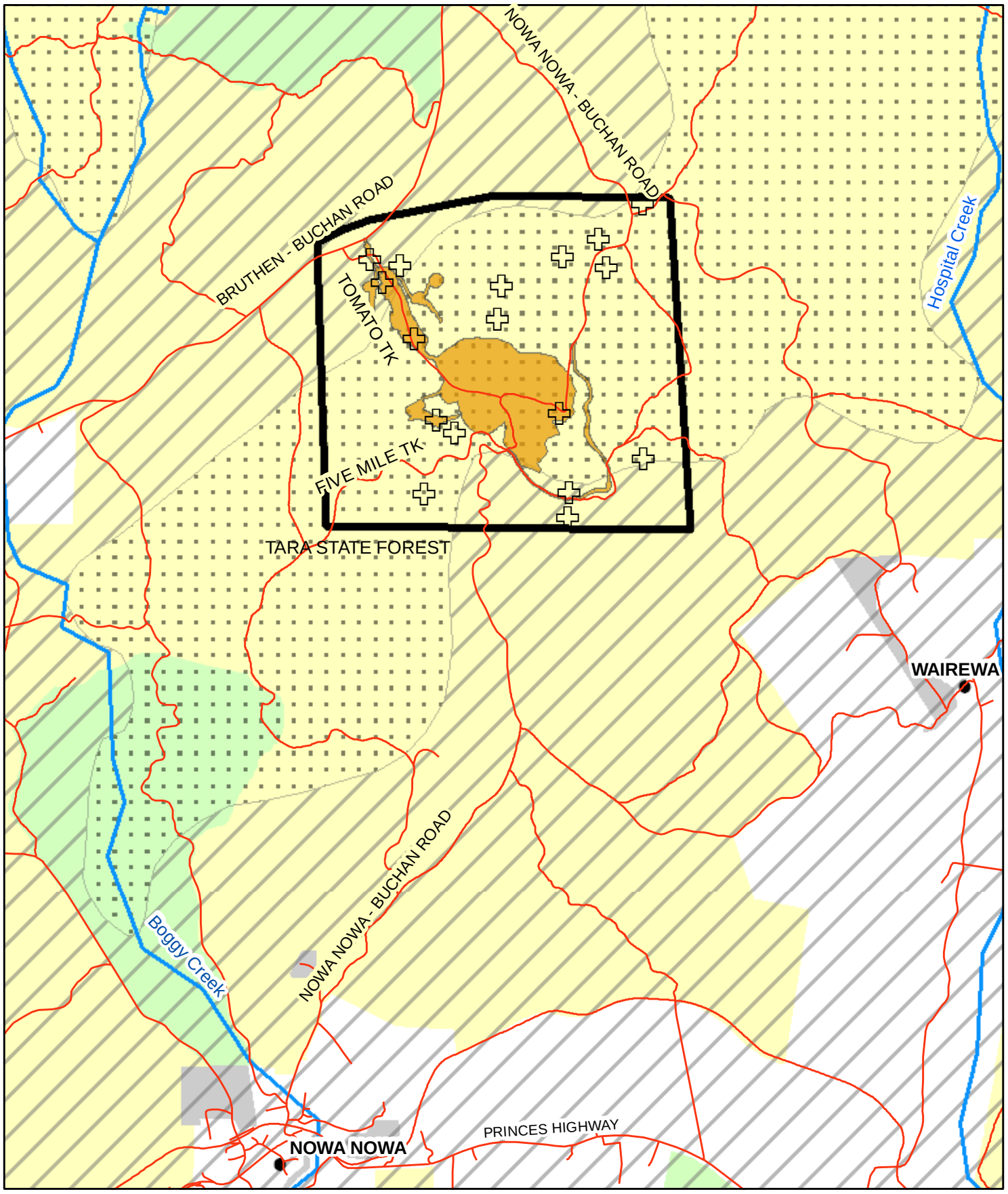
The Vegetation Study Area is approximately 1100 hectares in size and encompasses all components associated with the Nowa Nowa Iron Project. The Vegetation Study Area was determined prior to delineation of the mine footprint, and included a broad area surrounding the proposed mine site. Site access is proposed from the Bruthen-Buchan Road which is managed by VicRoads. Refer to **Figure 1** for the mine site location.

The topography across the Vegetation Study Area is undulating, with several creeks dissecting the site. The steepest slopes occur to the south of Five Mile Track, with moderate slopes along Harris Creek and its tributaries in the north to north-west of the site. Areas to the east and west edges of the site have lower relief with relatively flat, wide spurs. Soils are generally well draining silty loams, with exposed rock dominant on dry spurs and slopes, with lower slopes and sheltered aspects having higher clay content and lacking the rock component.

The area within and surrounding the mine site is zoned Public Conservation and Resource Zone (PCRZ) under the East Gippsland Planning Scheme (DPCD, 2013), and is covered by the Wildfire Management Overlay (WMO) and the majority of the site is covered by the Erosion Management Overlay (EMO).

Forest Management Zones across the Vegetation Study Area and the mine site include parts of several different Special Management Zones (SMZs) and Special Protection Zones (SPZs), identified using DSE's Biodiversity Interactive Map (DSE, 2013a). Section 5.2.4 provides more detail on Forest Management Zones.

Logging history available from DSE's Biodiversity Interactive Map (DSE, 2013a) shows that timber harvesting has impacted approximately 50% of the Vegetation Study Area since the 1960s. Within the last 15 years, approximately 20% of the total Vegetation Study Area has been subject to timber harvesting.



Nowa Nowa Iron Project - Preliminary VQA & EVC Mapping
Figure 1. Vegetation Study Area Location

Legend

- Major creeks
- Roads and tracks

Public Land

- Other Public Land
- Conservation Reserves
- State Forest

Bioregion

- East Gippsland Lowlands (EGL)
- East Gippsland Uplands (EGU)
- Survey Sample Points
- VegetationSurvey Area
- NowaNowaProjectComponents_withbuffers

N

0 0.25 0.5 1 1.5 Km

1:50,000 | Version 3

Date: 08/10/2013

Coordinate System:
GDA 94 MGA Zone 55

Map Produced by: Ethos NRM,
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2 METHODOLOGY

This report has been prepared primarily to address current native vegetation policy requirements prescribed by Victoria's Native Vegetation Management - A Framework for Action (DNRE, 2002; herein referred to as the '*Framework*'). However, at the time of writing, it is acknowledged that a new policy is proposed; Reforms to Victoria's Native Vegetation Permitted Clearing Regulations (DEPI, 2013) which will have implications for the calculation of offset requirements for this project. Ethos NRM has incorporated comments on potential implications of the new policy where relevant throughout this document based on information currently available from the Department of Environment and Primary Industries (DEPI). Further details regarding this are included in Sections 4.4, 5.4 and 6.6.

2.1 Data and Literature Review

This report has used a number of data sources to aid in the identification of potential flora and fauna values associated with the proposed vegetation removal, as well as any other conditions that may be relevant to the quantification of vegetation loss and calculation of the Offset like-for-like conditions. The report has reviewed the following data sources:

- Biodiversity Interactive Map (DSE interactive maps);
- Planning Maps Online;
- DSE rare and threatened species database;
- EPBC on-line Protect Matters Search Tool; and
- Ecological Vegetation Class Descriptions and Benchmarks.

2.2 Field Survey

A field survey within the Vegetation Study Area of approximately 1100 hectares surrounding the proposed mine site was undertaken on the 26th and 27th of March and 5th of April, 2013.

Habitat Hectare assessment (using the Department of Sustainability and Environment (DSE) prescribed methodology: Vegetation Quality Assessment Manual (DSE, 2004a)) was undertaken to determine the type and quality of the vegetation at 15 specified sample survey sites. The sample survey sites were selected in consultation with Earth Systems, as a representative sample of the different mapped EVCs and bioregions across the site.

During field investigations, an additional two sites were also scored, as they comprised either an EVC (Warm Temperate Rainforest) or vegetation condition (Shrubby Dry Forest near the Bruthen-Buchan Rd – Tomato Track intersection) not represented in the initial 15 sites.

Information which was acquired from on-site vegetation quality assessment includes:

- Site Description (location) and Site Specific Details;
- Ecological Vegetation Class descriptions; and
- Habitat Hectares Assessment (VQA) of 17 sample sites.

All field assessments were undertaken by a DSE accredited Native Vegetation Assessor.

2.3 EVC Mapping

EVC mapping of the 1100 ha area surrounding the proposed mine site was undertaken at a broad scale, and based on a combination of field observations, DSE EVC mapping, aerial imagery interpretation, aspect and topography.

In addition to the 17 VQA sample sites, ground-truthing of vegetation types and boundaries was undertaken in locations which appeared to be different to the sample sites, and with a focus on the Project area. In particular, further ground-truthing was undertaken near the proposed upgrade to the Bruthen-Buchan Road for mine site access, and along creeklines within the mine footprint.

Additional observations regarding EVC distribution and general condition were recorded while walking to sample sites and driving along tracks within the survey area (all except the southern extent of the Nowa Nowa-Buchan Road and eastern extent of Five Mile Track were traversed).

2.4 Limitations of Field Survey and EVC Mapping

Certain flora species are only readily identifiable onsite during periods of particular environmental and climatic conditions. The cover and diversity of herbaceous species was generally low, however it would be expected that both diversity and cover of herbaceous species would increase particularly within areas of Lowland Forest and moister localities during Spring. A variety of grasses, herbs, ferns and shrubs were identified to genus and not species level during the survey due to the lack of flowering/fruiting/reproductive material available. However, the information collected is considered sufficient to provide an accurate determination of the quality of vegetation at the sample sites.

Only a portion of the Vegetation Study Area was sampled for vegetation quality and ground-truthed for EVC identification and distribution. Whilst undertaking field surveys observation of patterns of occurrence of EVCs within the landscape was recorded, and this information has provided the basis to enable the broader scale mapping of EVCs across the Vegetation Study Area. For example, in areas not visited, slope, slope position and aspect were primary determinants of the EVCs attributed. Where clear patterns were not observed, DSE EVC mapping was used as the default.

Boundaries of EVCs are often not discrete, and eco-tones (areas of EVC overlap) can be 100 metres or more wide, in particular where topographic relief was low at the survey site. Broad eco-tones were observed between Shrubby Dry Forest and Lowland Forest in such circumstances, and can partly be attributed to the similarity of the floristics of these two EVCs at the Vegetation Study Area. The most well-defined EVC boundaries tended to be along creeklines, where the EVC along the creekline was a 'damper' EVC than the EVC on the adjacent slope, and where there was also a greater difference in floristic assemblages.

This lack of precision in EVC boundaries (eco-tones) is inherent in EVC mapping, and is expected to have only a minor impact on the estimation of vegetation loss in Habitat Hectares, due to generally low variation in condition and similar floristics between related EVCs across the Vegetation Study Area.

2.5 Estimation of Native Vegetation Loss and Offsets

Estimation of vegetation loss from proposed works associated with the Nowa Nowa Iron Project mine site was calculated within an impact footprint provided by Earth Systems.

The impact footprint comprises all related infrastructure, dams and roads including the following buffers:

- Mine pit – 50m
- Buildings (inner and outer bushfire management zones) – 59m
- All other components – 5m

Total loss of native vegetation has been assumed within the proposed mine footprint, associated infrastructure and access tracks, including buffers. Refer to **Appendix 1** for the Project Infrastructure and Layout Map provided by Earth Systems.

The broad-scale EVC mapping of the Vegetation Study Area and VQA sample sites were not sufficient to prescribe habitat zones for the calculation of native vegetation loss, to meet all requirements of the *Framework,* within the proposed mine site impact footprints. However the data collected was used to ascribe estimated condition scores across the site to provide an estimation of indicative vegetation loss and offset requirements in Habitat Hectares.

This involved attributing mapped EVC polygons within the mine footprint with the habitat score of the estimated most similar VQA survey sample site, based on field survey observations of EVC distribution and condition, Aerial Photograph Interpretation, topography and proximity.

The scale of the EVC mapping and sampling effort at the mine site is not adequate for the determination of conservation significance and offset like-for-like criteria, and hence calculation of the net gain offset requirement, as specified in the Native Vegetation Framework (DNRE, 2002). However, based on the data collected, broad analysis of likely conservation significance determinations has been undertaken to provide an indicative range of offset requirements in Habitat Hectares. The best or remaining habitat for individual threatened species and communities has not been determined due to the broad scale of data collection, limited sampling within the mine footprint, and forthcoming changes to the State vegetation policy.

A detailed Habitat Hectare assessment will need to be undertaken within the mine site during the approvals process for the Project to quantify the vegetation loss and offset requirements.

3 FLORA VALUES

Flora values have been assessed across the Vegetation Study Area, which includes coverage of a broader area than the proposed mine impact footprints.

3.1 Bioregion

The Vegetation Study Area is dissected by two bioregions, the East Gippsland Lowlands and East Gippsland Uplands, with the latter covering about two thirds of the Vegetation Study Area and almost 95% of the mine footprints. The East Gippsland Lowlands occur in lower relief areas to the south-east and north-west of the Vegetation Study Area. The East Gippsland Uplands dominate the centre of the Vegetation Study Area with generally higher elevation and steeper slopes, extending from the north-east to south-west and extending beyond Mount Nowa Nowa.

The East Gippsland Uplands comprise of tablelands and mountains up to 1400 metres in altitude. The vegetation is dominated by Shrubby Dry Forest and Damp Forest on the upland slopes, with Wet Forest ecosystems restricted to higher altitudes (DPI, 2013).

The East Gippsland Lowlands comprise gently undulating terraces flanked by coastal plains, dunefields and inlets. The vegetation is dominated by Lowland Forest with Damp Forest and Shrubby Dry Forest ecosystems interspersed throughout the foothills (DPI, 2013).

In some sections of the Vegetation Study Area it is difficult to locate the on-ground bioregion boundary, as the boundary does not appear to align with obvious topographic features. This is particularly notable in the north and north-west sections, for which DSE mapped boundaries have been used. The boundary between the bioregions was more obvious on-ground in the south-east corner and where a discrepancy with the mapped boundary was observed. Hence, for the purposes of EVC mapping and habitat hectare calculation, a portion of the DSE mapped bioregion boundary was altered by Ethos NRM to align with Five Mile Road where it follows a ridgeline east of the Nowa Nowa-Buchan Road.

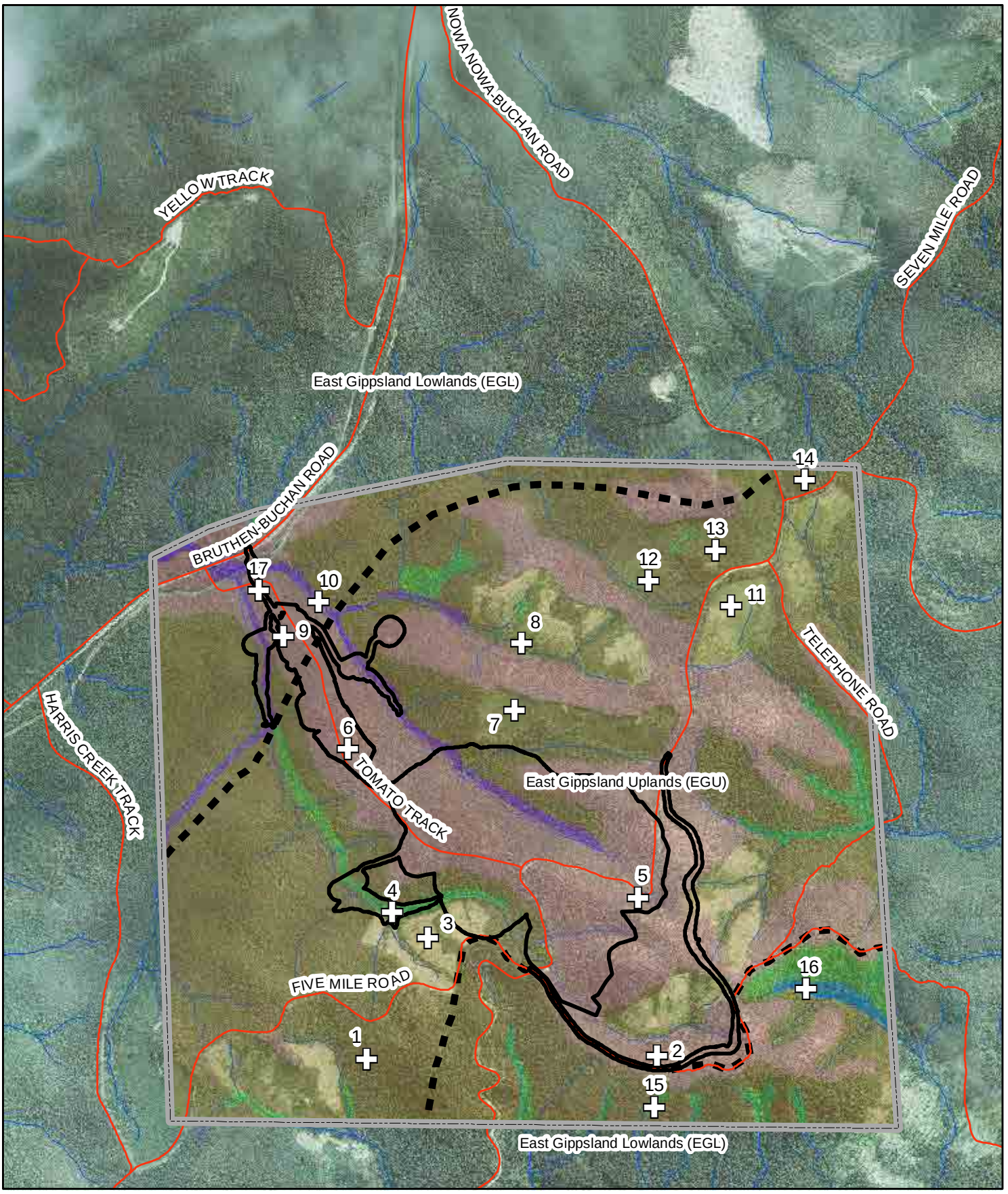
3.2 Ecological Vegetation Classes

A total of five Ecological Vegetation Classes (EVCs) were identified within the Vegetation Study Area by Ethos NRM during the field survey, including one EVC (Riparian Forest) which was not included in DSE's modelled EVC layer (DSE, 2013a; refer to Appendix 2). The distribution of EVCs across the site varied from the DSE EVC modelling, with the main differences being that Lowland Forest (EVC 16) is more extensive, Shrubby Dry Forest (EVC 21) and Damp Forest (EVC 29) more restricted, and Riparian Forest occurring in some areas mapped as Damp Forest (EVC 18) along creeks.

Lowland Forest was the dominant EVC mapped by Ethos NRM, representing approximately 65% of the Vegetation Study Area. Shrubby Dry Forest was restricted to ridges and northerly aspects, and was more prevalent in the East Gippsland Uplands bioregion, occurring across almost 30% of the Vegetation Study Area. The remaining EVCs comprised less than 10% of the Vegetation Study Area, including; Damp Forest 4.1%, Riparian Forest 1.6% and Warm Temperate Rainforest (EVC 32) 0.4%.

Within the mine footprint, Shrubby Dry Forest is the dominant EVC covering almost 75% of the mine site, with Lowland Forest comprising almost 20%, Riparian Forest 4% and Damp Forest 3%. Warm Temperate Rainforest will not be impacted by the mine footprint or other Project components at the mine site.

The distribution of EVCs mapped within the Vegetation Study Area and the locations of sample sites are displayed in **Figure 2**. EVC descriptions below provide typical floristics and structure of vegetation at the survey sites.



Nowa Nowa Iron Project - Preliminary VQA & EVC Mapping
Figure 2. Ecological Vegetation Class mapping by Ethos NRM

Legend

- Hydrology
- Roads and Tracks
- Bioregion boundary (revised by Ethos)
- Vegetation Study Area boundary
- Survey Sample Points

Ecological Vegetation Class

- Damp Forest
- Lowland Forest
- Riparian Forest
- Shrubby Dry Forest
- Warm Temperate Rainforest

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0 0.15 0.3 0.6 0.9 Km

1:25,000 | Version 3

Date:08/10/2013

Coordinate System:
GDA 94 MGA Zone 55

Map Produced by: Ethos NRM,
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3.2.1 Lowland Forest

Lowland Forest was the most widespread EVC within the vegetation survey area, occurring on moderate slopes to relatively flat areas. The eucalypt canopy species were diverse across the Vegetation Study Area, with White Stringybark (*Eucalyptus globoidea*) and Silvertop (*Eucalyptus sieberi*) dominant, with Messmate (*Eucalyptus obliqua*) and Mountain Grey-gum (*Eucalyptus cypellocarpa*) also commonly recorded. There were very few canopy trees remaining in logging coupes.

Understorey trees were uncommon and included Sallow Wattle (*Acacia longifolia*) and Cherry Ballart (*Exocarpos cupressiformis*).

The shrub layer was diverse, and frequently recorded species included; Shiny Cassinia (*Cassinia longifolia*), Common Cassinia (*Cassinia aculeata*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Large-leaf Bush-pea (*Pultenaea daphnoides*), Common Heath (*Epacris impressa*), Snowy Daisy-bush (*Olearia lirata*), Narrow-leaf Geebung (*Persoonia linearis*), Shrubby Platysace (*Platysace lanceolata*), Hairy Mint-bush (*Prostanthera hirtula*), Hop Goodenia (*Goodenia ovata*), White Marianth (*Rhytidosporum procumbens*), Blue Dampiera (*Dampiera stricta*), Tangled Guinea-flower (*Hibbertia empetrifolia*) and Honey-pots (*Acrotriche serrulata*).

The herbaceous layer generally had moderate diversity, which varied across the site, and often higher in coupes where the shrub layer was dense or on more damp sites. Herb species included Milkmaids (*Burchardia umbellata*), Bedstraw (*Galium spp.*), Germander Raspwort (*Gonocarpus teucrioides*), Bottle-daisy (*Lagenophora spp.*), Nodding Blue-lily (*Stypandra glauca*), Ivy-leaf Violet (*Viola hederacea*), Pennywort (*Hydrocotyle spp.*) and Wood-sorrel (*Oxalis spp.*).

Grasses were diverse, and included species such as; Forest Wire-grass (*Tetrarrhena juncea*), Reed Bent-grass (*Deyeuxia quadriseta*), Silvertop Wallaby-grass (*Joycea pallida*), Spiny-headed Mat-rush (*Lomandra longifolia*), Small Grass-tree (*Xanthorrhoea minor*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Spear-grass (*Austrostipa spp.*), Paroo Lily (*Dianella caerulea*), Common Rapier-sedge (*Lepidosperma filiforme*), Variable Sword-sedge (*Lepidosperma laterale*) and Weeping Grass (*Microlaena stipoides*).

Bracken (*Pteridium esculentum*) was common throughout most of the Lowland Forest, but other ferns were present in damper areas near gullies, such as Common Maidenhair (*Adiantum aethiopicum*) and Rough Tree-fern (*Cyathea australis*). There were few scramblers including Common Apple-berry (*Billardiera scandens*) and Forest Clematis (*Clematis glycinoides*).

3.2.2 Shrubby Dry Forest

Shrubby Dry Forest occurs along exposed ridgelines, and was restricted to the upper slope where gradients drop steeply into adjacent gullies in the north-east and south-east. In areas of lower relief, such as along Tomato Track, the EVC was more widespread, occurring up to the edge of Riparian Forest, where a distinctive eco-tone dominated by a tall shrub layer occurred between the two EVCs.

The eucalypt canopy was relatively open and diverse, with a varying composition across the Vegetation Study Area. Widespread species included Yertchuk (*Eucalyptus consideniana*), Red Stringybark (*Eucalyptus macrorhyncha*), Red Ironbark (*Eucalyptus tricarpa*) and Brittle Gum (*Eucalyptus mannifera*). Rare species Gippsland Stringybark (*Eucalyptus mackintii*) and Forest Red Box (*Eucalyptus polyanthemos subsp. longior*) were recorded along Tomato Track.

Understorey trees were sparse and included Black She-oak (*Allocasuarina littoralis*) and Cherry Ballart (*Exocarpos cupressiformis*).

Shrub density was variable across sites and is possibly related to fire regime. Some of the more frequently recorded shrubs were Common Cassinia (*Cassinia aculeata*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Large-leaf Bush-pea (*Pultenaea daphnoides*), Common Heath (*Epacris impressa*), Narrow-leaf Geebung (*Persoonia linearis*), White Marianth (*Rhytidosporum procumbens*), Blue Dampiera (*Dampiera stricta*), Smooth Parrot-pea (*Dillwynia glaberrima*), Grey Guinea-flower (*Hibbertia obtusifolia*), Rough Guinea Flower (*Hibbertia aspera*), Hairy Pink-bells (*Tetratheca pilosa subsp. latifolia*) and Honey-pots (*Acrotriche serrulata*).

Herbaceous cover was low, and included species such as Germander Raspwort (*Gonocarpus teucroides*), Nodding Blue-lily (*Stypandra glauca*), and Bluebell (*Wahlenbergia* spp.).

Graminoids were diverse and patchily distributed including; Spiny-headed Mat-rush (*Lomandra longifolia*), Small Grass-tree (*Xanthorrhoea minor*), Paroo Lily (*Dianella caerulea*), Common Rapier-sedge (*Lepidosperma filiforme*), Leafy Purple-flag (*Patersonia glabrata*), Oat Spear-grass (*Anisopogon avenaceus*), Forest Wire-grass (*Tetrarrhena juncea*) and Weeping Grass (*Microlaena stipoides*).

Ground ferns were generally absent and the most common scrambler recorded was Common Apple-berry (*Billardiera scandens*).

3.2.3 Damp Forest

The tall eucalypt canopy was dominated by Messmate (*Eucalyptus obliqua*) and Mountain Grey-gum (*E. cypellocarpa*) over understorey trees of Blue Oliveberry (*Elaeocarpus reticulatus*).

The medium to tall shrub layer was moderately dense, including; Shiny Cassinia (*Cassinia longifolia*), Prickly Currant-bush (*Coprosma quadrifida*), Snowy Daisy-bush (*Olearia lirata*), Large Mock-olive (*Notelaea venosa*), Wallaby-bush (*Beyeria lasiocarpa; rare*), Burgan (*Kunzea ericoides*) and Common Correa (*Correa reflexa*).

The diverse ground layer included herbaceous species such as; Austral Brooklime (*Gratiola peruviana*), Angled Lobelia (*Lobelia anceps*), Dwarf Nertera (*Leptostigma reptans*), Ivy-leaf Violet (*Viola hederacea*) Germander Raspwort (*Gonocarpus teucrioides*) and Stinkweed (*Opercularia* spp.).

Graminoids included Variable Sword-sedge (*Lepidosperma laterale*), Spiny-headed Mat-rush (*Lomandra longifolia*), Red-fruit Saw-sedge (*Gahnia sieberiana*) and Forest Wire-grass (*Tetrarrhena juncea*).

A variety of ferns were present including; Fishbone Water-fern (*Blechnum nudum*), Gristle Fern (*B. cartilagineum*), Shiny Shield-fern (*Lastreopsis acuminata*), Common Maidenhair (*Adiantum aethiopicum*), Austral Bracken (*Pteridium esculentum*) and Rough Tree-fern (*Cyathea australis*).

Several scramblers and climbers were recorded, comprising; Bearded Tylophora (*Tylophora barbata*), Wombat Berry (*Eustrephus latifolius*), Wonga Vine (*Pandorea*

pandorana), Twining Glycine (*Glycine clandestina*) and Forest Clematis (*Clematis glycinoides*).

Damp Forest was only recorded in the upper reaches of relatively steep, sheltered gullies with a southerly aspect. The quality of this EVC varied across the Vegetation Study Area, as some occurrences of the EVCs were lacking structural components such as woody life-forms and canopy cover, had lower species diversity, and low density of large old trees and logs.

3.2.4 Riparian Forest

Riparian Forest occurred as linear corridors along Harris Creek, Tomato Creek and Gap Creek. The tall eucalypt canopy was dominated by River Peppermint (*Eucalyptus elata*), with Mountain Grey-gum (*E. cypellocarpa*), Gippsland Peppermint (E. *croajingalensis*) and Messmate (E. *obliqua*) also present.

The understorey tree Blue Oliveberry (*Elaeocarpus reticulatus*) was common, with tall shrubs including Sweet Bursaria (*Bursaria spinosa*), Burgan (*Kunzea ericoides*) and Paperbark Tea-tree (*Leptospermum trinervia, rare)*.

A dense small to medium shrub layer included; Tree Lomatia (*Lomatia fraseri*), Shiny Cassinia (*Cassinia longifolia*), Prickly Currant-bush (*Coprosma quadrifida*), Snowy Daisy-bush (*Olearia lirata*) and Common Flat-pea (*Platylobium obtusangulum*).

Scattered small herbaceous species recorded included; Austral Brooklime (*Gratiola peruviana*), Small St John's Wort (*Hypericum gramineum*), Germander Raspwort (*Gonocarpus teucrioides*), Ivy-leaf Violet (*Viola hederacea*), Bluebell (*Wahlenbergia* spp.), Pennywort (*Hydrocotyle* spp.) and Stinkweed (*Opercularia* spp.).

Graminoids were dominant in the ground layer, and included species such as; Tussock-grass (*Poa* spp.), Spiny-headed Mat-rush (*Lomandra longifolia*), Wood-rush (*Luzula* spp.) and Variable Sword-sedge (*Lepidosperma laterale*).

Ground-ferns were diverse including; Gristle Fern (*Blechnum cartilagineum*), Fishbone Water-fern (*B. nudum*), Shiny Shield-fern (*Lastreopsis acuminata*), Common Maidenhair (*Adiantum aethiopicum*) and Austral Bracken (*Pteridium esculentum*).

Scramblers recorded were Common Apple-berry (*Billardiera scandens*) and Purple Coral-pea (*Hardenbergia violacea*).

3.2.5 Warm Temperate Rainforest

Warm Temperate Rainforest was recorded in a single gully in the south-east corner of the Vegetation Study Area, in the location mapped by DSE. Only the upper section of the EVC was visited, but appeared to increase in area and canopy cover further down the gully. It is not expected to occur elsewhere within the current Vegetation Study Area.

The non-eucalypt canopy comprised of Lilly Pilly (*Syzygium smithii*) and Blue Oliveberry (*Elaeocarpus reticulatus*) over understorey trees including Hazel Pomaderris (*Pomaderris aspera*) and Blanket Leaf (*Bedfordia arborescens*).

The ground layer was scattered and generally sparse, with small to medium shrubs such as Shiny Cassinia (*Cassinia longifolia*), Prickly Currant-bush (*Coprosma quadrifida*), Snowy Daisy-bush (*Olearia lirata*) and Large Mock-olive (*Notelaea venosa*).

