Victorian Murray Floodplain Restoration Project

Flora and Fauna Assessment - Vinifera

| V0

27/03/2020

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Contents

Contents

Executive Summary

Project understanding and study area

The Vinifera Floodplain Restoration Project is one of nine discrete environmental works projects being undertaken as part of the Victorian Murray Floodplain Restoration Project (VMFRP), which is being implemented as part of Victoria's obligations under the Murray Darling Basin Plan. The VMFRP aims to return a more natural wetting and drying regime across more than 14,000 ha of Murray River floodplain and wetlands of high ecological value in Victoria through the construction of new infrastructure and modification of existing infrastructure.

The VMFRP is being implemented in partnership between Lower Murray Urban and Rural Water Corporation (LMW), Goulburn Murray Rural Water Corporation (GMW), Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority (North Central CMA), Parks Victoria and the Department of Environment, Land, Water and Planning (DELWP), and is funded by the Commonwealth Department of Agriculture, Water and Environment.

The Vinifera Floodplain Management Project (the Vinifera Project) aims to facilitate environmental watering and inundate 350 ha of the Vinifera component of the Nyah-Vinifera Park. Construction of infrastructure and modification of existing infrastructure is required for the project to divert, retain, release and control environmental water (Seran BL&A, 2018). The works associated with the Vinifera Project are located at three locations within Vinifera Park. Ecological and biodiversity survey information is required for the proposed construction footprint at the locations and also for the inundation area, to assist with the planning approvals process for the project.

VMFRP engaged R8 (GHD Pty Ltd and Jacobs Group Australia Pty Ltd partnering as the R8 Joint Venture) to survey the construction footprints at each Study Site, to identify any rare or threatened flora or fauna and communities within the sites, and to provide information on the flora and fauna that may potentially occur in the inundation area.

The purpose of this report is to provide a consolidated ecological assessment report of the project area (construction footprint and inundation area), which includes findings from the recent flora and fauna survey (October and December 2019, and January 2020) as well as summarising previous ecological assessments undertaken within the project area (ARI 2013, GHD 2013, Australian Ecosystems 2016).

Results

Native vegetation was identified within the construction footprint that has the potential to be impacted by the proposed works. In total, 6.657 hectares of native vegetation comprising five different Ecological Vegetation Classes (EVCs) was identified within the construction footprint. A further 1.165 hectares of native vegetation has been mapped along access tracks that will be required to access the construction area and may require upgrades and/or trimming of adjacent vegetation.

No communities listed under either the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Flora and Fauna Guarantee (FFG) Act 1988* are present within the construction footprint or anticipated to be impacted by the proposed inundation.

No EPBC Act-listed plant species were identified within the study area. However, rare or threatened flora were recorded in, or close to, the construction footprint including:

- One *Flora and Fauna Guarantee (FFG) Act 1988* listed threatened flora species;
- Four flora species considered rare or threatened in Victoria (DELWP advisory);
- Eight flora species listed as protected under the FFG Act.

Fauna species (and communities) listed under the EPBC Act or the FFG Act were not recorded during the survey. However, an assessment of the likelihood of occurrence identified the following listed fauna species/communities as possibly occurring in the construction footprint or surrounding study area at the time of the assessment:

- One EPBC Act listed species (the Regent Parrot, *Polytelis anthopeplus monarchoides*);
- Seventeen EPBC Act Migratory species;
- Seven FFG Act listed fauna species; and
- One FFG Act listed fauna community (Victorian Temperate Woodland Bird Community).

Impacts to EPBC Act and FFG Act listed fauna species/communities that are considered to have the potential to occur within the construction footprint are likely to be low.

The Ramsar Wetland Hattah-Kulkyne National Park is located 50-100 km downstream of the study area. It is unlikely that the project will negatively impact on the character of the Ramsar site.

VMFRP have utilised the results of this ecology report (and other specialist reports) to determine footprints within the construction areas that avoid and minimise impacts to areas of ecological value. Particular efforts have been made during the detailed design phase of the project to avoid and minimise impacts to patches of native vegetation containing habitat for rare or threatened species and large trees (particularly hollow bearing large trees).

Legislation

There are a number of ecological values present within the construction footprint with the potential to trigger the requirement to obtain a permit under various items of legislation if impacted.

The following permits/approvals are likely to be, required for this project:

- A permit (Management Authorisation) under the *Wildlife Act 1975* is likely to be required for salvage, handling and disturbance of native fauna that may be at risk of harm during construction. This could be achieved by engaging a qualified ecologist in possession of this permit to undertake this task.
- A Permit under the *FFG Act 1988* is required where works may impact threatened and/or protected flora and native vegetation that threatened fauna are likely to use. Once the construction footprint at each of the sites is finalised a permit will need to be obtained for impacts to both listed and protected flora species.
- Planning approval to remove native vegetation under the Swan Hill Planning Scheme in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017).
- Offsets would be sought in accordance with the requirements of the *Guidelines for removal, destruction or lopping of native vegetation* (DELWP 2017) or through an alternate arrangement agreed with the Secretary to DELWP. The loss of native vegetation due to construction activities is proposed to be offset, at least in part, by the expected improvement in native vegetation quality in the inundation area resulting from environmental watering. The method for confirming this offset would be developed in consultation with DELWP. Any offset requirements that cannot be met through environmental watering would be purchased by the project.
- A referral to the Commonwealth Environment Minister for a determination under the *EPBC Act 1999* has been developed, as although it has been suggested that it is unlikely that a significant impact will occur on Matters of National Environmental Significance (MNES) a precautionary approach to refer the project has been adopted.

Recommendations and Next Steps

Additional steps that could be taken to further avoid and minimise impacts to ecological values during the construction and implementation of the project have been outlined in Section 10.

The following steps are recommended for the project:

- Develop specific mitigation measures related to the works and incorporate these into a project specific CEMP.
- Liaise with DELWP to confirm an approved approach for obtaining offsets for the project. Preliminary discussions with DELWP (Penny Croupcamp, *pers. comm*) have indicated that DELWP in principal agree with the project achieving some or all of the required offsets through the benefits of environmental watering at the park. If additional offsets are required to be purchased, i.e. for particular rare or threatened species, they would need to be purchased via an accredited offset broker and incorporate in an Offset Plan for the project.
- Obtain planning approval for the removal of native vegetation under the Mildura Planning Scheme.
- Obtain a permit for removal of flora listed as threatened and/or protected under the FFG Act.

This report is subject to, and must be read in conjunction with, the limitations set out in section **3** and the assumptions and qualifications contained throughout the Report.

Abbreviations

Abbreviation	Description
CaLP Act	Victorian *Catchment and Land Protection Act 1994*
CMA	Catchment Management Authority
DAWE	Commonwealth Department of Agriculture, Water and Environment (formerly DOEE)
DBH	Diameter at Breast Height
DELWP	Department of Environment, Land, Water and Planning (formerly DEPI)
DEPI	Department of Environment and Primary Industries (now DELWP)
DOEE	Commonwealth Department of the Environment and Energy (formerly DOTE, now DAWE)
DOTE	Commonwealth Department of the Environment (now DAWE)
EE Act	Victorian *Environment Effects Act 1978*
EMP	Environmental Management Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVC	Ecological Vegetation Class
FFG Act	Victorian *Flora and Fauna Guarantee Act 1988*
GHD	GHD Pty Ltd
GIS	Geographic Information System
LGA	Local Government Authority
MDB	Murray Darling Basin
MNES	Matters of National Environmental Significance
Mallee CMA	Mallee Catchment Management Authority
MRCC	Mildura Rural City Council
PMST	Protected Matters Search Tool
R8	R8 Joint Venture by GHD and Jacobs
SDL	Sustainable Diversion Limits
sp.	Species
spp.	More than one species
subsp.	Subspecies
RobP	Robinvale Plains Bioregion
TPZ	Tree Protection Zone
var.	Variety
VBA	Victorian Biodiversity Atlas
VMBC	Victorian Mallee Bird Community
VMFRP	Victorian Murray Floodplain Restoration Project
VTWBC	Victorian Temperate Woodland Bird Community
VROTS	Species listed on DELWP's *Advisory List of Rare or Threatened Plants in Victoria*

WoNS	Weed of National Significance

1. Introduction

The Vinifera Floodplain Restoration Project is one of nine discrete environmental works projects being undertaken as part of the Victorian Murray Floodplain Restoration Project (VMFRP), which is being implemented as part of Victoria's obligations under the Murray Darling Basin Plan. The VMFRP aims to return a more natural wetting and drying regime across more than 14,000 ha of Murray River floodplain and wetlands of high ecological value in Victoria through the construction of new infrastructure and modification of existing infrastructure.

The VMFRP is being implemented in partnership between Lower Murray Urban and Rural Water Corporation (LMW), Goulburn Murray Rural Water Corporation (GMW), Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority (North Central CMA), Parks Victoria and the Department of Environment, Land, Water and Planning (DELWP), and is funded by the Commonwealth Department of Agriculture, Water and Environment.

The Vinifera Floodplain Management Project (the Project) involves the construction of four new regulators (V1, V2, V3 and V4) to retain and regulate water in the Vinifera part of the Nyah Vinifera Park. The project aims to return a more natural inundation regime across approximately 350 ha of high-ecological-value Murray River floodplain, through the construction of new infrastructure and modification of existing infrastructure at the Vinifera component of the Nyah Vinifera Park. This would mimic natural flood events, improve the condition of vegetation communities, and restore floodplain productivity for resident populations of native fauna.

The main components of the project are shown are shown in project drawings (refer section 7 below for links) and include:

- Two regulators located at the northern end of the proposed system (downstream), referred to as regulators V1 and V2 (main regulators). Regulator V1 is located about 330m north-west of regulator V2, and will pass flows through the broad depression leading to the Murray River.
- A regulator at the upstream end of the forest (referred to as regulator V3) to pass local drainage flows, pass overland flows in large events and prevent backflow onto private land during a managed event.
- A regulator at the upstream end of the system (referred to as regulator V4) to prevent backflow into the Murray River when retaining water in the forest and allow inflows from the Murray River.
- A water retaining embankment labelled Main Bank at the northern end of the forest, designed to contain water, including two overflow sills.
- Drop structure, located at the confluence of the River Murray and the outflow path from regulator V2. This will consist of:
    - rock erosion protection within the basin, gabion cut off beam/weir at the upstream end and rock mattress in the outlet cutting and extending to the edge of the Murray River
    - a second gabion cut off beam at the location where the channel steepens as it re-enters the river
    - rock mattresses down the river bank into the water.
- Two banks at the upstream end of Vinifera Park located between regulators V3 to V4 to separate the inundated area from private land, referred to as Forest Track Bank North and Forest Track Bank South.
- Seven sites comprising minor works, block banks and overflow sills between the Murray River and the forest to secure local low points in the natural levee system and contain the water within the floodplain.

1.1.1 Construction footprint

The project consists of four infrastructure sites (Figure 1). The construction footprint was assessed as three sub-sites by Australian Ecosystems (2016). These sub-sites as described in the Australian Ecosystems (2016) report as follows:

- Site 1-(V1 & V2 Regulators & Drop Structure)

- Site 2-(V4 Regulator & Laydown Area)
- Site 3- (V3 Regulator & Laydown Area)

The construction footprint includes roads and tracks, which were subject to rapid, less intensive surveys as part of the 2016 surveys (Australian Ecosystems 2016). The mapping of the access tracks was reviewed in 2019 and found to be an accurate representation of conditions at that time.

1.1.2 Inundation area

Previous ecological investigations into the Vinifera Project Study Sites have not considered impacts to inundation areas. Inundation areas are considered in this report as a desktop level only.

The project aims to inundate an area of floodplain habitat up to 350 ha (Figure 2) (Seran BL&A, 2018). The designed water levels for these inundation areas are 64.40 mAHD (Seran BL&A, 2018).

1.2 Project location

The project is located on the southern bank of the Murray River in the Nyah-Vinifera (Regional) Park, 30 km north of Swan Hill between Nyah and Wood Wood. The project is located within the Murray Fans Bioregion and is located within the Swan Hill Rural City Council LGA and Mallee Catchment Management Authority (CMA) regions. The floodplain is one of the most downstream areas of the central river red gum forests which include Barmah-Millewa, Gunbower-Koondrook-Perricoota, Werei, Campbells Island, Guttrum and Benwell.

The Vinifera Project component of the Nyah-Vinifera Park includes 638 ha of floodplain (Mallee CMA 2015). It is an elongated basin adjacent to the Murray River, and is formed from terrestrial landscape to the south and a natural levee to the north. The Study Sites consists of a floodplain complex of wetlands, waterways and woodlands, receiving water from the Murray River via the Vinifera Creek. Historically Vinifera Creek was an anabranch from the river, however has been modified so it functions as a distinct wetland (Mallee CMA 2015).

1.2.1 Construction footprint

The majority of the proposed construction footprint is located on Crown land within the Vinifera part of the Nyah-Vinifera Park. Mapping shows the regulator and construction footprint extending slightly into private property (SPI 48\PP3676) in the vicinity of Regulator 3. However, it is unclear at this stage if this is correct or a mapping error. Cadastral survey will need to be undertaken to confirm the private property boundary in relation to the location of project works.

1.2.2 Inundation area

The majority of the proposed 350 ha inundation area is within Crown land, within the Vinifera part of the Nyah-Vinifera Park as shown in Attachment 3 – Managed Inundation Area. One private property is within the proposed inundation area as identified in Part 1, Section 9 (Land availability and control) of this referral. However, it is unclear at this stage if this is correct or a mapping error. Cadastral survey will need to be undertaken to confirm the private property boundary in relation to the location of project works.

FIGURE 1: Construction footprint at Vinifera

VMFRP

Murray River
School Hill Road
Bell Street
River Street
Murray River
Church Road
Speewa Road
Drop Structure
Thwaites Road
Spillway 1
Containment Bank - North Bank
Laydown area
Regulator V1
Spillway 2
Regulator V2
Containment Bank - Bank 1
Containment Bank - Bank 2
Containment Bank - Bank 4
Containment Bank - Bank 3
Laydown area
Regulator V4
Hardstand
Spillway 4
Spillway 3
Murray River
Containment Bank - Forest Track Bank North
Containment Bank - Forest Track Bank South
Containment Bank - V3
Regulator V3
River Road
Vernon Lane
Boulton Road
Dickinson Road
Heywood Lane
School Lane
Murray Valley Highway
Takasuka Road
Takasuka Road
Mclean Lane
Hungerford Lane
Wootinen-Vinifera Road
Munro Lane
Shadbolt Lane
Shadbolt Lane

Legend

- Area of Investigation
- Development footprint
- Construction footprint
- Major Road
- Minor Road
- Channel / Drain
- Watercourse Stream
- Waterbody
- Cadastre

SWAN HILL
Murray Valley Highway
WAKOOL
NYAH WEST
Nyah West
SWAN HILL
Tyntyn
Murrawee
0 5 10 km

IS297742

N

Name: GDA 1994 MGA Zone 55

0 500 1,000

Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data © State of Victoria 2019; Jacobs & GHD 2020.

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FIGURE 2: Inundation Extent at Vinifera

VMFRP

Murray River
School Hill Road
Bell Street
River Street
Murray River
Church Road
Speewa Road
Drop Structure
Thwaites Road
Spillway 1
Containment Bank - North Bank
Laydown area
Regulator V1
Spillway 2
Regulator V2
River Road
Containment Bank - Bank 1
Containment Bank - Bank 2
Containment Bank - Bank 4
Containment Bank - Bank 3
Laydown area
Regulator V4
Hardstand
Spillway 4
Murray River
Spillway 3
Containment Bank - Forest Track Bank North
Vernon Lane
Boulton Road
Containment Bank - Forest Track Bank South
Dickinson Road
Containment Bank - V3
Regulator V3
Heywood Lane
school Lane
Murray Valley Highway
Takasuka Road
Woorinen-Vinifera Road
Shadbolt Lane

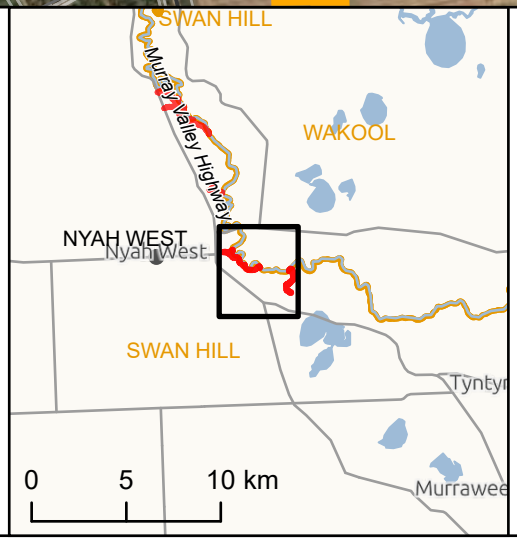
Legend

NV2005_EVCBCS

- 66, Low Rises Woodland
- 96, Ridged Plains Mallee
- 97, Semi-arid Woodland
- 98, Semi-arid Chenopod Woodland
- 102, Low Chenopod Shrubland
- 103, Riverine Chenopod Woodland
- 106, Grassy Riverine Forest
- 158, Chenopod Mallee
- 295, Riverine Grassy Woodland
- 810, Floodway Pond Herbland
- 811, Grassy Riverine Forest/Floodway Pond Herbland Complex
- 814, Riverine Swamp Forest
- 816, Sedgy Riverine Forest
- 819, Spike-sedge Wetland
- 821, Tall Marsh
- 824, Woorinen Mallee
- 826, Plains Savannah

Legend

- Area of Investigation
- Development footprint
- Construction footprint
- Inundation Area
- Major Road
- Minor Road
- Channel / Drain
- Watercourse Stream
- Waterbody
- Cadastre
- Public Land Management



IS297742

N

Name: GDA 1994 MGA Zone 55

0 400 800

Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data © State of Victoria 2019; Jacobs & GHD 2020.

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1.3 Previous ecological assessments

Ecological and biodiversity information has been collected for the project over a number of years. Previous ecological studies for the project that were reviewed as part of this assessment, considered slightly different assessment areas to those described below in Section 4.1. Over time, the extent and impacts associated with the construction footprint at each site has been revised with the overall intent of avoiding and minimising impacts to native vegetation and fauna habitat.

This following previous studies undertaken for the project have been used to help inform the current report:

- In 2013, GHD was engage by Mallee CMA to undertake a baseline flora census across a broad area of Nyah, Vinifera and Burra Creek to address ecological knowledge gaps and provide further inputs into the SDL business case. GHD (2013) Flora Census Summary Report- Memorandum prepared by GHD for Mallee CMA.
- In 2013, ARI undertook baseline fauna surveys of the Burra Creek and Nyah-Vinifera area to inform the SDL business case. ARI (2013) Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria. A report to the Mallee Catchment Management Authority.
- In October 2015, Australian Ecosystems conducted flora, fauna and habitat values of the construction footprint and study area. Australian Ecosystems Pty Ltd (2016). Nyah and Vinifera SDL Project Flora and Fauna Assessment. Detailed Design Stage. Report for Mallee Catchment Management Authority.
- DELWP (2017) Wetland Monitoring and Assessment Program (WetMAP).
- In Spring 2019 R8 were engaged by VMFRP to conduct targeted surveys for threatened flora and fauna species at the construction footprint. The results of these surveys were compiled into a draft report which has been used as the basis for this report.

A summary of previous ecological assessments, including methods, key findings and recommendations is presented in Section 10, with conclusions and recommendations incorporated throughout this report.

1.4 Purpose of this report

The scope of this assessment and report is to:

- Summarise the findings of an updated desktop assessment to review flora, fauna (native species and habitat) and vegetation communities within 10 km of the project area.
- Summarise the previous ecological assessments (GHD 2013, ARI 2013, Australian Ecosystems 2016; R8 2019) undertaken for the project.
- Describe targeted surveys for populations of flora and fauna and communities, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) undertaken by R8 in 2019.
- Provide an inventory of all incidental observations of flora and fauna recorded during 2019 and 2020 surveys undertaken by R8.
- Determine the extent of impacts to native vegetation (including large trees) within the proposed construction areas in accordance with the *Guidelines for the removal, destruction or lopping or native vegetation* (DELWP 2017a).
- Describe specific threatening processes associated with the project as listed under the FFG Act and EPBC Act.
- Determine the likelihood of occurrence of listed threatened flora and fauna species, listed migratory species and listed threatened ecological communities within the proposed construction and inundation areas. Where listed threatened species, migratory species or ecological communities are identified as occurring or having the potential to occur, determine the likely impact on these listed species and ecological communities by the project (during both the construction and operation phases).

- Undertake an assessment of potential impacts on significant wetlands (e.g. Ramsar sites, nationally important wetlands) and other aquatic ecosystems and species.
- Identify potential impacts to ecological values during the construction and operation of the project and recommend mitigation measures to minimise these impacts.
- Discuss potential legislative requirements of the proposed works during the construction and operation phase (with respect to potential flora and fauna impacts).
- The report also provides desktop level assessment only regarding the inundation area.

2. Biodiversity responses to environmental watering

The lowland-dryland rivers of the Murray-Darling Basin (MDB) have either perennial, seasonal, intermittent or ephemeral hydrological regimes and their flows are variable over annual, decadal and centennial time-scales. Weather and climate variability drive the flow regimes of inland Australian rivers, while inland floodplain wetlands experience changes in the frequency, magnitude and duration of flooding in response to climatic cycles and extreme events of rainfall and runoff in their catchments (Ralph and Rogers 2011).

Over the past century, the natural pattern of wetting and drying on floodplains of the MDB has been altered by flow regulation due to dam and weir construction, extraction of water for irrigation, stock and domestic uses, and construction of levees (Boulton & Brock 1999, Brock et al. 1999; Kingsford 2000; Kingsford et al. 2006; Walker 2006). In many cases, the effect has been to remove water from the environment, with the result that inundation of floodplain wetlands occurs less frequently and/or for shorter periods than in pre-European times, leading to chronic desiccation.

Flooding is essential for the effective functioning of floodplain ecosystems; however, flow-ecology relationships and processes in rivers and floodplain wetlands are complex. Many biota in the MDB are adapted to variable flow and respond to flooding, but the optimal frequency, timing, duration and magnitude of floods vary between biota. Despite the variability in response, some common themes emerge when the benefits of flooding are examined for different groups of plants and animals:

- **Vegetation**: Hydrological regimes are the major factor responsible for determining the composition, structure, diversity and function of floodplain forest and wetland communities;
- **Trees**: Successful regeneration of floodplain trees usually occurs after major floods, while floods also provide an essential source of water to maintain tree canopy health;
- **Lignum**: Provides unique floodplain habitat and is dependent on floods for rapid vegetative growth and reproduction;
- **Waterbirds**: Flooding acts as the primary stimulus for breeding waterbirds, increasing reproductive performance as the flood pulse stimulates productivity in the wetlands;
- **Fish**: Flooding may trigger spawning or migration to suitable breeding habitat; and
- **Frogs**: Flooding promotes a rapid response in frog activity, including calling, spawning, and tadpole development and metamorphosis.

The most extensive and severe drought of the past century, known as the Millennium drought (1997-2010), brought the issue of floodplain ecosystem health into the mainstream, with widespread tree dieback across the MDB symptomatic of an ecosystem in decline. During this time, the Murray Darling Basin Committee (MDBC) acknowledged that for the condition of floodplain ecosystems to be improved and to function effectively, adequate amounts of water needed to be provided to key iconic sites to ensure their continued survival. Consequently, since this time the focus of floodplain restoration/rehabilitation has centred on the return of water to help facilitate a more natural (i.e. pre-European settlement) hydrological regime (Boon 2011).

While drought-breaking rain (and subsequent flooding) in 2010-11 and natural floods again in 2016 have provided a much needed boost to MDB floodplain ecosystem condition, these natural floods have been supplemented by a range of environmental watering measures over the past decade, which have been considerably aided by the construction of water infrastructure (e.g. regulators, levees, channels) in strategic locations at a number of Murray River icon sites. This infrastructure has allowed floodplain managers to control the timing, volume, rate, depth and duration of environmental water into designated sites, so that maximum benefit of the water to the environment is able to be generated.

During this time, numerous long-term monitoring programs have been established, including The Living Murray icon site condition monitoring program, to monitor and track the response of floodplain forests and wetlands over time, and in particular, determine how the ecosystem responds to watering. Results to date indicate that the floodplain systems of the mid-lower Murray respond positively to flooding, whether it be landscape-scale overbank flooding or smaller scale events, e.g. watering of creeks, floodrunners and low-lying wetlands.

2.1 Ecological benefits- Vinifera project

Previous investigations on environmental watering has occurred at the Hattah-Kulkyne National Park. The park had received environmental water in spring-summer 2014-15, followed by a natural flood in 2016-17 and which was supplemented with an allocation of environmental water. Following the 2017 monitoring, it was concluded

that the overarching ecological objective for the Hattah Lakes (i.e. “to restore a mosaic of healthy wetland communities”) was being achieved (Wood et al. 2018).

For some components, e.g. River Red Gum and Black Box, condition rebounded strongly after the breaking of the Millennium drought in 2010-11, and has subsequently been maintained, while responses to floods since then have been more subtle, most likely because the baseline condition is now higher than 2010. Conversely, for other components (e.g. wetland and floodplain vegetation, birds), objectives are only partially being met, and there is still work to be done to ensure that these components of the ecosystem are restored so that they meet the benchmark objectives of the program. To summarise, environmental benefits of watering at the Hattah Lakes were multiple and included (DELWP 2017; VEWH 2019):

- Maintenance or improvement in the abundance of native vegetation and water-dependent plant functional groups, particularly on the lakebed, lake edges and the lower floodplain (DELWP 2017);
- Reduction in abundance of plants favouring terrestrial dry habitats (DELWP 2017), although this trend was most evident at sites receiving more frequent flooding (whereas rarely flooded sites were still dominated by drought tolerant species) (Wood et al. 2018); and
- Improved tree canopy cover (and by extension, health) of River Red Gum and Eumong (DELWP 2017; Wood et al. 2018).

Cook et al. (2011) and Wood et al. (2018) have shown that the introduction of environmental water has had positive benefits for threatened water birds including observations of the nationally endangered (EPBC-listed) Australian Painted Snipe (*Rostratula australis*). Other threatened waterbirds recorded during the 2018 inundation event included Freckled Duck (*Stictonetta naevosa*), Blue-billed Duck (*Oxyura australis*) and Glossy Ibis (*Plegadis falcinellus*), with several White-bellied Sea-eagle (*Haliaeetus leucogaster)* observed including a successful breeding pair.

The key environmental objectives of the Vinifera project are to restore the environmental functions of the Nyah Vinifera Park, and to restore key indigenous species, communities and habitats through construction of hydrological environments (MCMA 2015). Specifically, the business case for the Nyah Vinifera Environmental Water Management Plan (MCMA 2015) with regards to ecological benefits where to:

- Restore the structure of wetland plant communities.
- Restore resident populations of frogs and small fish.
- Providing seasonal feeding and reproductive opportunities for riverine fish species.
- Provide reliable breeding habitat for waterbirds, including colonial nesting species.
- Restoring floodplain productivity to maintain resident populations of vertebrate fauna including carpet python, sugar glider and grey-crowned babbler.
- Contribute to the carbon requirements of the River Murray channel ecosystem.
- Attainment of the ecological objectives is anticipated to have wider benefits for the landscape.

Despite multiple benefits of flooding to a range of biota, altered flow regimes also pose potential risks to the environment and biodiversity, including black water events, activation of acid sulphate soils and increased salinity.

3. Limitations and assumptions

This report has been prepared by R8 for VMFRP and may only be used and relied on by VMFRP for the purpose agreed between R8 and VMFRP as set out in Section 1.4 of this report.

