Ecological Assessment:

Wetland Development Area

609-619 & 621 Burwood Highway, Knoxfield

March 2021

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ACRONYMS

BoM	Bureau of Meteorology
CaLP Act 1994 (Vic)	Victorian Catchment and Land Protection Act 1994
Cwlth	Commonwealth
DAWE	Federal Department of Agriculture, Water and the Environment (formerly DoEE)
DELWP	Victorian Department of Environment, Land, Water and Planning (formerly DEPI)
EPBC Act 1999 (Cwlth)	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FFG Act 1988 (Vic)	Victorian Flora and Fauna Guarantee Act 1988
GIS	Geographical Information System (mapping system)
MNES	Matter of National Environmental Significance
PPWCMA	Port Phillip and Westernport Catchment Management Authority
VBA	DELWP's Victorian Biodiversity Atlas
Wildlife Act 1975 (Vic)	Victorian Wildlife Act 1975

SPECIES SIGNIFICANCE

Significant Species / Threatened Species are defined as taxa listed under:

- The EPBC Act 1999 (Cwlth);
- The FFG Act 1988 (Vic);
- DELWP's Advisory List of Rare or Threatened Plants in Victoria, either as 'endangered', 'vulnerable', or 'rare' (but not those included under the 'poorly known' category);
- DELWP's Advisory List of Threatened Vertebrate Fauna in Victoria, either as 'critically endangered', 'endangered' or 'vulnerable' (but not those included under the 'near threatened' or 'data deficient' categories); and/or
- DELWP's Advisory List of Threatened Invertebrate Fauna in Victoria, either as 'critically endangered', 'endangered' or 'vulnerable' (but not those included under the 'near threatened' or 'data deficient' categories).

NATIVE VEGETATION

The Victorian Planning Provisions identify *native vegetation* as flora species that are native to Victoria. This includes species that are indigenous to the project's location and the region, as well as species that may be found further afield but within the state of Victoria. Native vegetation is defined under the *Guidelines 2017* policy (DELWP 2017) as follows:

A **patch** of native vegetation is:

- an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native, or
- any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy, or
- any mapped wetland included in the 'Current wetlands map', available in DELWP systems and on-line GIS mapping layers (DELWP 2017).

A **scattered tree** is a native species that is found in the canopy strata, that is greater than 3m in height, and that does not form part of a remnant patch. Scattered trees have two sizes, small and large:

- a small scattered tree is less than the large tree benchmark for the species in the relevant EVC;
- a large tree is equal to or greater than the large tree benchmark for the species in the relevant EVC;
- a standing dead tree that does not form part of a patch is treated as a large scattered tree if it has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above the ground (DELWP 2017).

A **significant canopy tree** is a native species that is found in the canopy strata, that is greater than 3m in height AND greater than or equal to the appropriate EVC benchmark DBH for a large tree, and which is found within a patch of native vegetation (as defined above).

The current *Guidelines 2017* policy recognises that large trees are often the oldest part of an ecological system and are difficult to replace in the short term. The loss of large trees (native trees that would be found in the canopy of respective EVC with a DBH that is greater than the benchmark DBH) must be Offset with an equivalent number of large trees in order to ensure there is no net loss of biodiversity value associated with clearing.

GLOSSARY

TERM	DEFINITION
Bioregion	Biogeographical areas that capture the patterns of ecological characteristics in the landscape or seascape, providing a natural framework for recognising and responding to biodiversity values.
Bioregional Conservation Status (BCS of an EVC)	A state-wide classification of the degree of depletion in the extent and/or quality of an Ecological Conservation Class (EVC) within a bioregion in comparison to the State's estimation of its pre-1750 extent and condition.
Canopy tree	See 'Native canopy tree'.
Diameter at Breast Height (DBH)	The diameter of the trunk of a tree measured over bark at 1.3m above ground level.
Drip line	The outermost boundary of a tree canopy (leaves and/or branches) where the water drips onto the ground.
Ecological Vegetation Class (EVC)	A type of native vegetation classification that is described through a combination of its floristic, life form and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification that is based solely on groups of the same species) that occur across a biogeographical range, and although differing in species, have similar habitat and ecological processes operating.
EVC benchmark	A standard vegetation quality reference point relevant to the vegetation type that is applied in habitat hectare assessments. Represents the average characteristics of a mature and apparently long-undisturbed state of the same vegetation type.
General Habitat Unit	A General Habitat Unit is a measure of loss (or gain, in an Offset Site) in overall biodiversity value of native vegetation (both patches and scattered trees).
General Habitat Unit Offset target	A General Habitat Unit Offset target is that quantity of General Habitat Units that are to be secured to ensure that there is 'no net loss' in biodiversity value associated with the clearance of native vegetation (both patches and scattered trees). The General Habitat Units secured for an Offset target must meet the following attribute requirements: • *Minimum strategic biodiversity value score:* the Strategic Biodiversity Value score of the Offset Credits must be at least 80 per cent of the Strategic Biodiversity Value score of the native vegetation to be removed; • *Vicinity:* the offset must be located within the same Catchment Management Authority boundary or municipal district as the native vegetation to be removed.
General Offset	A General Offset is required when the removal of native vegetation does not have a significant impact on any habitat for rare or threatened species.
Habitat hectare	A site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type.
Habitat score	The score assigned to a Habitat Zone that indicates the quality of the vegetation relative to the EVC benchmark – sum of the site condition score and landscape context score usually expressed as a percentage or as a decimal fraction of 1.
Habitat zone	A discrete area of native vegetation consisting of a single vegetation type (EVC) with an assumed similar quality. This is the base spatial unit for conducting a habitat hectare assessment.
High threat weed	Introduced plant species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term, assuming on going current site characteristics and disturbance regime.

TERM	DEFINITION
Location category	There are three location categories that indicate the potential risk to biodiversity from removing a small amount of native vegetation. These location categories are identified by DELWP as follows: • Location 3 – includes locations where the removal of less than 0.5 hectares of native vegetation could have a significant impact on habitat for a rare or threatened species. • Location 2 – includes locations that are mapped as endangered EVCs and/or sensitive wetlands and coastal areas and are not included in Location 3. • Location 1 – includes all remaining locations in Victoria.
Mapped wetlands	Mapped wetlands may or may not be visible on the ground and are treated as a patch of native vegetation for the purpose of Offsets unless they are covered by a hardened, manufactured surface, for example, a roadway. The location and extent of mapped wetlands are available in NVIM and other DELWP GIS mapping systems.
Matters of National Environmental Significance (MNES)	There are nine MNES identified under the EPBC Act 1999 (Cwlth): World Heritage properties; National Heritage places; wetlands of international importance (listed under the Ramsar Convention); listed threatened species and ecological communities; migratory species protected under international agreements; Commonwealth marine areas, the Great Barrier Reef Marine Park; nuclear actions (including uranium mines); and water resources in relation to coal seam gas development and large coal mining development.
Native canopy tree	A native canopy tree is either: • a mature tree (able to flower) that is greater than three metres in height and is normally found in the upper layer of the relevant vegetation type (EVC); or • a standing dead tree (stag) if it has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above the ground.
Native vegetation	Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'.
No net loss	An outcome where a particular gain in the contribution to Victoria's biodiversity is equivalent to an associated loss in the contribution to Victoria's biodiversity from permitted clearing.
Offset	Protection and management (including revegetation) of native vegetation at a site to generate a gain in the contribution that native vegetation makes to Victoria's biodiversity. An Offset is used to compensate for the loss to Victoria's biodiversity from the removal of native vegetation. Offsets are to be secured in perpetuity with an on-Title conservation covenant.
Offset target	The amount of Offset required, measured in Habitat Units, to ensure permitted clearing of native vegetation results in no net loss in the contribution made by native vegetation to Victoria's biodiversity.
Patch of native vegetation	A patch of native vegetation is either: • an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native; or • any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy; or • any mapped wetland included in the current wetlands layer available in NVIM and other DELWP systems.
Perennial understorey	Plants that usually live for more than two years and are found in the lower layers of vegetation, like grasses and shrubs.
Plant cover	The proportion of the ground that is shaded by vegetation foliage when lit from directly above.
Protection (of a tree)	An area with twice the canopy diameter of the tree(s) fenced and protected from adverse impacts, with measures such as: grazing, burning and soil disturbance not permitted; fallen timber retained; weeds controlled; and other intervention

TERM	DEFINITION
	and/or management if necessary, to ensure adequate natural regeneration, or a protected area in which revegetation can occur.
Recruitment	The production of new generations of plants, either by allowing natural ecological processes to occur (regeneration etc.), by facilitating such processes, or by actively revegetating (replanting, reseeding). See revegetation.
Revegetation	Establishment of native vegetation to a minimum standard in formerly cleared areas, outside of a remnant patch.
Scattered trees	A scattered tree is a native canopy tree (see 'native canopy tree' above) that does not form part of a patch. Scattered trees have two sizes, small and large: • a small scattered tree is less than the large tree benchmark for the species in the relevant EVC; • a large tree is equal to or greater than the large tree benchmark for the species in the relevant EVC; • a standing dead tree that does not form part of a patch is treated as a large scattered tree if it has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above the ground.
Species – general offset test	The species – general offset test measures the proportional impact from the removal of native vegetation on the habitat of rare or threatened species, according to the *Habitat importance maps*, and compares this to the species offset threshold.
Species Habitat Unit	A Species Habitat Unit is a measure of loss (or gain, in an Offset Site) in biodiversity value of native vegetation (both patches and scattered trees) for a particular rare or threatened species.
Species Habitat Unit Offset target	A Species Habitat Unit Offset is required when the removal of native vegetation has a significant impact on habitat for a rare or threatened species. Species Offsets must compensate for the removal of that particular species' habitat.
Strategic Biodiversity Value (SBV)	The Strategic Biodiversity Value is a rank of a location's complementary contribution to Victoria's biodiversity, relative to other locations across the state with regard to its condition, extent, connectivity and the support function it plays for species.
Tree Protection Zone (TPZ)	Calculated area (based on AS 4970-2009 (Protection of trees on development sites)) of soil volume required to encompass sufficient absorbing tree root systems to ensure the long-term survival of a tree. Trees may be considered as lost (and may require an Offset) if impacts of greater than 10% intrusion into the TPZ occur.
Wetlands	See 'Mapped wetlands'.

1. INTRODUCTION

Ecocentric Environmental Consulting (hereafter referred to as Ecocentric) was engaged by Development Victoria in December 2014 to undertake preliminary ecological assessments at two properties; 609-619 and 621 Burwood Highway, Knoxfield, Victoria (SPI: 2258\PP3478 and 1\TP152947). Further detailed assessments including targeted surveys for threatened fauna were undertaken in 2016/2017, and again in order to inform this report in 2020.

The proposed development area consists of the entire 621 Burwood Highway parcel, and a subset of the 609-619 Burwood Highway parcel, hereafter collectively referred to as *the development area* (see Map 1 in Appendix 9.8). The development area is to be developed predominantly for residential purposes, in accordance with the C160 planning scheme amendment under the *Planning and Environment Act 1987* (Vic), and includes the establishment of a wetland and Water Sensitive Urban Design (WSUD) stormwater treatment system in the northern sector of the property.

This report identifies ecological values and unavoidable impacts within the northern sector of the property, generally referred to as the wetlands area. It includes the existing dam, some remnant and regenerating native vegetation at the dam's margins and to its north, and low-lying, open pasture areas in the northeast corner of the property (see Figure 1 for details). Please note that the remainder of the property, being all areas south of the dam, is identified as the Stage 1 – 7 development area and is assessed in an accompanying report (Ecocentric in preparation). Similarly, a sales information centre, driveway and carparking will be developed within the southeastern corner of the property; these works are also assessed in an accompanying report (Ecocentric in preparation).

The objectives of the project were to:

- Document the ecological values of the site, including:
    - Significant flora and fauna species, and areas supporting potential habitat for them; and
    - Native vegetation, including 'remnant patches' and 'scattered trees'.
- Map these ecological values and identify their quality and extent;
- Identify potential impacts to these ecological values from the proposed development, including implications under relevant legislation and policies; and
- Outline appropriate measures to avoid, mitigate and offset potential impacts.

1.1 WETLAND DEVELOPMENT AREA

The subject properties adjoin an industrial estate to the west, Burwood Highway and commercial / office development to the south, Scoresby Road and Fairhills High School / residential development to the east, and the Blind Creek corridor to the north. The topography of the property slopes gently from the highest

elevations in the southern sector of the site at ~97 m above sea level (ASL) to the lowest elevations (~77 m ASL) in the northern sector of the site.

The majority of the property is to be developed in accordance with the C160 planning scheme amendment and applied Comprehensive Development Zone (CDZ) and comprises the Stage 1 – 7 development area south of the dam. Impacts associated with the Stage 1 – 7 development are assessed in an accompanying report (Ecocentric in preparation) and assessment of that area is therefore not included in this report (see also Figure 1 below for an indication of the area covered by this report). The remaining northern sector of the site is situated on a floodplain formation that includes a constructed dam which also functions as a minor flood retarding basin. The floodplain area and northern quadrant of the property, hereafter referred to as the *wetlands area,* is generally described as land north of the area being developed as a Comprehensive Development Zone (CDZ).

The development of the total property will be subject to a number of Permit applications. Three Permit applications are being lodged at this time, namely:

- Access to Scoresby Road and the removal of some vegetation within the Future Mixed-use Precinct development area;
- Subdivision of Stages 1 and 2 within the Stage 1 – 7 development area; and,
- Development of wetland habitat and Water Sensitive Urban Design (WSUD) stormwater treatment systems within the Wetlands area (see also Figure 1 below for details).

The wetlands area would once have likely been subject to regular or periodic inundation prior to the alteration to hydrology within the local catchment. A drainage tributary enters the constructed dam from the eastern boundary picking up the bulk of surface flows from what is currently mown pasture, whilst the outflow from the dam is into Blind Creek via culverts and a constructed embankment.

The wetlands area is subject to an Environmental Significance Overlay (ESO2) and a Land Subject to Inundation Overlay (LSIO). This area is also recognised as an area of Aboriginal Cultural Heritage Sensitivity.

Figure 1 provides an overview of the wetland development area in the context of the local area and surrounding properties.

1.1.1 Limitations

The targeted surveys were carried out during suitable conditions for the detection of the target species. While it is possible that some threatened vertebrate fauna species not recorded during the current surveys may occasionally visit or occur within the site, it is unlikely that any of these additional species regularly occur on, or rely upon, the site.

Please also note that surveys were not limited to the target species at the time of assessment; rather, all flora and fauna taxa observed on site were recorded and assessed for their habitat requirements, capacity to be found within the development area, and their conservation significance.

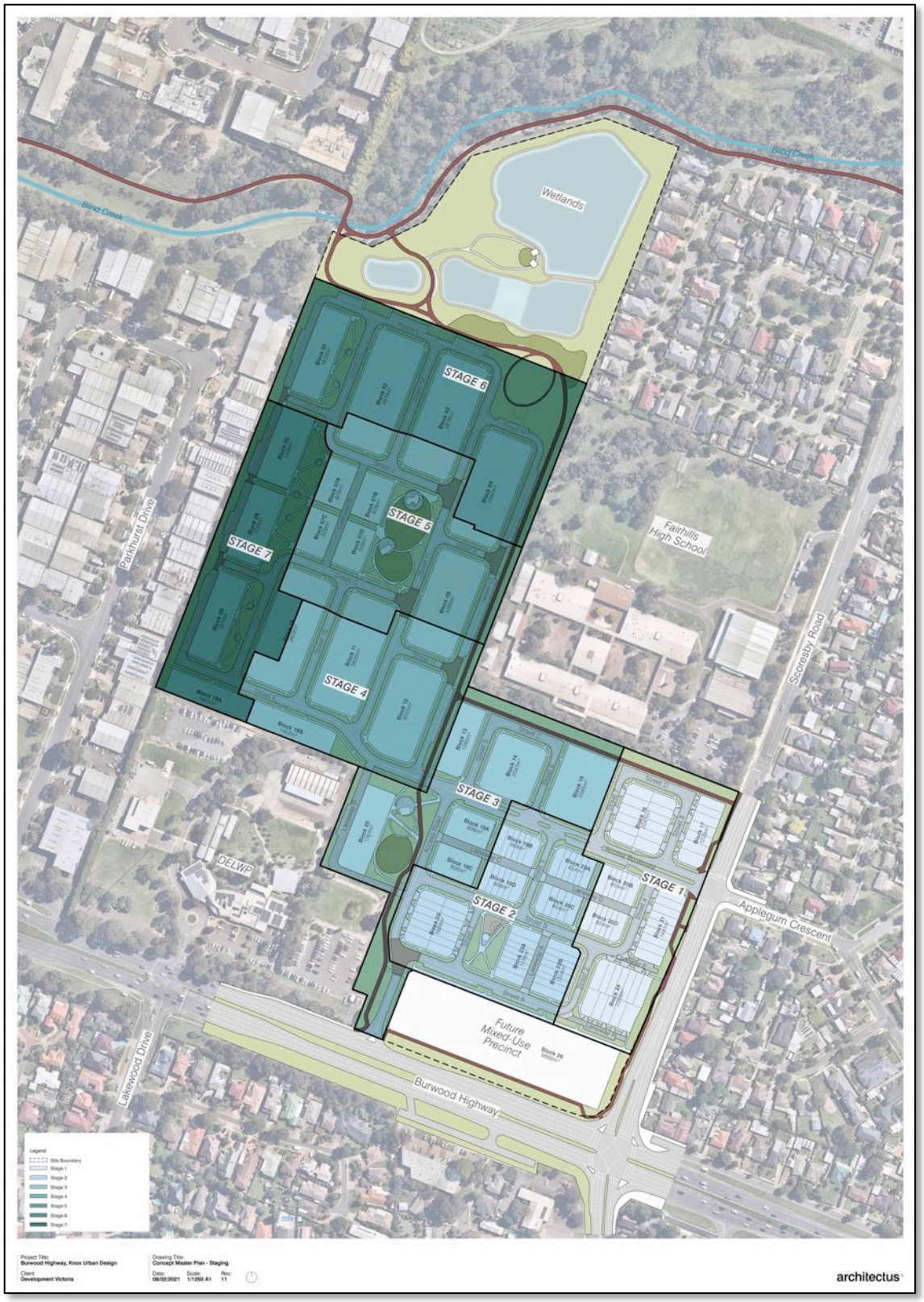
No targeted surveys for significant flora were conducted. Site assessments were undertaken utilising the 'random meander' process of undertaking assessment of suitable sites whilst selectively traversing preferred habitat for threatened species (see Section 2.1). Ecocentric is confident that this survey methodology meets the objectives of the project brief and criteria, and standards as set out in the *Vegetation Quality Assessment Manual* (DSE 2004; also commonly referred to as a Habitat Hectare Assessment).

This report does not consider development implications that relate to non-environmental zoning and overlays; including objectives set out in the CDZ and its Schedule 2. Similarly, this report does not consider development implications which may apply to the property under the Aboriginal Heritage Act 2006 (Vic).

This report relies on contributions from several consultancies and information provided by Development Victoria. Findings contained herein are therefore based on the reports provided at the date of publication; Ecocentric will not be held accountable for post-publication variations associated with report updates from external consultancies, agencies or parties.

This report assumes that the reader is familiar with the proposed development and its objectives, and the planning and financing context that brought about its instigation.

Figure 1. Property location (courtesy of Architectus Pty Ltd)



2. METHODOLOGY

2.1 DESKTOP REVIEW

A desktop review was undertaken as the first component of this project. This involved a review of on-line data resources available from relevant Victorian and Commonwealth departments, and a review of available management reports and documentation from other sites within the region. Maps of the site's indicative pre-1750 Ecological Vegetation Classes (EVCs), likely patches of remnant EVCs, and a map of the bioregion were generated on-line and were referred to on site during the assessment. An aerial photograph of the site was generated from NearMap and overlaid with property cadastre data from DataVic (available on-line).

Existing datasets, modelling and mapping for the site that were reviewed and interrogated consisted of the following:

- Biodiversity Interactive Maps classifying (but not limited to) extant and pre-disturbance EVCs, Bioregion, Location Risk and Strategic Biodiversity Values (SBV) within the property and surrounds (DELWP 2020[1]; Victorian Open Data Directory 2020[2]);
- EVC benchmarks (DELWP 2020[3]);
- Victorian Biodiversity Atlas on-line database for records of significant flora and fauna in the region (DELWP 2020[4]);
- The Atlas of Living Australia on-line database for records of significant flora and fauna in the region (ALA 2020[5]);
- Birds Australia on-line database for records of significant birds in the region;
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) EPBC Act Protected Matters Search Tool database for significant flora, fauna and vegetation communities in the region (DAWE 2020[6]);
- iNaturalist database records for flora and fauna identified in the region;
- DELWP species distribution and habitat importance models as produced for the *Guidelines 2017* policy (GIS mapping layers from Victorian Open Data Directory 2020[7]; DELWP 2017);
- Aerial imagery to determine habitat extents and linkages (NearMap 2020[8]);
- Relevant legislation, government policy and strategies (DELWP 2020[9]);

[1] http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit
[2] https://www.data.vic.gov.au
[3] https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks
[4] https://vba.dse.vic.gov.au/vba/
[5] https://spatial.ala.org.au
[6] http://www.environment.gov.au/epbc/pmst/index.html
[7] https://www.data.vic.gov.au
[8] http://maps.nearmap.com
[9] http://planningschemes.dpcd.vic.gov.au

- Publicly available geospatial datasets; and
- Existing ecological investigations undertaken at the site, including:
    - *Vegetation Survey of Linear Reserves: a management Strategy for Riparian and Flood Plain Vegetation* (Reid *et al* 1997);
    - *Sites of Biological Significance in Knox – 2nd Edition* (Lorimer 2010);
    - *Preliminary Biodiversity Assessment: 609-619 & 621 Burwood Highway, Knoxfield* (Ecocentric 2015);
    - *Preliminary Ecological Assessment of the Floodplain at 609-621 Burwood Highway, Knoxfield* (Lorimer 2017);
    - *Flora, Fauna and Native Vegetation Assessment 609-619 & 621 Burwood Highway Knoxfield* (Ecocentric 2018); and
    - *Review of Proposal to Drain Lake Knox & Replace it with a Constructed Stormwater Lake/wetland Complex: Ecological Considerations* (Boon 2020).

Independent assessments were also commissioned by Development Victoria for the purpose of informing the Planning Permit application, these include:

- *621 Burwood Highway, Knoxfield: Preliminary Stormwater Management Strategy* by Engeny Water Management Pty Ltd (2021; hereafter referred to as the *Stormwater Management Plan* report).
- *Dam Condition Assessment Report 621 Burwood Highway, Knoxfield* by Engeny Water Management Pty Ltd (2017; hereafter referred to as the *Dam Assessment* report).
- *Sediment Basin and Wetland Layout Plan and Sections* by Paroissien Grant and Associates (PGA) Pty Ltd (2021; hereafter referred to as the *Wetland Development* plans).
- Development Master Plan by Architectus Pty Ltd (Architectus 2021; hereafter referred to as the *Development Master Plan*).
- Arborist report by Galbraith and Associates Pty Ltd (Galbraith 2020; hereafter referred to as the *Arborist Assessment* report).
- Landscape Master Plan by MDG Landscape Architects (MDG 2021; hereafter referred to as the *Landscape Plan*).

Ecocentric has also conducted ecological assessments across the broader property in support of Permit applications for the Stage 1 – 7 Development Area and the Sales Centre Development Area. Findings and recommendations are reported in the following documents (in preparation at time of publication):

- *Ecological Assessment: Sales Centre Development Area 609-619 & 621 Burwood Highway, Knoxfield* (Ecocentric 2021 in preparation).
- *Ecological Assessment: Stage 1 - 7 Development Area 609-619 & 621 Burwood Highway, Knoxfield* (Ecocentric 2021 in preparation).

These reports and the data behind them have been used by Ecocentric to inform this assessment.

2.2 FIELD SURVEYS

Ecological values on the property were assessed during several studies in 2015, 2017 and 2020 by suitably qualified and experienced ecologists. Ecocentric staff hold accreditation in the Vegetation Quality Assessment Competency Check; the company is also a DELWP Accredited Organisation for the assessment and establishment of Offset Sites, and a registered over-the-counter Native Vegetation Offset Broker.

The following techniques were utilised during the field surveys:

- All areas of native vegetation across the property were assessed for habitat quality and conservation significance against relevant EVC benchmarks and in accordance with DELWP approved methodologies (see Section 2.1.1 for details), and also for the presence of trees classified as being of significance (see Section 2.2.2). Where appropriate, habitat areas were also assessed against impact threshold criteria as documented under the EPBC Act for threatened vegetation communities (available on the Species Profile and Threats Database).
- General flora and fauna surveys across the property included random meander searches for threatened flora and fauna species, and an assessment of habitat values and the site's potential to support threatened flora and fauna species, and/or threatened vegetation communities (see Section 2.2.3).
- Habitat values within the dam were additionally assessed utilising Index of Wetland Condition (IWC) methodology (see Section 2.2.4).
- The likelihood that threatened flora and fauna species would occur on site was assessed by comparing locally recorded species (records within 5 km) against the presence of species-suitable habitat on site (see Section 2.2.5).
- Requirements for targeted flora and fauna surveys were continuously refined as results from all other assessments were obtained. The targeted surveys that were conducted between 2017 and 2021 are detailed in Section 2.3.
- Any other incidental discussions, observations or evidence of flora or fauna were recorded.

The precautionary approach was adopted for all site surveys where discretionary decisions were made. In particular, the absence of evidence of threatened flora, fauna, vegetation communities or habitat values during surveys was not interpreted as evidence of their absence on site.

2.2.1 Native vegetation assessment

Native vegetation assessments were undertaken to determine the extent and quality of native vegetation present at the site, and to inform potential Offset requirements if native vegetation clearance is approved.

Ecological Vegetation Classes were determined based on EVC modelling and benchmarks (DELWP 2017), and as confirmed in the field during the site surveys. Mapped and extant EVCs on site were verified and assessed in the field to a hand-held tablet running Quantum GIS. Vegetation Quality Assessments (VQA; also commonly referred to as a Habitat Hectare Assessment) were undertaken for all areas of native vegetation (whether patches or scattered trees) in accordance with the *Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectare scoring method* (DSE 2004).

Patches of native vegetation were additionally assessed for habitat significance based on the criteria detailed below in Table 1.

Table 1. Habitat significance

Habitat significance category	DESCRIPTION
Very high significance	Site known to support long-term breeding population(s) of threatened flora or fauna; is contiguous with large areas (greater than 50ha) of remnant vegetation and habitat; and there is a very high cover (greater than 75%) of remnant, indigenous vegetation with EVC appropriate canopy structures intact.
High significance	Site provides optimal habitat conditions for rare or threatened flora or fauna; there is a high degree of connectivity to large areas (greater than 50ha) of remnant vegetation and habitat; and there is a good cover (greater than 50%) of remnant, indigenous vegetation with EVC appropriate canopy structures intact.
Medium significance	Site provides sub-optimal habitat conditions for rare or threatened flora or fauna; there is connectivity to areas (greater than 0.4ha) of remnant vegetation and habitat; and there is some cover (greater than 25%) of remnant, indigenous vegetation with EVC appropriate canopy structures intact.
Low significance	Site provides limited habitat conditions for flora or fauna, and there is some cover of remnant, indigenous vegetation on site.

Native vegetation is defined under the *Native Vegetation Permitted Clearing Regulations* as follows:

A **patch of native vegetation** is:

- an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native, or
- any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy, or
- any mapped wetland included in the 'Current Wetlands map', available in DELWP systems and tools.

A **scattered tree** is a native canopy tree that does not form part of a remnant patch. Scattered trees have two sizes, small and large:

- a small scattered tree is less than the large tree benchmark for the species in the relevant EVC;

- a large tree is equal to or greater than the large tree benchmark for the species in the relevant EVC;
- a standing dead tree that does not form part of a patch is treated as a large scattered tree if it has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above the ground (DELWP 2017).

The current *Guidelines 2017* policy recognises that large trees are often the oldest part of an ecological system and are difficult to replace in the short term. To address this and to ensure the protection of large trees in the landscape, when large trees are approved to be removed, the secured Offset must include large trees. A large tree can be either a large scattered tree or a large tree within a patch.

Native vegetation is further described in the Planning Scheme as flora native to Victoria which, in some cases, includes taxa that are not indigenous to the site. Table 2 below identifies vegetation types assessed in this study.

Table 2. Vegetation categories

VEGETATION CATEGORY	DESCRIPTION	PLANNING IMPLICATIONS
Site indigenous	Indigenous to a local area. Defined as 'taxa that have originated in a given area without human involvement or that have arrived there without intentional or unintentional intervention of humans from an area in which they are native'.	There are certain exemptions under all Victorian Planning Schemes. 'Planted vegetation' provides an exemption to Clause 52.17 for native vegetation that has been planted on site whereby: *Native vegetation that is to be removed, destroyed or lopped that was either planted or grown as a result of direct seeding.* *This exemption does not apply to native vegetation planted or managed with public funding for the purpose of land protection or enhancing biodiversity unless the removal, destruction or lopping of the native vegetation is in accordance with written permission of the agency (or its successor) that provided the funding.* Much of the native vegetation at this site has been planted for aesthetic purposes at the property boundaries, as evidenced by the ornamental garden-beds and linear nature of the vegetation. It is assumed in this instance however that public funds have been used, and this exemption is therefore not applied.
Native to Victoria	Non-indigenous to the local area but native to Victoria (such as Tasmanian Blue Gum, Spotted Gum and Giant Honey-myrtle). Defined in Victorian Planning Provisions – Definitions – Clause 72 as *'Plants that are indigenous to Victoria, including trees, shrubs, herbs, and grasses'.*	If vegetation is not exempt as above, it may require a permit for removal. The Schedule to the Knox Planning Scheme Section 52.17 further lists species that are considered by the municipality to be environmental weeds (and native to Victoria) and which are therefore also exempted under the Clause.

VEGETATION CATEGORY	DESCRIPTION	PLANNING IMPLICATIONS
Native to Australia	Non-indigenous Australian native plants or vegetation which are not indigenous to Victoria (such as Sugar Gums).	Usually do not require a permit for removal but are identified to demonstrate that these plants have not been overlooked.
Exotic Vegetation	Planted exotic vegetation, which is flora species that are not native to Australia.	Usually does not require a permit for removal, unless the vegetation is covered by an 'Environment Significance' or 'Vegetation Protection' Overlay that specifically addresses exotic vegetation.

2.2.2 Native canopy trees

The project arboricultural consultant mapped the location, species, DBH and TPZ of all canopy trees and non-canopy trees (tree and shrub species that form a secondary canopy layer) to the property feature survey; further details are provided in the *Arborist Assessment* report. The TPZ for each tree was then processed by the project landscape architect and imported to the Ecocentric GIS for analysis on site; further details are provided in the *Landscape Plan* for the project.

The tree data and GIS mapping layer were used by Ecocentric to identify all trees on site that are identified as being native to Victoria. These trees were then classified during the site assessments as being scattered or as part of a patch based on the number of trees and canopy spread.

The *Assessor's Handbook: Applications to Remove, Destroy or Lop Native Vegetation* (DELWP 2017; hereafter referred to as the *Handbook 2017*) defines a canopy tree as a mature tree (able to flower) that is greater than three metres in height, and of a species that is typically found in the upper layer of the relevant vegetation type (EVC). Significant canopy trees are trees which meet this description and which are greater than or equal to the large tree DBH as defined in the EVC benchmarks. If impacted, significant canopy trees are to be Offset or counterbalanced in accordance with Clause 52.17 of the Planning Scheme (see Section 6.3 for details).

For this project, assessment of canopy trees therefore included whether trees classify as 'large trees' (regardless of whether they occurred in 'patches' or as 'scattered trees') based on having a DBH of 70cm or greater, as appropriate to the Valley Heathy Forest EVC 127 or Swampy Woodland EVC 937 benchmarks (see Section 3.1.1 below), or as 'small trees' where these are greater than 3m in height but with a DBH of less than 70cm. The Knox Planning Scheme Section 52.17 schedule further lists native trees that are considered to be an environmental weed within the municipality, and which are therefore exempt of Offset requirements in accordance with the schedule. Exempted trees identified on site in this instance include the following species: Spotted Gum (*Corymbia maculata*); Blue-gum (*Eucalyptus globulus*); and Bracelet Honey-myrtle (*Melaleuca armillaris*).

The purpose of assessing and mapping the location of significant canopy trees was two-fold:

- To provide a large tree count per hectare for each defined Habitat Zone; and

- To provide a spatial representation of significant canopy trees within close proximity of the proposed development in order to inform minor realignments where it is necessary to protect Tree Protection Zones[10] (TPZs) and thereby retain and conserve these ecological assets.

Assessments of tree health and structure were undertaken by the project arborist (Galbraith 2020); assessments of public liability for trees identified as being retained within the wetland development area were not conducted as part of this study.

2.2.3 General flora, fauna and habitat survey

An incidental flora and fauna survey was undertaken throughout the proposed development area and property. All species of vascular flora and vertebrate and invertebrate fauna detected on the site were recorded.