Herbaceous species included Shade Nettle (*Australina pusilla*), Forest Nightshade (*Solanum prinophyllum*), Kidney-weed (*Dichondra repens*) and rare species Austral Tobacco (*Nicotiana suaveolens*).

Scattered graminoids included Tall Saw-sedge (*Gahnia clarkei*) and Weeping Grass (*Microlaena stipoides*).

There were few ferns including Mother Shield-fern (*Polystichum proliferum*), and abundant climbers such as; Austral Sarsaparilla (*Smilax australis*), Wonga Vine (*Pandorea pandorana*), Wombat Berry (*Eustrephus latifolius*), Bearded Tylophora (*Tylophora barbata*) and Forest Clematis (*Clematis glycinoides*).

3.3 Vegetation Quality and Conservation Status

Vegetation quality varied across the site, and largely depended on the density of large old trees (LOTs), eucalypt canopy cover and logs. Sites with the highest habitat scores were due to high diversity of understorey species and moderate to high density of LOTs. Habitat scores and estimated LOT densities are summarised in **Table 1** below, and details of VQA (Habitat Scores) are provided in **Tables 2 and 3** in **Section 3.4**.

Vegetation quality recorded at the sample sites corresponds well with the DSE modelled quality scores (DSE, 2013a), with most habitat scores being between 60 and 70, and some higher scores recorded within the vicinity of Tomato Track.

Bioregional Conservation Status (BCS) is defined by DEPI to describe how threatened or rare an EVC is within a bioregion, by comparing the current extent of an EVC compared to the predicted extent pre-European settlement (pre-1750). BCS contributes to decision-making for approval of native vegetation removal and determination of offsets under the Native Vegetation Framework (DNRE, 2002).

Of the vegetation impacted by the Project, Lowland Forest, Shrubby Dry Forest and Damp Forest have a BCS of Least Concern in both bioregions within the Vegetation Study Area, and Riparian Forest is Depleted in the East Gippsland Lowlands and Least Concern in the East Gippsland Uplands. The BCS and Habitat Scores of the EVCs recorded during the field survey are summarised in **Table 1** below. Further detail is provided on the completed Habitat Hectare scoring sheets in **Appendix 3**.

Table 1: Vegetation Quality Assessment scores at sample survey sites

Sample Survey Site/s	EVC #	EVC Name	Bioregion	Bioregional Conservation Status	Habitat Score /100	Large Old Trees/ ha	Comments
1	16	Lowland Forest	East Gippsland Lowlands	Least Concern	74	7	Mid-slope on south aspect, good quality
2	21	Shrubby Dry Forest	East Gippsland Uplands	Least Concern	72	0	Lacking LOTs
3, 11*	16	Lowland Forest	East Gippsland Uplands	Least Concern	67	3	Logging coupe, sparse-moderate shrub layer
4	29	Damp Forest	East Gippsland Uplands	Least Concern	82	6	On Tomato Creek, LOTs moderate, understorey diverse floristically and structurally
5, 6	21	Shrubby Dry Forest	East Gippsland Uplands	Least Concern	71	3	Mid-slope on north aspect, sparse LOTs and canopy
7, 13*#	16	Lowland Forest	East Gippsland Uplands	Least Concern	66	1	Logging coupe, dense medium shrub layer
8, 12, 14*	16	Lowland Forest	East Gippsland Uplands	Least Concern	72	4	Moderately diverse, LOTs moderate
9	21	Shrubby Dry Forest	East Gippsland Lowlands	Least Concern	69	4	Mid-slope to ridge, moderately diverse, LOTs moderate
10	18	Riparian Forest	East Gippsland Lowlands	Depleted	69	2	Restricted to narrow linear corridor along creekline, up to 20m wide, few LOTs within corridor
15#	29	Damp Forest	East Gippsland Lowlands	Least Concern	63	7	Low density of shrub and tree layers
16#	32	Warm Temperate Rainforest	East Gippsland Lowlands	Rare	69	0	Small section in south west corner of survey site only, in large, deep gully (not impacted by mine footprint).
17	21	Shrubby Dry Forest	East Gippsland Lowlands	Least Concern	76	6	Dense tall shrub layer, adjacent to Riparian Forest

*Sample survey sites have been grouped where EVC, bioregion, Habitat Score elements and LOT density estimates were the same
#Sample survey sites not used in calculation of native vegetation loss within mine impact footprints

3.4 Flora Species recorded

Ethos NRM recorded 141 flora species during the field survey, including 137 species of native plants and 4 weed species. A list of the flora species recorded is included in **Appendix 4**, with an indication of which survey sites they were present or if they were incidental records detected during ground-truthing. Six rare flora species were recorded including Forest Red Box *(Eucalyptus polyanthemos* subsp. *longior),* Gippsland Stringybark *(Eucalyptus mackintii),* Smooth Geebung (*Persoonia levis*) in Shrubby Dry Forest along Tomato Track, Wallaby-bush (*Beyeria lasiocarpa*) in Damp Forest near the Warm Temperate Rainforest, Austral Tobacco (*Nicotiana suaveolens*) in Warm Temperate Rainforest, and Paperbark Tea-tree (*Leptospermum trinervium*) in Riparian Forest. The identity of Smooth Geebung (*Persoonia levis*) is not completely certain, as

fruit is required to confirm identification of this species, which was not present at the time of survey.

Weed species included Flatweed (*Hypochoeris radicata*), Dandelion (*Taraxacum officinale* spp.agg.), Fleabane (*Conyza* spp.) and Blackberry (*Rubus fruticosus* spp. agg.). Blackberry is a declared noxious weed listed as a under the *Catchment and Land Protection Act 1994*, it was recorded once only along the Nowa-Nowa Buchan Road near survey site 5. Fleabane was only recorded along a logging coupe track near survey site 13. Flatweed was widespread, but in low densities across the site, with higher densities occurring near creeks and roads.

Table 2: VQA Scores for sample sites in the East Gippsland Uplands bioregion

Habitat Zone			SITE 2	SITE 3 & 11	SITE 4	SITE 5 & 6	SITE 7 & 13 #	SITE 8, 12 & 14
Bioregion			EG Uplands	EG Uplands	EG Uplands	EG Uplands	EG Uplands	EG Uplands
EVC #: Name			21: Shrubby Dry Forest	16: Lowland Forest	29: Damp Forest	21: Shrubby Dry Forest	16: Lowland Forest	16: Lowland Forest
EVC Bioregional Conservation Status			LC	LC	LC	LC	LC	LC
		Max Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	0	2	4	2	1	4
	Canopy Cover	5	5	0	5	4	0	4
	Understorey	25	15	15	20	15	15	15
	Lack of Weeds	15	15	15	15	15	15	15
	Recruitment	10	10	6	10	6	6	10
	Organic Matter	5	3	5	5	5	5	5
	Logs	5	5	5	4	5	5	2
	Total Site Score	75	53	48	63	52	47	55
	EVC standardiser (e.g. 75/55) [1]		n/a	n/a	n/a	n/a	n/a	n/a
	Adjusted Site Score		n/a	n/a	n/a	n/a	n/a	n/a
Landscape value	Patch Size	10	8	8	8	8	8	8
	Neighbourhood	10	7	7	7	7	7	7
	Distance to Core	5	4	4	4	4	4	4
Habitat Score		100	72	67	82	71	66	72
Habitat points = #/100		1	0.72	0.67	0.82	0.71	0.66	0.72
Conservation Significance: Conservation status x Habitat Score			Medium	Medium	Medium	Medium	Medium	Medium
Estimated LOTS/ha			0	3	6	3	1	7

[1] For non-forest or woodland vegetation or other vegetation types where some elements of the score are not relevant

Sample survey sites not used in calculation of native vegetation loss within mine impact footprints

Table 3: VQA Scores for sample sites in the East Gippsland Lowlands bioregion

Habitat Zone			SITE 1	SITE 9	SITE 10	SITE 15 #	SITE 16 #	SITE 17
Bioregion			EG Lowlands	EG Lowlands	EG Lowlands	EG Lowlands	EG Lowlands	EG Lowlands
EVC #: Name			16: Lowland Forest	21: Shrubby Dry Forest	18: Riparian Forest	29: Damp Forest	32: Warm Temperate Rainforest	21: Shrubby Dry Forest
EVC Bioregional Conservation Status			LC	LC	D	LC	R	LC
		Max Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	4	2	3	2	0	3
	Canopy Cover	5	4	4	2	2	5	5
	Understorey	25	15	15	15	15	15	20
	Lack of Weeds	15	15	15	15	15	15	15
	Recruitment	10	10	6	6	3	6	6
	Organic Matter	5	5	3	5	5	5	3
	Logs	5	2	5	4	2	4	5
	Total Site Score	75	55	50	50	44	50	57
	EVC standardiser (e.g. 75/55) [1]		n/a	n/a	n/a	n/a	n/a	n/a
	Adjusted Site Score		n/a	n/a	n/a	n/a	n/a	n/a
Landscape value	Patch Size	10	8	8	8	8	8	8
	Neighbourhood	10	7	7	7	7	7	7
	Distance to Core	5	4	4	4	4	4	4
Habitat Score		100	74	69	69	63	69	76
Habitat points = #/100		1	0.74	0.69	0.69	0.63	0.69	0.76
Conservation Significance: Conservation status x Habitat Score			Medium	Medium	High	Medium	Very High	Medium
Estimated LOTS/ha			7	4	2	7	0	6

[1] For non-forest or woodland vegetation or other vegetation types where some elements of the score are not relevant
#Sample survey sites not used in calculation of native vegetation loss within mine impact footprints

4 Rare and Threatened Species Overview

Victoria's Native Vegetation Management - A Framework for Action (DNRE, 2002; herein referred to as the '*Framework*') considers threatened flora, fauna and communities through the process of determining *Conservation Significance.* On-site observations of threatened flora, fauna and communities are supplemented by a desktop search to identify presence of, or potential for habitat of threatened species or communities within 5 km of the study area based on previous records of occurrence or habitat modelling. Species listed as rare or threatened on DSE's Advisory Lists are considered, which includes species listed under Victoria's *Flora and Fauna Guarantee* (FFG) *Act 1988* and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*.

Results of desktop searches provided below identify a range of flora, fauna, communities and other landscape values that must be considered by the *Framework*, and assessment of the likelihood of occurrence of these values contributes to the determination of Conservation Significance. This is discussed in more detail in **Section 4.3**.

4.1 EPBC Protected Matters Search

An online EPBC Protected Matters Search was undertaken and the results identified the following Matters of National Environmental Significance within a 5km radius of the centre of the Vegetation Study Area (see **Appendix 5**).

The EPBC Protected Matters Search results included:

- 1 Wetland of International Importance (RAMSAR);
- 17 Threatened flora and fauna species and 12 Migratory species; and
- 1 Threatened Ecological Community.

The Vegetation Study Area is not within the Gippsland Lakes Ramsar site. However it is within the Boggy Creek catchment which, as a tributary to Lake Tyers, flows into the Gippsland Lakes Ramsar site.

The listed Threatened Ecological Community White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derive Native Grassland (critically endangered) may occur within area. Neither this, nor any other EPBC listed communities, were identified within the Vegetation Study Area.

Threatened species are listed in **Table 4** below, and include 3 birds, 1 fish, 4 frogs, 7 mammals and 2 plants. No EPBC listed plants were identified within the Vegetation Study Area.

The Leafless Tongue-orchid is recorded only from immediately west of Orbost to Mallacoota in Victoria (VBA 2013; SEWPaC, 2008), where it occurs on *Xanthorrhoea resinosa* plains and adjacent heathlands and heathy woodlands, on moist, sometimes peaty, sandy soils (SEWPaC 2008; Backhouse & Jeanes, 1995). These habitats were not observed within the Vegetation Study Area, and are not expected to occur within the mine footprint.

Maroon Leek-orchid has a more scattered location in eastern Victoria, with the closest records to the mine site occurring near Murrindal, more than 25km to the north, Gillingal, about 40km to the north-northwest, and west of Bairnsdale, more than 40km from the mine site. Maroon Leek-orchid occurs in grasslands, grassy woodlands and heathlands, on sandy soils or black clay loams, in generally damp but well drained sites (DSE, 2003). These habitats were not observed within the Vegetation Study Area, and are not expected to occur within the mine footprint.

Table 4: EPBC Protected Matters Online Search Tool

SCIENTIFIC NAME	COMMON NAME	EPBC STATUS	TYPE OF PRESENCE
BIRDS			
Botaurus poiciloptilus	Australasian Bittern	Endangered	Species or species habitat likely to occur within area
Lathamus discolor	Swift Parrot	Endangered	Species or species habitat may occur within area
Rostratula australis	Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
FISH			
Prototroctes maraena	Australian Grayling	Vulnerable	Species or species habitat may occur within area
FROGS			
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	Species or species habitat may occur within area
Litoria raniformis	Growling Grass Frog, Southern Bell Frog,	Vulnerable	Species or species habitat likely to occur within area
MAMMALS			
Dasyurus maculatus maculatus	Spot-tailed Quoll, Tiger Quoll (SE mainland population)	Endangered	Species or species habitat may occur within area
Isoodon obesulus obesulus	Southern Brown Bandicoot (Eastern)	Endangered	Species or species habitat may occur within area
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Potorous longipes	Long-footed Potoroo	Endangered	Species or species habitat likely to occur within area
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANTS			
Cryptostylis hunteriana	Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Prasophyllum frenchii	Maroon Leek-orchid	Endangered	Species or species habitat likely to occur within area

4.2 DSE Rare & Threatened Species

DSE database searches were undertaken to identify species records within a 5km radius of the centre of the Vegetation Study Area. The results are provided below.

4.2.1 Flora

Ten flora species listed on DSE's *Advisory List of Rare or Threatened Plants in Victoria* (DSE, 2005) have been previously recorded within or near the Vegetation Study Area (see **Table 5**), and record locations are shown in **Appendix 6**. These species include 2 vulnerable, 7 rare, and one poorly known species. Two species are also listed under the FFG Act, Yellow-wood (*Acronychia oblongifolia*) and Colquhoun Grevillea (*Grevillea celata*); the latter is also listed as vulnerable under the EPBC Act. Yellow-wood is associated with Warm Temperate Rainforest, and may occur within this community in the Vegetation Study Area.

Colquhoun Grevillea has a restricted distribution around the Bruthen area, including along Lyles Break approximately 5km south-west of the Project site (VBA, 2013). The Project site is outside of the known distribution of this species, and typical habitat for this species was not observed at the study site. However, further vegetation surveys within the mine

footprint should increase certainty regarding the likely presence or absence of this species.

The only rare or threatened species previously recorded within the Vegetation Study Area is Slender Wire-lily (*Laxmannia gracilis*). The poorly known Long-flower Beard-heath (*Leucopogon juniperinus*) does not require further consideration in the determination of conservation significance. None of the species listed below were recorded during the field survey.

Table 5: DSE Threatened Flora records (DSE database)

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS			No. records
		FFG	Vic. Adv.	EPBC	
Acronychia oblongifolia	Yellow-wood	L	r		1
Eupomatia laurina	Bolwarra		r		2
Grevillea celata	Colquhoun Grevillea	L	v	VU	4
Lachnagrostis scabra	Rough Blown-grass		r		1
Leucopogon juniperinus	Long-flower Beard-heath		k		1
Laxmannia gracilis	Slender Wire-lily		r		2
Lysimachia japonica	Creeping Loosestrife		v		1
Ozothamnus argophyllus	Spicy Everlasting		r		1
Pittosporum revolutum	Rough-fruit Pittosporum		r		3
Platysace ericoides	Heath Platysace		r		1

L = listed as threatened under the *FFG Act 1988*; v = vulnerable in Victoria, r = rare in Victoria, k=poorly known (DSE, 2005); VU = vulnerable nationally (listed under EPBC Act).

Other rare flora species recorded by Ethos NRM during the survey included Forest Red Box *(Eucalyptus polyanthemos* subsp. *longior),* Gippsland Stringybark *(Eucalyptus mackintii),* Smooth Geebung (*Persoonia levis*), Wallaby-bush (*Beyeria lasiocarpa*), Austral Tobacco (*Nicotiana suaveolens*), Paperbark Tea-tree (*Leptospermum trinervium*).

4.2.2 Fauna

Sixteen fauna species have been recorded within 5km of the Vegetation Study Area on the DSE database (see **Table 6**). Two species are endangered, seven species are vulnerable, 6 are near threatened and one species is data deficient in Victoria. Eight of the fauna species are listed as threatened under the FFG Act, and two species are listed as vulnerable under the EPBC Act. Fauna listed on DSE's *Advisory List for Threatened Vertebrate Fauna in Victoria* (DSE, 2013b) as endangered or vulnerable must be considered in the determination of conservation significance within the *Framework*, however near threatened and data deficient species do not require further consideration. Lace Monitors were recorded twice during the field survey just to the north of the Vegetation Study Area on the Nowa Nowa-Buchan Road. No other rare or threatened fauna species were recorded during the field survey.

Table 6: DSE Threatened Fauna records (DSE database)

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS			No. records
		FFG	Vic. Adv.	EPBC	
Ardea modesta	Eastern Great Egret	L	v		1
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren	L	v		1
Cercartetus nanus	Eastern Pygmy-possum		nt		2
Cinclosoma punctatum	Spotted Quail-thrush		nt		2

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS			No. records
		FFG	Vic. Adv.	EPBC	
Gallinago hardwickii	Latham's Snipe		nt		2
Haliaeetus leucogaster	White-bellied Sea-Eagle	L	v		1
Litoria aurea	Green and Golden Bell Frog		v	VU	1
Litoria raniformis	Growling Grass Frog	L	e	VU	1
Melanodryas cucullata cucullata	Hooded Robin	L	nt		40
Ninox strenua	Powerful Owl	L	v		7
Phalacrocorax varius	Pied Cormorant		nt		1
Pseudophryne dendyi	Dendy's Toadlet		dd		27
Pseudophryne semimarmorata	Southern Toadlet		v		7
Sminthopsis leucopus	White-footed Dunnart	L	nt		1
Tyto tenebricosa tenebricosa	Sooty Owl	L	v		22
Varanus varius	Lace Monitor		e		2

L = listed as threatened under the *FFG Act 1988*; e = endangered in Victoria, v = vulnerable in Victoria, nt = near threatened in Victoria, dd=data deficient (DSE, 2013b); VU = vulnerable nationally (listed under EPBC Act).

4.3 Role of Rare and Threatened Species in the Determination of Conservation Significance for Native Vegetation

When threatened species have been recorded within close proximity to the area of vegetation removal, the importance of the vegetation in providing habitat for these species is assessed. This is determined by a decision making process of whether the vegetation meets the habitat requirements for the threatened flora and fauna species and if so whether the site is the best 50% or remaining 50% of habitat, rather than direct presence of taxa. This process is outlined on *Table 2 of Native Vegetation – Guide for assessment of referred planning permit applications* (DSE, 2007).

Whether or not the best 50% or remaining 50% of habitat for threatened flora and fauna occurs at the site of vegetation removal in turn contributes to the determination of *Conservation Significance*, which is defined in *Appendix 4 Table 5* of the *Framework* (DNRE, 2002).

Determination of the Conservation Significance of a Habitat Zone is important, as it has implications for the likelihood of gaining approval to remove vegetation, by DSE and also for the offset requirements. For the purposes of this investigation broad assumptions on the habitat have been applied across the Vegetation Study Area based on detailed information collected at the seventeen survey sample sites.

As part of the approvals process for the Project, further field survey is required to accurately map Habitat Zones, quantify vegetation condition and habitat attributes present for rare and threatened species within the mine site if the project progresses. This would enable a detailed assessment of the Best and Remaining 50% of Habitat specific to the defined footprint of impact for the project, as part of a VQA and Net Gain Report. The determination of the presence and quality of fauna habitat would be based on recommendations from Earth Systems fauna survey results.

4.4 Rare and Threatened Species and the Native Vegetation Reforms

The Native Vegetation Reforms apply a risk-based method to determine assessment requirements for applications to remove native vegetation. Where an application to remove native vegetation is determined to fall within the **moderate** or **high-risk pathways**, as the Nowa Nowa Iron Project would be due to the extent of vegetation loss,

assessment of impact on rare and threatened species habitat needs to be considered. Refer to section 5.4 for more detail about the process.

A list of species from an extent search of Species Distribution Models coinciding with an area approximately equal to the Vegetation Study Area is included in **Appendix 8**. The extent search results included 58 flora and 55 fauna species, which may need to be interrogated for significant impacts due to proposed native vegetation removal for the Nowa Nowa Iron Project. DEPI proposes a purpose built tool to assist with undertaking this analysis; however it is not yet available.

5 Policy and Legislative Implications

5.1 Commonwealth Laws

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act 1999* is the Australian Government's environmental legislation which provides a legal framework to protect and manage nationally and internationally significant flora, fauna, ecological communities and heritage places, defined in the EPBC Act 1999 as Matters of National Environmental Significance (SEWPAC, 2013).

If a proposed action has the potential to have a significant impact on a Matter of National Environmental Significance, then an EPBC Referral is required to determine whether approval will be granted to undertake the activity, and if the action is classified as a controlled or uncontrolled action.

No EPBC Act listed flora species or ecological communities were identified during field surveys. Based on observations across the Vegetation Study Area, suitable habitat for communities and flora species identified in the EPBC Protected Matters Search Tool (see 4.1) are not expected to be present within the mine site.

5.2 State Laws and Policy

Legislation relevant to native vegetation conservation and management in Victoria include the *FFG Act 1988*, the *Planning and Environment Act 1987* and the *Catchment and Land Protection Act 1994*.

Relevant policy documents include Victoria's Biodiversity Strategy (1997), the East Gippsland Native Vegetation Plan (2008) (Draft) and Forest Management Zones contained within Forest Management Plans and Victoria's Native Vegetation Management – A Framework for Action (the *Framework*) .

At the time of writing the Victorian Department of Environment and Primary Industries was intending to replace the *Framework* with 'Reform's to Victoria's native vegetation permitted clearing regulations'. This will be introduced through an amendment to the Victorian Planning Provisions in late September 2013.

5.2.1 *Flora and Fauna Guarantee Act 1988*

The *FFG Act 1988* is the Victorian Government's legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The FFG Act provides for the listing of threatened plant and animal species and ecological communities (Threatened List) and potentially threatening processes (Processes List). It also contains provisions for **protected flora**, which are not listed as threatened, but declared to be protected under section 46 of the FFG Act.

A permit is not required from DSE to remove flora or fauna from Crown Land which has legal protection under the *Act, for exploration or mining works authorised by an Exploration or a Mining licence issued under the Mineral Resources Development Act 1990 (Flora and Fauna Guarantee [Mineral Resources Development] Order 1994).*

While no flora species or communities listed as threatened under the FFG Act were recorded within the mine site, there is potential the Nowa Nowa Iron Project will indirectly trigger events which constitute a Threatening Process under the FFG Act. Further assessment of the nature of these impacts and their likelihood of occurrence is required, should the project progress.

Warm Temperate Rainforest was recorded within the Vegetation Study Area, and is listed under the FFG Act. While the current mine footprint does not have direct impact on Warm

Temperate Rainforest, any potential future changes to the footprint should attempt to avoid impacts on this community.

5.2.2 *Catchment and Land Protection Act 1994*

The *Catchment and Land Protection Act 1994* (CALP Act) contains provisions relating to catchment planning, land management, noxious weeds and pest animals. The Act provides a legislative framework for the management of private and public land. It sets out the responsibilities of landowners declaring that they must take all reasonable steps to:

- avoid causing or contributing to land degradation which causes or could cause damage to land of another landowner
- protect water resources and conserve soil
- eradicate regionally prohibited weeds and prevent the growth and spread of regionally controlled weeds
- prevent the spread of and eradicate established pest animals (Environmental Law Online, 2005).

In essence, the Act establishes a framework for the integrated management and protection of catchments to improve long-term land productivity and conservation of the environment (Environmental Law Online, 2005).

5.2.3 *Planning and Environment Act 1987* (Local Government Regulations)

Planning schemes contain provisions relating to the management of native vegetation, where a permit to remove, destroy or lop native vegetation may be required. Where vegetation removal occurs on Crown Land managed by the DEPI, permits for removal of vegetation under the Mineral Resources and Sustainable Development Act 1990 are addressed through a Work Plan or Work Authority issued by the former Department of Primary Industries (DPI) Earth Resources.

5.2.4 East Gippsland Forest Management Plan

Forest Management Zones have been established across State forest in Victoria and identify priorities for forest use within a Forest Management Plan specific to a regional area. Each Forest Management Plan is developed in accordance with the *Forest Act 1958, National Parks Act 1975, Land Act 1958, Reference Areas Act 1978, Heritage Rivers Act 1992, Flora and Fauna Guarantee Act 1988* and the *Catchment and Land Protection Act 1994* (DSE, 2004b).

Certain areas of State Forest covering the project area are designated for special management. This designation may be related to vegetation or landscape values, or specifically defined to protect a particular species or ecological community.

A Zoning Scheme has been developed by the DSE that defines a number of categories for forest management areas including:

- **Special Protection Zone (SPZ) -** to be managed for conservation. Timber harvesting is excluded. It forms a network designed to complement conservation reserves
- **Special Management Zone (SMZ)-** to be managed to conserve specific features, while catering for timber production under certain conditions
- **General Management Zone (GMZ)-** to be managed for a range of uses, but timber production has a high priority.

The Mineral Resources Sustainable Development Act 1990 defines State Forest as unrestricted Crown land and Special Protection and Special Management Zones have no formal authority over mining activities. Management of biodiversity values within State

Forest, including those located in SPZ and SMZs are required to adhere to the principles of Victoria's Native Vegetation Management Framework (Avoid, Minimise and Offset) and in accordance with the *FFG Act 1988*.

Forest Management Zones were identified using DEPI's Biodiversity Interactive Map (DEPI, 2013). The majority of the mine footprint is within Special Management Zones which are managed for apiary, road landscape and fire management values. The south-east portion (c. 30 ha) of the mine footprint, and the proposed Nowa Nowa-Buchan Road diversion occur within an SPZ which comprises National Estate Biodiversity and Old Growth values and is a Powerful Owl Management Area.

No old growth forest was observed during field surveys within the Vegetation Study Area; the area has been subject to extensive timber harvesting activities, and fire has been introduced through most of the site. Large, senescent trees were observed infrequently across the site.

Powerful Owls have been recorded previously within the area surrounding the Project site, but were not recorded within the Project site during fauna surveys conducted by Earth Systems. Availability of suitable habitat for Powerful Owl is expected to be limited within the Project site.

Table 7 details the SMZ and SPZ within the survey area, the value assigned to that area, and indicates where they occur within the survey area.

Table 7: Forest Management Zones summary

FMZ Type	Site Number	FMZ Values	Locations
SMZ	M-803-14	Apiary, Road Landscape, Fire Zone 2	Majority of mine footprint from Bruthen Buchan Road to Tomato Tk/ Buchan-NowaNowa Rd intersection (north-west half of the survey area).
SMZ	M-805-02	Apiary, Fire Zone 1	Mine footprint adjacent to but not within this zone (East and south-east of the survey area).
SPZ	P-805-01	POMA	Mine footprint not within this zone (South-east corner of the survey area).
SPZ	P-805-02	POMA, National Estate Biodiversity, EVC_OG (EVC 29, 4000)	South-east portion of mine footprint and all of Buchan-Nowa Nowa Road diversion (South-east of the Nowa Nowa-Buchan Rd, east of Tomato Tk intersection).
SPZ	P-803-10	Linear Reserve, POMA, SOMA, MOMA, National Estate Biodiversity, Local Use, Flora (Grevillea celata), Mt Nowa Nowa Fire Tower	Mine footprint adjacent to but not within this zone (South-west corner of the survey area).

Forest Management Zones (FMZs): SMZ = Special Management Zone; SPZ = Special Protection Zone.
POMA = Powerful Owl Management Area; SOMA = Sooty Owl Management Area; MOMA = Masked Owl Management Area

5.3 Victoria's Native Vegetation Management – A Framework for Action

The *Framework* is the Victorian State Government's strategy to protect, enhance and revegetate Victoria's native vegetation. All proposed developments and works in Victoria, whether undertaken by private citizens or the private or public corporate sector, are subject to the provisions and requirements of the *Framework* (DNRE, 2002).

The main goal of the *Framework* is to achieve a reversal of the long-term decline in the extent and quality of native vegetation, leading to a '*Net Gain'*. The *Framework* documents a three-step approach to achieving net gain and aims to (DNRE, 2002):

1. **avoid** adverse impacts, particularly those resulting from native vegetation clearance;
2. **minimise** impacts, where they are unavoidable, through appropriate consideration in planning processes and expert input to project design or management; and
3. identify appropriate **offset** options.

Documentation of consideration given to the three-step approach must be provided in any application to remove native vegetation.

Regardless of the relevant native vegetation policy applicable for further approvals of this Project, removal of native vegetation will require quantification in Habitat Hectares, identification of an appropriate offset and approval from DEPI for the Project to progress.

5.3.1 Quantifying Native Vegetation Loss and Offset Requirements

Based on the vegetation habitat scores recorded during the field survey (VQA) and Bioregional Conservation Status (BCS) of the identified EVCs, most of the vegetation within the survey area is likely to have a conservation significance of MEDIUM. The exception is the small area of Riparian Forest in the East Gippsland Lowlands bioregion, which based on habitat scores and BCS, has HIGH conservation significance.

Possible increases in Conservation Significance may occur due to presence of the best 50% or remaining 50% of habitat for rare or threatened flora and fauna identified in sections 4.1 and 4.2. Further field surveys will need to be undertaken as part of the approvals process for the Project to enable calculation of conservation significance, and hence offset requirements for the mine footprint. However, scenarios in **Table 8** below adapted from the *Framework* (Appendix 4, Table 5; DNRE, 2002) outline if and where it may be expected likely for the conservation significance to increase to High or Very High based on work done to date within the broader Vegetation Study Area. A broad assumption has been made for fauna habitat, although no judgement of the presence of best or remaining 50% of habitat for individual species has been made.

