10 Biodiversity

Tables

Figures

10.1 OVERVIEW

This chapter provides an assessment of the potential impacts on biodiversity, including flora, fauna and ecological character, from the Mordialloc Bypass (Freeway) (the project), including the construction, operation and maintenance phases. It is based on the impact assessment prepared by WSP and presented in Appendix C: *Flora and fauna impact assessment*. Impacts upon Matters of National Environmental Significance (MNES) are addressed specifically in Chapter 22: *Matters of national environmental significance* of this Environment Effects Statement (EES). This chapter draws on conclusions and impacts outlined in Chapter 12: *Noise and vibration effects*, Chapter 16: *Surface water and hydrology* and Chapter 17: *Groundwater*.

The project area for Mordialloc Bypass (Freeway) was proposed as a road reservation in the 1960s. Since then, much of the area has been cleared of native vegetation and now consists of exotic or planted roadside vegetation, modified agricultural land and constructed features such as roads and housing developments.

Despite the highly modified nature of the project area, the surrounding areas include sensitive and high-value environments. It is located across the Waterways Wetlands at Mordialloc Creek, between Braeside Park and Woodlands Industrial Estate Wetlands. The Edithvale component of the Edithvale-Seaford Ramsar Wetlands is located about 700m to the south-west of the project area. The catchments within the project area contribute surface water flow to the larger Mordialloc Creek drainage system. The project also lies within the Gippsland Plain Bioregion.

The project area itself supports patches of remnant and high quality planted native vegetation (particularly at Waterways Wetlands), scattered remnant trees (including large old trees), drainage lines and roadside revegetation, all of which provide habitat and connectivity for fauna. The biodiversity study area included land surrounding the project boundary within 20m. The study area supports 12 Ecological Vegetation Classes (EVCs), most of which are considered 'endangered' in the Gippsland Plain Bioregion. The study area also supports four threatened ecological communities, comprising:

- Two *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened ecological communities, both listed as critically endangered:
  - Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
  - Natural Damp Grassland of the Victorian Coastal Plains.
- Two listed *Flora and Fauna Guarantee Act 1988* (Vic) (FFG Act) threatened communities which, in part, correspond to the above EPBC Act communities:
  - Herb-rich Plains Grassy Wetland (West Gippsland) Community
  - Plains Grassland (South Gippsland) Community.

Targeted surveys identified five significant flora species in the study area, however, impacts are only anticipated on two species. These are Leafy Twig-sedge (Advisory List: Rare in Victoria) and Large River Buttercup (Advisory List: Poorly known in Victoria). Impacts on these species will be minor. Controls such as pre-clearing surveys and no-go zones will ensure that any impacts on flora not recorded during surveys are minor.

Land clearance, which is an EPBC Act listed threatening process, is the greatest risk to the EVCs, trees, EPBC Act communities and FFG Act communities due to native vegetation loss during construction to accommodate the project footprint. This cannot be avoided in its entirety but Environmental Performance Requirements (EPRs) require ongoing design refinement to limit vegetation loss where possible. No-go zones have been mapped as provided in Attachment III: *Maps and figures* to indicate areas within and adjacent to the project where works should not take place and therefore not result in clearance or damage to vegetation. Land clearance cannot be completely mitigated and will have some residual impact upon EVCs, threatened communities, flora, and fauna, however adherence to the EPRs will limit this through careful planning, management and monitoring of design, clearing and construction activities.

A total of 102 fauna species of state or national significance were assessed for the potential to occur in the study area. Of these, 44 species are considered to have a likelihood of occurrence within or nearby the project area greater than 'low'. Most significant species known or likely to occur are birds. High value wetland habitat is present near the alignment, and includes the shallow water habitats at Braeside Park Wetlands and Woodlands Industrial Estate Wetlands, which provide mudflat foraging habitat for migratory wader birds when water levels are low, as well as habitat for other significant bird species such as the Australasian Bittern.

There are various potential or likely impacts that threaten the ecological character, flora and fauna of the area. These include direct impacts such as habitat and tree loss and less direct impacts such as mortality and injury of wildlife due to collision with vehicles, reduced connectivity of habitat and noise and light disturbance. No impacts upon the habitat values of Edithvale Wetlands are anticipated.

The project has been designed to avoid and minimise impacts wherever possible. EPRs have been proposed for the project, including measures to minimise impacts to fauna habitat from noise, light, and loss of connectivity using fauna barriers and connectivity culverts.

With these measures in place, the residual impact of the project on significant ecological values and upon ecological character is anticipated to be low.

10.2 EES OBJECTIVES AND REQUIREMENTS

The draft evaluation objective for biodiversity is defined in the *Scoping Requirements for Mordialloc Bypass Environment Effects Statement* (scoping requirements (DELWP) 2018.

The key issues for biodiversity, as identified in the scoping requirements, are summarised in Table 10.1. It should be noted that aspects relating to MNES are also addressed in Chapter 22: *Matters of national environmental significance* of this EES, which includes summaries of all potential impacts to MNES (i.e. groundwater impacts, surface water impacts, biodiversity impacts).

DRAFT EVALUATION OBJECTIVE

To avoid, minimise or offset potential adverse effects on native vegetation, listed migratory and threatened species and communities, as well as habitat for other protected species.

Table 10.1 EES key issues – biodiversity

Key issues
Direct loss of native vegetation and any associated listed threatened flora and fauna species and communities known or likely to occur in the project site, such as Plains Grassy Woodland, Damp Sands Herb-rich Woodland/Heathy Woodland Mosaic, Plains Grassy Wetlands, Creekline Grassy Woodland and Swamp Scrub Plains Grassy Woodland.
Loss of, degradation, modification or hydrological alteration to any ecological communities listed as threatened under the FFG Act and EPBC Act, including revegetated areas, and including but not limited to: • Herb-rich Plains Grassy Wetland (West Gippsland) Community (FFG Act)/critically endangered Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (EPBC Act); and • Plains Grassland (South Gippsland) Community (FFG Act).
Direct loss of, or degradation to, habitat for flora and fauna species listed as threatened or migratory under the EPBC Act, the FFG Act and/or Department of Sustainability and Environment (DSE) Advisory List, including but not limited to avifauna species, in particular: • Australian Fairy Tern *Sternula nereis nereis* • Eastern Curlew *Numenius madagascariensis* • Curlew Sandpiper *Calidris ferruginea* • Australasian Bittern *Botaurus poiciloptilus* • Sharp-tailed Sandpiper *Calidris acuminata* • Latham's Snipe *Gallinago hardwickii* • Australian Painted Snipe *Rostratula australis.*
Indirect loss of vegetation or habitat quality, that may support any listed species or other protected fauna, resulting from hydrological or hydrogeological change, edge effects, overshadowing, habitat fragmentation, loss of connectivity, or other disturbance impacts including noise from haul trucks during construction and from potential increased traffic along Springvale Road through the Edithvale Wetland.
Potential for adverse effects on the ecological character and biodiversity values of the listed Edithvale-Seaford Wetlands Ramsar site including, but not limited to, the bird species mentioned above.

Key issues
Potential for indirect effects on biodiversity values including but not limited to those effects associated with changes in hydrology (including surface and groundwater changes), water quality (i.e. on water dependent ecosystems), contaminants and pollutants, weeds, pathogens and pest animals.
Potential for impacts on FFG Act and EPBC Act listed species and other protected species resulting from construction and operation activities, including but not limited to significantly increasing mortality due to road traffic, and disturbance to foraging, roosting and breeding of listed threatened species and listed migratory species due to increased lighting, noise and traffic.
Potential for indirect significant impacts due to shading of vegetation because of the project including but not limited to elevated structures, such as the proposed bridges over Mordialloc Creek and the Waterways wetlands.
The availability of suitable offsets for the loss of native vegetation and habitat for relevant listed threatened species, ecological communities and migratory species under the EPBC Act and/or FFG Act.

10.3 LEGISLATION AND POLICY

The biodiversity aspects of the project will be assessed and managed in accordance with relevant Commonwealth and Victorian legislation, policies and guidelines.

The relevant legislation and policies relating to the project are outlined in Table 10.2. Full details are provided in Appendix C: *Flora and fauna impact assessment*.

Table 10.2 Legislation and policy – Biodiversity

Legislation/policy	Description
Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act 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 MNES. There are nine MNES to which the EPBC Act applies. Three matters are relevant to the project area: wetlands of international importance, nationally threatened species and ecological communities and migratory species. This is addressed in more detail in Chapter 22: *Matters of National Environmental Significance.*
State	
Environment Effects Act 1978 (Vic)	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 *Environment 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 was completed (WSP 2017b) and identified that one or more individual effects may be triggered. A project with potentially significant adverse environmental effects is required to be referred to the Minister. The project was the subject of an EES Referral, and a determination was made by the Minister that an EES is required.

Legislation/policy	Description
Flora and Fauna Guarantee Act 1988 (FFG Act)	The FFG Act provides a legal framework for enabling and promoting the conservation in Victoria. Threatened flora and fauna as well as threatening processes are listed under this Act. Under Section 47 of the FFG Act, a permit is required to 'take' protected flora from public land. A permit is also required if FFG Act listed species and communities are proposed to be impacted by the project. The following species listed under this Act have the potential to be impacted by the project and therefore may require a permit: • Australasian Bittern • Australian Little Bittern • Australian Painted Snipe • Baillon's Crake • Blue-billed Duck • Caspian Tern • Curlew Sandpiper • Diamond Dove • Eastern Great Egret • Freckled Duck • Intermediate Egret • Lewin's Rail • Little Egret • Magpie Goose • Grey-headed Flying-fox. The study area also supports two FFG Act listed threatened communities that will be impacted and are likely to require a permit. • Plains Grassland (South Gippsland) Community • Herb-rich Plains Grassy Wetland (West Gippsland) Community.
Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)	The *Guidelines for the removal, destruction or lopping of native vegetation* (the Guidelines) are designed to manage the risk to Victoria's biodiversity associated with the removal of native vegetation. They set out and describe the application of Victoria's statewide policy in relation to assessing and compensating for the removal of native vegetation. They also provide the mechanism for offsetting residual native vegetation and habitat loss with emphasis on avoiding and minimising impacts prior to offsetting. Offsets are discussed in Section 10.8.5.
Wildlife Act 1975 (Vic)	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. Any persons involved in fauna removal, salvage capture or relocation of fauna during construction must hold a current Management Authorisation under the *Wildlife Act 1975*.
Catchment and Land Protection Act 1994 (Vic) (CaLP Act)	Plants declared noxious under the CaLP Act are known to or have the potential to result in detrimental environmental and/or economic effects. Declared noxious weeds are categorised into four groups depending on their known and potential impact and specific circumstances in each region. The project area supports eleven regionally controlled (C), four restricted (R) and one regionally prohibited (P) weed. The construction and maintenance of the project will need to comply with the provisions of the Act, which protect against the spread of these weeds.

Legislation/policy	Description
Local	
Kingston and Greater Dandenong Planning Schemes	The *Planning and Environment Act 1987* (Vic) (P&E Act) provides the legal framework for the operation of Victoria's planning system. Each Council in Victoria has its own Planning Scheme prepared under the P&E Act. Chapter 9: *Land use and planning* discusses the planning and approval process in detail, including detailed analysis of what planning schemes are triggered by the project.
Kingston Green Wedge Plan 2012	Kingston Green Wedge Plan identifies the values and features of the green wedge area. Green Wedges are the non-urban areas of the metropolitan Melbourne that are located outside of the Urban Growth Boundary. Various mitigation measures to maintain or enhance ecological values and waterway health will help the project better align with the objectives of the Green Wedge plan.
Living Links	Living Links is an urban nature project aimed at retaining and protecting the natural values within the Port Phillip and Westernport catchment. The project is unlikely to sever any of the links or substantially affect any of the Living Links projects within the area.
City of Kingston Biodiversity Strategy	The City of Kingston Biodiversity Strategy sets out goals, outlines strategic objectives and incorporates a management plan for protecting and preserving Kingston's terrestrial biodiversity. Mitigation measures will help the project align with the objectives set out in the Biodiversity Strategy.

10.4 METHODOLOGY

The flora and fauna impacts assessment included:

- determine the ecological values (existing conditions) of the project area, including:
  - a review of databases
  - detailed literature review and
  - extensive field work
- a risk assessment as described in detail in Chapter 4: *EES assessment framework and approach*
- an assessment of potential impacts to ecological character, fauna and flora by the project
- develop mitigation measure and EPRs to manage potential impacts.

Further details of the flora and fauna methodology can be found in Appendix C: *Flora and fauna impact assessment*. These activities built upon the work completed for the *Preliminary flora and fauna assessment for the Mordialloc Bypass* (WSP 2017a). The risk assessment process is described in detail in Chapter 4: *EES assessment framework and approach*.

10.4.1 Database and literature review

Government databases and mapping were searched for records of threatened species within 5km of the project area. These data sources were used to prepare a list of threatened flora and fauna, ecological communities, migratory species and any significant habitat previously recorded or predicted to occur in the study area.

Previous ecological survey and assessment literature for the project area and locality were reviewed to provide an overview of the known ecological values and systems of the area. It included reviewing past investigations of the project alignment and studies completed in neighbouring areas such as Braeside Park and nearby Edithvale Wetlands.

10.4.2 Field surveys

Field surveys were conducted to determine the likely presence of threatened species within and across the study area. Surveys undertaken are summarised in Table 10.3.

The survey information was used to:

- assess the existing site condition and habitats
- determine the likelihood of species occurring at the site
- assess potential impacts of the project on ecological values (including native vegetation, significant species, threatening processes, and ecological character)
- assess the potential for cumulative impacts
- map remnant native vegetation that can be avoided by construction works as 'no-go zones'
- inform design to avoid impacts where possible
- develop mitigation measures for significant species.

Table 10.3 provides a summary of all surveys and assessments undertaken within the project area, including surveys completed prior to the Flora and fauna impact assessment, and the survey undertaken for the assessment. Further details, including who undertook the surveys, and where the information is summarised from, is provided in Appendix C: *Flora and fauna impact assessment*. Figure 10.1 shows where the more recent flora and fauna studies have been undertaken – specifically around the Braeside Park, Woodlands Industrial Wetlands and Waterways Wetlands.

Table 10.3 Field work summary

Type of study or assessment	Date completed	Season
Vegetation and habitat assessments		
Vegetation mapping and habitat hectare assessment.	April 2013	Autumn
Detailed flora investigations, vegetation mapping and habitat hectare assessments.	November – December 2014	Spring – Summer
Field validation of vegetation communities and additional assessment of threatened ecological communities.	January – May 2017	Summer – Autumn
Additional habitat hectare assessment.	January – May 2017	Summer – Autumn
Further field validation of vegetation communities, additional habitat hectare assessments, and additional assessment of threatened ecological communities.	November – December 2017	Spring – Summer
Recording of additional trees (Thames Promenade).	March 2018	Autumn
Targeted flora survey		
Targeted flora surveys for: • Swamp Everlasting • Matted Flax-lily • River Swamp Wallaby-grass.	December 2014	Summer
Numerous flora species with a moderate or high likelihood of occurrence (prior to survey). Survey designs were based on relevant state and Commonwealth survey guidelines.	January – May 2017	Summer – Autumn
Follow up surveys to ensure sufficient effort during the most appropriate survey season for each of the target species.	November – December 2017	Spring – Summer

Type of study or assessment	Date completed	Season
Targeted fauna survey and habitat assessment		
Targeted surveys for: • Growling Grass Frog.	December 2012 – January 2013 December 2014 – January 2015	Summer
Surveys for threatened waterbird and migratory shorebirds.	March 2013 December 2014 – January 2015	Autumn and Summer
Targeted survey for: • Latham's Snipe • Australasian Bittern.	December 2014 – January 2015	Summer
Opportunistic bird survey	December 2016	Summer
Sound recorder surveys for: • Growling Grass Frog Sound recorder locations shown on Figure 10.1.	February – March 2017 November – December 2017	Summer – Autumn Spring – Summer
Sound recorder surveys for: • Lewin's Rail • Baillon's Crake • Little Bittern • Australasian Bittern Sound recorder locations shown on Figure 10.1.	October 2017	Spring
Detailed wetland bird surveys (study area, points and transects shown on Figure 10.1) including observations of activity (behaviour, flight height, and flight direction).	November 2017 – March 2018	Spring – Autumn
Detailed wetland bird habitat mapping (study area shown on Figure 10.1).	November 2017 – March 2018	Spring – Autumn
Owl habitat assessment and targeted owl survey.	February 2018	Summer
Aquatic fauna survey		
Aquatic habitat assessment and targeted surveys for: • Yarra Pygmy-perch • Dwarf Galaxias.	December 2014 – January 2015	Summer
Aquatic fauna field assessment and surveys for: • Dwarf Galaxias.	November 2016 – March 2017	Spring – Autumn

