

REFERRAL OF A PROJECT FOR A DECISION ON THE NEED FOR ASSESSMENT UNDER THE *ENVIRONMENT EFFECTS ACT 1978*

REFERRAL FORM

The *Environment Effects Act 1978* provides that where proposed works may have a significant effect on the environment, either a proponent or a decision-maker may refer these works (or project) to the Minister for Planning for advice as to whether an Environment Effects Statement (EES) is required.

This Referral Form is designed to assist in the provision of relevant information in accordance with the *Ministerial Guidelines for assessment of environmental effects under the Environment Effects Act 1978* (Seventh Edition, 2006). Where a decision-maker is referring a project, they should complete a Referral Form to the best of their ability, recognising that further information may need to be obtained from the proponent.

It will generally be useful for a proponent to discuss the preparation of a Referral with the Impact Assessment Unit (IAU) at the Department of Environment, Land, Water and Planning (DELWP) before submitting the Referral.

If a proponent believes that effective measures to address environmental risks are available, sufficient information could be provided in the Referral to substantiate this view. In contrast, if a proponent considers that further detailed environmental studies will be needed as part of project investigations, a more general description of potential effects and possible mitigation measures in the Referral may suffice.

In completing a Referral Form, the following should occur:

- Mark relevant boxes by changing the font colour of the 'cross' to black and provide additional information and explanation where requested.
- As a minimum, a brief response should be provided for each item in the Referral Form, with a more detailed response provided where the item is of particular relevance. Cross-references to sections or pages in supporting documents should also be provided. Information need only be provided once in the Referral Form, although relevant cross-referencing should be included.
- Responses should honestly reflect the potential for adverse environmental effects. A Referral will only be accepted for processing once IAU is satisfied that it has been completed appropriately.
- Potentially significant effects should be described in sufficient detail for a reasonable conclusion to be drawn on whether the project could pose a significant risk to environmental assets. Responses should include:
 - a brief description of potential changes or risks to environmental assets resulting from the project;
 - available information on the likelihood and significance of such changes;
 - the sources and accuracy of this information, and associated uncertainties.
- Any attachments, maps and supporting reports should be provided in a secure folder with the Referral Form.
- A USB copy of all documents will be needed, especially if the size of electronic documents may cause email difficulties. **Individual documents should not exceed 10MB as they will be published on the Department's website.**

Guttrum and Benwell Forests Floodplain Restoration Project

- A completed form would normally be between 15 and 30 pages in length. Responses should not be constrained by the size of the text boxes provided. Text boxes should be extended to allow for an appropriate level of detail.
- The form should be completed in MS Word and not handwritten.

The party referring a project should submit a covering letter to the Minister for Planning together with a completed Referral Form, attaching supporting reports and other information that may be relevant. This should be sent to:

Postal address

Minister for Planning

PO Box 500

EAST MELBOURNE VIC 8002

Couriers

Minister for Planning

Level 16, 8 Nicholson Street

EAST MELBOURNE VIC 3002

In addition to the submission of the hardcopy to the Minister, separate submission of an electronic copy of the Referral via email to ees.referrals@delwp.vic.gov.au is required. This will assist the timely processing of a referral.

PART 1 PROPONENT DETAILS, PROJECT DESCRIPTION & LOCATION

1. Information on proponent and person making Referral

Name of Proponent:	Lower Murray Urban and Rural Water Corporation (LMW)
Authorised person for proponent:	Josh White
Position:	Project Director – Victorian Murray Floodplain Restoration Project (VMFRP)
Postal address:	PO Box 1438, Mildura VIC 3502
Email address:	Josh.White@vmfrp.vic.gov.au
Phone number:	0400 697 304
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Person who prepared Referral:	Josh White
Position:	Project Director - VMFRP
Organisation:	VMFRP
Postal address:	PO Box 1438, Mildura VIC 3502
Email address:	Josh.White@vmfrp.vic.gov.au
Phone number:	0400 697 304
Facsimile number:	n/a
Available industry & environmental expertise: (areas of 'in-house' expertise & consultancy firms engaged for project)	<p>Victorian Murray Floodplain Restoration Project (VMFRP)</p> <p>The VMFRP is a regional partnership model between Lower Murray Water (LMW), Goulburn Murray Water (GMW), the Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority (North Central CMA) and Parks Victoria, set up to deliver the VMFRP works on behalf of the Department of Environment, Land, Water and Planning - Water (DELWP Water). LMW is the project proponent on behalf of the partnership.</p> <p>R8</p> <p>Jacobs and GHD teamed in December 2018 to form a joint venture (R8 Joint Venture) to deliver an integrated program approach across all packages of work.</p> <p>Both Jacobs and GHD are large consultancies who are providing a comprehensive suite of technical consulting services to support the VMFRP. These services include planning and approvals, design, cultural heritage, terrestrial and aquatic ecology, landscape and</p>

	visual, hydrology, geotechnical, survey and spatial amongst other services.
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2. Project – brief outline

Project title:

Guttrum and Benwell Forests Floodplain Restoration Project

Project location: (describe location with AMG coordinates and attach A4/A3 map(s) showing project site or investigation area, as well as its regional and local context)

Context

The Guttrum and Benwell Forests Floodplain Restoration Project (the project) is located on the northern Victorian Murray River floodplain. Guttrum State Forest (1,270 hectares) and Benwell State Forest (660 hectares) (hereinafter referred to as Guttrum Forest and Benwell Forest) are two of the few remaining intact River Red Gum (*Eucalyptus camaldulensis*) floodplain systems in Victoria and are of ecological importance within the Murray-Darling Basin. These two forests form part of a wider regional ecosystem with Campbells Island directly opposite in New South Wales, and the Gunbower-Koondrook-Perricoota Forest icon site immediately upstream.

Guttrum and Benwell Forests are predominantly State Forest managed by the Department of Environment, Land, Water and Planning (DELWP), with the exception of the land abutting the Murray River (Murray River Reserve) which is managed by Parks Victoria. The regional environmental water manager is the North Central Catchment Management Authority (CMA) and the regional water corporation is Goulburn Murray Water. Both Guttrum and Benwell Forests are 'working forests' that are used for timber harvesting and domestic timber collection as part of the mid-Murray Forest Management Plan Area.

The project is located predominately within the Shire of Gannawarra in Victoria, with a small portion of works associated with two pump stations (inlet pipes only) and two drop structures extending into NSW.

The project is designed to facilitate managed inundation to address the hydrological deficit in the Guttrum and Benwell Forests floodplain. Managed inundation is proposed through pumped inflows from the Murray River, replicating a natural inundation regime equivalent to a 24,000 to 26,000 ML/d flow, and inundating approximately 1,149 hectares of high ecological value Murray River floodplain. The planned inundation events would involve pumping to deliver water to target areas in the floodplain to achieve a similar degree of inundation as a natural event.

Project area definitions

The project location is shown in **Attachment 1, Map 1 – Project Location Map**. Throughout this referral the following terms are used to describe the project:

- Development footprint - this is the indicative area that the project infrastructure (e.g. regulators, pump stations, pipelines and drop structures) would occupy, based on the current design, and includes laydown areas to be used during construction. This does not include power supply and associated poles, stays or cables, levees or access tracks used for access during construction and operation. No construction working buffer is included in the development footprint.
- Construction footprint – this includes the current design footprint of the project infrastructure (included in the development footprint) as well as the indicative area of land required to construct the infrastructure, including access tracks. The construction footprint is the area that may be

Guttrum and Benwell Forests Floodplain Restoration Project

directly impacted by the proposed works and is the area that has been used for calculating impacts to native vegetation and listed threatened species and communities. This area may change in response to design refinements. To the extent practicable, any changes to the design and construction footprint would occur within the area of investigation.

- Area of investigation - this includes the development footprint, as well as a buffer around the development and construction footprint. This area has been used to inform desktop investigations for this referral.
- Inundation area - area of land subject to flooding during managed events, up to a specific design water level.

Reference to 'the project area' throughout this referral includes both the construction footprint and the inundation area.

Construction footprint location

The construction footprint of the project is predominately located within the Guttrum and Benwell Forests, on Crown land under the management of DELWP and Parks Victoria. The construction footprint also extends into four private land parcels within Guttrum Forest (associated with access tracks) and seven land parcels in Benwell Forest (associated with the construction of containment banks, laydown area, pipelines, outlets and access tracks in Benwell Forest). The potential levee works locations in Guttrum Forests, if required, would involve works on two additional private land parcels. The potential levee works are not included in the construction footprint as the need and scope of works required is subject to further risk assessment and therefore unknown. The emergency outlet to existing drainage system in Benwell Forest is located on land owned by Goulburn Murray Rural Water Corporation with encumbrances for water, power and drainage.

The construction footprint is shown in **Attachment 1, Map 2 – Project structures, construction and access**.

Inundation area location

The project involves works to support the inundation of 1,149 hectares of floodplain across the Guttrum and Benwell Forests. This comprises:

- 668 hectares in the Guttrum Forest, inundating the upper and lower wetland complexes including Reed Bed Swamp, Little Reed Bed Swamp and Guttrum Swamp
- 481 hectares in the Benwell Forest inundating Benwell Swamp (a wetland complex representing a large portion of the Forest), and Benwell South West forest area (a wetland complex in the south west corner of the forest), separated by a higher ridge and existing track

The inundation area is located entirely within the State Forests on Crown land. No freehold (privately owned) land parcels are to be inundated. The proposed inundation area is shown in **Attachment 1, Map 3 – Managed Inundation Area**.

Access track location

The proposed access arrangement for construction and operation of the project is illustrated in **Attachment 1, Map 2 – Project structures, construction and access**. This would involve use of existing access tracks and construction of short sections of new access tracks between existing access tracks and proposed infrastructure and associated with containment banks. Maintenance would need to be undertaken to the existing access tracks to ensure they are suitable for use during construction and operation. The construction footprint assessed in this referral provides for a 5 m wide corridor (i.e. 2.5 m either side of the centre line) along existing access tracks to carry out maintenance.

Guttrum and Benwell Forests Floodplain Restoration Project

Short project description (few sentences):

The Guttrum and Benwell Forests Floodplain Restoration Project aims to restore a more natural inundation regime across approximately 1,149 hectares of high-ecological-value Murray River floodplain within Guttrum and Benwell Forests floodplains. The project involves construction of one large and six small regulators, five pipelines, two drop structures, three pump stations, erosion control works and a series of containment banks to divert, retain and release environmental water.

The project is designed to enable managed inundation up to a design water level of 75.8 mAHD in Guttrum Forest, 74.8 mAHD in the Benwell Swamp area and 74.6 mAHD in the South West Benwell Swamp. These design water levels will be achieved through pumped inflows of up to 250 ML/ d of water from the Murray River into Guttrum Forest (125 ML at each pump station) and 125 ML/d in to Benwell Forest. The pumping would result in inundation of approximately 668 hectares of Guttrum Forest and 481 hectares of Benwell Forest.

3. Project description

Aim/objectives of the project (what is its purpose / intended to achieve?):

Purpose

Through the construction of new infrastructure and modification of existing infrastructure, the project aims to restore a more natural inundation regime across approximately 1,149 hectares (refer **Attachment 1, Map 3 – Managed Inundation Area**) of Murray River floodplain within Guttrum and Benwell Forests. These forests are of significant ecological importance in the Murray-Darling Basin, with a combined area of 1,930 hectares they comprise considerable areas of floodplain forest that support rare and threatened species and stands of large old trees. River regulation has modified the inundation regimes of these high value floodplain habitats, with the frequency and duration of inundation events now halved on average compared to natural conditions. The significant reduction in natural inundation events has lowered the biodiversity values, reducing the extent of wetlands, and the productivity and habitat value of the River Red Gum forest (North Central CMA, 2014a).

Reinstating a more nature water regime will protect and enhance the ecological values within the Guttrum and Benwell Forests, restoring healthy floodplain communities to ensure that indigenous plant and animal species and communities survive and flourish (North Central CMA, 2014a). The project aims to mimic a natural 26,000 ML/day inundation event in the Murray River for Guttrum Forest, and a 24,000 ML/day inundation event for Benwell Forest. It would do this by delivering environmental water to the forests by pumping from the Murray River. The key areas that will be targeted for managed inundation of water from the Murray River include:

- Guttrum Forest – inundation of approximately 668 hectares of River Red Gum floodplain forest containing permanent and semi-permanent wetland complexes:
 - Upper Wetland Complex – area of Guttrum Forest containing Reed Bed Swamp and Little Reed Bed Swamp
 - Lower Wetland Complex – area of Guttrum Forest containing Guttrum Swamp
- Benwell Forest – inundation of approximately 481 hectares of River Red Gum floodplain forest containing semi-permanent wetland complexes
 - Benwell Swamp – wetland complex representing a large portion of the Forest
 - South West Benwell Swamp – wetland complex in the southwest corner of the forest, separated by a higher ridge and track

Ecological objectives

Four water regime classes, have been identified for restoration through this project as described by Ecological Associates (2013), including: Permanent Wetlands; Semi-permanent wetlands; River Red Gum with Flood-dependent understorey; and River Red Gum with Flood-tolerant understorey. North Central CMA (2014 b and c) developed ecological objectives for the project and targets to measure progress towards achieving these ecological objectives. These objectives and targets are being refined as part of the VMFRP Ecological Monitoring Evaluation and Reporting (MER) Plan (ARI, 2020) to provide more specific objectives and targets against which progress can be measured and to support quantification of the degree of environmental benefit expected from the project.

Attachment 2 – Ecological Objectives and Hydrological Requirements Justification Papers (Guttrum and Benwell Forests) contain the detailed ecological objectives and targets for the project (as detailed in the project Business Case) and an overview of how these have been developed. These can be summarised as:

- Improved health of semi-permanent wetlands:

Guttrum and Benwell Forests Floodplain Restoration Project

- Achieve an appropriate cover and diversity of species characteristic of the Plant Functional Groups found in the semi-permanent wetlands.
- Reduce River Red Gum encroachment in semi-permanent wetland areas.
- Provide suitable habitat for the threatened (EPBC listed) Growling grass frog.
- Maintain and where possible increase the current diversity of threatened flora species.
- Reduce the area of high threat weed species.
- Healthy River Red Gum communities:
 - Achieve an appropriate cover and diversity of species characteristic of the Plant Functional Groups found in the River Red Gum forest understorey.
 - Maximise the proportion of trees with healthy canopy condition in the River Red Gum forests.
 - Maintain and where possible increase the current diversity of threatened flora species.
 - Reduce the area of high threat weed species.
- Healthy wetland bird communities across Guttrum and Benwell Forests through improved access to food and habitat that promotes breeding and recruitment
 - Support a suite of waterbirds including waterfowl, colonial waterbirds and other wetland dependent species.
 - Provide foraging areas for colonial nesting waterbirds in Guttrum and Benwell Forest and potentially elsewhere (e.g. lower Gunbower Forest).
 - Provide suitable habitat for the threatened (EPBC listed) Australasian Bittern in the Guttrum Forest.
 - Maintain and where possible increase the current diversity of threatened wetland bird species.
- Promote recruitment of the local Murray River channel specialist native fish community by increasing access to productive floodplain water exiting Guttrum and Benwell Forests.