Table 8: Scenarios of impacts of Best or Remaining Habitat on Conservation Significance

Conservation Significance	Best or Remaining 50% of habitat for threatened species	Examples of species to be considered (based on database search results and field survey)	Likely areas that may be affected
MEDIUM	Remaining 50% of habitat for rare species (flora only);	Rare flora: Yellow-wood, Bolwarra, Rough Blown-grass, Spicy Everlasting, Rough-fruit Pittosporum, Heath Platysace, Slender Wire-lily, Paperbark Tea-tree, Forest Red Box, Smooth Geebung, Wallaby-bush	Lowland Forest and/or Shrubby Dry Forest likely to be remaining 50% due to widespread extent of logging across the site, for Heathy Platysace, Slender Wire- lily, Red Box, Gippsland Stringy,Persoonia. Riparian Forest remaining 50% for Paperbark Tea-tree.
HIGH	Best 50% of habitat for rare species (flora only); Remaining 50% of habitat for threatened species (vulnerable, endangered, critically endangered)	Rare flora: Yellow-wood, Bolwarra, Rough Blown-grass, Spicy Everlasting, Rough-fruit Pittosporum, Heath Platysace, Slender Wire-lily Threatened flora: Colquhoun Grevillea, Creeping Loosestrife, Leafless Tongue-orchid Threatened fauna: Eastern Great Egret, Chestnut-rumped Heathwren, White-bellied Sea-Eagle, Green and Golden Bell Frog, Growling Grass Frog, Powerful Owl, Southern Toadlet, Sooty Owl, Lace Monitor	Possible Best 50% for flora associated with Warm-temperate Rainforest (Yellow-wood, Bolworra, Pittosporum), although currently not impacted by the mine footprint. Fauna not assessed in this study, although there is potential for remaining 50% for Lace Monitor in Lowland and Shrubby Dry Forest, as it was recorded on-site during the survey. Also potential for Powerful Owl habitat in Warm Temperate Rainforest and less disturbed areas of Damp Forest.

Conservation Significance	Best or Remaining 50% of habitat for threatened species	Examples of species to be considered (based on database search results and field survey)	Likely areas that may be affected
VERY HIGH	Best 50% of habitat for threatened species (vulnerable, endangered, critically endangered)	Threatened flora: Colquhoun Grevillea, Creeping Loosestrife Threatened fauna: Eastern Great Egret, Chestnut-rumped Heathwren, White-bellied Sea-Eagle, Green and Golden Bell Frog, Growling Grass Frog, Powerful Owl, Southern Toadlet, Sooty Owl, Lace Monitor	None – for flora; presence of suitable habitat for Grevillea and Loosestrife unlikely, given very restricted distributions of these species. Unlikely to be Best 50% of habitat for any species given high intensity of logging within the survey area, and general low density of large old trees (large tree hollows).

5.3.2 Offsetting Native Vegetation Losses

Where vegetation removal cannot be avoided, provision of offsets to compensate for the loss and achieve a 'net gain' must be undertaken. Offsets are achieved through the long-term protection, enhancement and management of the quality and quantity of native vegetation.

A detailed net gain calculation for proposed vegetation loss will be required within the final mine footprint if the Project progresses, to enable quantification of the offset and like-for-like requirements. Offsets can be sourced through accredited Bushbroker native vegetation Brokers.

5.4 Reforms to Victoria's native vegetation permitted clearing regulations

Reforms to Victoria's native vegetation policy are likely to have implications for the calculation of vegetation loss and offset requirements. The full extent of implications on the Nowa Nowa Iron Project are not yet known, as all the relevant data and guidance documents were not available at the time of writing.

The native vegetation Reforms determine assessment requirements for applications to remove vegetation through determination of **risk-based pathways**, as defined in *Chapter 6* and *Table 3* of the *Permitted Clearing of Native Vegetation Biodiversity Assessment Guidelines* (DEPI, 2013; referred to as the Guidelines). The risk-based pathway is determined by the *Location Risk Map* available from DEPI Biodiversity Interactive Maps, combined with the extent of proposed native vegetation removal.

Examination of the DEPI *Location Risk Map* (refer to **Appendix 7**) shows that the majority of the mine site to be within **Location A**, with portions of the Clean Water Dam (Mine footprint) and proposed Buchan-Nowa Nowa Road diversion in **Location C.**

Referring to *Table 3* in the *Guidelines*, given the presence of small portions of the Project in Location C, and the extent of proposed native vegetation clearing, the Nowa Nowa Iron Project would be determined to require the **High-risk pathway** to be followed. The requirements are detailed in *Chapter 7* of the *Guidelines*, which for moderate and high-risk pathways include:

- A habitat hectares assessment report
- A statement of how impacts on biodiversity from the removal of native vegetation have been minimised
- The Habitat Importance scores of the native vegetation to be removed
- An offset strategy that details how a compliant offset will be secured.

These major steps do not differ greatly from those currently required by the *Framework.* However the mechanisms for quantification of offset requirements have been changed.

Conservation Significance no longer forms part of the assessment process, and Bioregional Conservation Status of EVCs does not directly impact on offset requirements. Threatened species are considered through DEPI Habitat Importance Models which are

not currently available; however Species Habitat Distribution Models indicate lists of species within the area which may need to be considered in defining offset requirements.

A *Strategic Biodiversity Score* is an element used to calculate the offset requirement. Within the Project area, the *Strategic Biodiversity Score* is mostly in the lowest category (0.01-0.20), with approximately 10% of the mine footprints in the second lowest category (0.21- 0.40) and 10% in the middle category (0.41-0.60). The two highest categories are not mapped within the Project area. For DEPI *Strategic Biodiversity Score* map refer to **Appendix 9**.

Offsets compliant with the *Guidelines* will need to meet the following requirements, as described in *Chapter 9* of the *Guidelines*:

- Specific offset attributes (where a significant impact on a given species has been determined) for **each** relevant species
- General offset attributes (where no significant impacts on rare or threatened species have been determined) must be:
    - A minimum of 80% of the *Strategic Biodiversity Score* of the native vegetation to be removed; and
    - Within the same Catchment Management Authority boundary as the native vegetation to be removed.

6 Likely Impacts on Native Vegetation

Likely impacts of the Project mine site on native vegetation values have been inferred from data collected across the broader Vegetation Study Area. Vegetation types (EVC) and condition are expected to be similar to those observed during field surveys, although smaller scale variations may occur.

To assess vegetation loss within the *Framework*, a site must meet the definition of either a remnant patch or scattered trees. A remnant patch is an area of vegetation with or without trees where at least 25% of the understorey vegetation is native or where a group of three trees have a canopy cover of at least 20% (DNRE, 2002).

The native vegetation contained within the survey site and likely to be impacted by the proposed activities has been assessed as a remnant patch.

This section refers to the mine footprint (including infrastructure, access tracks and buffers) provided to Ethos NRM by Earth Systems, to provide an indication of the scale of native vegetation removal, and allow discussion of the likely vegetation impacts and identification of potential issues. The broad scale of the field assessment does not enable accurate calculation of vegetation loss in habitat hectares. Further detailed survey is likely to be required within the final Project footprint to determine the net gain and offset like-for-like requirements to compensate for the proposed vegetation loss. This will need to be undertaken as part of the approvals process for the Project.

Impacts at the Project mine site have been estimated based on sample habitat scores from the vegetation survey area within proposed disturbance areas provided for:

- the *mine footprint* (including all infrastructure except those listed below),
- the *diversion of the Nowa Nowa – Buchan Road*, and
- the *Bruthen – Buchan Road/mine access* track intersection.

6.1 Summary of Potential Vegetation Removal

The Project footprint for the Nowa Nowa Iron Project is estimated to result in the complete removal of approximately 146 hectares of vegetation.

Four EVCs are likely to be impacted, with the majority of vegetation impacts occurring within the East Gippsland Uplands bioregion, and a small portion within the East Gippsland Lowlands. Shrubby Dry Forest (EVC 21) and Lowland Forest (EVC 16) which are the principal EVCs across the proposed vegetation removal areas, and have BCS of least concern in both bioregions. Damp Forest (EVC 29) and Riparian Forest (EVC 18) will also be impacted. Damp Forest is least concern in both bioregions, while Riparian Forest is least concern in East Gippsland Uplands, and depleted in East Gippsland Lowlands. The removal of Riparian Forest will mostly be from the East Gippsland Uplands bioregion.

Proposed vegetation removal is summarised in **Table 9** below. Also refer to **Figure 2** for the location of proposed vegetation removal related to the EVCs and sample sites.

6.2 Habitat Hectares - Estimate of Vegetation Loss

In order to calculate the offset requirements for the removal of vegetation on the site, the Habitat Score is multiplied by the area of vegetation to be removed, to give the Habitat Hectare Score. Based on the sample habitat scores calculated during the field survey and EVC mapping, scores have been attributed broadly across the Project area to enable an estimate of vegetation loss to be quantified.

Within the Mine Footprint, and estimated 138.42 hectares of vegetation equating to 98.72 Habitat Hectares (HHa) will be removed. Within the proposed diversion of the Nowa Nowa-Buchan Road, an estimated 7.24 hectares equating to 5.16 HHa will be removed.

At the mine site access road intersection on the Bruthen-Buchan Road an estimated 0.13 hectares equating to 0.10 HHa will be removed.

All loss calculations include buffers around proposed footprints as defined in Section 2.5.

It is **estimated** that a total of **146 Ha** of vegetation equating to approximately **104 HHa** is proposed for removal for the Nowa Nowa Iron Project.

Table 9: Summary of vegetation loss estimates.

	Mine Footprint	Nowa Nowa-Buchan Rd Diversion	Bruthen-Buchan Rd Access	Totals
Area of vegetation removal (ha) [1]	138.42	7.24	0.13	**145.79 ha**
Habitat Hectares (HHa) loss estimate	98.72	5.16	0.10	**103.98 HHa**
Large Old Trees (LOTs) loss estimate	433	9	1	**443 LOTs**
EVCs present	Shrubby Dry Forest, Lowland Forest, Damp Forest, Riparian Forest	Shrubby Dry Forest, Lowland Forest	Shrubby Dry Forest	**4 EVCs**
Bioregions present	East Gippsland Uplands & East Gippsland Lowlands	East Gippsland Uplands & East Gippsland Lowlands	East Gippsland Lowlands	**2 Bioregions**
Survey Sample Point Habitat Scores used in calculations	1,2,3,4,5,6,9,10, 14,17	2,3,5,6,14	17	**10 survey sample points**
Area (ha) of vegetation in logging coupes (<10 years)	3.3	0.8	Nil	**4.1 ha**
Non-vegetated areas (existing tracks, other disturbed areas) [2]	2.14	0.70	0.02	**2.86 ha**
Total area (ha) within Mine footprint [1+2]	**140.56**	**7.94**	**0.15**	**148.65 ha**

6.3 Large Old Trees

The *Framework* (DNRE, 2002) stipulates requirements to both **protect** large old trees and **recruit** new trees as a part of the offset for clearing of any large old trees within a remnant patch of native vegetation.

Large old trees (LOTs) were estimated from sample plots across the vegetation survey area in varying densities, and will be removed within the Project Areas. Estimated loss of LOTs is included in **Table 9** above; offset requirements are included in **Tables 10 and 11** in **Section 6.4** below. In summary, an estimated 443 LOTs will be removed; 433 from the Mine Footprint, 9 from the Buchan-Nowa Nowa Road diversion and 1 from the mine site access intersection with the Bruthen-Buchan Road.

6.4 Conservation Significance & Gain Target

Following calculation of the quality x quantity of the vegetation to be removed by Habitat Hectare Assessment, the likely Conservation Significance of each Habitat Zone has been

detailed below in order to estimate the likely vegetation offset requirements for the Nowa Nowa Iron Project.

Table 5 of the *Framework* specifies that the Conservation Significance of an area is determined according to the relationship between the Conservation Status of the vegetation present and the quality of the vegetation as determined by the Habitat Score (DNRE, 2002). The presence of threatened flora or fauna also influences the Conservation Significance of a site. As detailed in Sections 4.3 and 5.3 of this report, a broadly applied habitat assessment has been undertaken in order to estimate the likely offset requirement for the Project. More detailed assessment specific to the footprint of impact will be required at a later date to confirm these assumptions.

Therefore two estimates of Conservation Significance are provided, to indicate the minimum, and likely maximum offset requirements in Habitat Hectares. Minimum offset requirement estimates are based on determination of Conservation Significance from sample Habitat Scores x BCS (refer to **Table 10**), and likely maximum offset requirements have assumed a conservation significance of High across the entire site due to potential presence for rare and threatened species habitat (refer to **Table 11**). Very High Conservation Significance within the mine footprint has been considered unlikely due to the extensive timber harvesting activities which have occurred across the Project area. It is expected that the actual offset requirement will be somewhere in between the two estimates.

Calculation of a **Gain Target** (Offset Requirement) is undertaken by multiplying the area to be cleared in Habitat Hectares by the offset multiplier. The offset multiplier is determined by the Conservation Significance within Table 6 of the *Framework* (DNRE, 2002). The Net Gain Target is the amount of gain that is needed to offset the loss, measured in Habitat Hectares.

A multiplier of 1 is applied to areas of Medium Conservation Significance and 1.5 to areas of High Conservation Significance, in order to determine the offset requirement or Gain Target.

The offset requirement for LOTs is determined by the Conservation Significance of the Habitat Zone from which the LOTs are removed. The likely offset for removal of Large Old Trees has been estimated to be the protection of a between 890 and 1772 LOTs.

Table 10: Offset estimate summary based on Habitat Score x Bioregional Conservation Status

Conservation Significance of vegetation	Mine Footprint loss	Nowa Nowa-Buchan Rd Diversion loss	Bruthen-Buchan Rd Access loss	Total Estimated Loss	Offset Multiplier	Estimated Offset Totals
HIGH	0.84 HHa of Riparian Forest in EG Lowlands	Nil	Nil	0.84 HHa	1.5	**1.26 HHa**
	2 LOTs	Nil	Nil	2 LOTs	4	**8 LOTs**
MEDIUM	97.88 HHa	5.16 HHa	0.10 HHa	103.14 HHa	1	**103.14 HHa**
	431 LOTs	9 LOTs	1 LOTs	441 LOTs	2	**882 LOTs**
TOTALS						**104.4 HHa**
						890 LOTS

Table 11: Offset estimate summary based on potential rare and threatened species

Conservation Significance of vegetation	Mine Footprint loss	Nowa Nowa-Buchan Rd Diversion loss	Bruthen-Buchan Rd Access loss	Total Estimated Loss	Offset Multiplier	Estimated Offset Totals
HIGH	98.72 HHa	5.16 HHa	0.10 HHa	103.98 HHa	1.5	**155.96 HHa**
	433 LOTs	9 LOTs	1 LOTs	443 LOTs	4	**1772 LOTs**

The loss of 146 hectares equating to 104 HHa of vegetation removal associated with the Nowa Nowa Iron Project mine site, will require an offset ranging between:

An **estimated minimum** combined net gain target of **104.4 Habitat Hectares (HHa)** comprised of:

- **1.26 HHa** of **High Conservation Significance** vegetation, and
- **103.14 HHa** of **Medium Conservation Significance** vegetation

An **estimated maximum** combined net gain target of:

- **155.96 HHa of High Conservation Significance** vegetation.

An **estimated** Large Old Tree (LOT) protection target of between **890** and **1772 LOTs** will be required to offset the loss of 443 LOTs.

6.5 Like-for-Like Requirements

Offset criteria requirements are graded within the *Framework* according to identified Conservation Significance. The following sections summarise the rationale for achieving offsets in the context of the *Framework*, but not specific to the Nowa Nowa Iron Project, as Like-for-Like Requirements have not yet been determined. A formal agreement is required in all instances to secure the ongoing protection and management of the nominated offset site.

6.5.1 Vegetation or Habitat type of Offset

For vegetation of HIGH Conservation Significance, the offset area must be in the same vegetation / habitat type or Very High Significance vegetation / habitat in the same Bioregion (DNRE, 2002). If the highest Conservation Significance rating is triggered by the presence of threatened species habitat then the identified habitat must also be provided by the Offset.

For vegetation of MEDIUM Conservation Significance, the offset area can consist of any EVC within the Bioregion, or be Very High of High significance vegetation / habitat in an adjacent Bioregion (DNRE, 2002). This approach is likely to be relevant for most of the proposed vegetation removal associated with the Nowa Nowa Iron Project.

6.5.2 Landscape Role

Due to the different levels of Conservation Significance determined for each component of the proposed vegetation loss, the landscape role required to be provided by the offset site also differs.

For vegetation of HIGH Conservation Significance the landscape role of the offset site must provide similar or more effective ecological function **or** similar or more effective land protection function as impacted by the loss within the offset site (DNRE, 2002).

For vegetation of MEDIUM Conservation Significance the landscape role of the offset site must provide similar or more effective land protection function as impacted by the loss within the offset site (DNRE, 2002).

6.5.3 Quality Objectives for Offset

The area of vegetation proposed as the offset when clearing in HIGH Conservation Significance areas must be at least 75% of the quality being lost.

The area of vegetation proposed as the offset when clearing in MEDIUM Conservation Significance areas, must be at least 50% of the quality being lost.

6.5.4 Proportion of revegetation included in offset

For clearing in HIGH Conservation Significance sites only 25% of the proposed offset can be revegetation. For clearing in MEDIUM Conservation Significance sites only 50% of the proposed offset can be revegetation. These values are calculated in Habitat Hectares.

6.5.5 Vicinity

For clearing in HIGH Conservation Significance sites, the gain must be within the same Bioregion as the loss (DNRE, 2002).

For clearing in MEDIUM Conservation Significance sites, the gain must be within the same Bioregion as the loss or within an adjacent Bioregion if the offset is located in Very High or High significance vegetation (DNRE, 2002).

6.5.6 Timing

For clearing in areas of both HIGH and MEDIUM Conservation Significance, the offsets are to be initiated as soon as possible after the loss occurs but no more than 1 year following (seasonal requirements will be considered).

6.5.7 Security of Gain

A number of mechanisms exist to secure third-party offset sites, including agreements made under the *Conservation Forests and Lands Act 1987* or the *Planning and Environment Act 1987*, as well as conservation covenants made under the *Victorian Conservation Trust Act 1972*. These agreements and covenants must be registered on-title.

6.6 Reforms to Victoria's native vegetation permitted clearing regulations

Reforms to Victoria's native vegetation policy use Habitat Hectares to derive two types of units to determine offset requirements. A **general biodiversity equivalence score** is derived from the mapped *Strategic Biodiversity Score*, which is multiplied by Habitat Hectares. A **specific biodiversity equivalence score** is derived from the mapped *Habitat Importance Score* from the model for each species which has habitat mapped within the native vegetation removal area. Offsets are then calculated through determination of the appropriate risk factor, to derive **risk adjusted general or risk adjusted scientific biodiversity equivalence scores.**

Given the current lack of available tools to allow full analysis of offset requirements under the *Reforms,* only an indicative **general offset requirement** has been provided here. *Habitat Importance Models* are not yet available, so the **specific offset** cannot be determined. Given the large area of native vegetation removal, there are likely to be at least small areas requiring specific offsets, for a subset of the species identified in **Appendix 8**.

Starting with a native vegetation loss of 103.98 HHa (see Table 9), an estimated range in *Strategic Biodiversity Score* of 0.2 to 0.6, and a *general offset risk factor* of 1.5, the

following indicative range for general offset requirements for the Project have been calculated:

- **Minimum**: 103.98 HHa x 0.2 x 1.5 = 31.19 General Biodiversity Equivalence Units
- **Maximum**:103.98 HHa x 0.6 x 1.5 = 93.58 General Biodiversity Equivalence Units

To offset the loss of 146 hectares equating to 104 HHa of vegetation removal associated with the Nowa Nowa Iron Project mine site, estimated offsets required are:

- Between **31.19** and **93.58 General Biodiversity Equivalence Units**
- Strategic Biodiversity Score of between **0.16** and **0.48**
- Within the East Gippsland Catchment Management Authority boundary
- **Unknown Specific Biodiversity Equivalence Units**

7 Recommendations for Further Vegetation Assessment

It is recommended that further vegetation assessment be undertaken within the mine footprint to address limitations of this Preliminary Vegetation Assessment (limited survey effort and coverage within the mine footprint, and seasonality), and to provide sufficient information to meet approval requirements for the Project.

Completion of detailed EVC and Habitat Zone mapping within the mine footprint would enable accurate calculation of proposed vegetation removal and quantification of offset requirements, as well as collection of a detailed flora list. Such surveys would also allow for the identification of potential habitat for threatened flora species, to define the need and locations for targeted searches.

Flora species which may require targeted surveys within and surrounding the footprint, if suitable habitat is identified, include;

- rare flora with restricted distributions or previously recorded within the study area such as Slender Wire-lily (*Laxmannia gracilis*),
- EPBC listed flora which are cryptic or with poorly understood habitat requirements such as Leafless Tongue-orchid (*Cryptostylis hunteriana*) and Maroon Leek-orchid (*Prasophyllum frenchii*),
- Other rare or threatened species identified by the desktop search as being recorded within 5km of the mine site, to be determined through consultation with DEPI.

Detailed EVC and Habitat Zone mapping and targeted surveys should be conducted in Spring to detect herbaceous and cryptic species not visible during field surveys in Autumn 2013, to improve detection of rare and threatened species, and to contribute to a more comprehensive list of flora within the mine footprint.

Less cryptic taxa, including shrubs such as Colquhoun Grevillea (*Grevillea celata*) which flowers in Spring (DSE, 2008), may not require targeted searches in addition to detailed habitat hectare related flora survey within the mine footprint, as surveys during Spring flowering time will improve detection rates.

EPBC listed taxa identified as having potential to occur within the mine site by the EPBC Protected Matters Search tool, the Maroon Leek-orchid and Leafless Tongue-orchid, are considered unlikely to occur based on the lack of suitable vegetation and habitat types observed during the preliminary vegetation survey. However, if additional vegetation assessment identifies suitable habitat for these species within the mine footprint, targeted surveys should be undertaken in Spring/Summer to coincide with flowering (Maroon Leek-orchid from late October to late November, and Leafless Tongue-orchid from November to February).

If threatened flora populations are located within the mine footprint, the size of populations within and surrounding the Project site may need to be quantified to better understand the relative impacts of the proposed mine on threatened flora.

Ethos NRM is aware that additional vegetation assessment and flora surveys are planned for Spring to address limitations of this Preliminary Vegetation Assessment and to confirm the unlikely impacts of the Project on threatened species.

8 REFERENCES

Backhouse, G. & Jeanes, J., 1995. *The Orchids of Victoria,* Melbourne University Press, Melbourne.

DEPI, 2013. *Permitted clearing of native vegetation Biodiversity Assessment Guidelines.* Victorian Government Department of Environment and Primary Industries, Melbourne, May 2013.

DNRE, 2002. *Victoria's Native Vegetation Management - A Framework for Action.* The State of Victoria, Department of Natural Resources and Environment.

DPCD, 2013. *Planning Property Report.* www.dpcd.vic.gov.au/planning website accessed on 03/04/2013. Victorian Department of Planning and Community Development.

DPI, 2013. *Bioregions of Victoria – Victorian Resources Online*. http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/biodiversity_bioregions_vic website accessed 03/04/13. Department of Primary Industries, State Government, Victoria.

DSE, 2003. *Flora and Fauna Guarantee Act 1988 Action Statement No. 154: Maroon Leek-orchid* Prasophyllum frenchii. The State of Victoria, Department of Sustainability and Environment, Melbourne.

DSE, 2004a. *Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectares scoring method. Version 1.3.* Victorian Government Department of Sustainability and Environment, Melbourne.

DSE, 2004b. Forest Management Plan for Gippsland. Department of Sustainability and Environment. Victorian Government.

DSE, 2005. *Advisory List of Rare or Threatened Plants in Victoria - 2005*. Victorian Department of Sustainability and Environment, East Melbourne, Victoria.

DSE, 2007. *Native Vegetation – Guide for assessment of referred planning permit applications*, Department of Sustainability and Environment, State Government, Victoria.

DSE, 2008. *Flora and Fauna Guarantee Act 1988 Action Statement No. 211: Colquhoun Grevillea* Grevillea celata. The State of Victoria, Department of Sustainability and Environment, Melbourne

DSE, 2013a. *Online Mapping - Biodiversity Interactive Map*. www.dse.vic.gov.au (website accessed 27/02/2013). Victorian Department of Sustainability and Environment.

DSE, 2013b. *Advisory List of Threatened Vertebrate Fauna in Victoria - 2013*. Victorian Department of Sustainability and Environment, East Melbourne, Victoria.

Environmental Law Online, 2005. Catchment and Land Protection Act 1994. Retrieved 15/02/2011 from Environmental Law Online. http://www.envirolaw.org.au/sources/legislation/calpa1994267 .

SEWPAC, 2008. *Approved Conservation Advice for* Cryptostylis hunteriana (*Leafless Tongue-orchid*). Australian Government Department of Sustainability, Environment, Water, Population and Communities.

SEWPAC, 2013. *Matters of National Environmental Significance***,** viewed 27/02/13 http://www.environment.gov.au/epbc/protect/index.html. Australian Government Department of Sustainability, Environment, Water, Population and Communities.

Viridans, 2013a. *Wild Animals of Victoria on the Web,* Viridans Biological database 2013, Viridans Pty Ltd, Victoria.

Viridans, 2013b. *Wild Plants of Victoria on the Web,* Viridans Biological database 2013, Viridans Pty Ltd, Victoria.

Walsh, N.G. and Entwisle, T.J. (eds)(1994). *Flora of Victoria. Volume 2. Ferns, Conifers, and Monocotyledons.* Inkata Press.

Walsh, N.G. and Entwisle, T.J. (eds)(1996). *Flora of Victoria. Volume 3. Dicotyledons. Winteraceae to Myrtaceae*. Inkata Press.

Walsh, N.G. and Entwisle, T.J. (eds)(1999). *Flora of Victoria. Volume 4. Dicotyledons. Comaceae to Asteraceae.* Inkata Press.

Rare and Threatened Species Data Source (DSE)

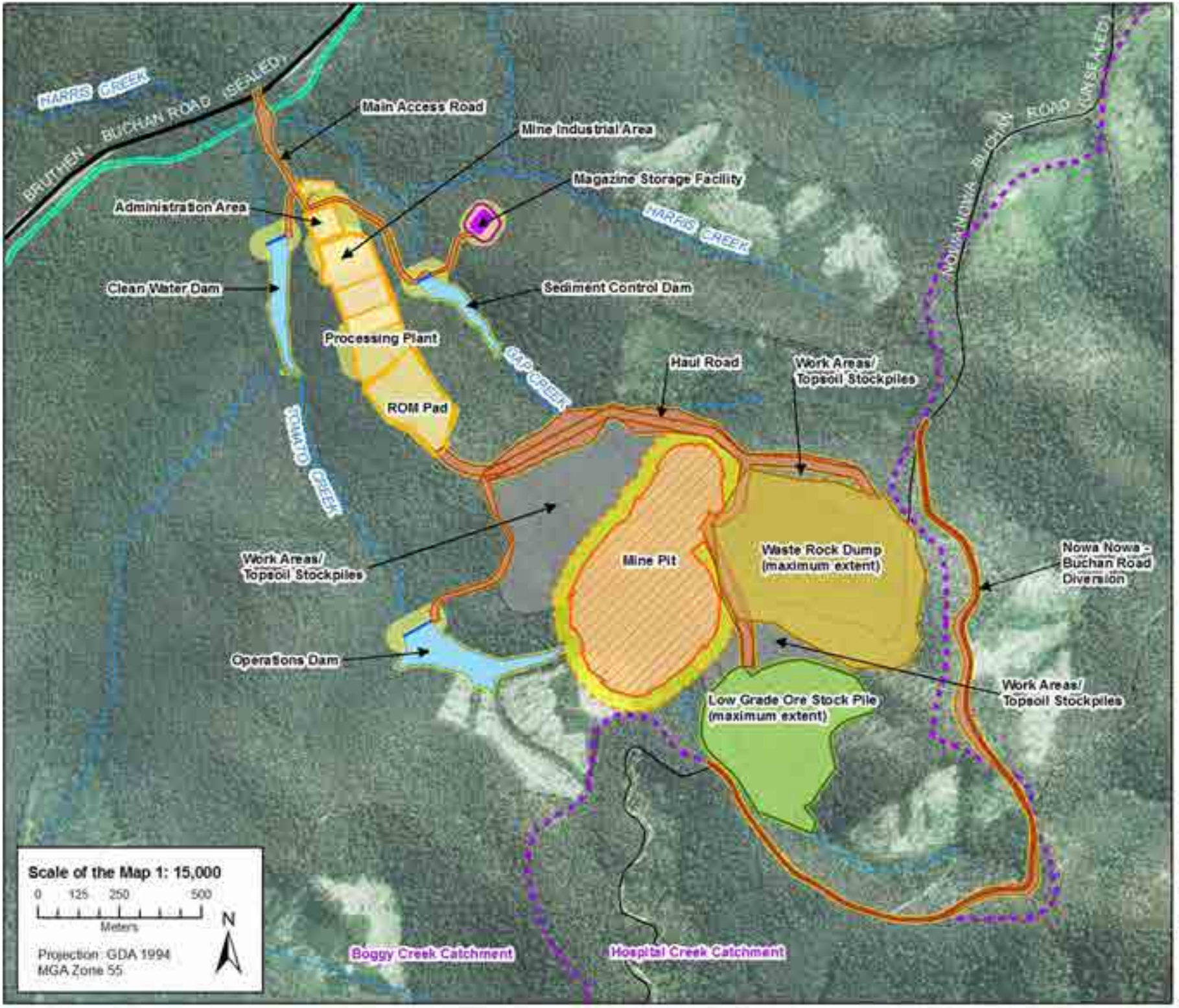
1. Data Source: 'Victorian Flora Site Database', © The State of Victoria, Department of Sustainability and Environment (accessed via the 'Flora Information System', [December 2010] - © Viridans Biological Databases). The contribution of the Royal Botanical Gardens Melbourne to the database is acknowledged.
2. Data Source: 'Atlas of Victorian Wildlife', © The State of Victoria, Department of Sustainability and Environment (accessed via the 'Victorian Fauna Database', [December 2010]- © Viridans Biological Databases).

VBA, 2013 Data Source (DEPI)

Data Source: 'Victorian Biodiversity Atlas', © The State of Victoria, Department of Environment and Primary Industries (accessed September, 2013]).