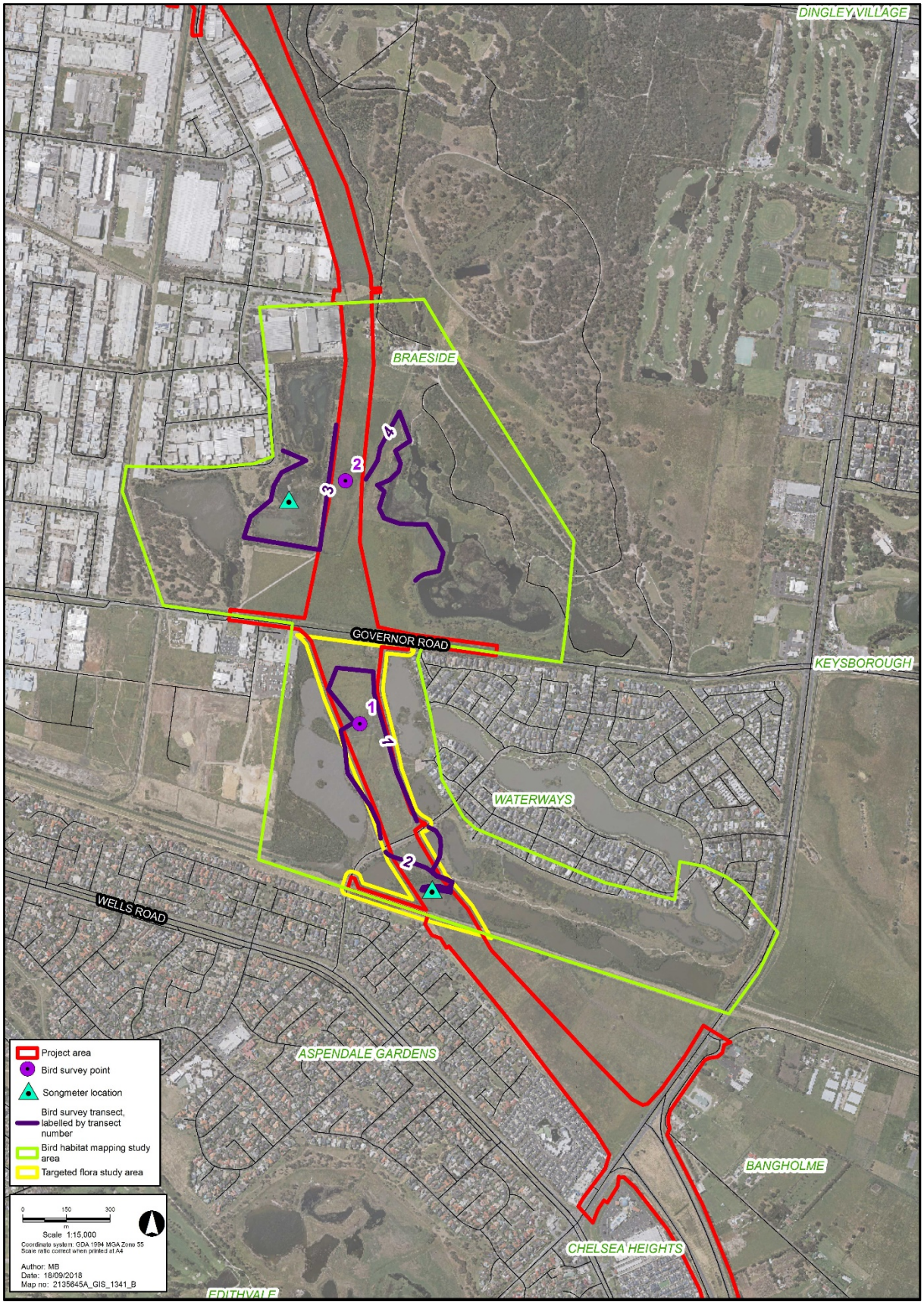


Figure 10.1 Targeted fauna survey study areas and survey effort

Tree surveys

Tree surveys were conducted (in accordance with AS 4970-2009 *Protection of trees on development sites*) by the project arborist and data were provided in GIS shapefile and are reported in Appendix O: *Preliminary tree assessment report* (including detailed tree maps). All living and dead trees 3 m and taller were assessed. For the Thames Promenade component of the project, tree data were collected by an ecologist using high accuracy DGPS.

A number of metrics were used to measure and record tree data consistent with *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017c) ('Guidelines 2017'), including Diameter at Breast Height (DBH) (diameter in centimetres measured at 1.3 metres above ground level). The Tree Protection Zone (TPZ) was calculated by the arborist for the project, with the exception of the Thames Promenade component, which was calculated by an ecologist. The TPZ was calculated as 12 x DBH, up to a maximum of 15m.

Data from both sources, arborist and ecologist, were collated by ecologists into one dataset and trees were categorised to best represent their ecological value and to meet the requirements of the Guidelines 2017. As such, the tree categories used by the ecologists do not necessarily correspond with those used by the arborist in Appendix O: *Preliminary tree assessment*. Tree data was used to determine the location and size class of all 'Canopy Trees' (indigenous trees > 3m which are canopy species for the relevant EVC), as per the Guidelines 2017. This included 'Scattered trees' and 'Trees in patches'. Large trees were defined as Canopy Trees which met or exceeded the DBH benchmark for the relevant EVC.

For trees with >10% TPZ impact from the project, tree loss was assumed when calculating offsets. The buffer for impact calculations (i.e. the area required to compensate for tree removal) was determined as per the Guidelines 2017, consisting of 10m for a small tree and 15m for a large tree.

10.4.3 Impact assessment

The impact assessment provides a detailed assessment of likely impacts from the project, based on the reference design and the latest research on road impacts and ecology. It involved:

- an examination of likely impacts upon each listed species/community and ecological character of nearby wetlands
- an examination of potential impacts upon the movement of threatened and non-threatened species in the area
- identifying and addressing all potential impacts in context with remaining and local populations, including the potential for the project to exacerbate threatening processes
- identifying mitigation measures, to avoid impacts on ecological character, flora and fauna
- develop recommendations to avoid and minimise where possible.

Likely impacts on MNES, including Commonwealth listed species/communities and the Edithvale-Seaford Ramsar Wetlands, was completed using relevant significant impact criteria. For further details about the significant impact criteria used, refer to Chapter 22: *Matters of national environmental significance*.

10.5 STUDY AREA

The project boundary is defined in Chapter 6: *Project description*. For the biodiversity study area, an additional 20m buffer, outside the project boundary, is included to ensure that potential connectivity impacts and any edge effects to vegetation, including impacts to tree protection zones (TPZ), are captured in the study. For some ecological surveys including wetland mapping, targeted bird surveys and bird habitat mapping, the study area extended further to include parts of the adjacent wetlands, to ensure all ecological values with the potential to be impacted were characterised.

The project will be constructed within an established road easement which passes through urban and industrial areas. It has been largely cleared and is highly modified, however, it passes close to sensitive and high-value environments, including Braeside Park and associated wetlands and the Woodlands Industrial Estate Wetlands. It also passes through the Waterways Wetlands and Mordialloc Creek and is located nearby (approximately 700m) to the Edithvale component of the Edithvale-Seaford Wetlands. The project location and nearby sites of ecological significance are shown in Figure 10.2. This figure also shows the pre-European wetland extent (Carrum Carrum Swamp), Key Biodiversity Areas (areas of significant bird and biodiversity value according to Birdlife Australia) and Melbourne Water Biosites, sites of biological significance.

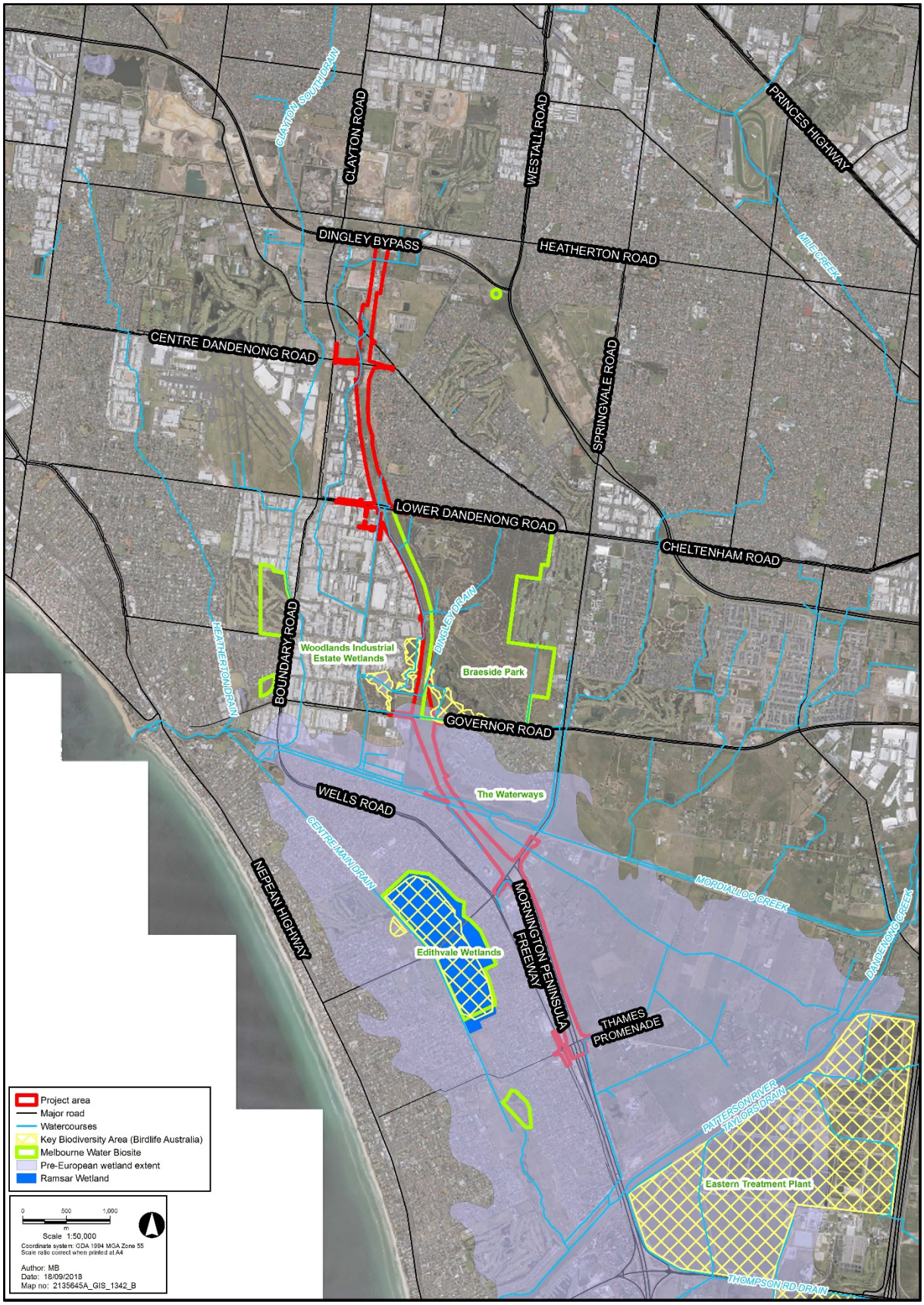


Figure 10.2 Project area and sites of ecological significance

10.6 EXISTING CONDITIONS

10.6.1 Vegetation and flora

High-quality native vegetation, including threatened species and communities, occurs at the Waterways Wetlands, where it was planted as part of a large-scale habitat creation project. Based on advice from the Department of Environment and Energy (DoEE) and DELWP, the planted vegetation at the Waterways Wetlands is considered remnant for this assessment.

However, most of the vegetation in the project area, approximately 125 ha, has previously been cleared and much of the remaining native vegetation is highly modified. Small patches of native vegetation remain in roadsides (revegetation), as scattered remnant trees and native wetlands. The EVCs and their quality were determined in accordance with the Vegetation Quality Assessment Manual Habitat Hectares Scoring Method. Twelve EVCs were recorded, ten of which are considered 'endangered' within the Gippsland Plain Bioregion. The EVCs and their corresponding bioregion conservation statuses are summarised in Table 10.4. Figure 10.3 shows the location of EVCs within the Waterways Wetlands, while Figures 10.4 to 10.8 provide mapping of native vegetation and tree locations within and adjacent to the project area.

Table 10.4 Ecological vegetation classes (EVCs) within the study area

EVC	Accepted bioregion conservation status	Indicative locations within the study area	Indicative photograph
Aquatic Herbland (EVC 653) Permanent to semi-permanent wetlands, dominated by sedges and/or aquatic herbs.	Endangered	Found throughout the project area in drains, dams and low lying depressions.	
Aquatic Sedgeland (EVC 308) Species-poor vegetation dominated by robust inundation-tolerant sedges.	Vulnerable	Only found in the Waterways Wetlands.	
Creekline Grassy Woodland (EVC 68) Eucalypt dominated woodland to 15m tall with occasional scattered shrubs over a mostly grassy/sedgy ground-layer.	Endangered	Scattered remnants of this EVC occur in the northern parts of the project area.	
Damp Sands Herb-rich Woodland (EVC 3) A grassy or bracken-dominated eucalypt forest/open woodland to 15m tall with large shrubs and a ground layer rich in herbs, grasses, and orchids.	Vulnerable	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.	Endangered	Throughout revegetated areas of The Waterways Wetlands, this EVC is 'very high quality'.	

EVC	Accepted bioregion conservation status	Indicative locations within the study area	Indicative photograph
Plains Grassy Woodland (EVC 55) An open, eucalypt dominated woodland to 15m tall Dominated by River Red-gum.	Endangered	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.	Endangered	Only found in the revegetated areas of Waterways Wetlands.	
South Gippsland Plains Grassland (EVC 132_62) Treeless vegetation dominated by grasses and herbs.	Endangered	Only found in The Waterways Wetlands.	
Submerged Aquatic Herbland (EVC 918) Submerged aquatic grass dominated beds of Eel Grass.	Endangered	Only found in The Waterways Wetlands.	
Swamp Scrub (EVC 53) Dense shrubby vegetation dominated by Swamp Paperbark with occasional emergent Blackwood.	Endangered	High quality patches are found throughout revegetated sections of Waterways Wetlands, with poorer quality remnant and regrowth found in study area.	
Swampy Woodland (EVC 937) Open eucalypt woodland dominated by Eucalyptus ovata with an understorey dominated by tussock grasses, herbs and occasional Swamp Paperbark.	Endangered	Small patches mapped in close association with Swamp Scrub.	
Tall Marsh (EVC 821) Wetland dominated by tall emergent grass Common Reed with very few other species present.	Endangered	Widespread on wetland edges, interspersed with Plains Sedgy Wetland.	

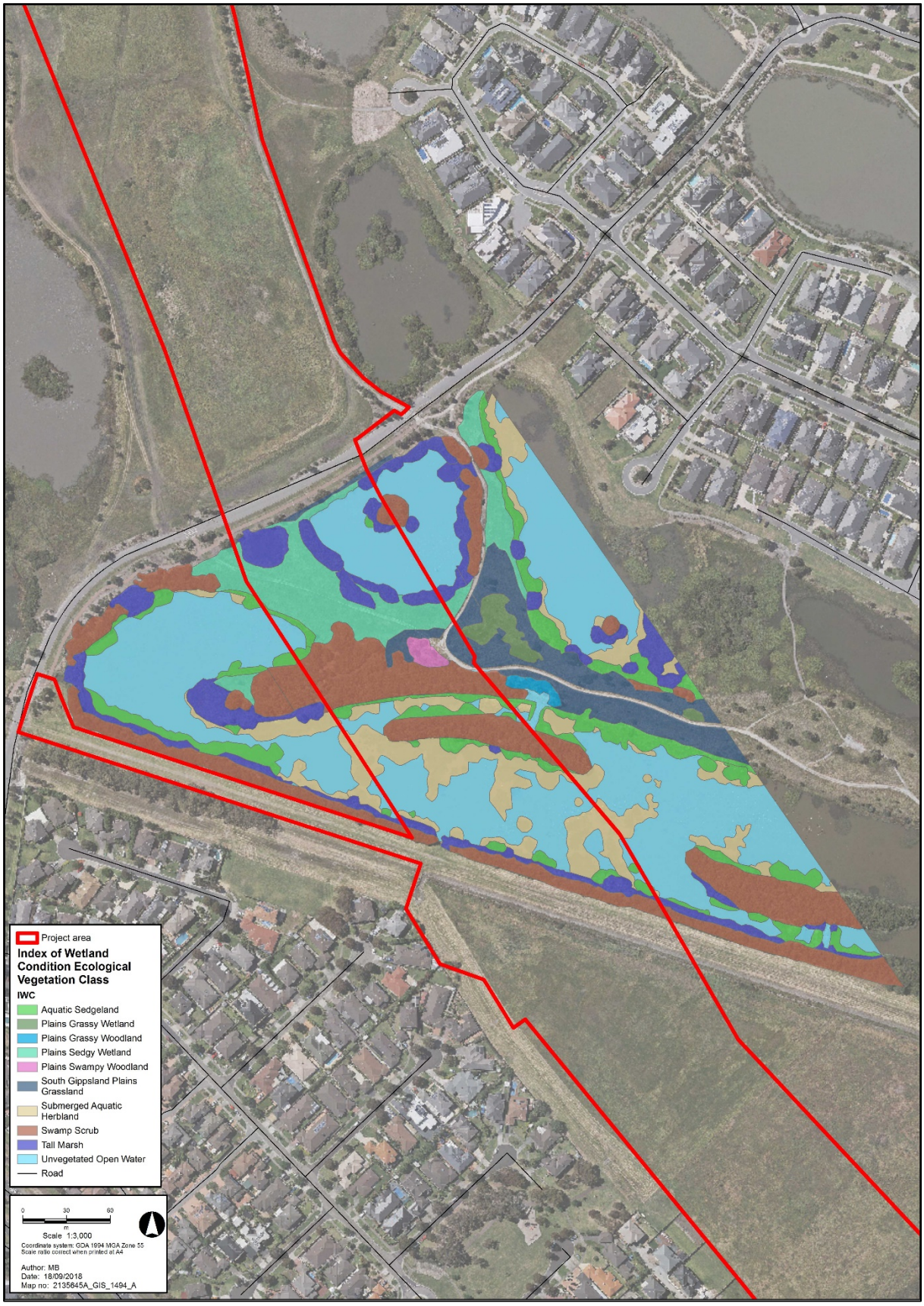


Figure 10.3 Wetland community mapping at Waterways Wetlands

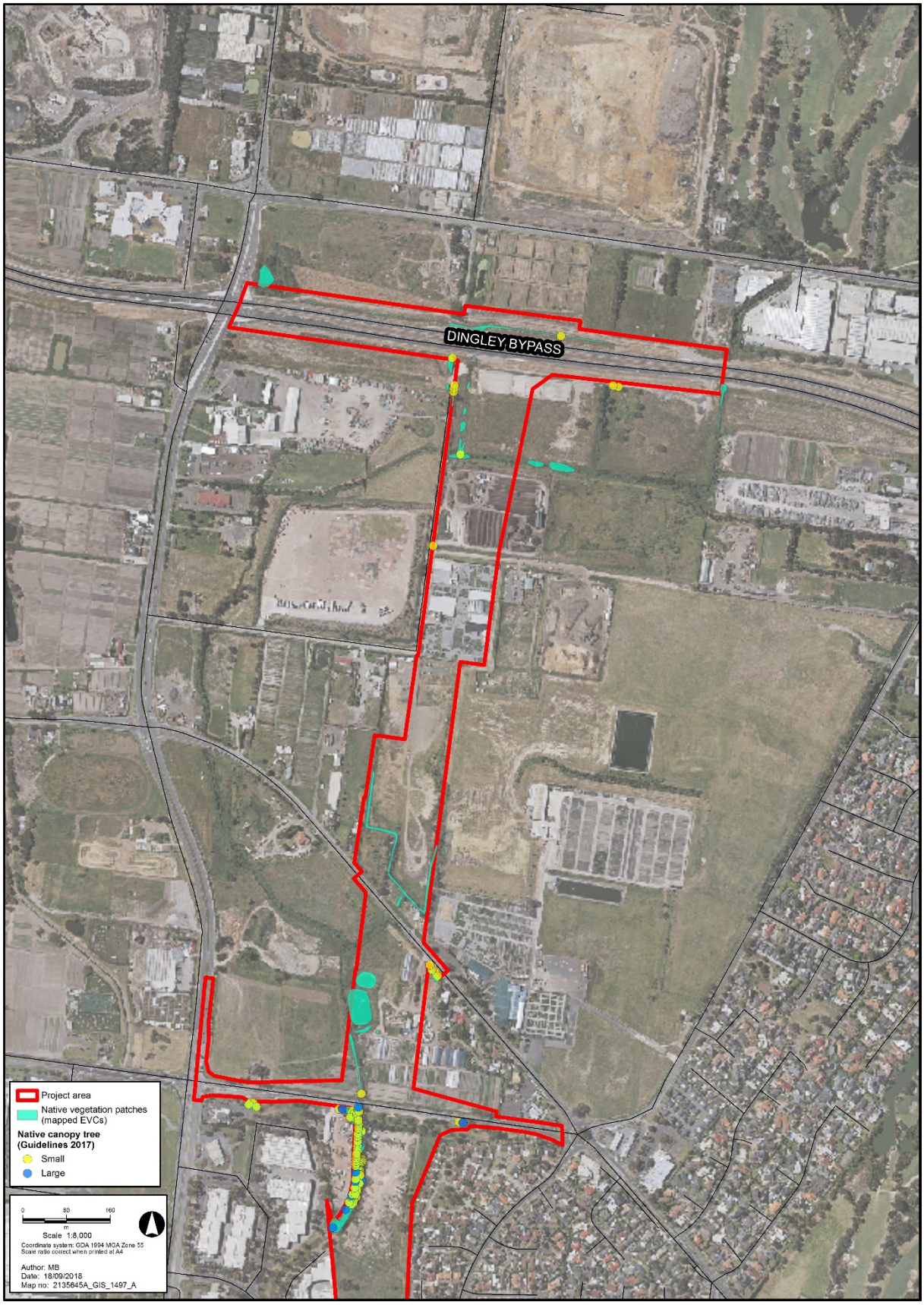


Figure 10.4 Native vegetation mapping (EVCs) – Map 1 (North)