R8 otherwise disclaims responsibility to any person other than VMFRP arising in connection with this report. R8 also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by R8 in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

- *Were limited to an ecological assessment of vascular plant species (ferns, conifers and flowering plants). Non-vascular flora (e.g. mosses, liverworts, lichens), fungi and terrestrial invertebrates have not been considered in detail as part of this assessment, except where listed threatened species are known or suspected to occur, or where bryophytes comprise part of the EVC benchmark used for the habitat hectare assessment (e.g. cover of Bryophytes).*
- *Maps in this report displaying site information should not be relied on for the detailed design during the construction process. Please refer to engineering drawings/specifications and survey for detailed site information.*
- *Were limited to terrestrial vertebrate fauna. Freshwater and marine fauna or invertebrate fauna were considered at a desktop level only.*
- *Involved the use of Collector for ArcGIS version 10.3.3 mapping application to record site information. This mapping tool is accurate to within ten metres on site.*
- *Assumed there will be no impacts to native vegetation outside the proposed construction footprint provided by VMFRP.*
- *Did not include a detailed assessment of planning implications with relation to legislation outside of those considered from an ecological perspective.*
- *Included flora investigations as part of the ecological assessment during late-spring, early-summer, which is not always an optimal time of year for conducting botanical assessments in the Mallee region, although timing suitability can vary depending on rainfall (surveys later in spring could be appropriate following previous rainfall). Some native flora are difficult or impossible to locate or identify at this time of year, due to a lack of reproductive material and/or the seasonal nature of some species (in particular, annuals and geophytes). Additional native species are likely to be recorded at the site later (in spring) or at other times of the year. Therefore, it is considered possible that additional rare or threatened flora may be present, but were not detected during the survey because of the timing of the survey, however, extensive previous surveys and database records partially offset this limitation.*
- *Included a field investigation as part of the ecological assessment during late spring-early summer which is an adequate time of year for conducting fauna assessments in the Mallee region. However, we did not conduct assessments which would be optimal for detecting other fauna species, e.g. February-March for juvenile and hence more readily detectable small mammals and reptiles. This was beyond the scope of this assessment. It should also be noted that we also did not conduct trapping (i.e. pitfall, Elliot and funnel trapping).*
- *Did not consider targeted surveys for rare or threatened fauna species that involved extensive trapping (e.g. pitfall, Elliot, funnel trapping). This was beyond the scope of this assessment. Fauna surveys were limited to timed bird survey, active searching and incidental observations.*

- *Using the VBA database, a defined geographical area can be searched to produce lists and details of flora and fauna species that have been documented within the defined search area. These database results are only as accurate as the quality and quantity of data that have been recorded and documented from the area. The use of the database for this assessment has the following limitations:*
    - *Observations are regularly updated but there is a delay. Consequently, all known records, particularly recent records, may not be available at the time of use. The VBA was most recently accessed in January 2020.*
    - *This dataset is not exhaustive. Many locations locally and across Victoria have a low level of documented survey effort for one or more groups of flora and fauna. During field surveys, it is not uncommon to find species at locations for which there are few or no previous nearby database records.*
    - *The inundation extent at this stage has been assessed at a desktop level only.*

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. R8 has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by R8 described in Section 3 of this report. R8 disclaims liability arising from any of the assumptions being incorrect.

R8 has prepared this report on the basis of information provided by VMFRP and others (including government authorities) who provided information to R8 which R8 has not independently verified or checked beyond the agreed scope of work. R8 does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Maps in this report displaying site information should not be relied on for the detailed design during the construction process.

3.1 Acknowledgments

R8 acknowledges the assistance, advice and/or information provided by.

- The Victorian Department of Environment, Land, Water and Planning (DELWP) for access to the VBA database and NatureKit.
- The Commonwealth Department of Agriculture, Water and Environment (DAWE) for access to its Protected Matters Search Tool (PMST).

4. Methods

4.1 Assessment areas

The following assessment areas are referred to throughout this report:

- **Construction footprint** = this includes the project infrastructure as well as the land required to construct the infrastructure. This includes access tracks.
- **Development footprint** = this is the area that the project infrastructure will occupy. This includes tracks used for access during construction and operation.
- **Inundation area** = area of land subject to flooding during managed events, up to a specific design water level.
- **Area of investigation =** this includes the development footprint, as well as a substantial buffer around the development footprint and access tracks.

4.2 Desktop assessment

A review of available biodiversity databases was undertaken to identify terrestrial and aquatic flora and fauna with potential to occur in the construction footprint, development footprint and inundation area. The review considered previous records, predicted occurrences of flora, fauna and vegetation communities, and an assessment of potential habitats from aerial imagery and native vegetation mapping.

The following databases and reports were used:

- The Commonwealth EPBC Act 1999 PMST[1].
- Weeds of National Significance database[2].
- The Victorian Biodiversity Atlas (VBA), maintained by the DELWP[3].
- NatureKit. Spatial database maintained by DELWP, for native vegetation (Ecological Vegetation Class) mapping throughout Victoria. [4]
- The Native Vegetation Information Management tool (NVIM), maintained by DELWP. [5]
- Seran BL&A (2018) Basin Environmental Works. Review of environmental approvals requirements.
- Australia Ecosystems (2016) Nyah and Vinifera SDL Project - Flora and Fauna assessment.
- ARI (2013) Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria. A report to the Mallee Catchment Management Authority.
- GHD (2013) Flora Census Summary Report- Memorandum prepared by GHD for Mallee CMA.

A VBA and PMST search was undertaken for the inundation area.

The results of the desktop assessment are presented in the likelihood of occurrence / impact tables contained in Appendix B (Construction footprint – Flora), Appendix C (Inundation area – Flora), Appendix E (Construction footprint – Fauna) and Appendix F (Inundation area – Fauna).

4.3 Field Assessments

The results of a number of field assessments have been incorporated in to this report, and a description of the methods for each of these is outlined below.

4.3.1 Vegetation and Targeted Threatened Flora Assessments

Field surveys were undertaken on October 28 and 31 2019 by R8 Senior Botanist (Drew King) and Ecologist (Tao Lee). Fieldwork was undertaken in all proposed construction footprints, and targeted surveys for rare or threatened flora were conducted (with particular emphasis on EPBC and FFG listed threatened flora) to update

[1] http://www.environment.gov.au/epbc/protected-matters-search-tool (accessed on January 2020)
[2] http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html (accessed Jan 2020)
[3] https://www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas (accessed on January 2020)
[4] http://maps.biodiversity.vic.gov.au/viewer/?viewer=NatureKit (accessed on Jan 2020)

the results of previous assessments undertaken in the original construction footprints (Australian Ecosystems 2016).

The surveys involved two field staff walking parallel linear transects 10 m apart over the extent of the three construction footprints, with each ecologist having a 5 m field of view each side of the transect. Rare and threatened flora encountered were GPS marked and details recorded.

4.3.2 Flora species

A detailed record of flora species within the study area is provided by Australian Ecosystems (2016) which involved detailed vegetation assessments.

4.3.3 Targeted Threatened Fauna Assessments

Field surveys were undertaken on the 25th October and 11th December 2019 by R8 Senior Zoologists Alex Holmes and Dan Eyles. The surveys were conducted within the construction footprint to confirm the condition and extent of fauna habitats and to conduct targeted surveys for threatened fauna known to occur in the construction footprint (ARI 2013, Australian Ecosystems 2016). Particular focus was given to the eastern subspecies of Regent Parrot (*Polytelis anthopeplus monarchoides*) which is known from the area, and has been recorded previously in the project area and is listed under both the EPBC Act and the FFG Act.

A search of the VBA and PMST indicated that 42 fauna species are either known or are predicted to occur within the construction area. Of the 42 species, eight were considered to have the potential to occur in the construction areas based on habitat requirements and number and period since last recorded). These eight species made up the target threatened species list for the surveys and include Grey-crowned Babbler (*Pomatostomus temporalis*), Ground Cuckoo-shrike (*Coracina maxima*), Hooded Robin (*Meladryas cucullata*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), Regent Parrot (*Polytelis anthopeplus monarchoides*), Black Falcon (*Falco subniger*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*) and Carpet Python (*Morelia spilota metcalfei*).

Surveys focussed on previously identified threatened fauna reported in ARI 2013 and Australian Ecosystems 2016. The surveys included:

- Surveys for the Nationally and State listed Regent Parrot (*Polytelis anthopeplus monarchoides*).
- Surveys of the FFG Act listed Grey-crowned Babbler (*Pomatostomus temporalis*)
- Recording all identified fauna, and their observed behaviour (e.g. feeding, roosting, breeding), abundance and conservation status.
- Pest fauna posing a threat to native vegetation and/or fauna.
- Active searching of appropriate fauna habitats\ (logs, tree hollows, tussocks, deep litter etc.) and food plants (i.e. fruit and/or nectar bearing) for mammals, birds, reptiles and frogs and habitat assessments for threatened fauna.
- Habitat assessments for threatened fauna were completed.
- Migratory terrestrial or migratory wetland species were considered as part of this assessment.

See Table 1 below for a summary of survey effort conducted at Vinifera. It should also be noted that methods described in 'Survey guidelines for Australia's threatened birds, Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*' (Department of the Environment, Water, Heritage and the Arts 2010) were consulted and employed for Regent Parrot.

Table 1 Summary of survey methods and effort employed for Vinifera fauna survey

Survey type	Survey effort	Species targeted
Habitat assessment	Conducted over approximately 2-3 person-hours per site, investigating construction area through various survey methods	All
Bird surveys	At least 2 x 20 minute, 2 ha diurnal surveys at each construction area (two ecologists distributed across sites undertaking survey	Grey-crowned Babbler, Ground Cuckoo-shrike, Hooded Robin, Major Mitchell's Cockatoo, Regent

	concurrently). Approx 14 surveys undertaken	Parrot, Black Falcon, White-bellied sea-eagle
Active searches	Conducted opportunistically by two ecologists concurrently at each construction area for a period of 30-60 mins. Approx 14 surveys conducted	Carpet Python
Scat / hair / bone / skin / pellet analysis	Assessed / Collected opportunistically	All
Opportunistic observations	Two ecologists over the entire survey period, including two 8-hour including travel to other construction areas inside of park Minimum of 32 person-hours of opportunistic observation	All

The Regent Parrot was not recorded within the construction footprint by ARI (2013) and Australian Ecological (2016), but has been previously recorded within 10 km of the construction footprint five times, most recently in 2019 (VBA). According to the National Recovery Plan for Regent Parrots, the construction footprint falls within mapped areas where Regent Parrots are likely to occur, however the Nyah-Vinifera Park falls outside of the mapped distribution of likely important breeding area (nesting and foraging) (Baker and Hurley 2011).

A precautionary approach was taken and surveys included area searches and assessments for potential nesting habitat according to the Survey Guidelines for Australia's Threatened Birds (Magrath et al. 2010). If nesting habitat (and breeding activity) was suspected to occur within the construction footprint, further surveys would be conducted to confirm the presence of breeding using methods described previously by Webster and Belcher (2008) and later refined by GHD (2009).

Migratory terrestrial and migratory wetland species were considered as part of this assessment.

Regent Parrot targeted nest surveys

The Regent Parrot is listed as threatened under the FFG Act 1988 and Vulnerable under the EPBC Act 1999. The Regent Parrot typically nests within suitable hollows of River Red-gum, with the male initially travelling up to 20 km to forage within Mallee habitats, returning to feed the female (when incubating eggs) and later the nestlings. There are limited records of this species within 10 km of the proposed construction footprint, and breeding activity has not been previously reported or mapped within the Nyah-Vinifera Park. As a precautionary measure, potential nesting habitat and nesting activity was investigated in the construction footprint within the prescribed targeted survey period (Magrath *et al*. 2010).

During the targeted fauna surveys, observers closely observed for potential nesting trees and recorded any Regent Parrot activity in the immediate vicinity. No Regent Parrots were observed during targeted surveys, and no trees with potential to provide Regent Parrot nesting habitat were observed within the construction footprint.

Timing of surveys for Regent Parrot nest sites

Surveys should be undertaken during the breeding season for Regent Parrots (within the period of September to January, inclusive), with a preference for October through December, depending on seasonal conditions such as winter/spring rainfall. Whilst this survey only included surveys for nesting habitat and not breeding activity for the Regent Parrot, surveys were completed in the optimal period for Regent Parrot breeding activity (November-December). If breeding habitat and breeding activity were suspected, further surveys would be conducted to confirm the presence of breeding using methods described previously by Webster and Belcher (2008) with later explanations provided from GHD (2009).

4.3.4 Inundation Area mapping and impact assessment

The extent of inundation that will result following the proposed works has been modelled and considered in this report. The potential impact on native vegetation has been considered using DELWP modelled vegetation

communities and potential impact on rare and threatened species has been based on VBA records and an assessment of whether species are likely to occur within the modelled vegetation communities inundated and whether any impact is likely to be positive, neutral or detrimental.

4.4 Nomenclature

4.4.1 Flora

Unless otherwise noted, common and scientific names for flora follow the VBA database (Version 3.2.5).

Flora conservation status was determined in accordance with the Commonwealth EPBC Act, the Victorian *Flora and Fauna Guarantee (FFG) Act 1988*, and the *Advisory List of Rare or Threatened Plants in Victoria* – 2014 (DEPI 2014).

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. For the purpose of the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017a), native vegetation is classified into two categories, a **Patch** of vegetation or a **Scattered Tree**:

- A **patch** of native vegetation is either:
  - An area of native vegetation where at least 25% of the total perennial understorey plant cover[6] is native.
  - Any area with three or more native canopy trees[7] where the drip line[8] of each tree touches the drip line of at least one other tree, forming a continuous canopy.
  - Any mapped wetland included in the Current wetlands map (available on DELWP online mapping tools).
- A **scattered tree** is a native canopy tree that does not form part of a patch.

Other forms of vegetation include:

- **Planted native vegetation,** i.e. includes non-indigenous native species and areas of revegetation).
- **Scattered native plants**, i.e. patches of vegetation dominated by introduced species where less than 25% of the total perennial understorey plant cover is native.
- **Non-native vegetation**, i.e. vegetation that comprises entirely introduced flora species.

4.4.2 Fauna species and communities

Unless otherwise noted, common and scientific names for fauna follow the VBA database (Version 3.2.6).

Fauna conservation significance was determined in accordance with the Victorian *Flora and Fauna Guarantee Act 1995* (FFG Act), DELWP's Advisory Lists (DSE 2009; DSE 2013) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPBC Act and the FFG Act list a number of threatened fauna communities, at a national or state scale, respectively. Fauna communities known or potentially occurring within the study area are only considered if they are listed under one or more of these Acts.

4.5 Permits

Surveys were completed in accordance with the R8 flora and fauna survey permit conditions issued under the Wildlife Act 1975 and National Parks Act 1975; Research Permit 10009193, and 10008653 administered by DELWP. One of the permit conditions requires that all fauna and flora data collected during the surveys are submitted to the Atlas of Victorian Wildlife database and the Victorian Biodiversity Atlas (which is also a condition of the data-sharing agreement between R8 and DELWP).

[6] Plant cover is the proportion of the ground cover that is shaded by vegetation foliage when lit directly from above. Areas that include non-vascular vegetation (such as mosses and lichens) but otherwise support no native vegetation are not considered to be patch for the purpose of the Guidelines. However, when non-vascular vegetation is present with vascular vegetation, it does contribute to the cover when determining the percentage of perennial understorey plant cover.

[7] A native canopy tree is a mature tree (i.e. it is able to flower) that is greater than 3 metres in height and is normally found in the upper layer of the relevant vegetation type.

[8] The drip line is the outer most boundary of a tree canopy (leaves and/or branches) where the water drips on to the ground.

In addition, R8 has an operating Animal Ethics Committee (AEC). Approval to undertake the proposed survey methods was obtained from the R8 AEC prior to the commencement of field studies.

5. Targeted threatened species surveys

Targeted surveys for rare or threatened species were undertaken in October to December 2019 within the construction footprint, these areas contained intact native vegetation and it was considered possible that they supported suitable habitat of varying qualities for rare or threatened species.

5.1 Threatened flora assessment

VBA and PMST searches identified 8 FFG and/or EPBC listed flora species that have been recorded or are modelled to occur within 10 km of the construction footprint. A further 36 species listed as rare or threatened on the Advisory list of Rare and Threatened Plants in Victoria have previously been recorded within a 10km buffer of the construction footprint (DEPI 2014).

Each of these 44 species were then assessed for their likelihood of occurrence (Appendix B), taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Vinifera construction footprints, and also the number of recent records within 10 km of the construction footprint.

Species for which habitat was present or that had previously been located within the Nyah-Vinifera Park were targeted during the threatened flora surveys (Appendix B). The survey did not locate any EPBC listed species within the construction footprint. One FFG listed species – *Acacia oswaldii* – was identified within the revised construction areas in 2019. Three further rare or threatened species listed on the Advisory list of Rare and Threatened Plants in Victoria (DEPI 2014) were located as summarised in Appendix B.

Table 2: Summary of threatened flora recorded during 2019 surveys

Species Name	Conservation Status	Location(s)
Acacia oswaldii (Umbrella Wattle)	DELWP Advisory list – vulnerable FFG listed	Site V3 (3 plants)
Atriplex pseudocampanulata (Fan Salt-bush)	DELWP Advisory list – rare	Site V3 (2 plants)
Senecio cunninghamii var. cunninghamii (Branching Groundsel)	DELWP Advisory list – rare	Site V1, V2, V3 >1000 likely to be impacted
Vittadinia pterochaeta (Winged New Holland Daisy)	DELWP Advisory list – vulnerable	Site V1 (1 plant)

5.2 Inundation area

VBA and PMST searches identified 8 FFG and/or EPBC listed flora species that have been recorded or are modelled to occur within 10 km of the inundation area. A further 37 species listed as rare or threatened on the Advisory list of Rare and Threatened Plants in Victoria have previously been recorded within a 10 km buffer of the inundation area(DEPI 2014).

Each of these 45 species were then assessed for their likelihood of occurrence (Appendix C) and potential response to the proposed inundation, taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the inundation area. The inundation area included mainly vegetation communities that were classified as swamp or wetland areas only. A small area of modelled dryland communities (~0.53 ha) are potentially impacted but field assessment has confirmed that the vegetation likely to be inundated is incorrectly mapped.

Adverse impacts were not predicted for any of the flora species for which habitat occurs within the inundation areas.

5.3 Targeted threatened fauna assessment results

5.3.1 Desktop assessment

Study area

VBA and PMST search identified 42 terrestrial fauna species previously recorded or have the potential to occur within 10 km of the construction footprint, that are FFG Act listed (34) and/or EPBC Act listed (14).

Each of these 42 species was then assessed for their likelihood of occurrence, taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Vinifera construction footprint and study area, and also the recentness of records (within the last 30 years) within 10 km of the construction footprint. This is discussed further in Section 6, along with an assessment of predicted impacts to species likely to occur or known to occur within the construction footprint.

Australian Ecosystems (2016) surveys recorded one FFG Act species within the construction footprint, the Grey-crowned Babbler (*Pomatostomus temporalis*).

ARI (2013) identified one species listed as near threatened within the construction footprint, the Little Broad-nosed Bat (*Scotorepens greyii*) DELWP Advisory listed species. This species was identified using bat detectors located within the construction footprint.

Inundation area

VBA and PMST searches identified 37 FFG and/or EPBC listed fauna species that have been recorded or have the potential to occur within the inundation area with a 10 km buffer.

Each of these 43 species was then assessed for their likelihood of occurrence, taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the Vinifera inundation area, and also the number of recent records within 10 km of the construction footprint. This is discussed further in Section 6, along with an assessment of predicted impacts to species likely to occur or known to occur within the construction footprint.

5.4 Targeted Threatened Fauna Assessment Results

During field surveys at the Vinifera construction footprints on the 25th November and 11th December 2019, R8 Ecologists identified 132 individual fauna across 25 species (all birds). No threatened fauna were recorded during these surveys. A summary of all fauna species recorded during the surveys is provided in Appendix D.

General observation of the habitat within the construction footprint consisted of River-Red Gum woodland with a grassy/herbaceous understory, chiefly lacking a mid-storey of shrubby vegetation. Fauna habitats broadly align with the EVC's described in 7.1. Many of these canopy trees were large old trees with many hollows, cracks, fissures and loose bark which provide many fauna habitat values.

6. Impacts to threatened flora, fauna and communities

The likelihood of each species or community of conservation significance occurring within the construction footprint and the broader study area was assessed on the basis of the species' or community's history of occurrence and its habitat requirements. For each species or community, the presence of suitable habitat within the construction footprint was determined, along with the condition and approximate extent of suitable habitat within the study area and the broader context of the surrounding landscape. This was coupled with how often and how recently each species or community had been recorded (if at all) within the construction footprint or within 10 km of the construction footprint. Resources utilised to assist in determining likelihood of occurrences included VBA and PMST searches (within a 10 km radius of the construction footprint), as well as the previous reports for the project and the most recent surveys. The basis of the likelihood of occurrence of each threatened species of community within one or more of the Study Sites was specifically:

PRESENT – Species known to occur within the construction footprint, or detected during the site visit.

POSSIBLE – Potentially suitable habitat occurs within the construction footprint and species' known range encompasses the construction footprint. Species recorded historically in the 10-km search area, and generally within the last 30 years.

UNLIKELY – Species' known range encompasses the construction footprint, but suitable habitat does not occur within construction footprint, or occurs within construction footprint but with generally low quality and quantity. Species recorded historically in the 10-km study area but generally not within the last 30 years.

HIGHLY UNLIKELY – No historical records of the species and/or no suitable habitat in the 10-km study area.

6.1 Impacts to threatened vegetation communities

The PMST identified four ecological communities with potential to occur within 10 km of the construction footprint. None of these communities is consistent with vegetation mapped or modelled within either the construction areas or inundation areas.

Community	Conservation Status	Likelihood of Occurrence
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	**Not Present**. Not detected in 2019 and no matching vegetation communities identified in previous assessments
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	**Not Present**. Not detected in 2019 and no matching vegetation communities identified in previous assessments
Natural Grasslands of the Murray Valley Plains	Critically Endangered	**Not Present**. Not detected in 2019 and no matching vegetation communities identified in previous assessments
Weeping Myall Woodlands	Endangered	**Not Present**. Not detected in 2019 and no matching vegetation communities identified in previous assessments

The EVCs previously mapped within the study area also do not correspond with the descriptions of any threatened communities listed under the FFG Act (DELWP 2018).

6.2 Impacts to threatened flora species

6.2.1 EPBC Act-listed flora

The presence of EPBC-listed flora species is identified in section 5.1. No species are considered likely to occur or be impacted by either the construction works or proposed inundation.

6.2.2 FFG Act-listed threatened flora

The presence of FFG-listed flora species is identified in section 5.1. The project is likely to impact on one FFG-listed threatened flora species, *Acacia oswaldii*, with three individuals within the construction footprint. There is potential that the proposed inundation will impact further unmapped individuals though the inundation is predicted to be beneficial for this species overall.

6.2.3 FFG Act protected flora species

FFG Act protected flora species include all FFG listed threatened species as well as many families, genera, and species that are generally common including all members of the Asteraceae family and most *Acacia* species. In addition to the species listed in section 6.2.2. The project is likely to impact on the protected flora species previously recorded at the site as listed below.:

- *Calotis scapigera* (common species with potential impact of ~50 throughout project area)
- *Helichrysum luteoalbum* (common species with potential impact of ~50 throughout project area)
- *Senecio cunninghamii var. cunninghamii* (rare species with ~1000 as shown on maps)
- *Senecio quadridentatus* (common species with potential impact of ~50 throughout project area)
- *Vittadinia cuneata var. cuneata* (common species with potential impact of ~100 throughout project area)
- *Vittadinia cuneata var. hirsuta* (rare species not mapped as being impacted but with potential for new recruits to be impacted)
- *Vittadinia pterochaeta* (rare species with 1 individual to be impacted as shown on maps)

6.3 Impacts to threatened fauna

Thirty-six terrestrial fauna listed under the EPBC Act and/or the FFG Act were VBA and PMST within 10 km of the construction footprint and the inundation area, or recorded from previous reports conducted within the construction footprint (ARI 2013, Australian Ecological 2016). Eight of these are considered to have the potential to occur within construction footprint (see Appendix E for rational). These species are summarised in Table 3. Impacts to these species are considered further in Section 6.3.1-6.3.4.

Table 3: Fauna listed on the EPBC Act and/or the FFG Act and considered possible or known to occur in the construction footprint.

Common name	*Scientific Name*	EPBC	FFG	DELWP	Impacts/reasoning
Grey-crowned Babbler	*Pomatostomus temporalis*		L	en	**Occurrence known**: Suitable habitat occurs within the construction footprint, this species may use habitats to forage. This species was previously recorded within the construction footprint by Australian Ecological (2016). **Impact Unlikely**. Species wide ranging and suitable surrounding habitat widespread
Black Falcon	*Falco subniger*		L	vu	**Occurrence possible:** This species may utilise habitats for foraging **Impact unlikely**. This species is wide ranging and suitable surrounding habitat is widespread.
Carpet Python	*Morelia spilota metcalfei*		L	en	**Occurrence possible:** Limited suitable habitat at the construction footprint, species may use habitats to forage **Impact possible**: Species wide ranging and suitable surrounding habitat widespread, however direct impacts (injury, stress, mortality) through habitat clearing should be mitigated.
Ground Cuckoo-shrike	*Coracina maxima*		L	vu	**Occurrence possible:** Suitable habitat at all sites, species may use habitats to forage **Impacts unlikely**: as it is a wide ranging species and suitable surrounding habitat is widespread.
Hooded Robin	*Melanodryas cucullata*		L	nt	**Occurrence possible:** Suitable habitat at all sites, species may use habitats to forage **Impact Unlikely**. Species wide ranging and suitable surrounding habitat widespread
Major Mitchell's Cockatoo	*Cacatua leadbeateri*		L	vu	**Occurrence possible:** Marginal suitable habitat occurs within the construction footprint, species may use habitat for traversing through larger ranges. **Impacts unlikely:** Impact areas do not include trees suitable for nesting, species wide ranging and suitable surrounding habitat widespread
Regent Parrot	*Polytelis anthopeplus monarchoides*	VU	L	vu	**Occurrence possible:** Recent previous records within the study area, with

Common name	*Scientific Name*	EPBC	FFG	DELWP	Impacts/reasoning
					suitable foraging habitat within the construction footprint. Suitable breeding habitat does not occur within the construction footprint. I**mpacts unlikely**: Losses to small area (5.8 ha) foraging habitat proposed to be lost, however the species is wide ranging and suitable surrounding habitat widespread.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Ma	L	vu	**Occurrence possible:** Limited suitable habitat within the construction footprint, species may use habitats to forage **Impact Unlikely:** Species wide ranging and suitable surrounding habitat widespread. Important habitat (breeding habitat) limited within the construction footprint.

6.3.1 Impacts to EPBC Act- listed fauna species and communities within the proposed construction footprint

No EPBC Act listed species were observed during the targeted field assessment in 2019. However, one species, the Regent Parrot (*Polytelis anthopeplus monarchoides*) (EPBC Act listed Vulnerable) was predicted as possible to occur within the construction footprint or the broader study area, based on the species distribution, previous records and habitat suitability at the time of the survey.

