



VicRoads

Western Highway Bypass Project - Beaufort Stage 1 - Flora, Fauna and Aquatic Assessment

January 2015

Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.3 and the assumptions and qualifications contained throughout the Report.

Project Understanding and Study Area

The project involves planning for a dual carriageway along a new alignment around the town of Beaufort. The project will be constructed to a freeway standard (Class AMP1) and link the already completed (or approved) sections of the Western Highway duplication to the east and west of Beaufort. The project will remove bypass-able traffic from the town and include interchanges to provide connectivity with the township and surrounding facilities. Connections from the existing Western Highway to the new alignment options are also included in the scope.

Three potential bypass alignments have been identified within a broader investigation corridor, which is termed hereafter as the study area.

The level of detail required for input into the planning processes for such an extensive area is significant and in order to streamline the process VicRoads has determined that the project be split into two stages: Stage 1 (rapid assessment of whole study area) and Stage 2 (detailed and targeted assessments of preferred alignment). This report presents the findings of Stage 1.

The purpose of this assessment (Stage 1) is to identify the main ecological values present within the study area for the proposed Western Highway Beaufort Bypass. This information will inform an assessment of the four alignment options identified within the study area. This report presents the findings of Stage 1. Undertaking a preliminary assessment for the study area at Stage 1 will allow project time and cost savings, as detailed assessments will only need to be undertaken for a 'preferred' alignment at Stage 2. This staged approach will contribute to a robust multi-criteria analysis for the project which is paramount for the planning processes, which may lead to an EES.

The study area for the Western Highway Beaufort Bypass encompasses an area of approximately 1,141 ha to the north of the township of Beaufort. Beaufort is located approximately 170 km west of Melbourne. The study area intersects two Bioregions: Central Victorian Uplands (CVU) and Victorian Volcanic Plains (VVP).

Surveys undertaken for the Western Highway Project, Sections 2 (between Beaufort and Ararat west of the study area) identified numerous flora and fauna species and communities of national and state significance that have previously been recorded, or have the potential to occur within the local area (Ecology and Heritage Partners, 2014).

The major named waterway within the project investigation corridor is Yam Holes Creek. A number of waterways drain through Beaufort before joining Yam Holes Creek. These include Garibaldi Creek, which is associated with the Beaufort Reservoir to the south of the investigation corridor.

Field surveys were conducted by a qualified botanist and zoologist on 5-7 and 10 November 2014, and by a qualified aquatic ecologist on 5 November 2014. GHD undertook field surveys and investigations within the study area and recorded incidental species sightings, habitat or potential habitat and its quality relating to flora and fauna. This was completed at a high level only for each portion of the study area visited.

Vegetation and Flora

The study area included a range of EVCs of varying quality, which have been mapped at a coarse scale. Five different EVCs were identified as well as three mosaics comprising two EVCs. The majority of the remaining area is considered non-native vegetation. The majority of the EVCs mapped within the study area are classified as depleted, with smaller areas also mapped as Endangered, Vulnerable or Least Concern.

One EPBC Act listed and one FFG Act listed vegetation communities have the potential to occur across the study area. Further survey is required to determine the presence of these communities.

A total of 155 flora species were recorded incidentally during the preliminary field survey (111 native and 44 exotic species). No species listed as threatened under the Commonwealth EPBC Act, the Victorian FFG Act and/or the Victorian Advisory List of Rare or Threatened Plants in Victoria were observed during the field survey. However eight rare and threatened flora species were considered possible to occur within the study area based on the presence of suitable habitat.

Twenty species listed as protected under the FFG Act were identified within the study area (i.e. all species of Asteraceae, most species of Acacia). However, this survey was a high level, broad-scale, rapid assessment, and did not include collecting detailed species lists. It is possible that additional listed threatened species may occur within the study area.

Forty-four weed species were recorded during the field investigation, including declared noxious weeds listed under the Catchment and Land Protection (CaLP) Act 1994 and/or Weeds of National Significance (WONS).

The study area occurs within a Phylloxera Exclusion Zone, which is known to be free of phylloxera.

Cinnamon Fungus (*Phytophthora cinnamomi*) was not detected during the field survey; however, it is possible this disease may be present within the study area, and future surveys should still consider the potential presence of this pathogen.

Terrestrial Fauna

Four broad fauna habitats were identified within the study area: Grassland, woodland, wetlands for waterbirds and wetlands for frogs. Each of these habitat types provides suitable habitat for a range of common and threatened fauna species.

A total of 48 terrestrial fauna species were identified during the site visit (45 native species and three non-native species). Three of the species detected are listed as threatened or near threatened under the DEWLP Advisory Lists of Threatened Vertebrate Fauna of Victoria. Five bird species that are members of the Victorian Temperate Woodland Bird Community were detected; two of these are listed as threatened species also. One bird species was detected which is listed under the EPBC Act as Migratory.

Nineteen threatened fauna species were identified during the assessment that are considered possible to occur within the study area.

Six key indicator species and two associated bird species of the Victorian Temperature Woodland Bird Community (VTWBC) were identified by the desktop assessment for the study area. Consequently, this threatened community occurs within the study area. It is considered likely that this community could occur within areas mapped as medium or high likelihood of woodland fauna habitat within Figure 9.

Twelve species (all birds) known or predicted to occur within 5 km of the study area are listed as Migratory under the EPBC Act. While some of these species are known to use parts of the study area, none of these species is considered likely to make significant use of the study area.

Wildlife corridors are areas of habitat that facilitate the movement of fauna between other areas of habitat. Corridors play important roles in linking otherwise isolated areas of habitat.

Within the study area connected patches or strips of remaining wooded habitat are likely to act as important wildlife corridors between the larger tracts of woodland that remain (e.g., Camp Hill State Forest and Snow Gums Bushland Reserve). In this study area, corridors are numerous and include all wooded watercourses and all wooded roadsides. That said, some corridors are likely to be more important than others for fauna movement.

Aquatic

A rapid field assessment of waterways was conducted at 45 locations in and adjacent to the study area.

Of the 45 sites assessed, ten were considered as moderate condition, and two were considered in good condition.

Yam Holes Creek and some tributaries at the western and north-western end of the study area contained some of the higher quality aquatic habitat, and this waterway often comprises a chain of pools with better riparian and aquatic habitat condition than other tributaries or streams within the study area. In general, the waterways observed were mostly ephemeral streams that were dry at the time of observation. Despite the absence of water in most waterways at the time of observation, these dry waterways should be considered as potential habitat or dispersal/migration corridors for aquatic species that utilise these ephemeral channels during wetted conditions. Within these ephemeral streams, remnant pools and are likely to provide critical refugia for aquatic species, particularly aquatic fauna, during dry periods.

Nine aquatic sites were considered to possibly contain habitat for one species of threatened aquatic fish, Dwarf Galaxias.