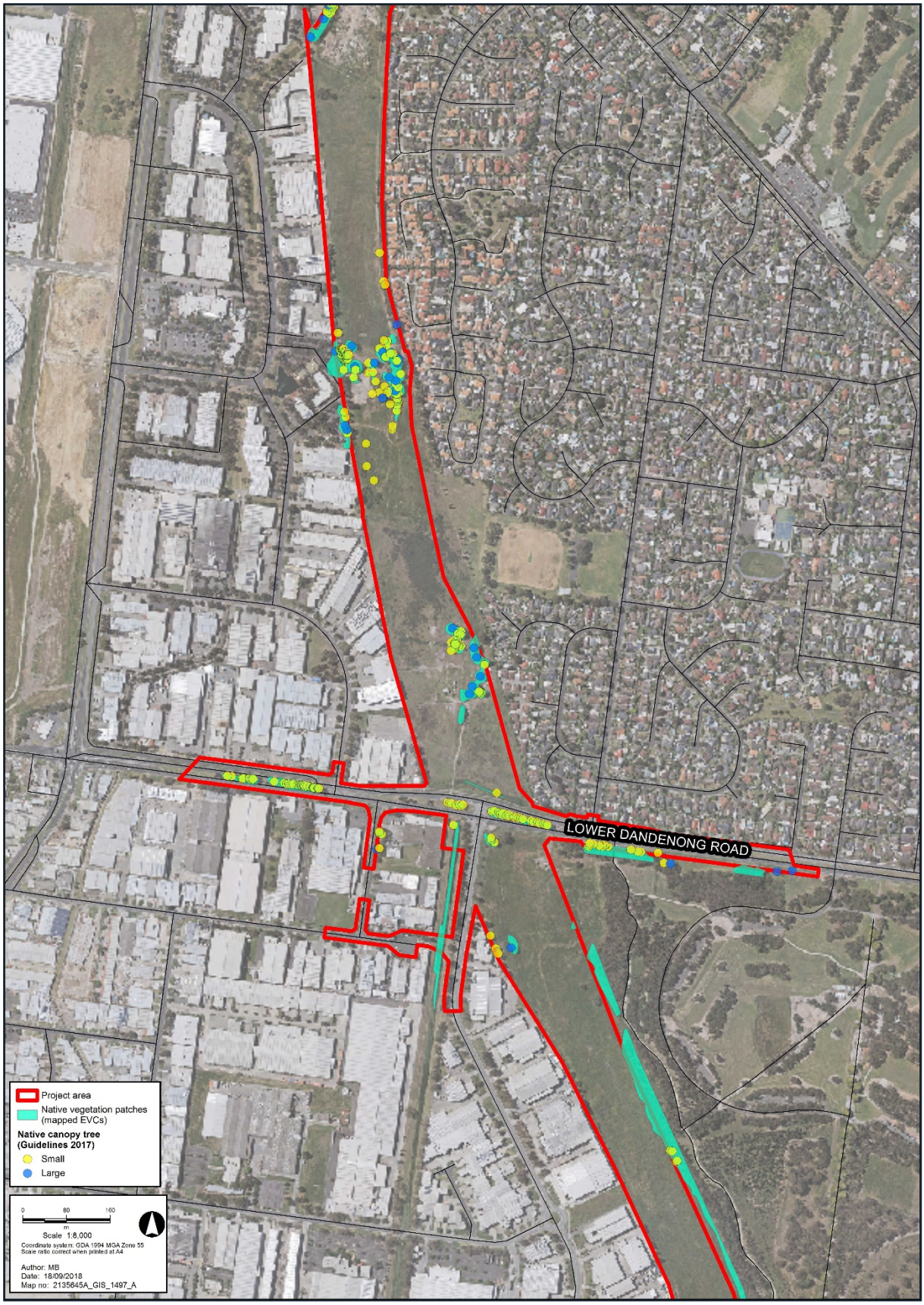


Figure 10.5 Native vegetation mapping (EVCs) – Map 2 (North)

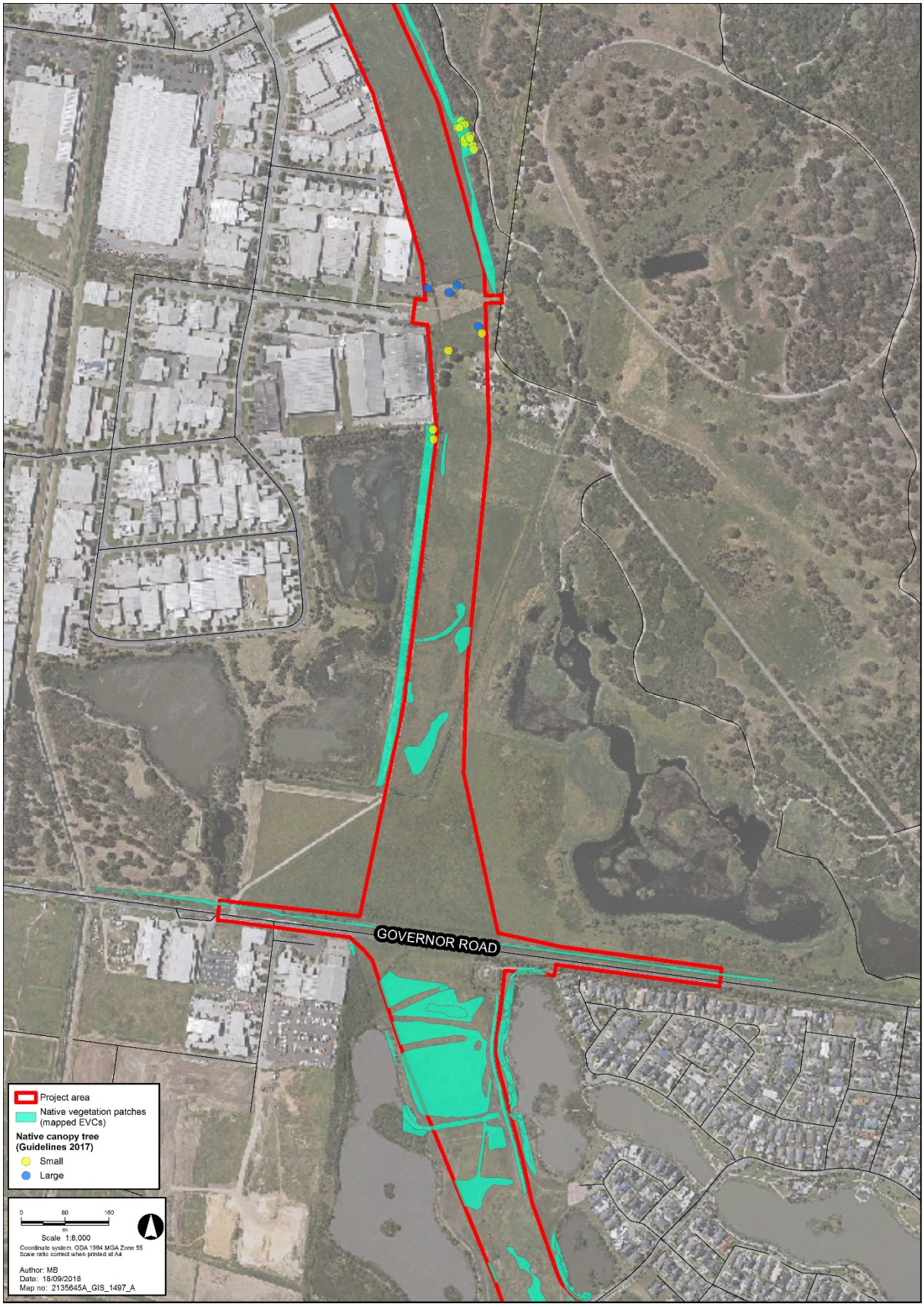


Figure 10.6 Native vegetation mapping (EVCs) – Map 3 (Middle)

Figure 10.7 Native vegetation mapping (EVCs) – Map 4 (South)

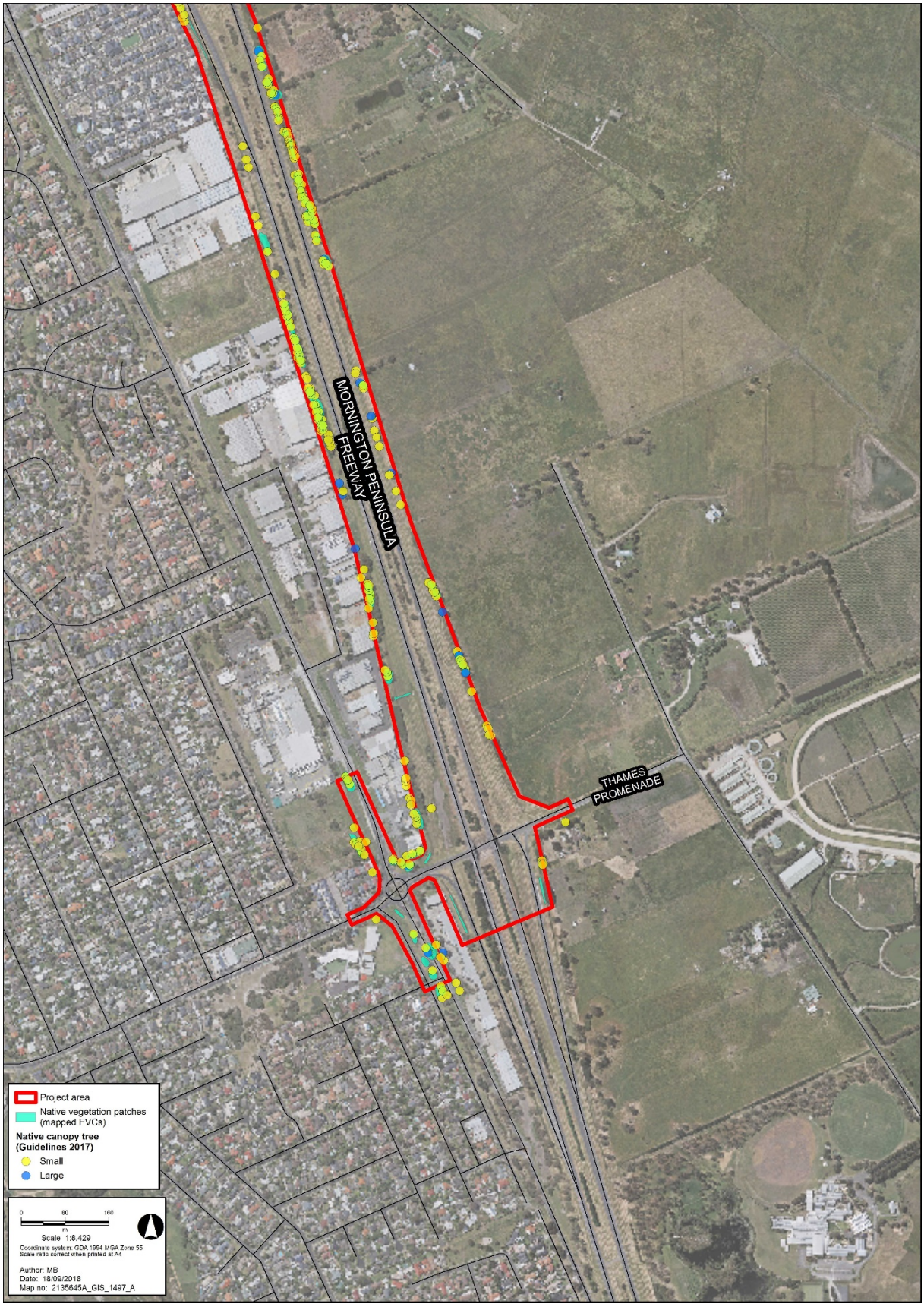


Figure 10.8 Native vegetation mapping (EVCs) – Map 5 (South)

Threatened communities

Two EPBC Act listed threatened ecological communities occur in the project area, both are 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 partially correspond to the above EPBC Act communities:

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

The locations of these communities are shown on Figure 10.9.

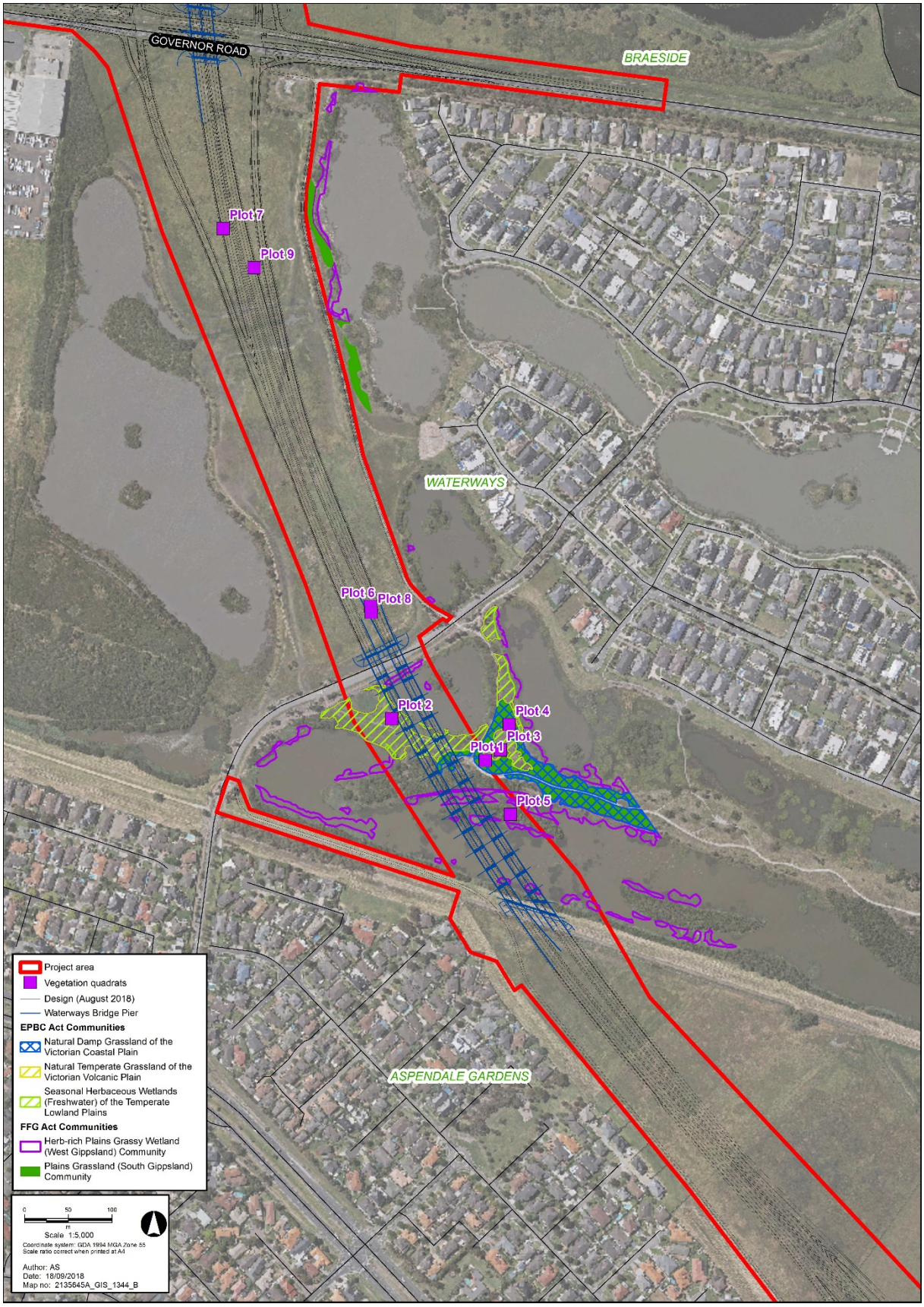


Figure 10.9 Location of threatened ecological communities in the Waterways Wetlands

Trees

A total of 3341 trees were recorded in the study area by either an arborist (refer to Appendix O: *Preliminary tree assessment*) or an ecologist (refer to Appendix C: *Flora and fauna impact assessment*). Most of these trees are planted native or exotic but 784 are considered by ecologists to be remnant native trees. Of the 784 remnant native trees, 703 are Canopy Trees as defined under the Guidelines 2017, and 81 are understorey trees. Of the 703 Canopy Trees, 60 of these are considered 'large trees' in the relevant EVCs and the remaining 643 are considered 'small trees'.