To achieve the ecological objectives and targets, the project aims to more closely align the frequency, duration and timing of future environmental watering events within the managed inundation area with the natural (pre-regulation) frequency, duration and timing of flood events experienced by the targeted water regime classes. Hydrological analysis by Gippel (2014) aimed to identify the water regime deficit within the managed inundation area by comparing the frequency, interval and duration of inundation events based on implementation of the proposed measure (the project) with inundation events under natural, baseline (current) and Basin Plan (2750) flows without the measure (refer **Table 3**). The hydrological analysis shows that while implementation of the Basin Plan flows does bridge the gap between natural and baseline conditions three to four years in ten, there are still shortfalls for both frequency and duration (North Central CMA 2014a). Therefore, environmental works are required to deliver water to the managed inundation area to achieve the ecological objectives and targets.

Expected benefits

Environmental water delivery to the Guttrum and Benwell Forests is expected to generate a range of environmental benefits in line with the ecological objectives of the project. These are summarised in **Table 1** below. Many of the ecological benefits of environmental watering have and continue to be demonstrated through a rigorous monitoring program at the neighbouring The Living Murray (TLM) program Gunbower Forest icon site, which aligns closely with the ecological character and hydrological requirements of Guttrum and Benwell Forests. As such, many of the demonstrated outcomes at Gunbower Forest are expected to also result from environmental watering at Guttrum and Benwell Forests.

Guttrum and Benwell Forests Floodplain Restoration Project

Long-term monitoring results at Gunbower Forest for example show that River Red Gum areas that have received the combination of water for the environment and natural floods over the past 10 years, typically have healthier canopies, faster tree growth and supported more native floodplain plants, than areas that only received natural floods and those that remained dry over the same period. At monitoring sites that have received no flooding since 2005, less than half of the River Red Gum trees had at least 50 per cent intact canopy (a measure of tree condition), and these trees continue to suffer from the Millennium Drought and lack of natural flooding. At sites that received only natural flooding since 2005, the trees are in slightly better condition with almost 60 per cent with at least 50 per cent intact canopy. However, the greatest improvement is seen at sites that received both natural floods and water for the environment, where 75 per cent of trees are now considered healthy (Bennetts and Jolly 2019). A range of surveys are also undertaken to monitor the direct response of water-dependent flora and fauna to environmental water delivery, including but not limited to fish monitoring (Bloink et al. 2019), frog monitoring (Durkin and Howard 2020) wetland productivity monitoring including the response of vegetation, micro and macroinvertebrates, fish and birds (Brown 2020), and water quality monitoring of return flows to improve instream productivity for native fish (Baldwin 2019). While there is some variability in ecological responses to environmental water due to the complexity of the systems and multiple contributing factors (e.g. the impact of carp on aquatic vegetation), the results of this monitoring overall show a positive response of water-dependent flora and fauna to the environmental water deliveries.

Table 1: Summary of anticipated ecological benefits in Guttrum and Benwell Forests (North Central CMA, 2014a)

Overarching ecological objective	Ecological benefits of inundation
Semi-permanent wetlands	
Healthy semi-permanent wetlands	<ul style="list-style-type: none"> Increased cover and diversity of wetland flora species, including rare and threatened species Wetting and drying flux stimulates a productive food web Halt encroachment of terrestrial species, including River Red Gums Diversity of habitat for fauna, including rare and threatened fauna species. Important drought refuge for amphibians and reptiles
Healthy wetland bird community in Guttrum and Benwell Forests through improved access to food and habitat that promotes breeding and recruitment	<ul style="list-style-type: none"> Shelter, nesting materials and nesting habitat for waterbirds Suitable hydrological conditions and habitat provided for colonial nesting species Foraging grounds for colonial nesting waterbirds and migratory wading birds Suitable habitat for rare and threatened waterbird species Abundance of food sources for waterbirds
River Red Gum with flood-dependent understorey	
Healthy River Red Gum FDU (temporary wetlands) across Guttrum and Benwell Forests	<ul style="list-style-type: none"> Increased cover and diversity of understorey flora species, including rare and threatened species Halt and reverse encroachment of terrestrial flood-tolerant species Improved tree and canopy condition, including in large old trees Wetting and drying flux stimulates a productive floodplain food web Diversity of habitat for fauna, including rare and threatened fauna species.
Healthy wetland bird community through improved access to food and habitat that promotes breeding and recruitment	<ul style="list-style-type: none"> Shelter, nesting materials and nesting habitat for waterbirds Foraging grounds for colonial nesting waterbirds and migratory wading birds Abundance of food sources for woodland birds.
Enhancement of Murray River native fish populations by increasing access to productive	<ul style="list-style-type: none"> Availability of floodplain habitat for small- and large-bodied fish An abundance of food sources (organic carbon, phytoplankton and zooplankton, nutrients) to support the riverine food web, including

Guttrum and Benwell Forests Floodplain Restoration Project

floodplain outflows	recruitment of large-bodied channel fish specialists
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For further detail on expected ecological benefits refer to Section 2 of **Attachment 3 Flora and Fauna Assessment**.

In addition to the expected ecological benefits summarised in **Table 1**, the project is also expected to contribute to the following socio-economic benefits:

- Enhanced recreational opportunities by improving the health, condition and amenity of riverine landscapes that attracts dispersed camping, horse riding, hunting, four-wheel driving, bird-watching and sightseeing pursuits to the forests
- Increased health of River Red Gums as a result of environmental watering will increase value of timber harvesting and apiary site opportunities
- Improved health of wetlands and floodplain ecosystems that are highly valued by Traditional Owners
- Reduced requirements to buyback water from consumptive users (for example, irrigators) and associated impacts on regional communities, while still contributing to achievement of the environmental objectives set by the Murray-Darling Basin Plan.

Background/rationale of project (describe the context / basis for the proposal, eg. for siting):

Legislative and policy context

The Murray-Darling Basin Plan establishes the legal and policy framework for the use of environmental water in the Murray-Darling Basin and places a Sustainable Diversion Limit (SDL) on the water that can be extracted from the system for irrigation and other consumptive uses. The SDL is based on an assessment of the water that must be left in the system to maintain ecosystem health. To comply with the initial Basin Plan SDL, water must be sourced from existing entitlement holders and applied to environmental needs. However, the Basin Plan includes a mechanism to adjust the SDLs (i.e. the SDL may be increased) if there are supply measures available that achieve an equivalent environmental benefit with less water.

Central to the SDL adjustment mechanism is a requirement that the environmental benefit of a proposed offset measure must exceed that of the base case (benchmark) scenario to justify an offset. Environmental benefit can be assessed in terms of how well the proposed measure addresses the Basin Plan's priorities for environmental water use, including, among other things, delivering benefits to ecosystems that are rare, near-natural or unique; provide vital habitat; support threatened species or communities; and support significant biodiversity.

In early 2019, the VMFRP secured funding from the Commonwealth government to progress engagement with communities and the development of detailed designs and approvals for nine projects designed to deliver water to floodplain ecosystems to directly address environmental water needs. Together, these projects aim to return a more natural inundation regime across more than 14,000 hectares of high ecological value Murray River floodplain in Victoria through the construction of new infrastructure and the modification of existing infrastructure designed and operated to mimic the impact of natural flood events and improve the ecological condition of floodplain ecosystems.

Rationale

To support the Business Cases for the two VMFRP sub-projects located in the North Central CMA region and to justify the SDL offset mechanism, an environmental benefits assessment was prepared by Ecological Associates (2013) to describe the ecological character of the floodplain systems; set objectives for the use of water (hydrological targets) to promote ecosystem function and health; and describe the contribution of each of the proposed SDL offset projects to achieving the ecological objectives.

Guttrum and Benwell Forests Floodplain Restoration Project

A copy of *The Ecological Justification for Works and Measures for the Guttrum and Benwell State Forests* (June 2013) prepared by Ecological Associates is available on request.

Further discussion of the floodplain hydrology and ecological objectives for the Guttrum and Benwell project is provided below.

Modified Floodplain hydrology

Guttrum and Benwell Forests are situated in the central River Murray system, comprising the Murray River and its anabranches from Yarrawonga to the confluence with the Darling River at Wentworth. Major tributaries of the central Murray include the Goulburn, Campaspe and Loddon rivers in Victoria, and the Murrumbidgee and Wakool rivers in New South Wales.

Flows downstream of Torrumbarry Weir – the major regulating structure upstream of the Guttrum and Benwell Forests - are the cumulative result of flows from the Murray River from Barmah, Goulburn River entering upstream of Echuca, and flows from the Campaspe River entering at Echuca. At Barmah, river flows are limited by geomorphological features, with channel capacity restricted to approximately 10,000 ML/d through the Barmah Choke. As levels rise, the Edward River and Gulpa system carry a larger proportion of flows, bypassing Torrumbarry Weir and the forest floodplain systems downstream (CSIRO, 2008; Atkins *et al.*, 1991).

At Torrumbarry the Gunbower-Koondrook-Perricoota floodplain system is formed. While flood flows to Gunbower Forest in Victoria are returned to the Murray River at Koondrook via Gunbower Creek, flood flows entering Koondrook-Perricoota Forest on the right bank are diverted to the Wakool River in New South Wales. The loss of floodwater to the Wakool system greatly reduces river flows downstream of Koondrook (MDBA, 2014a).

Guttrum and Benwell forests are components of the Campbells Island floodplain system downstream of Koondrook (Ecological Associates, 2013). The system comprises Guttrum and Benwell forests on the left bank and Campbells Island on the right bank. Campbells Island is enclosed by the Little River Murray anabranch, which at low flows departs from the Murray River opposite Guttrum Forest and re-joins the river at Murrabit, downstream of Benwell Forest (Ecological Associates, 2013). When higher river levels occur, water in the Little River Murray is diverted north to the Wakool River via Little Merran Creek.

Inundation of the Guttrum and Benwell Forests is determined by the height of the Murray River at Koondrook, downstream of Torrumbarry Weir regulation, and the diversion of the Little River Murray. The characteristics of the forests' physical connection with the Murray River, via effluents and the river bank, influences the inundation resulting from particular flows within the river. The hydraulics of the individual floodplains then determines the final inundation pattern in response to these flows. Guttrum and Benwell Forests are generally basins, characterised by wetlands in the low-lying parts, surrounded by River Red Gum forest at slightly higher elevations. The general distribution of water on the rising Murray River hydrograph in Guttrum and Benwell Forest is illustrated in **Attachment 4 Distribution of water through Guttrum and Benwell Forest** and summarised below in **Table 2**.

Table 2: Summary of the general distribution of water through Guttrum and Benwell Forests

Murray River Flow (ML/d)	Guttrum Forest	Benwell Forest
15,000	Water has not entered the forest.	Water initially enters through the western outlet B13 with water ponding in adjacent low lying areas.
16,000	Water has not entered the forest.	Water commences to flow from the upstream inlet B end of the forest. Water spreads by diffuse overland flow and accumulates in Benwell Swamp at the downstream end.

Guttrum and Benwell Forests Floodplain Restoration Project

18,000	Water first enters the forest, fills a wetland area between Millar Road and Smiths Drain Track then spreads along a small creek to the south and starts to fill Guttrum Swamp.	Water enters a second effluent upstream, creating widespread but shallow flooding in the River Red Gum forest. Benwell Swamp expands and spills to the river at a downstream effluent.
20,000	Guttrum Swamp has largely filled and water spreads into the surrounding River Red Gum forest, along a narrow creek, crossing Sawpit Track and filling a third wetland basin to the south.	A third upstream effluent becomes active consolidating the shallow flooding under the River Red Gum forest and around Benwell Swamp. Water reaches the levee at the southern boundary.
22,000	Flooding expands from these areas into the surrounding forest. Effluents in the upstream part of the forest also become active and introduce water to the Little Reed Bed wetland on the northern side of Reed Bed Swamp.	Floodwater overtops the natural rise that isolates the wetland area in the south-western corner of the forest. Flooding expands to the levees on the southern and western boundaries of the forest. The natural levee along the river bank narrows in the downstream part of the forest but remains broad further upstream.
24,000	Forest inundation increases dramatically. The upstream effluents start to dominate forest inflows and through-flow commences. Water spills into Reed Bed Swamp. A shallow levee surrounding Reed Bed Swamp remains exposed.	No specific change from 22,000 ML/d distribution.
26,000	No specific change from 24,000 ML/d distribution.	Flooding in the forest is widespread and deep. Only a narrow strip of the river levee remains at the downstream half of the system. The wetland areas are connected by continuous flooding of the understorey.
28,000	Flooding expands to the constructed levees enclosing the forest on the southern and western boundaries. Most of the forest is inundated, except for the river levee.	Water is encroaching on the river bank from the River Murray at numerous locations.
30,000	The river levee is mostly inundated in the lower part of the forest. A small, but very deep (>5 m) lagoon adjacent to the river is filled.	Floodwater has spread into the meander loops. The river levee is very narrow and overbank flow occurs at several locations.
32,000 to 34,000	Water spreads further into the river levee in the upper part of the forest.	No specific change from 30,000 ML/d distribution.

Flood modelling (Gippel, 2014) was undertaken to determine the change in inundation regime of the forests over time, using data from Barham (nearest gauging station upstream). Mean daily flow series were evaluated from 1895 through to 2009 (114 years) for historical 'natural' conditions and 'current' conditions (with TLM works) under the Basin Plan scenarios (2,750 GL and Basin Plan 2100 GL) (Gippel, 2014; Ecological Associates, 2013). The results found that under natural conditions there are near annual events at Barham for flows between 15,000 and 23,000 ML/d (refer **Table 3**). During these natural events, there is widespread inundation occurring across the River Red Gum Flood-dependent understorey and semi-permanent wetlands in Benwell Forest, and water is starting to spread from low-lying areas and the Guttrum Swamp complex, into surrounding River Red Gum forest in Guttrum Forest.

Under current conditions the results indicate that as flow rates increase the frequency in which they occur tends to decline significantly, from natural (refer **Table 3**). Events of 15,000 ML/d at Barham occur in 80% of years as opposed to annually. Flows in excess of 25,000 ML/d occur in less than 50% of years under current conditions, compared to 75% years under natural conditions. Events exceeding 31,000 ML/d occur in 20% of years, which is approximately half the natural frequency (Gippel, 2014). Under current conditions, modelling (Ecological Associates, 2013) also found that flows required to inundate the semi-permanent wetlands now

Guttrum and Benwell Forests Floodplain Restoration Project

occur in 61% of years rather than the recommended 90% of years and last for 1 to 4 months duration at 21,000 ML/d instead of the preferred duration of 3 to 6 months.

Under the Basin Plan 2750 GL scenario, there is an improvement in the frequency of events below 25,000 ML/d (refer **Table 3**). However, at 26,000 ML/d (to be mimicked by the project for Guttrum Forest) the gap between natural and the Basin Plan 2750 GL scenario is three to four years in ten. Low to mid-range flows that provide water to the more flood-dependent vegetation are particularly critical. At these thresholds, the frequency of events falls short by 30%, with duration generally 1-2 months short of natural.