Impacts and Mitigation

An assessment of potential high level impacts has been undertaken. In the absence of appropriate mitigation measures, this project could result in some or all of listed impacts upon ecological values within and surrounding the study area. The provided mitigation measures are intended as a summary of the main measures that considered likely to reduce the impact of the project on ecological values. Once an alignment is selected an EMP will be required to be developed which outlines measures to protect the environment.

Assessment of Options

The overarching project objective that relates to the protection of ecological values is “to minimise impacts on the biophysical environment, particularly fauna and flora species of state and national significance”. In order to address this objective a number of sub objectives and assessment criteria have been developed. Each alignment option has been ranked from “Very Poor” to “Very Well” against each assessment criterion.

Each alignment performed very differently against each of the assessment criterion. All assessment criteria however are not considered to be equal and it is recommended that individual criterion be weighted to determine the greatest impacts on ecological values of each alignment.

Legislation

Until a preferred alignment is chosen it is not possible to determine which permits and legislation will be required for the project however it is considered likely that a number are likely to be required (i.e. permit to remove native vegetation). These are summarised within section Table 21.

Recommendations

It is recommended that the information provided within this report be used in a risk assessment to determine the preferred alignment considering ecological and other values within the study area.

Targeted surveys are recommended for a number of species and communities to further inform the potential impacts to threatened species and communities as a result of the project – the level of survey effort required for threatened species and communities for this project would need to be determined in liaison with DEWLP.

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1. Introduction

1.1 Project understanding

The project involves planning for a dual carriageway along a new alignment around the town of Beaufort. The project will be constructed to a freeway standard (Class AMP1) and link the already completed (or approved) sections of the Western Highway duplication to the east and west of Beaufort. The project will remove bypass-able traffic from the town and include interchanges to provide connectivity with the township and surrounding facilities. Connections from the existing Western Highway to the new alignment options are also included.

The project is located on the eastern, northern and western outskirts of the Beaufort township. Three potential bypass alignment options north of Beaufort have been identified within the study area. The eastern end of the corridor ties in with the already duplicated section of the Western Highway immediately east of Beaufort and the western end ties in with the already approved section of the of the Western Highway duplication west of Beaufort.

The project will include the following components:

- Construction of a dual carriageway around the town of Beaufort;
- Construction of interchanges to connect the township of Beaufort to the Western Highway;
- Construction of an overpass of the Beaufort-Ballarat rail line; and
- Intersection treatment of local roads.

The two carriageways will be separated by a central median. The Right-of-Way (ROW, or road reservation) will be approximately 80 m for the dual carriageway increasing to approximately 250 m wide at interchanges.

The level of detail required for input into an Environmental Effects Statement (EES) for such an extensive area is significant and in order to streamline the process VicRoads has determined that the project be split into two stages: Stage 1 (rapid assessment of whole study area) and Stage 2 (detailed and targeted assessments of preferred alignment).

Undertaking a preliminary assessment for the study area will allow project time and cost savings, as detailed assessments will only need to be undertaken for a 'preferred' alignment. This staged approach will contribute to a robust multi-criteria analysis for the project which is paramount for the planning processes, which may lead to an EES.

1.2 Scope and objectives

The purpose of this assessment is to identify the main ecological values present within the study area determined for the potential Western Highway Beaufort Bypass. This information will inform an assessment of the four alignment options identified within the study area.

This flora, fauna and aquatic assessment includes:

- A background review of relevant government environmental databases;
- A rapid site assessment to identify ecological values within the study area and potential constraints on the project relating to these values;
- A high level assessment of potential impacts, mitigation and resultant impacts (following implementation of proposed mitigation measures);
- Provision of recommendations to avoid and/or minimise impacts on ecological values;
- Identifying potential implications of the project with respect to relevant environmental government legislation and policy; and
- Assessment of alignment options in relation to key ecology assessment criteria.

A more detailed account of the Scope can be found within our proposal, submitted to VicRoads 25 September 2014.

1.3 Limitations and assumptions

This Western Highway Bypass Project – Beaufort, Stage 1 – Flora, Fauna and Aquatic Assessment Report (“Report”):

- *has been prepared by GHD Pty Ltd (GHD) for VicRoads;*
- *may only be used and relied on by VicRoads;*
- *must not be copied to, used by, or relied on by any person other than VicRoads without the prior written consent of GHD;*
- *may only be used for the purpose of assessing the ecological values present within the proposed study area and evaluating the proposed impacts on native vegetation and native fauna habitat (and must not be used for any other purpose).*

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than VicRoads arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, study area and ecological limitations sections set out in the Report.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered onsite and information reviewed at the time of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report. GHD disclaims liability arising from any of the assumptions being incorrect.

Our survey was limited to the proposed study area provided by VicRoads. If construction plans change and a larger and/or different area is proposed to be included in the footprint of construction, further ecological survey may be required to determine impacts in these additional areas.

The following are limitations and assumptions have been made during the course of this assessment:

- Not all parts of the study area were assessed during the field assessment. This was a rapid assessment targeted at areas with potential for ecological values and constraints;
- The study area was assessed irrespective of alignment options to avoid bias within these areas and allow a broader picture of the ecological values within the study area to be gauged;
- This ecological assessment mostly covers species of vascular plants (ferns, conifers and flowering plants) and vertebrate fauna (mammals, birds, reptiles, frogs and fish). Non-vascular flora (e.g. mosses, liverworts, lichens), fungi and terrestrial invertebrates have not been considered in detail as part of this assessment, except where listed threatened species are known or suspected to occur;
- The maps presented in this report are indicative in nature (i.e. GPS accurate to +/- 10 m) and therefore this information should not be relied on for the detailed design during the construction process;
- The field assessment was undertaken during spring, which is considered a suitable time of year for conducting flora assessments but some native flora species are difficult or impossible to locate or identify at this time of year, due to a lack of reproductive material and/or the seasonal nature of some species (in particular, native orchids and forbs). Additional native species are likely to be recorded at the site at other times of the year. Therefore, it is considered possible that threatened flora species were overlooked during the survey, although this limitation is somewhat overcome by consideration of records from the Flora Information System (FIS) and Victorian Biodiversity Atlas (VBA) databases;
- This assessment did not involve any targeted surveys for rare or threatened species, although did include identification of flora species that were fertile and/or flowering at the time of the field investigations. It was beyond the scope of this assessment to employ more detailed flora or fauna survey techniques, such as flora quadrat surveys or fauna trapping (though if rare or threatened species were seen these were documented);
- Databases used e.g. [the Victorian Biodiversity Atlas (VBA), Flora Information System (FIS)] contain information that is only as accurate as the quality and quantity of data that has been recorded and documented from the area. The use of these databases in a desktop assessment has the following limitations:
 - The VBA is not updated regularly and information is uploaded in batches which means some existing records (particularly recent records) may not be available (the use of multiple sources of information helps to overcome this);
 - Many locations locally and across Victoria have a low level of documented survey effort for one or more groups of flora and fauna. During field surveys, it is not uncommon to find species at locations for which there are few or no previous nearby database records.