Weeds

Seventeen weed species listed under the CaLP Act occur within the study area, six of which are also listed as Weeds of National Significance (WoNS) by the Australian Government. These weeds are detailed in Table 10.5. Most of the significant weeds were recorded along roadsides and private land in the north of the project area. Very few CaLP Act weeds occur within the Waterways Wetlands.

Table 10.5 CaLP Act and WoNS weeds within the study area

Weed species	Catchment and Land Protection Act (CaLP Act)	Weeds of National Significance (WoNS)
Angled Onion *Allium triquetrum*	Restricted	–
Onion Weed *Asphodelus fistulosus*	Restricted	–
Spear Thistle *Cirsium vulgare*	Regionally controlled	–
English Broom *Cytisus scoparius*	Regionally controlled	Yes
Long-spine Thorn-apple *Datura ferox*	Regionally controlled	–
Stinkwort *Dittrichia graveolens*	Regionally controlled	–
Paterson's Curse *Echium plantagineum*	Regionally controlled	–
Fennel *Foeniculum vulgare*	Restricted	–
Flax-leaf Broom *Genista linifolia*	Regionally prohibited	Yes
Montpellier Broom *Genista monspessulana*	Regionally controlled	Yes
African Box-thorn *Lycium ferocissimum*	Regionally controlled	Yes
Soursob *Oxalis pes-caprae*	Restricted	–
Blackberry *Rubus fruticosus spp. agg.*	Regionally controlled	Yes
Weeping Willow *Salix babylonica s.l.*	Restricted	–
Pampas Lily-of-the-Valley *Salpichroa origanifolia*	Regionally controlled	–
Variegated Thistle *Silybum marianum*	Regionally controlled	–
Gorse *Ulex europaeus*	Regionally controlled	Yes

Flora species of state and/or national significance

DELWP's Victorian Biodiversity Atlas and the DoEE Protected Matters Search Tool were used to determine species of state and/or national significance that have been recorded or are predicted to occur within five kilometres of the project area. Forty-eight species were identified as having a moderate or higher likelihood of occurring in the project area. The full list of flora species recorded in the study area is included in Appendix C: *Flora and fauna impact assessment*.

Field 'targeted' surveys were used to confirm if these species were present. Five significant species were detected during field surveys, all of which were observed in the replanted Waterways Wetlands area. The locations of the significant flora recorded are shown on Figure 10.10. Two of the five species, the Leafy Twig-sedge *Cladium procerum (rare in Victoria)* and the Large River Buttercup *Ranunculus papulentus (poorly known in Victoria)* are located within the project area.

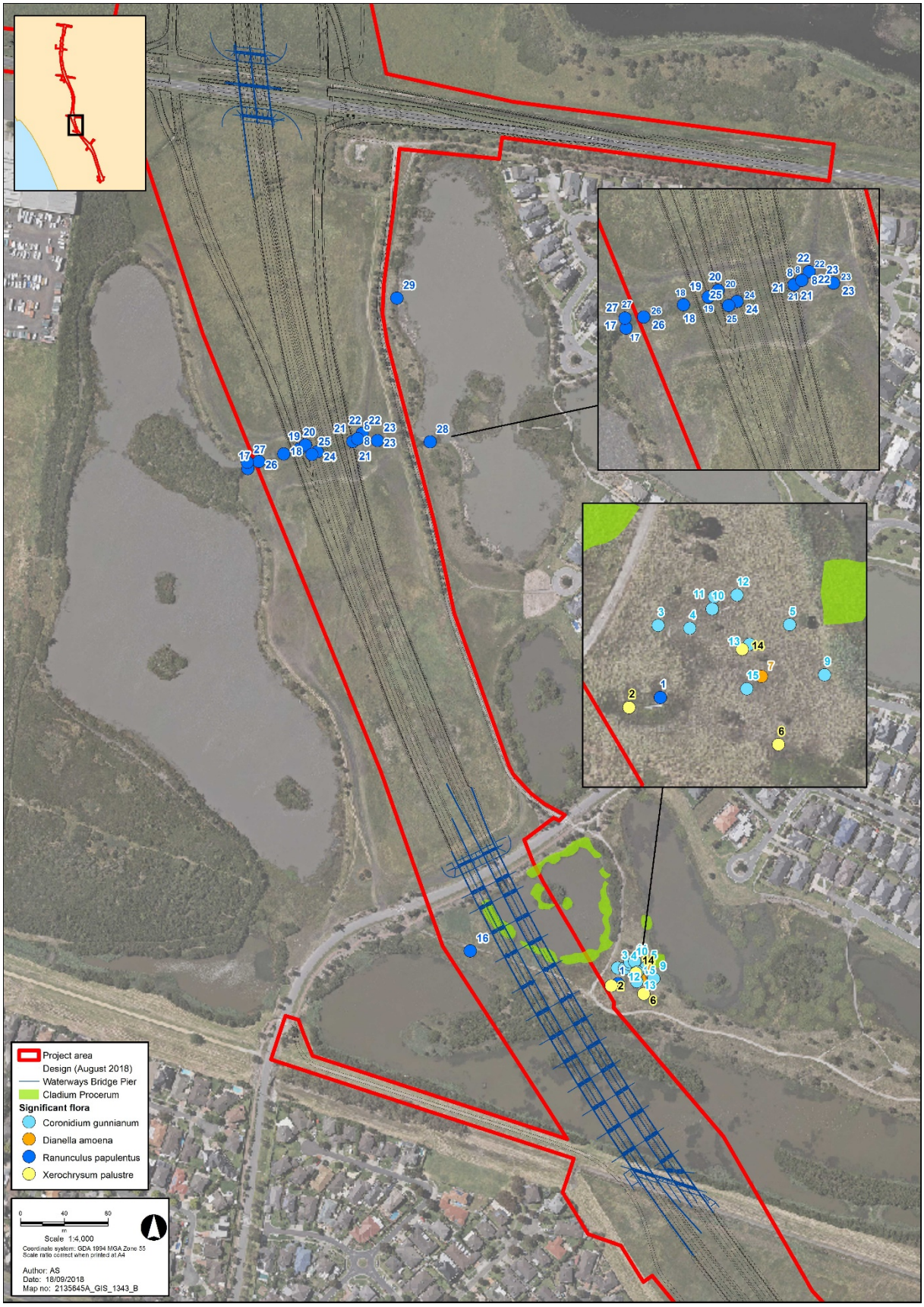


Figure 10.10 Location of significant flora species in the Waterways Wetlands

Threatened flora species identified during the field survey or which were not identified but may still occur (based on habitat assessments), are detailed in Table 10.6.

Table 10.6 Significant flora species in the study area

Name	Status			Habitat	Likelihood of occurrence
	EPBC	FFG	DELWP		
Observed during field survey					
Leafy Twig-sedge *Cladium procerum*			R	Occasional in swampy areas and stream margins of coastal lakes, tolerates low/moderate salinity levels.	Recorded, Some in current construction footprint.
Large River Buttercup *Ranunculus papulentus*			K	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 moist during flowering.	Recorded, planted, several occurrences within the project area.
Swamp Everlasting *Xerochrysum palustre*	VU	L	VU	Occurs in lowland swamps, usually on black cracking clay soils, scattered from the South Australian border north-west of Portland to Bairnsdale district, but rare due to habitat depletion.	Recorded, planted, outside of current construction footprint
Pale Swamp Everlasting *Coronidium gunnianum* *(*Figure 10.11*)*			VU	Widespread throughout the state except for the north-west and the alpine and adjacent mountainous areas. Usually at low elevations (under c. 100m) where mostly in grasslands and riverine *Eucalyptus camaldulensis* woodland on soils prone to inundation.	Recorded, planted, outside the current construction footprint.
Matted Flax-lily *Dianella amoena*	EN	L	EN	Largely confined to drier grassy woodland and grassland communities south of the Dividing Range. Now depleted through its range.	Recorded, planted
Likely to occur but not observed during field survey					
Lacey River Buttercup *Ranunculus amplus*			R	Scattered in southern Victoria, but most common in south-west. Grows in stream verges and swamps. Plants usually partially submerged, with emergent leaves and flowering stems.	Moderate, planted
Swamp Fireweed/ Smooth-fruited Groundsel *Senecio psilocarpus*	VU		VU	Restricted in Victoria to a few herb-rich winter-wet swamps throughout the south of the state, west of Sale, growing on volcanic clays/peaty soils.	Moderate, planted

L: Listed, R: Rare, EN: Endangered, VU: Vulnerable, K: Poorly Known

10.6.2 Fauna

Fauna habitat

Four types of fauna habitat have been identified within the project area. These include:

- **Constructed wetlands at the Waterways Estate**, occurring south of Governor Road, the wetlands provide permanent aquatic habitat at Mordialloc Creek and fringing swamp vegetation. The aquatic and terrestrial habitats support a diverse range of species. There are roosting and foraging sites for wetland birds, as well as potential habitat for bats, frogs, turtles and other reptiles. There is limited shallow water habitat for migratory birds, although they are occasionally recorded.
- **Agricultural grassland**, predominantly highly modified vegetation with some small patches of remnant vegetation, including the grassland occurring between Braeside park and Woodlands Industrial Estate.
- **Small drains**, some of which provide some foraging habitat and connectivity for wetland birds.

Source: Nic McCaffrey

Figure 10.11 Swamp Everlasting (EPBC and FFG Act listed), Waterways Wetlands

- **Remnant and planted trees**, comprised mainly of small patches providing foraging and nesting habitat for woodland birds. Some large trees and trees with hollows occur within the alignment.

The significant wetland habitat within and adjacent to the project area was mapped to inform the impact assessment, particularly for threatened and migratory wetland birds. The habitat included the Woodlands Industrial Estate Wetlands, Braeside Park Wetlands, and Waterways Wetlands. Waterbird habitat mapping is shown on Figure 10.12 and Figure 10.13. Edithvale-Seaford Wetlands was not mapped as the habitat present is already well-characterised and impacts on this habitat are not anticipated (refer to Chapter 22: *Matters of national environmental significance*).

The 'shallow water' (habitats that occur within shallow water) and 'emergent vegetation' habitats (habitats that occur at the fringe of wetlands onto dry land), particularly the larger areas in Braeside Park Wetlands, are of particular value to migratory shorebirds and other wading birds when water levels are low in the summer months. Mudflats at Edithvale-Seaford Wetlands draw large numbers of migratory birds, including at times, several thousand Sharp-tailed Sandpipers (>1 percent of the population). These shallow habitats and the surrounding reeds and rushes are likely to also be of value to bitterns and other more secretive wetland birds including crakes and rails. Snipes may also use these areas, as well as mapped 'transitional zone' habitat. These habitat types can be seen on Figure 10.12 and Figure 10.13, occurring mostly at Braeside Park Wetlands and Woodlands Wetlands.

The above shallow habitat types are of high value in the Melbourne region, where most wetlands are constructed deep wetlands with steep edges, or where water levels are controlled such that they no longer drop sufficiently in summer.

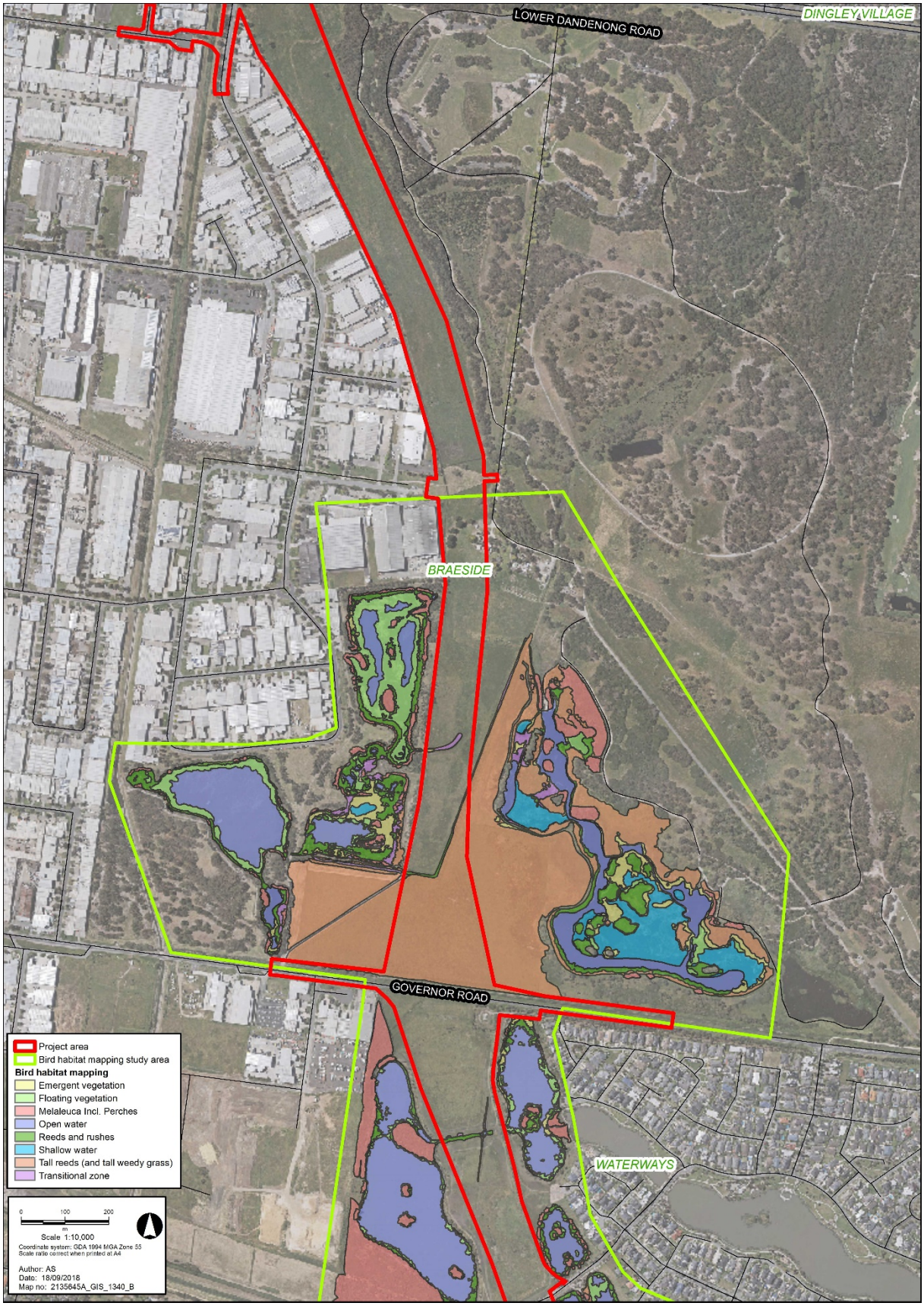


Figure 10.12 Waterbird habitat mapping in the study area

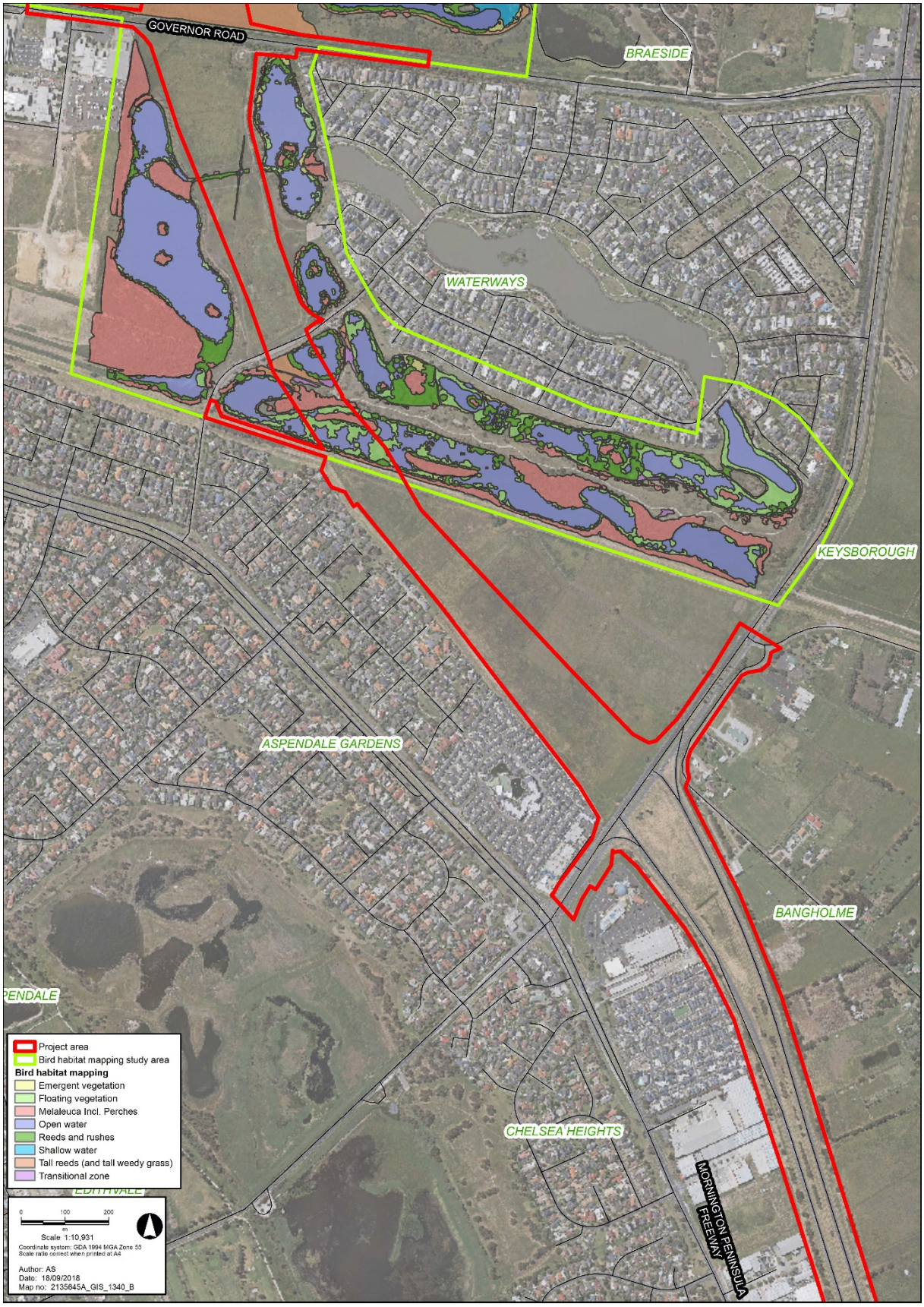


Figure 10.13 Waterbird habitat mapping in the study area

Fauna species

Two hundred and ten (210) vertebrate fauna species have been recorded at or adjacent to the project area. One hundred and six (106) fauna species have been recorded in the study area including:

- 167 native and 12 introduced birds
- eight native frogs
- five native and six introduced mammals
- six native and five introduced fish species.