For event timing, the date at which flow events in the Murray River commence has low variability and is similar under all scenarios. Events generally start in June and July, with higher flow thresholds achieved later in the year, closer to August and September. Events start marginally later (about 4 weeks) under current and Basin Plan 1750 GL conditions, compared with natural (Ecological Associates 2013).

For intervals between events, under natural conditions, for flow events between 15,000 and 25,000 ML/d, there is less than a year between events, highlighting the annual nature of these flows. The interval between events greater than 27,000 ML/d is greater and more variable, as these events are rarer. Under current conditions the interval between events is similar, but more variable for events less than 23,000 ML/d, and longer and significantly more variable at higher flow thresholds. The Basin Plan 2750 GL scenario reduces the variability and magnitude of intervals between events up to flows of 29,000 ML/d (North Central CMA, 2014a).

This shortfall in preferred frequency and duration of inundation and longer intervals between events has resulted in considerably altered vegetation communities and habitat across the floodplain. Key ecological impacts associated with the hydrological shortfall include:

- Semi-permanent wetlands have been encroached by terrestrial species, River Red Gum saplings, and colonisation of exotic species (SKM, 2007, Bennetts 2014)
- Wetland habitats are less persistent and reliable (Ecological Associates, 2013)
- Large, old River Red Gum trees are exhibiting signs of extensive drought stress (Biosis, 2014b) and some mature canopy trees have died and many other areas supporting epicormic growth (Bennetts 2014).
- Forests have shown considerable transformation of River Red Gum Flood Dependent Understorey to Flood Tolerant Understorey, indicating the forests are not receiving adequate flooding to maintain their character (North Central CMA, 2014a).
- Reduced opportunities for breeding events and foraging habitat for bird species in the Forest (Ecological Associates, 2013)
- Fewer opportunities for native fish to access the floodplain and reduced input of carbon and nutrients into the Murray River main channel (Ecological Associates 2013).

Table 3 Spell analyses for downstream of Barham over 114 year modelled period (1895-2009)*
(Source: Gippel, 2014)

Flow threshold exceeded (ML/day) ¹	Natural Conditions		Current Conditions ²		Basin Plan (2,750 GL)	
	Mean frequency ³ (events/100 yrs)	Mean duration ⁴ (days)	Mean frequency ³ (events/100 yrs)	Mean duration ⁴ (days)	Mean frequency ³ (events/100 yrs)	Mean duration ⁴ (days)
>15,000	100.9	173	80.7	75	92.1	114
>17,000	98.2	162	73.7	74	91.2	97
>19,000	96.5	153	66.7	78	86.0	91

Guttrum and Benwell Forests Floodplain Restoration Project

>21,000	94.7	139	61.4	69	75.4	86
>23,000	90.4	118	46.5	91	72.8	73
>25,000	83.3	99	44.7	74	59.6	81
>27,000	75.4	82	36.8	68	46.5	78
>29,000	62.3	76	35.1	32	39.5	64
>31,000	50.0	55	21.1	43	30.7	34
>33,000	26.3	36	7.0	42	8.8	42

* Data is based on modelled monthly flows from MDBA – Monthly Simulation Model for flows between 1895 and 1999.

1. Relevant water regime classes equivalent to Murray River flows include:

- Semi-permanent wetlands – 23,000 ML/d Guttrum, 21,000 ML/d Benwell
- River Red Gum (including semi-permanent wetlands) – 26,000 ML/d Guttrum, 23,000 ML/d Benwell

2. Benchmark conditions (with TLM). Note the DEPI BP971 and DP2100 scenarios produced inconclusive results.

3. Frequency is number of years, in the 100 years modelled, in which flows exceeded the threshold values shown in ML/day column.

4. Duration is number of days per event that flow exceeded the threshold values shown in the ML/day column.

Ecological condition

The forests and woodlands of the Murray River floodplain have been rapidly declining in condition over the past two decades. The decline is associated with increasing regulation of the Murray River and extended periods of drought (Cunningham et al, 2011). Additional disturbances and the threats within the Guttrum and Benwell Forests have also impacted the ecological condition (for example, cattle grazing, weed invasion and quarrying) (Bennetts, 2014). The two forests are also commercially used for timber harvesting and domestic timber collection, which is an ongoing threat to the condition of the forests due to the practices causing loss or damage to trees (and of archaeological sites) across the forests (North Central CMA, 2014a).

Current inundation patterns across the Guttrum and Benwell floodplains are not sufficient to meet the ecological requirements resulting in impacts to native fish populations, birds and other fauna (North Central CMA, 2014a). The core ecosystem communities influenced by the semi-permanent wetlands and River Red Gum Forest of the Guttrum and Benwell system include, native fish, a range of conservation significant threatened and migratory birds, as well as other fauna of interest; Yellow-footed Antechinus (*Antechinus flavipes*). However, there has been a considerable shift from the communities that would be expected under a more natural inundation regime, the most significant change being the terrestrialisation (colonisation by non-water dependent plant species) of water-dependent vegetation communities. River Red Gum Flood-dependent understorey has been replaced with drier, flood-tolerant understorey, and semi-permanent wetlands are encroached by terrestrial species and River Red Gums (North Central CMA, 2014a). Large old trees are also exhibiting stress, with dieback and mortality evident in many (North Central CMA, 2014a). This decline in condition reduces the suitability of the forests for many dependent flora and fauna (North Central CMA, 2014a).

In 2014 Ecological Objectives and Hydrological Requirements Justification Papers (**Attachment 2**) were developed for both Guttrum Forest and Benwell Forest to support the preparation of the project Business Case (North Central CMA, 2014a). These ecological objectives and targets are currently being refined as part of the VMFRP Ecological MER Plan (ARI, 2020) and have been adopted for this project (the Guttrum and Benwell Floodplain Management Project).

Ecological objectives and extent of project benefit

As outlined in Section 3 (Aim/objectives of the project) of this referral, ecological objectives have been established to address the changes in hydrology and condition of the floodplain outlined above and to restore the four specific water regime classes on the Guttrum-Benwell floodplain: Permanent Wetland, Semi-permanent Wetlands, Red Gum Forest and Woodland (with flood-dependent or flood-tolerant understorey). A

Guttrum and Benwell Forests Floodplain Restoration Project

summary of water regime classes and constituent EVCs within Guttrum and Benwell Forest is provided in **Table 4**.

Table 4: Water Regime Classes in Guttrum and Benwell Forests

Water Regime Class	Associated high value EVCs
Permanent Wetland	Billabong Aggregate
Semi-permanent Wetland	EVC - 819 Spike-sedge Wetland
	EVC 653 – Aquatic Herbland
	Floodway Wetland Aggregate
Red Gum with Flood Dependent Understorey	EVC 915 – Riverine Swampy Woodland
	EVC 814 – Riverine Swamp Forest
	EVC 945 - Floodway Pond Herbland / Riverine Swamp Forest Complex
Red Gum with Flood Tolerant Understorey	EVC 295 - Riverine Grassy Woodland
	EVC 056 - Floodplain Riparian Woodland
	EVC 816 - Sedgy Riverine Forest
	EVC 106 - Grassy Riverine Forest

The required frequency and duration of inundation for each water regime class targeted for restoration by the project, has been determined through a number of studies. Analysis of natural Murray River flow thresholds compared to inundation extents was modelled by DHI (2013) to determine river flow thresholds required to inundate different parts of the floodplain (e.g. semi-permanent wetlands, full floodplain). Ecological Associates 2013 used state wide modelled EVC data supported by hydrological modelling (Gippel, 2014; DHI, 2013 and 2014) and aerial imagery to identify historical water regime classes. Ecological Associates updated these water regime classes and associated vegetation communities based on updated EVC mapping completed by Biosis (2014b).

All EVCs identified within the Guttrum and Benwell inundation areas (refer **Attachment 1, Map 3 – Managed Inundation Area**) are swampy or wetland vegetation communities that require or are tolerant of inundation and therefore are likely to positively respond to the proposed inundation.

On this basis, replicating a more natural inundation regime in the forests through the delivery of environmental water is considered to be the most effective method to improve the ecological condition of the area given the overall reduction in frequency and duration of natural flooding. To replicate a more natural flood regime, the project must have the flexibility to operate under a range of flow conditions. This flexibility is also required to enable the operational regime to trigger a range of ecological responses across a representative area of flood dependent communities.

Main components of the project (nature, siting & approx. dimensions; attach A4/A3 plan(s) of site layout if available):

The main components of the project comprise construction of infrastructure to enable environmental watering. The current design includes one large and six small regulators, five pipelines, two drop structures, three pump stations, erosion control works and a series of containment banks to divert, retain and release water. Refer to **Attachment 1, Map 1 – Project Location Map**.

The design and location of project structures and extent of access track upgrades will be refined through the project design process, however will be similar in nature to the works described in the sections below. Findings from on-site assessments particularly ecology fieldwork and cultural heritage complex assessment (undertaken for the Cultural Heritage Management Plan) have and will continue to be progressively fed into the design, with

Guttrum and Benwell Forests Floodplain Restoration Project

modifications made to avoid and minimise impacts. Design and construction of the project would need to comply with the mitigation measures outlined in Part 2 of this referral.

Proposed works

A summary of the proposed works is provided in **Table 5** and shown **Attachment 1, Map 2 – Project structures, construction and access**. The proposed works are described in more detail below.

Table 5: Summary of proposed works at Guttrum and Benwell Forests

Forest	Main Components	Area of inundation (hectares)	Water level (m AHD)
Guttrum	<ul style="list-style-type: none"> • Four small regulators: <ul style="list-style-type: none"> - Guttrum Main Regulator - Reed Bed Swamp Regulator - North - Reed Bed Swamp Regulator - South - Little Reed Bed Swamp Regulator • Two Pump Stations located adjacent the Murray River: <ul style="list-style-type: none"> - Guttrum East Pump Station - Guttrum West Pump Station • Two main pipeline systems: <ul style="list-style-type: none"> - Pipeline from Guttrum East Pump Station to three locations within Reed Bed Swamp complex of wetlands - Pipeline from Guttrum West Pump Station to the Guttrum Main outfall channel. • Four outlet structures: <ul style="list-style-type: none"> - Little Reed Bed Swamp Outlet - Reed Bed Swamp North Outlet - Reed Bed Swamp South Outlet - Guttrum West Outlet (encompassed in Guttrum Main Regulator structure) • One drop structure on the Murray River connecting to Guttrum Main Regulator • One spillway on Guttrum Main Regulator Containment Bank • Four containment banks: <ul style="list-style-type: none"> - Guttrum Main Regulator including access track - Minor containment bank on Little Reed Bed Swamp Regulator - Minor containment bank on Reed Bed Swamp North Regulator - Minor containment bank on Reed Bed Swamp South Regulator • Works associated with power supply to pump stations including new poles, stays, cables/power lines and kiosk substations • Levees - Subject to further risk assessment and therefore requirement and location have not been confirmed. 	668	75.8 m AHD

Guttrum and Benwell Forests Floodplain Restoration Project

Benwell	<ul style="list-style-type: none"> • One large regulator; Benwell Main Regulator • Two small regulators: <ul style="list-style-type: none"> - Benwell East Regulator - South West Natural Flood Conveyance Regulator • One pump station located adjacent to Murray River; Benwell Pump Station. • Three pipelines: <ul style="list-style-type: none"> - Pipeline from Benwell Pump Station to Benwell Regulator Track Regulator and drainage path - Pipeline from Benwell Regulator Track Regulator to South West Benwell Swamp - Emergency Outlet Pipeline from the South West Benwell Swamp to the Benwell Drainage and Outfall System adjacent to the forest • Three outlet structures: <ul style="list-style-type: none"> - Benwell Main Outlet - Benwell South West Outlet - Emergency Outlet • One drop structure on the Murray River connecting from the Benwell Main Regulator • Two Containment banks: <ul style="list-style-type: none"> - Benwell Containment Bank 1 at Benwell Main Regulator - Benwell Containment Bank 2 between Benwell Main Swamp and South West Benwell Swamp. • Two spillways associated with the Benwell Main Regulator • Works associated with power supply to pump station including new poles, stays, cables/power lines and kiosk substation • Levees - Subject to further risk assessment and therefore required and location have not been confirmed. 	481	74.8 mAHD - Benwell swamp 74.6 mAHD - South West Benwell Swamp
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Guttrum Forest

Works in Guttrum Forest include:

- Guttrum Main Regulator– Small regulator at the western end of the site and the lowest point of connectivity with the Murray River. Regulator would enable the water to be contained in the swamp (when closed) and released at a controlled rate once the duration of planned inundation has been achieved (when opened). The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering events. The regulator would also be open during natural flooding conditions to allow water to enter the forest and be closed if required to increase the duration of the natural inundation.
- Reed Bed Swamp Regulator (North and South) – Two small regulators to prevent backflow to the Murray River from the pipe supply outlet into the flood runner on the wetland side of River Track. The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering events. The regulators would also be open during natural flooding conditions to allow water to enter the forest. An outlet at the end of the Guttrum East Pipeline would be located adjacent to both regulators.
- Little Reed Bed Swamp Regulator – Small regulator (box culvert) to prevent backflow from entry into Little Reed Bed Swamp to the Murray River (when closed). The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering

Guttrum and Benwell Forests Floodplain Restoration Project

events. The regulator would also be open during natural flooding conditions to allow water to enter the forest. An outlet at the end of the Guttrum East Pipeline would be located adjacent to both regulators.

- Guttrum East Pipeline – The pipeline would be located along an existing River Track from Guttrum East Pump Station north to three locations within the Reed Bed Swamp Complex of wetlands; Little Reed Bed Swamp flood runner, Reed Bed Swamp northern flood runner and Reed Bed Swamp southern flood runner.
- Guttrum West Pipeline - A pipeline from the Guttrum West Pump Station and discharge into the Guttrum Main outfall Channel, on the forest side of the Guttrum Main Regulator. The alignment to follow the containment bank.
- Little Reed Bed Swamp Outlet – located at the end of Guttrum East Pipeline and distribution of flow into the local floodrunner adjacent to the Little Reed Bed Swamp Regulator area, with erosion protection and rock beaching.
- Reed Bed Swamp North Outlet – located at the end of Guttrum East Pipeline and distribution of flow into the local floodrunner adjacent to the Reed Bed Swamp North Regulator area, with erosion protection and rock beaching.
- Reed Bed Swamp South Outlet – located at the end of Guttrum East Pipeline and distribution of flow into the local floodrunner adjacent to the Reed Bed Swamp South Regulator area, with erosion protection and rock beaching.
- Guttrum West Pipeline Outlet – located at the end of Guttrum West Pipeline and distribution of flow into the local channel adjacent to the Guttrum Main Regulator area, with erosion protection and rock beaching.
- Guttrum Main Drop Structure – Designed to transfer flows between Guttrum Main Regulator and the Murray River, passing planned inundation flow out of the forest to the river. Structure proposed is a gabion weir and rock beaching construction with extensive reno mattresses at the edge of the river and flood runner confluence to provide erosion control. The structure will also allow for natural high flows from the river to enter the forest.
- Guttrum West Pump Station – Enables pumping of water from Murray River via short pipeline to Guttrum Swamp via Guttrum Forest. Pumping rate ranges from 50 ML/d for semi-permanent wetland planned inundation to 125 ML/d for river red gum forest planned inundation. All pumps will contain screens on the pump inlets with a 2 mm hole aperture, a screen approach velocity of 0.12 m/s and automatic screen cleaning mechanisms.
- Guttrum East Pump Station – Enables pumping of water from Murray River via Guttrum East Pipeline to Reed Bed Swamp and Little Reed Bed Swamp either simultaneously or individually through offtake control. Pumping rate ranges from 25 ML/d for semi-permanent wetland planned inundation to 125 ML/d for full river red gum forest planned inundation. All pumps will contain screens on the pump inlets with a 2 mm hole aperture, a screen approach velocity of 0.12 m/s and automatic screen cleaning mechanisms.
- Guttrum Main Containment Bank – Containment bank located at and around Guttrum Main Regulator and along the river bank to hold the maximum design water level and form public access between Millar Road and River Track as well as all-weather access to the Guttrum West Pump Station.
- Little Reed Bed Swamp Containment Bank – Minor localised containment bank around Guttrum East Pipeline outlet and regulator.
- Reed Bed Swamp North Containment Bank – Minor localised containment bank around Guttrum East Pipeline outlet and regulator.