The study area was assessed for its faunal habitat values and potential to support threatened flora and fauna species, and/or threatened vegetation communities. The assessment involved site-based habitat assessments, and a review of aerial photography to gain an appreciation of habitat connectivity in a broader landscape context.

The general habitat assessment focused on the extent of native vegetation cover, composition and structure of the vegetation, as well as other features important in determining habitat quality. Habitat features observed and assessed included (but were not limited to):

- Presence of nectar-producing and hollow-bearing trees;
- Presence of ground logs, stone outcrops or exposed surface habitat;
- Level of disturbance (e.g. weed invasion) and ground-layer characteristics including leaf litter and logs;
- Size, shape and connectivity of vegetation patches;
- Presence of specific habitat features (e.g. aquatic vegetation); and
- Structural heterogeneity of the vegetation.

Habitat within the proposed wetland development area was also assessed on site using active searching techniques. Active searching included looking for sign of fauna activity, such as (but not limited to) scats, tracks, tree marks, burrowing, surface scratching (in particular conical pits formed by foraging bandicoots and ground fauna), hair scraps (particularly on fences), game trails, nests (and dreys), burrow chimneys, feed middens and scat sites. Surface habitats, such as rocks, logs, sheets of corrugated iron and building rubble, were lifted carefully and inspected for presence of fauna or sign of habitation. Avian surveys were conducted using binoculars while on site.

Any significant flora or fauna identified were mapped to the GIS spatial layers using a hand-held GPS (accurate to +/- 5m).

[10] TPZ is a calculated area (based on AS 4970-2009 (Protection of trees on development sites)) of soil volume required to encompass sufficient absorbing tree root systems to ensure the long-term survival of a tree. Trees may be considered as lost (and may require an Offset) if impacts of greater than 10% intrusion into the TPZ occur.

2.2.4 Dam assessment

In addition to the native vegetation assessment and general flora and fauna survey, the Index of Wetland Condition (IWC) methodology was also used to assess the habitat values within the dam; this assessment followed the methodology set out in the *Index of Wetland Condition Methods Manual version 14*.

The IWC is a rapid assessment tool that was specifically designed to determine the condition of natural wetlands in Victoria. The condition of a wetland, as defined within the IWC methodology, is the state of the biological, physical and chemical components of the wetland ecosystem and their interactions at a point in time. These attributes, referred to as sub-indices, combine to provide a condition measurement of the wetland catchment, soil, hydrology and vegetation. The total score for the wetland is calculated by summing each sub-index score multiplied by its respective weight.

Water quality parameters within the dam were assessed on 29 August 2017, as follows:

- Water temperature (Moseko TP300);
- pH (EcoTestr pH 2, Eutech);
- Conductivity (ECTestr Low, Eutech); and
- Turbidity (turbidity tube).

2.2.5 Likelihood of occurrence

All threatened flora and fauna species that were identified by the desktop assessment as potentially occurring within a five-kilometre radius of the property had their likelihood of occurrence on site assessed by an examination of species-suitable habitat on site (as identified through aerial imagery, previous reports and site surveys). A species was assumed to be present if suitable habitat was observed in the study area, and if that species was known to occur regionally. This is a conservative approach likely to include species that are difficult to detect.

The probability that each threatened species occurs within the study area was determined as being either Unlikely, Low, Moderate, High, Very High or Recorded, based on the criteria listed in Table 3 below.

Table 3. Likelihood of occurrence criteria

Likelihood of occurrence	Criteria - one or more of the following conditions applies for threatened flora and / or fauna species
Unlikely	The species has not been recorded previously within 5km of the study area. The study area is beyond the current known geographic range of the species. The species has specific habitat requirements that are not present in the study area. The species is considered to be extinct or regionally extinct.
Low	The species has historically (>20 years ago) been recorded within 5km of the study area. The species has specific habitat requirements that are present in the study area, and these habitat areas are considered to be of Low significance (see Table 1) for the species.
Moderate	The species has been recorded more recently (<20 years ago) within 5km of the study area. The species has specific habitat requirements that are present in the study area, and these habitat areas are considered to be of Low or Medium significance (see Table 1) for the species.
High	The species has been recorded more recently (<20 years ago) within 5km of the study area. The species has been recorded more recently (<20 years ago) within the study site. The species has specific habitat requirements that are present in the study area, and these habitat areas are considered to be of Medium or High significance (see Table 1) for the species. A known population of the species with records (typically >20) is located in similar habitat within 5km of the study area.
Very High	The species has been recorded more recently (<20 years ago) within 5km of the study area. The species has been recorded very recently (<5 years ago) within the study site. The species has specific habitat requirements that are present in the study area, and these habitat areas are considered to be of High or Very High significance (see Table 1) for the species. A known population of the species with records (typically >20) is located in similar habitat within 5km of the study area.
Recorded	The species was recorded in the study area during the current survey.

2.3 TARGETED FLORA AND FAUNA SURVEYS

Targeted surveys were conducted on site for key threatened fauna (as identified by Ecocentric, 2015) during winter to late spring 2017 (see Ecocentric 2018 for details). Follow up targeted surveys for Blue-billed Duck, and for evidence of a successful breeding season, were then conducted in 2020 through to early 2021 (this assessment). Targeted survey methods are provided below.

2.3.1 Flora surveys

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

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

2.3.2 Targeted fauna surveys 2017

Targeted surveys for key threatened fauna species, as identified by Ecocentric (2015), were undertaken during winter to late spring 2017.

The targeted surveys focused on the following target taxa and used the following approaches:

- Swift Parrot (*Lathamus discolor*): three (3) winter, pre-dusk bird census surveys, covering the study area and particularly targeting flowering eucalypts.
- Powerful Owl (*Ninox strenua*): five (5) owl call-playback and spotlighting surveys, commencing following dusk.
- Australasian Bittern (*Botaurus poiciloptilus*) and crakes and rails: six (6) dusk/dawn surveys (i.e. detection by sighting/unsolicited calls), including four (4) dusk-nocturnal surveys utilising call-playback.
- Other threatened waterbirds, including Blue-billed Duck (*Oxyura australis*), Freckled Duck (*Stictonetta naevosa*), Hardhead (*Aythya australis*) and Musk Duck (*Bizirua lobata*): fifteen (15) waterbird surveys, including six dawn surveys, eight dusk surveys and one diurnal survey.

Targeted surveys were undertaken by a team of ecologists on seven occasions between 27 June and 14 November 2017. Survey methodology and effort, timing and prevailing conditions are provided in Table 4 below (see also Ecocentric 2018 for details).

Table 4. Timing and prevailing conditions of surveys undertaken in the study area

Survey #	Date	Time on Site (person-hours)	Survey Type	Prevailing Conditions
1	8 June 2017	4 hours	Site inspection	Overcast, light breeze, ~11°C
2	27 June 2017	16 hours	Native vegetation and wetland assessment, diurnal general and targeted flora/fauna surveys	Overcast, calm to light breeze, ~8-10°C
3	5 July 2017	20 hours	Native vegetation and wetland assessment, diurnal and nocturnal targeted flora/fauna surveys	Partly cloudy, calm to light breeze, ~10-13°C
4	29 August 2017	7 hours	Targeted fauna surveys (pre-dusk and nocturnal)	Overcast, calm to light breeze, ~10-11°C
5	22 September 2017	7 hours	Targeted fauna surveys (pre-dusk and nocturnal)	Mostly clear, light breeze, ~20°C
6	12 October 2017	8 hours	Targeted fauna surveys (pre-dusk and nocturnal)	Overcast, light to moderate breeze, ~16°C
7	9 November 2017	7 hours	Targeted fauna surveys (pre-dusk and nocturnal)	Mostly clear, light to moderate breeze, ~18-19°C
8	14 November 2017	6 hours	Targeted fauna surveys (dawn)	Mostly clear, moderate breeze, ~20-21°C

Targeted surveys were undertaken in accordance with State (based on Action Statements and survey guidelines, where available) and Federal (EPBC Act 1999 survey guidelines) requirements and standards. Table 5 below details the survey effort for each of the target taxa, with regard to relevant survey guidelines, where they exist.

Table 5. Survey effort undertaken for target fauna species, with regard to relevant survey guidelines

Target Taxa	Targeted Survey Dates	Survey Type	Survey Effort (person-hours)	Relevant Survey Guidelines & Recommended Survey Effort
Swift Parrot	27 Jun, 5 Jul, 29 Aug 2017	Area searches and targeted surveys of flowering eucalypts	c. 25 hours	Survey guidelines for Australia's threatened birds (DEWHA 2010) - Minimum 20 person-hours per 50 ha area, late autumn to winter.
Powerful Owl	5 Jul, 29 Aug, 22 Sep, 12 Oct, 9 Nov 2017	Call-playback, spotlight search	c. 15 hours	Survey standard for Powerful Owl (*Ninox strenua*) (DSE 2011) – recommend a minimum of five (5) call-playback surveys, in winter to spring.
Australasian Bittern, crakes and rails	5 Jul, 29 Aug, 22 Sep, 12 Oct, 9 & 14 Nov 2017	Call-playback (broadcast) surveys, dawn/dusk detection surveys and area searches	c. 30 hours	Survey guidelines for Australia's threatened birds (DEWHA 2010) – Recommended survey methods: broadcast (call-playback) surveys, dawn/dusk detection surveys and area searches Birdlife Australia's Bittern Survey Guide - Dawn/dusk surveys recommended, between October and March.
Other threatened waterbirds	27 Jun, 5 Jul, 29 Aug, 22 Sep, 12 Oct, 9 & 14 Nov 2017	Dawn/dusk detection surveys and area searches	c. 52 hours	Dawn/dusk detection surveys and area searches.

2.3.3 Blue-billed Duck targeted surveys 2020

Targeted surveys were also conducted for Blue-billed Duck during the breeding season from late September 2020 to early January 2021; commencing again in March 2021 in response to a late breeding period (see also Section 3.3.2 below for details). A series of dawn, mid-day and dusk surveys were conducted by suitably qualified and experienced ecologists using binoculars from late September 2020 until early March 2021 (date of publication). The intent of these surveys was to gauge the extent of the Blue-billed Duck's breeding period on site, and in order to determine suitable monitoring protocols for implementation as part of the CEMP (see also Section 5.1.2 for details).

The Blue-billed Duck's breeding period is defined by the *Handbook of Australian, New Zealand and Antarctic Birds* (HANZAB) as varied, not regularly confined to September to November, with young in November through to April within Victoria. Laying periods are varied, with some response to water levels and availability of food sources. The clutch size ranges from 3-12 eggs, but more usually consists of 5-6 eggs (Marchant & Higgins 1990; DSE 2003). Egg clutches are only attended by females, with an incubation period of 24-26 days (Marchant & Higgins 1990; DSE 2003). Ducklings stay under the care of the female duck for the first 4-5 weeks (SWIFT 2020).

Nests are generally solitary, with construction initiated in some instances by males, and completed and attended by females only; females also construct a covering dome from nearby materials when incubation is initiated (Marchant & Higgins 1990). Nests are generally constructed within dense Cumbungi (*Typha* spp.) reed-beds over water, and usually within one metre of the edge of

vegetation on the deep-water side (Marchant & Higgins 1990; Garnett *et al* 2010; BirdLife International 2020; DSE 2003). Dense, old growth Cumbungi reed-beds are preferable but nesting within Spikerush (*Eleocharis* spp.) and lignum swamps is also known. New *Typha* beds, without detritus of dead leaves, are considered to be unsuitable (Marchant & Higgins 1990).

For the purpose of this assessment, **successful breeding** is therefore described as observed Blue-billed Duck male and female pairing, nesting and emergence of the female with a clutch of one or more ducklings (mating is assumed where pairing has been observed).

Table 6 Details the survey efforts conducted during the Blue-billed Duck breeding period. Results are detailed in Section 3.3.2.

Table 6. Timing and prevailing conditions of Blue-billed Duck breeding period surveys

Survey #	Date	Period	Time on Site (person-hours)	Prevailing Conditions
1	29 September 2020	Dusk	1 hour	Cloudy, light winds, ~17°C
2	1 October 2020	Dawn	1 hour	Partly cloudy, light winds, ~9°C
3	23 October 2020	Dawn	2 hours	Cloudy, calm, ~12°C
4	10 November 2020	Dawn	2 hours	Partly cloudy, light breeze, ~16-18°C
5	14 November 2020	Dawn	2 hours	Cloudy, calm, ~14°C
6	20 November 2020	Dusk	1.5 hours	Partly cloudy, light breeze, ~18°C
7	29 November 2020	Dusk	1.5 hours	Cloudy, calm, ~15°C
8	30 November 2020	Dawn	1.5 hours	Clear, calm, ~14°C
9	07 December 2020	Dawn	1.5 hours	Cloudy, light breeze, drizzle, ~10°C
10	14 December 2020	Dawn	2 hours	Clear, calm, ~18°C
11	20 December 2020	Dawn	2 hours	Clear, misty, calm, ~11°C
12	02 January 2021	Afternoon	1.5 hours	Overcast, light breeze, 29°C
13	09 March 2021	Dawn	2 hours	Overcast, light breeze, 12°C

3. RESULTS

The biodiversity values within the wetland development area have been highly modified compared to the pre-European settlement conditions, attributable to broad-scale clearing of vegetation, the planting of exotic and non-indigenous native vegetation, revegetation and planting of native species, long-term slashing and mowing, and construction of a dam and alterations to drainage patterns. Native vegetation within this area is now confined to submerged aquatic cover within the dam, a band of emergent aquatic vegetation at the dam's margins, and planted and regenerating canopy trees and understory vegetation that is generally consistent with a Swampy Woodland EVC (see Section 3.1.2 for details). The remainder of the wetland development area is generally described as open pasture dominated by exotic herbaceous flora, with Willow (**Salix* spp.) and Radiata Pine (*Pinus radiata*) planted within a constructed drainage-line that empties into the dam.

Please note that native and non-native vegetation on the property south of the wetland development area is assessed in a separate report of biodiversity values within the Stage 1 – 7 development area (Ecocentric in preparation).

3.1 NATIVE VEGETATION AND HABITAT

The following sections provide an outline of all native vegetation and habitat values assessed within the wetland development area. The definition of a native tree, and whether or not it is planted or exempt for Offset purposes, is provided in Section 2.1.1 above (see also Appendix 9.1 for details).

All intact native vegetation was assessed in accordance with the *Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectare scoring method* (DSE 2004; hereafter a VQA assessment), with definitions as provided in Section 2.1.1 above and in accordance with the DELWP *Assessor's Handbook: Applications to Remove, Destroy or Lop Native Vegetation* (DELWP 2017; hereafter referred to as the *Handbook 2017*).

3.1.1 Pre-disturbance EVCs

The determination of the 'pre-disturbance' EVCs within the wetland development area is based on the presence of remnant canopy and understorey species (in particular Swamp Gum (*Eucalyptus ovata*) in the upper canopy), landscape positioning, soils, aspect and analysis of the 2005 EVC modelling spatial data (see Figure 2 below). It is identified that this site supports a regenerating Swampy Woodland EVC (EVC 937) in the Gippsland Plain bioregion; sites of intact terrestrial vegetation are therefore assessed against this benchmark within this area.

Figure 2. DELWP 2005 EVC modelling (DELWP 2020)

Native vegetation was also recorded within the dam, with Eel Grass (*Vallisneria australis*) cover identified as occupying up to 70% of the open-water areas. It is acknowledged that, whilst the dam is constructed, the presence of aquatic vegetation cover within this site would qualify it as a Submerged Aquatic Herbland (EVC 918); the dam is also included in the DELWP 'wetland_current' GIS mapping layer as a *permanent freshwater lake*. We note however that there is currently no VQA benchmark for this EVC, so the open water habitat within the dam was assessed against the next best fit of Aquatic Herbland (EVC 653).

3.1.2 Intact native vegetation patches

Terrestrial native vegetation within the wetland development area qualifies as 'scattered trees' or 'patches' of Swampy Woodland EVC (EVC 937) in accordance with the *Handbook 2017*. Areas of Swampy Woodland include remnant and planted canopy trees of Swamp Gum, with some sites retaining understorey habitat comprised of revegetated plants that are likely to have been sourced from local provenance seed stocks as well as shrubs and graminoids that are naturally recruiting from the seed-bank of neighbouring seed sources. Several locally significant species (Reid *et al 1997;* Lorimer 2010; Lorimer 2018) are also present; some of these species are outside of their natural range and are likely to have been planted on site.

Patches of Swampy Woodland on the north side of the dam's embankment are of fair quality, however, environmental weeds within the understorey are common and long-term impacts associated with regular slashing and mowing in this area, as well as edge-effects due to fragmentation of the Swampy Woodland cover are evident. There are some canopy tree hollows within this area that are also likely to support arboreal mammals and hollow dependent birds, and there are bark fissure and canopy roosting and feeding opportunities for bats (fruit and insectivorous taxa), passerine and honeyeater birds, and arboreal mammals. These sites are assigned a rating of *low habitat significance*, with the exception being Habitat Zone 4A being of *high habitat significance* (see Table 1 for details).

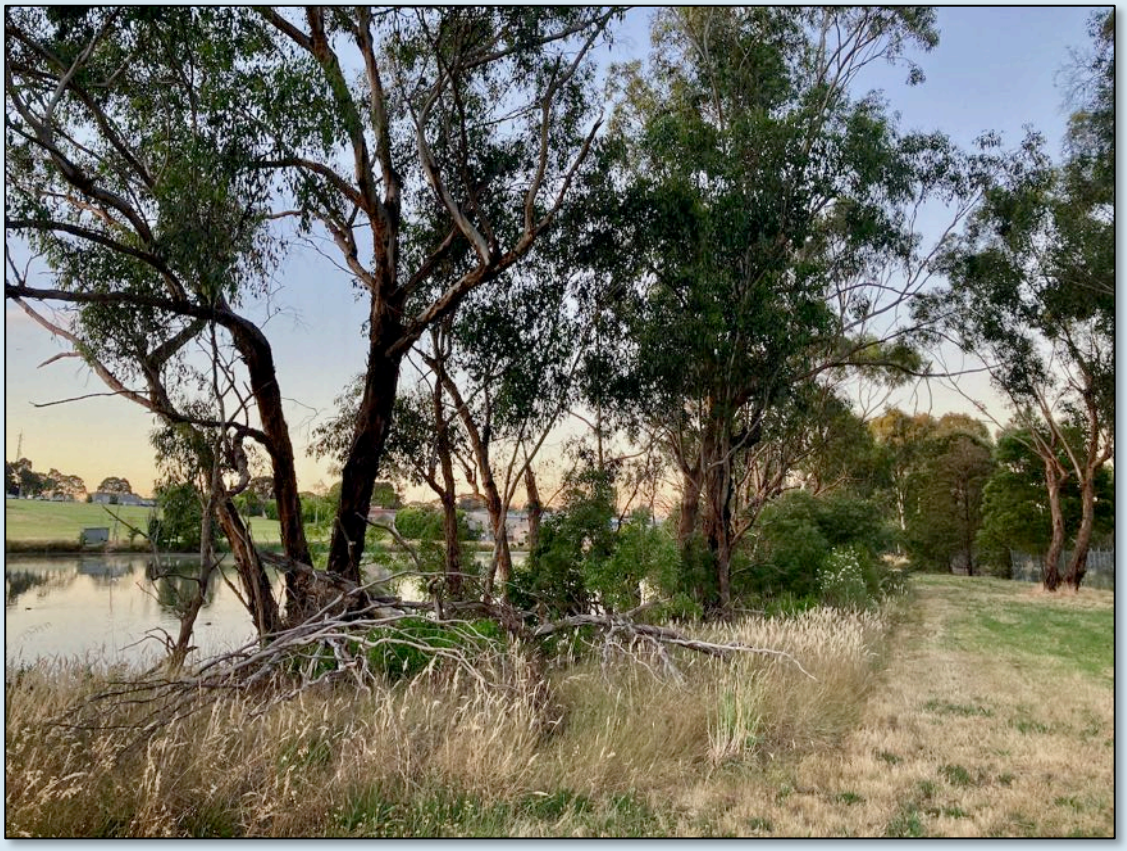
The open water areas within the dam qualify as a 'patch' of native vegetation and this area has been assessed as an Aquatic Herbland (EVC 653) (see also Section 2.2.1 for details). Submerged Eel Grass (*Vallisneria australis*), as well as Curly Pondweed (*Potamogeton crispus*) and Blunt Pondweed (*Potamogeton ochreatus*) offer feeding opportunities for Blue-billed Duck and other waterbirds present on site. Emergent aquatic vegetation at the margin of the dam is also present as small, narrow patches of Narrow-leaf Cumbungi (*Typha* ? *domingensis*) and scattered plants of Rush (*Juncus* spp.); these areas are included as part of the Aquatic Herbland Habitat Zone (as described below). The dam is assigned a rating of *high habitat significance* (see Table 1 for details).

Please note that with the exception of the dam, the remaining native vegetation within the wetland development area will be retained as part of the open water wetland construction program and staged redevelopment of the dam (see Section 5.1 for details). It is expected however that, due to changes in the site's soil hydrology associated with the redevelopment of the dam, native vegetation on the northern embankment (and canopy Swamp Gum trees in particular) may be impacted by this development. These native vegetation patches and scattered trees are therefore considered lost and will be Offset as a precaution,

though they will technically be retained on site (see Section 5.2.1 for native vegetation and scattered tree retention procedures).

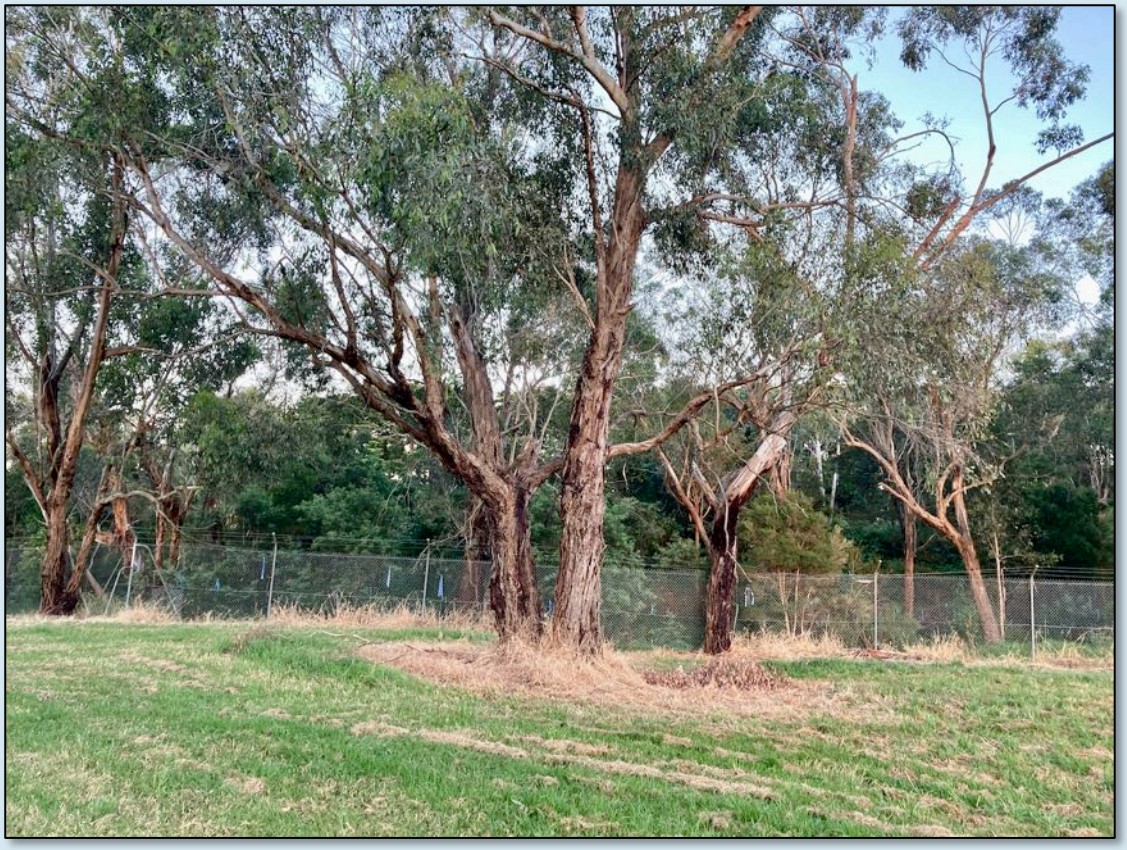
In total, 6 patches (containing 7 large trees) and 5 large scattered trees are identified and assessed as part of this assessment. Details of these are provided below (VQA value calculations are also provided in Appendix 9.6).

HABITAT ZONE 5A (northern embankment of dam)



EVC	Swampy Woodland (EVC 937)	Two large Swamp Gum (*Eucalyptus ovata*) (Tree ID #457 and #476) occur within the zone and the canopy is generally healthy. This zone has the highest diversity of understorey species within the study area, however, several lifeforms are either absent or modified. There is a relatively high cover of high threat weeds (approximately 30%), largely made up of (mostly annual) exotic grasses. Adequate recruitment was observed for the majority of woody species, for which there is a high diversity (as defined under the VQA). Native litter has a cover of approximately 30% and the zone reaches the benchmark log length, although large logs are 'absent'. **This habitat Zone will be RETAINED on site.**
Conservation Status	Endangered	
VQA	0.55	
Area (ha)	0.124	
Habitat significance	Medium	
Large trees	2	

HABITAT ZONE 6A (northern property boundary)



EVC	Swampy Woodland (EVC 937)	Located to the north of Habitat Zone 5A, between the dam and the northern property boundary, HZ6A was assessed as a habitat zone due to the presence of at least three adjoining canopy trees; however, the understorey does not contain more than 25% cover of native vegetation. Two large Swamp Gum (Tree ID #485 and #486) occur within the zone and the canopy is generally healthy. The understorey is dominated by pasture grasses and other weeds with very few indigenous species. No recruitment of woody species was observed. Native litter has a cover of approximately 8% and the zone contains several scattered logs, although large logs are absent. **This habitat Zone will be RETAINED on site.**
Conservation Status	Endangered	
VQA	0.22	
Area (ha)	0.046	
Habitat significance	Low	
Large trees	2	

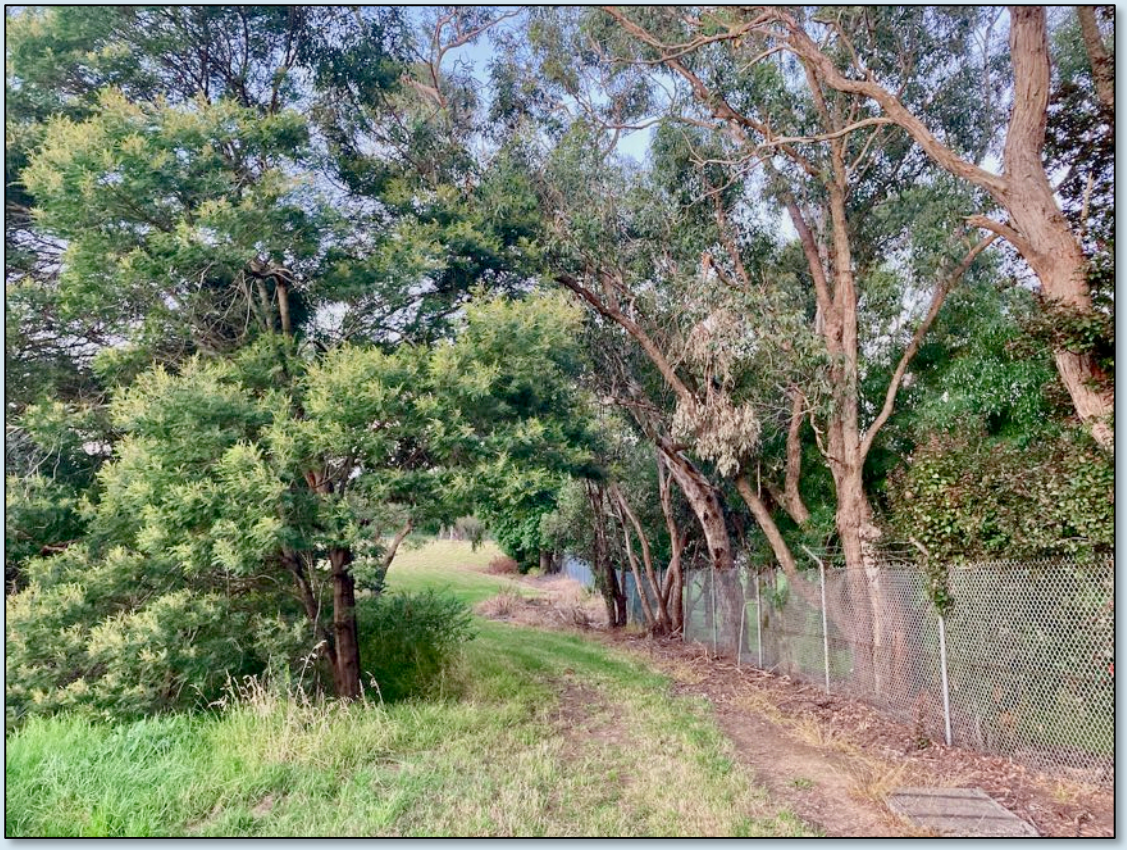
HABITAT ZONE 7A (eastern property boundary)

EVC	Swampy Woodland (EVC 937)	Located to east of the dam along the eastern boundary of the study area, HZ7A was assessed as a habitat zone due to the presence of at least three adjoining canopy trees; however, the understorey does not contain more than 25% cover of native vegetation. One large Swamp Gum (Tree ID #449 – DBH 105cm), considered likely to pre-date clearing and agricultural land use, occurs within the zone and the canopy is generally healthy; this tree is to be retained in an open-space reserve, with understorey planting using species that are appropriate to the Swampy Woodland EVC (EVC 937). The understorey is dominated by exotic grasses and other weeds with very few indigenous species. Recruitment of several woody species was observed. Native litter has a cover of approximately 25% and the zone contains less than 10% of benchmark log length. **This habitat Zone will be RETAINED on site.**
Conservation Status	Endangered	
VQA	0.25	
Area (ha)	0.024	
Habitat significance	Low	
Large trees	1	

HABITAT ZONES 12A (northern property boundary)

EVC	Swampy Woodland (EVC 937)	Located to the north of Habitat Zone 6A on the northern property boundary, HZ12A was assessed as a patch due to the presence of at least three adjoining canopy trees; however, the understorey does not contain more than 25% cover of native vegetation. Two large Swamp Gum (Tree ID #490 and #491) occur within the zone and the canopy is generally healthy. The understorey is dominated by pasture grasses and other weeds with very few indigenous species. No recruitment of woody species was observed. Native litter has a cover of approximately 8% and the zone contains several scattered logs, although large logs are 'absent'. **This habitat Zone will be RETAINED on site.**
Conservation Status	Endangered	
VQA	0.22	
Area (ha)	0.023	
Habitat significance	Low	
Large trees	2	

HABITAT ZONE 8A (adjacent Fairhills High School)



EVC	Swampy Woodland (EVC 937)	Located along the eastern boundary of the wetland development area (adjacent to the Fairhills High School buildings), HZ8A was assessed as a patch due to the presence of at least three adjoining canopy trees; however, the understorey does not contain more than 25% cover of native vegetation. Two small canopy Swamp Gum (Tree ID #415 and #416) are retained at this location in a pocket park to be constructed as part of the wetland development works. The understorey is dominated by exotic grasses and other weeds with very few indigenous species. Recruitment of several woody species was observed. Native litter has a cover of approximately 25% and the zone contains less than 10% of benchmark log length. Please also note that two small Swamp Gum (Tree ID #413 and #414), while technically being retained, are considered lost at this location due to TPZ impacts associated with the Stage 1 – 7 development; these trees are being Offset as part of that development's Permit, and their potential loss is therefore not considered as part of this study. **This habitat Zone will be RETAINED on site.**
Conservation Status	Endangered	
VQA	0.25	
Area (ha)	0.0296	
Habitat significance	Low	
Large trees	none	

HABITAT ZONE 4A (dam and aquatic margins)

EVC	Aquatic Herbland (EVC 653)	Encompasses the entire area of dam, excluding the fringing terrestrial vegetation. Although the aquatic vegetation of this zone is best referred to as Submerged Aquatic Herbland (EVC 918), there is currently no VQA benchmark for this EVC, so this zone was assessed against the next best fit of Aquatic Herbland (EVC 653). Due to the turbid state of the water column during the winter 2017 surveys it was difficult to determine the spatial extent of aquatic herbs across the floor of the dam. During the February 2017 survey conducted by Lorimer (2017), the water was less turbid and it was estimated that the entire dam supported aquatic herbs. This has also been confirmed by analysis of NearMap aerial imagery going back at least ten years. Based on these findings, this assessment also concluded that, over time, the entire dam is likely to support aquatic herbs (and thus constitutes 'intact' native vegetation). For treeless EVC benchmarks such as Aquatic Herbland, the woody components of 'Large Trees', 'Tree Canopy Cover' and 'Logs' can't be assessed. Regarding the remaining habitat components, 'Understorey' received a relatively high score as all lifeforms were 'present' and only two were 'modified', while only one high threat weed was recorded (a Willow on the southern fringe, the removal of which would increase the weed score from 13 to 15). There appeared to be approximately 30% cover of bare ground, which for treeless EVC's determines the Recruitment Score. Native litter had a cover of 5-10%. Please note that this Habitat Zone includes the modelled wetland area in the DELWP wetland_current GIS layer. The DELWP layer models this site as a permanent freshwater lake with no emergent vegetation, with a modeled condition score of 0.446; we have adopted the higher condition score of 0.67 as assessed on site for planning considerations and Native Vegetation Offset calculations (see Section 6.3 for details). Two regenerating Swamp Gum (*Eucalyptus ovata*) growing on the western margin
Conservation Status	Endangered	
VQA	0.67	
Area (ha)	1.681	
Habitat significance	High	
Large trees	none	

		of the dam have been included in this Habitat Zone (mapped to their canopy extent) since, as small scattered trees, these cannot be accounted for in the Native Vegetation Removal (NVR) report where the polygon centroids overlap with the shapefile. **This habitat Zone will be LOST on site.**

3.1.3 Intact native scattered trees

The *Handbook 2017* defines a native canopy tree as a mature tree (able to flower) that is greater than three metres in height, and of a species that is typically found in the upper layer of the relevant vegetation type (EVC). Significant canopy trees are trees which meet this description and which are greater than or equal to the large tree DBH as defined in the EVC benchmarks. If impacted, significant canopy trees are to be Offset or counterbalanced in accordance with Clause 52.17 of the Planning Scheme (see Section 6.3 for details).