9 APPENDICES

9.1 Appendix 1: Nowa Nowa Iron Project Infrastructure and Layout Map



Nowa Nowa Iron Project Infrastructure and Layout

Legend

- Towns/ Settlements
- Rivers / Streams
- Major/ Secondary Roads
- Tracks
- Existing Transmission Line
- Catchment Boundary (Boggy Creek / Hospital Creek)

Project Components

- Mine Pit
- Mine Infrastructure
- Waste Rock Dump
- Low Grade Ore Stock Pile
- Project Access Roads
- Magazine Storage Facility
- Dams
- Work Areas/ Topsoil Stockpiles

Buffer Zones

- Construction and Bushfire Management Buffers

Satellite Imagery:
Quickbird (April 2012)
Note: Cleared areas are logging coupes

Author : Earth Systems

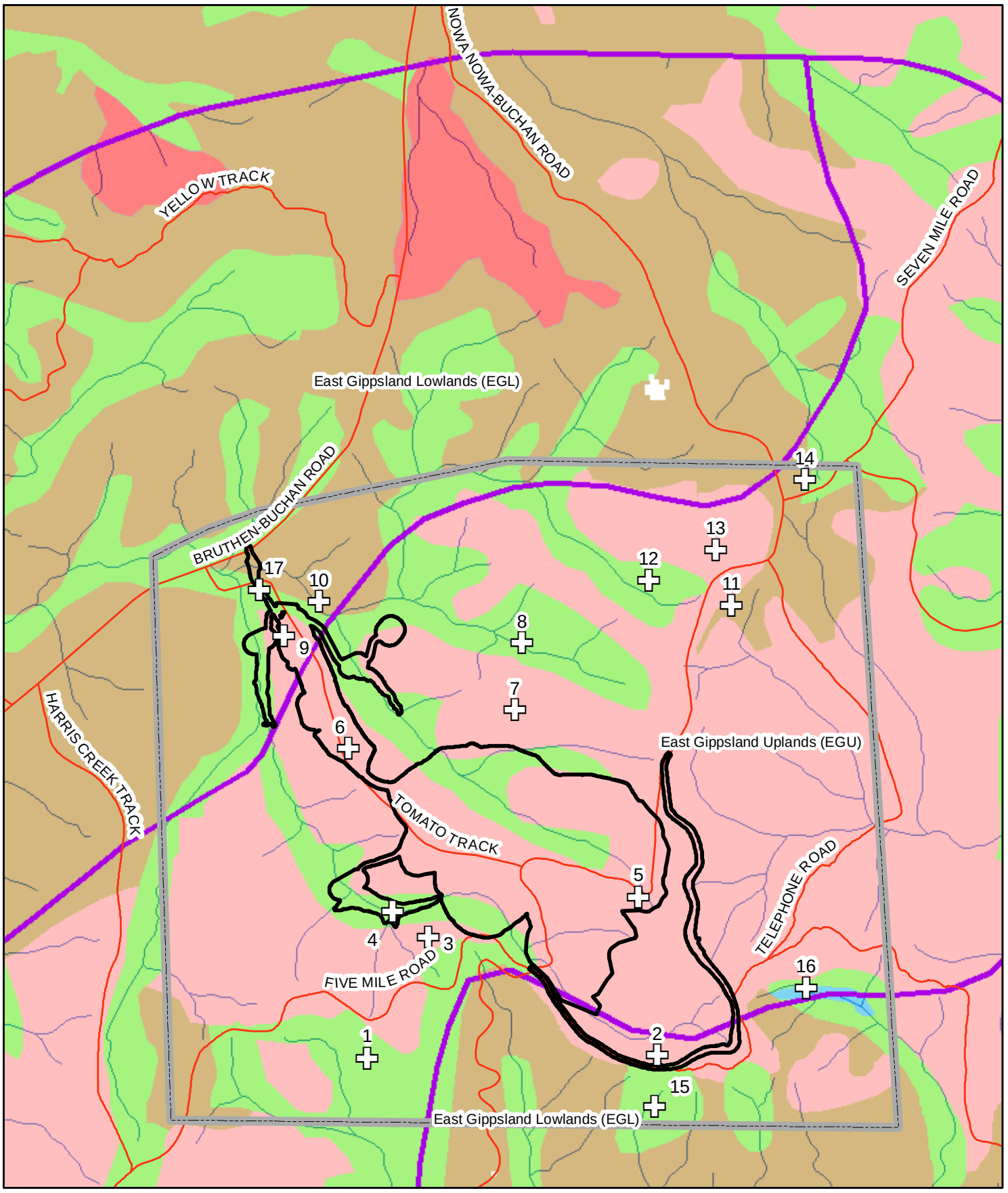
Client : Eastern Iron Ltd

Revision : Draft

Date : September 2013

EARTH SYSTEMS

9.2 Appendix 2: DSE EVC Mapping



Nowa Nowa Iron Project - Preliminary VQA & EVC Mapping
Appendix 2: DSE Ecological Vegetation Class mapping

Legend

- Hydrology
- Roads and Tracks
- Bioregion boundaries
- Vegetation Study Area boundary
- NowaNowaProjectComponents_withbuffers
- Survey Sample Points

Ecological Vegetation Class

- Clay Heathland
- Damp Forest
- Lowland Forest
- Riparian Forest
- Shrubby Dry Forest
- Warm Temperate Rainforest

N

0 0.15 0.3 0.6 0.9 Km

1:25,000 | Version 3

Date: 08/10/2013

Coordinate System:
GDA 94 MGA Zone 55

Map Produced by: Ethos NRM,
PO Box 204, Bairnsdale, Victoria 3875.
ph (03) 51530037
info@ethosnrm.com.au www.ethosnrm.com.au

9.3 Appendix 3: Habitat Hectare Sheets

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: [illegible] Location: [illegible] Date: 24/3/13

Assessor(s): [illegible] Map Name/No: [illegible] AMG / MGA

Tenure: State Forest EVC: Lowland Forest Bioregion: EG Uplands

'Site Condition Score'

Large Trees

Score: 4

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
> the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover

Score: 4

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds

Score: 15

Category & Description	'High threat' weeds*		
	None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	15	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a *high impact* are considered *high threat* regardless of their invasiveness.

** If total weed cover is negligible (< 1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Present	For life forms with benchmark cover of < 10%, considered 'present' if • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if • the life form occupies at least 10% of benchmark cover.
Modified (apply only where life form is 'present')	For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either • < 50% of the benchmark species diversity, or • no reproductively mature specimens are observed. For life forms with benchmark covers of ≥ 10%, then considered substantially 'modified' if the life form has either • < 50% of benchmark cover, or • < 50% of benchmark species diversity, or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey

Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	15
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria
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Vegetation Quality Field Assessment Sheet

Version 1.3 October 2004

Recruitment

Score 10

Category & Description			High diversity*¹	Low diversity*¹
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment"	< 30%	3	1
		30 - 70%	6	3
		> 70%	(10)	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).

^ refer to EVC benchmark for clarification.

" treat multiple eucalypt canopy species as one species.

¹ high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species) [illegible]	✓ ✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (SS and taller)	13

Organic Litter

Score 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
> 50% or ≤ 150% of benchmark cover	(5)	4

Logs

Score 2

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	(2)
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh.

* present if large log length is ≥ 25% of EVC benchmark log length.

absent if large log length is < 25% of EVC benchmark log length.

'Landscape Context Score'

Patch Size

Score 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
> 20 ha, but 'significantly disturbed'*	(8)
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area

Score 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	2
contiguous	5	(4)

* defined as per RFA 'Old Growth' analyses.

Neighbourhood

Score 7

Radius from site	% Native vegetation*	Weighting	
100 m	100	0.03	3
1 km	100	0.04	4
5 km	80	0.03	2.4
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
		Add Values and 'round-off'	7.4

* to nearest 10%.

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	4	4	15	15	10	5	2	8	7	4	74

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: 2 Location: 5 Mile Ck (mud) Date: 26/3/12

Assessor(s): [illegible] All & S Map Name/No: AMG / MGA:

Tenure: State Forest EVC: Shrubby Dry Forest Bioregion: EG Uplands

'Site Condition Score'

Large Trees — Score: 0

Category & Description	% Canopy Health* > 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 5

Category & Description	% Canopy Health* > 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	(5)	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds* None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'high threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered 'high threat' regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	5 / 4	5 / 5	✓	✗
T	0 / 1	– / 1	✗	–
MS	3 / 6	5 / 20	✓	✓
SS	6 / 8	10 / [illegible]	✓	✓
MH	3 / 5	1 / 5	✓	✓
LH	5 / [illegible]	– / 1	✗	–
LNG	0 / 2	– / 5	✗	–
MTG	5 / 2	5 / 10	✓	✗
MNG	1 / 1	1 / 1	✓	✓
GF	0 / 2	– / 5	✗	–
SC	1 / 3	1 / 5	✓	✓
BL	na / na	15 / 10	✓	✗
S/C	na / na	3 / 10	✓	✗
	/	/		
	/	/	9	4
	/	/	13	9

Present

For life forms with benchmark cover of < 10%, considered 'present' if:
- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if:
- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present')

For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either:
- ≥ 50% of the benchmark species diversity; or
- no reproductively-mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

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Vegetation Quality Field Assessment Sheet

Version 1.3 October 2004

Recruitment

Score 10

Category & Description			High diversity**	Low diversity**
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		≥ 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

* refer to EVC benchmark for clarification

^ treat multiple eucalypt canopy species as one species

* high diversity defined as ≥ 58% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (SS and tallies)	13

Logs

Score 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

\# absent if large log length is < 25% of EVC benchmark log length

Organic Litter

Score 3

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area

Score 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses

Neighbourhood

Score 7

Radius from site	% Native vegetation *	Weighting	
100 m	33	0.03	2
1 km	100	0.04	4
5 km	70	0.01	2.1
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7.1

* to nearest 10%

Multiply % native vegetation x Weighting for each radius from the core (eg. 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood value

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	0	5	15	15	10	3	5	8	7	4	72

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No. 3 | Location [illegible] | Date 16/2/13

Assessor(s) [illegible] | Map Name/No. | AMG / MGA

Tenure [illegible] | EVC Lowland Forest | Bioregion [illegible]

'Site Condition Score'

Large Trees — Score: 2

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) – see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 0

Category & Description	% Canopy Health *		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	(0)	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height – see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	5	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds – see EVC benchmark for guide.

High threat weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a *high impact* are considered *high threat* regardless of their invasiveness.

** If total weed cover is negligible (< 1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	1 / 1	1 / 5	✓	✓
T	5 / 3	- / 15	✗	—
MS	5 / 4	10 / 25	✓	✓
[illegible]	1 / 3	30 / 10	✓	✗
PS	2 / 1	2 / 1	✓	[illegible]
[illegible]	0 / 1	- / 1	✗	—
[illegible]	3 / 4	2 / 10	[illegible]	—
[illegible]	2 / 1	1 / 5	✓	✓
[illegible]	1 / 3	1 / 10	✓	✓
[illegible]	3 / 3	3 / 10	✓	✗
[illegible]	2 / 1	1 / 1	✓	✗
[illegible]	1 / 1	1 / 5	✓	✓
[illegible]	1 / 1	1 / 5	✓	✓
[illegible]	[illegible]	- / 10	✗	—
	/	/	10/14	[illegible]
	/	/		

Present: For life forms with benchmark cover of < 10%, considered 'present' if
- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if
- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present'): For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either:
- < 50% of the benchmark species diversity; or
- no reproductively-mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		Score
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria
The Place To Be

Vegetation Quality Field Assessment Sheet

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Recruitment

Score 6

Category & Description			High diversity*[1]	Low diversity*[2]
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		> 70%	10	5

+ 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).

^ refer to EVC benchmark for clarification.

[1] treat multiple eucalypt canopy species as one species.

[2] high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (25 and taller)	15

Logs

Score 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
> 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh.

* present if large log length is ≥ 25% of EVC benchmark log length.

absent if large log length is < 25% of EVC benchmark log length.

Organic Litter

Score 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score 2

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. ^ effectively most patches within fragmented landscapes.

Distance to Core Area

Score 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses

Neighbourhood

Score 7

Radius from site	% Native vegetation*	Weighting	
100 m	[illegible]	0.03	3
1 km	[illegible]	0.04	4
5 km	[illegible]	0.03	7
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
		Add Values and 'round-off'	14

* to nearest 20%.

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	0	15	15	6	5	5	8	14	4	67

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No: 4 Location: [illegible] Date: [illegible]

Assessor(s): [illegible] Map Name/No: AMG / MGA:

Tenure: State Forest EVC: [illegible] Bioregion: [illegible]

'Site Condition Score'

Large Trees

Score 4

Category & Description	*% Canopy Health**		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	(4)	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover

Score 5

Category & Description	*% Canopy Health **		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	(5)	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds

Score 15

Category & Description	*'high threat' weeds**		
	None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a 'high impact' are considered 'high threat' regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	2 / 3	<5 / 5	✓	✓
T	2 / 3	<5 / 15	✓	✓
MS	5 / 10	20 / 35	✓	✓
SS	5 / 2	5 / 5	✓	✓
TH	0 / 2	— / 1	×	—
MH	3 / 6	3 / 5	×	✓
SH	2 / 1	5 / 1		
LTG	1 / 2	/ 5	✓	
[illegible]	1 / 1	/ 5	✓	✓
MTG	3 / 4	<5 / 10	✓	✓
[illegible]	/ 1	2 / 1		
[illegible]	5 / 4	30 / 20		
TPT	1 / 1	/ 5		✓
[illegible]	/ 4	2 / 10		✓
[illegible]	[illegible]	8 / 20		
	/	/	[illegible]	[illegible]

Present	For life forms with benchmark cover of < 10%, considered 'present' if: • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if: • the life form occupies at least 10% of benchmark cover.
Modified (Apply only where life form is 'present')	For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either: • ≤ 50% of the benchmark species diversity; or • no reproductively-mature specimens are observed. For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either: • < 50% of benchmark cover; or • < 50% of benchmark species diversity; or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey

Score 20

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
> 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	15
> 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	(20)
	• of those present, none substantially modified	25

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Vegetation Quality Field Assessment Sheet

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Recruitment

Score: 15

Category & Description			High diversity**	Low diversity**
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events*	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		≥ 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

^ refer to EVC benchmark for clarification

~ treat multiple eucalypt canopy species as one species

** high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
Acacia [illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓

number of woody spp. in EVC benchmark (55 and taller)

Organic Litter

Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

Logs

Score: 4

Category & Description	Large logs present*	Large logs absent^
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

^ absent if large log length is < 25% of EVC benchmark log length

'Landscape Context Score'

Patch Size

Score: 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes

Distance to Core Area

Score: 2

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses

Neighbourhood

Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	50	0.03	3
1 km	100	0.04	4
5 km	70	0.03	2.1
subtract 2 if the neighbourhood is 'significantly disturbed'			0
Add Values and 'round-off'			7

* to nearest 10%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood value

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	14	5	15	20	15	5	4	8	7	4	82

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No. 5 | Location [illegible] | Date [illegible]

Assessor(s) [illegible] | Map Name/No. | AMG / MGA

Tenure State Forest | EVC Shrubby Dry Forest | Bioregion [illegible] Uplands

'Site Condition Score'

Large Trees

Score: 2

Category & Description	% Canopy Health* > 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Tree Canopy Cover

Score: 4

Category & Description	% Canopy Health * > 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds

Score: 15

Category & Description	'high threat' weeds* None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	15	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide

'high threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered 'high threat' regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	[illegible] / 1	[illegible] / 5	✓	✓
T	[illegible] / 1	– / 15	✓	–
MS	4 / 6	15 / 25	✓	✗
LS	18 / 5	5 / 15	✓	✗
MH	6 / 5	2 / 10	✓	✓
LTG	1 / 1	1 / 1	✓	✓
LNG	0 / 2	– / 5	✗	–
MTG	3 / 3	3 / 10	✓	✓
MNG	2 / 1	3 / 1	✓	✓
GF	0 / 2	– / 1	✗	–
SC	2 / 3	2 / 5	✓	✓
BL	[illegible]	5 / 10	✓	✓
S/C	[illegible]	0 / 10	✗	–
	/	/		
	/	/	9/13	5
	/	/		

Present	For life forms with benchmark cover of < 10%, considered 'present' if: • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if: • the life form occupies at least 10% of benchmark cover.
Modified (apply only where life form is 'present')	For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either: • < 50% of the benchmark species diversity; or • no reproductively-mature specimens are observed. For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either: • < 50% of benchmark cover; or • < 50% of benchmark species diversity; or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey

Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	15
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria
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Vegetation Quality Field Assessment Sheet

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Recruitment — Score: 6

Category & Description			High diversity*[1]	Low diversity*[2]
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment[3]	< 30%	3	1
		30 - 70%	6	3
		> 70%	10	5

+ 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

^ refer to EVC benchmark for clarification

[1] treat multiple eucalypt canopy species as one species

[2] high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (55 and taller)	19

Logs — Score: 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	1	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

absent if large log length is < 25% of EVC benchmark log length

Organic Litter — Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size — Score: 2

Category & Description	
< 3 ha	1
Between 3 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analysis eg. roading, cropping, grazing etc. – effectively most patches within fragmented landscapes

Distance to Core Area — Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analysis

Neighbourhood — Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	[illegible]	0.03	3
1 km	[illegible]	0.04	11
5 km	[illegible]	0.03	4
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7

* to nearest 10%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood value

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	4	5	5	6	5	5	2	7	4	71

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No. 6 Location [illegible] Track Date [illegible]

Assessor(s) [illegible] Map Name/No. ________ AMG / MGA ________

Tenure State Forest? EVC [illegible] Bioregion [illegible]

'Site Condition Score'

Large Trees

Score 2

Category & Description	*% Canopy Health**		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover

Score 4

Category & Description	*% Canopy Health **		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	(4)	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds

Score 15

Category & Description	*'high threat' weeds**		
	None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the Bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered high threat regardless of their invasiveness.

** If total weed cover is negligible (< 1%) and high threat weed species are present then score 13.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
T	1 / 5	[illegible] / 5	✓	[illegible]
[illegible]	0 / 1	— / 10	×	—
MS	3 / 6	[illegible] / 20	✓	[illegible]
SS	14 / 2	5 / 1	✓	[illegible]
PH?	4 / 5	2 / 5	✓	[illegible]
LTG	[illegible] / 1	1 / 1	✓	[illegible]
LNG?	0 / 3	— / 1	×	—
MTG	7 / 3	[illegible] / 15	✓	[illegible]
MH	2 / 1	[illegible] / 1	✓	[illegible]
SC?	0 / 2	— / 1	×	—
EC?	1 / 1	[illegible] / 5	✓	✓
BG?	[illegible] / [illegible]	3 / 10	✓	✓
S/C?	[illegible] / [illegible]	3 / [illegible]	✓	[illegible]
	/	/		
	/	/	10/13?	3/10?
	/	/		

Present

For life forms with benchmark cover of < 10%, considered 'present' if:

- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if:

- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present')

For life forms with benchmark cover of < 10%, then considered substantially 'modified' if the life form has either:

- < 50% of the benchmark species diversity; or
- no reproductively mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:

- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey

Score 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Vegetation Quality Field Assessment Sheet

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Recruitment — *Score* 6

Category & Description			High diversity**	Low diversity**
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment'	< 30%	3	1
		30 - 70%	(6)	3
		> 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).
^ refer to EVC benchmark for clarification.
' treat multiple eucalypt canopy species as one species.
** high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (3S and table)	[illegible]

Organic Litter — *Score* 3

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	(3)	2
≥ 50% or ≤ 150% of benchmark cover	5	4

Logs — *Score* 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	(5)	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh
* present if large log length is ≥ 25% of EVC benchmark log length.
\# absent if large log length is < 25% of EVC benchmark log length.

'Landscape Context Score'

Patch Size — *Score* 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	(8)
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area — *Score* 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	(4)

* defined as per RFA 'Old Growth' analyses.

Neighbourhood — *Score* 7

Radius from site	**% Native vegetation***	**Weighting**	
100 m	100	0.03	3
1 km	100	0.04	4
5 km	60	0.03	1.8
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
		Add Values and 'round-off'	7.4

* to nearest 20%.
Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood value.

Final Habitat Score

Component	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	**Total**
	'Site Condition Score'							'Landscape Context Score'			**100**
Score	2	4	15	15	6	3	5	8	7	4	69

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No. [illegible] Location [illegible] Date 5/4/12

Assessor(s) [illegible] Map Name/No. [illegible] AMG / MGA [illegible]

Tenure [illegible] EVC [illegible] Bioregion [illegible]

'Site Condition Score'

Large Trees — Score: 2

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
> the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 2

Category & Description	% Canopy Health *		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	1	(2)	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a 'high impact' are considered *high threat* regardless of their invasiveness.

** if total weed cover is negligible (< 1%) and high threat weed species are present then score '15'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
[illegible]				

Present	For life forms with benchmark cover of < 10%, considered 'present' if • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if • the life form occupies at least 10% of benchmark cover.
Modified (apply only where life form is 'present')	For life forms with benchmark cover of < 10%, then considered substantially 'modified' if the life form has either • < 50% of the benchmark species diversity, or • no reproductively-mature specimens are observed. For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either • < 50% of benchmark cover, or • < 50% of benchmark species diversity, or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria
The Place To Be

Vegetation Quality Field Assessment Sheet

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Recruitment

Score: 15

Category & Description			High diversity*^	Low diversity*^
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		≥ 70%	10	5

- 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).
* refer to EVC benchmark for clarification.
^ treat multiple eucalypt canopy species as one species.
* high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (SS and tallest)	12

Logs

Score: 5

Category & Description	Large logs present*	Large logs absent*
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large log diameter.
* present if large log length is ≥ 25% of EVC benchmark log length.
# absent if large log length is < 25% of EVC benchmark log length.

Organic Litter

Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score: 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area

Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses.

Neighbourhood

Score: 7

Radius from site	% Native vegetation *	Weighting	
100 m	100	0.03	3
1 km	80	0.04	3
5 km	80	0.03	2.4
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7.4

* to nearest 20%.
Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	2	15	15	10	5	5	8	7	4	73

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: 9 Location: [illegible] Date: 27/3/13

Assessor(s): [illegible] Map Name/No: AMG / MGA:

Tenure: State Forest EVC: Shrubby Dry Forest Bioregion: [illegible]

'Site Condition Score'

Large Trees — *Score* 2

Category & Description	% Canopy Health* > 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Tree Canopy Cover — *Score* 4

Category & Description	% Canopy Health * > 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	(4)	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Lack of Weeds — *Score* 15

Category & Description	'high threat' weeds* None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered high threat regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
LT	3 / 4	15 / 15	✓	✗
T	1 / 1	3 / 30	✓	✓
MS	0 / 1	15 / 30	✓	✗
SS	1 / 2	5 / [illegible]	✓	✗
ASH	1 / 5	2 / 8	✓	✓
LTG	[illegible] / 1	3 / 1	✓	✗
LNG	0 / 2	– / 10	✗	–
MTG	2 / 3	10 / 10	✓	✗
MNG	0 / 1	– / 1	✗	–
GF	1 / 2	1 / 5	✓	✗
SC	1 / 3	1 / 5	✓	✓
BL	na / na	4 / 10	✓	✓
S/C	na / na	3 / 10	✓	✓
	/	/		
	/	/	11/13	5/11

Present

For life forms with benchmark cover of < 10%, considered 'present' if:
- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if:
- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present')

For life forms with benchmark cover of < 10%, then considered substantially 'modified' if the life form has either:
- < 50% of the benchmark species diversity; or
- no reproductively-mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey — *Score* 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria The Place To Be

Vegetation Quality Field Assessment Sheet

Version 1.3 October 2004

Recruitment

Score: 6

Category & Description			High diversity**	Low diversity**
No evidence of a recruitment cohort*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		≥ 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).

^ refer to EVC benchmark for clarification.

" treat multiple eucalypt canopy species as one species.

* high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (55 and taller)	10

Organic Litter

Score: 3

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

Logs

Score: 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh.

* present if large log length is ≥ 25% of EVC benchmark log length.

absent if large log length is < 25% of EVC benchmark log length.

'Landscape Context Score'

Patch Size

Score: 6

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analysis eg. roading, coupes, grazing etc. - effectively most patches within fragmented landscapes.

Distance to Core Area

Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analysis.

Neighbourhood

Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	100	0.03	3
1 km	100	0.04	4
5 km	60	0.03	2
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7

* to nearest 20%.

^ Multiply % native vegetation x Weighting for each radius from the core (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	4	15	15	6	3	5	8	7	4	69

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: [illegible] Location: [illegible] Date: 29/9/1

Assessor(s): [illegible] Map Name/No: AMG / MGA

Tenure: [illegible] EVC: [illegible] Bioregion: [illegible]

'Site Condition Score'

Large Trees — Score: 3

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	(3)	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 2

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	(2)	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy from species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a 'high impact are considered 'high threat' regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
[illegible]	2 / 5	5 / 5	✓	✓
[illegible]	3 / 4	5 / 15	✓	✓
[illegible]	1 / 3	5 / 25	✓	✓
[illegible]	0 / 2	0 / 5	✓	✓
[illegible]	0 / 1	- / 1	x	-
[illegible]	2 / 3	- / 1	-	-
[illegible]	1 / 9	5 / 10	✓	✓
[illegible]	1 / 5	5 / 5	✓	✓
[illegible]	1 / 4	5 / 10	✓	-
[illegible]	1 / 1	10 / 3	✓	✓
[illegible]	4 / 14	15 / -	✓	x
[illegible]	1 / 2	5 / 3	✓	x
[illegible]	1 / 5	2 / 15	✓	x
[illegible]	0 / 1	- / 1	-	-
[illegible]	3 / 3	1 / 10	✓	-
[illegible]	[illegible]	[illegible]	✓	✓

Present — For life forms with benchmark cover of < 10%, considered 'present' if:
- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if:
- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present') — For life forms with benchmark cover of < 50%, then considered substantially 'modified' if the life form has either:
- < 50% of the benchmark species diversity; or
- no reproductively mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity, or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
> 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

Victoria
The Place To Be

Vegetation Quality Field Assessment Sheet

Version 1.3 October 2004

Recruitment — *Score* 6

Category & Description			High diversity*[1]	Low diversity*[1]
No evidence of a recruitment 'cohort'=	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life form	proportion of native woody species present that have adequate recruitment^	< 30%	3	1
		30 - 70%	(6)	3
		> 70%	10	5

= 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

^ refer to EVC benchmark for clarification

[1] treat multiple eucalypt canopy species as one species

* high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	✓
[illegible]	
[illegible]	
[illegible]	
[illegible]	✓
number of woody spp. in EVC benchmark (SS and taller)	[illegible]

8
14

Organic Litter — *Score* 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	(5)	4

Logs — *Score* 4

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	(4)

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

\# absent if large log length is < 25% of EVC benchmark log length

'Landscape Context Score'

Patch Size — *Score* 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	(8)
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes

Distance to Core Area — *Score* 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	(4)

* defined as per RFA 'Old Growth' analyses

Neighbourhood — *Score* 7

Radius from site	% Native vegetation*	Weighting	
100 m	[illegible]	0.03	3
1 km	[illegible]	0.04	[illegible]
5 km	[illegible]	0.03	[illegible]
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
		Add Values and 'round-off'	[illegible]

* to nearest 10%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood Value

Final Habitat Score

Component	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	Total
	'Site Condition Score'							'Landscape Context Score'			100
Score	3	2	15	15	6	5	4	8	7	4	69

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: 13 [illegible] Location: [illegible] Date: [illegible]

Assessor(s): [illegible] Map Name/No: AMG / MGA:

Tenure: State Forest EVC: [illegible] Bioregion: [illegible]

'Site Condition Score'

Large Trees

Score 1

Category & Description	*% Canopy Health**		
	> 70%	*30-70%*	*< 30%*
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	(1)
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover

Score 0

Category & Description	*% Canopy Health **		
	> 70%	*30-70%*	*< 30%*
< 10% of benchmark cover	0	(0)	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds

Score 15

Category & Description	*'High threat' weeds**		
	None	*≤ 50%*	*> 50%*
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered 'high threat' regardless of their invasiveness.

** If total weed cover is negligible (< 1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	0 / 3	— / 15	×	—
T	0 / [illegible]	— / 10	×	—
MS	4 / [illegible]	35 / 25	✓	×
SS	[illegible]	10 / 10	✓	×
PS	1 / 1	[illegible]	✓	×
TS	0 / 1	— / 1	×	
MH	3 / 4	1 / 15	✓	✓
LH	[illegible]	[illegible]	✓	✓
LH	[illegible]	[illegible]	✓	×
MTG	[illegible]	[illegible]	✓	✓
MNG	[illegible]	[illegible]	✓	×
GF	[illegible]	[illegible]	✓	×
SC	[illegible]	[illegible]	✓	×
BF	[illegible]	[illegible]		
	/	/	[illegible]	[illegible]
	/	/		

Present	For life forms with benchmark cover of < 10%, considered 'present' if • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if • the life form occupies at least 10% of benchmark cover.
Modified (apply only where life form is 'present')	For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either • < 50% of the benchmark species diversity; or • no reproductively mature specimens are observed. For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either • < 50% of benchmark cover; or • < 50% of benchmark species diversity; or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey

Score 15

Category & Description		
All strata and life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

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Recruitment

Score: 6

Category & Description			High diversity*'	Low diversity*'
No evidence of a recruitment 'cohort'+	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment'	< 30%	1	1
		30 - 70%	(6)	3
		> 70%	10	5

+ 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)
^ refer to EVC benchmark for clarification
' treat multiple eucalypt canopy species as one species
* high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	[illegible]
[illegible]	✓
[illegible]	–
[illegible]	✓
[illegible]	✓
[illegible]	–
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (SS and table)	[illegible]

Organic Litter

Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	(5)	4

Logs

Score: 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh
* present if large log length is ≥ 25% of EVC benchmark log length
# absent if large log length is < 25% of EVC benchmark log length

'Landscape Context Score'

Patch Size

Score: 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
> 20 ha, but 'significantly disturbed'*	(8)
> 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, logging, grazing etc. – effectively most patches within fragmented landscapes

Distance to Core Area

Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	(4)

* defined as per RFA 'Old Growth' analyses.

Neighbourhood

Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	[illegible]	0.03	[illegible]
1 km	[illegible]	0.04	[illegible]
5 km	[illegible]	0.03	[illegible]
	subtract 2 if the neighbourhood is 'significantly disturbed'		[illegible]
		Add Values and 'round-off'	[illegible]

* to nearest 20%
Multiply % native vegetation x Weighting for each radius from the zone (eg: 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood Value

Final Habitat Score

Component	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	Total
	'Site Condition Score'							'Landscape Context Score'			100
Score	1	0	15	15	6	5	5	8	7	4	66

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No. 14_12 Location 2 mile Date 5/4/13

Assessor(s) Chris - KH + KS Map Name/No. AMG / MGA

Tenure St H Forest EVC Lowland Forest Bioregion EG Uplands

'Site Condition Score'

Large Trees — Score: 2

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present.	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 5

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	(5)	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	≤ 50%	> 50%
> 50% cover of weeds	9	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for good.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC, in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a *high impact* are considered *high threat* regardless of their invasiveness.