Guttrum and Benwell Forests Floodplain Restoration Project

- Reed Bed Swamp South Containment Bank – Minor localised containment bank around Guttrum East Pipeline outlet and regulator.
- Spillway – One spillway on Guttrum Main Regulator Containment Bank to protect the regulator during natural flooding.

Benwell Forest

Works in Benwell Forest include:

- Benwell Main Regulator – Large regulator to allow natural flows into the forest (when opened) and enable water to be returned to the Murray River during planned inundation events and natural flooding events at a controlled rate (from closed to opened) once the duration of planned inundation has been achieved. The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering events.
- Benwell East Regulator – Small regulator designed to allow natural flows into the forest (when opened), enable water to be contained in the swamp (when closed) and to pass planned inundation flows out of the forest to the Murray River at a controlled rate (from closed to opened). The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering events.
- South West Natural Flood Conveyance Regulator – Small regulator designed to exclude water from Benwell Main Swamp from entering the South West Benwell Swamp. The regulator would generally remain open to avoid obstructions on the natural floodplain and would only be closed during environmental watering events.
- Main Pump Station Discharge Pipeline – Pipeline along an existing access track extending from Benwell Pump Station to Benwell Regulator Track Regulator to enable separate delivery of water to Benwell Main Swamp and South West Benwell Swamp. Water spreading and erosion control works required at discharge location.
- South West Station Discharge Pipeline – Pipeline along an existing access track extending from the Benwell Regulator Track Regulator to the discharge point in the South West Benwell Swamp
- Emergency Outlet Pipeline – Gated pipeline along an existing access track designed to enable emergency removal of water from the upper part of the Forest (South West Benwell Swamp) to the Benwell drainage system, in the event of extreme flooding or water quality issues.
- Benwell Main Outlet – Location at end of the Main Pump Station Discharge Pipeline discharge point and distribution of flow into the local existing channel adjacent, with erosion protection and rock beaching.
- Benwell South West Outlet – Location at end of South West Discharge Pipeline for discharge and distribution of flow into the South West forest area, with erosion protection and rock beaching.
- Emergency Outlet – Location at end of the emergency pipeline to enable emergency flows to discharge into the Benwell Drainage System, adjacent to the edge of the forest.
- Benwell Main Drop Structure – Designed to transfer flows between the Benwell Main Regulator and the Murray River, allowing natural flows into the forest and to pass planned inundation flow out of the forest. Structure proposed is a gabion weir and rock beaching construction with extensive reno mattresses at the edge of the river and flood runner confluence to provide erosion control. The structure will also allow for natural high flows from the river to enter the forest.
- Benwell Pump Station – Located adjacent to the Murray River at the far north-western end of the site and enables pumping of water from Murray River into Benwell Forest for delivery of water to Benwell main swamp and South West Benwell Swamp either simultaneously or individually (through offtake

Guttrum and Benwell Forests Floodplain Restoration Project

control). Pumping rate ranges from 10 ML/d for South West Benwell Swamp to 125 ML/d for full river red gum forest planned inundation. Fish screens to be included on pump offtake. All pumps will contain screens on the pump inlets with a 2 mm hole aperture, a screen approach velocity of 0.12 m/s and automatic screen cleaning mechanisms.

- Benwell Containment Bank 1 –Containment bank extending to and past the Benwell Main Regulator to hold the maximum design water level. Containment Bank will be trafficable to allow access to the Benwell Main Regulator and Benwell Drop Structure during managed inundation events.
- Benwell Containment Bank 2 –Containment bank designed to enable water to be separated between the Benwell Main Swamp area and Benwell South West Swamp area and enables some continuity of access along Regulator Track during managed inundation events.
- Spillway – Two spillways on Benwell Containment Bank 1, one adjacent to Benwell Main Regulator and one further south of Benwell Main Regulator. Spillways would include erosion protection works where containment bank meets existing low points/flood runners.

Regulator design

The following design philosophy for regulators has been applied:

- The regulating structures are designed to allow natural flows to pass unhindered, to and from the floodplain when the structures are not in use (fully open).
- The arrangement of regulating structures and containment banks have been developed to minimise the potential for erosion over the whole range of flow conditions.
- The regulating structures are designed to provide fish passage when not in use (fully open).

Table 6 summarises the regulator design specifications.

Table 6. Summary of regulator design specifications (based on current regulator design)

Regulator	Open / close / regulate flow	Proposed design (number (No.), width (W) x height (h) in mm	Proposed gates
Guttrum			
Guttrum Main Regulator	Regulate	2 No. 1800W x 1800H	Dual leaf gates
Reed Bed Swamp South Regulator	Open/Close	2 No. 1200W x 900H	Penstock Gate
Reed Bed Swamp North Regulator	Open/Close	2 No. 1200W x 900H	Penstock Gate
Little Reed bed Swamp Regulator	Open/ Close	1 No. 1200W x 900H	Penstock Gate
Benwell			
Benwell Main Regulator	Regulate	3 No. 2100W x 2100H	Dual leaf gates
Benwell East Regulator	Open/ Close	2 No. 1200W x 1200H	Penstock Gate
South West Natural Flood Conveyance Regulator	Open/ Close	1 No. 1200W x 900H	Penstock Gate

Pumping infrastructure

To enable pumping to occur at varying water levels in the Murray River three pump stations are proposed adjacent to the Murray River: Guttrum East Pump Station, Guttrum West Pump Station and Benwell Pump Station. Refer to **Attachment 1, Map 2 – Project structures, construction and access**. The proposed pumps would be located on the bank of the Murray River and include fine fish screens on the suction pipes which would have 2 mm hole apertures, a screen approach velocity of 0.12 m/s and automated mechanical cleaning.

The pump stations would consist of a reinforced concrete open structure on the bank housing the pumps and motors, with the suction pipes extending into the Murray River. The concrete structures on the river bank will be mostly below ground and have a removable cover (e.g. grate) that will be flush with the ground surface. The offtake pipe would be below the estimated 10th percentile river water levels. Construction associated with the pipe outlets would occur within the Murray River and riverbank, with excavation and structural works required for the pumps.

Consistent with recent Goulburn Murray Water pump station designs, weatherproof switchboards for the electrical works, variable speed drives and other components are proposed. These would be raised above the 1% planned inundation level and 1 in 100 year flood level and be protected from the direct heat with an awning structure. A fenced compound would be provided around the switchboard and the back of the pump station structure with a hardstand area for maintenance, pump removal and installation and other operational activities.

Pedestrian access along the river will be retained by providing access around the forest side of the Pump Station (i.e. not directly along the riverbank, access would be restricted by the fenced compound). Navigation warnings such as warning signage would also be required around the submerged offtake works.

The pumps would be electrically powered, with the power supply extending from the nearby Powercor supply system to the pump stations. Details for the proposed power supply are discussed below.

At the concept design stage, two higher flow rate pumps and two lower flow rate pumps are proposed to meet the flow rate range required from 25 ML/d to 125 ML/d for each of the Guttrum Forest Pump Stations and 10 ML/d to 125 ML/d for the Benwell Forest Pump Station.

Fish passage

The design of all regulators and drop structures allows for passive fish passage. Guttrum Main Regulator, Benwell Main Regulator and Benwell East Regulator are all dual leaf gate regulators and therefore will be designed to regulate and pass outflows at different water levels (i.e. they will not just be open or closed). This will ensure that passive fish passage can be achieved in overshot mode with water passing over the gates. A plunge pool at these three regulators will also be provided immediately downstream of the gate for safe fish passage. All other regulator structures would be operated either in fully open or fully closed position. When water is released with the regulator gate in fully open position, fish have passage through the regulator both in managed release and natural flood scenarios. Structures have also been designed to have flow velocities appropriate for fish passage (based on O'Connor et. al, 2015). During watering events, fish will be able to move across all submerged areas.

Ancillary components of the project (eg. upgraded access roads, new high-pressure gas pipeline; off-site resource processing):

Containment banks / access tracks

Typically, access to the project structures during construction and operation would be provided via existing tracks. The main access tracks include:

- Guttrum Forest:
 - Cassidy Lane
 - Brays Lane
 - River Track
 - Lyons Track
 - Millar Road

- Benwell Forest:
 - River Track
 - Regulator Track
 - Grasses Track
 - Hall Road
 - Watson Lane

The locations of the proposed containment banks and access tracks are shown in **Attachment 1, Map 2 – Project structures, construction and access**. Access is generally proposed utilising existing tracks, however some of these tracks would need to be upgraded as part of the project. A number of short sections of new access tracks between existing access tracks and proposed infrastructure and associated with containment banks would also need to be constructed. The extent of access track construction would be confirmed following outcomes from geotechnical investigations, complex cultural heritage assessment (as part of the Cultural Heritage Management Plan for this project) and ground truthing. Design and construction of the final access tracks would need to comply with the mitigation measures as outlined in Part 2, Section 18 (Environmental management) of this referral.

Maintenance would be undertaken to existing access tracks so that they are suitable for use during construction and operation. This would involve grading and applying additional road base to the surface undertaken in consultation with Parks Victoria and DELWP as the land managers.

Levees

Both Guttrum and Benwell Forests have extensive perimeter levee systems built to protect adjacent private land from inundation during large natural flood events (greater than the 26,000 ML/day River Murray flows mimicked by this project) (North Central CMA, 2014)

A Levee Risk Assessment is currently being undertaken by VMFRP to determine the works, if any, to be undertaken at existing sections of levees to support the project and provide protection of private land during management inundation events. The location of existing levees (representing potential works) have been included in the area of investigation for completeness, but not the construction footprint (as the need for work is unknown) and considered at a desktop level in this referral. If works on levees are deemed to be required, further assessment and ecology fieldwork will be carried out.

Power supply

New power supply connections are required to facilitate operation of the pump stations at both Guttrum and Benwell Forests. The key design components include new poles, stays, cables/power lines and substations.

The new power lines would extend across both public and private land. Within the State Forest boundary, the power lines would be directly buried (or bored depending on requirements) generally following the alignment of containment banks or existing access tracks to minimise the area of impact. Upgrades to existing overhead power lines within private property are required and new lines, both above ground and below ground, are proposed through private property. Consultation with relevant private landholders is currently being undertaken.

The project is working with Powercor to confirm the preferred alignment and develop preliminary footprints and designs for the power supplies to each pump station. These alignments will be selected to minimise impacts to native vegetation and cultural heritage values.

Preliminary designs have been developed by Powercor for Benwell Pump Station and Guttrum West Pump Station. The Guttrum West Pump Station power supply is likely to include an update of existing powerlines across a number of private properties, new underground high voltage cable from this existing supply line, across private property and into Guttrum Forest to supply Guttrum West Pump Station. The cable will follow the alignment of the proposed Guttrum Main Containment Bank to minimise the impact area, in particular, removal of native vegetation. The Benwell Pump Station power supply is likely to include a new overhead line constructed through private property to the boundary of Benwell Forest, a pole mounted substation located outside of Benwell Forest and a low voltage underground cable will be constructed in Benwell Forest to supply Benwell Pump Station.

There are several options for power supply to Guttrum East Pump Station still being considered. These options will undergo a multi-criteria assessment to identify the preferred option. The criteria will include how the proposed option minimises the impact to native vegetation and cultural heritage values.

As the preferred option for power supply to Guttrum East Pump Station is unknown at this stage and due to the preliminary nature of designs for the Guttrum West and Benwell Pump Stations, the power supply infrastructure requirements for the project are currently not included in the construction footprint shown in **Attachment 1, Map 2 – Project structures, construction and access**, nor considered in the specialist assessments prepared for this referral. However, an indicative location for the substation at each pump station has been included in the area of investigation and construction footprint, assuming that this would be located opposite the pump stations. Following selection of the preferred option, the infrastructure requirements will be included within the construction footprint and potential impacts assessments completed.

Concrete batching

Commercially sourced concrete for construction of the proposed works would be transported to the project area with no requirement for on-site concrete batching facilities.

Borrow pits / quarry sites

Construction of the project would require the import of material (clay/rock). VMFRP is in the process of identifying possible borrow pits to acquire this material, the locations of the borrow pits will be as close as possible to the project, on private land outside of Guttrum and Benwell Forests, while also avoiding and minimising impacts. Rock (rock beaching for erosion protection works) would be sourced from an existing commercial quarry. Borrow pits/quarry sites are not included in the area for investigation or construction footprint as their location(s) are currently unknown.

Key construction activities:

Construction activities would occur within the area identified in the construction footprint map (**Attachment 1, Map 2 – Project infrastructure and access**). Construction activities would include:

- Establishment of construction sites, including removal of vegetation, stripping and stockpiling of topsoil, establishing temporary parking and truck turnaround areas, laydown and stockpiling areas
- Removal of existing structures where required
- Construction / installation of new structures

Importation of construction materials, including regulators and imported soils, would comply with DELWP and Parks Victoria consent under the *Forests Act 1958* and the future *Environment Protection Act 2017* (this was due to commence on 1 July 2020 however has now been postponed until 1 July 2021 or earlier by proclamation) due to the COVID-19 emergency.

A Construction Environmental Management Plan (CEMP) would be prepared for the works and would detail the measures to avoid and minimise impacts during construction. Once construction of regulators, containment banks and all associated works are complete, all waste and surplus spoil will be removed from the sites and disposed of in accordance with the measures outlined in the CEMP.

Construction in the Murray River

All pump stations and drop structures would require construction works within the Murray River. For the pump stations this would include excavation and construction of intake pipes. The portion of the intake pipes near the edge of the bank profile would be concrete encased serving as an anchor for the suction pipes and protection for bank scouring/ erosion.

Construction of the drop structures requires modifying (re-shaping and re-grading) of the existing outlet channel and extending sections of rock mattress erosion protection into the Murray River. Installation of a rock mattress would involve excavating to ensure that the finished surface is flush with the natural surface/bed. Lengths of 6 m x 2 m mattress would be fabricated on the bank, complete with geotextile and lifting points. They would be lifted into place with a purpose built lifting frame. The top ends of each mattress would be secured at the top end to a gabion beam on the bank. Mattresses placed below water would not be tied at the sides.