Surveys of the project area and adjacent wetlands recorded 41 fauna species of conservation significance, 13 of which are EPBC Act listed migratory bird species. Introduced species included the Red Fox, European Rabbit, Brown Hare, Eastern Mosquitofish and European Carp.

A full species list, tabulated by source, is provided in Appendix C: *Flora and fauna impact assessment.*

Significant fauna likelihood and habitat

One hundred and two (102) fauna species of state and/or national significance were identified in the desktop assessment as potentially occurring within 5km of the study area. Of these, 44 species were identified as having a greater than 'low' likelihood of occurring in or nearby the project area based on an assessment of habitat availability and quality. Of these, 40 were bird species including the Curlew Sandpiper, Sharp-tailed Sandpiper (see Figure 10.14) and the Blue-billed Duck (see Figure 10.15), with the other four species being the Grey-headed Flying-fox, the Eastern Snake-necked Turtle, the Glossy Grass Skink and the Southern Toadlet. These species, their conservation statuses and key habitat are outlined in Table 10.7.

Source: Allan Richardson

Figure 10.14 Migratory birds Curlew Sandpipers (front two right) and Sharp-tailed Sandpipers (three behind). Grey Teal (four rear ducks) – Braeside Park Wetlands, March 2018

Source: Allan Richardson

Figure 10.15 Male Blue-billed Duck - Braeside Park Wetlands, March 2018

Table 10.7 Significant fauna species with greater than 'low' likelihood of occurring

Species (Common name)	Conservation status			Habitat at the project area	Likelihood of occurrence
	EPBC Act	FFG Act	DELWP		
Birds					
Australasian Bittern	EN	L	EN	Habitat occurs in Braeside wetlands, Woodlands wetlands and Waterways wetlands. Known to be a regular winter (non-breeding) visitor to these areas in low numbers.	High
Australasian Shoveler			VU	Suitable wetland habitat occurs within and adjacent to the project area. Sighted during survey.	High (observed)
Australian Little Bittern		L	EN	Habitat in Braeside Park wetlands, Woodlands wetlands and Waterways wetlands. Species recorded at Woodlands wetlands during surveys. Known to have bred at Woodlands wetlands.	Moderate-High (observed)
Australian Painted Snipe	EN	L	CE	Potential habitat is largely limited to the Braeside Park wetlands although there is the potential for the species to also visit Woodlands wetlands and Waterways wetlands. Habitat is unlikely to be of high value, and the species is not regularly recorded, however it may become more valuable when inland Australia is in drought.	Low-moderate
Baillon's Crake		L	VU	Suitable habitat exists within Braeside wetlands, Woodlands wetlands and Waterways wetlands.	High
Black Falcon			VU	Foraging habitat of relatively low value occurs within the project area, mainly consisting of treed areas near water courses and wetlands.	Moderate
Blue-billed Duck		L	EN	Suitable habitat occurs at Braeside Park wetlands, Woodlands wetlands and Waterways wetlands. Species has been recorded breeding at Braeside Park wetlands. Recorded at Braeside Park wetlands during surveys.	High (observed)
Caspian Tern		L	NT	Likely to forage periodically to regularly in large wetlands in Braeside Park, Woodlands and Waterways.	High
Common greenshank	M		VU	Preferred habitat of shallow fresh/brackish wetlands and mudflats is limited the south of Braeside Park.	Moderate
Common Sandpiper			VU	The project area itself is unlikely to support important habitat however the species is likely to visit nearby Braeside Park wetlands on occasion.	Low to Moderate
Curlew Sandpiper	CE; M	L	EN	Foraging habitat occurs at Braeside Park wetlands and Woodlands wetlands. Recorded at Braeside Park wetlands during surveys.	Moderate (observed)

Species (Common name)	Conservation status			Habitat at the project area	Likelihood of occurrence
	EPBC Act	FFG Act	DELWP		
Diamond Dove		L	NT	Foraging habitat at Braeside Park and potentially Woodlands Industrial Estate, however these areas only appear to be visited rarely.	Low-Moderate
Eastern Great Egret		L	VU	Suitable habitat includes wetlands and flooded grasslands within the project area and the surrounding wetlands. Recorded at Waterways wetlands, Woodlands wetlands, and Braeside Park wetlands during recent surveys.	High (observed)
Fork-tailed Swift	M			May fly over the project area. The project area is highly unlikely to provide important habitat for this species.	Moderate
Freckled Duck		L	EN	Habitat of freshwater wetlands with shallow areas and dense fringing and emergent vegetation occurs in Braeside Park wetlands, Woodlands wetlands and Waterways wetlands.	High
Glossy Ibis	M		NT	Habitat occurs in Braeside Park, Woodlands and Waterways.	High
Hardhead			VU	Suitable wetland habitat occurs within and adjacent to the project area.	High (observed)
Intermediate Egret		L	EN	Suitable habitat occurs within and adjacent to the project area, particularly at Waterways wetlands, Braeside Park wetlands, and Woodlands wetlands.	Moderate
Latham's Snipe	M		NT	Suitable habitat occurs around water bodies and low-lying areas at Braeside Park wetlands, Woodlands wetlands and Waterways wetlands. Vegetated drainage and riparian areas may also support suitable habitat (Dingley Drain and Mordialloc Creek).	High
Lewin's Rail		L	VU	Habitat at Braeside Park wetlands, Woodlands wetlands and Waterways, as well as dense reeds and rushes between these areas.	Moderate
Little Egret		L	EN	Habitat at Braeside Park wetlands, Woodlands wetlands and Waterways, as well as watercourses. The species may also roost in trees surrounding these areas.	Moderate
Long-toed Stint	M		NT	Project area is unlikely to support habitat for this species; however, potential foraging habitat occurs nearby at Braeside Park and Woodlands.	Low-Moderate
Magpie Goose		L	NT	Potentially suitable wetland habitat occurs within and adjacent to the project.	Moderate
Marsh Sandpiper	M		VU	Preferred habitat of shallow fresh/brackish wetlands and mudflats is limited the south of Braeside Park.	Moderate

Species (Common name)	Conservation status			Habitat at the project area	Likelihood of occurrence
	EPBC Act	FFG Act	DELWP		
Musk Duck			VU	Potentially suitable wetland habitat occurs within and adjacent to the project area. Recorded at Braeside Park wetlands during recent surveys.	High (observed)
Nankeen Night Heron			NT	Habitat at Braeside Park, Woodlands and Waterways.	High
Pacific Gull			NT	May periodically roost in wetlands in Braeside Park, Woodlands or Waterways.	Moderate
Pectoral Sandpiper	M		NT	Foraging habitat occurs at Braeside Park wetlands and Woodlands wetlands.	Moderate
Pied Cormorant			NT	Foraging habitat and some roosting habitat in Braeside Park, Woodlands and Waterways.	High
Red-necked Stint	M			Foraging habitat occurs at Braeside Park wetlands and Woodlands wetlands. Recorded at Braeside Park wetlands during recent surveys.	Moderate (observed)
Royal Spoonbill			NT	Habitat occurs in Braeside Park, Woodlands wetlands and Waterways wetlands. Recorded at Braeside Park wetlands and Waterways wetlands during recent surveys.	High (observed)
Ruff	M			Potential habitat occurs in Braeside Park and low-lying parts of the alignment. However species is a rare visitor to the area.	Low-moderate
Rufous Fantail	M			Potential habitat within the area would be limited to Braeside Park.	Low-moderate
Sharp-tailed Sandpiper	M			Foraging habitat occurs nearby at Braeside Park wetlands and Woodlands wetlands. May periodically occur within the project area. Recorded at Braeside Park wetlands during recent surveys.	Moderate (observed)
Spotted Harrier			NT	Grasslands within and adjacent to the alignment and open woodlands at Braeside Park and Woodlands.	Moderate
Whiskered Tern			NT	Foraging habitat occurs largely outside of the project area at Braeside Park wetlands and Woodlands wetlands.	High
White-bellied Sea-Eagle		L	VU	Some foraging habitat in the project area and study area, although this is unlikely to be of high value to the species.	Moderate
White-throated Needletail	M	L	VU	Likely to forage above the study area periodically, but would not be directly reliant upon vegetation in the project area.	Moderate

Species (Common name)	Conservation status			Habitat at the project area	Likelihood of occurrence
	EPBC Act	FFG Act	DELWP		
White-winged Black Tern			NT	Wetland foraging habitat occurs largely outside of the project area at Braeside Park wetlands and Woodlands wetlands.	Moderate
Wood Sandpiper	M		VU	Wetland foraging habitat occurs largely outside of the project area at Braeside Park wetlands and Woodlands wetlands. Species may also periodically visit Waterways wetlands.	Moderate
Mammals					
Grey-headed Flying-fox	VU	L	VU	Limited foraging habitat (eucalypt trees) occurs in the road alignment. Unlikely to roost or regularly forage in the study area, although potential habitat occurs at Braeside Park and Woodlands Industrial Estate.	Moderate
Reptiles and amphibians					
Eastern Snake-necked Turtle			DD	Suitable wetland habitat at Woodlands, Braeside Park and Waterways; periodic movements are likely between these wetlands and into surrounding areas.	High
Glossy Grass Skink			VU	Potentially suitable swampy and wet margin habitat in Braeside Park, and at Waterways wetlands, where it has previously been recorded.	Moderate
Southern Toadlet			VU	Potentially suitable habitat in Braeside Park, in heathy vegetation in and around Dingley Drain and ephemeral wetlands.	Moderate

The Eastern Dwarf Galaxias, Growling Grass Frog and Southern Brown Bandicoot are known to have once occurred within or adjacent to the project area, however, are now considered unlikely to occur. For the Growling Grass Frog and Eastern Dwarf Galaxias, this is largely due to failed attempts to detect these species despite ongoing and extensive surveys over several years. Similarly, the Southern Brown Bandicoot has no recent records in the locality and is now considered locally extinct.

Connectivity and fauna movement

The Waterways Wetlands, the Woodlands Industrial Estate Wetlands, and Braeside Park Wetlands form almost continuous habitat for wetland bird species throughout the area. These wetlands are also within easy flying distance from the Edithvale-Seaford Wetlands (between 1 and 9km away). Most migratory or nomadic waterbird species are likely to move freely between wetlands in the area depending on the local conditions.

The predominantly degraded agricultural grassland area between Woodlands Industrial Estate Wetlands and the southern part of Braeside Park is utilised for the movement of fauna between the two areas, including woodland and wetland birds, as observed during surveys completed for the project. Similarly, there is existing terrestrial connectivity between the northern ponds at the Waterways Wetlands. These areas can be seen in Figure 10.13.

Planted vegetation on the edges of the wetlands already force less mobile bird species to fly up and over the project area, although in strong winds they were often observed flying low where possible. Both areas are highly likely to be used for on-ground movement of reptiles such as turtles and snakes, and other ground-based fauna. The bird species that use flight less regularly, such as crakes, rails, and bitterns, generally walk or fly low at ground level to move between habitat areas when they are relatively close to each other. They are more likely to use the current vegetated channels between wetlands (Dingley Drain and the unnamed drain at the Waterways Wetlands) than more open, mown or dry areas.

10.7 RISK ASSESSMENT

An environmental risk assessment (ERA) was undertaken to identify environmental risks associated with the construction and operation of the project. Where initial risks were rated as 'medium' or higher (with standard controls in place) these issues were further assessed and investigated in Appendix C: *Flora and fauna impact assessment*. Where necessary, additional controls were identified as part of the impact assessment to reduce the identified risks to acceptable levels. These controls have been incorporated into the environmental performance requirements (EPRs) for the project. The initial risks were then re-assessed following application of the environmental performance requirements to derive the residual risk ratings. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*.

Several potential impacts were identified as low or negligible risk, this included potential impacts associated with the loss or fragmentation of habitat on migratory species, including on EPBC listed species, which would remain low risk due to the small area of vegetation loss predicted. Other low risk impacts included vegetation clearance outside of the works areas during construction (i.e. within no-go zones) or maintenance, dust from construction impacting vegetation or sediment from construction affecting wetland habitats. These low risk impacts would be managed by standard construction controls and EPRs containing no-go zone mapping for contractors to adhere with.

In some cases, the implementation of additional mitigation measures into the design or additional construction controls did not reduce the risk rating, despite a lowering of the likelihood of the impact occurring or the lessening of the potential for impact. This is a function of how the risk assessment matrix determines risks based on the likelihood and consequence of impacts occurring. In some cases, the risk of certain impacts cannot be substantially reduced, but MRPA is committed to limiting impacts as far as practicable by meeting the Environmental Performance Requirements (EPRs) in Section 10.9 and collated in Chapter 23: *Environmental management framework*.

A total of 26 risks associated with Biodiversity and Habitat (R-BH) values and an additional four risks associated with Wetlands and Waterways (R-WW) values were assessed. Impacts which were identified as having an initial risk of medium or higher are summarised in Table 10.8.

A full list of all R-BH and R-WW related risks and further information on potential impacts determined to be low risk, are contained in Appendix C: *Flora and fauna impact assessment* and Attachment I: *Environmental risk assessment report.*

Table 10.8 Biodiversity and Habitat (R-BH) and Wetlands and Waterways (R-WW) risk assessment

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-BH1	Impacts significant vegetation or ecological communities	Clearing results in loss of EVCs.	I, C	Extreme	B1 B3 B5	High
R-BH2	Impacts significant vegetation or ecological communities	Clearing results in loss or fragmentation of an EPBC Act and/or FFG Act listed community.	I, C	Medium	B1 B3 B5	Medium
R-BH3	Impacts fauna habitat values	Clearing results in direct loss of habitat for threatened fauna species including MNES, State-listed and advisory list fauna.	I, C	Medium	B1 B3 B5	Medium
R-BH4	Impacts significant flora species	Vegetation clearing results in impacts upon significant flora including MNES and State listed and advisory listed flora.	I, C	Medium	B5	Low
R-BH5	Impacts fauna habitat values	Clearing impacts large remnant native trees (Large trees under Guidelines 2017).	I, C	High	B3 B5	High

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-BH7	Impacts fauna habitat values	Design results in altered surface water flow/ movement or quality which impacts fauna habitat, including threatened or migratory species habitat, adjacent to the project area (Woodlands wetlands and Waterways wetlands/Mordialloc Creek).	D, C, O	Medium	B3 W2	Low
R-BH8	Impacts significant fauna species	Road lighting design leads to impacts on fauna: • Seriously disrupts the lifecycle of an ecologically significant proportion of the population of a migratory species. • Leads to reduction in area of occupancy of a threatened species, or modification of habitat quality leading to decline of the species.	D, C, O	High	B2 LV1 LV4 LV5	Medium
R-BH9	Impacts fauna habitat values	Design fragments fauna habitat/ wildlife corridors (Woodlands - Braeside corridor and the Waterways corridor).	D, C, O	High	B1 B6 LV1	Medium
R-BH10	Impacts significant flora species	Design results in altered surface water flow/ movement, volumes, or drainage which impacts threatened flora species by decreasing the quality of habitat (specifically at the Waterways where they are known to occur). Sediment-landed run-off from the road may lead to a decrease in the quality of habitat for significant flora.	D, C, O	Medium	B3 W2	Low
R-BH11	Impacts on MNES	Design leads to impact on Seasonal Herbaceous Wetlands of the Temperate Lowland Plains due to modification of abiotic factors necessary for community's survival: surface water drainage, groundwater systems, or increased pollution.	D, C, O	Medium	B3 W1 W2 W5 AQ1	Medium
R-BH13	Impacts on MNES – Impacts significant fauna species	Construction noise impacts on wetland habitat such that dependant species are seriously affected including MNES and State significant species.	I, C	Medium	B4 NV2	Low
R-BH14	Impacts on MNES – Impacts significant fauna species	Light from construction activities impacts on wetland habitat such that locally occurring species are significantly affected, including MNES and State significant species.	I, C	Medium	B4 LV5	Low
R-BH19	Impacts on MNES	Construction of road results in introduction or spread of an invasive species impacting habitat for significant species and reducing the quality of threatened communities.	I, C, O	Medium	B5 B6	Low
R-BH20	Impacts significant fauna species	Operation of the road (traffic noise) impacts fauna species/habitat, including listed migratory or threatened fauna.	O	High	B1 B6	Medium
R-BH21	Impacts significant fauna species	Operation of the road (Headlights) impacts fauna species/habitat, including listed migratory or threatened fauna.	O	Medium	B1 B2 LV1	Low

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-BH22	Impacts significant fauna species	Operation of the shared user path (SUP) impacts migratory species or leads to reduction in area of occupancy of a threatened species.	O	Medium	B1 B2 LV1 LV4	Low
R-BH23	Impacts significant fauna species	Operation of road results in increased mortality of fauna protected under the Wildlife Act 1975 (or otherwise listed).	O	High	B1 B6	Medium
R-BH24	Impacts significant vegetation or ecological communities	Operation and maintenance of road results in introduction or spread of an invasive species potentially impacting habitat for significant species and reducing the quality of threatened communities.	O	Medium	B5 B6	Medium
R-WW3	Impacts on MNES	Operation of the road results in change in the water quality of the wetland resulting in an adverse impact on biodiversity, ecological integrity, social amenity or human health.	O	Medium	W1	Low

10.8 IMPACT ASSESSMENT AND MITIGATION

The risk assessment process identified key impacts of the project which required detailed assessment. These impacts included:

- vegetation and habitat loss
- reduced habitat connectivity
- mortality and injury of wildlife due to collision with vehicles
- habitat degradation from increased disturbance due to:
  - noise impacts
  - light impacts
  - visual disturbance
- habitat degradation from physical changes including:
  - weed invasion
  - rubbish
  - erosion, sedimentation, and water pollutants
  - hydrological changes.

