VICROADS

Preliminary Flora and Fauna Impact Assessment for Mordialloc Bypass

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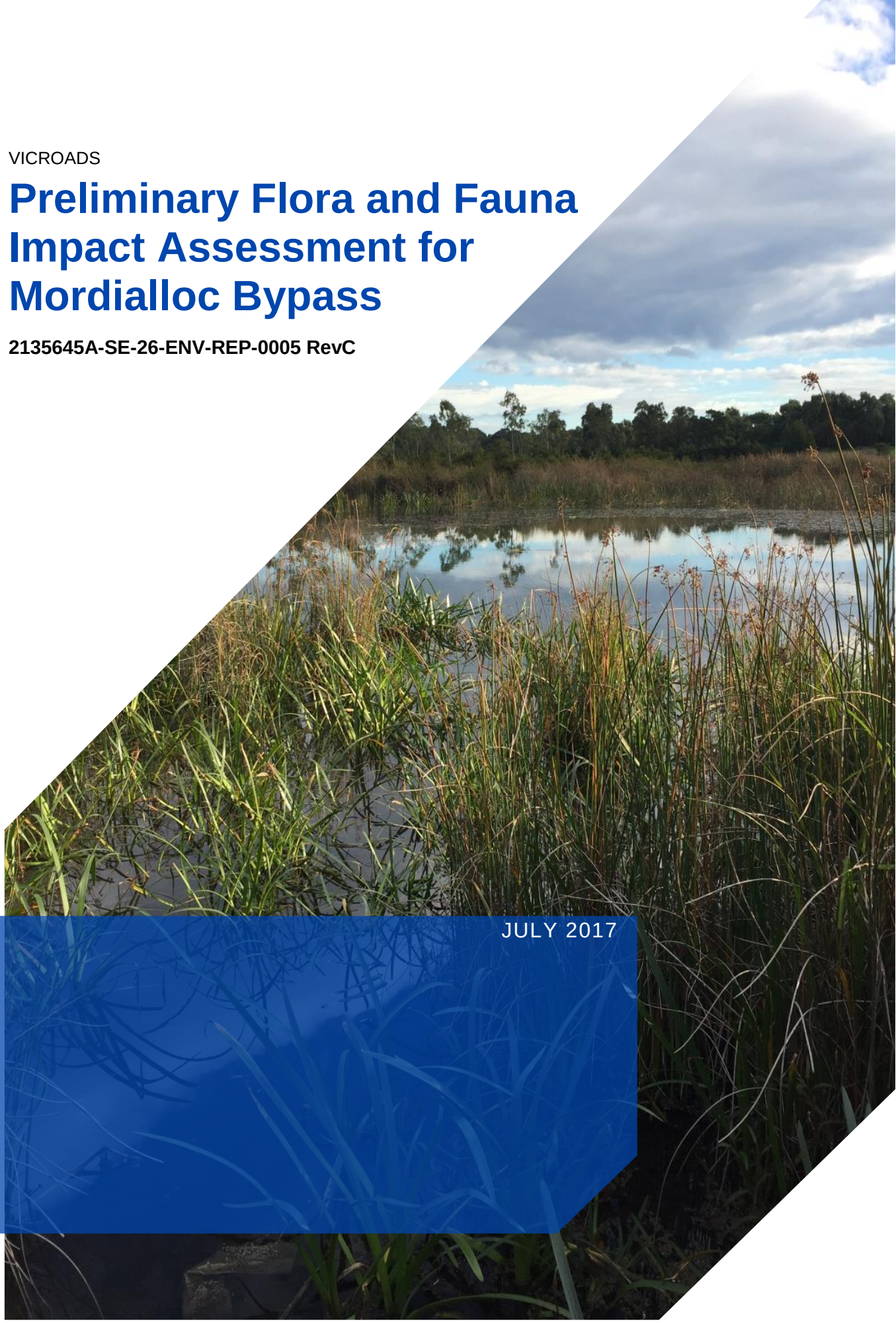

JULY 2017

WSP | PARSONS BRINCKERHOFF

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VicRoads

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EXECUTIVE SUMMARY

Introduction

WSP Australia Pty Limited (WSP) was engaged by VicRoads as the Technical Advisor (TA) to undertake a preliminary flora and fauna assessment for the proposed Mordialloc Bypass (the 'Project'), located in outer Melbourne, Victoria. The Mordialloc Bypass is a proposed new arterial road within Melbourne's southern movement corridor, located within an existing road reservation. The Project corridor is approximately 9 km in length, comprising 7.5 km of greenfield dedicated road corridor and a 1.5 km of upgrade to the Mornington Peninsular Freeway.

The objectives of this study were to detail the significant ecological values of the project area, conduct a preliminary assessment of the likely impacts of the Project under the relevant Commonwealth and State environmental legislation and provide recommendations for the Project to inform planning, approvals and detailed design. Significant ecological values are those listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Flora and Fauna Guarantee Act 1988* (FFG Act)). Species listed on the Victorian Rare or Threatened Species Advisory Lists (DEPI 2013a, 2014; DSE 2009) were also included.

Project area and study area

The project area is located 25 km south east of the Melbourne CBD and 5 km east of Mordialloc. The proposed road extends north-west from the Mornington Peninsula Freeway's existing terminus at Springvale Road in Aspendale Gardens and links to the Dingley Bypass, providing connections to Governor Road, Lower Dandenong Road and Centre Dandenong Road. The Project Area occurs within the municipalities of Kingston and Greater Dandenong and is located within the Gippsland Plain Bioregion.

The Mordialloc Bypass project area is a long-established reserved road corridor and much of the project area has been cleared of native vegetation. However, the project area includes patches of native vegetation and scattered trees and it bisects the 48 ha award-winning ecological restoration project, The Waterways wetlands. In addition, the area surrounding the project area includes sensitive and high-value environments including Braeside Park, Edithvale-Seaford Wetlands and the wetlands in the Woodlands Industrial Estate.

The study area for the vegetation mapping and habitat assessment components of this study is the project area plus a buffer of 20 m.

Methods

To determine the ecological values and constraints of the project area, a database and literature review, and field surveys were undertaken, following by a detailed assessment of potential impacts and provision of recommendations for the Project.

Specifically, the following were completed.

- A database and literature review used to prepare a list of threatened flora and fauna species, ecological communities, listed migratory species and any significant habitat previously recorded or predicted to occur in the study area and the broader locality. This included:
  - Government databases and mapping
  - review of the previous ecological assessment of the project area and locality of relevance to the Project, particularly (Biosis 2013) and (Biosis 2015)
  - other data sources.

- Field surveys to determine the significant values present including:
  - flora survey
  - vegetation mapping and categorisation, including Habitat Hectare assessments
  - terrestrial and wetland fauna survey and habitat assessment
  - aquatic fauna survey.
- Assessment and provision of recommendations including:
  - likelihood of occurrence and impact assessment
  - a detailed preliminary assessment of the impacts likely to occur from the Project
  - recommended avoidance, minimisation and mitigation measures for the Project
  - an assessment of the implications for the project under relevant government legislation and policy.

Results

Vegetation

The project area supports 11.99 ha of native vegetation, including 43 scattered trees, comprising 12 Ecological Vegetation Classes (EVCs). Most of these EVCs are considered 'endangered' within the Gippsland Plain Bioregion. The remainder of the project area (approximately 125 ha) consists of exotic vegetation (including exotic roadside vegetation and modified agricultural land) and constructed features such as roads.

Two EPBC Act listed threatened ecological communities were recorded, both listed as critically endangered:

- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
- Natural Damp Grassland of the Victorian Coastal Plains.

There are two listed FFG Act threatened communities which correspond to the above EPBC Act communities:

- Herb-rich Plains Grassy Wetland (West Gippsland) Community
- Plains Grassland (South Gippsland) Community.

Flora

A total of 240 vascular plant species were recorded in this study and in (Biosis 2015) during the field surveys, of which 102 (43%) were native, 7 planted street trees/shrubs (3%) and 131 (54%) introduced species. A number of species have also been planted throughout The Waterways, which significantly contributes to the diversity of native plant species recorded in the Project Area. Four significant species were detected during field surveys, including Leafy Twig-sedge *Cladium procerum* (rare in Victoria), Pale Swamp Everlasting *Coronidium gunnianum* (FFG listed, vulnerable in Victoria), Large River Buttercup *Ranunculus papulentus* (poorly known in Victoria) and Swamp Everlasting *Xerochrysum palustre* (EPBC and FFG listed, vulnerable in Victoria). Three additional significant species were considered to have the potential to occur in the project area and be impacted by the Project.

Fauna

RECORDS AND LIKELIHOOD

A total of 106 fauna species were recorded in this study and in (Biosis 2015). This included 74 native birds, nine introduced birds, seven frogs, six mammals (three introduced), and ten fish (including four introduced). Several significant (listed) bird species were recorded by Biosis, and one was recorded by WSP (Hardhead *Aythya australis*, which is listed as vulnerable on the Victorian Advisory list).

This assessment comprised a habitat-based fauna survey that did not include comprehensive fauna survey methods, however numerous listed EPBC Act and FFG Act species have been recorded within

or in the vicinity of the project area during past surveys by others, including Birdlife, casual birdwatchers, and other consultants. All available reports and records were analysed for this assessment.

A total of 101 fauna species of state and/or national significance were assessed for the potential to occur within 5 km of the study area. Of these species, 44 species are considered moderately or highly likely to occur within or nearby the study area on a permanent or intermittent basis. Twenty-seven significant species are considered to have a moderate or higher likelihood to be impacted by the proposed road. The majority of significant species likely to occur within the project area are birds.

HABITAT

The primary types of fauna habitat within the project area are:

- the constructed wetlands at the Waterways, immediately south of Governor Road, which includes some permanent aquatic habitat at Mordialloc Creek and fringing swamp vegetation (note that the majority of the Waterways occurs outside of the project area)
- agricultural grassland (predominantly highly modified with some small patches of remnant vegetation) occurring adjacent to Braeside park and Woodlands Industrial Estate
- roadside weedy grassland and small roadside drains, some of which provide foraging habitat for wetland birds
- some remnant and planted trees (providing some low quality foraging habitat for woodland birds and minimal nesting habitat).

Higher quality habitat for threatened and migratory fauna occurs in the broader locality of the project area. This includes the 'Carrum Swamp Important Bird Area' (BirdLife International 2017), which is comprised of a number of wetlands, including areas adjacent or nearby to the project area: Woodlands Industrial Estate, Braeside Park and Edithvale-Seaford Wetlands.

Preliminary impact assessment and mitigation measures

The likely impacts of the Project include the direct impacts of the loss of vegetation and habitat within the construction footprint, as well as indirect impacts from the road upon adjacent and nearby habitat.

The likely nature of the impacts upon significant biodiversity values are detailed below.

- Loss of habitat and vegetation
  - Up to 2.15 ha of EPBC Act listed threatened ecological communities
  - Up to 2.26 ha of FFG Act listed ecological communities
  - 4.90 ha habitat for the Australasian Bittern, 4.90 ha habitat for Latham's Snipe
  - Some habitat for several FFG Act listed birds
  - Some low value habitat for other significant fauna
  - Potential for some loss of planted threatened flora.
- Loss of connectivity for listed threatened fauna species and fragmentation of threatened ecological communties
- Increase in injury and mortality during construction and from the ongoing use of the road
  - May particularly impact low flying bird species (including threatened species such as the Australasian Bittern) and non-listed reptiles and frogs
- Noise and vibration which is likely to impact threatened and migratory bird species.
- Ecological light pollution which may impact threatened and migratory bird species.
- Visual impact which may affect use of the adjacent habitat by threatened and migratory bird species.
- Physical habitat disturbance to habitat outside construction footprint, including weed invasion and disease, rubbish, erosion, sedimentation, water pollutants, and changes in groundwater and surface hydrology.

A number of avoidance, minimisation and mitigation measures are required beyond the standard VicRoads measures to address the above impacts upon listed ecological values. The risk associated with the impacts upon listed values, the additional types of mitigation measures proposed, and the residual risk are listed in the summary table below.

SIGNIFICANT VALUE	OVERALL RISK WITH NO SPECIFIC MITIGATION MEASURES IMPLEMENTED	SUMMARY OF SPECIFIC MITIGATION MEASURES	OVERALL RESIDUAL RISK
Edithvale-Seaford Wetlands (Ramsar Wetland)	Moderate	→ Specific groundwater and surface water mitigation if required →	Low
EPBC Act listed migratory birds	Moderate	→ Specific groundwater and surface water mitigation if required → Investigate noise mitigation and incorporate if required → Visual impact mitigation measures → Barriers and buffer zones incorporated into landscape plan	Low
EPBC Act listed flora	Moderate	→ Specific groundwater and surface water mitigation if required → Salvage and relocation of listed species, if required → Additional weed management	Low
EPBC Act listed threatened fauna	Moderate	→ Specific groundwater and surface water mitigation if required → Light mitigation → Investigate noise mitigation and incorporate if required → Connectivity measures and revegetation under the Mordialloc Creek bridge → Barriers and buffer zones incorporated into landscape plan	Low
EPBC Act listed endangered ecological communities	Moderate	→ Specific groundwater and surface water mitigation if required → Additional weed management	Low
FFG Act listed birds	Moderate	→ Light mitigation → Investigate noise mitigation and incorporate if required → Connectivity measures and revegetation under the bridge	Low
FFG Act listed flora	Moderate	→ Specific groundwater and surface water mitigation if required → Salvage and relocation of listed species, if required → Additional weed management	Low

SIGNIFICANT VALUE	OVERALL RISK WITH NO SPECIFIC MITIGATION MEASURES IMPLEMENTED	SUMMARY OF SPECIFIC MITIGATION MEASURES	OVERALL RESIDUAL RISK
FFG Act listed ecological communities	Moderate	→ Specific groundwater and surface water mitigation if required → Additional weed management	Low
Protected fauna (mortality of non-listed species)	Moderate	→ Connectivity measures (culverts etc) → Low barriers, and plantings to reduce road mortality → Fauna management during construction and vegetation clearing	Low

Legislation and Policy

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

A number of Matters of National Environmental Significance (MNES) have been recorded within or near the project area. Several MNES with at least a moderate likelihood of occurrence and with the potential to be impacted by the Project have been assessed, which includes migratory bird species including Latham's Snipe and Sharp-tailed Sandpiper, two critically endangered EPBC Act communities, one threatened bird species (Australasian Bittern) and one threatened flora species (Swamp Everlasting).

Likely impacts with and without additional mitigation measures have been assessed against 'significant impact criteria' in this report.

Provided that a range of measures to avoid and minimise impacts are explored, and that detailed mitigation measures are planned and implemented, impacts upon MNES are not likely to be significant. Nevertheless, referral of the project to the Commonwealth Department of the Environment and Energy is highly recommended to provide legal certainty for the Project at this stage.

Environmental Effects Act 1978

An assessment against the Ministerial Guidelines for Assessment of Environmental Effects under the Environmental Effects Act 1978 identified that one or more individual 'effects' may be triggered, based upon the information available at the time. As such the Mordialloc Bypass project is the subject of an EES Referral, and a determination will be made by the Minister whether an EES will be required.

Flora and Fauna Guarantee Act 1988 (FFG Act)

As FFG Act listed species and communities were recorded within the study area and are proposed for removal, an FFG permit to remove threatened species and communities is required. A total of 12 listed values are considered likely to require a permit for habitat removal.

Permitted clearing of native vegetation – biodiversity assessment guidelines

Approximately 6.17 hectares comprising 12 EVCs is proposed for removal. This vegetation is located mostly within Location A, with exception of the area between Governor Road and Mordialloc Creek which is mostly mapped as Location B and C. As such, an application to removal native vegetation under Section 52.17 of the relevant Planning Scheme will likely proceed under a High-Risk pathway.

A preliminary calculation of biodiversity impacts and Offset requirements has been completed for the current construction footprint.

This has resulted in:

- 0.076 general units (General Offsets) for the Port Phillip and Westernport Catchment Management Authority (CMA) or Kingston City Council.
- The following Specific Offsets:
  - 1.261 specific units of habitat for Orange-bellied Parrot
  - 2.794 specific units of habitat for Marsh Saltbush
  - 1.684 specific units of habitat for Creeping Rush
  - 2.745 specific units of habitat for Salt Lawrencia
  - 2.725 specific units of habitat for Purple Blown-grass
  - 0.060 specific units of habitat for Lacey River Buttercup

Wildlife Act 1975

As there are five large trees within the proposed construction footprint and some trees appear to have hollows, it is likely that a permit is required for their removal.

Catchment and Land Protection Act 1994 (CaLP Act)

The field survey identified that project area supports eleven regionally controlled (C), four restricted (R) and one regionally prohibited (P) weed. The landholder must take all reasonable measures to prevent their spread and control these weed species on their land. Six of these weed species are also listed as Weeds of National Significance by the Australian Government.

Most of the significant weeds were recorded along roadsides and private land in the north of the project area. Very few noxious weeds were recorded from within the Waterways.

Planning and Environment Act 1987

The project will require approval under the Kingston Planning Scheme for works within the Public Use Zone, Land Subject to Inundation Overlay and the Special Building Overlay. Approvals for vegetation removal will be required under both the Kingston and Greater Dandenong Planning Schemes.

There are a number of areas with planted Victorian and other Australian native species (eg. Giant Honey-myrtle, Spotted Gum) along the Mornington Peninsula Freeway and other areas. Under Section 52.17 under all Victorian Planning Schemes, there is an exemption to obtaining a planning permit for planted vegetation, unless the vegetation was planted with government funding. The vegetation must have been planted or managed for conservation for a permit to be required. DELWP interprets vegetation planted along a roadside by a road authority not to be for conservation purposes, and therefore exempt from a planning permit and offsets. The exemption applies to the vegetation that was planted, not vegetation generated from the planted vegetation.

This exemption would not apply to native vegetation planted throughout The Waterways, as this area was planted for conservation purposes using (in part) public funds, and is located on public land (mostly owned by Melbourne Water).

Conclusions and recommendations

The main biodiversity values of the project area can be summarised as:

- Prescence of two EPBC Act and two FFG Act listed communities
- The habitat values of the Waterways for migratory bird species (EPBC Act), threatened bird species (EPBC Act and FFG Act) and planted threatened flora species (EPBC Act and FFG Act)

- The habitat and connectivity values of the agricultural land adjacent to Braeside Park (north of Govenor Road) to threatened and migratory bird species

The main biodiversity impacts from the Project can be summarised as:

- Loss of native vegetation (total 6.17 ha), including minor removal of low quality native vegetation north of Governor Road and south of Springvale Road, and removal of some high quality native revegetation at the Waterways
- some direct removal of habitat for birds listed under the EPBC Act and FFG Act
- some direct removal of EPBC Act (2.15 ha) and FFG Act (2.26 ha) listed ecological communities
- potential for direct and indirect impacts upon EPBC Act and FFG Act listed threatened flora
- indirect impacts on numerous migratory and threatened birds from increased fragmentation, noise, light, and habitat degradation.

There is limited scope to move the road within the project area corridor and there are no alternative corridor options available. Therefore, emphasis must be on the mitigation measures to minimise both the direct and indirect impacts from construction and operation of the road. There are opportunities for a range of innovative solutions (grounded in sound research and informed by expert opinion), to mitigate the indirect impacts of the Project and facilitate the required approvals.

There are additional opportunities for creation of wetland habitat suited to a wide range of threatened bird species. Any wetland creation program will need to cater for the requirements of migratory waders by incorporating seasonal fluctuations in water levels and promote habitat complexity (such as through annual control of macrophytes).

With regard to requirements for the Project under relevant environmental legislation and policy:

- Referral of the project under the EPBC Act is recommended for legal certainty
- An EES referral is in preparation for the Project
- Twelve listed values are likely to require a permit for habitat removal under the FFG Act.
- Based on a preliminary calculation of biodiversity impacts and Offset requirements, 0.076 general units (General Offsets) for the Port Phillip and Westernport Catchment Management Authority (CMA) or Kingston City Council, and specific units (between 0.060 and 2.794) for six species, will be required under the biodiversity assessment guidelines
- A permit is likely to be required under the *Wildlife Act 1975* for habitat removal and fauna salvage
- Approvals for vegetation removal will be required under both the Kingston and Greater Dandenong Planning Schemes.

Future studies which should be undertaken to further quantify the potential impacts upon biodiversity at the project area include:

- detailed design of the mitigation measures required to avoid or reduce the negative impacts on significant ecological values, specifically noise and fauna mortality mitigation measures
- further assessment of the impacts of the Project on surface and groundwater hydrology and determination of the required mitigation measures to ensure a negligible impact upon ecological values
- landscape plan incorporating mitigation measures for significant ecological values (particularly Australasian Bittern and migratory bird species)
- investigations into the feasibility of creating wetlands to go beyond mitigation, and have social and environmental benefit (whilst offsetting potential losses and impacts to existing values if required).

1 INTRODUCTION

WSP Australia Pty Limited (WSP) was engaged by VicRoads as the Technical Advisor to undertake a flora and fauna assessment for the proposed Mordialloc Bypass (the 'Project'), located in outer Melbourne, Victoria.

The Mordialloc Bypass is a proposed new arterial road within Melbourne's southern movement corridor, located within an existing road reservation. The bypass would provide a link between the termination of the Mornington Peninsula Freeway at Springvale Road, Aspendale Gardens and the Dingley Bypass in Dingley. The proposed road also provides connections via new junctions to three intersecting arterial roads; Governor Road, Lower Dandenong Road and Centre Dandenong Road.

The Project corridor ('project area') is approximately 9 km in length, comprising 7.5 km of greenfield dedicated road corridor and a 1.5 km of upgrade to the Mornington Peninsular Freeway. Road engineering design work is continuing, with the ultimate road design expected to be influenced by a range of economic, community, environmental and social considerations.

The Mordialloc Bypass project area is a long-established reserved road corridor, however the area surrounding the road corridor includes sensitive and high-value environments including Braeside Park, Edithvale-Seaford Wetlands and the wetlands in The Waterways estate and the Woodlands Industrial Estate. The potential direct and indirect impacts of the Project must be assessed against local, state and federal environmental legislation.

1.1 Project objectives and scope

The objectives of this study were to detail the significant ecological values of the project area, conduct a preliminary assessment of the likely impacts of the Project under the relevant Commonwealth and State environmental legislation, and provide recommendations for the Project to inform planning, approvals and detailed design.

The following scope of works was undertaken:

- a desktop review of flora and fauna databases and relevant biodiversity strategies, policies and legislation
- field flora and fauna survey to identify any threatened biodiversity, native vegetation patches, scattered trees and other relevant environmental features
- fauna habitat survey
- Habitat Hectare assessments
- likelihood of threatened flora and fauna and communities listed under *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *Flora and Fauna Guarantee Act 1988* (FFG Act)
- mapping undertaken using ArcGIS displaying relevant ecological features from the field assessment
- preliminary evaluation of implications of relevant biodiversity policy and legislation and triggers for permits (e.g. FFG permit, EPBC referral, permit to remove native vegetation)
- an evaluation of the environmental and noxious weeds found in the field, their general locations and implications under the *Catchment and Land Protection Act 1994*
- evaluation of the potential ecological impacts of the Project along with practical recommendations to avoid, minimise, mitigate and offset ecological impacts
- recommendations for any additional investigations required and for requirements under applicable environmental legislation and policy.

1.2 Project area

The project area for Mordialloc Bypass was set aside as a road reservation in the 1950s. It traverses the suburbs of Clayton South, Dingley Village, Braeside, Waterways, Aspley Gardens, Chelsea Heights and Bangholme in the City of Kingston. It is situated approximately 25 km south east of the Melbourne CBD and 5 km east of Mordialloc. The proposed road extends north-west from the Mornington Peninsula Freeway's existing terminus at Springvale Road in Aspendale Gardens and links to the Dingley Bypass, providing connections to Governor Road, Lower Dandenong Road and Centre Dandenong Road. The Project Area occurs within the municipalities of Kingston and Greater Dandenong and is located within the Gippsland Plain Bioregion.

The construction footprint of the works will occur within the project area, which provides a buffer to allow for detailed design of the bypass. For this study, the project area was assessed thoroughly in the field, however consideration was also given to fauna habitat outside of the project area, to allow for a more accurate assessment of potential indirect impacts.

The topography of the project area is relatively flat, with only gentle rises in the landscape. The lowest lying section of project area is in the south around the Waterways Estate Wetlands, at approximately 4 m above sea level. The topography rises gradually to the north, to around 30 m elevation.

The Project will occur partly within the designated Braeside West and Mordialloc Creek Wetlands (also referred to as 'The Waterways') catchment areas. Both these catchments contribute tributary runoff flow to the larger Mordialloc Creek drainage system. A bridge is proposed over Mordialloc Creek.

The Waterways is a 48 ha area planned and revegetated by Australian Ecosystems which commenced in 2000 and is now known for its significant values (Australian Ecosystems 2017; Cook, D. 2016). The project was partly funded by Melbourne Water and partly by the Haines Family, a developer. Recently, the Waterways was the recipient of the Award for Excellence in Restoration Practice by The Society for Ecological Restoration Australasia (http://www.seraustralasia.com/pages/SERAawards.html).

The location of the project area is shown on Figure 1 of Appendix A, and the location of the project area in relation to sites of ecological significance is shown on Figure 2 of Appendix A.

2 METHODOLOGY

2.1 Database and literature review

To determine the ecological values and potential constraints, a database search and literature review was undertaken. Relevant and available documents were reviewed for information on past land uses, presence of vegetation communities as well as flora and fauna. Relevant databases were searched for records of threatened species within a 5 km radius of the centre of the study area.

This review was used to prepare a list of threatened flora and fauna species, ecological communities, migratory species and any significant habitat previously recorded or predicted to occur in the study area and the broader locality (listed and preliminary listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Flora and Fauna Guarantee Act 1988* (FFG Act). The following sources of information were consulted:

- The Department of Environment, Land, Water and Planning (DELWP) Biodiversity Interactive Map (now NatureKit) (DELWP 2017a)
- The Victorian Biodiversity Atlas (DELWP 2017d) – 5 km radius of the study area
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool – 5 km radius of the study area (DoEE 2017b)
- The Commonwealth Department of the Environment Species Profile and Threats Database
- Victorian Rare or Threatened Species Advisory Lists (DEPI 2013a, 2014; DSE 2009)
- The Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines (DEPI 2013c)
- Biodiversity Information Tools used in Victoria's Native Vegetation Permitted Clearing Regulations and the Native Vegetation Information Management System (DELWP 2017c)
- Vegetation Quality Assessment Manual (DSE 2004)
- BioSites (DELWP 2014), wetlands and any significant roadside studies
- publically available reports
- reports provided by VicRoads, Melbourne Water and Parks Victoria
- aerial imagery to determine habitat extents and linkages
- relevant legislation, government policy and strategies
- publically available geospatial datasets.

The background reports of most relevance to ecological values of the project area (and reviewed in the Section 3.1 Literature Review) are:

- Groundwater Preliminary Impacts - Ecological Assessment – Rail Under Road. Frankston Package. 18 – Edithvale Road, Edithvale/46 – Station Street/Bondi Road, Bonbeach (AECOM-GHD JV 2016)
- Flora and Fauna Assessment – Rail Under Road. Frankston package. 18 – Edithvale Road, Edithvale(AECOM-GHD JV 2017a)
- Flora and Fauna Assessment – Rail Under Road. Frankston package. 46 – Station Street/Bondi Road, Bonbeach (AECOM-GHD JV 2017b)
- Establishment of Indigenous Flora and Fauna in Revegetated Areas at "The Waterways" (Australian Ecosystems 2017)
- Flora and Fauna Investigation: Northern Extension of the Mornington Peninsula Freeway (Biosis 2013)
- Mordialloc Bypass: Flora and Fauna Investigation Including Habitat Hectare Assessment (Draft Report) (Biosis 2015)

- Preliminary Ecological Assessment for 12km of proposed roadway between the South Gippsland Freeway and Warrigal Road (Biosis Research 2008b)
- Outer Suburban Arterial Road Program – Preliminary Biodiversity Assessment (Brett Lane & Associates 2016)
- Flora and Fauna Lists of "The Waterways" (Cook, D undated)
- Edithvale-Seaford Wetlands Ramsar Site Management Plan (Ecology Australia 2016)
- Entomology Society of Victoria, 2016. Moths of Braeside Park
- Field Naturalists Club of Victoria, 2016 – Braeside Park Frog Recording Data
- Field Naturalists Club of Victoria, 2017, Fauna Survey at Braeside Park
- Melbourne Water Regional Bird Monitoring Project, Annual Report: July 2015-June 2016 (Herman & Purnell 2016)
- Edithvale and Seaford Wetlands Bird Survey Project 2014-15 (Silcocks 2016)

2.2 Flora and vegetation assessment

Due to the size of the site and land access constraints, the field assessments were conducted over a series of days between January and May 2017 by WSP ecologists.

The following techniques were utilised:

- field validation of vegetation communities – the extent and condition of mapped EVCs was verified
- assessment of ecological communities against EPBC Act criteria
- targeted searches for threatened flora and fauna species were completed throughout the study area, as detailed in section 2.2.1 below
- habitat hectare assessment – completed for all habitat zones identified within the study area in accordance with the '*Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectares scoring method Version 1.3'* (DSE 2004)
- any other incidental discussions, observations or evidence of flora or fauna were recorded.

The likely presence of threatened species was determined through an assessment of suitable habitat in the study area. A species was assumed to be present if suitable habitat was observed in the study area, and if that species was known to occur regionally. This is a more conservative approach likely to include species that are difficult to detect.

2.2.1 Targeted threatened flora species surveys

Field surveys for threatened species were undertaken using a combination of random meander searches of preferred habitats, parallel line searches and other search methods where relevant.

The random meander technique involves targeting a particular or several, threatened plant species and traversing areas of suitable habitat in no set pattern (Cropper 1993). Parallel line traverses involves one or more observers surveying in parallel lines, as outlined by Cropper (Cropper 1993).

For some selected flora species, population demographic surveys may be undertaken where this data might be relevant for population estimates, and hence impact estimation as well as management implications.

The survey design was based on relevant state and Commonwealth survey guidelines. The following guidelines are considered: the *'Best Practice'* and formed the basis of the surveys undertaken:

- Biodiversity Precinct Structure Planning Kit (Department of Sustainability and Environment 2010)
- Management of Endangered Plants (Cropper 1993)
- Pest Plant Mapping & Monitoring Protocol (Parks Victoria 2007)
- Survey Guidelines For Australia's Threatened Orchids (Department of Environment 2013)

- Site examination for threatened and endangered plant species – for timed meander technique (Goff, Dawson & Rochow 1982)
- Monitoring Plant and Animal Populations (Elzinga et al. 2001).

Where possible, the field assessments were undertaken in the most appropriate season acknowledged in the relevant literature or survey guidelines. Only those species with a Moderate or high likelihood of occurrence were targeted during surveys.

2.2.2 Plant identification

Flora species that could not be identified in the field were recorded to the nearest possible family or genera. These were then collected and identified as per protocols of the Flora and Fauna Guarantee permit (10007800) for the collection of plant material.

2.3 Categorising vegetation within the study area

2.3.1 Determination of Ecological Vegetation Classes

An Ecological Vegetation Class (EVC) is a unit of consistent vegetation displaying broadly similar botanical characteristics reflecting consistent environmental and structural conditions (Oates & Taranto 2001). Field validation (or ground-truthing) of the DELWP vegetation modelled vegetation layer NV2005_EXTANT (DELWP 2017a) was undertaken to determine the site specific classification of the vegetation structure, floristics, wetland formations, dominant canopy species, native diversity and condition. NV2005_EXTANT was mapped with a focus on terrestrial vegetation and broader wetland types and has not been updated to include published wetland EVCs. Specific wetland EVCs were assessed using EVCs developed for the Index of Wetland Condition by (Frood 2009) and (DELWP 2016).

Terrestrial and wetland EVCs were mapped where the vegetation met the following requirements under the *Permitted Clearing of native vegetation: biodiversity assessment guidelines* (DEPI 2013c):

A remnant patch of native vegetation is either:

- an area of vegetation where at least 25 per cent of the total perennial understory plant cover is native
- any area with three or more native canopy trees where the canopy foliage cover is at least 20 per cent of the area.

A scattered tree is:

- a mature canopy tree that is greater than 3 meters in height and is normally found in the upper layer of the relevant vegetation type.

Where they did not meet the criteria for remnant patches, scattered trees were recorded with a handheld GPS.

Biosis conducted detailed flora and fauna investigations and habitat hectare assessments for the Project in 2015. They were unable to access a number of properties at the time of that study. The Project Area has also since changed. For these reasons, WSP conducted additional surveys of the project area in 2016 and 2017 to inform this assessment. This included habitat hectare assessments and application of wetland EVCs (as defined under the Index of Wetland Condition) to the vegetation in the project area. A number of areas in Biosis' mapping were used for this assessment. Where the Biosis vegetation mapping appeared to still be relevant, no changes were made by WSP. This included areas mapped as threatened vegetation communities under the EPBC Act and FFG Act.

2.3.2 Revegetation categorisation

Revegetation is extensive at some sites and can have different implications and exemptions under planning laws and other biodiversity legislation. For the purposes of categorising vegetation in the project study areas, the categories detailed in Table 2.1 were used.

Where possible, groups or rows of planted trees were lumped into revegetation polygons. Where planted trees occurred as individual trees, the location of individual planted trees were mapped and DBH was recorded for each tree. The planning implications for native vegetation recorded in the project area are provided in Section 6.3.

Table 2.1 Revegetation categories used for mapping

REVEGETATION/PLANTING MAPPING CATEGORY	DESCRIPTION	PLANNING IMPLICATIONS
Site indigenous	Indigenous to a local area. Described by (Pyšek, Richardson & Williamson 2004) and adopted by (Royal Botanic Gardens Melbourne 2016), defined as 'taxa that have originated in a given area without human involvement or that have arrived there without intentional or unintentional intervention of humans from an area in which they are native'.	There are certain exemptions under Victorian Planning Schemes, Clause 52.17 'planted vegetation', particularly if the vegetation has been planted for aesthetic or amenity purposes. The clause goes on to state *'this exemption does not apply if public funding was provided to assist in planting or managing the native vegetation and the terms of the funding did not anticipate removal or harvesting of the vegetation'*. Therefore, there may be circumstances where planted vegetation is not exempt from requiring a planning permit (eg. where revegetation has been planted for conservation, such as along creeks). If the vegetation is also covered by an overlay such as 'Environment Significance Overlay', it will likely require a permit to remove any vegetation. Revegetation can also meet criteria for FFG Act and/or EPBC Act communities – see further detail below table.
Native to Victoria	Non-indigenous to the local area but native to Victoria (eg Mahogany Gums, Giant Honey-myrtle). Defined in Victorian Planning Provisions – Definitions – Clause 72 as *'Plants that are indigenous to Victoria, including trees, shrubs, herbs, and grasses'.*	If vegetation is not exempt as above, it may require a permit for removal.
Native to Australia	Non-indigenous Australian native plants or vegetation (non-indigenous to Victoria) (eg Sugar Gums)	Usually do not require a permit for removal but are identified to show these have not been overlooked.

2.3.2.1 Revegetation under the FFG Act and EPBC Act

There is no clear guidance under the FFG Act regarding whether revegetation can be considered part of a listed threatened community under the FFG Act. Therefore, it is assumed that if the community has the attributes which are consistent with the *Characteristics of Threatened Communities* (DELWP undated), then the community is present.

The EPBC Act community Natural Damp Grassland of the Victorian Coastal Plains contains a provision in (TSSC 2015):

> *"Revegetated or replanted sites are not excluded from the listed ecological community so long as the patch meets the key diagnostic characteristics plus condition thresholds above. It is recognised that revegetation often requires longer-term effort and commitment and it may take some time for a degraded patch to reach a high quality condition".*

For the Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, the principle of including revegetated wetlands in the community listing is alluded to in (TSSC 2012):

> *"The following indicators should be considered when assessing the impacts of actions or proposed actions under the EPBC Act, or when considering recovery, management and funding priorities for a particular wetland…..connectivity or proximity to other natural features (e.g. native vegetation remnants, other water bodies) or restoration works. In particular, a wetland in an important position between (or linking) other wetlands in the landscape".*

To further clarify, staff from the Department of the Environment and Energy, Ecological Communities section were consulted. The following advice was received:

> *"Yes, I would accept that revegetated wetlands that can be improved to the point they meet the key diagnostic and condition criteria of the listing advice are included as part of the listed ecological community".*

2.3.3 Habitat hectare assessments

Habitat hectare assessments were undertaken to determine the condition of the vegetation in the context of the local area and the relevant bioregions. This methodology is outlined in *Vegetation Quality Assessment Manual-Guidelines for applying the habitat hectares scoring method* (DSE 2004). The habitat hectare method involves making visual and quantitative assessments on various characteristics of native vegetation according to established criteria that are set against an optimum benchmark. This process aims to establish the significance of native vegetation through an objective and repeatable methodology using working documents (benchmark data and field assessment score sheets) that are uniformly applied across Victoria.

In summary, this process begins with the identification of the EVC. Each EVC has a benchmark of optimal values which are found on DELWP's website (DELWP 2017b). Site assessments are undertaken using the DSE *Vegetation Quality Field Assessment Sheet* (Version 1.3 October 2004) from (DSE 2004). Further to the site condition criteria, the habitat hectare process also requires an assessment of the site in a landscape context (DSE 2004).

If a site meets or exceeds all benchmark criteria it will receive a total score of 100, which is a total of the above condition and landscape scores in pristine undisturbed condition. However, in many cases in the urban-influenced ecosystems in the Melbourne area, sites receive a score less than 60, due to their relatively high level of modification. The final habitat score is presented as a percentage and then converted to a score out of 1.00.

Areas defined as a 'remnant patch' were subject to habitat hectare assessments. According to the Native vegetation location risk 2013 (DELWP 2017a), the majority of the site is covered by Location A, meaning that proposed vegetation removal would only require habitat hectare assessments if more than one hectare or ≥15 scattered trees are proposed for removal under the *Permitted Clearing of Native Vegetation - Biodiversity Assessment Guidelines* (DEPI 2013c). As the quantity or remnant patches and scattered trees proposed for removal is unknown, all patches and trees were assessed. See Section 6 for more detail.

For some wetland EVCs there was no habitat hectare EVC benchmark, therefore the most similar available EVC benchmark for the bioregion was used – see Table 2.2.

Typically Bioregion Conservation Status is derived from (DELWP 2017b). However, several EVCs did not have a published conservation status, therefore a status in a nearby bioregion was used. Where this wasn't available, conservation status from (Frood & Papas 2016) was used.

Table 2.2 EVC Benchmark availability

EVC NUMBER	ECOLOGICAL VEGETATION CLASS	WETLAND EVC	EVC BENCHMARK AVAILABLE?	MOST SIMILAR EVC BENCHMARK USED
653	Aquatic Herbland	Yes	Yes	n/a

EVC NUMBER	ECOLOGICAL VEGETATION CLASS	WETLAND EVC	EVC BENCHMARK AVAILABLE?	MOST SIMILAR EVC BENCHMARK USED
308	Aquatic Sedgeland	Yes	No	Aquatic Herbland (EVC 653)
68	Creekline Grassy Woodland	No	Yes	
3	Damp Sands Herb-rich Woodland	No	Yes	
55	Plains Grassy Woodland	No	Yes	
125	Plains Grassy Wetland	Yes	Yes	n/a
647	Plains Sedgy Wetland	Yes	No	Sedge Wetland (EVC 136)
132_62	*South Gippsland* Plains Grassland	No	Yes	n/a
918	Submerged Aquatic Herbland	Yes	No	Aquatic Herbland (EVC 653)
937	Swampy Woodland	Yes	Yes	n/a
53	Swamp Scrub	Yes	Yes	n/a
821	Tall Marsh	Yes	Yes	n/a

2.3.4 Threatened vegetation communities

Several EPBC Act and FFG Act listed communities were considered likely to be present within the study area. These include:

FFG Act threatened communities:

- Herb-rich Plains Grassy Wetland (West Gippsland) Community
- Plains Grassland (South Gippsland) Community.

EPBC Act communities:

- Natural Damp Grassland of the Victorian Coastal Plains
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

There is no specific criteria which determines the presence of FFG Act communities except for an informal method of comparing site characteristics and floristics with community descriptions in (DELWP undated). Flora quadrats were undertaken in several patches to determine the presence of FFG Act threatened communities.

Several vegetation patches were assessed by undertaking 20 x 20 m flora quadrats to evaluate the scientific determination criteria for Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (TSSC 2012) and Natural Damp Grassland of the Victorian Coastal Plains (TSSC 2015).

Biosis' surveys were undertaken in a period of low rainfall and therefore a number of areas mapped as Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains were assessed in the 'dry phase' (Biosis 2015). The majority of vegetation surveys by WSP were undertaken in late summer and autumn, which are suboptimal times to identify wetlands. Also, Seasonal Herbaceous Wetlands can be difficult to identify during a 'dry phase' and some may only be evident irregularly from higher rainfall events as opposed to an annual filling phase. During a 'dry phase', most plants remain dormant and underground as seeds or underground propagules (such as tubers), thus making identification of this community difficult (Goulburn Broken CMA 2015). Therefore, WSP have adopted the areas of Seasonal Herbaceous Wetlands mapped by Biosis. However, should these patches be assessed in a 'wet phase', it is not known whether they would meet the criteria for Seasonal Herbaceous Wetlands.

2.4 Fauna survey

2.4.1 Targeted surveys for threatened fauna

Opportunistic bird surveys were undertaken in December 2016, however detailed surveys undertaken in (Biosis 2013) and (Biosis 2015) were the primary source of information, along with a number of other data sources identified above.

2.5 Aquatic fauna survey

An aquatic fauna field assessment was initiated on 29 November 2016 and concluded on 15 March 2017 by Streamline Research for this study (McGuckin 2017). The survey involved a visual examination of aquatic habitats to determine likelihood of presence of Dwarf Galaxias and using a dip net in areas of possible occurrence of the species. Six sites were surveyed in waterbodies around Waterways Estate, Mordialloc Creek and unnamed wetlands to the west of Braeside Park.

2.6 Likelihood of occurrence

As with most biological assessments, the presence or absence of a particular species cannot be definitively determined during a relative short survey timeline. For this study, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table 2.3 below. This method identifies the habitat requirements of the species, outcomes of a habitat assessment and habitat connectivity in conjunction with Victorian Biodiversity Atlas and Protected Matters Search Tool records.

Table 2.3 Likelihood of occurrence criteria for threatened flora and fauna species

LIKELIHOOD	DESCRIPTION
Low	Species considered to have a low likelihood of occurrence include species not recorded during the field surveys that fit one or more of the following criteria: → have not been recorded previously in the study area and surrounds and for which the study area is beyond the current distribution range → rely on specific habitat types or resources that are not present in the study area → are considered locally extinct → are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
Moderate	Species considered to have a moderate likelihood of occurrence include species not recorded during the field surveys that fit one or more of the following criteria: → have infrequently been recorded previously in the study area and surrounds → use habitat types or resources that are present in the study area, although generally in a poor or modified condition → are unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically during variable seasons or migration → are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
High	Species considered to have a high likelihood of occurrence include species not recorded that fit one or more of the following criteria: → have frequently been recorded previously in the study area and surrounds → use habitat types or resources that are present in the study area, that are abundant and/or in good condition within the study area → are known or likely to maintain resident populations surrounding the study area → are known or likely to visit the site during regular seasonal movements or migration.
Recorded	Any threatened species recorded during field surveys.

2.7 Limitations

A common limitation of ecological surveys is the short time period in which they are undertaken and the lack of seasonal sampling, which can lead to lack of detection of some species. Fieldwork for this study was undertaken in late summer and autumn. Spring is a more optimum time for surveying many plant species.

The likely presence of threatened species was determined primarily through habitat assessment, which is a more conservative approach likely to include species that are difficult to detect if suitable habitat was observed in the study area, and if that species was known to occur regionally.

The results are indicative of the environmental conditions at the time of assessment, including the presence or otherwise of species. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.

2.8 Permits

All relevant WSP staff are covered under the Victorian *Flora and Fauna Guarantee Act 1988* Permit to take/keep protected flora purposes of identification and lodging herbarium specimens (permit no. 10007800). Also, all relevant WSP staff are covered under the Standard Operating Procedures approved by the Department of Economic Development, Jobs, Transport and Resources, Wildlife and Small Institutions Animal Ethics Committee approval (08.17) and Victorian *Wildlife Act 1975* Research Permit (permit no. 10007800).

3 RESULTS

3.1 Literature review

Previous ecological assessment of the study area which were reviewed included:

FLORA AND FAUNA INVESTIGATION: NORTHERN EXTENSION OF THE MORNINGTON PENINSULA FREEWAY (BIOSIS 2013)

In 2013, Biosis completed the *Flora and Fauna Investigation: Northern Extension of the Mornington Peninsula Freeway* for VicRoads. The assessment was undertaken to inform a feasibility study of the Mornington Peninsula Freeway extension. The scope of the assessment included (but was not limited to) a review of relevant databases and literature, EVC mapping, complete a vegetation quality assessment, identify threatened species, noxious weeds, project constraints and potential effects. The assessment study area was located between Edithvale and Dingley Village southeast of the Melbourne CBD encompassing 206.9 ha within the Gippsland Plain Bioregion and Bunyip River Basin. The assessment recommended further targeted studies and identified that the most effective mitigation measure to reduce effects to biodiversity will be to limit the removal of native vegetation and habitat.

MORDIALLOC BYPASS: FLORA AND FAUNA INVESTIGATION INCLUDING HABITAT HECTARE ASSESSMENT (DRAFT REPORT) (BIOSIS 2015)

In 2015, Biosis completed the *Mordialloc Bypass: Flora and Fauna Investigation including habitat hectare assessment* for VicRoads. The assessment was undertaken to inform VicRoads of flora and fauna related project constraints associated with the Mordialloc Bypass. The scope of the assessment included (but not limited to) a review of relevant databases and literature, identify and map EVCs and species of management concern, conducted a Vegetation and Quality Assessment, conducted targeted surveys, review application legislation, assess potential effects and make recommendations for further assessment. The assessment study area was located between Edithvale and Dingley Village southeast of the Melbourne CBD encompassing 206.9 ha within the Gippsland Plain Bioregion and Bunyip River Basin. The assessment identified that the study area supports approximately 10 ha of native vegetation (~2 habitat hectares) and includes 28 scattered trees. Native vegetation was comprised of eight EVCs across 44 habitat zones, all of which are either endangered or considered vulnerable within the Gippsland Plains bioregion. The assessment also notes that the study area includes approximately 7 ha of EPBC/FFG listed ecological communities.

OUTER SUBURBAN ARTERIAL ROAD PROGRAM – PRELIMINARY BIODIVERSITY ASSESSMENT (BRETT LANE & ASSOCIATES 2016)

Brett Lane and Associates Pty. Ltd. completed the *Outer Suburban Arterial Road Program – Preliminary Biodiversity Assessment* in 2016 for VicRoads. The Assessment focussed on 25 proposed road upgrade projects across Melbourne. The assessment was undertaken to provide VicRoads with a high-level understanding of native vegetation including potential effects on species of management concern within the 25 project areas. The assessment notes that the majority of the project areas were comprised of heavily altered landscapes with inclusions of remnant patch native vegetation and scattered trees. The report further identifies project areas with the potential to support threatened species listed under the FFG Act and EPBC Act. The report provides further detail on offset requirements and a review of legislation and their potential implications on the various projects.

ESTABLISHMENT OF INDIGENOUS FLORA AND FAUNA IN REVEGETATED AREAS AT "THE WATERWAYS (AUSTRALIAN ECOSYSTEMS 2017)

In 2017, Australian Ecosystems completed the *Establishment of Indigenous Flora and Fauna in Revegetated Areas at "The Waterways"* case study. The case study involves a review of the acclaimed restoration efforts at "The Waterways" located on Mordialloc Creek. Restoration efforts were designed to restore habitats to those associated with the Carrum Carrum Swamp. The successful establishment of the desired habitats has

resulted in the observations of 19 threated fauna species including Australasian Bittern. The case study further describes the habitat types and the observations of flora and fauna located within The Waterways.

MELBOURNE WATER REGIONAL BIRD MONITORING PROJECT. ANNUAL REPORT: JULY 2015 – JUNE 2016 (HERMAN & PURNELL 2016)

Herman and Pernell completed the *Melbourne Water Regional Bird Monitoring Project. Annual report: July 2015 – June 2016* in 2016 for Melbourne Water. The monitoring program and reports are a requirement for Melbourne Water to complete for rivers, estuaries, wetlands and floodplains that may be affected by water management activities. The 2015-16 monitoring report summaries the results of 2373 targeted surveys from 177 sites across Melbourne and the outer suburbs. Monitoring observations included 250 species, 23 listed as *endangered/threatened* on the Victorian Advisory List, 4 EPBC Act listed threated species, and 22 migratory species protected under international agreements, including 13 shorebird species.

FLORA AND FAUNA LISTS OF "THE WATERWAYS" (COOK, D UNDATED)

Damien Cook provided detailed lists of flora and fauna species observed at the Waterways. The fauna list includes presence (including nests) of species at the Waterways from 2001 to 2007, while the flora list shows species observed at the Waterways.

PRELIMINARY ECOLOGICAL ASSESSMENT FOR 12 KILOMETRES OF PROPOSED ROADWAY BETWEEN THE SOUTH GIPPSLAND FREEWAY AND WARRIGAL ROAD (BIOSIS RESEARCH 2008A)

Biosis was retained by Maunsell Pty. Ltd. On behalf of the Eastern Integrated Transport Authority to completed a preliminary ecological assessment along a proposed freeway easement between the South Gippsland Freeway, Dandenong South and Warrigla Road, Oakleigh South, Victoria. This study area is situated within the Gippsland Plain Bioregion and the Bunyip River Basin. The preliminary ecological assessment was informed by a combination of field assessments (completed in October 2008) and various relevant databases and literature sources. The report summarizes the results of the database and literature review noting historical records of numerous flora and fauna species of national and state significance across the various databases. The field assessments provide insight of the existing vegetation conditions at the time of the study and note the presence of small patches of native vegetation comprised of five EVCs.

EDITHVALE AND SEAFORD WETLANDS BIRD SURVEY PROJECT 2014-15 (SILCOCKS 2016)

Silcocks provides a summary of fauna survey data at the Edithvale and Seaford Wetlands for the 2014-15 monitoring year in this document. The report notes that 110 and 114 species were recorded at Edithvale and Seaford respectively, during the July 2014 to June 2015 monitoring period. The report indicates that these species counts exceed the annual averages recorded since 1989 (Edithvale) and 1994 (Seaford). The report outlines that numerous significant species were recorded at Edithvale and Seaford wetlands, and that the Edithvale provides habitat for at least 1% of the estimated world population of Sharp-tailed Sandpiper. The monitoring report explains that the value of Edithvale and Seaford wetlands centres on the wetland and associated remnant/revegetated upland habitat it provides birds. The monitoring report continues on to provide management recommendations highlighting the importance of controlling invasive flora and fauna species.

EDITHVALE-SEAFORD WETLANDS RAMSAR SITE MANAGEMENT PLAN (ECOLOGY AUSTRALIA 2016)

In 2016, Ecology Australia prepared the *Edithvale-Seaford Wetlands Ramsar Site Management Plan* Melbourne Water. The report explains that Melbourne Water, owner/manager of Edithvale Wetlands and joint manager of Seaford Wetlands is required to complete management plans for the wetlands every 7 years. This management plan will guide management efforts at the Edithvale-Seaford wetlands through until 2023 when a new management plan is drafted. The management plan provides a detailed assessment of ecological components, processes and services of the wetlands including a detailed explanation of the various EVCs present and the flora and fauna the wetlands support. The management plan later provides a detailed management plan outlining various strategies to maintain and improve the ecological character of the wetlands.

GROUNDWATER PRELIMINARY IMPACTS - ECOLOGICAL ASSESSMENT – RAIL UNDER ROAD. FRANKSTON PACKAGE. 18 – EDITHVALE ROAD, EDITHVALE/46 – STATION STREET/BONDI ROAD, BONBEACH (AECOM-GHD JV 2016)

In 2016, AECOM-GHD Joint Venture was delivered a *Groundwater Preliminary Impacts – Ecological Assessment – Rail Under Road* report for the Level Crossing Removal Authority. The project area was defined as the Edithvale Road level crossing, but includes a study area which aligns with the Edithvale-Seaford wetlands. The purpose of the assessment was to investigate ecological impacts of changes to local groundwater as a result of the project. The preliminary assessment identifies the potential for groundwater levels to rise by 0.1 metre at the Edithvale wetland and Bonbeach. The report notes that the Level Crossing Removal Authority is undertaking a detailed groundwater impact assessment to better understand the potential groundwater effects resulting for the project and their potential to affect to Edithvale-Seaford Wetlands.

FLORA AND FAUNA ASSESSMENT – RAIL UNDER ROAD. FRANKSTON PACKAGE. 18 – EDITHVALE ROAD, EDITHVALE (AECOM-GHD JV 2017A)

In 2017, AECOM-GHD Joint Venture delivered a Flora and Fauna Assessment to inform the proposed level crossing removal at Edithvale level crossing. The scope of the assessment was to provide a desktop and field assessment to evaluate ecological constraints for the level crossing which included 530 m north from Edithvale Road to Lochiel Avenue and 800 m south to Elsie Grove. The report describes the presence of the twelve remnant patches classified as the following EVCs Coast Banksia Woodland, Coastal Dune scrub and Damp Sands Herb-rich Woodland. These EVCs accounted for 0.573 ha and account for 0.15 habitat hectares. In addition to the remnant patches, the report identifies the presence of three scattered trees equating to 0.042 habitat hectares. The impact assessment component of the report indicates that the project has the potential to affect Ramsar listed wetlands which has implications with the *Environment Protection and Biodiversity Conservation Act (1999) and the Environmental Effects Act (1978).* The report concludes that the project is unlikely to affect *significant* flora and fauna species.

FLORA AND FAUNA ASSESSMENT – RAIL UNDER ROAD. FRANKSTON PACKAGE. 46 – STATION STREET/BONDI ROAD, BONBEACH (AECOM-GHD JV 2017B)

In 2017, AECOM-GHD Joint Venture delivered a Flora and Fauna Assessment to inform the proposed level crossing at Station Street/Bondi Road, Bonbeach level crossing removal process for the Level Crossing Removal Authority. The scope of the assessment was to provide a desktop and field assessment to evaluate ecological constraints for the area including 730 m north of Station Street/Bondi Road to Glenola Road and 900 metres south to Mascot Avenue. The report highlighted 16 remnant patches classified as the following EVCs: Coast Banksia Woodland and Coastal Dune Scrub totalling 0.936 ha (0.231 habitat hectares) within the Study Area. The report also identified the presence of one scattered tree (0.014 habitat hectares) within the project area. The impact assessment component of the report indicates that the project has the potential to affect the Edithvale-Seaford Ramsar listed wetlands. The report concludes that the limited habitat within the project area is unlikely to support *significant* flora and fauna species.

BRAESIDE PARK FAUNA SURVEY REPORTS

Fauna survey at Braeside Park (The Field Naturalists Club of Victoria 2017)

Fauna surveys were completed at Braeside Park using ground-based remote cameras, hair tubes, spotlighting, harp traps, tiles and acoustic frog surveys. The surveys recorded 46 different species including 2 amphibians, 29 birds, eight mammals and seven reptiles. Three species of conservation significance were located during the surveys and in incidental sightings: the endangered Blue Billed Duck *Oxyura australis* (FFG Act listed and Advisory List endangered), Common Long-Necked Turtle *Chelodina longicollis* (Advisory List data deficient) and the Grey-headed Flying Fox *Pteropus poliocephalus* (EPBC Act vulnerable, FFG Act listed and Advisory List vulnerable). The survey failed to detect any Growling Grass Frogs which were translocated to Braeside Park in 2002 but have not been recorded since 2006.

Braeside Park Frog Recording Data (The Field Naturalists Club of Victoria 2016)

Eight species of frogs were recorded at Braeside Park in the 2016 survey, however no species of conservation significance (including Growling Grass Frog) were detected.

Moths of the Braeside Park Heathland (Entomological Society of Victoria 2017)

The Field Naturalists Club of Victoria conducted a moth survey at Braeside Park on 26 November, 2016. The survey revealed a highly diverse range of moth species at the park but none of conservation significance.

3.2 Vegetation

Twelve native Ecological Vegetation Classes (EVCs) were mapped within the study area (and the project area). The EVCs recorded and their corresponding conservation significance statuses are summarised in Table 3.1 and shown in Appendix A, Figure 3. Brief descriptions are provided in Section 3.2.1.

Based on the latest vegetation assessments from March to May 2017, the project area supports 11.99 ha of native vegetation, including a number of scattered trees, comprising 12 EVCs. Most of these EVCs are considered ‘endangered’ within the Gippsland Plain Bioregion. The remainder of the project area (approximately 125 ha) consists of exotic vegetation and constructed features such as roads.

Table 3.1 Ecological vegetation classes

EVC NO.	ECOLOGICAL VEGETATION CLASS	BIOREGION CONSERVATION STATUS (DELWP 2017B)	WETLAND EVC BIOREGION CONSERVATION STATUS (FROOD & PAPAS 2016)	ACCEPTED BIOREGION CONSERVATION STATUS	FFG ACT COMMUNITY EQUIVALENT*	EPBC ACT COMMUNITY EQUIVALENT*
653	Aquatic Herbland	EVC not listed in Gippsland Plain Bioregion (GipP). Aquatic Herbland is 'endangered' in most bioregions	Endangered	Endangered	Herb-rich Plains Grassy Wetland (West Gippsland) Community	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
308	Aquatic Sedgeland	EVC not listed	Vulnerable	Vulnerable	Drier edges may be consistent with Herb-rich Plains Grassy Wetland (West Gippsland) Community	No Contra-indicated from Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
68	Creekline Grassy Woodland	Endangered	None	Endangered	No	No
3	Damp Sands Herb-rich Woodland	Vulnerable	None		No	No
125	Plains Grassy Wetland	Endangered	Endangered	Endangered	Herb-rich Plains Grassy Wetland (West Gippsland) Community	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
55	Plains Grassy Woodland	Endangered	None	Endangered	No	No
647	Plains Sedgy Wetland	No status in GipP. Listed as 'endangered' in most bioregions	Endangered	Endangered	Herb-rich Plains Grassy Wetland (West Gippsland) Community	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
132_62	*South Gippsland* Plains Grassland	Endangered	None	Endangered	Plains Grassland (South Gippsland) Community	Natural Damp Grassland of the Victorian Coastal Plains

EVC NO.	ECOLOGICAL VEGETATION CLASS	BIOREGION CONSERVATION STATUS (DELWP 2017B)	WETLAND EVC BIOREGION CONSERVATION STATUS (FROOD & PAPAS 2016)	ACCEPTED BIOREGION CONSERVATION STATUS	FFG ACT COMMUNITY EQUIVALENT*	EPBC ACT COMMUNITY EQUIVALENT*
918	Submerged Aquatic Herbland	EVC not listed Most similar EVC Aquatic Herbland is 'endangered' in most bioregions	Endangered	Endangered	No	No
53	Swamp Scrub	Endangered	Endangered	Endangered	No	No
937	Swampy Woodland	Endangered	Endangered	Endangered	No	No
821	Tall Marsh	No status in GipP. Most similar EVC Floodplain Reedbed is 'endangered' in GipP	Endangered	Endangered	No	No Contra-indicated from Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
990	Unvegetated (open water/bare soil/mud – 'Non Vegetation'	n/a	n/a	n/a	No	No

*Equivalence to FFG Act and EPBC Act communities as assessed by criteria in Section 3.2.3 Threatened vegetation communities

3.2.1 Vegetation descriptions

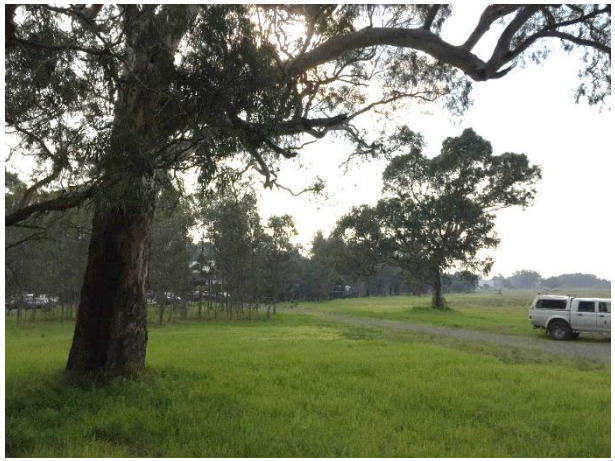
Twelve EVCs have been recorded within the project area. These are described in the following table.