The Regent Parrot has been recorded within 10 km of the construction footprint five times, most recently in 2019 (VBA). According to the National Recovery Plan for Regent Parrots (eastern subspecies) (Baker and Hurley 2011), the most easterly distribution of breeding habitat is mapped as likely to occur (or may occur) adjacent to Windomal, which is ~38 km north of the construction footprint. Additionally, Baker and Hurley (2011) state that important foraging habitat during the breeding season occurs within 20 km of nest sites in Mallee Woodlands (Baker and Hurley 2011). Whilst the Nyah-Vinifera Park is mapped as an area where Regent Parrots are likely to occur (Baker and Hurley 2011), the Nyah-Vinifera Park falls outside of the distribution of important breeding (nesting and foraging) habitat. Given the lack of records within 10 km of the construction footprint, and the lack of suitable breeding habitat surveyed during targeted surveys, this species is considered possible to be an occasional visitor, and to utilise habitat within the construction footprint as non-important foraging.

Impacts to Regent Parrots are expected to be marginal, and will include losses to a small area (~ 5.8 ha) of potential foraging habitat. Furthermore, previous reports by Seran BL&A (2018) found that the Vinifera Project would not likely trigger a significant impact based of the EPBC Act significant impact criteria (DotE 2013). A current full assessment of the EPBC Act significant impact criteria for this species from the proposed works for this species are provided in Appendix G.

The '*National Recovery Plan for the Regent Parrot (eastern subspecies) Polytelis anthopeplus monarchoides*' (Baker-Gabb and Hurley 2011) lists a range of threatening processes including disturbance around nesting colonies. As mentioned above, there are no known nesting colonies in the Nyah-Vinifera Park and based on further habitat assessment and survey conducted for this report, there appears to be a continued lack of nesting activity and habitat. Based on current and previous assessment of Regent Parrot habitat in the area of investigation it seems reasonable to suggest that disturbance to known nesting colonies is unlikely.

One of the protection measures outlined in the recovery plan mentioned "the use of environmental water to initially rescue River Red Gum from drought was first undertaken in Victoria in 2002". The recovery plan then mentions that this continued under The Living Murray (TLM) project with important breeding sites for Regent

Parrot such as Hattah Lakes being listed as one of six 'icon' sites and targeted for the construction of water regulation structures to provide a more natural watering regime to these wetland ecosystems. The VMFRP project has similar objectives as TLM and will aim to maintain and enhance the condition of River Red Gum habitats and broader floodplain and wetland habitats which are likely to assist with the recovery of the Regent Parrot.

6.3.2 Impacts to EPBC Act- migratory species within the construction footprint

Seventeen species listed is migratory under the EPBC Act are predicted to occur, or were previously recorded from a VBA/PMST search of the study area (10 km buffer of the construction footprint). None of these species were considered as likely to occur within the construction footprint during the time of the survey, mostly due to the lack of recent records within the construction footprint and/or a lack of suitable habitat present (see Appendix E for rational).

It is highly unlikely that the construction footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species, prior to the proposed construction. A current full assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works for this species are provided in Appendix H.

Reinstating historical environmental flows within the Vinifera Project Study Area will improve the quality of habitat present. Such enhancements correspond to increased productivity of the swamp forest communities, increased vegetation diversity and structure from more dominant drought-tolerant species and increase the overall health and integrity of the area, which will likely improve breeding, foraging and refuge resources for listed Migratory species, such as the Glossy Ibis (*Plegadis falcinellus*).

6.3.3 Impacts to FFG Act Listed fauna and communities within the construction footprint

No FFG Act listed species were observed during the field assessment in 2019. However, eight species are predicted as possible to occur, or previously recorded within the construction footprint or the broader Study Area (VBA, PMST, and Australian Ecology 2019):

- Black Falcon (*Falco subniger*)
- Ground Cuckoo-shrike (*Coracina maxima*)
- Major Mitchell's Cockatoo (*Cacatua leadbeateri*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Hooded Robin (*Melanodryas cucullata*)
- Carpet Python (*Morelia spilota metcalfei*)
- Grey-crowned Babbler (*Pomatostomus temporalis*)

One additional FFG Act listed species, the Regent Parrot, is also listed at Vulnerable under the EPBC Act and is considered above (Section 6.3.1).

Most of these FFG Act listed species possibly occurring in the construction footprint are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse. From a landscape perspective the proposed construction footprints represent an extremely small area of around ~1.5 ha (Seran BL&A 2018), centred on existing tracks and degraded areas, within a very large intact area of over 648 ha of high quality native vegetation within the Nyah-Vinifera Park. All structures are proposed to be centred on and adjacent to existing vehicle tracks and areas of previous disturbance, with many trees already in poor health, these areas largely represent lower quality areas of habitats to those which surround them. For these reasons the proposed construction impacts are considered unlikely to significantly impact threatened fauna species.

Direct impacts as a result of habitat removal, e.g. the removal of hollow bearing trees, should be mitigated for acute impacts to species such as the Carpet Python (refuges in hollow-bearing trees). An on-site ecologist with Management Authorisation under the *Wildlife Act 1975* should be present during vegetation removal to readily

relocate any pythons found within larger trees. Additionally, all hollow-bearing trees proposed for removal should be thoroughly inspected prior to removal for refuging wildlife and at risk of harm from felling. A Fauna Management Plan (FMP) or equivalent should be developed and implemented during the works associated with the project to mitigate impacts to all native fauna that may result from removal of vegetation during works.

One FFG Act listed fauna community was considered with the potential to occur within the Study Area and the broader inundation area: The Victorian Temperate Woodland Bird Community (VTWBC). This community is defined by a group of woodland dependent bird species, characteristically found in a range of woodland types, and over a broad geographic area. The geographic area is defined as the slopes and plains inland of the Great Dividing Range within Victoria. Riverine floodplains associated with the Murray River are not specifically included or excluded from the VTWBC description. Eleven bird species characteristic to the community were identified in the desktop assessment.

Table 4). Impacts to this community are likely to be negligible as Vinifera is comprised largely of intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC.

Hollow dead or live trees are essential for some species within the VTWBC, for example the Brown Treecreeper (*Climacteris picumnus*) relies on hollow-bearing trees for nesting. Acute, short term impacts to species of this community as a result of the unavoidable removal of hollow-bearing trees should be mitigated. It is recommended that if the removal of hollow-bearing trees is unavoidable, seasonal restrictions should be implemented for vegetation clearing to avoid breeding periods when these species are more vulnerable to impacts. Overall, impacts to this community are likely to be negligible as the Nyah-Vinifera Park is comprised of largely intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove habitat important for the VTWBC. The proposed inundation of floodplain and wetland habitats however, is likely to provide important future benefits to the VTWBC particularly under climate change scenarios of longer, dryer conditions in a semi-arid environment.

While the project would remove 121 large old trees (trees that are may contain suitable refuge hollows for native fauna), most of the large old trees recorded within the Study Area will remain. Furthermore, numerous hollow bearing trees occur within contiguous habitat outside and adjacent to the Study Area.

Table 4 Fauna species listed in the VTWBC and previously recorded or predicted to occur (VBA, PMST) within the study area

Common name	Scientific name	construction footprint (and buffer)	Inundation area (and buffer)
Barking Owl	*Ninox connivens*	X	x
Brown-headed Honeyeater	*Melithreptus brevirostris*	X	x
Bush Stone-curlew	*Burhinus grallarius*	X	x
Grey-crowned Babbler	*Pomatostomus temporalis*	X	x
Ground Cuckoo-shrike	*Coracina maxima*	X	x
Hooded Robin	Melanodryas cucullata	X	x
Jacky Winter	*Microeca fascinans*	X	x

Common name	Scientific name	construction footprint (and buffer)	Inundation area (and buffer)
Little Lorikeet	*Parvipsitta pusilla*	X	x
Painted Button-quail	*Turnix varius*	X	x
Painted Honeyeater	Grantiella picta	X	x
Red-capped Robin	Petroica goodenovii	X	x

6.3.4 Impacts to EPBC Act and FFG Act Listed fauna within the proposed inundation area

The proposed Vinifera Project aims to inundate approximately 350 ha of periodically inundated River Red-gum swamp and woodland, and wetland habitat (Section 7.2). Although these habitats are currently dry (at the time of surveys) and occupied by terrestrial ground-layer vegetation, historically these water-dependant EVC's would have received more frequent inundation prior to river regulation (Seran BL&A 2018).

One EPBC Act listed species, the Growling Grass Frog (*Litoria raniformis*), was not predicted to occur within the construction footprint at the time of the survey as no suitable habitat was present. Previous records from a VBA search indicate this species has been recorded eight times within 10 km of the construction footprint. Four of these records were from 1788-1972, which encompasses the period of initial Chytrid Fungus outbreak in Australia (DSEWPC 2013). Four more recent records occur from 2000-2004. During times of inundation, this species may utilise open wetland habitat that is generally containing abundant submerged and emergent vegetation.

Whilst direct impacts from works are not predicted for the Growling Grass Frog, indirect impacts from the proposed works may include the introduction or spread of Chytrid Fungus. Transmission of the disease from vehicle is unlikely, if vehicles traverse between sites and result in water and mud being transferred to/from other water bodies, hygiene protocols for Chytrid Fungus should be included in a site specific EMP (Murray et al 2011). Additionally if the handling of frogs is required during the proposed works (i.e. during salvage), a suitably qualified and experienced ecologist should be engaged, and employ hygiene protocols identified in Murray et al (2011). No significant impacts are expected, as per the significant impact thresholds by DEWHA 2010 for Growling Grass Frog. Additionally, Seran BL&A (2018) found that the Vinifera Project would not likely trigger a significant impact based of the EPBC Act significant impact criteria (DotE 2013).The return of environmental watering to the construction footprint will restore and enhance important ecological values, including suitable habitat for this species (DEWHA 2010), and many other species reliant of periodic flooding.

Several threatened fauna species are either known or have the potential to occur within the inundation area including; Carpet Python (*Morelia spilota metcalfei*), Regent Parrot (*Polytelis anthopeplus monarchoides*), Hooded Robin (*Melanodryas cucullata*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), Diamond Dove (*Geopelia cuneata*), Ground Cuckoo-Shrike (*Coracina maxima*) White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Black Falcon (*Falco subniger*) and Grey-crowned Babbler (*Pomatostomus temporalis*) (Appendix E). Each of these species either have a broad foraging/dispersal range and are unlikely to be adversely impacted by short and very occasional periods of inundation (e.g. Major Mitchell's Cockatoo, Ground Cuckoo-shrike) or would have the ability to continue utilising these habitats during inundation (e.g. Carpet Python). Certainly, the application of episodic environmental water would be expected to maintain and enhance the conditions of these woodland communities in the face of future climate change scenarios rather than a 'do nothing' approach to leaving these habitats in their current ecological state.

From a desktop assessment, nineteen EPBC Act listed Migratory Species were predicted to occur within the inundation area and the broader 10 km area (Appendix E). As discussed previously, listed Migratory Species

are not considered likely to occur within the inundation area at the time of the survey given the lack of habitat available (waterbodies, wetlands etc.) (Section 6.3.2), therefore no adverse impacts to these species are predicted to occur as a result of the proposed works. However, reinstating historical environmental flows within the Vinifera floodplain will certainly improve the quality of habitat present for water dependant avifauna, with several species of Migratory birds including Eastern Great Egret (*Ardea modesta*) and Glossy Ibis (*Plegadis falcinellus*) known to respond to environmental watering (Cook *et al.* 2011 and Wood *et al.* 2018). Such habitat enhancements include increased productivity of floodplain vegetation communities, increased floral diversity and structure by reducing more dominant drought-tolerant species and increase overall health and integrity of the area to improve breeding, foraging and refuge resources for listed Migratory species, and other wetland-dependant bird species.

6.3.5 Wetlands of International Importance

While reinstating a wetting and drying regime of appropriate frequency, duration and extent to the broader Nyah-Vinifera area is likely to impart significant ecological benefits for the Vinifera Project area, large infrastructure projects such as this can also have environmental risks, particularly localised, short-term impacts during the construction phase. According to a PMST Search, the Ramsar Wetland Hattah-Kulkyne National Park is located 100-150 km downstream of the study area. An additional three Ramsar Wetlands were identified 250-500 km downstream of the Vinifera construction footprint (Banrock Station Wetland Complex, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland).

Whilst impacts to the Hattah-Kulkyne National Park is expected to be negligible (Seran BL&A 2018) an Environmental Framework will be developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise these risks. Any impacts will be localised and site rehabilitation will occur following completion. The Environmental Framework will set out specific measures that will be employed to minimise impacts during construction. This plan will be submitted with the planning permit application and will be implemented by all construction contractors.

Black-water events may also occur following floodplain inundation due to breakdown of leaf litter and terrestrial vegetation by bacteria, which releases nutrients into the water, but again, this is not considered a significant risk associated with the works, as black-water events are a natural process. Operation of the proposed works may actually reduce the incidence of black-water events by restoring more frequent floods to the system and reducing the accumulation of leaf litter and nutrient loads between inundation events, therefore blackwater incidence is likely to diminish in the future.

Overall, the project is likely to significantly benefit the environment, reinstating appropriate wetting and drying regimes to over 350 ha of wetlands and floodplain. This will increase the extent and condition of habitat for aquatic and floodplain fauna, including waterbirds, fish, frogs, turtles and terrestrial species reliant on floodplain habitats, such as woodland birds, bats, small/medium mammals and reptiles.

6.4 FFG Act- threatening processes

Potentially threatening processes are listed in accordance with Section 10 of the Flora and Fauna Guarantee (FFG) Act 1988. There are a number of threatening processes that are relevant to the Vinifera Project that have the potential to exacerbate by either the construction process or proposed inundation of 350 ha of floodplain and wetlands:

Construction Phase:

- Loss of hollow-bearing trees from Victorian native forests.
- The spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority.

A qualified ecologist will be on-site to manage the removal of any fauna habitat and capture and translocate fauna observed within the construction area. It is still possible that hollow-bearing trees will be removed as part of the project, however the broader objective to inundate 350 ha of swampy woodland and wetland vegetation is likely to contribute to the maintenance of hollow-bearing trees into the future.

An Environmental Framework will be prepared as part of the project that will include measures such as vehicle hygiene protocols to mitigate the potential spread of weeds and *Phytophthora cinnamomi.*

Operation Phase:

- Predation of native wildlife by the introduced Cat, *Felis catus*.
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*.
- Soil degradation and reduction of biodiversity through browsing and competition by Feral Goats (*Capra hircus*).

There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (Cats, Foxes), herbivores (e.g. Goats) and omnivores (e.g. Pigs) due to the associated increase in productivity. Some of the species such as cats, foxes and pigs could potentially prey on migratory waterbirds, woodland birds, small mammals, reptiles and frogs that may respond to the application of water to floodplains/wetlands. An accompanying pest animal management and control program would need to be implemented within the inundation area, however this may require Parks Victoria to expand current pest control programs within the park to target these areas during inundation events.

7. Impacts to native vegetation Impacts to native vegetation

7.1 Construction footprint

The project will impact on the following EVCs (all within the Murray Fans Bioregion) that have been previously mapped (Australian Ecosystems 2016) within the construction footprint or along access tracks that have the potential to require upgrading or trimming of overhanging vegetation.

- 0.639 ha of Riverine Grassy Woodland (EVC 295) - Vulnerable
- 5.939 ha of Riverine Swamp Forest (EVC 814) – Depleted
- 0.077 ha of Dwarf Aquatic Herbland (EVC 949) - Depleted

In total, the construction is expected to impact on 6.657 ha of native vegetation of which 1.163 comprises access tracks. The vast majority which is mapped as Riverine Swamp Forest comprises River Red Gums (*Eucalyptus camaldulensis*) over a very sparse understorey with scattered native herbs and grasses. In addition, 121 large old trees (all River Red Gums) that are mapped are likely have potential to be impacted by the construction activities proposed, however, an assessment by an arborist is recommended to assess potentially impacted trees to advise on methods by which they could be retained.

The native vegetation identified for removal has been subject to a habitat hectares assessment and the results are included in the Ensym report included in Appendix I. The Ensym tool does not accurately map the border of Victoria and identifies some removal in NSW, however, all vegetation removal is above the top of the bank of the Murray River which is the official border between the states. As such the location for some vegetation removal has been spatially moved to accurately identify the extent if not the location of the removal. The identified offset requirement as currently identified is for 0.166 general units and 4 trees within a minimum Strategic Biodiversity Value of 0.166 in the Mallee CMA region AND 7.270 units and 117 trees of habitat for Darling Lily (*Crinum flaccidum*) or an alternative offset if agreed with DELWP. It is recommended that the requirement to offset for Darling Lily is raised with DELWP as the known Victorian distribution of the species is limited to areas along the Murray River ~200 km downstream where it merges with the Darling River (RBGV 2019).

7.2 Inundation area

The project will impact on the following EVCs that are modelled to occur within the inundation areas:

- 34.319 ha of Floodway Pond Herbland (EVC 810)
- 1.258 ha of Grassy Riverine Forest (EVC 106)
- 3.233 ha of Riverine Grassy Woodland (EVC 295)
- 192.743 ha of Riverine Swamp Forest (EVC 814)
- 55.603 ha of Sedgy Riverine Forest (EVC 816)
- 0.066 ha of Semi-arid Woodland (EVC 97)
- 0.015 ha of Riverine Chenopod Woodland (EVC103)
- 43.045 ha of Spike-sedge Wetland (EVC 819)
- 20.335 ha of Tall Marsh (EVC 821)

The majority EVCs listed above are swampy or wetland vegetation communities that require or are tolerant of inundation and therefore are likely to positively respond to the proposed inundation. A single obligate dry-land community – Semi Arid Woodland - is modelled as occurring within the inundation area that may be adversely impacted by the proposed inundation. This area has been field assessed and determined to not be Semi-Arid Woodland but rather Riverine Swamp Forest and therefore no impact to obligate terrestrial vegetation is considered to be likely to occur as a result of the inundation.

FIGURE 3: Flora and Fauna in construction footprints at Vinifera, Page 1 of 3

VMFRP

Coburn Road
Thwaites Road
River Road
Hobson Road
Murray Valley Highway
Drop Structure
Regulator V1
Spillway 1
Laydown area
Containment Bank - North Bank
Regulator V2
Spillway 2
Murray River
Containment Bank - Bank 1

Legend

- Area of Investigation
- Development footprint
- Construction footprint

Australian Ecology - LOTS 2015

- Australian Ecology - LOTS 2015

R8 Field Data 2019 - 2020

- Threatened Flora Species
- Canopy Tree

- Major Road
- Minor Road
- Channel / Drain
- Waterbody
- Cadastre
- Inundation Area
- Public Land Management

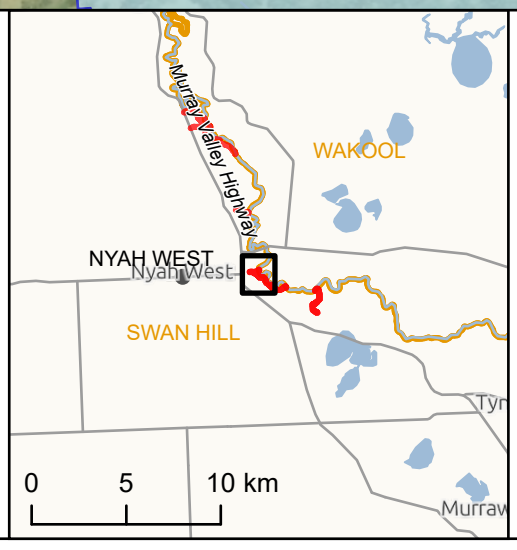

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FIGURE 3: Flora and Fauna in construction footprints at Vinifera, Page 2 of 3

VMFRP

Spillway 2

Containment Bank - North Bank

Containment Bank - Bank 1

Murray River

Containment Bank - Bank 2

Containment Bank - Bank 3

Containment Bank - Bank 4

River Road

Murray Valley Highway

Legend

- Area of Investigation
- Development footprint
- Construction footprint

Australian Ecology - LOTS 2015

- Australian Ecology - LOTS 2015

R8 Field Data 2019 - 2020

- Threatened Flora Species
- Canopy Tree

- Major Road
- Minor Road
- Channel / Drain
- Watercourse Stream
- Waterbody
- Cadastre
- Inundation Area
- Public Land Management

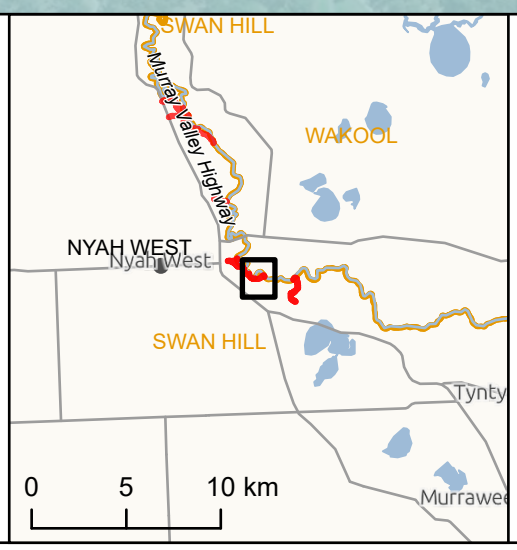

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FIGURE 3: Flora and Fauna in construction footprints at Vinifera, Page 3 of 3

VMFRP

Laydown area
Hardstand
Spillway 4
Regulator V4
Containment Bank - Forest Track Bank North
Spillway 3
Containment Bank - Forest Track Bank South
Containment Bank - V3
Regulator V3
Takasuka Road
Murray River
Murray River

Legend

- Area of Investigation
- Development footprint
- Construction footprint

Australian Ecology - Incidental Flora Records 2015

- Australian Ecology - Incidental Flora Records 2015

Australian Ecology - LOTS 2015

- Australian Ecology - LOTS 2015

R8 Field Data 2019 - 2020

- Threatened Flora Species
- Minor Road
- Channel / Drain
- Watercourse Stream
- Waterbody
- Cadastre
- Inundation Area
- Public Land Management

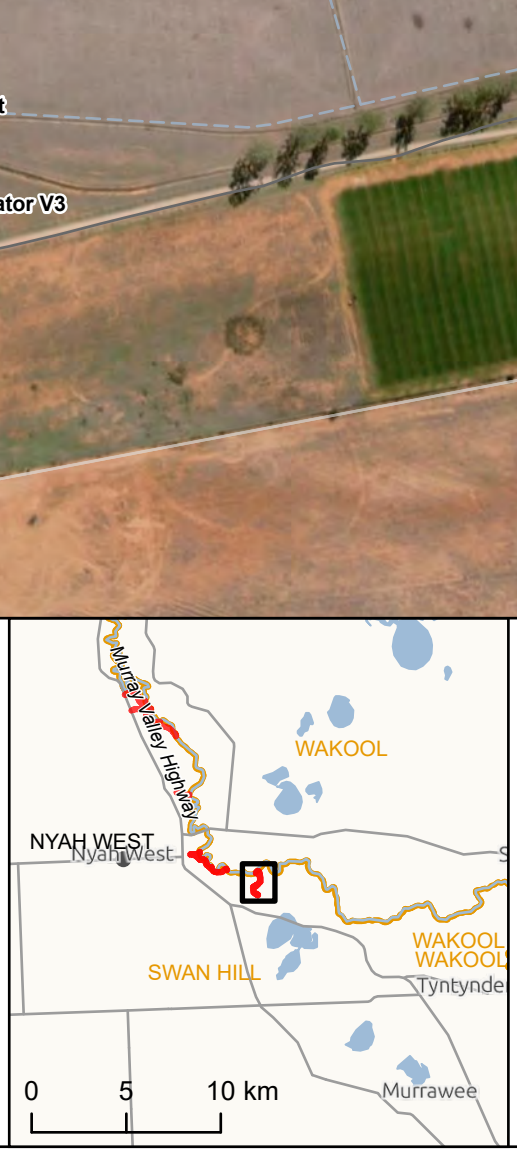

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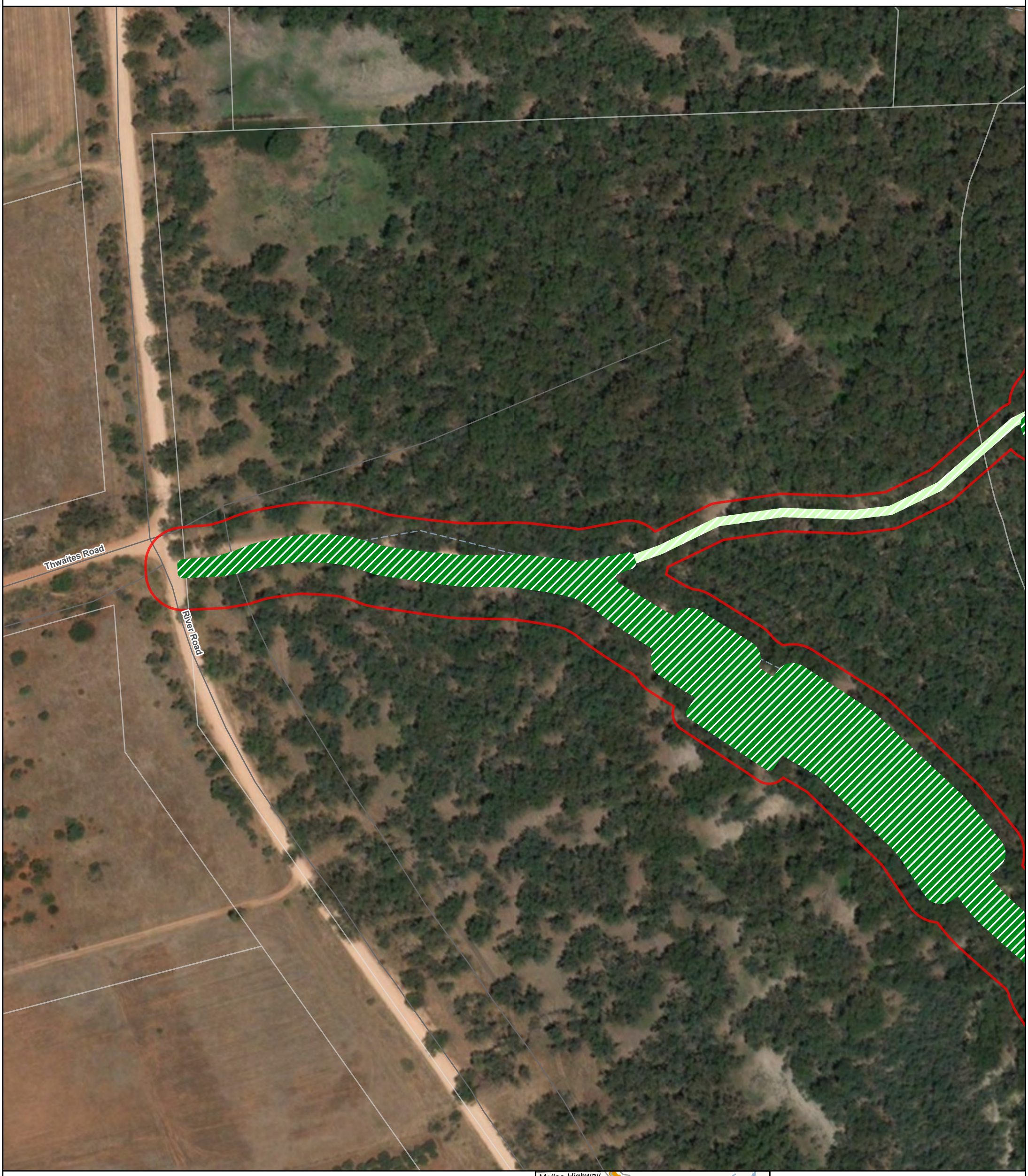
FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 1 of 8 VMFRP



Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ1,814,Riverine Swamp Forest
- EVC - Track
- HZ1,814,Riverine Swamp Forest
- Minor Road
- Channel / Drain
- Cadastre

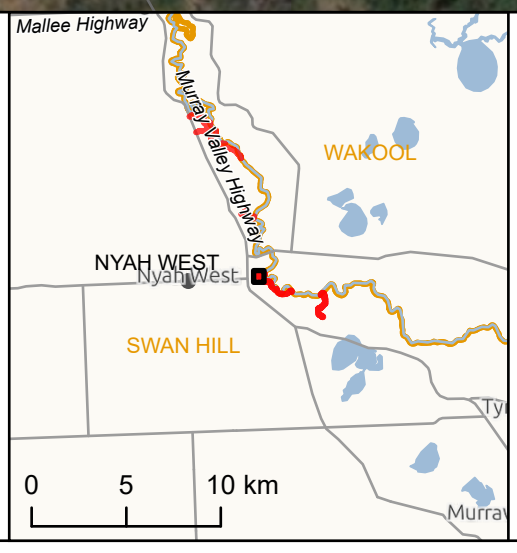


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FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 2 of 8 VMFRP

Murray River

Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ1,814,Riverine Swamp Forest
- EVC - Track
- HZ1,814,Riverine Swamp Forest
- Channel / Drain
- Waterbody
- Cadastre

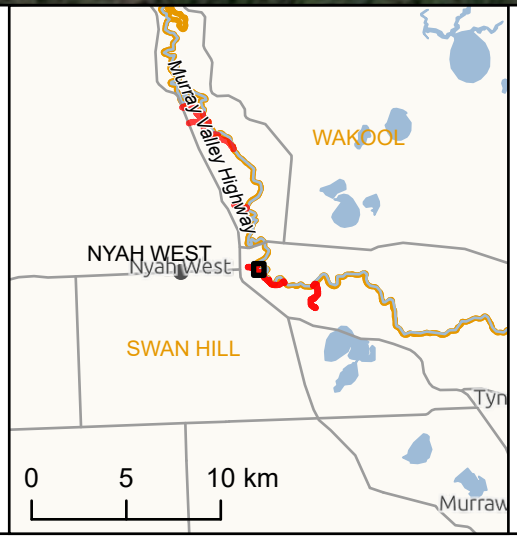

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FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 3 of 8 VMFRP

Murray River

Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ1,814,Riverine Swamp Forest
- HZ7,814,Riverine Swamp Forest
- EVC - Track
- HZ7,814,Riverine Swamp Forest
- Waterbody
- Cadastre

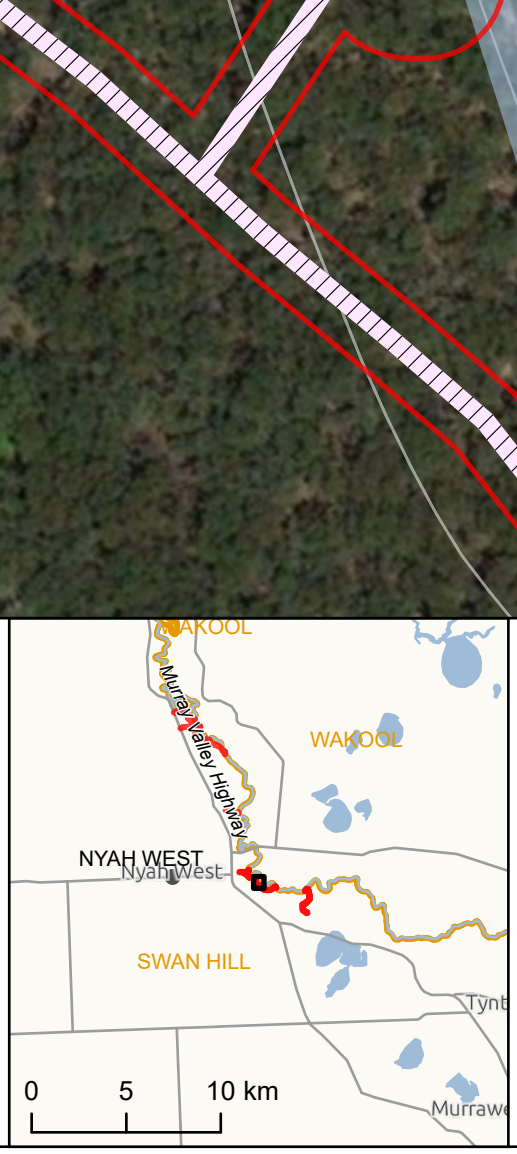

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FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 4 of 8 VMFRP

Murray River

Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ7,814,Riverine Swamp Forest
- EVC - Track
- HZ7,814,Riverine Swamp Forest
- Channel / Drain
- Waterbody
- Cadastre

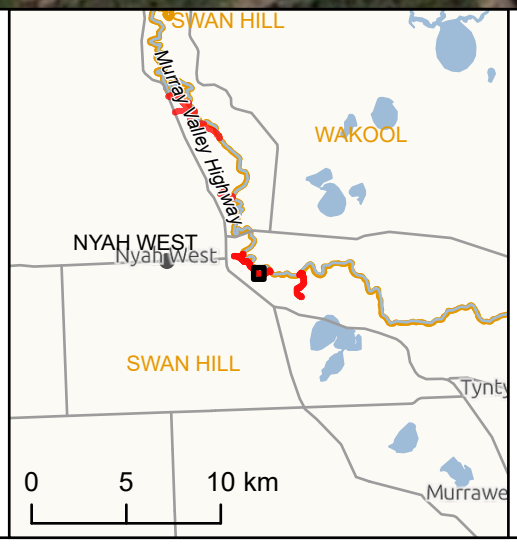

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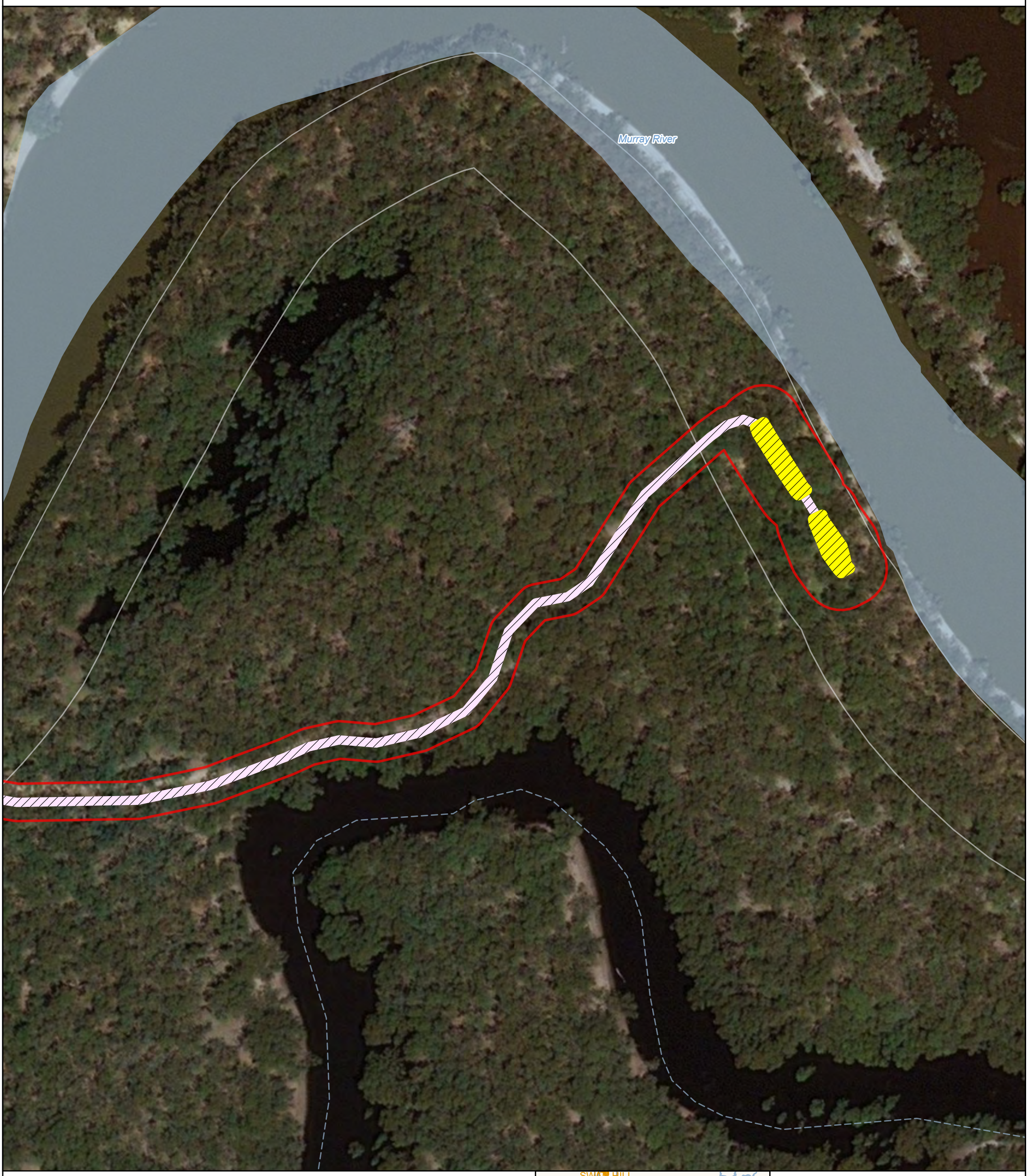
FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 5 of 8 VMFRP



Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ7,814,Riverine Swamp Forest
- EVC - Track
- HZ7,814,Riverine Swamp Forest
- Channel / Drain
- Waterbody
- Cadastre

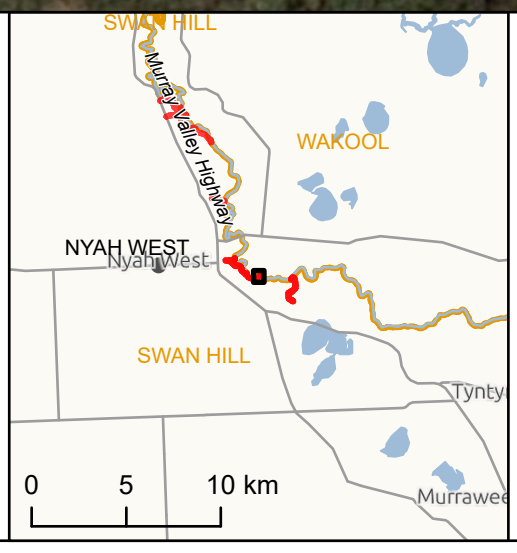


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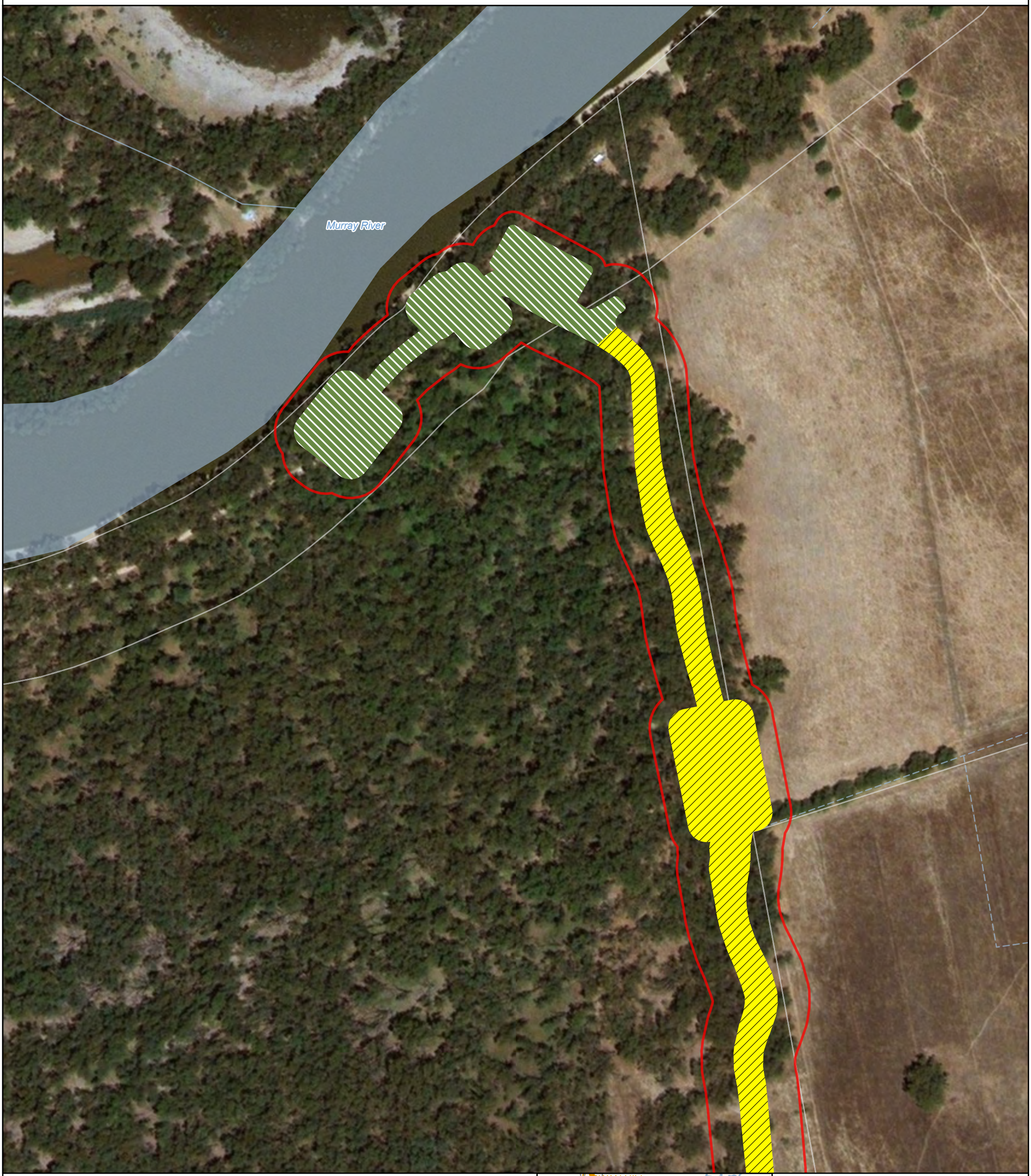
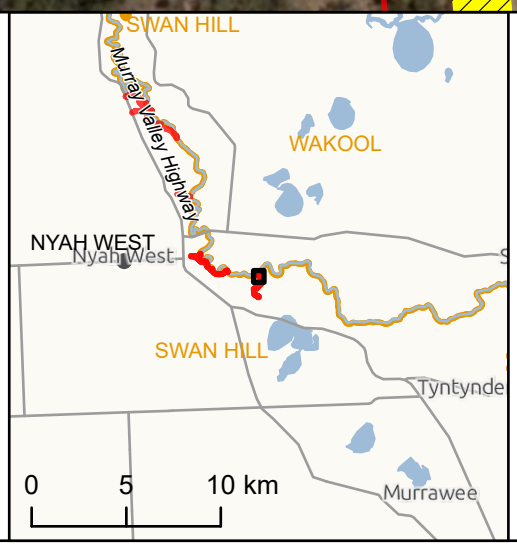
FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 6 of 8

VMFRP



Legend

- Area of Investigation
- EVC - Construction Footprint
- HZ2,814,Riverine Swamp Forest
- HZ7,814,Riverine Swamp Forest
- Channel / Drain
- Watercourse Stream
- Waterbody
- Cadastre



IS297742

N

Name: GDA 1994 MGA Zone 55

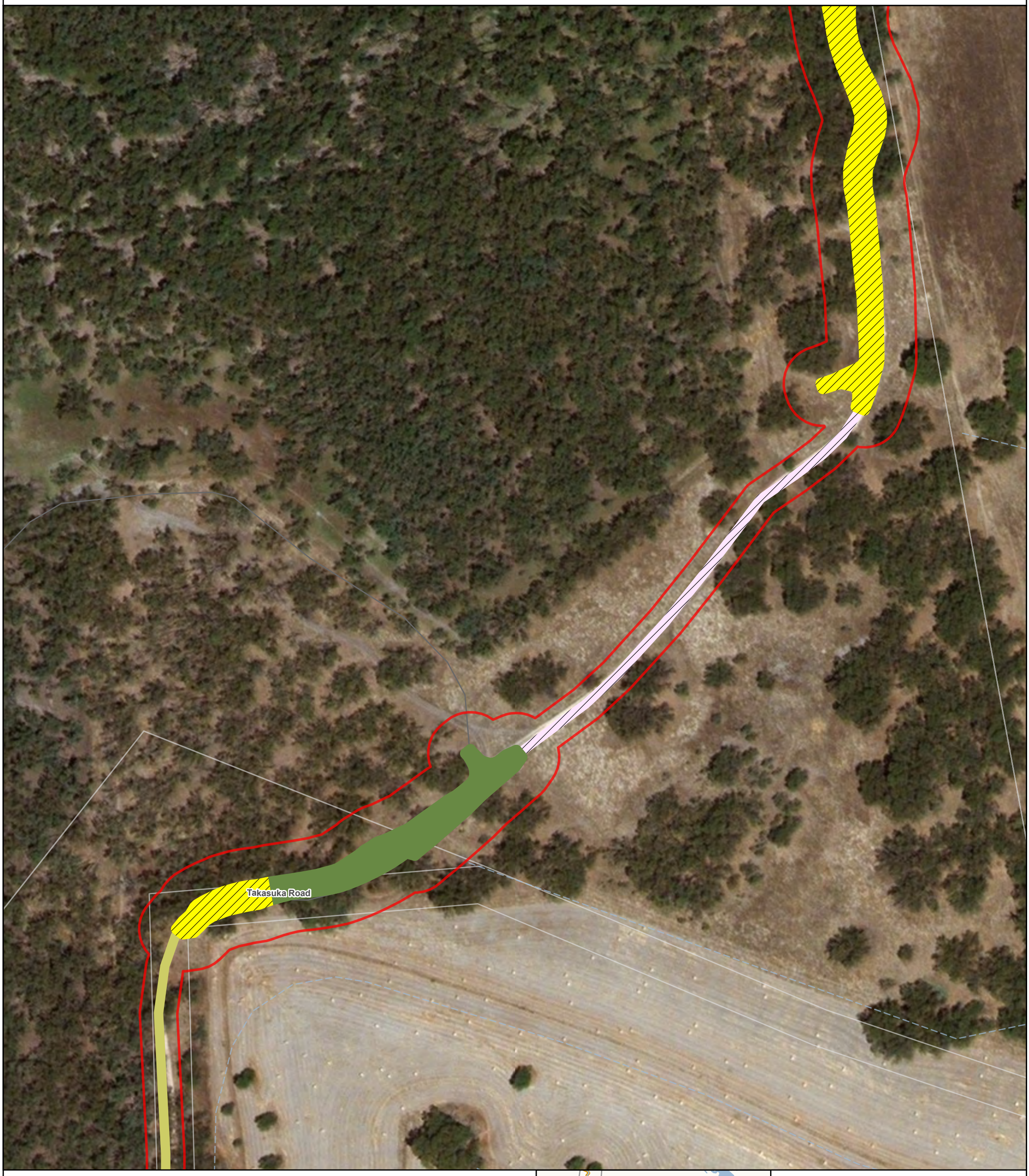
0 50 100

Metres

DATA SOURCES

Path: J:\IE\Projects\03_Southern\IS297700\Spatial\ArcPro\AGP\Ecology\Vinifera\Vinifera_EcologyReport.aprx

FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 7 of 8 VMFRP



Legend

- Area of Investigation
- EVC - Construction Footprint
  - HZ7,814,Riverine Swamp Forest
  - HZ8,295,Riverine Grassy Woodland
- EVC - Track
  - HZ7,814,Riverine Swamp Forest
- HZ8,295,Riverine Grassy Woodland
- Minor Road
- Channel / Drain
- Cadastre

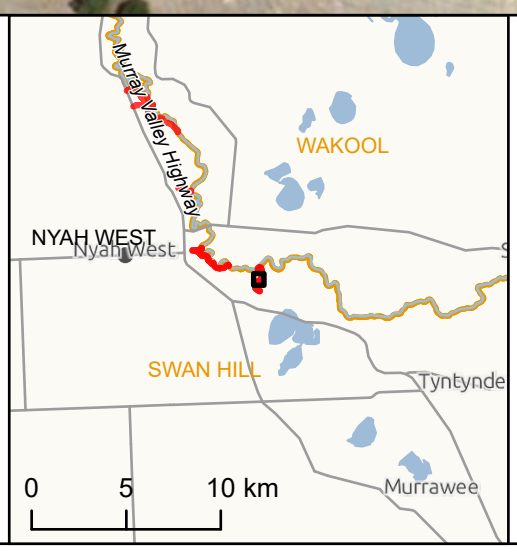


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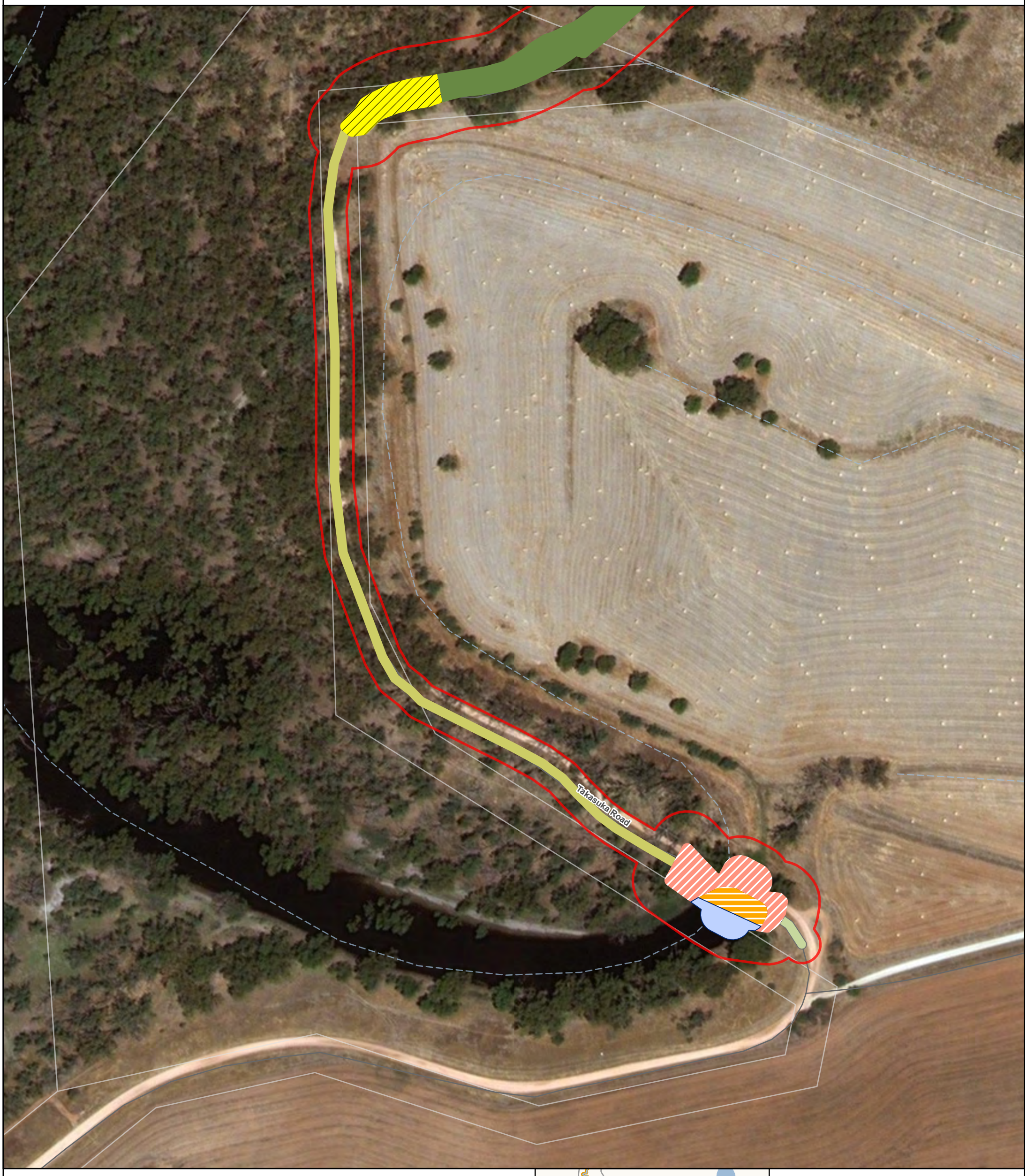
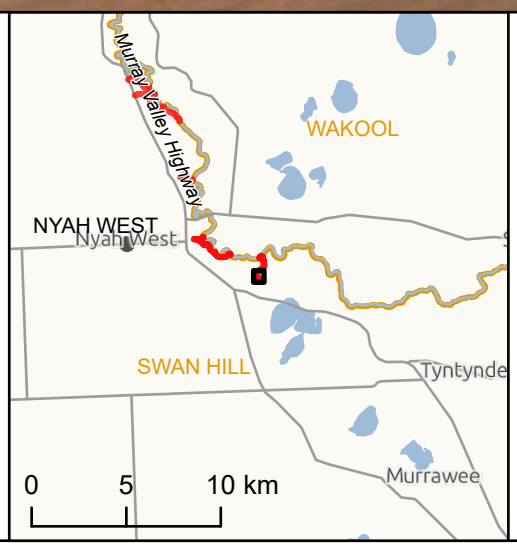
FIGURE 4: Ecological values mapped in the construction footprints at Vinifera, Page 8 of 8 VMFRP



Legend

- Area of Investigation
- EVC - Construction Footprint
  - HZ4,814,Riverine Swamp Forest
  - HZ6,949,Dwarf Floating Aquatic Herbland
  - HZ7,814,Riverine Swamp Forest
  - HZ8,295,Riverine Grassy Woodland
- NA,990,Open Water
- EVC - Track
  - HZ8,295,Riverine Grassy Woodland
  - Non-intact vegetation
- Minor Road
- Channel / Drain
- Cadastre



IS297742

N

Name: GDA 1994 MGA Zone 55

0 50 100

Metres

DATA SOURCES
© Commonwealth of Australia (Geoscience Australia) 2006 Geodata Topo 250k Series 3; Vicmap Data © State of Victoria 2019; Jacobs & GHD 2020.

Path: J:\IE\Projects\03_Southern\IS297700\Spatial\ArcPro\AGP\Ecology\Vinifera\Vinifera_EcologyReport.aprx

8. Avoidance, Minimisation and Mitigation Measures

Efforts have been made throughout the planning and design phases for the proposed construction to avoid and minimise impacts to ecological values including native vegetation and fauna habitat, threatened flora, fauna and communities. All areas of native vegetation that are proposed to be impacted are adjacent to existing vehicle tracks and areas of previous disturbance, and represent inferior areas of habitat to those which surround them. From a landscape perspective the proposed construction footprints represent an extremely small area within a very large intact area of high quality native vegetation.