It is likely that a cofferdam would be temporarily installed in the Murray River to allow the rock mattress to be placed and tied together. Works are proposed to occur when the river level is low. The coffer dam would likely comprise sheet piles and would only extend into the Murray River as far as necessary to safely and efficiently construct the works. The cofferdam would not extend across the full width of the river (i.e. likely to be less than half way across) and would therefore allow fish passage to be maintained while works are being undertaken.

Construction footprint and laydown areas

The proposed construction footprint includes a working area (approximately 10 m) around the development footprint for proposed infrastructure to accommodate movement of vehicles and machinery and some limited storage of equipment and materials.

Construction laydown areas included in the construction footprint are proposed within proximity to Guttrum Main Pump Station (location directly north), Benwell Pump Station (location directly south) and at the end of South West Regulator near the South West Benwell Swamp. The locations are currently under review by VMFRP and it is proposed to move these laydown areas to private land outside of the forests to minimise and avoid impacts. Consultation with relevant landholders is currently being undertaken.

Laydown areas would provide the primary location for site offices, amenities, vehicle manoeuvres / parking, storage of equipment and materials, etc.

Guttrum and Benwell Forests Floodplain Restoration Project

Smaller, more localised laydown areas would also be provided at or within proximity to the other regulator structures.

Project area rehabilitation

Following completion of works, rehabilitation of construction areas would be undertaken in accordance with DELWP and Parks Victoria consent under the *Crown Land (Reserves) Act 1978* and *Forests Act 1958*.

General principles for site rehabilitation include:

- Use of local indigenous plant species
- Placement of habitat logs
- Retention and reuse of topsoil

Details of rehabilitation will be included in the CEMP

Key operational activities:

The proposed works are intended to inundate areas of the Guttrum and Benwell Forest floodplain with pumped inflows from the Murray River through a series of Pump Stations on the river.

Three operating scenarios have been identified for water delivery to the Guttrum and Benwell Forests:

- Forest floodplain watering – broader floodplain (River Red Gum flood dependent understorey and semi-permanent wetlands). The flooding would replicate a 26,000 ML/day natural event in Guttrum Forest and a 24,000 ML/day event in Benwell Forest. The target frequency for forest floodplain watering based on water regime requirements is on average eight years in 10 for between three to five months. Pumping would be required on average three years in 10 to achieve the target eight years in 10 inundation frequency, with inundation in other years provided through natural inundation and Basin Plan 2750 flows.
- Semi-permanent wetland watering – targeted water delivery to wetlands only. The target inundation regime for semi-permanent wetlands is nine years in 10 for a duration of six months. Top up watering events after natural inflow events (under Basin Plan 2750 flows) to semi-permanent wetlands would be required on average seven years in 10 to achieve this inundation regime. This pumping would be in addition to the forest floodplain watering scenario which would also inundate the semi-permanent wetlands on average three years in 10. Both scenarios combined would require pumping to semi-permanent wetlands every year, which would achieve the target nine years in 10 inundation frequency.
- Hybrid events – topping up natural flow events for the forest floodplain and semi-permanent wetland watering due to natural flood duration deficits. There are three options for extending the duration of natural floods that inundate the broader forest and semi-permanent wetlands:
 - Follow up watering of the forest floodplain following natural flow peaks and/or flood capture to achieve required flooding extent and/or duration where natural flood event extent or duration is inadequate to achieve ecological objectives.
 - Top-up watering of the semi-permanent wetlands following natural flow peaks to achieve required flooding duration where natural flood event duration is inadequate to achieve ecological objectives.
 - Delivering a waterbird breeding scenario in association with environmental cues including topping up wetlands to support natural bird breeding events when required.

There are two options for extending the duration of natural floods that inundate the broader forest:

Guttrum and Benwell Forests Floodplain Restoration Project

- Flood capture to retain floodwater on the floodplain for the required duration by closing the outlet regulators and low-lying inlet regulators from the River Murray after the river flow peak has passed
- Pumped deliveries of up to 125 ML/ day at each of the three pump stations to top up the natural inflows with additional volume of water from the river.

Forest floodplain watering

Watering the forest floodplain includes inundating the River Red Gum forests with flood dependent understorey and the lower lying semi-permanent wetland systems. The proposed watering will include three phases:

- Filling phase: Gradual ramp up with filling at peak flows of 125 ML/day at each pump station to achieve the desired inundation extent
- Maintenance phase: Reducing inflows from 125 ML/day to between 45 to 90 ML/day from the pump stations only to offset losses and provide return flows to the Murray River. Continue providing maintenance inflows to meet the duration requirements of either the River Red Gum forests or semi-permanent wetlands (with approx. 25 ML/day return flows to the Murray River during this period)
- Ramp down phase: gradual ramp down of inflows.

The proposed operation of infrastructure to deliver water (from dry) to Guttrum and Benwell Forests under this scenario is outlined below.

Guttrum Forest

Water will be delivered via two pump stations situated on the Murray River in both the east and west of the forest. The eastern pump station (Guttrum East) will have three outlet points that facilitate filling of the eastern semi-permanent wetlands as well as the forest floodplain. All of these outlets would typically be used to fill the forest from dry, with a maximum inflow capacity of 125 ML/d. An additional 125 ML/d will be delivered from Guttrum West pump station, totalling 250 ML/d flow rate to fill the forest from dry (North Central CMA, 2020).

To achieve an equivalent inundation extent of an approximate 26,000ML/day Murray River inflow, the pump stations would be allowed to run until the level at the forest outlet (Guttrum Main Regulator) reaches 75.8 m AHD (DHI 2020). At this level, hydraulic modelling shows there are no return flows to the Murray River via the other natural inlet points along the Murray River (DHI 2014). Therefore, only the Main Regulator would need to be closed during the operation (assuming water levels remain at 75.8 m AHD at the outlet). However, depending on which environmental water inlets are utilised during a full forest watering event, three small regulators (Little Reed Bed Swamp Regulator, Reed Bed Swamp North Regulator and Reed Bed Swamp South Regulator) will be built on these effluents along River Track in the eastern part of the forest. These regulators would be closed if required to contain water on the floodplain and direct it into the forest (North Central CMA, 2020).

Once the maximum environmental watering level of 75.80 mAHD is reached at the Guttrum Regulator, the Guttrum West Pump Station would be turned off and the Guttrum Regulator would commence automatic modulation to maintain the desired water level. The Guttrum East Pump Station would continue to operate at a high to maximum flow rate to maintain the maximum inundation extent possible for the east and south parts of the forest. The Guttrum East Pump Station would then reduce its flow rate to provide "maintenance flows" and the forest will be operated as a through-flow system. Maintenance flows aim to maintain the extent for the optimal duration to support the ecological objectives; provide freshening inflows that will assist with managing water quality; and return continuous carbon and nutrient-rich outflows to the Murray River. Outflows would occur through the Main Regulator and water would drain from the forest floodplain to the Murray River as occurs naturally (North Central CMA, 2020).

Benwell Forest

Water will be delivered via a pump station situated on the Murray River at the western end of Benwell forest at

a maximum rate of 125 ML/d. To achieve an equivalent inundation extent of a 24,000 ML/day Murray River inflow, water would be delivered from the pump station via two outlets (one main one to central and eastern forest, and one smaller one to south west area) while regulators at low points along the Murray River would be closed during the filling stage (i.e. Benwell Main Regulator and Benwell East Regulator) (DHI 2014; R8, 2020b). The ground profile along the western bank of the river at the downstream end of the forest mostly utilising the existing alignment of River Track will be raised as part of infrastructure works, which will contain water on the floodplain and prevent outflows during delivery (DHI 2014). Further investigation is ongoing to determine if additional infrastructure is required within the containment bank along River Track so that natural flow paths remain uninhibited as much as possible (North Central CMA, 2020).

Once the maximum desired inundation extent and depth is achieved, the Benwell Main Regulator and Benwell East Regulator will be opened (partially or fully, depending on river conditions) to create a throughflow, with maintenance flows provided at lower flow rates to match losses within the forest and enable return flows. The regulators would actively operate to maintain the target water level. This water delivery would continue to maintain the area of inundation for the required duration. Towards the end of the watering event, larger volumes of outflows would be released by opening the outlet regulators, and water would drain from the forest floodplain to the Murray River as occurs naturally (North Central CMA, 2020).

Semi-permanent wetland watering

The semi-permanent wetlands in each forest include:

- Guttrum Forest - Reed Bed Swamp, Little Reed Bed Swamp and the Guttrum Swamp wetland complex.
- Benwell Forest - Benwell Swamp and Southwest Benwell Swamp.

The proposed watering will include two phases:

- Filling phase: In winter or early spring, gradual ramp up with filling at peak flows of between 12 - 100 ML/day to achieve the desired inundation extent in semi-permanent wetlands
- Maintenance phase: In late spring, deliver one or more top-ups to the wetlands (as required) by ramping up again to up to between 25 -50 ML/d until desired water level is reached. Flows can be held steady to maintain water levels under nests if required. This flow rate will depend on climatic conditions and will need to account for losses through evaporation.

The proposed operation of infrastructure to deliver water (from dry) to semi-permanent wetlands in Guttrum and Benwell Forests under this scenario is outlined below.

Guttrum Forest

For semi-permanent wetland watering into a dry system, independent of the River Red Gum forest floodplain, water will be delivered via the Guttrum East and Guttrum West Pump Stations. The east pump station will water Reed Bed Swamp and Little Reed Bed wetland. The west pump station will water the Guttrum Swamp complex (DHI 2017). To inundate the eastern wetlands, water will be pumped through a pipeline following the alignment of River Track and will be released into three different flood runners to fill Reed Bed Swamp and Little Reed Bed Swamp (North Central CMA, 2020).

Small regulators are proposed for these flood runners to block water from running back towards the Murray River or inundating River Track, and instead will direct it west or southwest towards the wetlands and broader forest. These small regulators will be formed by gated culvert crossings of River Track at the locations of the existing flood runners. The Guttrum East Pump Station will provide for wetland fills up to a full supply level of 75.7 m AHD for the Reed Bed southern inlet (DHI 2020) and 75.5 mAHD for the main Reed Bed Swamp (DHI 2020). As water is held within the wetlands, the outlet (Main Regulator) would not be required. Water would eventually infiltrate and evaporate until the wetlands dried out.

Guttrum and Benwell Forests Floodplain Restoration Project

To inundate the western wetlands, water will be pumped from the Guttrum west pump station and follow the natural flow paths to fill Guttrum Swamp complex. The wetland system would gradually fill from the north to the central / eastern and then southern end. The Main Regulator outlet is located close to the east pump station and will be closed during filling of the wetlands to full supply level (North Central CMA, 2020).

Benwell Forest

For semi-permanent wetland watering into a dry system, independent of the River Red Gum forest floodplain, water will be delivered via the Benwell West Pump Station. Water will travel via a short pipeline to two outfall locations that target the central Benwell Swamp and the South West Benwell Swamp, enabling the two wetlands to be filled independently (R8 2020b). Water will be delivered at a flow rate of approximately 50 ML/d in total, with 22 ML/d directed to the central Benwell Swamp and 28 ML/d towards the South West Benwell Swamp (DHI 2017).

Both wetlands will be filled to a full supply level of approximately 74.6 mAHD. At this level, some water will pool against the containment bank along River Track for central Benwell Swamp and against a section of the outer levee for Benwell South West Swamp. The Benwell Main Regulator would be closed prior to operations commencing, but may be opened again if a high river peak was expected that would result in natural inflows. The wetlands would gradually evaporate and infiltrate over a four to six-month period. Flows to top-up the wetlands or maintain water levels may be delivered if required to meet ecological objectives, such as supporting a waterbird breeding event.

A summary of the proposed operating scenarios for Guttrum and Benwell Forests is provided in **Table 7**.

Table 7: Modelled frequency of operational scenarios for the Guttrum and Benwell Forests Floodplain Restoration Project (North Central CMA, 2020)

Operating Scenario	Peak filling inflow rate (ML/d)	Optimal watering regime (frequency under natural conditions)	Frequency of infrastructure operation *	Duration	Required timing
Forest Floodplain – Guttrum Forest	250 (125 ML/d at each pump station)	8 years in 10	3 years in 10**	4 months	Winter/Spring
Forest Floodplain – Benwell Forest	125	8 years in 10	3 years in 10**	4 months	Winter/Spring
Semi-permanent wetland watering – Guttrum Forest	25 - eastern wetland 100 - western wetlands	9 years in 10	7 years in 10***	6 months	Spring – eastern wetland Late winter/ Spring – western wetland
Semi-permanent wetland watering – Benwell Forest	22 – Benwell Swamp 28 – South West Benwell Swamp	9 years in 10	7 years in 10***	6 months	Late winter/ Spring

* Operating regime based on Basin Plan 2750 flows.

** Inundation in other years provided through Basin Plan 2750 inflows to achieve the 8 in 10 year inundation frequency

*** On top of the full forest watering scenario which would also inundate the semi-permanent wetlands 3 years in 10 to achieve the 9 in 10 years inundation frequency

Guttrum and Benwell Forests Floodplain Restoration Project

Key decommissioning activities (if applicable):

The design life of the structures is 100 years. If the structures are no longer required at the end of life, all structures will be removed to a practical extent from the site by the operator, and the area rehabilitated to the satisfaction of DELWP and Parks Victoria.

Is the project an element or stage in a larger project?

No Yes If yes, please describe: the overall project strategy for delivery of all stages and components; the concept design for the overall project; and the intended scheduling of the design and development of project stages).

Environmental Water has been delivered to Reed Bed Swamp and Little Reed Bed Swamp once in 2019 via temporary pumping in response to declining conditions of these wetlands. It is intended that this watering will continue at the preferred semi- permanent wetland frequency outlined above until construction of the environmental watering infrastructure proposed is completed as part of this project.

No further stages are currently proposed at the Guttrum and Benwell Forest floodplain beyond the current project.

Is the project related to any other past, current or mooted proposals in the region?

No Yes If yes, please identify related proposals.

The Guttrum and Benwell Forests Floodplain Restoration Project is one of nine discrete environmental works sub-projects being undertaken as part of the 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 inundation regime across more than 14,000 hectares of high ecological value Murray River floodplain in Victoria through the construction of new infrastructure and modification of existing infrastructure.

The VMFRP is being implemented by a partnership between LMW, GMW, Mallee CMA, North Central CMA, Parks Victoria and the DELWP, and is funded by the Commonwealth Department of Agriculture, Water and Environment (DAWE). The VMFRP is being implemented by a partnership between LMW, GMW, Mallee CMA, North Central CMA, Parks Victoria and the DELWP, and is funded by the Commonwealth Department of Agriculture, Water and Environment (DAWE). LMW is the project proponent.

Further details of these projects are available at: <https://www.vmfrp.com.au/>

Separate referrals are being prepared for each of these sub-projects under the *Environment Effects Act 1978* and the *Environment Protection and Biodiversity Conservation Act 1999*.

What is the estimated capital expenditure for development of the project?