The most significant project impacts are expected to effect birdlife, however, there is also a range of terrestrial and aquatic fauna that are likely to be impacted by the project. The main indirect impacts within the project area are road noise, reduced habitat connectivity and vehicle lighting.

The impacts listed above are applicable to both construction and operation phases however they have been discussed below under the phase in which the highest impacts would likely occur.

10.8.1 Construction

Vegetation and habitat loss due to clearing (Risks R-BH1 to R-BH5)

Loss of habitat, together with habitat degradation and fragmentation, is one of the most critical impacts to native wildlife in Australia. The project will require the clearing of native and non-native vegetation that provides habitat for a range of wildlife species.

ECOLOGICAL VEGETATION CLASSES

MRPA expects that up to 10.56ha of EVCs will be cleared for the project. These EVCs are considered either 'endangered' or 'vulnerable' within the Gippsland Plain Bioregion. The bridge over Mordialloc Creek will result in the shading of native vegetation and habitat, including threatened vegetation communities. All vegetation under and within eight metres of the bridge has been considered lost or removed for the calculation of vegetation impacts.

The anticipated maximum impacts (loss) on each EVC are provided in Table 10.9. The loss of EVCs through clearing is reported in Section 10.7 as an extreme initial risk and a high residual risk, while clearance of habitat for threatened flora and fauna species are assessed with low to medium residual risk with the application of EPRs.

EPRs B3, B4 and B5 will ensure vegetation loss (particularly to EVCs and threatened species) are avoided or limited. The design has undertaken extensive review and refinement to avoid vegetation loss and this process will continue through the detailed design and engagement with the Contractor. CEMPs will be produced containing no-go zone mapping and guidance and requirements in relation to clearance methods, timing and ongoing monitoring and maintenance.

Table 10.9 Maximum anticipated loss of EVCs

EVC name	Maximum anticipated loss (ha)
Aquatic Herbland[1]	0.81
Creekline Grassy Woodland	0.22
Damp Sands Herb-rich Woodland	0.01
Plains Grassland – South Gippsland	0.05
Plains Grassy Wetland	4.53
Plains Grassy Woodland	2.02
Sedge Wetland[1]	0.47
Swamp Scrub	0.53
Swampy Woodland	0.04
Tall Marsh	1.23
DELWP modelled wetland	0.64
Grand Total	**10.56**

1. Refer to Table 4.3 in Appendix C: *Flora and fauna impact assessment*. Total figures for Aquatic Herbland is comprised of Aquatic Herbland and the EVC without benchmarks Submerged Aquatic Herbland. Sedge Wetland represents Plains Sedgy Wetland and Aquatic Sedgeland. There is no Sedge Wetland in the study area.

TREES

A total of up to 294 of the 703 recorded remnant native canopy trees (Canopy Trees as defined under Guidelines 2017) will be impacted, including both scattered trees and trees in patches; see Table 10.10. When understorey trees are included, the total will be up to 331 remnant native trees will be impacted. The retained trees will be protected by no-go zones.

No-go zones have not yet been developed for trees which are not remnant native trees, however it is anticipated that approximately 491 (of total 939 recorded) exotic or invasive trees and 730 (of total 1618) planted native and indigenous trees may be removed or otherwise impacted by the project (see Table 10.10). Amenity impacts related to the removal of trees, including planted and exotic trees, are assessed in Chapter 11: *Landscape and visual effects*.

KEY TREE CATEGORY DEFINITIONS

Canopy tree: remnant native tree of a canopy species (defined under Guidelines 2017); includes scattered trees and trees in patches.

Understorey tree: remnant native tree of an understorey species.

Exotic: trees not native to Australia.

Invasive: exotic or non-local native trees which are weedy and can be troublesome in the local area (included with exotic trees for simplicity).

Planted native and indigenous: planted trees native to Australia (non-local) or to the local area.

Table 10.10 Assessment of impacts on all trees

Tree category	Trees retained	Trees removed or lost due to tree protection zone (TPZ) impacts	Total trees surveyed
Canopy trees	409	294	703
Understorey trees	44	37	81
Exotic and/or invasive*	448	491	939
Planted native and indigenous*	888	730	1618
Grand Total	**1789**	**1552**	**3341**

*No-go zones have not yet been developed for 'exotic and/or invasive' and 'planted native and indigenous' trees, so the assessment of impacts for these categories is preliminary only.

Important to the assessment of tree impacts and sourcing of vegetation offsets is the consideration of large trees, as defined under Guidelines 2017. Up to 24 of the 60 large canopy trees (both in patches and scattered) are proposed to be impacted; see Table 10.11.

The clearing of large remnant native trees was identified as a high initial risk. Clearing of large trees will be subject to EPRs B3, B4 and B5 and it will be important that the design development beyond the EES continues to find opportunities to limit vegetation removal (this will be incentivised in the D&C contract), while maintaining the identified no-go zones (see Attachment III: *Maps and figures*) and the committed offsets based on current calculations of habitat loss.

Table 10.11 Breakdown of anticipated maximum impacts on Canopy Trees

Tree size	Retained	Removed or lost due to tree protection zone (TPZ) impacts	Grand total
Large	36	24	60
Small	373	270	643
Grand Total	**409**	**294**	**703**

Disturbance

Disturbance, including noise, vibration, and visual impacts, is a major component of the road effect zone on fauna. The alignment for the project passes through an area that is already extensively modified and includes major roads, walking paths, and industrial and residential land-uses, as well as wetlands. Species currently utilising the area around the proposed road appear to be tolerant of the current level of disturbance. However, noise and light can travel far over wetland habitat (generally flat open spaces) and a consideration of the potential impacts of an additional road in the area with respect to noise, vibration and light is provided below.

NOISE (RISK R-BH13)

Road construction noise is typically louder for short periods of time, while road-traffic noise generally occurs at lower intensities but is more persistent. Animals can find noise from road construction and traffic stressful, with some animals moving away from the noise, either temporarily or permanently. Noise disturbance can therefore affect the quality of habitat and would be a temporary disturbance during construction which may affect breeding success and survival rates. Refer to Chapter 12: *Noise and vibration effects* for further information regarding current and predicted noise conditions during construction.

Noise impacts on wetland habitat and biodiversity during construction, will be reduced to low risk with the application of EPR B4 and NV2 which recommend the need for noise mitigating measures in the CEMP including exclusion of haulage use along Edithvale Road near sensitive habitats and considering ecological values as part of the noise management plan.

VIBRATION

Vibration is generally a short-term impact occurring during the construction earthworks or structural works e.g. piling. Impacts from vibration during project construction are expected to be minimal. Refer to Chapter 12: *Noise and vibration effects* for further information.

LIGHT (RISK R-BH14)

Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution'. Light from vehicle headlights and works area lighting during construction has the potential to impact fauna utilising habitat near the project area.

Artificial light affects species in different ways but can cause disorientation, attraction and avoidance responses, which can affect critical behaviours (foraging, reproduction, communication).

EPRs B4 and LV1 will mitigate the potential impact risk from medium to a low rating through ensuring the CEMP includes details on directional lighting, avoiding lighting near ecologically sensitive areas, removing lighting promptly when not required, and use of shields to limit light spill.

Physical changes

WEEDS AND DISEASE (RISK R-BH19)

Construction results in bare ground that is susceptible to colonisation by weeds or introduction of disease. Standard controls, including the reuse of site topsoil and the use of sterile fill, will reduce the risk of spreading or introducing weeds during construction of the project

Soil pathogens are not currently known in the project vicinity and are unlikely to be introduced by the project, as minimal earthworks and trenching is expected. Other pathogens, such as the amphibian disease Chytrid fungus, will not be worsened by the project.

The potential spread of invasive species during construction is identified as an initial medium risk. With the application of EPR B5, which prescribe the need for specific weed control and management measures in the CEMP, the residual risk will be reduced to low.

EROSION, SEDIMENTATION AND WATER POLLUTANTS (RISK R-BH15)

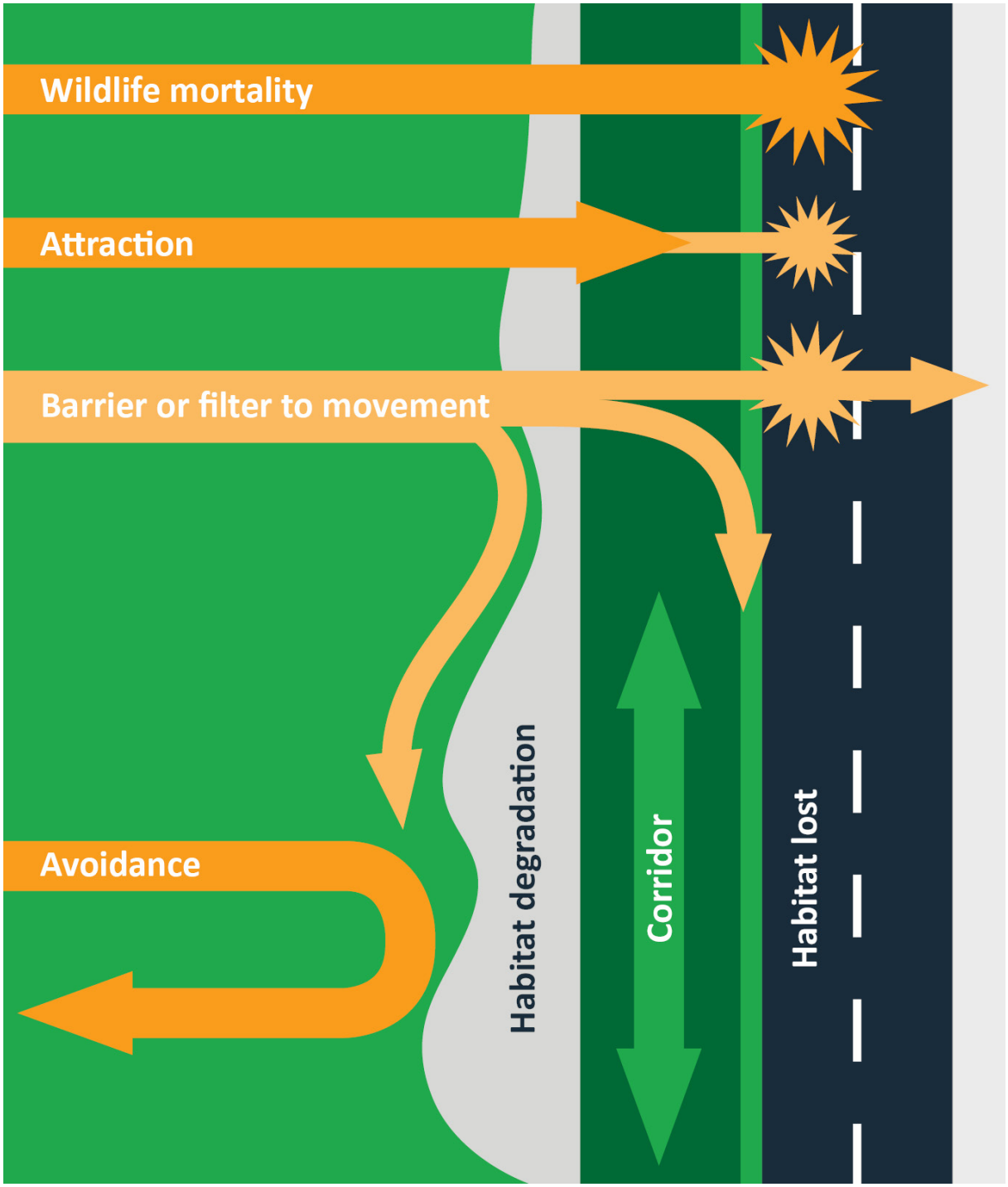
Clearing and construction of the project increases the risk for sediment-laden run-off and other pollutants to enter nearby waterways. Woodlands Industrial Estate Wetlands, the Waterways Wetlands, Mordialloc Creek, and Edithvale Wetlands are considered the most sensitive areas, occurring downstream of the project, however standard erosion and sedimentation controls contained in EPR B4 and B5 to be included in the CEMP will minimise these risks. This issue is covered in more detail in Chapter 16: *Surface water and hydrology*.

10.8.2 Operation

Loss of connectivity (Risk R-BH9)

The movement of animals, plants and ecosystem processes is critical to species survival and healthy ecosystems. Clearing and construction of roads commonly result in habitat fragmentation, thereby limiting or preventing animal movements, creating smaller populations that are more susceptible to decline. Roads and traffic can form a barrier or filter to movement for certain species, particularly those that are sensitive to the noise, light and disturbance by vehicles. The project is likely to result in some fragmentation, primarily for ground-dwelling and low-flying fauna, and particularly those which utilise the terrestrial connectivity currently available (e.g. between Braeside Park Wetlands and Woodlands Industrial Estate Wetlands). Some potential impacts of roads on wildlife linked to loss of connectivity are shown on Figure 10.16.

A potential impact is fragmentation of fauna habitats and wildlife corridors from the project; in particular the Woodlands-Braeside corridor and the Waterways corridor. An initial high risk rating can be mitigated to a medium through the implementation of EPRs B1 and B6 which include design consideration and provision of fauna crossings/culverts, barriers and the operational monitoring of these features to ensure their intended use is realised and effective.



Source: Adapted from van der Ree, R., Smith, D. J. & Grilo, C. 2015

Figure 10.16 Potential impacts of roads on wildlife

Increase in wildlife injury and mortality (Risk R-BH23)

The project has the potential to increase the rate of fauna injury and mortality during both the construction and the operational phase of the project. The most obvious impacts of traffic on wildlife is injury and mortality due to wildlife vehicle collisions. Wildlife vehicle collisions are difficult to estimate, especially for small species, as most collisions are not reported. All roads have the potential to result in the mortality (roadkill) of native animals, but risks increase when roads:

- pass through areas with naturally high rates of wildlife movement
- pass through areas that support high-density populations of wildlife
- are located close to natural or artificial water bodies, that support high-density populations of wildlife, principally birds
- pass through areas containing road side food sources which attract animals
- have high speed limits
- have poor visibility (e.g. bends, crests and poor lighting).

Wildlife vehicle collisions and wildlife mortality in the project area is expected to be highest near and between wetlands, where the road is at grade or above. Rates at the bridge would be expected to be lower because there is space underneath for wildlife to cross, including birds.

The project will minimise the direct and indirect impacts on fauna through design (EPR B1). Design inclusions that minimise impacts on fauna include fauna connectivity culverts and fauna barriers to reduce mortality in key wildlife areas. B6 will also monitor the effectiveness of these measures and adapt the design as necessary should they not be performing as intended. These measures will reduce the initial high risk of impact to a residual medium. An excerpt from the current indicative fauna mitigation plan is shown in Figure 10.19.

Disturbance (Risk R-BH22)

As noted above, disturbance can occur during operation and construction. Operational disturbance is characterised generally by long term noise and light exposure rather than short term and often high intensity noise, vibration and light during construction.

Disturbance from users on the proposed shared use path alongside the project is identified as a medium initial risk which is reduced to low risk by the application of EPR B1 including design inclusion of wildlife-friendly fencing to limit disturbance from people and dogs on sensitive habitats and species especially in the Wetlands, and EPR B2 which contains details on lighting restrictions on areas of the project to reduce disturbance to habitats and species nearby.

NOISE (RISK R-BH20)

Operational road noise from traffic can lead to permanent avoidance of habitat, or impacts to breeding and survival in certain species, particularly if the species relies on acoustic signals (e.g. mating calls or alarm calls) which can be masked by road noise.

Noise measurements of approximately 45–55dBA (Leq) and below 60dBA during peak times were recorded at five parkland locations close to the proposed project. Noise levels at these areas with no mitigation measures are predicted to increase to 65dBA and up to 75dBA (Leq) during peak traffic times. There is no threshold traffic noise level above which negative impacts occur to ecology, however a review of relevant studies suggested that traffic noise should ideally be kept below 55–60dBA (18hr exposure). The expected increase in parkland noise levels due to the project (approximately 20dBA without mitigation) would exceed the estimated range identified in the scientific literature and mitigation measures have been developed to minimise noise disturbance impacts to fauna.

Noise modelling was undertaken using the reference design to assess the acoustic benefits of the proposed multi-function fauna barrier. Table 10.12 provides details on modelled noise levels at points around Braeside Park Wetlands, Waterways Estate Wetlands and the Waterways Wetlands. Modelled noise levels and the locations referred to in the table can be seen in Figure 10.17 and Figure 10.18. The predicted noise levels with the multi-function fauna barrier have decreased to between 56 to 62 $L_{10,18hr}$ dBA.

Table 10.12 Summary of the acoustic benefits of the multi-function fauna barrier

Location	Existing levels ($L_{10,18hr}$ dBA)	Predicted levels (2031) without mitigation ($L_{10,18hr}$ dBA)	Predicted levels (2031) with multi-function fauna barrier and noise barriers for residences ($L_{10,18hr}$ dBA)
1	51	66	61
2	51	65	61
3	57	61	57
4	50	64	60
5	49	65	62
6	50	63	60
7	53	64	61
8	55	59	56
9	52	70	63

Operational noise risk related to affects on threatened fauna species was identified as an initial high risk. The incorporation of a multi-function fauna barrier in the key wetland areas to reduce noise impacts would reduce the residual risk to medium (EPR B1).

LIGHT (RISK R-BH8 AND R-BH21)

Currently the project area is affected by low to moderate levels of light pollution. However, a major change in light levels is expected at the southern end of the road where the road would pass over wetlands and beside residential areas. Fauna occurring in the Waterways Wetlands, Braeside Park Wetlands and at Woodlands Industrial Estate Wetlands are considered most at risk from artificial lighting and headlights.