For this project, canopy trees were therefore assessed against the Swampy Woodland EVC 937 benchmark, whereby 'large trees' are defined as those with a DBH of 70cm or greater.

The purpose of assessing and mapping the location of significant canopy trees was two-fold:

- To provide a large tree count per hectare for each defined patch; and
- To provide a spatial representation of significant canopy trees within close proximity of the wetlands development area and construction footprint, in order to help inform minor realignments that could better protect TPZs and thereby retain and conserve these ecological assets.

The location of all native trees within the wetland development area was mapped to the site feature survey by the project arborist, and TPZ extents were added by the project landscape architect. Each tree was further assessed on site by Ecocentric and identified as being either: native to Victoria; exempt of Offset requirements as specified under Section 52.17 schedule of the Knox Planning Scheme; or exotic (non-native to Victoria and/or environmental weeds).

All options to retain all native trees were further explored with the project engineers and Development Victoria in an effort to avoid and minimise losses.

Efforts to avoid impacts included the staged redevelopment of the dam whereby Swampy Woodland on the northern dam embankment can be retained with impacts limited to alteration of the current hydrology. The construction of the sediment pond and WSUD reed-bed habitat will be conducted such that earthworks are limited to the south side of the embankment, with material carefully placed as required to construct the sediment pond and WSUD reed-bed. There will be no removal of canopy trees or Swampy Woodland habitat at this location, and no direct impact on the tree root systems. The altered soil hydrology, associated with the removal of the dam, is expected however to impact the short-term viability of these canopy trees; these trees are therefore Offset as a precaution, and in accordance with the *Guidelines 2017* policy (see also Section 6.3 for details).

All native canopy trees within the wetlands development area will be retained and incorporated into the wetland design including:

- Retention of the two stags at the eastern margin of the open water wetland habitat area – these stags will provide roosting habitat for waterbirds and can be fitted with hollows for nesting;
- Retention of all Swamp Gum canopy trees (in patches and scattered) for the provision of canopy tree hollows, and of canopy feeding and habitat values;
- Retention of ground logs, fallen branches and leaf litter for understorey and groundstorey habitat values.

While all native canopy trees within the wetlands area have been incorporated into the wetland design, and will technically be retained on site, those presented below in Table 7 will be Offset in accordance with the *Guidelines 2017* policy prior to the commencement of works on site (see also Section 6.3 for details) as a precautionary measure (see also Section 5.2.1 for tree retention protocols). The maps provided in Appendix 9.8 and the *Landscape Plan* and *Arborist Assessment* reports provide further detail on trees that are to be retained within this study area.

Table 7. Native canopy trees Offset as a precaution within the wetland development area

Tree	Species	DBH	Offset category
415	Eucalyptus ovata (Swamp Gum)	22	8A
416	Eucalyptus ovata (Swamp Gum)	28	8A
428	Eucalyptus ovata (Swamp Gum)	80	Stag
429	Eucalyptus ovata (Swamp Gum)	77	Stag
442	Eucalyptus cephalocarpa (Mealy Stringybark)	72	LST
449	Eucalyptus ovata (Swamp Gum)	105	7A
450	Eucalyptus ovata (Swamp Gum)	25	7A
451	Eucalyptus ovata (Swamp Gum)	44	7A
454	Eucalyptus ovata (Swamp Gum)	49	5A
455	Eucalyptus ovata (Swamp Gum)	20	5A
456	Eucalyptus ovata (Swamp Gum)	20	5A
457	Eucalyptus ovata (Swamp Gum)	72	5A
459	Eucalyptus ovata (Swamp Gum)	28	5A
460	Eucalyptus ovata (Swamp Gum)	16	5A
461	Eucalyptus ovata (Swamp Gum)	25	5A
462	Eucalyptus ovata (Swamp Gum)	40	5A
463	Eucalyptus ovata (Swamp Gum)	52	5A
464	Eucalyptus ovata (Swamp Gum)	23	5A

Tree	Species	DBH	Offset category
465	Eucalyptus ovata (Swamp Gum)	24	5A
466	Eucalyptus ovata (Swamp Gum)	38	5A
467	Eucalyptus ovata (Swamp Gum)	45	5A
468	Eucalyptus ovata (Swamp Gum)	53	5A
469	Eucalyptus ovata (Swamp Gum)	54	5A
470	Eucalyptus ovata (Swamp Gum)	32	5A
471	Eucalyptus ovata (Swamp Gum)	55	5A
472	Eucalyptus ovata (Swamp Gum)	43	5A
473	Eucalyptus ovata (Swamp Gum)	14	5A
474	Eucalyptus ovata (Swamp Gum)	37	5A
475	Eucalyptus radiata (Narrow-leaved Peppermint)	22	5A
476	Eucalyptus ovata (Swamp Gum)	76	5A
482	Eucalyptus ovata (Swamp Gum)	47	6A
483	Eucalyptus ovata (Swamp Gum)	41	6A
484	Eucalyptus ovata (Swamp Gum)	38	6A
485	Eucalyptus ovata (Swamp Gum)		6A
486	Eucalyptus ovata (Swamp Gum)		6A
487	Eucalyptus ovata (Swamp Gum)	56	6A
488	Eucalyptus ovata (Swamp Gum)	70	LST
489	Eucalyptus ovata (Swamp Gum)	86	LST
490	Eucalyptus ovata (Swamp Gum)	82	12A
491	Eucalyptus ovata (Swamp Gum)	70	12A
492	Eucalyptus ovata (Swamp Gum)	42	12A
500	Eucalyptus ovata (Swamp Gum)	31	Lost (4A)
501	Eucalyptus ovata (Swamp Gum)	33	Lost (4A)

Tree ID is as per Galbraith (2020) (*Arborist Assessment* report)
Size class based on 70cm DBH for a large tree in the Swampy Woodland EVC 937
SST – Small scattered tree
LST – Large scattered tree
Patch – tree occurring within a patch of native vegetation

A total of 12 large canopy trees (7 in patches and 5 scattered listed above) are Offset as a precaution. We note however that none of these large trees are proposed for removal, and that these trees will be retained on site as part of the CEMP (see Section 5.2.1 & 5.3 for details).

Two small Swamp Gum on the western margin of the dam are lost and Offset as part of Habitat Zone 4A. These trees are both self-sown, in poor canopy health, and their loss is not considered significant in this instance. Several native shrubs and non-canopy tree species (identified in the Arborist report) are also scattered throughout the wetland development area and at the margin of the dam; these will be retained where practicable to do so. Please note however that the loss of these shrubs and non-canopy trees does not trigger Native Vegetation Offset requirements under the *Guidelines 2017* policy.

The GIS aerial maps provided in Appendix 9.8 identify the extent of remnant native vegetation and scattered trees recorded within the wetland development area.

3.2 FLORA

3.2.1 General flora

Flora surveys conducted on site have identified a total of 170 vascular plant taxa across the total property area, including 49 that are indigenous (29%) and 121 that are introduced (71%). Thirty of the introduced taxa recorded have been planted (mostly in the southern portion of the property around the perimeters) and are largely comprised of non-indigenous native species.

A full list of vascular plant species recorded on the property is presented in Appendix 9.1. A complete list of flora species that are included within the Victorian Biodiversity Atlas (DELWP 2015) as occurring within five (5) kilometers of the site is available on request from the authors.

Seven species recorded on the site are listed under the *Catchment and Land Protection Act 1994 (Vic)* (*CaLP Act 1994 (Vic)*) as noxious weeds ('controlled' or 'restricted') in the Port Phillip and Westernport Catchment Management Authority area (refer to Section 6.4 for details).

3.2.2 Significant flora

Seven flora species of regional (Victorian Rare or Threatened Species (VROTS)) and/or local (Knox municipality) conservation significance were recorded on site by Ecocentric (2015; 2017; this study), while Lorimer (2017) recorded an additional two species of local significance (Table 8). All of the significant species were recorded in close proximity to the dam.

An additional six flora species of regional significance listed on the *Advisory List of Rare or Threatened Plants in Victoria* (DEPI 2014) were recorded on site, but were not considered to be of conservation significance as they have been planted for their ornamental value; these species are also considered to be outside of their natural distribution range, and/or are identified as environmental weeds in the Knox Planning Scheme.

Appendix 9.3 lists 54 flora species recorded within five kilometers of the site, and/or which are predicted to occur by the Federal Protected Matters Search Tool (DAWE 2020), that are classified as significant under the EPBC Act, the FFG Act, the *Advisory List of Rare or Threatened Plants in Victoria* (DEPI 2014), or are considered by Lorimer (2010) to be significant in Knox. This is an increase on the 22 reported in Ecocentric's 2018 report, partially because of new data entries since the original 2017 database search, but principally

because three additional databases (Atlas of Living Australia, Birdata and iNaturalist), were queried for this round of works.

The nine significant flora species that were recorded on site, plus one species identified as having a moderate likelihood of presence on site are listed in Table 8 below and discussed further thereafter. The majority of these will be retained within the Swampy Woodland habitat area on the dam's embankment. Any significant flora that are likely to be impacted, including plants within and at the margins of the existing dam, can be relocated to the wetland development area which will include approximately 1.47 hectares of terrestrial and 1.75 hectares of aquatic habitat for revegetation purposes. Finally, all losses of native vegetation will be Offset in accordance with the *Guidelines 2017* Offset policy to ensure that there is no net loss of biodiversity value associated with these works (see also Section 6.3 for details).

All other significant flora species that have been recorded within five kilometers of the site, or that are predicted to occur by Protected Matters Search Tool, have an *unlikely* to *low* likelihood of occurrence on site, and a *negligible* to *low* likelihood of impact with the implementation of impact mitigation measures outlined in Section 5 (see Also Appendix 9.3 for occurrence and impact details).

Table 8. Significant flora recorded, or likely to occur, in the study area

Cons. Status (VROTS)	Local Significance	Scientific Name	Common Name	Source	Likelihood
r		*Senecio campylocarpus*	Floodplain Fireweed	Field survey	Present
	ce (r – regional)	*Vallisneria australis*	Eel Grass	Field survey	Present
	ce	*Persicaria subsessilis*	Hairy Knotweed	Field survey	Present
r		*Glossostigma cleistanthum*	Small-flower Mud-mat	VBA	Moderate
	ce	*Glossostigma ?elatinoides*	Small Mud-mat	Field survey ^	Present
	e	*Acacia stricta*	Hop Wattle	Field survey	Present
	e	*Ozothamnus ferrugineus*	Tree Everlasting	Field survey	Present
	e	*Rytidosperma semiannulare*	Tasmanian Wallaby-grass	Field survey ^	Present
	e	*Typha ?domingensis*	Narrow-leaf Cumbungi	Field survey	Present
	v	*Dianella laevis*	Pale Flax-lily	Field survey	Present

^ Species recorded on site by Lorimer (2017)
LRO = Likelihood of regular occurrence
Victorian Rare or Threatened species (VROTS): r = rare.
Local significance (Lorimer 2010; 2017; Beardsell 2014): ce = critically endangered; e = endangered; v = vulnerable; r = rare.
'Regionally' significant refers to the Melbourne area, 'local' significance refers to the Knox area.

Each species is discussed separately below in order of significance. The local significance rating follows Lorimer (2010), who conducted a detailed survey and review of the municipality's flora.

Floodplain Fireweed (*Senecio campylocarpus*)

Several hundred plants of *Senecio campylocarpus* were recorded around the fringes of the dam. This species is listed as 'rare' in Victoria under the *Advisory*

List of Rare or Threatened Plants in Victoria (DEPI 2014). While plants were observed around the entire perimeter of the dam, the majority were recorded on the western side. As noted by Lorimer (2017), since being added to the *Advisory List*, this species has been found to be relatively common throughout large areas of Victoria.

Eel Grass (*Vallisneria australis*)

Vallisneria australis is recorded across most of the floor of the dam. This species is considered to be critically endangered in Knox and rare in the Melbourne Area by Lorimer (2010) and rare in the Greater Melbourne area by Beardsell (2014). *Vallisneria australis* has been severely depleted in the region by clearance and degradation of wetlands and destruction by European Carp (**Cyprinus carpio*). For a description of the ecology of this species see Lorimer (2017).

Hairy Knotweed (*Persicaria subsessilis*)

Several plants of *Persicaria subsessilis* were recorded on the north-west bank of the dam. While not of state or regional significance, this species is considered to be critically endangered in Knox (Lorimer 2010).

Small-flower Mud-mat (*Glossostigma cleistanthum*)

Glossostigma cleistanthum is ascribed a *moderate* likelihood of presence on site due to records in the VBA and the presence of its sibling, Small Mud-mat (*Glossostigma elatinoides*), as recorded on site by Lorimer (2017; see also details below). Whilst *Glossostigma cleistanthum* was not recorded on site, there is a moderate likelihood of its presence within the dam; this species is listed as 'rare' on the *Advisory List of Rare or Threatened Plants in Victoria* (DEPI 2014).

Small Mudmat (*Glossostigma elatinoides*)

Some fragments of a *Glossostigma* species were found floating on the edge of the dam by Lorimer (2017) but no further evidence of the species could be found during the current survey despite targeted searches. It undoubtedly persists but could not be relocated because the fringing mudflats were inundated with very turbid water. There are no other records for *Glossostigma elatinoides* in Knox while the other (less likely) possibility is that it is the Victorian rare *Glossostigma cleistanthum*, for which there are only two other populations known in Greater Melbourne (Quandong and nearby in the Lakewood Nature Reserve). As noted by Lorimer (2017), either species is of high local or regional significance.

Hop Wattle (*Acacia stricta*)

Approximately eight plants of *Acacia stricta* occur on the north-eastern fringe of the dam; plants disturbed on site (if any) can be relocated to the open water wetland area. This species is considered to be endangered in Knox (Lorimer 2010).

Tree Everlasting (*Ozothamnus ferrugineus*)

One plant of *Ozothamnus ferrugineus* occurs on the northern border of the dam; plants disturbed on site (if any) may be relocated to, or propagated from seed

into terrestrial habitat within the open water wetland area. This species is considered to be endangered in Knox (Lorimer 2010).

Tasmanian Wallaby-grass (*Rytidosperma semiannulare*)

Approximately five plants of *Rytidosperma semiannulare* were recorded near the south-west corner of the dam by Lorimer (2017) but the species could not be located during the current survey despite targeted searches (the species can be difficult to locate outside of its flowering season). *Rytidosperma semiannulare* is considered to be endangered in Knox (Lorimer 2010) and depleted in Greater Melbourne (Beardsell 2014).

Narrow-leaf Cumbungi (*Typha domingensis*)

A small patch of *Typha* spp. occurs in the shallows of the south-western section of the dam. No flowering material was present, but the author concurs with Lorimer (2017) that it most closely resembles *Typha domingensis*, considered to be endangered in Knox (Lorimer 2010).

Pale Flax-lily (*Dianella laevis*)

One plant of *Dianella laevis* was recorded in the intact vegetation occurring immediately north of the dam. This species is considered to be vulnerable in Knox (Lorimer 2010).

Veined Spear-grass (*Austrostipa rudis* subsp. *australis*)

*Austrostipa rudi*s subsp. *australis* ('rare' in Victoria (DEPI 2014)) was assigned a 'moderate' likelihood of occurrence on the site by Ecocentric (2015); this was based on an *Austrostipa* spp. recorded at the study area that was unable to be identified to species level due to a lack of floristic material. However, subsequent surveys by Lorimer (2017) and Ecocentric (this survey), when floristic material was likely available, showed the spear grass at the site to be the non-threatened *Austrostipa rudis* subsp. *rudis*. *Austrostipa rudi*s subsp. *australis* is therefore not considered likely to be found on site.

3.3 FAUNA

3.3.1 General fauna

The programme of general and targeted fauna surveys conducted on site to date has identified a total of 59 terrestrial vertebrate species across the total property area, including 50 that are indigenous (85%) and nine that are exotic (15%). The species list includes 47 birds (six exotic), five mammals (two exotic), three native frogs, two native reptiles and two fish (one exotic). A full list of fauna species recorded on the property is presented in Appendix 9.2.

Fifteen species of wetland birds were recorded within or adjacent to the dam in the northern sector. Two additional species, Black Swan (*Cygnus atratus*) and Pink-eared Duck (*Malacorhynchus membranaceus*), have recently been reported on site by the local Knox community. These species have not been recorded by Ecocentric, but both taxa are within their expected range, and have therefore been added to Appendix 9.2.

A complete list of fauna species that are included within the Victorian Biodiversity Atlas (DELWP 2017) as occurring within 5 km of the site is available upon request from the authors.

3.3.2 Significant fauna

A total of 76 fauna species of conservation significance, and an additional 12 fauna species listed under the Migratory and/or Marine Overfly Schedules of the EPBC Act, have been recorded within five kilometers of the site and/or are predicted to occur by the Federal *Protected Matters Search Tool* (DAWE 2020). A list of these species, plus their 'likelihood of regular occurrence' (LRO), is provided in Appendix 9.4. The likelihood of regular occurrence is based on an assessment of the number, distribution and age of previous records, the habitat requirements for each species, and the presence of suitable habitat within or adjacent to the study area.

Eight of the fauna species of conservation significance listed in Appendix 9.4 weren't actually recorded within 5km of the site, but were predicted to occur by the Department of Agriculture, Water and the Environment's *Protected Matters Search Tool* (DAWE 2020).

Of the 76 significant species previously recorded or predicted to occur within five kilometers, three were recorded on site by Ecocentric: Blue-billed Duck (*Oxyura australis*); Hardhead (*Aythya australis*); and Grey-headed Flying-fox (*Pteropus poliocephalus*) – see Table 9. An additional five significant wetland bird species are considered to have a high likelihood of regular occurrence on site due to the presence of wetland habitat within the dam, and an additional three significant species are considered to have a *moderate* likelihood of regular occurrence on site; as listed below in Table 9. All threatened species that were recorded and/or assigned a *moderate* or higher likelihood of regular occurrence in the study area are discussed further below. The majority of these species are considered to be highly mobile and, if impacted, are likely to seek alternate nearby habitat; impact mitigation options are also provided in Section 5 below. All losses of native vegetation and habitat will also be Offset in accordance with the *Guidelines 2017* Offset policy to ensure that there is no net loss of biodiversity value associated with these works (see also Section 6.3 for details). Further discussion of potential impacts and implications of the proposed development in relation to significant fauna is also provided in Section 4.

All other significant fauna species that have been recorded within five kilometers of the site, or that are predicted to occur by Protected Matters Search Tool, have an *unlikely* to *low* likelihood of regular occurrence and a *negligible* to *low* likelihood of impact. See Appendix 9.4 for likelihood of regular occurrence and likelihood of impact reasoning.

Table 9. Significant fauna recorded, or likely to occur, in the study area

Conservation Status	Scientific Name	Common Name	Source	LRO	Likelihood reasoning
BIRDS					
vu L	*Ardea alba modesta*	Eastern Great Egret	ALA / BD / PMST / iN / VBA	High	Many records within 5km, including a small number of recent records. May occasionally visit the dam at the development area.
vu	*Aythya australis*	Hardhead	Field survey / ALA / BD / iN / VBA	**Present**	Many records within 5km, including a small number of recent records. Was recorded during targeted surveys, and appears to occasionally utilise the dam at the development area.

Conservation Status	Scientific Name	Common Name	Source	LRO	Likelihood reasoning
vu	*Biziura lobata*	Musk Duck	ALA / BD / VBA	High	Many records within 5km, including a small number of recent records. May occasionally visit the dam at the development area.
en L	*Egretta garzetta*	Little Egret	BD / VBA	High	Some records within 5km. May occasionally visit the dam at the development area.
CR en L	*Lathamus discolor*	Swift Parrot	ALA / BD / PMST / VBA	Moderate	May occasionally feed on the relatively large areas of flowering Eucalypts at the site (including non-indigenous Eucalypts).
vu L	*Ninox strenua*	Powerful Owl	ALA / BD / VBA	Moderate	No recent records, however, with a large home range Powerful Owl may be found within the Blind Creek riparian corridor.
en L	*Oxyura australis*	Blue-billed Duck	Field survey / ALA / BD / iN / VBA	**Present**	Species recorded consistently at the dam within the development area.
vu	*Spatula rhynchotis*	Australasian Shoveler	ALA / BD / VBA	High	Recorded within Blind Creek wetland complex (adjacent to Dandenong Valley parklands) in 2001. Potentially suitable wetland habitat comprising open areas of water with some fringing aquatic vegetation present at the development area.
en L	*Stictonetta naevosa*	Freckled Duck	ALA / BD / VBA	High	Eight records from within 5 km, with the latest in 2015. May occasionally visit the dam at the development area.
MAMMALS					
VU vu L	*Pteropus poliocephalus*	Grey-headed Flying-fox	Field survey / ALA / PMST / VBA	**Present**	Periodically over-flies the site, may forage on flowering Eucalypts (including non-indigenous Eucalypts).
REPTILES					
en L	*Chelodina expansa*	Broad-shelled Turtle	VBA	Moderate	May be found in the dam; species has the capacity to travel overland from the Blind Creek waterway corridor. Eastern Snake-necked Turtle was recorded on site.

LRO = Likelihood of regular occurrence

***EPBC Act 1999 (CwIth)* conservation status: X = Extinct; CR = Critically Endangered; E = Endangered; VU = Vulnerable; CD = Conservation Dependant.**

***FFG Act 1988 (Vic)* conservation status: L = Listed; N: =Nominated; D = Delisted; X = Rejected or Invalid.**

Victorian Rare or Threatened Species (VROTS): ex = Extinct; rx = Regionally Extinct; wx = Extinct in the Wild; cr = Critically Endangered; en = Endangered; vu = Vulnerable; r = Rare; nt = Near Threatened; dd = Data Deficient; k = Poorly Known; p = Parent taxa not formally included to avoid duplication.

Source: ALA = *Atlas of Living Australia database*; BD = *Birdata database*; EPBC PMST = *Protected Matters Search Tool*; iN = *iNaturalist database*; VBA = *Victorian Biodiversity Atlas database*.

Fauna surveys conducted on site previously (Ecocentric 2015; Ecocentric 2018) and as part of this study have identified a number of threatened fauna that are either intermittent visitors or permanent residents on site. One species in particular, Blue-billed Duck (*Oxyura australis*), is regularly recorded at the existing dam. Significant fauna recorded on site, as well as those considered to have a moderate or higher likelihood of presence on site, are discussed individually below.

SIGNIFICANT SPECIES PRESENT AT THE SITE

Blue-billed Duck (Oxyura australis)

Blue-billed Duck (*Oxyura australis*) were identified during the desktop assessment as having a high likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property, and the presence of wetland habitat available within the dam. The VBA returns 121 records of Blue-billed Duck with the most recent record being from 2019, while the Birdata database holds 970 records. Blue-billed Duck is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as endangered in Victoria (DSE 2013).

Blue-billed Duck is almost wholly aquatic and found almost exclusively by open bodies of water. It prefers deep pools where conditions are stable, with abundant aquatic flora and vegetated aquatic margins (Marchant & Higgins 1990). Although it will fly if disturbed, the species prefers to dive if approached. Blue-billed Duck is a mostly sedentary species (DSE 2003; Pizzey & Knight 2012), and shows a propensity to persist at a location while suitable feeding resources are available.

The Australian Blue-billed Duck population is estimated at approximately 12,000 - 18,000 individuals (BirdLife International 2020; SWIFT 2020), with the majority of the Victorian population found on artificial wetlands; the main site being the Melbourne Western Treatment Works at Werribee (SWIFT 2020; DSE 2003). The 2012 Victorian Summer Waterbird Count recorded 845 Blue-billed Ducks, with 94% within the Port Phillip and Westernport CMA, the vast majority of which (over 90%) were recorded at the Western Treatment Plant (SWIFT 2020; Purdey and Loyn 2013). It has also been noted that Blue-billed Ducks tend to congregate at the Western Treatment Plant wetlands in drought years when habitat across their range becomes unsuitable, with dispersal in years when other wetlands hold more suitable water levels (SWIFT 2020).

Blue-billed Duck 'duck dives' to feed on aquatic insect larvae, seeds and leaves of freshwater plants, and is regularly observed on site feeding on Eel Grass (*Vallisneria australis*) (Garnett *et al* 2010; BirdLife International 2020; Environment Australia 2000; Marchant & Higgins 1990; observed). The species aggregates during autumn and winter in large flocks but also known to disperse in spring to smaller waterbodies when breeding (BirdLife International 2020; SWIFT 2020). The breeding period varies in response to resources, but is generally described in Victoria as being from September to November, with young in November through to April (Marchant & Higgins 1990; SWIFT 2020).

Nests are generally solitary, with construction initiated in some instances by males, and completed and attended by females only; females also construct a covering dome from nearby materials when incubation is initiated (Marchant & Higgins 1990). Nests are generally constructed within dense Cumbungi (*Typha* spp.) reed-beds over water, and usually within one metre of the edge of vegetation on the deep-water side (Marchant & Higgins 1990; Garnett *et al* 2010; BirdLife International 2020; DSE 2003). Dense, old growth Cumbungi reed-beds are preferable but nesting within Spikerush (*Eleocharis* spp.) and lignum swamps is also known. New *Typha* beds, without detritus of dead leaves, are considered to be unsuitable (Marchant & Higgins 1990).

Blue-billed Duck was recorded on the dam on site during the 2015 preliminary assessment (Ecocentric 2015), during the 2017 targeted surveys (Ecocentric 2018) and as part of this study looking at breeding behavior and duration at this

location. The species was also recorded on the site by Lorimer (2017), who also notes making a record of the species in 2009 at the site. The survey data identifies that this species is a permanent resident on site at low numbers, with the maximum number of adults recorded at 7 (09 November 2009), and a sustainable population of between one to two adult birds outside of the breeding period. Population increases were observed in September 2017 and again in 2020, suggesting that adult birds may be flying into the site in preparation for the breeding season.

Table 10. Blue-billed Duck survey data

DATE	OBSERVATIONS	BEHAVIOUR
2015-09-30	x3 adult male & x1 adult female	
2015-10-06	x1 adult male & x1 adult female	
2015-10-19	x1 adult male	
2017-06-27	x1 adult male	
2017-07-05	x1 adult male & x1 adult female	
2017-08-29	x1 adult male & x1 adult female	
2017-09-22	x1 adult male & x1 adult female	
2017-10-12	x3 adult male & x3 adult female	
2017-11-09	x4 adult male & x3 adult female	
2017-11-14	x2 adult male & x3 adult female	
2020-09-29	x2 adult males & x1 adult female	No pairing
2020-10-01	x3 adult males	One dominant male
2020-10-23	x3 adult males & x1 adult female	Pairing behavior observed
2020-11-10	x2 adult males & x1 adult female	Pair; other male harassed by dominant male of the pair
2020-11-14	x3 adult males & x1 adult female	Pair plus one 2nd male (may be more juvenile); other male harassed by dominant male of the pair
2020-11-20	x1 adult male	Solitary male; no sign of female
2020-11-29	x1 adult male	Solitary male; no sign of female
2020-11-30	x1 adult male	Solitary male; no sign of female
2020-12-07	x1 adult male	Solitary male; no sign of female
2020-12-14	x2 adult males	Males remained separate; no females sighted
2020-12-20	x2 adult males	Males as a pair but one dominant; no females sighted
2021-01-02	x1 adult male & x1 adult female	Male and female feeding together; no paring behavior

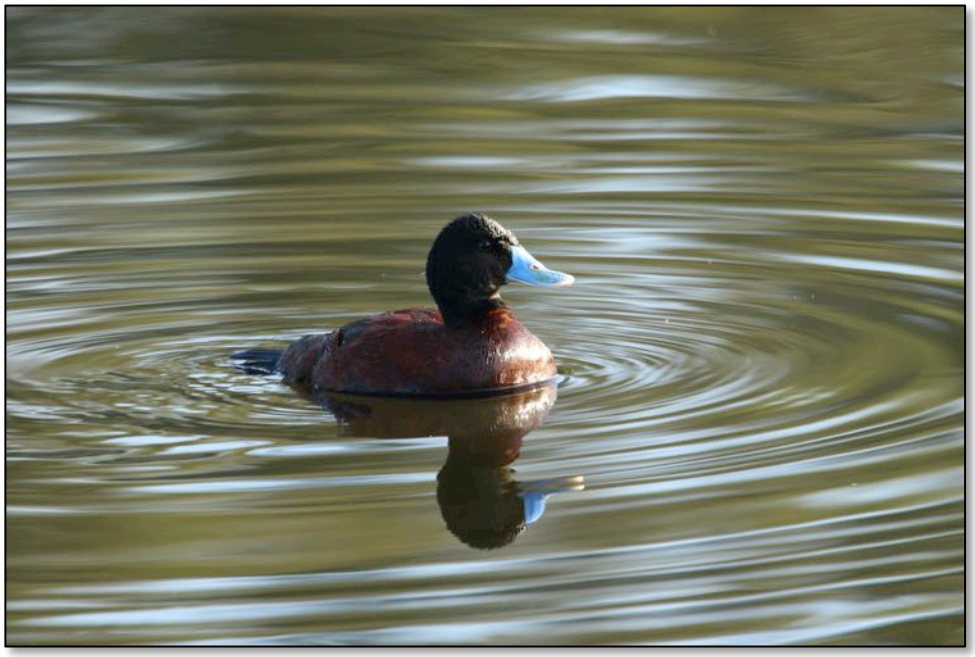
The increased numbers of Blue-billed Duck recorded during targeted surveys in October and November, and apparent pairing of males and females, support the view that breeding is attempted at the site most years. Pairing between adult males and females was incidentally observed during the 2017 surveys, and directly observed during 2020 surveys, with pairing behavior including herding of females by dominant males, pairing response by females (partnering with selected males), and with aggression shown to challenging males by the dominant males. A single Blue-billed Duckling was also recorded at the dam on 9th March 2021, which is evidence that breeding can occur successfully on site, albeit at low numbers in this instance given a typical clutch size of 5-6 eggs (Marchant & Higgins 1990; DSE 2003; see also Section 2.2.3 for details).

At all occasions care was taken to not disturb female Blue-billed Duck behavior during surveys, and there was no active searching for nests conducted on site. Rather, the intent of targeted surveys conducted during the 2020 breeding season was to observe females emerging from nest sites with ducklings; the female observed on the water with a single duckling in March 2021 is evidence of breeding having successfully occurred on site (see also Section 2.3.3 for details).

Blue-billed Duck pairing activity was observed from mid-October to mid-November 2020: subsequently, follow-up surveys were conducted until early January 2021 to ensure accommodation of an incubation period of 24-26 days (Marchant & Higgins 1990; DSE 2003). The presence of a Blue-billed Duckling in March is therefore outside of the generally accepted breeding period, however, not an unusual occurrence as reported in HANZAB which notes *laying period varies; not regularly confined to September to November.* The late breeding that has occurred this season suggests therefore that monitoring for Blue-billed Duck breeding activity may be required on site during the construction process. Mitigation for Blue-billed Duck impacts that cannot be avoided on site, principally through the staged development of the site and through provision of more suitable breeding habitat to complement the existing open water habitat, is therefore provided in Section 5.1 below.

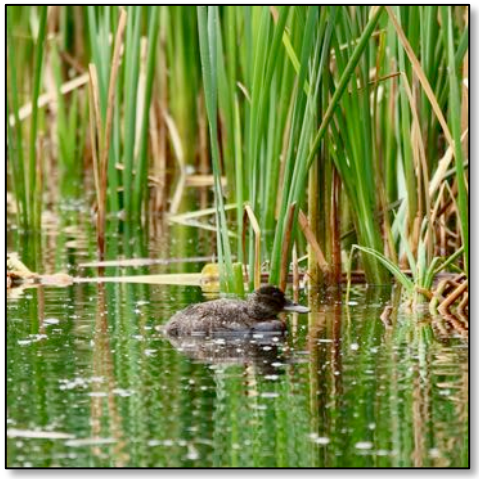
It was also observed that Blue-billed Duck and other water birds observed at this site showed little to no regard to pedestrians, attributable to the high level of public usage on the shared pathway adjacent the dam to the north (less than 10m from the water's edge in the northwest corner). Blue-billed Duck males and females were regularly observed approaching observers during all surveys.