Table 3.2 Ecological vegetation classes descriptions

EVC	INDICATIVE IMAGE	DESCRIPTION
Aquatic Herbland (EVC653)		Herbland of permanent to semi-permanent wetlands, dominated by sedges (especially on shallower verges) and/or aquatic herbs. Occurs on fertile paludal soils, typically heavy clays beneath organic accumulations. Typical species include native plants *Persicaria decipiens, Eleocharis acuta, Cycnogeton procerum* (broad erect leaf variant), *Juncus sarophorus* and *Alisma plantago-aquatica.* Introduced species typically include **Paspalum distichum, *Aster subulatus, *Rumex crispus and *Cyperus eragrostis.* Found throughout the project area in drains, dams and low lying depressions.

EVC	INDICATIVE IMAGE	DESCRIPTION
Aquatic Sedgeland (EVC 308)		Typically species-poor vegetation dominated by robust inundation-tolerant rhizomatous sedges including *Eleocharis sphacelata* and *Baumea articulata* occasionally in deeper areas. Widespread on deeper wetland edges, often adjacent to Plains Sedgy Wetland, Wet Verge Sedgeland and Swamp Scrub. Few weeds in this EVC except **Myriophyllum aquaticum* in some areas. Areas of this EVC merging into Plains Sedgy Wetland contain weeds such as **Paspalum distichum, *Aster subulatus, *Rumex crispus* and **Cyperus eragrostis.* Only found in The Waterways.
Creekline Grassy Woodland (EVC 68)		Eucalypt dominated woodland to 15 m tall with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. Occurs on low-gradient ephemeral to intermittent drainage lines, typically on fertile colluvial/alluvial soils, on a wide range of suitably fertile geological gradients. Dominated by River Red-gum canopy with mid-storey shrubs including Swamp Paperbark and Hedge Wattle (Biosis 2015). The understorey is highly modified with majority of areas dominated by weeds including **Genista linifolia*,**Rubus fruticosus* spp. agg. and**Ulex europaeus*. Scattered remnants of this EVC occur in the northern parts of the project area.

EVC	INDICATIVE IMAGE	DESCRIPTION
Damp Sands Herb-rich Woodland (EVC 3)		A low, grassy or bracken-dominated eucalypt forest or open woodland to 15m tall with a large shrub layer and ground layer rich in herbs, grasses, and orchids. Occurs mainly on flat or undulating areas on moderately fertile, relatively well-drained, deep sandy or loamy topsoils over heavier subsoils. Canopy species include *Eucalyptus viminalis* subsp. *pryoriana*, with a modified understorey dominated by *Lomandra longifolia*, *Acacia paradoxa* and introduced species **Bromus diandrus*, **Salpichroa origanifolia*, **Ulex europaeus* and **Galenia pubescens* var. *pubescens.* Scattered remnants in the northern parts of the project area.
Plains Grassy Wetland (EVC 125)		Grassy-herbaceous, shallow seasonal wetlands which are typically species-rich. Throughout revegetated areas of The Waterways, this EVC is considered 'very high quality' according to the Scientific Determination Criteria for Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. Characteristic species in drier zones of this EVC include *Rytidosperma duttonianum, Eryngium vesiculosum, Poa labillardierei, Rytidosperma semiannulare, Coronidium gunnianum, Haloragis heterophylla, Calocephalus lacteus* and *Deyeuxia quadriseta*. In wetter zones, species typically include *Ornduffia reniformis, Amphibromus nervosus, Eleocharis acuta, Eleocharis pusilla, Myriophyllum crispatum* and *Xerochrysum palustre.* Some areas contain localised dominance of *Baumea arthrophylla* and *Carex tereticaulis*, however where these sedges become structurally dominant, this merges into Plains Sedgy Wetland. In high quality areas, typical weeds comprise <5%, which include **Aster subulatus, *Paspalum dilatatum, *Phalaris aquatica, *Leontodon saxatilis subsp. saxatilis* and **Plantago lanceolata.* See Plot 3. In remnant areas outside of the revegetated areas, these patches are in much poorer condition, dominated by the weed **Phalaris aquatica.*

EVC	INDICATIVE IMAGE	DESCRIPTION
Plains Grassy Woodland (EVC 55)		An open, eucalypt dominated woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. Dominated by River Red-gum *Eucalyptus camaldulensis* canopy over a highly modified understorey dominated by a number of introduced grasses and herbs including Perennial Rye-grass **Lolium perenne,* Paterson's Curse **Echium plantagineum* and Chickweed **Stellaria media.* Scattered remnants in the northern parts of the project area.
Plains Sedgy Wetland (EVC 647)		Sedge dominated wetland vegetation in areas where moisture supply is more reliable. Only found in the revegetated areas of Waterways. Occurs throughout low-lying areas, often between Plains Grassy Wetland (in drier zones) and Aquatic Sedgeland or Wet Verge Sedgeland in the wetter zones. Indicator species include Carex tereticaulis and sometimes Baumea arthrophylla along with Eleocharis acuta, Alternanthera denticulata s.l., Carex fascicularis, Juncus sarophorus, Persicaria hydropiper and Persicaria decipiens. Weeds typically comprise 10% cover, which include *Paspalum distichum, *Aster subulatus, *Rumex crispus, *Rorippa palustris and *Cyperus eragrostis. See Plot 2.

EVC	INDICATIVE IMAGE	DESCRIPTION
South Gippsland Plains Grassland (EVC 132_62)		Treeless vegetation dominated by grasses and herbs. High quality patches are typically dominated by *Poa labillardierei*, *Themeda triandra*, *Rytidosperma semiannulare*, *Eryngium vesiculosum*, *Calocephalus lacteus* and occasional *Acacia melanoxylon*. Weeds typically comprise 5% cover, which include **Erigeron sumatrensis*, **Trifolium angustifolium var. angustifolium*, **Helminthotheca echioides* and **Leontodon saxatilis subsp. saxatilis*. See Plot 1 and Plot 4. Only found in The Waterways.
Submerged Aquatic Herbland (EVC 918)		Submerged aquatic grass dominated beds of *Vallisneria australis* found throughout deeper areas of the Waterways lake and wetland systems. Typically only *Vallisneria australis* tolerates deeper, permanent inundation but in shallower areas, *Eleocharis sphacelata* and *Baumea articulata* can be present. No weeds are typically found in this vegetation. Only found in The Waterways.

EVC	INDICATIVE IMAGE	DESCRIPTION
Swamp Scrub (EVC 53)		Dense shrubby vegetation dominated by *Melaleuca ericifolia* with occasional emergent *Acacia melanoxylon*. High quality patches of Swamp Scrub found throughout revegetated sections of Waterways, with poorer quality remnant and regrowth elsewhere in the study area. Understorey species often include *Microlaena stipoides* var. *stipoides, Poa labillardierei, Carex breviculmis, Juncus amabilis, Senecio glomeratus* and in damper areas, *Carex tereticaulis* and *Phragmites australis.* Weeds throughout Waterways typically comprise 10% cover, which include **Rubus fruticosus spp. agg.*, **Aster subulatus, *Cirsium vulgare, *Solanum nigrum s.l.* and **Lactuca serriola.* See Plot 5.
Swampy Woodland (EVC 937)	No Photo	Open eucalypt woodland dominated by Eucalyptus ovata with an understorey dominated by Poa labillardierei, Themeda triandra, Senecio quadridentatus and occasional Melaleuca ericifolia. Small patches mapped in close association with Swamp Scrub. Weeds typically comprise 10% cover, which include *Paspalum distichum, *Bromus catharticus, *Cynodon dactylon var. dactylon and *Epilobium ciliatum.

EVC	INDICATIVE IMAGE	DESCRIPTION
Tall Marsh (EVC 821)		Wetland dominated by tall emergent grass Phragmites australis with very few other species present. More species-rich on the edges which merge into Plains Sedgy Wetland with species such as Juncus sarophorus, Carex tereticaulis Eleocharis acuta, Alternanthera denticulata s.l. and Persicaria decipiens. Widespread on wetland edges, interspersed with Wet Verge Sedgeland. Sometimes mono-dominant swards of Cladium procerum.

3.2.2 Scattered trees

A total of 43 scattered trees were recorded within the project area – see Appendix G. Ten of these trees are considered 'large trees' as per the EVC Benchmark for the Bioregion, which is 70 cm DBH (diameter at breast height) for the treed EVCs Damp Sands Herb-rich Woodland and Swampy Woodland and 80 cm DBH for Plains Grassy Woodland and Creekline Grassy Woodland. Five 'large trees' occur within the construction footprint and are therefore likely to require removal for the project. At least six trees within the construction footprint appear to contain hollows. Not all trees were able to be ground-truthed during surveys.

3.2.3 Threatened vegetation communities

Two EPBC Act listed threatened ecological communities were recorded within the project area. There are two corresponding FFG Act listed communities:

EPBC Act communities:

- Natural Damp Grassland of the Victorian Coastal Plains
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

FFG Act threatened communities:

- Herb-rich Plains Grassy Wetland (West Gippsland) Community
- Plains Grassland (South Gippsland) Community.

To assess the communities against the criteria listed in the condition thresholds, (DoE 2014) and (TSSC 2012), cover abundance surveys were undertaken in quadrats. All areas mapped as either of the two EPBC communities meet the condition thresholds based on the plot data (See Appendix B for plot data and Appendix F for the assessments against the EPBC Act threatened ecological community criteria).

In a previous study by Biosis (2013) additional areas between Bowen Parkway and Governor Road were mapped as potential Seasonal Herbaceous Wetlands. The survey was not considered to have been conducted at an appropriate time to properly assess against the condition thresholds due to dry weather conditions. Further surveys in March 2017 still did not record a sufficiently high diversity to meet the condition thresholds, however March is also a suboptimal time to be undertaking the survey, which should ideally be conducted in spring. It is recommended that this area be surveyed again in spring 2017 to properly assess against the condition thresholds.

3.3 Flora

3.3.1 Flora species recorded

A total of 240 vascular plant species were recorded in this study and in (Biosis 2015) during the field surveys, of which 102 (43%) were native, 7 planted street trees/shrubs (3%) and 131 (54%) introduced species. A number of species have also been planted throughout The Waterways, which significantly contributes to the diversity of native plant species recorded in the Project Area. Four significant species were detected during field surveys, as detailed in Table 3.3.

Table 3.3 Significant flora species recorded within the study area

SCIENTIFIC NAME	COMMON NAME	EPBC STATUS	FFG STATUS	VIC ADVISORY STATUS	COMMENT
Cladium procerum	Leafy Twig-sedge	–	–	Rare	Recorded in this study, revegetation in The Waterways
Coronidium gunnianum	Pale Swamp Everlasting	–	Listed	Vulnerable	Recorded in this study, revegetation in The Waterways
Ranunculus papulentus	Large River Buttercup	–	–	Poorly known	Recorded in (Biosis 2015) and this study
Xerochrysum palustre	Swamp Everlasting	Vulnerable	Listed	Vulnerable	Recorded in this study, revegetation in The Waterways

The full list of flora species recorded in the study area is included as Appendix C.

3.3.2 Database records and previous surveys

As identified in the desktop assessment, 39 flora species of state and/or national significance have been recorded within 5 km of the project area according to DELWP's Victorian Biodiversity Atlas (VBA), or are predicted to occur by Department of the Environment and Energy (DoEE) Protected Matters Search Tool (Figure 4 Appendix A). These species are assessed in Appendix D for their potential to occur within the study area and to be impacted by the proposed works. Some species which had been planted in Waterways Estate Wetlands but which did not come up in database searches for the area have also been included in Appendix D. A list of threatened flora species with moderate likelihood of occurrence or higher, are shown in the table below.

Table 3.4 Significant flora species with moderate likelihood of occurrence or higher

COMMON NAME	CONSERVATION STATUS			COUNT OF SIGHTINGS, 5 KM BUFFER (VBA)	LIKELIHOOD OF OCCURRENCE
	EPBC Act	FFG Act	Victorian Advisory List		
Lacey River Buttercup			Rare	1	Moderate - Planted
Large River Buttercup			Poorly known	9	Moderate - Planted
Leafy Twig-sedge			Rare		High – Recorded, planted. Some occur in current costruction footprint.
Matted Flax-lily	Endangered	Listed	Endangered		Moderate - Planted
Pale Swamp Everlasting			Vulnerable	2	High – Recorded, planted, outside the current construction footprint.
Purple Blown-grass		Listed	Rare	2	Moderate – Planted
River Swamp Wallaby-grass	Vulnerable			2	Moderate - Planted

COMMON NAME	CONSERVATION STATUS			COUNT OF SIGHTINGS, 5 KM BUFFER (VBA)	LIKELIHOOD OF OCCURRENCE
	EPBC Act	FFG Act	Victorian Advisory List		
Swamp Everlasting	Vulnerable	Listed	Vulnerable	1	High – Recorded, planted, outside of current construction footprint
Swamp Fireweed / Smooth-fruited Groundsel	Vulnerable		Vulnerable		Moderate - planted

3.4 Fauna

3.4.1 Fauna species recorded

A total of 106 fauna species were recorded in this study and in (Biosis 2015). This included 74 native birds, nine introduced birds, seven frogs, six mammals (three introduced), and ten fish (including four introduced). Several significant (listed) bird species were recorded by Biosis, and one was recorded by WSP (Hardhead *Aythya australis*, which is listed as vulnerable on the Victorian Advisory list).

With regards to previous surveys:

- a targeted survey for wetland and migratory shorebirds at the site by Biosis (2013) found 8 birds of conservation significance and five migratory species
- at the Wetlands (Cook, date unknown) 17 birds of conservation significance, 6 migratory species, as well as Growling Grass Frog and Glossy Grass Skink, have been recorded
- there is a large amount of record data available from regular Birdlife Australia surveys as well as from birdwatchers visiting the wetlands in the vicinity of the project area. These data have been reviewed and taken into consideration for the likelihood of occurrence assessment.

The species recorded by WSP as well as the species recorded by Biosis (2013), are listed in Appendix C.

3.4.2 Likelihood of occurrence and impact assessment

The 101 fauna species of state and/or national significance, identified in the desktop assessment to have the potential to occur within 5 km of the study area, are specified in Appendix D. They include 81 birds (See Figure 5 Appendix A for map of bird records), 4 fish, 8 mammals, 2 frogs, 2 insects, and four reptiles. Of these species, 44 are considered moderately or highly likely to occur within or nearby the study area on a permanent or intermittent basis. Many of these species were preliminarily assessed in the Likelihood of occurrence and impact assessment as having a low likelihood of impact (prior to mitigation) and therefore have not been considered further. Rationale for the likelihood of occurrence and impact for each species is provided in Appendix D.

Twenty-six species are considered to have a moderate or higher likelihood of impact by the proposed road. These species and their conservation statuses are listed in Table 3.5.

We note that the VBA records for some species which regularly occur in the area are underreported. This is particularly the case for the Sharp-tailed Sandpiper, a summer migrant which is regularly recorded in the thousands at Edithvale Wetlands, nearby the project area.

Species reliant solely on pelagic/oceanic habitat were excluded from the likelihood of occurrence assessment; this includes pelagic birds, whales, sharks and marine turtles.

Table 3.5 Fauna species with a moderate or higher likelihood of impact

COMMON NAME	CONSERVATION STATUS			VBA COUNT FROM 5 KM BUFFER	LIKELIHOOD OF OCURRENCE	LIKELIHOOD OF IMPACT WITHOUT MITIGATION
	EPBC Act	FFG	Victorian Advisory List			
Migratory, waterfowl and waterbirds						
Australasian Bittern	Endangered	Listed	Endangered	167	High	High
Australasian Shoveler			Vulnerable	431	High	Moderate
Baillon's Crake		Listed	Vulnerable	88	High	Moderate
Blue-billed Duck		Listed	Endangered	390	High	Moderate
Caspian Tern		Listed	Near threatened	47	High	Moderate
Curlew Sandpiper	Critically endangered, Migratory	Listed	Endangered	73	Moderate	Moderate
Eastern Curlew	Critically Endangered, Migratory	Listed	Vulnerable	5	Low-moderate	Low-moderate
Eastern Great Egret		Listed	Vulnerable	215	High	Moderate
Freckled Duck		Listed	Endangered	22	High	Moderate
Glossy Ibis	Migratory		Near threatened	55	High	Moderate
Hardhead			Vulnerable	367		Moderate
Latham's Snipe	Migratory		Near threatened	261	high	Moderate
Little Bittern		Listed	Endangered	28	Moderate-high	Moderate
Little Egret		Listed	Endangered	16	Moderate	Low - Moderate
Magpie Goose		Listed	Near threatened	144	Moderate	Moderate
Musk Duck			Vulnerable	267	High	Moderate
Nankeen Night Heron			Near threatened	43	High	Moderate
Pectoral Sandpiper	Migratory		Near threatened	41	Moderate	Moderate
Pied Cormorant			Near threatened	112	High	Moderate
Red-necked Stint	Migratory			98*	Low-Moderate	Moderate
Royal Spoonbill			Near threatened	240	High	Moderate

COMMON NAME	CONSERVATION STATUS			VBA COUNT FROM 5 KM BUFFER	LIKELIHOOD OF OCURRENCE	LIKELIHOOD OF IMPACT WITHOUT MITIGATION
	EPBC Act	FFG	Victorian Advisory List			
Sharp-tailed Sandpiper	Migratory			197*	High	Moderate-High
Whiskered Tern			Near threatened	174	High	Moderate
White-winged Black Tern			Near threatened	22	Moderate	Low – Moderate
Wood Sandpiper	Migratory		Vulnerable	55	Moderate	Low-moderate
Reptiles						
Eastern Snake-necked Turtle			Data deficient	10	High	Moderate
Glossy Grass Skink			Vulnerable		Moderate	Moderate

* Species known or likely to be underreported.

3.4.3 Fauna habitat

3.4.3.1 Description of habitat

The primary types of fauna habitat within the project area are (see Figure 6, Appendix A):

- The constructed wetlands at the Waterways, immediately south of Governor Road, which includes some permanent aquatic habitat at Mordialloc Creek and fringing swamp vegetation. The wetlands provide habitat for a diverse range of species with aquatic and terrestrial habits, and support areas with dense understorey cover and some canopy trees for nesting. There is potential roosting and foraging sites for wetland and migratory birds, as well as potential habitat for bats, frogs, turtles and other reptiles.
- Agricultural grassland (predominantly highly modified with some small patches of remnant vegetation) occurring adjacent to Braeside park and Woodlands Industrial Estate.
- Roadside weedy grassland and small roadside drains, some of which provide some foraging habitat for wetland birds.
- Some remnant and planted trees (providing some low quality foraging habitat for woodland birds and minimal nesting habitat).

High quality fauna habitat occurs nearby the project area. These adjacent areas of habitat are shown on Figure 2 Appendix A and include:

- The broader Waterways area (outside of the project area). The proposed development bisects the 48 ha area of constructed and rehabilitated wetlands and fringing grassland immediately south of Governor Road. Although threatened and listed migratory species have been recorded at Waterways, the wetland is not managed purely for conservation as it is surrounded by housing estates. It has therefore been planned to be visually appealing and contain permanent water. It is also relatively newly established, having been rehabilitated in 2000. It is regularly visited by nearby residents and their dogs, and is likely to also support roaming cats from local residences (although cats are not allowed). Given the above, and from examination of species record data, it is likely to be of less value to the threatened and migratory birds of the area than the other wetlands discussed below.

- Woodlands Industrial Estate wetlands, located immediately west of the project area, north of Govenor Road, a partially constructed area of permanent wetlands which occasionally supports large numbers of migratory and other wetland birds.
- Braeside Park, a large parkland area comprised of predominately constructed and/or rehabilitated wetlands and rehabilitated woodland. Braeside Park is located immediately east of the project area north of Govenor Road and provides habitat for numerous common and threatened species and is a popular birding hotspot.
- The Edithvale component of the Edithvale-Seaford Wetlands Ramsar site, which provides high value habitat for wetland birds, including listed threatened and/or migratory species. It regularly supports over 1% of the population of the migratory shorebird Sharp-tailed Sandpiper, and is a birding hotspot. Although all wetlands in the area are likely to occasionally or regularly support the migratory and threatened bird species recorded at this site, this wetland is groundwater fed and thus provides high-value seasonal mudflat foraging habitat for migratory waders which is not provided by the permanent wetlands immediately adjacent to the project area. The Edithvale component of the Ramsar site is located approximately 700 metres west of the project boundary, in the southern extent of the alignment. Further information is provided in Section 6.1.1.1.
- The Carrum Swamp 'Important Bird Area (IBA)' (BirdLife International 2017) is comprised of a number of wetlands, including areas adjacent to the project area: Woodlands Wetlands, Braeside Park and Edithvale-Seaford Wetlands. It is known to be important as a coastal refuge for waterbirds during drought periods (Clarke et al. 2015).
- Other waterbird habitat present in the wider locality, although more distant and unlikely to be affected by the proposed development. For example, the Eastern Treatment Plant is a high value bird area located south of the study area.

3.4.3.2 Connectivity

The present day suburbs of Mordialloc through to Frankston once comprised a large wetland area known as Carrum Carrum Swamp, covering approximately 5260 hectares (Victorian Places, 2015). The swamp was drained in 1879, creating agricultural land, and few remnants now remain. The estimated pre-draining swamp extent is shown on Figure 2 (Appendix A). One such remnant is The Wetland of International Importance, Edithvale-Seaford Wetlands. Braeside Park, Woodlands Industrial Estate, and the Waterways also all occur partly within or adjacent to the historic area of Callum Callum Swamp (although all are created wetlands to some extent).

The Waterways, the Woodlands Industrial Estate wetland, and Braeside Park form almost continuous habitat for migratory and wetland bird species. These wetlands are also within easy flying distance from the Edithvale-Seaford Wetlands, with the Edithvale component of this wetland approximately 1 km from the Waterways Estate wetland and the Seaford component approximately 9 km away. Most migratory or nomadic waterbird species are likely to move freely between all wetlands in the area depending on the local conditions. The predominantly degraded agricultural grassland area between Woodlands Industrial Estate and the southern part of Braeside Park is likely to be utilised for the movement of fauna between the two areas, including woodland and wetland birds, as well as reptiles such as turtles.

4 PRELIMINARY IMPACT ASSESSMENT

4.1 Potential impacts of the proposed development and literature review

The proposed construction of the Mordialloc Bypass is likely to affect the local ecology in a number of ways. Impacts may be temporary, predominantly occurring during the construction phase, or ongoing for the operational phase of the bypass. The impacts can be classified as 'direct' impacts, for example the loss of vegetation through clearing for the road, and 'indirect' impacts, such as increased noise and light from the new road. The broad types of impacts likely to be associated with this development, and the potential nature of the impacts without specific mitigation measures, are discussed in the following sections. The likely severity of impacts is addressed at the end of this section and assessed in Appendix D and F. Mitigation measures require to reduce the impacts of the proposed development are provided in Section 5 and the implications of residual impacts under relevant legislation are provided in Section 6.

4.1.1 Loss of vegetation and habitat

Loss of habitat, together with habitat degradation and fragmentation, is one of the most critical impacts to native wildlife in Australia (Gleeson & Gleeson 2012). These processes reduce the ability of the land to provide necessary resources (including foraging, roosting and breeding resources) for fauna species, and increase competition between species. Clearing can also result in habitat fragmentation, discussed under section 4.1.2 below.

The Project will require clearing of vegetation and habitat along the alignment to construct the bypass. The bridge over Mordialloc Creek will result in the shading of some native vegetation and habitat, including parts of threatened communities. For the purpose of this assessment, vegetation and habitat areas which will be substantially shaded by the road and bridge should also be considered lost. Shading can result in substantial changes in vegetation structure and composition through the loss of particular plant species and the proliferation of others. This can, in turn, affect the suitability of vegetation as habitat for animals, including threatened species.

The extent of direct vegetation/habitat loss and the impacts upon significant biodiversity values are detailed below.

4.1.1.1 Native vegetation and threatened vegetation communities

Based on the latest vegetation assessments from March to May 2017, the project area supports 11.99 ha of native vegetation (including scattered trees), comprising 12 EVCs. Most of these EVCs are considered 'endangered' within the Gippsland Plain Bioregion. A total of 6.17 ha of native vegetation occurs within the construction footprint and is therefore proposed to be lost. The breakdown of areas (in hectares) of EVCs within the project area and the construction footprint is provided in the table below.

Table 4.1 Breakdown of EVCs within the project area and construction footprint

EVC NO.	EVC NAME	EVC CONSERVATION STATUS	COMPLETE PROJECT AREA (HA)	CONSTRUCTION FOOTPRINT (HA)
Ecological Vegetation Classes				
EVC 653	Aquatic Herbland	Endangered	0.53	0.16
EVC 308	Aquatic Sedgeland	Vulnerable	0.31	0.08
EVC 68	Creekline Grassy Woodland	Endangered	0.42	0.27
EVC 125	Plains Grassy Wetland	Endangered	4.48	2.43
EVC 55	Plains Grassy Woodland	Endangered	1.11	0.23

EVC NO.	EVC NAME	EVC CONSERVATION STATUS	COMPLETE PROJECT AREA (HA)	CONSTRUCTION FOOTPRINT (HA)
EVC 647	Plains Sedgy Wetland	Endangered	0.47	0.30
EVC 651	Plains Swampy Woodland	Endangered	0.04	0.03
EVC 132_62	South Gippsland Plains Grassland	Endangered	0.09	0.04
EVC 918	Submerged Aquatic Herbland	Endangered	0.53	0.25
EVC 53	Swamp Scrub	Endangered	0.87	0.51
EVC 821	Tall Marsh	Endangered	0.74	0.30
Scattered tree – converted to area of 15m radius tree = 0.07ha per tree (DELWP 2015)				
EVC 55	Scattered Tree - Plains Grassy Woodland	Endangered	1.84	0.99
EVC 68	Scattered Tree - Creekline Grassy Woodland	Endangered	0.07	0.07
EVC 3	Scattered Tree - Damp Sands Herb-rich Woodland	Vulnerable	0.49	0.49
Total (ha)			**11.99**	**6.17** †
Total (ha) with Vulnerable EVCs subtracted (for EES Act criteria)			**11.18**	**5.59** †

† total figures calculated based on six decimal places, rounded to two decimal places

A total of 23 scattered trees are proposed for removal, this includes 5 'large trees' in the EVC Benchmark for the Bioregion, which is 70 cm DBH (diameter at breast height) for the treed EVCs Damp Sands Herb-rich Woodland and Swampy Woodland and 80 cm DBH for Plains Grassy Woodland and Creekline Grassy Woodland. See Appendix G for details.

Several EVCs are also consistent with up to four threatened vegetation communities under the EPBC Act and FFG Act. The breakdown of areas (in hectares) of threatened vegetation communities within the project area and the construction footprint is provided in the table below.

Table 4.2 Breakdown of Threatened Vegetation Communities within the project area and construction footprint

	COMMUNITY NAME	STATUS	PROJECT AREA (HA)	CONSTRUCTION FOOTPRINT (HA)
FFG Act threatened communities:				
	Herb-rich Plains Grassy Wetland (West Gippsland) Community	Threatened	4.40	2.22
	Plains Grassland (South Gippsland) Community	Threatened	0.07	0.03
Total (ha)			**4.47**	**2.26**
EPBC Act communities:				
	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered	4.20	2.12

	COMMUNITY NAME	STATUS	PROJECT AREA (HA)	CONSTRUCTION FOOTPRINT (HA)
	Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	0.07	0.03
Total (ha)			**4.27**	**2.15**

4.1.1.2 Migratory birds, waterfowl and other waterbirds

The amount of habitat for the different waterbird groups were mapped by Biosis (2013) within and adjacent to the project area. The extent of direct permanent removal of the mapped bird habitat proposed from the Project (i.e. within the construction footprint) is presented in Table 4.3. Note that the habitat mapped is primary habitat for the species. Birds are likely to ocassionally utilise adjacent less suitable habitat.

The primary impacts to migratory and threatened waterbirds from this loss (particularly Australasian Bittern and Latham's Snipe) is a reduction in foraging and/or roosting habitat.

Table 4.3 Breakdown of bird habitats mapped in Biosis (2013) within the construction footprint

SIGNIFCANT BIRD HABITAT	AREA (HA) WITHIN CONSTRUCTION FOOTPRINT
Spoonbills and Egrets	0.09 Note that these species are likely to also utilise agricultural grassland when flooded.
Crakes, Bitterns and Rails	4.90
Lathams's Snipe	4.90
Threatened ducks	0.75
Migratory shorebirds	0.0 Note that migratory shorebirds may utilise habitat within the construction footprint during particular conditions, and habitat is mapped for migratory shorebirds at the Waterways immediately adjacent to the construction footprint.

4.1.1.3 Threatened fauna species (excluding waterbirds)

Some habitat loss for terrestrial fauna species (excluding all waterbirds) listed as threatened under the Commonwealth EPBC Act and/or the VIC FFG Act may occur as a consequence of the proposed development. Some habitat for species listed only on the Victorian Advisory List may also be impacted upon. Five significant fauna species were considered to have a moderate to high likelihood of occurrence in the project area. Non-waterbird species include Eastern Snake-necked Turtle, Grey-headed Flying-fox and Glossy Grass Skink. The extent of direct habitat loss for threatened terrestrial fauna is generally low for the following reasons:

- The majority of the project area supports highly modified agricultural or roadside vegetation. Very few threatened fauna species are likely to utilise this vegetation. We note that some threatened species may utilise the agricultural grassland to move between areas of habitat (e.g. Eastern Snake-necked Turtle), or may utilise this vegetation for foraging as a part of a broader area (e.g. Grey Goshawk). This has been considered in the individual assessment of impacts for each species.
- Only some low value scattered remnant and planted trees are proposed to be lost. These trees are unlikely to comprise foraging or nesting habitat of value to any threatened species.
- Foraging habitat for the Grey-headed Flying-fox is present in trees and other vegetation within and adjacent to the construction footprint, however Grey-headed Flying-fox has a large home range and area in which it can forage across its range.

The list of significant species assessed for their potential to occur at the study area and be impacted by the works (without mitigation measures) are provided in Appendix D.

4.1.1.4 Threatened flora

Some habitat loss for significant terrestrial and wetland flora species may occur as a consequence of the proposed development. The likely impacts are described in Table 4.4.

Table 4.4 Significant flora species recorded or with the potential to occur within the study area

COMMON NAME	CONSERVATION STATUS			PROPOSED IMPACTS
	EPBC Act	FFG Act	Victorian Advisory List	
Lacey River Buttercup			Rare	May occur however not recorded.
Large River Buttercup			Poorly known	Plant tubestock originally used in revegetation in The Waterways. Unlikely for any direct loss as plants were recorded outside the current construction footprint.
Leafy Twig-sedge			Rare	A bridge is proposed over areas colonised by Leafy Twig-sedge, a large sedge which was originally planted in The Waterways. All plants under the bridge should be considered lost.
Matted Flax-lily	Endangered	Listed	Endangered	May occur however not recorded.
Pale Swamp Everlasting			Vulnerable	Plant tubestock originally used in revegetation in The Waterways. Unlikely for any direct loss as plants were recorded outside the current construction footprint.
Purple Blown-grass		Listed	Rare	May occur however not recorded.
River Swamp Wallaby-grass	Vulnerable			May occur however not recorded.
Swamp Everlasting	Vulnerable	Listed	Vulnerable	Plant tubestock originally used in revegetation in The Waterways. Unlikely for any direct loss as plants were recorded outside the current construction footprint.
Swamp Fireweed / Smooth-fruited Groundsel	Vulnerable		Vulnerable	May occur however not recorded.

4.1.2 Loss of connectivity

Clearing and construction can result in habitat fragmentation, where a patch of native vegetation is spilt into multiple smaller patches. This effect is listed under the FFG Act as *'habitat fragmentation as a threatening process for fauna in Victoria'*. It can lead to increased 'edge effects', which is where habitat at the edge of the patch suffer more impacts from dust, noise, light and weed invasion than the middle of patch (Gleeson & Gleeson 2012). Fragmentation can also split a population of a species and cause a barrier to dispersal which can lead to inbreeding depression, greater susceptibility to environmental variation, and local extinction. Roads form a barrier for certain species, particularly those that are sensitive to the noise, are slow moving (and suffer high mortality – discussed in Section 4.1.3), or require protective cover to move around.

The fauna habitat in the locality of the project area, particularly the wetland habitat (i.e. the remnants of the original Carrum Carrum Swamp, now the Carrum IBA) is already fragmented, and the species utilising the habitat are tolerant of the current level of fragmentation. Nevertheless, the connectivity which currently exists between the wetlands at Woodlands Industrial Estate and Braeside Park will be affected by the proposed road. In additional, the works will fragment The Waterways. Species most likely to be impacted by a loss of connectivity at the project area are small or less mobile fauna such as turtles and secretive (reliant on vegetative cover) bird species such as bitterns and crakes. The construction of the road may lead to road avoidance or road mortality for the above taxa. The Proposed Road may increase fauna injury and mortality during both the construction and the operational phase of the project, as discussed in the following sections.

The proposed road does not involve the clearing of any vegetation that comprises a regionally significant movement corridor for small woodland birds. Flora species at the study area are considered unlikely to be affected in this case, as pollen flow (usually driven by wind, invertebrates, and/or birds) is unlikely to be substantially hindered by the road.

4.1.3 Fauna injury and mortality

The Proposed Road may increase fauna injury and mortality during both the construction and the operational phase of the project, as discussed in the following sections.

4.1.3.1 Construction phase

Mortality of wildlife during construction may occur during clearing, or from collisions when wildlife strays into the construction zone (van der Ree, Smith & Grilo 2015). The potential for injury and mortality of wildlife from the Project is summarised in Table 4.5.

Table 4.5 Summary of potential for increased injury and mortality from Construction Phase

ACTIVITY WITH POTENTIAL TO CAUSE MORTALITY	NATIVE ANIMALS WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT OF THE PROJECT
Vegetation/habitat removal during construction: → Removal of mature trees with hollows and dead standing trees	→ Hollow-dependent bats → Hollow-nesting and canopy-nesting birds → Arboreal mammals → Arboreal reptiles → Arboreal frogs → Invertebrates	The level of mortality and injury of both non-threatened and threatened species of birds, bats, arboreal mammals is likely to be low. With regard to potential fauna habitat trees, twenty-three trees are likely to require removal for the Project, including at least six which appear to contain hollows. Mortality of species of native (non-threatened) reptiles and frogs is likely to occur in higher numbers from vegetation (groundcover) clearance.
→ Removal of understorey, groundcover, topsoil and debris (wood, rocks, rubbish etc.)	→ Small woodland birds → Ground-dwelling reptiles → Frogs → Invertebrates	
Machinery/plant and vehicle collisions with fauna during construction	→ Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals → Birds, especially waterbirds	Occasional mortality of native animals may occur during vehicle movements within the project area.

4.1.3.2 Operational phase (ongoing impacts)

Many species are vulnerable to injury and mortality from roads, with the impacts on populations differing between species (Donaldson & Bennett 2004). The impacts will differ for different taxa depending on their ability to move out of the way of moving vehicles, the extent to which the species is attracted to the road, and (if a bird or bat) the height at which the species flies.

All roads have potential to result in the mortality (roadkill) of native animals. The risk of roadkill is higher where roads:

- traverse areas of substantial animal habitat
- are located in close proximity to natural or artificial water bodies
- contain food sources (e.g. mown grass verges, nectar-producing shrubs) which attract animals to the road edge
- have high speed limits
- provide poor visibility of wildlife (e.g. due to bends, crests and poor lighting).

A number of studies on the impacts of roads on birds in Australia provide differing information, depending on the spatial and temporal influences on bird habitats and times (e.g. breeding cycles) (Donaldson & Bennett 2004). For example, in one study, mortality was recorded at the highest levels at the intersection of roads and creeks (Brown, Brown & Pesotto 1986). Raptor species may be attracted to the carrion left on roadsides, although if sufficiently mobile, may experience a net benefit from increased food availability (Fahrig & Rytwinski 2009). Amphibians and reptiles show the greatest negative effect from roads due to their relative lack of mobility and low car avoidance behaviour. Small mammals generally show a positive or no effect, with impacts increasing with size in mammals and size of movement range, and depending on whether their predators have been affected (Fahrig & Rytwinski 2009).

The impact of introduced carnivores, specifically cats and foxes, is considered unlikely to be noticeably increased by the proposed works. Cats are likely to already be present in the area in high numbers, particularly at the Waterways where the wetland abuts residential estates, and both species are more likely to experience higher mortality from the construction of a road than they area to benefit. This should be taken into account when designing mitigation measures, as particular measures can be co-opted by predators and provide them an advantage, although increased predation does not seem to be an issue at most wildlife passages (Little, Harcourt & Clevenger 2002).

At the project area, mortality from the road is expected to be highest near wetlands, where the road is at grade or above (i.e. not at the bridge), and where there are no other barriers. Mortality of wetland fauna such as turtles and frogs, which move between areas of habitat (i.e. such as between Woodlands Industrial Estate Wetlands and wetlands in Braeside Park) is expected to be high during particular weather conditions. Mortality of secretive, low-flying wetland birds such as bitterns and crakes, may also occur in these locations.

4.1.4 Noise and vibration

A recent study has demonstrated that there is unequivocal evidence that noise is one of the factors responsible for the road-effect zone on birds (McClure et al. 2013).

Noise and vibration from construction and traffic associated with the Project is likely to impact upon native fauna at and nearby the project area. The impacts from noise emissions are likely to be localised to the vicinity of the project area although further assessment and modelling of construction and traffic noise is required. Vibration is expected to be short term as it is generally associated with earthworks only. There is a possibility that traffic will cause some vibration where vehicles pass over expansion joints in the bridge however this has not been assessed.

Substantial variation has been shown in scientific studies in the responses of wildlife to human-generated noise and vibration, ranging from serious to non-existent in different species and situations. The main impacts on wildlife associated with noise are behavioural. Vehicle noise has been shown, particularly in some species of birds and frogs, to interfere with communication essential for reproduction. An increase in traffic noise may impact birds' ability to maintain territories, attract mates and maintain pair bonds and possibly lead to a decrease in mating success (Parris & Schneider 2008). Noise may affect behaviour by causing animals to retreat from favourable habitat near noise sources, reducing time spent feeding and resulting in energy depletion and lower likelihood of survival and reproduction (Larkin 1996). These impacts will be most pronounced in species with low-frequency signals as they are likely to experience the most interference with traffic noise.

The presence or otherwise of direct physiological effects of noise on wildlife is poorly known (Larkin 1996) however construction is considered unlikely to result in hearing damage or other physiological impacts pm

fauna. Although likely to be louder than traffic noise, construction noise will be temporary and concentrated during daytime hours.

Some level of background traffic noise is likely to be already present at the project area, particularly from Springvale Road (to the east of the project area), Governer Road, which bounds Waterways Estate to the north, and from Waterways Estate itself. It is likely that most animal species in the vicinity of the project area are already habituated to this background noise and, as such, may not be noticeably affected by the Project's standard operational noise.

However, some species which utilise the project area and vicinity may be affected by the Project. Traffic noise will be permanent and relatively constant through day and night, and there are locations at which the noise increase is likely to be considerable and where threatened species are known to periodically or permanently occur. These sensitive locations are:

- where the project bisects The Waterways (noise likely to travel across the water, particularly at the location of the bridge)
- where the project area occurs adjacent to Braeside Park
- where the project area occurs adjacent to Woodlands Industrial Estate
- where the project area occurs nearby to the Edithvale component of the Edithvale-Seaford Wetlands Ramsar site (operational noise unlikely to impact resident fauna however migratory and nomadic species may be affected).

4.1.5 Ecological light pollution

Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution' (Longcore & Rich 2004). Types of ecological light pollution include chronic or periodically increased illumination, unexpected changes in illumination, and direct glare (Longcore & Rich 2004). Light pollution from the project has the potential to impact fauna during construction of the proposed bypass through use of artificial lighting for early morning or night work, as well as ongoing (during the operational phase of the road) from car headlights and street lighting. With regard to construction lighting, night work is not currently expected for the Project. Any night work would be at intersecting roads and would be short-term only. Work is not expected to occur early enough that lights are required. As such, impacts from the permanent road lighting are expected to be far greater than for the temporary construction lighting.

Artificial light affects species in different ways but the main responses are either:

- Disorientation – Artificial light sources may disorient night flying species including birds and bats, as well as other species such as turtles (Gleeson & Gleeson 2012). Conversely, artificial lighting may increase orientation, providing a benefit to particular species.
- Attraction – Predator species such as Magpies and Kookaburras are attracted to the lights due to the increased insect activity (Patriarca 2010). Wading birds have also shown increased foraging success under artificial lighting (Santos et al. 2010), however this may lead to increased predation.
- Avoidance – Some species may avoid well-lit areas due to an increased risk of predation (Longcore & Rich 2004), however it can be difficult to separate any avoidance behaviour shown by fauna as being the result of the lighting compared to noise or a physical barrier (Gleeson & Gleeson 2012).

The above responses may affect foraging, reproduction, communication, and other critical behaviours (Longcore & Rich 2004). One of the most notable implications of light pollution is alteration of interspecific interactions (e.g. predator-prey and competitive interactions) (Longcore & Rich 2004).

Under present conditions much of the project area and surrounds is likely to be affected by a low to moderate level of light pollution. The ecological values most at risk of impact from artificial lighting and headlightsare:

- fauna occurring at the Waterways on either side of the project area (likely to be habituated to a moderate level of light)
- fauna occurring within Braeside Park immediately east of the project area
- fauna (including migratory birds) occurring at Woodlands Industrial Estate

- migratory and nomadic birds visiting the Edithvale component of the Edithvale-Seaford Wetlands Ramsar site which must fly over the road. Resident fauna are unlikely to be affected.

A Preliminary Landscape Visual Impact Assessment completed for the Project (Tract 2017) determined that the major change in light levels from the Project is likely to be at the southern end of the road where the road passes through/over wetlands and beside residential areas.

With regard to permanent lighting for the Project, the following is currently proposed/expected:

- It is expected that the bypass will have street lighting 200m on the approach and departure of intersections with Governor Road, Lower Dandenong Road, Centre Dandenong Road and the Dingley Bypass. The dual outreach light poles will be spaced approximately 50m apart and be approximately 15m high. There will be additional poles required at the intersections to increase lighting levels. Subject to further assessment each pole will have 2 luminaries, each being 250w if incandescent is used, or less if LED is used. There will be no lighting on the Bypass between these intersections.
- Under structure lighting will be provided over Springvale Road (typically 250w), and over Bowen Parkway (typically 150w). No lighting is currently proposed on the bridge over the Waterways wetlands.
- At this stage it is likely that the shared user path will have low level lighting. Typically, single outreach poles 5m high will be placed 70m apart, with a single 80w luminarie.

4.1.6 Visual impact

Closely linked to the impacts of artificial light is the visual impact of the road, a large human structure with moving vehicles, raised in key points above the surrounding landscape. A Preliminary Landscape Visual Impact Assessment completed for the Project (Tract 2017) determined that The Bowen Parkway/Waterways/ Mordialloc Creek crossing point will be a “large elevated structure” in a “relatively flat landscape” which would be “clearly seen from a range of sensitive receptor locations such as residential settings”.

The impacts of the presence of human structures and car movement (as separate from noise, light and mortality impacts) are poorly known, however it is understood that certain species, including migratory wetland birds, may be affected. This may lead to decreased use of habitat nearby to the structure.

4.1.7 Physical habitat disturbance/modification

4.1.7.1 Weed invasion and disease

The type of disturbance associated with the construction of road pavement can result in a window of opportunity for weeds and soil pathogens such as Phytophthora *Phytophthora cinnamomi* to establish. Clearing vegetation, stockpiling of materials and driving on site leaves bare ground that is particularly susceptible to colonisation by weeds or introduction of disease. Weed seeds and pathogens contained within material being used for construction or within mud from vehicles may be deposited into disturbed areas. Without effective weed and disease hygiene control protocols, contaminants from construction material and un-clean vehicles have the potential to introduce a suite of avoidable impacts to ecological values on site.

In addition, construction of the road will fragment patches of vegetation, creating additional edges from which weed invasion may occur. After completion of the road weed seed may be carried on vehicles to colonise the road edges and spread into nearby vegetation.

The part of the project area which bisects the Waterways currently supports a low cover of weeds due to ongoing weed control and maintenance. The remainder of the project area is moderately-highly affected by weeds, particularly introduced pasture grasses, however the cover of *Catchment and Land Protection Act 1994* (CaLP Act) listed species, Weeds of National Significance, or other species regarded as highly invasive is currently generally low.

Weed and disease introduction or spread may lead to degradation/loss of threatened ecological communities and reduction in the value of the habitat for threatened and migratory species.

4.1.7.2 Rubbish

The Project is expected to result in an increase in rubbish in terrestrial and aquatic habitats adjacent to the construction footprint. As well as reducing visual amenity, this may have a negative impact upon habitat quality.

4.1.7.3 Erosion, sedimentation, and water pollutants

Bare ground after clearing, stockpiling, earthworks, or driving vehicles and plant off-road is susceptible to erosion. Similarly, there is the potential for an increase in water pollutants in wetlands at or near the project area as a result of road construction or ongoing use of the road, through spills or run-off.

The risk of erosion, sedimentation, and water pollution is highest near Woodlands Industrial Estate, the Waterways, and Mordialloc Creek. Lack of appropriate erosion, sediment and pollution control may lead to death of aquatic flora and fauna, and resulting impacts to foraging wetland birds (including migratory and/or threatened species), and degradation of the relevant EVCs.

4.1.7.4 Changes in groundwater and surface hydrology

The Project has the potential to impact groundwater and surface hydrology at the Waterways and nearby wetlands. Several groundwater dependant ecosystems were identified within 2 km of the project area in the preliminary groundwater assessment (WSP 2017a). These include the Edithvale Wetlands Ramsar site. Compression of shallow aquifers from the Project has the potential to alter flow characteristics of the surficial aquifer which could reduce groundwater flows into the Edithvale Wetland.

Road construction can also affect surface water flows, redirecting water from wetlands. A preliminary surface water report has been completed (WSP 2017b).however additional study and development of specific mitigation measures has not yet been undertaken.

The above may have flow-on effects upon migratory waders and other waterbirds relying on seasonally inundated wetlands, and other wetland or aquatic flora and fauna in the area.

Notwithstanding the above, preliminary groundwater and surface water studies currently in preparation indicate that impacts upon groundwater and surface water hydrology from the Project will be able to be mitigated such that any changes are negligible and do not have any impacts upon threatened ecological values.

4.1.8 Summary

Table 4.6 summarises the main potential impacts on biodiversity, including the duration of impacts.

Table 4.6 Summary of impacts

IMPACT	BIODIVERSITY WITH POTENTIAL TO BE AFFECTED	NATURE OF THE IMPACT	LIKELY DEGREE OF IMPACT FROM THE PROJECT WITH STANDARD MITIGATION ONLY	DURATION OF IMPACTS
Loss of vegetation and habitat	Threatened ecological communities, some threatened species habitat, although extent of direct loss is generally small.	Direct loss of habitat and vegetation from construction of the bypass.	Moderate	Permanent. Some temporary loss also likely.

IMPACT	BIODIVERSITY WITH POTENTIAL TO BE AFFECTED	NATURE OF THE IMPACT	LIKELY DEGREE OF IMPACT FROM THE PROJECT WITH STANDARD MITIGATION ONLY	DURATION OF IMPACTS
Loss of connectivity	Particularly small or less mobile fauna such as turtles. Secretive (reliant on vegetative cover) bird species.	Fragmentation of habitat through construction of the road. Reduction of connectivity between wetland areas.	Moderate	Permanent
Noise and vibration	Many animal species, including threatened and/or migratory birds	Works may lead to increased noise in certain locations (e.g. Woodland Industrial Estate) and some species may be highly affected.	Moderate	Temporary – construction noise and vibration Permanent – vehicle noise
Ecological Light pollution	Many animal species, including threatened and/or migratory birds	Ecological light pollution in certain locations (i.e. particularly Braeside Park, woodlands Industrial Estate, and the Waterways) may impact fauna behaviour and use of the nearby habitat.	Moderate	Temporary - construction site lighting Permanent - street lighting and vehicle headlights
Increase in Injury and Mortality	Birds, particularly low flying species. Reptiles, particularly turtles, and common frogs.	Impact from clearing during construction, and ongoing risk of wildlife vehicle collisions for the life of the road.	Low-moderate	Some temporary (vegetation clearing), some permanent (roadkill)
Visual impact	Birds, particularly threatened and migratory waterbirds	Visual impact of the road itself and movement of vehicles may affect use of the nearby habitat by fauna.	Low-moderate	Permanent (may lessen slightly over time a revegetation matures)
Changes in hydrology	Waterbirds, aquatic flora and fauna, vegetation communities, threatened flora	Changes to groundwater hydrology and/or surface water flows.	Moderate	Unknown
Weed invasion	Threatened flora at the Waterways. Threatened ecological communities at the Waterways. Native vegetation elsewhere in the project area.	Construction projects increase risk of weed invasion through soil disturbance and introduction of weed seed/propagule carrying material. The greatest risk will be from the road fragmenting native vegetation and providing space for weed colonisation as this is an ongoing risk and more difficult to mitigate.	Moderate	Permanent
Rubbish	Vegetation communities and habitat adjacent to the project area	Rubbish may reduce vegetation and habitat quality.	Low	Permanent/ongoing
Erosion, sedimentation and water pollutants	Aquatic flora and fauna, wetland birds	Wetlands connected to/adjacent to the project area may be impacted should adequate controls not be in place. Some residual risk of water pollution from spills on the road is likely to be unavoidable.	Moderate	Temporary (construction) and ongoing risk

4.2 Potential significance of impacts

An assessment of the likelihood of impact of the proposed development upon each of the listed threatened, rare, and migratory species with the potential to occur in the study area is provided in Appendix D. This is a preliminary assessment to determine the requirement for more detailed assessment and as such was completed under the assumption that no mitigation measures/controls (beyond standard VicRoads measures) will be in place.

For those species with a low-moderate or higher likelihood of impact (without specific controls), further assessment has been undertaken. Appendix F provides a detailed assessment of each EPBC Act listed matter and the additional mitigation measures required to reduce the likelihood of significant impact. The suite of additional (non-standard) mitigation measures recommended for the Project are provided in the following section (Section 5). The potential residual impacts upon these listed species and communities in accordance with relevant legislation and policy, as well as the implications for the development, are addressed in Section 6.

5 AVOIDANCE, MINIMISATION, AND MITIGATION MEASURES

The project area has been highly modified due to past disturbances including the draining of Carrum-Carrum Swamp, clearing of vegetation, modification of the landscape for urban development and agriculture, alterations to local hydrology through the extensive modification of waterways, and the introduction of exotic flora and fauna species. Most of the project area has been significantly degraded and supports predominantly introduced vegetation that is of limited value for the region's native flora and fauna.

Despite this, patches of remnant vegetation persist and the constructed wetlands at the Waterways/ Mordialloc creek offer habitat values for a range of threatened species. Furthermore, there are ecological values within adjoining areas, such as the nearby Edithvale – Seaford Wetlands, Braeside Park, the wetlands at Woodlands Industrial Estate and surrounding open space, which also require consideration and protection.

This section provides strategies (beyond standard VicRoads mitigation measures – see section 5.2) which are required to avoid, minimise, and mitigate ecological impacts upon significant ecological values at the planning stage and during construction. These measures are to be used as a guide for detailed design and for contractors.

Additional measures can be incorporated, and may be required. There are several key documents which describe detailed mitigation measures for the effects of roads on fauna, which can be drawn upon for further information if required:

- VicRoads Fauna Sensitive Road Design Guidelines (VicRoads 2012).
- Fauna Sensitive Road Design Manual – Volume 1: Past and Existing Practices (Queensland Department of Transport and Main Roads 2010a).
- Fauna Sensitive Road Design Manual – Volume 2 (Queensland Department of Transport and Main Roads 2010b).
- Review of mitigation measures used to deal with the issues of habitat fragmentation (van der Ree et al. 2008).
- Road Ecology (Foreman et al. 2003).
- Handbook of Road Ecology (van der Ree, Smith & Grilo 2015).

5.1 Preliminary measures to avoid and minimise impacts

A key tenet of the *Biodiversity Assessment Guidelines* (DEPI 2013c) is the requirement to *avoid and minimise* impacts to native vegetation; this principal is also common to legislative Acts such as the EPBC Act and the FFG Act. The principal is that preference should be given to avoidance > minimisation > mitigation > offset, and that this should be considered early in the design of the project.

Avoidance and minimisation of ecological impacts have been considered during the early design stages of this project, however, further work to avoid and minimise impacts during the planning and implementation phases will be required.

5.2 Standard controls and procedures

VicRoads has a well-established environmental management system for managing the potential environmental impacts of major road projects. The Project Environment Protection Strategy (PEPS) is prepared prior to any construction works being undertaken for the project. The contractor is required to prepare, implement and maintain an Environmental Management Plan (EMP) that will meet the requirements of the Contract Specification and VicRoads PEPS.

During and after construction, the mitigation process is typically managed through a Construction Environmental Management Plan (CEMP). A CEMP typically outlines all practicable measures to minimise

and mitigate impacts on biodiversity from the construction and operational phase to the management and maintenance phases.

Contractors are required to undertake monitoring and audits for construction activities, including works undertaken by subcontractors employed on their behalf to verify compliance with the contract Specification and their Environmental Management Plan. In addition to the contractor auditing and monitoring of the works, VicRoads also conducts its own surveillance and auditing to assess the contractor's compliance with the Environmental Management and the requirements of the Contract Specifications.

VicRoads has standard environmental protection measures as well as more specific measures relating to fauna sensitive road design. The CEMP will include the standard flora and fauna mitigation measures in VicRoads' Section 177 Environmental Management document (VicRoads 2016). Other standard measures which will be followed during the relevant stages of the Project are detailed in VicRoads' Section 720 Landscape Works, and Section 750 Routine Maintenance.

In addition to the above, protection measures outlined in the *VicRoads Fauna Sensitive Road Design Guidelines* (VicRoads 2012) are to be included, where appropriate, in the bypass design and in the CEMP.

The Australian Standard for *Protection of trees on development sites* (AS4970-2009) (Standards Australia 2009) and the Australian Standard for *Pruning of amenity trees* (AS4373-2007) (Standards Australia 2007) will be followed during construction.

5.3 Specific measures

The measures provided in the following sections are in response to the types of impacts described in Section 4. They have been developed to mitigate specific risks upon Matters of National Environmental Significance, State significant species and communities and wildlife protected under the *Wildlife Act* and *Flora and Fauna Guarantee Act*. They include some of the standard controls provided in Section 177 (VicRoads 2016) with additional detail or additional measures targeted to the specific significant values at the project area.

The applicability of the measures to the listed values relevant to the Project is summarised in Section 5.4. The requirement for measures targeted to MNES is detailed in Section 6.1 and determined through Appendix F. The requirement for measures targeted to FFG Act listed values is detailed in Section 6.2.2.

Monitoring the effectiveness of these mitigation measures upon listed ecological values is required to determine whether additional measures are required after construction to further mitigate impacts (additional planting, weed control, fences etc). Monitoring will also provide valuable information regarding the effectiveness of mitigation measures, which will contribute to future projects. With regards to monitoring of bird populations, a method developed for for the Edithvale-Seaford Wetlands Ramsar Site such as the Limits of Acceptable Change (LAC) (Ecology Australia 2016) may be one approach for detecting impacts. Should the results of the monitoring program indicate that the mitigation measures in place are insufficient, additional actions should be taken as recommended by the site ecologist.

5.3.1 Loss of vegetation and habitat

Within the construction footprint, the majority of native vegetation, scattered trees and revegetation is proposed to be cleared. Some temporary disturbance outside of the construction footprint but within the project area, may also occur.

The most significant areas of vegetation and habitat for listed species at the project area are:

- scattered trees and remnant patches of vegetation adjacent to Elm Tree Drive
- patches of threatened ecological communities and fauna habitat
- wetland and native vegetation within the Waterways Estate/Mordialloc Creek wetlands and fringing grassland habitat
- vegetation (including the exotic-dominated grassland) between Braeside Park and Woodlands Industrial Estate which may periodically support threatened species.

The measures required to minimise and control vegetation and habitat loss on site during construction are provided in the following sections.

5.3.1.1 Minimising impacts to vegetation and habitat during construction

The following should be completed in addition to standard controls:

- Install temporary fencing around vegetation that is to be retained (no-go zones). No go zones should be fenced conservatively (i.e. with a vegetative buffer of at least one metre) where possible. No-go areas should be well defined visually in the field and identified to all works crew as part of an induction undertaken on site. The proposed no-go zones are provided on Figure 7, Appendix A. Some revision of the no-go zones may be required to ensure that they are workable. Any reduction in size may require revision of the impact assessment and vegetation and habitat offset calculations.
- When fencing the no-go zones, ensure that fencing includes the Tree Protection Zones (TPZs) of trees to be retained (Figure 7, Appendix A does not include TPZs). Unless specific advice to the contrary has been obtained from an arborist, the TPZ is defined for standing trees and stags (dead but upright trees) as follows:
  - Live trees: an area around the trunk of the tree which has a radius of 12 x the diameter at breast height (to a maximum of 15 metres but no less than 2 metres in diameter) and/or an area sufficient to protect the Structural Root Zone as identified in consultation with an arborist; and
  - Dead (stag) trees: an area around the trunk of the tree which has a radius of 15 metres from the base (DELWP 2015).
- If the works involve an impact to an area of greater than 10% of a TPZ and/or within the Structural Root Zone (SRZ) of a tree, an arborist is required to conduct a root investigation to determine if the tree will remain viable. Unless determined otherwise by a suitably qualified and experienced arborist, the tree will be considered 'removed' for purposes of the *Permitted Clearing of Native Vegetation - Biodiversity Assessment Guidelines* (DEPI 2013) and will need to be Offset. Lopping of canopy trees in excess of what is provided for in the 'lopping and pruning for maintenance exemption in Clause 52.17' is also treated as assumed lost, unless an arborist report concludes that the tree will survive (DELWP 2015).
- Locate any access track/storage areas within the construction footprint to all extent practicable.
- Prior to the commencement of any works, brief contractors regarding the protection of vegetation and the purpose for avoiding impacts in no-go zones and minimising impacts outside of the construction footprint.
- Utilise temporary signage to clearly identify areas as environmentally sensitive zones or no-go zones.
- Prior to works commencing at The Waterways, a pre-clearing survey for threatened flora will be conducted. Any flora listed under the EPBC Act or FFG Act recorded within the project area (outside of existing no go zones) will be fenced off (to establish a new no go zone) or relocated to nearby habitat habitat that is not proposed to be impacted.