- The proposed works area will be limited to the study area mapped within Figure 1;
- The opinions, conclusions and any recommendations in this report are based on conditions encountered, observations made and information reviewed up to the date of preparation of the report. Due to the fact that GHD was only present at specific points within the relevant study area on specific dates and certain time periods, this report is only indicative (and not definitive) of flora and fauna present on the site(s). Flora and fauna (whether in type or quantity) can also change and fluctuate at different times throughout the year (due to factors including seasonal changes, external events or third party intervention), and it is generally not possible to observe such changes or fluctuations where only discrete site(s) visits have taken place. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared;
- GHD has prepared this report on the basis of information provided by VicRoads and others (including Government authorities and other consultancy reports). GHD has not independently verified or checked this information beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information;
- The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD and described in this report. GHD disclaims liability arising from any of the assumptions being incorrect; and
- Since receiving the brief from VicRoads, the scope has changed considerably and as explained in section 1.1 the project has been split into Stage 1 and Stage 2. It should be noted that this report does not address everything identified within the original brief due to the changes as described.

1.4 Acknowledgements

GHD acknowledges the assistance, advice and/or information provided by the following:

- Sam Brown (VicRoads) and Ben Clark (VicRoads) for assistance with landholder access and the provision of background documents;
- DELWP Staff (Lisa Macaulay, Mark Chisolm, Gary Peterson);
- The Victorian Department of Environment, Land, Water and Planning (DELWP¹) for access to the VBA database and Biodiversity Interactive Maps;
- Viridans for access to the FIS database; and
- The Commonwealth Department of the Environment (DotE) for access to its Protected Matters Search Tool (PMST).

¹ Department was known as DEPI when the databases were accessed in November 2014

1.5 Study area

The study area for the Western Highway Beaufort Bypass encompasses an area of approximately 1,141 ha to the north of the township of Beaufort. Beaufort is located approximately 170 km west of Melbourne. The study area skirts the northern boundary of the town and intersects a mixture of private and public land.

The township of Beaufort adjoins the central southern boundary of the project investigation corridor. Beaufort is the largest town within the Pyrenees Shire, with a population of just over 1,000 people. The town is horizontally bisected by the Western Highway, and as such it currently functions as a highway service centre. The majority of residential development in the Shire is concentrated in the township of Beaufort. Commercial activities within the local area are primarily focussed around agriculture, timber plantations and timber processing.

The topography of the investigation corridor is characterised by undulating plains and rolling low hills, steepest in the north where the project investigation corridor converges with the Camp Hill State Forest.

The Camp Hill State Forest (105 ha), partly covered by the study area, extends from the northern boundary of Beaufort and continues northwards. The State Forest is managed by the Victorian Department of Environment, Land, Water and Planning (DELWP) for both conservation and timber production.

The Snowgums Bushland Reserve (27 ha) (managed by Parks Victoria) is located in the eastern part of the study area, between the railway line and Racecourse Road. To the west of the reserve is the Central Highlands Water sewage treatment plant. To the north-west of the reserve, between Racecourse Road and Beaufort-Lexton Road is the Beaufort Motorcycle Track.

There are areas subject to flooding within the project investigation corridor; these areas are primarily associated with the Yam Holes Creek catchment, and are located in the southern part of the project investigation corridor, either side of the Camp Hill ridge in particular, and include the area between Racecourse Road and Beaufort-Lexton Road, as well as the land immediately west of Main Lead Road (near Camp Hill). This land to the west of Main Lead Road contains the Beaufort Main Lead Common recreation area, as well as the Beaufort Trotting Training Track.

These floodplains, in addition to the hilly terrain to the north of the railway line, have informed Council's preference for future residential development to be generally directed toward the south of the Beaufort township. Most of the project investigation corridor has been identified by Council as being unsuitable for extensive small lot rural development.

The major named waterway within the project investigation corridor is Yam Holes Creek. A number of waterways drain through Beaufort before joining Yam Holes Creek. These include Garibaldi Creek, which is associated with the Beaufort Reservoir to the south of the investigation corridor. There are a large number of smaller waterways and tributaries as well as flood / retention areas (Beca, 2012) within the study area.

The study area for the Beaufort Bypass intersects two Bioregions: Central Victorian Uplands (CVU) and Victorian Volcanic Plains (VVP). The project study area is comprised of areas of both native and non-native vegetation.

According to extant (2005) Ecological Vegetation Class mapping, a large proportion of the existing native vegetation within the corridor is classified as Endangered within its respective Bioregion.

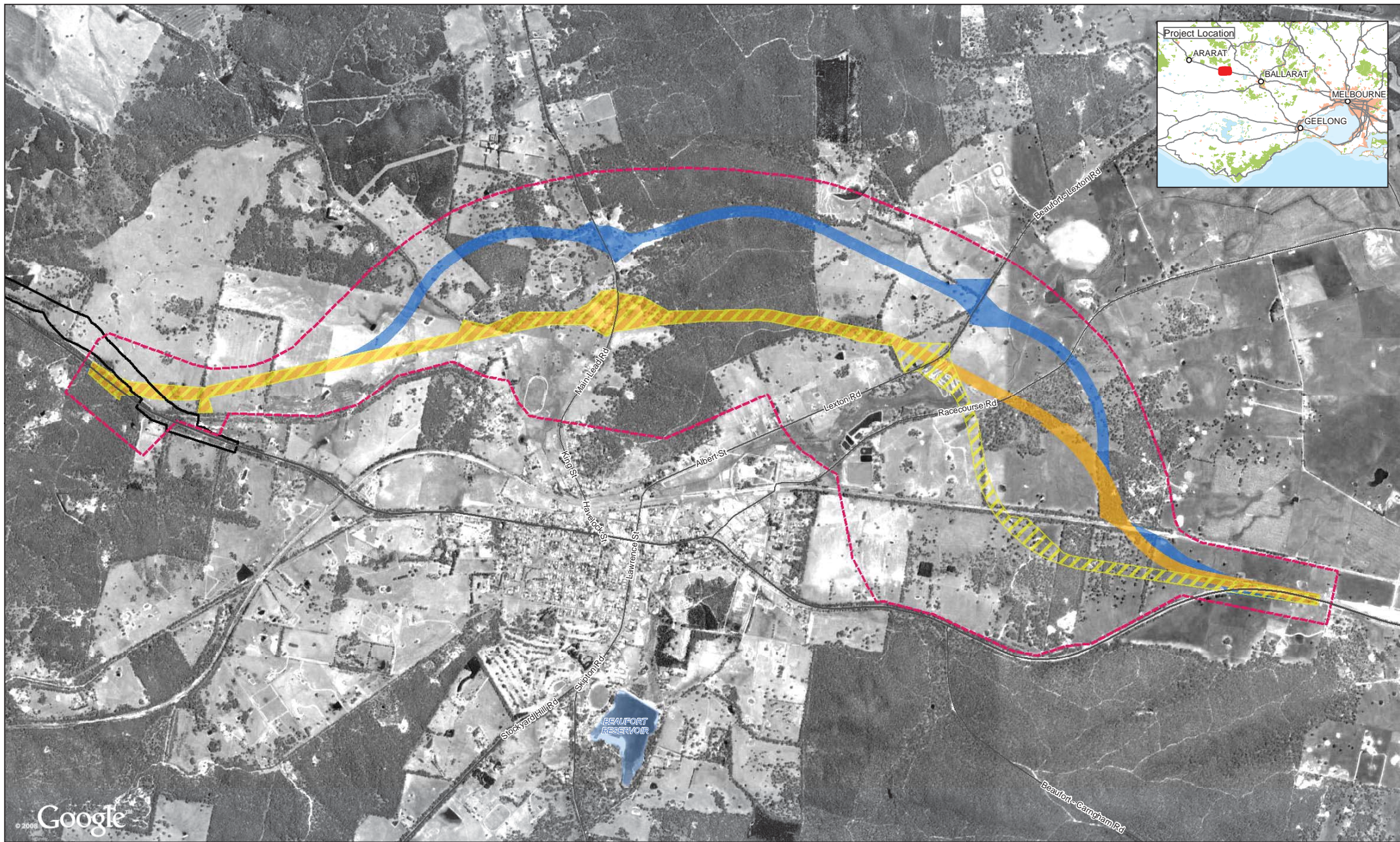
Surveys undertaken for the Western Highway Project, Sections 2 (between Beaufort and Ararat west of the study area) identified numerous flora and fauna species and communities of national and state significance that have previously been recorded, or have the potential to occur within the local area (Ecology and Heritage Partners, 2014).