8.1 General mitigation measures

The following should be considered during the construction, planning approval phase and implementation of the project:

- Manage habitat clearing and removal of hollow-bearing trees/limbs with respect to fauna.
- Flag no go zones for significant species (e.g. FFG threatened flora) that occur close to the construction area to avoid impacts.
- Retain as many Large Trees as practicable where there are potential impacts to Tree Protection Zones for the construction footprint area.
- Flag areas of native vegetation adjacent to the proposed works that have not been approved for removal as no-go zones.
- Use existing disturbed areas or areas of non-native vegetation for lay-downs and stockpiling.
- Where practical, avoid areas of high quality vegetation and vegetation that supports rare or threatened flora (e.g. patches of Branching Groundsel).
- Include the above points to develop and implement mitigation measures for incorporation into an EMP to minimize the potential for ecological impacts within and around the site before, during and after the construction process. These may also include:
    - Minimise and adhere to the approved footprint and supervise construction activities to ensure that activities do not encroach on retained native vegetation.
    - Standard vehicle hygiene measures to prevent the spread and introduction of weed species, particularly the weeds of national significance and noxious weeds listed under the Catchment and Land Protection Act 1994 (CaLP Act).
    - Standard vehicle hygiene measures to prevent the spread or transmission of Chytrid Fungus as per Murray et al (2011)
    - Management of run-off, spills and sediment to avoid impacts on Vinifera Creek
    - Delineation of areas of remnant native vegetation to be retained from those areas to be removed as no-go zones to avoid encroachment into areas of retained vegetation.

8.2 Design phase

The following mitigation measures have been implemented during the design phase to minimise and mitigate impacts to threatened flora and fauna identified in previous ecological surveys within the construction footprint (ARI 2013, Australian Ecosystems 2016):

- Avoid where possible mapped rare and threatened flora species. This has proved difficult for the Branching Groundsel however this rare species is considered to be locally common within the study area.
- Micro-aligning construction footprints to avoid impacting hollow-bearing trees to reduce impacts to hollow-dependant fauna (such as species within the FFG Act Listed community, VTWBC).
- Refinement of the design and construction methods to minimise the construction footprints (including access track and laydown areas).

8.3 Construction phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values (FFG Act listed threatened species).;

- Follow the avoid, minimise protocol in determining the construction works footprint at each site (i.e. make every effort to avoid threatened flora species loss as a high priority).
- Temporary fencing should be erected around 'sensitive' areas to indicate areas to avoid during construction,
- Establish work zones for each site to avoid 'sensitive' habitats (including areas containing threatened flora). This could be implemented through an initial briefing of construction works crews by a qualified ecologist and subsequent planning of safe work distances and establishment of each site.
- Develop and implement a Flora and Fauna Management Plan to manage impacts to all flora and fauna values and particularly threatened species and the habitat preclearance and clearance process.
- Manage the removal of hollow-bearing trees within the construction footprint (if required, based on final footprints and potential impacts to tree root zones from track establishment, setdown areas) where construction may impact habitat trees of native fauna, particularly FFG Act listed fauna species and communities;
    - Avoiding the breeding season of hollow-dependant species is recommended, however where this is not practical an assessment must include surveys undertaken by a suitably qualified ecologist of the hollow-bearing trees being removed during the breeding season. The survey should also include other native hollow-dependent fauna. A protocol needs to be developed prior to/during construction.
    - Where clearing is proposed outside the breeding season, complete pre-clearance surveys for any remnant hollow-bearing trees to be removed. These trees could harbour one or more species of native hollow-dependent fauna. Pre-clearance surveys should be conducted prior to (within 24 hours) the hollow-bearing trees being removed.
- Develop and implement an Environmental Management Plan (EMP) for the construction phase. This EMP should provide appropriate measures to avoid or minimise indirect impacts such as erosion, sedimentation and the accidental spill of oils or other chemicals. It would also provide a protocol for minimising impacts in ecologically sensitive areas such as creek lines. Ideally, the EMP would be audited during and following the construction process to ensure works have been conducted appropriately,
- Develop and implement a plan to manage weeds during and after the construction phase within the study area (this will be described in an overarching Environmental Framework),
- Rehabilitate construction areas, including setting aside topsoil to reinstate when works are complete and compacting to original levels. If native vegetation must be removed, re-spreading of stored topsoil should occur, followed by monitoring to assess germination in the following year. Appropriate weed control measures at the site following the works should be incorporated into the rehabilitation program, as soon as possible. If the site is not naturally recolonised by locally indigenous species, planting of locally indigenous species appropriate to that particular position in the landscape may be undertaken in the following year. Ground debris that is temporarily removed to allow construction activities, should be reinstated.
- Minimise the need to create new tracks and use existing tracks as much as possible.

8.4 Operation phase

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values (FFG Act listed threatened species). These measures are general across the construction footprint and are not site specific;

- Implement pest animal management and control within the inundation area (and ideally surrounding areas), however this may require Parks Victoria to expand current pest control programs within the park to target these areas during inundation events.

9. Policy and legislative requirements

There are a number of ecological values present within the construction footprint as discussed within this report, with the potential to trigger the requirement to obtain permits if impacted (e.g. the removal of native vegetation will require a permit under the *Planning and Environment Act*). Table 5 below outlines the potential legislative implications for the project that may result from the removal of native vegetation and/or fauna habitat within the construction footprint.

Table 5 Summary of probable legislative requirements

Federal legislation	Relevance to project
Environment Protection and Biodiversity Conservation Act 1999	No listed flora or ecological communities were identified during the assessment, nor are they considered likely to occur. No listed fauna were identified during the assessment field assessment in 2019 by R8 ecologists. The EPBC Act listed Regent Parrot (*Polytelus anthopeplus monarchoides*) was identified as possibly occurring within the construction footprint and is mapped as likely to occur within the construction footprint according to the National Recovery Plan for the species (Baker and Hurley 2011). However, the Nyah-Vinifera Park falls outside of the mapped distribution of important for breeding (nesting and foraging) (Baker and Hurley 2011). Additionally, given the lack of records within 10 km of the construction footprint, this species is likely to be an occasional visitor, to utilise habitat within the as non-important foraging. Impacts as a result of the proposed works are not expected. A full assessment of the EPBC Act significant impact criteria to this species from the proposed works for this species are provided in Appendix G. Seventeen migratory species were identified as having the potential to occur within the construction footprint, and nineteen in the proposed inundation area (PMST and VBA). Most of these species are either highly unlikely to occur (e.g. Bar-tailed Godwit, Eastern Curlew) or would very rarely use airspace over these footprints (e.g. White-throated Needletail). It is highly unlikely that the construction footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. A current full assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works for this species are provided in Appendix H. The Ramsar Wetland Hattah-Kulkyne National Park is located 100-150 km downstream of the study area. It is unlikely that the project will negatively impact on the character of the Ramsar site. Whilst impacts to the Hattah-Kulkyne National Park are not expected (Seran BL&A 2018) an Environmental Management Plan (EMP) should developed that identifies potential environmental risks and puts in place mitigation strategies to avoid or minimise these risks (e.g. sediment runoff) It is unlikely that the proposed Vinifera Project will result in the chance of a significant impact to a MNES, and an EPBC referral is not required.
State legislation	Relevance to project

Environment Effects (EE*) Act 1978*	A project can trigger an EES referral if over 10 ha of native vegetation is proposed to be impacted. It is currently estimated that up to 6.657 ha of native vegetation will require removal with 121 Large Trees potentially impacted. This includes 1.163 ha of native vegetation mapped along access tracks proposed to be used that has potential to be impacted through upgrading of tracks and trimming of adjacent native vegetation. The project does not trigger an EES referral based on the extent of native vegetation identified within the construction footprint as combined the construction area and access tracks are less than 10 ha.
Planning and Environment Act 1987 (P&E Act)	The construction footprint indicates that 6.657 ha of native vegetation will require removal with 121 Large Trees potentially impacted. for the project. This includes 1.163 ha of native vegetation mapped along access tracks proposed to be used that has potential to be impacted through upgrading of tracks and trimming of adjacent native vegetation. Approval under the P&E Act will be required for the removal of any native vegetation unless exemptions (as specified in Clause 52.17) apply. Given the extent of native vegetation identified within the construction footprint, as well as the presence of scattered native individuals (<25% cover) within areas considered to be non-native vegetation, it is considered likely that planning permission under the P&E Act will be required for the project.
Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) – the Guidelines.	The location mapping for the Study Area identifies that the impact area is classified as Location Risk 3 and a detailed assessment pathway is triggered. An assessment of impacts according to the Guidelines will need to be developed.
Flora and Fauna Guarantee Act 1988	**Fauna species and communities** No FFG Act listed species were observed during the field assessment in 2019. However, seven species are predicted as possible to occur, or previously recorded within the construction footprint or the broader Study Area (VBA, PMST, and Australian Ecology 2019): • Black Falcon (*Falco subniger*) • Ground Cuckoo-shrike (*Coracina maxima*) • Major Mitchell's Cockatoo (*Cacatua leadbeateri*) • White-bellied Sea-Eagle (*Haliaeetus leucogaster*) • Hooded Robin (*Melanodryas cucullata*) • Carpet Python (*Morelia spilota metcalfei*) • Grey-crowned Babbler (*Pomatostomus temporalis*) All species have been recorded within 10 km of the construction footprints, and utilise habitats such as those found within the construction footprint. None of these species is considered likely to be significantly impacted by the proposed construction, although localised impacts on hollow-dependent species such as Carpet Python are possible. Most are highly mobile bird species and all have access to large areas of suitable habitat in the immediate surrounding areas in which to disperse.

	One FFG Act listed fauna community was considered with the potential to occur within the Study Area and the broader inundation area: The Victorian Temperate Woodland Bird Community (VTWBC). Impacts to this community are likely to be negligible as Vinifera is comprised largely of intact vegetation and the proposed construction of floodplain infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC. The proposed inundation of floodplain and wetland habitats however, is likely to provide important future benefits to the VTWBC particularly under climate change scenarios of longer, dryer conditions in a semi-arid environment. Other than VTWBC, no other threatened communities listed under the FFG Act are likely to occur within the construction footprint or inundation area. One listed flora species – *Acacia oswaldii* – is within the proposed construction footprint and three individuals are likely to be removed. There are seven recorded protected flora species that are likely to be impacted by either the construction works or subsequent inundation. It is recommended that efforts should be made to avoid and minimise impacts to any species and/or communities listed as threatened or protected under the FFG Act during the design and construction phases of the project and that any relevant FFG Act Management Plans for relevant species adhered to.
Wildlife Act 1975	Any persons engaged to remove, salvage, hold or relocate native fauna during construction must hold a current Management Authorisation under the Wildlife Act 1975 (e.g. if hollow-bearing trees are removed or fauna are rescued from open trenches during construction). A Management Authorisation (MA) will almost certainly be required for this project as hollow-bearing trees and fauna habitat will likely be removed. The MA would be obtained at the time of the construction, and in the name of the ecologist who would handle/relocate the fauna.
Catchment and Land Protection Act 1994	Six weeds listed under the CaLP Act have been recorded within the construction footprint.

10. Project recommendations

The proposed Vinifera project aims to inundate approximately 350 ha of floodplain and wetland habitats that support water dependent vegetation threatened by river regulation, on-going drought and a drying climate.

10.1 Next steps

R8 recommends the following next steps:

- Refine the construction footprint within the bounds of the 6.657 ha footprint utilising the existing ecological values mapping to avoid and minimise impacts to native vegetation, Large Trees and threatened flora/fauna and communities within the construction footprint.
- Engage with DELWP, discussing the proposed construction footprint and the efforts that have been made to avoid and minimise impacts to native vegetation during the preliminary and refinement phases of the project.
- Depending on the extent of impacts to areas of treed vegetation a qualified arborist may need to be engaged to determine the full extent of impacts to native trees (both within and immediately adjacent to the proposed construction footprint). This assessment would take in to account direct impacts to trees (tree removal) and indirect impacts to trees (through encroachment of their TPZs). An arborist assessment would also consider the individual tree location and habit, as well as specific characteristics of certain tree species (e.g. mallee eucalypts) where it's possible that individual trees will survive greater than 10% encroachment of their TPZs or the pruning of over 30% of the existing crown (the standard measures for determining indirect tree losses under the guidelines).
- Engage with DELWP, discussing the proposed approach for obtaining offsets for the project and whether an offset exemption may apply to the works at Vinifera. This approach may include the establishment of a vegetation condition monitoring regime within the proposed inundation areas that would identify changes in condition to the vegetation within these areas that results from the environmental watering regime.
- Prepare an Offset Plan for the project – this will include a plan for obtaining the required offsets.
- Develop specific impact mitigation measures related to the works. These should be incorporated into a Construction Environmental Management Plan (CEMP).
- Submit an application for a permit to remove native vegetation under the *Planning and Environment Act 1987*.
- Once the Offset Plan has been approved by Local Council and DELWP and the process of obtaining the offsets has commenced, obtain a permit for the removal of native vegetation under the *Planning and Environment Act 1987*.
- A CEMP should be developed for the project and implemented in full to further avoid and minimise impacts to areas of ecological value. The CEMP should be prepared once the footprint and construction methods for the proposed works have been finalised, and should include provisions relevant to protecting the ecological values identified within the Construction Footprints.

11. References

ARI (2013) Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria. A report to the Mallee Catchment Management Authority.

Australian Ecosystems Pty Ltd (2016). Nyah and Vinifera SDL Project Flora and Fauna Assessment. Detailed Design Stage. Report for Mallee Catchment Management Authority.

Baker-Gabb, D. and Hurley, V (2011). National Recovery Plan for the Regent Parrot (eastern subspecies) Polytelis anthopeplus monarchoides. Department of Sustainability and Environment, Melbourne.

Boon P. (2011). Ecological effects of a shift from permanent to variable water levels in floodplain wetlands. Dodo Environmental 31 May 2011. Report to GHD Pty Ltd.

Cook D. Bayes E. Jolly K. Backstrom, A. (2009). Ecological response of four wetlands to the application of environmental water. Final report on monitoring from May to December 2008. Goulburn Broken Catchment Management Authority.

DSE. (2013). Advisory List of Threatened Vertebrate Fauna in Victoria – 2013. Victorian Department of Sustainability and Environment, East Melbourne, Victoria

DSEWPC (2013). Chytridiomycosis (Amphibian chytrid fungus disease) - Fact sheet. Department of Sustainability, Environment, Water, Population and Communities

DotE (2013). Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Australian Government Department of the Environment, Canberra.

DEWHA (2010) Significant impact guidelines for the vulnerable growling grass frog (*Litoria raniformis*). Australian Government Department of the Environment, Water, Heritage and the Art.

DELWP (2017). The Living Murray Hattah Lakes Intervention Monitoring Annual Report: Understorey Vegetation Program. Department of Environment, Land, Water and Planning, authors: Claire Moxham, Sally Kenny and Paul Moloney.

DELWP (2017). Guidelines for the or the removal, destruction or lopping of native vegetation. Department of Environment, Land, Water and Planning, East Melbourne, Victoria

DEPI (2014) Advisory List of Rare or Threatened Plants in Victoria, Department of Environment and Primary Industries

GHD (2009). A population monitoring protocol for known Regent Parrot (*Polytelis anthopeplus monarchoides*) breeding colonies at two locations along the Murray River. Report prepared for Mallee Catchment Management Authority.

Kingsford, R. (2000). Ecological impacts of dams, water diversions and river management on floodplain wetlands in Australia. Austral Ecology, 2, 109-127.

Kingsford, R., Georges, A., and Unmack, P. (2006). Vertebrates of desert rivers: meeting the challenges of temporal and spatial unpredictability. In Ecology of Desert Rivers Cambridge University Press, 154-200.

Magrath, M., Weston, M., Olsen, P., & Antos, M. (2010). Survey guidelines for Australia's threatened birds. Australian Government Department of the Environment, Water, Heritage and the Arts.

Mallee CMA (2015). Nyah and Vinifera Environmental Water Management Plan, Mallee Catchment Management Authority, Mildura Victoria

Murray, K. A., Skerratt, L. F., Marantelli, G., Berger, L., Hunter, D., Mahony, M., & Hines, H. (2011). Hygiene protocols for the control of diseases in Australian frogs. Australian Government Department of Sustainability, Environment, Water, Population and Communities: Canberra.

Seran BL&A, (2018) Basin Environmental Works. Review of Environmental approvals requirements. Review 0. July 2018.

Threatened Species Scientific Committee (2015). Conservation Advice *Nyctophilus corbeni* south-eastern long-eared bat. Canberra: Department of the Environment.

Webster, R. and Belcher, C. (2005). A Survey of Regent Parrot *Polytelis anthopeplus monarchoides* Breeding Colonies along the Murray River in Victoria. Report prepared for the Department of Sustainability and Environment.

Wood D., Romanin L., Brown P., Loyn R., McKillop T. and Cheers G. (2018) The Living Murray: Annual condition monitoring at Hattah Lakes Icon Site 2017–18. Part A. Final Report prepared for the Mallee Catchment Management Authority by the School of Life Sciences Albury–Wodonga and Mildura, SLS Publication 186.

Appendix A. **Summary of ecological investigations undertaken at Vinifera**

Table 6 Summary of ecological investigations undertaken at Nyah

Report	Methods- desktop assessment	Key Findings	Recommendations
GHD (2013) *Flora Census Summary Report*- Memorandum prepared by GHD for Mallee CMA	**Desktop review:** VBA (DEPI) Flora Information System (Viridans); Atlas of Living Australian (online database); Biodiversity Interactive Maps (DEPI); and Protected Matters Search Tool (Commonwealth Department of the Environment). **Flora site assessment** (November 2013): Eight Quadrats (30 x 30 m) Cover percentages of litter, logs, bare ground and soil crust; and EVC Full flora species list recorded	Two DEPI Listed flora species identified *Dianella porracea* (Leek Flax-lily), vu *Cuscuta australis* (Australian dodder), pk Five EVC's: Riverine Chenopod Woodland (103) Endangered Riverine Swamp Forest (814) Depleted Shrubby Riverine Forest (818) Least Concern Grassy Riverine Forest (106) Depleted Floodway Pond Herbland (910) Depleted	Nil
ARI (2013) *Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria.* A report to the Mallee Catchment Management Authority.	**Desktop review:** VBA (DEPI) Atlas of Living Australian (online database); Protected Matters Search Tool (Commonwealth Department of the Environment) Lumsden L., Brown G. & Cheers G. (2007) Floodplain fauna surveys – Macredie Island. A report to the Mallee Catchment Management Authority. Arthur Rylah Institute for Environmental Research, DSE, Heidelberg, Victoria. Mallee CMA and Parks Victoria staff (M. Thompson and J. Cameron pers. comm.).	One FFG Act listed fauna species: Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) (dd, L) (Bat detector)	Nil

Report	Methods- desktop assessment	Key Findings	Recommendations
	Fauna site assessment (November-December 2013) 20 min, 2 ha bird census (morning and night) Nocturnal bird call-playback (Powerful Owl, Masked Owl, Barking Owl, Barn Owl, Southern Boobook, Australian Owlet-nightjar, White-throated Nightjar, Spotted Nightjar and Tawny Frogmouth) Pitfall trapping (and funnel trapping) Camera traps Bat detector		
Australia Ecosystems (2016) *Nyah and Vinifera SDL Project - Flora and Fauna assessment*	**Desktop review:** VBA (DEPI) Flora and Fauna Information System (Viridans); Atlas of Living Australian (online database); Biodiversity Interactive Maps (DEPI); and Protected Matters Search Tool (Commonwealth Department of the Environment). **Flora site assessment** (November 2015)**:** Potential footprint traversed Comprehensive observed flora list recorded LOT's mapped Habitat Hectare assessed EVC's assigned **Fauna site assessmen**t (November 2015) 20 min bird census Nocturnal spotlight surveys (arboreal fauna)	Nine EVC's Riverine Swamp Forest (EVC 814) Semi Arid Woodland (EVC 97) Riverine Grassy Woodland (EVC 295) Sedgy Riverine Forest (EVC 816) Flood Pondway Herbland (810) Grassy Riverine Forest (106) Open Water (EVC 990) Shrubby Riverine Woodland (EVC 818) 14 rare/threatened flora: *Acacia oswaldii* (Umbrella Wattle) (v) *Cynodon dactylon var. pulchellus* (Native Couch) (pk) *Senecio cunninghamii var. cunninghamii* (Branching Groundsel) (r) *Vittadinia cuneata var. hirsuta* (Fuzzy New Holland Daisy) (r)	Avoid impacts to listed flora, where possible Where impacts can't be avoided, translocation and ex situ propagation is recommended

Report	Methods- desktop assessment	Key Findings	Recommendations
		Dianella sp. aff. longifolia (Riverina) (Pale Flax-lily) (vu) *Eragrostis lacunaria* (Purple Love-grass) (vu) *Alternanthera sp. 1* (Plains) (Plains Joyweed) (pk) *Haloragis glauca f. glauca* (Bluish Raspwort) (pk) *Tetragonia moorei* (Annual Spinach) (pk) *Asperula wimmerana* (Wimmera Woodruff) (r) *Eremophila divaricata subsp. divaricata* (Spreading Emu-bush) (r) *Picris squarrosa* (Squat Picris) (r) *Atriplex pseudocampanulata* (Mealy Saltbush) (r) *Sida intricata* (Twiggy Sida) (vu) 288 LOT's recorded No threatened fauna detected	
WetMAP (2017)	**Fish site assessment** Parnee Malloo Creek fyke and seine netting and bait traps	Native fish Carp gudgeon *(Hypseleotris spp.)* Australian smelt *(Retropinna semoni)* Non-native fish Mosquitofish (*Gambusia holbrooki*) Carp (*Cyprinus carpio*) No threatened fish captured.	Nill

Note: EN Listed as Endangered under the EPBC Act, VU Listed as Vulnerable under the EPBC Act, L Listed as threatened under the FFG Act, en Listed as endangered under Vic Advisory List, vu Listed as vulnerable under Vic Advisory List, r Listed as rare under the Vic Advisory List, pk Listed as poorly known under the Vic Advisory List, dd Listed as data deficient under the Vic Advisory List

Appendix B. **Likelihood of occurrence for rare or threatened flora (construction footprints)**

Likelihood of occurrence:

Not all of the threatened species identified during this assessment are equally likely to occur in the study area, due to the geographic location or context of the site, or the habitat type and condition. For each species, the likelihood of occurrence was evaluated using the following rationale:

PRESENT – Species known to occur within the site, or detected during the site visit.

POSSIBLE – Potentially suitable habitat occurs within the construction footprint and species' known range encompasses the construction footprint. Species recorded historically in the 10-km search area, and generally within the last 30 years.

UNLIKELY – Species' known range encompasses the construction footprint, but suitable habitat does not occur within construction footprint, or occurs within the construction footprint but with generally low quality and quantity. Species recorded historically in the 10-km study area but generally not within the last 30 years.

HIGHLY UNLIKELY – No historical records of the species and/or no suitable habitat in the 10-km study area.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
Acacia colletioides	Wait-a-while			r	3	2011	VBA	**Unlikely.** Conspicuous species not recorded in this or previous surveys.
Acacia loderi	Nealie		L	vu	6	2011	VBA	**Unlikely.** Conspicuous species not recorded in this or previous surveys.
Acacia melvillei	Yarran		L	vu	13	2011	VBA	**Unlikely.** Conspicuous species not recorded in this or previous surveys.
Acacia oswaldii	Umbrella Wattle		L	vu	14	2015	This assessment	**Present.** Previously recorded in V3 area. **Impact likely.** 2 plants likely to require removal.
Amaranthus macrocarpus var. macrocarpus	Dwarf Amaranth			vu	1	2007	VBA	**Possible.** Favourable habitat in construction footprintand potentially not recorded as responds to flood conditions. **Impact possible.** Potential impact likely to be low given previously not recorded within construction area.
Amyema linophylla subsp. orientalis	Buloke Mistletoe			vu	4	2011	VBA	**Unlikely.** Host plants not recorded within construction areas.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
Asperula gemella	Twin-leaf Bedstraw			r	2	1999	VBA	**Possible.** Sites have situable habitat. Can persist without flooding conditions **Impact unlikely.** Not recorded in this or previous surveys
Asperula wimmerana	Wimmera Woodruff			r	2	2011	VBA	**Possible.** Sites have suitable habitat, but largely known downstream from project area. Can persist without flooding conditions **Impact unlikely.** Not recorded in this or previous surveys.
Atriplex acutibractea subsp. karoniensis	Pointed Saltbush			r	3	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Atriplex pseudocampanulata	Mealy Saltbush			r	1	2019	This assessment	**Present.** Previously recorded in V3 area. **Impact likely.** 2 plants likely to require removal.
Austrostipa metatoris		V			-	-	PMST	**Unlikely** Not previously recorded in Victoria.
Austrostipa puberula	Fine-hairy Spear-grass			r	1	2005	VBA	**Unlikely**. Lack of habitat in construction area.
Bromus arenarius	Sand Brome			r	1	2004	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Caladenia tensa	Rigid Spider-orchid	EN		vu	-	-	PMST	**Unlikely**. Lack of habitat within construction areas..
Calandrinia volubilis	Twining Purslane			r	4	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Calotis cuneifolia	Blue Burr-daisy			r	1	2013	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Calotis lappulacea	Yellow Burr-daisy			r	4	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Cardamine moirensis	Riverina Bitter-cress			r	5	2013	VBA	**Likely.** Favourable habitat in construction footprint and previously recorded throughout park. Potentialy not recorded during assessments as responds to flood conditions. **Impact possible.** Potential impact likely to be low given

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
								previously not recorded within construction areas.
Centipeda thespidioides s.s.	Desert Sneezeweed			r	1	2010	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Chenopodium desertorum subsp. desertorum	Frosted Goosefoot			r	1	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Convolvulus graminetinus	Grassland Bindweed			en	1	2007	VBA	**Unlikely**. Lack of habitat in construction area.
Cyperus pygmaeus	Dwarf Flat-sedge			vu	2	1986	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in previous surveys.
Dianella porracea	Riverine Flax-lily			vu	3	2019	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in previous surveys.
Eragrostis setifolia	Bristly Love-grass			vu	1	2007	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Jasminum didymum subsp. lineare	Desert Jasmine			vu	5	2009	VBA	**Unlikely**. Lack of habitat in construction area.
Maireana cheelii	Chariot Wheels	V	L	vu	-	-	PMST	**Unlikely**. Lack of habitat in construction area.
Maireana sedifolia	Pearl Bluebush			r	1	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Marsdenia australis	Doubah			vu	2	2019	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Minuria cunninghamii	Bush Minuria			r	1	1990	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Myoporum montanum	Waterbush			r	1	1986	VBA	**Unlikely.** Conspicuous species not recorded in this or previous surveys.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
Nymphoides crenata	Wavy Marshwort		L	vu	1	1986	VBA	**Unlikely**. Lack of habitat in construction area.
Olearia minor	Satin Daisy-bush			r	2	2011	VBA	**Unlikely.** Conspicuous species not recorded in this or previous surveys.
Phebalium glandulosum subsp. macrocalyx	Glandular Phebalium			en	1	1999	VBA	**Unlikely**. Lack of habitat in construction area.
Ranunculus undosus	Swamp Buttercup			vu	2	1986	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Rhagodia ulicina	Spiny Goosefoot			r	1	2003	VBA	**Unlikely**. Lack of habitat in construction area.
Rhyncharrhena linearis	Purple Pentatrope			vu	1	2011	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Sarcozona praecox	Sarcozona			r	5	2013	VBA	**Unlikely**. Lack of habitat in construction area.
Senecio cunninghamii var. cunninghamii	Branching Groundsel			r	2	2013	VBA, AE (2016), This report	**Present.** Locally common throughout park. **Impact likely.** Based on current construction area, a number of plants are likely to require removal.
Sida intricata	Twiggy Sida			vu	2	2011	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** All *Sida sp.*. observed were not attributable to this species. Not recorded in this or previous surveys.
Swainsona murrayana	Slender Darling-pea	V	L	en	-	-	PMST	**Unlikely.** Not previously recorded in project area and lack of suitable habitat**.**
Templetonia egena	Round Templetonia			vu	1	2019	VBA	**Unlikely**. Lack of habitat in construction area.
Velleia arguta	Grassland Velleia			r	3	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Vittadinia cuneata var. hirsuta	Fuzzy New Holland Daisy			r	8	2019	AE (2016), This report	**Possible.** Sites have suitable habitat, but not previously recorded in project area.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
								Impact unlikely. All *Vittadinia*.. observed were not attributable to this species. Not recorded in this or previous surveys.
Vittadinia pterochaeta	Winged New Holland Daisy			vu	2	2019	VBA	**Present.** Recorded within the construction areas. **Impact likely.** Based on current construction area, a single plant is likely to require removal.
Vittadinia pustulata	Warty New Holland Daisy			en	2	2013	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** All *Vittadinia*.. observed were not attributable to this species. Not recorded in this or previous surveys.