5.3.1.2 Rehabilitation, habitat creation, and landscape plan

Rehabilitation of any areas temporarily disturbed by the works (equipment storage areas, access tracks, underneath the Mordialloc Creek bridge etc.), should be completed following works, with revegetation using only native species from the project area's EVCs with plants or seed of local provenance. Any revegetation should be completed with consideration of fauna connectivity and mortality mitigation measures (refer sections 5.3.2 and 5.3.3.2). This should be incorporated into the landscape plan for the project. Also in the landscape plan, buffer zones around important habitat areas should be planned and implemented as recommended in (DoEE 2017a), and barriers (including vegetation and low walls or fences as required) should be incorporated to reduce impacts upon wetland bird habitat (particularly migratory and threatened species) occurring adjacent to the project area (specifically Woodlands Industrial Estate wetlands and Braeside Park).

Though strictly not mitigation, VicRoads has also commenced a feasibility study into opportunities to create wetlands in proximity to the Mordialloc Bypass with the aim of:

- offsetting flooding areas lost to the proposed road
- integrating Water Sensitive Road Design
- offsetting impacts to vegetation communities
- provision of open space and wetland amenity affected throughout Waterways.

5.3.2 Loss of connectivity

The proposed flyover of the Waterways Estate wetlands will assist in the retention of connectivity for a suite of threatened wetland flora and fauna. Threatened taxa which will benefit from this approach include a number of migratory wetland birds, ducks, Rails, Bitterns and Crakes, as well as harriers and assorted raptors, frogs, ground mammals, reptiles, and insectivorous bats.

Along the remainder of the roadway there will be limited opportunity for the maintenance of connectivity across the road between patches of retained habitat within and outside of the project area. The locations where loss of connectivity is considered most likely to affect listed species such as Australasian Bittern, as well as non-listed species (turtles etc), is between Braeside Park and the Woodlands Estate wetlands, and to a lesser extent, at the Waterways, north of the proposed bridge.

Design features suggested to promote connectivity across the road include:

- Bridge design over Mordialloc Creek at the Waterways which incorporates extensive vegetated habitat (Swamp Scrub, Tall Marsh or other shade-tolerant vegetation, as well as habitat features such as rocks and logs) underneath on each bank. VicRoads' Fauna Sensitive Road Design guidelines specify 3 m dry passage underneath bridges. This should be extended to at least 5 m where possible at the banks of Mordialloc Creek. This will provide a terrestrial movement corridor for species otherwise at risk of vehicle collisions and/or reduced movement between habitat on either side of the construction footprint. Temporarily cleared vegetation under the bridge will be rehabilitated to Swamp Scrub, Tall Marsh or other shade-tolerant vegetation where sufficient light is present.
- The use of structures designed to improve connectivity should be considered to direct fauna movement away from roadways. Such features/structures include culverts.. Fauna crossings should be considered between Woodlands Industrial Estate Wetlands and Braeside Park, and at the Waterways north of the proposed bridge to reduce mortality and facilitate movement for turtles and other non-listed ground-based fauna.
- The Fauna Sensitive Road Design Guidelines provide details of the design specifications for culverts to also provide wildlife passage. These specifications include:
  - culvert no longer then 25 m in length to enable light penetration
  - fencing on either side of culvert entry to help direct fauna into the culvert
  - proper drainage to prevent culvert retaining water
  - landscaping around entry point to create a natural appearance
  - size of culvert should take into consideration the species present in the area
  - natural substrate such as dirt and mulch
  - dry ledges or logs inside the culvert
  - post construction monitoring to ensure species are utilising the culverts
- Plantings appropriate to the site's pre-clearance EVCs, using local provenance, indigenous flora. Vegetation plantings of a sufficient height may encourage birds to fly at a safe height across traffic. Wetland plantings in modified drainage swales may create additional stopover points for wetland birds to improve connectivity.
- Landscape plans to incorporate large scattered trees that are retained within the project area, and with the aim to establish connectivity between these trees and any remnant patches of habitat in adjacent properties.

- Where possible, relocation of logs cut from trees to be removed to sites within, or at the perimeter of, remnant patches and areas of retained habitat within the project area. These structures can contribute to habitat values for the region's fauna and flora, including threatened species.

The design features to mitigate loss of connectivity should be developed in consultation with ecologists, with consideration of the ecology of the relevant specific species most requiring mitigation.

5.3.3 Fauna injury and mortality

5.3.3.1 Fauna management during construction

Although listed threatened and migratory species are unlikely to be inadvertently killed or injured during construction, management of wildlife protected under the *Wildlife Act* and *Flora and Fauna Guarantee Act* is required. Ground-based fauna is likely to occur within the proposed construction footprint, particularly within areas of remnant or planted vegetation. Large trees with hollows have also been identified within the alignment.

All construction personnel will attend a project-specific induction prior to commencing site work. The inductions should include relevant information about the ecological sensitivities of the site and appropriate management measures.

It will be necessary to engage suitably qualified and experienced fauna rescue and welfare contractors to salvage and release fauna dislodged during construction, including: bats, birds and possums from hollows, lizards, turtles, and echidnas, and any fish, frogs or aquatic fauna within wetland areas.

It will also be necessary to engage a suitably qualified, experienced and licensed ecologist to identify tree hollows that are likely to support native fauna, to inspect these prior to tree removal, and to supervise removal. A protocol for staged tree clearing and management and relocation of fauna during tree clearing should be developed in consultation with the arborist and a suitably qualified and licenced wildlife handler.

The following guidelines should also be followed to minimise harm to fauna during construction:

- Fencing near areas of native vegetation should be used to prevent ground-based fauna accessing the construction site from adjacent habitat, to be determined by an ecologist. No-go zone fencing may be adequate for this.
- Pits and trenches will be filled in each day (or covered as appropriate) to prevent reptiles, mammals and frogs being trapped. If this is not practicable, they will be checked in the morning prior to the start of works. Where possible, trapped animals will be removed through the placement of a ramp to allow animals to escape themselves.
- Sides of the trenches will be graded to allow for animal escape where practicable.
- Vehicle speeds along the access road will be kept low.

5.3.3.2 Vehicle-wildlife collisions after road completion

Refer to Section 5.3.2. Loss of connectivity, as measures which promote connectivity by encouraging safe movement of fauna under or over the road will also reduce mortality from road collisions. Specifically, the potential for fencing in targeted areas should be considered, particularly adjacent to Braeside Park and near the Waterways north of the proposed bridge, where fauna collisions are most expected.

5.3.4 Noise and vibration

The management of noise impacts will be subject to requirements as set out in the relevant EPA guidelines (EPA Publication 480 and 1254, as appropriate), and potentially the VicRoads *Traffic Noise Reduction Policy 2005* (VicRoads TNRP). Additional specific mitigation measures required are detailed below.

5.3.4.1 During construction

Noise and vibration sources from construction activities are typically associated with the use of plant and equipment at the worksite.

The following mitigation techniques are required:

- Fit all pneumatic tools, vehicles and plant with silencers where specifications allow.
- Maintain noise suppression devices to the manufacturer's specifications.
- Regularly maintain equipment and machinery to minimise operational noise.
- Where practicable enclose noisy equipment and establish suitable noise attenuation and insulation devices.
- Where appropriate use a less noise generating activity (e.g. such as saw –cutting instead of jack hammering).
- Where practicable, limit activities that are likely to generate high noise levels such as blasting (if required) to periods outside of September – March inclusive (when migratory birds are most likely to be present).
- Limit activities outside of daytime hours.

- Avoid or sufficiently minimise (thresholds to be determined) usage of Edithvale Road through the Edithvale wetland for hauling equipment and materials, particularly during the season when migratory waders are present between October and March; include options for alternate haulage routes.

Ensure traffic volume is not significantly increased (threshold to be determined) on Edithvale Road through the Edithvale wetland.

5.3.4.2 Ongoing impacts

Post-construction traffic noise associated with the completed roadway will be on-going and relatively constant through day and night. The noise is expected to be within current levels of background traffic noise from the surrounding road network along parts of the alignment, however in some sensitive locations this is not expected to be the case.

Further assessment is required of the potential significance of the impacts of noise upon birds and the potential noise attenuation structures feasible for the Project before specific design recommendations can be made at this stage.

5.3.5 Ecological light pollution

Artificial lights have the capacity to contribute to 'ecological light pollution' during construction, in particular due to the use of high powered lighting used for night-time construction, and post-construction associated with roadside lighting and vehicle headlights. Confining light spread by using directional lighting, lowered lighting and screening can reduce impacts to wildlife (Gleeson & Gleeson 2012).

5.3.5.1 During construction

It is preferable that light impacts during construction are avoided (or substantially minimised) by conducting work during daylight hours only. It is expected that the vast majority of the works will be conducted during daylight hours. Where lighting is required for construction purposes the following is recommended for consideration:

- Ensure lighting is located away from sites of ecological value or areas of retained habitat wherever practicable.
- Ensure lighting is directed to works areas only and away from sites of ecological value wherever practicable.
- Near sites of ecological values, install shields or fittings to minimise light spill and direct light to where it is needed.
- Ensure temporary lighting is removed promptly from site once not required.

5.3.5.2 Ongoing impacts

For the mitigation of ecological light pollution from the operational phase of the road, the following should be completed:

- Ensure lighting is directed to roadways only and away from sites of ecological value wherever practicable.
- Install shields or fittings to minimise light spill onto habitat/sites of ecological value.
- Use low walls and/or plantings to prevent headlight and streetlight spill across habitat/sites of ecological value. Densly planted vegetation on the roadsides can prevent light spill into the adjacent environment and may prevent light attracted species such as bats from being drawn to the lights to feed off insects (VicRoads 2012).
- Lighting can be placed lower and at a lower luminoscity (VicRoads 2012). Lower light placement and luminocity to minimise ecological impact should be considered for the Project.

5.3.6 Visual impacts

Mitigation measures for the most significant visual impacts (i.e. the bridge over the Waterways/Mordialloc Creek) are limited. However in general, measures which should be used reduce the visual impact of roads upon fauna (specifically threatened and migratory wetland birds) are:

- use of walls and/or revegetation to block moving vehicles partially or completely from sight (with particular consideration of line-of-site of wetland birds)
- use of neutral or earthy colours in construction (Tract 2017)
- measures for reducing light pollution listed under 5.3.5.

5.3.7 Physical habitat disturbance and modification

5.3.7.1 Weed and disease management

The standard weed and pathogen management measures stipulated in VicRoads' Section 177 document is likely to effectively mitigate most of the risks associated with weeds and pathogens. Additional requirements include:

- Prior to commencement of works, a detailed weed assessment will be completed in the project area in areas of ecological sensitivity, and preliminary weed control will be undertaken.
- Immediately following works, a program of weed monitoring and control will be commenced, targeting high-risk species and areas of ecological sensitivity in the project area. High risk species will be regularly controlled along road edges for the life of the road.
- Mowing regime and timing of road edges will be determined with consideration of ecological impacts and timing of seed set. Slashers will be cleaned prior to mowing near areas of ecological sensitivity to avoid spreading weeds.

5.3.7.2 Rubbish

Standard regular roadside maintenance and clean-up (to be extended into adjacent vegetation where required), is expected to be sufficient at mitigating this impact upon significant values.

5.3.7.3 Erosion, sedimentation and water pollutants

CONSTRUCTION

Areas of exposed and destabilised soil will inevitably be created during the construction process as a result of roadway construction activities. Erosion mitigation measures will be required to prevent the movement of sediment and soil to sites outside of approved construction sites. While vegetation provides the most effective form of erosion control, interim measures involving a variety of soil erosion techniques and

materials may be required on an as needs basis to ensure that there are no off-target impacts or ecological losses.

Clause 56 of the SEPP (Waters of Victoria) requires construction works be managed to minimise land disturbance, soil erosion and the discharge of sediment and other pollutants to surface waters. Throughout the study area, a number of principles should be applied in order to limit erosion and sedimentation. These should be in line with the Victoria EPA Principals of Best Practice Guidelines, including Environmental Guidelines for Major Construction Sites (Environmental Protection Agency 1996), Construction Techniques for Sediment Pollution Control (Environmental Protection Agency 1991), and EPA Publication 960 'Doing it right on subdivisions' (Environmental Protection Agency 2004).

DESIGN AND OPERATION OF ROAD

Clause 46 of the SEPP (Waters of Victoria) requires urban stormwater, which includes road runoff, provides for the protection of beneficial users and the demonstration of best practice. The best practice approach requires proposed road projects meet the best practice performance objectives and process outlined in Urban Stormwater: Best Practice Environmental Management Guidelines (Victorian Stormwater Committee 1999). To achieve this, increases to pollutant loads will be assessed and mitigated using Water Sensitive Road Design (WSRD) elements as part of the design phase.

Specific mitigation, corrective action and contingency measures to protect waterway habitat from pollutants must be determined, to ensure negligible or low impacts upon significant ecological values.

5.3.7.4 Groundwater and surface hydrology

Specific hydrological mitigation measures are to be determined by surface and groundwater hydrologists to ensure that impacts to hydrological regeimes are negligible.

Groundwater mitigation measures (if required) may include drainage blankets and/or sub-surface drains installed as per VicRoads guidelines.

Mitigation for surface water changes (eg. overland flows) may include incorporation of relevant parts of the Melbourne Water drainage schemes into the Project design, adoption of steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage (or adopt cut and fill balance between road embankments and new excavation), and/or allocation of space for stormwater detention and water sensitive road design elements (WSP 2017b).

5.4 Summary of mitigation measures for each ecological value

Table 5.1 provides a summary of the applicability of the mitigation measures specified in this chapter to the relevant significant values with the potential to be impacted by the Project.

The requirement for measures targeted to MNES is detailed in Section 6.1 and determined through Appendix F. The requirement for measures targeted to FFG Act listed values is detailed in Section 6.2.2.

Table 5.1. Summary of specific mitigation measures required for each ecological value

SIGNIFICANT VALUE	OVERALL RISK WITH NO SPECIFIC MITIGATION MEASURES IMPLEMENTED	SUMMARY OF SPECIFIC MITIGATION MEASURES	OVERALL RESIDUAL RISK
Edithvale-Seaford Wetlands (Ramsar Wetland)	Moderate	→ Specific groundwater and surface water mitigation if required →	Low

SIGNIFICANT VALUE	OVERALL RISK WITH NO SPECIFIC MITIGATION MEASURES IMPLEMENTED	SUMMARY OF SPECIFIC MITIGATION MEASURES	OVERALL RESIDUAL RISK
EPBC Act listed migratory birds	Moderate	→ Specific groundwater and surface water mitigation if required → Investigate noise mitigation and incorporate if required → Visual impact mitigation measures → Barriers and buffer zones incorporated into landscape plan	Low
EPBC Act listed flora	Moderate	→ Specific groundwater and surface water mitigation if required → Salvage and relocation of listed species, if required → Additional weed management	Low
EPBC Act listed threatened fauna	Moderate	→ Specific groundwater and surface water mitigation if required → Light mitigation → Investigate noise mitigation and incorporate if required → Connectivity measures and revegetation under the Mordialloc Creek bridge → Barriers and buffer zones incorporated into landscape plan	Low
EPBC Act listed endangered ecological communities	Moderate	→ Specific groundwater and surface water mitigation if required → Additional weed management	Low
FFG Act listed birds	Moderate	→ Light mitigation → Investigate noise mitigation and incorporate if required → Connectivity measures and revegetation under the bridge	Low
FFG Act listed flora	Moderate	→ Specific groundwater and surface water mitigation if required → Salvage and relocation of listed species, if required → Additional weed management	Low
FFG Act listed ecological communities	Moderate	→ Specific groundwater and surface water mitigation if required → Additional weed management	Low
Protected fauna (mortality of non-listed species)	Moderate	→ Connectivity measures (culverts etc) → Low barriers and plantings to reduce road mortality → Fauna management during construction and vegetation clearing	Low

6 LEGISLATION AND POLICY

This section includes a preliminary impact assessment under relevant federal, State and local government environmental legislation, and covers any permits, approvals, management plans and offset requirements that may be required for the project.

6.1 Commonwealth

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

The *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the Act as matters of national environmental significance (MNES). There are nine matters of national environmental significance to which the EPBC Act applies, these are:

- World heritage sites
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions
- the Great Barrier Reef Marine Park
- a water resource, in relation to coal seam gas development and large coal mining development.

A 'significant impact' is defined under the EPBC Act as 'an impact that is important, notable, or of consequence, having regard to its context or intensity' (Department of the Environment 2013). If a project is likely to have a significant impact on one of the nine MNES, the 'action' must be referred to the Commonwealth Department of the Environment and Energy (DoEE). This 'referral' is then released to the public for comment.

Three out of the nine matters are relevant to the project area. This includes wetlands of international importance, nationally threatened species and ecological communities and migratory species. The MNES with the potential to be affected by the proposed development are discussed in the following sections and a preliminary assessment of the potential for the works to have a significant impact upon these MNES is made.

The preliminary assessments of significant impact have been made based on the following:

- *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* for EPBC Act listed biodiversity (Department of the Environment 2013) (the 'significant impact guidelines').
- EPBC Act Policy Statement 3.21 *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DoEE 2017a).
- Referral guidelines for particular species listed under the EPBC Act if available.

6.1.1.1 Ramsar Wetland – Edithvale-Seaford Wetlands

One Ramsar wetland site, Edithvale-Seaford Wetlands,occurs nearby to the project area. The Edithvale–Seaford Wetlands are remnants of the Carrum Carrum Swamp, an expansive swampland which once stretched from Mordialloc to Frankston. Much of the swamp was drained in the 19th Century leaving a string of wetlands. Braeside Park, Woodlands Industrial Estate, and Waterways also occur within the historic area of Carrum Carrum swamp.

The Ramsar site is comprised of two discrete wetlands. The Edithvale component is located approximately 700 metres southwest of the project boundary, in the southern extent of the alignment. It is approximately

103 ha and is made up of constructed ponds on the Northern side of Edithvale Road and swampland south of Edithvale Road. The 158 ha Seaford Swamp is located approximately 4 km from the project area. It is sufficiently distant from the proposed works that there is a very low likelihood of impact. As such, this assessment addresses potential impacts upon the Edithvale component only.

Whilst there is the potential for the proposed works to impact on a Ramsar wetland, these impacts are likely to be able to be sufficiently minimised and mitigated through detailed design such that the impact is unlikely to be significant. This is specifically with regard to hydrology and the numerous bird species dependant on the wetland. See Appendix F for the assessment of significant impacts.

6.1.1.2 Migratory species

The study area and vicinity is foraging and/or roosting habitat for multiple migratory bird species, including species listed on one or more of several international agreements (JAMBA, CAMBA and ROKAMBA) and thus listed pursuant to the EPBC Act.

The Edithvale-Seaford Wetlands are internationally important for their value to migratory birds and the wetlands more closely associated with the proposed development (and more likely to be impacted) can be considered part of the same habitat area for the species which visit the area. Migratory bird species are generally highly mobile and will move between habitat patches depending on local conditions (water levels etc.), thus all habitat patches in an area can be important at different times.

Most migratory bird species which visit Australia, particularly the migratory shorebirds, are primarily present in Australia during the non-breeding period, from as early as August to as late as April/May each year, with numbers at the wetlands associated with the study area generally peaking in the summer months. As such, the habitat present at and nearby the study area is non-breeding habitat only (i.e. foraging and/or roosting). Breeding of these birds primarily occurs elsewhere in Asia (DoEE 2017a). Impacts to non-breeding habitat for these species which reduce birds' ability to forage effectively can force some individuals to travel further to find feeding and roosting sites. This could potentially impact on their migration should they not have the ability to rest and replenish their condition prior to their onward migration.

A preliminary assessment under the EPBC Act significant impact criteria has been completed for the migratory species with a moderate or higher likelihood of impact without mitigation: Sharp-tailed Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Red-necked Stint, Latham's Snipe, Glossy Ibis and Wood Sandpiper (refer Appendix F), and is presented in Table F.2. The results of the impact assessment are summarised in the table below.

Table 6.1. Summary of migratory bird impact assessment

MIGRATORY BIRD SPECIES WITH THE POTENTIAL TO BE IMPACTED	HABITAT AT PROJECT AREA	LIKELIHOOD OF OCCURRENCE AND IMPACT
→ Sharp-tailed Sandpiper *Calidris acuminate* → Curlew Sandpiper *Calidris ferruginea* → Pectoral Sandpiper *Calidris melanotos* → Red-necked Stint *Calidris ruficollis* → Latham's Snipe *Gallinago hardwickii* → Eastern Curlew Numenius madagascariensis → Glossy Ibis Plegadis falcinellus → Wood Sandpiper Tringa glareola	No primary habitat mapped in construction foorprint for migratory shorebirds, however they are likely to periodically occur, and known habitat is mapped outside of the construction footprint. (Biosis 2013) 4.9 ha of habitat mapped in construction footprint for Latham's Snipe (Biosis 2013), which has different habitat requirements to the other listed migratory species. Refer Figure 6 Appendix A	Species recorded at the project area in low numbers, however a number of species have been recorded in the local area. **High likelihood of occurrence** **Moderate likelihood of significant impact without mitigation** **Low likelihood of significant impact with specific mitigation** **See Appendix F for full assessment of significant impacts**

6.1.1.3 Threatened species and ecological communities

THREATENED FLORA

One EPBC Act listed plant species, Swamp Everlasting *Xerochrysum palustre*, was recorded within the project area. Three additional EPBC Act listed plant species were not recorded during field surveys, however may still occur in the project area. These four species were all planted at The Waterways. The likelihood and summary of impacts is provided in the table below. Full assessment of impacts upon each species using the relevant significant impact criteria is provided in Appendix F.

Table 6.2 EPBC Act threatened flora species with the potential to be impacted by the Project

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)	SUMMARY OF PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE AND IMPACT (WITH MITIGATION)
River Swamp Wallaby-grass *Amphibromus fluitans* EPBC Act Vulnerable	Permanent swamps, lagoons, billabongs, dams and roadside ditches. The species requires moderately fertile soils with some bare ground; conditions that are caused by seasonally-fluctuating water levels.	Unlikely to occur in remnant patches of Plains Grassy Wetland due to the poor condition. Species has been planted within the Waterways but was not detected in the project area in this study or previous surveys by (Biosis 2015). It is possible that this plant occurs in the project area in low numbers. **Moderate likelihood of occurrence** Assuming presence, a full assessment was completed using the significant impact criteria. **Low likelihood of significant impact with mitigation as determined through an assessment using the significant impact criteria – see Appendix F for full assessment of significant impacts**

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)	SUMMARY OF PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE AND IMPACT (WITH MITIGATION)
Swamp Everlasting *Xerochrysum palustre* EPBC Act Vulnerable	Sedge-swamps and shallow freshwater marshes and swamps in lowlands, on black cracking clay soils.	This species has been planted within the project area in the Waterways. One location of Swamp Everlasting was located in the project area in Plains Grassy Wetland/Plains Sedgy Wetland. Whilst recorded close to the impact area, it is expected that there will be no direct losses to replanted individuals and that overland flow changes are likely minimal. **Confirmed occurrence within project area outside of construction footprint, low likelihood elsewhere** **Low likelihood of significant impact with mitigation as determined through an assessment using the significant impact criteria – see Appendix F for full assessment of significant impacts**
Matted Flax-lily *Dianella amoeana* EPBC Act Endangered	Lowland grassland and grassy woodland, on well-drained to seasonally waterlogged fertile sandy loam soils to heavy cracking clays.	Unlikely to occur in remnant patches of Plains Grassy Woodland. Species has been planted within the Waterways but was not detected in the project area in this study or previous surveys by (Biosis 2015). It is possible that this plant occurs in the project area in low numbers. **Moderate likelihood of occurrence** The species is unlikely to occur within the construction footprint itself as the highest quality potential habitat for the species occurs in the dryer parts of the Waterways. **Low likelihood of occurrence within the construction footprint** **Low likelihood of significant impact as determined through an assessment using the significant impact criteria – see Appendix F for full assessment of significant impacts**
Swamp Senecio *Senecio psilocarpus* EPBC Act Vulnerable	Herb-rich winter-wet swamps throughout the south of the state, west from Sale, growing on volcanic clays or peaty soils.	Species has been planted within the Waterways but was not detected in the project area. It is possible that this plant occurs in the project area in low numbers. **Moderate likelihood of occurrence** Assuming presence, a full assessment was completed using the significant impact criteria. **Low likelihood of significant impact with mitigation as determined through an assessment using the significant impact criteria – see Appendix F for full assessment of significant impacts**

THREATENED FAUNA

EPBC Act listed fauna species with at least a moderate likelihood of occurrence and with the potential to be impacted by the Project are detailed in Table 6.3, which also provides a summary of the habitat requirements for each species. Several iconic species which previously occurred in the project area have also been addressed in the table. Where at least moderate impacts are likely, a full assessment of impacts in accordance with the relevant significant impact criteria is provided in Appendix F.

Table 6.3 EPBC Act fauna species likely to occur in the project area

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)	SUMMARY OF PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE AND IMPACT (WITH MITIGATION)
Species with at least a moderate likelihood of occurrence		
Australasian Bittern *Botaurus poiciloptilus*	Wetland habitats including constructed wetlands, farm dams and natural wetlands.	Australasian Bittern has been recorded within study area. It is generally a solitary bird, but sometimes occurs in pairs, or dispersed aggregations of 12 birds. It is capable of moving between habitats as suitability changes. Small areas of potential habitat would be removed with larger, more extensive areas retained. **High likelihood of occurrence** **Moderate likelihood of significant impact without mitigation** **Low likelihood of significant impact with mitigation** **See Appendix F for full assessment of significant impact**
Curlew Sandpiper *Calidris ferruginea*	Occurs in intertidal mudflats in sheltered coastal areas, pods, sewage ponds. Also occurs inland.	Previously recorded from Waterways estate. This species is listed as Migratory and Critically Endangered. The study area is not an area identified as internationally important. **High likelihood of occurrence.** **Moderate likelihood of significant impact without mitigation** **Low likelihood of significant impact with mitigation** **See Appendix F for full assessment of significant impact**
Eastern Curlew Numenius madagascariensis		Low numbers recorded in locality. This species is listed as Migratory and Critically Endangered. **Low-moderate likelihood of occurrence** **Moderate likelihood of significant impact without mitigation** **Low likelihood of significant impact with mitigation** **See Appendix F for full assessment of significant impact**
Species with a low likelihood of occurrence, which previously had a higher likelihood of occurrence – No significant impact criteria assessment required		

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)	SUMMARY OF PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE AND IMPACT (WITH MITIGATION)
Eastern Dwarf Galaxias *Galaxiella pusilla*	Slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks, often (but not always) containing dense aquatic macrophytes and emergent plants.	Potential habitat occurs within Mordialloc Creek and associated wetlands. Targeted surveys undertaken by (Biosis 2015) failed to detect this species. In addition to this study, Streamline Research has undertaken extensive sampling for Melbourne Water throughout the length of the Mordialloc Bypass over the past decade without detecting the species. A study undertaken during the current assessment (McGuckin 2017) determined that the species is unlikely to occur. **Low likelihood of occurrence** **Low likelihood of significant impact**
Growling Grass Frog *Litoria raniformis*	Still or slow moving water such as lagoons, swamps, lakes and ponds, with emergent vegetation included reeds, rushes and sedges. Also known to occur in artificial waterbodies such as farm dams, irrigation channels and disused quarries.	A translocated population of the species was introduced to the Waterways Estate in January 2002, and have since been regularly monitored, however there have been no records of the species in that location or elsewhere in the locality since 2006. Surveys were completed in 2012-2013 (Biosis 2013), and 2014-2015 (Biosis 2015). Areas surveyed included Waterways Estate, Melbourne Water wetlands to the north of Waterways, and wetlands within Braeside Park. The species is considered unlikely to currently occur within the project area or vicinity. **Low likelihood of occurrence** **Low likelihood of significant impact**
Southern Brown Bandicoot *Isoodon obesulus obesulus*	Inhabit a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland and are usually associated with infertile, sandy and well drained soils, but can be found in a range of soil types. Within these vegetation communities they typically inhabit areas of dense ground cover.	There are no recent records of the species in the locality. The species was known to occur in the Braeside area but is now considered locally extinct. The closest known extant population is in Cranbourne. **Low likelihood of occurrence** **Low likelihood of significant impact**

THREATENED ECOLOGICAL COMMUNITIES

The following two ecological communities listed as critically endangered pursuant to the EPBC Act were recorded within the study area:

- Natural Damp Grassland of the Victorian Coastal Plains (0.03 ha proposed to be lost/modified).
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (2.12 ha proposed to be lost/modified).

A preliminary impact assessment has been completed for both communities in accordance with the significant impact guidelines and is provided in Appendix F. From the assessment, we have concluded that the works are unlikely to have a significant impact upon either of the threatened communities, provided that the recommended mitigation measures are applied.

6.1.1.4 Summary

Table 6.4 provides a summary of the potential for significant impacts upon MNES.

The results of this preliminary assessment indicate that the project has the potential for signigicant impacts upon MNES without appropriate mitigation beyond the standard measures followed by VicRoads. However, provided that the specific measures to avoid, minimise, and mitigate impacts are implemented, no significant impacts on listed MNES are anticipated. Some of these measures have not been designed in detail at this early stage of the Project and the residual impact is difficult to assess quantitatively. Further assessment of the significance of residual impacts is likely to be required following the detailed design of the recommended mitigation measures, however some uncertainty may remain regarding the degree of residual impact.

Given the above, referral of the project to the Commonwealth Department of the Environment and Energy is recommended to provide legal certainty for the Project at this stage.

Table 6.4 Summary of significant impact assessments without and with mitigation

MNES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)	CONCLUSION ON THE LIKELIHOOD OF SIGNIFICANT IMPACTS
Ramsar Wetland – Edithvale-Seaford Wetlands	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken.
Migratory species – Sharp-tailed Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Red-necked Stint, Latham's Snipe, Eastern Curlew, Glossy Ibis and Wood Sandpiper	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken.
Australasian Bittern	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken.
River Swamp Wallaby-grass	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken
Swamp Everlasting	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken
Matted Flax-lily	Moderate	Low	Significant impact unlikely.

MNES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)	CONCLUSION ON THE LIKELIHOOD OF SIGNIFICANT IMPACTS
Swamp Senecio	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken
Natural Damp Grassland of the Victorian Coastal Plains	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Moderate	Low	Significant impact unlikely provided appropriate avoidance and mitigation is undertaken.

6.2 State

6.2.1 *Environment Effects Act 1978*

Under Victoria's *Environmental Effects Act 1978* (EE Act), projects that could have a 'significant effect' on Victoria's environment can potentially require an Environmental Effects Statement (EES). This Act applies to any public works 'reasonably considered to have or be capable of having a significant effect on the environment'. The Minister for Planning and Environment is the responsible person for assessing whether this Act applies.

Before commencing any public works to which this Act applies, the proponent must initiate an EES to be prepared and submit it to the Minister for the Minister's assessment of the environmental effects of the works.

The criteria for the types of potential effects on the environment that might be of significance are provided in the Ministerial Guidelines for Assessment of Environmental Effects under the Environmental Effects Act 1978 (DSE 2006). They include impacts to native vegetation, matters listed under the FFG Act, and wetlands. The criteria come under two categories:

- individual potential environmental effects (one or more effects indicates potential significance of the impacts)
- a combination of potential environmental effects (two or more effects indicate potential significance of the impacts).

An assessment against the criteria has been completed in (WSP 2017e). This identified that one or more individual effects may be triggered, with the information available at the time. Based on the type and scope of works proposed, the Mordialloc Bypass project is the subject of an EES Referral, and a determination will be made by the Minister whether an EES will be required.

6.2.2 *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 all 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 and communities of flora and fauna, and the processes that threaten native flora and fauna are listed in the schedules of the Act. This assists in identifying those species and communities that require management to survive, and identifies the processes that require management to minimise the threat to native flora and fauna species and communities within Victoria.

A permit from DELWP is required to 'take' listed flora species that are 'protected flora' from public land. A permit is not required under the FFG Act for private land, unless listed species are present and the land is declared 'critical habitat' for the species. Protected flora are all listed species, species which belong to listed

communities, and other species which have been included on the protected flora list, managed by the DELWP.

A permit is also required for removal of FFG Act listed fauna habitat or ecological communities.

As FFG Act listed species and communities were recorded within the study area and are proposed for removal, an FFG Act permit to remove threatened species and communities is required.

A total of 26 significant fauna species (12 FFG Act listed), six significant flora species (two FFG Act listed) and 2 FFG Act listed communities are considered to have the potential to be impacted upon by the Project. These species and communities are listed in Table 6.5. Species listed solely on the Victorian Advisory Lists have been included although they are not legislatively protected. Estimated extent of habitat for birds is based on the habitat mapping from (Biosis 2013).

With regard to FFG Act and Advisory List flora, no remnant populations were recorded within the project area, however several planted populations were recorded. These are considered in the table.

As per the table, 12 listed values are likely to require a permit for habitat removal under the FFG Act.

Table 6.5 FFG Act and Advisory List species with the potential to be affected by the Project

COMMON NAME	CONSERVATION STATUS			LIKELIHOOD OF HABITAT LOSS WITHOUT MITIGATION	LIKELIHOOD OF HABITAT LOSS WITH APPROPRIATE MITIGATION	RESIDUAL RISK IMPLICATIONS AND PERMIT REQUIREMENTS
	EPBC Act	FFG	Victorian Advisory List			
Migratory birds, waterfowl and other waterbirds						
Australasian Shoveler			Vulnerable	Moderate	Low	Approximately 0.75 ha habitat proposed for removal. Low impact expected. No permit required.
Magpie Goose		Listed	Near threatened	Moderate	Low	Approximately 0.09 ha habitat proposed for removal. Low impact expected. **Permit required.**
Eastern Great Egret		Listed	Vulnerable	Moderate	Low	Approximately 0.09 ha habitat proposed for removal. Low impact expected. **Permit required.**
Hardhead			Vulnerable	Moderate	Low	Approximately 0.75 ha habitat proposed for removal. Low impact expected. No permit required.
Musk Duck			Vulnerable	Moderate	Low	Approximately 0.75 ha habitat proposed for removal. Low impact expected. No permit required.

COMMON NAME	CONSERVATION STATUS			LIKELIHOOD OF HABITAT LOSS WITHOUT MITIGATION	LIKELIHOOD OF HABITAT LOSS WITH APPROPRIATE MITIGATION	RESIDUAL RISK IMPLICATIONS AND PERMIT REQUIREMENTS
	EPBC Act	FFG	Victorian Advisory List			
Australasian Bittern	Endangered	Listed	Endangered	High	Moderate	Approximately 4.90 ha habitat proposed for removal. Some impact expected. **Permit required.**
Curlew Sandpiper	Critically endangered, Migratory	Listed	Endangered	Moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
Pectoral Sandpiper	Migratory		Near threatened	Moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
Whiskered Tern			Near threatened	Moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
White-winged Black Tern			Near threatened	Low – Moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
Little Egret		Listed	Endangered	Low - Moderate	Low	Approximately 0.09 ha habitat proposed for removal. Low impact expected. **Permit required.**
Latham's Snipe	Migratory		Near threatened	Moderate	Low	Approximately 4.90 ha habitat proposed for removal. Some impact expected. **Permit required.**
Caspian Tern		Listed	Near threatened	Moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
Little Bittern		Listed	Endangered	Moderate-High	Moderate	Approximately 4.90 ha ha habitat proposed for removal. Some impact expected. **Permit required.**

COMMON NAME	CONSERVATION STATUS			LIKELIHOOD OF HABITAT LOSS WITHOUT MITIGATION	LIKELIHOOD OF HABITAT LOSS WITH APPROPRIATE MITIGATION	RESIDUAL RISK IMPLICATIONS AND PERMIT REQUIREMENTS
	EPBC Act	FFG	Victorian Advisory List			
Lewin's Rail		Listed	Vulnerable	Moderate-High	Moderate	Approximately 4.90 ha ha habitat proposed for removal. Some impact expected. **Permit required.**
Eastern Curlew	Critically Endangered, Migratory	Listed	Vulnerable	Low-moderate	Low	No habitat directly proposed for removal. Low impact expected. No permit required
Nankeen Night Heron			Near threatened	Moderate	Low	Some habitat may be lost however this is expected to be low. Habitat not mapped. No permit required
Blue-billed Duck		Listed	Endangered	Moderate	Low	Approximately 0.09 ha habitat proposed for removal. Low impact expected. **Permit required.**
Pied Cormorant			Near threatened	Moderate	Low	Negligible impact expected No permit required
Royal Spoonbill			Near threatened	Moderate	Low	Negligible impact expected No permit required
Glossy Ibis	Migratory		Near threatened	Moderate	Low	Negligible impact expected No permit required
Baillon's Crake		Listed	Vulnerable	Moderate	Low	Approximately 4.90 ha habitat proposed for removal. Some impact expected. **Permit required.**
Freckled Duck		Listed	Endangered	Moderate	Low	Approximately 0.09 ha habitat proposed for removal. Low impact expected. **Permit required.**
Wood Sandpiper	Migratory		Vulnerable	Low-moderate	Low	No primary habitat proposed to be removed. Negligible impact expected. No permit required
Reptiles						

COMMON NAME	CONSERVATION STATUS			LIKELIHOOD OF HABITAT LOSS WITHOUT MITIGATION	LIKELIHOOD OF HABITAT LOSS WITH APPROPRIATE MITIGATION	RESIDUAL RISK IMPLICATIONS AND PERMIT REQUIREMENTS
	EPBC Act	FFG	Victorian Advisory List			
Eastern Snake-necked Turtle			Data deficient	High	Moderate	Some residual impact may occur from road mortality however species likely to persist in the area. No permit required
Glossy Grass Skink			Vulnerable	Moderate	Moderate	Some residual impact may occur from habitat loss however species likely to persist in the area. No permit required
Flora						
Leafy Twig-sedge			Rare	High	Moderate	Planted in Waterways and recorded during survey. Some plants may be lost. No permit required
Pale Swamp Everlasting			Vulnerable	Moderate	Low	Planted in Waterways and recorded during survey outside of construction footprint. No permit required
Matted Flax-lily	Endangered	Listed	Endangered	Moderate	Low	Species was planted within Waterways however was not recorded in project area. No impact or habitat loss expected. Pre-clearing survery and relocation to mitigate any impacts. No permit reqired.
Lacey River Buttercup			Rare	Moderate	Low	Species was planted within Waterways however was not recorded in project area. No permit reqired.
Large River Buttercup			Poorly known	Moderate	Low	Species was planted within Waterways however was not recorded in project area. No permit reqired.

COMMON NAME	CONSERVATION STATUS			LIKELIHOOD OF HABITAT LOSS WITHOUT MITIGATION	LIKELIHOOD OF HABITAT LOSS WITH APPROPRIATE MITIGATION	RESIDUAL RISK IMPLICATIONS AND PERMIT REQUIREMENTS
	EPBC Act	FFG	Victorian Advisory List			
Swamp Everlasting	Vulnerable	Listed	Vulnerable	Moderate	Low	Recorded within project area (outside of construction footprint). Unlikely to be impacted by the Project. No impact or habitat loss expected. Pre-clearing survery and relocation to mitigate any impacts. No permit reqired.
Threatened Ecological Communities						
Herb-rich Plains Grassy Wetland (West Gippsland) Community		Listed		High	High	Some residual impact (2.22 ha) will occur. This is a small extent and considered low risk to the Project, provided the measures in Section 5 are implemented. **Permit required**
Plains Grassland (South Gippsland) Community		Listed		High	High	Only 0.03 ha will be impacted. This is a small extent and considered low risk to the Project, provided the measures in Section 5 are implemented. **Permit required**

6.2.3 Permitted clearing of native vegetation – biodiversity assessment guidelines

The guidelines have been designed to manage the risk to Victoria's biodiversity associated with the removal of native vegetation. This risk is determined via an assessment of the location risk and the extent risk. Location risk is determined by assessing the likelihood that the removal of a small amount of native vegetation may impact the persistence of a rare or threatened species. Location risk has been determined for all of Victoria. The native vegetation location risk map is available from the Native Vegetation Information Management tool found on the DELWP website (DELWP 2017c).

Extent risk is determined by the amount of the native vegetation that is proposed to be removed. Together, these two risk types are used to determine the risk-based pathway for assessing a permit application to remove native vegetation (DEPI 2013b). An application to remove native vegetation can be assessed under one of three risk-based pathways of the guidelines – Low, Moderate or High risk. The risk-based pathway determines the process to be followed for the assessment of planning permit applications and dictates the types of offsets that are required to be implemented for the vegetation removal. Table 6.6 presents the risk-based pathways for remnant patches of native vegetation and Table 6.7 presents the risk-based pathways for scattered trees.

Table 6.6 Remnant patch risk-based pathways

EXTENT	LOCATION		
	LOCATION A	LOCATION B	LOCATION C
<0.5 hectares	Low	Low	High
≥0.5 hectares and <1 hectare	Low	Moderate	High
≥1 hectare	Moderate	High	High

Table 6.7 Scattered tree risk-based pathways

EXTENT	LOCATION		
	LOCATION A	LOCATION B	LOCATION C
<15 scattered trees	Low	Moderate	High
≥15 scattered trees	Moderate	High	High

LOW RISK-BASED PATHWAYS APPLICATIONS

A habitat hectare assessment is not required for vegetation removals determined to be of low risk. Modelled site condition scores are used to assess low risk-based pathway applications. It is important to note that a habitat hectare report can be obtained if the applicant wishes to dispute the condition of the native vegetation provided in the spatial data. If a proponent provides a habitat hectare assessment report with their application to remove native vegetation, this will be used in place of the modelled data.

MODERATE AND HIGH RISK-BASED PATHWAY APPLICATIONS

Moderate and high-risk applications must include a habitat-hectare assessment report of the native vegetation to be removed. They must also be accompanied by a statement outlining the steps that have been taken to ensure that impacts on biodiversity from the removal of native vegetation have been minimised. These steps should have regard to the contribution the native vegetation removed and retained makes to biodiversity. The application must also include an assessment of whether the proposed removal of native vegetation will have a significant impact on Victoria's biodiversity, with regard to the proportional impact on habitat for any rare or threatened species. An offset strategy must also be provided that details how a compliant offset will be secured to offset biodiversity impacts from the removal of native vegetation.

Victoria's Permitted Clearing Regulations are relevant to the project as the removal of remnant vegetation patches or scattered trees are proposed.

6.2.3.1 Preliminary calculations under the Biodiversity Assessment Guidelines

Planning approvals are being sought as part of a Planning Scheme amendment. The associated *Incorporated Document* states that Native Vegetation Offset requirements will be met through the implementation of an Offset Management Strategy, subject to endorsement by DEWLP, operating under the current *Biodiveristy Assessment Guidelines* policy. Native Vegetation Offset requirements will be sourced by the State, and in accordance with the current policy. The revised Guidelines policy, due to be gazetted in July 2017, will not be applied to this project.

Approximately 6.12 hectares comprising 12 EVCs is proposed for removal. This vegetation is located mostly within Location A, with exception of the area between Governor Road and Mordialloc Creek which is mostly mapped as Location B and C. As such, an application to removal native vegetation under Section 52.17 of the relevant Planning Scheme will likely proceed under a High-Risk pathway.

A preliminary calculation of biodiversity impacts and Offset requirements has been completed for the current construction footprint (refer Appendix H).

This has resulted in:

- 0.076 general units (General Offsets) for the Port Phillip and Westernport Catchment Management Authority (CMA) or Kingston City Council.
- The following Specific Offsets:
  - 1.261 specific units of habitat for Orange-bellied Parrot
  - 2.794 specific units of habitat for Marsh Saltbush
  - 1.684 specific units of habitat for Creeping Rush
  - 2.745 specific units of habitat for Salt Lawrencia
  - 2.725 specific units of habitat for Purple Blown-grass
  - 0.060 specific units of habitat for Lacey River Buttercup

6.2.3.2 Tree Protection Zones

Any works proposed near patches of native vegetation with trees should consider how the impact might affect the critical root zone of tree species by following the *Permitted clearing of native vegetation – Biodiversity assessment handbook* (DELWP 2015).This recommends Tree Protection Zones to prevent indirect losses of native vegetation during construction activities. If the activities impact on <10% of the total area of the Tree Protection Zones, the tree is considered 'retained' unless a qualified arborist confirms that specific works will not significantly impact a greater area of the Tree Retention Zones.

The above has been incorporated into the avoidance, minimisation, and mitigation measures for the Project (Section 5.3.1).

6.2.4 *Wildlife Act 1975*

The *Wildlife Act 1975* is the primary legislation in Victoria for the protection of wildlife. The Act requires that wildlife research (including fauna salvage and translocation) is regulated through a permit system, which is managed by the DELWP.

Authorisation for habitat removal must be obtained under the *Wildlife Act 1975* through a licence granted by the DELWP. As there are five large trees within the proposed construction footprint and some trees appear to have hollows, it is likely that a permit will be required for their removal.

Any persons involved in fauna removal, salvage capture or relocation of fauna during mitigation measures must hold a current Management Authorisation under the *Wildlife Act 1975*.

6.2.5 Catchment and Land Protection Act 1994

6.2.5.1 Declared noxious weeds

The study area supports a number of weeds that are declared noxious under the *Catchment and Land Protection Act 1994* (CaLP Act). Plants occurring on this list are known to or have the potential to result in detrimental environmental and / or economic impact.

Under the CaLP Act declared noxious weeds are categorised into four groups depending on their known and potential impact and specific circumstances for each region. These categories are:

- State Prohibited Weeds (S) – Plants that do not occur in Victoria but would pose a significant threat if they did invade. If found they are to be eradicated with responsibility falling on the Victorian Government.
- Regionally Prohibited Weeds (P) – Weeds that are not widely distributed in a region but are capable of spreading further. Land owners, including public authorities responsible for managing land must take all reasonable steps to eradicate Regionally Prohibited weeds on their land.

- Regionally Controlled Weeds (C) – Invasive plants that are usually widespread in a region. Ongoing control measures are required to prevent their spread. Land owners, including public authorities responsible for managing land, must take all reasonable steps to prevent growth and spread of Regionally Controlled weeds on their land.
- Restricted Weeds (R) – Plants that pose an unacceptable risk of spreading in this state and are a serious threat to another State or Territory. Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited.

The field survey identified that project area supports eleven regionally controlled (C), four restricted (R) and one regionally prohibited (P) weed. These weeds are listed in Table 6.8. It is the responsibility of the landowner to control these weeds on their property and on adjacent roadside reserves. Six of these weed species are also listed as Weeds of National Significance by the Australian Government.

Most of the significant weeds were recorded along roadsides and private land in the north of the project area. Very few noxious weeds were recorded from within the Waterways.

Table 6.8 Declared noxious weeds occurring within the study area

SCIENTIFIC NAME	COMMON NAME	CALP ACT STATUS	WONS?
Allium triquetrum	Angled Onion	R	
Asphodelus fistulosus	Onion Weed	R	
Cirsium vulgare	Spear Thistle	C	
Cytisus scoparius	English Broom	C	Yes
Datura ferox	Long-spine Thorn-apple	C	
Dittrichia graveolens	Stinkwort	C	
Echium plantagineum	Paterson's Curse	C	
Foeniculum vulgare	Fennel	R	
Genista linifolia	Flax-leaf Broom	P	Yes
Genista monspessulana	Montpellier Broom	C	Yes
Lycium ferocissimum	African Box-thorn	C	Yes
Oxalis pes-caprae	Soursob	R	
Rubus fruticosus spp. agg.	Blackberry	C	Yes
Salix babylonica s.l.	Weeping Willow	R	
Salpichroa origanifolia	Pampas Lily-of-the-Valley	C	
Silybum marianum	Variegated Thistle	C	
Ulex europaeus	Gorse	C	Yes

6.3 Local

6.3.1 Kingston and Greater Dandenong Planning Schemes

The *Planning and Environment Act 1987* provides the legal framework for the operation of Victoria's planning system, commonly referred to as *the Planning Scheme*. The project will require approval under the Kingston Planning Scheme for works within the Public Use Zone, Land Subject to Inundation Overlay and the Special Building Overlay. Approvals for vegetation removal will be required under both the Kingston and Greater Dandenong Planning Schemes.

A *Preliminary Planning Assessment - Mordialloc Bypass* (WSP 2017d) has been prepared which identifies the potential constraints, issues and opportunities from a planning perspective that may influence the progress of the Project.

6.3.1.1 Exemption for planted vegetation

As there are a number of areas with planted Victorian and other Australian native species (eg. Giant Honey-myrtle, Spotted Gum) along the Mornington Peninsula Freeway and other areas, it is worth exploring the exemption in more detail.

Under Section 52.17 under all Victorian Planning Schemes, there is an exemption to obtaining a planning permit for planted vegetation, unless it was planted with government funding.

The wording of the exemption under Section 52.17:

> *Planted vegetation*
>
> *The native vegetation has been planted or grown as a result of direct seeding for Crop raising, Extensive animal husbandry, aesthetic or amenity purposes, including: agroforestry (the simultaneous and substantial production of forest and other agricultural products from the same land unit), shelter belts, woodlots, street trees, gardens or the like. This exemption does not apply if public funding was provided to assist in planting or managing the native vegetation and the terms of the funding did not anticipate removal or harvesting of the vegetation.*

The vegetation must have been planted or managed for conservation objectives. DELWP interprets vegetation planted along a roadside by a road authority to not be for conservation purposes, and therefore exempt from a planning permit and offsets. The exemption applies to the vegetation that was planted, not vegetation generated from the planted vegetation.

This exemption would not apply to native vegetation planted throughout The Waterways, as it was planted for conservation purposes using in part, public funds and is located on public land (mostly owned by Melbourne Water).

7 CONCLUSIONS AND RECOMMENDATIONS

The main biodiversity impacts from the Project can be summarised as:

- minor removal of low quality native vegetation north of Governor Road and south of Springvale Road
- removal of some high quality native revegetation at the Waterways
- some direct removal of habitat for birds listed under the EPBC Act and FFG Act
- some direct removal of EPBC Act and FFG Act listed ecological communities
- moderate levels of indirect impacts on numerous migratory and threatened birds from increased fragmentation, noise, light effects, and habitat degradation.

There is limited scope to move the road within the project area, and there are no alternative corridor options available. Therefore, emphasis must be on the mitigation measures to minimise both the direct and indirect impacts from construction and operation of the road. There are opportunities for a range of innovative solutions (grounded in sound research and informed by expert opinion), to mitigate the indirect impacts of the Project (light, noise, etc) and facilitate the required approvals.

There are additional opportunities for creation of wetland habitat suited to a wide range of threatened bird species. Any wetland creation program will need to cater for the requirements of migratory waders by incorporating seasonal fluctuations in water levels and promote habitat complexity (such as through annual control of macrophytes).

With regard to requirements for the Project under applicable environmental legislation and policy:

- Referral of the project under the EPBC Act is recommended for legal certainty
- An EES referral is in preparation for the Project
- Twelve listed values are likely to require a permit for habitat removal under the FFG Act.
- Based on a preliminary calculation of biodiversity impacts and Offset requirements, 0.076 general units (General Offsets) for the Port Phillip and Westernport Catchment Management Authority (CMA) or Kingston City Council, and specific units (between 0.060 and 2.794) for six species, will be required under the biodiversity assessment guidelines
- A permit is likely to be required under the *Wildlife Act 1975* for habitat removal and fauna salvage
- Approvals for vegetation removal will be required under both the Kingston and Greater Dandenong Planning Schemes.

Future studies required to ensure that the ecological impacts of the Project are sufficiently reduced include:

- detailed design of the mitigation measures required to avoid or reduce the negative impacts on significant ecological values, specifically noise and fauna mortality mitigation measures
- further assessment of the impacts of the Project on surface and groundwater hydrology and determination of the required mitigation measures to ensure a negligible impact upon ecological values
- landscape plan incorporating mitigation measures for significant ecological values (particularly Australasian Bittern and migratory bird species)
- investigations into the feasibility of creating wetlands to go beyond mitigation, and have social and environmental benefit (whilst offsetting potential losses and impacts to existing values if required).

8 GLOSSARY

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: → Genetic diversity — the variety of genes (or units of heredity) in any population. → Species diversity — the variety of species. → Ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. The majority of the Study Area falls within the Central Victorian Uplands bioregion with smaller areas covered by the Victorian Volcanic Plain bioregion.
CMA	Catchment Management Area.
Department of Environment, Land, Water and Planning (DELWP)	This department was formerly known as: → Department of Environment and Primary Industries (DEPI) → Department of Planning, Local Government, and Property and Land Titles (DTPLI).
Department of the Environment (DoE)	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of the Environment was previously known as: → Department of Sustainability, Environment, Water, Population and Communities (SEWPAC). → Department of the Environment, Water, Heritage and the Arts (DEWHA). → Department of Environment and Heritage (DEH). → Department of the Environment and Water Resources (DEWR).
Ecological community	An assemblage of species occupying a particular area.
Ecological Vegetation Class (EVC)	A type of native vegetation classification that is described through a combination of its floristics, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification that is based solely on groups in the same species) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
EES	Environment Effects Statement
Elliot Trapping	Aluminium box-style folding trap made and used to trap small marsupials and rats.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Exotic	Introduced from outside the area. Used in the context of this report to refer to species introduced from overseas.
Funnel trap	Reptile trap for fauna surveys
Fyke Nets	A bag net for catching fish

GPS	Global Positioning System- a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Hair tube trapping	Device designed to capture mammalian hair on a specially developed sticky sampling wafer. Subsequent analysis of the captured hair sample enables reliable identification of many species of small to medium mammals.
Indigenous	Native to the area: not introduced.
Introduced	Not native to the area: not indigenous. Refers to both exotic and non-indigenous Australian native species of plants and animals.
Likely	Taken to be a real chance or possibility.
Local population	The population that occurs within the site, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated.
Locality	The area within a 10 km radius of the site.
Migratory species	Species listed as Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Matters of National Environmental Significance (MNES)	The following Matters of National Environmental Significance are protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): listed threatened species and communities, listed Migratory species, Ramsar wetlands of international importance, Commonwealth marine environment, World Heritage Properties, National Heritage Places, the Great Barrier Reef Marine Park and nuclear actions.
Nocturnal call playback	A survey technique undertaken (at night) which attempts to stimulate fauna species to call by imitating or playing their call at probable breeding sites.
Noxious weed	An introduced species listed under the Noxious Weeds Act 1993. Under the Act, noxious weeds have specific control measure and reporting requirements.
P&E Act	*Planning and Environment Act 1987*
Potentially Threatening Processes	The state equivalents of Key Threatening Processes, Potentially Threatening Processes are listed under Section 10 of the *Flora and Fauna Guarantee Act 1988* (FFG Act).
Protected species	Those species defined as protected under the National Parks and Wildlife Act 1974. Includes all native animals, as well as all native plants listed on Schedule 13 of the National Parks and Wildlife Act 1974.
Recovery plan	A plan prepared under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 to assist the recovery of a Threatened species, population or ecological community.