There are three potential bypass alignment options to the north of Beaufort (B4-A, B4-B and B5) which are considered feasible and are encompassed by the study area. The following descriptions of these alignment options are from east to west. Each alignment option is described in Table 1 and shown in Figure 1.

Table 1 Description of Alignment Options²

Alignment Option	Description	Approximate length (km)	Approximate Land take (ha)
B4-A	This option leaves the Western Highway and travels parallel to the Beaufort-Ballarat rail line before travelling north, crossing the rail line. It then travels immediately east of the sewage treatment plant to a point north of the Beaufort-Lexton Road. It then continues to the north of the town before tying into the Western Highway at a point west of the Red Kangaroo Roadhouse.	9.8	104
B4-B	This option is a slight variation to B4-A differing at the eastern end only. It leaves the Western Highway, travels parallel to the Beaufort-Ballarat rail line before travelling north, crossing the rail line at a point more easterly than B4-A. It then travels east of the sewage treatment plant to a point north of the Beaufort-Lexton Road. It then continues to the north of the town before tying into the Western Highway at a point west of the Red Kangaroo Roadhouse.	9.6	96
B5	This option leaves the Western Highway, travels parallel to the Beaufort-Ballarat rail line before travelling north and crossing the rail line. It then continues north of the town, more northerly than option B4 before tying into the Western Highway at the same location as B4 to a point immediately north of the rail line.	10.5	105

² Information provided by VicRoads (Appendix A)



2. Methods

2.1 Nomenclature

2.1.1 Flora species

Common and scientific names for plants follow the VBA database (accessed 2014).

2.1.2 Vegetation communities

Native vegetation in Victoria is classified into units known as Ecological Vegetation Classes (EVCs). EVCs are described according to a combination of floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC occurs under a common regime of ecological processes within a given biogeographic range, and may contain multiple floristic communities (DNRE 2002).

Other vegetation types that may occur in Victoria include flora communities listed as threatened on the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and/or the Victorian *Flora and Fauna Guarantee (FFG) Act 1988*. These two Acts have separate vegetation classification systems that are also separate from the EVC classification system. As such, any single patch of native vegetation occurring within the project area (or anywhere in Victoria) will be classifiable as a particular EVC type, and it may also be separately classified as a different vegetation community under the EPBC Act, and/or as another vegetation community under the FFG Act.

2.1.3 Fauna species

Unless otherwise noted, common and scientific names for terrestrial fauna (mammals, birds, reptiles, amphibians, invertebrates) follow the VBA database (accessed 2014).

2.1.4 Fauna communities

Unlike flora and the use of EVCs, there is no official widespread classification system for fauna communities in Victoria. Both the EPBC Act and the FFG Act list a small number of fauna communities that are threatened, at a national or state scale, respectively. Fauna communities known or potentially occurring within the project area or surrounds are only considered in this report if they are listed under either of these two Acts.

2.2 Consultation

A review of relevant ecological databases was undertaken to determine any recorded information relevant to the study area. This review included:

- Lisa Macaulay – Senior Biodiversity Officer, Department of Environment and Primary Industries, Ballarat
- Mark Chisolm – Biodiversity Officer, Department of Environment and Primary Industries, Melbourne
- Gary Peterson – Senior Biodiversity Officer, Department of Environment and Primary Industries, Ballarat

2.3 Desktop assessment

2.3.1 Ecological database searches

A review of relevant ecological databases was undertaken relating to the target species/communities to determine any recorded information relevant to the study area. This review included:

- Victorian Biodiversity Atlas (VBA) database for flora and fauna species recorded within the local area;
- Flora Information System (FIS) to supplement VBA records;
- Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST), which predicts the occurrence of Matters of National Environmental Significance;
- GIS mapping by the DELWP maintained Biodiversity Interactive Map tool, e.g. mapping of extant and pre-European settlement Ecological Vegetation Classes (EVCs), threatened species records; and
- Aerial imagery of the study site.

2.3.2 Review of previous documents

A review of the following documents was also undertaken to help determine any recorded information relevant to the study area that is not documented within the ecological databases:

- Beca (2012) *Alignment Options Report Beaufort Bypass – Western Highway*. Report for VicRoads
- Ecology and Heritage Partners (2014) *Environmental Effects Statement Referral for the Beaufort Bypass – update to flora and fauna information*. Report for VicRoads
- Ecology Partners (2008) Desktop Flora and Fauna Assessment of the Western Highway, Burrumbeet to Stawell
- GHD (2014) *Referral of a Project for a Decision on the need for Assessment under the Environment Effects Act 1978*. Draft referral for VicRoads
- VicRoads (2012) Western Highway Project Section 2: Beaufort to Ararat. Environmental Effects Statement and Draft Planning Scheme Amendment
- VicRoads (2013) Western highway Project Section 3: Ararat to Stawell. Environmental Effects Statement and Draft Planning Scheme Amendment
- Some overlap between the carriageway corridor presented in the Section 2 EES and the current study area occurs. This overlap has been excluded from any area calculations within this report but has been used to help inform the presence of potential ecological issues.