Figure 3. Blue-billed Duck on site.



Adult Blue-billed Duck male (2020-10-01; Mark Shepherd)

X3 adult Blue-billed Duck males and x1 female (2017-10-12)



Blue-billed Duckling (2021-03-09; Mark Shepherd)

Hardhead (Aythya australis)

Hardhead (*Aythya australis*) (formerly known as White-eyed Duck) were identified during the desktop assessment as having a high likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property. The VBA returns 156 records of Hardhead with the most recent record being from 2019, while the Birdata database holds 2,458 records. Hardhead is classified as vulnerable in Victoria (DSE 2013).

Hardhead prefers aquatic environments, especially deep water in large permanent wetlands with stable conditions and abundant aquatic flora,

particularly deep swamps, lakes, billabongs, pools and creeks (Marchant and Higgins 1990). The species is occasionally found in estuarine and littoral habitats such as saltpans, coastal lagoons and sheltered inshore waters (Marchant and Higgins 1990), but generally avoids main streams or rivers, except in calm reaches where aquatic flora is developed (Marchant & Higgins 1990). It is rarely seen on land, and tends to roost on low branches and stumps near the water (BirdLife Australia 2020).

Hardhead dives for its food, leaping forward and diving smoothly under the water to feed on aquatic invertebrates and insects, mussels and freshwater shellfish (BirdLife Australia 2020). It was also observed on site foraging on Eel Grass (*Vallisneria australis*). Hardhead nests in aquatic margin vegetation of wetlands and waterways forming a trampled, slightly hollowed platform in dense reed-bed vegetation; it is also known to nest within dense tea-tree or swamp paperbark vegetation. Nests are constructed and attended, and eggs are incubated, by females only. Typical incubation period is up to 30 days (Marchant & Higgins 1990).

Hardhead was recorded on the dam at the site during the dawn survey on 14 November 2017, as a pair at dawn and dusk on the 29 September and 01 October 2020 respectively, and again as a group of three (x1 male in breeding plumage plus two females; no pairing behavior observed) at dusk on 20 November 2020. It is likely that the site is utilised opportunistically by Hardhead for foraging, however, the dam is unlikely to support large numbers of the species, and the presence of suitable breeding habitat is uncertain, due to the general lack of emergent vegetation and the limited availability of dense fringing vegetation.

As an intermittent visitor there is a low likelihood of Hardhead being impacted by the wetland development program. Nevertheless, mitigation for Hardhead impacts that cannot be avoided on site, principally through the staged development of the site and through provision of more suitable breeding habitat to complement the existing open water habitat, is therefore provided in Section 5.1 below.

Figure 4. Hardhead on site

Adult Hardhead male (foreground) and female (2020-09-29; Mark Shepherd)

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Grey-headed Flying-fox (*Pteropus poliocephalus*) were identified during the desktop assessment as having a high likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property. The VBA returns five records of Grey-headed Flying-fox with the most recent record being from 2020. Grey-headed Flying-fox is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as vulnerable in Victoria (DSE 2013).

Grey-headed Flying-fox occurs along the east coast of Australia from Rockhampton in Queensland to western Victoria. Its movements and local distribution is usually governed by climate and the flowering and fruiting of major food plants (Menkhorst 2001). Approximately 8,000 bats roost permanently in Melbourne; however an additional 20,000 flying-foxes augment this population during summer, when they visit southern Australia to take advantage of seasonal food supplies. Preferred camp (roosting) sites include gullies close to water containing dense canopy vegetation (Churchill 1998). Grey-headed Flying-foxes occupy a permanent colony at Bell Bird Picnic Area along the Yarra River in Kew (DELWP 2017a). Flying-foxes can travel 20–50 km from their roost sites to feed. Preferred food resources include eucalypt blossoms (and those from other *Myrtaceae* spp. and *Proteaceae* spp.) and fruit (particularly figs (*Ficus* spp.), Lilly Pilly (*Syzygium smithii*) and plums (*Prunus* spp.)) in bushland, suburban parks and gardens (Menkhorst 2001).

This species was recorded at the site on the following occasions:

- One individual was observed traversing over the site during nocturnal surveys on 05 July 2017;
- Twelve individuals were recorded traversing over the site on 29 August 2017;
- Seven individuals were recorded traversing over the site on 12 October 2017; and
- Four individuals were recorded traversing over the site on 9 November 2017.

We note that all Grey-headed Flying-fox records for the site are 'fly-overs'. No Grey-headed Flying-fox were observed on the site, and neither this site, nor the adjoining Blind Creek riparian corridor, support a resident population. Nevertheless, based on the frequency of records, it is assumed that this species would feed opportunistically on flowering eucalypts within the study area. The dam may also be used during hot weather periods by Grey-headed Flying-fox for dipping, whereby bats skim the water's surface for the purpose of cooling and gathering of water (licked from fur when roosting); this behaviour was not observed on site. Typically, this behaviour is only observed at roosting sites which are generally located adjacent to waterways or wetlands, and where bats can return to their roosts to drink and cool.

None of the canopy trees within the wetland development area are likely to be removed during the works program and, given the high mobility of this species, it is not expected that Grey-headed Flying-fox will be impacted by this development. Subsequently, no mitigation works are required. It is expected that Grey-headed Flying-fox will benefit in the longer term through revegetation of Swampy Woodland terrestrial habitat within the wetland development area, and the retention of open water habitat areas for cooling and watering during hot weather spells. A *self-assessment* against the Significant Impact Criteria for Grey-headed Flying-fox is provided in Section 6.1 below.

MODERATE LIKELIHOOD OF REGULAR OCCURRENCE

Several threatened species, in addition to those detailed above, were identified during the desktop assessment as having a *high* or *moderate* likelihood of occurrence on site, and as having a *moderate* or *high* likelihood of impact on site. These species are discussed below.

Eastern Great Egret (*Ardea alba modesta*)

Eastern Great Egret (*Ardea modesta*) was identified during the desktop assessment as having a *high* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of wetland habitat within the dam. The VBA returns 106 records of Eastern Great Egret with the most recent record being from 2019, while the Birdata database holds 1,662 records. Eastern Great Egret is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as *vulnerable* in Victoria (DSE 2013).

The Eastern Great Egret utilises a variety of waterbodies, foraging primarily by wading in open, shallow water (Marchant and Higgins 1990). The species generally roosts in trees, and also breeds in trees or other tall vegetation surrounding wetlands.

While wetland habitat at the site is of limited quality through the lack of shallow flats and limited potential nesting resources, the species may periodically utilise open pasture areas within the flood zone in the northeast of the site, or may be found at the margins of the dam.

Mitigation for potential impacts on Eastern Great Egret is provided principally through the provision of the open water wetland and staged redevelopment of the dam.

Musk Duck (*Biziura lobata*)

Musk Duck (*Biziura lobata*) was identified during the desktop assessment as having a *high* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of wetland habitat within the dam. The VBA returns 35 records of Musk Duck with the most recent record being from 2018, while the Birdata database holds 231 records. Musk Duck is classified as *vulnerable* in Victoria (DSE 2013).

Musk Duck occur throughout most of Victoria, though rarely Mallee or Alpine areas. This species is often found within deep and often sheltered permanent freshwater lakes and swamps with abundant aquatic vegetation (Marchant and Higgins 1990), and is less commonly recorded in small or shallow waters such as billabongs, sewage ponds, freshwater rivers and densely vegetated farm dams (Marchant and Higgins 1990).

Given the potential suitability of wetland habitat, including the partial overlap in habitat requirements of Musk Duck and Blue-billed Duck, the Musk Duck has been given a *moderate* likelihood of regular occurrence at the site. However, as for Blue-billed Duck, the site is unlikely to support large numbers of the species when present, and the site is unlikely to support suitable breeding habitat due to the general lack of emergent and dense fringing vegetation.

Mitigation for potential impacts on Musk Duck is provided principally through the provision of the open water wetland and staged redevelopment of the dam.

Little Egret (*Egretta garzetta*)

Little Egret (*Egretta garzetta*) was identified during the desktop assessment as having a *high* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of wetland habitat within the dam. The VBA returns four records of Little Egret with the most recent record being from 2018, while the Birdata database holds 73 records. Little Egret is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as *endangered* in Victoria (DSE 2013).

The Little Egret usually forages at the margins and shallows of open waters, wetlands, billabongs, swamps, floodplain pools, mangroves and mud-flats; it is also found at sewage treatment ponds (Marchant and Higgins 1990). The species generally roosts in trees, and also breeds in trees or other tall vegetation surrounding wetlands.

While wetland habitat at the site is of limited quality through the lack of shallow flats and limited potential nesting resources, the species may periodically utilise

open pasture areas within the flood zone in the northeast of the site, or may be found at the margins of the dam.

Mitigation for potential impacts on Little Egret is provided principally through the provision of the open water wetland and staged redevelopment of the dam.

Australasian Shoveler (*Spatula rhynchotis*)

Australasian Shoveler (*Anas rhynchotis*) was identified during the desktop assessment as having a *high* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of wetland habitat within the dam. The VBA returns 11 records of Australasian Shoveler with the most recent record being from 2017, while the Birdata database holds 413 records. Australasian Shoveler is classified as *vulnerable* in Victoria (DSE 2013).

Australasian Shoveler prefers large permanent, sheltered freshwater swamps, lakes and waterways with a high cover of emergent vegetation (Marchant and Higgins 1990). The large bill is used to feed on small invertebrates, insects and a variety of plants which it filters from the water and bed sediments. Australasian Shoveler may occasionally visit or utilise the study area, however, it is unlikely to successfully breed or be reliant upon the site.

Given the potential suitability of wetland habitat, including the availability of open water, the Australasian Shoveler been given a *moderate* likelihood of regular occurrence at the site. However, as for Blue-billed Duck, the site is unlikely to support large numbers of the species when present, and the site is unlikely to support suitable breeding habitat due to the general lack of emergent and dense fringing vegetation.

Mitigation for potential impacts on Australasian Shoveler is provided principally through the provision of the open water wetland and staged redevelopment of the dam.

Freckled Duck (*Stictonetta naevosa*)

Freckled Duck (*Stictonetta naevosa*) was identified during the desktop assessment as having a *high* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of wetland habitat within the dam. The VBA returns 12 records of Freckled Duck with the most recent record being from 2019, while the Birdata database holds 199 records. Freckled Duck is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as *endangered* in Victoria (DSE 2013).

Freckled Duck is most commonly recorded across the Volcanic Plains in the west of the state, or along the mid-Murray basin in the north. There are scattered records along or near the coast in eastern Victoria. Freckled Duck is a filter feeder that occurs in a variety of wetland habitats, preferring highly productive, well vegetated swamps, creeks and channels, but it also occurs in rivers, dams, and deep freshwater swamps (Marchant & Higgins 1990). The foraging activities of this duck are generally restricted to the shallow edges or soft mud areas of these wetlands.

Given the potential suitability of wetland habitat, including the availability of open water, the Freckled Duck been given a *moderate* likelihood of regular

occurrence at the site. However, as for Blue-billed Duck, the site is unlikely to support large numbers of the species when present, and the site is unlikely to support suitable breeding habitat due to the general lack of emergent and dense fringing vegetation.

Mitigation for potential impacts on Freckled Duck is provided principally through the provision of the open water wetland and staged redevelopment of the dam.

Swift Parrot (*Lathamus discolor*)

Swift Parrot (*Lathamus discolour*) was identified during the desktop assessment as having a *moderate* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of canopy trees on site. The VBA returns three records of Swift Parrot with the most recent record being from 1981, while the Birdata database holds 151 records. Swift Parrot is listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as endangered in Victoria (DSE 2013).

Swift Parrot is a migratory species, breeding in Tasmania during the summer months, then moving to feed on flowering eucalypts in south-eastern mainland Australia during the winter months. In Victoria, it occurs more often on the north side of the Great Divide, in Box-Ironbark forests supporting winter-flowering eucalypts (e.g. *Eucalyptus sideroxylon, E. tricarpa* and *E. microcarpa*) or psyllid-infested eucalypts (e.g. River Red Gum). In southern Victoria, it occurs in Manna Gum, Swamp Gum and Yellow Gum habitats, and within flowering street trees or psyllid-infested eucalypts (Higgins 1999, Webster *et al*. 2003), but its movements (in response to food resources) is often irregular and unpredictable (likely attributable to the sporadic nature of its food sources).

Swift Parrots may occasionally utilise the site to forage on flowering eucalypts or shelter in hollows, however, the species has a large home range and is therefore unlikely to be reliant upon the relatively small area of suitable habitat on a long-term basis.

No direct mitigation is required for this species since the majority of canopy trees will not be impacted within the wetland development area, and this is a highly mobile taxa which will move to alternate habitat nearby. A *self-assessment* against the Significant Impact Criteria for Swift Parrot is provided in Section 6.1 below.

Powerful Owl (*Ninox strenua*)

Powerful Owl (*Ninox strenua*) was identified during the desktop assessment as having a *moderate* likelihood of presence on site, as based on the VBA, Birds Australia and Australian Living Atlas (ALA) database records for this species within 5km of the property. The VBA returns 29 records of Powerful Owl with the most recent record being from 2020, while the Birdata database holds 540 records. Powerful Owl is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as *vulnerable* in Victoria (DSE 2013).

Powerful Owl is the largest of the Australian owl species and inhabits eucalypt forests and woodlands, rainforest and inland riverine woodlands (Higgins 1999). Powerful Owl nests in large hollows with entrance diameters greater than 45 cm,

greater than 100 cm depth and typically greater than 6 m above the ground; preferably in live rather than dead trees (McNabb 1996, Higgins 1999). Powerful Owl feeds mostly on arboreal mammals, especially possums and gliders, but its diet also incorporates other prey items such as flying-foxes, birds and large insects (Higgins 1999). Powerful Owl is thought to form lifelong monogamous pairs, which occupy large territories (Higgins 1999). Courtship, breeding and raising young lasts several months from autumn through to spring (March–October). The Powerful Owl is particularly sensitive to disturbance during this period, and will defend or even abandon nests if disturbed (Higgins 1999). In forested areas, Powerful Owl forages over a home range that can range between approximately 1,000 ha and 2,000 ha; in urban areas, however, the home range is often substantially reduced, and can be as little as 500 ha (Ed McNabb, pers.comm. 2017).

Five call-playback and spotlighting surveys were undertaken for the Powerful Owl, with no individuals recorded. In combination with the availability of habitat in the area, these results suggest that while the Powerful Owl may be present in the general area, it is unlikely to regularly utilise the site or be reliant upon it. Individuals, if present in the area, may occasionally move through the study area, but in general are more likely to occur in areas of higher-quality habitat with a greater amount of wooded/riparian habitat and sites with canopy hollows that support its prey. Arboreal mammals occurring in the study area may occasionally provide foraging resources for Powerful Owl.

No direct mitigation is required for this species since the majority of canopy trees will not be impacted within the wetland development area, and there are no hollows suitable for nesting on site; this is also a highly mobile taxa which will move to alternate habitat nearby.

Broad-shelled Turtle (*Chelodina expansa*)

Broad-shelled Turtle (*Chelodina expansa*) was identified during the desktop assessment as having a *moderate* likelihood of presence on site, as based on the VBA and Australian Living Atlas (ALA) database records for this species within 5km of the property and the presence of aquatic habitat within the dam. The VBA returns one record of Broad-shelled Turtle from 2012 at Lakewood Reserve. Broad-shelled Turtle is Listed under the *Flora and Fauna Guarantee Act 1988* (DELWP 2017), and is classified as *endangered* in Victoria (DSE 2013).

Broad-shelled Turtle is most commonly encountered in billabongs and slow flowing rivers. This species depends on permanent water bodies and seldom emerges from the water, apart from when females come ashore to nest, or males roam to find new ambush points, where they lie in wait among water weeds for small fishes, shrimps and large aquatic insects.

Mitigation for potential impacts on Broad-shelled Turtle encountered (if any) within the dam will be provided through the relocation of individuals to the open water wetland, the incorporation of deep water pools and the incorporation of emergent logs at the margins of the wetland.

UNLIKELY TO LOW LIKELIHOOD OF OCCURRENCE

There are numerous additional species that are identified as having an *unlikely* to *low* likelihood of presence on site, and a proportionally *negligible* or *low* likelihood of impact attributable to the wetland development area construction

program. These species are not expected to be significantly impacted and are not considered further in this report. Details of mitigation requirements for each species are however provided in Section 9.4.

We note also that Platypus (*Ornithorhynchus anatinus*) is recently (November 2020) recommended for listing as Vulnerable under the FFG Act, and is being considered for listing as Vulnerable under the IUCN Red List and the EPBC Act (Hawke *et al* 2020). There are no recent records for this species in the VBA within 5km and as such it was determined to have a *low* likelihood of presence on site. This is a relatively mobile species which, if present, is considered likely to utilize habitat within the open water wetland area; no additional mitigation measures are required for this species.

3.4 DAM CONDITION AND HABITAT

The area with the highest potential to support significant fauna species within the development area is the dam in the northern sector. This large (approximately 1.4 hectares) open water habitat is fringed by a generally thin (<5 m) aquatic margin of semi-aquatic indigenous vegetation. Terrestrial vegetation, including mature eucalypts and wattles, with logs and areas of dense understorey vegetation, bounds the northern margin of the dam. This area of vegetation provides cover, roosting, perching and potential nesting habitat for a range of wetland and other birds (Figure 5; see also Section 9.5).

The general lack of emergent and floating aquatic vegetation, and the limited cover of dense fringing vegetation, limits the suitability of the dam for most significant waterbirds. Beyond potentially the Blue-billed Duck, it is considered unlikely that, in its current condition, the site would regularly support successful breeding by the threatened waterbirds that may occur on the site (Table 11).

Water quality parameters at the dam were assessed during the 2017 targeted surveys, and are presented below:

- Water temperature - 13.3°C;
- Turbidity - <15 NTU;
- pH - 8.6; and
- Salinity 140 µS/cm.

Values recorded above are considered to be typical for an artificial water body that is fed predominantly from stormwater sources. Litter was also noted at the dam's margins, in particular in the northeast corner and at the northwest outlet structure; likely sources include the neighbouring school and stormwater drains within the urban catchment.

A condition report on the structural integrity and function of the dam was also undertaken by Engeny Water Management (2017), as summarised below:

- The embankment on the dam's northern boundary is of unknown construction materials and quality;
- The embankment is very close to Blind Creek and very close to the existing development to the west;

- The dam fills with untreated stormwater and its current design is not suitable to provide stormwater treatment;
- The dam provides limited flood storage as it is usually full to capacity; and
- The dam does not comply with safety requirements for urban public water bodies (Engeny 2017).

3.4.1 Index of Wetland Condition (IWC) assessment

An Index of Wetland Condition assessment was utilised to quantify the condition of wetland values within the dam area on site. However, it should be noted that the IWC method was not designed to assess artificial wetlands (Papas & Lyon 2012), and that its application during this project encountered some difficulties. The IWC indices that were most difficult to complete included 'hydrology', 'physical form' and the 'altered process' component of the biota section, as discussed below:

- Physical form: the dam within the study site was originally constructed by excavating the substrate. It is therefore irrelevant to assess changes to the size of the dam or its bathymetry.
- Hydrology: as a constructed dam this site has a man-made hydrological regime. It is therefore difficult to define hydrological change in the context of an IWC assessment.
- Altered processes: This component of the Biota assessment focuses on wetland plants that are in the wrong place due to altered processes. If the entire wetland is artificial, it is difficult to define an altered process.

Considering that the IWC was not designed for constructed wetlands, the results should be viewed with some caution (particularly for the sub-indices discussed above). However, they do provide a rough guide to the condition of wetland habitat within the dam, which is aided by further discussion provided below.

Table 11. IWC assessment results for the dam

Bioregion: Gippsland Plain			
Sub-index	**Scores**	**Maximum Possible Score**	**Condition Category**
Wetland catchment	0	20	Very Poor
Physical form	20	20	Excellent
Hydrology	5	20	Very Poor
Water properties	15	20	Good
Soils	19.8	20	Excellent
Biota	17.6	20	Good
Overall Condition Score (Extant EVC's)	**6**	**10**	**Moderate***

* This score and rating has likely been inflated by the artificial nature of the wetland (dam), which the IWC assessment process was not designed to include.

Wetland catchment

The Wetland catchment index assesses the extent of native vegetation buffering the dam as well as the ecological health of the landscape for a radius of 250 metres. This is because the overall health and condition of wetlands are significantly influenced by their surrounding vegetation and land use.

Because the dam has a poor buffer of native vegetation and the surrounding landscape is heavily urbanised or cleared, this index scored very poorly. The score could potentially be improved by increasing the buffer around the dam through revegetation.

Physical form

The Physical form index assesses whether the dam has been modified via artificial barriers such as drains and levees.

This index received a full score, as the shape of the wetland has not been altered in recent times. However as discussed above, this high score is misleading as the overall shape of the wetland is itself artificial.

Hydrology

The Hydrology index assesses whether there has been any change to the dam's natural hydrology, more specifically relating to the timing and duration of inundation.

For this index, it was assumed that there has been no significant change to the season of flooding, as stormwater would mostly enter the dam during natural rain events. However the score was greatly reduced by a marked change to the extent of inundation, as the floodplain has shifted from seasonal to near permanent inundation.

Water properties

The Water properties index assesses changes in nutrient enrichment or salinisation.

The score was reduced due to nutrient enrichment caused by stormwater input; however, there has been no apparent salinisation of the dam.

Soils

The Soils index assesses any disturbance caused to the soils through various activities (e.g. feral animals, driving of vehicles, human trampling).

This index scored relatively highly as the near permanent inundation has prevented most forms of soil disturbance occurring to the floor of the dam.

Biota

The Biota index assesses the condition of each Ecological Vegetation Class occurring across the dam. For the current assessment, the entire dam was assessed as Submerged Aquatic Herbland (EVC 918), which is the best fit for the submerged herbfields of Eel Grass (*Vallisneria australis*) and Pond-weed (*Potamogeton* spp.) that cover much of the dam's floor. The patch of Bull-rush (*Typha* spp.) was considered too small to qualify as Tall Marsh (EVC 821).

The Biota index scored relatively highly – all lifeforms were present and unmodified, there are very few weeds extending into the water, there are no evident altered processes, and the structural dominants was moderately healthy.

Figure 5. Dam habitat on site

Fringing terrestrial vegetation on the dam's northern margin

Fringing indigenous semi-aquatic vegetation and Blackberry on the dam's margins

4. POTENTIAL IMPACTS

The proposed development may result in a range of impacts to flora and fauna species extant at the site. Impacts may be temporary, predominantly occurring during the construction phase, or ongoing, once the site has been developed. The impacts can be classified as 'direct' impacts, for example the loss of vegetation through clearing, and 'indirect' impacts, such as increased noise and light from urbanisation.

Impacts discussed below relate to those potentially affecting rare or threatened flora and fauna species and areas of native vegetation (i.e. with regard to relevant legislation and policy). Impacts to other values (e.g. common fauna species) are not considered explicitly, except where they may directly affect significant ecological values.

Potential impacts from the proposed development may occur through the following mechanisms:

- Draining the dam;
- Loss of native vegetation and habitat;
- Reduction in the area of breeding, foraging and/or refuge habitat for threatened flora and fauna;
- Changes to aquatic habitat quality, including hydrology and water quality;
- Impacts on individuals, including direct mortality, disease/pathogens, and disturbance from the development;
- Population-level impacts influencing local/regional persistence of significant species; and
- Urbanization and construction impacts.

These potential impacts are discussed in further detail below; measures aimed at the mitigation of these impacts are discussed in Section 5.

4.1 DRAINING OF DAM

Engeny Water Management (2017) identified that maintaining the dam on the site poses a number of engineering challenges associated with the construction of the retarding embankment and outlet structure, proximity to Blind Creek and flooding impacts, overtopping of waters from the dam in the northwest corner, and public safety issues around water depths and retardation failure.

Options to address these failings were explored by the project engineers and it was determined that stabilisation of the outflow structure and northern embankment, as well as regrading of the western and southern embankments (for safety purposes) cannot be completed without draining of water from the dam. The loss of water and the degradation of water quality associated with draining or engineering works within the dam is recognised as a significant impact on the aquatic habitat available at this location, and any works of this nature are considered likely to have a significant impact on Blue-billed Duck and other significant flora and fauna on site. Similarly, any earthworks conducted on

the dam wall and associated native vegetation losses are also recognised as a significant impact and loss of Swampy Woodland habitat at this location.

A staged development program wherein the dam and its embankment can be stabilised, and where the Swampy Woodland habitat can be retained, is outlined in Section 5.1 below.

4.2 LOSS OF NATIVE VEGETATION

The staged development of the existing dam and its repurposing for provision of a sediment pond and WSUD reed-bed will result in the loss of native vegetation, and in particular, the loss of Submerged Aquatic Herbland (EVC 918) within the dam. Approximately half of the extant dam area will be developed, while the other (northern) half will be re-purposed as wetland habitat (see Section 5.1 for details); the net impact will be the complete loss of native vegetation within the dam.

The dam has a soft mud bed that retains a cover of, primarily, Eel Grass (*Vallisneria australis*) and Pondweed (*Potamogeton* spp.). The extent and cover of submergent flora varies between seasons, as evident through temporal analysis of aerial photographs available on NearMap. For the purpose of this assessment, however, we are taking a conservative approach and the total area of the extant dam will be Offset as an Aquatic Herbland (EVC 653) native vegetation patch in accordance with the *Guidelines 2017* policy (see Section. 6.3 for details).

The dam wall, as well as native vegetation on the wall and within the wetland development area, will be retained, and supplementary revegetation of understorey taxa appropriate to the site's EVCs will be implemented for the provision of habitat for threatened flora and fauna found on site. It is expected, however, that changes to the site's hydrology associated with the repurposing of the dam, as well as changes to the current stormwater and surface water flow regimes, may have an impact on canopy Swamp Gum (*Eucalyptus ovata*). Subsequently, it will be necessary to Offset these habitat areas as a precaution (see Section 6.3 for details). We stress, however, that there is no intent to physically remove these trees: rather, the staged development program outlined in Section 5.1 below will focus on the retention of these habitat areas and the values therein.

4.3 REDUCTION IN AREA OF AQUATIC HABITAT

The dam currently supports habitat for a range of common native fauna, and some threatened species, including most notably, Blue-billed Duck, which has been regularly recorded on site, Hardhead, which is recorded as an intermittent visitor to the site, and numerous common water bird species. An unmitigated loss of the dam would be likely to have a significant impact on resident waterbirds, resulting in reduced abundance and breeding success.

Under the proposed development, approximately half of the existing dam will be removed and substituted with an equivalent area of wetland habitat, while the remaining half will be re-purposed as wetland habitat for stormwater treatment purposes and provision of reed-bed habitat for waterbirds. This will result in the staged loss of 1.681 hectares of aquatic habitat on site.

A staged development program is therefore outlined in Section 5.1 which provides for the establishment of 1.75 hectares of aquatic habitat within the wetland development area, which will include the open water wetland area (11,000 m^2), sediment pond (1,300 m^2) and the WSUD reed-beds (5,000 m^2). In addition, approximately 1.47 hectares of supportive terrestrial habitat will be conserved and revegetated, including the retained Swampy Woodland habitat on the dam's northern embankment, canopy trees north of the dam, and the revegetation of EVC appropriate habitat across the whole of the wetland development area.

4.3.1 Loss of connectivity

Clearing and construction can result in habitat fragmentation, where a patch of native vegetation is spilt into multiple smaller patches. This effect is listed under the FFG Act as *'habitat fragmentation as a threatening process for fauna in Victoria'*. It can lead to increased 'edge effects', whereby habitat at the edge of a patch suffers more impacts from dust, noise, light and weed invasion than the middle of patch (Gleeson & Gleeson 2012). Fragmentation can also split a population of a species and cause a barrier to dispersal, which can lead to inbreeding, greater susceptibility to environmental variation, and localised extinction.

In this instance, the loss of Submerged Aquatic Herbland EVC within the dam may contribute to the fragmentation of available wetland habitat for Blue-billed Duck and other waterbirds. It will be necessary therefore to ensure that initial loss of the dam's habitat is mitigated through provision of alternate aquatic habitat on site (see Section 5.1 for details).

4.4 CHANGES IN AQUATIC HABITAT AVAILABILITY

The wetland area will be developed in stages, with the construction and establishment of an open water wetland adjacent to the existing dam prior to the dam's removal. The dam will ultimately be repurposed as a sediment pond and WSUD reed-bed habitat area, with retention and conservation of Swampy Woodland terrestrial habitat on the dam's embankment and surrounds (see Section 5.1 for details).

The staged redevelopment of the dam and establishment of the open water wetland, sediment pond and WSUD reed-bed will result in a change of aquatic habitat being provided at the site, with the end result being a more diverse wetland complex including tapered embankments, vegetated aquatic margins, and dense establishment of reed-beds suitable for Blue-billed Duck and other threatened waterbird nesting purposes. The proposed staged development will provide for an equivalent total area of wetland habitat, however, the wetland habitat provided will be different to extant conditions and the total surface area of open water will be reduced. There is a risk therefore that the redeveloped wetland complex as proposed (see Section 5.1 for details) may not provide equitable habitat for all of the site's current flora and fauna residents.

The development of the Stage 1 – 7 area will also result in a change in stormwater volumes, flow rates and water quality conditions being delivered to the wetland development area. Waters from the Stage 1 – 7 development area post construction will be directed to the sediment pond and WSUD reed-bed for treatment prior to entering the open water wetland, with delivery of treated waters to the Blind Creek in accordance with the *Stormwater Management*

Strategy being developed for this site. The open water wetland area will act in its capacity to regulate water release rates to Blind Creek and mitigate flood impacts associated with development of the Stage 1 – 7 catchment area.

The dam on site is also known to remain at, or near full throughout the year, thereby providing open water for Blue-billed Duck (which is considered to be a sedentary species). The open water wetland to be created as part of this proposal will therefore be designed to remain at, or near full throughout the year to accommodate this behavior, and in order to support the waterbird population at this site (created wetlands will generally provide equivalent habitat and water holding capacity except under exceptional circumstances).

4.5 IMPACTS ON THREATENED FAUNA

The proposed development of the site, including draining and repurposing of the existing dam, if unmitigated, could potentially impact waterbirds utilising the available open-water habitat, including the Blue-billed Duck, through factors such as:

- Loss of habitat;
- Direct mortality;
- Health impacts (i.e. injury or disease); and/or
- Disturbance-related impacts.

Direct mortality or injury could occur through bulk earthworks and other construction activities, for example, destruction of nests (if present). Given the propensity of Blue-billed Ducks to remain on the water surface or in dense vegetation on the margins of wetlands, the greatest risk of potential mortality of this species would be during the creation of new wetlands and the removal/re-purposing of the existing dam.

The proposed development is likely to increase the risk of predation from domestic animals (i.e. cats and dogs). The provision of dense fringing and emergent vegetation would reduce this risk, as would any measures to discourage free-roaming cats and dogs in the vicinity of the wetland (see Section 5 for details).

European Fox (*Vulpes Vulpes*) was regularly observed during the pre-dawn and dusk Blue-billed Duck surveys conducted as part of this study. This species is likely to be preying on fauna at the site, and may be taking female Blue-billed Duck, ducklings or eggs off nests at the margin of the dam (NB: this behavior was not directly observed). Fox control measures are therefore considered as part of the mitigation of development impacts at this site.

The proposed development of the site would likely increase the human use, and hence potential disturbance, of waterbirds and their habitat. The Blue-billed Duck in particular is a cryptic and shy species, and increased disturbance by people and/or domestic animals (e.g. dogs) could potentially result in increased flushing and avoidance behavior. Measures to reduce this risk are presented in Section 5.

4.6 POPULATION-LEVEL IMPACTS

The potential for the proposed development, and associated loss/alteration of dam habitat, to result in population-level impacts on significant species is considered low. This is primarily due to the relatively small number of individuals of threatened waterbirds that are likely to use or be reliant upon the site, and as supported by the implementation of mitigation measures provided in Section 5 below. Repeated surveys at the site (Ecocentric 2015; Lorimer 2017; Ecocentric 2018; current surveys) have consistently recorded less than eight individuals of Blue-billed Duck, and low numbers of another threatened waterbird species, Hardhead, on an intermittent basis.

We note that there is alternate wetland habitat available in the surrounding landscape in proximity (within 3km) of the site. The nearest independent open water body is Lakewood Nature Reserve, approximately 1 km to the southwest of the dam on the site, and riparian habitat is available within the Blind Creek waterway reserve. There are numerous records of Blue-billed Duck at the Lakewood Nature Reserve and it is possible that individuals would utilize both habitat sites.

4.7 URBANISATION AND CONSTRUCTION PHASE IMPACTS

The increased level of urbanization associated with development on site, as well as impacts associated with construction works, are likely to have an impact on ecological values on site. Potential impacts include increased environmental weed invasion, erosion and sedimentation loss impacts, light pollution impacts associated with street and building lighting, and changes to groundwater and surface flows. These potential impacts are discussed below.