KEY

EN	Listed as Endangered under the EPBC Act
VU	Listed as Vulnerable under the EPBC Act
L	Listed as threatened under the FFG Act
en	Listed as endangered under the Victorian Rare or Threatened Species (VROT) List
vu	Listed as vulnerable under the Victorian Rare or Threatened Species (VROT) List
r	Listed as rare under the Victorian Rare or Threatened Species (VROT) List

Appendix C. **Likelihood of occurrence for rare or threatened flora (inundation area)**

This assessment has been determined on the basis of desktop information only (previously recorded species and modelled vegetation communities and extents) and has not been validated by field assessments.

Likelihood of occurrence:

Not all of the threatened species identified during this assessment are equally likely to occur in the study area, due to the geographic location or context of the site, or the habitat type and condition. For each species, the likelihood of occurrence was evaluated using the following rationale:

PRESENT – Species known to occur within the site, or detected during the site visit.

POSSIBLE – Potentially suitable habitat occurs within the construction footprintand species' known range encompasses the construction footprint. Species recorded historically in the 10-km search area, and generally within the last 30 years.

UNLIKELY – Species' known range encompasses the construction footprint, but suitable habitat does not occur within construction footprint, or occurs within construction footprint but with generally low quality and quantity. Species recorded historically in the 10-km study area but generally not within the last 30 years.

HIGHLY UNLIKELY – No historical records of the species and/or no suitable habitat in the 10-km study area.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
Acacia colletioides	Wait-a-while			r	3	2011	VBA	**Unlikely**. Lack of habitat in inundation area.
Acacia loderi	Nealie		L	vu	8	2011	VBA	**Unlikely**. Lack of habitat in inundation area.
Acacia melvillei	Yarran		L	vu	13	2011	VBA	**Unlikely**. Lack of habitat in inundation area.
Acacia oswaldii	Umbrella Wattle		L	vu	14	2015	AE (2016)	**Unlikely**. Lack of habitat in inundation area.
Amaranthus macrocarpus var. macrocarpus	Dwarf Amaranth			vu	1	2007	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to be positive**. **Adverse impacts minimal**. This species is adapted to inundation and would possibly establish in higher (than current) numbers once waters start to recede.
Amyema linophylla subsp. orientalis	Buloke Mistletoe			vu	4	2011	VBA	**Unlikely.** Host plants unlikely to occur in inundation area.
Asperula gemella	Twin-leaf Bedstraw			r	2	1999	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
								inundation and known from areas prone to flood
Asperula wimmerana	Wimmera Woodruff			r	2	2011	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Atriplex acutibractea subsp. karoniensis	Pointed Saltbush			r	3	2011	VBA	**Unlikely**. Lack of habitat in inundation area.
Atriplex pseudocampanulata	Mealy Saltbush			r	1	2019	This assessment	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Austrostipa metatoris		V			-	-	PMST	**Unlikely** Not previously recorded in Victoria.
Austrostipa puberula	Fine-hairy Spear-grass			r	1	2005	VBA	**Unlikely**. Lack of habitat in inundation area.
Bromus arenarius	Sand Brome			r	2	2004	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Caladenia tensa	Rigid Spider-orchid	EN		vu	-	-	PMST	**Unlikely**. Lack of habitat in construction area.
Calandrinia volubilis	Twining Purslane			r	4	2011	VBA	**Unlikely**. Lack of habitat in construction area.
Calotis cuneifolia	Blue Burr-daisy			r	2	2013	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Calotis lappulacea	Yellow Burr-daisy			r	4	2011	VBA	**Unlikely.** Lack of habitat in inundation area.
Cardamine moirensis	Riverina Bitter-cress			r	5	2013	VBA	**Likely.** Favourable habitat in construction footprint and previously recorded throughout park. **Impact likely to be positive**. **Adverse impacts minimal**. This species is adapted to

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
								inundation and would possibly establish in higher (than current) numbers once waters start to recede.
Centipeda thespidioides s.s.	Desert Sneezeweed			r	1	2010	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Chenopodium desertorum subsp. desertorum	Frosted Goosefoot			r	1	2011	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Convolvulus graminetinus	Grassland Bindweed			en	1	2007	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Cyperus pygmaeus	Dwarf Flat-sedge			vu	2	1986	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to be positive**. **Adverse impacts minimal**. This species is adapted to inundation and would possibly establish in higher (than current) numbers once waters start to recede.
Dianella porracea	Riverine Flax-lily			vu	12	2019	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. Currently restricted to areas of slightly higher elevations. This species is known from areas prone to flood
Eragrostis setifolia	Bristly Love-grass			vu	1	2007	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Jasminum didymum subsp. lineare	Desert Jasmine			vu	7	2009	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Maireana cheelii	Chariot Wheels	V	L	vu	-	-	PMST	**Unlikely.** Lack of habitat in inundation area.
Maireana sedifolia	Pearl Bluebush			r	1	2011	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Marsdenia australis	Doubah			vu	3	2019	VBA	**Possible.** Favourable habitat in inundation area.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
								Impact likely to neutral. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Minuria cunninghamii	Bush Minuria			r	1	1990	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Myoporum montanum	Waterbush			r	1	1986	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Nymphoides crenata	Wavy Marshwort		L	vu	1	1986	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Olearia minor	Satin Daisy-bush			r	3	2011	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to neutral**. **Adverse impacts minimal**. This species is tolerant to inundation and known from areas prone to flood
Phebalium glandulosum subsp. macrocalyx	Glandular Phebalium			en	1	1999	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Ranunculus undosus	Swamp Buttercup			vu	2	1986	VBA	**Possible.** Favourable habitat in inundation area. **Impact likely to be positive**. **Adverse impacts minimal**. This species is adapted to inundation and would possibly establish in higher (than current) numbers once waters start to recede.
Rhagodia ulicina	Spiny Goosefoot			r	1	2003	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Rhyncharrhena linearis	Purple Pentatrope			vu	1	2011	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Sarcozona praecox	Sarcozona			r	5	2013	VBA	**Unlikely**. Lack of habitat in construction area.

Species Name	Common Name	EPBC Act	FFG Act	DELWP advisory	No. of Records	Most Recent Record	Source	Likelihood of Occurrence and Impacts
Senecio cunninghamii var. cunninghamii	Branching Groundsel			r	2	2013	VBA, AE (2016), This report	**Present.** Locally common throughout park. **Impact likely to be positive**. **Adverse impacts minimal**. Based on current known areas, this species is likely to respond positively to inundation, rapidly growing as flood waters recede.
Sida intricata	Twiggy Sida			vu	2	2011	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** All *Sida* sp. observed were not attributable to this species. Not recorded in this or previous surveys.
Swainsona murrayana	Slender Darling-pea	V	L	en	-	-	PMST	**Unlikely.** Not previously recorded in project area and lack of suitable habitat**.**
Templetonia egena	Round Templetonia			vu	1	2019	VBA	**Unlikely.** Lack of habitat in inundation area**.**
Vittadinia cuneata var. hirsuta	Fuzzy New Holland Daisy			r	8	2019	VBA	**Present.** Recorded at a number of locations close to and in the construction areas. **Impact likely.** Based on current construction area, a number of plants are likely to require removal.
Vittadinia pterochaeta	Winged New Holland Daisy			vu	2	2019	This report	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.
Vittadinia pustulata	Warty New Holland Daisy			en	2	2013	VBA	**Possible.** Sites have suitable habitat, but not previously recorded in project area. **Impact unlikely.** Not recorded in this or previous surveys.

KEY

EN Listed as Endangered under the EPBC Act

VU Listed as Vulnerable under the EPBC Act

L Listed as threatened under the FFG Act

en Listed as endangered under the Victorian Rare or Threatened Species (VROT) List

vu Listed as vulnerable under the Victorian Rare or Threatened Species (VROT) List

r Listed as rare under the Victorian Rare or Threatened Species (VROT) List

Appendix D. **Fauna species recorded during surveys**

Summary of the fauna species recorded during surveys on 25th October and 11th December 2019.

Key:

V – Vulnerable under EPBC Act

L – Listed under FFG Act

vu – Victorian Advisory List

Common name	Species name	Number	Comments
11/12//2019			
Australian Magpie	*Gymnorhina tibicen*	5	
Brown Treecreeper	*Climacteris picumnus*	3	
Eastern Rosella	*Platycercus eximius*	4	
Grey Shrikethrush	*Colluricincla harmonica*	3	
Little Black Cormorant	*Phalacrocorax sulcirostris*	1	
Little Pied Cormorant	*Microcarbo melanoleucos*	3	
Magpie-lark	*Grallina cyanoleuca*	4	
Masked Lapwing	*Vanellus miles*	1	
Musk Lorikeet	*Glossopsitta concinna*	6	
Noisy Miner	*Manorina melanocephala*	10	
Peaceful Dove	*Geopelia placida*	2	
Pied Cormorant	*Phalacrocorax varius*	1	
Rainbow Bee-eater	*Merops ornatus*	4	
Sacred Kingfisher	*Todiramphus sanctus*	2	
Striated Pardalote	*Pardalotus striatus*	4	

Tree Martin	*Petrochelidon nigricans*	25	
Weebill	*Smicrornis brevirostris*	4	
White-plumed Honeyeater	*Ptilotula penicillata*	4	
White-winged Chough	*Corcorax melanorhamphos*	8	
Willie Wagtail	*Rhipidura leucophrys*	2	
25/11/2019			
Australian Raven	*Corvus coronoides*	3	
Black-tailed Nativehen	*Tribonyx ventralis*	4	
Laughing Kookaburra	*Dacelo novaeguineae*	1	
Magpie-lark	*Grallina cyanoleuca*	2	
Noisy Miner	*Manorina melanocephala*	5	
Pacific Black Duck	*Anas superciliosa*	4	
Sacred Kingfisher	*Todiramphus sanctus*	1	
Striated Pardalote	*Pardalotus striatus*	2	
Welcome Swallow	*Hirundo neoxena*	4	
White-plumed Honeyeater	*Ptilotula penicillata*	2	
White-winged Chough	*Corcorax melanorhamphos*	8	

Appendix E. **Likelihood of occurrence of threatened fauna (construction footprint and inundation area)**

The following assessment of likelihood of occurrence and impact to threatened fauna considers the potential to occur within the construction footprint based on the VBA and PMST searches combined with habitat requirements of the species.

Key:

Status

EN Listed as Endangered under the EPBC Act

VU Listed as Vulnerable under the EPBC Act

L Listed as threatened under the FFG Act

Mi Listed as Migratory under the EPBC Act

Ma Listed as Marine under the EPBC Act

en Listed as endangered under the Victorian Rare or Threatened Species (DELWP) List

vu Listed as vulnerable under the Victorian Rare or Threatened Species (DELWP) List

cr Listed as critically endangered under the Victorian Rare or Threatened Species (DELWP) List

rx Listed as extinct in Victoria under the Victorian Rare or Threatened Species (DELWP) List

Likelihood of Occurrence (LoO):

PRESENT – Species known to occur within the site, or detected during the site visit.

POSSIBLE – Potentially suitable habitat occurs within the construction footprint and species' known range encompasses the construction footprint. Species recorded historically in the 10-km search area, and generally within the last 30 years.

UNLIKELY – Species' known range encompasses the construction footprint, but suitable habitat does not occur within construction footprint, or occurs within the construction footprint but with generally low quality and quantity. Species recorded historically in the 10-km study area but generally not within the last 30 years.

HIGHLY UNLIKELY – No historical records of the species and/or no suitable habitat in the 10-km study area.

Table 7 Likelihood of occurrence of FFG Act and EPBC Act listed threatened fauna species, as developed from VBA and PMST searches within a 10 km radius of the construction footprint.

Common name	*Scientific Name*	EPBC	FFG	DELWP	VTWBC	No. of records	Most recent record	Preferred habitat in Victoria	Impacts/reasoning	Source
Australasian Bittern	*Botaurus poiciloptilus*	EN	L	en				Wetlands with tall, dense vegetation in permanent freshwater habitats, particularly when dominated by sedges, rushes and reeds.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	PMST
Australian Bustard	*Ardeotis australis*		L	cr		1	1995	Grasslands and grassy woodlands	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Australian Painted Snipe	*Rostratula australis (=benghalensis)*	EN	L	cr				Generally in shallow, terrestrial freshwater wetlands with rank, emergent tussocks of grass, sedges and rushes. Occurs in well vegetated lakes, swamps, inundated pasture, saltmarsh and dams. Fresh to saline water. May use riverine forest.	**Occurrence highly unlikely:** No records occur within the construction footprint.	PMST
Barking Owl	*Ninox connivens*		L	en	y	1	1979	Woodland and dry open forest	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat	VBA

									available within the construction footprint.	
Bar-tailed Godwit	*Limosa lapponica*	VU, MiMa				1	1980	Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.	**Occurrence unlikely:** No recent records within the study area, and no suitable habitat available.	VBA
Black Falcon	*Falco subniger*		L	vu		16	1981	Grassy woodlands	**Occurrence highly unlikely:** This species may utilise habitats for foraging Impact are unlikely. This species is wide ranging and suitable surrounding habitat is widespread.	VBA
Black-tailed Godwit	*Limosa limosa*	MiMa		vu		3	1980	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.	**Occurrence highly unlikely:** No records within the study area. No habitat present within the construction footprint at the time of the survey.	VBA & PMST

Blue-billed Duck	*Oxyura australis*		L	en		17	2001	Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available at the time of the survey.	VBA
Brolga	*Antigone rubicunda*		L	vu		1	1996	Wetlands, dams, flooded fields	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA
Bush Stone-curlew	*Burhinus grallarius*		L	en	y	6	1980	Open woodlands with coarse woody debris	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA
Carpet Python	*Morelia spilota metcalfei*		L	en		4	2009	Inhabits diverse habitats, in Murray/Darling drainage basin of eastern interior. shelter in hollow trunks and limbs, disused burrows, caves, rock crevices and under boulders.	**Occurrence highly unlikely:** Limited suitable habitat at the construction footprint, species may use habitats to forage Impact possible: Species wide ranging and suitable surrounding habitat	VBA

									widespread, however direct impacts (injury, stress, mortality) through habitat clearing should be mitigated.	
Caspian Tern	*Hydroprogne caspia*	MiMa	L	nt		3	2001	Coastal areas and large inland wetlands and rivers. Exposed ocean beaches, sheltered coastal bays, harbours, lagoons, inlets, estuaries, usually with sandy or muddy margins. Breeds in a variety of coastal habitats including banks, ridges and beaches of sand and shell, often in open or among low or sparse vegetation.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA
Common Greenshank	*Tringa nebularia*	MiMa		vu		35	2018	Does not breed in Australia, but occurs in all types of wetlands. It has been recorded in most coastal regions and is widespread west of the Great Dividing Range, particularly in the north-west, Macquarie Marshes and areas between the Lachlan and Murray Rivers and Darling River drainage basin.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey.	VBA & PMST
Common Sandpiper	*Actitis hypoleucos*	MiMa		vu				Migrates to Australia for austral summer. In Australia, inhabits a wide variety of coastal and inland wetlands with muddy margins, including lakes, rivers, sewage ponds.	**Occurrence highly unlikely:**: No records within the study area. No habitat present within the construction footprint at the time of the survey.	PMST

Curlew Sandpiper	*Calidris ferruginea*	CR, MiMa	L	en		28	2018	Regular summer migrant to Victoria. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.	**Occurrence unlikely:** Recent records occur within the broader study area, however there is no suitable habitat within the construction footprint at the time of the survey.	VBA & PMST & PMSTMiMa
Diamond Dove	*Geopelia cuneata*		L	nt		7	1980	Woodland and shrubland in dry areas	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Eastern Curlew	*Numenius madagascariensis*	CR, MiMa	L	vu				Non-breeding migrant to Australia during the austral summer. Coastal. Sheltered coastal habitats, usually with large sand flats or intertidal mudflats with seagrass, estuaries, open sandy beaches. Occasionally on coastal rock platforms.	**Occurrence highly unlikely:** No records available within the study area. There is no suitable habitat within the construction footprint.	PMST
Freckled Duck	*Stictonetta naevosa*		L	en		7	1985	Well vegetated shallow wetlands	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA

Glossy Ibis	*Plegadis falcinellus*	MiMa		nt		8	1980	Occurs throughout eastern and northern Australia, east of the Kimberley and Eyre Peninsula. Largest areas of prime habitat are inland and northern floodplains, with largest numbers in the Top End and Channel Country. Preferred habitats are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation.	**Occurrence highly unlikely:** No habitat present within the construction footprint at the time of the survey, with minimal recent records within the study area. This species will benefit from the project.	VBA
Great Egret	*Ardea alba*	Ma	L	vu		24	2001	Saltwater and freshwater wetlands, lakes, dams, river margins, estuaries, mudflats	**Occurrence unlikely:** Recent previous records within the study area, suitable habitat exists in areas of water (e.g. the Murray River). Impacts to this species will be minimal however the species is wide ranging and suitable surrounding habitat widespread. This species will benifit from the project.	VBA & PMST
Great Knot	*Calidris tenuirostris*	CR, MiMa	L	en		3	1980	Non-breeding migrant to Australia during the austral summer. Coastal. Mainly	**Occurrence highly unlikely:** No recent records within the study area, and limited	VBA

								found on intertidal mudflats, sandflats and sandy beaches.	suitable habitat available.	
Grey Goshawk	*Accipiter novaehollandiae*		L	vu		1	1983	Woodlands, forests and riparian habitats, mainly in wetter areas	**Occurrence unlikely:** Limited records within the study area, and no suitable habitat available.	VBA
Grey-crowned Babbler	*Pomatostomus temporalis*		L	en	y	13	2018	The eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (OEH 2012).	**Occurrence present:** Suitable habitat at all sites, species may use habitats to forage **Impact Unlikely:** Species wide ranging and suitable surrounding habitat widespread	VBA, Australian Ecosystems 2016
Ground Cuckoo-shrike	*Coracina maxima*		L	vu	y	4	2017	Open woodlands and grasslands of low rainfall areas.	**Occurrence highly unlikely:** Suitable habitat at all sites, species may use habitats to forage Impacts are unlikely, as it is a wide ranging species and suitable surrounding habitat is widespread.	VBA

Growling Grass Frog	*Litoria raniformis*	VU	L	en		8	2004	Permanent and semi-permanent waterbodies, generally containing abundant submerged and emergent vegetation. Within lowland grasslands, woodlands and open forests. Open vegetated wetlands, flooded paddocks, drains, farm dams, river pools.	**Occurrence unlikely:** There was no suitable habitat within the construction footprint during the time of the survey, additionally most of the eight previous records within the study area occurred before 1972 (previous to the Chytrid Fungus outbreak in Australia (DSEWPC 2013)). The species may colonize the construction footprint during flooding events, when conditions are suitable and habitat is available. Hygiene protocols for Chytrid Fungus should be included in a site specific EMP.	VBA & PMST
Gull-billed Tern	*Gelochelidon macrotarsa*	MiMa	L	nt		7	1980	Shallow terrestrial wetlands and sheltered embayments, estuaries, tidal mudflats and beaches. In Australia, mainly breeds in inland areas following floods.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA

Hooded Robin	*Melanodryas cucullata*		L	nt	y	15	2000	Woodlands, generally in drier areas	**Occurrence highly unlikely:** Suitable habitat at all sites, species may use habitats to forage Impact Unlikely. Species wide ranging and suitable surrounding habitat widespread	VBA
Latham's Snipe	*Gallinago hardwickii*	MiMa		nt		3	1978	Non-breeding migrant to Australia during the austral summer. Uses a wide variety of permanent and ephemeral wetlands, generally freshwater wetlands with cover. Also recorded along creeks, rivers and floodplains. Forages in soft mud at edge of wetlands and roosts in a variety of vegetation around wetlands including tussock grasslands, reeds and rushes, tea-tree scrub, woodlands and forests.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey, with no recent records within the study area.	VBA & PMST
Little Egret	*Egretta garzetta*	Ma	L	en		16	2003	Uses wide range of wetlands, mudflats, estuaries. Typically prefers shallows of wetlands for foraging. Occasionally in small waterways or wet grassland areas.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Long-toed Stint	*Calidris subminuta*	MiMa		nt		1	1981	Non-breeding migrant to Australia during the austral summer. Mudflats and weedy margins of coastal and inland wetlands.	**Occurrence highly unlikely:** No recent records within the study area, and limited	VBA

									suitable habitat available.	
Magpie Goose	*Anseranas semipalmata*	Ma	L	nt		7	1980	Seasonal wetlands, flooded fields. Aquatic and terrestrial habitat, mostly in wetlands on flood plains. Historically occurred in SE Australia, but extinct in Victoria by early 1900s. Re-introduction attempts have had mixed results.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*		L	vu		7	2018	Uses open, sparsely wooded country in arid areas, including grassland, open mulga and mallee, and areas dominated by callitris and casuarina.	**Occurrence highly unlikely:** Marginal suitable habitat occurs within the construction footprint, species may use habitat for traversing through larger ranges. **Impacts unlikely**: Impact areas do not include trees suitable for nesting, species wide ranging and suitable surrounding habitat widespread	VBA
Malleefowl	*Leipoa ocellata*	VU	L	en		1	1913	Mallee, Acacia, she-oak scrubs and woodland	**Occurrence highly unlikely:**: No recent records within the study area, and no suitable habitat available.	VBA PMST

Marsh Sandpiper	*Tringa stagnatilis*	MiMa		vu		24	2018	Non-breeding migrant to Australia during the austral summer. Estuaries, and coastal and inland shallow wetlands.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey.	VBA & PMST
Night Parrot	*Pezoporus occidentalis*	EN, Mi		rx				Lives in arid and semi-arid areas of inland Australia. It prefers long unburnt spinifex.	**Occurrence highly unlikely:** Regionally extinct	PMST
Painted Honeyeater	*Grantiella picta*	VU	L	vu	y			Nomadic, it occurs in highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	PMST
Pectoral Sandpiper	*Calidris melanotos*	MiMa		nt		2	1980	Nomadic. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey, with no recent records within the study area.	VBA & PMST
Plains-wanderer	*Pedionomus torquatus*	CR	L	cr		2	1978	Grasslands	**Occurrence unlikely:** No recent records within the study area,	VBA & PMST

									and no suitable habitat available.	
Regent Parrot	*Polytelis anthopeplus*	VU	L	vu		5	2019	Inhabits riverine forests and woodlands. Nests in eucalypt hollows.	**Occurrence highly unlikely:** Recent previous records within the study area, with suitable foraging habitat within the construction footprint. **Impact Unlikely:**: Losses to small area (~ 5.8 ha) of potential foraging habitat proposed to be lost, however the species is wide ranging and suitable surrounding habitat widespread. Important habitat (breeding habitat) limited within the construction footprint.	VBA & PMST
Ruddy Turnstone	*Arenaria interpres*	MiMa		vu		3	2000	Non-breeding migrant, regular to Victoria. Typically coastal, on intertidal mudflats, sandflats and sandy beaches, rocky shores and intertidal reefs.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
South-eastern Long-eared Bat	*Nyctophilus corbeni*	VU	L	en				Dry woodland and shrubland in arid areas	**Occurrence unlikely**: No records within the construction footprint or the broader study	PMST

									area. Previous research shows this species likely requires large areas of intact vegetation (Threatened Species Scientific Committee 2015).	
Spotted Bowerbird	*Chlamydera maculata*		L	cr		1	1932	Open woodlands, with dense ground cover, in low rainfall areas. May be extinct in Victoria	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA
Square-tailed Kite	*Lophoictinia isura*		L	vu		6	1980	Woodland and open forest in drier areas	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Ma	L	vu		5	2018	Coastal, marine and inland. Estuaries, beaches, large wetlands, including deep freshwater swamps, lakes, reservoirs, billabongs and rivers. Uses tall trees in or near water for breeding.	**Occurrence highly unlikely:** Limited suitable habitat within the construction footprint, species may use habitats to forage **Impact Unlikely:** Species wide ranging and suitable surrounding habitat	VBA & PMST

									widespread. Important habitat (breeding habitat) limited within the construction footprint.	
White-throated Needletail	*Hirundapus caudacutus*	VU, MiMa	L	vu		1	1978	Almost exclusively aerial within Australia, occurring over most types of habitat, particularly wooded areas. Less often seen over open farm paddocks but has been recorded in vineyards flying between the rows of trees.	**Occurrence unlikely:** No recent records within the study area, and no suitable habitat available.	VBA
White-winged Black Tern	*Chlidonias leucopterus*	MiMa		nt		2	1983	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Wood Sandpiper	*Tringa glareola*	MiMa		vu		1	1980	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Silver Perch	*Bidyanus bidyanus*	CR	L	vu				Silver perch inhabit a multitude of environments within its natural range, encompassing the cool clear waters of the upper reaches and highlands, to the lower turbid slow flowing rivers of the west. It is an omnivorous species, with a	**Possible**. The Silver Perch could occasionally occur during inundation events, particularly at the larval or fingerling stage.	PMST

								diet including insects, small crustaceans and vegetation.		
Murray Hardyhead	*Craterocephalus fluviatilis*	EN	L	cr				The species is found around the margins of lakes, wetlands, backwaters and billabongs. The Murray Hardyhead prefers open water, shallow, slow flowing or still habitats, with sand or silt substrates (Lintermans 2007).	**Highly unlikely**. No previous records. Unlikely to be present even during inundation events.	PMST
Flathead Galaxias	*Galaxias rostratus*	CR		vu		1	1950	The Flathead Galaxias inhabits still or gently flowing water on the margins of lakes, billabongs and streams. It usually occurs in shoals in midwater over rocky or sandy bottoms near aquatic vegetation.	**Highly unlikely**. Last record from the 1950s. Unlikely to be present even during inundation events.	VBA, PMST
Murray Cod	*Maccullochella peelii*	VU	L	vu				The Murray Cod utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs (McDowall 1996). Murray Cod are frequently found in the main channels of rivers and larger tributaries.	**Possible**. The Murray Cod could occasionally occur during inundation events, particularly at the larval or fingerling stage.	PMST
Macquarie Perch	*Macquaria australasica*	EN	L	en				Macquarie Perch is primarily a riverine species but can establish populations in suitable lakes where fish undergo migrations to riverine habitats in Spring. Lake Eildon and Lake Dartmouth are important impoundments which have	**Highly unlikely**. No previous records. Unlikely to be present even during inundation events.	PMST

								been the focus of research into this species.		
River Snail	*Notopala sublineata*	CR	L			4	1972	The ecology of the River Snail is not well known. This snail is a herbivore that grazes on organic matter found on hard surfaces in free-flowing bodies of water. It is a member of the family Viviparidae so named because they give birth to small young snails rather than laying eggs. In this family, the female broods the young until they are able to crawl away, so species within this family have limited dispersal abilities.	**Highly unlikely**. Previous records from the 1970s almost 50 years ago.	VBA

Appendix F. **Likelihood of occurrence of threatened fauna (inundation area)**

The following assessment of likelihood of occurrence and impact to threatened fauna considers the potential to occur at the construction footprint based on the VBA and PMST searches combined with habitat requirements of the species.