\$12,400,000

4. Project alternatives

Brief description of key alternatives considered to date (eg. locational, scale or design alternatives. If relevant, attach A4/A3 plans):

Do nothing (maintain status quo)

The other alternative is to not undertake the project. However, this alternative is not being considered further as it would:

- Lead to ongoing deterioration of floodplain ecosystems in the targeted inundation area. The targeted inundation area is displaying evidence of ecological stress caused primarily by river regulation, which has significantly reduced the frequency, depth and duration of flood events entering these areas. This deterioration has been well documented and has prompted the emergency watering measures previously described.
- Mean foregoing an opportunity to deliver long-term positive impacts to areas that are significant at a local, regional, and national level.
- Impact on the ability for Victoria to meet its obligation under the Murray Darling Basin Plan as the project is a supply measure project designed to off-set the Basin Plans' water recovery targets.

Alternative design/ reduced project area

A range of alternative design options have been evaluated. The preferred design of the works is the result of detailed assessments drawing on extensive investigations at the site and overseen by ecological, hydrological, and engineering expert review panels. The preferred option was the result of detailed options assessments, post the submission of the 2014 business case for this project. The project business case was approved within the Basin Plan process as part of a package of 36 SDL projects which collectively achieve targeted environmental outcomes for the Basin. Refinements can be considered in finalising the design to respond to environmental and heritage assessment and any stakeholder or landholder requirements. Alternatives could include minor re-alignments of banks and siting of structures to avoid and minimise impacts. However, consideration of fundamental project alternatives which would result in a lesser area of targeted EVCs being watered would compromise Victoria's ability to achieve the required SDL offset.

Proposed Project

Planning and design of the project has considered a range of alternatives to achieve the specific ecological objectives described in Section 3 (Project description: Aims/objectives of the project) of this referral. This has involved numerous studies over the last decade to evaluate and refine water management options to identify the most effective and efficient design for environmental watering of the Guttrum and Benwell Forests. This optimised design seeks to maximise the benefits of the project, whilst minimising construction impacts. Key investigations that informed and considered project design alternatives are summarised below.

Guttrum and Benwell State Forests Water Management Investigation, 2007

In 2007, SKM developed a set of ecological objectives for Guttrum and Benwell Forests which documented a total of 13 water management options that could be implemented in order to deliver water to the forests. The report made recommendations for further work to fill knowledge gaps so that an informed decision could be made on preferred water management options. **Table 8** below summarises the water management options identified for each forest.

Guttrum and Benwell Forests Floodplain Restoration Project

Table 8: Summary of water management options investigated by SKM (2007)

Option	Description
Guttrum Forest Water Management Options	
1	Install one or two new regulators at the Guttrum Forest outflow path with the intent to capture and retain peak water levels from the Murray River high flow events.
2	Define the fixed sill level at Smiths Drain (Guttrum Forest) and construct overflow sills at one or more points in the channel. This will increase the duration but reduce the area of inundation when compared to Option 1.
3	Refurbish the existing Guttrum Swamp regulator and define its operating procedures with the aim to control the frequency, duration and timing of flooding in the forest.
4	Extensive modification of the forest inlet regulator leading to inflow at the Guttrum Swamp at a low Murray River level. This would result in more frequent inundation of water bodies within the swamp.
5	Lower (deepening and widening) of one or more of the Guttrum forest inlet channels, with the aim of more frequent filling of the forest at lower river levels
6	Lower (deepening and widening) of the inflow path through a billabong near Billabong Track within the Guttrum Forest.
7	Use the gravity irrigation network to supplement natural flood events in the Guttrum Forest. This option would be limited to watering of lower lying temporary wetlands.
8	Construct a pump(s) alongside the Murray River for the purpose of delivering water to the temporary wetlands at Guttrum Swamp and/or Reed Bed. Pumping into either of these locations would provide benefits to the temporary and semi-permanent wetlands.
Benwell Forest Water Management Options	
9	One or several new regulators/ culverts and bank on a shallow poorly defined outflow path to the Murray River to retain water in Benwell Forest.
10	Lower (deepening and widening) the inflow channel into the Benwell forest so as to achieve earlier inflow from the Murray River.
11	Use the gravity irrigation network to supplement natural flood events in the Benwell Forest. This option would be limited to watering of lower lying temporary wetlands.
12	Use the irrigation drainage system as a potential source of water. The proposed Benwell Drain, which includes a pump station near the south west corner of the forest to provide pumped drainage when the river is too high for gravity flow, could be used to pump drainage water in to the forest at select times.
13	Construct a pump alongside the Murray River for the purpose of delivering water to the temporary wetlands at Benwell Forest. Pumping, in combination with a bank and regulator, benefits to the temporary and semi-permanent wetlands.

2014 Guttrum and Benwell Infrastructure Options Assessment

In 2014, the North Central CMA used the water management options developed by SKM in 2007 and developed a background paper assessing preferred infrastructure options for the Guttrum and Benwell Forests. Three options were assessed for Guttrum Forest and two for Benwell Forest. The options were assessed (as summarised in **Table 9**) based on benefit expected (e.g. ecological outcomes provided), feasibility, cost and comparison of risk.

Guttrum and Benwell Forests Floodplain Restoration Project

Table 9: Summary of water delivery options assessed for Guttrum and Benwell Forests

Option	Description	Benefit	Evaluation
Guttrum Forest			
G1. Channel deepening	Deepening the existing forest inlet channel to a consistent level between the river offtake point and the Little Reed Bed wetland. Constructing a new 210m long channel (approx.) through the natural embankment between Little Reed Bed and Reed Bed Swamp.	Achieves inundation frequency for eastern semi-permanent wetlands	<ul style="list-style-type: none"> Can inundate dry forest but requires Murray River flows >16,000ML/d. This may limit opportunities for watering. Not progressed based on uncertainty around Murray River flows during dry periods.
G2. Irrigation supply	Supply water from the Torrumbarry Irrigation Network to deliver either full flows or top-up flows to the forest.	Broadscale flooding – larger area and deeper for 250ML/d compared to 100ML/d. Two supply points enable all wetlands to be watered.	<ul style="list-style-type: none"> Channel capacity available. Delivery time faster for 250ML/d (11 days not 29 days) This was the preferred option with the 250ML/d through South East inlet being the preferred flow rate due to greater chance of achieving ecological outcomes. Smaller inflow rate through South West inlet for wetland watering.
G3. Pumping	Install a pump at the forest inlet channel and pump water directly from the Murray River to target wetlands (Reed Bed Swamp and Little Reed Bed) and maximise inundation of the forest	Broadscale inundation (assumed similar to G1). 100ML/d better replicates natural inflows than 250 ML/d (proposed in G2).	<ul style="list-style-type: none"> Simple engineering, but underground power installation required. Not progressed based on high cost compared to equivalent irrigation supply and risk of increasing costs over time – power/fuel.
Benwell Forest			
B1. Irrigation supply	Supply water from the Torrumbarry Irrigation Network to deliver either full flows or top-up flows to the forest.	Broadscale flooding	<ul style="list-style-type: none"> Channel capacity available. Delivery time faster for 250ML/d (15 days not 44 days). This is the preferred option with the 250ML/d flow rate as this has the greater chance of achieving ecological outcomes. Smaller inflow rate for wetland watering.
B2. Pumping	Install a pump at the forest inlet channel and pump water directly from the River Murray to target wetlands (Benwell Swamp) and maximise inundation of the forest	Broadscale inundation (assumed similar to irrigation supply).	<ul style="list-style-type: none"> Simple engineering, but underground power installation required. Not progressed based on high operating cost negates lower capital cost (for diesel options) compared to equivalent irrigation supply and risk of increasing costs over time – power/fuel.

Combinations of the above options were also assessed but not progressed based on the delivery costs.

At the time of this assessment, irrigation water was determined to be the most appropriate water delivery option for both Guttrum and Benwell Forests based on the certainty of supply through the irrigation system and the cost associated with the pumping infrastructure (including power supply). When comparing the

irrigation and pumping (both electric and diesel powered) supply option using a whole of life-cycle cost analysis, the irrigation supply was the preferred option. In addition, at around the same time, works were being completed in Gunbower Forest nearby as part of The Living Murray program of works utilising the irrigation system to deliver environmental water. Therefore, adopting irrigation supply provided a consistent approach to environmental water projects across the region.

As part of the proposed works to support irrigation system delivery, regulators were proposed to: contain water within the floodplain to enable the desired inundation extent to be achieved and water containment within the forests, to manage potential water quality impacts downstream, and to provide operational flexibility. Perimeter levee works to manage risk of private property flooding were also recommended.

2014 Guttrum and Benwell Forest Concept Design (URS, 2014)

As part of the design process for the Business Case, the 2014 Options Assessments by the North Central CMA was progressed and a concept design for the proposed gravity irrigation supply option for both forests was prepared by URS. The concept design considered and aimed to avoid and minimise possible, adverse impacts to environmental and cultural heritage values as a result of the works. The construction activities associated with the concept design was largely located outside the forest resulting in a relatively small impact footprint within both Guttrum and Benwell Forests.

The works package proposed in the concept design is summarised in **Table 10**.

Table 10: Summary of proposed works for Guttrum and Benwell Forests in concept design

Guttrum Forest	Benwell Forest
<ul style="list-style-type: none"> • Two irrigation supply channels connecting from the Torrumbarry Irrigation Network (G1 & G2) • One new effluent regulator, including raised track/levee at the forest outlet, to contain water on the floodplain, control water levels and provide a fish exit (G5) • Connection between Little Reed Bed and Reed Bed Swamp • Perimeter levee banks • Access tracks • Erosion protection works at G5 to protect existing infrastructure. 	<ul style="list-style-type: none"> • One irrigation supply channel from the Torrumbarry Irrigation Network (B1) • Effluent regulator including primary spillway weir, vehicle crossing and raised forest access track to contain water on the floodplain. • Culvert crossing (B7) with dual leaf gate water on the floodplain and provide accurate water release control for through-flows. • Perimeter levee banks • Access tracks

Guttrum and Benwell Forests – Key Decisions Summary Report (North Central CMA, 2017)

Following the submission of the Business Case, the MDBA undertook an engineering assessment on the nine Business Cases submitted by Victoria for SDL adjustment projects including the Guttrum and Benwell Forests Floodplain Restoration Project and recommended that the whole of life-cycle cost estimates for the pumping option for Guttrum and Benwell Forests be reassessed to reconsider pumped supply from the Murray River.

At a similar time, The Living Murray environmental water delivery highlighted that the irrigation system (e.g. Gunbower Creek) had insufficient capacity to support the proposed works at Guttrum and Benwell Forests in addition to irrigation demand and existing environmental water delivery requirements in the system.

Consequently, there was a fundamental shift in the design for the Guttrum and Benwell Forests Floodplain Restoration Project from the gravity irrigation supply presented in the Business Case to pump supply from the Murray River.

Guttrum and Benwell Forests Floodplain Restoration Project

North Central CMA undertook further assessment of environmental watering scenarios for the Guttrum and Benwell Forest and documented it in the Key Decision Summary Report (North Central CMA, 2017). The report investigated a number of pumping options and a Stakeholder Reference Group meeting was held on 7 June 2016 and discussed each of the options. A summary of the outcome is outlined in **Table 11** below, including key benefits of moving from an irrigation supply option to a pumped supply option. The recommended preferred option was a pump station at the north west end of the Benwell Forest and two pump stations in Guttrum Forest – one on the western most corner and the other at the eastern most corner. The additional benefits of this pumped supply arrangement is that installation of infrastructure on private property is no longer needed.

Table 11: Summary of pumping options for the Guttrum and Benwell Forests.

Option	Evaluation
Murray River pump station to No. 4 Channel and three irrigation channels	<p>This option was not considered the preferred option due to:</p> <ul style="list-style-type: none"> • Noise and aesthetic issues associated with the location of the pump station being in a public area. There could be a very high risk of objections from both nearby residents and the Gannawarra Shire; and • Costs associated with the pump station and pipeline to the No. 4 Channel would be in addition to the cost of the gravity supply options to the forests as contained within the Business Case submissions.
Common pump station to service Guttrum West and Benwell Forest	<p>This option was not considered the preferred option due to:</p> <ul style="list-style-type: none"> • Delivering water into the east side of Benwell Forest, the Benwell West semi-permanent Wetlands could not be serviced without overwatering the river red gum areas; • The high cost of a large pipeline to connect the forests; and • The pipeline, access and power would need to be routed through private farmland, increasing cost and risk to the option.
Murray River Pump Station options Guttrum and Benwell	<p>This option was considered the preferred option and hydraulic modeling was undertaken to determine the required number and locations of the pump stations in the forests:</p> <ul style="list-style-type: none"> • Guttrum Forest - Two pump stations required. Full forest watering could be achieved using the Guttrum East pump station at a 250 ML/day inflow rate however this single pump station was unable to deliver water to the semi-permanent wetlands in the west of the forest without over watering red gum areas. By filling the forest using two pump stations (one in the east and one in the west of the forest) each at a rate of 125 ML/day, the semi-permanent wetlands in the west can be watered without overwatering the south east corner of the forest. • Benwell Forest - One pump station required. The Benwell West pump station was the preferred location for a pump station as, when combined with the track raising and flow splitting, was able to adequately service the semi-permanent wetlands without overwatering the river red gums and also create a large inundation extent across the river red gum areas during a full watering event.
Two Murray River pump stations (one in Benwell and one in Guttrum) plus use of one irrigation channel for Guttrum West Forest	<p>This option was not considered the preferred option due to:</p> <ul style="list-style-type: none"> • A pumped supply was preferred over 50ML/day gravity fed supply point for the semi-permanent wetland complex in the west section of Guttrum Forest due to the pump station option providing a more natural fill pattern of the floodplain and increase operational flexibility due to not relying on the irrigation system • This option proposed Guttrum Forest to be watered using dual pump stations each with a capacity of 250 ML/day.

A number of investigations have been historically undertaken into the installation of permanent or temporary pump station options at Guttrum and Benwell Forest and this was further discussed with the Stakeholder Reference Group as part of this project. At this meeting Parks Victoria noted that a temporary diesel pump

may be permissible on the Murray River, however a permanent diesel pump station would be against Parks Victoria policy due to the risk of a diesel spill. Parks Victoria noted that an electric power supply is the preferred option.

The use of temporary diesel pumps still introduces the undesirable risk of a diesel spill within the State Forest and creates further operational risk associated with noise, fire, time / administration required to secure funding, organise temporary diesel pumping contractors and approvals. This additional administration time would reduce the ability to react quickly to opportunities to deliver water to the forest. For example, hybrid events which would attempt to take advantage of windows within the hydrograph to 'piggy back' environmental water onto natural flood events. This operational risk was seen to compromise the ability to achieve the ecological outcomes of the proposed works by meeting the required watering frequency if hybrid events were not achieved as intended. Therefore the preferred option selected at the Stakeholder Reference Group was for permanent electric pumps to be adopted.

2019 / 2020 Project refinements

The project design as developed in 2017 is currently being refined further by VMFRP. Findings from on-site assessments particularly ecology fieldwork have progressively fed into the design, with modifications made from the concepts developed in 2017 to avoid and minimise environmental impacts.

Design requirements from project stakeholders such as GMW, North Central CMA, and Parks Victoria have also influenced the design to date.