4.7.1 Weed invasion and disease

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

The current Submerged Aquatic Herbland EVC wetlands within the dam are relatively weed free; with the exception of the terrestrial margins where Blackberry (**Rubus fruticosus* spp. agg.) has been repeatedly sprayed and where dead canes are visible. The remainder of the project area is moderately to highly affected by weeds, particularly introduced pasture grasses; however, the cover of *Catchment and Land Protection Act 1994* (CaLP Act) listed species, Weeds of National Significance, or other species regarded as highly invasive is currently generally low.

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

4.7.2 Erosion, sedimentation, and water pollutants

Bare ground resulting from clearing, stockpiling, earthworks, or driving vehicles and plant off-road is susceptible to erosion. Given the proximity to the Submerged Aquatic Herbland habitat within the dam, which is staged to be retained until other wetland habitat is established, it is imperative that erosion and sedimentation is carefully controlled. Similarly, there is the potential for an increase in water pollutants in wetlands at or near the project area as a result of construction works or urbanisation of the site, through spills or run-off.

The risk of erosion, sedimentation, and water pollution is highest in the northern sector of the property and in the adjacent Blind Creek riparian corridor. Lack of appropriate erosion, sediment and pollution control may lead to death of aquatic flora and fauna, and resulting impacts to foraging wetland birds (including migratory and/or threatened species), and degradation of the relevant EVCs.

4.7.3 Ecological light pollution

Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution' (Longcore & Rich 2004). Types of ecological light pollution include chronic or periodically increased illumination, unexpected changes in illumination, and direct glare (Longcore & Rich 2004). Light pollution from the project has the potential to impact fauna during the construction phase through use of high-powered artificial lighting for early morning or night work. Following the completion of construction, fauna may be impacted by light pollution on an ongoing basis from streetlights, vehicle headlights, and residential lighting. With regard to construction lighting, night work is not currently expected for the project; any required night work would likely be on an intermittent, short-term basis. Work is also not expected to occur early enough that lights are required. As such, post-construction impacts are expected to be far greater than those of temporary construction lighting.

We note that night-time light pollution levels at the dam are currently high. Figure 6 below provides a pre-dawn photo of the dam and what appears to be security lighting from a neighbouring property south of the wetland development area. Water birds appeared to be accustomed to the lighting regime, however, it is noted that this level of light pollution is not considered to be a natural state, and may be impacting on the natural ecological functions of fauna at this location.

Figure 6. Extant light pollution levels.

Pre-dawn looking south across the dam

4.7.4 Stormwater surface flows

Surficial stormwater flows have the potential to increase erosion across the site, and to direct sediment and chemical pollutants downgradient to the dam. As per Section 4.7.2 above, it is imperative that stormwater flow is carefully controlled to decrease risks of erosion and sedimentation, and to prevent degradation of water quality within the dam. The management of stormwater on site during the construction phase and once the Stage 1 – 7 development is completed is considered in the *Stormwater Management Plan* for this site, with engineering details of the wetland complex provided in the *Sediment Basin and Wetland Layout Plan and Sections* (see also Section 5.2.11 for details).

5. IMPACT MITIGATION

The proposed development of this property is likely to have an impact on the current ecological values on site. Impacts are generally categorized in this instance as the loss of some remnant and regenerating native vegetation and scattered trees, the loss of non-native vegetation and trees, and a partial loss of the extant dam in the northern sector, with attendant losses or reductions in native fauna occurring in or dependent upon these habitats. A process for the mitigation of these impacts is outlined below which includes (at minimum):

- Retention of remnant vegetation and scattered trees wherever practicable;
- Retention of non-native vegetation where practicable;
- Staged redevelopment of the existing dam.

The principal mechanism for the mitigation of impacts, in particular impacts on listed threatened flora and fauna including (but not limited to) Blue-billed Duck, is the establishment or retention of approximately 1.47 hectares of terrestrial habitat, and the construction of 1.75 hectares of aquatic habitat within the wetland development area. This will include the staged development of an open water wetland area, and the replacement of the dam with reed-bed habitat suitable for the breeding purposes of threatened species including Blue-billed Duck, Hardhead, Musk Duck (*Biziura lobata*), and numerous common species that are recorded at this site as resident or intermittent visitors.

Water birds in particular are considered likely to utilise the open water wetland habitat that is to be provided as part of a staged development program (see Section 5.1 for details). Blue-billed Duck are recorded at several constructed wetlands in the region (within 5km) where suitable open-water habitat is made available. Sites include open water wetlands at the Caribbean Gardens, Lakewood Nature Reserve, Karkarook Lake and Jells Park. Male Blue-billed Duck were also recorded at the Braeside Park Wetlands in March 2018 feeding and utilising open water habitat, and were also observed within close proximity (less than 100m) of the constructed viewing platform at the margin of this site (MRPV 2018; personal observations by the author).

The re-development of the dam therefore presents an opportunity to repurpose this site for the provision of stormwater treatment services in conjunction with the provision of habitat for threatened flora and fauna identified on site (see Section 3 for details).

Sections below outline general requirements for the mitigation of impacts on site; detailed design drawings will be developed at a later date and as subject to endorsement by the Responsible Authority as a Planning Permit condition.

5.1 REDEVELOPMENT OF THE DAM

It was identified by Engeny Water Management (2021 & 2017) that maintaining the dam on the site poses a number of engineering challenges associated with the construction of the retarding embankment and outlet structure, proximity to Blind Creek and flooding impacts, overtopping of waters from the dam in the northwest corner, and public safety issues around water depths and retardation failure.

There is an opportunity therefore to mitigate the impacts of the proposed development through an upgrade of the dam and its wall, and the re-development of wetland habitat. This action will be the principal measure adopted on site for the mitigation of impacts associated with the re-purposing of the existing dam area. These actions, and additional measures that can be adopted as part of a Construction Environmental Management Plan (CEMP) for the project, are described in detail below.

5.1.1 Modification of existing wetland (dam) habitat

The dam in the northern sector is known to support the Blue-billed Duck (a species listed as threatened under the *FFG Act 1988 (Vic)*, and endangered under the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013)), and provides habitat for a range of other wetland bird species that were recorded during the current assessment. Furthermore, the dam habitat is potentially suitable for other flora and fauna wetland species of State and National significance, which have a moderate or high likelihood of regular occurrence at the site, including the threatened Hardhead (recorded on site) and Musk Duck (not recorded on site but considered moderately likely to be found on site on an intermittent basis) (see Tables 8 and 9, and Sections 9.3 and 9.4 for details). Any proposal to develop the area must therefore carefully consider how to avoid and minimise impacts to wetland habitat at the site, both during and after construction.

It is noted above that the existing dam on site is not considered to be a safe asset and that works are required to ensure public safety and mitigate against overtopping and downstream flood risks (see also Engeny 2017 for details). A re-design of the dam at the site presents an opportunity to increase the habitat values in the medium to long term through the creation of additional wetlands and reed/marsh areas that are more suitable as breeding habitat for wetland birds; in particular for Blue-billed Duck which prefers dense marginal vegetation and reed-beds for nesting and breeding habitat (Marchant & Higgins 1990). This type of vegetation is currently scarce at the extant dam.

The establishment of reed/marsh habitat areas, as well as improved vegetation conditions at the wetland margins and increased diversity of submergent and emergent vegetation, is also considered likely to benefit a suite of additional threatened and near threatened fauna including (but not limited to):

- Australasian Bittern (*Botaurus poiciloptilus*), Baillon's Crake (*Porzana pusilla palustris*), Latham's Snipe (*Gallinago hardwickii*) and Blue-billed Duck (*Oxyura australis*) – potential to utilise reed-beds and Tall Marsh habitat;
- Australasian Shoveler (*Spatula rhynchotis*), Eastern Great Egret (*Ardea alba modesta*), Hardhead (*Aythya australis*) and Royal Spoonbill (*Platalea regia*) – potential to utilise open-water habitat with vegetated margins;
- Australian Painted Snipe (*Rostratula australis*) – potential to utilise shallow, vegetated wetland margins;
- Azure Kingfisher (*Ceyx azureus*) and Pied Cormorant (*Phalacrocorax varius*) – potential to utilise standing stags or roost sites at the wetland margins.

The following measures are proposed as part of the proposed re-design of the wetland:

- The removal of the existing dam is to be mitigated by the creation of a new wetland complex comprising an interconnected sedimentation basin, stormwater treatment wetland and an open water habitat wetland. The current proposed specifications are for a:
    - **Sedimentation basin** of approximately 1,300 m^2 with dense planting on the banks, fringing vegetation for first four metres from edge of the normal water level, and for the remainder to be deep (up to 1.5-2 m) open water.
    - **Stormwater treatment wetland** (WSUD wetland) of approximately 5,000 m^2 with dense planting on banks, 80% vegetation cover (comprising robust emergent macrophytes) over the full treatment wetland area and several small deep pools of open water.
    - **Open water habitat wetland** of approximately 11,000 m^2 with dense planting on banks above the extended detention depth (EDD) and ephemeral planting within the EDD zone and for 4-5 m inward from the edge of the normal water level. The remainder should be relatively deep open water (up to 2m depth), or a mix of open water with submergent macrophytes and ephemeral vegetation.
- Some key features of the design and staging of the wetland construction to be followed include:
    - The open water habitat wetland is to be constructed and planted at least 12 months prior to any clearance of the current dam. This will ensure that any displaced fauna species have nearby habitat to move into, and that significant plant species from the old (extant) dam can be translocated to the new site.
    - The planting of the new wetlands is to be undertaken in spring and when at 80-90% water capacity, rather than when full, so that the aquatics have time to establish in shallower water before being deeply inundated in the following year. Spring is the ideal time to plant because as the water levels recede leading into summer, the plants will be stimulated into growth by the roots 'chasing' the receding moisture down the wetland profile (Wong *et al* 1999; CSIRO 2006).
    - The open water habitat wetland is to have at least five vegetation zones (CSIRO 2006) for the provision of a range of habitat types based on water depth and the grading of the embankments. If the floor of the wetland is undulating, then the spatial arrangement of zones may be complex. If, however, the floor of the wetland is flat, the zones will appear as roughly concentric, with each zone grading into the next based on water depth.
    - The five vegetation zones are to be generally in accordance with Melbourne Water design standards (Melbourne Water 2017; refer *Wetland Design Manual Part A2 Tables 1-4*) with species as appropriate for this site and as described below.

1) **Open (deep) water zone** (>1.5 metres at full capacity). This zone will be mostly open water with submerged and floating aquatics and will be the most important habitat zone for Blue-billed Duck and other threatened waterbirds such as Hardhead and Musk Duck. Key plant species should include Eel Grass (*Vallisneria australis*), Curly Pondweed (*Potamogeton crispus*), and Blunt Pondweed (*Potamogeton ochreatus*).

2) **Submerged marsh zone** (0.35-1.5 metres). This zone will largely be planted with robust aquatic sedges with patches of aquatic herbs in shallower sections. Note that aquatic sedges will not grow far beyond one meter in depth. Key species should include Tall Spike-sedge (*Eleocharis spathulata*), Course Water-milfoil (*Myriophyllum caput-medusae*), Amphibious Water-milfoil (*Myriophyllum simulans*) and Water-ribbons (*Cycnogeton procerum*).

3) **Deep marsh zone** (0.15-0.35 metres). This zone will mainly be comprised of a band of sedges. Key species should include Fine Twig-sedge (*Baumea arthrophylla*), Tall Rush (*Juncus procerus*), Upright Water Milfoil (*Myriophyllum crispatum*), Running Marsh-flower (*Ornduffia reniformis*), Blunt Pondweed (*Potamogeton cheesemanii*), Mud Dock (*Rumex bidens*) and River Buttercup (*Ranunculus inundatus*).

4) **Shallow marsh zone** (0–0.15 metres). This zone will be planted with a variety of sedges and herbs including Common Swamp Wallaby-grass (*Amphibromus nervosus*), Common Spike-sedge (*Eleocharis acuta*) and White Purslane (*Montia australasica*).

5) **Ephemeral batter zone**: this zone will occupy areas that are approximately 0.2 metres from the waters' edge, will comprise sedgeland, grassland and rushland, and will be ecotonal with the Swampy Woodland remnants and terrestrial revegetation areas. Key species should include Tall Sedge (*Carex appressa*), Fen Sedge (*Carex gaudichaudii*), Tassel Sedge (*Carex fascicularis*), Flecked Flat-sedge (*Cyperus gunnii* ssp. *gunnii*), Hollow Rush (*Juncus amabilis*), Broom Rush (*Juncus sarophorus*) and Common Tussock-grass, (*Poa labillardierei*).

- Planting of the wetland complex is to be responsive to taxa that recruit naturally on site, and is to include, where appropriate, relocation of key flora species that have been identified in the existing dam. The provision of a well-prepared substratum that encourages macrophyte growth, while also controlling weed and non-target plant propagation, is essential. The successful propagation of wetland plants requires an adequate covering of top soil – usually about 20 centimetres – which is to be stabilized using a non-woven, biodegradable geotextile for both weed control and prevention of step-erosion associated with wind fetch (CSIRO 2006; Melbourne Water 2020 (refer Melbourne Water Standard Drawing 7251/08/124)). Planting density is to be adequate for establishment of 80% vegetation coverage within the vegetated zones, and in order to

reduce the risk of weed invasion (Melbourne Water 2017; Wong *et al.* 1999).

- It is important that significant plant species occurring around the current dam are reinstated to the new wetland, either through translocation or propagation, as follows:
    - Floodplain Fireweed (*Senecio campylocarpus*) – this species would be best grown from seed and planted around the edge of the new wetland, extending from the banks into the shallowly submerged mudflats (ephemeral batter to shallow marsh zone).
    - Eel Grass (*Vallisneria australis*) – this species is difficult to grow from seed and so efforts will be taken to translocate as many plants as possible into the new habitat wetland. It is to be planted in areas that will be regularly inundated at a depth of 30-60 cm (open (deep) water to submerged marsh zone).
    - Hairy Knotweed (*Persicaria subsessilis*) – this species could be grown from cuttings or seed and planted around the wetter fringes of the new wetlands (ephemeral batter to shallow marsh zone).
    - Small Mudmat (*Glossostigma elatinoides*) – this species is usually grown by division and could be planted on the shallowly submerged mudflats around the new wetlands (ephemeral batter to shallow marsh zone).
    - Tasmanian Wallaby-grass (*Rytidosperma semiannulare*) – this species would be best grown from seed and planted around the wetter banks (ephemeral batter zone).
    - Hop Wattle (*Acacia stricta*) – The current patch of Hop Wattle will be retained, and in addition, further plants are to be grown from seed and planted around the fringe of the new wetlands (terrestrial margins).
    - Narrow-leaf Cumbungi (*Typha domingensis*) – this species is to be planted in areas that are regularly inundated from 50-100 cm depth (submerged marsh to deep marsh zone).
    - Tree Everlasting *Ozothamnus ferrugineus*) – this species is to be grown from seed and planted around the terrestrial margins of the new wetlands (terrestrial margins).
    - Pale Flax-lily (*Dianella laevis*) – only one plant of this species was recorded on the northern fringe of the current dam. This plant is to be translocated and additional plants grown from seed to plant around the terrestrial margins of the new wetlands (terrestrial margins).
- During the establishment phase of the new wetlands (e.g. first 12 months), sensitive aquatic herbs are to be protected from waterfowl using netting guards. Examples of species that will need this protection include Eel Grass (*Vallisneria australis*) and Water Ribbons *(Cycnogeton procerum*).

- The current dam has a very narrow to no buffer of native vegetation around the majority of its margin, which reduces its habitat values and ability to prevent weed invasion. The new wetlands are therefore to include as large a buffer of indigenous revegetation as possible, for a minimum of 5 m around the perimeters. These buffer areas are to include retention of existing native vegetation wherever possible.

- Terrestrial habitat areas surrounding the open water wetland, sediment pond and WSUD reed-beds are to be revegetated using species that are appropriate to the Swampy Woodland EVC (EVC 937), including Swamp Gum (*Eucalyptus ovata*) and understorey shrubs sourced from local provenance, indigenous seed sources. Planting rates are to be in accordance with DELWP *Minimum standard for revegetation and* supplementary planting (DELWP 2017 Appendix 1).

- Revegetation works are also to be used to control and manage pedestrians and to deter persons and domestic dogs from entering the open water wetland habitat areas using 'prickly' species, such as Hop Wattle (*Acacia stricta*), Prickly Tea-tree (*Leptospermum continentale*) and Sweet Bursaria (*Bursaria spinosa*), and/or by establishing dense thickets using species such as Tree Everlasting (*Ozothamnus ferrugineus*), Swamp Paperbark (*Melaleuca ericifolia*) and Kangaroo Apple (*Solanum laciniatum* and *S. aviculare*).

- Construction of fences, and/or retention of the existing northern property boundary fence, is to be considered for the prevention / control of dogs accessing the open water wetland area.

- Embankments grading into the water are to be constructed with batters that are in accordance with Melbourne Water wetland design and construction best practice guidelines (Melbourne Water 2020; refer to Melbourne Water Standard Drawing 7251/12/006). Transitions between the batters are to be natural with no engineered steps. Biodegradable erosion control geotextiles are to be utilized as necessary to stablise the constructed batters against wave erosion and establishment of 'steps' in the vegetated aquatic margins.

- The ability to manipulate water levels is to be engineered into the inlet and outlet structures for the sediment pond, WSUD reed-bed and open water wetland area and intrinsic to the wetland design. The capacity to manage water flows is important for the following purposes:

    - Management of fill rates to ensure that there is no scouring of substrates within the wetland structures, and in order to ensure adequate water depths for the planting and establishment of vegetated aquatic margins and submergent macrophytes (CSIRO 2006);

    - Facilitation of the isolation of individual pondages for maintenance purposes, and the prevention of sediment loss to down-stream structures during maintenance works (Melbourne Water 2017);

    - Facilitation of natural fill and drain cycles for the maintenance of macrophyte zones through mimicking of seasonal water cycles (Wong *et al.* 1999);

- Facilitation of the management of Gambusia (*Gambusia holbrooki*), an introduced pest fish species, and manipulation of water levels for weed control programs (O'Meara & Darcovich 2015).

- Emergent logs, placed at the margins, are to be utilized to provide underwater snags and basking habitat for frogs and reptiles. There are currently two standing dead trees (stags) in the northern sector of the property which will also be retained as roosting habitat, either within the open water area or at the wetland's eastern margin. Hollows suitable for waterbirds (such as Wood Duck and Pacific Black Duck observed with young at the site) are to be installed at these stags.

- Wood Duck were observed roosting at night on the roof of a small maintenance shed at the southern margin of the existing dam (see also photographs in Section 9.5). There is an opportunity to accommodate this behavior through careful design of the proposed 'bird hide' with provision of a similar roosting structure and/or incorporation of suitable artificial hollows for nesting purposes. The proposed bird hide structure will be at the open water wetland margin (or overhanging) and is therefore considered to be an opportunity to provide habitat diversity for this species and other hollow dependent taxa.

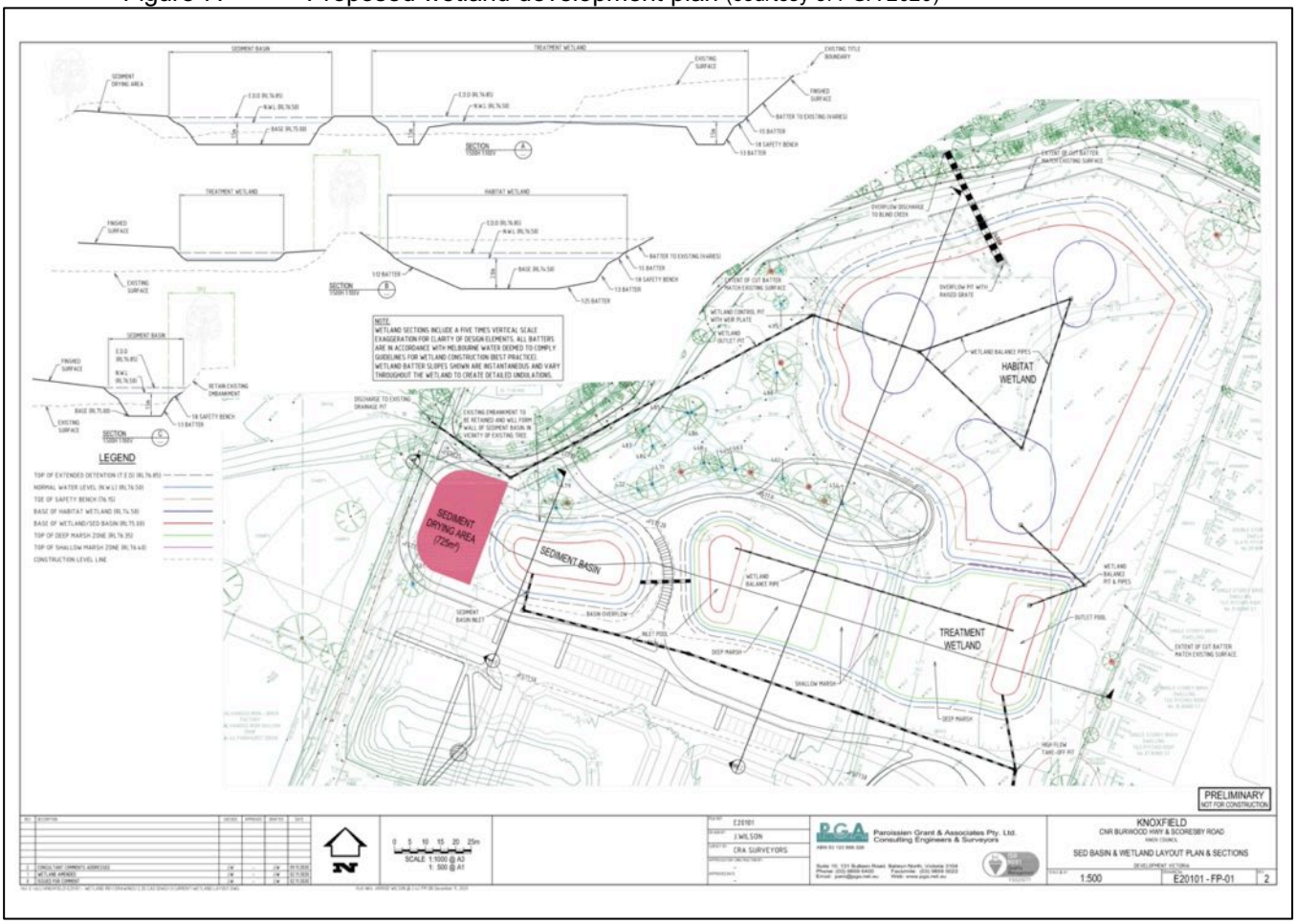
- Walking tracks and passive recreation (e.g. viewing platforms) must not be located within or directly adjacent to the created open water wetlands to minimize disturbance to waterbirds. Shared paths should be located along the southern and western boundary of the site where possible (i.e. not encircling the open water wetlands).

- Major construction works involving use of heavy machinery is to be undertaken outside of the breeding period for Blue-billed Duck, which is subject to seasonal variation but was observed on site as being from late September to early January (not including the raising of ducklings). An ecologist is to be engaged as part of the project's Construction Environmental Management Plan (CEMP – see below) to monitor Blue-billed Duck breeding activity on site. All major construction works are to cease within 50m of the dam from the first observation of Blue-billed Duck pairing activity, through until it can be demonstrated that the breeding period is over (see also Section 5.1.2 for details).

Any proposal to modify or re-design the existing dam must be subject to a detailed Construction Environmental Management Plan (CEMP) that guides the timing and other constraints that are required to minimise biodiversity impacts. Of particular concern is the potential to impact Blue-billed Duck or Hardhead (recorded on-site), and other significant waterfowl that potentially utilise the site. It will be important to incorporate staged removal of existing vegetation and habitat in accordance with the CEMP prepared for the site, and in order to allow wetland fauna to adapt to incrementally changing conditions at the site.

Figure 7 below (reproduced with permission from PGA 2020) provides a concept plan for the wetlands proposed above.

Figure 7. Proposed wetland development plan (courtesy of PGA 2020)



5.1.2 Blue-billed Duck and Hardhead monitoring

Blue-billed Duck were observed pairing on site in mid-October 2017, and again in 2020 from mid- to late-October. It is assumed that mating occurs as a result of the pairing, and that nesting and/or laying activity may also be occurring on site; this despite the paucity of suitable nesting habitat within the existing dam. It is necessary therefore to minimize disturbance on site during the pairing, mating and nesting period and, if Blue-billed Duck ducklings are observed, during the raising and fledging period also. It is also acknowledged that the Blue-billed Duck breeding period can be varied, and not regularly confined to September to November (Marchant & Higgins 1990; see also Section 2.3.3). Monitoring for Blue-billed Duck pairing and breeding behavior should therefore be sufficient to cover the period beginning October until late March[11] annually.

Hardhead were also observed on an intermittent basis on site as individuals and in pairs, and it possible that this species is also pairing and mating on site. We note that no pairs were observed on site for sufficient time to be considered to be nesting successfully, however, the possibility of nesting and laying activity cannot be ruled out for this species. Monitoring for Hardhead breeding activity

[11] A single Blue-billed Duckling was recorded at the dam in early March 2021, considered to be outside of the generally accepted breeding period.

will therefore also be necessary on site and is to be conducted concurrently with the Blue-billed Duck monitoring program outlined below.

The following Blue-billed Duck monitoring schedule is therefore to be implemented on site at the existing dam, and, once constructed and filled, at the open water wetland.

MONITORING MEASURE 1

The Site Manager and/or appointed Environmental Officer is to conduct regular monthly (at minimum) monitoring of Blue-billed Duck activity on the dam for the duration of the Stage 1 – 7 construction program (except at any time that observation is occurring under monitoring measure 2 as detailed below).

The Site Manager and/or appointed Environmental Officer is to be inducted by the project ecologist and trained to identify Blue-billed Duck, and to identify what constitutes pairing and/or signs of disturbance/distress by this species. These monitoring works are to be implemented as a component of the CEMP for the duration of the project.

The project ecologist is to be notified immediately if any Blue-billed Duck pairing activity is observed, and in the event that Blue-billed Duck or any other fauna is displaying signs of disturbance / distress that may be attributable to construction activity. Upon notification, the project ecologist must attend the site as soon as practicable. If the project ecologist confirms that Blue-billed Duck pairing activity is evident, monitoring measure 3 will apply (see below). If the project ecologist confirms that Blue-billed Ducks or any other fauna are displaying signs of disturbance / distress that might be attributable to construction activity, then major construction works within a 50m buffer of the dam are to be halted whilst appropriate mitigation measures are developed by the project ecologist in consultation with Development Victoria.

MONITORING MEASURE 2

In addition to monitoring measure 1 above the project ecologist is to conduct fortnightly (at minimum) monitoring for Blue-billed Duck pairing behavior commencing no later than the beginning of October annually. Fortnightly monitoring is to continue until it can be confirmed that pairing and/or incubation and/or nesting behavior has ceased, and/or until any Blue-billed Ducklings are fledged (no longer under the care of a female) and/or absent from the site.

MONITORING MEASURE 3

If Blue-billed Duck pairing behavior is observed, all major construction works within a 50m buffer of the dam are to be ceased for a minimum period of 6 weeks in order to accommodate an incubation period of 24-26 days (see Section 2.3.3 for details). Light work activity - works not involving the use of heavy machinery such as revegetation of the open water wetland and Swampy Woodland habitat areas, water filling and maintenance of erosion control geotextiles within wetland habitat areas, slashing/mowing of open space areas, and minor utility works of this nature - are permitted unless such works are observed to be affecting Blue-billed Duck behavior on the dam.

The intent of differentiating major construction works, involving the use of heavy machinery, from non-major works, being works conducted by hand or with light vehicles, is to ensure that revegetation of the open water wetlands can occur during the optimal growth period for aquatic flora; being spring and into summer (Wong *et al* 1999; CSIRO 2006).

The Blue-billed Duck monitoring program outlined above is to be conducted by a suitably qualified and experienced ecologist as part of the CEMP. The Blue-billed Duck monitoring period is to commence no later than the beginning of October, and is to be conducted annually until management of the wetlands site is completed and ceded to Council.

All major construction works within 50m of the wetland development area are to cease immediately when/if Blue-billed Duck are engaged in pairing activity, and a works halt is to remain until it can be conclusively demonstrated that the breeding season of this species is finalized and/or ducklings, if present, are fledged. The works halt measures are to be implemented as part of the CEMP.

5.2 GENERAL IMPACT MITIGATION MEASURES

A Construction Environmental Management Plan (CEMP) is required for the mitigation of impacts associated with development of the site and construction of the wetlands. A Construction Environmental Management Plan typically outlines all practicable measures to minimise and mitigate impacts on biodiversity from the construction and operation phase through to the management and maintenance phases. Clear prescriptive guidelines are to be developed that detail how impacts on Matters of National Environmental Significance, State significant species and wildlife protected under the *Wildlife Act 1975 (Vic)* and *Flora and Fauna Guarantee Act 1988 (Vic)* are going to be minimised. This includes, in particular, potential impacts to Blue-billed Duck and other listed threatened flora and fauna taxa.

The CEMP will include, where appropriate, procedures for:

- The staged removal of the existing dam with pre-construction of the proposed wetlands (see Section 5.1.1).
- Detailed design of mitigation measures associated with retention of trees and/or areas of remnant vegetation;
- Staff and contractor inductions to address the location of sensitive biodiversity and their role and responsibilities to the protection and/or minimisation of impacts to all native biodiversity;
- Pre-clearing surveys and fauna salvage/translocation where practical;
- Vegetation clearing protocols;
- Flora and fauna salvage;
- Post-construction monitoring; and
- Rehabilitation and restoration, including:
    - establishing rehabilitation protocols;
    - establishing weed control measures; and

- establishing pest management measures.

The CEMP will include clear objectives and actions including:

- Minimising human interferences to flora and fauna;
- Minimising vegetation clearing/disturbance;
- Minimising impact to threatened species and communities;
- Erosion and sediment control; and
- Handling and storage of hazardous / toxic substances.

The CEMP will therefore cover (at minimum) mitigation measures for impacts associated with the loss of remnant vegetation and scattered trees, the potential for spread within, or introduction to the site of weeds and/or soil pathogens, erosion and sediment loss, light pollution, and the potential for increased pedestrian access to habitat areas (see also Section 5.3 below for details).

5.2.1 Tree and remnant vegetation retention

The majority of the site consists primarily of cleared land that provides limited habitat for native fauna species. However, patches of native vegetation and scattered trees occur throughout the wetland development area; several of these canopy trees also provide hollows for arboreal mammals and birds. All eucalypt-dominated vegetation at the site (including non-indigenous eucalypts), and particularly vegetation that is part of a larger patch of contiguous tree canopy, has some value for arboreal fauna, including bats, possums and birds. This vegetation should therefore be retained as part of the staged development of the dam and retained within the wetland development area for its habitat values.

Native vegetation and habitat areas that are to be retained on site are to be clearly demarcated to avoid any inadvertent or unapproved clearing or damage to areas outside of Permitted works areas. Conservation zones are to be established prior to commencement of works, and as appropriate for the phased revegetation and restoration of habitat areas, and maintained during the works program and development of the wetland complex.

To ensure that any vegetation that is to be retained is not damaged or inadvertently removed during the works program, the following steps are to be taken into consideration:

- Installation of temporary star pickets with white poly-pipe covers to demarcate conservation zone areas on site;
- Installation of temporary fencing adjacent to vegetation that is to be retained and around any large trees that are to be retained whilst native vegetation and habitat clearing works are underway and/or for the development of the open water wetland, the wetland complex in general and/or associated access routes;
- Avoidance of disturbance of the root zones of trees to be retained (feeder-root zones generally extend to the edge of the canopy plus half the radius of the canopy again);

- Briefing of contractors regarding the need to adhere to vegetation protection plans;
- Selection of the appropriate type and size of machine so that disturbance and impact to vegetation is minimised and the chances of successful rehabilitation (if applicable) are enhanced; and
- Adherence to any other construction mitigation requirements outlined by the consultant arborist.

'Conservation zones' must be well defined visually using star pickets with white poly-pipe covers within the Permitted development area, and must be identified to all works crew as part of an induction undertaken on site. Permissible works areas are also to be clearly identified on working plans and within site development schedules. Construction activity and vehicles are to remain within a defined 'Limits of Works' identified on plans prior to commencement of works, and the painted star pickets identifying the 'Limit of Works' are to be serviced and maintained throughout the duration of the development program.

5.2.2 Tree and remnant vegetation removal

A total area of 1.681 hectares of Submerged Aquatic Herbland from the existing dam will be lost as part of the staged redevelopment of this site; this loss is unavoidable and will therefore be Offset in accordance with the *Guidelines 2017* Offset policy (see Section 6.3 for details). An Allocated Credit Extract from a third-party Offset Site will be sourced through the DELWP Offset Credit Register as mitigation of these losses and to ensure that there is 'no net loss' of biodiversity associated with these impacts.