** if total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)

Present

For life forms with benchmark cover of < 10%, considered 'present' if

- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if

- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present')

For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either:

- < 50% of the benchmark species diversity, or
- no reproductively mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:

- < 50% of benchmark cover, or
- < 50% of benchmark species diversity, or
- ≤ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≤ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

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Recruitment

Score 6

Category & Description			High diversity*^	Low diversity*^
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment*	< 30%	3	3
		30 - 70%	6	4
		> 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

* refer to EVC benchmark for clarification

^ treat multiple eucalypt canopy species as one species

^ high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
	✓
	✓
	✓
	✓
	✓
	✓
	✓
	✓
	✓
number of woody spp. in EVC benchmark (55 and rising)	12

Logs

Score 5

Category & Description	Large logs present*	Large logs absent#
> 10% of benchmark length	0	0
< 50% of benchmark length	1	2
≥ 50% of benchmark length	3	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

absent if large log length is < 25% of EVC benchmark log length

Organic Litter

Score 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score 2

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
> 20 ha, but 'significantly disturbed'*	8
> 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. - effectively most patches within fragmented landscapes

Distance to Core Area

Score 11

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses

Neighbourhood

Score 7

Radius from site	% Native vegetation *	Weighting	
100 m	100	0.03	3
1 km	100	0.04	4
5 km	80	0.01	0.8
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7

* to nearest 20%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.01 = 1.2), then add values to obtain final Neighbourhood Value

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	5	15	15	6	5	5	2	7	11	72

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No: [illegible] Location: [illegible] Date: 26/4/13

Assessor(s): [illegible] Map Name/No: [illegible] AMG / MGA: [illegible]

Tenure: [illegible] EVC: [illegible] Bioregion: [illegible]

'Site Condition Score'

Large Trees — Score: 2

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	(2)	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Tree Canopy Cover — Score: 2

Category & Description	% Canopy Health *		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	(2)	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	5	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to high threat weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous "natives") with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered high threat regardless of their invasiveness.

** If total weed cover is negligible (<1%) and high threat weed species are present then score '13'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
[illegible]				

Present

For life forms with benchmark cover of < 10%, considered 'present' if:
- any specimens are observed

For life forms with benchmark cover of > 10%, considered 'present' if:
- the life form occupies at least 10% of benchmark cover

Modified (apply only where life form is 'present')

For life forms with benchmark cover of < 10%, then considered substantially 'modified' if the life form has either:
- < 50% of the benchmark species diversity; or
- no reproductively mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
> 50% to 90% of Life forms present	• of those present, > 50% substantially modified	10
	• of those present, < 50% substantially modified	(15)
> 90% of Life forms present	• of those present, > 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

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Recruitment

Score: 3

Category & Description			High diversity*	Low diversity*
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	9	9
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment^	< 30%	3	1
		30 - 70%	6	3
		> 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episodic 'cohort' include suppressed canopy species individuals)

^ refer to EVC benchmark for clarification.

' treat multiple eucalypt canopy species as one species.

* high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓

number of woody spp. in EVC benchmark (55 and taller): 5

Organic Litter

Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

Logs

Score: 2

Category & Description	Large logs present*	Large logs absent^
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large tree dbh

* present if large log length is ≥ 25% of EVC benchmark log length

^ absent if large log length is < 25% of EVC benchmark log length

'Landscape Context Score'

Patch Size

Score: 8

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coppice, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area

Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analysis.

Neighbourhood

Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	100	0.03	3
1 km	100	0.04	4
5 km	80	0.03	2.4
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
		Add Values and 'round-off'	7.4

* to nearest 20%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	2	2	15	15	6	5	2	8	7	4	63

Vegetation Quality Field Assessment Sheet

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Department of Sustainability and Environment

Site Name/No: 16 Location: [illegible] Date: [illegible]

Assessor(s): [illegible] Map Name/No: AMG / MGA

Tenure: [illegible] EVC: [illegible] Bioregion: [illegible]

'Site Condition Score'

Large Trees — Score: 0

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	3	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Tree Canopy Cover — Score: 5

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	5	4	3

Tree canopy is defined as those canopy tree species reaching > 80% of mature height - see EVC benchmark description.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation).

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	< 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	15	11	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a high impact are considered 'high threat' regardless of their invasiveness.

** if total weed cover is negligible (< 1%) and high threat weed species are present then score '11'.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	—
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	—	—
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	—
[illegible]	[illegible]	[illegible]	—	—
[illegible]	[illegible]	[illegible]	—	—
[illegible]	[illegible]	[illegible]	✓	✓
[illegible]	[illegible]	[illegible]	✓	✓
			[illegible]	[illegible]

Present: For life forms with benchmark cover of < 10%, considered 'present' if:
- any specimens are observed.

For life forms with benchmark cover of ≥ 10%, considered 'present' if:
- the life form occupies at least 10% of benchmark cover.

Modified (apply only where life form is 'present'): For life forms with benchmark cover of < 10%, then considered substantially 'modified' if the life form has either:
- < 50% of the benchmark species diversity; or
- no reproductively-mature specimens are observed.

For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either:
- < 50% of benchmark cover; or
- < 50% of benchmark species diversity; or
- ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively-mature specimens is < 10% of the benchmark cover.

Understorey — Score: 15

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
> 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	15
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	20
	• of those present, none substantially modified	25

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Recruitment

Score: 3

Category & Description			High diversity*[1]	Low diversity*[1]
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events*	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life form	proportion of native woody species present that have adequate recruitment*	< 30%	3	3
		30 - 70%	6	3
		≥ 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals)

[1] refer to EVC benchmark for clarification

[2] treat multiple eucalypt canopy species as one species

* high diversity defined as ≥ 50% of benchmark woody species diversity

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
[illegible]	✓
number of woody spp. in EVC benchmark (SS and taller)	11

Logs

Score: 4

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large log dbh

* present if large log length is ≥ 25% of EVC benchmark log length

absent if large log length is < 25% of EVC benchmark log length

Organic Litter

Score: 5

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
< 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score: 4

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analysis eg. roading, coupes, grazing etc. - effectively most patches within fragmented landscapes

Distance to Core Area

Score: 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
> 5 km	0	0
1 to 5 km	2	1
< 1 km	4	2
contiguous	5	4

* defined as per RFA 'Old Growth' analysis

Neighbourhood

Score: 7

Radius from site	% Native vegetation*	Weighting	
100 m	[illegible]	0.03	[illegible]
1 km	[illegible]	0.04	[illegible]
5 km	[illegible]	0.03	[illegible]
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		74

* to nearest 20%

Multiply % native vegetation x Weighting for each radius from the zone (eg. 40% x 0.03 = 1.2); then add values to obtain final Neighbourhood value

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	10	5	15	15	6	5	5	8	7	4	69

Vegetation Quality Field Assessment Sheet

Version 1.3 - October 2004

Department of Sustainability and Environment

Site Name/No: 17   Location: Tomato Track   Date: 5/4/13

Assessor(s): Ettros - A.H. + K.S.   Map Name/No: AMG / MGA:

Tenure: State Forest   EVC: Shrubby Dry Forest   Bioregion: EG Lowlands

'Site Condition Score'

Large Trees — Score: 3

Category & Description	% Canopy Health*		
	> 70%	30-70%	< 30%
None present	0	0	0
> 0 to 20% of the benchmark number of large trees/ha	3	2	1
> 20% to 40% of the benchmark number of large trees/ha	4	(3)	2
> 40% to 70% of the benchmark number of large trees/ha	6	5	4
> 70% to 100% of the benchmark number of large trees/ha	8	7	6
≥ the benchmark number of large trees/ha	10	9	8

Large trees are defined by diameter at breast height (dbh) - see EVC benchmark.

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Tree Canopy Cover — Score: 5

Category & Description	% Canopy Health *		
	> 70%	30-70%	< 30%
< 10% of benchmark cover	0	0	0
< 50% or > 150% of benchmark cover	3	2	1
≥ 50% or ≤ 150% of benchmark cover	(5)	4	3

Tree canopy is defined as those canopy tree species reaching ≥ 80% of mature height - see EVC benchmark description

* Estimate proportion of an expected healthy canopy cover that is present (i.e. not missing due to tree death or decline, or mistletoe infestation)

Lack of Weeds — Score: 15

Category & Description	'high threat' weeds*		
	None	≤ 50%	> 50%
> 50% cover of weeds	4	2	0
25 - 50% cover of weeds	7	6	4
5 - 25% cover of weeds	11	9	7
< 5% cover of weeds**	(15)	13	11

* proportion of weed cover due to 'high threat' weeds - see EVC benchmark for guide.

'High threat' weed species are defined as those introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.

The EVC benchmark lists typical weed species for the EVC in the bioregion and provides an estimate of their 'invasiveness' and 'impact'. In general, those weed species considered to have a *high impact* are considered *high threat* regardless of their invasiveness.

** if total weed cover is negligible (< 1%) and high threat weed species are present then score 13.

Understorey Life forms

LF Code from EVC benchmark	# spp observed / Benchmark spp.	% cover observed / Benchmark % cover	Present (✓)	Modified (✓)
IT	2 / 11	15 / 5	✓	✗
T	2 / 1	12 / 15	✓	✗
MS	1 / 2	12 /	✓	✓
SS	1 / 2	1 / 5	✓	
MH	3 / 5	2 / 3	✓	✓
LH	3 / 1	2 / 1	✓	
LNG	1 / 2	10 / 15	✓	
MTG	3 / 3	5 /	✓	✓
[illegible]	2 / 1	5 /	✓	
GF	2 / 2	2 / 1	✓	
SC	2 / 3	1 / 3	✓	
BL	10 / [illegible]	10 / [illegible]	✓	
[illegible]	[illegible]	[illegible]	✓	
	/	/		
	/	/	[illegible]	[illegible]
	/	/		

Present	For life forms with benchmark cover of < 10%, considered 'present' if: • any specimens are observed. For life forms with benchmark cover of ≥ 10%, considered 'present' if: • the life form occupies at least 10% of benchmark cover.
Modified (apply only where life form is 'present')	For life forms with benchmark cover of <10%, then considered substantially 'modified' if the life form has either: • ≤ 50% of the benchmark species diversity; or • no reproductively mature specimens are observed. For life forms with benchmark cover of ≥ 10%, then considered substantially 'modified' if the life form has either: • < 50% of benchmark cover; or • < 50% of benchmark species diversity; or • ≥ 50% of benchmark cover due largely to immature canopy specimens but the cover of reproductively mature specimens is < 10% of the benchmark cover.

Understorey — Score: 20

Category & Description		
All strata and Life forms effectively absent		0
Up to 50% of life forms present		5
≥ 50% to 90% of Life forms present	• of those present, ≥ 50% substantially modified	10
	• of those present, < 50% substantially modified	15
≥ 90% of Life forms present	• of those present, ≥ 50% substantially modified	15
	• of those present, < 50% substantially modified	(20)
	• of those present, none substantially modified	25

Victoria The Place To Be

Vegetation Quality Field Assessment Sheet

Version 1.3 October 2004

Recruitment

Score 6

Category & Description			High diversity*^	Low diversity*^
No evidence of a recruitment 'cohort'*	within EVC not driven by episodic events		0	0
	within EVC driven by episodic events^	clear evidence of appropriate episodic event	0	0
		no clear evidence of appropriate episodic event	5	5
Evidence of at least one recruitment 'cohort' in at least one life-form	proportion of native woody species present that have adequate recruitment*	< 30%	3	1
		30 - 70%	6	3
		≥ 70%	10	5

* 'cohort' refers to a group of woody plants established in a single episode (can include suppressed canopy species individuals).

^ refer to EVC benchmark for clarification.

* treat multiple eucalypt canopy species as one species.

* high diversity defined as ≥ 50% of benchmark woody species diversity.

Species Recruitment

Woody species recorded in habitat zone	Adequate Recruitment (✓)
Eucalypt canopy (combined species)	✓
	✓
	✓
	✓
	✓
	✓
	✓
	✓
	✓
number of woody spp. in EVC benchmark (55 and taller)	10

Logs

Score 5

Category & Description	Large logs present*	Large logs absent#
< 10% of benchmark length	0	0
< 50% of benchmark length	3	2
≥ 50% of benchmark length	5	4

Large logs defined as those with diameter ≥ 0.5 of benchmark large log diameter.

* present if large log length is ≥ 25% of EVC benchmark log length.

absent if large log length is < 25% of EVC benchmark log length.

Organic Litter

Score 3

Category & Description	Dominated by native organic litter	Dominated by non-native organic litter
< 10% of benchmark cover	0	0
≤ 50% or > 150% of benchmark cover	3	2
≥ 50% or ≤ 150% of benchmark cover	5	4

'Landscape Context Score'

Patch Size

Score 2

Category & Description	
< 2 ha	1
Between 2 and 5 ha	2
Between 5 and 10 ha	4
Between 10 and 20 ha	6
≥ 20 ha, but 'significantly disturbed'*	8
≥ 20 ha, but not 'significantly disturbed'*	10

* 'significantly disturbed' defined as per RFA 'Old Growth' analyses eg. roading, coupes, grazing etc. – effectively most patches within fragmented landscapes.

Distance to Core Area

Score 4

Distance	Core Area not significantly disturbed*	Core Area significantly disturbed*
≥ 5 km	0	0
1 to 5 km	2	1
< 1 km	4	3
contiguous	5	4

* defined as per RFA 'Old Growth' analyses.

Neighbourhood

Score 7

Radius from site	% Native vegetation*	Weighting	
100 m	30	0.03	3
1 km	80	0.04	3
5 km	60	0.03	2
	subtract 2 if the neighbourhood is 'significantly disturbed'		-2
	Add Values and 'round-off'		7

* to nearest 20%

Multiply % native vegetation x Weighting for each radius from the core (eg. 40% x 0.03 = 1.2), then add values to obtain final Neighbourhood Value.

Final Habitat Score

Component	'Site Condition Score'							'Landscape Context Score'			Total
	Large Trees	Tree Canopy Cover	Lack of Weeds	Understorey	Recruitment	Organic Litter	Logs	Patch Size	Neighbourhood	Distance to Core Area	100
Score	3	5	15	20	6	3	5	2	7	4	75

9.4 Appendix 4: Flora species list recorded by Ethos NRM, April 2013

Status	Species	Common Name	Lifeform	Survey Sample Sites														
				1	2	3, 11	4	5	6	7, 13	8, 12	9	10	11	14	15	16	17	Other
	Acacia dealbata	Silver Wattle	T															X	
	Acacia longifolia	Sallow Wattle	T			X				X				X				X	
	Acacia myrtifolia	Myrtle Wattle	MS			X								X					
	Acacia terminalis	Sunshine Wattle	MS																X
	Acacia verniciflua	Varnish Wattle	MS					X											
	Acacia verticillata	Prickly Moses	MS						X										
	Acrotriche serrulata	Honey-pots	PS	X					X	X		X			X			X	
	Adiantum aethiopicum	Common Maidenhair	GF				X			X	X		X		X			X	
	Allocasuarina littoralis	Black Sheoak	T									X						X	
	Amperea xiphoclada	Broom Spurge	SS							X					X				
	Anisopogon avenaceus	Oat Spear-grass	LTG						X			X							
	Australina pusilla	Shade Nettle	MH														X		
	Austrodanthonia spp.	Wallaby-grass	MTG	X	X			X	X										
	Austrostipa spp.	Spear-grass	MTG			X				X				X	X			X	
	Bedfordia arborescens	Blanket Leaf	T														X		
r	Beyeria lasiocarpa	Wallaby-bush	MS																X
	Billardiera scandens	Common Apple-berry	SC	X	X	X	X	X	X	X		X	X	X	X			X	
	Blechnum cartilagineum	Gristle Fern	GF				X				X		X			X			X
	Blechnum nudum	Fishbone Water-fern	GF								X								X
	Burchardia umbellata	Milkmaids	MH							X					X			X	
	Bursaria spinosa subsp. spinosa	Sweet Bursaria	MS										X						
	Cassinia aculeata	Common Cassinia	MS	X	X	X		X	X	X		X		X	X		X	X	
	Cassinia longifolia	Shiny Cassinia	MS	X			X	X	X	X	X		X		X	X	X	X	
	Clematis glycinoides	Forest Clematis	SC				X			X					X	X	X	X	
	Comesperma ericinum	Heath Milkwort	MS						X										
*	*Conyza spp.*	Fleabane	MH																X
	Coprosma quadrifida	Prickly Currant-bush	MS				X				X		X			X	X		
	Correa reflexa	Common Correa	MS																X
	Cyathea australis	Rough Tree-fern	TF				X			X					X	X			X
	Dampiera stricta	Blue Dampiera	SS			X		X	X	X		X		X	X			X	
	Daviesia leptophylla	Narrow-leaf Bitter-pea	MS		X	X	X	X	X	X	X	X		X	X			X	

Status	Species	Common Name	Lifeform	Survey Sample Sites															
				1	2	3, 11	4	5	6	7, 13	8, 12	9	10	11	14	15	16	17	Other
	Deyeuxia quadriseta	Reed Bent-grass	LTG			X	X			X				X	X			X	
	Dianella caerulea	Paroo Lily	MTG	X		X		X	X	X		X		X	X			X	
	Dianella revoluta	Black-anther Flax-lily	MTG									X							
	Dichelachne spp.	Plume Grass	MTG			X		X						X				X	
	Dichondra repens	Kidney-weed	SH														X		
	Dillwynia glaberrima	Smooth Parrot-pea	SS									X							
	Echinopogon ovatus	Common Hedgehog-grass	MNG						X										X
	Elaeocarpus reticulatus	Blue Oliveberry	T				X				X		X			X	X		X
	Epacris impressa	Common Heath	MS			X		X	X	X	X	X	X	X	X			X	
	Eucalyptus baxteri	Brown Stringybark	T/IT	X	X				X										
	Eucalyptus bridgesiana	But But	T/IT									X						X	
	Eucalyptus consideniana	Yertchuk	T/IT	X	X			X	X			X						X	
	Eucalyptus croajingalensis	Gippsland Peppermint	T/IT				X						X						
	Eucalyptus cypellocarpa	Mountain Grey-gum	T/IT	X			X	X			X		X			X			X
	Eucalyptus elata	River Peppermint	T/IT										X						
	Eucalyptus globoidea	White Stringybark	T/IT	X		X				X				X		X			
r	Eucalyptus mackintii	Gippsland Stringybark	T/IT															X	
	Eucalyptus macrorhyncha	Red Stringybark	T/IT					X	X			X						X	
	Eucalyptus mannifera	Brittle Gum	T/IT		X			X											
	Eucalyptus obliqua	Messmate	T/IT				X	X		X	X		X		X	X			
r	Eucalyptus polyanthemos subsp. longior	Forest Red Box	T/IT						X										
	Eucalyptus sieberi	Silvertop Ash	T/IT	X		X				X				X	X				
	Eucalyptus tricarpa	Red Ironbark	T/IT		X	X		X	X					X				X	
	Euchiton spp.	Cudweed	MH					X					X						
	Eustrephus latifolius	Wombat Berry	SC													X	X		
	Exocarpos cupressiformis	Cherry Ballart	T	X														X	
	Gahnia clarkei	Tall Saw-sedge	LTG														X		
	Gahnia sieberiana	Red-fruit Saw-sedge	LTG			X								X					
	Gahnia spp.	Saw-sedge	MTG	X	X		X		X	X	X	X			X				
	Galium spp.	Bedstraw	MH							X	X				X				
	Glycine clandestina	Twining Glycine	SC	X			X	X											
	Gonocarpus spp.	Raspwort	MH				X			X					X				

Status	Species	Common Name	Lifeform	Survey Sample Sites															
				1	2	3, 11	4	5	6	7, 13	8, 12	9	10	11	14	15	16	17	Other
	Gonocarpus teucroides	Germander Raspwort	MH	X		X		X	X	X	X		X	X	X			X	
	Goodenia ovata	Hop Goodenia	MS	X	X		X	X			X		X			X		X	
	Gratiola peruviana	Austral Brooklime	MH				X						X						
	Hakea eriantha	Tree Hakea	MS	X															
	Hardenbergia violacea	Purple Coral-pea	SC										X						
	Helichrysum leucopsidum	Satin Everlasting	MH			X								X					
	Hibbertia aspera	Rough Guinea Flower	SS	X		X		X		X	X	X	X	X	X			X	
	Hibbertia crinita	Hoary Guinea-flower	SS																X
	Hibbertia empetrifolia	Tangled Guinea-flower	SS	X				X		X					X				
	Hibbertia obtusifolia	Grey Guinea-flower	SS					X	X	X		X			X			X	
	Hydrocotyle laxiflora	Stinking Pennywort	SH				X												
	Hydrocotyle spp.	Pennywort	SH							X			X		X				
	Hypericum gramineum	Small St John's Wort	MH	X						X		X	X		X			X	
*	*Hypochaeris radicata*	Flatweed	MH				X			X					X			X	
	Indigofera australis	Austral Indigo	MS									X							
	Joycea pallida	Silvertop Wallaby-grass	LTG			X		X		X				X	X				
	Juncus pauciflorus	Loose-flower Rush	MTG																X
	Kunzea ericoides spp. agg.	Burgan	MS				X			X		X	X		X			X	
	Lagenophora spp.	Bottle-daisy	MH							X		X			X	X			
	Lastreopsis acuminata	Shiny Shield-fern	GF				X				X		X						
	Lepidosperma filiforme	Common Rapier-sedge	MTG	?	X				X	X		X			X				
	Lepidosperma laterale	Variable Sword-sedge	MTG	X		X	X					X		X		X		X	X
	Leptospermum brevipes	Slender Tea-tree	MS									X							
	Leptospermum continentale	Prickly Tea-tree	MS							X					X			X	
r	*Leptospermum trinervium*	Paperbark Tea-tree	MS									X	X						
	Leptostigma reptans	Dwarf Nertera	SH				X												
	Lobelia anceps	Angled Lobelia	MH				X												
	Lomandra filiformis	Wattle Mat-rush	MTG	X				X	X										
	Lomandra longifolia	Spiny-headed Mat-rush	LTG		X	X	X	X	X	X	X	X	X	X	X			X	
	Lomatia fraseri	Tree Lomatia	MS										X						
	Lomatia ilicifolia	Holly Lomatia	SS							X					X				
	Luzula spp.	Wood-rush	MTG				X						X						X

Status	Species	Common Name	Lifeform	Survey Sample Sites															
				1	2	3, 11	4	5	6	7, 13	8, 12	9	10	11	14	15	16	17	Other
	Microlaena stipoides	Weeping Grass	MNG		X	X		X	X	X				X	X		X	X	
r	Nicotiana suaveolens	Austral Tobacco	MH														X		
	Notelaea ligustrina	Privet Mock-olive	MS																X
	Notelaea venosa	Large Mock-olive	MS														X		X
	Olearia lirata	Snowy Daisy-bush	MS				X			X	X		X		X		X		X
	Olearia spp.	Daisy-bush	MS			X								X					
	Opercularia spp.	Stinkweed	MH	X				X	X										
	Opercularia spp.	Stinkweed	SH				X						X						
	Oxalis spp.	Wood-sorrel	SH				X			X			X		X	X			
	Ozothamnus cuneifolius	Wedge-leaf Everlasting	MS			X		X						X		X			
	Pandorea pandorana	Wonga Vine	SC								X					X	X		
	Patersonia glabrata	Leafy Purple-flag	MTG					X				X							
	Persoonia chamaepeuce	Dwarf Geebung	PS									X							
	Persoonia confertiflora	Cluster-flower Geebung	MS	X					X										
r	Persoonia levis#	Smooth Geebung	MS									X							
	Persoonia linearis	Narrow-leaf Geebung	MS	X	X	X		X	X	X		X		X	X				
	Pimelea humilis	Common Rice-flower	SS	X				X	X										
	Platylobium obtusangulum	Common Flat-pea	PS										X						
	Platysace lanceolata	Shrubby Platysace	MS			X				X				X	X			X	
	Poa spp.	Tussock-grass	MTG	X				X	X		X		X			X		X	
	Poa spp.	Tussock-grass (branched)	MTG										X						
	Polystichum proliferum	Mother Shield-fern	GF														X		
	Pomaderris aspera	Hazel Pomaderris	T														X		
	Pomaderris spp.	Smooth Pomaderris	MS																X
	Pomax umbellata	Pomax	SS			X								X					
	Prostanthera hirtula	Hairy Mint-bush	MS			X				X				X	X				
	Pteridium esculentum	Austral Bracken	GF			X	X			X	X	X	X	X	X	X		X	
	Pultenaea daphnoides	Large-leaf Bush-pea	MS	X		X		X		X			X	X	X				
	Pultenaea retusa	Blunt Bush-pea	SS							X		X			X				
	Rhytidosporum procumbens	White Marianth	SS		X	X		X	X					X				X	
*	*Rubus fruticosus spp. agg.*	Blackberry	SC					X											
	Senecio spp.	Groundsel	MH					X											

Status	Species	Common Name	Lifeform	Survey Sample Sites															
				1	2	3, 11	4	5	6	7, 13	8, 12	9	10	11	14	15	16	17	Other
	Smilax australis	Austral Sarsaparilla	SC														X		
	Solanum prinophyllum	Forest Nightshade	MH			X								X			X		
	Stypandra glauca	Nodding Blue-lily	MH		X			X	X	X					X				
	Syzygium smithii	Lilly Pilly	T														X		
*	Taraxicum officinale spp. agg.	Dandelion	MH			X							X	X					
	Tetrarrhena juncea	Forest Wire-grass	LNG			X	X	X	X	X				X	X			X	
	Tetratheca pilosa	Hairy Pink-bells	SS		X		X	X	X			X							
	Tylophora barbata	Bearded Tylophora	SC	X			X									X	X		
	Veronica spp.	Speedwell;	MH	X									X			X			
	Viola betonicifolia	Showy Violet	MH																X
	Viola hederacea	Ivy-leaf Violet	MH				X			X			X		X	X		X	
	Wahlenbergia spp.	Bluebell	MH		X			X	X				X					X	
	Xanthorrhoea minor	Small Grass-tree	LTG	X					X	X		X			X				
		unidentified orchid	SH							X					X				

Status: r = rare in Victoria (DSE, 2005). * = Weed species

9.5 Appendix 5: EPBC Protected Matters Search

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

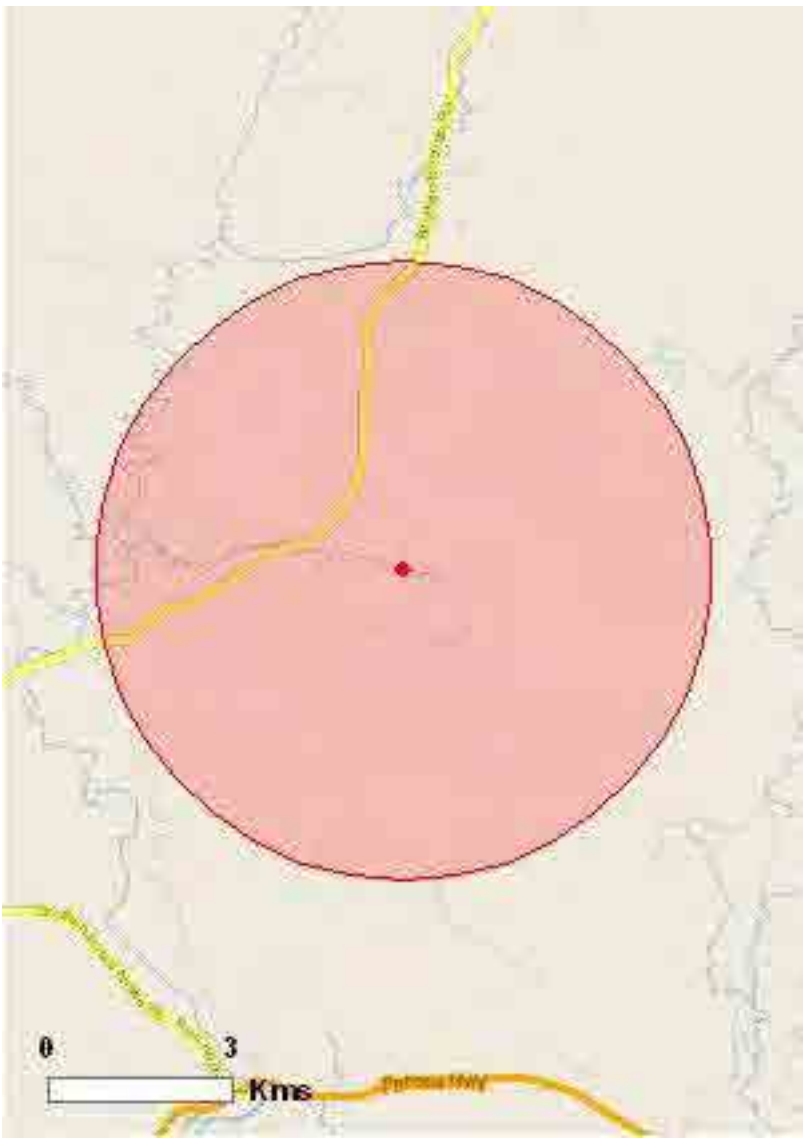
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/02/13 13:22:21



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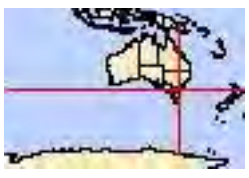

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	17
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	3
State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	12
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR) [Resource Information]

Name	Proximity
Gippsland lakes	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area
[Litoria raniformis](#)		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
[Dasyurus maculatus maculatus (SE mainland population)](#)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
[Isoodon obesulus obesulus](#)		
Southern Brown Bandicoot (Eastern) [68050]	Endangered	Species or species habitat may occur within area
[Petrogale penicillata](#)		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
[Potorous longipes](#)		
Long-footed Potoroo [217]	Endangered	Species or species habitat likely to occur within area
[Potorous tridactylus tridactylus](#)		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
[Pseudomys novaehollandiae](#)		
New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
[Pteropus poliocephalus](#)		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
[Cryptostylis hunteriana](#)		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
[Prasophyllum frenchii](#)		
Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#)		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Ardea ibis](#)		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Haliaeetus leucogaster](#)		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
[Hirundapus caudacutus](#)		
White-throated Needletail [682]		Species or species habitat known to occur within area
[Merops ornatus](#)		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#)		
Black-faced Monarch [609]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Dominion Mine Area	VIC	Interim List
Mount Nowa Nowa Area	VIC	Interim List
Yellow Waterholes Creek Area	VIC	Interim List

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
East Gippsland RFA	Victoria

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area

Name	Status	Type of Presence
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Coordinates