2.4 Field assessment

The field assessment was designed to gather ecological data to inform VicRoads on:

- The ecological values present within the study area;
- Threatened species and communities occurring within the study area (incidental records);

- Likelihood of occurrence of threatened species not recorded during field surveys (based on habitat suitability);
- Information on any other ecological features deemed potentially relevant to the project (e.g. fauna corridors, or important habitat for Migratory species, or proximity to Ramsar site); and
- Permit requirements and offset obligations for removal of native vegetation/habitat and threatened species, in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, the Victorian *Flora and Fauna Guarantee (FFG) Act 1988*, the Victorian *Planning and Environment Act 1987* and the *Permitted Clearing of native vegetation: biodiversity assessment guidelines* (DEPI 2013).

Field surveys were conducted by a qualified and experienced botanist, zoologist and aquatic ecologist on 5-7 and 10 November 2014. GHD undertook field surveys and investigations within the study area and recorded species sightings, habitat or potential habitat and its quality relating to terrestrial flora and fauna. This was completed at a high level only for each portion of the study area visited i.e. information of a preliminary nature only was collected. The following approach to the Stage 1 ecological assessment was used:

- Undertake rapid four day site reconnaissance to ascertain extent of native vegetation and terrestrial threatened species habitat;
- Undertake rapid one day site reconnaissance to ascertain extent of waterways and threatened aquatic species habitat;
- Sample as much of the variation in vegetation types (EVCs) and vegetation condition as possible. Both public and private land was assessed with a higher priority given to sampling areas of potentially high value habitat, e.g. patches of remnant woodland/forest, wetlands/waterways and areas of potential native grassland;
- Sample as many points/polygons in the landscape as possible. It was not possible to map all areas of the study area. Where polygons were not completed, points were used to sample an area which would then be extrapolated to other like areas of habitat to give a whole mapping surface across the study area;
- Our assessments at sites (sample points/polygons) were restricted to a rapid assessment, identifying the EVC, vegetation condition (high/medium/low), any threatened species present and any potential habitat for listed threatened species and communities;
- Any species recorded from the sample points or polygons during the assessment were compiled into a single list for the study area;
- Records of location and population size estimate (where possible) of any rare or threatened species listed under the EPBC Act, FFG Act or DEWLP Advisory lists (Advisory List of Rare or Threatened Plants in Victoria 2014, Advisory List of Threatened Vertebrate Fauna 2009, Advisory List of Threatened Invertebrate Fauna in Victoria 2009) encountered will be documented;
- Potential habitat for listed rare or threatened species will be identified; and
- Detail of any major infestations of environmental or noxious weeds (where they intercept a sample point) will be produced.

The GHD proposal provides a summary of the outlined methods and the expected level of assessment by GHD during Stage 1 against the specific tasks outlined within The Assignment (document submitted to VicRoads 25 September 2014).

3. Flora results

3.1 Desktop results

3.1.1 Vegetation

Ecological Vegetation Classes

Remnant native vegetation within and surrounding the study site has been previously mapped at a scale of 1:25,000 (DEPI 2014a). In summary, 13 Ecological Vegetation Classes (EVCs) across two different bioregions have been identified from the EVC mapping within the vicinity of the study area, as shown in Table 2 below.

Table 2 Vegetation mapped by DEWLP within the vicinity of the study site

EVC No.	EVC Name	Bioregional Conservation Status	Bioregion CVU	VVP
20	Heathy Dry Forest	Least Concern	✓	✓
22	Grassy Dry Forest	Depleted	✓	
47	Valley Grassy Forest	Vulnerable	✓	
55	Plains Grassy Woodland	Endangered	✓	✓
67	Alluvial Terraces Herb-rich Woodland	Endangered	✓	✓
68	Creekline Grassy Woodland	Endangered	✓	✓
125	Plains Grassy Wetland	Endangered	✓	✓
132	Plains Grassland	Endangered	✓	✓
320	Grassy Dry Forest/Heathy Dry Forest Complex	Depleted	Y	✓
647	Plains Sedgy Wetland	Endangered		✓
691	Aquatic Herbland/Plains Sedgy Wetland Mosaic	Endangered		✓
896	Grassy Woodland/Heathy Dry Forest Complex	Endangered	✓	✓
897	Plains Grassland/Plains Grassy Woodland Mosaic	Endangered	✓	✓

CVU = Central Victorian Uplands Bioregion

VVP = Victorian Volcanic Plain Bioregion

There are limitations to the DEWLP mapping and it is therefore possible that EVCs other than those listed above could occur in close proximity to the assessed site.

3.1.2 Listed vegetation communities

DEWLP's Biodiversity Interactive Map (DEPI 2014a) predicts the occurrence of four flora communities listed as threatened under the FFG Act within the vicinity of the study site:

Table 3 Ecological communities listed under the FFG Act predicted to occur within the vicinity of the study area

Threatened Flora Communities Listed under the FFG Act	FFG Status
Creekline Grassy Woodland (Goldfields);	Listed
Grey Box - Buloke Grassy Woodland	Listed
Western (Basalt) Plains Grasslands	Listed
Western (Basalt) Plains (River Red Gum) Grassy Woodland	Listed

The PMST identified five threatened ecological communities listed under the EPBC Act that could potentially occur within the study area (see Table 4).

Table 4 Ecological communities listed under the EPBC Act predicted to occur within the vicinity of the study area

Listed Nationally Threatened Ecological Communities	National Status
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered
Natural Temperate Grasslands of the Victorian Volcanic Plain	Critically Endangered
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered

3.1.3 Native vegetation location risk

The native vegetation permitted clearing regulations are designed to manage risks to Victoria's biodiversity from the removal of native vegetation. All applications for a permit to remove native vegetation in Victoria are assigned a level of risk: low, moderate or high risk. The risk-based pathway assigned determines the process for how an application is assessed (DEPI 2013).

The risk-based pathway is determined by combining the **extent** risk (size of clearing) and the **location** risk (from map maintained by DEWLP) of each project area, in accordance with recently revised DEWLP guidelines (DEPI 2013). The risk-based approach enables the early identification of risks to biodiversity that may result from a proposed project.