Every effort will be made to ensure that canopy trees and Swampy Woodland habitat is retained on the dam's embankment and surrounding the wetland complex. In the event that a canopy tree cannot be retained due to poor health or structural condition (see *Arborist Assessment* report for details), then individual trees that are designated for removal must be assessed for their potential to support arboreal birds and mammals (including an assessment of hollows and fissures). Trees deemed habitat for arboreal species must be removed in a manner that allows for the relocation of fauna to nearby suitable habitat or replacement nesting boxes that are installed prior to tree removal.

A fauna relocation and salvage plan is to be incorporated into a CEMP for the site, which guides the mitigation of impacts to arboreal mammals, bats and birds. The following steps are an example of the types of mitigation measures that are to be deployed by an arborist, under the supervision of an appropriately qualified zoologist during the tree removal works:

- Engagement of a suitably qualified, experienced and licensed contractor to oversee the salvage and relocation program being conducted on site.
- Visual identification of any tree hollows, trunk fissures and/or loose bark habitat, by climbing the tree prior to removal.
- Gentle knocking of the tree with a sledge hammer or excavator bucket in an effort to expel any fauna residing in the tree hollows.

- Cutting of upper branches to a minimum diameter of 150 mm, taking care to avoid cutting within approximately 1 m of any hollows or fissures where possible (regardless of hollow size).
- Lowering branches containing visible hollows to the ground with rope (instead of allowing branches to fall to the ground) to avoid injuring animals that may be residing inside the hollows.
- Leaving all cut branches (minimum 150 mm diameter) and felled trees lying on the ground for a minimum of 48 hours, to allow animals to find alternative habitat in nearby habitat or installed nest boxes.
- Capture of immature or injured fauna by a qualified zoologist or wildlife carer, for assessment to determine whether to relocate the animal to suitable nearby habitat, or transport the animals to suitable veterinary treatment facilities.

5.2.3 Aquatic fauna relocation

An aquatic fauna relocation and salvage plan is to be incorporated into a CEMP for the site, which guides the mitigation of impacts associated with the re-development of the dam for fish, amphibians and reptiles. The following steps are an example of the types of mitigation measures that are to be deployed by an aquatic ecologist during the draining of the dam:

- Engagement of a suitably qualified, experienced and licensed contractor to oversee the salvage and relocation program being conducted on site.
- Pumping of water from the dam to the adjacent open water wetlands, taking care to employ a sieve for the prevention of injury to fish or other aquatic fauna present within the waters, and ensuring that there are no water-fowl within the proximity of the pump head, the discharge point, or pump unit.
- Visually ensuring, when water levels are lowered, that there are no impacts on aquatic fauna such as fish, turtles (Eastern Snake-necked Turtle was observed on site), reptiles or macro-invertebrates (such as native freshwater crayfish).
- Salvage and relocation of any native fauna that are trapped in the lowered water levels in the dam to the adjacent open water wetlands, taking care to ensure that any sick or injured fauna are treated and cared for by qualified wildlife handlers.
- Monitoring the open water wetland area post-transfer to ensure that there are no injured or distressed fauna within the dam site or wetland areas; ensuring that any injured fauna are treated and cared for by qualified wildlife handlers.

5.2.4 Minimising damage to trees

There are native vegetation patches and scattered trees within the wetland development area which are to be retained on site. To prevent detrimental impacts to trees, the *Australian Standard for protection of trees on development*

sites (AS4970-2009) (Standards Australia 2009) and the *Australian Standard for pruning of amenity trees* (AS4373-2007) (Standards Australia 2007) are to be followed during construction.

Trenching and drilling works within Tree Protection Zones (TPZs; as defined in the standards) should be avoided; however, an encroachment of up to 10% of the TPZ without the need for an arborist assessment of the tree's future viability is permitted, as per *Defining an acceptable distance for tree retention during construction works* (DSE 2011). If the works are to be conducted inside more than 10% of a TPZ and/or within the Structural Root Zone (SRZ) of a tree, an arborist will be required to conduct a root investigation to determine if the tree will remain viable. Otherwise the tree will be considered 'removed' for the purposes of the *Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines* (DEPI 2014), and will require a Native Vegetation Offset in accordance with the policy.

Appropriate TPZ fences are to be installed in consultation with an arborist around all trees that are to be retained on site. The TPZ fences must be erected at the extent of each tree's TPZ or at no less than two meters in radius around the tree to be protected.

5.2.5 Revegetation and landscaping

The prompt establishment of a Submerged Aquatic Herbland within the constructed open water wetland area will be a major contributing factor to the successful mitigation of impacts associated with re-purposing of the dam. The establishment of a cover of Eel Grass (*Vallisneria australis*) in particular will be important, as this is an important food source for Blue-billed Duck at this location. The sooner the open water wetland can be constructed, the sooner it can be filled and revegetated with Eel Grass and other EVC-appropriate herbs. Construction of the open water wetland therefore should be a priority in order to maximise the available establishment time for habitat elements at this location.

It is our experience that aquatic flora can be established rapidly within constructed wetlands when the following processes can be achieved:

1. Construction of the water body mid-year with concurrent stabilisation using biodegradable geotextiles.
2. This is followed by filling, leaving time for the waters to settle and temperatures to stabilize.
3. Once filled the wetlands are then to be revegetated generally in accordance with Melbourne Water's planting density standards (Melbourne Water 2017 *Wetland Design Manual Part A2*); planting should also include the use of netting to protect young plants against browsing by waterbirds.
4. Planting of the wetlands should ideally occur during spring to early summer when waters are warmer and after settling, and once the soil moisture profile is suitable; revegetation works are also required to accommodate the Blue-billed Duck breeding season (as monitored on site, see Section 5.1.2 for details).

The relocation of Eel Grass from the existing dam will also facilitate establishment of the open water wetland and maintenance of Blue-billed Duck

habitat requirements during the whole of the construction schedule. Details of wetland structure and establishment requirements are provided in Section 5.1.1 above.

Revegetation of terrestrial Swampy Woodland habitat is required within the understorey and groundstorey of patches and scattered trees north of the dam and its embankment. The establishment of EVC appropriate flora, at appropriate canopy cover rates, is important to ensure that these sites will improve and provide habitat for the site's flora and fauna, and to help mitigate against impacts associated with the development of the wetland complex. Revegetation can also help with the establishment or maintenance of buffer zones, with the control of environmental weeds, and with the improvement of aesthetics on site.

The following table sets out revegetation targets for the establishment of Swampy Woodland revegetation areas, as specified in Appendix 1 of Victoria's *Native Vegetation Gain Scoring Manual (version 2)* (DELWP 2017).

Table 12. Swampy Woodland revegetation template

LIFE-FORM	COMMON NAME	REVEGETATION ESTABLISHMENT TARGET
Canopy tree	Swamp Gum (*Eucalyptus ovata*)	50 plants per hectare ^
Understorey tree / shrub	Blackwood *(Acacia melanoxylon)*	50 plants per hectare ^
Medium / small shrubs	Prickly Tea-tree (*Leptospermum continentale*)	800 plants per hectare ^
	Swamp Paperbark (*Melaleuca ericifolia*)	
	Hop Wattle (*Acacia stricta*)	
	Tree Everlasting (*Ozothamnus ferrugineus*)	
Large graminoids	Red-fruit Saw-sedge (*Gahnia sieberiana*)	3,500 plants per hectare ^
	Common Tussock-grass (*Poa labillardierei*)	
	Thatch Saw-sedge (*Gahnia radula*)	
	Tall Sedge (*Carex appressa*)	
^ natural recruits count towards the revegetation targets.		

Any revegetation works conducted on site can include species as listed above, or species which are appropriate to the Swampy Woodland EVC (EVC 937) and as available from a reputable, local indigenous plant nursery. Revegetation works are to be conducted by an appropriately licensed and experienced contractor.

5.2.6 Weed and soil pathogen control

Bare ground exposed by development works is particularly susceptible to invasion by weeds and soil pathogens. One of the most common forms of introduction is from weed seeds contained within mud on vehicle tyres being deposited into disturbed areas. Without effective weed hygiene, vehicles have

the potential to introduce new weeds and pathogens that were not present prior to construction.

To ensure that weeds and diseases are not brought onto work sites, or existing weeds and diseases (if they occur) are not spread to other sites, the following steps are to be taken:

- Prepare a contractor environmental hygiene manual (or follow an existing one) outlining the necessary actions required to prevent weeds and diseases entering and/or leaving the site including:
    - All machinery and vehicles are to be free of weed propagules and/or material carrying potential diseases prior to commencement of work;
    - If possible, begin work in areas close to native vegetation and move to areas dominated by introduced species, and ensure machinery is thoroughly cleaned between sites.

It will also be necessary to ensure that environmental weeds are not established during the construction phase of the open water wetland, sediment pond or WSUD reed-bed. Nut-grass (*Cyperus eragrostis*) in particular will establish rapidly where exposed, wet soils are present. Newly constructed wetland basins should therefore be stabilised with a biodegradable geotextile to not only protect against wave erosion, but also the establishment of weeds at the aquatic margins.

Monitoring for, and implementation of prompt controls in response to weeds introduced on site, will be necessary therefore during the construction and establishment phase of the wetland development works. These management requirements are to be included in a CEMP, developed prior to construction taking place.

5.2.7 Fox and cat controls

European Fox (*Vulpes Vulpes*) was recorded regularly on site during the recent surveys (see Section 9.2 for details); feral cat (*Felis catus*) is also considered likely to be present on site. The development of Stage 1 – 7 and an increase in pedestrian activity within the wetland development area is considered likely to also result in an increase in cat and domestic dog (*Canis lupus familiaris*) activity.

These introduced predators are considered likely to be having an impact on fauna, and may be having an impact on the Blue-billed Duck population at the dam. Successful control of introduced predators is likely to result in reduced predation activity on site, which is likely to directly benefit the Blue-billed Duck population and its long-term population viability. Responsive control measures are therefore to be promptly implemented within the wetland development area should these, or other feral species, be identified during the monitoring programs.

Fox control measures will be implemented annually for a period of not less than 2 years and/or until transfer of the asset to Council and will include alternative and complementary control options for vertebrate pest species including shooting and trapping, and the use of repellents or other poisons. We recommend investigation of the use of Canid Pest-ejectors which bury and tether baits to a depth of 8-10 cm, as well as consideration of the use of pre-

baiting trials, with non-toxic baits buried at marked stations, to identify animals visiting the stations. Poison baits should be placed only in those stations not visited by non-target animals. Further details of DAWE's approved threat abatement plans and best practice guidelines for fox and feral cat control methodologies are available online (DAWE 2020[12]).

An integrated approach to pest animal management adopting a combination of control techniques will achieve the best outcomes since different methods will target different sections of the pest populations at different times. All care must be taken to avoid off-target impacts or inadvertent harm to native fauna. Regardless of the control option(s) used, these must be the most effective, safe and humane methods available.

Control measures for fox, cat, dog and any other identified predator are to be implemented as part of the CEMP, and are to include options such as (but not limited to) the following:

- Prompt removal of identified fox dens or surface harbor, including fumigation to be applied where appropriate by a licensed, qualified and experienced pest exterminator;
- Use of a licensed, qualified and experienced professional shooter for spot-light control of foxes, and/or, where appropriate, deployment of Canid Pest-ejectors;
- Application of humane trapping and disposal techniques for feral cats;
- Maintenance of a 'dogs on leads' policy for all areas within proximity of the open water wetland and wetland development area in general;
- Promotion of a 'cats inside' policy for the urban development areas.

5.2.8 Erosion control

Areas of exposed and de-stabilised soil will inevitably be created during the construction process as a result of excavation and trenching. Erosion mitigation measures are to be applied to prevent the movement of soil off the proposed construction sites. This includes drainage lines in the study area; sediment-laden run-off should be minimised in these areas. While vegetation provides the most effective form of erosion control, there will need to be interim measures applied. A wide variety of soil erosion techniques can be applied using a range of materials such as erosion control geotextiles and rock aggregates.

Throughout the study area, a number of principles should be applied in order to avoid erosion. These include:

- Limiting machinery and earthworks to construction areas only;
- Limiting the exposure of disturbed soil for the shortest possible time (e.g., do not clear an area prior to a weekend if rain is forecast);
- Diverting water away from exposed soil or loose material;

[12] http://www.environment.gov.au/biodiversity/threatened/tap-approved.html

- Applying temporary silt trapping techniques, particularly near the existing dam prior to establishment of the wetlands;
- Retaining the natural drainage lines of the sites as much as possible.

These management requirements are to be included in a CEMP, developed prior to construction taking place.

5.2.9 Maintenance and pedestrian access

An access track is required for the maintenance of the sediment pond (see Figure 7 above for details) and the constructed wetlands. Similarly, pedestrian access linking the development area to the Blind Creek riparian corridor and open space is required as part of the development of the site. Much of the proposed wetlands to be constructed on site, however, will ultimately serve as provision of habitat for threatened flora and fauna, in particular as habitat for Blue-billed Duck. Pedestrian access to these habitat sites is therefore to be carefully managed such that increased activity does not detrimentally impact on waterbird foraging and breeding activity.

It will be necessary therefore to manage pedestrians (and their dogs) through the use of natural measures such as:

- Use of dense plantings of prickly, sclerophyllous shrubs at the margins of the wetland to provide a physical deterrent to access and a buffer to habitat areas;
- Clearly defined access pathways with bollards and rope/cable barriers to direct pedestrian movement and deter off-track walking;
- Use of pathway lighting that is sensitive to light-spill impacts (see Section 5.2.10 for details);
- Signage reminding pedestrians that they are within the proximity of Blue-billed Duck and threatened waterbird habitat areas, and that dogs are to remain on leads at all times when in proximity of the wetlands;
- Implementation of a ‘cat and dog curfew’ policy across the estate with signage reminding patrons that it is their responsibility to ensure that pets are not unattended within the wetland habitat areas.

These management requirements are to be included in a CEMP, developed prior to construction taking place.

5.2.10 Light pollution

Light pollution and light spill impacts are identified as a potential threat to the site’s fauna. Consideration of lighting design, the location, direction and placement of construction lighting, and/or placement and direction of permanent streetlighting will therefore be required for the project to ensure that there is no inadvertent light pollution or light spill impacts. These considerations include (at minimum) confining light spread by using directional lighting, lowered lighting and/or screening to direct light away from habitat areas, thereby reducing impacts to wildlife (Gleeson & Gleeson 2012). Controls that may be appropriate include the use of hoods or shields on construction lighting, early installation of noise-walls aimed at mitigation of both noise and light-spill impacts, and the

careful siting and orientation of street lights directed away from ecological assets such as the wetlands and areas of retained habitat.

Densely planted vegetation around the wetlands is to be utilised to prevent light spill into this environment, and may help prevent light-attracted species such as bats from being drawn to the lights to feed off insects. Consideration of lighting placed at a lower elevation and at a lower luminosity is also required.

These management requirements are to be included in a CEMP, developed prior to construction taking place.

5.2.11 Stormwater, and protection of wetland habitats

There is potential during the construction phase to impact the existing dam and, once constructed, the wetlands. Impact avoidance and mitigation measures are therefore required throughout the construction period.

- Installation and maintenance of erosion and sedimentation controls are to be in accordance with the Victorian Environment Protection Authority (EPA) best practice guidelines including *Environmental Guidelines for Major Construction Sites (1996)* (EPA 1996 publication number 480) and *Construction Techniques for Sediment Pollution Control (1991)* (EPA 1991 publication number 275).
- Erosion and sediment controls must be adaptive and may require variations as works progress. Implementation will be conducted in accordance with the *Demonstrating Best Practice* (EPA 2017 publication number 1517.1) EPA guidelines. Controls need to be monitored on a weekly basis at minimum, and additionally during and after rain events. Any defects or deficiencies in control measures identified by monitoring shall be rectified immediately. Control measures shall be cleaned, repaired and augmented as required to ensure effective control thereafter.
- Refilling of vehicles and machinery shall be done in a designated area no closer than 100 metres from any areas of retained vegetation or habitat or surface / stormwater drainage systems to any wetland area or the Blind Creek waterway.
- Fuel and chemical are to be bunded to EPA guidelines and stored outside of flood zones. A contingency plan shall address containment, treatment and disposal of any spill.
- During works, clear communication must be made to construction personnel of expected mitigation measures and the importance to maintaining ecological values. Direct disturbance such as unplanned movement of construction equipment or indirect disturbances such as spills from machinery which could have a detrimental effect on retained vegetation or habitat areas or aquatic habitat are to be immediately rectified and measures put in place to prevent reoccurrences.
- Contractors are to be provided clear instructions regarding reporting requirements around accidents (disturbance to aquatic habitat) that may impact on wetlands or Blind Creek. A chain of command between construction personnel, Development Victoria and a qualified biologist is

required for the reporting of problems and to provide immediate, appropriate on-ground responses.

- Monitoring following an incident will comprise an aquatic survey (if deemed necessary) and appropriate water quality sampling to confirm the extent of the disturbance to aquatic habitat. For spillages, post incident monitoring will be repeated at weekly intervals until the contaminant is no longer considered to be a threat. Monitoring will be performed by a suitably qualified aquatic biologist. An interpretative report will be prepared for each monitoring exercise and distributed to Development Victoria and the project ecologist.

These management requirements are to be included in a CEMP, developed prior to construction taking place.

5.3 GENERAL CONSTRUCTION ENVIROMENTAL MANAGEMENT PLAN REQUIREMENTS

Many of the site management requirements outlined above are to be implemented as part of a CEMP for the wetland development area. Standard CEMP measures, such as site inductions for contractors and visitors, Blue-billed Duck identification and 'no harm' protocols, will also be included in the CEMP as required to ensure that the work site is safe, and that there are no inadvertent impacts outside of Permitted works.

The final CEMP will be subject to endorsement by Council as a Permit condition, since details of the CEMP cannot be provided until such time that a development plan is finalised. The CEMP will however incorporate the following as minimum standards, with details to be determined in consultation with the project team and Council.

- Development and implementation of induction programs for the identification of significant species and significance habitat areas on site that are to be conserved;
- Monitoring of the Blue-billed Duck population on site and implementation of 'stop work' protocols as required to ensure there are no significant disturbances during the breeding season;
- Monitoring of the wetland development area to ensure that there are no inadvertent impacts (e.g. sediment impacts or unauthorized construction impacts) on the existing dam during the construction of the open water wetland area and development of Stages 1 – 7 (see also accompanying Stages 1 – 7 development report (Ecocentric in preparation));
- Provision of open water wetland habitat through the staged development of the wetland complex prior to commencement of works within the dam;
- Development and implementation of aquatic flora and fauna relocation protocols for transfer (if required) to the open water wetland area;
- Details of protection measures associated with retention of native vegetation and/or areas of remnant vegetation and the protection of the dam during staged development of the wetland complex;

- Details of protection measures associated with retention of Swampy Woodland habitat and scattered trees within the wetland development area;
- Fencing and demarcation requirements that clearly identify conservation areas and scattered trees that are to be retained on site, carefully allowing for:
    - Access corridors for the construction of the open water wetland;
    - Machinery storage and maintenance areas;
    - Chemical storage areas and bunding;
- Conservation areas must be well defined visually using star pickets with white poly-pipe covers within the Permitted development area, and must be identified to all works crew as part of an induction undertaken on site;
- Monitoring programs aimed at ensuring that fences are maintained during the construction period, and that there are no unauthorised incursions to conservation areas or impacts on retained native vegetation and habitat;
- Revegetation and conservation protocols to be adopted within the conservation areas and at the base of retained scattered trees, and across the property as part of any revegetation and/or landscaping programs;
- Control and eradication programs aimed at ensuring that there is no unnecessary spread of environmental weed species (exotic flora (introduced to Victoria) which have naturalised with capacity to dominate native vegetation habitat areas) or pathogens within the property or to neighbouring properties;
- Development and implementation of fox and, as required, feral cat control programs;
- General erosion control protocols aimed at ensuring that there are no unintentional impacts associated with sediment losses on site to conservation areas or retained scattered trees.

The CEMP is to be developed once a development plan has been finalized, and then endorsed by Council as the Responsible Authority.

6. LEGISLATIVE AND POLICY IMPLICATIONS

6.1 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action will require approval from the Federal Environment Minister if the action has, will have, or is likely to have a significant impact on a matter of national environmental significance.

Documentation on the referral process, including documentation requirements, can be obtained by contacting the Department of the Environment's Community Information Unit on (02) 6274 1111, or by accessing the EPBC website.

Two threatened ecological communities*, Natural Damp Grassland of the Victorian Coastal Plains* and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, both Critically Endangered, were nominated by the Protected Matters Search Tool (DAWE 2020) as being likely to occur within the development area. Neither of these vegetation communities were identified on site. Furthermore, the predominant remnant canopy trees found on site, namely Mealy Stringybark (*Eucalyptus cephalocarpa* s.s.) and Swamp Gum (*Eucalyptus ovata*)*,* are not indicative of either of these communities.

Four fauna taxa listed as threatened under the EPBC Act were either recorded flying over the site, or identified as species which may utilize the site on an intermittent basis. These species include:

- Australasian Bittern (*Botaurus poiciloptilus*), which may make occasional use of the wetland at the site foraging at the margins and/or within grass pastures adjacent.
- Swift Parrot (*Lathamus discolor*), which may occasionally forage on flowering eucalypts at the site during migration between Tasmania and the mainland. It is unlikely that the species regularly utilises habitat at the site or is reliant upon it.
- Australian Painted Snipe (*Rostratula australis*), which may make occasional use of the wetland at the site foraging at the margins and/or within grass pastures adjacent.
- Grey-headed Flying-fox (*Pteropus poliocephalus*), which appears to periodically fly over the site, and may occasionally feed on flowering eucalypts within the study area. However, the relatively small number of eucalypts at the site and the high mobility of this species suggests that the Grey-headed Flying-fox is unlikely to be reliant upon habitat at the site.

The Federal *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Department of the Environment 2013) sets out the process for undertaking a 'self-assessment' to decide whether or not a proposed action is likely to have a significant impact on any Matters of National Environmental Significance (MNES). Processes deemed to be potential 'significant impacts' are identified at each of the conservation significance levels in the Guidelines in order to facilitate this process.

Tables 13-16 below set out 'significant impact criteria' as for Endangered and Vulnerable fauna identified under the EPBC Act 1999 (Cwlth) (Department of the Environment 2013). The impact criteria have been considered in relation to each of the four species which may make occasional use of habitat values on site, and in the context of the proposed development and ecological values that may be impacted.

Table 13. EPBC Act Significant Impact Criteria - Australasian Bittern

Significant impact criteria	Assessment of impacts
Lead to a long-term decrease in the size of a population of a species; where a 'population' as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations, or • a population, or collection of local populations, that occurs within a particular bioregion. This may include populations identified as such in recovery plans, and/or that are: • Key source populations either for breeding or dispersal; • Populations that are necessary for maintaining genetic diversity; and/or • Populations that are near the limit of the species range.	The site has a low likelihood of the Australasian Bittern occurring, and is considered highly unlikely to support a population of this species; this is attributable to the relatively small amount and low quality of habitat on site. The loss of the dam on the site would be highly unlikely to lead to a long-term decrease in the size of the Australasian Bittern population. We note that the proposed redevelopment of the site includes a net increase in the area of potential habitat (i.e. potentially suitable wetland habitat), including vegetation types and structure that are favourable for this species and which are currently largely absent from the site.
Reduce the area of occupancy of the species.	As noted above, the site is not considered likely to support the Australasian Bittern, and any works on site are not considered likely to have a significant impact in the context of available habitat for this species (approx. 1,150 km^2; Threatened Species Scientific Committee 2011). The establishment of open water wetlands and the wetland complex in general is also considered likely to be an improvement of habitat availability for this species in the longer term.
Fragment an existing population into two or more populations.	As noted above, the site is not considered likely to support the Australasian Bittern. If the species does periodically utilise wetland habitat at the site, the loss of the wetland may increase fragmentation in the landscape to some extent. However, given the low quality of the habitat for this species and that the loss of it will be temporary, the proposed action is unlikely to fragment an existing population into two or more populations.

Significant impact criteria	Assessment of impacts
Adversely affect habitat critical to the survival of a species, where 'habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • For activities such as foraging, breeding, roosting, or dispersal; • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); • To maintain genetic diversity and long term evolutionary development; or, • For the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	Habitat values in and surrounding the wetland are relatively low for the Australasian Bittern (e.g. general lack of emergent vegetation), and does not constitute habitat that is necessary for foraging, breeding, roosting or dispersal. The site is not considered necessary for the long-term maintenance of the species or associated genetic processes, and does not constitute an area that is necessary for the reintroduction of a population; we note, however, that the proposed increase in size and quality of the habitat for this species under the proposed action may be beneficial in one or more aspects of the species' ecology. The temporary loss of the wetland is therefore not considered to adversely affect habitat that is critical to the survival of the species.
Disrupt the breeding cycle of a population.	As noted above, the species is considered unlikely to regularly occur at the site, and combined with the generally low quality of habitat present, the likelihood of successful breeding occurring and being disrupted is considered very low.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	As noted above, habitat values in and surrounding the wetland are relatively low for the Australasian Bittern (e.g. general lack of emergent vegetation), and does not constitute habitat considered important for foraging, breeding, roosting or dispersal. The alteration of potential habitat at the site is unlikely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The majority of the site is proposed to be developed and there will be no increase in invasive species spread post-construction; weed taxa will be controlled on site during construction. Weed spread to the Blind Creek riparian corridor will be prevented through implementation of a Site or Construction Environmental Management Plan during development. With the exception of the Blind Creek there are limited habitat areas adjacent to this site and there is unlikely to be an increase in invasive species distribution within nearby habitat sites as a result of the proposed action.
Introduce disease that may cause the species to decline.	There is a low likelihood of the species occurring at the site, as well as a lack of evidence for the introduction of disease to this species from such actions; hence it is unlikely that a novel disease would be introduced from the proposed action that would result in the decline of the species.

Significant impact criteria	Assessment of impacts
Interfere with the recovery of the species.	There is currently no recovery plan for this species. It is unlikely that the proposed action would interfere with any future actions for the recovery of the species. We note again the increase in the extent and quality of wetland habitat for this species under the proposed action.

Table 14. EPBC Act Significant Impact Criteria – Swift Parrot

Significant impact criteria	Assessment of impacts
Lead to a long-term decrease in the size of a population of a species; where a 'population' as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations, or • a population, or collection of local populations, that occurs within a particular bioregion. This may include populations identified as such in recovery plans, and/or that are: • Key source populations either for breeding or dispersal; • Populations that are necessary for maintaining genetic diversity; and/or • Populations that are near the limit of the species range.	The site may be periodically utilised by Swift Parrots for foraging during migrations between Tasmania and the mainland (particularly central/northern Victoria and NSW). However, given the availability of a range of eucalypt species in the broader landscape and the variability of Swift Parrot movements, the species is unlikely to be reliant upon the site for foraging; hence, the proposed removal of native and exotic eucalypts, many of which were planted and generally provide limited foraging and nesting resources (see below), is considered unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species.	As noted above, the site may periodically provide foraging resources for the species, but is unlikely to be regularly occupied. The majority of eucalypt trees present within the wetland development area are not considered key tree species for the Swift Parrot in the species' recovery plan (Saunders & Tzaros 2011), and there are relatively few hollows recorded on the site that would support potential shelter habitat for the species. Hence the proposed action is considered unlikely to reduce the area of occupancy for the species.
Fragment an existing population into two or more populations.	As noted above, given the availability of a range of eucalypt species in the broader landscape, the mobility of the species and variability of their movements, and the limited amount of foraging and nesting resources provided at the site, the species is unlikely to be reliant upon the site for foraging; hence, the development of the wetland area is considered unlikely to fragment an existing population.

Significant impact criteria	Assessment of impacts
Adversely affect habitat critical to the survival of a species, where 'habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • For activities such as foraging, breeding, roosting, or dispersal; • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); • To maintain genetic diversity and long term evolutionary development; or, • For the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	As noted above, the site does not constitute habitat that is necessary for the breeding or roosting of the species based on its location and low quality of breeding/roosting habitat, and is unlikely to be necessary for foraging or dispersal due to the generally limited availability of food resources and the movement patterns of the species. While the site may be utilised occasionally for foraging, i.e. whilst eucalypts are in flower, the site is not considered necessary for the long-term maintenance of the species or associated genetic processes, and does not constitute an area that is necessary for the reintroduction of a population.
Disrupt the breeding cycle of a population.	As noted above, the species is considered unlikely to be reliant upon or to breed at the site; combined with the relatively limited habitat resources present, the likelihood of successful breeding occurring and being disrupted is considered very low.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	As noted above, habitat values at the site are relatively low for the Swift Parrot, and it is unlikely to be considered important for foraging, breeding, roosting or dispersal. The alteration of potential habitat at the site is unlikely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The majority of the site is proposed to be developed and there will be no increase in invasive species spread post-construction; weed taxa will be controlled on site during construction. There is unlikely to be an increase in invasive species distribution within nearby habitat sites as a result of the proposed action.
Introduce disease that may cause the species to decline.	There is a low likelihood of the species occurring at the site, as well as a general lack of evidence for the introduction of disease (such as Psittacine Beak and Feather disease) to this species from such actions; hence it is unlikely that a novel disease would be introduced from the proposed action that would result in the decline of the species.
Interfere with the recovery of the species.	The site does not constitute 'priority habitat' under the Swift Parrot Recovery Plan, and the proposed action does not interfere with any the measures outlined in the recovery plan (Saunders & Tzaros 2011).

Table 15. EPBC Act Significant Impact Criteria – Australian Painted Snipe

Significant impact criteria	Assessment of impacts
Lead to a long-term decrease in the size of a population of a species; where a 'population' as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations, or • a population, or collection of local populations, that occurs within a particular bioregion. This may include populations identified as such in recovery plans, and/or that are: • Key source populations either for breeding or dispersal; • Populations that are necessary for maintaining genetic diversity; and/or • Populations that are near the limit of the species range.	The site has a low likelihood of the Australian Painted Snipe occurring, and is considered highly unlikely to support a population of this species; this is attributable to the relatively small amount and low quality of habitat on site (e.g. very limited availability of shallow water areas), and the low regional population base of this species. The loss of the dam on the site would be highly unlikely to lead to a long-term decrease in the size of the population. We note that the proposed redevelopment of the site includes a net increase in the area of potential habitat (i.e. potentially suitable wetland habitat), including water depths and vegetation types that are favourable for this species and which are currently largely absent from the site.
Reduce the area of occupancy of the species.	As noted above, the site is not considered likely to support the Australian Painted Snipe. Furthermore, if the species were present, the loss of (approx.) 1.5 hectares of relatively low quality habitat would not be considered significant in and of itself in the context of available habitat for this species (approx. 2,000 km^2; Threatened Species Scientific Committee 2013).
Fragment an existing population into two or more populations.	As noted above, the site is not considered likely to support the Australian Painted Snipe. If the species does periodically utilise wetland habitat at the site, the loss of the wetland may increase fragmentation in the landscape to some extent. However, given the low quality and limited extent of the habitat for this species, and that the loss of habitat will be temporary, the proposed action is unlikely to fragment an existing population into two or more populations.

Significant impact criteria	Assessment of impacts
Adversely affect habitat critical to the survival of a species, where 'habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • For activities such as foraging, breeding, roosting, or dispersal; • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); • To maintain genetic diversity and long term evolutionary development; or, • For the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	Habitat values in and surrounding the wetland are relatively low for the Australian Painted Snipe (e.g. general lack of shallow areas and emergent vegetation), and the site does not constitute habitat that is necessary for foraging, breeding, roosting or dispersal. The site is not considered necessary for the long-term maintenance of the species or associated genetic processes, and does not constitute an area that is necessary for the reintroduction of a population. We note, however, that the proposed increase in size and quality of wetland habitat under the proposed action may be beneficial in one or more ways for this species. The temporary loss of the wetland is therefore not considered to adversely affect habitat that is critical to the survival of the species.
Disrupt the breeding cycle of a population.	As noted above, the species is considered unlikely to regularly occur at the site, and combined with the generally low quality of habitat present, the likelihood of successful breeding occurring and being disrupted is considered very low.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	As noted above, habitat values in and surrounding the wetland are relatively low for the Australian Painted Snipe (e.g. general lack of shallow areas and emergent vegetation), and does not constitute habitat considered important for foraging, breeding, roosting or dispersal. The alteration of potential habitat at the site is unlikely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The majority of the site is proposed to be developed and there will be no increase in invasive species spread post-construction; weed taxa will be controlled on site during construction. There are limited habitat areas adjacent to this site and there is unlikely to be an increase in invasive species distribution within nearby habitat sites as a result of the proposed action.
Introduce disease that may cause the species to decline.	There is a low likelihood of the species occurring at the site, as well as a lack of evidence for the introduction of disease to this species from such actions; hence it is unlikely that a novel disease would be introduced from the proposed action that would result in the decline of the species.

Significant impact criteria	Assessment of impacts
Interfere with the recovery of the species.	There is currently no recovery plan for this species. It is unlikely that the proposed action would interfere with any future actions for the recovery of the species. We note again the increase in the extent and quality of wetland habitat for this species under the proposed action.