-37.65523 148.11652

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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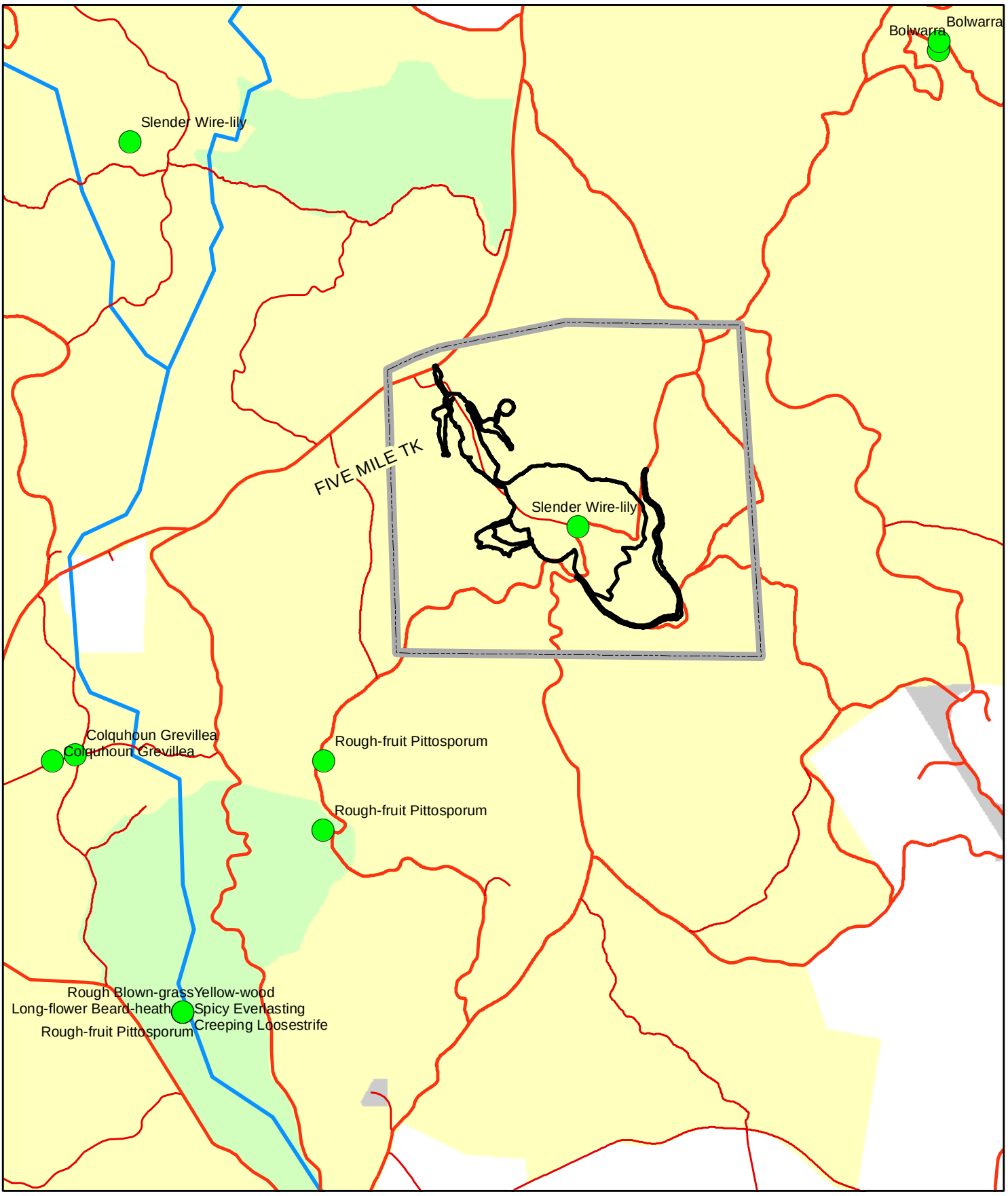
9.6 Appendix 6: DSE Database Rare & Threatened Flora Records Map



Nowa Nowa Iron Project - Preliminary VQA & EVC Mapping
Appendix 6: DSE Database Rare & Threatened Flora records

Legend

- Major creeks
- Roads and tracks

Public Land

- Other Public Land
- Conservation Reserves
- State Forest

- Threatened Flora records within 5km (DSE Database)
- Vegetation Study Area boundary
- NowaNowaProjectComponents_withbuffers

N

0 0.25 0.5 1 1.5 Km

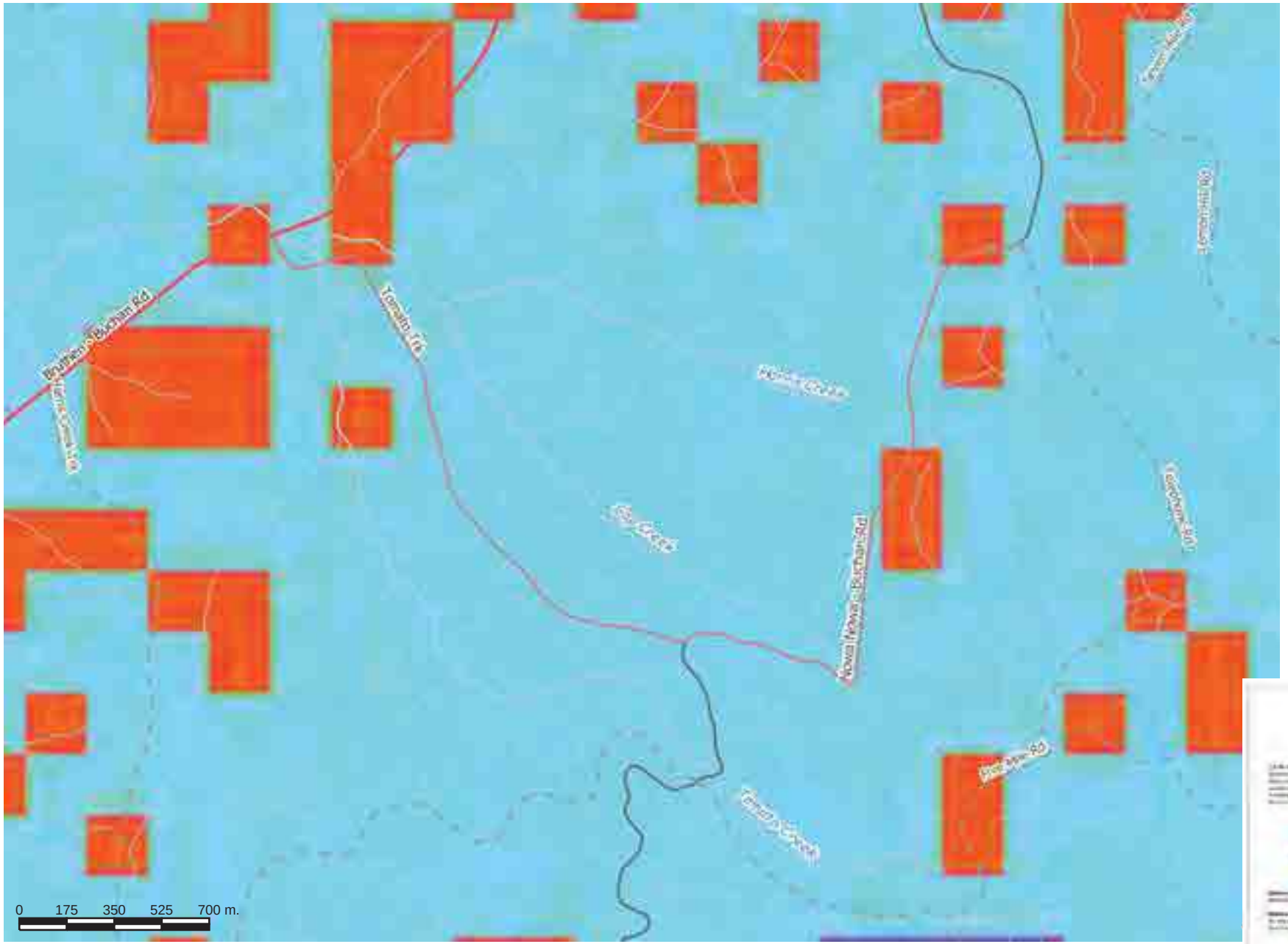
1:50,000	Version 3
Date: 08/10/2013	

Coordinate System:
GDA 94 MGA Zone 55

Map Produced by: Ethos NRM,
PO Box 204, Bairnsdale, Victoria 3875.
ph (03) 51530037
info@ethosnrm.com.au www.ethosnrm.com.au

9.7 Appendix 7: DEPI Native Vegetation Reforms Location Risk Map

Map created Tue Sep 17 11:54:58 EST 2013



ROADS
- Freeway
- Highway
- Main Road
- Secondary Road
- Local Road
- 2WD (Unsealed)
- 4WD Only
- Walking or Cycle Track

WATERCOURSES

UNNAMED DRAINAGE LINES

WATERBODIES
- Watercourse Area
- Permanent Waterbody
- Wetland Area
- Inundation Area

BUILT UP AREAS

Map Scale 1:20,506

Biodiversity Interactive Map A4 Landscape

Produced on Tue Sep 17 11:59:02 EST 2013

GDA

9.8 Appendix 8: DEPI Biodiversity Interactive Map Habitat Models for Native Vegetation Regulation

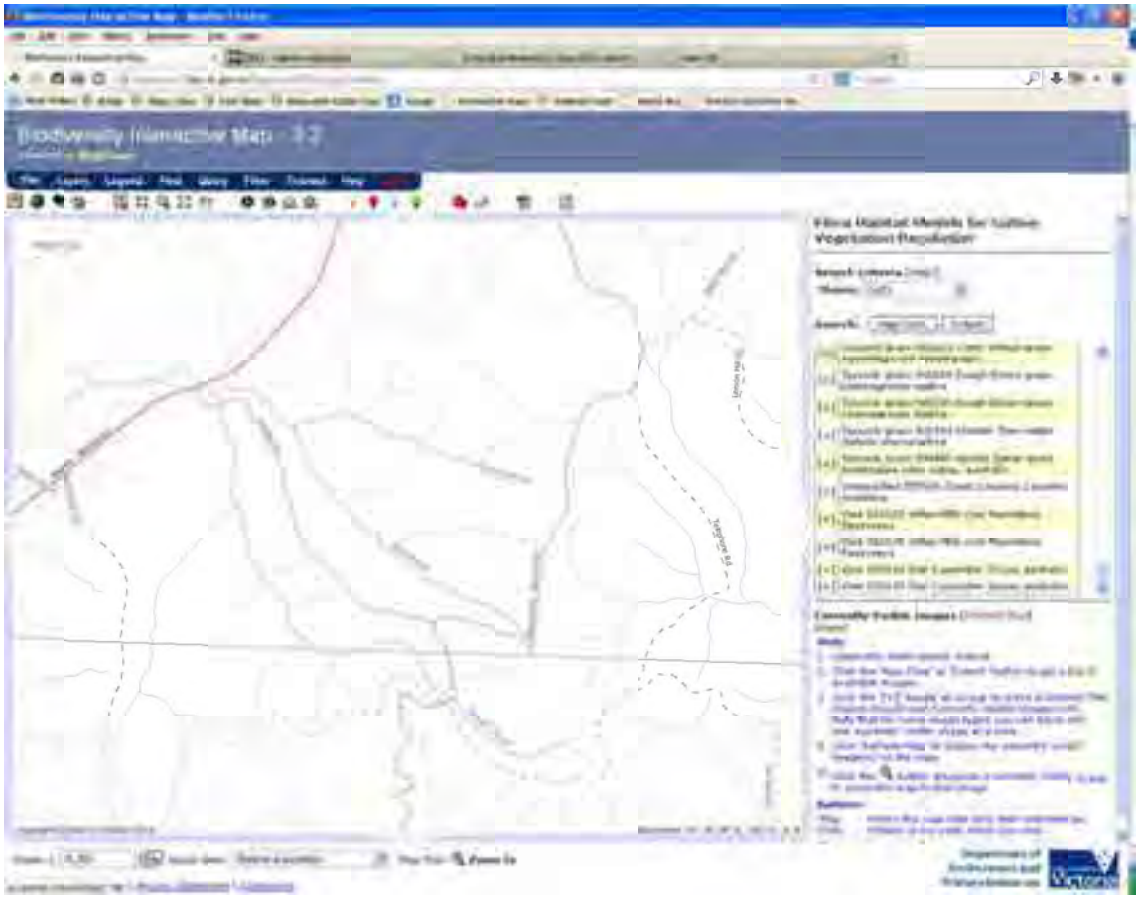


Figure 8.8-1: Biodiversity Interactive Map Search Extent

Table 8.8-1: List of Flora and Fauna Habitat Models in Project area

List of Flora Species Distribution Models from extent search of the Project area
Epiphyte 501853 Jointed Mistletoe Korthalsella rubra subsp. rubra
Fern 500133 Rough Maidenhair Adiantum hispidulum
Fern 500294 Common Spleenwort Asplenium trichomanes
Fern 500313 Japanese Lady-fern Deparia petersenii subsp. congrua
Fern 502644 Broad Shield-fern Polystichum formosum
Forb 500471 Rock Daisy Brachyscome petrophila
Forb 500839 Fringed Helmet-orchid Corybas fimbriatus
Forb 501003 Streaked Rock-orchid Dockrillia striolata subsp. striolata
Forb 501084 Purple Diuris Diuris punctata var. punctata
Forb 501711 Slender Violet-bush Hybanthus monopetalus
Forb 501889 Slender Wire-lily Laxmannia gracilis
Forb 502089 Creeping Loosestrife Lysimachia japonica
Forb 502275 Austral Tobacco Nicotiana suaveolens
Forb 502390 Dune Wood-sorrel Oxalis rubens
Forb 502709 Maroon Leek-orchid Prasophyllum frenchii
Forb 502790 Leafy Greenhood Pterostylis cucullata

Forb 502795 Fisch's Greenhood Pterostylis fischii
Forb 502798 Cobra Greenhood Pterostylis grandiflora
Forb 503002 Water Pimpernel Samolus valerandi
Forb 503103 Shingle Fireweed Senecio diaschides
Forb 503383 Naked Sun-orchid Thelymitra circumsepta
Forb 503527 Swamp Violet Viola caleyana
Forb 503583 One-flower Early Nancy Wurmbea uniflora
Forb 505337 Austral Crane's-bill Geranium solanderi var. solanderi s.s.
Other grass 500786 Leafy Twig-sedge Cladium procerum
Shrub 500135 Eastern Bitter-bush Adriana urticoides var. urticoides
Shrub 500393 Wallaby-bush Beyeria lasiocarpa
Shrub 500396 Pinkwood Beyeria lanceolata
Shrub 500426 Showy Boronia Boronia ledifolia
Shrub 501091 Broad-leaf Hop-bush Dodonaea rhombifolia
Shrub 501970 Chinese Lespedeza Lespedeza juncea subsp. sericea
Shrub 501971 Grey Beard-heath Leucopogon attenuatus
Shrub 501988 Hairy Beard-heath Leucopogon microphyllus var. pilibundus
Shrub 502145 Giant Honey-myrtle Melaleuca armillaris subsp. armillaris
Shrub 502309 Violet Daisy-bush Olearia iodochroa
Shrub 502331 Viscid Daisy-bush Olearia viscosa
Shrub 502651 Golden Pomaderris Pomaderris aurea
Shrub 502652 Birch Pomaderris Pomaderris betulina subsp. betulina
Shrub 502657 Woolly-head Pomaderris Pomaderris eriocephala
Shrub 502669 Striped Pomaderris Pomaderris pilifera subsp. pilifera
Shrub 502674 Convex Pomaderris Pomaderris subcapitata
Shrub 503605 Sandfly Zieria Zieria smithii subsp. smithii
Shrub 503946 Limestone Pomaderris Pomaderris oraria subsp. calcicola
Shrub 504217 Eastern Bitter-bush Adriana urticoides var. urticoides (pubescent form)
Shrub 504716 Colquhoun Grevillea Grevillea celata
Tree 500116 Yellow-wood Acronychia oblongifolia
Tree 500365 Rock Banksia Banksia saxicola
Tree 501253 Coast Grey-box Eucalyptus bosistoana
Tree 501295 Spotted Gum Corymbia maculata
Tree 503633 Limestone Blue Wattle Acacia caerulescens
Tree 503712 Gippsland Stringybark Eucalyptus mackintii
Tussock grass 500143 Comb Wheat-grass Australopyrum retrofractum
Tussock grass 500159 Rough Blown-grass Lachnagrostis scabra
Tussock grass 501393 Slender Saw-sedge Gahnia microstachya
Tussock grass 504940 Veined Spear-grass Austrostipa rudis subsp. australis
Unclassified 507665 Coast Cassinia Cassinia maritima
Vine 502124 Yellow Milk-vine Marsdenia flavescens
Vine 503139 Star Cucumber Sicyos australis

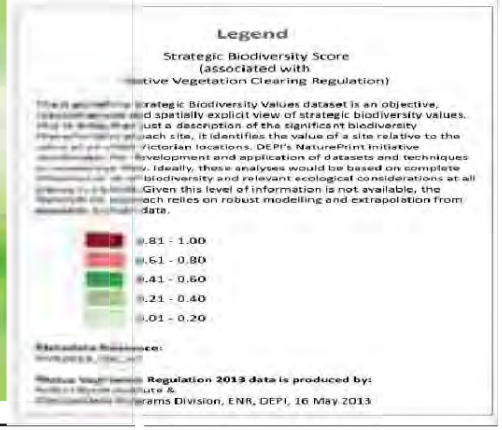
List of Fauna Species Distribution Models from extent search of the Project area
Amphibians 13042 Giant Burrowing Frog Heleioporus australiacus
Amphibians 13117 Brown Toadlet Pseudophryne bibronii
Amphibians 13125 Southern Toadlet Pseudophryne semimarmorata
Amphibians 13166 Green and Golden Bell Frog Litoria aurea
Amphibians 13207 Growling Grass Frog Litoria raniformis
Amphibians 13930 Martin's Toadlet Uperoleia martini
Bats 11280 Grey-headed Flying-fox Pteropus poliocephalus
Bats 11303 Eastern Horseshoe Bat Rhinolophus megaphyllus megaphyllus
Fish 4686 Australian Grayling Prototroctes maraena
Fish 4949 River Blackfish Gadopsis marmoratus
Fish 5051 Coxs Gudgeon Gobiomorphus coxii
Invertebrates 15021 Golden Sun Moth Synemon plana
Mammals 11008 Spot-tailed Quoll Dasyurus maculatus maculatus
Mammals 11017 Brush-tailed Phascogale Phascogale tapoatafa
Mammals 11061 Common Dunnart Sminthopsis murina murina
Mammals 11137 Squirrel Glider Petaurus norfolcensis
Mammals 11215 Brush-tailed Rock-wallaby Petrogale penicillata
Other Non-passerine birds 10045 Lewin's Rail Lewinia pectoralis pectoralis
Other Non-passerine birds 10050 Baillon's Crake Porzana pusilla palustris
Other Non-passerine birds 10170 Australian Painted Snipe Rostratula benghalensis australis
Other Non-passerine birds 10185 Little Egret Egretta garzetta nigripes
Other Non-passerine birds 10186 Intermediate Egret Ardea intermedia
Other Non-passerine birds 10187 Eastern Great Egret Ardea modesta
Other Non-passerine birds 10195 Little Bittern Ixobrychus minutus dubius
Other Non-passerine birds 10197 Australasian Bittern Botaurus poiciloptilus
Other Non-passerine birds 10212 Australasian Shoveler Anas rhynchotis
Other Non-passerine birds 10214 Freckled Duck Stictonetta naevosa
Other Non-passerine birds 10215 Hardhead Aythya australis
Other Non-passerine birds 10216 Blue-billed Duck Oxyura australis
Other Non-passerine birds 10217 Musk Duck Biziura lobata
Other Non-passerine birds 10220 Grey Goshawk Accipiter novaehollandiae novaehollandiae
Other Non-passerine birds 10226 White-bellied Sea-Eagle Haliaeetus leucogaster
Other Non-passerine birds 10230 Square-tailed Kite Lophoictinia isura
Other Non-passerine birds 10238 Black Falcon Falco subniger
Other Non-passerine birds 10246 Barking Owl Ninox connivens connivens
Other Non-passerine birds 10248 Powerful Owl Ninox strenua
Other Non-passerine birds 10250 Masked Owl Tyto novaehollandiae novaehollandiae
Other Non-passerine birds 10253 Sooty Owl Tyto tenebricosa tenebricosa
Passerine birds 10498 Chestnut-rumped Heathwren Calamanthus pyrrhopygius
Passerine birds 10504 Speckled Warbler Chthonicola sagittatus
Passerine birds 10598 Painted Honeyeater Grantiella picta
Passerine birds 10603 Regent Honeyeater Anthochaera phrygia
Reptiles 12283 Lace Monitor Varanus varius

Waders 10111 Gull-billed Tern Gelochelidon nilotica macrotarsa
Waders 10117 Little Tern Sternula albifrons sinensis
Waders 10118 Fairy Tern Sternula nereis nereis
Waders 10137 Pacific Golden Plover Pluvialis fulva
Waders 10138 Hooded Plover Thinornis rubricollis rubricollis
Waders 10141 Greater Sand Plover Charadrius leschenaultii
Waders 10149 Eastern Curlew Numenius madagascariensis
Waders 10152 Godwits fam. Scolopacidae gen. Limosa
Waders 10154 Wood Sandpiper Tringa glareola
Waders 10157 Common Sandpiper Actitis hypoleucos
Waders 10164 Red Knot Calidris canutus
Waders 10165 Great Knot Calidris tenuirostris

9.9 Appendix 9: DEPI Native Vegetation Reforms Strategic Biodiversity Score Map

Map created Tue Sep 17 11:54:58 EST 2013

ROADS
Freeway
Highway
Main Road
Secondary Road
Local Road
2WD (Unsealed)
4WD Only
Walking or Cycle Track
WATERCOURSES
UNNAMED DRAINAGE LINES
WATERBODIES
Watercourse Area
Permanent Waterbody
Wetland Area
Inundation Area
BUILT UP AREAS



Map Scale 1:20,506

Biodiversity Interactive Map A4 Landscape

Produced on Tue Sep 17 11:55:02 EST 2013

Annex 2 Targeted Survey for Colquhoun Grevillea (*Grevillea celata*); (Ethos NRM)

Targeted survey for Colquhoun Grevillea (*Grevillea celata*):

Nowa Nowa Iron Project (5 Mile Deposit)

FINAL

Prepared For:

Earth Systems

October 2013

ETHOS NRM Pty Ltd

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TABLE OF CONTENTS

TABLES

FIGURES

Cover Photo: Colquhoun Grevillea within the fenced area on the Bruthen-Nowa Nowa Road, 1.5km west of the Bruthen-Buchan Road (Sean Phillipson).

Ethos NRM Pty Ltd				
Document Control				
Client	Earth Systems			
Title	Targeted Survey for Colquhoun Grevillea (*Grevillea celata*) – Nowa Nowa Iron Project			
Author	Amie Hill			
Manager	Eric Sjerp			
Version	Final			
Electronic File Name	13031 nowa nowa iron project grevillea celata survey final.docx			
Date Last Saved	24/10/2013 2:36 PM			
Date Last Printed	24/10/2013 2:43 PM	No	Format	Date
Distribution:	Sean Phillipson, Eric Sjerp	1	Draft v1.0 for review	18/10/13
	Earth Systems (Megan Price and Daniel Banfai)	1	Draft v1.0 pdf via email	18/10/13
	Cc: Planning & Property Partners (Nick Baker)	1	Draft v1.0 pdf via email	18/10/13
	Earth Systems (Megan Price and Daniel Banfai) Cc: Planning & Property Partners (Nick Baker)	1	Final pdf via email	24/10/13

1 INTRODUCTION

1.1 Project Background

The Nowa Nowa Iron Project (5 Mile Deposit) (the Project) proposed by Eastern Iron Limited, through their wholly owned subsidiary Gippsland Iron Pty Ltd, is a greenfield development of a high grade magnetite/hematite deposit generally referred to as 'Five Mile' and within EL4509. The Project is located approximately 7 km north of the township of Nowa Nowa, which is situated on the Princes Highway between Bairnsdale and Orbost in East Gippsland, Victoria (see **Figure 1**).

The Project site (including open pit, waste rock dump, infrastructure and access/haul roads and buffers) covers almost 150 hectares, between the Bruthen-Buchan Road, along Tomato Track to the Buchan-Nowa Nowa Road and Five Mile Track (see **Appendix 1**).

The Nowa Nowa Iron Project will have impacts on approximately 146 hectares of native vegetation at the mine site, for the proposed diversion of the Nowa Nowa-Buchan Road and for works to upgrade the intersection of the mine access road at the Bruthen-Buchan Road. No additional vegetation loss is expected along the proposed Project transportation route within Victoria to the existing South East Fibre Exports (SEFE) wharf at the Port of Eden in Edrom, NSW.

Assessment of vegetation type and condition has been previously undertaken by Ethos NRM (Ethos, 2013*)* within a broad area, referred to as the 'Vegetation Study Area', which contains the proposed mine site and associated infrastructure. During a desktop review of rare and threatened flora records, the occurrence of the vulnerable plant Colquhoun Grevillea (*Grevillea celata*) was identified within 5km of the Project site.

1.2 Objectives

Ethos NRM Pty Ltd has been engaged by Earth Systems to undertake a targeted survey for Colquhoun Grevillea (*Grevillea celata*) to investigate the potential presence of the species within the Project site.

The survey was requested by the Department of Environment and Primary Industries (DEPI), due to the proximity of the Project site to existing known populations.

The purposes of this survey and report are to:

1. Undertake targeted surveys for *Grevillea celata* within the Project site.
2. If *Grevillea celata* is located within the Project site, collect data such as population size estimates, map population extent and life stage.
3. If *Grevillea celata* is located within the Project site, provide recommendations for further surveys to document the population extent within the Project site and the surrounding area.
4. Document survey effort and results of the survey

The Project footprint comprises all related infrastructure, dams and roads including buffers for fire protection.

1.3 Site Location and Description

The Project site is located wholly within the Tara State Forest (Crown land) which is primarily managed for forestry activities in the vicinity of the proposed works (see **Figure 1**).

The Project site is located mostly within the East Gippsland Uplands bioregion. A small portion of the northern extent of the footprint, and part of the proposed diversion of the Nowa Nowa - Buchan Road, are within the East Gippsland Lowlands.

The topography across the Project site is undulating, with several creeks and drainage lines dissecting the site. Slopes are generally moderate along drainage lines in the north to north-west of the site, with lower relief along Tomato Track and to the west which are relatively flat, wide spurs. Steeper slopes occur outside the Project site to the south of Five Mile Track. Soils are generally well draining silty loams, with exposed rock and shallow soils dominant on dry spurs and slopes, with lower slopes and sheltered aspects having higher clay content and lacking the rock component.

Ethos NRM Ecological Vegetation Class (EVC) mapping across the broad Vegetation Study Area recorded four EVCs, including; Shrubby Dry Forest, the dominant EVC covering almost 75% of the mine site, Lowland Forest comprising almost 20%, Riparian Forest covering 4% and Damp Forest a further 3%.

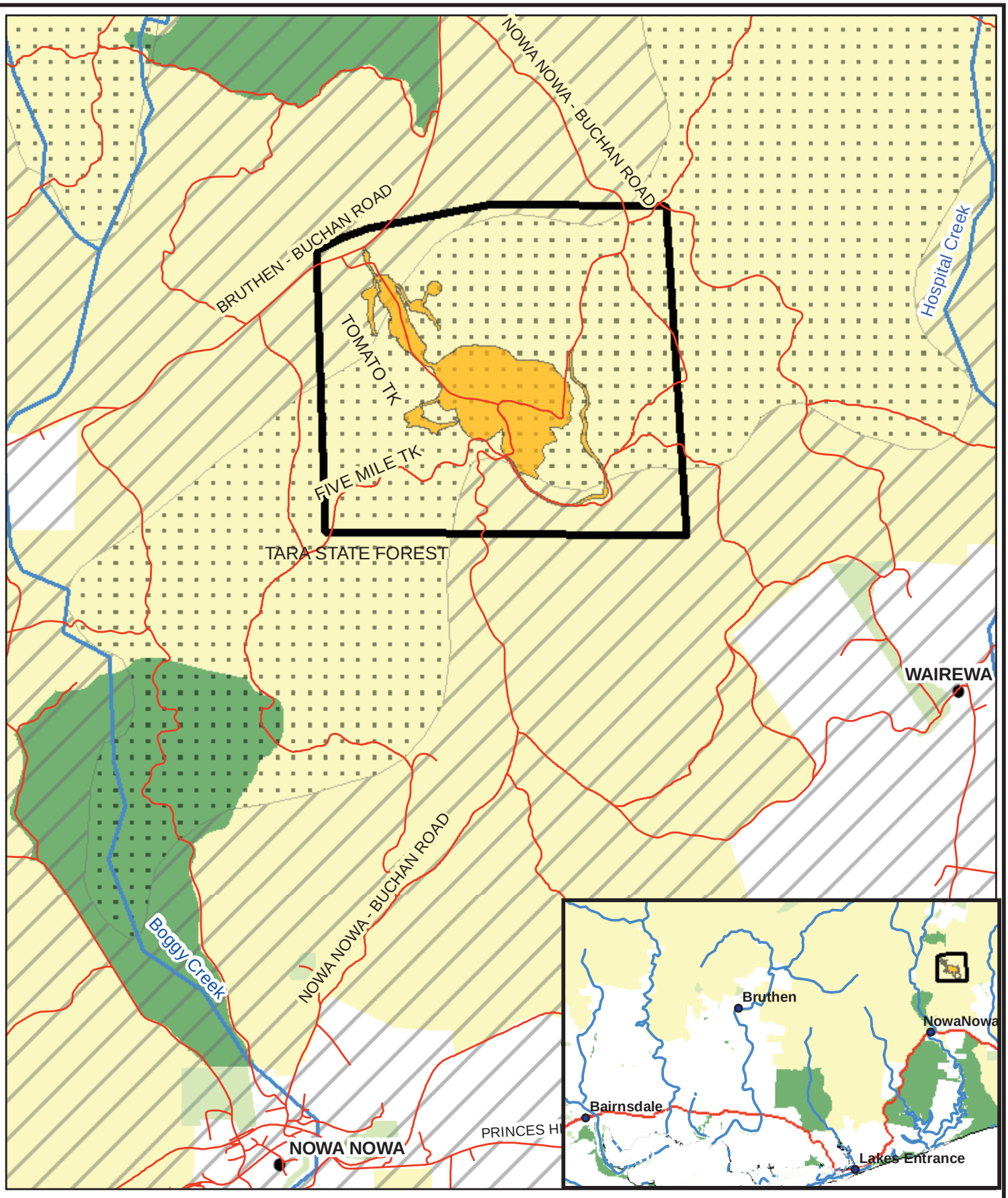
The Project Site has been subject to extensive timber harvesting. Logging history available from DEPI's Biodiversity Interactive Map (DEPI, 2013a) shows that timber harvesting has impacted the majority of the Project since the 1960s. All vegetation within the Project site has been burnt (planned burning) over the last 5 to 30 years.