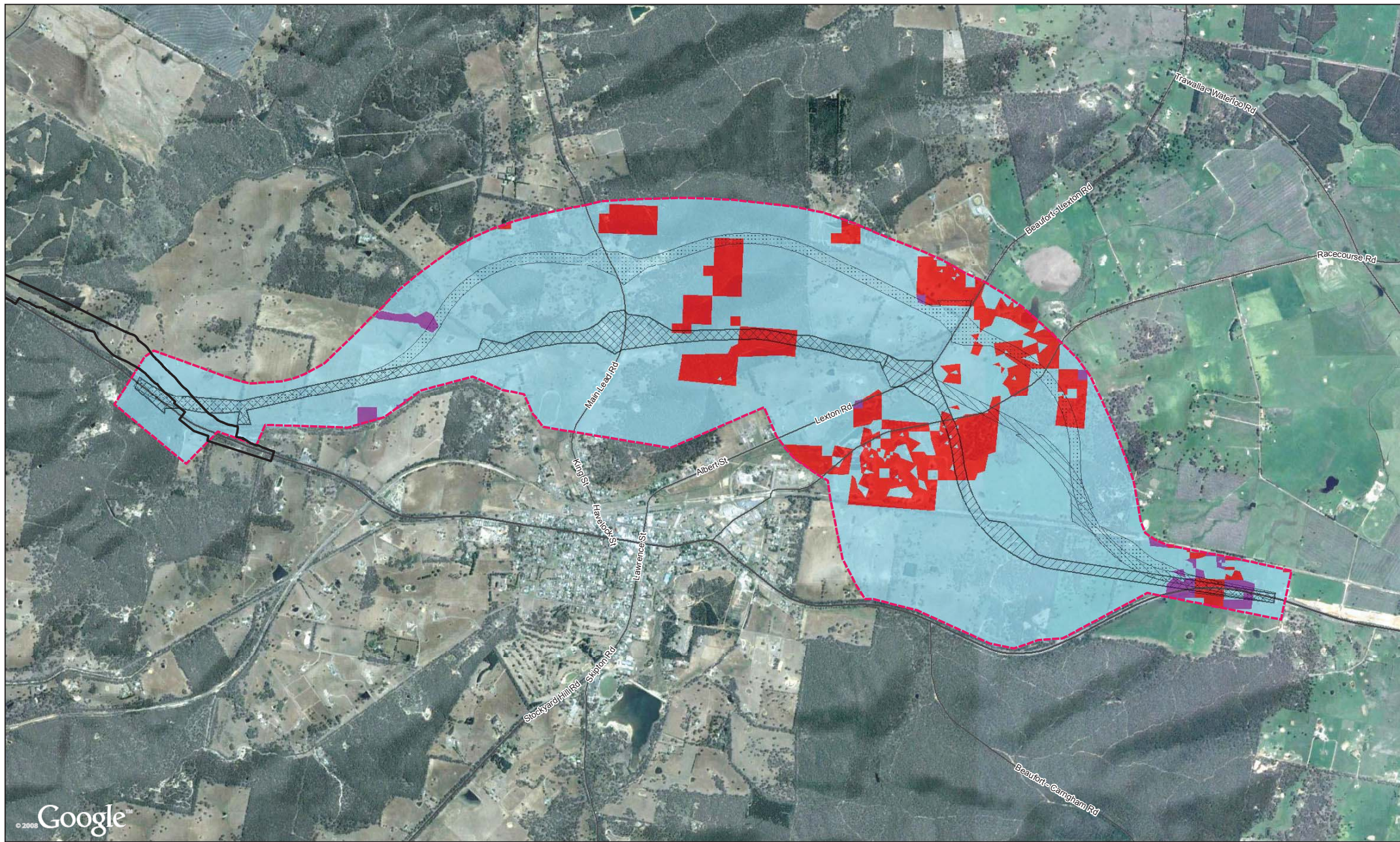
The DEWLP maintained Native Vegetation Location Risk mapping for the study area (see Figure 2) has been used as an additional source of information to identify areas of biodiversity value within the study area as well as to identify the likely risk based approach that the project will need to take.

The majority of the study area falls within areas mapped as Location A (blue - see Figure 2). If less than 1 ha of native vegetation is proposed to be removed once the construction footprint has been finalised then the project would follow the **low** risk pathway, when being assessed by the relevant authorities (Local Government Authority). If over 1 ha of native vegetation classified as Location Risk A is proposed to be removed then the project will follow the **moderate** risk pathway. This determination is demonstrated in Table 5.

It is considered likely that greater than 1 ha of native vegetation will be required to be removed for the project, and this vegetation would be a combination of areas mapped as Location Risk A, B and C. Scattered trees may also be impacted as a part of the project. Therefore it is likely that the project will follow the moderate or high risk pathway (Table 5) and need to be referred to the Local Government Authority as well as DEWLP. Therefore it is likely that offsets will be required for the project.

Table 5 Risk matrix (which define risk based pathways) for remnant patches of native vegetation and scattered trees

Patches extent	Location		
	Location A	Location B	Location C
< 0.5 hectares (ha)	Low	Low	High
≥ 0.5 ha and < 1 ha	Low	Moderate	High
≥ 1 ha	Moderate	High	High
Scattered trees extent	Location A	Location B	Location C
< 15 scattered trees	Low	Moderate	High
≥ 15 scattered trees	Moderate	High	High



Paper Size A3
0 0.125 0.25 0.5 0.75 1
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 54



LEGEND

Study Area
Carriageway (Section 2)

Alignment Options (Landtake)

B4-A
B4-B
B5

Native Vegetation Location Risk

Location A
Location B
Location C



VicRoads
Beaufort Bypass Ecology Preliminary

Job Number 31-32208
Revision A
Date 19 Jan 2015

Native Vegetation Location Risk

Figure 2

G:\3132208\GIS\Map\Deliverables\31_32208_002_NativeVegetationLocationRisk_A3L.mxd

© 2015. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason. DEPI, VicMap, 2014 and Native Vegetation Location Risk, 2013; Google Earth Pro, Aerial Imagery, 2014

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

3.1.4 Flora species

The VBA database has records of 457 flora species from within 5 km of the study area. These records include 343 native species and 114 introduced species.

3.1.5 Threatened flora species

A total of 19 listed flora species have been either previously recorded (on the VBA and FIS databases) or are predicted to occur (on the PMST Report) within 5 km of the study area. A full likelihood of concurrence for these species is shown in Appendix B. Of these, it is considered possible that nine of these species could occur within the study area based on the presence of suitable habitat (Table 6).

Table 6 Rare and threatened flora species considered possible to occur within the study area based on suitable habitat

Scientific Name	Common Name	Conservation Status
<i>Acacia aspera</i> subsp. <i>parviceps</i>	Rough Wattle	r
<i>Caladenia versicolor</i>	Candy Spider-orchid	e / L / V
<i>Dianella amoena</i>	Matted Flax-lily	e / L / E
<i>Diuris behrii</i>	Golden Cowslips	v
<i>Dodonaea procumbens</i>	Trailing Hop-bush	v / V
<i>Eucalyptus yarraensis</i>	Yarra Gum	r
<i>Grevillea floripendula</i>	Ben Major Grevillea	v / L / V
<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	White Sunray	e / E
<i>Thelymitra matthewsii</i>	Spiral Sun-orchid	v / L / V

Conservation Status under the EPBC Act: E – Endangered; V – Vulnerable

Listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*: L - Listed

Conservation Status in Victoria: e – Endangered; v – Vulnerable; r – Rare

Additional listed flora species may also occur within the study site for which there are currently no local records on the FIS and/or VBA databases, and/or they are not predicted to occur in the local area by the PMST. This can only be determined with detailed on-ground surveys, preferably undertaken at the appropriate time of the year. As a general rule, listed flora species are most likely to occur in areas of intact native vegetation, and are least likely to occur in areas of non-native vegetation.