Table 16. EPBC Act Significant Impact Criteria – Grey-headed Flying-fox

Significant impact criteria	Assessment of impacts
Lead to a long-term decrease in the size of an important population; where an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • Key source populations either for breeding or dispersal; • Populations that are necessary for maintaining genetic diversity; and/or • Populations that are near the limit of the species range.	The Grey-headed Flying-fox was recorded traversing the site; it was not recorded feeding at the site, although this may occur at other times of the year based on the flowering of eucalypts. Given the availability of a range of eucalypt species in the broader landscape, and the wide-ranging foraging of the species (up to 50 km nightly flights, though usually within 15 km; Threatened Species Scientific Committee 2001) the species is unlikely to be reliant upon the site for foraging. Hence, the proposed removal of native and exotic eucalypts, which were largely planted and generally provide limited foraging and nesting resources (see below), is considered in and of itself unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population.	The Grey-headed Flying-fox appears to transit the site regularly or periodically, and may intermittently forage on flowering eucalypts at the site. The majority of eucalypt trees present at the site are relatively small (DBH < 50 cm); most of the trees are proposed to be retained under the proposed action. Given the distribution of potential foraging habitat in the landscape, including the adjacent Fairhills High School and Blind Creek reserve, as well as the retention of the majority of trees in and bordering the site, the proposed action is considered unlikely to reduce the area of occupancy for the species.
Fragment an existing important population into two or more populations.	As noted above, given the availability of a range of eucalypt species adjacent to the site and in the broader landscape, the mobility of the species, and the limited amount of foraging resources proposed to be removed at the site, the proposed action is considered unlikely to fragment an existing important population.

Significant impact criteria	Assessment of impacts
Adversely affect habitat critical to the survival of a species, where 'habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • For activities such as foraging, breeding, roosting, or dispersal; • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); • To maintain genetic diversity and long term evolutionary development; or, • For the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	As discussed above, the site does not constitute habitat that is considered necessary for foraging, breeding, roosting or dispersal of the species; no colonies were recorded on site and none are recorded within the Blind Creek riparian corridor. The availability of habitat surrounding the site and the relatively small number of trees proposed to be removed suggest the proposed action is unlikely to adversely affect important habitat for the species. While the site may be utilised occasionally for foraging, i.e. whilst eucalypts are in flower, the site is not considered necessary for the long-term maintenance of the species or associated genetic processes, and does not constitute an area that is necessary for the reintroduction of a population.
Disrupt the breeding cycle of an important population.	As discussed above, the species is considered unlikely to breed at the site, which is not proximate to a known breeding camp or colony. Combined with the relatively limited habitat resources present, the likelihood of successful breeding occurring at the site and being disrupted under the proposed action is considered low.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	As noted above, given the distribution of foraging resources near the site and in the broader landscape, and the small number of potential foraging trees to be removed, the proposed action is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The majority of the site is proposed to be developed and there will be no increase in invasive species spread post-construction; weed taxa will be controlled on site during construction. There is unlikely to be an increase in invasive species distribution within nearby habitat sites as a result of the proposed action.
Introduce disease that may cause the species to decline.	The effects of bat pathogens on this species are unknown (Threatened Species Scientific Committee 2001). There is a lack of evidence suggesting the introduction or increase of disease to this species from such actions; hence it is considered unlikely that a novel disease would be introduced from the proposed action that would result in the decline of the species.
Interfere substantially with the recovery of the species.	There is currently no recovery plan for this species. It is unlikely that the proposed action would interfere with any future actions for the recovery of the species.

In this instance the proposed development is considered unlikely to result in a significant impact on a Matter of National Environmental Significance (MNES) and a referral under the EPBC Act 1999 (Cwlth) is NOT required. Liaison with Department of the Environment and Energy staff may be beneficial with regard to assessing the likelihood of the proposal being subject to investigation or compliance actions if the development was to proceed without a referral under the EPBC Act.

6.2 FLORA AND FAUNA GUARANTEE ACT

The Victorian *Flora and Fauna Guarantee Act 1988 (Vic)* (FFG Act) endeavors to prevent the extinction of biota and ecological communities within the state. Under the Act, a permit is required to remove listed flora or fauna species from public land.

The proposed development area is located on public land, and furthermore, the dam at the site is known to support at least one FFG Act-listed fauna species; the Blue-billed Duck. It is our understanding that the proposed development would therefore require approval from the Department of Environment, Land, Water and Planning under the FFG Act; this is generally addressed through the Planning Permit process.

6.2.1 Potentially threatening processes

There are several threatening processes (as defined under the FFG Act), outlined below, that may require consideration as part of the proposed development. Schedule 3 for the FFG Act lists a range of 'Potentially Threatening Processes'. These processes have been identified as a threat to the survival of one or more species of flora or fauna or a community. Threatening processes include (amongst others):

- Invasion of native vegetation by Blackberry (**Rubus fructicosus* spp. agg.).
- Invasion of native vegetation by 'environmental weeds'.
- Predation of native wildlife by the Domestic Cat (**Felis catus*).
- Predation of native wildlife by the introduced Red Fox (**Vulpes vulpes*).
- Reduction in biomass and biodiversity of native vegetation through grazing by Rabbits (**Oryctolagus cuniculus*).
- Spread of Root Rot Fungus (**Phytophthora cinnamomi*) from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority.
- Use of Root Rot Fungus-infected gravel for the construction of roads, bridges and reservoirs.

Containment and/or mitigation measures for some, or all, of these threatening processes listed under the Act should be incorporated in a Construction Environmental Management Plan for the proposed development.

6.3 PLANNING AND ENVIRONMENT ACT

The *Planning and Environment Act 1987 (Vic)* provides a legislative framework for the *Victorian Planning Provisions*, commonly referred to as the Planning Scheme. The Planning Scheme sets out the conditions for development within Victoria. Section 52.17 *Native vegetation* is considered below.

6.3.1 Guidelines for the Removal, Destruction or Lopping of Native Vegetation

The *Guidelines for the Removal, Destruction or Lopping of Native Vegetation* policy (DELWP 2017; the *Guidelines 2017* policy) have been designed to manage the risk to Victoria's biodiversity associated with the removal of native vegetation. The *Guidelines 2017* policy is incorporated into the Victoria Planning Provisions and all planning schemes in Victoria under the *Planning and Environment Act 1987 (Vic).* The principal tenet of the Guidelines 2017 policy is to ensure permitted clearing of native vegetation results in no net loss in the contribution made by native vegetation to Victoria's biodiversity. This is achieved through the following approach:

- Avoid the removal, destruction or lopping of native vegetation.
- Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.
- Provide an offset to compensate for the biodiversity impact from the removal, destruction or lopping of native vegetation (DELWP 2017).

Native vegetation is defined in planning schemes as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. The *Guidelines 2017* policy further classify native vegetation as a patch or a scattered tree (see Section 2.1.1).

The three-step approach (avoid, minimise, offset) is the key policy in relation to the removal of native vegetation to achieve no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. It is a precautionary approach that aims to ensure that the removal of native vegetation is restricted to only what is reasonably necessary, and that biodiversity is appropriately compensated for in the event that native vegetation losses cannot be avoided, and where Permitted by the Responsible Authority (DELWP 2017). A combination of site-based and landscape scale information is used to calculate the biodiversity value of native vegetation to be removed. This information is used to determine the loss in biodiversity value that needs to be compensated with an offset that provides an equivalent gain in biodiversity value, and the assessment pathway that is to be applied in an application to remove native vegetation.

The assessment pathway for an application to remove native vegetation reflects its potential impact on biodiversity and is determined from the location and extent of the native vegetation to be removed. The three assessment pathways are:

Basic – limited impacts on biodiversity.

Intermediate – could impact on large trees, endangered EVCs, and sensitive wetlands and coastal areas.

Detailed – could impact on large trees, endangered EVCs, sensitive wetlands and coastal areas, and could significantly impact on habitat for rare or threatened species.

The assessment pathway determines the information that accompanies an application and the decision guidelines that are considered in determining the outcome of an application (DELWP 2017). The assessment pathway of an application is determined in accordance with the table below.

Table 17. Determining assessment pathway

EXTENT	LOCATION CATEGORY		
	LOCATION 1	LOCATION 2	LOCATION 3
<0.5 hectares and not including any large trees	Basic	Intermediate	Detailed
<0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed
≥ 0.5 hectare	Detailed	Detailed	Detailed

6.3.2 Native vegetation clearance legislative and policy implications

A total area of 1.681 hectares of Submerged Aquatic Herbland EVC (918; assessed in EnSym using the Aquatic Herbland (EVC 653)) from the existing dam will be lost as part of the staged redevelopment of this site. An additional 0.493 hectares of Swampy Woodland (EVC 937) habitat, although planned for retention, will also be Offset as a precaution against expected impacts on the current soil hydrology and changes to stormwater management regimes which *may* have an impact on canopy trees at these locations. Please note that there is no intention to physically remove any of the Swampy Woodland canopy trees, and that Swampy Woodland understorey habitat values will be actively improved through revegetation with EVC appropriate species and planting rates (see Appendix 9.8 maps for details).

The extent of native vegetation loss, habitat condition and modelled species habitat mapping layers were processed using the EnSym tool in order to determine native Vegetation Offset targets; the EnSym report provides offset requirements for internal testing of different proposals to remove native vegetation. GIS shapefiles for the native vegetation loss area will be further processed by DELWP to produce a Native Vegetation Removal (NVR) report identifying an Offset target for the project once detailed designs are finalized (and as a Permit condition for an endorsed Offset Management Plan for the project). This Offset target is to be secured prior to the commencement of works in order to ensure that there is 'no net loss' of biodiversity value associated with this project.

Table 18 below outlines the extent of native vegetation clearance associated with the wetland development area, and identifies the commensurate Offset target as identified in the EnSym report (see also Appendix 9.7 for details); a Native Vegetation Removal (NVR) report will be obtained as a Permit condition and once the extent of the development is finalised. These Offset targets will be purchased from a third-party Offset Credit supplier registered on the DELWP Native Vegetation Credit Register and transferred to the project with an

Allocated Credit Extract. The Allocated Credit Extract is to be secured prior to the clearance of any native vegetation on site.

Table 18. Vegetation clearance and offset requirements

VEGETATION CLEARANCE	
Assessment pathway	Detailed Assessment Pathway
Extent including past and proposed	2.174 ha
Extent of past removal	0.000 ha
Extent of proposed removal	2.174 ha
No. Large trees proposed to be removed	12
Location category	Location 2 The native vegetation is in an area mapped as an endangered Ecological Vegetation Class (as per the statewide EVC map). Removal of less than 0.5 hectares of native vegetation in this location will not have a significant impact on any habitat for a rare or threatened species.
OFFSET REQUIREMENTS	
General offset amount	**1.211 general habitat units**
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Knox City Council.
Minimum strategic biodiversity value score	0.216
Large trees	12 large trees

6.3.3 Native vegetation avoid and minimise statement

Every effort has been made through careful consideration of the project design and siting of proposed building envelopes to avoid and minimise impacts associated with the loss of native vegetation on site. Avoidance measures include (but are not limited to):

- Swampy Woodland habitat areas north of the dam and on its embankment are to be retained and improved through revegetation of understorey and groundstorey canopies; habitat areas are comprised of native vegetation patches and scattered trees (see also GIS aerial maps in Section 9.8. These areas are Offset as a precaution against impacts associated with unavoidable alterations to the site's soil hydrology and wetting processes, they will nevertheless be retained on site for their habitat values.
- Construction of the wetland development area is to be constrained to the extent of the construction footprint identified in the *Development Master Plan* with no impacts to native vegetation outside of the works area other than impacts on TPZ.
- There is to be no storage of construction material, parking of vehicles, or clearing of native vegetation outside of the wetland development areas as identified by the *Development Master Plan* and the existing site access corridor.

- Native vegetation losses associated with the proposed development are to be limited to the minimum extent necessary for construction of the wetland complex and estate.
- With the exception of the aforementioned losses, there is to be no additional loss of canopy trees associated with this project; with the possible exception of impacts, not losses, associated with judicious pruning of selective branches under the supervision of a qualified and experienced arboriculture consultant if required to make the site safe for contractors and visitors.

We also note that no feasible opportunities exist to further avoid and minimise impacts on native vegetation without undermining the key objectives of the CDP.

The Offset target for this project is for **1.211 General Habitat Units and twelve (12) large trees only** (with a minimum Strategic Biodiversity Value (SBV) score of 0.216), from an Offset Site in the Port Phillip and Westernport Catchment Management Authority (CMA) or Knox City Council.

A suitable Offset Site, listed on the DELWP Native Vegetation Credit Register (TFN-C1763_3), has been identified, and the Offset target has been reserved from that site for this project (see also Appendix 9.7 for details). These Offset Credits will therefore be purchased and secured with an Allocated Credit Extract prior to the commencement of native vegetation clearance works.

6.3.4 Advisory Lists of threatened flora and fauna

There are several flora and fauna species listed on the Advisory lists with a moderate likelihood of occurrence on site (Tables 8 and 9), and some that were recorded on site: Floodplain Fireweed (*Senecio campylocarpus*); Hardhead (*Aythya australis*); Blue-billed Duck (*Oxyura australis*); and Grey-headed Flying-fox (*Pteropus poliocephalus*).

The Advisory documents note:

> "There are no direct legal requirements or consequences that flow from inclusion of a species in this advisory list, although they are afforded some protection through Victoria's *Native Vegetation Management: A Framework for Action*." (DSE 2013).

We note that the *Framework* policy was recently superseded by Victoria's *Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines* (DEPI 2013). As such, impacts to this species associated with any proposed future land-use on site will be offset with native vegetation offset requirements under the *Guidelines* policy.

It may also be appropriate to relocate any species listed as rare or threatened on the Advisory Lists that are encountered on site prior to or during construction works (see Section 5). Any fauna removal from site should be done by a suitably qualified wildlife handler licensed, permitted or authorised under the Wildlife Regulations 2014 and the *Wildlife Act 1975 (Vic)* (see Section 6.7 for details).

6.3.5 Sites of biological significance (ESO2)

The area covered by this schedule includes a range of sites of biological significance identified in *Sites of Biological Significance in Knox – 2nd Edition* (Lorimer 2010). Their protection and appropriate management is of particular

importance for the maintenance of both Knox's and Victoria's biodiversity, as well as for liveability and the health and wellbeing of the community.

6.4 CATCHMENT AND LAND PROTECTION ACT

The Victorian *Catchment and Land Protection Act 1994* (CaLP Act) contains provisions relating to the integrated management and protection of catchments, encourages community participation in the management of land and water resources, and sets up a system of controls for the management of noxious weeds and pest animals (Agriculture Victoria 2020[13]). This Act also provides a legislative framework for the integrated and coordinated management of private and public land at a catchment level which:

- Focuses on long-term land productivity while also conserving the environment.
- Ensures that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.
- Establishes processes that can be used to assess the condition of the State's land and water resources and the effectiveness of land protection measures.
- Establishes processes to encourage and support participation of land holders, resource managers and other members of the community in catchment management and land protection.
- Establishes and supports the operation of the Victorian Catchment Management Council and the Catchment Management Authorities.
- Provides for the control of noxious weeds and pest animals.

6.4.1 Declared noxious weeds

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

- State Prohibited Weeds (SP) are either currently absent in Victoria or are restricted enough to be eradicated. The Victorian Government is responsible for their control.
- Regionally Prohibited Weeds (RP) in the Port Phillip Catchment Management Authority area are not necessarily widespread, but have the potential to become widespread. It is expected that weeds that meet this criterion can be eradicated from the region. Control of weeds considered to be Regionally Prohibited is the responsibility of the land owner on their own land, although not on adjacent roadside reserves.
- Regionally Controlled Weeds (RC) are usually widespread; however, it is important to prevent their further spread. It is the responsibility of the landowner to control these weeds on their property and on adjacent roadside reserves.

[13] https://agriculture.vic.gov.au/biosecurity/weeds/invasive-plant-classifications

- Restricted weeds occur in other states and are considered to be a serious threat to primary production, Crown land, the environment and/or community health if they were traded in Victoria.

Please note that seven noxious weeds were recorded on site. Table 19 lists noxious weeds and their CaLP Act status within the Port Phillip and Westernport Catchment Management Authority area.

Table 19. Noxious weeds recorded within the wetland development area

Common name	Scientific name	CaLP status
Angled Onion	*Allium triquetrum*	Restricted
Spear Thistle	*Cirsium vulgare*	Controlled
Artichoke Thistle	*Cynara cardunculus*	Controlled
Montpellier Broom	*Genista monspessulana*	Controlled
Blackberry	*Rubus fruticosus* spp. agg	Controlled
Willow	*Salix* spp.	Restricted
Bulbil Watsonia	*Watsonia meriana* var. *bulbillifera*	Controlled

These species will require control at the site in order to prevent their spread from the property during and after construction, in accordance with the CaLP Act. The ultimate goal should be to completely eradicate these species from the site, in order to prevent any possibility that they would spread into adjacent natural areas.

6.4.2 Declared pest animals

Under the CaLP Act, certain animals are declared as pest animals in Victoria. These animals are, or have the potential to become, a serious threat to primary production, Crown land, the environment or community health in Victoria (Agriculture Victoria 2020[14]).

Under the CaLP Act, animal species can be declared in one of four categories:

- Prohibited pest animals
- Controlled pest animals
- Regulated pest animals
- Established pest animals.

Under the CaLP Act, Prohibited, Controlled and Regulated pest animals are collectively defined as Restricted pest animals.

Please note that four priority pest animals were recorded on site or are considered highly likely to be on site as based on records for these species from the region. Table 20 lists restricted animals and their CaLP Act status within Victoria.

[14] https://agriculture.vic.gov.au/biosecurity/pest-animals/invasive-animal-classifications

Table 20. Priority pest animals recorded or likely within the wetland development area

Common name	Scientific name	CaLP status
European Fox ^	*Vulpes vulpes*	Established pest
European Rabbit ^	*Oryctolagus cuniculus*	Established pest animal (feral or wild populations only)
European Hare	*Lepus europaeus*	Established pest
Feral cat	*Felis catus*	Declared established pest animal on specified Crown land

^ species recorded on site
Further information is available at: https://agriculture.vic.gov.au/biosecurity/pest-animals/priority-pest-animals

These species will require control at the site in order to prevent their spread from the property during and after construction, in accordance with the CaLP Act. The ultimate goal should be to completely eradicate these species from the site, in order to prevent any possibility that they would spread into adjacent natural areas.

6.5 ENVIRONMENT EFFECTS ACT

The Victorian *Environment Effects Act 1978 (Vic)* is the legislation that applies to the process of investigating and considering the potential environmental impacts or effects of a proposed development. The Act requires the preparation for an Environmental Effects Statement (EES) if the Minister for Planning determines that a statement is required upon review of a referral. The Minister might typically require a proponent to prepare an EES when:

- There is a likelihood of regionally or State significant adverse effects on the environment;
- There is a need for integrated assessment of potential environmental effects (including economic and social effects) of a project and relevant alternatives; and
- Normal statutory processes would not provide a sufficiently comprehensive, integrated and transparent assessment (DSE 2006).

Triggers for referral under the Act fall into two categories: potential effects on individually defined criteria; or, potential effects on a combination of two or more criteria. Individual types of potential effects on the environment that might be of regional or State significance, and therefore warrant referral of a project, include:

- Potential clearing of 10 ha or more of native vegetation from an area that:
    - is of an Ecological Vegetation Class identified as endangered by DELWP; or
    - is, or is likely to be, of very high conservation significance; and
    - is not authorised under an approved Forest Management Plan or Fire Protection Plan.

- Potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of known remaining habitat or population of a threatened species within Victoria;
- Potential long-term change to the ecological character of a wetland listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia';
- Potential extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems, over the long term;
- Potential extensive or major effects on the health, safety or well-being of a human community, due to emissions to air or water or chemical hazards or displacement of residences; or
- Potential greenhouse gas emissions exceeding 200,000 tonnes of carbon dioxide equivalent per annum, directly attributable to the operation of the facility (DSE 2006).

A combination of two or more of the following types of potential effects on the environment that might be of regional or State significance, and therefore warrant referral of a project, include:

- Potential clearing of 10 ha or more of native vegetation, unless authorised under an approved Forest Management Plan or Fire Protection Plan;
- Matters listed under the Flora and Fauna Guarantee Act 1988:
    - potential loss of a significant area of a listed ecological community; or
    - potential loss of a genetically important population of an endangered or threatened species (listed or nominated for listing), including as a result of loss or fragmentation of habitats; or
    - potential loss of critical habitat; or
    - potential significant effects on habitat values of a wetland supporting migratory bird species.
- Potential extensive or major effects on landscape values of regional importance, especially where recognised by a planning scheme overlay or within or adjoining land reserved under the National Parks Act 1975;
- Potential extensive or major effects on land stability, acid sulphate soils or highly erodible soils over the short or long term
- Potential extensive or major effects on beneficial uses of waterbodies over the long term due to changes in water quality, streamflows or regional groundwater levels;
- Potential extensive or major effects on social or economic well-being due to direct or indirect displacement of non-residential land use activities;

- Potential for extensive displacement of residences or severance of residential access to community resources due to infrastructure development;
- Potential significant effects on the amenity of a substantial number of residents, due to extensive or major, long-term changes in visual, noise and traffic conditions;
- Potential exposure of a human community to severe or chronic health or safety hazards over the short or long term, due to emissions to air or water or noise or chemical hazards or associated transport;
- Potential extensive or major effects on Aboriginal cultural heritage;
- Potential extensive or major effects on cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the Heritage Act 1995 (DSE 2006).

There is potential for remnants of the Swampy Woodland EVC and Swampy Riparian Woodland EVC to be found on site adjacent to the wetlands. These are Endangered EVCs in the Gippsland Plain bioregion, however, due to the degraded nature of remnants on site these would not qualify as Very High Conservation Significance remnants and would therefore not trigger the *Environment Effects Act 1978 (Vic)*. Furthermore, the extent of remnant EVCs on site in its entirety is under 10 hectares in area. Hence, the proposed development is not recommended for referral to the Minister for Planning for consideration under the Environmental Effects Act.

6.6 WATER ACT

The Victorian Water Act 1989 is the primary legislative framework for the management and allocation of Victorian surface water and groundwater and the maintenance of aquatic ecosystem functions. The Act is administered by DELWP and regional water authorities, and applies to all surface water in Victoria, including river management, water supply, irrigation and sewerage. Among other things, the Act encompasses:

- environmental flows,
- rights to water,
- allocation of water entitlements,
- issuing of licences,
- control of construction of works on waterways,
- protection of groundwater,
- underground (groundwater) disposal, and/or
- waterway management.

Relevant Authorities as listed under Schedule 12 of the Act include, regional water authorities, water boards, city and shire councils, and catchment management authorities. The authorities have powers to regulate works within and in the vicinity of waterways, including any works that may affect water

quality and quantity, riparian vegetation or waterway streambed or banks. Works on waterways usually also require a permit and/or other works approvals under the Water Act.

Details of considerations associated with the wetland complex and its development are provided in the *Preliminary Stormwater Management Strategy* (Engeny 2021).

6.7 WILDLIFE ACT

The purpose of the Victorian *Wildlife Act 1975 (Vic)* is to establish procedures in order to promote the protection and conservation of wildlife, prevent wildlife from becoming extinct, and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife. The Act requires people engaged in wildlife research (such as fauna surveys, salvage or translocation activities) to obtain a permit in order to ensure that these activities are undertaken with appropriate conservation and protection measures.

6.7.1 Wildlife Regulations 2014

The objectives of the *Wildlife Regulations 2014* are:

- To provide for the management and conservation of wildlife and wildlife habitat;
- To provide for humane use of and access to wildlife;
- To make further provision in relation to the licensing system established by section 22 of the *Wildlife Act 1975*;
- To prescribe fees, offences, royalties and various other matters for the purposes of the *Wildlife Act 1975*; and
- To provide for exemptions from certain provisions of the *Wildlife Act 1975*.

Under the *Wildlife Regulations 2014* a person, unless licensed, permitted or authorised to do so under the Act:

- Must not willfully damage, disturb or destroy any wildlife habitat;
- Must not use a bait, lure, poison, decoy, or live animal to attract wildlife for the purpose of taking that wildlife;
- Must not use a firearm from an aircraft, motor vehicle, boat, or any other vehicle to take wildlife;
- Must not use an aircraft, motor vehicle, boat, or any other vehicle to pursue, chase, or harass wildlife;
- Must not use an artificial light, electronic device, or recorded sound to hunt or take wildlife; and
- Must not use a gun, bow or other weapon, trap, or any other equipment or substance for the purpose of taking wildlife.

Authorisation to conduct wildlife research or wildlife management can be obtained under the Act, and is subject to any conditions, limitations or restrictions placed on that authorisation. Proponents must allow inspection by an authorised officer, at any reasonable time, for the purpose of monitoring compliance with this Act.

The *Wildlife Regulations 2014* supersede the *Wildlife Regulations 2002*, *Wildlife (Amendment) Regulations 2004*, and the *Wildlife Amendment Regulations 2009*.

The relocation or removal of any native wildlife from the wetlands development area must therefore be conducted by a qualified, licenced and experienced contractor with Permits as required to conduct these works. This includes the salvage and relocation of any wildlife from tree hollows that may be encountered during construction, and the relocation of wildlife from the dam before, during and after it is drained.

7. CONCLUSION

This report assesses ecological impacts associated with the development of the northern sector of the property; referred to as the wetland development area. This includes areas of remnant and revegetated native vegetation and planted native trees that will be impacted by the construction works program, and the loss of Submerged Aquatic Herbland habitat associated with the staged redevelopment of the existing dam and construction of wetland habitat areas. These works are expected to have short-term impacts on threatened flora and fauna that are recorded on site, and have potential to impact threatened species that are considered likely to be present on site.

The quality of terrestrial habitat within the wetland development area is generally poor and it is considered unlikely that these environs would support a regionally significant population of threatened flora or fauna species. There is nevertheless potential to retain the bulk of, if not all of, the terrestrial native vegetation and habitat at this location through careful development of the dam and retention of the existing embankment. A program for the staged development of this site is provided in Section 5.

By contrast the dam at the site is relatively large in area and provides aquatic habitat for several significant flora species of local to State significance, and also provides habitat for wetland birds, including the threatened Blue-billed Duck and Hardhead; both species have been recorded at the dam during surveys at the site. It was identified by Engeny Water Management (2021 & 2017), however, that maintaining the dam on the site poses a number of engineering challenges associated with the state of its embankment and outlet structure, proximity to Blind Creek and flooding impacts, overtopping of waters from the dam in the northwest corner, and public safety issues around water depths and retardation failure.

Given the potential importance of the existing dam at the site for a range of flora and fauna species, including some significant species recorded on site, a number of recommendations and proposed mitigation measures are proposed. Principally, the proposed development includes the creation of an equivalent area of wetland habitat to that currently extant at the site. The new wetlands complex will function as a stormwater treatment system and will include a number of features to promote high quality habitat for waterbirds; this includes extensive fringing and emergent vegetation, which are currently lacking at the existing dam. Furthermore, it is proposed to establish an open water wetland adjacent to the extant dam prior to the latter's removal. Such a staged removal will ensure that adequate habitat is always available for Blue-billed Duck on site.

The staged development program outlined above will have some impacts on native flora and fauna, however, these are not considered to be significant if implemented concurrently with the mitigation measures outlined in Section 5 of this report. As a precaution, all native vegetation within the wetlands development area will be Offset in accordance with the *Guidelines 2017* Offset policy, and to ensure that there is *no net loss of biodiversity value* associated with this proposal. The securing of Offsets prior to the commencement of works will also ensure that any impacts to the site's canopy trees associated with unavoidable alterations of the site's soil hydrology and stormwater processes will also meet legislative obligations under Section 52.17 of the Planning Scheme.

With the exception of the aforementioned losses, there is to be no additional loss of canopy trees associated with this project; with the possible exception of impacts, not losses, associated with judicious pruning of selective branches under the supervision of a qualified and experienced arboriculture consultant and as required to ensure site safety. Assessments of tree structural integrity and pedestrian safety is provided in the *Arborist Assessment* report (Galbraith 2020) and is not considered in detail in this report. Tree losses associated with maintenance of public safety, if required or deemed necessary, may trigger additional Native Vegetation Offset requirements in accordance with the *Guidelines 2017* policy.

Table 21 below provides a summary of legislative and associated policy requirements for this proposal.

Table 21. Summary of legislative and associated policy requirements

Legislative Act and associated policy		Planning considerations	Further actions
EPBC Act 1999 (Cwlth)		No vegetation communities listed as threatened under the EPBC Act were identified on site. No flora or fauna listed as threatened under the EPBC Act were recorded on site, and it is considered unlikely that this property would support a viable population of any threatened flora or fauna taxa. Significant impact criteria, as set out in the Federal *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Department of the Environment 2013), have been considered in relation to all fauna identified as having a moderate likelihood of presence on site or which were identified flying over site. No impacts associated with the development of this site are considered likely to result in a significant impact on a Matter of National Environmental Significance (MNES); a referral to the Federal Department of the Environment and Energy is not required in this instance.	No referral required. A letter of intent appraising the Department of the proposal and development schedule is recommended.
FFG Act 1988 (Vic)		The occurrence of the FFG Act listed Blue-billed Duck and potential presence of Broad-shelled Turtle on site may require departmental approval to impact and/or remove this species on site. There are several threatening processes that may also have to be considered as part of the proposal's development plan and Construction Environmental Management Plan.	A Permit under the FFG Act may be required for this project. Consideration of threatening processes are to be incorporated in a CEMP for the development of this site.
Planning and Environment Act 1987 (Vic)	Section 52.17: *Guidelines for the Removal, Destruction or Lopping of Native Vegetation* (DELWP 2017)	Six Habitat Zones meet the definition of a 'Patch' and five eucalypts meet the definition of 'Scattered Trees' under Victoria's *Guidelines for the Removal, Destruction or Lopping of Native Vegetation* policy (DELWP 2017). Any proposed removal of Patches or Scattered Trees will require a permit under Section 52.17 of the Planning Scheme, and Native Vegetation Offsets in accordance with the *Guidelines 2017* (DEPI 2017) policy. A Native Vegetation Removal (NVR) report will be required to identify Offset targets once a development plan is finalised.	Submit a Planning Permit application to Knox City Council identifying avoidance and minimisation measures adopted, and unavoidable losses and commensurate *Guidelines 2017* Offset policy targets. A CEMP is to be developed for the site and implemented by the contractors to ensure that mitigation measures outlined in Section 5 are delivered on site; the CEMP is to be subject to endorsement by the Responsible Authority. An Offset Management Plan is to be provided upon confirmation of an endorsed development plan; the OMP is to be subject to endorsement by the Responsible Authority.

Legislative Act and associated policy	Planning considerations	Further actions
Catchment and Land Protection Act 1994 (Vic)	Seven Regionally Controlled or Restricted noxious weeds were recorded at the development area. Four priority pest animals were recorded on site or are considered highly likely to be on site. These species are to be controlled on site, and prevented from spreading beyond the property during and after the construction phase.	Control and/or eliminate regionally controlled or noxious weeds and priority pest animals as part of the CEMP.
Environment Effects Act 1978 (Vic)	No individually defined criteria, nor combinations of two or more criteria, trigger referral of this project to the Minister for Planning.	No referral required.
Water Act 1989 (Vic)	It is our understanding that the catchment for this project is less than 60 hectares and that a 'works on waterways' Permit is not required in this instance; refer to Engeny (2021) for details.	Confirm with the project's waterway engineers.
Wildlife Act 1975 (Vic)	It may be necessary to contract the wildlife rescue services of a suitably qualified and experienced zoologist – a firm or individual with a current permit to handle wildlife under the Wildlife Act 1975 (Vic) – for salvage of arboreal mammals, bats and/or birds if mature eucalypts (including exotic species) are removed. It may be necessary to contract the wildlife rescue services of a suitably qualified and experienced zoologist – a firm or individual with a current permit to handle wildlife under the Wildlife Act 1975 (Vic) – for salvage and relocation of Eastern Long-necked Turtle or aquatic fauna from the dam to the adjacent open water wetland (once constructed) during the development process.	Engage a suitably qualified and experienced contractor, if required, to manage the salvage and relocation of native fauna associated with the draining of the dam and/or the removal of any large trees on site.