Key:

Status

EN Listed as Endangered under the EPBC Act

VU Listed as Vulnerable under the EPBC Act

L Listed as threatened under the FFG Act

Mi Listed as Migratory under the EPBC Act

Ma Listed as Marine under the EPBC Act

en Listed as endangered under the Victorian Rare or Threatened Species (DELWP) List

vu Listed as vulnerable under the Victorian Rare or Threatened Species (DELWP) List

cr Listed as critically endangered under the Victorian Rare or Threatened Species (DELWP) List

rx Listed as extinct in Victoria under the Victorian Rare or Threatened Species (DELWP) List

Likelihood of Occurrence (LoO)

PRESENT – Species known to occur within the site, or detected during the site visit.

POSSIBLE – Potentially suitable habitat occurs within the construction footprint and species' known range encompasses the construction footprint. Species recorded historically in the 10-km search area, and generally within the last 30 years.

UNLIKELY – Species' known range encompasses the construction footprint, but suitable habitat does not occur within construction footprint, or occurs within construction footprint but with generally low quality and quantity. Species recorded historically in the 10-km study area but generally not within the last 30 years.

HIGHLY UNLIKELY – No historical records of the species and/or no suitable habitat in the 10-km study area.

Table 8 Likelihood of occurrence of FFG Act and EPBC Act listed threatened fauna species, as developed from VBA and PMST searches within a 10 km radius of the inundation footprint.

Common name	*Scientific Name*	EPBC	FFG	DELWP	VTWBC	Count of records	Last record	Preferred habitat in Victoria	Impacts/reasoning	Source
Australasian Bittern	*Botaurus poiciloptilus*	EN	L	en				Wetlands with tall, dense vegetation in permanent freshwater habitats, particularly when dominated by sedges, rushes and reeds.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	PMST
Australian Bustard	*Ardeotis australis*		L	cr		1	1995	Grasslands and grassy woodlands	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Australian Painted Snipe	*Rostratula australis (=benghalensis)*	EN, Ma	L	cr				Generally in shallow, terrestrial freshwater wetlands with rank, emergent tussocks of grass, sedges and rushes. Occurs in well vegetated lakes, swamps, inundated pasture, saltmarsh and dams. Fresh to saline water. May use riverine forest.	**Occurrence highly unlikely:** No records occur within the construction footprint. This species will benefit from the project.	PMST
Barking Owl	*Ninox connivens*		L	en	y	1	1979	Woodland and dry open forest	**Occurrence highly unlikely:** No recent records within the study area, and limited	VBA

									suitable habitat available within the construction footprint.	
Bar-tailed Godwit	*Limosa lapponica*	VU, MiMa				1	1980	Mudflats, sandflats, estuaries, large wetlands. Coastal, but occasionally inland.	**Occurrence unlikely**: No recent records within the study area, and no suitable habitat available.	VBA
Black Falcon	*Falco subniger*		L	vu		16	1981	Grassy woodlands	**Occurrence possible:** This species may utilise habitats for foraging **Impact unlikely**. This species is wide ranging and suitable surrounding habitat is widespread.	VBA
Black-tailed Godwit	*Limosa limosa*	MiMa		vu		3	1980	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.	**Occurrence highly unlikely:** No records within the study area. No habitat present within the construction footprint at the time of the survey.	VBA & PMST

Blue-billed Duck	*Oxyura australis*		L	en		17	2001	Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available at the time of the survey.	VBA
Brolga	*Grus rubicunda*		L	vu		1	1996	Wetlands, dams, flooded fields	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA
Bush Stone-curlew	*Burhinus grallarius*		L	en	y	6	1980	Open woodlands with coarse woody debris	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA
Carpet Python	*Morelia spilota metcalfei*		L	en		5	2009	Inhabits diverse habitats, in Murray/Darling drainage basin of eastern interior. shelter in hollow trunks and limbs, disused burrows, caves, rock crevices and under boulders.	**Occurrence possible:** Limited suitable habitat within the construction footprint, species may use habitats to forage **Impact possible**: Species wide ranging and suitable surrounding habitat widespread, however	VBA

									direct impacts (injury, stress, mortality) through habitat clearing should be mitigated.	
Caspian Tern	*Sterna caspia*	MiMa	L	nt		3	2001	Coastal areas and large inland wetlands and rivers. Exposed ocean beaches, sheltered coastal bays, harbours, lagoons, inlets, estuaries, usually with sandy or muddy margins. Breeds in a variety of coastal habitats including banks, ridges and beaches of sand and shell, often in open or among low or sparse vegetation.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA
Common Greenshank	*Tringa nebularia*	MiMa		vu		35	2018	Does not breed in Australia, but occurs in all types of wetlands. It has been recorded in most coastal regions and is widespread west of the Great Dividing Range, particularly in the north-west, Macquarie Marshes and areas between the Lachlan and Murray Rivers and Darling River drainage basin.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey.	VBA & PMST
Common Sandpiper	*Actitis hypoleucos*	MiMa		vu				Migrates to Australia for austral summer. In Australia, inhabits a wide variety of coastal and inland wetlands with muddy margins, including lakes, rivers, sewage ponds.	**Occurrence highly unlikely:** No records within the study area. No habitat present within the construction footprint at the time of the survey.	PMST

Curlew Sandpiper	*Calidris ferruginea*	CR, MiMa	L	en		28	2018	Regular summer migrant to Victoria. Occurs in a variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.	**Occurrence unlikely:** Recent records occur within the broader construction footprint, however there is no suitable habitat within the construction footprint at the time of the survey.	VBA & PMST
Diamond Dove	*Geopelia cuneata*		L	nt		7	1980	Woodland and shrubland in dry areas	**Occurrence unlikely**: No recent records within the study area, and limited suitable habitat available.	VBA
Eastern Curlew	*Numenius madagascariensis*	CR, MiMa	L	vu				Non-breeding migrant to Australia during the austral summer. Coastal. Sheltered coastal habitats, usually with large sand flats or intertidal mudflats with seagrass, estuaries, open sandy beaches. Occasionally on coastal rock platforms.	**Occurrence highly unlikely:** No records available within the study area. There is no suitable habitat within the construction footprint.	PMST
Freckled Duck	*Stictonetta naevosa*		L	en		7	1985	Well vegetated shallow wetlands	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA

Glossy Ibis	*Plegadis falcinellus*	MiMa		nt		8	1980	Occurs throughout eastern and northern Australia, east of the Kimberley and Eyre Peninsula. Largest areas of prime habitat are inland and northern floodplains, with largest numbers in the Top End and Channel Country. Preferred habitats are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Breeds at limited locations, with most records from the Murray Darling Basin (NSW), western Riverina (VIC), south-east (SA), Channel Country (Qld/ SA) and lower Ord/Keep Rivers (WA).	**Occurrence highly unlikely:** No habitat present within the construction footprint at the time of the survey, with minimal recent records within the study area.	VBA
Great Egret	*Ardea modesta (=alba)*	Ma	L	vu		24	2001	Saltwater and freshwater wetlands, lakes, dams, river margins, estuaries, mudflats	**Occurrence unlikely:** Recent previous records within the study area, however no habitat occurs within the construction footprint at the time of the survey.	VBA & PMST
Great Knot	*Calidris tenuirostris*	CR, MiMa	L	en		3	1980	Non-breeding migrant to Australia during the austral summer. Coastal. Mainly found on intertidal mudflats, sandflats and sandy beaches.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA

Grey Goshawk	*Accipiter novaehollandiae*	L	vu		1	1983	Woodlands, forests and riparian habitats, mainly in wetter areas	**Occurrence unlikely:** Limited records within the study area, and no suitable habitat available.	VBA
Grey-crowned Babbler	*Pomatostomus temporalis*	L	en	y	13	2018	The eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (OEH 2012).	**Occurrence present:** Suitable habitat at all sites, species may use habitats to forage **Impact Unlikely.** Species wide ranging and suitable surrounding habitat widespread	VBA
Ground Cuckoo-shrike	*Coracina maxima*		L	vu	y	4	2017	Open woodlands and grasslands of low rainfall areas.	**Occurrence possible**: Suitable habitat at all sites, species may use habitats to forage **Impacts unlikely**: as it is a wide ranging species and suitable surrounding habitat is widespread.	VBA

Growling Grass Frog	*Litoria raniformis*	VU	L	en		8	2004	Permanent and semi-permanent waterbodies, generally containing abundant submerged and emergent vegetation. Within lowland grasslands, woodlands and open forests. Open vegetated wetlands, flooded paddocks, drains, farm dams, river pools.	**Occurrence unlikely:** There was no suitable habitat within the during the time of the survey, additionally most of the eight previous records within the study area occurred before 1972 (previous to the Chytrid Fungus outbreak in Australia (DSEWPC 2013)). The species may colonize the Study Sites during flooding events, when conditions are suitable and habitat is available. Hygiene protocols for Chytrid Fungus should be included in a site specific EMP.	VBA & PMST
Gull-billed Tern	*Gelochelidon macrotarsa*	MiMa	L	nt		7	1980	Shallow terrestrial wetlands and sheltered embayments, estuaries, tidal mudflats and beaches. In Australia, mainly breeds in inland areas following floods.	**Occurrence unlikely:** Limited recent records within the study area, and no suitable habitat available.	VBA

Hooded Robin	*Melanodryas cucullata*		L	nt	y	15	2000	Woodlands, generally in drier areas	**Occurrence possible:** Suitable habitat at all sites, species may use habitats to forage **Impact Unlikely**. Species wide ranging and suitable surrounding habitat widespread	VBA
Latham's Snipe	*Gallinago hardwickii*	MiMa		nt		3	1978	Non-breeding migrant to Australia during the austral summer. Uses a wide variety of permanent and ephemeral wetlands, generally freshwater wetlands with cover. Also recorded along creeks, rivers and floodplains. Forages in soft mud at edge of wetlands and roosts in a variety of vegetation around wetlands including tussock grasslands, reeds and rushes, tea-tree scrub, woodlands and forests.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey, with no recent records within the study area.	VBA & PMST
Little Egret	*Egretta garzetta*	Ma	L	en		16	2003	Uses wide range of wetlands, mudflats, estuaries. Typically prefers shallows of wetlands for foraging. Occasionally in small waterways or wet grassland areas.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Long-toed Stint	*Calidris subminuta*	MiMa		nt		1	1981	Non-breeding migrant to Australia during the austral summer. Mudflats and weedy margins of coastal and inland wetlands.	**Occurrence highly unlikely:** No recent records within the study area, and limited	VBA

									suitable habitat available.	
Magpie Goose	*Anseranas semipalmata*	Ma	L	nt		7	1980	Seasonal wetlands, flooded fields. Aquatic and terrestrial habitat, mostly in wetlands on flood plains. Historically occurred in SE Australia, but extinct in Victoria by early 1900s. Re-introduction attempts have had mixed results.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Major Mitchell's Cockatoo	*Cacatua leadbeateri*		L	vu		7	2018	Uses open, sparsely wooded country in arid areas, including grassland, open mulga and mallee, and areas dominated by callitris and casuarina.	**Occurrence possible:** Marginal suitable habitat occurs within the construction footprint, species may use habitat for traversing through larger ranges. **Impacts unlikely:** Impact areas do not include trees suitable for nesting, species wide ranging and suitable surrounding habitat widespread	VBA
Malleefowl	*Leipoa ocellata*	VU	L	en		1	1913	Mallee, Acacia, she-oak scrubs and woodland	**Occurrence highly unlikely:** No recent records within the study area, and no suitable habitat available.	VBA & PMST

Marsh Sandpiper	*Tringa stagnatilis*	MiMa		vu		24	2018	Non-breeding migrant to Australia during the austral summer. Estuaries, and coastal and inland shallow wetlands.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey.	VBA & PMST
Night Parrot	*Pezoporus occidentalis*	EN, Mi		rx				Lives in arid and semi-arid areas of inland Australia. It prefers long unburnt spinifex.	**Occurrence highly unlikely:** Regionally extinct	PMST
Painted Honeyeater	*Grantiella picta*	VU	L	vu	y			Nomadic, it occurs in highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	**Occurrence unlikely:** No recent records within the study area, and limited suitable habitat available.	PMST
Pectoral Sandpiper	*Calidris melanotos*	MiMa		nt		2	1980	Nomadic. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	**Occurrence unlikely:** No habitat present within the construction footprint at the time of the survey, with no recent records within the study area.	VBA & PMST

Plains-wanderer	*Pedionomus torquatus*	CR	L	cr		2	1978	Grasslands	**Occurrence unlikely:** No recent records within the study area, and no suitable habitat available.	VBA & PMST
Plumed Egret	*Ardea intermedia plumifera*		L	en		1	2017	Occurs in inland wetlands, coastal marine habitats and grasslands.	**Occurrence unlikely:** Marginal suitable habitat occurs within the construction footprint, species may use habitats to forage when flooded. Impacts are unlikely, as it is a wide ranging species and suitable surrounding habitat is widespread.	VBA
Regent Parrot	*Polytelis anthopeplus monarchoides*	VU	L	vu		5	2019	Inhabits riverine forests and woodlands. Nests in eucalypt hollows.	**Occurrence possible:** Recent previous records within the study area, with suitable foraging habitat within the construction footprint. **Impacts unlikely:** Losses to small area (~ 5.8 ha) of potential foraging habitat	VBA & PMST

									proposed to be lost, however the species is wide ranging and suitable surrounding habitat widespread. Important habitat (breeding habitat) limited within the construction footprint.	
Ruddy Turnstone	*Arenaria interpres*	MiMa		vu		3	2000	Non-breeding migrant, regular to Victoria. Typically coastal, on intertidal mudflats, sandflats and sandy beaches, rocky shores and intertidal reefs.	**Occurrence highly unlikely**: No recent records within the study area, and limited suitable habitat available.	VBA
South-eastern Long-eared Bat	*Nyctophilus corbeni*	VU	L	en				Dry woodland and shrubland in arid areas	**Occurrence unlikely:** No records within the construction footprint or the broader study area. Previous research shows this species likely requires large areas of intact vegetation (Threatened Species Scientific Committee 2015).	PMST
Spotted Bowerbird	*Chlamydera maculata*		L	cr		1	1932	Open woodlands, with dense ground cover, in low rainfall areas. May be extinct in Victoria	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat	VBA

									available within the construction footprint.	
Square-tailed Kite	*Lophoictinia isura*		L	vu		6	1980	Woodland and open forest in drier areas	**Occurrence unlikely**: No recent records within the study area, and limited suitable habitat available within the construction footprint.	VBA
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Ma	L	vu		5	2018	Coastal, marine and inland. Estuaries, beaches, large wetlands, including deep freshwater swamps, lakes, reservoirs, billabongs and rivers. Uses tall trees in or near water for breeding.	**Occurrence possible:** Limited suitable habitat at the construction footprint, species may use habitats to forage **Impact Unlikely:** Species wide ranging and suitable surrounding habitat widespread. Important habitat (breeding habitat) limited within the construction footprint.	VBA & PMST
White-throated Needletail	*Hirundapus caudacutus*	VU, MiMa	L	vu		1	1978	Almost exclusively aerial within Australia, occurring over most types of habitat, particularly wooded areas. Less often seen over open farm paddocks but has been recorded in vineyards flying between the rows of trees.	**Occurrence unlikely:** No recent records within the study area, and no suitable habitat available.	VBA

White-winged Black Tern	*Chlidonias leucopterus*	MiMa		nt		2	1983	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Wood Sandpiper	*Tringa glareola*	MiMa		vu		1	1980	Non-breeding migrant to Australia during the austral summer. Inhabits well vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation. Occasionally in intertidal habitats, including mangroves.	**Occurrence highly unlikely:** No recent records within the study area, and limited suitable habitat available.	VBA
Silver Perch	*Bidyanus bidyanus*	CR	L	vu				Silver perch inhabit a multitude of environments within its natural range, encompassing the cool clear waters of the upper reaches and highlands, to the lower turbid slow flowing rivers of the west. It is an omnivorous species, with a diet including insects, small crustaceans and vegetation.	**Occurrence unlikely.** No previous records. Suitable habitat not present within Construction Footprints - no water.	PMST
Murray Hardyhead	*Craterocephalus fluviatilis*	EN	L	cr				The species is found around the margins of lakes, wetlands, backwaters and billabongs. The Murray Hardyhead prefers open water, shallow, slow flowing or still habitats, with sand or silt substrates (Lintermans 2007).	**Highly Unlikely**. No previous records. Suitable habitat not present within Construction Footprints - no water.	PMST

Flathead Galaxias	*Galaxias rostratus*	CR		vu		1	1950	The Flathead Galaxias inhabits still or gently flowing water on the margins of lakes, billabongs and streams. It usually occurs in shoals in midwater over rocky or sandy bottoms near aquatic vegetation.	**Highly Unlikely**. Last record from the 1950s. Suitable habitat not present within Construction Footprints - no water.	VBA, PMST
Murray Cod	*Maccullochella peelii*	VU	L	vu				The Murray Cod utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs (McDowall 1996). Murray Cod are frequently found in the main channels of rivers and larger tributaries.	**Highly Unlikely**. No previous records. Suitable habitat not present within Construction Footprints - no water.	PMST
Macquarie Perch	*Macquaria australasica*	EN	L	en				Macquarie Perch is primarily a riverine species but can establish populations in suitable lakes where fish undergo migrations to riverine habitats in Spring. Lake Eildon and Lake Dartmouth are important impoundments which have been the focus of research into this species.	**Highly Unlikely**. No previous records. Suitable habitat not present within Construction Footprints - no water.	PMST
River Snail	*Notopala sublineata*	CR	L			4	1972	The ecology of the River Snail is not well known. This snail is a herbivore that grazes on organic matter found on hard surfaces in free-flowing bodies of water. It is a member of the family Viviparidae so named because they give birth to small young snails rather than laying eggs. In this family, the female broods the young until they are able to crawl away, so species within this family have limited dispersal abilities.	**Highly Unlikely**. Previous records from the 1970s almost 50 years ago. Suitable habitat not present within Construction Footprints - no water.	VBA

Appendix G. **Significance assessment for EPBC-listed Regent Parrot**

Below are the significant impact criteria for species listed under the EPBC Act as vulnerable. The criteria are addressed below for the EPBC Act Vulnerable (VU) listed Regent Parrot (eastern) (*Polytelis anthopeplus monarchoides*) and any potential impacts to this species from the proposed works.

NB – What is an important population of a species?

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

Lead to a long-term decrease in the size of an important population of a species
The Regent Parrot is well known and frequently recorded throughout Hattah-Kulkyne National Park, with a number of well-known breeding populations along the Murray River at the southern park boundary (Messenger's/Oatey's Regulator), more than 70 km north-west of the Study Area. The Nyah-Vinifera Park occurs within areas where Regent Parrots are known to occur, however falls outside of areas mapped as breeding habitat (Baker and Hurley 2011) The proposed construction footprint represent a very small, moderate quality area of foraging habitat for this highly mobile species, and is very unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population
The proposed construction footprint areas are centred on existing tracks and degraded areas. This will not significantly reduce the area of occupancy of this population as the structures will be established on already disturbed tracks and levees.
Fragment an existing important population into two or more populations
The proposed construction footprint represents very small, isolated and discreet areas of habitat within an extensive area of suitable habitat for this highly mobile species, and will not fragment the existing population into two or more populations. Previous similar and larger impacts in this area for TLM projects did not negatively impact Regent Parrot nesting extent and success.
Adversely affect habitat critical to the survival of a species
The proposed construction fall outside areas mapped as breeding habitat for the Regent Parrot (approximately 38 km north) (Baker and Hurley 2011, Seran 2018). The proposed construction footprint will not adversely affect habitat critical to the survival of this species, as construction footprints represent very small, isolated and discreet areas of habitat within an extensive area of suitable habitat for this highly mobile species. The proposal does not plan to remove any potential nesting habitat.
Disrupt the breeding cycle of an important population
Mapped potential areas for breeding habitat for the Regent Parrot occurs approximately 38 km north of the construction footprint (Baker and Hurley 2011, Seran 2018).
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The proposed construction footprint represents very small, isolated and discreet area of habitat within an extensive area of suitable habitat (~ 5.8 ha within an area of 488 ha). Areas mapped as likely important

habitat for this species within the National Recovery Plan occurs approximately 38 km north of the proposed construction footprint (Baker and Hurley 2011). Additionally, the construction footprint occurs outside of the 20 km limit from nesting sites for foraging during breeding.

The proposed construction will not impact nesting trees or suitable foraging habitat during breeding season, and therefore will not significantly modify, destroy, remove, isolate or decrease the availability or quality of Regent Parrot habitat within the area.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Weed infiltration is possible from the proposed works, within the limited area of the construction. Appropriate systems must be followed to minimise the possibility of weed dispersal and exotic predator control, and will be included in a Construction Environmental Management Plan (CEMP). Impacts to this species from invasive species have not been identified as a threatening process previously and are highly unlikely in this case.
Introduce disease that may cause the species to decline
The proposed construction works do not pose a risk of introducing disease that could cause the species to decline.
Interfere substantially with the recovery of the species.
The proposed construction activities will not interfere substantially with the recovery of the species, as this species and its breeding and foraging habitats will not be impacted by the proposed works, directly or indirectly. The project is likely to enhance habitat for this species, by promoting healthy woodlands for foraging (Seran 2018)

Appendix H. **Significance assessment for EPBC-listed Migratory fauna**

Below are the significant impact criteria for EPBC Act listed migratory species used to determine whether there is a chance of a significant impact.

Important information regarding migratory species includes the following (taken from DAWE Significant Impact guidelines 2013):

What is important habitat for a migratory species?

An area of 'important habitat' for a migratory species is:

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

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

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

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

What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

What is the population of a migratory species?

'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
Seventeen migratory species were identified as having the potential to occur within the construction footprint (PMST and VBA). Most of these species are either highly unlikely to occur (e.g. Bar-tailed Godwit, Eastern Curlew) or would very rarely use airspace over these footprints (e.g. White-throated Needletail). It is highly unlikely that the construction footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. Within the proposed construction footprint it is unlikely that the proposed Vinifera project will result in the introduction of invasive species that might be harmful to migratory species. A Construction Environmental Management Plan will be developed for the project that will include measures such as vehicle hygiene protocols to mitigate the potential spread of weeds. There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (cats, foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in productivity. Some of the species such as cats and foxes could potentially prey on migratory waterbirds. An accompanying feral animal management and control program would need to be implemented within the inundation area, however this may simply require Parks Victoria to expand current pest control programs within the park. Given that the proposed construction footprint does not provide important habitat for listed migratory species, it is unlikely that the planned works would disrupt the lifecycle of an ecologically significant proportion of a population of a migratory species.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
Within the proposed construction footprint it is unlikely that the proposed Vinifera project will result in the introduction of invasive species that might be harmful to migratory species. A Construction Environmental Management Plan will be developed for the project that will include measures such as vehicle hygiene protocols to mitigate the potential spread of weeds. There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (cats, foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in productivity. Some of the species such as cats and foxes could potentially prey on migratory waterbirds. An accompanying feral animal management and control program would need to be implemented within the inundation area, however this may simply require Parks Victoria to expand current pest control programs within the park.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.
Given that the proposed construction footprint does not provide important habitat for listed migratory species, it is unlikely that the planned works would disrupt the lifecycle of an ecologically significant proportion of a population of a migratory species.

Appendix I. **Ensym report of offsets required for native vegetation removal.**

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: **26/03/2020**
Time of issue: **8:10 pm**

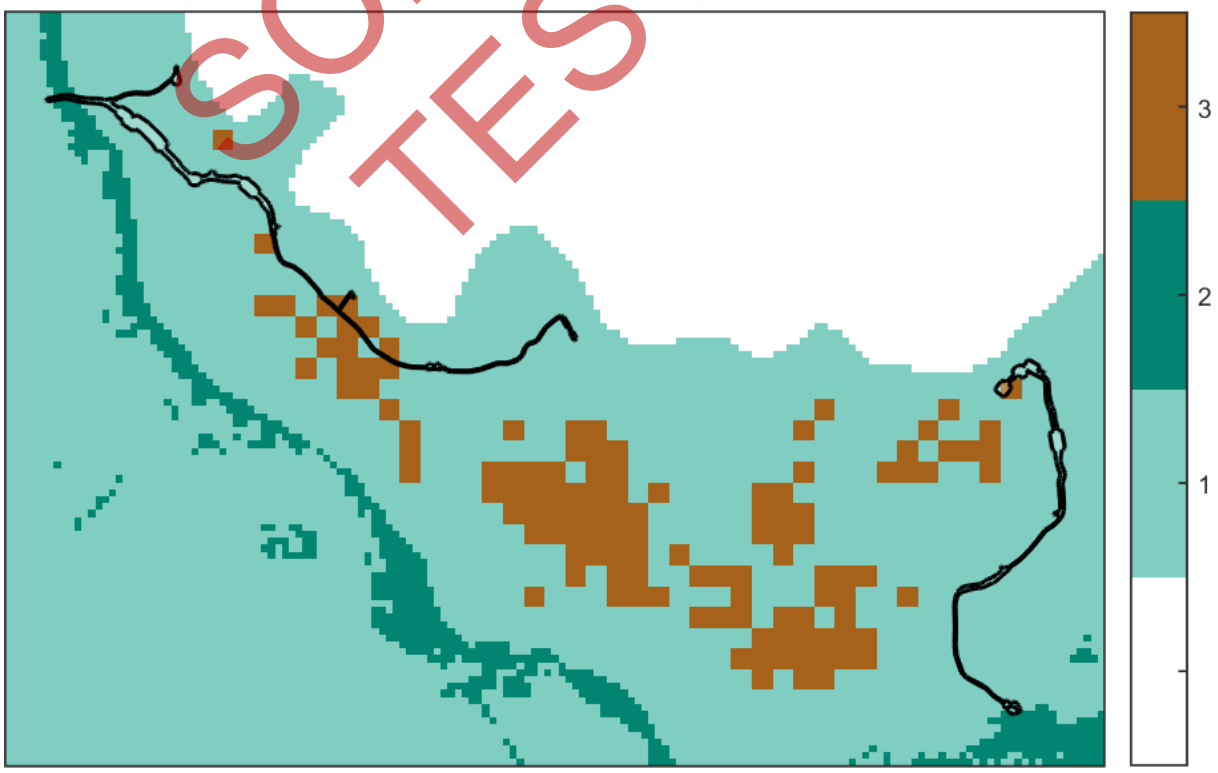
Report ID: Scenario Testing

Project ID	Vinifera_ENSYM_shifted

Assessment pathway

Assessment pathway	**Detailed Assessment Pathway**
Extent including past and proposed	6.657 ha
Extent of past removal	0.000 ha
Extent of proposed removal	6.657 ha
No. Large trees proposed to be removed	121
Location category of proposed removal	Location 3 The native vegetation is in an area where the removal of less than 0.5 hectares could have a significant impact on habitat for one or more rare or threatened species.The native vegetation is also in an area mapped as an endangered Ecological Vegetation Class (as per the statewide EVC map).