Remnant Patch	An area of vegetation, with or without trees, where less than 75% of the total understorey plant cover is weeds or non-native plants (bare ground is not included). That is at least 25% of the understorey cover is native; or a group (i.e. three or more) of trees where the tree canopy cover is at least 20%.
Revegetation	Establishment of native vegetation to a minimum standard in formerly cleared areas, outside of a Remnant Patch
Significant	Important, weighty or more than ordinary; typically used to describe the importance of a species or community at local, regional, state or federal levels.
Species richness	Species richness is simply the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity, which also incorporates evenness, that is, the relative abundance of species.
Spp.	Abbreviation of species
Study area	The study area is the area of contained between the Western Highway to the east and west of Beaufort township to the north of Camp Hill State Forest.
Subsp.	Abbreviation for subspecies
The project	The project is located on the eastern, northern and western outskirts of the Beaufort township. Preliminary bypass alignments have been identified within a broader investigation corridor (the study area). The eastern end of the study area joins to the duplicated section of the Western Highway immediately east of Beaufort and the western end ties in with the currently under construction (as of late 2015) section of the of the Western Highway duplication west of Beaufort.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as Threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'Threatened', 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
Weed	A plant growing out of place or where it is not wanted: often characterized by high seed production and the ability to colonise disturbed ground quickly. Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

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Appendix A

FIGURES

Figure 1. Location of the project area

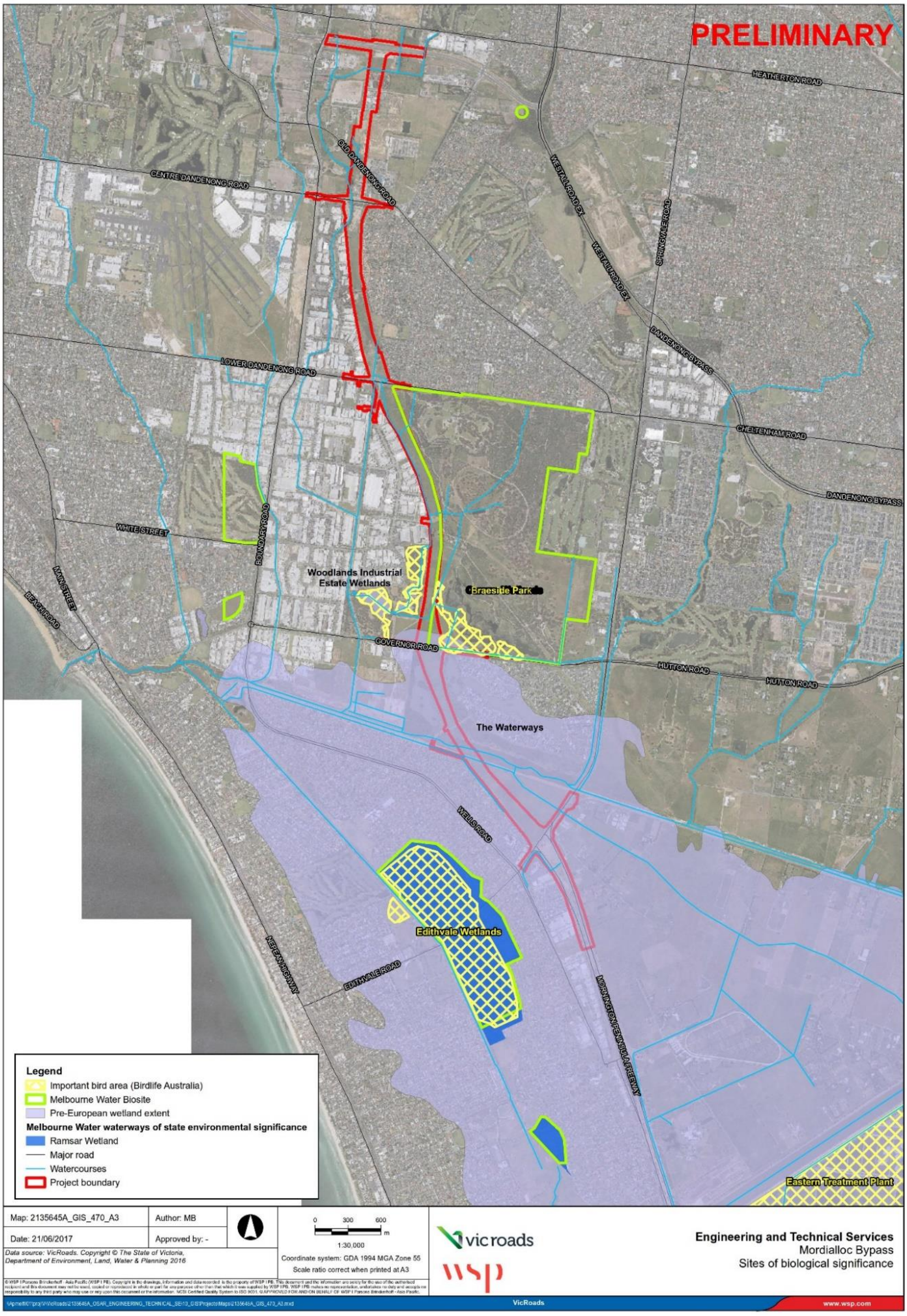


Figure 2. Sites of ecological significance

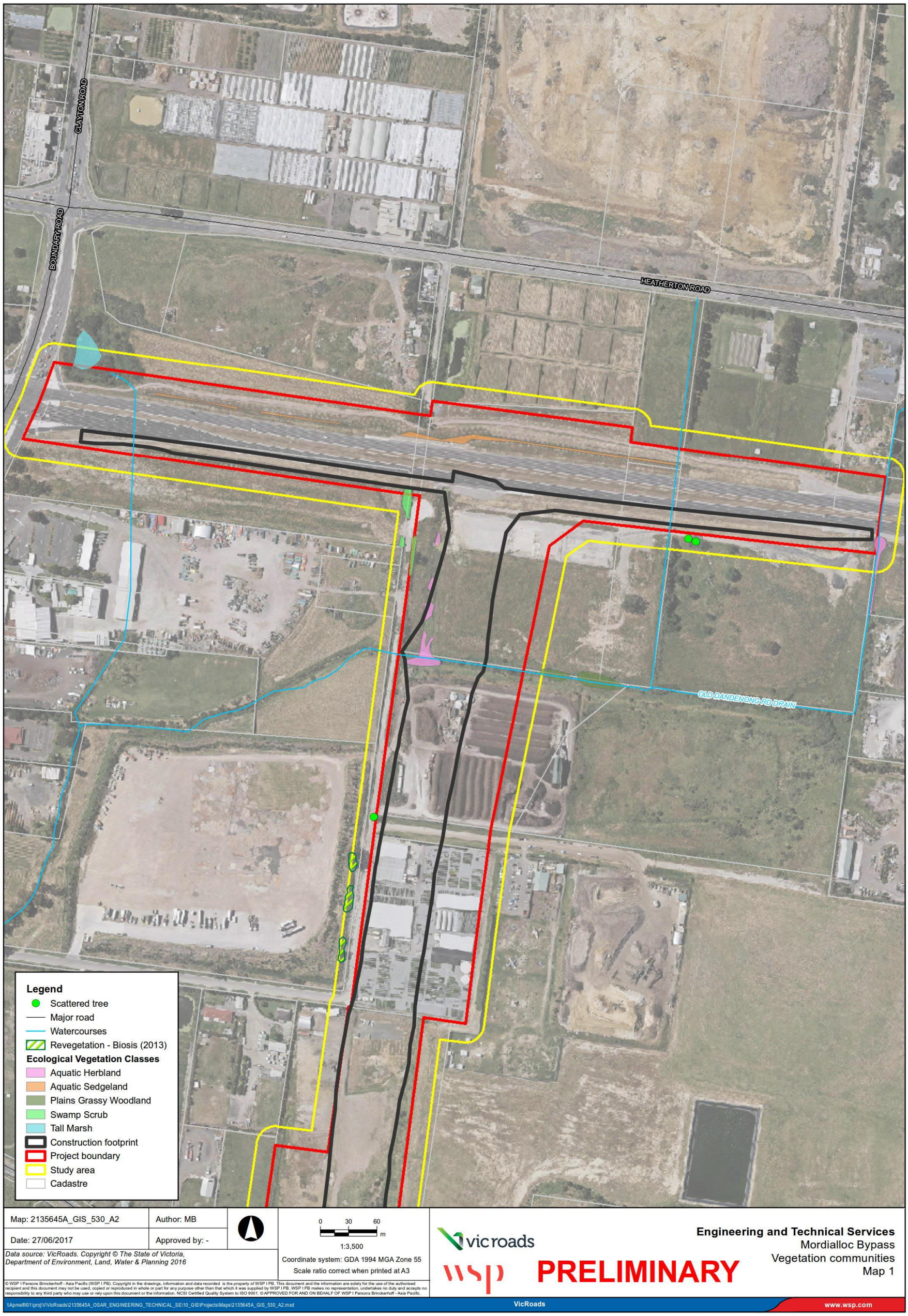
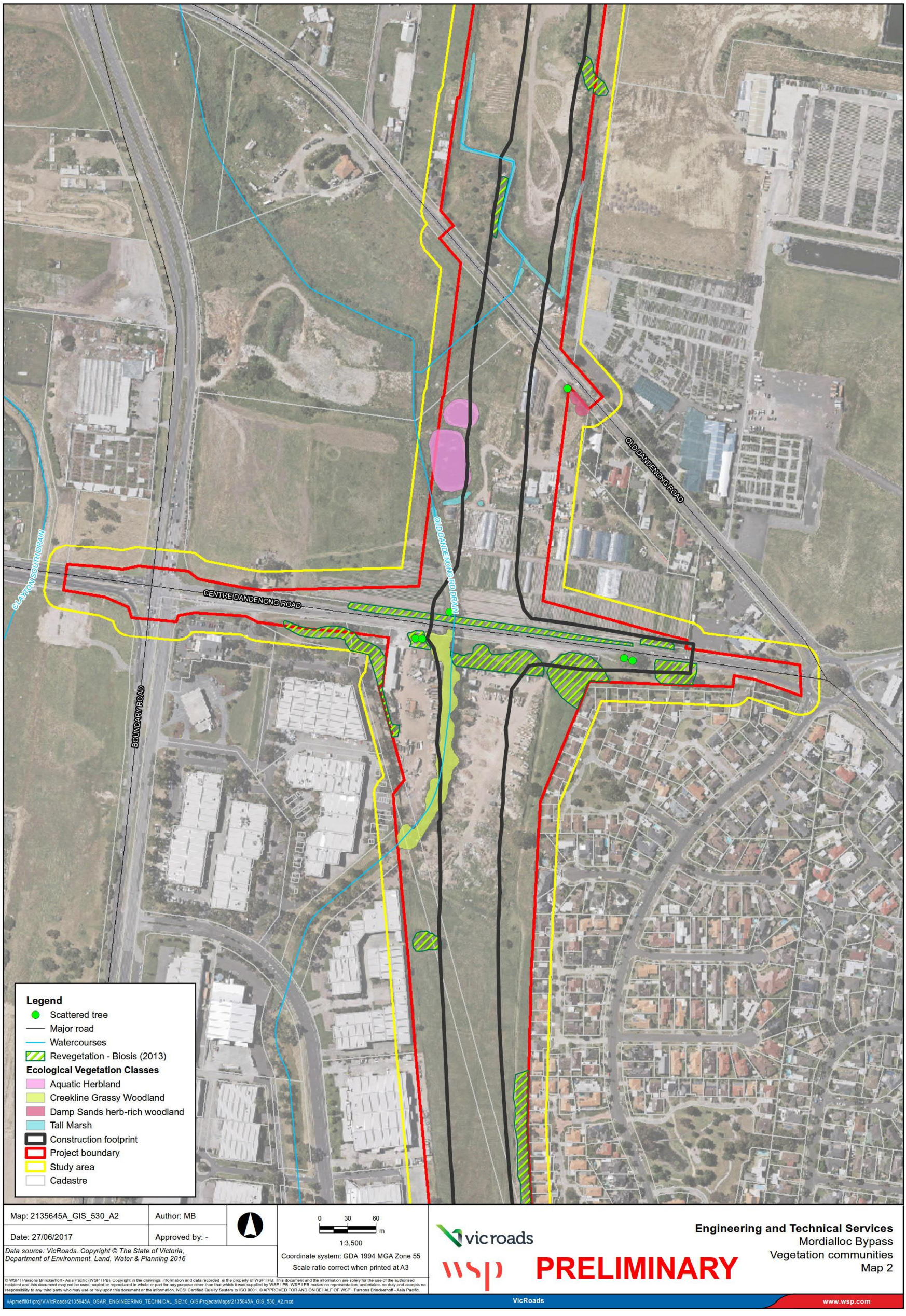


Figure 3. Vegetation Communities


CLAYTON SOUTH DRAIN
CENTRE DANDENONG ROAD
BOUNDARY ROAD
OLD DANDENONG RD DRAIN
OLD DANDENONG ROAD
Legend
Scattered tree
Major road
Watercourses
Revegetation - Biosis (2013)
Ecological Vegetation Classes
Aquatic Herbland
Creekline Grassy Woodland
Damp Sands herb-rich woodland
Tall Marsh
Construction footprint
Project boundary
Study area
Cadastre
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Author: MB
Date: 27/06/2017
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Map 2
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LOWER DANDENONG ROAD
Legend
Scattered tree
Major road
Watercourses
Revegetation - Biosis (2013)
Ecological Vegetation Classes
Plains Grassy Woodland
Construction footprint
Project boundary
Study area
Cadastre
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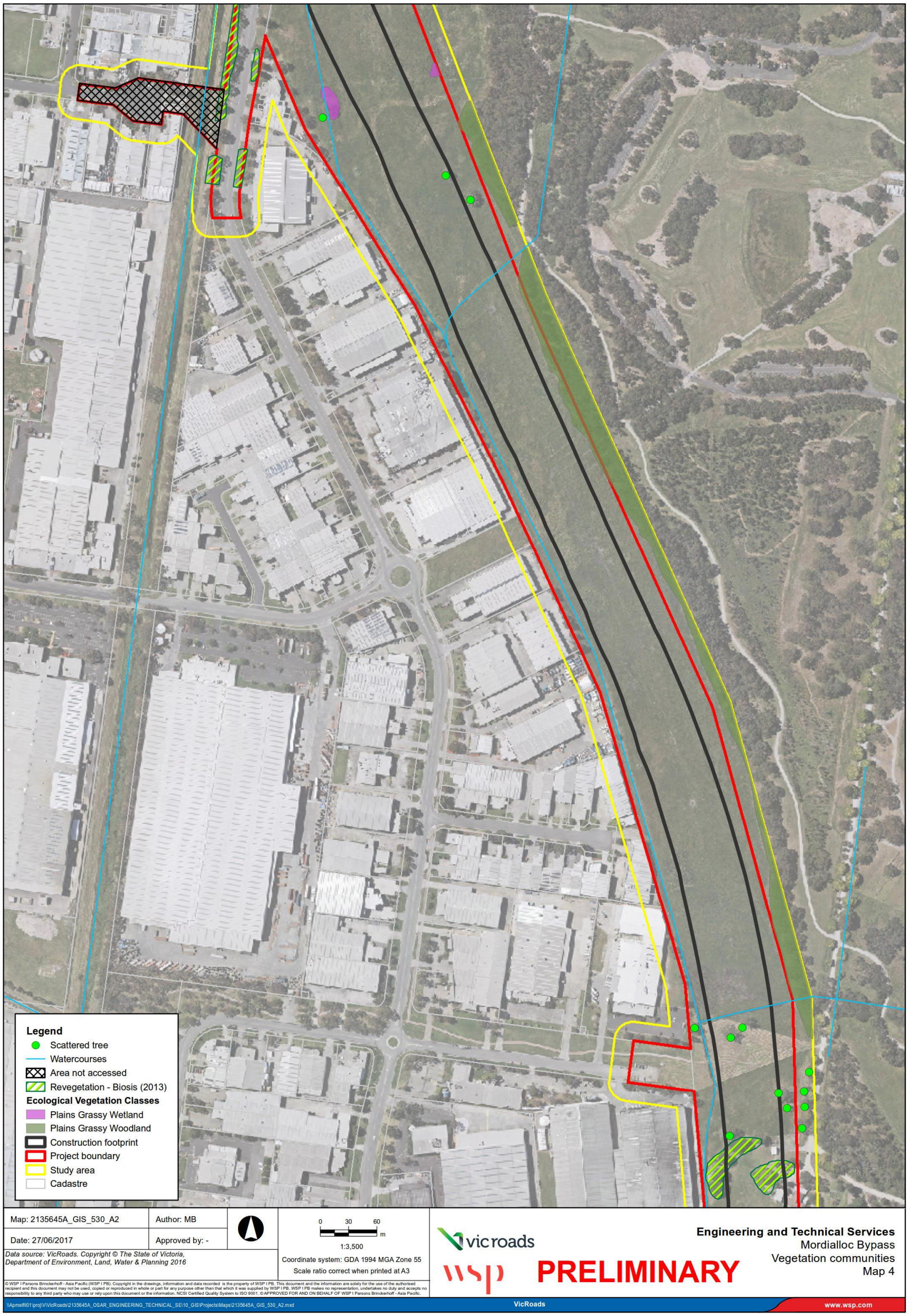
Legend
Scattered tree
Watercourses
Area not accessed
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Map 4
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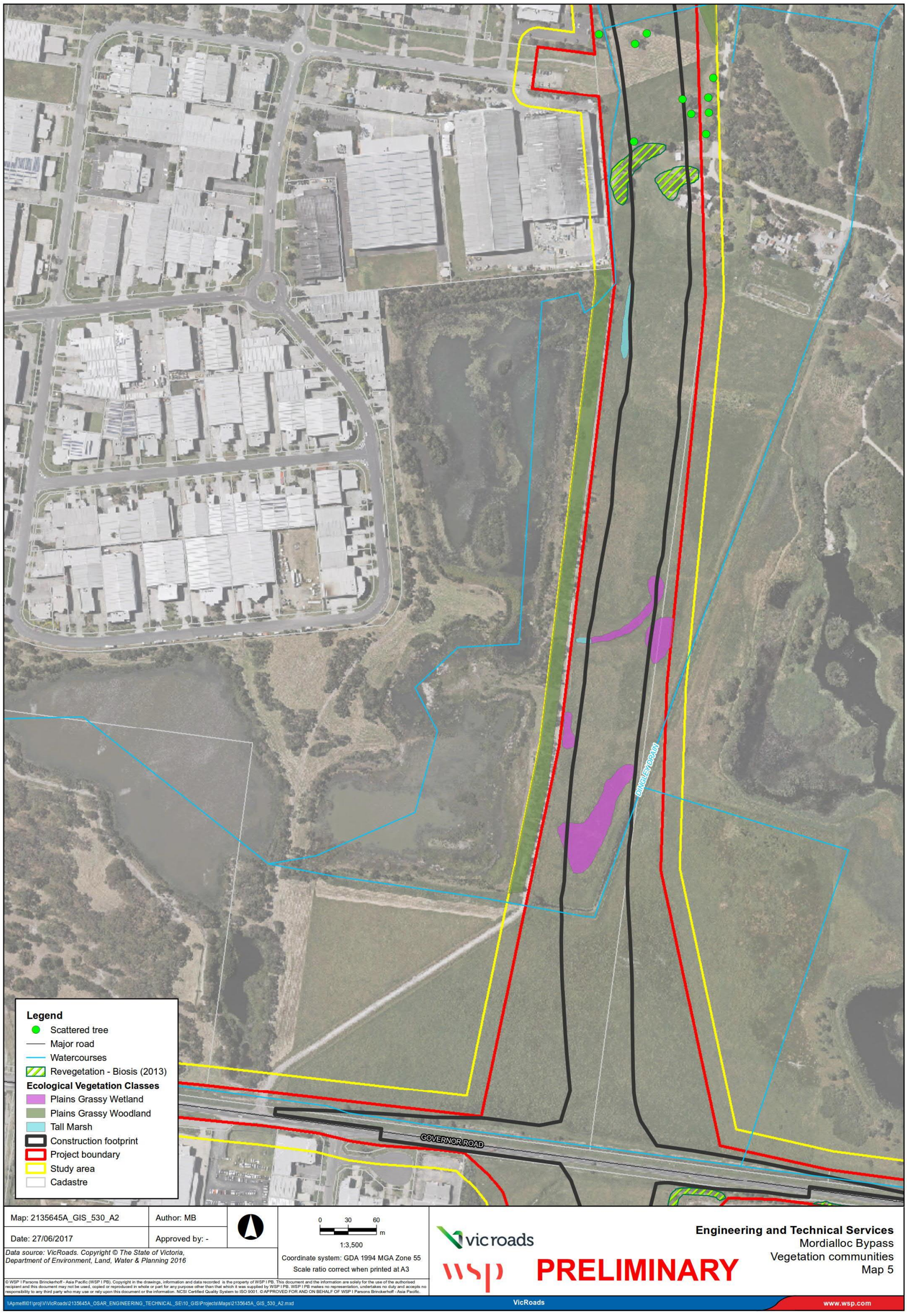
DINGLEYDRAIN
GOVERNOR ROAD
Legend
Scattered tree
Major road
Watercourses
Revegetation - Biosis (2013)
Ecological Vegetation Classes
Plains Grassy Wetland
Plains Grassy Woodland
Tall Marsh
Construction footprint
Project boundary
Study area
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Map 5
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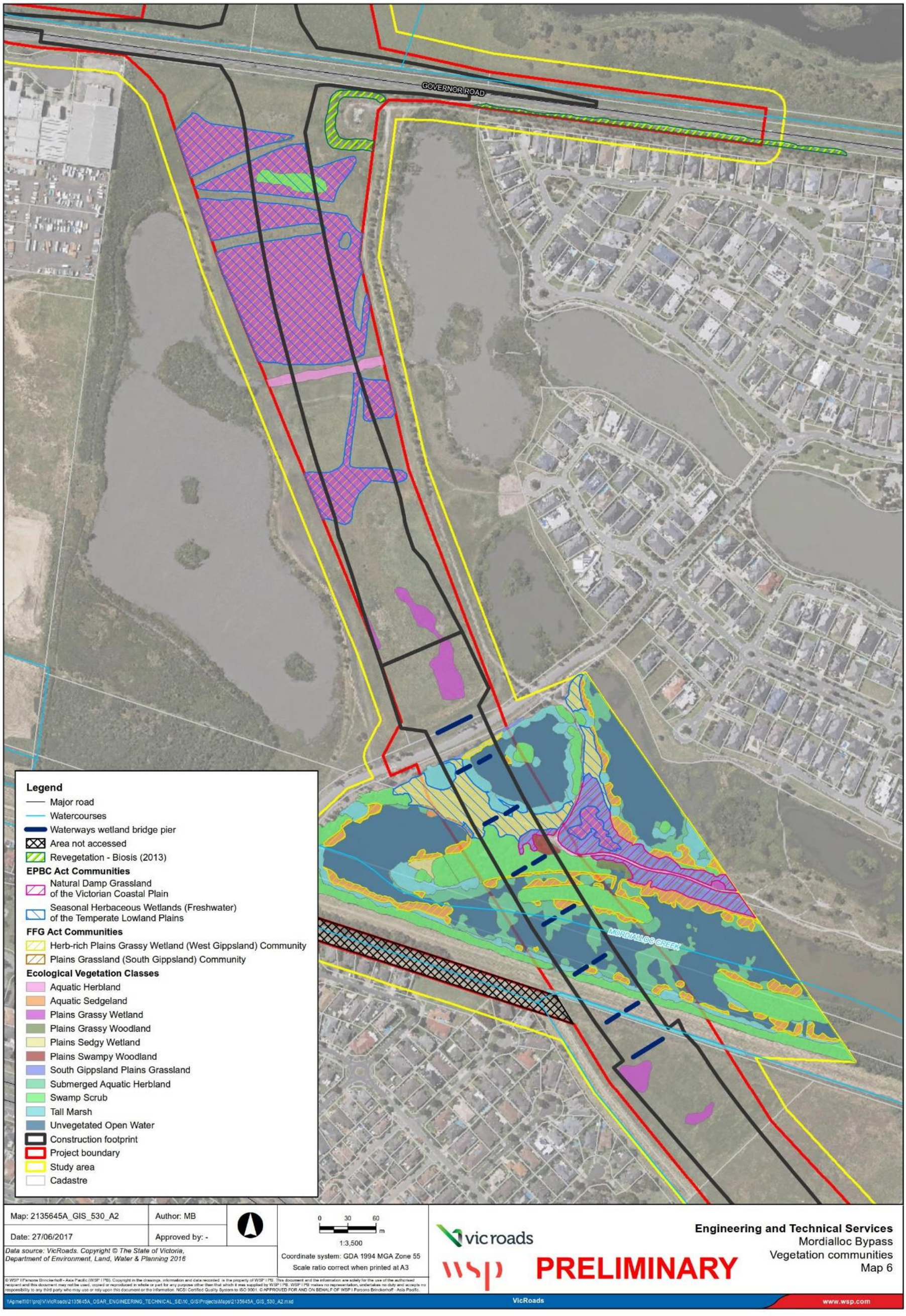
GOVERNOR ROAD
MORDIALLOC CREEK
Legend
Major road
Watercourses
Waterways wetland bridge pier
Area not accessed
Revegetation - Biosis (2013)
EPBC Act Communities
Natural Damp Grassland of the Victorian Coastal Plain
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
FFG Act Communities
Herb-rich Plains Grassy Wetland (West Gippsland) Community
Plains Grassland (South Gippsland) Community
Ecological Vegetation Classes
Aquatic Herbland
Aquatic Sedgeland
Plains Grassy Wetland
Plains Grassy Woodland
Plains Sedgy Wetland
Plains Swampy Woodland
South Gippsland Plains Grassland
Submerged Aquatic Herbland
Swamp Scrub
Tall Marsh
Unvegetated Open Water
Construction footprint
Project boundary
Study area
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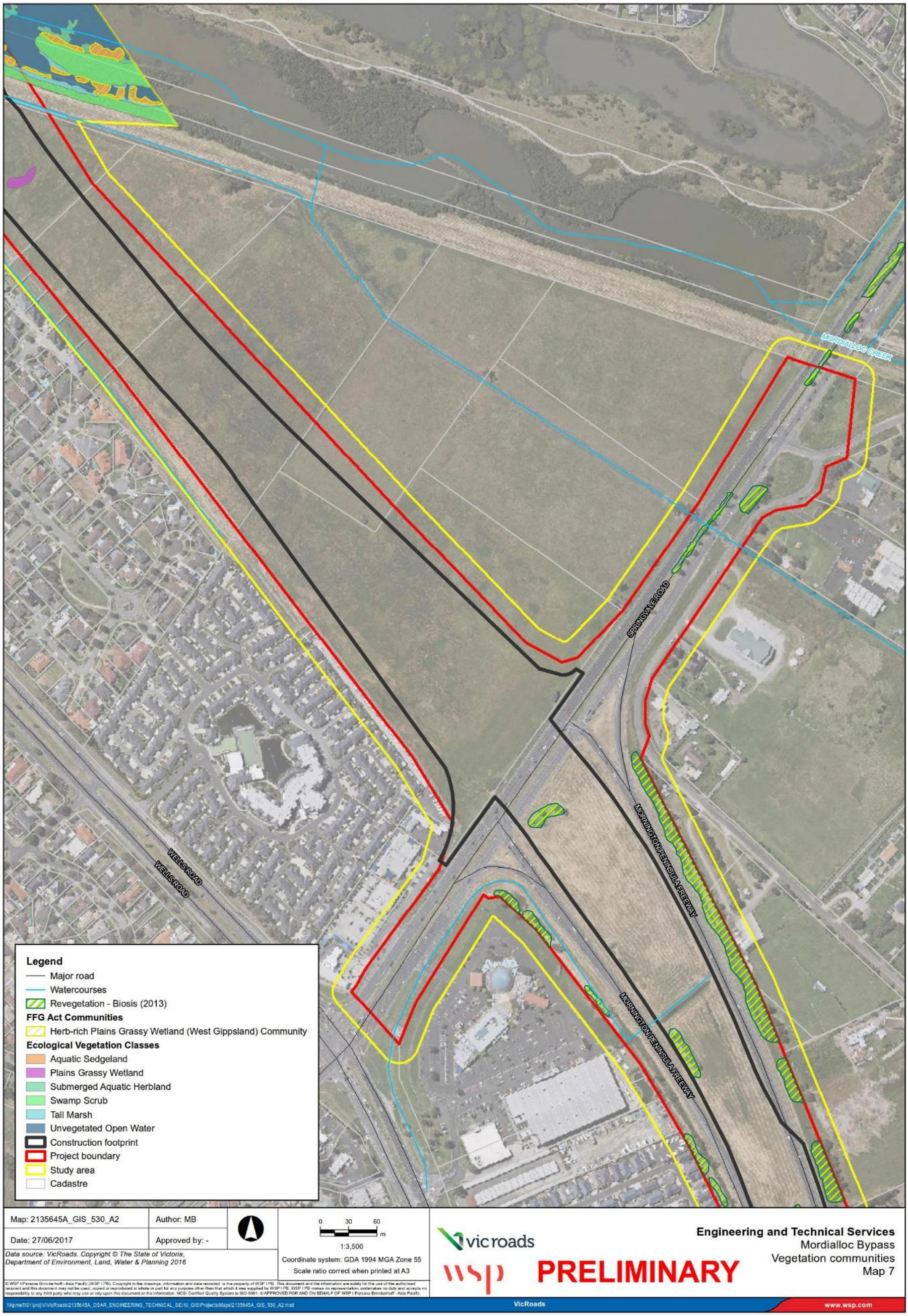
MORDIALLOC CREEK
SPRINGVALE ROAD
WELLS ROAD
WELLS ROAD
MORNINGTON PENINSULA FREEWAY
MORNINGTON PENINSULA FREEWAY
Legend
Major road
Watercourses
Revegetation - Biosis (2013)
FFG Act Communities
Herb-rich Plains Grassy Wetland (West Gippsland) Community
Ecological Vegetation Classes
Aquatic Sedgeland
Plains Grassy Wetland
Submerged Aquatic Herbland
Swamp Scrub
Tall Marsh
Unvegetated Open Water
Construction footprint
Project boundary
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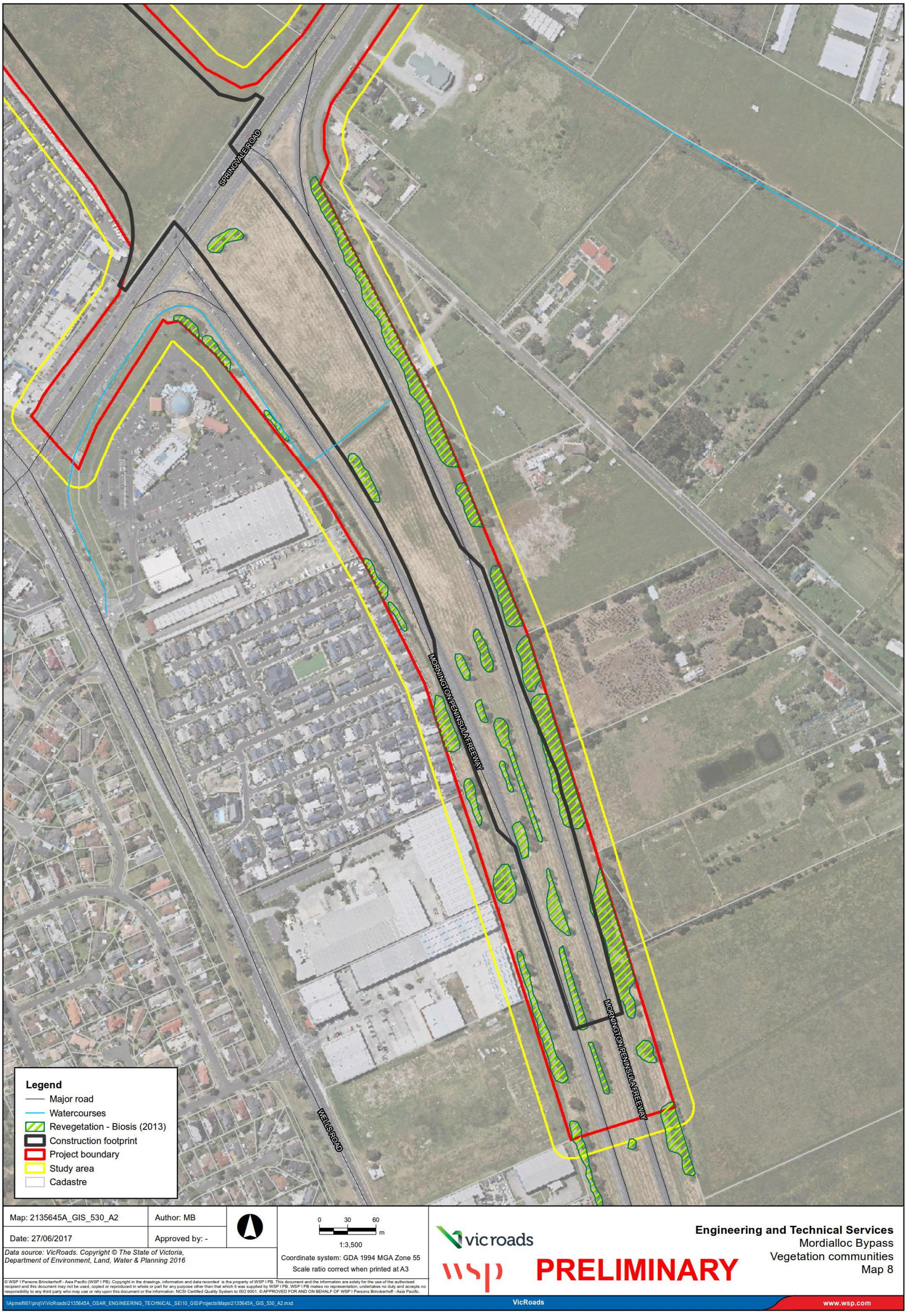
SPRINGVALE ROAD
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MORNINGTON PENINSULA FREEWAY
WELLS ROAD
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Major road
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Revegetation - Biosis (2013)
Construction footprint
Project boundary
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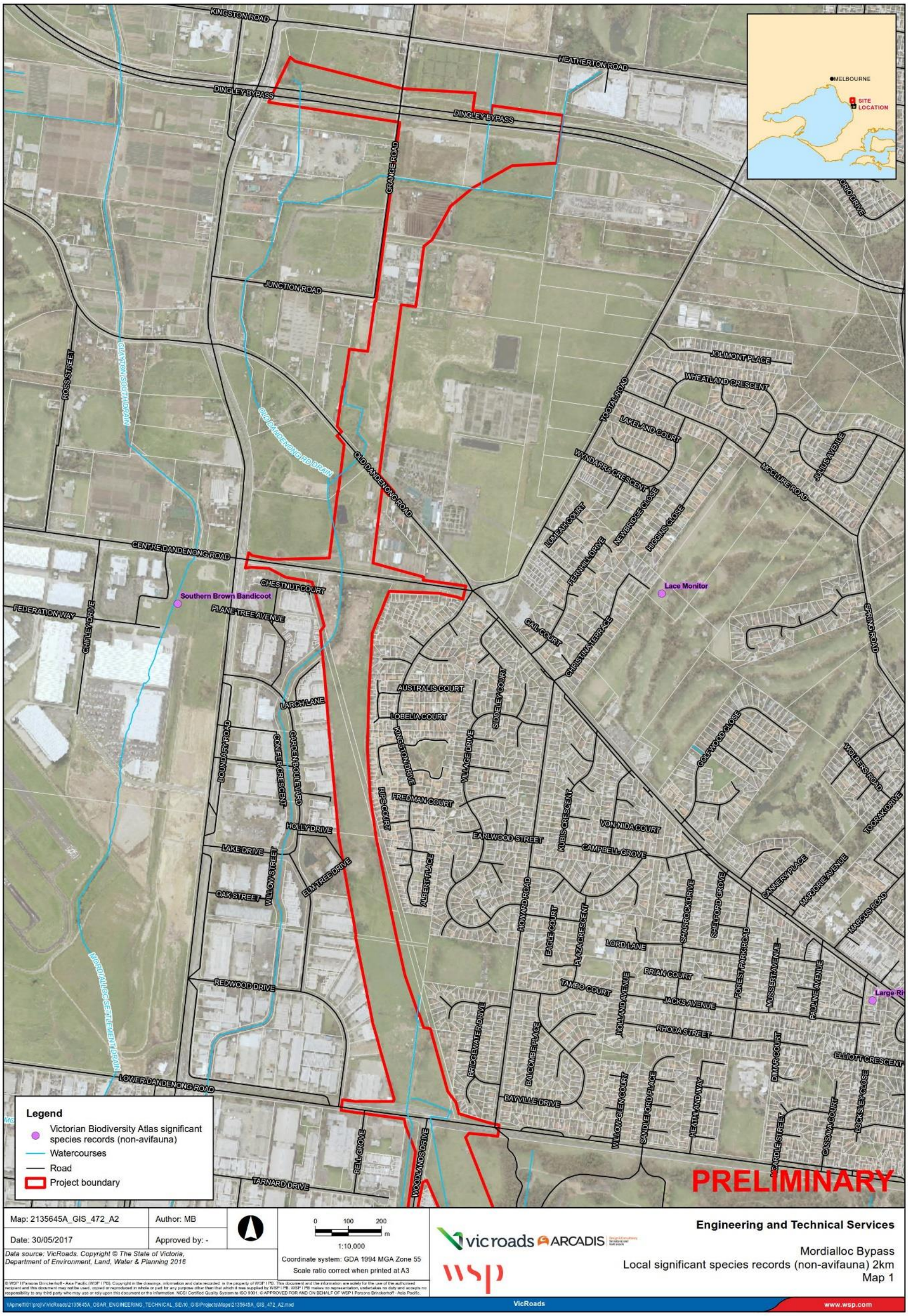
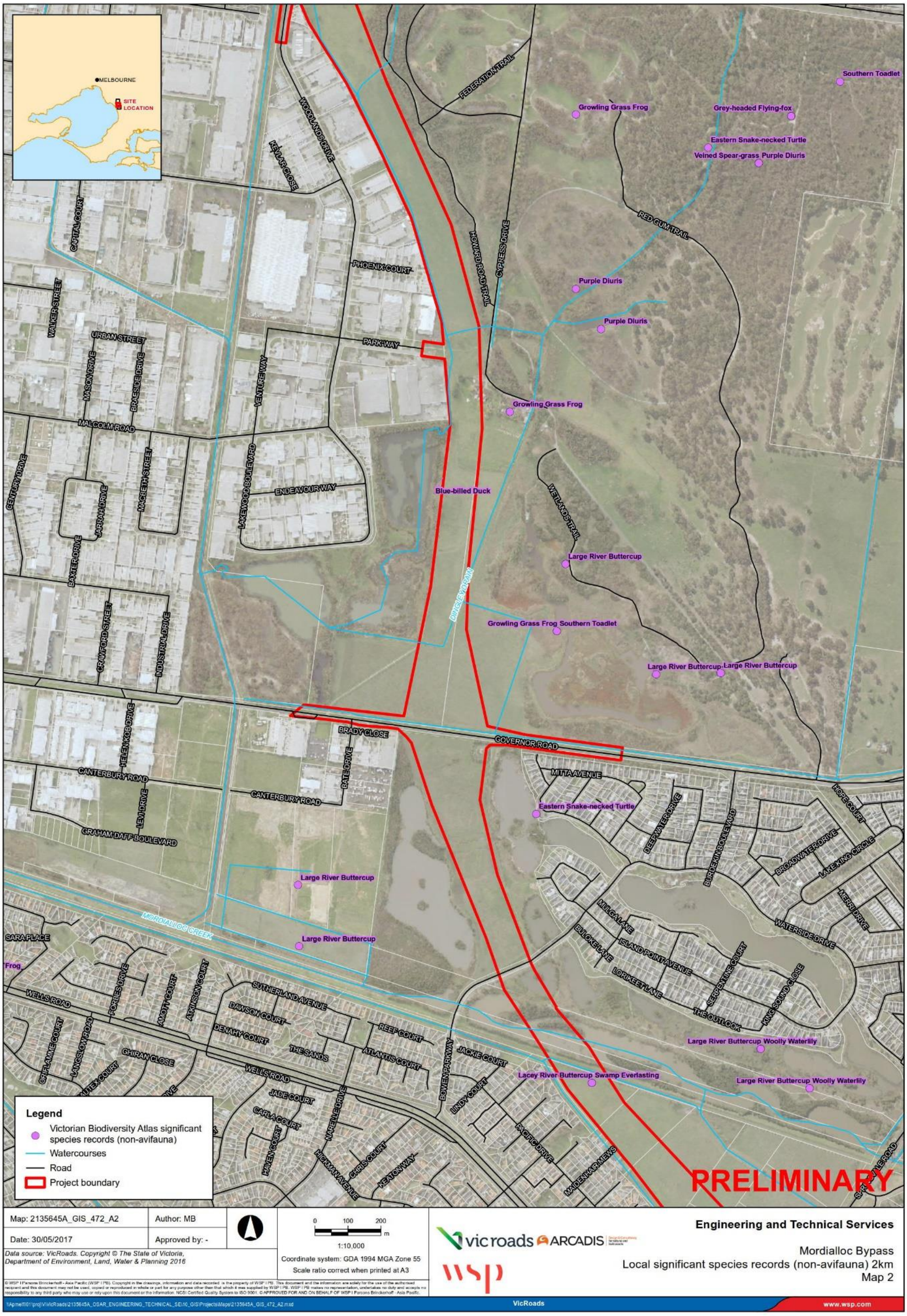


Figure 4. Species of significance (Non-Avian) within 2km of project area


MELBOURNE
SITE LOCATION
Southern Toadlet
Growling Grass Frog
Grey-headed Flying-fox
Eastern Snake-necked Turtle
Veined Spear-grass Purple Diuris
Purple Diuris
Purple Diuris
Growling Grass Frog
Blue-billed Duck
Large River Buttercup
Growling Grass Frog Southern Toadlet
Large River Buttercup
Large River Buttercup
Eastern Snake-necked Turtle
Large River Buttercup
Large River Buttercup
Large River Buttercup
Large River Buttercup Woolly Waterlily
Lacey River Buttercup Swamp Everlasting
Large River Buttercup Woolly Waterlily
FEDERATION TRAIL
WOODLANDS DRIVE
KELVAR CLOSE
CAPITAL COURT
PHOENIX COURT
HOWARD ROAD TRAIL
CYPRESS DRIVE
RED GUM TRAIL
WETLANDS TRAIL
DINGLEY DRAIN
WALKER STREET
URBAN STREET
MASON DRIVE
BRAESIDE DRIVE
VENTURE WAY
PARK WAY
MALCOLM ROAD
CENTURY DRIVE
JARRAH DRIVE
BAXTER DRIVE
MACBETH STREET
LAKEWOOD BOULEVARD
ENDEAVOUR WAY
CRAWFORD STREET
INDUSTRIAL DRIVE
HELENKOB DRIVE
CANTERBURY ROAD
LEVI DRIVE
GRAHAM DAFF BOULEVARD
BRADY CLOSE
BATE DRIVE
GOVERNOR ROAD
MITTA AVENUE
DEERWATER DRIVE
BURDEKIN BOULEVARD
HOPE COURT
BROADWATER DRIVE
LAKE KING CIRCLE
MERRI DRIVE
WATERSIDE DRIVE
MULGA LANE
BULOKE LANE
ISLAND POINT AVENUE
LORIKEET LANE
SERPENTINE COURT
THE OUTLOOK
KING SOUND CLOSE
MORDIALLOC CREEK
SARA PLACE
WELLS ROAD
FORBES DRIVE
AMOTT COURT
ARKWSON COURT
SUTHERLAND AVENUE
DAWSON COURT
DENAHY COURT
THE SANDS
REEF COURT
ATLANTIS COURT
JACKIE COURT
BOWEN PARK WAY
LINDY COURT
PACIFIC DRIVE
MAIDENHAIR MEWS
GHIRAN CLOSE
JADE COURT
CARLA COURT
HAVEN COURT
NARELLE DRIVE
HICKMAN AVENUE
CHRIS COURT
KEATON WAY
GRIFLAMME COURT
LANGSLOW ROAD
Legend
Victorian Biodiversity Atlas significant species records (non-avifauna)
Watercourses
Road
Project boundary
PRELIMINARY
Map: 2135645A_GIS_472_A2
Author: MB
Date: 30/05/2017
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Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016
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1:10,000
Coordinate system: GDA 1994 MGA Zone 55
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Engineering and Technical Services
Mordialloc Bypass
Local significant species records (non-avifauna) 2km
Map 2
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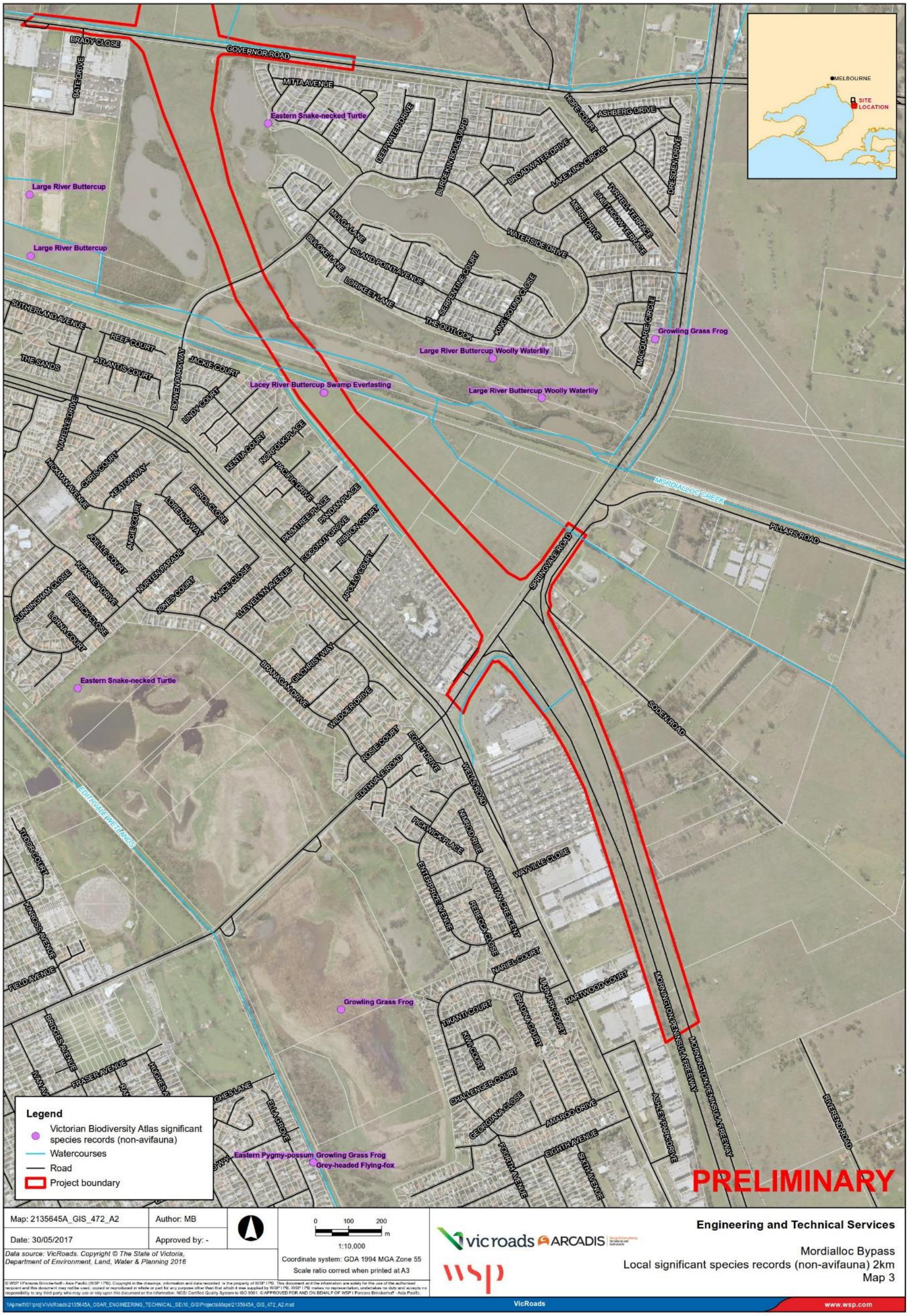
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BATE DRIVE
GOVERNOR ROAD
MITTA AVENUE
Eastern Snake-necked Turtle
DEERWATER DRIVE
BURDEKIN BOULEVARD
HOPE COURT
ASHBERG DRIVE
BROADWATER DRIVE
LAKE KING CIRCLE
DRESDEN DRIVE
TYRRELL TERRACE
LINLITHGOW TERRACE
MERRI DRIVE
WATERSIDE DRIVE
MULGA LANE
BULOKE LANE
ISLAND POINT AVENUE
LORIKEET LANE
SERPENTINE COURT
THE OUTLOOK
KING SOUND CLOSE
MACQUARIE CIRCLE
Growling Grass Frog
Large River Buttercup
Large River Buttercup
Large River Buttercup Woolly Waterlily
Large River Buttercup Woolly Waterlily
Lacey River Buttercup Swamp Everlasting
SUTHERLAND AVENUE
REEF COURT
THE SANDS
ATLANTIS COURT
JACKIE COURT
BOWEN PARK WAY
LINDY COURT
KENTIA COURT
NORFOLK PLACE
PACIFIC DRIVE
PALM TREE PLACE
PANDAN PLACE
COCONUT GROVE
RIBBON COURT
APOLLO COURT
NAREWA DRIVE
HICKMAN AVENUE
CHRIS COURT
KEATON WAY
ERROL CLOSE
LORENZO WAY
ANGLE COURT
JOELLE COURT
KEARNEY DRIVE
NURTEN PARADE
JONES COURT
LANCE CLOSE
LLEWELLYN AVENUE
CUNNINGHAM CLOSE
DERRICK CLOSE
LORNA COURT
Eastern Snake-necked Turtle
BRANAGAN DRIVE
GILCHRIST WAY
WILDOER DRIVE
ROSIE COURT
EDITH VALE ROAD
EGRET DRIVE
WELLS ROAD
PICKWICK PLACE
NIMROD RISE
ENTERPRIZE AVENUE
REBECCA CLOSE
ARMISTAN CRESCENT
WAYVILLE CLOSE
MORDIALLOC CREEK
PILLARS ROAD
SPRINGVALE ROAD
SODEN ROAD
EDITH VALE WETLANDS
TUDOR COURT
KINROSS AVENUE
FIELD AVENUE
BRIDGES AVENUE
FRASER AVENUE
GHES LANE
ELLA GROVE
Growling Grass Frog
NARIEL COURT
TIKANTI COURT
KIWI COURT
BRADMA COURT
LASMARK COURT
HARTWOOD COURT
CHALLENGER COURT
GEORGIANA CLOSE
AMAROO DRIVE
EIGHTH AVENUE
SIXTH AVENUE
FOURTH AVENUE
ASHLEY PARK DRIVE
MORNINGTON PENINSULA FREEWAY
MORNINGTON PENINSULA FREEWAY
RIVERENDROAD
Eastern Pygmy-possum
Grey-headed Flying-fox
Growling Grass Frog
MELBOURNE
SITE LOCATION
Legend
Victorian Biodiversity Atlas significant species records (non-avifauna)
Watercourses
Road
Project boundary
PRELIMINARY
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Engineering and Technical Services
Mordialloc Bypass
Local significant species records (non-avifauna) 2km
Map 3
VicRoads
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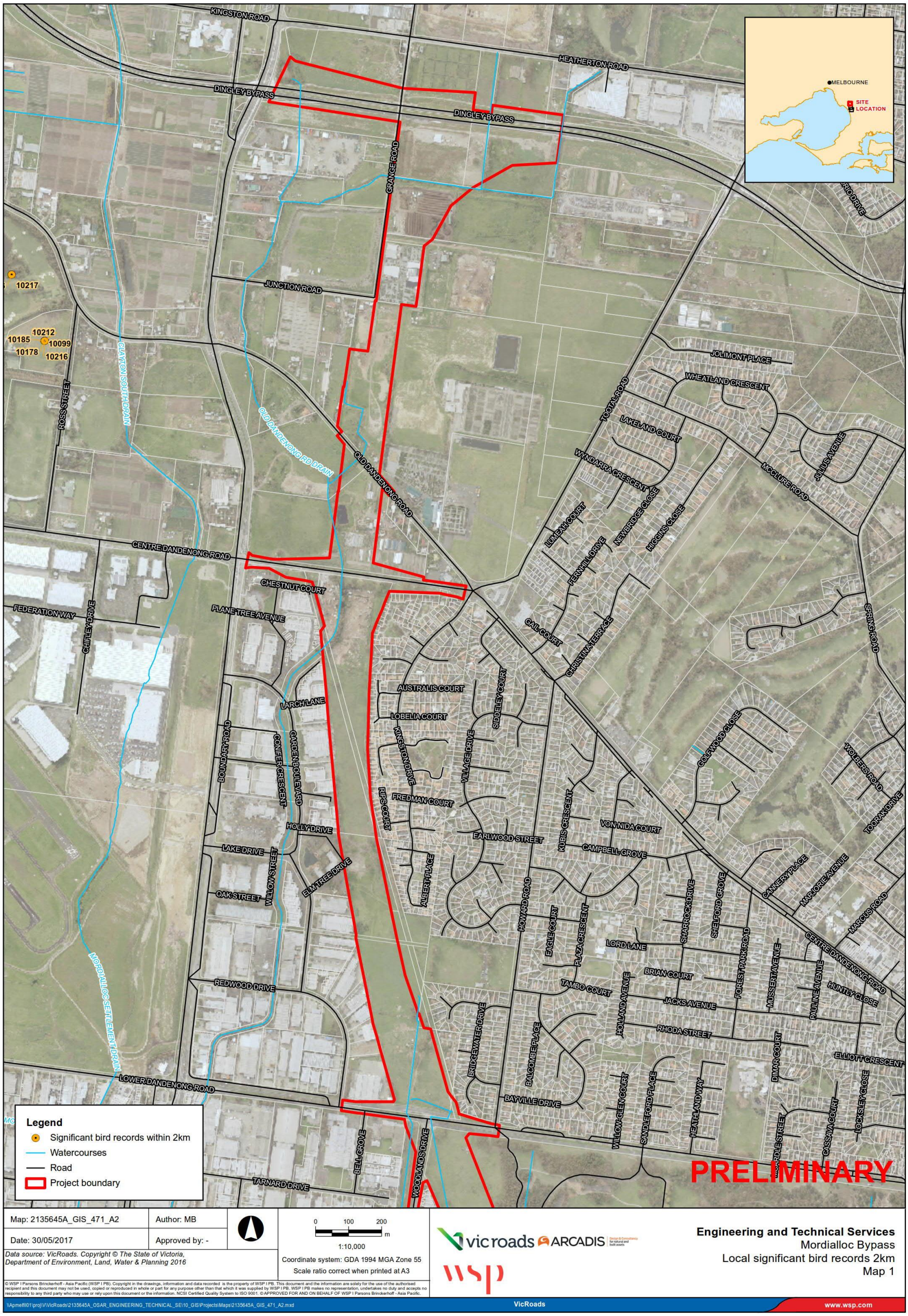
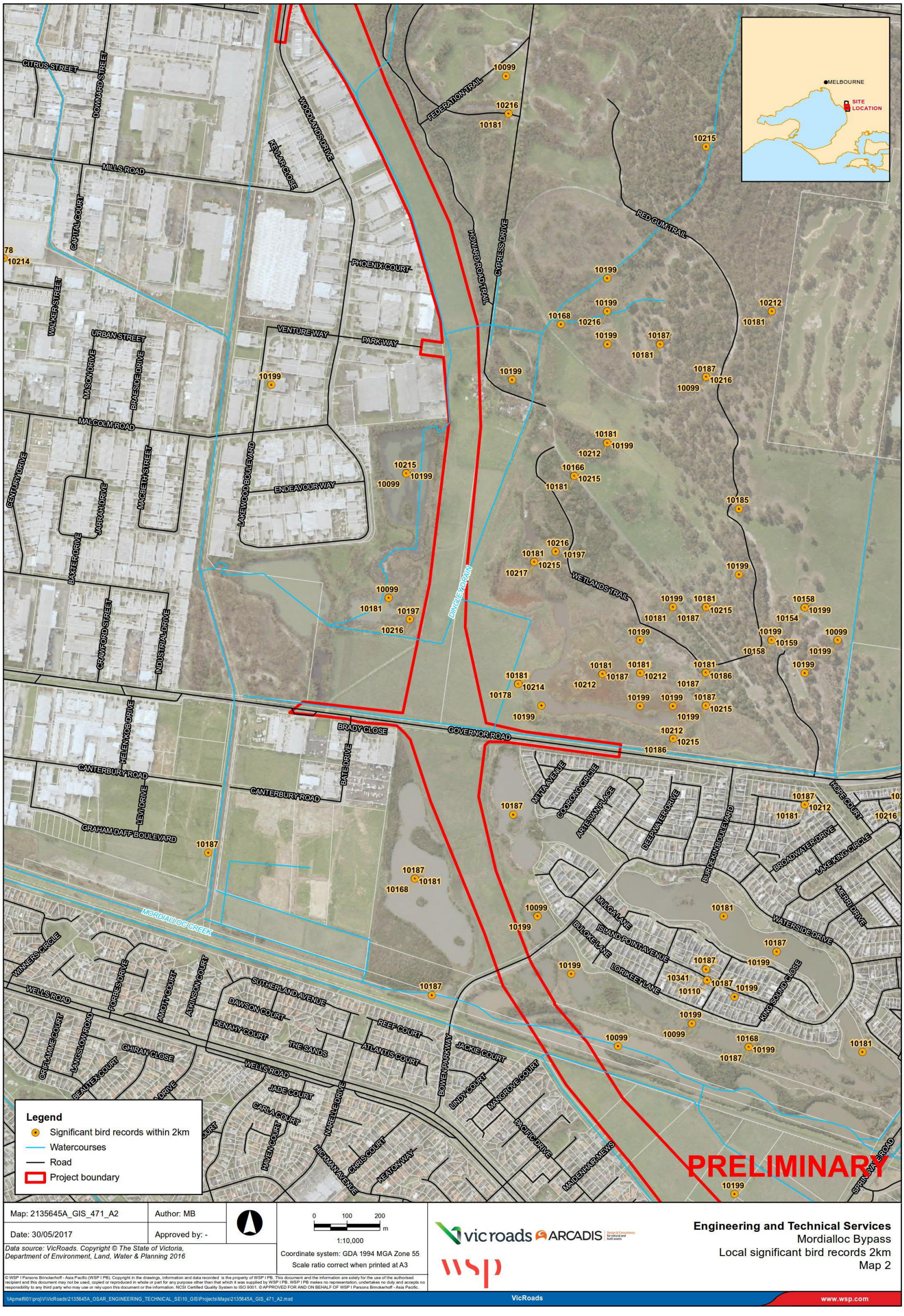


Figure 5. Significant bird species recorded within 2 km of the project area since 1997 (key provided after figures).