Artificial light affects species in different ways but can cause disorientation, attraction and avoidance responses, which can affect critical behaviours (foraging, reproduction, communication). This is considered a medium (headlights) to high (road lighting) risk without controls, however through the application of EPRs B1 and B2 including implementing fauna-sensitive lighting design guidelines and multi-function fauna barriers and landscaping the residual risk is reduced to low (headlights) to medium (road lighting) (EPR B1 and B2).

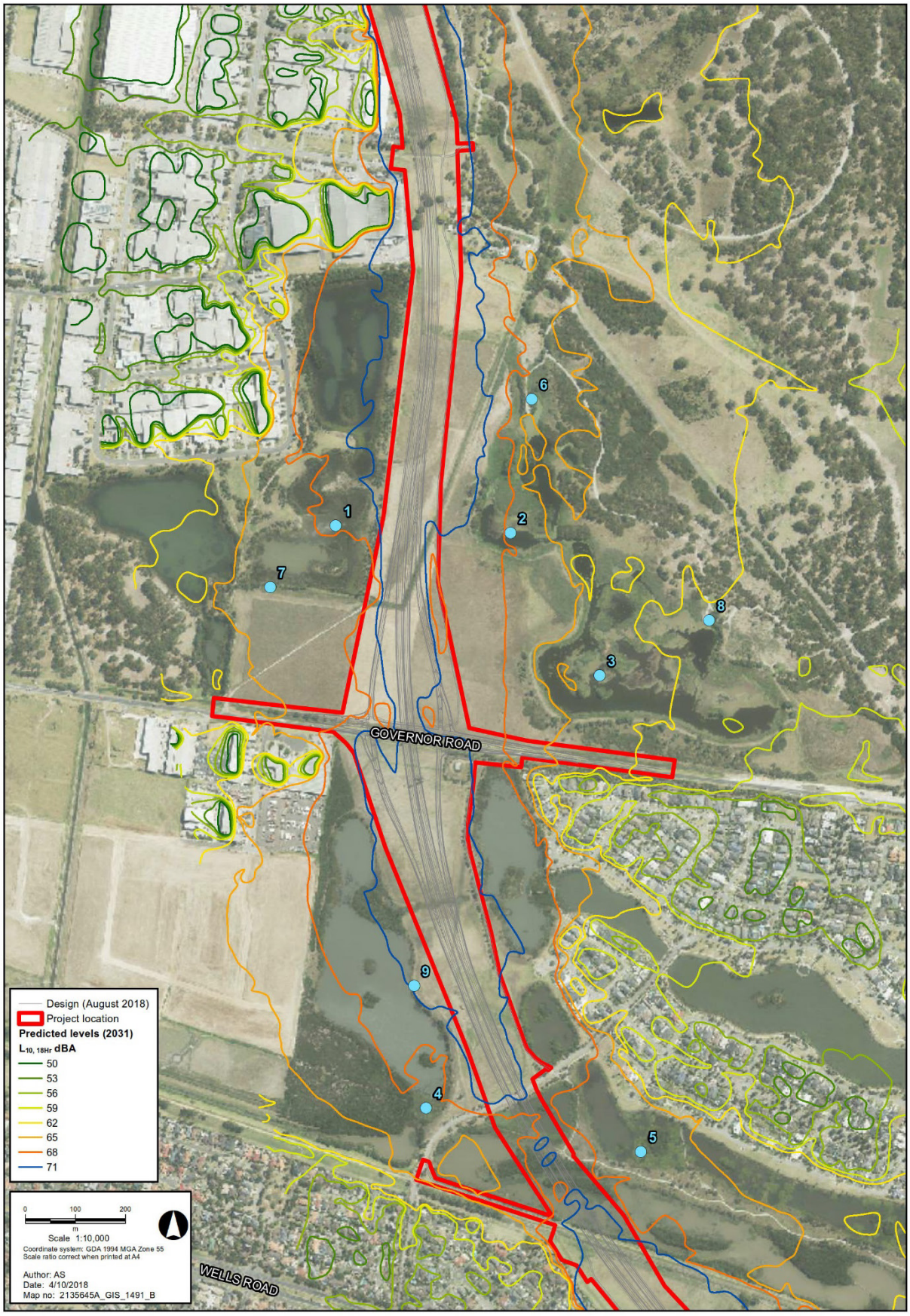


Figure 10.17 **Unmitigated predicted noise levels at Braeside Park Wetlands, Woodlands Estate Wetlands and Waterways Wetlands**

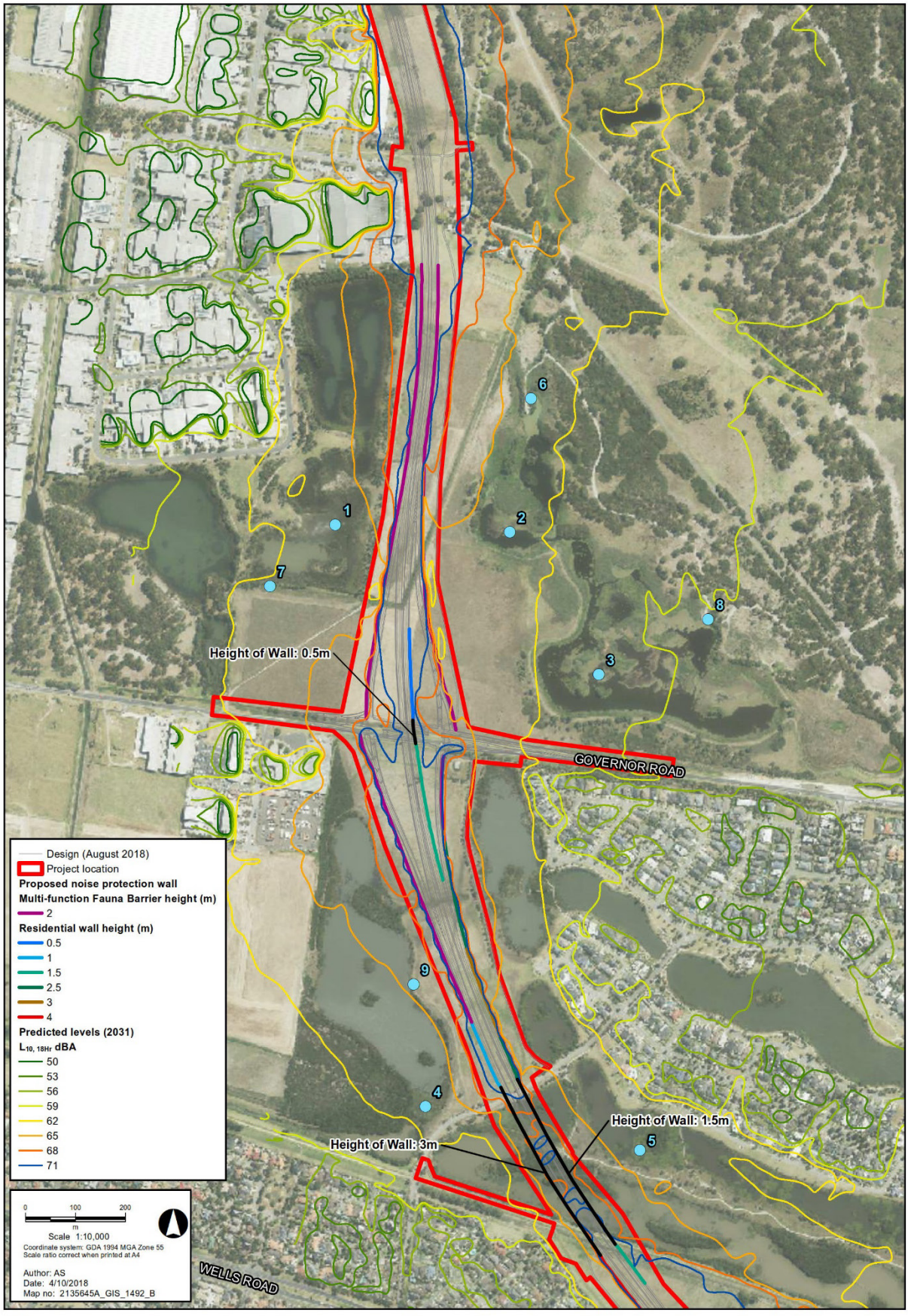


Figure 10.18 **Acoustic Benefits attributed to multi-function fauna fence and residential noise mitigation treatments**

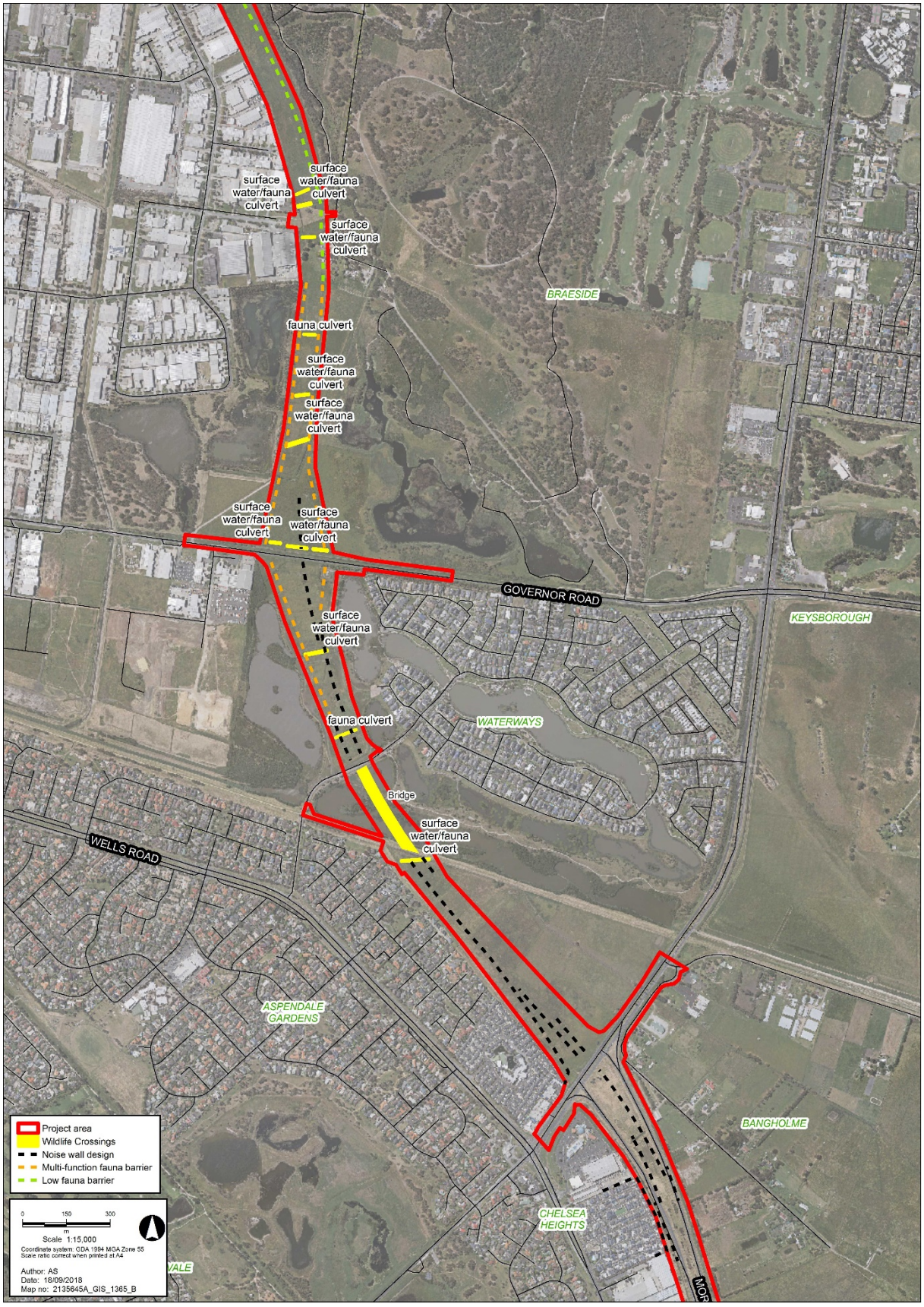


Figure 10.19 **Excerpt from current indicative fauna mitigation plan (refer Appendix C: *Flora and fauna impact assessment*)**

Physical changes

RUBBISH

A slight increase in rubbish in terrestrial and aquatic habitats adjacent to the project is expected from the project. Rubbish reduces visual amenity and can have a negative impact on habitat quality. Standard roadside fencing will assist in reducing this impact in most parts of the project area. Where the project passes near important wetlands (Woodlands Wetlands, Braeside Park Wetlands and the Waterways Wetlands), noise barriers and multi-function fauna barriers (in areas without noise barriers) will prevent rubbish from entering wetlands. There will be some residual risk from users of the shared use path, however this path will be located some distance from the most sensitive wetlands, particularly Braeside Park Wetlands.

HYDROLOGICAL CHANGES (RISK R-BH7, R-BH10, R-BH11 AND R-WW3)

The project has been assessed for the potential to impact the flow of groundwater and surface water at the Waterways Wetlands and other nearby wetlands, including Woodlands Wetlands, Braeside Park Wetlands and the Edithvale component of the Edithvale-Seaford Ramsar Wetlands. Changes in water levels, the hydraulic system and water pollution (from road runoff) within the wetlands can alter the habitat conditions and may degrade the quality of the habitat or begin to change the species composition in the long term. Changes resulting from the project could therefore have subsequent affects on migratory waders and other waterbirds that rely on seasonally inundated wetlands and other wetland or aquatic flora and fauna.

The project is expected to have a negligible impact on groundwater volumes and flows. More information can be found in Chapter 17: *Groundwater*.

Potential surface water impacts assessed include:

- impacts on vegetation and wetland habitat from changes in water flow/volume to surrounding wetlands
- water quality impacts from the road use to nearby wetlands
- water quality impacts from spills that flow to nearby wetlands.

The project is expected to result in up to 0.046m higher flood level (afflux) in a 1% Annual Exceedance Probability (AEP) flood event (i.e. a one in a hundred year flood event) in the Braeside Park and Woodlands Industrial Estate Wetlands area (refer to Chapter 16: *Surface water and hydrology*). The increased water levels during flooding would affect Woodlands Industrial Estate Wetlands and the grassland on either side of the project north of Governor Road. There would be a negligible to minor increase in the amount of time that areas are inundated after a flood event. No increase in water levels in Braeside Park wetlands are expected.

The shallow wetland habitat at Woodlands Wetlands is arguably the most valuable habitat within the area likely to be affected, particularly for threatened species. This habitat, most of which is located near the alignment just north of the central wetland pool, is reliant on flooding and drying. It is unlikely to lose value as the wetting/drying cycles are unlikely to change, with the water levels continuing to draw down in summer.

An increase in flood levels in the grassland next to the project is unlikely to substantially change the habitat values of this area. It may actually increase the value of this area to wetland species, providing improved foraging habitat and connectivity after flooding. This degree of afflux is unlikely to change the local environment.

EPRs B1, W1 and W2 include design considerations such as swale design to offer drainage solutions and biodiversity benefits and treatment of road run-off prior to entering the water catchment. This will reduce the potential impacts on surface water flow and quality within the wetland habitat and MNES from an initial medium to a residual low risk.

Potential impacts are also identified in relation to flora and changes to the hydrology and sedimentation in existing habitats. EPR B3 will ensure design considerations to limit impacts on native vegetation, while surface water measures in W1 and W2 will offer controls to manage sediment and pollutant runoff from the road and embankments during operations through the use of swales and bio-treatment, while EPRs GW1 and AQ1 will also assist in reducing dust and groundwater impacts to threatened flora.

Bio-retention systems will be incorporated into the project to ensure the increase in nutrient levels from road runoff is reduced prior to flowing to downstream sensitive receptors (Woodlands Wetlands, Waterways Wetlands/Mordialloc Creek and Edithvale Wetlands). Ecological impacts due to water quality and hydrological changes are considered unlikely, based on surface water assessments and modelling completed for the project. More information can be found in Chapter 16: *Surface water and hydrology*.

WEEDS AND DISEASE (RISK R-BH24)

Operation and maintenance activities will also provide potential pathways for the introduction of invasive species to habitats alongside the project. A potential impact of weed spread during operation is identified as a medium risk, however with EPRs B5 and B6 the potential for weed and disease spread will be minimised through application of monitoring and management protocols to be included in the CEMP and monitored during operation.

10.8.3 Impacts on significant flora, fauna and communities

When considering impacts upon species of conservation significance, all potential types of direct and indirect impact were considered. The FFG and EPBC Act species and communities discussed below would potentially be affected during the pre-construction clearing of vegetation and construction works which may lead to disturbance and loss of habitat connectivity or quality. Several impacts may also be experienced during operation of the project due to the proximity of traffic and associated noise, lighting, water run-off from the road and rubbish. The potential impacts on these species and communities are reported for both construction and operation together in the section below to avoid duplication and show links to the standard and additional control measures.

The assessment also showed that, although several threatening processes are currently or potentially relevant to the project area, standard controls and additional mitigation will assist in managing these risks such that the project is unlikely to exacerbate all but one threatening process. The EPBC Act listed threatening process, 'land clearance' cannot be completely mitigated, and will have some residual impact upon EVCs, threatened communities, flora, and fauna.

Flora

Eight significant flora species were identified as having a moderate or higher likelihood of occurrence at the project area and were assessed for the potential to be affected by the project.

Three of those species (Purple Blown-grass, Lacey River Buttercup, and Swamp Fireweed) were not recorded during field surveys for this project, despite several targeted surveys. If any of these species are present within the project area, it is predicted that the project will have a negligible or minor impact on each. Pre-clearing surveys will be undertaken at the Waterways Wetlands to ensure relocation of plants to suitable habitat nearby if required.

Three species, Matted Flax-lily, Swamp Everlasting, and Pale Swamp Everlasting, were recorded at the Waterways Wetlands, outside of the project area. The known populations of these species occur to the east of the proposed bridge. By establishing construction no-go zones (EPR B5) at the Waterways Wetlands/Mordialloc Creek, these populations will be appropriately buffered such that they will not be directly or indirectly affected by the project. Pre-clearing surveys and additional follow-up weed management at the Waterways Wetlands will be undertaken to further minimise the risk of impacts on these flora species (EPR B6). These species are therefore unlikely to be impacted.