1. Location map



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]	0.166 general habitat units
Vicinity	Mallee Catchment Management Authority (CMA) or Swan Hill Rural City Council
Minimum strategic biodiversity value score[2]	0.584
Large trees*	4 large trees
Species offset amount[3]	7.270 species units of habitat for Darling Lily, *Crinum flaccidum*
Large trees*	117 trees
*** The total number of large trees that the offset must protect**	121 large trees to be protected in either the general, species or combination across all habitat units protected

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

3 The species offset amount(s) required is the sum of all species habitat units in Appendix 1.

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**
1-HZ8	Patch	muf_0295	Vulnerable	3	no	0.530	0.272	0.272	0.780	0.661	0.239	500874 Darling Lily *Crinum flaccidum*
1-HZ7	Patch	muf_0295	Vulnerable	4	no	0.640	0.240	0.240	0.781	0.733	0.266	500874 Darling Lily *Crinum flaccidum*
1-HZ1	Patch	muf_0814	Depleted	59	no	0.650	2.878	2.878	0.782	0.787	3.343	500874 Darling Lily *Crinum flaccidum*
2-HZ1	Patch	muf_0814	Depleted	7	no	0.650	0.121	0.121	0.800	0.770	0.140	500874 Darling Lily *Crinum flaccidum*
2-HZ7	Patch	muf_0814	Depleted	2	no	0.640	0.087	0.087	0.788	0.676	0.094	500874 Darling Lily *Crinum flaccidum*
3-HZ7	Patch	muf_0814	Depleted	21	no	0.640	1.047	1.047	0.707	0.690	1.132	500874 Darling Lily *Crinum flaccidum*
4-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.099	0.099	0.820	0.770	0.112	500874 Darling Lily *Crinum flaccidum*

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
5-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.047	0.047	0.820	0.740	0.053	500874 Darling Lily *Crinum flaccidum*
6-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.055	0.055	0.820	0.744	0.062	500874 Darling Lily *Crinum flaccidum*
7-HZ7	Patch	muf_0814	Depleted	2	no	0.640	0.027	0.027	0.876	0.799	0.031	500874 Darling Lily *Crinum flaccidum*
1-HZ4	Patch	muf_0814	Depleted	4	no	0.610	0.125	0.125	0.730		0.099	General
4-HZ2	Patch	muf_0814	Depleted	14	no	0.650	0.659	0.659	0.768	0.795	0.769	500874 Darling Lily *Crinum flaccidum*
2-HZ8	Patch	muf_0295	Vulnerable	2	no	0.530	0.128	0.128	0.733	0.739	0.118	500874 Darling Lily *Crinum flaccidum*
8-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.005	0.005	0.820	0.740	0.005	500874 Darling Lily *Crinum flaccidum*
9-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.257	0.257	0.837	0.763	0.290	500874 Darling Lily *Crinum flaccidum*
10-HZ7	Patch	muf_0814	Depleted	0	no	0.640	0.420	0.420	0.884	0.806	0.485	500874 Darling Lily *Crinum flaccidum*
3-HZ1	Patch	muf_0814	Depleted	3	no	0.650	0.114	0.114	0.734	0.781	0.132	500874 Darling Lily *Crinum flaccidum*
1-HZ6	Patch	muf_0949	Endangered	0	no	0.680	0.077	0.077	0.730		0.068	General

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
Darling Lily	*Crinum flaccidum*	500874	Vulnerable	Dispersed	Top ranking map	0.0122
Darling Lily	*Crinum flaccidum*	500874	Vulnerable	Dispersed	Habitat importance map	0.0027
Silver Saltbush	*Atriplex rhagodioides*	500331	Vulnerable	Dispersed	Top ranking map	0.0024
Jerry-jerry	*Ammannia multiflora*	500202	Vulnerable	Dispersed	Habitat importance map	0.0023
Cotton Sneezeweed	*Centipeda nidiformis*	505616	Rare	Dispersed	Habitat importance map	0.0020
Winged New Holland Daisy	*Vittadinia pterochaeta*	503542	Vulnerable	Dispersed	Top ranking map	0.0019
Spreading Emu-bush	*Eremophila divaricata subsp. divaricata*	501200	Rare	Dispersed	Habitat importance map	0.0018
Downs Nutgrass	*Cyperus bifax*	500913	Vulnerable	Dispersed	Habitat importance map	0.0018
Spotted Emu-bush	*Eremophila maculata subsp. maculata*	501204	Rare	Dispersed	Habitat importance map	0.0017
Bignonia Emu-bush	*Eremophila bignoniiflora*	501198	Vulnerable	Dispersed	Top ranking map	0.0016
Silver Saltbush	*Atriplex rhagodioides*	500331	Vulnerable	Dispersed	Habitat importance map	0.0015
Twin-flower Saltbush	*Dissocarpus biflorus var. biflorus*	501074	Rare	Dispersed	Habitat importance map	0.0014
Northern Sandalwood	*Santalum lanceolatum*	503005	Endangered	Dispersed	Habitat importance map	0.0014
Riverina Bitter-cress	*Cardamine moirensis*	505032	Rare	Dispersed	Habitat importance map	0.0014
Flat Spike-sedge	*Eleocharis plana*	501144	Vulnerable	Dispersed	Habitat importance map	0.0013
Fuzzy New Holland Daisy	*Vittadinia cuneata var. hirsuta*	505068	Rare	Dispersed	Habitat importance map	0.0013
Woolly Minuria	*Minuria denticulata*	502200	Rare	Dispersed	Habitat importance map	0.0012
Small Water-fire	*Bergia trimera*	500387	Vulnerable	Dispersed	Habitat importance map	0.0012
Winged New Holland Daisy	*Vittadinia pterochaeta*	503542	Vulnerable	Dispersed	Habitat importance map	0.0012

Nealie	*Acacia loderi*	500052	Vulnerable	Dispersed	Habitat importance map	0.0012
Desert Lantern	*Abutilon otocarpum*	500003	Vulnerable	Dispersed	Habitat importance map	0.0011
Squat Picris	*Picris squarrosa*	504827	Rare	Dispersed	Habitat importance map	0.0011
Yarran	*Acacia melvillei*	500058	Vulnerable	Dispersed	Habitat importance map	0.0011
Growling Grass Frog	*Litoria raniformis*	13207	Endangered	Dispersed	Habitat importance map	0.0011
Twin-leaf Bedstraw	*Asperula gemella*	500280	Rare	Dispersed	Habitat importance map	0.0011
Purple Love-grass	*Eragrostis lacunaria*	501190	Vulnerable	Dispersed	Habitat importance map	0.0010
Mealy Saltbush	*Atriplex pseudocampanulata*	500330	Rare	Dispersed	Habitat importance map	0.0010
Carpet Python	*Morelia spilota metcalfei*	62969	Endangered	Dispersed	Habitat importance map	0.0010
Twiggy Sida	*Sida intricata*	503143	Vulnerable	Dispersed	Habitat importance map	0.0010
Coral Saltbush	*Atriplex papillata*	500327	Rare	Dispersed	Habitat importance map	0.0010
Spear-fruit Copperburr	*Sclerolaena patenticuspis*	503079	Vulnerable	Dispersed	Habitat importance map	0.0009
Blue Burr-daisy	*Calotis cuneifolia*	500594	Rare	Dispersed	Habitat importance map	0.0009
Tough Scurf-pea	*Cullen tenax*	502776	Endangered	Dispersed	Habitat importance map	0.0009
Dwarf Bitter-cress	*Rorippa eustylis*	502944	Rare	Dispersed	Habitat importance map	0.0009
Cane Grass	*Eragrostis australasica*	501184	Vulnerable	Dispersed	Habitat importance map	0.0008
Riverine Flax-lily	*Dianella porracea*	504266	Vulnerable	Dispersed	Habitat importance map	0.0008
Silky Umbrella-grass	*Digitaria ammophila*	501041	Vulnerable	Dispersed	Habitat importance map	0.0008
Pin Sida	*Sida fibulifera*	503142	Vulnerable	Dispersed	Habitat importance map	0.0007
Small Monkey-flower	*Elacholoma prostrata*	502196	Rare	Dispersed	Habitat importance map	0.0007
Smooth Minuria	*Minuria integerrima*	502201	Rare	Dispersed	Habitat importance map	0.0007
Small-leaf Swainson-pea	*Swainsona microphylla*	503320	Rare	Dispersed	Habitat importance map	0.0007
Spiny Lignum	*Duma horrida subsp. horrida*	502230	Rare	Dispersed	Habitat importance map	0.0007
Bristly Love-grass	*Eragrostis setifolia*	501195	Vulnerable	Dispersed	Habitat importance map	0.0007
Sand Sida	*Sida ammophila*	503140	Vulnerable	Dispersed	Habitat importance map	0.0006

Three-wing Bluebush	*Maireana triptera*	502115	Rare	Dispersed	Habitat importance map	0.0006
Murray Hardyhead	*Craterocephalus fluviatilis*	4784	Critically endangered	Dispersed	Habitat importance map	0.0006
Rye Beetle-grass	*Tripogon loliiformis*	503455	Rare	Dispersed	Habitat importance map	0.0006
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	10443	Endangered	Dispersed	Habitat importance map	0.0006
Bush Stone-curlew	*Burhinus grallarius*	10174	Endangered	Dispersed	Habitat importance map	0.0006
White Twin-leaf	*Zygophyllum simile*	504116	Rare	Dispersed	Habitat importance map	0.0006
Branching Groundsel	*Senecio cunninghamii var. cunninghamii*	503104	Rare	Dispersed	Habitat importance map	0.0006
Spreading Saltbush	*Atriplex limbata*	500322	Vulnerable	Dispersed	Habitat importance map	0.0006
Small-flower Tobacco	*Nicotiana goodspeedii*	502273	Rare	Dispersed	Habitat importance map	0.0005
Swamp Buttercup	*Ranunculus undosus*	502915	Vulnerable	Dispersed	Habitat importance map	0.0005
Pale Flax-lily	*Dianella sp. aff. longifolia (Riverina)*	507399	Vulnerable	Dispersed	Habitat importance map	0.0005
Sarcozona	*Sarcozona praecox*	503014	Rare	Dispersed	Habitat importance map	0.0005
Scaly Mantle	*Eriochlamys squamata*	505661	Vulnerable	Dispersed	Habitat importance map	0.0005
Twining Purslane	*Calandrinia volubilis*	500556	Rare	Dispersed	Habitat importance map	0.0005
Small Elachanth	*Elachanthus pusillus*	501135	Rare	Dispersed	Habitat importance map	0.0004
Goat Head	*Malacocera tricornis*	502117	Rare	Dispersed	Habitat importance map	0.0004
Downy Swainson-pea	*Swainsona swainsonioides*	503328	Endangered	Dispersed	Habitat importance map	0.0004
Pearl Bluebush	*Maireana sedifolia*	502113	Rare	Dispersed	Habitat importance map	0.0004
Red Swainson-pea	*Swainsona plagiotropis*	503324	Endangered	Dispersed	Habitat importance map	0.0004
Grassland Bindweed	*Convolvulus graminetinus*	507683	Endangered	Dispersed	Habitat importance map	0.0004
Dwarf Swainson-pea	*Swainsona phacoides*	503323	Endangered	Dispersed	Habitat importance map	0.0004
Scrambling Twin-leaf	*Zygophyllum angustifolium*	504117	Rare	Dispersed	Habitat importance map	0.0004
Umbrella Wattle	*Acacia oswaldii*	500070	Vulnerable	Dispersed	Habitat importance map	0.0003

Slender Club-sedge	*Isolepis congrua*	501773	Vulnerable	Dispersed	Habitat importance map	0.0003
Waterbush	*Myoporum montanum*	502240	Rare	Dispersed	Habitat importance map	0.0003
Finger Grass	*Dactyloctenium radulans*	500949	Rare	Dispersed	Habitat importance map	0.0003
Yakka Grass	*Sporobolus caroli*	503227	Rare	Dispersed	Habitat importance map	0.0003
Sand Brome	*Bromus arenarius*	500497	Rare	Dispersed	Habitat importance map	0.0003
Bignonia Emu-bush	*Eremophila bignoniiflora*	501198	Vulnerable	Dispersed	Habitat importance map	0.0003
Mallee Annual-bluebell	*Wahlenbergia tumidifructa*	504060	Rare	Dispersed	Habitat importance map	0.0003
Barking Owl	*Ninox connivens connivens*	10246	Endangered	Dispersed	Habitat importance map	0.0003
Gull-billed Tern	*Gelochelidon nilotica macrotarsa*	10111	Endangered	Dispersed	Habitat importance map	0.0003
Slit-wing Bluebush	*Maireana georgei*	503863	Vulnerable	Dispersed	Habitat importance map	0.0003
Port Lincoln Snake	*Parasuta spectabilis*	12813	Vulnerable	Dispersed	Habitat importance map	0.0003
Wilga	*Geijera parviflora*	501419	Endangered	Dispersed	Habitat importance map	0.0003
Long Eryngium	*Eryngium paludosum*	501238	Vulnerable	Dispersed	Habitat importance map	0.0003
Spear-grass	*Austrostipa trichophylla*	504512	Rare	Dispersed	Habitat importance map	0.0002
Club-hair New Holland Daisy	*Vittadinia condyloides*	503536	Rare	Dispersed	Habitat importance map	0.0002
Dwarf Brooklime	*Gratiola pumilo*	503753	Rare	Dispersed	Habitat importance map	0.0002
Little Egret	*Egretta garzetta nigripes*	10185	Endangered	Dispersed	Habitat importance map	0.0002
Prickly Cudweed	*Stuartina hamata*	503299	Rare	Dispersed	Habitat importance map	0.0002
Lagoon Spurge	*Phyllanthus lacunarius*	502502	Vulnerable	Dispersed	Habitat importance map	0.0002
Freckled Duck	*Stictonetta naevosa*	10214	Endangered	Dispersed	Habitat importance map	0.0002
Blue-billed Duck	*Oxyura australis*	10216	Endangered	Dispersed	Habitat importance map	0.0002
Freshwater Catfish	*Tandanus tandanus*	528545	Endangered	Dispersed	Habitat importance map	0.0002
Desert Jasmine	*Jasminum didymum subsp. lineare*	501801	Vulnerable	Dispersed	Habitat importance map	0.0002

Regent Parrot	*Polytelis anthopeplus monarchoides*	10278	Vulnerable	Dispersed	Habitat importance map	0.0002
Winged Peppercress	*Lepidium monoplocoides*	501905	Endangered	Dispersed	Habitat importance map	0.0002
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	10226	Vulnerable	Dispersed	Habitat importance map	0.0002
Slender Darling-pea	*Swainsona murrayana*	503321	Endangered	Dispersed	Habitat importance map	0.0002
Intermediate Egret	*Ardea intermedia*	10186	Endangered	Dispersed	Habitat importance map	0.0002
Round Templetonia	*Templetonia egena*	503340	Vulnerable	Dispersed	Habitat importance map	0.0002
Murray-Darling Rainbowfish	*Melanotaenia fluviatilis*	4774	Vulnerable	Dispersed	Habitat importance map	0.0002
Eastern Great Egret	*Ardea modesta*	10187	Vulnerable	Dispersed	Habitat importance map	0.0002
Fine-hairy Spear-grass	*Austrostipa puberula*	503988	Rare	Dispersed	Habitat importance map	0.0002
Grey Falcon	*Falco hypoleucos*	10236	Endangered	Dispersed	Habitat importance map	0.0002
Small Pop Saltbush	*Atriplex spongiosa*	503700	Endangered	Dispersed	Habitat importance map	0.0002
Musk Duck	*Biziura lobata*	10217	Vulnerable	Dispersed	Habitat importance map	0.0002
Australian Little Bittern	*Ixobrychus dubius*	10195	Endangered	Dispersed	Habitat importance map	0.0002
Broom Bitter-pea	*Daviesia genistifolia s.s.*	503813	Rare	Dispersed	Habitat importance map	0.0002
Small Burr-grass	*Tragus australianus*	503418	Rare	Dispersed	Habitat importance map	0.0002
Chariot Wheels	*Maireana cheelii*	502099	Vulnerable	Dispersed	Habitat importance map	0.0002
Fuzzy New Holland Daisy	*Vittadinia cuneata var. morrisii*	505060	Rare	Dispersed	Habitat importance map	0.0002
Neat Spear-grass	*Austrostipa mundula*	503281	Rare	Dispersed	Habitat importance map	0.0002
Baillon's Crake	*Porzana pusilla palustris*	10050	Vulnerable	Dispersed	Habitat importance map	0.0002
Grassland Velleia	*Velleia arguta*	503487	Rare	Dispersed	Habitat importance map	0.0002
Silver Cassia	*Senna form taxon 'artemisioides'*	500663	Endangered	Dispersed	Habitat importance map	0.0001
Frosted Goosefoot	*Chenopodium desertorum subsp. desertorum*	504380	Rare	Dispersed	Habitat importance map	0.0001
Superb Parrot	*Polytelis swainsonii*	10277	Endangered	Dispersed	Habitat importance map	0.0001

Hardhead	*Aythya australis*	10215	Vulnerable	Dispersed	Habitat importance map	0.0001
Grey Podolepis	*Podolepis aristata subsp. affinis*	502614	Rare	Dispersed	Habitat importance map	0.0001
Wavy Marshwort	*Nymphoides crenata*	502287	Vulnerable	Dispersed	Habitat importance map	0.0001
Dookie Daisy	*Brachyscome gracilis*	505494	Vulnerable	Dispersed	Habitat importance map	0.0001
Murray Cod	*Maccullochella peelii*	4871	Vulnerable	Dispersed	Habitat importance map	0.0001
Button Immortelle	*Leptorhynchos waitzia*	501949	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Bittern	*Botaurus poiciloptilus*	10197	Endangered	Dispersed	Habitat importance map	0.0001
Australasian Shoveler	*Anas rhynchotis*	10212	Vulnerable	Dispersed	Habitat importance map	0.0001
Square-tailed Kite	*Lophoictinia isura*	10230	Vulnerable	Dispersed	Habitat importance map	0.0001
Spreading Cress	*Phlegmatospermum eremaeum*	502495	Vulnerable	Dispersed	Habitat importance map	0.0001
Australian Painted Snipe	*Rostratula australis*	10170	Critically endangered	Dispersed	Habitat importance map	0.0001
Needle Grass	*Triraphis mollis*	503456	Rare	Dispersed	Habitat importance map	0.0001
Giant New Holland Daisy	*Vittadinia megacephala*	503540	Vulnerable	Dispersed	Habitat importance map	0.0001
Painted Honeyeater	*Grantiella picta*	10598	Vulnerable	Dispersed	Habitat importance map	0.0001
Brolga	*Grus rubicunda*	10177	Vulnerable	Dispersed	Habitat importance map	0.0001
Yellow-tongue Daisy	*Brachyscome chrysoglossa*	503654	Vulnerable	Dispersed	Habitat importance map	0.0001
Veined Peppercress	*Lepidium phlebopetalum*	501907	Endangered	Dispersed	Habitat importance map	0.0001
Lace Monitor	*Varanus varius*	12283	Endangered	Dispersed	Habitat importance map	0.0001
Buloke Mistletoe	*Amyema linophylla subsp. orientalis*	500217	Vulnerable	Dispersed	Habitat importance map	0.0001
Bush Minuria	*Minuria cunninghamii*	502199	Rare	Dispersed	Habitat importance map	0.0001
Green-leaf Mallee	*Eucalyptus phenax subsp. phenax*	504270	Rare	Dispersed	Habitat importance map	0.0001
Scaly Poa	*Poa fax*	502592	Rare	Dispersed	Habitat importance map	0.0001
Dwarf Burrowing Skink	*Lerista timida*	12492	Endangered	Dispersed	Habitat importance map	0.0001
Hairy Tails	*Ptilotus erubescens*	502825	Vulnerable	Dispersed	Habitat importance map	0.0001

Spiny-fruit Saltbush	*Atriplex spinibractea*	504608	Endangered	Dispersed	Habitat importance map	0.0001
Bear's-ear	*Cymbonotus lawsonianus*	500902	Rare	Dispersed	Habitat importance map	0.0001
Mallee Tussock-grass	*Poa lowanensis*	503890	Rare	Dispersed	Habitat importance map	0.0001
Southern Swainson-pea	*Swainsona behriana*	504944	Rare	Dispersed	Habitat importance map	0.0001
Purple Pentatrope	*Rhyncharrhena linearis*	502934	Vulnerable	Dispersed	Habitat importance map	0.0001
Bearded Dragon	*Pogona barbata*	12177	Vulnerable	Dispersed	Habitat importance map	0.0001
Black Falcon	*Falco subniger*	10238	Vulnerable	Dispersed	Habitat importance map	0.0001
Silky Swainson-pea	*Swainsona sericea*	504946	Vulnerable	Dispersed	Habitat importance map	0.0001
Pointed Saltbush	*Atriplex acutibractea subsp. karoniensis*	504228	Rare	Dispersed	Habitat importance map	0.0001
Satin Daisy-bush	*Olearia minor*	504130	Rare	Dispersed	Habitat importance map	0.0000
Pop Saltbush	*Atriplex holocarpa*	500333	Vulnerable	Dispersed	Habitat importance map	0.0000
Streaked Wattle	*Acacia lineata*	500050	Rare	Dispersed	Habitat importance map	0.0000
Spiny Goosefoot	*Rhagodia ulicina*	502931	Rare	Dispersed	Habitat importance map	0.0000
Major Mitchell's Cockatoo	*Lophocroa leadbeateri*	10270	Vulnerable	Dispersed	Habitat importance map	0.0000
Swamp Sheoak	*Casuarina obesa*	500682	Endangered	Dispersed	Habitat importance map	0.0000
Pale Plover-daisy	*Leiocarpa leptolepis*	503782	Endangered	Dispersed	Habitat importance map	0.0000
Lewin's Rail	*Lewinia pectoralis pectoralis*	10045	Vulnerable	Dispersed	Habitat importance map	0.0000
Milkwort Sunray	*Rhodanthe polygalifolia*	501649	Rare	Dispersed	Habitat importance map	0.0000
Wait-a-while	*Acacia colletioides*	500022	Rare	Dispersed	Habitat importance map	0.0000
Spotted Bowerbird	*Ptilonorhynchus maculatus*	10680	Critically endangered	Dispersed	Habitat importance map	0.0000
Finger-leaved Daisy	*Brachyscome exilis*	500457	Rare	Dispersed	Habitat importance map	0.0000
Yellow Burr-daisy	*Calotis lappulacea*	500598	Rare	Dispersed	Habitat importance map	0.0000
Bramble Wattle	*Acacia victoriae subsp. victoriae*	500101	Rare	Dispersed	Habitat importance map	0.0000
Burr-daisy	*Calotis cymbacantha*	500595	Rare	Dispersed	Habitat importance map	0.0000

Heathy Bluebush	*Maireana oppositifolia*	502106	Rare	Dispersed	Habitat importance map	0.0000
Buloke	*Allocasuarina luehmannii*	500678	Endangered	Dispersed	Habitat importance map	0.0000
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	10220	Vulnerable	Dispersed	Habitat importance map	0.0000
Half-bearded Spear-grass	*Austrostipa hemipogon*	503985	Rare	Dispersed	Habitat importance map	0.0000
White-browed Treecreeper	*Climacteris affinis*	10561	Vulnerable	Dispersed	Habitat importance map	0.0000
Elegant Parrot	*Neophema elegans*	10307	Vulnerable	Dispersed	Habitat importance map	0.0000
Frosted Goosefoot	*Chenopodium desertorum subsp. rectum*	504382	Vulnerable	Dispersed	Habitat importance map	0.0000
Broad-shelled Turtle	*Chelodina expansa*	5133	Endangered	Dispersed	Habitat importance map	0.0000
Common Dunnart	*Sminthopsis murina murina*	11061	Vulnerable	Dispersed	Habitat importance map	0.0000
Black-tailed Godwit	*Limosa limosa*	528553	Vulnerable	Dispersed	Habitat importance map	0.0000
Bristly Sea-heath	*Frankenia serpyllifolia*	501374	Rare	Dispersed	Habitat importance map	0.0000
Rock Wattle	*Acacia rupicola*	500082	Rare	Dispersed	Habitat importance map	0.0000
Red Microcybe	*Microcybe multiflora subsp. multiflora*	502177	Vulnerable	Dispersed	Habitat importance map	0.0000
Bandy Bandy	*Vermicella annulata*	12734	Vulnerable	Dispersed	Habitat importance map	0.0000

Habitat group

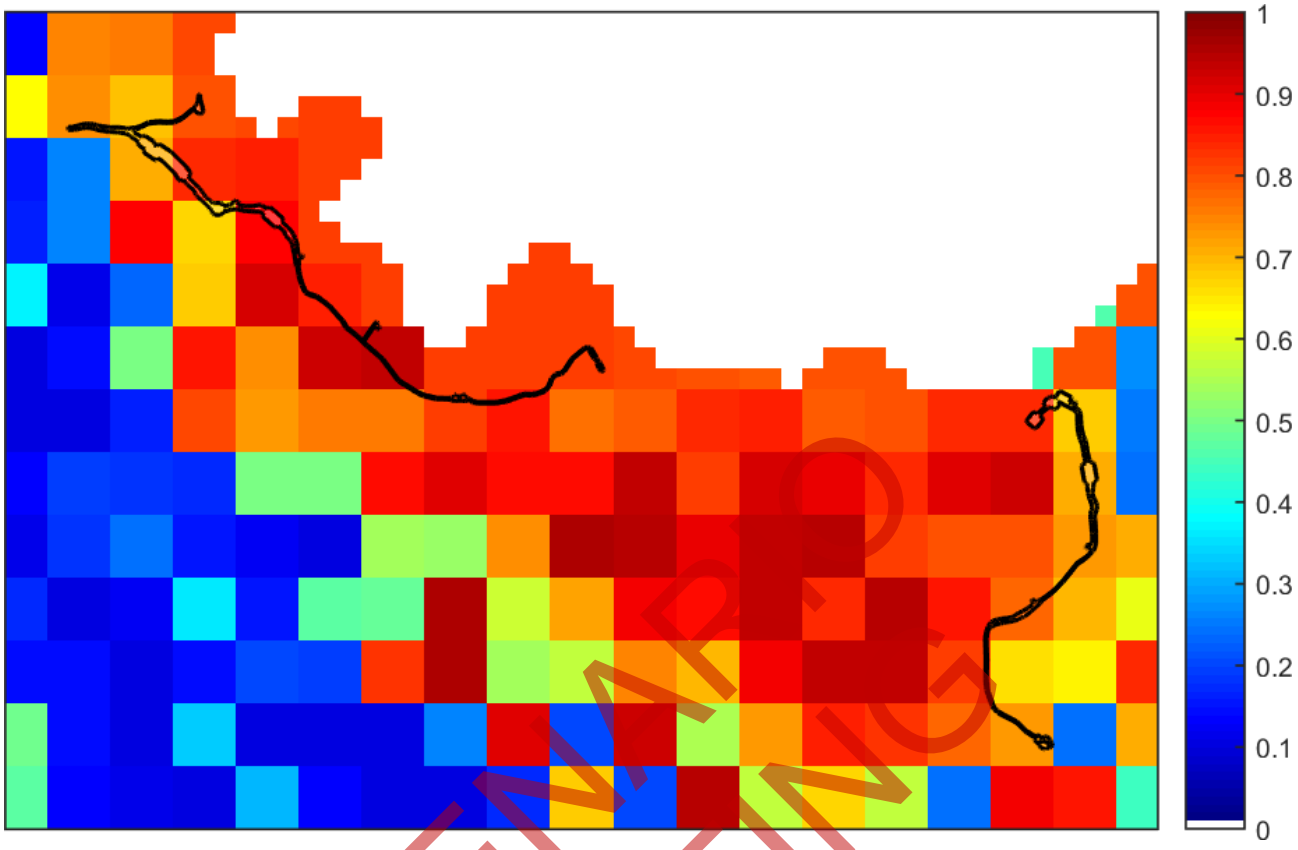
- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

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



3. Habitat importance maps

Darling Lily
Crinum flaccidum
500874