MELBOURNE
SITE LOCATION
CITRUS STREET
DOWNARD STREET
MILLS ROAD
CAPITAL COURT
KELVIN CLOSE
WOODLANDS DRIVE
FEDERATION TRAIL
HOWARD ROAD TRAIL
CYPRESS DRIVE
RED GUM TRAIL
PHOENIX COURT
WALKER STREET
URBAN STREET
MASON DRIVE
BRAESIDE DRIVE
VENTURE WAY
PARK WAY
MALCOLM ROAD
CENTURY DRIVE
JARRAH DRIVE
BAXTER DRIVE
MACBETH STREET
LAKEWOOD BOULEVARD
ENDEAVOUR WAY
CRAWFORD STREET
INDUSTRIAL DRIVE
DINGLEY DRAIN
WETLANDS TRAIL
BRADY CLOSE
GOVERNOR ROAD
HELEN KOB DRIVE
CANTERBURY ROAD
LEVI DRIVE
GRAHAM DAFF BOULEVARD
BATE DRIVE
MORDIALLOC CREEK
MILITA AVENUE
COORONG CIRCLE
ARTESIAN PLACE
BEEPWATER DRIVE
BURDEKIN BOULEVARD
HOPE COURT
BROADWATER DRIVE
LAKE KING CIRCLE
MERRI DRIVE
WATERSIDE DRIVE
MULGA LANE
BULOKE LANE
ISLAND POINT AVENUE
LORIKEET LANE
KING SOUND CLOSE
WINNERS CIRCLE
WELLS ROAD
FORBES DRIVE
AMOTT COURT
ATKINSON COURT
SUTHERLAND AVENUE
DAWSON COURT
DENAHY COURT
REEF COURT
THE SANDS
ATLANTIS COURT
BOWEN PARKWAY
JACKIE COURT
LINDY COURT
MANGROVE COURT
PACIFIC DRIVE
MAIDENHAIR MEWS
ORIFLAMME COURT
LANGSLOW ROAD
BEAUTEX COURT
GHIRAN CLOSE
JADE COURT
CARLA COURT
HAVEN COURT
NARELLE DRIVE
HICKMAN AVENUE
CHRIS COURT
KEATON WAY
10099
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10110
10154
10158
10159
10212
10216
PRELIMINARY
Legend
Significant bird records within 2km
Watercourses
Road
Project boundary
Map: 2135645A_GIS_471_A2
Author: MB
Date: 30/05/2017
Approved by: -
Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016
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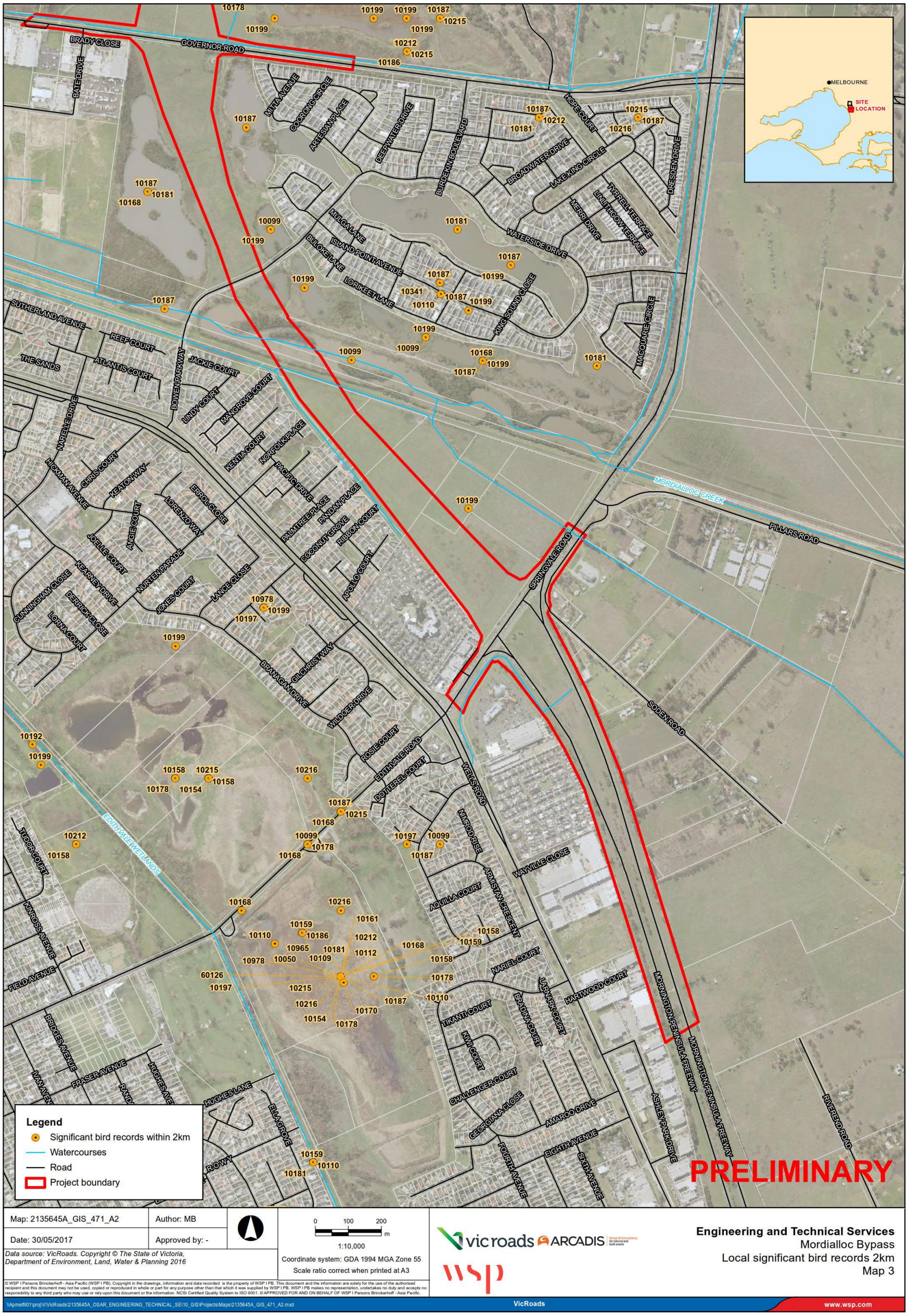
Local significant bird records 2km
Map 2


MELBOURNE
SITE LOCATION
GOVERNOR ROAD
BRADY CLOSE
BATE DRIVE
MITTA AVENUE
COORONG CIRCLE
ARTESIAN PLACE
DEEPWATER DRIVE
BURDEKIN BOULEVARD
HOPE COURT
BROADWATER DRIVE
LAKE KING CIRCLE
DRESDEN DRIVE
TYRRELL TERRACE
LINLITHGOW TERRACE
MERRI DRIVE
WATERSIDE DRIVE
MULGA LANE
BULOKE LANE
ISLAND POINT AVENUE
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MANGROVE COURT
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CHRIS COURT
KEATON WAY
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NORFOLK PLACE
PACIFIC DRIVE
PALMTREE PLACE
PANDAN PLACE
COCONUT GROVE
RIBBON COURT
ERROL CLOSE
LORENZO WAY
ANGIE COURT
JOELLE COURT
KEARNEY DRIVE
NURTEN PARADE
LANCE CLOSE
JONES COURT
APOLLO COURT
GUNNINGHAM CLOSE
DERRICK CLOSE
LORNA COURT
BRANAGAN DRIVE
GILCHRIST WAY
WILDOER DRIVE
ROSIE COURT
EDITHVALE ROAD
DOITEREL COURT
WELLS ROAD
NIMROD RISE
ARMISTEAD CRESCENT
WAYVILLE CLOSE
AQUILLA COURT
NARIEL COURT
HARTWOOD COURT
LARKMARK COURT
BRADMA COURT
TIKANTI COURT
KIWI COURT
CHALLENGER COURT
GEORGIANA CLOSE
AMAROO DRIVE
EIGHTH AVENUE
SIXTH AVENUE
FOURTH AVENUE
ASHLEY PARK DRIVE
MORNINGTON PENINSULA FREEWAY
RIVERENDROAD
SODEN ROAD
SPRINGVALE ROAD
PILLARS ROAD
MORDIALLOC CREEK
EDITHVALE WETLANDS
KINROSS AVENUE
TUDOR COURT
FIELD AVENUE
BRIDGES AVENUE
FRASER AVENUE
HUGHES AVE
HUGHES LANE
ELLAGROVE
ROWAY
NAN AVEN
10178 10199 10199 10187 10215 10199 10212 10215 10186 10187 10181 10168 10099 10199 10181 10187 10199 10187 10341 10187 10199 10110 10199 10099 10099 10168 10199 10187 10187 10212 10216 10187 10212 10181 10215 10187 10216 10187 10181 10187 10199 10187 10199 10187 10215 10168 10099 10178 10168 10197 10099 10187 10199 10978 10199 10197 10199 10192 10199 10158 10215 10158 10178 10154 10216 10187 10215 10168 10212 10158 10216 10161 10159 10110 10186 10212 10168 10965 10181 10112 10159 10978 10050 10109 10158 60126 10178 10197 10215 10216 10187 10110 10170 10154 10178 10159 10110 10181
Legend
Significant bird records within 2km
Watercourses
Road
Project boundary
PRELIMINARY
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Coordinate system: GDA 1994 MGA Zone 55
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vicroads ARCADIS
wsp
Engineering and Technical Services
Mordialloc Bypass
Local significant bird records 2km
Map 3
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MAP KEY

Table of the species shown in the Figure 3 series: Significant bird species recorded within 2 km of the project area since 1997.

TAXON ID	SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS
10018	*Turnix velox*	Little Button-quail	nt
10019	*Turnix pyrrhothorax*	Red-chested Button-quail	vu L
10045	*Lewinia pectoralis pectoralis*	Lewin's Rail	vu L
10050	*Porzana pusilla palustris*	Baillon's Crake	vu L
10099	*Phalacrocorax varius*	Pied Cormorant	nt
10109	*Chlidonias leucopterus*	White-winged Black Tern	nt
10110	*Chlidonias hybridus javanicus*	Whiskered Tern	nt
10112	*Hydroprogne caspia*	Caspian Tern	nt L
10154	*Tringa glareola*	Wood Sandpiper	vu
10157	*Actitis hypoleucos*	Common Sandpiper	vu
10158	*Tringa nebularia*	Common Greenshank	vu
10159	*Tringa stagnatilis*	Marsh Sandpiper	vu
10161	*Calidris ferruginea*	Curlew Sandpiper	CR en
10166	*Calidris alba*	Sanderling	nt
10168	*Gallinago hardwickii*	Latham's Snipe	nt
10170	*Rostratula australis*	Australian Painted Snipe	VU cr L
10178	*Plegadis falcinellus*	Glossy Ibis	nt
10181	*Platalea regia*	Royal Spoonbill	nt
10185	*Egretta garzetta nigripes*	Little Egret	en L
10186	*Ardea intermedia*	Intermediate Egret	en L
10187	*Ardea modesta*	Eastern Great Egret	vu L
10192	*Nycticorax caledonicus hillii*	Nankeen Night Heron	nt
10195	*Ixobrychus minutus dubius*	Little Bittern	en L
10197	*Botaurus poiciloptilus*	Australasian Bittern	EN en L
10199	*Anseranas semipalmata*	Magpie Goose	nt L
10212	*Anas rhynchotis*	Australasian Shoveler	vu
10214	*Stictonetta naevosa*	Freckled Duck	en L
10215	*Aythya australis*	Hardhead	vu
10216	*Oxyura australis*	Blue-billed Duck	en L
10217	*Biziura lobata*	Musk Duck	vu
10218	*Circus assimilis*	Spotted Harrier	nt
10238	*Falco subniger*	Black Falcon	vu
10311	*Pezoporus wallicus wallicus*	Ground Parrot	en L
10334	*Hirundapus caudacutus*	White-throated Needletail	vu
10341	*Chrysococcyx osculans*	Black-eared Cuckoo	nt
10443	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler	en L
10504	*Chthonicola sagittatus*	Speckled Warbler	vu L
10652	*Stagonopleura guttata*	Diamond Firetail	nt L
10965	*Calidris subminuta*	Long-toed Stint	nt
10978	*Calidris melanotos*	Pectoral Sandpiper	nt
60126	*Larus pacificus pacificus*	Pacific Gull	nt

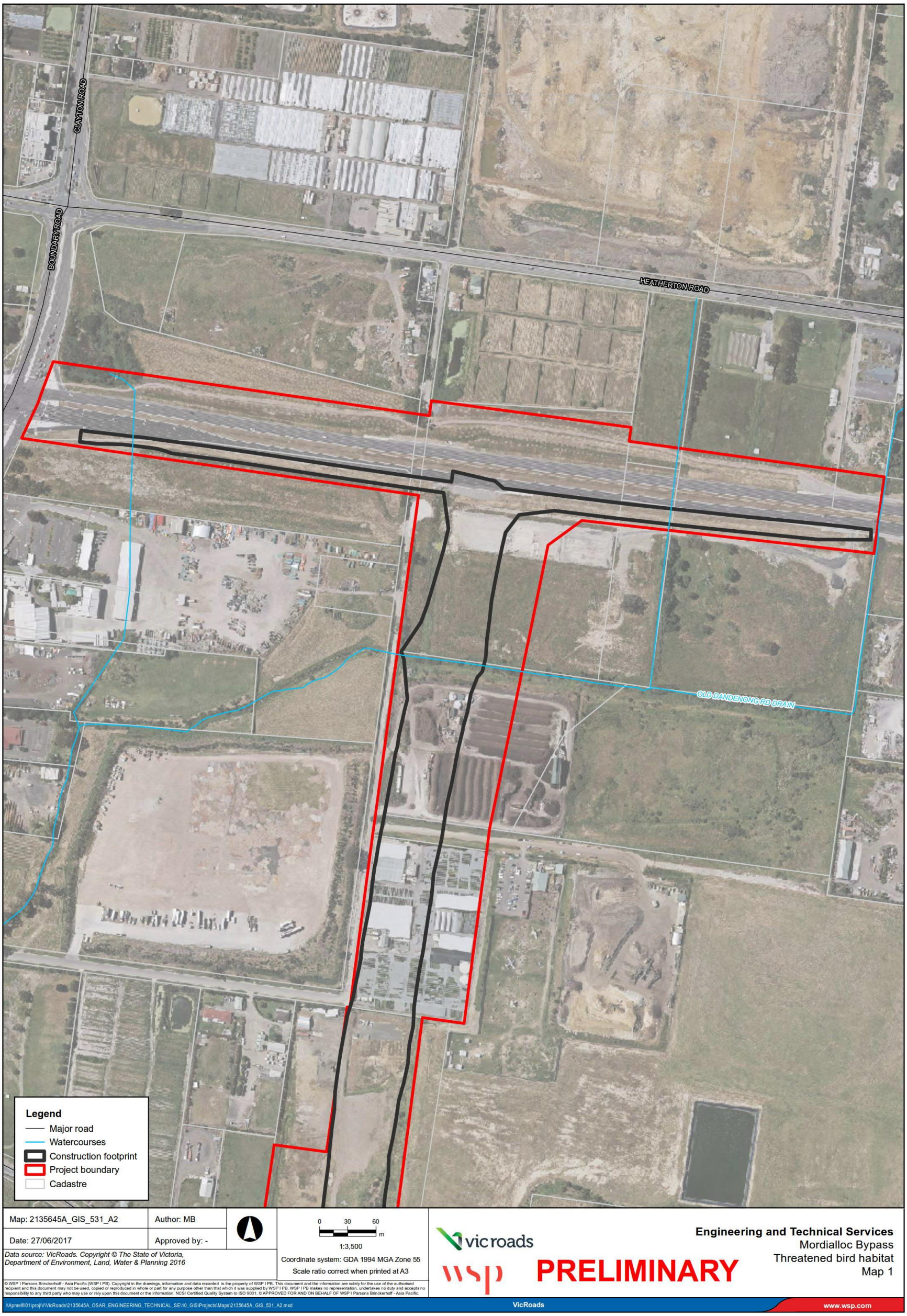

Figure 6. Threatened Bird Habitat at the project area, mapped by (Biosis 2013)


CLAYTON SOUTH DRAIN
CENTRE DANDENONG ROAD
BOUNDARY ROAD
OLD DANDENONG RD DRAIN
OLD DANDENONG ROAD
Legend
Major road
Watercourses
Construction footprint
Project boundary
Cadastre
Map: 2135645A_GIS_531_A2
Author: MB
Date: 27/06/2017
Approved by: -
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Coordinate system: GDA 1994 MGA Zone 55
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LOWER DANDENONG ROAD
Legend
Major road
Watercourses
Threatened bird habitats - Biosis (2013)
Crakes, Bitterns and Rails
Threatened bird habitats - Biosis (2013)
Latham's Snipe
Construction footprint
Project boundary
Cadastre
Map: 2135645A_GIS_531_A2
Author: MB
Date: 27/06/2017
Approved by: -
Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016
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Threatened bird habitat
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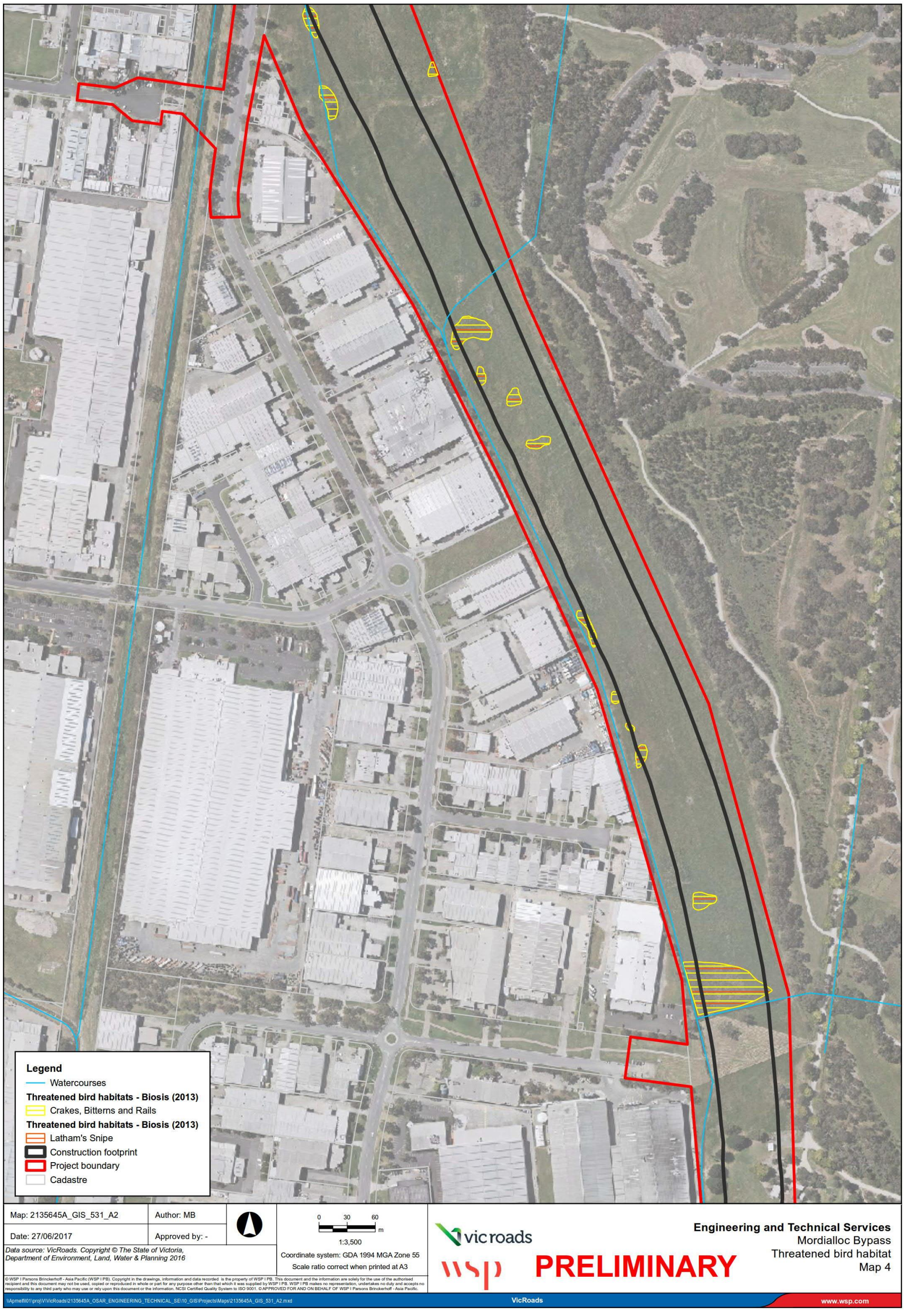
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Watercourses
Threatened bird habitats - Biosis (2013)
Crakes, Bitterns and Rails
Threatened bird habitats - Biosis (2013)
Latham's Snipe
Construction footprint
Project boundary
Cadastre
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PRELIMINARY
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Threatened bird habitat
Map 4
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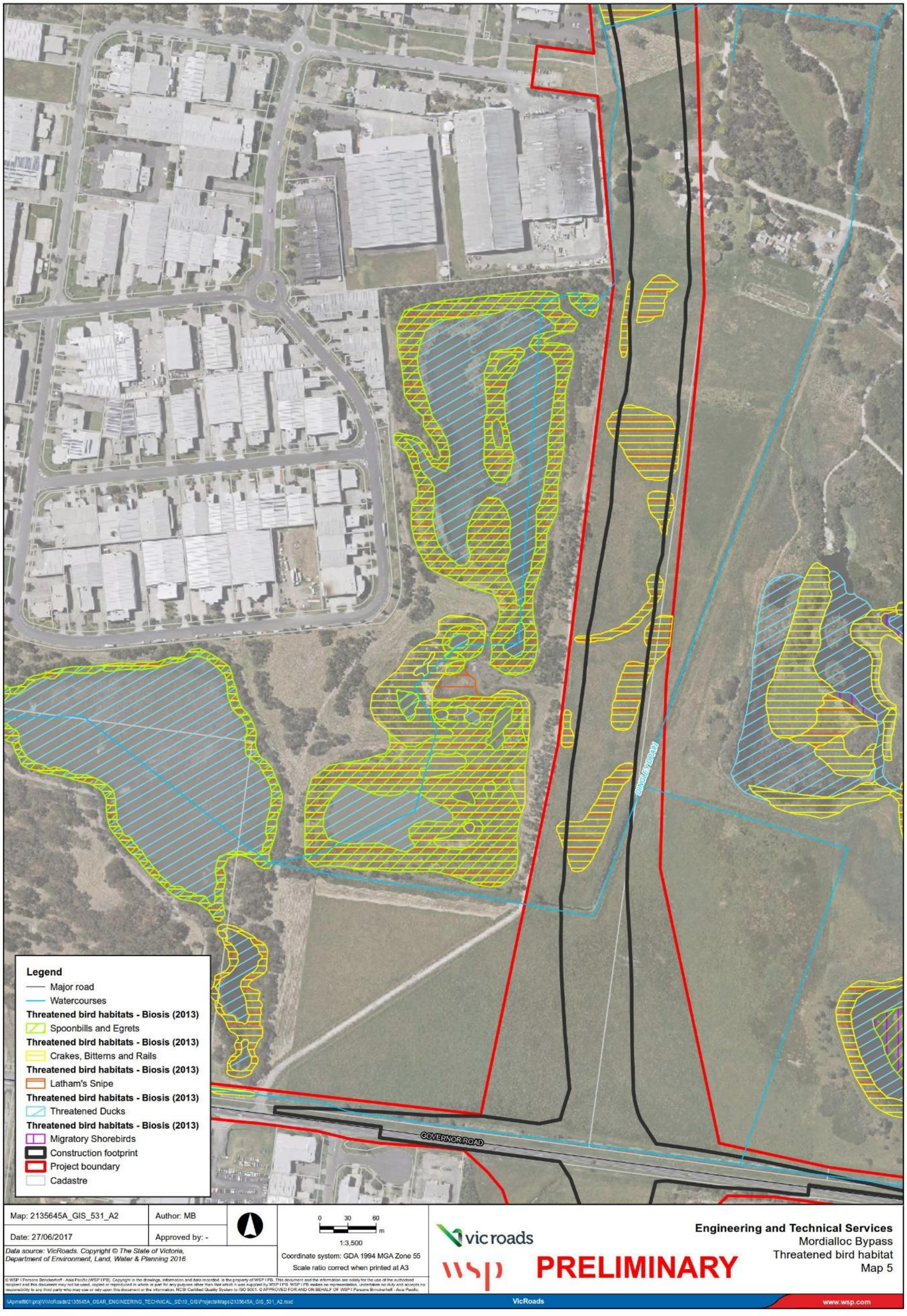
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Major road
Watercourses
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Spoonbills and Egrets
Threatened bird habitats - Biosis (2013)
Crakes, Bitterns and Rails
Threatened bird habitats - Biosis (2013)
Latham's Snipe
Threatened bird habitats - Biosis (2013)
Threatened Ducks
Threatened bird habitats - Biosis (2013)
Migratory Shorebirds
Construction footprint
Project boundary
Cadastre
DINGLEYDALE
GOVERNOR ROAD
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Engineering and Technical Services
Mordialloc Bypass
Threatened bird habitat
Map 5
VicRoads
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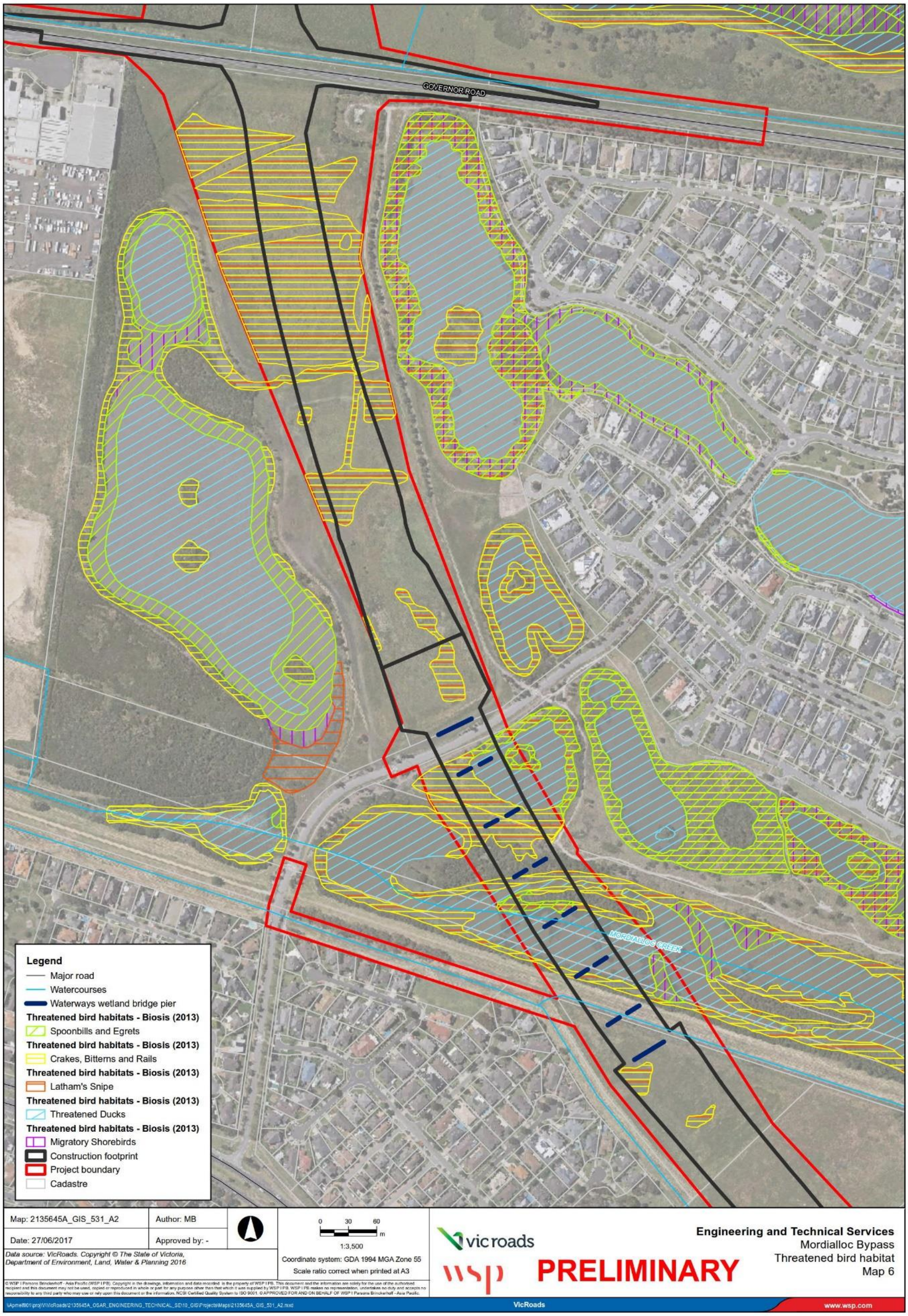
GOVERNOR ROAD
MORDIALLOC CREEK
Legend
Major road
Watercourses
Waterways wetland bridge pier
Threatened bird habitats - Biosis (2013)
Spoonbills and Egrets
Threatened bird habitats - Biosis (2013)
Crakes, Bitterns and Rails
Threatened bird habitats - Biosis (2013)
Latham's Snipe
Threatened bird habitats - Biosis (2013)
Threatened Ducks
Threatened bird habitats - Biosis (2013)
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Map 6
VicRoads
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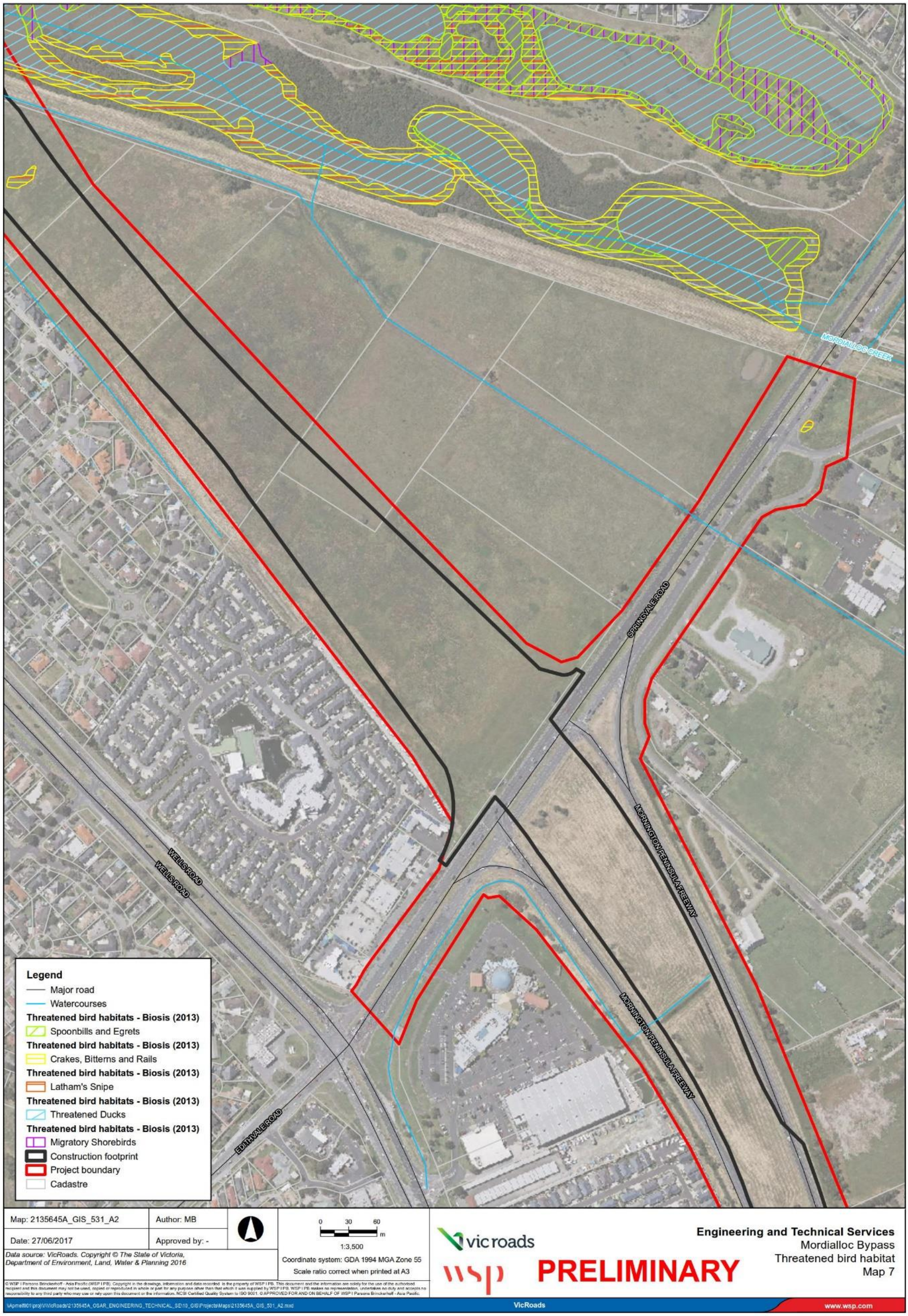
MORDIALLOC CREEK
SPRINGVALE ROAD
WELLS ROAD
WELLS ROAD
MORNINGTON PENINSULA FREEWAY
MORNINGTON PENINSULA FREEWAY
EDITH VALE ROAD
Legend
Major road
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Threatened bird habitats - Biosis (2013)
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Date: 27/06/2017
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Coordinate system: GDA 1994 MGA Zone 55
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SPRINGVALE ROAD
MORNINGTON PENINSULA FREEWAY
WELLS ROAD
MORNINGTON PENINSULA FREEWAY
Legend
Major road
Watercourses
Construction footprint
Project boundary
Cadastre
Map: 2135645A_GIS_531_A2
Author: MB
Date: 27/06/2017
Approved by: -
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Coordinate system: GDA 1994 MGA Zone 55
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Threatened bird habitat
Map 8
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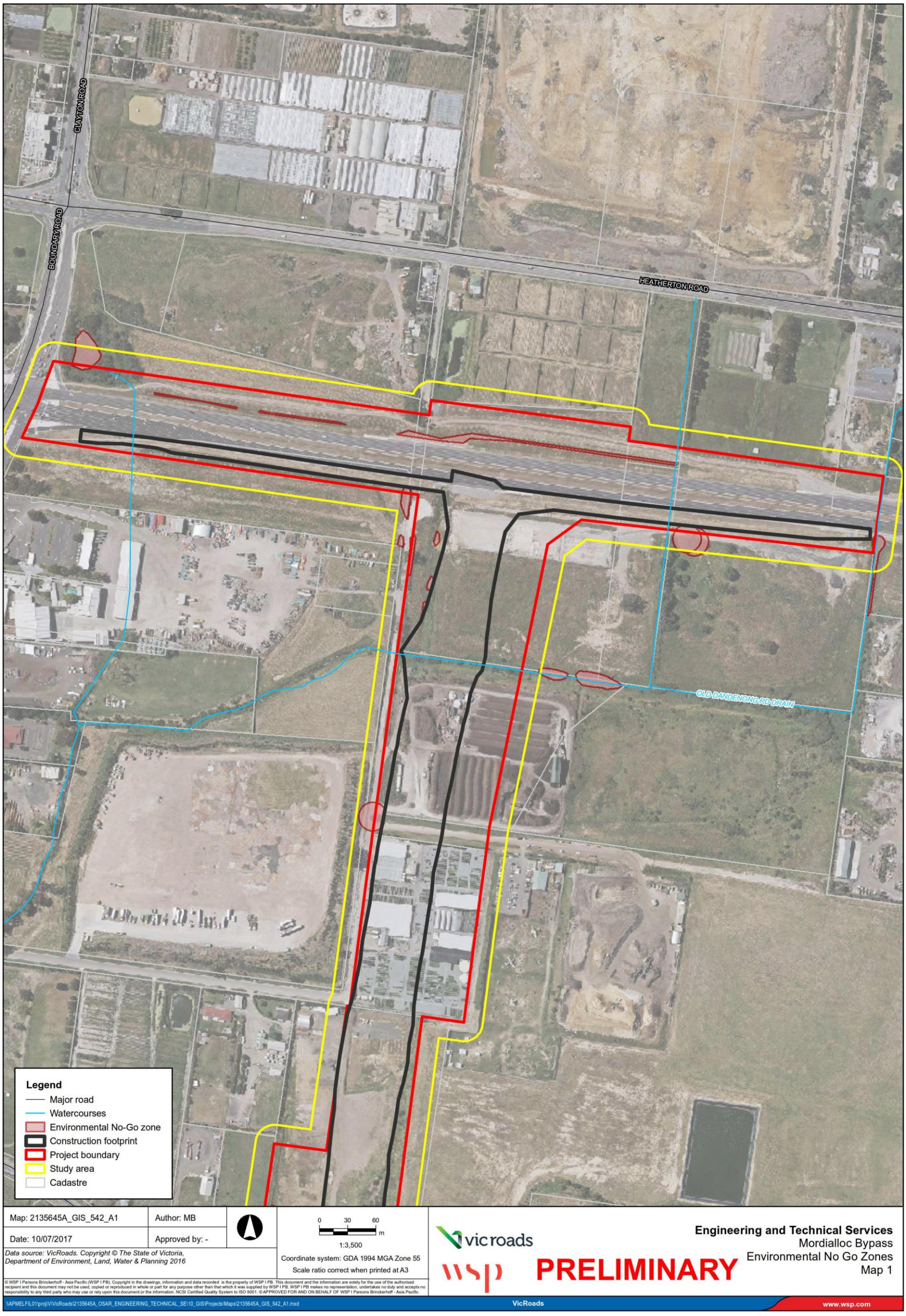
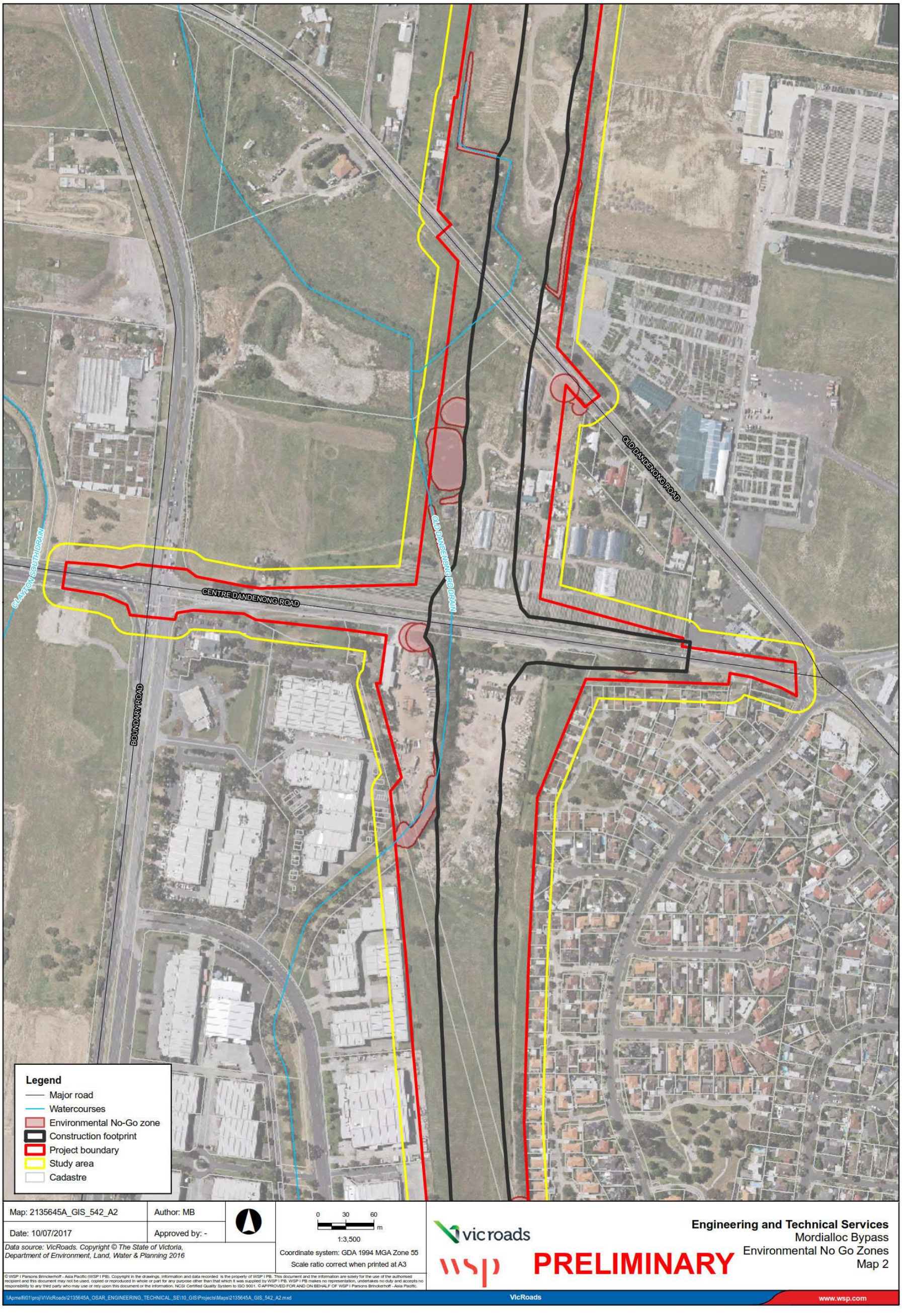


Figure 7. Envrionmental No-Go Zones


CLAYTON SOUTH DRAIN
CENTRE DANDENONG ROAD
BOUNDARY ROAD
OLD DANDENONG RD DRAIN
OLD DANDENONG ROAD
Legend
Major road
Watercourses
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A2
Author: MB
Date: 10/07/2017
Approved by: -
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Map 2
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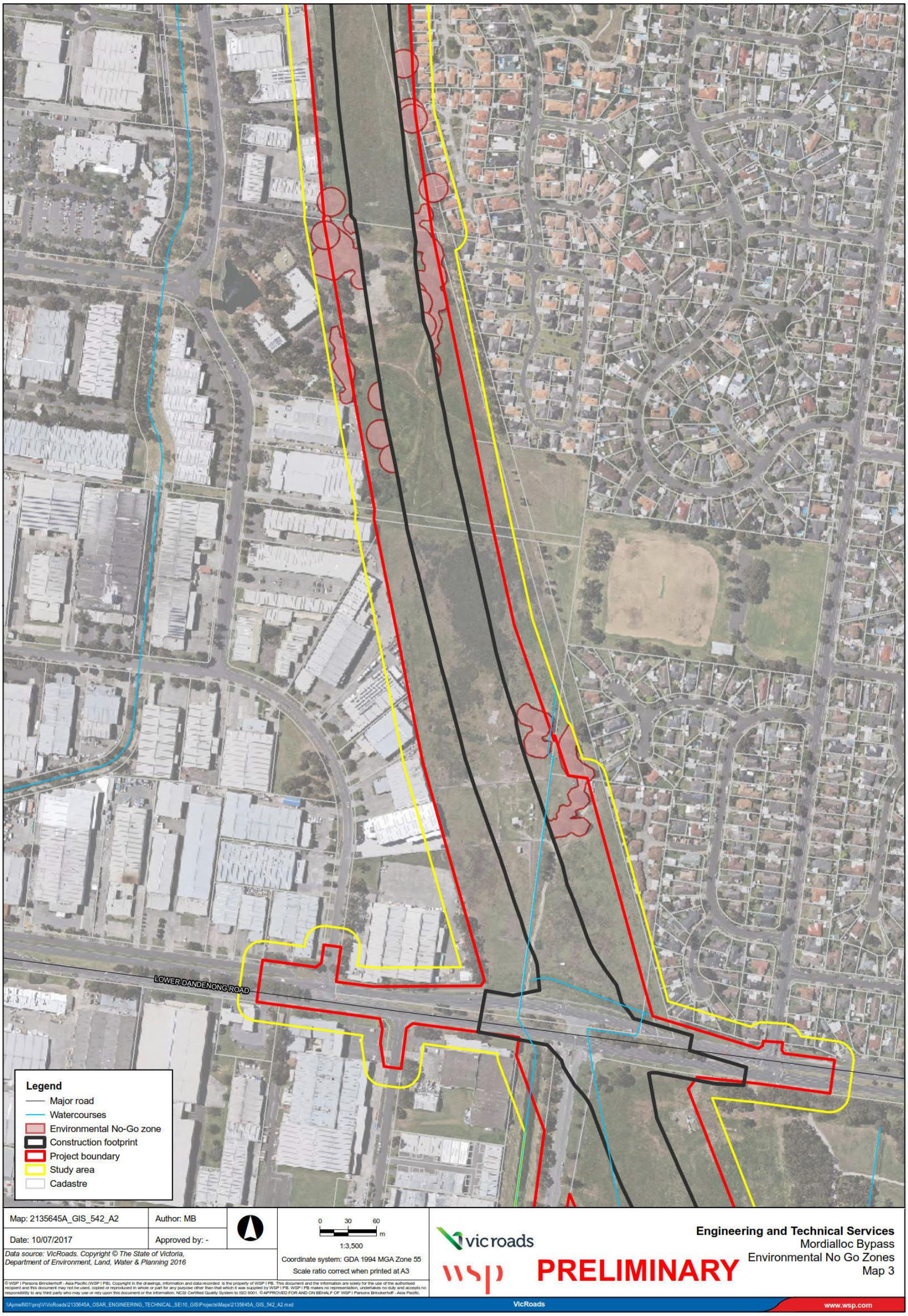
LOWER DANDENONG ROAD
Legend
Major road
Watercourses
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A2
Author: MB
Date: 10/07/2017
Approved by: -
Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016
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Coordinate system: GDA 1994 MGA Zone 55
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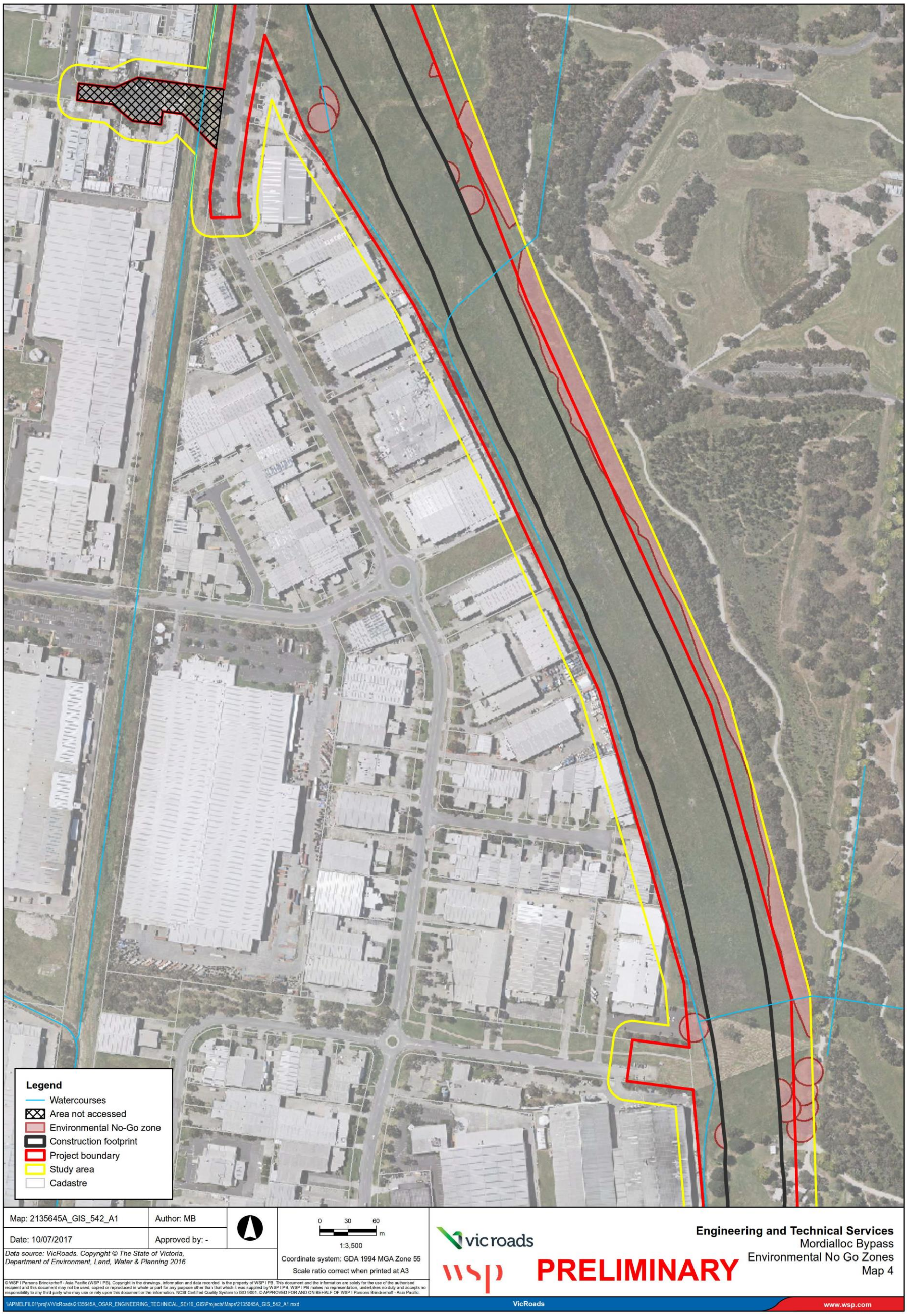
Legend
Watercourses
Area not accessed
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A1
Author: MB
Date: 10/07/2017
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Environmental No Go Zones
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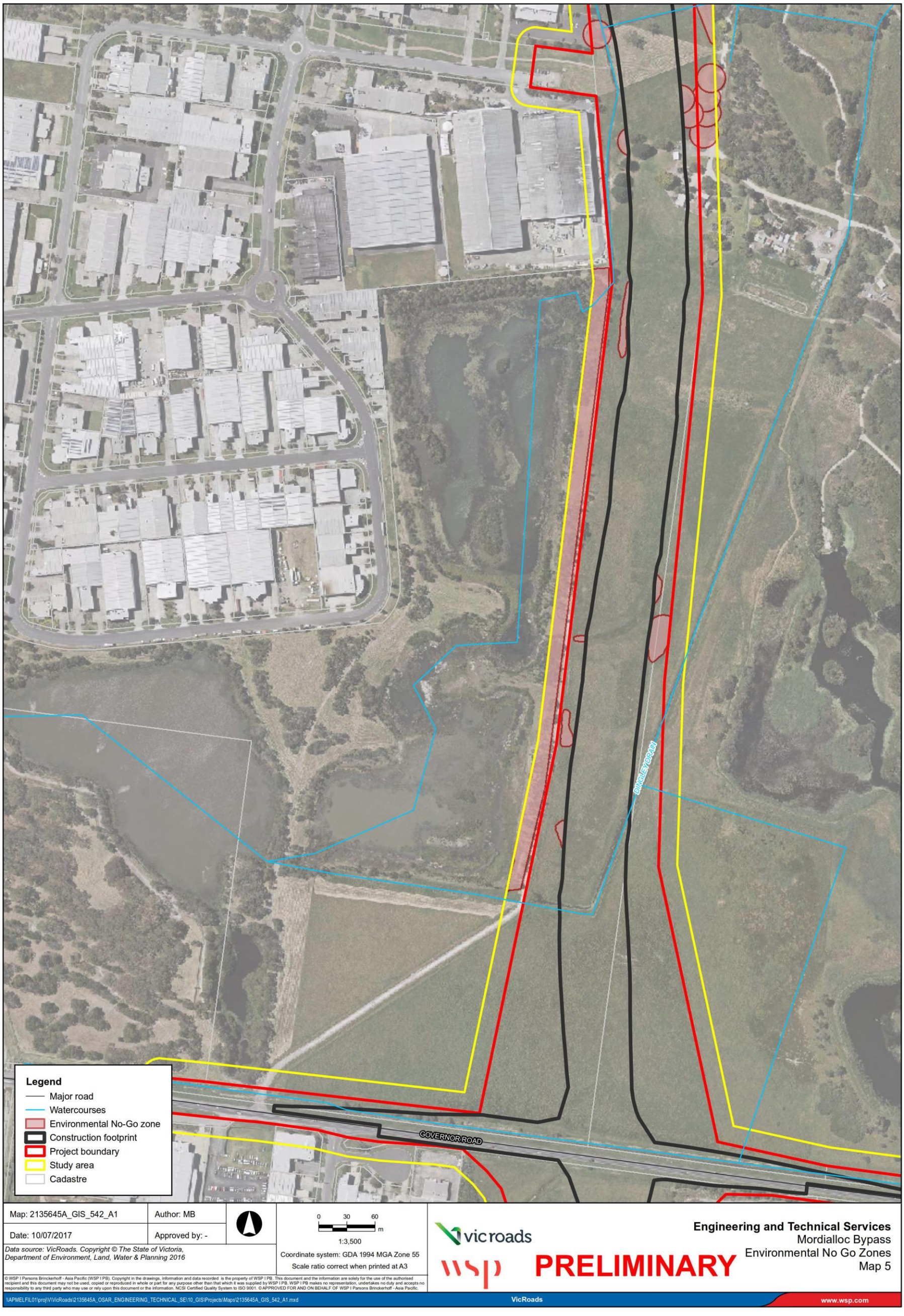
DINGLEYDALE
GOVERNOR ROAD
Legend
Major road
Watercourses
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A1
Author: MB
Date: 10/07/2017
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Data source: VicRoads. Copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2016
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Coordinate system: GDA 1994 MGA Zone 55
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Map 5
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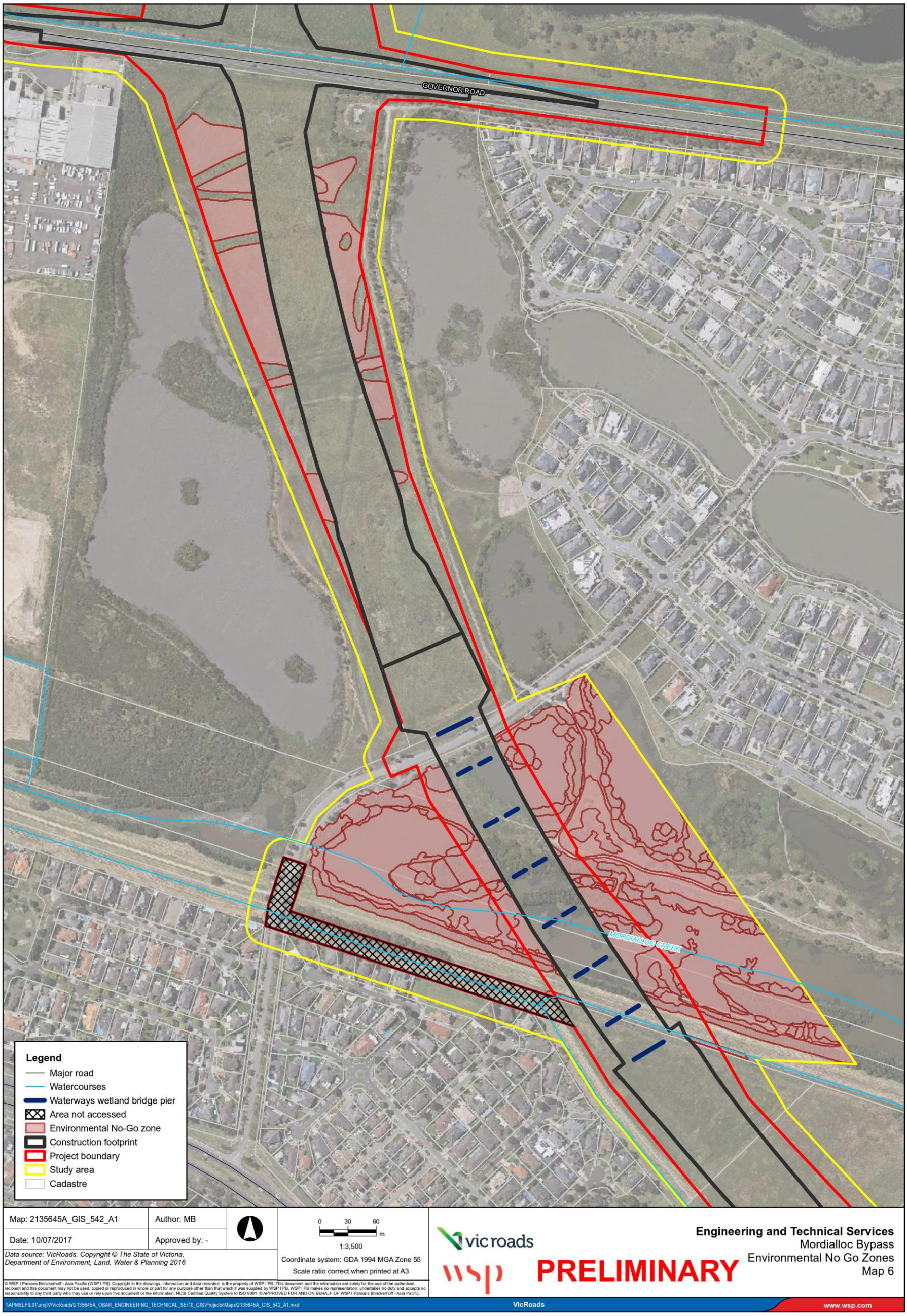
GOVERNOR ROAD
MORDIALLOC CREEK
Legend
Major road
Watercourses
Waterways wetland bridge pier
Area not accessed
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A1
Author: MB
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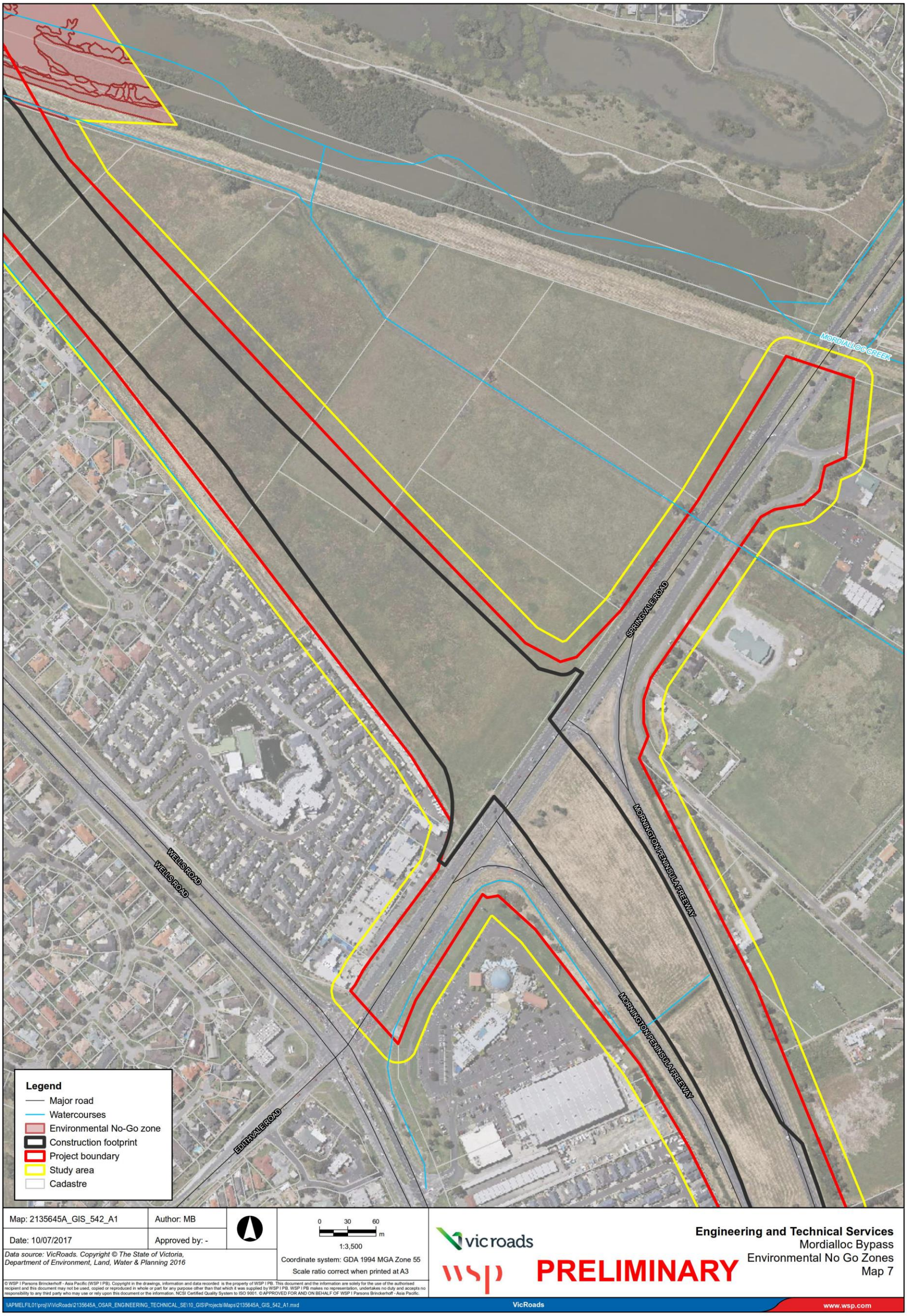
MORDIALLOC CREEK
SPRINGVALE ROAD
MORNINGTON PENINSULA FREEWAY
WELLS ROAD
WELLS ROAD
EDITH VALE ROAD
Legend
Major road
Watercourses
Environmental No-Go zone
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A1
Author: MB
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Coordinate system: GDA 1994 MGA Zone 55
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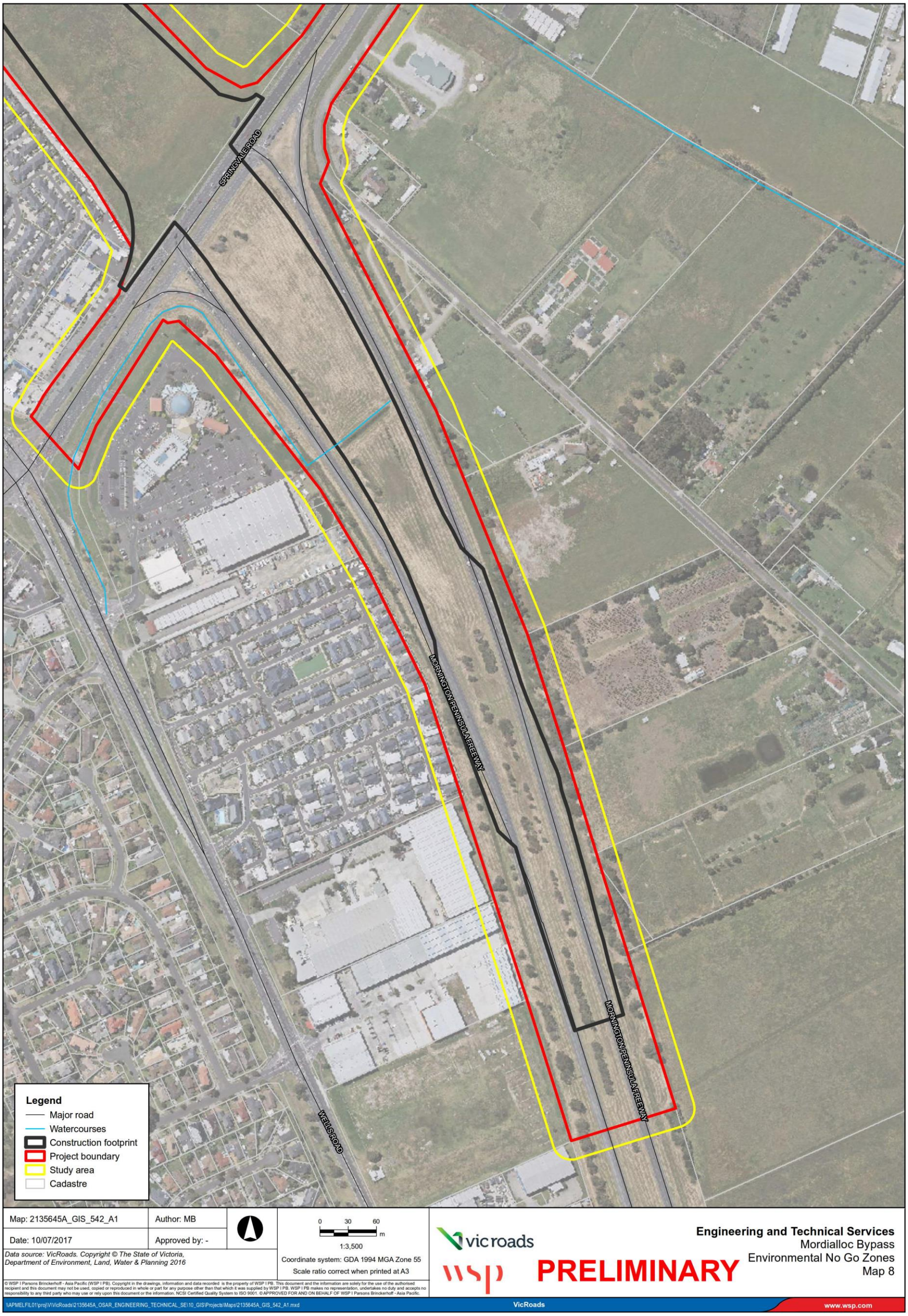
SPRINGVALE ROAD
MORNINGTON PENINSULA FREEWAY
MORNINGTON PENINSULA FREEWAY
WELLS ROAD
Legend
Major road
Watercourses
Construction footprint
Project boundary
Study area
Cadastre
Map: 2135645A_GIS_542_A1
Author: MB
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Appendix B

FLORA SPECIES LISTS AND PLOT DATA

B.1 FLORA LIST

Table B.1 provides a full list of species recorded within the project area, both within plots and incidentally. It also includes the species recorded by Biosis (2015).