1.4 Colquhoun Grevillea (*Grevillea celata*)

Colquhoun Grevillea (*Grevillea celata*) is known only from the Colquhoun State Forest, and is a low, dense shrub to 1.8m high, with red and yellow flowers appearing from July to February (Walsh & Entwisle, 1996). The total known range of the species is approximately 11km^2, and the total population is estimated to be between 1000 and 1600 plants (DSE, 2008). It is mostly confined to roadsides and natural forest clearings with high light levels (DSE, 2008), and most populations are located along the edge of the Bruthen-Nowa Nowa Road and the adjacent forest tracks to the north and south (VBA, 2013; refer to **Appendix 2**).

Its habitat consists of heathy open forest with an overstorey of eucalypts including; *Eucalyptus consideniana*, *E. cypellocarpa, E. globoidea, E. macrorhyncha* or *E. obliqua* (DSE, 2008). Associated species include a variety of small to medium shrubs, Bracken, graminoids and herbs. Spiny Bossiaea (*Bossiaea obcordata*) is considered a good indicator species as it is present in almost all populations of Colquhoun Grevillea (Walsh & Entwisle, 1996).

Grevillea celata is listed as Vulnerable under both the Commonwealth *Environment Protection and Biodiversity Conservation* (*EPBC) Act 1999* and the DEPI Advisory List of Rare or Threatened Plants in Victoria (DSE, 2005). It is also listed as threatened under Victoria's *Flora and Fauna Guarantee* (*FFG) Act 1988*. The population of Colquhoun Grevillea which is closest to the Project site is along Lyle's Break, approximately 5km south-west. This population is listed as an important population in the species' FFG Action Statement. Other populations of Colquhoun Grevillea extend to the west and south of Lyle's Break (see **Appendix 2**).



Nowa Nowa Iron Project (5 Mile Deposit) - Targeted Survey for Colquhoun Grevillea
Figure 1. Project Site Location

Legend

- Rivers
- Roads and tracks

Public Land

- Other Public Land
- Conservation Reserves
- State Forest

Bioregion

- East Gippsland Lowlands (EGL)
- East Gippsland Uplands (EGU)
- Nowa Nowa Iron Project (5 Mile Deposit) site
- Preliminary Vegetation Survey Area

0 0.25 0.5 1 1.5 Km

1:50,000 | Version 2

Date: 24/10/2013

Coordinate System:
GDA 94 MGA Zone 55

ETHOS NRM

Map Produced by: Ethos NRM,
PO Box 204, Bairnsdale, Victoria 3875.
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2 METHODOLOGY

A targeted field survey for Colquhoun Grevillea (*Grevillea celata*) was undertaken within the Project site on the 16th of October, 2013. Surveys were conducted by 2 observers.

Prior to conducting the survey, the current flowering of the species was confirmed at a fenced population on the Bruthen-Nowa Nowa Road 1.5km west of the intersection with Bruthen-Buchan Road. Reference photos were taken at this site.

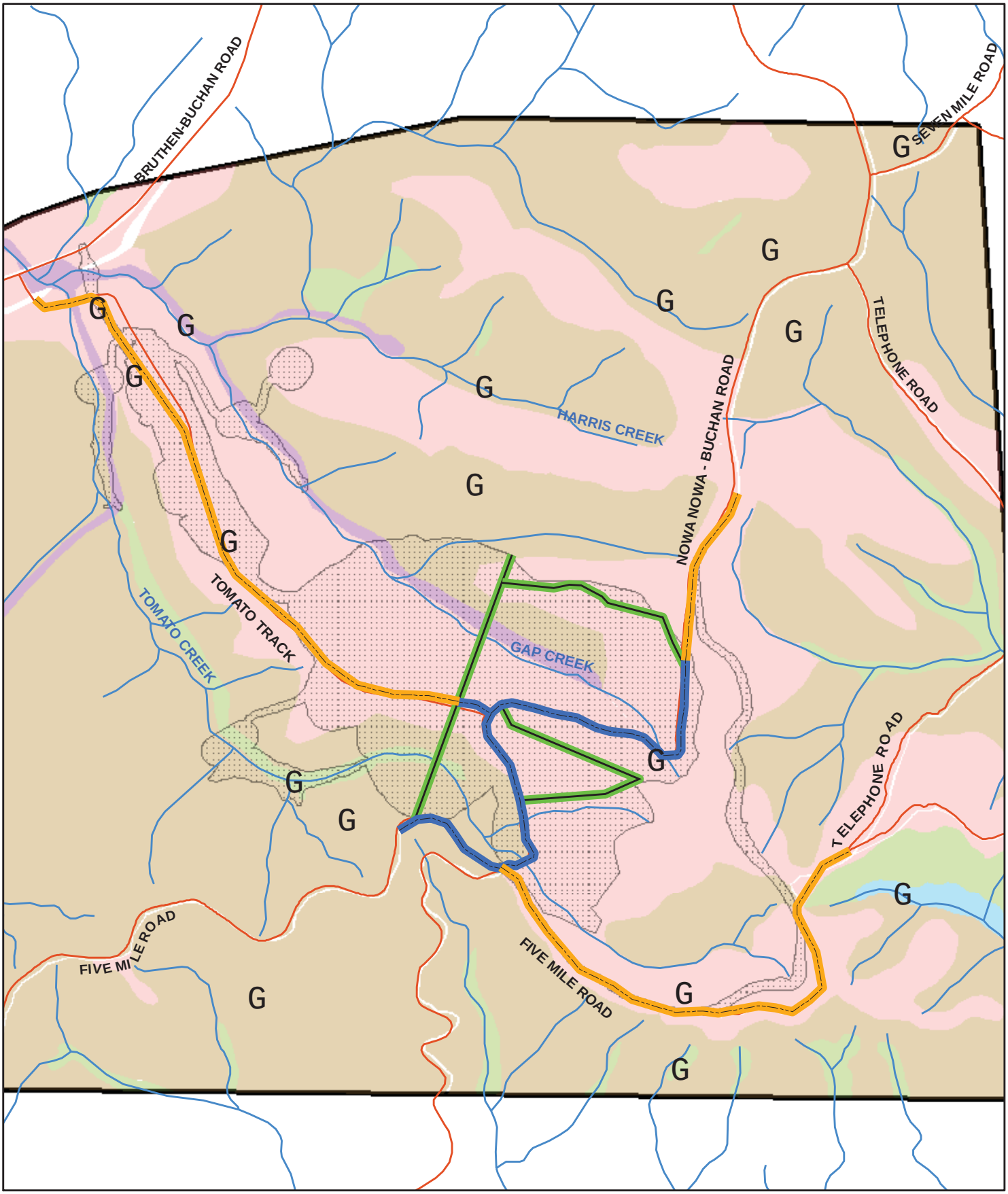
The survey adopted a combination of methods to maximise coverage of the most likely locations for populations as well as ensuring a representative sample of vegetation and habitats present within the Project site, including:

- Foot and vehicle-based survey of vegetation adjacent to existing vehicle tracks dissecting and bounding the Project Site, and
- Walking transects through the mine pit and other areas of the Project site.

The method and survey effort was confirmed with DEPI (Mick Bramwell, Environmental Advice and Approvals) prior to undertaking field work.

Walking transects involved traversing through native vegetation, with observers at a spacing of approximately 20 metres, and observing vegetation within 5-10 metres per person either side of the line traversed depending on vegetation density. Average transect width was 30 metres, although a minimum of 20m was used to calculate survey effort. Roadside survey involved each observer focussing on one side of the road, either walking slowly along the edge of the roadside vegetation, or from a vehicle traveling at approximately 5km per hour. Survey width varied from 5-10 metres per person depending on understorey density, a minimum width of 5m per person (10m total width) was assumed in calculating survey effort.

Targeted survey transects are shown in **Figure 2**.



Nowa Nowa Iron Project (5 Mile Deposit) - Targeted Survey for Colquhoun Grevillea
Figure 2. Survey Effort

Targeted Grevillea celata survey Transects

- Transect - Walking
- Roadside - Walking
- Roadside - Vehicle
- G Preliminary Survey Sample Points
- Roads and Tracks
- Creeks
- Nowa Nowa Iron Project (5 Mile Deposit) site

Ecological Vegetation Classes (Draftv2.1)

- Damp Forest
- Lowland Forest
- Riparian Forest
- Shrubby Dry Forest
- Warm Temperate Rainforest

0 0.1 0.2 0.4 0.6 Km

1:17,023 | Version 2

Date: 24/10/2013

Coordinate System:
GDA 94 MGA Zone 55

ETHOS NRM

Map Produced by: Ethos NRM,
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3 RESULTS

3.1 Targeted survey results

The targeted survey for Colquhoun Grevillea consisted of 9.37 km of transects (4.8km walking and 4.6km vehicle) covering an area of approximately 11.2 hectares (ha) along roadsides and through native vegetation within the proposed mine footprint (refer to **Table 1**). Transects through vegetation traversed project components including the mine pit, waste rock dump and low grade ore stock pile (refer to Appendix 1 for Project Infrastructure and Layout Map). Transects traversed the range of Ecological Vegetation Classes present within the Project site, as well as varied vegetation condition, fire history and timber harvesting history. Roadside searches traversed all vehicle tracks dissecting and immediately adjacent to the Project site.

Colquhoun Grevillea was not located during the Targeted survey conducted by Ethos NRM on 16th October, 2013.

The survey effort is detailed in **Table 1** below. The width of the area surveyed along transects depended on the density of understorey vegetation, and a conservative estimate of survey area coverage is provided to allow for this variation.

Table 1: Survey effort

Survey Type	Survey Method	General location	Width of transect (m)	Length of transect (m)	Estimated search area (ha)
Transect 1	Walking	mine pit	20	4597	1.9
Transect 2	Walking	haul road/waste rock dump (old logging trk)	10	935	0.7
Transect 3	Walking	waste rock dump/ low grade ore stock pile	20	734	1.9
Roadsides	Walking	5 Mile Track (west), part Nowa Nowa-Buchan Road	10	944	2.2
Roadsides	Vehicle (<5km/hr)	Tomato Track, 5 Mile Track (east), part Nowa Nowa-Buchan Road	10	2160	4.6
TOTALS				**9370**	**11.2**

3.2 Previous survey results

Detailed flora lists were collected by Ethos NRM at 17 sample sites across the Vegetation Study Area (VQA) during the previous Preliminary Vegetation Quality Assessment and EVC Mapping fieldwork, with a total of 141 terrestrial flora species recorded (Ethos NRM, 2013). Additional species were also recorded while traversing native vegetation on the site. The survey coverage included approximately 24 ha of vegetation sampling across an 1100 ha Vegetation Survey Area, conducted over 3 days in Autumn, 2013 (including Habitat Hectare Assessment sample sites and traverse across the study area). Approximately 15 ha of this survey coverage occurred within or adjacent to the Project site.

Ethos NRM was aware of the potential presence of Colquhoun Grevillea at the Project site prior to undertaking the Preliminary VQA and EVC Mapping fieldwork, through interrogation of the DSE Rare and Threatened Species Database. **Colquhoun Grevillea was not observed during the surveys conducted by Ethos NRM in Autumn 2013**.

The Preliminary survey (Autumn 2013) recorded many of the associated species listed in the Colquhoun Grevillea Action Statement (DSE, 2008) across the entire Vegetation Survey area, but did not record the indicator species Spiny Bossiaea. Individual VQA sample sites recorded less than half of the 'associated species', with most sites recording few of the species. Areas of Lowland Forest sampled outside of the Project site (to the east) had the most similar floristic assemblages to the described habitat for Colquhoun Grevillea. A single sample site within the Project site, located near the western boundary of the proposed Waste Rock Dump, had almost half of the 'associated species', and was covered by the targeted surveys.

The Victorian Biodiversity Atlas (VBA, 2013) shows several flora survey sites located in close vicinity to the Project site (8 sites within 1km), between 1967 and 1994, none of which have recorded Colquhoun Grevillea.

4 CONCLUSION

Colquhoun Grevillea has not been recorded by Ethos NRM at the Project site, following the targeted and general flora surveys conducted in Autumn and Spring of 2013.

Targeted surveys for Colquhoun Grevillea were conducted across the Project Site in Spring, covering almost 10% of the area of vegetation proposed for removal.

Roadsides were considered to be the most likely location to detect the species presence within the Project site (confirmed by DEPI), and these were systematically surveyed on foot or from a slow-moving vehicle. Transects through vegetation were also undertaken within the Project site, covering a representative variety of habitat types, vegetation condition, and management history.

Earlier preliminary surveys carried out by Ethos NRM in Autumn (Ethos, 2013) covered an additional 10% of the Project site, and did not detect Colquhoun Grevillea, or the indicator species Spiny Bossiaea. Other historic surveys recorded on the Victorian Biodiversity Atlas (VBA, 2013) have not detected the species within the Project site, and only one population has been recorded at the outer edge of a 5km database search radius.

The closest record of Colquhoun Grevillea to the Project site is approximately 5km to the south-west along Lyle's Break, which represents the eastern extent of the known range of the species.

Ethos NRM considers that it is unlikely that a substantial population of Colquhoun Grevillea is present within the Project site.

5 REFERENCES

DSE, 2005. *Advisory List of Rare or Threatened Plants in Victoria - 2005*. Victorian Department of Sustainability and Environment, East Melbourne, Victoria.

DSE, 2008. *Flora and Fauna Guarantee Act 1988 Action Statement No. 211: Colquhoun Grevillea* Grevillea celata. The State of Victoria, Department of Sustainability and Environment, Melbourne

DSE, 2013a. *Online Mapping - Biodiversity Interactive Map*. www.dse.vic.gov.au (website accessed 27/02/2013). Victorian Department of Sustainability and Environment.

Ethos NRM, 2013. *Preliminary Vegetation Quality Assessment and Ecological Vegetation Class Mapping: Nowa Nowa Iron Project.* Report prepared for Earth Systems, October, 2013 by Ethos NRM Pty Ltd, Victoria.

SEWPAC, 2013. *Matters of National Environmental Significance***,** viewed 27/02/13 http://www.environment.gov.au/epbc/protect/index.html. Australian Government Department of Sustainability, Environment, Water, Population and Communities.

Viridans, 2013b. *Wild Plants of Victoria on the Web,* Viridans Biological database 2013, Viridans Pty Ltd, Victoria.

Walsh, N.G. and Entwisle, T.J. (eds)(1996). *Flora of Victoria. Volume 3. Dicotyledons. Winteraceae to Myrtaceae*. Inkata Press.

Rare and Threatened Species Data Source (DSE)

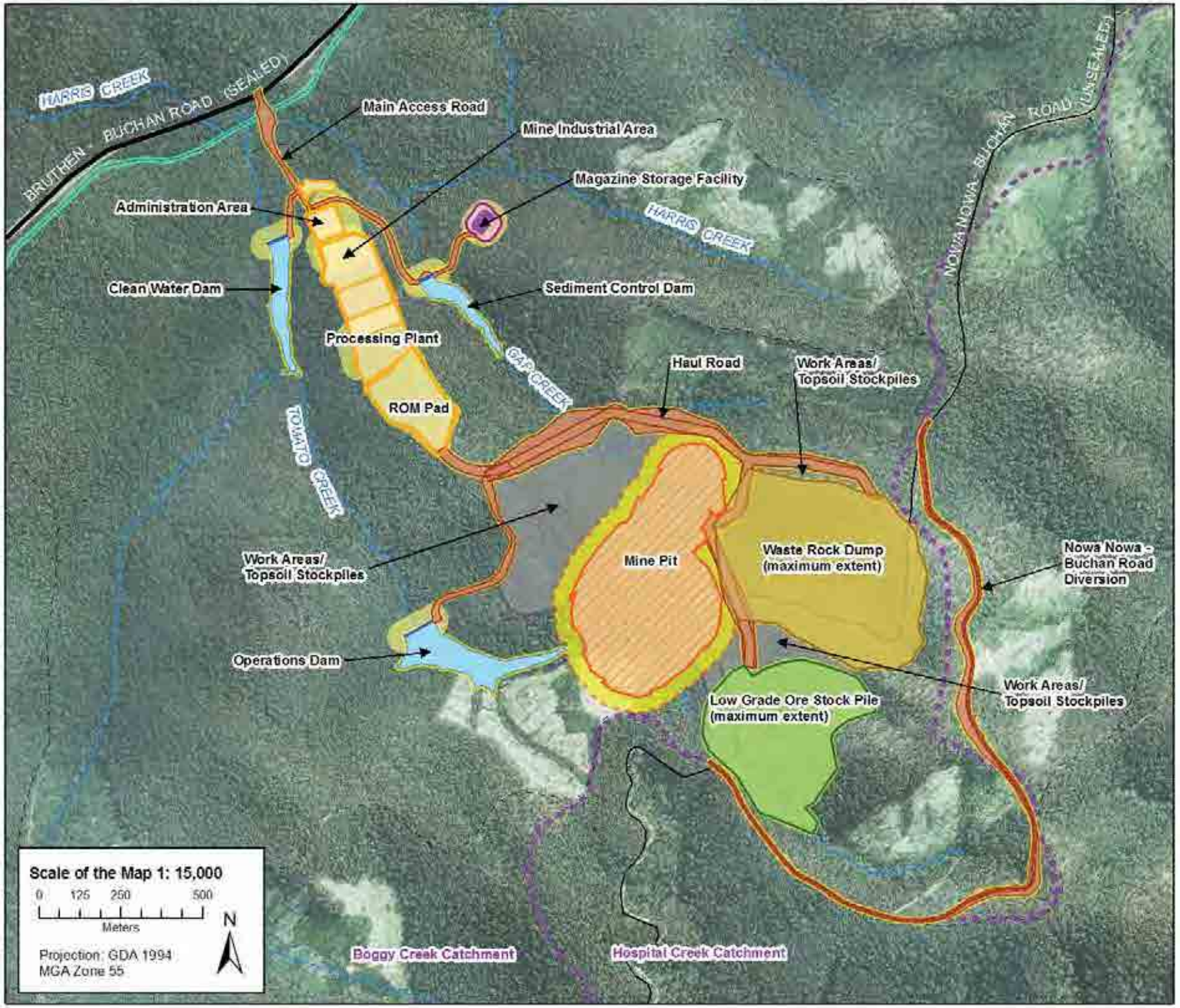
1. Data Source: 'Victorian Flora Site Database', © The State of Victoria, Department of Sustainability and Environment (accessed via the 'Flora Information System', [December 2010] - © Viridans Biological Databases). The contribution of the Royal Botanical Gardens Melbourne to the database is acknowledged.
2. Data Source: 'Atlas of Victorian Wildlife', © The State of Victoria, Department of Sustainability and Environment (accessed via the 'Victorian Fauna Database', [December 2010]- © Viridans Biological Databases).

VBA, 2013 Data Source (DEPI)

Data Source: 'Victorian Biodiversity Atlas', © The State of Victoria, Department of Environment and Primary Industries (Version 3.0.6, October 2013]).

6 APPENDICES

6.1 Appendix 1: Nowa Nowa Iron Project Infrastructure and Layout Map



Nowa Nowa Iron Project Infrastructure and Layout

Legend

- Towns/ Settlements
- Rivers / Streams
- Major/ Secondary Roads
- Tracks
- Existing Transmission Line
- Catchment Boundary (Boggy Creek / Hospital Creek)

Project Components

- Mine Pit
- Mine Infrastructure
- Waste Rock Dump
- Low Grade Ore Stock Pile
- Project Access Roads
- Magazine Storage Facility
- Dams
- Work Areas/ Topsoil Stockpiles

Buffer Zones

- Construction and Bushfire Management Buffers

Satellite Imagery:
Quickbird (April 2012)
Note: Cleared areas are logging coupes

Author : Earth Systems

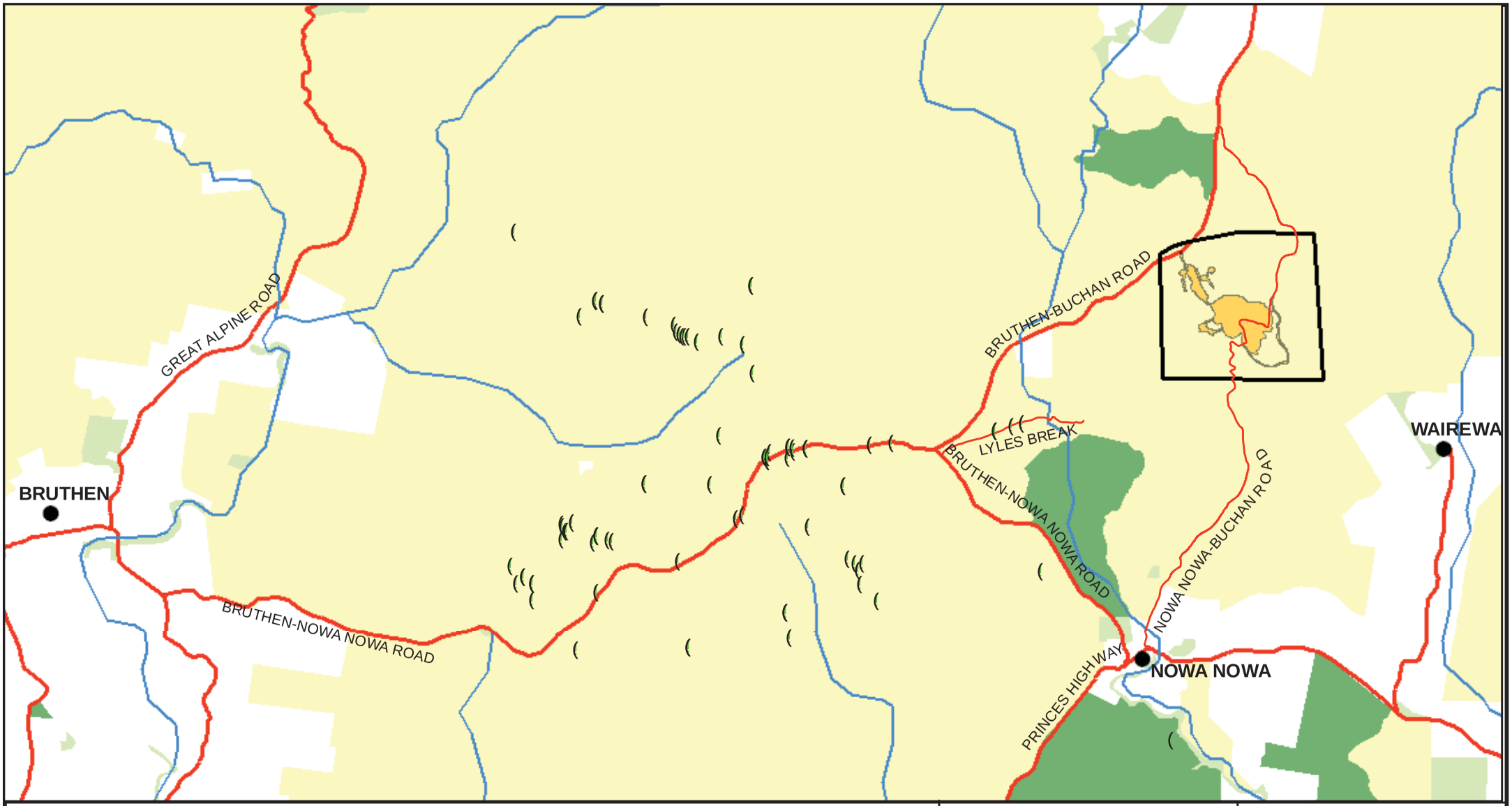
Client : Eastern Iron Ltd

Revision : Draft

Date : September 2013

EARTH SYSTEMS

6.2 Appendix 2: VBA Records of Colquhoun Grevillea



Nowa Nowa Iron Project (5 Mile Deposit) - Targeted Survey for Colquhoun Grevillea
Appendix 2: VBA Database Colquhoun Grevillea records

- Grevillea celata records (VBA v3.0.6, 2013)
- Towns
- Rivers
- Roads
- Nowa Nowa Iron Project (5 Mile Deposit) site
- Preliminary Vegetation Survey Area

Public Land

- Other Public Land
- Conservation Reserves
- State Forest

0 1 2 4 6 Km

1:116,806

Version 2

Date: 24/10/2013

Coordinate System:
GDA 94 MGA Zone 55

ETHOS NRM

Map Produced by: Ethos NRM,
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Annex 3 Nationally and State threatened/significant flora species within, and potentially in, the region and likelihood of presence in mine site (DSE 2013d)

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Maroon Leek-orchid	*Prasophyllum frenchii*	EN	L	EN	N/A	N/A	U - Habitat absent or of insufficient quality	Grassland and grassy woodland habitats that are generally damp but well drained	Herb
Matted Flax-lily	*Dianella amoena*	EN	L	EN	N/A	N/A	H/U - Habitat absent or of insufficient quality	Lowland grasslands, grassy woodlands and creeklines of herb-rich woodland	Herb
Colquhoun Grevillea	*Grevillea celata*	VU	L	VU	1937	2008	U – Some habitat present; patchily distributed	Terrain tends to be flat or with a slight northerly aspect. Populations occur from c. 140–300 m above sea level; occasionally present in disturbed areas	Shrub
Leafy Nematolepis	*Nematolepis frondosa*	VU	L	VU	1987	2002	U - Habitat absent or of insufficient quality	Varied habitat ranging from low rock outcrop scrub to tall open forest dominated by *Eucalyptus regnans*	Shrub
Limestone Blue Wattle	*Acacia caerulescens*	VU	L	VU	1990	2008	H/U - Habitat too disturbed	Restricted to the Lakes Entrance-Buchan district. Small stands persist along the roadside to the north of Buchan	Tree
Leafless Tongue-orchid	*Cryptostylis hunteriana*	VU	L	EN	N/A	N/A	U - Undergrowth probably of insufficient quality	Reported to occur in a wide variety of habitats including heathlands, dry sclerophyll forests, forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests	Herb
Thick-lipped Spider-Orchid	*Caladenia tessellata*	VU			N/A	N/A	U - Undergrowth probably of insufficient quality	Heathland, heathy or grassy woodland, and grassy or sedgy open forests in well drained sand and clay loams	Herb
Austral Moonwort	*Botrychium australe*		L	VU	1994	1994	H/U - Habitat absent	Damp sites in open forest or grassland; widespread but uncommon	
Yellow-wood	*Acronychia oblongifolia*		L	R	1975	2000	U - Habitat too disturbed	Warmer rainforest and on their margins, also in regrowth rainforest, widespread in coastal districts	Shrub - tree
Dainty Bitter-cress	*Cardamine tryssa*		L	EN	1995	1995	H/U - Undergrowth probably of insufficient quality	Moist areas	Herb

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Slender Mud-grass	*Pseudoraphis paradoxa*		L	EN	1979	1992	H/U - Habitat absent	Ephemeral or permanent pools and watercourses, often forming floating mats	Other grass
Coastal Greenhood	*Pterostylis alveata*			VU	1993	1999	U - Habitat absent or of insufficient quality	Grows among grass on moist slopes and near streams in coastal and near-coastal districts	Herb
Creeping Loosestrife	*Lysimachia japonica*			VU	1976	1976	U - Habitat absent or of insufficient quality	Moist situations, in and on margins of rainforest, on stream banks and in swamps	Herb
Japanese Lady-fern	*Deparia petersenii subsp. congrua*			VU	1985	1985	U - Habitat absent or of insufficient quality	Frequently forms large colonies in or close to stream banks and damp rock faces and crevices	Fern
Jointed Mistletoe	*Korthalsella rubra subsp. rubra*			VU	1976	1999	U - Habitat absent or of insufficient quality	Parasitic on a wide range of trees in rainforest and wet sclerophyll forest	Epiphyte
Naked Sun-orchid	*Thelymitra circumsepta*			VU	1974	2005	U - Habitat absent or of insufficient quality	Mountainous districts with high rainfall and in seepage areas on tablelands	Herb
Showy Boronia	*Boronia ledifolia*			VU	1987	2004	P - Habitat present	Heath and dry sclerophyll forest on sandstone and granite	Shrub
Spotted Gum	*Corymbia maculata*			VU	1979	1980	P – Habitat may be present	Community dominant, in open forest on somewhat infertile and drier sites on shales and slates	tree
Star Cucumber	*Sicyos australis*			VU	1985	1999	U - Habitat absent or of insufficient quality	Chiefly on margins of warmer rainforest, mainly on the coast	Vine
Tullach Ard Grevillea	*Grevillea polychroma*			VU	1987	1987	U - Habitat may be present, but probably not sufficient	Open forest and rocky shrub associations	Shrub
Viscid Daisy-bush	*Olearia viscosa*			VU	1976	2000	U - Habitat absent or of insufficient quality	Coastal scrub and rainforest margins	Shrub
Wild Sorghum	*Sarga leiocladum*			VU	1999	1999	P - Habitat may be present	In woodland on poorer soils	Other grass
Bear's-ear	*Cymbonotus lawsonianus*			R	1990	1990	P - Habitat/conditions present	Range of situations such as open forest, roadsides and disturbed areas	Herb
Birch Pomaderris	*Pomaderris betulina subsp. betulina*			R	1940	1994	P - Habitat may be present	Open forest	Shrub
Blotched Hyacinth-orchid	*Dipodium variegatum*			R	N/A	N/A	U - Habitat absent or of insufficient quality	Wet sclerophyll forest to heath, on a variety of soils	Herb