3.2 Field results

3.2.1 Flora species

A total of 155 flora species were recorded incidentally during the preliminary field survey. This included 111 native and 44 exotic species. A full incidental flora species list is provided in Appendix B. Please note this list was collected during a rapid assessment, and only incidental species were recorded. A more detailed survey is likely to identify a substantially greater number of species within the study area.

3.2.2 Flora species of conservation significance

No species listed as threatened under the Commonwealth EPBC Act, the Victorian FFG Act and/or the Victorian Advisory List of Rare or Threatened Plants in Victoria were observed during the field survey. Twenty species listed as protected under the FFG Act were identified within the study area (i.e. all species of *Asteraceae*, most species of *Acacia*). However, this survey was a high level, broad-scale, rapid assessment, and did not include collecting detailed species lists. It is possible that listed threatened species may occur within the study area.

The likelihood of occurrence of rare or threatened species known or predicted to occur in the region is outlined in Table 6 and Appendix B. In addition, the study area has been mapped to provide an indication of the areas with a greater likelihood for threatened species to occur (Figure 8).

Targeted surveys are recommended for seven threatened flora species that have been previously recorded or predicted to occur within 5 km of the study area (Table 7). These species are relevant for all of the different alignment options for the project. None of these species were observed during the current assessment.

Due to the flowering times for the different flora species that targeted surveys have been recommended for, surveys would need to be carried out over two different field visits in 2015 (September and November – see detail in Table 7). These are recommended survey times based on optimal flowering time for each species, depending on seasonal conditions some of the species may be surveyed earlier or later than proposed below.

However, prior to undertaking targeted surveys DEWLP should be consulted to determine the need for targeted surveys for each species or community that has been identified as likely to occur within the study area (see section Table 7).

Table 7 Threatened flora species for which targeted surveys are recommended

Common Name	Scientific Name	Conservation Status			Observed During Assessment? (Y/N)	Targeted surveys Recommended? (Y/N)	Relevant Proportion of Study Area (Low/Mod/High)	Flowering Time	Proposed timing for survey
		EPBC	FFG	DEWL _P					
<i>Caladenia versicolor</i>	Candy Spider-orchid	V	L	e	No	Y	Moderate	September – October - November	September and /or November 2015
<i>Dianella amoena</i>	Matted Flax-lily	E	L	e	No	Y	Moderate	November - December	November 2015
<i>Dodonaea procumbens</i>	Trailing Hop-bush	V		v	No	Y	Moderate	October - February	November 2015
<i>Glycine latrobeana</i>	Clover Glycine	V	L	v	No	Y	Low	September – early October	September 2015
<i>Grevillea floripendula</i>	Ben Major Grevillea	V	L	v	No	Y	Moderate	October - December	November 2015
<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	White Sunray	E		e	No	Y	Low	November - December	November 2015
<i>Thelymitra matthewsii</i>	Spiral Sun-orchid	V	L	v	No	Y	Moderate	August - September	September 2015

3.2.3 Extent and condition of Ecological Vegetation Classes (EVCs)

The study area included a range of EVCs of varying quality, which have been mapped at a coarse scale in Figure 3. The conservation status of these EVCs is shown in Figure 4, and the general condition of vegetation patches has been mapped in Figure 5. The determination of vegetation condition (poor/moderate/good) was based on the extent and condition of the canopy, the presence of a diverse midstorey and understorey, the size of the patch and its connectivity to other native vegetation, and the cover of weeds (with particular note taken of CaLP Act-listed weeds and Weeds of National Significance (WONS)).

The mapped EVCs include three mosaics, where two discrete EVCs occur at a scale too fine to map at this stage of the project.

A brief description and photos of each of the mapped EVCs is provided below.

Alluvial Terraces Herb-rich Woodland (EVC 67)

This open woodland to 15 m tall occurs on broad alluvial plains and along ephemeral drainage lines. Soils are generally poorly drained duplex soils with sandy loam, overlying heavier clay subsoil. The understorey generally consists of few, if any, shrubs, with the striking feature of this EVC being the high species richness of the ground-layer and the low biomass of this cover, particularly in summer.

This EVC was generally highly modified/degraded within the study area and generally located within isolated patches in paddocks or along road reserves (see Plate 1). The overstorey was dominated by *Eucalyptus melliodora* (Yellow Box) and *Eucalyptus rubida* (Candlebark) over a primarily grassy understorey dominated by non-native pasture grasses. This EVC was also mapped as a mosaic with Grassy Dry Forest (EVC 22) within the study area.

Dominant weeds within this EVC were *Aira* sp. (Hair Grass), *Briza maxima* (Large Quaking-grass), *Dactylis glomerata* (Cocksfoot), and *Hypochaeris radicata* (Flatweed).

More detailed assessments of the final alignment will be required to determine the extent and condition of this EVC that is proposed to be impacted by the project.



Plate 1 Examples of Alluvial Terraces Herb-rich Woodland within the study area

Grassy Dry Forest (EVC 22)

Grassy Dry Forest occurs on a variety of gradients and altitudes and on a range of geologies. The overstorey is usually dominated by a low to medium height forest of eucalypts to 20 m tall, sometimes resembling open woodland with a secondary, smaller tree layer including a number of *Acacia* species. The understorey usually consists of a sparse shrub layer of medium height. Grassy Dry Forest is characterised by a ground layer dominated by a high diversity of drought-tolerant grasses and herbs, often including a suite of fern species.

This EVC varied in condition throughout the study area. There were large patches of good quality vegetation, dominated by *Eucalyptus dives* (Broad-leaf Peppermint), *Eucalyptus macrorhyncha* (Red Stringybark), *Eucalyptus melliodora* (Yellow Box) with poorer quality vegetation located in smaller and more isolated patches, and on the fringe or large patches where they adjoin paddocks and farming areas on private properties (see Plate 2). In some patches scattered shrubs were present within the midstorey including *Acacia aculeatissima* (Thin-leaf Wattle) and *Acacia genistifolia* (Spreading Wattle). In large intact areas in good condition the understorey was dominated by a diverse range of native graminoids and forbs including *Arthropodium strictum* s.l. (Chocolate Lily), *Dianella revoluta* s.l. (Black-anther Flax-lily), *Gonocarpus tetragynus* (Common Raspwort), *Goodenia lanata* (Trailing Goodenia), *Poa sieberiana* (Grey Tussock-grass), and *Rytidosperma pallidum* (Silvertop Wallaby Grass). In areas on the fringe of paddocks that were more disturbed, the understorey was highly modified and was dominated by introduced pasture grasses.