As key to the A.1 and A.2 tables is provided at the end of Appendix B.

Table B.1 Flora species list

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Acacia baileyana	Cootamundra Wattle	* P	-								x		
Acacia dealbata	Silver Wattle	P	-								x	x	
Acacia longifolia subsp. sophorae	Coast Wattle	#	-								x		
Acacia mearnsii	Black Wattle		-					+					
Acacia melanoxylon	Blackwood		-				+	1					x
Acacia paradoxa	Hedge Wattle		-								x		x
Acacia pycnantha	Golden Wattle		-										x
Acacia saligna	Golden Wreath Wattle	*	-								x		
Acaena novae-zelandiae	Bidgee-widgee		-	+									
Acetosella vulgaris	Sheep Sorrel	*	-										x
Agrostis capillaris	Brown-top Bent	*	-								x	x	x
Alisma plantago-aquatica	Water Plantain		-								x	x	x
Allium triquetrum	Angled Onion	*	R										x
Alopecurus pratensis	Meadow Fox-tail	*	-										x
Alternanthera denticulata s.l.	Lesser Joyweed		-	+	1								

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Amphibromus nervosus	Common Swamp Wallaby-grass		-		1	+							x
Anthoxanthum odoratum	Sweet Vernal-grass	*	-								x	x	x
Arctotheca calendula	Cape weed	*	-								x	x	x
Asphodelus fistulosus	Onion Weed	*	R	1									
Aster subulatus	Aster-weed	*	-	+	+	+		+				x	x
Atriplex prostrata	Hastate Orache	*	-		+						x	x	x
Avena barbata	Bearded Oat	*	-										x
Avena sativa	Oat	*	-										x
Baumea arthrophylla	Fine Twig-sedge		-		1	2							
Bolboschoenus caldwellii	Salt Club-sedge		-								x		x
Brassica fruticulosa	Twiggy Turnip	*	-								x	x	x
Brassica rapa	White Turnip	*	-										x
Briza minor	Lesser Quaking-grass	*	-										x
Bromus catharticus	Prairie Grass	*	-	1								x	x
Bromus diandrus	Great Brome	*	-								x	x	x
Bromus hordeaceus	Soft Brome	*	-										x
Calocephalus lacteus	Milky Beauty-heads		-			1	+						
Carex appressa	Tall Sedge		-		1			+					
Carex breviculmis	Common Grass-sedge		-					+					
Carex fascicularis	Tassel Sedge		-		+								
Carex inversa	Knob Sedge		-						+				x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Carex tereticaulis	Poong'ort		-		3	+		1					x
Cenchrus clandestinus	Kikuyu	*	-										x
Centaurium tenuiflorum	Slender Centaury	*	-	+		+	1			+			x
Cerastium glomeratum s.l.	Common Mouse-ear Chickweed	*	-										x
Chenopodium album	Fat Hen	*	-								x		
Chenopodium murale	Sowbane	*	-										x
Chloris truncata	Windmill Grass		-								x		
Cirsium vulgare	Spear Thistle	*	C					+					x
Cladium procerum	Leafy Twig-sedge	r	-								x		
Clematis microphylla s.l.	Small-leaved Clematis		-										x
Conyza sp	Fleabane	*	-										x
Coprosma repens	Mirror Bush	*	-								x		x
Coronidium gunnianum	Pale Swamp Everlasting	vu	-				+						
Cortaderia selloana	Pampas Grass	*	-								x		
Crassula helmsii	Swamp Crassula		-								x	x	x
Cycnogeton procerum (broad erect leaf variant)	Common Water-ribbons		-		+								x
Cynara cardunculus subsp. flavescens	Artichoke Thistle	*	-										x
Cynodon dactylon var. dactylon	Couch	*	-		1				1		x	x	x
Cyperus difformis	Variable Flat-sedge	#	-								x		
Cyperus eragrostis	Drain Flat-sedge	*	-	+	1								x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Cytisus scoparius	English Broom	*	C, WoNS								x		
Dactylis glomerata	Cocksfoot	*	-										x
Datura ferox	Long-spine Thorn-apple	*	C								x		
Deyeuxia quadriseta	Reed Bent-grass		-			+							
Dianella longifolia s.l.	Pale Flax-lily		-				+						
Dipogon lignosus	Common Dipogon	*	-								x		
Distichlis distichophylla	Australian Salt-grass		-	+									
Dittrichia graveolens	Stinkwort	*	C								x		
Echinochloa crus-galli	Barnyard Grass	*	-	+									
Echium plantagineum	Paterson's Curse	*	C								x	x	x
Ehrharta erecta var. erecta	Panic Veldt-grass	*	-										x
Ehrharta longiflora	Annual Veldt-grass	*	-										x
Eleocharis acuta	Common Spike-sedge		-		1	+			2			x	x
Eleocharis pusilla	Small Spike-sedge		-								x		
Eleocharis sphacelata	Tall Spike-sedge		-										x
Epilobium billardierianum	Variable Willow-herb		-	1		+						x	
Epilobium ciliatum	Glandular Willow-herb	*	-	1									
Epilobium hirtigerum	Hairy Willow-herb		-	1	+							x	
Erigeron bonariense	Flaxleaf Fleabane	*	-								x		
Erigeron spp.	Fleabane	*	-								x		
Erigeron sumatrensis	Tall Fleabane	*	-			+	+	+					
Eryngium vesiculosum	Prickfoot		-			2	1			2			x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Eucalyptus botryoides	Southern Mahogany	# P	-								x	x	
Eucalyptus camaldulensis	River Red-gum	X	-								x	x	x
Eucalyptus leucoxylon	Yellow Gum	# P	-								x	x	
Eucalyptus leucoxylon subsp. megalocarpa	Large-fruit Yellow-gum	en L # P	-								x	x	
Eucalyptus ovata	Swamp Gum		-				+					x	x
Eucalyptus viminalis subsp. pryoriana	Coast Manna-gum		-								x		x
Euchiton involucratus s.l.	Common Cudweed		-					+					
Euphorbia peplus	Petty Spurge	*	-								x		
Festuca arundinacea	Tall Fescue	*	-						1	+			x
Ficinia nodosa	Knobby Club-sedge		-								x		
Foeniculum vulgare	Fennel	*	R								x		
Fraxinus angustifolia	Desert Ash	*	-								x		x
Fumaria capreolata	White Fumitory	*	-								x		
Galenia pubescens var. pubescens	Galenia	*	-								x		x
Galium aparine	Cleavers	*	-		+							x	
Gazania linearis	Gazania	*	-								x		
Genista linifolia	Flax-leaf Broom	*	P, WoNS								x		x
Genista monspessulana	Montpellier Broom	*	C, WoNS										x
Geranium dissectum	Cut-leaf Crane's-bill	*	-								x	x	x
Geranium sp. 2	Variable Crane's-bill		-	1									

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Geranium spp.	Crane's Bill		-										x
Glycine clandestina	Twining Glycine		-	+									
Goodenia ovata	Hop Goodenia		-					+					
Grevillea robusta	Silky Oak	* P	-								x		
Hainardia cylindrica	Common Barb-grass	*	-										x
Haloragis heterophylla	Varied Raspwort		-			1	1						
Helichrysum luteoalbum	Jersey Cudweed		-					+					
Helminthotheca echioides	Ox-tongue	*	-				+	+	+	+			x
Hemarthria uncinata var. uncinata	Mat Grass		-			+	1						
Holcus lanatus	Yorkshire Fog	*	-		+						x	x	x
Hordeum leporinum	Barley-grass	*	-										x
Hypochaeris radicata	Flatweed	*	-	+		+	+	+	+			x	x
Imperata cylindrica	Blady Grass	#	-	+									
Isolepis cernua var. platycarpa	Broad-fruit Club-sedge		-										x
Isolepis inundata	Swamp Club-sedge		-								x		
Juncus acutus subsp. acutus	Spiny Rush	*	-										x
Juncus amabilis	Hollow Rush		-	+	+			+	1	+			x
Juncus articulatus subsp. articulatus	Jointed Rush	*	-										x
Juncus australis	Austral Rush		-										x
Juncus bufonius	Toad Rush		-										x
Juncus holoschoenus	Joint-leaf Rush		-								x		

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Juncus kraussii subsp. australiensis	Sea Rush		-								x		
Juncus pallidus	Pale Rush		-								x		x
Juncus sarophorus	Broom Rush		-		+							x	
Lachnagrostis filiformis s.l.	Common Blown-grass		-		+	+						x	x
Lactuca serriola	Prickly Lettuce	*	-					+				x	x
Lemna disperma	Common Duckweed		-								x	x	
Leontodon saxatilis subsp. saxatilis	Hairy Hawkbit	*	-			1	+	1	+			x	
Leontodon taraxacoides	Lesser Hawkbit	*	-										x
Lepidium africanum	Common Peppercress	*	-								x	x	x
Leptospermum laevigatum	Coast Tea-tree	#	-								x		
Leptospermum lanigerum	Woolly Tea-tree		-								x		
Leptospermum scoparium	Manuka		-					+					
Linum marginale	Native Flax		-	1			+						x
Livistona australis	Cabbage Fan-palm	vu L P	-								x		
Lobelia anceps	Angled Lobelia		-								x		
Lolium perenne	Perennial Rye-grass	*	-	1	1						x	x	x
Lolium rigidum	Wimmera Rye-grass	*	-										x
Lomandra longifolia	Spiny-headed Mat-rush		-	+			+				x		
Lotus angustissimus	Slender Bird's-foot Trefoil	*	-					+					
Lotus subbiflorus	Hairy Bird's-foot Trefoil	*	-										x
Lycium ferocissimum	African Box-thorn	*	C, WoNS								x	x	

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Lycopus australis	Australian Gipsywort		-										x
Lysimachia arvensis	Pimpernel	*	-	+									x
Lythrum hyssopifolia	Small Loosestrife		-								x	x	x
Lythrum salicaria	Purple Loosestrife		-		+								
Malva nicaeensis	Mallow of Nice	*	-										x
Malva parviflora	Small-flower Mallow	*	-										x
Malva sylvestris	Tall Mallow	*	-										x
Medicago polymorpha	Burr Medic	*	-								x		
Melaleuca armillaris subsp. armillaris	Giant Honey-myrtle	r # P	-								x	x	
Melaleuca ericifolia	Swamp Paperbark	#	-	+				4				x	x
Melilotus indicus	Sweet Melilot	*	-										x
Microlaena stipoides var. stipoides	Weeping Grass		-					1					
Modiola caroliniana	Red-flower Mallow	*	-								x		
Muellerina eucalyptoides	Creeping Mistletoe		-										x
Myriophyllum crispatum	Upright Water-milfoil		-			+							
Myriophyllum verrucosum	Red Water-milfoil		-										x
Nasturtium officinale	Watercress	*	-								x		
Olea europaea	Olive	*	-								x		
Ornduffia reniformis	Running Marsh-flower		-			1							
Oxalis incarnata	Pale Wood-sorrel	*	-								x		
Oxalis perennans	Grassland Wood-sorrel		-			+	+						

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Oxalis pes-caprae	Soursob	*	R								x		
Oxalis purpurea	Large-flower Wood-sorrel	*	-								x		
Oxalis spp.	Wood Sorrel		-					+					
Paraserianthes lophantha subsp. lophantha	Cape Wattle	*	-								x		x
Paspalum dilatatum	Paspalum	*	-			+			3	+		x	x
Paspalum distichum	Water Couch	*	-		1							x	x
Persicaria decipiens	Slender Knotweed		-		1							x	x
Persicaria hydropiper	Water Pepper		-		+								
Phalaris aquatica	Toowoomba Canary-grass	*	-	+		+			2	3	x	x	x
Phragmites australis	Common Reed		-			1	1	+				x	x
Phytolacca octandra	Red-ink Weed	*	-								x		
Plantago coronopus	Buck's-horn Plantain	*	-								x	x	x
Plantago lanceolata	Ribwort	*	-	1	+	+	1	+	1	1		x	
Plantago major	Greater Plantain	*	-								x		x
Poa annua	Annual Meadow-grass	*	-										x
Poa bulbosa	Bulbous Meadow-grass	*	-										x
Poa labillardierei	Common Tussock-grass		-	2		1	3	2					x
Poa pratensis	Kentucky Blue-grass	*	-								x		x
Polycarpon tetraphyllum	Four-leaved Allseed	*	-										x
Polygonum aviculare s.l.	Prostrate Knotweed	*	-	1									x
Polypogon monspeliensis	Annual Beard-grass	*	-										x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Pomaderris aspera	Hazel Pomaderris		-								x		
Populus alba	White Poplar	*	-								x	x	
Portulaca oleracea	Common Purslane		-								x		
Potamogeton crispus	Curly Pondweed		-										x
Potamogeton ochreatus	Blunt Pondweed		-								x		
Potamogeton tricarinatus s.l.	Floating Pondweed		-										x
Ranunculus muricatus	Sharp Buttercup	*	-										x
Ranunculus papulentus	Large River Buttercup	k	-										x
Ranunculus sceleratus subsp. sceleratus	Celery Buttercup	*	-										x
Ranunculus spp.	Buttercup		-			+							
Raphanus raphanistrum	Wild Radish	*	-	+	+							x	
Rapistrum rugosum	Giant Mustard	*	-										x
Romulea rosea	Onion Grass	*	-			+	+					x	x
Rorippa palustris	Marsh Yellow-cress	*	-		+								
Rubus fruticosus spp. agg.	Blackberry	*	C, WoNS	+				+				x	x
Rubus parvifolius	Small-leaf Bramble		-	2									
Rumex conglomeratus	Clustered Dock	*	-	+	1							x	
Rumex crispus	Curled Dock	*	-	+	1							x	x
Rytidosperma caespitosum	Common Wallaby-grass		-	+				+					x
Rytidosperma duttonianum	Brown-back Wallaby-grass		-			+				2			x
Rytidosperma semiannulare	Wetland Wallaby-grass		-			1	1						x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Rytidosperma setaceum	Bristly Wallaby-grass		-	+				+					
Salix babylonica s.l.	Weeping Willow	*	R								x		
Salpichroa origanifolia	Pampas Lily-of-the-Valley	*	C								x		
Schoenoplectus tabernaemontani	River Club-sedge		-								x		x
Senecio glomeratus	Annual Fireweed		-					+					
Senecio quadridentatus	Cotton Fireweed		-								x		
Senecio spp.	Groundsel		-			+							
Setaria parviflora	Slender Pigeon Grass	*	-										x
Setaria verticillata	Whorled Pigeon-grass	*	-								x		
Silybum marianum	Variegated Thistle	*	C								x		x
Sisyrinchium iridifolium	Striped Rush-leaf	*	-										x
Solanum aviculare	Kangaroo Apple		-					+					
Solanum laciniatum	Large Kangaroo Apple		-										x
Solanum nigrum s.l.	Black Nightshade	*	-					1					
Sonchus asper s.l.	Rough Sow-thistle	*	-	+									x
Sonchus oleraceus	Common Sow-thistle	*	-	+									x
Sporobolus africanus	Rat-tail Grass	*	-										x
Stellaria media	Chickweed	*	-								x		
Stenotaphrum secundatum	Buffalo Grass	*	-								x		
Taraxacum officinale spp. agg.	Garden Dandelion	*	-								x		
Themeda triandra	Kangaroo Grass		-	1		+	1						

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WEED STATUS	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	ADD. SPP - NTH	ADD. SPP- STH	BIOSIS 2015
Tradescantia fluminensis	Wandering Jew	*	-										x
Tragopogon porrifolius subsp. porrifolius	Salsify	*	-	+									
Trifolium angustifolium var. angustifolium	Narrow-leaf Clover	*	-				+						x
Trifolium dubium	Suckling Clover	*	-										x
Trifolium repens var. repens	White Clover	*	-										x
Trifolium subterraneum	Subterranean Clover	*	-										x
Triglochin striata	Streaked Arrowgrass		-										x
Typha domingensis	Narrow-leaf Cumbungi		-								x	x	x
Ulex europaeus	Gorse	*	C, WoNS								x		x
Ulmus spp.	Elm	*	-								x		
Urtica urens	Small Nettle	*	-								x		
Vallisneria americana var. americana	Eel Grass		-								x		
Vicia hirsuta	Tiny Vetch	*	-								x		
Vicia sativa	Common Vetch	*	-	1								x	x
Vinca major	Blue Periwinkle	*	-								x		x
Vulpia bromoides	Squirrel-tail Fescue	*	-										x
Xerochrysum palustre	Swamp Everlasting	VU vu L	-			+							
Zantedeschia aethiopica	White Arum-lily	*	-										x

B.2 PLOT DATA

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
PLOT 1	***South Gippsland* Plains Grassland. Date:*17/3/2017* Recorder: NM Plot size: 20x20m**				
	Overall native plant cover: 60%; overall introduced plant cover 30%; bare cover 10%				
	Acaena novae-zelandiae	Bidgee-widgee		-	+
	Alternanthera denticulata s.l.	Lesser Joyweed		-	+
*	*Asphodelus fistulosus*	Onion Weed		R	1
*	*Aster subulatus*	Aster-weed		-	+
	Austrostipa spp.	Spear Grass		-	+
*	*Bromus catharticus*	Prairie Grass		-	1
*	*Centaurium tenuiflorum*	Slender Centaury		-	+
*	*Cyperus eragrostis*	Drain Flat-sedge		-	+
	Distichlis distichophylla	Australian Salt-grass		-	+
*	*Echinochloa crus-galli*	Barnyard Grass		-	+
	Epilobium billardierianum	Variable Willow-herb		-	1
*	*Epilobium ciliatum*	Glandular Willow-herb		-	1
	Epilobium hirtigerum	Hairy Willow-herb		-	1
	Geranium sp. 2	Variable Crane's-bill		-	1
	Glycine clandestina	Twining Glycine		-	+
*	*Hypochaeris radicata*	Flatweed		-	+
#	*Imperata cylindrica*	Blady Grass		-	+
	Juncus amabilis	Hollow Rush		-	+
	Linum marginale	Native Flax		-	1
*	*Lolium perenne*	Perennial Rye-grass		-	1
	Lomandra longifolia	Spiny-headed Mat-rush		-	+
*	*Lysimachia arvensis*	Pimpernel		-	+
#	*Melaleuca ericifolia*	Swamp Paperbark		-	+
*	*Phalaris aquatica*	Toowoomba Canary-grass		-	+
*	*Plantago lanceolata*	Ribwort		-	1
	Poa labillardierei	Common Tussock-grass		-	2
*	*Polygonum aviculare s.l.*	Prostrate Knotweed		-	1
*	*Raphanus raphanistrum*	Wild Radish		-	+

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
*	*Rubus fruticosus spp. agg.*	Blackberry		C	+
	Rubus parvifolius	Small-leaf Bramble		-	2
*	*Rumex conglomeratus*	Clustered Dock		-	+
*	*Rumex crispus*	Curled Dock		-	+
	Rytidosperma caespitosum	Common Wallaby-grass		-	+
	Rytidosperma setaceum	Bristly Wallaby-grass		-	+
*	*Sonchus asper s.l.*	Rough Sow-thistle		-	+
*	*Sonchus oleraceus*	Common Sow-thistle		-	+
	Themeda triandra	Kangaroo Grass		-	1
*	*Tragopogon porrifolius subsp. porrifolius*	Salsify		-	+
*	*Vicia sativa*	Common Vetch		-	1
PLOT 2	**Plains Sedgy Wetland Date:17/3/2017 Recorder: NM Plot size: 20x20m**				
	Overall native plant cover: 90%; overall introduced plant cover 10%				
	Alternanthera denticulata s.l.	Lesser Joyweed		-	1
	Amphibromus nervosus	Common Swamp Wallaby-grass		-	1
*	*Aster subulatus*	Aster-weed		-	+
*	*Atriplex prostrata*	Hastate Orache		-	+
	Baumea arthrophylla	Fine Twig-sedge		-	1
	Carex appressa	Tall Sedge		-	1
	Carex fascicularis	Tassel Sedge		-	+
	Carex tereticaulis	Poong'ort		-	3
	Cycnogeton procerum (broad erect leaf variant)	Common Water-ribbons		-	+
*	*Cynodon dactylon var. dactylon*	Couch		-	1
*	*Cyperus eragrostis*	Drain Flat-sedge		-	1
	Eleocharis acuta	Common Spike-sedge		-	1
	Epilobium hirtigerum	Hairy Willow-herb		-	+
*	*Galium aparine*	Cleavers		-	+
*	*Holcus lanatus*	Yorkshire Fog		-	+
	Juncus amabilis	Hollow Rush		-	+
	Juncus sarophorus	Broom Rush		-	+

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
	Lachnagrostis filiformis s.l.	Common Blown-grass		-	+
*	*Lolium perenne*	Perennial Rye-grass		-	1
	Lythrum salicaria	Purple Loosestrife		-	+
*	*Paspalum distichum*	Water Couch		-	1
	Persicaria decipiens	Slender Knotweed		-	1
	Persicaria hydropiper	Water Pepper		-	+
*	*Plantago lanceolata*	Ribwort		-	+
*	Raphanus raphanistrum	Wild Radish		-	+
*	*Rorippa palustris*	Marsh Yellow-cress		-	+
*	*Rumex conglomeratus*	Clustered Dock		-	1
*	*Rumex crispus*	Curled Dock		-	1
PLOT 3	**Plains Grassy Wetland Date:24/3/2017 Recorder: NM Plot size: 20x10m**				
	Overall native plant cover: 90%; overall introduced plant cover 10%				
	Amphibromus nervosus	Common Swamp Wallaby-grass		-	+
*	*Aster subulatus*	Aster-weed		-	+
	Baumea arthrophylla	Fine Twig-sedge		-	2
	Calocephalus lacteus	Milky Beauty-heads		-	1
	Carex tereticaulis	Poong'ort		-	+
*	*Centaurium tenuiflorum*	Slender Centaury		-	+
	Deyeuxia quadriseta	Reed Bent-grass		-	+
	Eleocharis acuta	Common Spike-sedge		-	+
	Epilobium billardierianum	Variable Willow-herb		-	+
*	*Erigeron sumatrensis*	Tall Fleabane		-	+
	Eryngium vesiculosum	Prickfoot		-	2
	Haloragis heterophylla	Varied Raspwort		-	1
	Hemarthria uncinata var. uncinata	Mat Grass		-	+
*	*Hypochaeris radicata*	Flatweed		-	+
	Lachnagrostis filiformis s.l.	Common Blown-grass		-	+
*	*Leontodon saxatilis subsp. saxatilis*	Hairy Hawkbit		-	1
	Myriophyllum crispatum	Upright Water-milfoil		-	+

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
	Ornduffia reniformis	Running Marsh-flower		-	1
	Oxalis perennans	Grassland Wood-sorrel		-	+
*	*Paspalum dilatatum*	Paspalum		-	+
*	*Phalaris aquatica*	Toowoomba Canary-grass		-	+
	Phragmites australis	Common Reed		-	1
*	*Plantago lanceolata*	Ribwort		-	+
	Poa labillardierei	Common Tussock-grass		-	1
	Ranunculus spp.	Buttercup		-	+
*	*Romulea rosea*	Onion Grass		-	+
	Rytidosperma duttonianum	Brown-back Wallaby-grass		-	+
	Rytidosperma semiannulare	Wetland Wallaby-grass		-	1
	Senecio spp.	Groundsel		-	+
	Themeda triandra	Kangaroo Grass		-	+
VU vu L	*Xerochrysum palustre*	Swamp Everlasting	Vulnerable	-	+
PLOT 4	***South Gippsland* Plains Grassland Date:24/3/2017 Recorder: NM Plot size: 40x10m**				
	Overall native plant cover: 95%; overall introduced plant cover 5%				
	Acacia melanoxylon	Blackwood		-	+
	Calocephalus lacteus	Milky Beauty-heads		-	+
*	*Centaurium tenuiflorum*	Slender Centaury		-	1
vu	*Coronidium gunnianum*	Pale Swamp Everlasting	Vulnerable	-	+
	Dianella longifolia s.l.	Pale Flax-lily		-	+
*	*Erigeron sumatrensis*	Tall Fleabane		-	+
	Eryngium vesiculosum	Prickfoot		-	1
	Eucalyptus ovata	Swamp Gum		-	+
	Haloragis heterophylla	Varied Raspwort		-	1
*	*Helminthotheca echioides*	Ox-tongue		-	+
	Hemarthria uncinata var. uncinata	Mat Grass		-	1
*	*Hypochaeris radicata*	Flatweed		-	+
*	*Leontodon saxatilis subsp. saxatilis*	Hairy Hawkbit		-	+
	Linum marginale	Native Flax		-	+
	Lomandra longifolia	Spiny-headed Mat-rush		-	+

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
	Oxalis perennans	Grassland Wood-sorrel		-	+
	Phragmites australis	Common Reed		-	1
*	*Plantago lanceolata*	Ribwort		-	1
	Poa labillardierei	Common Tussock-grass		-	3
*	*Romulea rosea*	Onion Grass		-	+
	Rytidosperma semiannulare	Wetland Wallaby-grass		-	1
	Themeda triandra	Kangaroo Grass		-	1
*	*Trifolium angustifolium var. angustifolium*	Narrow-leaf Clover		-	+
PLOT 5	**Swamp Scrub Date:24/3/2017 Recorder: NM Plot size: 40x10m**				
	Overall native plant cover: 95%; overall introduced plant cover 5%				
	Acacia mearnsii	Black Wattle		-	+
	Acacia melanoxylon	Blackwood		-	1
*	*Aster subulatus*	Aster-weed		-	+
	Carex appressa	Tall Sedge		-	+
	Carex breviculmis	Common Grass-sedge		-	+
	Carex tereticaulis	Poong'ort		-	1
*	*Cirsium vulgare*	Spear Thistle		C	+
*	*Erigeron sumatrensis*	Tall Fleabane		-	+
	Euchiton involucratus s.l.	Common Cudweed		-	+
	Goodenia ovata	Hop Goodenia		-	+
	Helichrysum luteoalbum	Jersey Cudweed		-	+
*	*Helminthotheca echioides*	Ox-tongue		-	+
*	*Hypochaeris radicata*	Flatweed		-	+
	Juncus amabilis	Hollow Rush		-	+
*	*Lactuca serriola*	Prickly Lettuce		-	+
*	*Leontodon saxatilis subsp. saxatilis*	Hairy Hawkbit		-	1
	Leptospermum scoparium	Manuka		-	+
*	*Lotus angustissimus*	Slender Bird's-foot Trefoil		-	+
#	*Melaleuca ericifolia*	Swamp Paperbark		-	4
	Microlaena stipoides var. stipoides	Weeping Grass		-	1
	Oxalis spp.	Wood Sorrel		-	+

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
	Phragmites australis	Common Reed		-	+
*	*Plantago lanceolata*	Ribwort		-	+
	Poa labillardierei	Common Tussock-grass		-	2
*	Rubus fruticosus spp. agg.	Blackberry		C	+
	Rytidosperma caespitosum	Common Wallaby-grass		-	+
	Rytidosperma setaceum	Bristly Wallaby-grass		-	+
	Senecio glomeratus	Annual Fireweed		-	+
	Solanum aviculare	Kangaroo Apple		-	+
*	*Solanum nigrum s.l.*	Black Nightshade		-	1
PLOT 6	**Plains Grassy Wetland Date: 24/2/2017 Recorder: MS, NM, ZS Plot size: 10x10m**				
	Overall native plant cover: 30%; overall introduced plant cover 70%.				
*	*Cynodon dactylon var. dactylon*	Couch		-	1
	Eleocharis acuta	Common Spike-sedge		-	2
*	*Helminthotheca echioides*	Ox-tongue		-	+
*	*Hypochaeris radicata*	Flatweed		-	+
	Juncus amabilis	Hollow Rush		-	1
*	*Leontodon saxatilis subsp. saxatilis*	Hairy Hawkbit		-	+
*	*Paspalum dilatatum*	Paspalum		-	3
*	*Phalaris aquatica*	Toowoomba Canary-grass		-	2
*	*Plantago lanceolata*	Ribwort		-	1
	Carex inversa	Knob Sedge		-	+
*	*Festuca arundinacea*	Tall Fescue		-	1
PLOT 7	**Plains Grassy Wetland Date: 24/2/2017 Recorder: MS, NM, ZS Plot size: 10x10m**				
	Overall native plant cover: 30%; overall introduced plant cover 70%.				
*	*Centaurium tenuiflorum*	Slender Centaury		-	+
	Eryngium vesiculosum	Prickfoot		-	2
*	*Helminthotheca echioides*	Ox-tongue		-	+
	Juncus amabilis	Hollow Rush		-	+
*	*Paspalum dilatatum*	Paspalum		-	+
*	*Phalaris aquatica*	Toowoomba Canary-grass		-	3
*	*Plantago lanceolata*	Ribwort		-	1

STATUS	SCIENTIFIC NAME	COMMON NAME	VICTORIAN ADVISORY LIST	CALP ACT	COVER
	Rytidosperma duttonianum	Brown-back Wallaby-grass		-	2
*	*Festuca arundinacea*	Tall Fescue		-	+

Key to the tables above

Conservation status

- **Commonwealth EPBC Act:** Shown as EX = Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable.
- **Victorian FFG Act:** Shown as D = Delisted as threatened, I = Rejected for listing as threatened; taxon invalid, L = Listed as threatened, N = Nominated for listing as threatened, X = Rejected for listing as threatened; taxon ineligible
- **Victorian Advisory List** (DEPI 2014)**:** Shown as x = Presumed Extinct, e = Endangered, v = Vulnerable, r = Rare, k = Poorly Known
- **Other:** Shown as P = Planted, * = introduced

Weed Status

- **CALP Act weeds:** C = Regionally controlled, R = Regionally restricted
- **WoNS:** Weed of National Significance

Plot and Record Data

- Columns labelled 'Plot 1 and Plot 2' are plot or quadrat data used to assess patches of native vegetation against determination criteria for the EPBC Act listed ecological communities. They were conducted to sample the floristics according to a modified version of the Braun-Blanquet system from 1951, described in Specht (1981):

Cover value	Cover of foliage/branch	Number of individuals
7+	<5%	< 10 individuals
1	<5%	>10 individuals
2	5 – 25%	Any number
3	25 – 50%	Any number
4	50 – 75%	Any number
5	75 – 100%	Any number

- **Additional species columns and Biosis record data column:** x = denotes species presence

Appendix C

FAUNA SPECIES LIST

C.1 FAUNA SPECIES LIST

This table provides a full list of species recorded within or adjacent to the project area. It also includes the species recorded by Biosis in (Biosis 2013, 2015). A key is

Table C.1 Fauna species recorded at the project area

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WSP 2017	BIOSIS 2013 AND/OR 2015
Birds				
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			x
Acanthiza lineata	Striated Thornbill			x
Acanthiza pusilla	Brown Thornbill		x	x
Acridotheres tristis	Common Myna	*	x	x
Acrocephalus australis	Australian Reed-warbler		x	X (listed as *Acrocephalus stentoreus*)
Alauda arvensis	European Skylark	*		x
Anas castanea	Chestnut Teal		x	x
Anas gracilis	Grey Teal		x	x
Anas rhynchotis	Australasian Shoveler	vu		x
Anas superciliosa	Pacific Black Duck		x	x
Anhinga novaehollandiae	Darter		x	x
Anseranas semipalmata	Magpie Goose	nt L		x
Anthochaera carunculata	Red Wattlebird		x	x
Anthus novaeseelandiae	Australasian Pipit			x
Ardea modesta	Eastern Great Egret	vu L		x
Aythya australis	Hardhead	vu	x	x
Biziura lobata	Musk Duck	vu		x
Cacatua galerita	Sulphur-crested Cockatoo			x
Cacatua tenuirostris	Long-billed Corella			x
Carduelis carduelis	European Goldfinch	*	x	x
Chenonetta jubata	Australian Wood Duck		x	x
Chloris chloris	European Greenfinch	*	x	x
Chroicocephalus novaehollandiae	Silver Gull		x	x
Circus approximans	Swamp Harrier		x	x
Cisticola exilis	Golden-headed Cisticola		x	x
Columba livia	Rock Dove	*	x	x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WSP 2017	BIOSIS 2013 AND/OR 2015
Corvus mellori	Little Raven		x	x
Coturnix pectoralis	Stubble Quail			x
Cracticus tibicen	Australian Magpie		x	x
Cracticus torquatus	Grey Butcherbird		x	
Cygnus atratus	Black Swan		x	x
Dacelo novaeguineae	Laughing Kookaburra			x
Egretta garzetta nigripes	Little Egret	en L		x
Egretta novaehollandiae	White-faced Heron			x
Elanus axillaris	Black-shouldered Kite			x
Elseyornis melanops	Black-fronted Dotterel			x
Eolophus roseicapillus	Galah			x
Erythrogonys cinctus	Red-kneed Dotterel			x
Falco berigora	Brown Falcon			x
Falco cenchroides	Nankeen Kestrel			x
Fulica atra	Eurasian Coot		x	x
Gallinago hardwickii	Latham's Snipe	nt M		x
Gallinula tenebrosa	Dusky Moorhen		x	x
Glossopsitta concinna	Musk Lorikeet		x	x
Grallina cyanoleuca	Magpie-lark		x	x
Hieraaetus morphnoides)	Little Eagle		x	
Himantopus himantopus	Black-winged Stilt			x
Hirundo neoxena	Welcome Swallow		x	x
Lichenostomus penicillatus	White-plumed Honeyeater		x	x
Malacorhynchus membranaceus	Pink-eared Duck			x
Malurus cyaneus	Superb Fairy-wren		x	x
Manorina melanocephala	Noisy Miner		x	x
Megalurus gramineus	Little Grassbird		x	
Microcarbo melanoleucos	Little Pied Cormorant		x	x
Neochmia temporalis	Red-browed Finch		x	
Ocyphaps lophotes	Crested Pigeon		x	x
Oxyura australis	Blue-billed Duck	en L		x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WSP 2017	BIOSIS 2013 AND/OR 2015
Pardalotus punctatus punctatus	Spotted Pardalote		x	x
Passer domesticus	House Sparrow	*	x	x
Pelecanus conspicillatus	Australian Pelican			x
Phalacrocorax carbo	Great Cormorant			x
Phalacrocorax sulcirostris	Little Black Cormorant		x	x
Phalacrocorax varius	Pied Cormorant	nt		x
Phylidonyris novaehollandiae	New Holland Honeyeater		x	x
Platalea flavipes	Yellow-billed Spoonbill			x
Platalea regia	Royal Spoonbill	nt		x
Platycercus eximius	Eastern Rosella		x	x
Podiceps cristatus	Great Crested Grebe			x
Poliocephalus poliocephalus	Hoary-headed Grebe			x
Porphyrio porphyrio	Purple Swamphen		x	x
Psephotus haematonotus	Red-rumped Parrot		x	x
Rhipidura albiscapa	Grey Fantail			x
Rhipidura leucophrys	Willie Wagtail		x	x
Sericornis frontalis	White-browed Scrubwren		x	
Stictonetta naevosa	Freckled Duck	en L		x
Streptopelia chinensis	Spotted Turtle-Dove	*	x	x
Sturnus vulgaris	Common Starling	*	x	x
Tachybaptus novaehollandiae	Australasian Grebe			x
Threskiornis molucca	Australian White Ibis			x
Threskiornis spinicollis	Straw-necked Ibis			x
Trichoglossus haematodus	Rainbow Lorikeet		x	x
Turdus merula	Common Blackbird	*	x	x
Vanellus miles	Masked Lapwing		x	x
Zosterops lateralis	Silvereye		x	
Mammals				
Felis catus	Cat	*		x
Oryctolagus cuniculus	European Rabbit	*	x	
Pseudocheirus peregrinus	Common Ringtail Possum			x

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	WSP 2017	BIOSIS 2013 AND/OR 2015
Tadarida australis	White-striped Freetail Bat			x
Trichosurus vulpecula	Common Brushtail Possum			x
Vulpes vulpes	Red Fox	*		x
Frogs				
Crinia signifera	Common Froglet		x	x
Limnodynastes dumerilii	Southern Bullfrog (ssp. unknown)			x
Limnodynastes peronii	Striped Marsh Frog			x
Limnodynastes tasmaniensis	Spotted Marsh Frog (race unknown)			x
Litoria ewingii	Southern Brown Tree Frog			x
Litoria fallax	Eastern Dwarf Tree Frog			x
Litoria verreauxii verreauxii	Verreaux's Tree Frog			x
Fish				
Anguilla australis	Short-finned Eel			x
Carassius auratus	Goldfish	*		x
Cyprinus carpio	European Carp	*		x
Galaxias maculatus	Common Galaxias			x
Gambusia holbrooki	Gambusia	*	X	x
Nannoperca australis	Southern Pygmy Perch			x
Perca fluviatilis	Redfin	*		x
Philypnodon grandiceps	Flathead Gudgeon			x
Pseudaphritis urvillii	Congolli			x
Rhombosolea tapirina	Greenback Flounder			x

Key to the table

Conservation status

- **Commonwealth EPBC Act:** Shown as EX = Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable.
- **Victorian FFG Act:** Shown as D = Delisted as threatened, I = Rejected for listing as threatened; taxon invalid, L = Listed as threatened, N = Nominated for listing as threatened, X = Rejected for listing as threatened; taxon ineligible
- **Victorian Advisory List** (DEPI 2014)**:** Shown as x = Presumed Extinct, e = Endangered, v = Vulnerable, r = Rare, k = Poorly Known

Appendix D

LIKELIHOOD OF OCCURRENCE AND PRELIMINARY IMPACT

D.1 LIKELIHOOD OF OCCURRENCE & IMPACT ASSESSMENT – FLORA

A search of the DELWP's VBA and the EPBC Act Protected Matters Search Tool PMST was undertaken within a 5 km radius of the project area to identify threatened species with potential to occur. The results of these searches and an assessment of their likelihood of occurring within the study area based on the availability of habitat observed during the site survey is provided below in Table D.1 for flora. Note that the assessment of the likelihood of impact here does not address the potential significance of impacts.

The brief habitat descriptions for flora are appropriated from the species descriptions on VicFlora (website by the Royal Botanic Gardens Victoria), and species-specific publically-available Commonwealth and State government resources, including conservation advice.

Table D.1 Threatened flora species with the potential to occur within the study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	FFG ACT	VICTORIAN ADVISORY LIST	COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	HABITAT	LIKELIHOOD OF OCCURRENCE	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
Acacia howittii	Sticky Wattle			Rare	1	3/10/2015	Tree species endemic to Victoria to approx. 9 m high. Commonly cultivated. Endemic to areas of Gippsland further east.	Low - not recorded during field surveys. Not likely to naturally occur in the study area.	Low - species unlikely to occur
Amphibromus fluitans	River Swamp Wallaby-grass	Vulnerable			2	14/07/1993	Largely confined to permanent swamps, principally along the Murray River between Wodonga and Echuca, uncommon to rare in the south (e.g. Casterton, Moe, Yarram), probably due to historic drainage of wetlands.	Moderate - Planted in Waterways (Cook, D undated) although not recorded during the field survey.	Moderate Potential loss of plants
Austrostipa rudis subsp. australis	Veined Spear-grass			Rare	1	1/01/1985	Uncommon, mostly in cool areas of southern Victoria. Usually at moderate altitude, in open-forest on sandy or sandstone-derived soils.	Low – although possilble on paleo dunes and recorded form contiguous Braseide Park, species was not observed during field surveys.	Low – not observed.
Billardiera scandens s.s.	Velvet Apple-berry			Rare	1	21/05/1902	Open eucalypt forest and woodland.	Low - not recorded during field surveys	Low - unlikely to occur
Caladenia australis	Southern Spider-orchid			Poorly known	1	1/10/1927	Heath and woodland of near coastal areas in Victoria	Low - project area likely too disturbed to support this species	Low - unlikely to occur
Caladenia oenochila	Wine-lipped Spider-orchid			Vulnerable	1	13/10/1916	Endemic to Victoria where apparently confined to the southern foothills of the Great Dividing Range between the Latrobe Valley and Kilmore, with an isolated record from Anglesea. Relatively common in moist, often grassy forest or woodland, often in shaded habitats.	Low - project area likely too disturbed to support this species	Low - unlikely to occur
Caladenia orientalis	Eastern Spider Orchid	Endangered	Listed	Endangered			Species which only occurs near Mornington Peninsula (Southeast Coastal Plain) in coastal heath and woodland	Low - there are no recent records of this species in the locality	Low - unlikely to occur
Caladenia venusta	Large White Spider-orchid			Rare	4	13/10/1916	In woodlands and heathy woodland west of Port Phillip Bay, usually coastal or subcoastal but also in the Grampians, on well-drained or moisture-retentive soils.	Low - preferred habitat unlikely on site. project area likely too disturbed to support this species.	Low - unlikely to occur
Callitriche umbonata	Winged Water-starwort			Rare	1	1/09/1910	Scattered and uncommon, mainly in inland parts of Victoria, in damp and swampy places	Low - no recent records in area	Low - unlikely to occur
Carex chlorantha	Green-top Sedge			Poorly known	1	1/01/1986	Scattered in cooler, mostly southern parts of the state from near sea-level (Orbost) to the alps (e.g. Buckety Plain), usually in open sites on permanently moist to wet, rather fertile soils, but rather uncommon.	Low - no recent records in locality	Low - unlikely to occur

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	FFG ACT	VICTORIAN ADVISORY LIST	COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	HABITAT	LIKELIHOOD OF OCCURRENCE	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
Chorizandra australis	Southern Bristle-sedge			Poorly known			Recorded across southern Victoria in swamps and around waterholes	Moderate - planted in Waterways (Cook, D undated) but not recorded during field survey	Potential loss of plants
Cladium procerum	Leafy Twig-sedge			Rare			Occasional in swampy areas and margins of streams and lakes near the coast, tolerating low to moderate levels of salinity.	High - Recorded in construction footprint under the proposed Mordialloc bridge - (planted)	High Loss of plants proposed.
Coronidium gunnianum	Pale Swamp Everlasting			Vulnerable	2	18/11/1999	Widespread throughout the state except for the north-west and the alpine and adjacent mountainous areas, and usually at low elevations (under c. 100m) where mostly in grasslands and riverine Eucalyptus camaldulensis woodland on soils that are prone to inundation.	High - Recorded in project area (planted).	Moderate Recorded outside of construction footprint but may be impacted by works.
Correa alba var. pannosa	Velvet White Correa			Rare	1	1/05/1904	Occurring in coastal areas from the lower Glenelg River to Port Phillip Bay, usually on calcareous substrates.	Low - no recent records in the locality	Low - unlikely to occur
Corunastylis ciliata	Fringed Midge-orchid			Poorly known	1	1/03/1928	Heathland, grassy woodland and open forest in well-drained soil.	Low - no recent records in the locality	Low - unlikely to occur
Corybas fimbriatus	Fringed Helmet-orchid			Rare	1	9/08/1900	Usually forming colonies on moist, shaded sandy soil near the coast and generally east of Western Port, but with isolated occurrences near Melbourne at Gembrook, Warrandyte and Greensborough.	Low - no recent records in the locality	Low - unlikely to occur
Corymbia maculata	Spotted Gum			Vulnerable	3	17/02/2011	Only known in Victoria from the Tara Range, south of Buchan. Widely planted as an ornamental.	Low - outside natural range, if present likely planted	Low - unlikely to occur
Craspedia canens	Grey Billy-buttons		Listed	Endangered	2	11/11/1991	Known in Victoria only from grassland (often bordering swamps) at low altitude between c. Cranbourne and Traralgon. .	Low - Planted in Waterways although not recorded during the field survey.	Potential loss of plants
Dianella amoena	Matted Flax-lily	Endangered	Listed	Endangered			Largely confined to drier grassy woodland and grassland communities south of the Dividing Range and now much depleted through its range.	Moderate - Planted in Waterways although not recorded during the field survey.	Moderate
Diuris behrii	Golden Cowslips			Vulnerable	1	13/10/1916	Locally common in grassland and open woodland mostly in western Victoria	Low - no recent records in the locality	Low - unlikely to occur
Diuris punctata	Purple Diuris		Listed	Vulnerable	4	18/11/1998	Occurs in the open forests, woodlands and grasslands of the fertile lowlands, now much reduced through clearing for agriculture and restricted to relatively few, isolated sites, but sometimes locally abundant.	Low - potential habitat unlikely on site	Low - unlikely to occur
Eleocharis macbarronii	Grey Spike-sedge			Poorly known			Scattered in the west and north where it usually occurs along drainage lines in areas of heavy, often clayey soils, sometimes partly submerged	Low - Planted in Waterways although not recorded during the field survey. Searches in ideal habitat were undertaken and the species was observed in other areas outside the project area.	Low - unlikely to occur

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	FFG ACT	VICTORIAN ADVISORY LIST	COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	HABITAT	LIKELIHOOD OF OCCURRENCE	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
Euphrasia collina subsp. muelleri	Purple Eyebright	Endangered	Listed	Endangered	2	9/08/1900	Endemic in Victoria. Formerly widespread in lowland to montane central and western Victoria, but now exceedingly rare through habitat destruction, surviving in heathland and heathy woodland on the Mornington Peninsula and near Jamieson. .	Low - no recent records in the locality	Low - unlikely to occur
Geranium solanderi var. solanderi s.s.	Austral Crane's-bill			Vulnerable	1	2/08/1900	An uncommon species of damp to dryish, usually sheltered sites in grassy woodlands, often along drainage lines or in seepage areas.	Low - no recent records in the locality	Low - unlikely to occur
Geranium sp. 3	Pale-flower Cranesbill			Rare			In Victoria, currently known only from Stawell, Yan Yean, Eltham, and Bonegilla areas. Found in open, grassy areas of dry woodland to forest.	Low - Planted in Waterways although not recorded during the field survey. Searches didn't find Geranium sp.3.	Low - unlikely to occur
Glycine latrobeana	Clover Glycine	Vulnerable	Listed	Vulnerable			Widespread but of sporadic occurrence and rarely encountered. Grows mainly in grasslands and grassy woodlands.	Low - no records in the locality, not recorded during field surveys.	Low - unlikely to occur
Isolepis gaudichaudiana	Benambra Club-sedge			Vulnerable	1	9/11/1991	Apparently uncommon, known from a few scattered records from the coast to subalps, where occurring in moist open situations.	Low - no recent records in the locality	Low - unlikely to occur
Lachnagrostis punicea subsp. filifolia	Purple Blown-grass		Listed	Rare	5	18/11/1999	Occurs mainly in grassland, occasionally woodland communities in somewhat saline depressions of the volcanic plain, but also known from seasonal, slightly brackish swampy sites east of Melbourne.	Moderate - Planted in Waterways although not recorded during the field survey. However, survey was undertaken outside of ideal flowering/seeding season.	Moderate Potential loss of plants
Livistona australis	Cabbage Fan-palm		Listed	Vulnerable			Very rare, known from only three populations on Cabbage Tree Creek, Caleys Creek and the lower Brodribb River in far eastern Victoria.	High – Planted, not indigenous to region	Low. Planted
Melaleuca armillaris subsp. armillaris	Giant Honey-myrtle			Rare	5	14/07/2011	Mainly confined to near-coastal sandy heaths, scrubs slightly raised above saltmarsh, riparian scrubs, rocky coastlines and foothill outcrops eastwards from about Marlo.	Low – Not likely to naturally occur. Plantings of this species occur.	Low – unlikely to naturally occur
Microseris scapigera	Plains Yam-daisy			Vulnerable			Formerly widespread in moist depressions on the basalt plains of western Victoria, but now very rare due to loss of habitat.	Low - Planted in Waterways although not recorded during the field survey. Unlikely to occur within the study area	Low - unlikely to occur
Philydrum lanuginosum	Woolly Waterlily			Vulnerable	2	10/10/2007	Scattered, and very localized throughout lowland Victoria in shallow freshwater swamps.	Low - Planted in Waterways although not recorded during the field survey. Easy to detect.	Low - unlikely to occur
Prasophyllum frenchii	Maroon Leek-orchid	Endangered	Listed				Widespread across southern Victoria, but rare. Occurs in grassland, heathland and open forest on well-drained or water-retentive sand or clay loams.	Low - no records in the locality, not recorded during field surveys.	Low - unlikely to occur
Pterostylis cucullata	Leafy Greenhood	Vulnerable	Listed	Endangered (subsp.. cucullata) Rare (subsp. sylvicola)			Widely distributed but disjunct, mostly occurring in small groups in coastal areas, sometimes near inland watercourses.	Low - no records in the locality, not recorded during field surveys.	Low - unlikely to occur
Pterostylis pedoglossa	Prawn Greenhood			Vulnerable	3	1/04/1931	Scattered in coastal and near-coastal heath and grasstree plains east of Melbourne, often on moist peaty soils.	Low - no recent records in the locality	Low - unlikely to occur

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	FFG ACT	VICTORIAN ADVISORY LIST	COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	HABITAT	LIKELIHOOD OF OCCURRENCE	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
Pterostylis tasmanica	Southern Plume-orchid			Poorly known	1	15/10/1915	Scattered mostly in near coastal scrubs, heathland and heathy forests west of Wilsons Promontory, on well-drained sandy or peaty soils	Low - no recent records in the locality	Low - unlikely to occur
Pterostylis X ingens	Sharp Greenhood			Rare	1	1/08/1910	Favours moist areas around swamps and stream banks on heavy soils.	Low - no recent records in the locality	Low - unlikely to occur
Pterostylis X toveyana	Mentone Greenhood			Vulnerable	9	1/06/1926	Grows in moist areas of open forest and in coastal scrub, usually on sandy soils.	Low - no recent records in the locality	Low - unlikely to occur
Ranunculus amplus	Lacey River Buttercup			Rare	1	1/12/2005	Scattered throughout southern Victoria, but most common in south-west. Grows in stream verges and swamps. Plants are usually partially submerged, with emergent leaves and flowering stems.	Moderate – Planted, preferred habitat likely on site. Not recorded during field surveys.	Moderate Potential loss of plants
Ranunculus papulentus	Large River Buttercup			Poorly known	9	10/10/2007	Uncommon in Victoria and known with certainty from the Wulgulmerang-Benambra area, Braeside and near Natimuk. Occurs in seasonally wet areas, but ground usually dry or only moist at time of flowering.	Moderate – Planted at the Waterways, preferred habitat likely on site. Ranunculus spp identified during fieldwork in 2017 likely to be this species. Was found in Biosis 2015	Moderate Potential loss of plants
Salsola tragus subsp. pontica	Coast Saltwort			Rare	1	1/04/1938	Plants from coastal sites near Portland and around Port Phillip Bay and Western Port.	Low - no recent records in the locality	Low - unlikely to occur
Sclerolaena muricata var. muricata	Black Roly-poly			Poorly known	1	1/04/1987	Occasional along the Murray River and associated lakes and floodplains from near Kerang downstream toward the South Australian border, with isolated old records from Sunbury.	Low - no recent records in the locality	Low - unlikely to occur
Senecio glomeratus subsp. longifructus	Annual Fireweed			Rare	1	5/12/2003	Grows adjacent to streams and swamps throughout the south and north-east of the state.	Low - not recorded during field surveys	Low - unlikely to occur
Senecio psilocarpus	Swamp Fireweed / Smooth-fruited Groundsel	Vulnerable		Vulnerable			Restricted in Victoria to a few herb-rich winter-wet swamps throughout the south of the state, west from Sale, growing on volcanic clays or peaty soils.	Moderate – no natural local records however planted at the Waterways. Not recorded during surveys however species is difficult to tell from other Senecio species unless survey is completed at the most appropriate time of year.	Moderate – not recorded but may occur and be impacted
Thelymitra epipactoides	Metallic Sun-orchid	Endangered	Listed	Endangered			Grows mostly in coastal heathland, grassland and woodland, but extending further inland into similar habitats in the western part of its range. Substrates may be moist or dry sandy soils.	No records in the locality	Low - unlikely to occur
Xerochrysum palustre	Swamp Everlasting	Vulnerable	Listed	Vulnerable	1	1/12/2005	Occurs in lowland swamps, usually on black cracking clay soils, scattered from near the South Australian border north-west of Portland to Bairnsdale district, but rare due to habitat depletion.	High - Recorded within the study area (planted).	Moderate - species has been recorded during surveys

D.2 LIKELIHOOD OF OCURRENCE AND IMPACT ASSESSMENT – FAUNA

A search of the DELWP's VBA and the EPBC Act Protected Matters Search Tool PMST was undertaken within a 5 km radius of the project area to identify threatened species with potential to occur. The results of these searches and an assessment of their likelihood of occurring within the study area based on the availability of habitat observed during the site survey is provided below in Table D.2 for fauna. Note that the assessment of the likelihood of impact here does not address the potential significance of impacts.

The brief habitat descriptions for fauna have been sourced from several sources, including Birdlife Australia species profiles, Commonwealth DoEE species profiles (SPRAT) and other publically-available Commonwealth and State government resources.

Table D.2 Fauna likelihood of occurrence and impact assessment

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS			COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	RECORDED BY BIOSIS (2013-2015)?	RECORDED AT EDITHVALE (BIRDLIFE 2014-2015)?	BIRDLIFE OR OTHER RECENT RECORDS IN AREA? (EBIRD, ALA ETC)	HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY AREA	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
		EPBC Act	FFG	Victorian Advisory List								
Accipiter novaehollandiae novaehollandiae	Grey Goshawk		Listed	Vulnerable	1	1/04/1990			Yes	Found in most forest types, especially tall closed forests, including rainforests	**Moderate -** the study area does not support preferred habitat for this species however nearby records indicate that the species may occasionally fly over the study area.	Low - the works may slightly increase the roadkill risk for the species in the area however the impact is likely to be negligible as the species is unlikely to regularly utilise the project area.
Actitis hypoleucos	Common Sandpiper			Vulnerable	63	28/02/2010			Yes although very few. Most nearby records are from Eastern Treatment Plant	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats	**Low - Moderate -** Although the study area doesn't not constitute the usual preferred habitat for this species, the species may ocassionally visit the study area and vicinity.	Low - given the paucity of records from the wetlands associated with the study area, the potential habitat does not appear to be of value to the species. The proposed works will not impact upon the Eastern Treatment Plant, a nearby site where they are more commonly recorded.
Anas rhynchotis	Australasian Shoveler			Vulnerable	431	13/03/2013	Yes	Yes (recorded in low numbers July 2014-January 2015)	Yes, regularly recorded at Braeside, Waterways, Woodlands and Edithvale	Uses a wide variety of wetlands; prefers large permanent lakes or swamps that have abundant cover.	**High -** potential habitat present and high number of records in locality	**Moderate -** some loss and fragmentation of species foraging habitat is likely.
Anseranas semipalmata	Magpie Goose		Listed	Near threatened	144	7/07/2013	Yes	Yes (eight records in December 2014)	Yes	Mainly found in shallow wetlands with dense growth of rushes or sedges. Occasionally on terrestrial habitats feeding on grasses, bulbs and rhizomes. Found in the tropics with vagrants as far south as northern Victoria	**Moderate -** potential habitat present and records in locality, including in the wetlands associated with the project. Appears to be a regular, although not common, visitor to the area.	**Moderate -** some loss and fragmentation of species foraging habitat is likely.
Anthochaera phrygia	Regent Honeyeater	Critically endangered	Listed	Critically endangered	4	22/06/1976			No	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with *Casuarina cunninghamiana* and *Amyema cambagei* are important for feeding and breeding.	Low - no recent records and potential habitat present is of low quality	Low - the species is unlikely to use the study area.

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS			COUNT OF SIGHTINGS (VBA)	LAST VBA RECORD	RECORDED BY BIOSIS (2013-2015)?	RECORDED AT EDITHVALE (BIRDLIFE 2014-2015)?	BIRDLIFE OR OTHER RECENT RECORDS IN AREA? (EBIRD, ALA ETC)	HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY AREA	LIKELIHOOD OF IMPACT WITHOUT CONTROLS
		EPBC Act	FFG	Victorian Advisory List								
Apus pacificus	Fork-tailed Swift	Migratory							Yes	Migratory species (non-breeding in Australia) which is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests.	**Moderate -** species may fly over the study area on an intermittent, seasonal basis.	Low - the study area is highly unlikely to be important habitat for this species, a predominantly aerial species which occurs across many different habitat types and is considered secure.
Ardea intermedia	Intermediate Egret		Listed	Endangered	15	14/02/2008			Yes (very irregularly)	Found in freshwater wetlands, especially lake margins, billabongs and swamps with abundant emergent vegetation; also occasionally mangrove swamps, tidal mudflats.	**Moderate -** potential habitat present and several records in locality	Low - some loss of species habitat likely. The direct loss of habitat is unlikely to have a significant impact upon the species as the potential habitat lost is a small component of the potential habitat in the region and in the vicinity of the study area.
Ardea modesta	Eastern Great Egret		Listed	Vulnerable	215	4/01/2015	Yes	Yes	Yes	Prefers shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	**High -** potential habitat present and high number of records in locality. Recorded from Waterways Estate.	**Moderate -** some loss and fragmentation of species foraging habitat is likely.
Arenaria interpres	Ruddy Turnstone			Vulnerable	4	10/10/1982			No	Strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed	Low - not preferred habitat and no recent records	Low - unlikely to occur within or nearby the study area.
Aythya australis	Hardhead			Vulnerable	367	13/03/2013	Yes	Yes (very low records in September and December 2014 only)	Yes (Braeside, Woodland, Waterways, and Edithvale)	On terrestrial wetlands and occasionally sheltered estuarine and inshore waters. Almost entirely aquatic, preferring large deep fresh waters with abundant aquatic vegetation; particularly deep swamps, lakes, creeks, billabongs and alluvial plains.	**High -** habitat present and high number of records	**Moderate -** some loss and fragmentation of species foraging habitat is likely.
Biziura lobata	Musk Duck			Vulnerable	267	5/03/2013	Yes		Yes (Braeside, Woodlands, Waterways, and Edithvale)	Widespread in Southeast and Southwest parts of continent, on terrestrial wetlands, estuarine habitats and sheltered inshore waters. Almost entirely aquatic; preferring deep water of large permanent swamps, lakes and estuaries, where conditions stable and aquatic flora abundant.	**High** habitat present and high number of records	**Moderate -** some loss and fragmentation of species foraging habitat is likely.