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9. APPENDICES

9.1 FLORA RECORDED ON THE PROPERTY

(current surveys and Ecocentric 2015 & 2018)

Origin	Scientific name	Common name	CaLP Act listing	Significant species^
# P	*Acacia baileyana*	Cootamundra Wattle		
# P	*Acacia boormanii*	Snowy River Wattle		
	Acacia dealbata subsp. *dealbata*	Silver Wattle		
# P	*Acacia floribunda*	White Sallow-wattle		
# P	*Acacia howittii*	Sticky Wattle		
	Acacia mearnsii	Black Wattle		
	Acacia melanoxylon	Blackwood		
# P	*Acacia prominens*	Gosford Wattle		
P	*Acacia pycnantha*	Golden Wattle		
	Acacia stricta	Hop Wattle		Y
	Acaena novae-zelandiae	Bidgee-widgee		
*	*Acetosella vulgaris*	Sheep Sorrel		
*	*Agapanthus praecox* subsp. *orientalis*	Agapanthus		
*	*Agrostis capillaris* var. *capillaris*	Brown-top Bent		
*	*Allium triquetrum*	Angled Onion	Restricted	
P	*Allocasuarina littoralis*	Black Sheoak		
# P	*Allocasuarina torulosa*	Forest Oak		
P	*Allocasuarina verticillata*	Drooping Sheoak		
	Alternanthera denticulata	Lesser Joyweed		
# P	*Angophora costata* subsp. *costata*	Smooth-barked Apple		
*	*Anthoxanthum odoratum*	Sweet Vernal-grass		
*	*Aphanes arvensis*	Parsley Piert		
*	*Arctotheca calendula*	Cape Weed		
*	*Aster subulatus*	Aster-weed		
	Austrostipa rudis subsp. *rudis*	Veined Spear-grass		
# P	*Baeckea spp.*	Baeckea		
# P	*Banksia integrifolia*	Coast Banksia		
*	*Bellis perennis*	English Daisy		
*	*Betula pendula*	Silver Birch		
*	*Briza maxima*	Large Quaking-grass		
*	*Bromus catharticus* var. *catharticus*	Prairie Grass		
	Bursaria spinosa subsp. *spinosa*	Sweet Bursaria		
# P	*Callistemon citrinus*	Crimson Bottlebrush		
*	*Calystegia silvatica*	Greater Bindweed		
*	*Cardamine hirsuta s.s.*	Common Bitter-cress		
	Cassinia arcuata	Drooping Cassinia		
*	*Cenchrus clandestinus*	Kikuyu		
*	*Centaurium erythraea*	Common Centaury		
*	*Cerastium glomeratum s.l.*	Common Mouse-ear Chickweed		
*	*Chamaecytisus palmensis*	Tree Lucerne		
*	*Cirsium vulgare*	Spear Thistle	Controlled	
*	*Coprosma repens*	Mirror Bush		
P	*Correa glabra*	Rock Correa		
# P	*Corymbia ficifolia*	Red-flowering Gum		
# P	*Corymbia maculata*	Spotted Gum		
*	*Cotoneaster glaucophyllus* var. *serotinus*	Large-leaf Cotoneaster		
* P	*Cupressus spp.*	Cypress		
*	*Cynara cardunculus*	Artichoke Thistle	Controlled	
*	*Cynodon dactylon* var. *dactylon*	Couch		
*	*Cyperus eragrostis*	Drain Flat-sedge		
*	*Dactylis glomerata*	Cocksfoot		

Origin	Scientific name	Common name	CaLP Act listing	Significant species^
	Dianella laevis	Smooth Flax-lily		Y
*	*Echinochloa crus-galli*	Barnyard Grass		
*	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass		
*	*Ehrharta longiflora*	Annual Veldt-grass		
	Einadia nutans	Nodding Saltbush		
	Epilobium billardierianum subsp. *billardierianum*	Smooth Willow-herb		
*	*Eragrostis pilosa*	Soft Love-grass		
*	*Erica lusitanica*	Spanish Heath		
*	*Erigeron bonariensis*	Flaxleaf Fleabane		
*	*Erigeron sumatrensis*	Tall Fleabane		
*	*Erodium moschatum*	Musky Heron's-bill		
# P	*Eucalyptus botryoides*	Southern Mahogany		
	Eucalyptus cephalocarpa	Mealy Stringybark		
# P	*Eucalyptus cladocalyx*	Sugar Gum		
# P	*Eucalyptus cosmophylla*	Cup Gum		
# P	*Eucalyptus globulus* subsp. *globulus*	Southern Blue-gum		
	Eucalyptus goniocalyx s.s.	Bundy		
# P	*Eucalyptus leucoxylon* ssp. *rosea*	Yellow Gum		
	Eucalyptus melliodora	Yellow Box		
# P	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint		
	Eucalyptus ovata var. *ovata*	Swamp Gum		
# P	*Eucalyptus sideroxylon* subsp. *sideroxylon*	Mugga		
	Eucalyptus viminalis subsp. *viminalis*	Manna Gum		
	Euchiton japonicus	Creeping Cudweed		
*	*Fraxinus angustifolia* subsp. *angustifolia*	Desert Ash		
*	*Fumaria bastardii*	Bastard's Fumitory		
*	*Fumaria capreolata*	White Fumitory		
*	*Galium aparine*	Cleavers		
*	*Gamochaeta purpurea s.l.*	Purple Cudweed		
*	*Genista linifolia*	Flax-leaf Broom		
*	*Genista monspessulana*	Montpellier Broom	Controlled	
*	*Geranium dissectum*	Cut-leaf Crane's-bill		
	Goodenia ovata	Hop Goodenia		
# P	*Grevillea robusta*	Silky Oak		
# P	*Grevillea* spp.	Grevillea cultivar		
# P	*Hardenbergia violacea* (shrubby form)	Purple Coral-pea (shrubby form)		
*	*Hedera helix*	English Ivy		
*	*Helminthotheca echioides*	Ox-tongue		
*	*Holcus lanatus*	Yorkshire Fog		
*	*Hypochaeris radicata*	Flatweed		
	Juncus amabilis	Hollow Rush		
	Juncus gregiflorus	Green Rush		
	Juncus procerus	Tall Rush		
	Juncus sarophorus	Broom Rush		
	Juncus subsecundus	Finger Rush		
	Lachnagrostis filiformis	Common Blown-grass		
*	*Lamium amplexicaule*	Dead Nettle		
*	*Lepidium africanum*	Common Peppercress		
*	*Ligustrum lucidum*	Large-leaf Privet		
*	*Lolium perenne* var. *perenne*	Perennial Rye-grass		
# P	*Lophostemon confertus*	Brush Box		
*	*Lotus subbiflorus*	Hairy Bird's-foot Trefoil		
*	*Lysimachia arvensis* var. *arvensis*	Scarlet Pimpernel		
	Lythrum hyssopifolia	Small Loosestrife		
*	*Malus pumila*	Apple		
*	*Malva nicaeensis*	Mallow of Nice		

Origin	Scientific name	Common name	CaLP Act listing	Significant species^
# P	*Melaleuca armillaris* subsp. *armillaris*	Giant Honey-myrtle		
# P	*Melaleuca nesophila*	Showy Honey-myrtle		
# P	*Melaleuca styphelioides*	Prickly Paperbark		
	Microlaena stipoides var. *stipoides*	Weeping Grass		
*	*Modiola caroliniana*	Red-flower Mallow		
# P	*Myoporum insulare*	Common Boobialla		
	Oxalis exilis	Shady Wood-sorrel		
*	*Oxalis pes-caprae*	Soursob		
	Ozothamnus ferrugineus	Tree Everlasting		Y
*	*Paspalum dilatatum*	Paspalum		
*	*Pelargonium X hortorum*	Zonal Pelargonium		
	Persicaria decipiens	Slender Knotweed		
	Persicaria subsessilis	Hairy Knotweed		Y
*	*Phleum pratense*	Timothy Grass		
*	*Pinus radiata* var. *radiata*	Radiata Pine		
#	*Pittosporum undulatum*	Sweet Pittosporum		
*	*Plantago lanceolata*	Ribwort		
*	*Plantago coronopus*	Buck's-horn Plantain		
*	*Poa annua*	Annual Meadow-grass		
*	*Polygonum aviculare s.l.*	Prostrate Knotweed		
	Potamogeton crispus	Curly Pondweed		
	Potamogeton ochreatus	Blunt Pondweed		
*	*Prunella vulgaris*	Self-heal		
*	*Prunus cerasifera*	Cherry Plum		
	Pseudognaphalium luteoalbum	Jersey Cudweed		
*	*Ranunculus repens*	Creeping Buttercup		
*	*Raphanus raphanistrum*	Wild Radish		
*	*Romulea rosea* var. *australis s.s.*	Common Onion-grass		
*	*Rubus anglocandicans*	Common Blackberry	Controlled	
*	*Rumex crispus*	Curled Dock		
	Rytidosperma fulvum	Copper-awned Wallaby-grass		
	Rytidosperma racemosum var. *racemosum*	Slender Wallaby-grass		
	Rytidosperma setaceum	Bristly Wallaby-grass		
	Rytidosperma spp.	Wallaby Grass		
*	*Salix* spp.	Willow	Restricted	
	Senecio campylocarpus	Floodplain Fireweed		Y
	Senecio glomeratus	Annual Fireweed		
	Senecio quadridentatus	Cotton Fireweed		
*	*Senecio vulgaris*	Common Groundsel		
	Solanum laciniatum	Large Kangaroo Apple		
*	*Solanum mauritianum*	Wild Tobacco Tree		
*	*Solanum nigrum s.l.*	Black Nightshade		
*	*Solanum pseudocapsicum*	Madeira Winter-cherry		
*	*Sonchus asper s.l.*	Rough Sow-thistle		
*	*Sonchus oleraceus*	Common Sow-thistle		
*	*Sporobolus africanus*	Rat-tail Grass		
*	*Stellaria media*	Chickweed		
# P	*Syzygium smithii*	Lilly Pilly		
*	*Taraxacum officinale* spp. agg.	Garden Dandelion		
	Thelymitra arenaria	Forest Sun-orchid		
*	*Trifolium fragiferum* var. *fragiferum*	Strawberry Clover		
*	*Trifolium glomeratum*	Cluster Clover		
*	*Trifolium repens* var. *repens*	White Clover		
# P	*Tristaniopsis laurina*	Kanooka		
*	*Tropaeolum majus*	Nasturtium		
	Typha ?domingensis	Narrow-leaf Cumbungi		Y
	Vallisneria australis	Eel Grass		Y

Origin	Scientific name	Common name	CaLP Act listing	Significant species^
*	*Veronica arvensis*	Wall Speedwell		
*	*Vicia faba*	Broad Bean		
*	*Vicia sativa* subsp. *sativa*	Common Vetch		
*	*Vulpia bromoides*	Squirrel-tail Fescue		
*	*Vulpia myuros*	Rat's-tail Fescue		
*	*Watsonia meriana* var. *bulbillifera*	Bulbil Watsonia	Controlled	

# = native species occurring outside of its natural range
P = planted
* = exotic species
^ = significant species described in Section 3.2.2

9.2 FAUNA RECORDED ON THE PROPERTY

(current surveys and Ecocentric 2015 & 2018)

Taxon Origin	Common Name	Scientific Name	EPBC	FFG	DSE (2013)
	Mammals				
Introduced	Black Rat	*Rattus rattus*			
	Common Brushtail Possum	*Trichosurus vulpecula*			
	Common Ringtail Possum	*Pseudocheirus peregrinus*			
	Grey-headed Flying-fox	*Pteropus poliocephalus*	Vu	L	vu
Introduced	Red Fox	*Vulpes vulpes*			
	Frogs				
	Common Eastern Froglet	*Crinia signifera*			
	Southern Brown Tree-frog	*Litoria ewingii*			
	Spotted Marsh Frog	*Limnodynastes tasmaniensis*			
	Reptiles				
	Garden Skink	*Lampropholis guichenoti*			
	Weasel Skink	*Saproscincus mustelinus*			
	Fish				
Introduced	Goldfish	*Carassius auratus*			
	Short-fin Eel	*Anguilla australis*			
	Birds				
	Australasian Grebe	*Tachybaptus novaehollandiae*			
	Australasian Hobby	*Falco longipennis*			
	Australian King-Parrot	*Alisterus scapularis*			
	Australian Magpie	*Gymnorhina tibicen*			
	Australian Raven	*Corvus coronoides*			
	Australian White Ibis	*Threskiornis molucca*			
	Australian Wood Duck	*Chenonetta jubata*			
	Black Swan ^	*Cygnus atratus*			
	Blue-billed Duck	*Oxyura australis*		L	en
	Chestnut Teal	*Anas castanea*			
Introduced	Common Blackbird	*Turdus merula*			
Introduced	Common Myna	*Acridotheres tristis*			
Introduced	Common Starling	*Sturnus vulgaris*			
	Crested Pigeon	*Ocyphaps lophotes*			
	Crimson Rosella	*Platycercus elegans*			
	Dusky Moorhen	*Gallinula tenebrosa*			
	Eastern Rosella	*Platycercus eximius*			
	Eurasian Coot	*Fulica atra*			
	Galah	*Eolophus roseicapilla*			
	Grey Butcherbird	*Cracticus torquatus*			
	Hardhead	*Aythya australis*			vu
	Hoary-headed Grebe	*Poliocephalus poliocephalus*			
	Laughing Kookaburra	*Dacelo novaeguineae*			
	Little Corella	*Cacatua sanguinea*			
	Little Lorikeet	*Glossopsitta pusilla*			
	Little Pied Cormorant	*Microcarbo melanoleucos*			
	Little Raven	*Corvus mellori*			
	Little Wattlebird	*Anthochaera chrysoptera*			
	Long-billed Corella	*Cacatua tenuirostris*			
	Magpie-lark	*Grallina cyanoleuca*			
	Masked Lapwing	*Vanellus miles*			
	Musk Lorikeet	*Glossopsitta concinna*			
Introduced	Noisy Miner	*Manorina melanocephala*			
Introduced	Northern Mallard	*Anas platyrhynchos*			
	Pacific Black Duck	*Anas superciliosa*			
	Pied Currawong	*Strepera graculina*			

Taxon Origin	Common Name	Scientific Name	EPBC	FFG	DSE (2013)
	Pink-eared Duck ^	*Malacorhynchus membranaceus*			
	Purple Swamphen	*Porphyrio porphyrio*			
	Rainbow Lorikeet	*Trichoglossus haematodus*			
	Red Wattlebird	*Anthochaera carunculata*			
	Sacred Kingfisher	*Halcyon sancta*			
Introduced	Spotted Turtle-Dove	*Streptopelia chinensis*			
	Straw-necked Ibis	*Threskiornis spinicollis*			
	Striated Pardalote	*Pardalotus striatus*			
	Sulphur-crested Cockatoo	*Cacatua galerita*			
	Welcome Swallow	*Petrochelidon neoxena*			
	White-necked Heron	*Ardea pacifica*			
	White-plumed Honeyeater	*Lichenostomus penicillatus*			
	Willie Wagtail	*Rhipidura leucophrys*			

^ recorded by the local community – not sighted during these surveys.

EPBC Act 1999 (Commonwealth) **conservation status:** EX: Extinct, CR: Critically endangered, EN: Endangered, VU: Vulnerable, CD: Conservation dependant.

Advisory List of Threatened Fauna (DSE 2013) status in Victoria: ex: Extinct, rx: Regionally Extinct, wx: Extinct in the Wild, cr: Critically Endangered, en: Endangered, vu: Vulnerable, r: Rare, nt: Near Threatened, dd: Data Deficient.

FFG Act 1988 (Vic) **conservation status:** L: Listed, N: Nominated, I: Invalid or ineligible, D: Delisted.

9.3 SIGNIFICANT FLORA RECORDED WITHIN 5 KM OR PREDICTED TO OCCUR

Refer to spreadsheet – available upon request to author.

9.4 SIGNIFICANT FAUNA RECORDED WITHIN 5 KM OR PREDICTED TO OCCUR

Refer to spreadsheet – available upon request to author.

9.5 SITE PHOTOGRAPHS

Blue Billed Duck on the dam (2020)

Eastern boundary of dam (2017)

Eastern boundary of dam (2017)

Swampy Woodland habitat on northern property boundary

Swampy Woodland habitat on dam embankment

Wood Duck roosting on maintenance shed adjacent dam

Dam and environs (2020)

9.6 VQA ASSESSMENT SCORES

Habitat Zone			5A	6A	7A
Benchmark criteria		Max. Score	Swampy Woodland	Swampy Woodland	Swampy Woodland
			EVC 937	EVC 937	EVC 937
Site condition	Large Old Trees	10	10	10	10
	Canopy cover	5	5	5	5
	Understorey	25	15	0	0
	Lack of weeds	15	4	0	0
	Recruitment	10	10	0	3
	Organic litter	5	5	3	5
	Logs	5	4	2	0
Multiplier			1	1	1
Site condition total		100%	53	20	23
	Patch Size	10	1	1	1
	Neighbourhood	10	1	1	1
	Distance to Core	5	0	0	0
Landscape total			2	2	2
Habitat quality score		100	55	22	25
Habitat score as above = #/100			0.55	0.22	0.25

Habitat Zone			12A	8A	4A
Benchmark criteria		Max. Score	Swampy Woodland	Swampy Woodland	Aquatic Herbland
			EVC 937	EVC 937	EVC 653
Site condition	Large Old Trees	10	10	10	n/a
	Canopy cover	5	5	5	n/a
	Understorey	25	0	0	20
	Lack of weeds	15	0	0	13
	Recruitment	10	0	3	10
	Organic litter	5	3	3	5
	Logs	5	2	0	n/a
Multiplier			1	1	1.36
Site condition total		100%	20	21	65.28
	Patch Size	10	1	1	1
	Neighbourhood	10	1	1	1
	Distance to Core	5	0	0	0
Landscape total			2	2	2
Habitat quality score		100	**22**	**23**	**67**
Habitat score as above = #/100			0.22	0.25	0.67

9.7 ENSYM OFFSET REPORT

(to be substituted with a DELWP NVR report upon confirmation of the development extent)

Scenario test – native vegetation removal

This report provides offset requirements for internal testing of different proposals to remove native vegetation. **This report DOES NOT support an application to remove, destroy or lop native vegetation under Clause 52.16 or 52.17 of planning schemes in Victoria.** A report must be obtained from the Department of Environment, Land, Water and Planning (DELWP).

Date of issue: **10/01/2021**
Time of issue: **7:30 pm**

Report ID: Scenario Testing

Project ID	2021-01-03_20042_wetland_losses_v1.0

Assessment pathway

Assessment pathway	**Detailed Assessment Pathway**
Extent including past and proposed	2.174 ha
Extent of past removal	0.000 ha
Extent of proposed removal	2.174 ha
No. Large trees proposed to be removed	12
Location category of proposed removal	Location 2 The native vegetation is in an area mapped as an endangered Ecological Vegetation Class (as per the statewide EVC map). Removal of less than 0.5 hectares of native vegetation in this location will not have a significant impact on any habitat for a rare or threatened species.

1. Location map

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Scenario test – native vegetation removal

Offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

General offset amount[1]	1.211 general habitat units
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Knox City Council
Minimum strategic biodiversity value score[2]	0.216
Large trees	12 large trees

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

1 The general offset amount required is the sum of all general habitat units in Appendix 1.

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

Scenario test – native vegetation removal

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Detailed Assessment Pathway and it will be assessed under the Detailed Assessment Pathway.

This report DOES NOT support an application to remove, destroy or lop native vegetation under Clause 52.16 or 52.17 of planning schemes in Victoria.

If you wish to remove the mapped native vegetation you must submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to ensymnvrtool.support@delwp.vic.gov.au. DELWP will provide a *Native vegetation removal report* that is required to meet the permit application requirements in accordance with *Guidelines for the removal, destruction or lopping of native vegetation* (Guidelines).

Appendix 1: Description of native vegetation to be removed

The species-general offset test was applied to your proposal. This test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the species offset threshold. The threshold is set at 0.005 per cent of the mapped habitat value for a species. When the proportional impact is above the species offset threshold a species offset is required. This test is done for all species mapped at the site. Multiple species offsets will be required if the species offset threshold is exceeded for multiple species.

Where a zone requires species offset(s), the species habitat units for each species in that zone is calculated by the following equation in accordance with the Guidelines:

Species habitat units = extent x condition x species landscape factor x 2, where the species landscape factor = 0.5 + (habitat importance score/2)

The species offset amount(s) required is the sum of all species habitat units per zone

Where a zone does not require a species offset, the general habitat units in that zone is calculated by the following equation in accordance with the Guidelines:

General habitat units = extent x condition x general landscape factor x 1.5, where the general landscape factor = 0.5 + (strategic biodiversity value score/2)

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
4-A	Patch	gipp0653	Endangered	0	no	0.670	1.681	1.681	0.270		1.073	General
5-A	Patch	gipp0937	Endangered	2	no	0.550	0.124	0.124	0.270		0.065	General
489-LS	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.071	0.039	0.270		0.007	General
488-LS	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.071	0.039	0.270		0.007	General
6-A	Patch	gipp0937	Endangered	2	no	0.220	0.046	0.046	0.268		0.010	General
442-LS	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.071	0.071	0.270		0.013	General
7-A	Patch	gipp0937	Endangered	1	no	0.250	0.024	0.024	0.270		0.006	General
8-A	Patch	gipp0937	Endangered	0	no	0.230	0.030	0.030	0.269		0.006	General
12-A	Patch	gipp0937	Endangered	2	no	0.220	0.023	0.023	0.270		0.005	General

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Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
428-LS	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.071	0.048	0.270		0.009	General
429-LS	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.071	0.048	0.270		0.009	General

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Appendix 2: Information about impacts to rare or threatened species' habitats on site

This table lists all rare or threatened species' habitats mapped at the site.

Species common name	Species scientific name	Species number	Conservation status	Group	Habitat impacted	% habitat value affected
Australian Grayling	*Prototroctes maraena*	4686	Vulnerable	Dispersed	Habitat importance map	0.0019
Grey-headed Flying-fox	*Pteropus poliocephalus*	11280	Vulnerable	Dispersed	Habitat importance map	0.0019
Grey Billy-buttons	*Craspedia canens*	504643	Endangered	Dispersed	Habitat importance map	0.0005
Lacey River Buttercup	*Ranunculus amplus*	505019	Rare	Dispersed	Habitat importance map	0.0004
Veined Spear-grass	*Austrostipa rudis subsp. australis*	504940	Rare	Dispersed	Habitat importance map	0.0004
Veiled Fringe-sedge	*Fimbristylis velata*	501369	Rare	Dispersed	Habitat importance map	0.0003
Growling Grass Frog	*Litoria raniformis*	13207	Endangered	Dispersed	Habitat importance map	0.0003
Green Scentbark	*Eucalyptus fulgens*	505175	Rare	Dispersed	Habitat importance map	0.0003
Spurred Helmet-orchid	*Corybas aconitiflorus*	500835	Rare	Dispersed	Habitat importance map	0.0002
Fringed Helmet-orchid	*Corybas fimbriatus*	500839	Rare	Dispersed	Habitat importance map	0.0002
Hardhead	*Aythya australis*	10215	Vulnerable	Dispersed	Habitat importance map	0.0002
Lewin's Rail	*Lewinia pectoralis pectoralis*	10045	Vulnerable	Dispersed	Habitat importance map	0.0002
Glossy Grass Skink	*Pseudemoia rawlinsoni*	12683	Vulnerable	Dispersed	Habitat importance map	0.0002
Australasian Shoveler	*Anas rhynchotis*	10212	Vulnerable	Dispersed	Habitat importance map	0.0002
Matted Flax-lily	*Dianella amoena*	505084	Endangered	Dispersed	Habitat importance map	0.0002
Blue-billed Duck	*Oxyura australis*	10216	Endangered	Dispersed	Habitat importance map	0.0001
Southern Toadlet	*Pseudophryne semimarmorata*	13125	Vulnerable	Dispersed	Habitat importance map	0.0001
Australian Little Bittern	*Ixobrychus dubius*	10195	Endangered	Dispersed	Habitat importance map	0.0001
Floodplain Fireweed	*Senecio campylocarpus*	507136	Rare	Dispersed	Habitat importance map	0.0001
Sticky Wattle	*Acacia howittii*	500044	Rare	Dispersed	Habitat importance map	0.0001

Yarra Gum	*Eucalyptus yarraensis*	501326	Rare	Dispersed	Habitat importance map	0.0001
Pale Swamp Everlasting	*Coronidium gunnianum*	504655	Vulnerable	Dispersed	Habitat importance map	0.0001
Baillon's Crake	*Porzana pusilla palustris*	10050	Vulnerable	Dispersed	Habitat importance map	0.0001
Purple Diuris	*Diuris punctata*	501084	Vulnerable	Dispersed	Habitat importance map	0.0001
Eastern Great Egret	*Ardea modesta*	10187	Vulnerable	Dispersed	Habitat importance map	0.0001
Musk Duck	*Biziura lobata*	10217	Vulnerable	Dispersed	Habitat importance map	0.0001
Arching Flax-lily	*Dianella sp. aff. longifolia (Benambra)*	505560	Vulnerable	Dispersed	Habitat importance map	0.0001
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	10220	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Bittern	*Botaurus poiciloptilus*	10197	Endangered	Dispersed	Habitat importance map	0.0000
Round-leaf Pomaderris	*Pomaderris vaccinifolia*	502675	Endangered	Dispersed	Habitat importance map	0.0000
Black Falcon	*Falco subniger*	10238	Vulnerable	Dispersed	Habitat importance map	0.0000
White-throated Needletail	*Hirundapus caudacutus*	10334	Vulnerable	Dispersed	Habitat importance map	0.0000
Small Golden Moths	*Diuris basaltica*	501473	Endangered	Dispersed	Habitat importance map	0.0000
Square-tailed Kite	*Lophoictinia isura*	10230	Vulnerable	Dispersed	Habitat importance map	0.0000
Powerful Owl	*Ninox strenua*	10248	Vulnerable	Dispersed	Habitat importance map	0.0000
Melbourne Yellow-gum	*Eucalyptus leucoxylon subsp. connata*	504484	Vulnerable	Dispersed	Habitat importance map	0.0000
Common Bent-wing Bat (eastern ssp.)	*Miniopterus schreibersii oceanensis*	61342	Vulnerable	Dispersed	Habitat importance map	0.0000

Habitat group

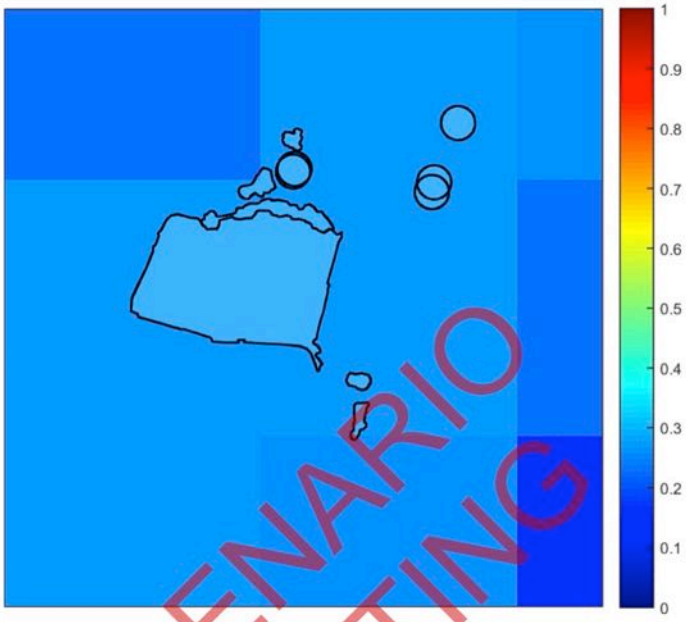
- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

Habitat impacted

- Habitat importance maps are the maps defined in the Guidelines that include all the mapped habitat for a rare or threatened species
- Top ranking maps are the maps defined in the Guidelines that depict the important areas of a dispersed species habitat, developed from the highest habitat importance scores in dispersed species habitat maps and selected VBA records
- Selected VBA record is an area in Victoria that represents a large population, roosting or breeding site etc.

Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map



9.8 GIS MAPS

The following *Native Vegetation Losses* aerial map was produced using Quantum GIS (QGIS 3.10) and were developed from various datasets including:

- Aerial photography provided by Development Victoria,
- VicMap layers (Parcel, Roads, Waterways and Contours),
- GPS based data collected in the field.

The *Existing Tree Mapping* plan was provided by MDG Landscape Architects (2021) and includes:

- *Development Master Plan* layout as provided by Architectus Pty Ltd (2021),
- Tree locations and identification details as provided by *Arborist Assessment* report (Galbraith 2020)
- Identification of retained, lost and retained where practicable tree categories as determined in collaboration by MDG Landscape Architects and Ecocentric.

NATIVE VEGETATION OFFSETS

lost and Offset

retained and Offset

(denotes patch and scattered tree numbers)

CDP extent

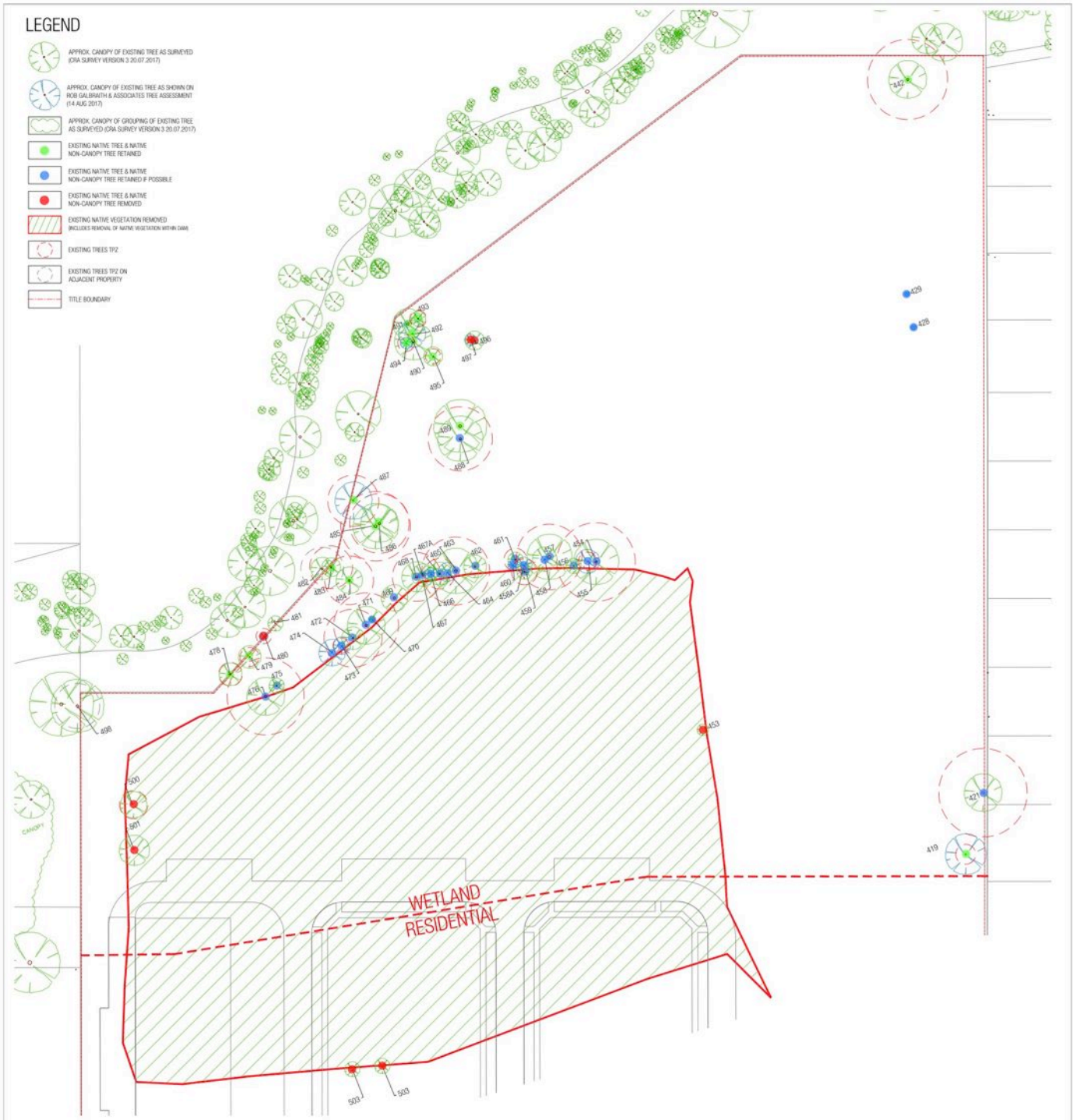
wetland study area

Property boundaries (cadastre)

Scale: 1 : 2,000

Datum: GDA94MGA55

0 50 100 m



KNOXFIELD

EXISTING TREE MAPPING

WETLAND NATIVE & NATIVE NON-CANOPY TREES

1:500 @ A1 | DATE FEB 2021 | JOB No.1878C

DWG No. 1878C LSK02 [E]

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LEGEND
APPROX. CANOPY OF EXISTING NATIVE TREE & NATIVE NON-CANOPY TREES AS SURVEYED (CRA SURVEY VERSION 3 20.07.2017)
APPROX. CANOPY OF EXISTING NON NATIVE TREE & NATIVE EXEMPT TREE AS SURVEYED (CRA SURVEY VERSION 3 20.07.2017)
APPROX. CANOPY OF GROUPING OF EXISTING NATIVE TREES AS SURVEYED (CRA SURVEY VERSION 3 20.07.2017)
APPROX. CANOPY OF GROUPING OF EXISTING NON NATIVE TREES AS SURVEYED (CRA SURVEY VERSION 3 20.07.2017)
EXISTING NATIVE VEGETATION
TITLE BOUNDARY
WETLAND RESIDENTIAL
KNOXFIELD
EXISTING TREE MAPPING - FOR INFORMATION ONLY
1:1250 @ A1
DATE FEB 2021
JOB No.1878C
DWG No. 1878C LSK01 [E]
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