Large River Buttercup is listed as "poorly known" on the Victorian Advisory List. It was recorded in several locations throughout the project area and the works will result in the removal of some individual plants. Despite this, the species is not threatened and the likely overall impact to this species will be minor.

Leafy Twig-sedge is listed as 'rare' on the Victorian Advisory List. Up to 0.071ha of this species is proposed to be cleared for the project. This is expected to have a minor impact upon the species given a total recorded area of 0.325ha was mapped during field surveys, with additional individuals likely to occur outside of the surveyed area.

Fauna

Several fauna species were identified as having a likelihood of occurrence greater than 'low' at or nearby the project area. This includes 40 birds, one mammal, two reptiles and one amphibian. The anticipated impact on each species is outlined below.

BIRDS

For all bird species, impacts from noise and light, loss of connectivity and road mortality will be reduced through the implementation of fauna sensitive design and mitigation measures. Although some of the impacts and the likely effectiveness of mitigation measures are difficult to quantify, the overall residual impact upon these species is expected to be minor.

- *Sea birds*

  The Pacific Gull is unlikely to experience impacts as the habitat within the study area and vicinity is unlikely to be of high value to the species. Four other species (Caspian Tern, Pied Cormorant, Whiskered Tern and White-winged Black Tern) are expected to experience some loss of foraging and/or roosting habitat and potential indirect impacts of noise disturbance and surrounding habitat degradation. Through the implementation of no-go zones for retained habitat at the Waterways Wetlands (B4 and B5), noise attenuation barriers in and around wetland areas (EPR B4) and revegetation and maintenance of habitat (B1), impacts to these species will be reduced and the overall residual impact is expected to be negligible to minor.

- *Shore birds, waders*

  The habitat that these birds are most likely to visit, the shallow water areas of Braeside Park Wetlands, occur outside of the project area. Potential impacts relate primarily to disturbance from noise and light spill upon this habitat. The majority of the migratory bird species that visit the area are recorded in low numbers only (as a proportion of population). This includes Australian Painted Snipe, Marsh Sandpiper, Pectoral Sandpiper, Ruff, Wood Sandpiper, Common Greenshank, Common Sandpiper, Long-toed Stint and Red-necked Stint. With appropriate mitigation measures to reduce noise and light impacts such as fauna sensitive lighting design and multi-function fauna barriers around wetland areas, the project is expected to have a negligible impact on these species. For the Curlew Sandpiper, Latham's Snipe, and Sharp-tailed Sandpiper, habitat at and near the project area (particularly at Braeside Park Wetlands) should be considered important. By designating no-go zones for retained habitat, minimising wetland vegetation clearance and revegetating under the Mordialloc Creek bridge and constructing barriers to minimise road mortality, as well as the mitigation for noise and light described above (EPRs B1, B4, B5), impacts upon these species is expected to be minor.

- *Waterfowl*

  Six significant waterfowl species (Australasian Shoveler, Blue-billed Duck, Freckled Duck, Hardhead, Magpie Goose and Musk Duck) are likely to experience some fragmentation and loss/degradation of wetland habitat that is used for foraging, roosting and/or shelter. No direct impacts upon known breeding habitat is anticipated. Some of the impacts will be temporary during bridge construction. Disturbance related impacts including impacts from noise and light, will be reduced through the implementation of fauna sensitive lighting and noise attenuation barriers (multi-function fauna barrier). For breeding waterfowl, such as Blue-billed Duck and other non-listed species, ongoing loss of connectivity and increase in road mortality is a potential risk of the project. Barriers to minimise road mortality (multi-function fauna barrier), fauna connectivity culverts and revegetation of disturbed areas and areas to/from fauna passages will help to mitigate these impacts and reduce potential risks to these species (EPR BWH1).

- *Other water birds*

  A total of ten other significant waterbird species are likely to experience some direct loss of foraging, roosting and/or breeding habitat as a result of the project. These species are Australasian Bittern, Australian Little Bittern, Baillon's Crake, Lewin's Rail, Eastern Great Egret, Glossy Ibis, Intermediate Egret, Royal Spoonbill, Nankeen Night Heron and Little Egret. For some of these species, impacts include the loss of grassland habitat which may be used occasionally for foraging or movement, particularly when flooded.

  None of the species examined are likely to be substantially affected by direct habitat loss, given the higher quality habitat in the area. All species will be subject to various impacts including disturbance from noise and light and a potential increase in mortality from road collisions. However, these impacts are likely to be substantially reduced by the application of EPRs B1 and B2 including roadside barriers (multi-function fauna barrier) and fauna connectivity culverts to minimise road mortality and fauna sensitive lighting design and noise attenuation (multi-function fauna barrier) in and around wetland areas to reduce habitat disturbance.

  For Australasian Bittern, Australian Little Bittern, Baillon's Crake, and Lewin's Rail, all of which are known to occur on occasion at the wetlands associated with the project, loss of connectivity is a particular risk. This is because these birds are more secretive and prefer to move via terrestrial corridors where possible. The Australasian Bittern also prefers larger, less disturbed wetlands than many of the other species assessed. Some residual impacts from loss of connectivity are possible, even after mitigation. However, with the mitigation proposed (described above) focusing on maintaining existing drains for movement and buffering the nearby habitat from noise and light impacts, the species are still considered likely to utilise the habitat, and the residual impact is unlikely to be significant.

- *Terrestrial birds*

  The White-throated Needletail and Fork-tailed Swift are predominately aerial species that are only likely to occur over the study area during seasonal movements. They are unlikely to use any terrestrial habitat within the study area and are therefore unlikely to be impacted by the project. Three species (White-bellied Sea-Eagle, Black Falcon and Spotted Harrier) will experience the loss of small amounts of foraging or hunting habitat. Impacts to these species is either negligible or minor due to the low quality or small amount of habitat lost or the wide foraging ranges of the species. A final two species (Diamond Dove and Rufous Fantail) could potentially experience impacts from road mortality or light and noise disturbance. However, as per EPRs B1 and B2, barriers to reduce road mortality, noise and light impacts (multi-function fauna barrier), and fauna sensitive lighting design are expected to reduce impacts such that the residual impact on these species will be minor.

MAMMALS

The Grey-headed Flying-fox is likely to fly over the study area while foraging and may visit trees in the area. Impacts to this species are not expected given the small amount of potential habitat loss and the species' large foraging range.

REPTILES

The Eastern Snake-necked Turtle and Glossy Grass Skink are both listed on the Victorian Advisory List. MRPA expects that both species will experience some impacts from loss of habitat, reduced connectivity and increased road mortality. Such impacts are likely to be significantly reduced through various mitigation measures. This includes constructing barriers to minimise road mortality at wetland areas, minimising wetland vegetation clearance and revegetating at the Mordialloc Creek bridge, as well as constructing fauna culverts, to maintain habitat connectivity.

AMPHIBIANS

The Southern Toadlet has previously been recorded near the study area. Some potential habitat for this species will be lost however fauna sensitive design and noise barriers will reduce impacts on the remaining habitat.

Communities

Full details of MNES impacts are provided in Chapter 22: *Matters of national environmental significance* with a summary of the outcomes provided within this chapter.

Two EPBC Act listed communities were recorded in the project area, they are listed below along with the anticipated maximum area of impact:

- Natural Damp Grassland of the Victorian Coastal Plains, Critically Endangered, 0.04ha
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains, Critically Endangered, 0.24ha.

An assessment against the significant impact criteria found that these impacts would not be considered significant.

There are two largely corresponding FFG Act listed communities:

- Plains Grassland (South Gippsland) Community, Listed, 0.04ha
- Herb-rich Plains Grassy Wetland (West Gippsland) Community, Listed 0.35ha.

Similarly, these are relatively minor areas of impact. Nevertheless, an FFG Act permit will be required for the removal of these communities.

EPRs B3, B4 and B5 provide details of design considerations to avoid vegetation loss where possible, establishment of no-go zone mapping, incentivising Contractors to seek greater reductions in habitat loss and protection measures to limit disturbance and damage to threatened communities. However, a residual impact risk of medium is likely to remain for clearance of EPBC Act and/or FFG Act listed communities.

10.8.4 Avoidance and minimisation

The Guidelines (DELWP 2017) require that all efforts to avoid and minimise impacts to native vegetation be considered before offsets are purchased for native vegetation removal. The following design modifications have been incorporated into the project design to avoid and minimise native vegetation loss:

- Separation of dual carriageway over Mordialloc Creek to allow light penetration and facilitate vegetation growth under the bridge.
- Micro-alignment of shared use path to avoid TPZ and reduce the number of trees impacted.
- No-go zones developed with a focus on areas with higher retention value such as large trees and wetland vegetation at Waterways Wetlands. These have been refined through several iterations to ensure that the maximum number of large trees would be retained, without making the road too difficult. During detailed design, it is anticipated that additional areas will be added to no-go zones and that with further advice from an arborist, more trees can be retained. No-go zones can be seen in the Attachment III: *Maps and figures* (EPR B3).
- Around sensitive receptors, such as Waterways Wetlands, surface water design will aim for no change in nutrient levels in these waterways as a result of the project, instead of the maximum limit allowable.

In addition, financial incentive have been provided to ensure tenderers further minimise losses, particularly to large trees through alterations to design and construction methodology (EPR B3).

10.8.5 Native vegetation offsets

Where native vegetation cannot be avoided, and must be removed, native vegetation offsets will be purchased. Up to a total of 12.10ha of native vegetation is proposed to be removed (10.56ha of EVCs plus tree buffers for scattered trees). This equates to 4.426 General Habitat Units being required with a minimum strategic biodiversity score of 0.422 and 24 large trees (Native Vegetation Removal report). These offsets will be secured through a third party offset provider and registered on the DELWP Native Vegetation Credit Register.

Financial incentives are being provided to tenderers to further reduce the amount of native vegetation lost from the 12.10ha and 24 large trees that offsets will be purchased for.

Discussion of offset requirements for MNES (DSEWPaC 2012) is provided in Chapter 22: *Matters of national environmental significance*.

10.8.6 Aggregate cumulative impacts

Aggregate cumulative impacts are a combination of in-project effects such as when multiple project activities occur concurrently. For example, aggregate risk is the risk posed of road noise, lighting from vehicles and increase air pollution all impacting on native fauna. Each of these individual aspects has been assessed during the specialist impact assessment and reported within this EES. No further mitigations were recommended beyond mitigations proposed to account for the individual risks.

10.9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRs)

Table 10.13 outlines the EPRs developed to protect and minimise impacts to biodiversity values. The focus of these EPRs is firstly avoiding impacts where possible to do so, and secondly, developing, preparing and implementing management plans to achieve acceptable outcomes for biodiversity.

Table 10.13 Environmental performance requirements

EPR reference	EPR	Project phase
B1	**Fauna habitat** Direct and indirect impacts on fauna must be minimised by preserving and enhancing habitat and facilitating habitat connectivity where practicable. This will be achieved through implementation of (as a minimum): • fauna crossings, including culverts modified for fauna movement between the Braeside Park wetlands and Woodlands Industrial Estate wetlands (minimum of 3 culverts), and between the Waterways wetland waterbodies south of Governor Road (minimum of 2 culverts) • multi-function fauna barriers to limit fauna mortality, limit disturbance to surrounding habitat areas and encourage culvert use by fauna between Braeside Wetlands and Woodlands Wetlands, and between the Waterways Wetland waterbodies south of Governor Road • a low fauna barrier to limit fauna mortality and encourage culvert use on the eastern side of the new roadway, north of the Parks Victoria office and adjacent to Braeside Park • wildlife friendly fencing to control human and dog access to Braeside Wetlands and Braeside Park from the shared user path or roadway • landscaping including: – the use of site-specific indigenous species – creating or revegetating habitat that maximises connectivity at fauna crossing points and under the constructed bridge over Waterways wetlands – open wetland and grassy habitat where appropriate, including swales adjacent to fauna barriers • a dual bridge structure at Mordialloc Creek/Waterways wetland to allow light penetration and facilitate fauna movement.	All

EPR reference	EPR	Project phase
B2	**Lighting design** Fauna sensitive lighting design principles must be incorporated into lighting design in sensitive areas around wetlands and Braeside Park. The design principles are: • Siting of lights – Use lights only where necessary and use the minimum brightness (lumens) possible – Site lighting columns away sites of ecological value to the extent possible – Minimise the height of lighting where possible. • Fixtures: – Use shielding to fully shield bulbs and lenses and to minimise light spill onto sites of ecological value – Avoid reflective surfaces under lights. • Wavelengths: – Use narrow-spectrum light sources to lower the range of species affected by lighting, and avoid blue and white wavelengths (4200 kelvin, ideally <3000 kelvin) – Use long wavelength bulbs to minimise the emission of UV light.	Design, Construction
B3	**Native vegetation and habitat** Native vegetation removal must be avoided, minimised and managed in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation 2017 (*Guidelines 2017*)*. Native vegetation offsets will be required for the removal of native vegetation, with the area (in hectares) to be calculated and approved in accordance with these guidelines. No-go zones will be established to protect sensitive vegetation, trees and habitat areas that are not removed in accordance with the Guidelines 2017. No-go zones will be specified in the project EMF.	Design, Construction
B4	**Fauna (construction)** Minimise, monitor and document impacts on fauna during construction works, including: • obtaining all relevant permits under the *Wildlife Act 1975* • pre-clearing fauna surveys and relocation of fauna by qualified fauna handlers to nearby suitable habitat • directional temporary construction lighting to minimise lighting impact on sensitive fauna habitat • noise and vibration impacts on sensitive fauna • if construction works near wetlands occur between September and March, monitoring of birds before and at regular intervals during construction to assess disturbance impacts, with minimisation of noisy and high disturbance works where practicable • regular inspections of excavations/trenches • avoiding heavy construction vehicles along Edithvale Road • adding high value habitat trees (including hollow-bearing and large trees) into no-go zones where suitable • closure of all excavations/trenches at the end of each day • installation of fauna movement devices • enforced speed limits of 40km per hour within construction areas, outside of existing arterial roads.	Construction

EPR reference	EPR	Project phase
B5	**Native vegetation (construction)** Monitor, minimise and document impacts on retained/adjacent native vegetation, including: • pre-clearing surveys for threatened flora in the Mordialloc Creek/ Waterways wetland impact area are to be conducted by a suitably qualified ecologist, and plants are to be relocated to a suitable recipient site where considered practicable by the ecologist • mapping and fencing of no-go zones and tree protection zones • no site compound, temporary offices, hardstand, plant storage facility or stockpiles will be established within no-go zones, nor will any works be conducted in such areas • environmental induction/training for construction personnel • development and implementation of weed hygiene measures to avoid the spread or introduction of weeds during construction, including vehicle and equipment hygiene measures as far as practicable, re-establishing the landform and substrate under the Mordialloc Creek bridge following bridge construction.	Construction
B6	**Flora and Fauna (operation)** Prior to opening the project to the public, a Flora and Fauna Monitoring and Management Plan must be prepared in consultation with Department of Environment and Energy (DoEE), Department of Environment, Land, Water and Planning (DELWP), Melbourne Water, Parks Victoria, VicRoads and any other relevant land manager. The plan must include: • flora and fauna monitoring by ecologists for 5 years after opening, including bird use of nearby wetlands (Woodlands Wetlands, Braeside Park Wetlands, and Waterways Wetlands) and threatened flora and weeds at the Waterways, to include at least one monitoring event prior to opening • measures to be implemented to manage any flora and fauna impacts resulting from the operation of the freeway, including: – ecological rehabilitation measures developed by a suitably qualified ecologist – measures to reinstate sensitive habitat to the extent practicable under the Waterways bridge – weed management • monitoring of measures to improve habitat connectivity for threatened fauna including Waterways bridge, fauna culverts, and revegetation.	Operation

10.10 CONCLUSIONS

Wetland areas of high ecological value occur adjacent or nearby to the project area including Waterways Wetlands, Woodlands Industrial Estate Wetlands, Braeside Park Wetlands, and Edithvale Wetlands.

A total of 12 EVCs were mapped within the project area, the majority of which are classified as endangered in the Gippsland Plain Bioregion. Of the 12.10ha of native vegetation to be cleared for the project, 10.56ha are EVCs and the remainder are from scattered tree buffers. Up to 294 canopy trees including up to 24 large trees will be lost due to the project works. Actual anticipated impacts on vegetation and trees are likely to be substantially lower following detailed design, assessment by an arborist and consultation with the contractor.

Two EPBC Act listed communities and two FFG Act listed communities were mapped within the project area. The amount of these communities to be impacted is small and not considered to have a significant impact. Five significant flora species were recorded in the study area. Only two of these species are likely to be directly impacted: Leafy Twig-sedge (rare), and Large River Buttercup (poorly known). The impact on both species is considered minor and does not warrant any specific mitigation measures. No significant flora species are expected to be substantially affected by the project.

A total of 210 fauna species have been recorded at the site, including 41 species of conservation significance, 13 of which are EPBC Act listed migratory birds. Habitat loss, mortality and injury of wildlife from vehicle collisions, reduced habitat connectivity, habitat degradation from increased disturbance and physical changes are considered the main biodiversity impacts from the project, as detailed in the risk Table 10.8.

Although, there is limited scope to move the road within the project area, several EPRs have been developed to provide minimisation and mitigation strategies, monitoring and management measures to reduce the identified impacts.

The four main operational phase impacts that require mitigation concern reduced habitat connectivity, vehicle lighting, road noise and wildlife mortality due to vehicle collisions. EPR B1 describes provision of fauna crossings, barriers and landscaping to reduce impacts to fauna connectivity and reduce the exposure to road noise, lighting and mortality risk. EPR B2 specifically relates to lighting guidance to be considered in design and construction to limit disturbance or attraction to fauna.

With the implementation of EPRs B3, B4, B5 and B6 the potential impacts to flora and fauna communities will be reduced through the identification and application of no-go zones around the project and pre-clearance surveys, management of noise and vibration during construction especially near sensitive habitats, developing weed management measures, avoiding heavy vehicle use of Edithvale Road, and post-construction fauna monitoring (use of culverts/barriers) and weed management. Application of these requirements will ensure that the nearby wetland habitat maintains its habitat values both during and after construction and that impacts to threatened species and native vegetation are not significant.