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Botaurus poiciloptilus	Australasian Bittern	Endangered	Listed	Endangered	179	15/06/2014			Yes (Braeside, Woodlands, Waterways, and Edithvale)	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spike rushes.	**High -** Some suitable habitat is present and there are a high number of records from within and nearby the study area. The area appears to be important to the species.	**High** Some loss of species foraging habitat is likely. The proposed development may impact upon the species through direct loss of habitat and/or indirect impacts such as increased mortality through road collisions. The species usually requires large, relatively undisturbed wetlands and as such, further fragmentation of the wetland network through the proposed bypass may affect the suitability of nearby habitat for the species.
Calidris acuminata	Sharp-tailed Sandpiper	Migratory			197 (under-reported)			Yes - recorded over several months but very high numbers in January 2015 (3200)	Yes (Braeside, Woodlands, Waterways, and Edithvale.)	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	**Moderate** Edithvale Wetland is recognised as being an internationally important site for Sharp-tailed Sandpiper, regularly holding at least 1% of the Asian-Australasian Flyway population. It is likely that the species will also forage within the study area on occasion (such as when water levels are low). Of the wetlands near the study area, Edithvale usually supports the greatest number, however high numbers are occasionally recorded at others. E.g. in 2004, 2000 were observed at Woodlands Industrial Estate. Not as commonly seen at the Waterways.	**Moderate-High** The project area itself is unlikely to support important habitat for this species. However, the potential for indirect impacts upon adjacent and nearby important habitat should be considered.
Calidris alba	Sanderling			Near threatened	3	14/06/2010			No	Occurs in coastal areas around Australia. Inland records have occurred in most states of singles or small groups, birds probably on migration. They are regular around Corner Inlet, Shallow Inlet and Wilson's Promontory, and on the southwest coast between Killarney and Nelson.	Low - the species has been recorded in low numbers in the locality, however, as an estuarine bird, is unlikely to visit the study area or vicinity.	Low - the study area and potential habitat in the vicinity is unlikely to be important to this species, given the paucity of records from the area.

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Calidris canutus	Red Knot	Endangered, Migratory		Endangered	1	18/10/2009			No	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps	Low - not preferred habitat (species is predominantly an estaurine bird) and only one record (VBA) in the locality	Low - species is unlikely to visit the study area.
Calidris ferruginea	Curlew Sandpiper	Critically endangered, Migratory	Listed	Endangered	73	3/01/2010		Yes	Yes (Braeside, Woodlands, and Edithvale) although only in low numbers.	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes.	**Moderate** Low quality habitat present within the study area, and higher quality habitat at nearby wetlands. High number of records, although reduction in numbers in the area in recent years.	**Moderate** The project area itself is unlikely to support important habitat for this species. However, there is the potential for indirect impacts upon adjacent and nearby habitat.
Calidris melanotos	Pectoral Sandpiper	Migratory		Near threatened	41	28/02/2010		Yes - recorded in one month	Yes - (Woodlands and Braeside)	Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland.	**Moderate** The species occurs as a regular vagrant in very low numbers and may ocassionally forage within the study area.	**Moderate** The project area itself is unlikely to support important habitat for this species. However, there is the potential for indirect impacts upon adjacent and nearby habitat.
Calidris ruficollis	Red-necked Stint	Migratory			98 (likely to be under-reported)			Yes	Yes, mostly at Edithvale	In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting. They are a non-breeding migrant to South-east Asia and Australasia, arriving in Australia from late August to September and leaving from early March to mid-April.	**Low-Moderate** The species may periodically visit the study area or vicinity.	**Moderate** The project area itself is unlikely to support important habitat for this species. However, there is the potential for indirect impacts upon adjacent and nearby habitat.

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Calidris subminuta	Long-toed Stint	Migratory		Near threatened	5	16/02/2008			Edithvale only. Low numbers	Prefers shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds.	**Low-Moderate** The species is a cryptic vagrant. It has been recorded in the locality in very low numbers only, however it may have been under-reported due to confusion with the Reck-necked Stint. The species may periodically visit the study area or vicinity.	Low - although the species may be under-reported, the very low number of records indicate that the locality is unlikely to support important habitat for this species.
Charadrius bicinctus	Double-banded Plover	Migratory							Edithvale (1 record) and Water Treatment Plant (many records)	Fresh or saline terrestrial wetlands, saltmarsh, grasslands and pasture. Non-breeding season migrant in Australia	Low - the species does not appear to regularly visit the wetlands associated with the study area although may periodically occur. There are very few records from the vicinity of the study area.	Low - unlikely to regularly occur.
Chlidonias hybridus javanicus	Whiskered Tern			Near threatened	174	12/01/2010		Yes - over five months with highest numbers in December	Yes (Braeside, Woodland, Waterways, and Edithvale)	Prefers shallow terrestrial freshwater wetlands, either permanent or ephemeral, including lakes swamps, billabongs, river pools, reservoirs, large dams, sewage ponds, flooded saltmarsh and farmland; often round floodwaters. Usually in wetlands with much submerged and emergent vegetation, such as grass, sedges, reeds and rushes, occasionally also in swamps of lignum, bluebush, canegrass or saltmarsh.	**High** Habitat present and high number of records	**Moderate** Some minor loss of species habitat likely and potential for indirect impacts upon adjacent and nearby habitat.
Chlidonias leucopterus	White-winged Black Tern			Near threatened	22	27/06/2010			Edithvale only. Low numbers	Mostly inhabits fresh, brackish or saline, and coastal or subcoastal wetlands. White-winged Black Terns frequent tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated tidal sandflats and mudflats. Terrestrial wetlands, including swamps, lakes, billabongs, rivers, floodplains, reservoirs, saltworks, sewage ponds and outfalls are also inhabited.	**Moderate** Habitat present and low number of records in locality indicate that the species may periodically visit the study area and surrounds. There are no records from the wetlands associated with the study area, however the species is no to visit Edithvale on occassion.	**Low – Moderate** The project area itself is unlikely to support important habitat for this species. However, there is the potential for indirect impacts upon adjacent and nearby habitat.
Chrysococcyx osculans	Black-eared Cuckoo			Near threatened	2	21/12/2007			Yes but Waterways only and very low numbers	Mainly open vegetation associations, especially open woodlands and open shrublands. Often in open woodlands dominated by Eucalyptus, particularly stunted mallee communities; Open woodlands of River Red Gum or Coolibah along rivers or round other wetlands in otherwise open grasslands	Low - the study area does not support the preferred habitat of this species. The species may occur very ocassionally.	Low - species unlikely to regularly occur within or nearby the study area.

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Chthonicola sagittatus	Speckled Warbler		Listed	Vulnerable	1	21/09/1883			No	Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies.	Low - not preferred habitat and no recent records	Low - species unlikely to occur within or nearby the study area.
Circus assimilis	Spotted Harrier			Near threatened	6	31/12/2006			Yes, intermittant records	Found in open grasslands, woodland including mallee country, inland riparian woodland and shrubland particularly in arid and semi-arid areas.	**Moderate** Preferred habitat present on site	Low The most important habitat for this species locally will be grasslands associated with the bypass corridor. As such, the road will remove some suitable foraging habitat for this species. However, given the wide foraging range of this species and the low/intermittent record, this is unlikely to impact the species.
Coturnix chinensis victoriae	King Quail		Listed	Endangered	1	01/01/1800			No	Habitat is heathy and swampy vegetation of northern and eastern Australia, now rarely reported in Victoria except at a few key localities, and French Island in Western Port Bay appears to be its stronghold in Victoria.	Low - no recent records	Low - species unlikely to occur within or nearby the study area.
Egretta garzetta nigripes	Little Egret		Listed	Endangered	16	22/11/2009	Yes		Yes – Braeside Park and Edithvale	Inhabits mudflats, saltworks and shallow margins of tidal estuaries and inland rivers and lakes	**Moderate** Preferred habitat present on site	**Low - Moderate** Some loss of species habitat likely and some potential for indirect impacts upon adjacent and nearby habitat.
Falco subniger	Black Falcon			Vulnerable	4	17/06/2008			Yes. Woodlands and Braeside	Found in the arid and semi arid zones. The species is usually found near watercourses or utilising patches of isolated trees. It hunts over open wooded grasslands, saltbush plains, bluebush plains and other low vegetation.	**Moderate -** the study area and vicinity is not preferred habitat for this species however the species is likely to fly over the study area on occassion, based on records from the area.	Low - loss of a small amount of low value foraging habitat only.
Gallinago hardwickii	Latham's Snipe	Migratory		Near threatened	261	7/10/2013	Yes	Yes	Yes - Many records from Braeside, Woodlands, Waterways, Edithvale	Occurs in freshwater or brackish wetlands generally near protective vegetation cover.	**High -** habitat present within and adjacent to the study area and high number of records from the area, including from Woodlands Industrial Estate, Braeside Park, Waterways, and Edithvale.	**Moderate -** some loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.

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Geopelia cuneata	Diamond Dove		Listed	Near threatened	3	3/10/2009			No	The species is widely distributed in arid and semi-arid grassland savannah. They gather in small parties or flocks in dry open savanna in mulga areas often among spinifex or grasses. They are also often in open riparian woodland (beside waterways). They breed throughout their range, at any time after heavy rainfall.	Low - there are only a small number of records in the locality, and the study area (and nearby wetlands) is unlikely to constitute potential habitat for the species.	Low - unlikely to occur.
Grantiella picta	Painted Honeyeater	Vulnerable	Listed	Vulnerable					No	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees.	Low - no records within 5 km and no potential habitat present.	Low - unlikely to be present
Grus rubicunda	Brolga		Listed	Vulnerable	1	01/01/1800			No. Eastern treatment plant only (very few records)	Occurs in well vegetated shallow freshwater wetlands, small isolated swamps in eucalypt forests, floodplains, grasslands, paddocks, ploughed fields, irrigated pastures, stubbles, crops, desert claypans, bore drains, tidal areas, mangroves, beach wastes.	Low - Although the species has been recorded in the area (Eastern Treatement Plant), there are very few records and the species is unlikely to visit the study area or connected/nearby wetlands.	Low - unlikely to be present
Haliaeetus leucogaster	White-bellied Sea-Eagle		Listed	Vulnerable	9	3/10/2009		Yes (one record)	Yes, ocassional records from area including from Woodlands, Braeside, and Waterways	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs.	**Moderate -** there are several records of the species in the area, an the species often feeds on waterbirds.	Low - the loss of a small amount of hunting habitat is unlikely to impact this species.
Hirundapus caudacutus	White-throated Needletail	Migratory	Listed	Vulnerable	28	1/03/1999			Yes but very few	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns.	**Moderate -** the species may fly over the study area on an intermittent seasonal basis, although there are only a few records from the area (Braeside).	Low - predominantly an aerial species which occurs over many different habitat types. As such the works are unlikely to impact the species.
Hydroprogne caspia	Caspian Tern		Listed	Near threatened	47	6/01/2011		Yes (one record)	Yes	Occur in most coastal regions, with scattered records throughout the western half of the state, including the Murray Valley	**High -** species likely to periodically occur within the study area and surrounds in low numbers.	**Moderate -** minor loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.

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Ixobrychus minutus dubius	Little Bittern		Listed	Endangered	28	21/04/2014			Yes - low number of records	Mainly found in freshwater wetlands, where they inhabit dense emergent vegetation of reeds and sedges, and inundated shrub thickets. They are also occasionally found in brackish and saline wetlands such as mangrove swamps, *Juncus*-dominated salt marsh and the wooded margins of coastal lagoons.	**Moderate-high -** habitat present and some records (low number perhaps due to cryptic habits). Known to occur at Edithvale (regularly recorded). Recorded breeding at Edithvale.	**Moderate-High -** some loss of species foraging and breeding habitat is likely. The proposed development may have a impact upon the species through direct loss of habitat and/or indirect impacts such as increased mortality through road collisions. As the species is able to inhabit small patches of dense wetland vegetation (and does not rely solely on large undisturbed wetlands like the Australasian Bittern), the works are unlikely to reduce the species' use of nearby habitat.
Larus pacificus pacificus	Pacific Gull			Near threatened	156	27/06/2011			Yes, many records	The Pacific Gull prefers sandy, or less often, rocky coasts and sandy beaches. In eastern Australia, the Pacific Gull prefers areas that are protected from ocean swells such as estuaries, bays and harbours.	**Moderate - High -** although not usually a wetland species, Pacific Gulls are regularly recorded near the study area, including at Waterways, Braeside Park, Woodlands, and Edithvale. Usually recorded in low numbers only.	Low - the habitat within the study area and vicinity is unlikely to be of particular value to the species, for which there is a large amount of habitat in the locality.
Lathamus discolor	Swift Parrot	Critically Endangered	Listed	Endangered	9	26/11/1983			Nothing recent	On mainland Australia the species is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. It has a preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering *Acacia pycnantha*.	Low - there are records of this species from the locality, however these are not recent and the species is not known to rely on habitat in the vicinity of the study area. The species may be a very rare visitor to the area,. The potential habitat within and near the study area is of low quality, with very few large eucalypts proposed to be lost.	Low - the species is unlikely to regularly occur at the study area. Any habitat used by this species, even only rarely, can be important, however, based on past records and habitat quality, the species is unlikely to be dependant upon the habitat within the study area and vicinity. Controls to prevent any unecessary tree clearing will ensure no impacts to habitat beyond the construction footprint.
Lewinia pectoralis pectoralis	Lewin's Rail		Listed	Vulnerable	7	10/05/2007			Yes, intermittent records	Coastal saltwater areas, also freshwater wetlands and swamps.	**Moderate -** the species has been recorded ocassionally in the area and there is potential habitat present on site. Recorded most often when water levels are low.	Low - some loss of species foraging and breeding habitat may occur. The proposed development may have an impact upon the species through direct loss of habitat and/or indirect impacts however there are low numbers of Lewin's Rail recorded near the project area. As such, it is unlikely that the habitat is of importance to the species.
Limosa lapponica	Bar-tailed Godwit	Refer below			10	22/11/2009				Refer below		

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Limosa lapponica baueri	Bar-tailed Godwit	Vulnerable (baueri subspecies), Migratory							No	mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh	Low - not preferred habitat and no recent records	Low - species unlikely to occur within or nearby the study area.
Limosa lapponica menzbieri	Northern Siberian Godwit	Critically endangered, Migratory							No	Occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, harbours and bays.	Low - not preferred habitat and no recent records	Low - species unlikely to occur within or nearby the study area.
Limosa limosa	Black-tailed Godwit			Vulnerable	7	4/03/1996			No	Migratory wetland species. In Australia (non-breeding overwintering habitat) the species occurs generally in brackish habitats such as sheltered estuaries and lagoons with large intertidal mudflats, sandy beaches, salt-marshes and salt-flats.	Low - the study area is not preferred habitat, however there are a small number of records in the locality and the species may occassionally occur.	Low - habitat within and nearby to the study area is unlikely to be of significance to the species.
Lophochroa leadbeateri	Major Mitchell's Cockatoo		Listed	Vulnerable	1	1/01/1979			No	Favours callitris, allocasuarina and eucalyptus woodlands in arid or semi arid regions	Low - no recent records and no potential habitat present	Low - species unlikely to occur within or nearby the study area.
Melanodryas cucullata cucullata	Hooded Robin		Listed	Near threatened	4	1/01/1973			No	Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland.	Low - no recent records	Low - species unlikely to occur within or nearby the study area.
Monarcha melanopsis	Black-faced Monarch	Migratory							No	Mainly occurs in rainforest ecosystems, and sometimes in nearby open eucalypt forest with a dense, shrubby understorey. In Victoria mainly found in East Gippsland, it is a vagrant in the west.	Low - no records in the locality and no potential habitat present.	Low - species unlikely to occur within or nearby the study area.
Motacilla flava	Yellow Wagtail	Migratory							No	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams.	**Moderate -** there are two ALA records for this species in the locality, and the species may periodically visit the study area, although this is likely to be a rare ocurrence.	Low - habitat at the study area unlikely to be important to the species.
Myiagra cyanoleuca	Satin Flycatcher	Migratory							One record at Braeside (eBird)	Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens.	Low - there's one record of this species on e-bird - the species may be a rare visitor to the locality.	Low - species unlikely to occur within or nearby the study area and habitat unlikely to be of value.

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Neophema chrysogaster	Orange-bellied Parrot	Critically Endangered	Listed	Critically endangered	1	1/01/1977			No	usually found in locations associated with coastal saltmarshes and adjacent pastures, close to free-standing water bodies	Low - no preferred habitat within or nearby the study area	Low - species unlikely to occur within or nearby the study area.
Ninox strenua	Powerful Owl		Listed	Vulnerable	1	19/05/1995			No	Typically found in open forests and woodlands, sheltered gullies in wet forests with dense understoreys along watercourses. Will sometimes be found in open areas near forests such as farmland, parks and suburban areas, as well as in remnant bushland patches.	Low - not preferred habitat and no recent records in the locality	Low - species unlikely to occur within or nearby the study area.
Numenius madagascariensis	Eastern Curlew	Critically Endangered, Migratory	Listed	Vulnerable	5	27/01/2001			Very few (Braeside and Edithvale)	Primarily coastal in distribution, commonly associated with sheltered coasts, estuaries, harbours and lagoons. Breeds in the northern hemisphere, returning to Australia for the non-breeding season.	**Low-moderate -** The species has been very occasionally recorded in the vicinity in low numbers.	**Moderate** the study area itself is unlikely to support the species however nearby habitat appears to be ocassionally utilised. Potential for indirect impacts upon adjacent and nearby habitat. As a critically endangered species, any habitat utilised by the species should be considered important.
Numenius phaeopus	Whimbrel			Vulnerable	2	1/01/1977			No	found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.	Low - no recent records and no preferred habitat at the study area.	Low - species unlikely to occur within or nearby the study area.
Nycticorax caledonicus hillii	Nankeen Night Heron			Near threatened	43	27/02/2011			Yes (Braeside Park, Woodlands Industrial Estate, and Edithvale)	The Nankeen Night Heron frequents well-vegetated wetlands, and is found along shallow river margins, mangroves, floodplains, swamps, and parks and gardens	**High -** potential habitat present and high number of records.	**Moderate -** some loss of species foraging and breeding habitat likely and potential for indirect impacts upon adjacent and nearby habitat.
Oxyura australis	Blue-billed Duck		Listed	Endangered	390	15/06/2014	Yes	Yes (low numbers of records August - November 2014)	Yes (Braeside Park, Woodlands Industrial Estate, Waterways, and Edithvale)	Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, Lignum, (*Muehlenbeckia cunninghami)* and paperbark Melaleuca.	**High -** habitat present and high number of records	**Moderate -** some loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.

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Pandion haliaetus	Osprey	Migratory							No	Tolerates a wide variety of habitats, nesting in any location near a body of water providing an adequate food supply.	Low - no nearby records however species may periodically occur	Low - if it periodically occurs, habitat at the study area unlikely to be important to the species. Species is predominantly estuarine.
Pezoporus wallicus wallicus	Ground Parrot		Listed	Endangered	1	01/01/1854			No	Occurs mostly in coastal heathland or sedgeland with very dense cover and a high density of the parrot's food plants	Low - no recent records	Low - species highly unlikely to occur within or nearby the study area.
Phalacrocorax fuscescens	Black-faced Cormorant			Near threatened	2	2/03/2008			No	Exclusively coastal and marine habitat around much of the south coast of Australia	Low - no recent records	Low - species unlikely to occur within or nearby the study area.
Phalacrocorax varius	Pied Cormorant			Near threatened	112	7/07/2013	Yes		Yes (Braeside, Woodlands Industrial Estate, Waterways, Edithvale)	Inhabit terrestrial wetlands and coastal waters. Inland on lakes, swamps, rivers, billabongs, pools and sewage ponds. Associated with large sheets of open water, particularly permanent freshwater lakes and reservoirs and open water in deep freshwater marshes.	**High -** habitat present and high number of records	**Moderate -** the study area and vicinity is likely to be primarily roosting habitat for the species, which often forages in coastal estuaries and bays. Potential for indirect impacts upon nearby habitat.
Philomachus pugnax	Ruff	Migratory							Yes, very few	Fresh, brackish or saline wetlands with exposed mud flats, occasionally on sheltered coasts, harbours, estauries, sewage farms and salt works.	**Low - moderate -** the species has been recorded from Woodlands Industrial Estate and Braeside Park, although rarely and in low numbers.	Low - the species is a vagrant to the area and the study area and locality do not appear to be of significance to the species, supporting very few individuals at any one time of the year.
Platalea regia	Royal Spoonbill			Near threatened	240	4/01/2015	Yes	Yes (low numbers November - February within the survey period)	Yes - regularly recorded all around the study area	Found in terrestrial wetlands, sheltered marine habitats and wet grasslands; permanent and ephemeral waters used where available in arid interior. Feeds in shallow waters (less than0.4m) over substrate of sand, mud or clay.	**High -** habitat present and high number of records	**Moderate -** some minor loss of species foraging habitat may occur and potential for indirect impacts upon adjacent and nearby habitat.
Plegadis falcinellus	Glossy Ibis	Migratory		Near threatened	55	12/01/2010		Yes	Yes (Braeside and Edithvale)	The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons	**High -** habitat present and moderate number of records in the area.	**Moderate -** some loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.

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Pluvialis fulva	Pacific Golden Plover			Vulnerable	13	1/12/2005			No (closest records at Eastern Treatment Plant)	In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.	Low - very few records in locality although pecies may periodically visit the study area	Low - the study area is unlikely to constitute habitat of any significance to this species given the more suitable potential habitat in the locality.
Pluvialis squatarola	Grey Plover			Endangered	1	1/01/1977			No	occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.	Low - no preferred habitat within or adjacent ot the study area and no recent records	Low - species unlikely to be present
Polytelis anthopeplus monarchoides	Regent Parrot	Vulnerable	Listed	Vulnerable	1	10/02/2008			No	Primarily inhabits riparian or littoral River Red Gum (Eucalyptus camaldulensis) forests or woodlands and adjacent Black Box (E. largiflorens) woodlands. Nearby open mallee woodland or shrubland, usually with a ground cover of spinifex (Triodia) or other grasses	Low - no preferred habitat within or adjacent ot the study area	Low - species unlikely to be present
Pomatostomus temporalis temporalis	Grey-crowned Babbler		Listed	Endangered	29	15/06/2002			No	Occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.	Low - no preferred habitat within or adjacent ot the study area	Low - species unlikely to be present
Porzana pusilla palustris	Baillon's Crake		Listed	Vulnerable	88	17/02/2010		Yes	Yes (Braeside, Woodlands, Waterways, Edithvale)	Baillon's Crakes inhabit vegetated wetlands, usually with fresh or brackish water, including swamps, billabongs, lakes and reservoirs and temporarily inundated areas. They often prefer wetlands with floating aquatic vegetation.	**High -** habitat present and high number of records	**Moderate -** some of loss of species habitat and increase in roadkill risk likely.
Rhipidura rufifrons	Rufous Fantail	Migratory							Yes, one recent record at Braeside	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens.	**Low - moderate -** species may periodically occur within the study area and surrounds	Low - the study area and surrounds are unlikely to support important habitat for this species.

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Rostratula australis	Australian Painted Snipe	Endangered	Listed	Critically endangered	7	9/12/2008			Yes, Edithvale	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as *Eucalyptus camaldulensis* (River Red Gum) or shrubs such as *Muehlenbeckia florulenta* (Lignum) or *Sarcocornia quinqueflora* (Samphire).	**Low-moderate -** the study area predominantly supports permanent wetlands however there are records from the locality and the species may periodically occur	Low - although the study area does not support preferred habitat for this species, the species may periodically occur within or adjacent to the study area. Any habitat utilised by the species should be considered important, however the very low numbers indicate that this habitat is not regularly utilised and is not of significance (may be more of a stopover than regular foraging or roosting habitat)
Stagonopleura guttata	Diamond Firetail		Listed	Near threatened	3	4/04/1990			No	Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee.	Low - there is no preferred habitat for this species within or adjacent to the study area and no recent records in the locality	Low - species unlikely to be present
Sterna striata	White-fronted Tern			Near threatened	1	1/01/1980			No	The White-fronted Tern is native to south-west Australasia, breeding on the North and South Island of New Zealand and Flinders and Cape Barren Island off the north-east of Tasmania. It is also a winter visitor to Australia, from south Queensland to Tasmania and west to South Australia.	Low - not preferred habitat	Low - species unlikely to be present
Sternula albifrons sinensis	Little Tern	Migratory (Sternula albifrons)	Listed	Vulnerable	1	1/07/1975			No	Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches.	Low - no recent records	Low - species unlikely to be present
Sternula nereis nereis	Fairy Tern	Vulnerable	Listed	Endangered	1	1/07/1975			No	Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline	Low - no recent records	Low - species unlikely to be present
Stictonetta naevosa	Freckled Duck		Listed	Endangered	22	22/11/2009	Yes		Yes (Braeside, Woodlands, Waterways, and Edithvale.)	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast.	**High -** potential habitat present within the study area and records in the locality	**Moderate -** some minor loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.

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Todiramphus pyrropygia pyrropygia	Red-backed Kingfisher			Near threatened	1	3/10/1993			No	Species is known to occur in sparse inland woodlands, scrublands and often far from water. Is also known from gibber, spinifex and other grasslands along with tree-lined dry watercourses and in some grassy tropical woodlands	Low - not preferred habitat	Low - species unlikely to be present
Tringa brevipes	Grey-tailed Tattler		Listed	Critically endangered	3	18/10/1987			No	Grey-tailed Tattlers are usually seen in small flocks on sheltered coasts with reefs and rock platforms or with intertidal mudflats. They are also found in intertidal rocky, coral or stony reefs, platforms and islets that are exposed at high tide, also shores of rock, shingle, gravel and shells and on intertidal mudflats in embayments, estuaries and coastal lagoons, especially those fringed with mangroves.	Low - no potential habitat present for this species within or nearby the study area	Low - species unlikely to be present
Tringa glareola	Wood Sandpiper	Migratory		Vulnerable	55	28/03/2010		Yes - one record	Yes (Braeside and Edithvale)	Found in well-vegetated, shallow, freshwater wetlands such as swamps, billabongs, lakes, pools and waterholes with emergent aquatic plants and taller fringing vegetation.	**Moderate -** habitat and records present (including Braeside and Edithvale). Species usually recorded in low numbers only	**Low - moderate** some minor loss of species foraging habitat likely and potential for indirect impacts upon adjacent and nearby habitat.
Tringa nebularia	Common Greenshank	Migratory		Vulnerable	79	15/02/2009			Yes, Edithvale	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass.	**Moderate -** sub-optimal habitat present. Species ocassionally recorded at Edithvale in low numbers.	Low - the study area and surrounds are unlikely to support habitat of significance to this species. The species is more suited to estuarine settings and occurs in the locality on an intermittent basis and in low numbers only.
Tringa stagnatilis	Marsh Sandpiper	Migratory		Vulnerable	51	26/10/2008		Yes - four records in one month	Yes (Braeside and Edithvale)	Permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks.	**Moderate -** species may periodically occur within the study area	Low - the study area and surrounds are unlikely to support habitat of significance to this species. The species occurs in the locality on an intermittent basis and in low numbers only.

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Turnix pyrrhothorax	Red-chested Button-quail		Listed	Vulnerable	1	15/02/2000			No	Dense grasslands, and open, grassy, woodland of *Acacia* (Fabaceae), River Red Gum (*Eucalyptus camaldulensis)* and Black box (*E. largiflorens)* or *Melaleuca* (Myrtaceae), but also in crops and weedy fields with dense ground cover, and from coastal plains.	Low - not preferred habitat	Low - species unlikely to be present
Turnix velox	Little Button-quail			Near threatened	1	01/01/1888			No	This species is known to inhabit grassy plains, creekflats, woodlands, burned areas, areas containing saltbush, spinifex, mulga and mallee species. It is also known to occur along the margins of wetlands and within crops, pastures, stubble	Low - no recent records	Low - species unlikely to be present
Xenus cinereus	Terek Sandpiper		Listed	Endangered	1	1/01/1977			No	Mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mudbanks, sandbanks and spits, and near mangroves and occasionally in samphire	Low - no recent records and no potential habitat within the study area.	Low - species unlikely to be present
FISH												
Galaxiella pusilla	Dwarf Galaxias		Listed	Endangered						Occurs in slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks, often (but not always) containing dense aquatic macrophytes and emergent plants	Low - there are no records of the species within 5km of the study area. Targeted surveys by Biosis (2015) of potential habitat in the vicinity and downstream of the study area did not detect the species. Surveys were completed in mid-summer (December 2014 and January 2015) and used bait traps baited with glowsticks. Six sites were surveyed, encompassing waterbodies within Waterways Estate, Mordialloc Creek, and wetlands to the west of Braeside Park. In addition to this study, Streamline Research has undertaken extensive sampling for Melbourne Water throughout the length of the Mordialloc Bypass over the past decade. In none of the numerous investigations were the dwarf galaxias or Yarra pygmy perch captured.	Low - species considered unlikely to occur within or nearby the study area

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Maccullochella peelii	Murray Cod		Listed	Vulnerable						Occurs in lower reaches of the Murray-Darling Basin, where the water temperature is warm. The diverse range of habitats frequented by the Murray Cod includes slow moving rivers, murky billabongs and clear, rocky rivers	Low - there are no records of the species within 5km	Low - species considered unlikely to occur within or nearby the study area
Nannoperca obscura	Yarra Pygmy Perch	Vulnerable	Listed	Vulnerable	3	26/02/1983					Low - Targeted surveys by Biosis (2015) of potential habitat in the vicinity and downstream of the study area did not detect the species. Surveys were completed in mid-summer (December 2014 and January 2015) and used bait traps baited with glowsticks. Six sites were surveyed, encompassing waterbodies within Waterways Estate, Mordialloc Creek, and wetlands to the west of Braeside Park. In addition to this study, Streamline Research has undertaken extensive sampling for Melbourne Water throughout the length of the Mordialloc Bypass over the past decade. In none of the numerous investigations were the dwarf galaxias or Yarra pygmy perch captured.	Low - species considered unlikely to occur within or nearby the study area
Prototroctes maraena	Australian Grayling		Listed	Vulnerable						It is a mid-water, freshwater species that occurs most commonly in clear, gravelly streams with a moderate flow. Prefers deep, slow flowing pools.	Low - no records wihtin 5km	Low - species considered unlikely to occur within or nearby the study area
MAMMALS												
Antechinus minimus maritimus	Swamp Antechinus	Vulnerable	Listed	Near threatened						habitat includes dense wet heathlands, tussock grasslands, sedgelands, damp gullies, swamps and some shrubby woodlands (Menkhorst 1995), often in landscape settings with little exposure to the sun	Low - no records wihtin 5km	Low - unlikely to be present
Cercartetus nanus	Eastern Pygmy-possum			Near threatened	3	31/12/1887				Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred	Low - no recent records and no potential habitat present	Low - unlikely to be present

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Dasyurus maculatus maculatus	Spot-tailed Quoll	Endangered	Listed	Endangered	1	01/01/1886				The Spot-tailed Quoll has been recorded from a wide range of habitats, although has a preference for mature wet forest habitat. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (NPWS 1999at). Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage.	Low - there is no potential habitat for this species in the locality and no recent records.	Low - unlikely to be present
Dasyurus viverrinus	Eastern Quoll	Endangered	Listed	Regionally Extinct	1	01/01/1880				The species is considered extinct on the mainland.	Low - considered extinct on the mainland.	Low - unlikely to be present
Isoodon obesulus obesulus	Southern Brown Bandicoot	Endangered	Listed	Near threatened	30	16/11/1990				Inhabit a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland and are usually associated with infertile, sandy and well drained soils, but can be found in a range of soil types. Within these vegetation communities they typically inhabit areas of dense ground cover.	Low - there are no recent records of the species in the locality. Was known to occur in the Braeside area but now considered locally extinct. The closest known extant population is in Cranbourne.	Low - species unlikely to be present
Petauroides volans	Greater Glider	Vulnerable		Vulnerable						The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species	Low - no potential habitat present at or near the study area and no records within 5km	Low - species unlikely to be present
Pseudomys fumeus	Smoky Mouse		Listed	Endangered						The Smoky Mouse occurs in a variety of vegetation communities, ranging from coastal heath to dry ridgeline forest, sub-alpine heath and, occasionally, wetter gullies. Except for the wetter sites, a consistent feature of Smoky Mouse habitats is the diversity of heath and bush-pea species present, combined with potential shelter sites in the form of woody debris or rocks.	Low - no potential habitat present at or near the study area and no records within 5km	Low - species unlikely to be present

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Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Listed	Vulnerable	5	14/09/2013				Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species.	**Moderate -** likely to fly over study area while foraging, however the species is not known to roost within the study area.	Low - the vegetation at the project area is predominantly grassland and not foraging habitat for the species. A small amount of potential foraging habitat may be lost as a consequence of the proposed development however this is considered highly unlikely to impact upon the species. Indirect impacts are unlikely to affect this species given the large area over which it forages.
FROGS												
Litoria raniformis	Growling Grass Frog	Vulnerable	Listed	Endangered	13	14/09/2006				Usually found amongst emergent vegetation such as Typha, Phragmites and Eleocharis within or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds, and farm dams. It also in occurs in irrigation channels and crops, lignum shrublands, black box and river red gum woodlands and at the periphery of rivers.	Low - detailed surveys by Biosis did not detect this species within or adjacent to the study area. A translocated population of the species was introduced to the Waterways Estate in January 2002, and have since been regularly monitored, however there have been no records of the species in that location or elsewhere in the locality since 2006. Surveys were completed in 2012-2013 (Biosis 2013), and 2014-2015 (Biosis 2015). Areas surveyed included Waterways Estate, Melbourne Water wetlands to the north of Waterways, and wetlands within Braeside Park. The species is considered unlikely to currently occur within the project area or vicinity.	Low - species considered unlikely to currently occur within or nearby the study area.
Pseudophryne semimarmorata	Southern Toadlet			Vulnerable	2	24/04/1990				It occurs mainly to the north, east and south-east of Melbourne. It is found in forested areas, where it shelters under fallen timber, rocks, etc.	Low - not preferred habitat	Low - unlikely to be present
INVERTEBRATES												
Plectrotarsus gravenhorstii	Caddisfly			Vulnerable	2	1/12/1915				The species is known to inhabit shallow and densely-vegetated waterways and swamps in its nymph stage. Most common in the Melbourne area.	Low To our knowledge, the species has not been recorded at or near the project area in recent years, despite the aquatic surveys which have been completed.	Low Species unlikely to occur. If present, species is unlikely to be affected by the works.

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Synemon plana	Golden Sun Moth	Critically Endangered	Listed	Critically Endangered						Natural habitat for this species is grassy communities (such as Box-Gum Woodlands or Natural Temperate Grasslands) where wallaby grasses (Rytidosperma spp.) dominate the understory. The larvae of the species feed on the roots of wallaby grass and emerge as adults the breed. Bare ground separating low tussocks of wallaby grass appear to be key microhabitat features for the Golden Sun Moth in native habitat. More recently, the species has been recorded breeding and thriving in grassland dominated by the noxious grassy weed Chilean Needlegrass (Nassella neesiana).	Low - no potential habitat occurs within the study area for this species. The vegetation at the study area does not support suitable dry grassland habitat and there are no nearby records of the species.	Low - species considered unlikely to occur at the study area or nearby
REPTILES												
Chelodina longicollis	Eastern Snake-necked Turtle			Data deficient	10	2/02/2011				Typically inhabiting swamps, lagoons and slow-moving rivers and creeks, but often seen wandering overland far from any apparent water	**High -** preferred habitat present on site	**Moderate -** some habitat likely to be lost, and impacts to the species from loss of connectivity and increased roadkill are likely.
Emydura macquarii	Murray River Turtle			Vulnerable	1	11/01/2011				This species is restricted to the Murray-Darling River system in southeastern Australia. It occurs in larger rivers and permanent lakes in this region	Low: - there is one record from Karkarook Park northwest of the study area. Species unlikely to occur at the study area.	Low – Species unlikely to be present
Varanus varius	Lace Monitor			Endangered	1	9/08/1977				Occurs in well-timbered areas, from dry woodlands to cool temperate southern forests. Arboreal, ascending large trees when disturbed.	Low - no recent records and poor quality potential habitat	Low - species considered unlikely to occur at the study area or nearby
Pseudemoia rawlinsoni	Glossy Grass Skink			Vulnerable						Species is distributed widely over coastal areas, as well as areas to the north east of Melbourne including the high plains. It appears to be restricted to swampy habitat including brackish marshes.	**Moderate -** the species has been recorded at Waterways (Cook, D undated), and probably occurs in the study area however there are no records in VBA.	**Moderate** some habitat for this species may be lost

Appendix E

ASSESSMENT OF EPBC ACT LISTED COMMUNITIES

Table E.1 Assessment of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Key Diagnostic Characteristics			
Landscape			
Limited to the temperate zone of mainland south-eastern Australia.	Yes	Yes	Yes
The ecological community occurs in south-east SA, Victoria and southern NSW.	Yes	Yes	Yes
On flat plains grading into slopes, below 500 m asl.	Yes	Yes	Yes
Associated soils are generally fertile but poorly draining clays derived from a range of geologies.	Yes	Yes	Yes
Typically in rainfall zones with a Winter seasonal rainfall pattern, extending into a Uniform seasonal rainfall pattern at the edge of its range.	Yes	Yes	Yes
Hydrology			
On isolated drainage lines or depressions which are seasonally inundated (typically during winter-spring) and subsequently dry (typically by late summer).	Part of constructed wetlands along Mordialloc Creek where the flood levels are regulated by Melbourne Water. Without regulated flooding, these recreated wetlands are likely to persist, with greater change in response to seasonal inundation.	Yes	Yes
Rainfall is the main water source. These wetlands are not dependent on overbank flooding from riverine systems.	Directly adjacent to the constructed wetlands. As above.	Yes - typically dependent on rainfall unless there is a flood event.	Yes
Salinity of the water is fresh to slightly brackish.	Yes	Yes	Yes

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Biota			
Trees and shrubs are sparse to absent. When present, they mostly occur as fringing or scattered individuals. The cover of woody species accounts for no more than 10% projective foliage cover across the wetland.	Trees and shrubs are absent – see Plot 2 data	Trees and shrubs are absent – see Plot 3 data	Trees and shrubs are absent – see Plot 6 and 7 data
The vegetative cover of the ecological community is dominated by a ground layer of native wetland graminoids and/or native wetland forbs.	Yes. Dominated by Carex tereticaulis	Yes. Dominated by Baumea arthrophylla and wetland forbs.	No. Currently dominated by weeds such as Paspalum
A range of graminoids is often present and typically includes one or more of the following taxa: Amphibromus spp., Carex tereticaulis, Deyeuxia spp., Glyceria spp., Lachnagrostis spp., Poa labillardieri, and Rytidosperma duttonianum. Note that other graminoid taxa may also occur, though are not necessarily common.	Typical species include Carex tereticaulis, Amphibromus nervosus, Carex appressa and Eleocharis acuta.	Typical species include Baumea arthrophylla, Poa labillardierei Rytidosperma semiannulare and Rytidosperma duttonianum,	Low levels of *Rytidosperma duttonianum*
At least one native wetland forb species must be present (preferably more) after the ecological community is inundated. The suite of forbs that may occur within the ecological community's range is variable and potentially large. Refer to Appendix B for a plant species list.	Several herbs are present including Persicaria hydropiper, Persicaria decipiens and Cycnogeton procerum	Several herbs are present including Ornduffia reniformis, Calocephalus lacteus, Eryngium vesiculosum,	One forb is present - *Eryngium vesiculosum*
Freshwater algae often are present when the wetland is, or recently has been, wet. The most evident representatives are green algae from the groups Charales (stoneworts) and Zygnematales (pond scums).	Freshwater algae were likely to be present in mud and shallow water surface however none of the 'macro' freshwater algae were evident.	Wetland mostly dry, no freshwater algae readily observable	Wetland mostly dry, no freshwater algae readily observable
Characteristic fauna that may be associated with the ecological community include invertebrate groups that are temporary water specialists. The types of fauna present can be highly variable, depending on the inundation history, current conditions and other factors	Many bird and frog species have been recorded from the wetlands (Australian Ecosystems 2017; Cook, D. 2016).	Many bird and frog species have been recorded from the wetlands (Australian Ecosystems 2017; Cook, D. 2016).	Many bird and frog species have been recorded from the broader wetland systems (Australian Ecosystems 2017; Cook, D. 2016).

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Modified wetlands			
Modifications to other types of wetland may result in the ecological community being present where it was formerly absent. These modified wetland sites are included as part of the national ecological community, if they remain a functional natural wetland and conform to the description of the ecological community.	All wetlands have been established by a comprehensive restoration plan and management.	All wetlands have been established by a comprehensive restoration plan and management.	Wetlands are part of a modified system – originally part of the Carrum Carrum Swamp
Condition Thresholds			
Part A) Condition during 'typical' wet cycles			
Step A1) Is the wetland consistent with the key diagnostic characteristics, noted above? - If yes, go to Step A2. - If no, the wetland is of a different type to the Seasonal Herbaceous Wetlands	Yes	Yes	Potentially – see dry cycle below
Step A2) Is 50% or more of the total cover of plants in the ground layer of the wetland dominated by native species characteristic of the Seasonal Herbaceous Wetlands ecological community? - If the answer is yes, the wetland retains sufficient native cover. Go to Part C Minimum wetland size. - If the answer is no, the wetland no longer retains sufficient natural values to be considered part of the national ecological community.	Yes. Overall native plant cover >90% native.	Yes. Overall native plant cover >95% native.	No - see dry cycle below
Part B) For dry conditions (e.g. drought):			
Step B1. Determine landscape position, including any modifications of the surrounds. - If the landscape does not, or is no longer able to, support a seasonal wetland, then the ecological community is unlikely to be present. to its hydrology. - If the landscape is consistent with the formation of a functional seasonal wetland, then go to Step B2.	n/a – wetland adequate to assess under Part A 'wet cycle'	n/a – wetland adequate to assess under Part A 'wet cycle'	Potentially consistent with a functional wetland

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Step B2. Investigate the known or inferred history of the likely wetland. - If yes, and the information on plant species composition is sufficiently detailed, then the site may be assessed according to Parts C and D, below, using the existing information. - If no, or not as above, then go to Step B3.	n/a – wetland adequate to assess under Part A 'wet cycle'	n/a – wetland adequate to assess under Part A 'wet cycle'	Wetland possibly present
Step B3. Determine the nature of the vegetation surrounding the wetland. Is the wetland surrounded by or adjoining a native vegetation remnant? - If yes, the wetland ecological community is likely to be present. Go to Part C Minimum wetland size, below. - If no, and the area immediately around and within the wetland is cropped, then the wetland ecological community is unlikely to be present.	n/a – wetland adequate to assess under Part A 'wet cycle'	n/a – wetland adequate to assess under Part A 'wet cycle'	Surrounded by restored and remnant wetlands. Site and drainage highly modified but difficult to determine when dry

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Part C) Minimum wetland size			
If the wetland occurs as a single isolated wetland, then it must be 0.5 ha or larger in size; OR If the wetland occurs as a cluster of many small wetlands in reasonably close proximity, then the cluster effectively functions as a single unit. The wetlands within the cluster must total at least 0.5 ha and this area of wetland must lie across a polygon (i.e. total area of wetland plus non-wetland in the cluster site) of at least 5ha. This means the area of wetland proper accounts for 10% or more of the total cluster area; OR If an individual wetland or wetland cluster is smaller than 0.5 ha, it may be included as part of the national ecological community if: i) the actual wetland or wetland cluster is 0.1 ha or more in size; AND ii) the wetland is contiguous with a native vegetation remnant; AND iii) the total area of the wetland plus other native vegetation remnant or type of natural wetland is 1 ha or more. - If the wetland meets the size and other thresholds above, it is part of the Seasonal Herbaceous Wetlands ecological community. Go to Part D Very high quality wetlands to determine if the wetland is of very high quality. - If the wetland falls outside of the situations described above, the wetland is too small for consideration as a matter of national environmental significance.	Yes – patch >0.5ha	Yes – patch >0.5ha	Yes – previous mapping suggests patches >0.5ha or part of a complex of wetlands >0.5ha

SCIENTIFIC DETERMINATION CRITERIA	PLAINS SEDGY WETLAND (PLOT 1)	PLAINS GRASSY WETLAND (PLOT 2)	PLAINS GRASSY WETLAND (REMNANT)
Part D. Very high quality wetlands			
Are three or more native plant taxa listed in Table 1 of (TSSC 2012) present within the wetland? - If yes, the wetland is considered to be of very high quality. - If no, the ecological community is still present if the criteria under Parts A to C are met but is not considered to be of very high quality. A wetland may merit further consideration for protection as outlined in the Additional considerations: surrounding environmental and landscape context in (TSSC 2012).	No	Yes – four species present: *Ornduffia reniformis, Calocephalus lacteus, Eryngium vesiculosum, Xerochrysum palustre*	No
FINAL DETERMINATION	Present	Present	Potentially present – reassess in wet cycle

Table E.2 Assessment of Natural Damp Grassland of the Victorian Coastal Plains

SCIENTIFIC DETERMINATION CRITERIA	
Key Diagnostic Characteristics	
Occurs within the South East Coastal Plain IBRA bioregion and is associated with seasonally damp sites	Yes
AND	
The vegetation structure is a tussock grassland in which: trees and larger shrubs (>1 metre tall) are sparse to absent, such that their projective foliage cover is 5% or less across the grassland patch; and the dominant feature is a ground layer primarily comprised of herbaceous species.	Yes – see Plot 1 and Plot 4 floristic data
AND	
The ground layer of the patch must contain four or more ground layer species from the indicative list in Table 2 of (TSSC 2015), including at least one of the key grass species Themeda triandra (kangaroo grass) and/or Poa labillardierei (common tussock grass).	Plot 1 contains three species Acaena novae-zelandiae, Poa labillardierei and Themeda triandra. Plot 4 contains seven species *Calocephalus lacteus, Eryngium vesiculosum, Haloragis heterophylla, Hemarthria uncinata var. uncinata, Poa labillardierei, Rytidosperma semiannulare* and *Themeda triandra.*
Contra-indicators	
There are a number of contra-indicators such as the substantial presence of trees, shrubs and halophytic species – see (TSSC 2015) for more details.	Contra-indicators are not present.
Condition Thresholds	
The minimum condition thresholds are: 30% or more of the perennial ground layer vegetation cover comprises native species; and	Overall cover of Plot 1 is 60% native and Plot 4 is 95% native cover.
The minimum patch size for the ecological community is 0.04 hectares.	Patch is well over 0.04ha
FINAL DETERMINATION	Present

Appendix F

ASSESSMENT OF SIGNIFICANT IMPACTS UNDER THE EPBC ACT

F.1 RAMSAR WETLANDS

One Wetland of International Importance, the Edithvale-Seaford Wetlands, occurs nearby to the project area, with the Edithvale component approximately 700 m southwest of the project area. These wetlands are registered under the International Ramsar Convention on Wetlands and qualify as representative, rare or unique wetlands that are important for conserving biological diversity. An assessment of the potential for significant impacts upon this wetland has been completed using the significant impact criteria in the Significant Impact Guidelines (Department of the Environment 2013) and is provided in Table F.1.

Table F.1 Potential impacts on Ramsar Wetland – Edithvale-Seaford Wetlands assessed under the EPBC Act Significant Impact Guidelines for Wetlands of international Importance in (Department of the Environment 2013)

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Areas of the wetland being destroyed or substantially modified	The works for the proposed road will occur over 700 m distance from the wetlands such that no direct impacts upon the wetlands are proposed to occur.	Low	No further mitigation measures required for the management of this impact.	None	Low
A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland	Water from the project area does not flow to the Edithvale-Seaford Wetland Complex, instead draining west along Mordialloc creek. Nevertheless, Edithvale is predominantly a groundwater-fed wetland, and the potential impacts upon groundwater are being assessed. Hydrological and hydrogeological assessments are currently being undertaken to determine pre-construction groundwater levels and groundwater quality to assess the likely impacts of the project on surrounding water environments. Preliminary results suggest that impacts are possible, however engineering controls are available to sufficiently mitigate any impacts.	Moderate	Specific mitigation measures (if required) to be determined by groundwater hydrologists to ensure that impacts to hydrological regimes are negligible. These groundwater mitigation measures may include: drainage blankets and/or sub-surface drains installed as per VicRoads guidelines.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected	The proposed development may impact upon waterbird use of the Ramsar wetland through noise from haul trucks during construction and from potential increased traffic along Springvale Road through the wetland. Species most at risk of disturbance include migratory shorebirds such as the Sharp-tailed Sandpiper, which are reliant on the wetlands for foraging and roosting habitat. Other fauna species including invertebrate fauna and fish species are unlikely to be significantly affected.	Moderate	Sufficiently minimise (thresholds to be determined) usage of Edithvale Road through the Edithvale wetland for hauling equipment and materials, particularly during the season when migratory waders are present; include options for alternate haulage routes. Ensure traffic volume is not significantly increased (threshold to be determined) on Edithvale Road through the Edithvale wetland.	There may still be increased traffic volumes along Edithvale Road as a result of changed traffic flow conditions – refer to traffic modelling.	Low
A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or	Water from the project area does not flow to the Edithvale-Seaford Wetland Complex.	Low	Implement standard mitigation measures in accordance with VicRoads 177 Environmental Management (Major); no further mitigation measures required for the management of this impact.	None	Low
An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland	The works are unlikely to lead to the introduction or spread of a harmful invasive species within the wetland. The project area, located in a landscape which is moderately to highly modified already, is a sufficient distance from the wetland complex such that impacts from weeds are unlikely to be an issue. The proposed works are unlikely to lead to an increase in pest fauna.	Low	Implement standard mitigation measures in accordance with VicRoads 177 Environmental Management (Major); no further mitigation measures required for the management of this impact.	None	Low

F.2 MIGRATORY SPECIES

F.2.1 Significant impact criteria

The significant impact criteria for migratory species are detailed below from (Department of the Environment 2013; DoEE 2017a):

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

Criterion 1. *substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

Criterion 2. *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*

Criterion 3. *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*

F.2.2 Important habitat

Critical to the assessment of significant impact is the definition of 'important habitat':

a. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or

b. habitat that is of critical importance to the species at particular life-cycle stages, and/or

c. habitat utilised by a migratory species which is at the limit of the species range, and/or

d. habitat within an area where the species is declining.

The migratory bird species with the potential to be affected by the works include several species considered to be migratory shorebirds. The assessment of important habitat for these species is more specific than the general migratory species definition and is detailed in EPBC Act Policy Statement 3.21 *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DoEE 2017a).

According to (DoEE 2017a), wetland habitat should be considered internationally important if it regularly supports:

- *1 per cent of the individuals in a population of one species or subspecies of waterbird OR*
- *a total abundance of at least 20 000 waterbirds.*

Nationally important habitat for migratory shorebirds supports:

- *0.1% of the flyaway population of a single species of migratory shorebird OR*
- *2000 migratory shorebirds OR*
- *15 migratory shorebird species.*

A habitat area is the geographic area that had been used by the same group of shorebirds over the main non-breeding period. This is effectively the home range of the local population when present.

Important habitat for Latham Snipe is classified by any area that has previous identified as internationally important for the species, or any area that supports at least 18 individuals of the species (DoEE 2017a).

By this definition:

- Edithvale-Seaford Wetlands classifies as nationally important migratory shorebird habitat (also reflected by its Ramsar status). It regularly supports 1% of the East Asian-Australasian Flyway population of Sharp-tailed Sandpipers (DSE 2012).
- Braeside Park, Waterways, and Woodlands Industrial Estate may also classify as important habitat for Latham's Snipe, given the regular records of Latham's Snipe at these wetlands.

F.2.3 Preliminary significant impact assessment

Eight bird species listed as migratory under the EPBC Act were assessed as having a moderate or higher likelihood of impact from the Project (without mitigation). The rationale for likelihood and preliminary impact assessment of each species is provided in Appendix D.

The species with a moderate or higher potential for impact are provided in Table F.2 below, with an assessment of the potential for this impact to be significant in accordance with the criteria.

Table F.2 Assessment of potential for significant impacts upon migratory species

SPECIES NAME	COMMON NAME	CRITERION 1	CRITERION 2	CRITERION 3
Calidris acuminata	Sharp-tailed Sandpiper	Possible but unlikely Important habitat present however habitat unlikely to be substantially modified. Nevertheless, carefully-considered mitigation measures are required to ensure the species is not affected by the works.	Unlikely	**Potential**. Potential impacts on feeding and roosting behaviour.
Calidris ferruginea	Curlew Sandpiper*	Important habitat unlikely to be present. Species utilises study area and locality only occasionally and in low numbers with respect to the species' estimated population size.	No important habitat present	Unlikely Species utilises study area and locality only occasionally and in low numbers and the lifecycle is unlikely to be disrupted.
Calidris melanotos	Pectoral Sandpiper	No important habitat present. Species utilises study area and locality in low numbers only with respect to the estimated population size of the species.	No important habitat present	Unlikely. Potential impacts on feeding and resting behaviour however unlikely to impact an ecologically significant proportion of the species.
Calidris ruficollis	Red-necked Stint	No important habitat present. Species utilises study area and locality in low numbers only with respect to the estimated population size of the species.	No important habitat present	Unlikely. Potential impacts on feeding and resting behaviour however unlikely to impact an ecologically significant proportion of the species.
Gallinago hardwickii	Latham's Snipe	**Potential** The Waterways and nearby habitat should be assumed to be important habitat. Some habitat (approximately 4.9 ha) proposed to be lost.	Unlikely – no harmful invasive species likely to become established	Unlikely. Potential impacts on feeding and resting behaviour however this is unlikely to impact an ecologically significant proportion of the species.
Numenius madagascariensis	Eastern Curlew*	Important habitat unlikely to be present. Species utilises study area and locality in low numbers only with respect to the estimated population size of the species.	No important habitat present	Unlikely Species utilises study area and locality only occasionally and in low numbers and the lifecycle is unlikely to be disrupted.

SPECIES NAME	COMMON NAME	CRITERION 1	CRITERION 2	CRITERION 3
Plegadis falcinellus	Glossy Ibis	No important habitat present. Species utilises study area and locality in low numbers only with respect to the estimated population size of the species.	No important habitat present	Unlikely. Potential impacts on feeding and resting behaviour however unlikely to impact an ecologically significant proportion of the species.
Tringa glareola	Wood Sandpiper	No important habitat present. Species utilises study area and locality in low numbers only with respect to the estimated population size of the species.	No important habitat present	Unlikely. Potential impacts on feeding and resting behaviour however unlikely to impact an ecologically significant proportion of the species.

*also listed as critically endangered under the EPBC Act

Table F.3 Potential impacts on migratory species assessed together under the EPBC Act Significant Impact Guidelines (Department of the Environment 2013)

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat present for Sharp-tailed Sandpiper at Edithvale-Seaford Wetlands and possibly at Braeside Park, Waterways, and Woodlands Industrial Estate Wetlands for Latham's Snipe. Approximately 4.9 ha of habitat for Latham's Snipe is proposed to be lost. Additional impacts through habitat fragmentation and modification are possible. Substantial modification of Sharp-tailed Sandpiper habitat is not expected. Changes to groundwater and/or surface hydrology are possible. Specific mitigation measures may be required to reduce this risk.	Moderate	Specific no-go zones have been identified to prevent disturbance of habitat outside of the construction footprint (Figure 7 Appendix A). Buffer zones around important habitat areas should be planned and implemented in the landscape plan for the Project, as recommended in (DoEE 2017a). Barriers close to wetlands, specifically adjacent to Woodlands Industrial Estate wetlands should be incorporated into the landscape plan for the Project where possible to restrict access to habitat. Specific hydrological mitigation measures to be determined by surface and groundwater hydrologists to ensure that impacts to hydrological regeimes are negligible. Groundwater mitigation measures may include: drainage blankets and/or sub-surface drains installed as per VicRoads guidelines. Mitigation for surface water changes may include incorporation of relevant parts of the Melbourne Water drainage schemes into the Project design, adoption of steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage (or adopt cut and fill balance between road embankments and new excavation), and/or allocation of space for stormwater detention and water sensitive road design elements (WSP 2017b).	Some direct loss of Latham's Snipe habitat is unavoidable. This alone is unlikely to constitute a significant impact, provided the mitigation measures are implemented.	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	It is unlikely that the proposed road will introduce invasive species which are not already in the local area.	Low	Implement standard mitigation measures in accordance with VicRoads 177 Environmental Management (Major); no further mitigation measures required for the management of this impact.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Potential impacts on feeding and resting behaviour from noise and lighting. For the Sharp-tailed Sandpiper, which visits the area regularly in high numbers, this may impact an ecologically significant proportion of the species.	Moderate	Lighting solutions and sound attenuation measures are required to minimise ongoing impacts to important habitat. The solutions which should be considered are provided in Sections 5.3.4 and 5.3.5 of this report. Not all solutions will be practicable, and a revised assessment of residual impact may be required after these measures are fully developed. Barriers close to wetlands, specifically adjacent to Woodlands Industrial Estate wetlands are required to restrict access to habitat. This should be considered in conjunction with design features to promote connectivity across the road including vegetation plantings. *Sufficiently minimise (thresholds to be determined) usage of Edithvale Road through the Edithvale wetland for hauling equipment and materials, particularly during the season when migratory waders are present ; include options for alternate haulage routes.* *Ensure traffic volume is not significantly increased (threshold to be determined) on Edithvale Road through the Edithvale wetland.*	None	Low

F.3 THREATENED FLORA

The only EPBC Act listed threatened flora species recently recorded in the project area is the Swamp Everlasting *Xerochrysum palustre*. River Swamp Wallaby-grass *Amphibromus fluitans*, Swamp Senecio *Senecio psilocarpus*, and Matted Flax-lily *Dianella amoeana* may also occur within the project area but was not recorded during surveys. They have been assumed to be present for the purpose of the assessment.

Matted Flax-lily is listed as EPBC Act endangered, and the remaining three species are listed as EPBC Act vulnerable. For vulnerable species, key to the assessment of a significant impact is the determination of whether the population at the project area constitutes an 'important population' as per the definition in the Significant Impact Guidelines (Department of the Environment 2013).

An assessment under the EPBC Act criteria for each species is provided on the following pages.

F.3.1 Swamp Everlasting

The population at the project area does not meet the criteria for an important population for the following reasons:

- It is not a key source population either for breeding or dispersal, being very small (~ 5 plants) and having been planted during the rehabilitation of the Waterways.
- It is not necessary for maintaining genetic diversity. The population was introduced from a source population and is likely to be of low genetic diversity compared with remnant populations of the species.
- It is not near the limit of the species' range. Populations of the species occur across southern Victoria, in the southeast of NSW, and in Tasmania.

In addition to the above, the population at the Waterways is not listed as a significant population in the Recovery Plan for the species (Carter 2011).

An assessment of the potential significance of impacts upon this species is provided in Table F.4.