The key refinements of the design to date have included:

- Reduction of the capacity of Benwell Pump Station to 125 ML/d
- Maintaining capacity of pump stations in Guttrum Forest at 250 ML/d, but now two Pump Stations with 125 ML/ d capacity
- Refinement in location and number of small regulators required to enable water to be contained within the project area
- Relocation of the Guttrum East Pump Station to better service the semi-permanent water regime requirements, particularly Little Reed Bed Swamp (which operates at a higher water level than Reed Bed Swamp)
- Expansion to three Pump Station outlet points (into existing natural flood runners) and the removal of the main forest outfall pipeline
- Selecting areas for construction laydown to avoid areas of high ecological value

This work is ongoing and refinements would continue based on the outcomes of the approvals and design process.

Brief description of key alternatives to be further investigated (if known):

No alternatives to the project are being further investigated. The Feasibility Assessment (Phase 1) and Business Case (Phase 2) and concept design which included changes to pumped supply post Business Case for this project have been submitted to and approved by the Commonwealth Government and included extensive documentation of the alternatives investigated. The options assessment and design development have been informed by various investigations, which were undertaken with a view to minimising impacts on ecology and heritage values, whilst maximising the area to receive benefit from watering.

Design of the proposed structures would continue to be refined through the design process to respond to environmental and heritage assessments, and stakeholder / landowner requirements.

5. Proposed exclusions

Statement of reasons for the proposed exclusion of any ancillary activities or further project stages from the scope of the project for assessment:

No other ancillary activities or further project stages have been excluded from the scope of the project for assessment.

6. Project implementation

Implementing organisation (ultimately responsible for project, ie. not contractor):

LMW will be the implementing organisation responsible for managing construction of the project, the project will then be transferred to GMW for operation. As such, GMW will be primarily responsible for operation and maintenance of the environmental watering infrastructure.

In order to minimise potential adverse environmental effects and maximise environmental benefits across the nine sub-projects being undertaken as part of the VMFRP, existing frameworks for collaborative and adaptive environmental water management will be used. The Victorian Environmental Water Holder (VEWH) is the independent statutory body responsible for holding and managing environmental water entitlements on behalf of the state. VEWH administers the ongoing collaborative management of water available under environmental entitlements, which are used to improve the health of Victoria's rivers and wetlands and the native plants and animals that depend on them, through regulation of the river systems.

VEWH works collaboratively with a range of partners to plan the release and delivery of environmental water, including:

- The Commonwealth Environmental Water Holder and the MDBA to access water held on behalf of the Commonwealth Government
- Water authorities (e.g. GMW) and waterway managers (e.g. North Central CMA) which oversee investigations to determine water requirements, undertake water planning and coordinate the delivery of water and monitoring programs that support a process of learning and adaptation

Environmental watering at Guttrum and Benwell Forest would be undertaken in accordance with the VEWH's annual seasonal watering plan and in partnership between GMW, the North Central CMA and Parks Victoria.

Before a watering action can commence, a Seasonal Watering Proposal must be prepared by the North Central CMA and approved by the VEWH. Submissions for environmental water allocations are presented by the VEWH to the relevant water holders who subsequently prioritise the watering proposals against all other watering proposals. Once a watering action is approved, the VEWH ensures sufficient water is in the appropriate allocation bank account (ABA). This may require a transfer of water from one ABA to another. The VEWH would then issue a Seasonal Watering Statement to the North Central CMA allowing access to an allocation of water in the ABA. Once the Seasonal Watering Statement is approved, a water order can be placed by North Central CMA with GMW, enabling a diversion to commence.

Implementation timeframe:

Construction is anticipated to commence in January 2023 and to be complete by June 2024.

Proposed staging (if applicable):

Not applicable.

7. Description of proposed site or area of investigation

Has a preferred site for the project been selected?

No Yes If no, please describe area for investigation.

If yes, please describe the preferred site in the next items (if practicable).

General description of preferred site, (including aspects such as topography/landform, soil types/degradation, drainage/ waterways, native/exotic vegetation cover, physical features, built structures, road frontages; attach ground-level photographs of site, as well as A4/A3 aerial/satellite image(s) and/or map(s) of site & surrounds, showing project footprint):

General

The Guttrum and Benwell Forests are situated in the northern Victorian Murray Floodplain and are managed by DELWP and Parks Victoria (area of Murray River Reserve). Guttrum (1,270 hectares) and Benwell (660 hectares) Forests are situated immediately downstream of the 19,450 hectares Gunbower Forest and the 32,000 hectares Koondrook-Perricoota State Forest, and opposite the 3,100 hectares Campbells Island State Forest.

The Guttrum and Benwell Forest floodplains comprise River Red Gum forests and woodlands interspersed with swamp low-lying habitats including complexes of semi-permanent wetlands which provide diverse habitats for a wide variety of aquatic and terrestrial flora and fauna (North Central CMA, 2014).

Geomorphology, topography and landform

Guttrum and Benwell Forests are within the Northern Riverine Plain (NRP). The NRP is a very extensive and complex alluvial plain associated with the Murray River.

The project area is located in the Murray Fans bioregion, which is characterised by a flat to gently undulating landscape on recent, unconsolidated sediments with evidence of former stream channels, braided old river meanders and paleochannels, and broad floodplains areas associated with major river systems and prior streams (DPI, 2009).

The topography of the Guttrum and Benwell Forests differ, Guttrum Forest has more variable elevation and Benwell Forest has a relatively flat elevation. The variable elevation in Guttrum Forest leads to several wetland depressions and a small number of channels that hold water during rainfall and flooding events. The two main semi-permanent wetland areas (Guttrum Swamp and Reed Bed Swamp) are connected at an intermediate level through a shared broad floodplain (North Central CMA, 2014d).

The flatter elevation in Benwell Forest means that the forest is made up of only two shallow depressions and a small number of channels that lie predominately within a single basin that is enclosed by the river levee to the north and east and by constructed levees to the south and west. Benwell Swamp represents the low-point of this basin and a natural rise in the floodplain surface separates Benwell Swamp from the south west corner of the forest (Ecological Associates 2013). The relatively flat topography results in water spreading thinly over a large area instead of pooling in confined spots (North Central CMA, 2014e).

Wetlands, waterways and drainage

The Guttrum and Benwell Forests comprise swampy low-lying habitats that include both permanent wetlands and semi-permanent wetlands (refer to **Attachment 5 – Waterways and Wetlands Map**).

Guttrum Forest

The Guttrum Forests comprises broad wetland systems; notably the Reed Bed Swamp, Little Reed Bed and Guttrum Swamp. At low Murray River levels, the low-lying riverbank inlet and outlet channels are the primary flow connections between the river and forest. Water initially flows through the north-western inlet/ outlet when flows reach approximately 16,000 ML/d downstream of the Barham gauge (at Koondrook). Below flows of 22,000 ML/d water ponds in low-lying areas in the Guttrum Swamp complex, between Smiths Drain (a former irrigation channel that divides Guttrum Swamp), the southern levee and the outlet (Guttrum Western). A break in Smiths Drain does allow some movement of water, but there is no continuous flow through to the rest of the swamp complex.

Once river flows exceed 22,000 ML/d water flows through the G1, G2 and G3 inlets flowing into the Reed Bed Swamp semi-permanent wetland complex, and connecting through low-lying runners into Guttrum Swamp, from the east. The forest starts to operate as a throughflow system, with a steady flow of water from the east to west, as these major inlets engage (NRE 1997; SKM 2007; Ecological Associates, 2013). Water then spreads across the floodplain inundating large areas of the River Red Gum forest with flood-dependent understorey.

On flood recession, water is retained in depressions throughout the forest, most notably including the Reed Bed and Guttrum Swamp (to depths in excess of 0.7-0.8 m, Ecological Associates, 2013). Other areas retain water at shallower depths and are more likely to dry out between inundation events.

Benwell Forest

Most of Benwell Forest lies within a single basin that is enclosed by the river levee to the north and east and by levees to the south and west (Ecological Associates, 2013). Benwell Swamp represents the low-point of this basin. A natural rise in the floodplain surface separates Benwell Swamp from a second, smaller basin in the south west corner of the forest (South West Benwell Swamp).

Similar to Guttrum Forest, as the water level rises in the Murray River water enters Benwell Forest through small floodplain creeks and flood runners. Water initially commences to flow through the western outlet (B13) when flows reach approximately 15,000 ML/d. At this flow water ponds in low lying semi-permanent wetlands in the northwest of the forest (Benwell Centre Swamp).

The inlet B7 to the northeast starts to flow at approximately 16,000 ML/d. At these river levels inflows are low, and it takes a long time for the flow to connect east and west i.e. B7 to B13 and inundate the lower lying areas. This means filling times for lower flow rates are comparatively long. For smaller floods with continuous low inflows, the forest operates as a throughflow system with inflows from the east flowing through the forest and returning to the Murray River through B13 (DHI, 2013).

On flood recession, water is principally retained in Benwell Swamp (to depths of 0.5 m) and the South West Benwell Swamp (to depths of 0.7 m, Ecological Associates, 2013).

Hydrogeology

The Guttrum and Benwell Forests are located in the Murray Geological Basin, which was infilled with sediments during the Tertiary and Quaternary period. The project area is underlain by shallow, relatively fresh, groundwater with direct connection to the Murray River. Depth to groundwater ranges between 5 – 9 m below the ground surface. **Figure 1** shows a generalised hydrogeological cross section for this area, identifying the main units and their relationships.

The shallow groundwater hydrogeological conditions of the project area comprise:

- The Quaternary aquifer: alluvial sedimentary deposits, consisting of fine-grained silts and clays overlying coarser-grained sediments that are part of the contemporary floodplain and the recent

Guttrum and Benwell Forests Floodplain Restoration Project

geological past, between 2 and 5 m thick across the project area. This unit is typically unsaturated in the project area (Dyson & Hocking, 2014).

- The Shepparton Formation Aquifer: a thick sequence of Upper Tertiary to Quaternary aged sediments, interpreted as consisting of an Upper and Lower Shepparton Formations in the project area:
 - Upper Shepparton Formation: Generally fine grained sediments, with occasional shoestring sands throughout. The sand lenses are thought to be limited in connection and appear to be small and discrete, representing paleochannels of the river. This formation is a regional aquifer and is typically saline or brackish in water quality. The sub-unit is between around 10 and 20m thick under the project area and holds the watertable in the project area (Dyson & Hocking, 2014).
 - Lower Shepparton Formation - Yando Clay: Heavy, grey clay, equivalent in age to the Loxton-Parilla Sand. At least 35 m thick across the project area and acts to limit vertical flow between the Upper Shepparton Formation the underlying Calivil/Renmark Formations (Dyson & Hocking, 2014).

The Quaternary aquifer (Coonambidgal Formation) is present across almost all of the project area and aligns with the southern boundary of the forest extents. In the south of the Benwell Forest, where available geological mapping shows the Upper Shepparton Formation outcropping at the surface (FedUni, 2015), the interpretation of bore logs from North Central CMA's 2014 work suggests that the Coonambidgal Formation may be present further south than geological mapping may indicate (HGEC, 2014). The presence of the clay matrix in the Quaternary aquifer may act to impede infiltration of groundwater from the surface into the underlying Upper Shepparton Formation and the watertable. The Yando Clay is also expected to impede vertical groundwater flow between the Upper Shepparton Formation and underlying aquifers, and preference lateral groundwater flow of the Upper Shepparton to and from the Murray River (Dyson & Hocking, 2014).

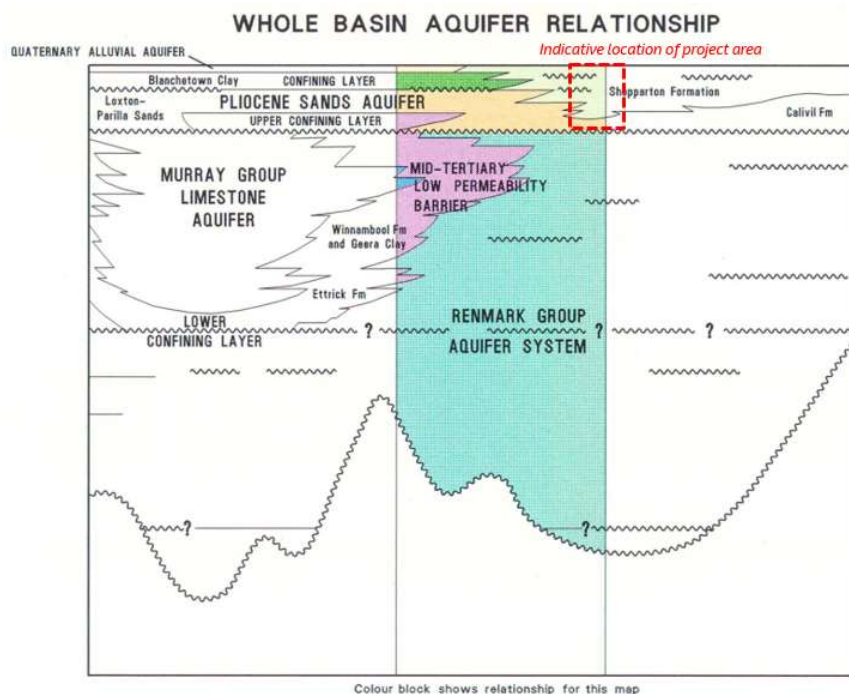


Figure 1: Representative cross section of Guttrum and Benwell Forests hydrogeology (Indicative project area marked – Source: Swan Hill 1:250,000 Hydrogeological Map)

Guttrum and Benwell Forests Floodplain Restoration Project

Regional groundwater flow is generally to the north-west, parallel to the course of the Murray River. However, it is expected that there would be localised flow toward the Murray River with flow cells that may change the local flow direction.

Further detail on the hydrogeological environment is provided in **Attachment 6 – Desktop Groundwater Assessment**.

Salinity

Groundwater salinity in the watertable aquifer across the project area has been measured as low to moderate, typically 300 – 1,400 mg/L (NCMA, 2014a). While salinities in the underlying Yando Clay are significantly higher (7,200 – 15,600 mg/L), and groundwater gradients between this unit and the Upper Shepparton Formation indicate an upward flux, the low permeability of the Yando Clay is thought to be limiting the vertical flow of more saline groundwater into the watertable (Dyson & Hocking, 2014).

Soil salinity at the site is at low (most of the area is below 100 t/ha/m) to occasionally moderate (up to 200 t/ha/m) levels. Soil salinity has been mapped for the site and for the riverine corridor in the area by airborne electromagnetic surveys (AEM). The project area falls in the Barr Creek to Gunbower (North) AEM survey area (Cullen et al. 2008).

Figure 2 shows the interpreted salt loads in the area from the AEM survey which are predominantly low for this region. The risk of salinity mobilisation from either the soil surface or from shallow groundwater to return to the Murray River is also considered low (R8, 2020a).