Dominant weeds within this EVC were *Anthoxanthum odoratum* (Sweet Vernal-grass), *Avena barbata* (Bearded Oat), *Briza maxima* (Large Quaking-grass), and *Hypochaeris radicata* (Flatweed).

This EVC was also mapped as a mosaic with Heathy Dry Forest (EVC 20) within the study area. More detailed assessments of the final alignment will be required to determine the extent and condition of this EVC that is proposed to be impacted by the project.



Plate 2 Examples of Grassy Dry Forest within the study area

Heathy Dry Forest (EVC 20)

Heathy Dry Forest occurs on shallow, rocky skeletal soils on a variety of geologies and on a range of landforms from gently undulating hills to exposed aspects on ridge tops and steep slopes at a range of elevations. The overstorey is generally low, open eucalypt forest to 20 m tall, poor in form with an open crown cover. The understorey is dominated by a low, sparse to dense layer of ericoid-leaved shrubs including heaths and peas. Graminoids and grasses are frequently present in the ground layer, but do not provide much cover.

This EVC was found in more isolated patches throughout the study area and was generally in a moderate-good condition (see Plate 3). Where present this community was dominated by *Eucalyptus dives* (Broad-leaf Peppermint), *Eucalyptus goniocalyx* (Bundy), *Eucalyptus macrorhyncha* (Red Stringybark), and *Eucalyptus polyanthemos* (Red Box). The shrub layer was diverse and dominated by species including *Acacia paradoxa* (Hedge Wattle), *Daviesia leptophylla* (Narrow-leaf Bitter-pea), *Monotoca scoparia* (Prickly Broom-heath). The understorey consisted of an array of prostrate shrubs, graminoids and forbs including *Acrotriche serrulata* (Honey-pots), *Leucopogon virgatus* (Common Beard-heath), *Lomandra filiformis* (Wattle Mat-rush), and *Poa* spp. (Tussock grass).

Dominant weeds within this EVC were *Anthoxanthum odoratum* (Sweet Vernal-grass), *Briza maxima* (Large Quaking-grass), and *Hypochaeris radicata* (Flatweed).

This EVC was also mapped as a mosaic with Grassy Dry Forest (EVC 22) within the study area. More detailed assessments of the final alignment will be required to determine the extent and condition of this EVC that is proposed to be impacted by the project.



Plate 3 Examples of Heathy Dry Forest identified within the study area

Spike-sedge Wetland (EVC 819)

Spike-sedge wetlands are low sedgey vegetation of seasonal or intermittent wetlands, dominated by spike-sedges and usually species-poor. They are typically treeless, but sparse eucalypts (mostly *Eucalyptus camaldulensis*, River Red-Gum) can be present in marginal sites. This community is scattered in the drier lowlands, including western volcanics, Riverina floodplains and Wimmera.

Spike-sedge Wetlands throughout the study area were highly degraded, with low species diversity and signs of grazing evident (see Plate 4). They were largely dominated by *Eleocharis acuta* (Common Spike-sedge) and/or *Eleocharis spachelata* (Tall Spike-sedge) with one site also containing *Lachnagrostis filiformis* (Common Blown-grass) and an array of other aquatic herbs.

More detailed assessments of the final alignment will be required to determine the extent and condition of this EVC that is proposed to be impacted by the project.



Plate 4 Examples of Spike-sedge Wetland within the study area

Valley Grassy Forest (EVC 47)

Valley Grassy Forest occurs under moderate rainfall regimes of 700-800 mm per annum on fertile well-drained colluvial or alluvial soils on gently undulating lower slopes and valley floors. Valley Grassy Forest is usually an open forest to 25 m tall may carry a variety of eucalypts, usually species that prefer more moist or more fertile conditions over a sparse shrub cover. In season, a rich array of herbs, lilies, grasses and sedges dominate the ground layer but at the drier end of the spectrum the ground layer may be sparse and slightly less diverse, but with the moisture-loving species still remaining.

This EVC was generally modified within the study area and located along the fringes of paddocks (see Plate 5). The overstorey was dominated by *Eucalyptus melliodora* (Yellow Box), *Eucalyptus obliqua* (Messmate Stringybark), with *Eucalyptus rubida* (Candlebark) over a variable understorey that was sometimes dominated by non-native pasture grasses and occasionally dominated by native graminoids and forbs including *Austrostipa* spp. (Spear Grass), *Burchardia umbellata* (Milkmaids), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass). Scattered shrubs were also present throughout the midstorey including *Acacia melanoxylon* (Blackwood), and *Daviesia leptophylla* (Narrow-leaf Bitter-pea).

Dominant weeds within this EVC were *Briza maxima* (Large Quaking-grass), *Hypochaeris radicata* (Flatweed), and *Trifolium* spp. (Clover).

This EVC was also mapped as a mosaic with Grassy Dry Forest (EVC 20) within the study area. More detailed assessments of the final alignment will be required to determine the extent and condition of this EVC that is proposed to be impacted by the project.






Plate 5 Examples of Valley Grassy Forest within the study area

3.2.4 Other vegetation types identified during the field assessment

Other vegetation types that could not be classified as EVCs was identified and mapped during the field assessment. These vegetation types have been summarised below (Table 8).

Table 8 Other vegetation types identified during the field assessment

Description	Representative Photo
<p>Scattered Trees</p> <p>Native vegetation was also present as scattered trees throughout the study area. These have been mapped as in most instances as either individual trees or as patches of Scattered Tree mosaic (see Figure 3).</p>	
<p>Modified Drainage Line</p> <p>Numerous drainage lines and low-lying ephemeral wet depressions were identified during the field assessment that contained over 25% cover of <i>Juncus</i> sp. These areas were highly degraded, and generally mono-specific and did not meet the criteria to be mapped as an EVC. DEWLP should be contacted to determine whether an EVC should be attributed to these areas if it is determined they will be impacted as a part of the project. Whilst it is unlikely that these areas meet the criteria to be classified as native vegetation a permit may be required for the removal of individual scattered native species within these areas.</p>	
<p>Non-Native Vegetation</p> <p>A large portion of the study area was mapped as <i>Non-Native Vegetation</i>, which includes some scattered native species; however, the cover of native perennial understorey plants is <25% and tree canopy cover is <20%, and therefore this vegetation is not considered a remnant patch. Whilst these areas do not meet the criteria to be classified as native vegetation a permit may be required for the removal of individual scattered native species within these areas.</p>	

Planted Vegetation

Some indigenous trees have been planted within the study site, as well as a variety of non-indigenous species planted in both private property and the road reserve. The majority of these occurred within areas mapped as *Non-Native Vegetation* mapped in Figure 3, and have been delineated in the mapping where possible. Most planted species have not been included in the incidental flora list in Appendix B.