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Bluish Pigface	*Carpobrotus glaucescens*			R	2007	2007	H/U - Habitat absent	Coastal sand dunes	Herb
Bolwarra	*Eupomatia laurina*			R	1977	1994	U - Habitat absent or of insufficient quality	Moist eucalypt forest on the coast and lower ranges	Tree
Coast Cassinia	*Cassinia maritima*			R	1992	1992	U - Habitat absent	Genus under revision, coastal areas	Herb
Coast Grey-box	*Eucalyptus bosistoana*			R	1976	2008	P - Habitat may be present	Near streams in lowland areas on better quality soils, particularly over limestone	Tree
Coast Mistletoe	*Muellerina celastroides*			R	1978	2007	U - Habitat absent or of insufficient quality	Coastal areas in sclerophyll forest and rainforest, usually parasitic on species of Banksia and Casuarinaceae	Epiphyte
Comb Wheat-grass	*Australopyrum retrofractum*			R	N/A	N/A	H/U - Habitat absent	Grows at high elevations in high alpine herbfields and sod tussock grassland	Grass
Common Spleenwort	*Asplenium trichomanes*			R	1992	1999	P - Habitat present	It is a widespread and common species, occurring almost worldwide in a variety of rocky habitats	Fern
Convex Pomaderris	*Pomaderris subcapitata*			R	1980	2004	P - Habitat may be present	Open forest	Shrub
Dark Wire-grass	*Aristida calycina var. calycina*			R	1987	1987	P - Habitat present	Grows on poor or sandy soils	Tussock grass
Dune Wood-sorrel	*Oxalis rubens*			R	2007	2007	H/U - Habitat absent	Commonly grows on islands, beaches and coastal sand dunes	Herb
Dwarf Brooklime	*Gratiola pumilo*			R	N/A	N/A	P - Habitat may be present	Permanently or seasonally swampy ground, and the margins of dams and reservoirs	Herb
Eastern Bitter-bush	*Adriana urticoides var. urticoides*			R	1987	1995	P - Habitat present	Sand dunes, watercourses, valleys and gorges, roadsides	Shrub
Eastern Pomaderris	*Pomaderris discolor*			R	1970	1970	P - Habitat may be present	Open forest	Shrub
Forest Phebalium	*Phebalium squamulosum subsp. squamulosum*			R	1978	1978	P - Habitat may be present	Chiefly in sclerophyll forest, widespread on sandstone	Shrub
Forest Red-box	*Eucalyptus polyanthemos subsp. longior*			R	1949	1949	U - Habitat absent or of insufficient quality	Undulating terrain comprising stony or gravelly clays	Tree

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Fringed Helmet-orchid	*Corybas fimbriatus*			R	1979	1985	H/U - Habitat too dry	Common in moist forests in coastal districts	Herb
Gippsland Stringybark	*Eucalyptus mackintii*			R	1986	1992	P - Habitat may be present	Dry sclerophyll forest or woodland on shallow poor soils on rises	Tree
Golden Pomaderris	*Pomaderris aurea*			R	1984	1984	P - Habitat may be present	Open forest	Shrub
Grey Beard-heath	*Leucopogon attenuatus*			R	1987	1987	P - Habitat may be present	Dry sclerophyll forest, open woodland and open rocky platforms within heath	Shrub
Heath Platysace	*Platysace ericoides*			R	2000	2000	P - Habitat may be present	Coastal heath, scrubby heath and sclerophyll woodland on sandy soils over various substrates	Shrub
Large-bract Hovea	*Hovea magnibractea*			R	1987	1996	P - Habitat may be present	Wet and dry forests	Shrub
Leafless Pink-bells	*Tetratheca subaphylla*			R	1987	1987	U - Habitat conditions absent	Grows on rocky hillsides usually in mountain eucalypt forest	Shrub
Limestone Pomaderris	*Pomaderris oraria subsp. calcicola*			R	1978	2002	P - Habitat may be present	Open forest	Shrub
Monkey Mint-bush	*Prostanthera walteri*			R	1987	1987	P - Habitat may be present	Commonly sclerophyll forest on granitic soils	Shrub
Mountain Kangaroo Apple	*Solanum linearifolium*			R	N/A	N/A	P - Habitat may be present	Disturbed or open areas of coastal ranges and tablelands	Shrub
Outcrop Guinea-flower	*Hibbertia hermanniifolia*			R	1987	2002	P - Habitat may be present	Open forest on sandstone	Shrub
Paperbark Tea-tree	*Leptospermum trinervium*			R	1979	1979	P - Habitat may be present	Dry sclerophyll forest, heath and scrub in deep or shallow sandy soil	Shrub
Pinkwood	*Beyeria viscosa*			R	1975	2000	U - Habitat too forested	Widespread in skeletal soils on ridges and hilltops or in crevices of rock slabs and on steep bluffs	Shrub
Rough Blown-grass	*Lachnagrostis scabra*			R	1976	1976	U - Habitat absent or of insufficient quality	Occurs in coastal habitats, including seepage slopes, stream banks and swamps	Grass
Rough-fruit Pittosporum	*Pittosporum revolutum*			R	1974	1996	P - Habitat may be present	Rainforest, wet and dry sclerophyll forest; chiefly in coastal districts	Shrub
Salt Lawrencia	*Lawrencia spicata*			R	1978	2007	H/U - Habitat absent	Coastal margins, estuaries, river banks	Herb

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Sandfly Zieria	*Zieria smithii subsp. smithii*			R	1999	1999	U - Habitat absent or of insufficient quality	Widespread on the coast and ranges	Shrub
Slender Bog-sedge	*Schoenus lepidosperma subsp. pachylepis*			R	1984	1984	U - Habitat absent or of insufficient quality	Grass-like; coastal areas	Herb
Slender Mint-bush	*Prostanthera saxicola var. bracteolata*			R	1987	1987	U - Habitat may be present, but not sheltered	Heath, dry sclerophyll forest and woodland, on sandstone in sheltered gullies	Shrub
Slender Saw-sedge	*Gahnia microstachya*			R	1987	1987	P - Habitat may be present	Sclerophyll forest and woodland in drier situations	Tussock grass
Slender Wire-lily	*Laxmannia gracilis*			R	1980	1992	P - Habitat may be present	Usually woodland or open stony areas, on sandstone- or granite-derived soils	Herb
Small Autumn Greenhood	*Pterostylis longipetala*			R	1985	1985	U - Habitat absent	Moist slopes in sclerophyll forest of coastal and near-coastal districts	Herb
Small Fork-fern	*Tmesipteris parva*			R	1995	1995	U - Habitat absent or of insufficient quality	Usually epiphytic on tree ferns, widespread but not common, in rainforest and moist eucalypt forest	Epiphyte
Small Wax-lip Orchid	*Glossodia minor*			R	1976	1984	U - Undergrowth probably of insufficient quality	Coastal and near-coastal districts, especially in heath	Herb
Southern Blue-gum	*Eucalyptus globulus subsp. globulus*			R	N/A	N/A	P - Habitat may be present	Gently undulating sub-coastal hills or in protected valleys	Tree
Spicy Everlasting	*Ozothamnus argophyllus*			R	1940	1999	P - Habitat may be present	Woodland and on edges of rainforest, on granite or basalt; chiefly on the escarpment ranges	Shrub
Spurred Helmet-orchid	*Corybas aconitiflorus*			R	1985	2000	U - Undergrowth probably of insufficient quality	Widespread in sclerophyll forest, particularly in coastal and near-coastal localities	Herb
Stalked Adder's-tongue	*Ophioglossum reticulatum*			R	1970	1970	U - Habitat absent or of insufficient quality	Poorly known species. In other countries it grows along rivers	Herb
Streaked Rock-orchid	*Dockrillia striolata subsp. striolata*			R	1985	2006	U - Habitat absent or of insufficient quality	Cliff faces and granite boulders up to 1000 meters in elevation in exposed locations	Herb
Swamp Violet	*Viola caleyana*			R	1992	1992	H/U - Habitat absent	Wet situations in forest or woodland or near swamps	Herb

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Tall Acrotriche	*Acrotriche leucocarpa*			R	1987	1987	P - Habitat present	Montane open eucalypt woodlands, in sandy clays or sandy loams over sandstone	Shrub
Twin-flower Tea-tree	*Leptospermum emarginatum*			R	1984	2005	U - Habitat absent or of insufficient quality	Grows along river banks and rocky creeks	Shrub
Varied Mitrewort	*Mitrasacme polymorpha*			R	1992	1992	U - Habitat absent or of insufficient quality	Widespread, often growing in sandy soil overlying sandstone, mainly coastal districts	Herb
Veined Spear-grass	*Austrostipa rudis subsp. australis*			R	1992	1992	U - Too far from coast	Woodland near the coast	Tussock grass
Velvet Apple-berry	*Billardiera scandens s.s.*			R	1995	1995	P - Habitat present	Common in open eucalypt forest and woodland, particularly at higher altitudes	Shrub
Violet Daisy-bush	*Olearia iodochroa*			R	1977	2004	P - Habitat may be present	Low woodland or sclerophyll forest, on rocky outcrops	Shrub
Violet Westringia	*Westringia glabra*			R	2002	2002	U - Habitat absent or of insufficient quality	Low open woodland and shrubland, in skeletal soils of steep rocky gorges	Shrub
Wallaby-bush	*Beyeria lasiocarpa*			R	1977	2004	U - Habitat too dry	Wet sclerophyll forest or in moist gullies along the coast and in rocky situations on the ranges	Shrub - tree
Water Pimpernel	*Samolus valerandii*			R	1987	1995	U - Habitat absent or of insufficient quality	Moist shady situations and freshwater stream margins	Herb
Woolly-head Pomaderris	*Pomaderris eriocephala*			R	1978	2004	P - Habitat may be present	Open forest	Shrub
Yellow Milk-vine	*Marsdenia flavescens*			R	1975	1999	U - Habitat absent	Subtropical and dry rainforest; widespread, chiefly in coastal districts	Vine
Blue-leaf Tussock-grass	*Poa sieberiana var. cyanophylla*			DD	1987	1987	P - Habitat may be present	A variable grass of wide distribution and growing in many habitats	Tussock grass
Floating Bur-reed	*Sparganium subglobosum*			DD	1964	1964	H/U - Habitat absent	Still or slow-flowing fresh water	Aquatic perennial
Hypsela	*Hypsela tridens*			DD	1970	1970	U - Habitat absent or of insufficient quality	Grows on the edges of lakes, pools and slow-moving streams	Herb
Long-flower Beard-heath	*Leucopogon juniperinus*			DD	1940	2000	P - Habitat may be present	Dry and wet sclerophyll forest and woodland on various soils over shale or sandstone	Shrub

Common Name	Scientific Name	Conservation Status			Previously recorded in the region between years		Likelihood in mine site and justification	Habitat/Species Characteristics	Type
		EPBC Act	FFG Act	DSE					
Skeleton Vine	*Clematis leptophylla*			DD	1995	2004	U - Undergrowth probably of insufficient quality	More common in valleys and slopes of the southern highlands	Vine
Slender Tick-trefoil	*Desmodium varians*			DD	2000	2000	U - Habitat absent or of insufficient quality	Chiefly in woodland or eucalypt forest; not common	Herb
Upright Panic	*Entolasia stricta*			DD	1988	1995	U - Habitat absent or of insufficient quality	Scrub in dry areas on sandy or sandstone-derived soils	Herb
Water Parsnip	*Berula erecta*			DD	1999	1999	H/U - Habitat absent	Swamp areas and shallow water lakes	Herb

EN – Endangered; VU – Vulnerable; R – Rare; L – Listed; DD – Data deficient; H/U – Highly Unlikely; U – Unlikely; P – Potential. Habitat information sourced from (Walsh & Entwisle 1996), (Orchard & Wilson 2001), (Greig 1999) and (Costermans 2009)

Annex 4 Threatened or internationally listed bird species recorded or potentially present in the region and the likelihood of presence in the mine site

Common Name	Scientific Name	Conservation Status				Previously recorded between years		Present in Study Area	Future likelihood in mine site justification	Habitat characteristics
		EPBC Act	Treaty	FFG Act	DSE					
Australasian bittern	*Botaurus poiciloptilus*	EN		L	EN	1977	1977	-	***H/U -*** Rare species, habitat not present on site	Reedbeds, swamps, streams, estuaries
Australasian shoveler	*Anas rhynchotis*				VU	1977	1977	-	***H/U -*** Habitat absent	Heavily vegetated swamps
Australian painted snipe	*Rostratula australis*	VU; Marine; M	CAMBA	L	CR	N/A	N/A	-	***H/U -*** Rare species, habitat absent	Shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps
Azure kingfisher	*Alcedo azurea*				NT	1976	2008	-	***O -*** If creeks on site are flowing at high levels, this species may visit the site	Rivers, creeks, mangroves
Baillon's crake	*Porzana pusilla palustris*			L	VU	1977	1977	-	***H/U -*** Habitat absent	Coasts, wetlands, mangroves
Black-faced monarch	*Monarcha melanopsis*	M; Marine	Bonn			1977	1993	-	***P -*** Habitat present but species is less common in southern section of range	East coast forests, rainforests, eucalypt woodlands, coastal scrub and damp gullies
Brown treecreeper	*Climacteris picumnus victoriae*				NT	N/A	N/A	Yes	***R -*** Habitat present	Temperate or dry forests, can live in disturbed forests
Cattle egret	*Ardea ibis*	M; Marine	CAMBA JAMBA			1981	2006	-	***O -*** Habitat patchy, may fly-over	Pasture, among stock, occasionally shallows of wetlands
Chestnut-rumped heathwren	*Calamanthus pyrrhopygius*			L	VU	1977	2006	-	***O -*** Habitat probably insufficient	Coastal heath, mountain and hinterland areas, dense undergrowth of forests and woodlands
Diamond firetail	*Stagonopleura guttata*			L	NT	1977	1978	-	***U -*** Habitat absent or of insufficient quality	Grassy woodland
Eastern curlew	*Numenius madagascariensis*	M; Marine	Bonn CAMBA JAMBA ROKAMBA		NT	1977	1977	-	***H/U -*** Habitat absent	Coastal estuaries, mud flats, mangroves, sandpits
Eastern great egret	*Ardea modesta (also*	M;	CAMBA	L	VU	1977	2002	-	***U -*** Habitat patchy, unless	Wide range of wetland habitats,

Common Name	Scientific Name	Conservation Status				Previously recorded between years		Present in Study Area	Future likelihood in mine site justification	Habitat characteristics
		EPBC Act	Treaty	FFG Act	DSE					
	Egretta alba, Ardea alba)	Marine	JAMBA						creeks flood, may fly over	e.g. inland and coastal, freshwater and saline
Fairy tern (Australian)	*Sternula nereis nereis*	VU; Marine		L	EN	N/A	N/A	-	***H/U -*** Habitat absent, too far inland to fly over	Coasts, estuaries, breed on sandy beaches and sand pits
Fork-tailed swift	*Apus pacificus*	M; Marine	CAMBA JAMBA ROKAMBA			N/A	N/A	-	***U -*** May fly over during summer	Many habitats, migrant during summer
Glossy ibis	*Plegadis falcinellus*	M; Marine	CAMBA		NT	1981	1981	-	***H/U -*** Habitat absent	Freshwater marshes, swamps and lagoons
Glossy-black cockatoo	*Calyptorhynchus lathami*			L	VU	N/A	N/A	-	***O -*** Habitat probably of insufficient quality to forage or roost, but may stop over between foraging and roosting sites	Open forest, especially in she-oaks
Grey falcon	*Falco hypoleucos*			L	EN	1980	1980	-	***H/U -*** Beyond normal range	Woodland and scrub in arid zones
Grey goshawk	*Accipiter novaehollandiae novaehollandiae*			L	VU	1977	1981	-	***O -*** Habitat absent	Forested areas, especially coastal closed forests
Hooded plover	*Thinornis rubricollis rubricollis*	Marine		L	VU	1977	1977	-	***H/U -*** Habitat absent	Ocean beaches, rarely coastal lakes
Hooded robin	*Melanodryas cucullata cucullata*			L	NT	1977	2008	-	***U -*** Habitat absent and beyond normal range	Dry forests, woodlands, mallee, scrublands
Latham's snipe	*Gallinago hardwickii*	M; Marine	Bonn CAMBA JAMBA ROKAMBA	N	NT	1977	2007	-	***U -*** Rare migrant, habitat absent unless creeks flood, may be seen flying over	Occurs in permanent and ephemeral wetlands with low, dense vegetation. But also occur in habitats with saline or brackish water
Lewin's rail	*Lewinia pectoralis pectoralis*			L	VU	1977	1977	-	***H/U -*** Recorded once in area, habitat absent	Grassy, reedy, thickly vegetated waterways
Little egret	*Egretta garzetta nigripes*			L	EN	1980	1980	-	***H/U -*** Recorded once in area, habitat absent	Wetlands, inter-tidal mudflats

Common Name	Scientific Name	Conservation Status				Previously recorded between years		Present in Study Area	Future likelihood in mine site justification	Habitat characteristics
		EPBC Act	Treaty	FFG Act	DSE					
Magpie goose	*Anseranas semipalmata*			L	NT	1978	1978	-	***H/U -*** Recorded once in area, habitat absent, beyond normal range	Rush and sedge dominated wetlands
Masked owl	*Tyto novaehollandiae novaehollandiae*			L	EN	1977	2007	Yes	***O -*** Habitat present for hunting, unlikely to roost on site	Forests, woodlands, caves. Roosts in tree hollows, dense foliage, out-buildings, caves
Musk duck	*Biziura lobata*				VU	1977	1981	-	***H/U -*** Habitat absent	Permanent swamps with dense vegetation; large open lakes, tidal inlets and bays
Nankeen night heron	*Nycticorax caledonicus hillii*				NT	1977	1981	-	***H/U -*** Habitat absent	Swamps, inter-tidal flats, estuaries, rivers
Orange-bellied parrot	*Neophema chrysogaster*	CR		L	CR	N/A	N/A	-	***H/U -*** Species population too small and habitat insufficient	Breeds in Tasmania in open forest copse in heath. Winters in mainland coastal saltmarsh, dunes, damp grasslands
Painted honeyeater	*Grantiella picta*			L	VU	N/A	N/A	-	***H/U -*** Area is beyond normal range, probably insufficient quality habitat	Open box-ironbark forests, woodlands, especially with mistletoe
Pied cormorant	*Phalacrocorax varius*				NT	1977	1987	-	***H/U -*** Habitat absent	Large areas of water, coastal or inland lakes, rivers and mangrove line estuaries
Powerful owl	*Ninox strenua*			L	VU	1977	2009	-	***O -*** Habitat probably of insufficient quality to nest or roost, but may forage	Tall open forests, woodlands, roost in large trees in gullies
Rainbow bee-eater	*Merops ornatus*	M; Marine	JAMBA			N/A	N/A	-	***U -*** Habitat absent, may fly-over	Open country, sand dunes, banks
Regent honeyeater	*Anthochaera phrygia*	EN; M	JAMBA	L	CR	N/A	N/A	-	***H/U -*** Population reduced, habitat probably of insufficient quality	Open forests, woodlands, especially near blossoming eucalypts and mistletoe
Royal spoonbill	*Platalea regia*				NT	1980	1981	-	***H/U -*** Habitat absent	Shallows of fresh and saltwater wetlands, intertidal flats

Common Name	Scientific Name	Conservation Status				Previously recorded between years		Present in Study Area	Future likelihood in mine site justification	Habitat characteristics
		EPBC Act	Treaty	FFG Act	DSE					
Rufous fantail	*Rhipidura rufifrons*	M; Marine	Bonn			1977	1993	-	***O*** **-** More likely further north but may visit area occasionally	Wet forests, occasionally in open forests
Satin flycatcher	*Myiagra cyanoleuca*	M; Marine	Bonn			1977	1977	-	***O*** **-** Habitat understorey too dense but may move through the area occasionally	Tall and medium open forests, often at height
Sooty owl	*Tyto tenebricosa tenebricosa*			L	VU	1979	2008	-	***O*** **-** Habitat probably of insufficient quality to nest or roost, but may forage	Closed and tall forests, especially in gullies; roost in tree hollows, caves by day; active in canopy at night
Speckled warbler	*Chthonicola sagittata*			L	VU	1978	1978	-	***H/U*** **-** Recorded once in area >30 years ago, habitat insufficient quality	Open woodlands
Spotted harrier	*Circus assimilis*				NT	N/A	N/A	-	***U*** **-** Habitat absent, may fly-over	Open grassland, crops and windbreaks
Spotted quail-thrush	*Cinclosoma punctatum*				NT	N/A	N/A	-	***U*** **-** Habitat absent or of insufficient quality	Sclerophyll forests, ideally on leaf-littered rocky ridges with short grass tussocks
Square-tailed kite	*Lophoictinia isura*			L	VU	N/A	N/A	-	***U*** **-** Habitat absent, may fly-over	Open forests, riverine woodlands, scrubs, heathlands
Swift parrot	*Lathamus discolor*	EN; Marine		L	EN	1977	1977	-	***U*** **-** Habitat understorey too dense but may move through the area occasionally	Drier open forests, woodlands, parks, gardens
Turquoise parrot	*Neophema pulchella*			L	NT	2004	2004	-	***O*** **-** Habitat insufficient to forage or roost, but may stop over	Open forests; eucalyptus woodlands and open forests, with a ground cover of grasses and low understorey of shrubs
White-bellied sea-eagle	*Haliaeetus leucogaster*	M; Marine	CAMBA	L	VU	1977	2008	-	***O*** **-** Habitat absent, may fly-over	Large rivers, fresh and saline lakes, reservoirs, coastal seas, islands
White-fronted tern	*Sterna striata*				NT	1977	1977	-	***H/U*** **-** Habitat absent	Oceanic, rocky reefs, in Australia during non-breeding season

Common Name	Scientific Name	Conservation Status				Previously recorded between years		Present in Study Area	Future likelihood in mine site justification	Habitat characteristics
		EPBC Act	Treaty	FFG Act	DSE					
White-throated needletail	*Hirundapus caudacutus*	M; Marine	CAMBA JAMBA ROKAMBA			N/A	N/A	-	***O -*** Habitat insufficient to forage or roost, but may stop over	Coastal and mountainous regions; migrant in summer

Key: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; M – Migratory; Marine – Marine; NT – Near Threatened; L – Listed; N – Nominated; Bonn – Bonn Convention; CAMBA – China-Australia Migratory Bird Agreement; JAMBA – Japan-Australia Migratory Bird Agreement; ROKAMBA – Republic of Korea-Australia Migratory Bird Agreement; H/U – Highly unlikely; U – Unlikely; O – Occasional visitor; P – Potential resident; R – Resident. Habitat characteristics generally sought from (Simpson & Day 1999) and common knowledge.

Annex 5 Nationally and state threatened mammalian species recorded or potentially present in the region and the likelihood of presence in the mine site

Common Name	Scientific Name	Conservation Status			Previously recorded between years		Present in Study Area	Future likelihood in mine site and justification	Habitat characteristics
		EPBC Act	FFG Act	DSE					
Brush-tailed rock-wallaby	*Petrogale penicillata*	VU	L	CR	N/A	N/A	-	***H/U -*** Species population too small and habitat insufficient	Rocky escarpments, caves and ledges for shelter and face north for warmth
Common bent-wing bat	*Miniopterus schreibersii GROUP*		L		1965	1969	-	***H/U -*** Habitat absent	Roosts in caves, old mines, road culvets. Forages above canopy of forested areas
Eastern horseshoe bat	*Rhinolophus megaphyllus*		L	VU	1964	1965	-	***H/U -*** Habitat insufficient to forage or roost	Cave roosting in closed tropical forest habitats and hot humid roosting sites
Eastern pygmy possum	*Cercartetus nanus*		I	NT	1961	1961	-	***O -*** Habitat absent or of insufficient quality, but may infrequently move through site	Temperate rainforest, dry and wet sclerophyll forest, banksia woodland, and coastal heath
Greater glider	*Petauroides volans*			VU	1978	2000	-	***P -*** Habitat present; may breed in area	Wet sclerophyll forest, needs large tree hollows for shelter
Grey-headed flying-fox	*Pteropus poliocephalus*	VU	L	VU	N/A	N/A	-	***H/U -*** Habitat absent or of insufficient quality. No established colonies in area	Utilises vegetation communities including rainforests, open forests, closed and open woodlands
Long-footed potoroo	*Potorous longipes*	EN	L		N/A	N/A	-	***H/U -*** Habitat absent or of insufficient quality	Temperate rainforest, riparian forest and wet sclerophyll forest
Long-nosed potoroo	*Potorous tridactylus tridactylus*	VU	L	NT	N/A	N/A	-	***O -*** Rare species, habitat probably of insufficient quality to permit constant/resident populations	Open forest and woodland and the ecotone in-between
New Holland mouse	*Pseudomys novaehollandiae*	VU	L	VU	N/A	N/A	-	***U -*** Understorey heath probably of insufficient quality to provide habitat	Coastal areas and up to 100 km inland, open heathland, vegetated sand dunes, open woodland with a heathland understorey

Common Name	Scientific Name	Conservation Status			Previously recorded between years		Present in Study Area	Future likelihood in mine site and justification	Habitat characteristics
		EPBC Act	FFG Act	DSE					
Southern brown bandicoot	*Isoodon obesulus obesulus*	EN	L	NT	N/A	N/A	-	***P -*** Habitat may be present, local populations known in Gippsland area; however likelihood of occurrence limited by presence of predators and insufficient ground cover	Variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland
Southern myotis	*Myotis macropus*			NT	N/A	N/A	-	***U -*** Habitat absent	Preferred habitat is riparian. Roosts in caves, mines, tree hollows
Spot-tailed quoll	*Dasyurus maculatus maculatus*	EN	L	EN	N/A	N/A	-	***O -*** Habitat probably unsuitable	Temperate and subtropical rainforests in mountain areas, wet schlerophyll forest, lowland forests, open and closed eucalypt woodlands
White-footed dunnart	*Sminthopsis leucopus*		L	NT	1978	1978	-	***P -*** Habitat may be present, may be of insufficient quality to sustain population	Occurs in forests and woodlands with an open understorey of low density vegetation; also in grassy fore-dune complexes

Key: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; L – Listed; I – Insufficient data; H/U – Highly unlikely; U – Unlikely; O – Occasional visitor; P – Potential resident. Habitat characteristics sought from (Menkhorst 1995)

Annex 6 Nationally and state threatened reptilian and amphibian species recorded or potentially present in the region and the likelihood of presence in the mine site

Common Name	Scientific Name	Conservation Status			Previously recorded between years		Present in the Study Area	Future likelihood in mine site and justification	Habitat characteristics
		EPBC Act	FFG Act	DSE					
Lace monitor	*Varanus varius*			EN	1992	2002	Yes	***O*** **-** Habitat present; presence dependent on prey; large home ranges and can travel several km a day	Common; semi-arboreal, forested areas
Dendy's toadlet	*Pseudophryne dendyi*			DD	1961	1977	-	***O*** **-** Habitat absent; unless creeks flood	Adults often in damp leaf litter or sheltering under other debris and can be in both wet and dry forests and alpine areas
Giant burrowing frog	*Heleioporus australiacus*	VU	L	CR	N/A	N/A	-	***U*** **-** Several records in the Lakes Entrance area; species found far from water; potential habitat present but still unlikely	Appears dependent on areas with native vegetation, with eucalypt forests. Occur in a wide range of forest communities including montane sclerophyll and riparian woodland
Green and golden bell frog	*Litoria aurea*	VU	I	VU	1965	1993	-	***U*** **-** Habitat currently absent; if creeks flood, frogs may move in from more permanent nearby streams	Coastal plains and lowland forest, damp forest, shrubby dry forest. Breeding habitat includes dams, coastal lagoons and streamside pools. Habitats are mostly permanent
Growling grass frog	*Litoria raniformis*	VU	L	EN	N/A	N/A	-	***H/U*** **-** Habitat currently absent. Beyond normal range	Emergent vegetation, such as lagoons, ponds and farm dams. Also in open grassland, open forest, and ephemeral and permanent non-saline marshes and swamps
Littlejohn's tree frog	*Litoria littlejohni*	VU	L	EN	N/A	N/A	-	***U*** **-** Some habitat may be present; if creeks flood	Forest, coastal woodland and heath. Breeding habitat may be temporary pools in forested areas, deep permanent pools of slow creeks
Martin's toadlet	*Uperoleia martini*			CR	N/A	N/A	Yes	***O*** **-** Some habitat may be present; if creeks flood	Adults are found in dry forest, shrublands, grasslands, and open and disturbed areas. Mostly near water, but also in dry depressions that flood in winter or spring

Common Name	Scientific Name	Conservation Status			Previously recorded between years		Present in the Study Area	Future likelihood in mine site and justification	Habitat characteristics
		EPBC Act	FFG Act	DSE					
Southern toadlet	*Pseudophryne semimarmorata*			VU	1961	1979	-	***O*** **-** Some habitat may be present; if creeks flood	Adults in dry forest, shrubland, grassland, and heaths; under leaf litter and other debris in moist soaks
Tyler's toadlet	*Uperoleia tyleri*			DD	N/A	N/A	-	***O*** **-** Some habitat may be present; if creeks flood	Adults are found in dry forest, shrublands, grasslands, and open and disturbed areas. Most common near water, but can be found in dry depressions that flood in winter or spring

Key: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; L – Listed; DD – Data deficient; H/U – Highly unlikely; U – Unlikely; O – Occasional seasonally dependant visitor. Information generally sourced from (Tyler & Knight 2011) and (Swanson 2007)

Annex 7 Owl survey and sighting information

Requirement	Details
Names and contact details	Dr Megan Price and Naveena Wijesekara Earth Systems Suite 17, 79-83 High Street Kew, VIC 3101 Tel: +61398107500
Species present, number of individuals and type of observation	One masked owl seen No other species within 10 m Yellow-bellied glider ~200 m
Date and time	08/05/2013 at 19:41 AEST
Precise geographic location	55 H 600258 5831487 Halfway along Telephone Rd, sitting on a branch overhanging the track Appeared to be hunting
Weather details	Approximately 16°C Beaufort wind scale: 2 (light breeze)
Method of observation	Spotlighting
Targeted owl sampling effort	For general surveying effort see Section 5.3 Time searching for owls 37 hours, 40 minutes Call playback and recognition covered 3500 ha Transect spotlighting covered 200 ha Number of nights: 12 Number of days: 18 (dusk, dawn and day) Sequence: powerful, sooty and then masked owl vocalisations (i.e. territorial screams and trilling) were played and all calls were followed by at least 2 min silence
Quality of light and optical aids	250 lumen portable spotlight 42 x 8 binoculars
Experience and qualifications of observers	
Dr Megan Price	Bsc (Hons) and PhD (Biological Sciences, Monash University) Extensive field experience with bird and mammal behaviour

Requirement	Details
	and physiology A-class ABBBS authority Select publications: Price, M. (2008). The impact of human disturbance on birds: a selective review. *Too Close for Comfort: Conflicts in Human Wildlife Encounters*. D. Lunney, A. Munn and W. Meikle. Sydney, Royal Zoological Society of NSW: 163-196. Price, M. & A. Lill (2008). Does pedestrian traffic affect the composition of 'bush bird' assemblages? *Pacific Conservation Biology* 14: 54-62.
Naveena Wijesekara	BSc (Hons) Biological Sciences, University of Brunei Darussalam MEnv, University of Melbourne Grad. Dip. Environmental Planning, RMIT Extensive experience with bird behaviour and ecology Honours thesis: Behaviour, movement and habitat usage non-breeding pied hornbills (*Anthracoceros albirostris*) groups in Panaga, Brunei Darassalam
Supporting evidence	See Plate 5-6