Table F.4 Assessment of potential for significant impacts upon Swamp Everlasting

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Lead to a long-term decrease in the size of an important population of a species	Population at the project area is not considered an 'important population'. Plants were not recorded within the construction footprint.	Low	No further mitigation measures required for the management of this impact.	None	Low
Reduce the area of occupancy of an important population	Population at the project area is not considered an 'important population'. Plants were not recorded within the construction footprint.	Low	No further mitigation measures required for the management of this impact.	None	Low
Fragment an existing important population into two or more populations	Population at the project area is not considered an 'important population'. Plants were only recorded on one side of the proposed alignment during the survey. Fragmentation is considered unlikely as pollinators are unlikely to be affected by the road.	Low	No further mitigation measures required for the management of this impact.	None	Low
Adversely affect habitat critical to the survival of a species	The habitat at the project area is revegetated/planted habitat, not listed in the recovery plan for the species and not considered critical to the species' survival.	Low	No further mitigation measures required for the management of this impact.	None	Low
Disrupt the breeding cycle of an important population	Population at the project area is not considered an 'important population'. The Project will not disrupt the breeding cycle of the species which reproduces by rizomes (asexual spreading) and sexually (generalist pollinators unlikely to be affected by the works).	Low	No further mitigation measures required for the management of this impact.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will remove some potential habitat for this species although the recorded plants occur outside of the construction footprint. Additional plants not recorded during targeted survey may be impacted. Without specific mitigation there is also the potential for habitat modification due to changes in overland water flow and drainage which may decrease the quality of the habitat and cause the species to decline in this location.	Moderate	Standard establishment of no go zones (proposed no-go zones provided on Figure 7) is expected to protect the plants recorded during survey, however a pre-clearing survey at the Waterways is required to locate any new plants within the project area (outside of existing no go zones) and either fence them off to establish a new no go zone or relocate them to nearby potential habitat that is not proposed to be impacted. Specific hydrological mitigation measures (if required) are expected to reduce the risk of habitat modification from changes in hydrology, such as maintaining existing surface flow conditions.	None	Low
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Although the habitat occurs in an already disturbed landscape, weed invasion is a major threat to the remaining populations of this species across its range (Carter 2011). The works may lead to harmful invasive species becoming established in the species' habitat.	Moderate	Comprehensive weed and disease hygiene measures in the CEMP should include additional monitoring and control following works to protect this threatened species.	None	Low
Introduce disease that may cause the species to decline	There are no known disease risks for this species.	Low	The inclusion of standard comprehensive weed and disease hygiene measures in the CEMP as per VicRoads 177 Environmental Management (Major) should sufficiently manage any risk.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Interfere with the recovery of the species	The Project does not conflict with any of the stated objectives of the Recovery Plan for this species.	Low	No specific mitigation measures required for the management of this impact.	None	Low

F.3.2 River Swamp Wallaby-grass and Swamp Senecio (assessed together)

These species have been assessed together as their habitat requirements are similar and both are listed as vulnerable under the EPBC Act.

For each of these species, if present in the project area, the population does not meet the criteria for an important population for the following reasons.

- It is not a key source population either for breeding or dispersal, being below detectability in surveys, and having been planted during the rehabilitation of the Waterways.
- It is not necessary for maintaining genetic diversity. The population was introduced from a source population and is likely to be of low genetic diversity compared with remnant populations of the species.
- It is not near the limit of the species' range. Populations of River Swamp Wallaby-grass occur in Victoria, New South Wales, South Australia, Tasmania, and in New Zealand. Populations of Swamp Senecio occur across southern Victoria and in Tasmania.

There are no current or planned Recovery Plan for these species.

Table F.5 provides an assessment of the potential for significant impacts upon the species (assessed together) in accordance with the significant impact criteria.

Table F.5 Assessment of potential for significant impacts upon River Swamp Wallaby-grass and Swamp Senecio

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Lead to a long-term decrease in the size of an important population of a species	A population at the project area would not be considered an 'important population'.	Low	No specific mitigation measures required.	None	Low
Reduce the area of occupancy of an important population	A population at the project area would not be considered an 'important population'.	Low	No specific mitigation measures required.	None	Low
Fragment an existing important population into two or more populations	A population at the project area would not be considered an 'important population'.	Low	No specific mitigation measures required.	None	Low
Adversely affect habitat critical to the survival of a species	The habitat at the project area is suboptimal revegetated/planted habitat and not considered critical to the species' survival.	Low	No specific mitigation measures required.	None	Low
Disrupt the breeding cycle of an important population	A population at the project area would not be considered an 'important population'. The Project would not disrupt the breeding cycle of the species.	Low	No specific mitigation measures required.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will modify or remove some potential habitat for the species at the project area through shading and vegetation loss. There is the potential for minor changes in overland water flow and drainage which may decrease the quality of the habitat and cause the species to decline in this location. Sediment-laded run-off from the road may lead to a decrease in the quality of habitat for these species.	Moderate	Standard establishment of no go zones (shown on Figure 7 Appendix A) is expected to protect the potential habitat present from direct impacts. Specific hydrological mitigation measures (if required) are expected to negate the risk of habitat modification from changes in hydrology. Erosion and sedimentation measures should be in line with the Victoria EPA Principals of Best Practice Guidelines, including Environmental Guidelines for Major Construction Sites (Environmental Protection Agency 1996), Construction Techniques for Sediment Pollution Control (Environmental Protection Agency 1991), and EPA Publication 960 ‘Doing it right on subdivisions’ (Environmental Protection Agency 2004).	None	Low
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat	The works may lead to additional invasive species becoming established in the species’ habitat, however this is unlikely. The potential habitat occurs in an already disturbed landscape.	Low	The inclusion of standard comprehensive weed and disease hygiene measures in the CEMP as per VicRoads 177 Environmental Management (Major) should sufficiently manage this risk.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Introduce disease that may cause the species to decline, or	There are no known disease risks for this species.	Low	The inclusion of standard comprehensive weed and disease hygiene measures in the CEMP as per VicRoads 177 Environmental Management (Major) should sufficiently manage this risk.	None	Low
Interfere with the recovery of the species.	There is no Recovery Plan for this species. There are numerous populations of this species in Victoria and the potential habitat within the project area	Low	No specific mitigation measures required.	None	Low

F.3.3 Matted Flax-lily

Table F.5 provides an assessment of the potential for significant impacts upon the species (assessed together) in accordance with the significant impact criteria.

Table F.6 Assessment of potential for significant impacts upon Matted Flax-lily

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Lead to a long-term decrease in the size of a population	The species is known to occur (planted) in the broader Waterways area, east of the project area. It was not recorded during surveys of the project area. If species is present, it is most likely to occur outside of wetland areas at the Waterways and therefore outside of the construction footprint (although it may still occur within the broader project area). If present, it occurs in low numbers only and any loss would be unlikely to result in a long term decrease in the size of a population.	Low	No specific mitigation measures required.	None	Low
Reduce the area of occupancy of the species	As above.	Low	No specific mitigation measures required.	None	Low
Fragment an existing population into two or more populations	The Project may bisect a population (if present), however this is unlikely to substantially reduce gene flow (as pollination of this species is unlikely to be hindered by the road).	Low	No specific mitigation measures required.	None	Low
Adversely affect habitat critical to the survival of the species	The habitat at the project area is suboptimal revegetated/planted habitat and not considered critical to the species' survival.	Low	No specific mitigation measures required.	None	Low
Disrupt the breeding cycle of a population	The Project would not disrupt the breeding cycle of a population.	Low	No specific mitigation measures required.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project may remove some potential habitat for the species, although the species is most likely to occur outside of the construction footprint. This is unlikely to cause the species to decline at the Waterways.	Low	No specific mitigation measures required.	None	Low
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The works may lead to additional invasive species becoming established in the species' habitat, however this is unlikely. The potential habitat occurs in an already disturbed landscape	Low	The inclusion of standard comprehensive weed and disease hygiene measures in the CEMP as per VicRoads 177 Environmental Management (Major) should sufficiently manage this risk.	None	Low
Introduce disease that may cause the species to decline	There are no known disease risks for this species.	Low	The inclusion of standard comprehensive weed and disease hygiene measures in the CEMP as per VicRoads 177 Environmental Management (Major) should sufficiently manage this risk.	None	Low
Interfere with the recovery of the species.	There is no Recovery Plan for this species. There are numerous populations of this species in Victoria and the potential habitat within the project area is unlikely to be of value to the species' recovery.	Low	No specific mitigation measures required.	None	Low

F.4 THREATENED FAUNA

Two EPBC Act listed threatened fauna species, Australasian Bittern *Botaurus poiciloptilus*, and Curlew Sandpiper *Calidris ferruginea,* have the potential to be impacted by the project. An additional species, Eastern Curlew *Numenius madagascariensis*, has been assessed in conjunction with the Curlew Sandpiper as it is critically endangered, although the habitat at the project area is unlikely to be of significance to the species as it is only rarely recorded in the locality.

F.4.1 Australasian Bittern

The Australasian Bittern, listed as Endangered, is commonly recorded within the Edithvale-Seaford Wetlands, Woodlands Industrial Estate Wetlands, Braeside Park, and the Waterways. It is a non-breeding visitor to these areas, however the habitat in the area appears to be valuable foraging habitat for the species when it is present.

There is no current Recovery Plan for this species; a Recovery Plan is being developed by DoEE. The Australian Government currently supports funding for seven projects through the National Landcare Programme to help restore bittern habitat as part of the *Threatened Species Strategy Action Plan 2015-16 - 20 birds by 2020 (DotE 2015).*

The following table provide an assessment of the potential for significant impacts upon Australasian Bittern in accordance with the significant impact criteria.

Table F.7 Potential impacts on Australasian Bittern assessed under the EPBC Act Significant Impact Guidelines (Critically Endangered and Endangered Species) (Department of the Environment 2013)

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Lead to a long-term decrease in the size of a population	The proposed development may have a significant impact upon the species through direct loss of habitat and/or indirect impacts such as increased mortality through road collisions. Approximately 4.9 ha of habitat for this species is proposed to be removed. The species usually requires large, relatively undisturbed wetlands and as such, further fragmentation of the wetland network through the proposed bypass may affect the suitability of nearby habitat for the species.	Moderate	Specific no-go zones have been identified to prevent disturbance of habitat outside of the construction footprint (Figure 7 Appendix A). Lighting solutions and sound attenuation measures should be considered to minimise ongoing impacts to important habitat. The solutions which should be considered are provided in Sections 5.3.4 and 5.3.5 of this report. Not all solutions will be practicable, and a revised assessment of residual impact may be required after these measures are fully developed. Barriers close to wetlands, specifically adjacent to Woodlands Industrial Estate wetlands are required to restrict access to habitat and minimise mortality from vehicle collisions. This should be considered in conjunction with design features to promote connectivity across the road including vegetation plantings. Buffer zones around important habitat areas should be planned and implemented in the landscape plan for the Project.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Reduce the area of occupancy of a species	The works may slightly reduce the area of occupancy for the Australasian Bittern as 4.90 ha of habitat is proposed to be lost.	Moderate	Mitigation measures provided above are required to ensure that the species continues to utilise the habitat at the project area and surrounds after the works are complete.	None	Low
Fragment an existing population into two or more populations	The proposed road will fragment habitats at Braeside Park, Waterways, and Woodlands Industrial Estate Wetlands which are currently joined or have 'soft barriers' with agricultural landscapes. The broader landscape is highly modified with urban, industrial, agricultural and road networks currently creating a fragmented landscape on throughout the broader region. Therefore, Australasian Bittern must be somewhat tolerant of some level of fragmentation.	Moderate	Measures to maintain connectivity for this species are required for areas north of the proposed bridge (between Woodlands Industrial Estate and Braesode Park) as stipulated in Section 5.3.2. Revegetation under the bridge and minimisation of wetland vegetation clearance under the bridge is required to ensure that the species is able to safely pass beneath.	Some reduction in connectivity is likely to be unavoidable however the residual impact is likely to be small.	Low
Adversely affect habitat critical to the survival of a species	There have been a number of sightings of Australasian Bittern throughout The Waterways (Cook, D undated) and the broader area (Appendix D). The habitat area proposed to be lost is relatively small (4.9 ha) and is highly modified. However, wetlands either side of the project area Braeside Park and Woodland Wetlands are part of the Carrum IBA which is recognised as supporting globally important bird populations, including Australasian Bittern 0 - 14 individuals (Ecology Australia 2016).	Moderate	Mitigation measures posed above should assist to manage risks to critical habitat.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Disrupt the breeding cycle of an population	There is limited evidence about the extent of breeding Australasian Bittern near the project area. Two bird survey reports didn't report breeding (Herman & Purnell 2016; Silcocks 2016) and (Ecology Australia 2016) report that Edithvale-Seaford Wetlands is an important non-breeding refuge.	Low	No specific mitigation measures required to mitigate this risk.	None	Low
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Whilst there have been a number of sightings close to the project area, the habitat area impacted is relatively small (4.9 ha) and is highly modified. However, any reduction of habitat and indirect impacts such as increased noise, light and disturbance may affect the species.	Moderate	Mitigation measures posed above should assist to manage risks.	None	Low
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The works are unlikely to lead to the introduction or spread of a harmful invasive species within the wetland. The project area, located in a landscape which is moderately to highly modified already, is a sufficient distance from the wetland complex such that impacts from weeds are unlikely to be an issues. The proposed works are unlikely to lead to an increase in pest fauna.	Low	No specific mitigation measures required to mitigate this risk.	None	Low
Introduce disease that may cause the species to decline, or	As above	Low	No specific mitigation measures required to mitigate this risk.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Interfere with the recovery of the species.	There is currently no Recovery Plan for this species. Projects such as Bittern Project by Birdlife Australia, management by Melbourne Water and other bodies are working towards the recovery of the species in the region. Whilst there have been a number of sightings close to the project area, the habitat area impacted is relatively small. However, any reduction of habitat and indirect impacts such as increased noise, light and disturbance may affect the species.	Moderate	Mitigation measures posed above should assist to manage risks.	None	Low

F.4.2 Curlew Sandpiper and Eastern Curlew

The Curlew Sandpiper, listed as Critically Endangered, is regularly recorded within the Edithvale-Seaford Wetlands, Woodlands Industrial Estate Wetlands, and Braeside Park. It is a non-breeding migrant to these areas and is generally recorded in low numbers only. There is no primary habitat for the species mapped within the construction footprint, however the species may ocassionally occur. The Eastern Curlew is ocassionally recorded at the Edithvale and Braeside Park wetlands and is a not breeding migrant. There is no primary habitat for the species mapped within the construction footprint, however this is the potential for indirect impacts open nearby habitat.

There are no current Recovery Plans for these species.

The following table provide an assessment of the potential for significant impacts upon Curlew Sandpiper and Eastern Curlew in accordance with the significant impact criteria.

Table F.8 Potential impacts on Curlew Sandpiper and Eastern Curlew assessed under the EPBC Act Significant Impact Guidelines (Critically Endangered and Endangered Species) (Department of the Environment 2013)

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Lead to a long-term decrease in the size of a population	The proposed development is unlikely to lead to a long term decrease in the size of a population as no primary habitat for the species is proposed to be removed.	Low	No mitigation measures required	None	Low
Reduce the area of occupancy of a species	Unlikely to significantly reduce the area of occupancy as no primary habitat for the species is proposed to be removed.	Low	No mitigation measures required	None	Low
Fragment an existing population into two or more populations	The proposed road will fragment wetland habitats at Braeside Park, Waterways, and Woodlands Industrial Estate Wetlands which are currently joined or have 'soft barriers' with agricultural landscapes. The broader landscape is highly modified with urban, industrial, agricultural and road networks currently creating a fragmented landscape on throughout the broader region. The species are highly mobile and the increase in fragmentation is unlikely to affect the species.	Low	No mitigation measures required	None.	Low
Adversely affect habitat critical to the survival of a species	The habitat at the project area and immediate vicinity supports low numbers of the species only. Provided that the nearby Edithvale Wetlands are not affected, the Project is highly unlikely to adversely affect any habitat critical to the species' survival.	Low	No mitigation measures required	None	Low
Disrupt the breeding cycle of a population	The species do not breed at the project area or area (non-breeding migrant).	Low	No specific mitigation measures required to mitigate this risk.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Whilst there have been sightings close to the project area, no primary habitat for the species is proposed to be lost. However, any indirect impacts upon nearby habitat such as increased noise, light and disturbance may affect the species.	Moderate	Lighting solutions and sound attenuation measures should be considered to minimise ongoing impacts to important habitat. The solutions which should be considered are provided in Sections 5.3.4 and 5.3.5 of this report. Not all solutions will be practicable, and a revised assessment of residual impact may be required after these measures are fully developed. Barriers close to wetlands, specifically adjacent to Woodlands Industrial Estate wetlands are required to restrict access to habitat and minimise mortality from vehicle collisions. This should be considered in conjunction with design features to promote connectivity across the road including vegetation plantings. Buffer zones around important habitat areas should be planned and implemented in the landscape plan for the Project.	None	Low
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The works are unlikely to lead to the introduction or spread of a invasive species within the wetland which is harmful to this species. The project area, located in a landscape which is moderately to highly modified already, is a sufficient distance from primary habitat such that impacts from weeds are unlikely to be an issue. The proposed works are unlikely to lead to an increase in pest fauna.	Low	No specific mitigation measures required to mitigate this risk.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Introduce disease that may cause the species to decline, or	As above	Low	No specific mitigation measures required to mitigate this risk.	None	Low
Interfere with the recovery of the species.	There is currently no Recovery Plan for these species. Whilst there have been sightings close to the project area, no primary habitat for the species is proposed to be lost. However, any reduction of habitat and indirect impacts such as increased noise, light and disturbance may affect the species.	Moderate	Mitigation measures posed above should assist to manage risks.	None	Low

F.5 THREATENED ECOLOGICAL COMMUNITIES

Two threatened ecological communities listed under the EPBC Act: Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, and Natural Damp Grassland of the Victorian Coastal Plains, were identified within the relevant area. The presence of these communities was confirmed via plot analysis (see Appendix E for details).

Both communities are listed as Critically Endangered pursuant to the EPBC Act. Neither community has a Recover Plan, and there are no Threat Abatement Plans.

The following impact assessment tables are based on the significant impact criteria identified in the Significant Impact Guidelines (Department of the Environment 2013).

Table F.9 Potential impacts on Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH NO MITIGATION MEASURES	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH MITIGATION MEASURES
Reduce the extent of an ecological community	Project would clear approximately 2.12ha of the community. In Victoria, it is estimated that there is 18,224 ha of EVCs most similar to Seasonal Herbaceous Wetlands, with 490 ha remaining in the South East Coastal Plain IBRA bioregion according to (TSSC 2012). Approximately 30% (0.49 ha) of the Seasonal Herbaceous Wetlands is high quality revegetated wetland at The Waterways, whereas the remainder is low quality remnants which may not constitute the community, but have been assessed in the dry phase. The removal of 2.12 ha in this project would constitute 0.01% of total area of known community in the South East Coastal Plain. Although any loss may constitute a significant impact, provided that the impact is kept to 2.12 ha, this is unlikely to be a significant impact upon the ecological community.	Moderate	Establishment of standard no-go zones (shown on Figure 7 Appendix A) will ensure no direct impacts to the community outside of the construction footprint, however the following may also be required. Use appropriate specific mitigation measures to mitigate any impacts associated with groundwater and/or surface water changes, advised by hydrologists. Use Water Sensitive Urban Design (WSUD) to pre-treat water prior to run-off into Seasonal Herbaceous Wetlands. Further assessment of shading impacts is required to ensure that no more than 2.12 ha of the community is lost. Though strictly not mitigation, VicRoads has also commenced a feasibility study into opportunities to create wetlands in proximity to the Mordialloc Bypass. Refer to 5.3.1.2.	The residual impact is expected to be 2.12 ha of loss of this community. This is unlikely to constitute a significant impact upon the community.	Low
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The project would fragment a number of patches of Seasonal Herbaceous Wetlands, most notably at the Waterways.	Moderate	A bridge is proposed to pass over the majority of Seasonal Herbaceous Wetlands through the Waterways. However, minimisation of impacts at the Waterways and revegetation under the bridge is required to maintain the connectivity of this community.	Some fragmentation is unavoidable however the impact is not likely to be significant.	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH NO MITIGATION MEASURES	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH MITIGATION MEASURES
Adversely affect habitat critical to the survival of an ecological community	Project would clear approximately 2.12ha of the community. Within the study area this community is a mix of high quality revegeted Seasonal Herbaceous Wetlands or highly modified and species poor remnants through paddocks. The relatively small area of modified vegetation is unlikely to be critical to the survival of the community.	Low	No specific mitigation measures required.	None	Low
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The construction of the road has the potential to modify abiotic factors which could impact the remaining areas of the community. This includes potential changes to surface water drainage, groundwater systems and increased pollution. Given the project is anticipated to be built at or above ground level with minimal excavation, the risks to surrounding groundwater reliant ecosystems is considered to be low. Hydrological and hydrogeological assessments are currently being undertaken to determine pre-construction groundwater levels and groundwater quality to assess potential impacts of the project on surrounding water environments. Preliminary results suggest that impacts are possible, however engineering controls are available to sufficiently mitigate any impacts.	Moderate	Specific mitigation measures to be determined by groundwater amnd surface water hydrologists as required. Groundwater mitigation measures may include: drainage blankets and/or sub-surface drains installed as per VicRoads guidelines. Mitigation for surface water changes may include incorporation of relevant parts of the Melbourne Water drainage schemes into the Project design, adoption of steep batters, retaining walls or bridge structures across floodplains to minimise the loss of floodplain storage (or adopt cut and fill balance between road embankments and new excavation), and/or allocation of space for stormwater detention and water sensitive road design elements (WSP 2017b).	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH NO MITIGATION MEASURES	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT WITH MITIGATION MEASURES
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Species composition under the bridges in the Waterways may be altered from increased shading, therefore the extent of community under the bridge is included within the 2.12 ha proposed to be lost. Additional study into the potential impacts of shading to vegetation outside of the construction footprint is required. Species composition outside of the construction footprint may be substantially altered if there are significant changes to abiotic factors such as surface water drainage or as a result of roadside vegetation management (leading to increase in weed cover etc).	Moderate	Specific hydrology mitigation measures if required, to be dictated by hydrologists. Comprehensive weed and disease hygiene measures in the CEMP should include additional monitoring and management of the road edges following works to protect this community. Mowing regime and timing should also be determined with consideration of ecological impacts.	Shading due to the bridge may substantially alter the floristic composition of the wetland.	Low

Table F.10 Potential impacts on Natural Damp Grassland of the Victorian Coastal Plains assessed under the EPBC Act Significant Impact Guidelines

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Reduce the extent of an ecological community	Project would clear approximately 0.03 ha of the community. In Victoria, it is estimated that there is approximately 10 ha of Natural Damp Grassland remaining, according to (TSSC 2015). The removal in this project would constitute 0.3% of total area of known community. However, all of this community is revegetated (i.e. non natural). There is the potential for additional loss of this community without specific mitigation measures.	Moderate	Establishment of standard no-go zones (shown on Figure 7 Appendix A) will ensure no direct impacts to the community outside of the construction footprint, however the following may also be required. Use appropriate specific mitigation measures to mitigate any impacts associated with groundwater and/or surface water changes, advised by hydrologists. Further assessment of shading impacts is required to ensure that no more than 0.03 ha of the community is lost. Though strictly not mitigation, VicRoads has also commenced a feasibility study into opportunities to create wetlands in proximity to the Mordialloc Bypass. Refer to Section 5.3.1.2.	Residual impact of 0.03 ha of this community is unavoidable. This is unlikely to be a significant impact upon the community.	Low
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The project may increase fragmentation of this community at the Waterways, however as this is a revegetated community, and the project will not be directly splitting a patch, the impact is likely to be negligible.	Low	No specific mitigation measures required.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Adversely affect habitat critical to the survival of an ecological community	The small area of the community proposed to be removed is unlikely to be critical to the survival of the community. Standard no go zones are likely to be sufficient to prevent direct impacts outside of the construction footprint.	Low	No specific mitigation measures required.	None	Low
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The construction of the road has the potential to modify abiotic factors which could impact the remaining areas of the community. This includes potential changes to surface water drainage, groundwater systems and increased pollution.	Moderate	Establishment of standard no-go zones will ensure no direct impacts to the community outside of the construction footprint, however the following may also be required. Use appropriate specific mitigation measures to mitigate any impacts associated with groundwater and/or surface water changes, advised by hydrologists. Further assessment of shading impacts is required to ensure that no more than 0.03 ha of the community is impacted. Though strictly not mitigation, VicRoads has also commenced a feasibility study into opportunities to create wetlands in proximity to the Mordialloc Bypass. Refer to Section 5.3.1.2.	None	Low

SIGNIFICANT IMPACT CRITERIA	RISK TO MNES WITHOUT MITIGATION MEASURES	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH NO MITIGATION MEASURES IMPLEMENTED)	SPECIFIC MITIGATION MEASURE(S)	RESIDUAL RISK TO MNES WITH MITIGATION MEASURES APPLIED	LIKELIHOOD OF A SIGNIFICANT IMPACT (WITH MITIGATION MEASURES IMPLEMENTED)
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Species composition beyond the construction footprint may be substantially altered if there are significant changes vegetation management (leading to an increase in weed cover etc).	Moderate	Comprehensive weed and disease hygiene measures in the CEMP should include additional monitoring and management of the road edges following works to protect this community. Mowing regime and timing should also be determined with consideration of ecological impacts.	Shading due to the bridge may substantially alter the floristic composition of the wetland. Offsets are likely required to mitigate the losses through this area.	Low

Appendix G

SCATTERED TREES

G.1 SCATTERED TREES

ID	SPECIES	COMMON NAME	DBH (CM)	TPZ (M)	DATE RECORDED	ASSESSOR	EVC	WITHIN CONSTRUCTION FOOTPRINT?	COMMENT
1					26/06/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, considered required for removal	Not ground-truthed
2						WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	Not ground-truthed
3						WSP (J. Pegg)	Plains Grassy Woodland		Not ground-truthed
4						WSP (J. Pegg)	Plains Grassy Woodland		Not ground-truthed
5						WSP (J. Pegg)	Plains Grassy Woodland		Not ground-truthed
6						WSP (J. Pegg)	Plains Grassy Woodland		Not ground-truthed
7	Eucalyptus camaldulensis	River Red Gum	95	11.40	5/05/2017	WSP (N. McCaffrey)	Plains Grassy Woodland	Yes, as above	Hollows present
8	Eucalyptus camaldulensis	River Red Gum	24	2.88	5/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		
9	Eucalyptus camaldulensis	River Red Gum	114	13.68	5/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	Hollows present
10	Eucalyptus camaldulensis	River Red Gum	119	14.28	5/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	Hollows present
11	Eucalyptus camaldulensis	River Red Gum	124	14.88	5/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		Hollows present
12	Eucalyptus camaldulensis	River Red Gum				Biosis	Plains Grassy Woodland	Yes, as above	
13	Eucalyptus camaldulensis	River Red Gum	62	7.44	12/04/2017	WSP (J. Pegg)	Creekline Grassy Woodland	Yes, as above	
14	Eucalyptus camaldulensis	River Red Gum	48	5.76	12/04/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
15	Eucalyptus camaldulensis	River Red Gum	122	14.64	12/04/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
16	Eucalyptus camaldulensis	River Red Gum	65	7.80	12/04/2017	WSP (J. Pegg)	Creekline Grassy Woodland		
17	Eucalyptus camaldulensis	River Red Gum	83	9.96	12/04/2017	WSP (J. Pegg)	Creekline Grassy Woodland		
18	Eucalyptus camaldulensis	River Red Gum	46	5.52	12/04/2017	WSP (J. Pegg)	Plains Grassy Woodland		
19	Eucalyptus camaldulensis	River Red Gum	57	6.84	12/04/2017	WSP (J. Pegg)	Plains Grassy Woodland		
20	Eucalyptus viminalis ssp. pryoriana	Coast Manna-gum	48	5.76	11/04/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland		
21	Eucalyptus viminalis ssp. pryoriana	Coast Manna-gum	80	9.60	10/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland		DBH estimated
22	Eucalyptus camaldulensis	River Red Gum	109	13.08	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		Hollows present
23	Eucalyptus sp.		16	1.92	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	Dead
24	Eucalyptus camaldulensis	River Red Gum	7	0.84	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
25	Eucalyptus camaldulensis	River Red Gum	12	1.44	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
26	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	69	8.28	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	Dead stump over 3m
27	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	69	8.28	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	Dead. Loose bark present
28	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	60	7.20	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	
29	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	83	9.96	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	
30	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	34	4.08	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	Hollows present
31	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	28	3.36	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	Hollows present

ID	SPECIES	COMMON NAME	DBH (CM)	TPZ (M)	DATE RECORDED	ASSESSOR	EVC	WITHIN CONSTRUCTION FOOTPRINT?	COMMENT
32	Eucalyptus viminalis ssp. prioriana	Coast Manna-gum	28	3.36	12/05/2017	WSP (J. Pegg)	Damp Sands Herb-rich Woodland	Yes, as above	Hollows present
33	Eucalyptus camaldulensis	River Red Gum	17	2.04	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
34	Eucalyptus camaldulensis	River Red Gum	25	3.00	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		
35	Eucalyptus camaldulensis	River Red Gum	60	7.20	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		Possibly planted
36	Eucalyptus camaldulensis	River Red Gum	67	8.04	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		Possibly planted
37	Eucalyptus camaldulensis	River Red Gum	70	8.40	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		Possibly planted
38	Eucalyptus camaldulensis	River Red Gum	109	13.08	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		
39	Eucalyptus camaldulensis	River Red Gum	10	1.20	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
40	Eucalyptus camaldulensis	River Red Gum	15	1.80	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland		
41	Eucalyptus camaldulensis	River Red Gum	17	2.04	12/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
42	Eucalyptus camaldulensis	River Red Gum	22	2.64	25/05/2017	WSP (J. Pegg)	Plains Grassy Woodland	Yes, as above	
43	Eucalyptus camaldulensis	River Red Gum				Biosis	Plains Grassy Woodland		

Appendix H

PRELIMINARY CLEARING PROPOSAL UNDER THE BIODIVERSITY ASSESSMENT GUIDELINES

Testing Clearing proposal (modelled)

This report provides biodiversity information associated with the proposed native vegetation clearing. PLEASE NOTE: This report used modelled condition scores. A habitat hectare assessment is required before the shapefiles are submitted to DELWP for processing.

Date of issue: 14/07/2017
Time of issue: 3:22 pm

Ref: Scenario Testing

Project ID	DELWP_NVR_Template_Clearing

Summary of marked native vegetation

Risk-based pathway	High
Total extent	6.118 ha
Remnant patches	4.706 ha
Scattered trees	20 trees
Location risk	C

Strategic biodiversity score of all marked native vegetation	0.472

Offset requirements

If the marked vegetation was cleared, using modelled scores, the following offsets would be applicable.

Offset type	**General offset**
General offset amount (general biodiversity equivalence units)	0.076 general units
General offset attributes	
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Kingston City Council
Minimum strategic biodiversity score	0.100[1]
Offset type	**Specific offset(s)**
Specific offset amount (specific biodiversity equivalence units) and attributes	1.261 specific units of habitat for Orange-bellied Parrot 2.794 specific units of habitat for Marsh Saltbush 1.684 specific units of habitat for Creeping Rush 2.745 specific units of habitat for Salt Lawrencia 2.725 specific units of habitat for Purple Blown-grass 0.060 specific units of habitat for Lacey River Buttercup

NB: values presented in tables throughout this document may not add to totals due to rounding

[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

Page1

Testing Clearing proposal (modelled)

Next steps

Any proposal to remove native vegetation must meet the application requirements of the high risk-based pathway and it will be assessed under the high risk-based pathway.

If you wish to remove the marked native vegetation, you must complete the required habitat hectare assessment to determine the condition score of the native vegetation and then submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to nativevegetation.support@delwp.vic.gov.au. DELWP will provide a Biodiversity impact and offset requirements report that is required to meet the permit application requirements.

Biodiversity impact of removal of native vegetation

Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent in the GIS data you provided and modelled condition scores.

Habitat zone	Modelled condition score	Extent (ha)	Habitat hectares
1-1-1	0.200	0.071	0.014
2-2-2	0.200	0.071	0.014
3-3-3	0.200	0.071	0.014
4-4-4	0.200	0.010	0.002
5-5-5	0.200	0.071	0.014
6-6-6	0.200	0.071	0.014
7-7-7	0.200	0.071	0.014
8-8-8	0.200	0.071	0.014
9-9-9	0.200	0.071	0.014
10-10-10	0.200	0.015	0.003
11-11-11	0.200	0.005	0.001
12-12-12	0.200	0.006	0.001
13-13-13	0.200	0.022	0.004
14-14-14	0.200	0.071	0.014
15-15-15	0.200	0.071	0.014
16-16-16	0.200	0.071	0.014
17-17-17	0.200	0.071	0.014
18-18-18	0.200	0.071	0.014
19-19-19	0.200	0.071	0.014
20-20-20	0.590	0.045	0.027
21-21-21	0.590	0.000	0.000

Testing Clearing proposal (modelled)

Habitat zone	Modelled condition score	Extent (ha)	Habitat hectares
22-22-22	0.570	0.009	0.005
23-23-23	0.570	0.000	0.000
24-24-24	0.570	0.025	0.014
25-25-25	0.511	0.033	0.017
26-26-26	0.570	0.006	0.003
27-27-27	0.531	0.028	0.015
28-28-28	0.570	0.007	0.004
29-29-29	0.495	0.003	0.001
30-30-30	0.570	0.020	0.011
31-31-31	0.570	0.011	0.006
32-32-32	0.590	0.032	0.019
33-33-33	0.570	0.001	0.000
34-34-34	0.515	0.100	0.051
35-35-35	0.529	0.032	0.017
36-36-36	0.242	0.032	0.008
37-37-37	0.590	0.013	0.008
38-38-38	0.590	0.000	0.000
39-39-39	0.530	0.096	0.051
40-40-40	0.577	0.220	0.127
41-41-41	0.200	0.033	0.007
42-42-42	0.300	0.087	0.026
43-43-43	0.390	0.014	0.005
44-44-44	0.200	0.027	0.005
45-45-45	0.200	0.002	0.000
46-46-46	0.200	0.018	0.004
47-47-47	0.200	0.040	0.008
48-48-48	0.200	0.012	0.002
49-49-49	0.200	0.003	0.001
50-50-50	0.550	0.018	0.010
51-51-51	0.380	0.006	0.002
52-52-52	0.540	0.169	0.092
53-53-53	0.570	0.001	0.000
54-54-54	0.472	0.015	0.007
55-55-55	0.570	0.036	0.020

Testing Clearing proposal (modelled)

Habitat zone	Modelled condition score	Extent (ha)	Habitat hectares
56-56-56	0.590	0.019	0.011
57-57-57	0.504	0.238	0.120
58-58-58	0.570	0.077	0.044
59-59-59	0.585	0.296	0.173
60-60-60	0.590	0.024	0.014
61-61-61	0.570	0.000	0.000
62-62-62	0.570	0.000	0.000
63-63-63	0.590	0.000	0.000
64-64-64	0.330	0.079	0.026
65-65-65	0.200	0.060	0.012
66-66-66	0.494	0.318	0.157
67-67-67	0.221	0.064	0.014
68-68-68	0.355	0.218	0.077
69-69-69	0.530	0.150	0.080
70-70-70	0.385	0.929	0.357
71-71-71	0.200	0.002	0.000
72-72-72	0.205	0.307	0.063
73-73-73	0.200	0.045	0.009
74-74-74	0.200	0.032	0.006
75-75-75	0.200	0.016	0.003
76-76-76	0.200	0.272	0.054
77-77-77	0.200	0.005	0.001
78-78-78	0.200	0.019	0.004
79-79-79	0.200	0.009	0.002
80-80-80	0.200	0.064	0.013
81-81-81	0.200	0.012	0.002
82-82-82	0.200	0.055	0.011
83-83-83	0.393	0.050	0.020
84-84-84	0.200	0.071	0.014
85-85-85	0.200	0.047	0.009
86-86-86	0.209	0.071	0.015
87-87-87	0.200	0.047	0.009
88-88-88	0.200	0.071	0.014
89-89-89	0.200	0.071	0.014

Testing Clearing proposal (modelled)

Habitat zone	Modelled condition score	Extent (ha)	Habitat hectares
90-90-90	0.200	0.071	0.014
91-91-91	0.200	0.071	0.014
TOTAL			**2.163**

Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal has a proportional impact above the specific offset threshold for the following rare or threatened species' habitats.

Species number	Species common name	Species scientific name	Species type	Area of mapped habitat (ha)	Proportional impact (%)
10305	Orange-bellied Parrot	Neophema chrysogaster	Dispersed	2.262	0.005 %
500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	Dispersed	4.093	0.023 %
501839	Creeping Rush	Juncus revolutus	Dispersed	2.528	0.037 %
501888	Salt Lawrencia	Lawrencia spicata	Dispersed	4.093	0.008 %
504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	Dispersed	4.093	0.012 %
505019	Lacey River Buttercup	Ranunculus amplus	Highly Localised - model & points	0.085	0.089 %

Clearing site biodiversity equivalence score(s)

Where a habitat zone requires specific offset(s), the specific biodiversity equivalence score(s) for each species in that habitat zone is calculated by multiplying the habitat hectares of the habitat zone by the habitat importance score for each species impacted in the habitat zone.

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
20-20-20	0.027	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.022
20-20-20	0.027	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.022
20-20-20	0.027	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.022
20-20-20	0.027	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.810	0.022

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
21-21-21	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.000
21-21-21	0.000	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.000
21-21-21	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.000
21-21-21	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.800	0.000
22-22-22	0.005	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.794	0.004
22-22-22	0.005	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.783	0.004
22-22-22	0.005	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.763	0.004
23-23-23	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.000
23-23-23	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.800	0.000
23-23-23	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.780	0.000
24-24-24	0.014	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.794	0.011
24-24-24	0.014	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.781	0.011
24-24-24	0.014	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.761	0.011
25-25-25	0.017	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.013
25-25-25	0.017	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.013
25-25-25	0.017	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.013
26-26-26	0.003	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.790	0.003
26-26-26	0.003	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.770	0.003

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
26-26-26	0.003	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.750	0.003
27-27-27	0.015	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.012
27-27-27	0.015	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.012
27-27-27	0.015	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.011
28-28-28	0.004	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.790	0.003
28-28-28	0.004	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.770	0.003
28-28-28	0.004	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.750	0.003
29-29-29	0.001	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.001
29-29-29	0.001	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.001
29-29-29	0.001	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.001
30-30-30	0.011	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.009
30-30-30	0.011	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.009
30-30-30	0.011	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.009
31-31-31	0.006	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.005
31-31-31	0.006	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.800	0.005
31-31-31	0.006	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.780	0.005
32-32-32	0.019	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.016
32-32-32	0.019	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.015

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
32-32-32	0.019	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.015
32-32-32	0.019	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.802	0.015
33-33-33	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.000
33-33-33	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.000
33-33-33	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.000
34-34-34	0.051	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.041
34-34-34	0.051	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.040
34-34-34	0.051	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.039
35-35-35	0.017	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.818	0.014
35-35-35	0.017	100.000 %	501839	Creeping Rush	Juncus revolutus	0.808	0.014
35-35-35	0.017	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.808	0.014
35-35-35	0.017	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.798	0.013
36-36-36	0.008	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.811	0.006
36-36-36	0.008	100.000 %	501839	Creeping Rush	Juncus revolutus	0.801	0.006
36-36-36	0.008	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.801	0.006
36-36-36	0.008	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.791	0.006
37-37-37	0.008	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.006
37-37-37	0.008	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.006

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
37-37-37	0.008	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.006
37-37-37	0.008	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.810	0.006
38-38-38	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.000
38-38-38	0.000	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.000
38-38-38	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.000
38-38-38	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.810	0.000
39-39-39	0.051	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.752	0.038
39-39-39	0.051	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.792	0.040
39-39-39	0.051	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.782	0.040
39-39-39	0.051	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.782	0.040
40-40-40	0.127	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.830	0.105
40-40-40	0.127	50.453 %	501839	Creeping Rush	Juncus revolutus	0.820	0.052
40-40-40	0.127	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.815	0.103
40-40-40	0.127	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.805	0.102
41-41-41	0.007	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.720	0.005
41-41-41	0.007	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.700	0.005
41-41-41	0.007	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.690	0.005
42-42-42	0.026	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.700	0.018

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
42-42-42	0.026	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.746	0.019
42-42-42	0.026	100.000 %	501839	Creeping Rush	Juncus revolutus	0.730	0.019
42-42-42	0.026	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.730	0.019
42-42-42	0.026	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.730	0.019
43-43-43	0.005	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.747	0.004
43-43-43	0.005	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.788	0.004
43-43-43	0.005	100.000 %	501839	Creeping Rush	Juncus revolutus	0.777	0.004
43-43-43	0.005	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.777	0.004
43-43-43	0.005	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.777	0.004
50-50-50	0.010	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.770	0.007
50-50-50	0.010	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.008
50-50-50	0.010	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.008
50-50-50	0.010	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.800	0.008
50-50-50	0.010	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.800	0.008
51-51-51	0.002	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.002
51-51-51	0.002	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.002
51-51-51	0.002	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.002
52-52-52	0.092	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.799	0.073

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
52-52-52	0.092	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.779	0.071
52-52-52	0.092	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.759	0.070
53-53-53	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.790	0.000
53-53-53	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.770	0.000
53-53-53	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.750	0.000
54-54-54	0.007	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.006
54-54-54	0.007	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.005
54-54-54	0.007	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.005
55-55-55	0.020	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.793	0.016
55-55-55	0.020	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.016
55-55-55	0.020	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.015
56-56-56	0.011	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.009
56-56-56	0.011	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.009
56-56-56	0.011	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.009
56-56-56	0.011	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.810	0.009
57-57-57	0.120	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.816	0.098
57-57-57	0.120	86.805 %	501839	Creeping Rush	Juncus revolutus	0.808	0.084
57-57-57	0.120	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.804	0.096

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
57-57-57	0.120	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.793	0.095
58-58-58	0.044	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.795	0.035
58-58-58	0.044	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.784	0.034
58-58-58	0.044	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.764	0.034
59-59-59	0.173	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.142
59-59-59	0.173	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.140
59-59-59	0.173	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.140
59-59-59	0.173	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.803	0.139
60-60-60	0.014	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.012
60-60-60	0.014	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.012
60-60-60	0.014	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.012
60-60-60	0.014	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.801	0.011
61-61-61	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.000
61-61-61	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.000
61-61-61	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.000
62-62-62	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.800	0.000
62-62-62	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.780	0.000
62-62-62	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.760	0.000

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
63-63-63	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.820	0.000
63-63-63	0.000	100.000 %	501839	Creeping Rush	Juncus revolutus	0.810	0.000
63-63-63	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.810	0.000
63-63-63	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.800	0.000
64-64-64	0.026	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.752	0.020
64-64-64	0.026	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.738	0.019
64-64-64	0.026	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.722	0.019
64-64-64	0.026	64.833 %	505019	Lacey River Buttercup	Ranunculus amplus	1.000	0.017
65-65-65	0.012	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.720	0.009
65-65-65	0.012	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.760	0.009
65-65-65	0.012	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.750	0.009
65-65-65	0.012	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.750	0.009
66-66-66	0.157	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.773	0.121
66-66-66	0.157	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.823	0.129
66-66-66	0.157	96.752 %	501839	Creeping Rush	Juncus revolutus	0.813	0.123
66-66-66	0.157	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.803	0.126
66-66-66	0.157	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.803	0.126
67-67-67	0.014	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.732	0.010

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
67-67-67	0.014	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.779	0.011
67-67-67	0.014	100.000 %	501839	Creeping Rush	Juncus revolutus	0.769	0.011
67-67-67	0.014	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.759	0.011
67-67-67	0.014	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.762	0.011
68-68-68	0.077	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.735	0.057
68-68-68	0.077	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.775	0.060
68-68-68	0.077	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.765	0.059
68-68-68	0.077	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.765	0.059
69-69-69	0.080	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.752	0.060
69-69-69	0.080	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.792	0.063
69-69-69	0.080	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.782	0.062
69-69-69	0.080	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.782	0.062
70-70-70	0.357	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.738	0.264
70-70-70	0.357	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.782	0.279
70-70-70	0.357	98.867 %	501839	Creeping Rush	Juncus revolutus	0.771	0.273
70-70-70	0.357	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.766	0.274
70-70-70	0.357	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.768	0.274
71-71-71	0.000	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.670	0.000

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
71-71-71	0.000	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.710	0.000
71-71-71	0.000	100.000 %	501839	Creeping Rush	Juncus revolutus	0.700	0.000
71-71-71	0.000	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.700	0.000
71-71-71	0.000	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.700	0.000
72-72-72	0.063	100.000 %	10305	Orange-bellied Parrot	Neophema chrysogaster	0.660	0.042
72-72-72	0.063	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.700	0.044
72-72-72	0.063	100.000 %	501839	Creeping Rush	Juncus revolutus	0.690	0.043
72-72-72	0.063	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.690	0.043
72-72-72	0.063	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.693	0.044
83-83-83	0.020	94.838 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.782	0.015
83-83-83	0.020	94.838 %	501888	Salt Lawrencia	Lawrencia spicata	0.770	0.014
83-83-83	0.020	94.838 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.750	0.014
83-83-83	0.020	66.967 %	505019	Lacey River Buttercup	Ranunculus amplus	1.000	0.013
85-85-85	0.009	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.710	0.007
85-85-85	0.009	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.690	0.007
85-85-85	0.009	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.710	0.007
86-86-86	0.015	100.000 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.713	0.011
86-86-86	0.015	100.000 %	501888	Salt Lawrencia	Lawrencia spicata	0.713	0.011

Testing Clearing proposal (modelled)

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
86-86-86	0.015	100.000 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.704	0.010
87-87-87	0.009	95.404 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.710	0.006
87-87-87	0.009	95.404 %	501888	Salt Lawrencia	Lawrencia spicata	0.690	0.006
87-87-87	0.009	95.404 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.710	0.006
88-88-88	0.014	15.863 %	500326	Marsh Saltbush	Atriplex paludosa subsp. paludosa	0.710	0.002
88-88-88	0.014	15.863 %	501888	Salt Lawrencia	Lawrencia spicata	0.710	0.002
88-88-88	0.014	15.863 %	504222	Purple Blown-grass	Lachnagrostis punicea subsp. filifolia	0.700	0.002

There are habitat zones in your proposal which are not habitat for the species above. A general offset is required for the(se) habitat zone(s).

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
1-1-1	0.014	100.000 %	0.100	0.001
2-2-2	0.014	100.000 %	0.100	0.001
3-3-3	0.014	100.000 %	0.100	0.001
4-4-4	0.002	100.000 %	0.100	0.000
5-5-5	0.014	100.000 %	0.100	0.001
6-6-6	0.014	100.000 %	0.100	0.001
7-7-7	0.014	100.000 %	0.100	0.001
8-8-8	0.014	100.000 %	0.100	0.001
9-9-9	0.014	100.000 %	0.100	0.001
10-10-10	0.003	100.000 %	0.100	0.000
11-11-11	0.001	100.000 %	0.100	0.000
12-12-12	0.001	100.000 %	0.100	0.000
13-13-13	0.004	100.000 %	0.100	0.000

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Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
14-14-14	0.014	100.000 %	0.100	0.001
15-15-15	0.014	100.000 %	0.100	0.001
16-16-16	0.014	100.000 %	0.100	0.001
17-17-17	0.014	100.000 %	0.100	0.001
18-18-18	0.014	100.000 %	0.100	0.001
19-19-19	0.014	100.000 %	0.100	0.001
44-44-44	0.005	100.000 %	0.100	0.001
45-45-45	0.000	100.000 %	0.100	0.000
46-46-46	0.004	100.000 %	0.100	0.000
47-47-47	0.008	100.000 %	0.100	0.001
48-48-48	0.002	100.000 %	0.100	0.000
49-49-49	0.001	100.000 %	0.100	0.000
73-73-73	0.009	100.000 %	0.100	0.001
74-74-74	0.006	100.000 %	0.100	0.001
75-75-75	0.003	100.000 %	0.100	0.000
76-76-76	0.054	100.000 %	0.100	0.005
77-77-77	0.001	100.000 %	0.100	0.000
78-78-78	0.004	100.000 %	0.100	0.000
79-79-79	0.002	100.000 %	0.100	0.000
80-80-80	0.013	100.000 %	0.100	0.001
81-81-81	0.002	100.000 %	0.100	0.000
82-82-82	0.011	100.000 %	0.100	0.001
83-83-83	0.020	5.162 %	0.453	0.000
84-84-84	0.014	100.000 %	0.503	0.007
87-87-87	0.009	4.596 %	0.100	0.000
88-88-88	0.014	84.137 %	0.439	0.005
89-89-89	0.014	100.000 %	0.100	0.001
90-90-90	0.014	100.000 %	0.100	0.001
91-91-91	0.014	100.000 %	0.100	0.001

Mapped rare or threatened species' habitats on site

Testing Clearing proposal (modelled)

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

Species number	Species common name	Species scientific name
10045	Lewin's Rail	Lewinia pectoralis pectoralis
10050	Baillon's Crake	Porzana pusilla palustris
10111	Gull-billed Tern	Gelochelidon nilotica macrotarsa
10118	Fairy Tern	Sternula nereis nereis
10137	Pacific Golden Plover	Pluvialis fulva
10149	Eastern Curlew	Numenius madagascariensis
10154	Wood Sandpiper	Tringa glareola
10170	Australian Painted Snipe	Rostratula benghalensis australis
10185	Little Egret	Egretta garzetta nigripes
10186	Intermediate Egret	Ardea intermedia
10187	Eastern Great Egret	Ardea modesta
10195	Australian Little Bittern	Ixobrychus minutus dubius
10197	Australasian Bittern	Botaurus poiciloptilus
10212	Australasian Shoveler	Anas rhynchotis
10214	Freckled Duck	Stictonetta naevosa
10215	Hardhead	Aythya australis
10216	Blue-billed Duck	Oxyura australis
10217	Musk Duck	Biziura lobata
10220	Grey Goshawk	Accipiter novaehollandiae novaehollandiae
10226	White-bellied Sea-Eagle	Haliaeetus leucogaster
10230	Square-tailed Kite	Lophoictinia isura
10238	Black Falcon	Falco subniger
10498	Chestnut-rumped Heathwren	Calamanthus pyrrhopygius
10598	Painted Honeyeater	Grantiella picta
11280	Grey-headed Flying-fox	Pteropus poliocephalus
12283	Lace Monitor	Varanus varius
12683	Glossy Grass Skink	Pseudemoia rawlinsoni
13117	Brown Toadlet	Pseudophryne bibronii
13125	Southern Toadlet	Pseudophryne semimarmorata
13207	Growling Grass Frog	Litoria raniformis
4701	Dwarf Galaxias	Galaxiella pusilla
500786	Leafy Twig-sedge	Cladium procerum

Testing Clearing proposal (modelled)

Species number	Species common name	Species scientific name
503367	Metallic Sun-orchid	Thelymitra epipactoides
503763	Swamp Everlasting	Xerochrysum palustre
504206	Purple Blown-grass	Lachnagrostis punicea subsp. punicea
504643	Grey Billy-buttons	Craspedia canens
505337	Austral Crane's-bill	Geranium solanderi var. solanderi s.s.
528553	Black-tailed Godwit	Limosa limosa

Offset requirements

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]
- Specific offsets must be located in the same species habitat as that being removed, as determined by the habitat importance map for that species.

The offset requirements for your proposal are as follows:

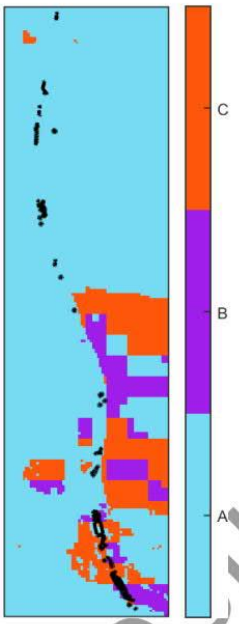
Offset type	Clearing site biodiversity equivalence score	Risk multiplier	Offset requirements	
			Offset amount (biodiversity equivalence units)	Offset attributes
Specific	0.630 SBES	2	1.261 specific units	Offset must provide habitat for 10305, Orange-bellied Parrot, Neophema chrysogaster
Specific	1.397 SBES	2	2.794 specific units	Offset must provide habitat for 500326, Marsh Saltbush, Atriplex paludosa subsp. paludosa
Specific	0.842 SBES	2	1.684 specific units	Offset must provide habitat for 501839, Creeping Rush, Juncus revolutus
Specific	1.372 SBES	2	2.745 specific units	Offset must provide habitat for 501888, Salt Lawrencia, Lawrencia spicata
Specific	1.362 SBES	2	2.725 specific units	Offset must provide habitat for 504222, Purple Blown-grass, Lachnagrostis punicea subsp. filifolia
Specific	0.030 SBES	2	0.060 specific units	Offset must provide habitat for 505019, Lacey River Buttercup, Ranunculus amplus
General	0.051 GBES	1.5	0.076 general units	Offset must be within Port Phillip And Westernport CMA or Kingston City Council Offset must have a minimum strategic biodiversity score of 0.100

[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

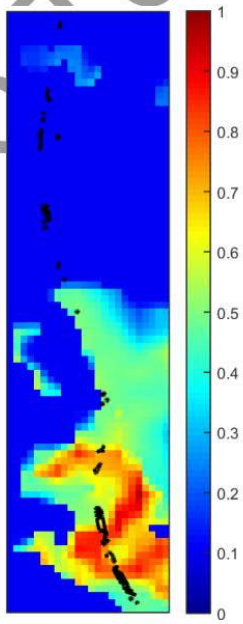
Testing Clearing proposal (modelled)

Images of marked native vegetation

1. Native vegetation location risk map



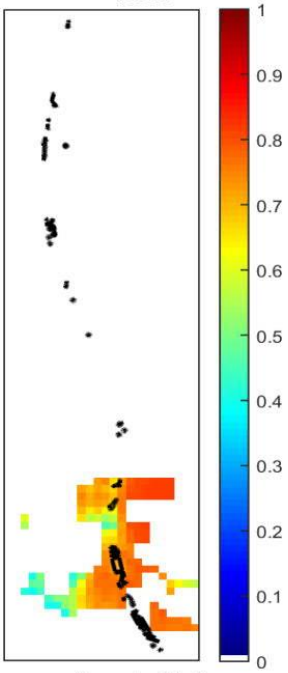
2. Strategic biodiversity score map



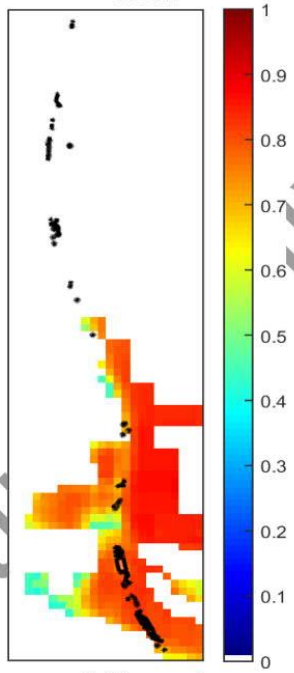
Testing Clearing proposal (modelled)

3. Habitat importance maps

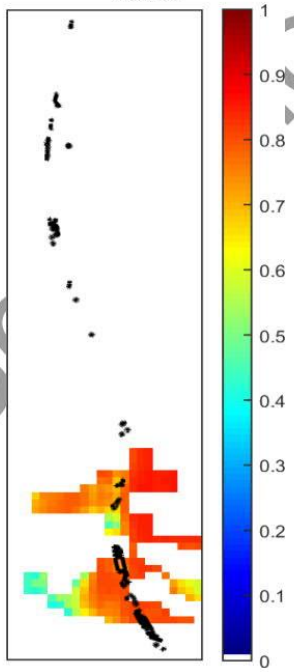
Orange-bellied Parrot
Neophema chrysogaster
10305



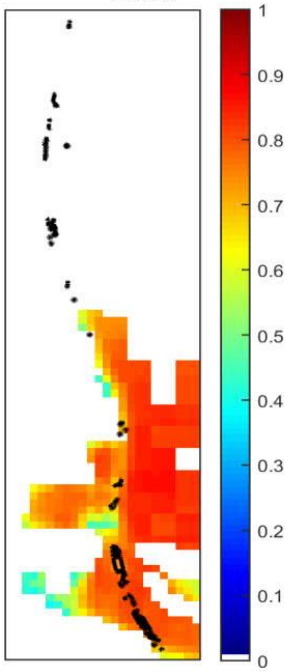
Marsh Saltbush
Atriplex paludosa subsp. paludosa
500326



Creeping Rush
Juncus revolutus
501839



Salt Lawrencia
Lawrencia spicata
501888



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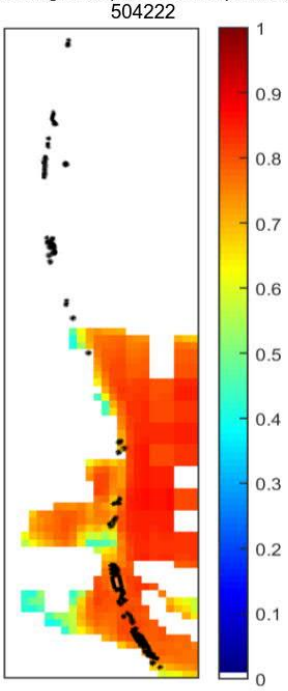
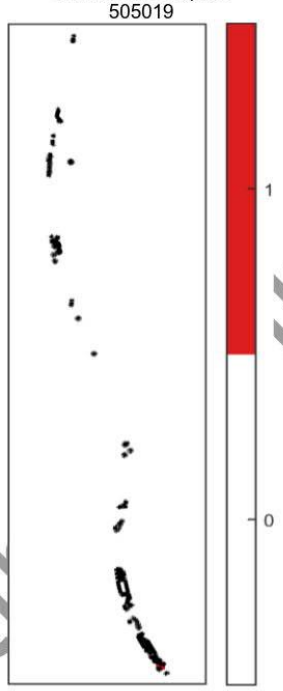
Testing Clearing proposal (modelled)

Purple Blown-grass
Lachnagrostis punicea subsp. filifolia
504222



Lacey River Buttercup
Ranunculus amplus
505019



Testing Clearing proposal (modelled)

Glossary

Condition score

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

Dispersed habitat

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

General biodiversity equivalence score

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\textit{General biodiversity equivalence score} = \textit{habitat hectares} \times \textit{strategic biodiversity score}$$

General offset amount

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\textit{Risk adjusted general biodiversity equivalence score} = \textit{general biodiversity equivalence score clearing} \times 1.5$$

General offset attributes

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

Habitat hectares

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\textit{Habitat hectares} = \textit{total extent (hectares)} \times \textit{condition score}$$

Habitat importance score

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

Habitat zone

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

Testing Clearing proposal (modelled)

Highly localised habitat

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

Minimum strategic biodiversity score

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

Offset risk factor

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$Risk\ factor\ for\ general\ offsets = 1.5$$

$$Risk\ factor\ for\ specific\ offset = 2$$

Offset type

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

Proportional impact on species

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

Specific offset amount

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$Risk\ adjusted\ specific\ biodiversity\ equivalence\ score = specific\ biodiversity\ equivalence\ score\ clearing \times 2$$

Testing Clearing proposal (modelled)

Specific offset attributes

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

Specific biodiversity equivalence score

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\textit{Specific biodiversity equivalence score} = \textit{habitat hectares} \times \textit{habitat importance score}$$

Strategic biodiversity score

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

Total extent (hectares) for calculating habitat hectares

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

Vicinity

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.