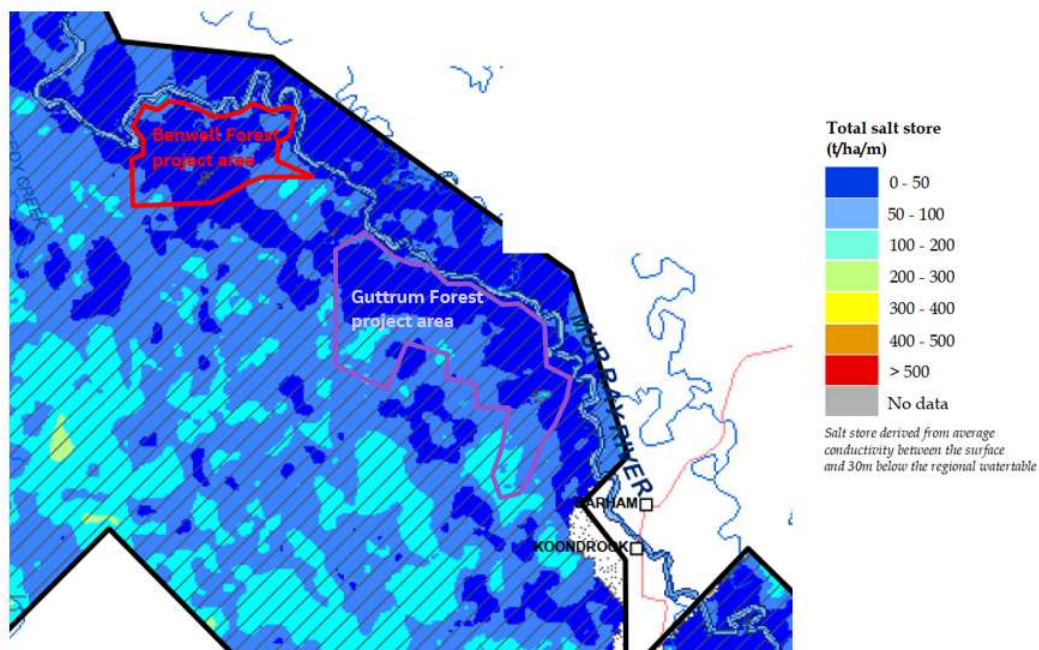


Figure 2 Interpreted salt store in the unsaturated zone for the project area (R8 2020a, originally from Cullen et al. 2008)

Vegetation and habitat

Guttrum and Benwell Forests provide a diversity of habitats including River Red Gum floodplain forest and woodland ecosystems, and complexes of shallow semi-permanent wetlands. The semi-permanent wetlands, or swamps, are characterised by open water, marshland, reed bed and herbland vegetation, fringed with River Red Gum (North Central CMA, 2014). The forests support a wide range of water-dependent communities and species; many listed as rare or threatened under state and national legislation and contain representative floodplain vegetation (Bennetts 2014).

Guttrum and Benwell Forests Floodplain Restoration Project

The forests are located within the Murray Fans Bioregion, one of three bioregions along the Murray River floodplain. The Murray Fans Bioregion supports a mosaic of Plains Grassy Woodland, Pine Box Woodland, Riverina Plains Grassy Woodland and Riverina Grassy Woodland Ecological Vegetation Classes (VEAC, 2008) which help to maintain the ecological diversity of the bioregion by supporting vegetation communities representative of it. A summary of the EVCs making up the 1,149 hectares of vegetation within the managed inundation area is outlined in **Table 12**.

Table 12: EVC extent (Biosis, 2014b) (hectares) within managed inundation area

Water Regime Class	Ecological Vegetation Class	Biodiversity conservation significance	EVC extent within inundation area (hectares) (Biosis 2014b)
Permanent Wetlands	EVC 653 – Aquatic Herbland	Depleted	0.09
Semi-permanent Wetlands	EVC 819 - Spike-sedge Wetland	Vulnerable	24.03
	EVC 821 - Tall Marsh	Least Concern	21.67
Red Gum Forest with Flood-dependent Understorey	EVC 814 - Riverine Swamp Forest	Depleted	705.05
	EVC 945 - Floodway Pond Herbland/Riverine Swamp Forest Complex	Depleted	208.79
Red Gum Forest with Flood-tolerant Understorey	EVC 106 - Grassy Riverine Forest	Depleted	128.92
	EVC 295 - Riverine Grassy Woodland	Vulnerable	22.49
	EVC 816 - Sedgy Riverine Forest	Depleted	38.52
TOTAL			1,149 (rounded)

A significant number of large old River Red Gums (>100cm DBH) are present within Guttrum and Benwell Forest. These trees were established prior to European settlement, which has significance in the area as large or River Red Gums in other nearby River Red Gum forests such as Gunbower Forest have been harvested or ringbarked to promote mill timber (Bennetts 2014). Healthy trees of this stature provide valuable habitat for birds and marsupials (Biosis 2014b), and have a key role in maintaining the diversity of ground- and understorey, species by outcompeting other saplings and maintaining the open, widely spaced woodland character of the forest (North Central CMA, 2014).

The habitats across the forests also support a number of native frogs and reptiles and would have benefited from the dense reedy vegetation and sustained flooding that previously existed in the semi-permanent wetlands (Ecological Associates, 2014). Two other water-dependent vertebrate species recorded within and adjacent to the forests include the FFG Act listed Broad-shelled Turtle and the Common Long-necked Turtle (North Central CMA, 2013).

Further detail on the flora and fauna present within the Guttrum and Benwell Forests is provided in Part 1, Section 8 (Existing environment), and also Part 2, Section 12 (Native vegetation, flora and fauna) of this referral.

Site area (if known): (hectares)

Design of the project infrastructure is currently being refined as part of the design process and in response to environmental and cultural heritage studies. An area of investigation of 64.15 hectares has been established and assessed at a desktop level for the purposes of this referral. This area of investigation is the area within which future design changes are anticipated to occur.

The proposed construction footprint is located within the area of investigation and is based on the current design. This has an area of approximately 15.28 hectares (which includes approximately 6.13 hectares of

Guttrum and Benwell Forests Floodplain Restoration Project

access tracks). The construction footprint has provided the basis for ecology fieldwork and native vegetation removal calculations described in Part 2, Section 12 (Native vegetation, flora and fauna) of this referral.

The location and size of any borrow pits / quarry sites is yet to be determined. The locations will be located as close as possible to the project, on private land outside of Guttrum and Benwell Forests, while also avoiding and minimising impacts.

The Guttrum Forest inundation area is approximately 668 hectares. The Benwell Forest inundation area is approximately 481 hectares.

(Refer to **Attachment 1, Map 2 – Project structures, construction and access** and **Attachments 1, Map 3 – Managed Inundation Area**).

Route length (for linear infrastructure) (km) **and width** (m)

N/A

Current land use and development:

The project is predominately located on Crown land, on State Forests managed by DELWP and the linear Murray River Reserve abutting the Murray River managed by Parks Victoria. All of the Crown land is associated with the Guttrum and Benwell Forests, which are reserved under the Crown Land (Reserves) Act 1978. The project also involves some works on and inundation of freehold land (as described in Section 9).

The Guttrum and Benwell Forests are located off Koondrook-Murrabit Road between the townships of Koondrook and Murrabit. The area of Koondrook has a long history of timber harvesting and dairy farming, from as far back as the 1800's. Timber harvesting in the area is now focused on selective harvesting of local forests to produce high quality building products.

Dairy and cropping are currently the prominent agricultural activities of the region and solar farming is a growing activity within the region.

The Murray River Reserve and the Guttrum Forest and Benwell Forest are highly valued for recreation activities such as camping, fishing, canoeing, trail-bike riding and horse riding. The area also forms part of the Murray River Trail for tourism and recreation purposes and provides direct access to the Murray River for water-based activities and river camping or caravanning. The Gannawarra Shire Council have committed to supporting and promoting nature-based tourism within this area.

Description of local setting (eg. adjoining land uses, road access, infrastructure, proximity to residences & urban centres):

The Guttrum and Benwell Forests are located between Koondrook and Murrabit, within the Local Government Area of Gannawarra. A bridge over the Murray River at Koondrook provides direct connection to the NSW town of Barham which is a larger town across the Victorian/NSW border. Both towns form the commercial centre for the region's timber, citrus groves, and cattle and dairy production. Guttrum and Benwell Forests are also an important source of timber for the River Red Gum timber sawmill in Koondrook.

The Gannawarra Shire Council has a strategic objective to develop new businesses and grow tourism and existing businesses as part of strategic regional projects. The development of the Koondrook Wharf is a regional project undertaken as part of this strategic plan and is aimed specifically at further development of tourism in the area. The township and surrounding area contain a number of tourist accommodation facilities and a caravan park along the banks of the Murray River.

The surrounding area of Guttrum and Benwell Forest (i.e. Koondrook and Murrabit) now supports close to 1,000 people (ABS, 2016), along with a growing recreational tourism industry and the surrounding agricultural production in dairy and mixed farming.

The small town of Murrabit is the closest population hub to the project area. The town and surrounding area have a population of just 200 (ABS, 2016) and is declining. It is known as a major citrus producing area with many orchards and packing sheds.

The project is located off Koondrook–Murrabit Road, accessible from the Murray Valley Highway at Cohuna and the Loddon Valley Highway at Kerang. The project is located at least 20 km from Kerang (to the south west) and Swan Hill (to the north-west).

Planning context (eg. strategic planning, zoning & overlays, management plans):

A desktop land use planning assessment has been prepared and is provided in **Attachment 7 – Land Use Planning Assessment**.

Gannawarra Planning Scheme

The project is situated within the Shire of Gannawarra and is therefore subject to the provisions of the Gannawarra Planning Scheme.

Planning Policy Framework

The Planning Policy Framework relevant to the project under the planning scheme is discussed in Section 4.1 of **Attachment 7 – Land Use Planning Assessment**.

Zones and overlays

The following zones and overlay apply to the land in the project area:

- Public Conservation and Resource Zone (PCRZ)
- Farming Zone (FZ)
- Road Zone, Category 1 (RDZ1)
- Environmental Significance Overlay (Schedule 1 – Waterway, Wetlands and Lakes Environs) (ESO1)
- Environmental Significance Overlay (Schedule 4 – Areas of Poor Drainage or Potentially Subject to Inundation) (ESO4)
- Vegetation Protection Overlay (Schedule 1 – Roadside and Corridor Protection) (VPO1)
- Specific Controls Overlay (Schedule 2 – Goulburn -Murray Water Connections Project Incorporated Document, June 2020) (SCO2)
- Public Acquisition Overlay (Schedule to Public Acquisition Overlay – Goulburn-Murray Water Benwell Primary Surface Water Management System) (PAO2)
- Land Subject to Inundation Overlay (LSIO)
- Bushfire Management Overlay (BMO)

Planning permit triggers

In accordance with the controls identified in **Table 13** the project will require planning approval in relation to;

- Use
- Buildings and works, including earthworks

Guttrum and Benwell Forests Floodplain Restoration Project

- Removal, destruction or lopping of native vegetation
- Removal, destruction or lopping of any vegetation, including dead vegetation in ESO1.

Table 13: Summary of potential planning permit triggers.

Gannawarra Planning Scheme	Planning approval trigger (Y/N/NA)		
	Use	Buildings and works	Vegetation removal
Clause 36.03 Public Conservation and Resource Zone (PCRZ)	Y	Y	NA
Clause 35.07 Farming Zone (FZ)	Y	Y	NA
Overlays			
Clause 42.01 Environmental Significance Overlay (Schedule 1 Waterway Environs) (ESO1)	NA	N	Y
Clause 42.01 Environmental Significance Overlay (Schedule 4 Areas of Poor Drainage or Potentially Subject to Inundation) (ESO4)	NA	N	Y
Clause 42.02 Vegetation Protection Overlay (Schedule 1 – Remnant Vegetation) (VPO1)	NA	N	Y
Clause 45.01 Public Acquisition Overlay (Schedule to the Public Acquisition Overlay PAO2)	N	N	N
Clause 45.12 Specific Controls Overlay	Y	Y	Y
Clause 44.04 Land Subject to Inundation Overlay, Schedule to the Land Subject to Inundation Overlay (LSIO)	NA	Y	N
Clause 44.04 Bushfire Management Overlay (BMO)	NA	N	N
Particular provisions			
Clause 52.17 Native Vegetation	NA	NA	Y

Relevant strategies and management plans

The following strategies and plans provide land use and planning objectives and plans for action associated within the region:

- Gannawarra Urban and Rural Strategy Plan 2007
- North Central Regional Floodplain Management Strategy, 2018 - 2028
- North Central Waterway Strategy 2014-2022
- DRAFT North Central CMA Regional Catchment Strategy (for consultation)
- North Central CMA Regional Catchment Strategy 2013-19
- Parks Victoria River Red Gum Parks Management Plan, July 2018
- Conservation Action Plan for River Red Gum Parks and Reserves managed by Parks Victoria, December 2019

NSW Planning Framework

Works within NSW are associated with two pump stations and one drop structure on the Murray River at Guttrum Forest and one pump station and two drop structures on the river at Benwell Forest. Construction of the pump stations within the Murray River and its bank would include excavation and construction of intake

Guttrum and Benwell Forests Floodplain Restoration Project

pipes near the edge of the bank profile. Works for the drop structures would involve modifying the existing outlet channel and extending the section of rock mattress erosion protection into the Murray River.

Development in NSW is assessed in accordance with the provisions of the NSW *Environmental Planning and Assessment Act 1979* (NSW EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The EP&A Act institutes a system for environmental assessment, including approvals and environmental impact assessment for proposed developments. The need or otherwise for development control is set out in environmental planning instruments.

The intake pipes and the drop structures would be located on land that is zoned W1 Natural Waterways under the Wakool Local Environmental Plan 2013. No activities are permitted without development consent within the W1 zone (**Attachment 7 – Land Use Planning Assessment**).

As the proposed intake pipes and drop structures would be used to transport water and would be part of a water reticulation system (clause 125(5)(e)) these would be permissible with development consent due to the application of clause 126A.

The proposed work would be undertaken in the Murray River Council area. A development application would need to be submitted to the Murray River Shire Council as the consent authority, and this would need to be supported by a Statement of Environmental Effects that addresses section 4.15 of the NSW EP&A Act.

Local government area(s):

Gannawarra Shire Council in Victoria.

Murray River Council in NSW.

8. Existing environment

Overview of key environmental assets/sensitivities in project area and vicinity (cf. general description of project site/study area under section 7):

Key environmental assets, values and uses include:

- The project area is predominantly located within the confines of two State Forests (Guttrum Forest and Benwell Forest) reserved under the *Crown Land (Reserves) Act 1978* for protection of its natural features (Murray River floodplains), but with smaller development on parcels of freehold (privately owned) land.
- Both Guttrum and Benwell Forests are currently used for timber harvesting and domestic timber collection, as part of the mid-Murray Forest Management Plan Area. There are no quantified figures available for the current volume of timber extracted from these forests but both Guttrum and Benwell Forests are increasingly valuable for this resource given that timber harvesting is now prohibited in the nearby Gunbower National Park (North Central CMA, 2014).
- No EPBC Act listed flora communities are likely to occur in the construction footprint or within the inundation extent. Two FFG Act listed fauna communities are present; Victorian Temperate Woodland Bird Community (VTWBC) and Lowland Riverine Fish Community of the Southern Murray-Darling Basin.
- Two EPBC Act listed flora species, River Swamp Wallaby-grass (*Amphibromus fluitans*) and Winged Peppergrass (*Lepidium monoplacoides*), two FFG Act and DELWP Advisory listed species (Wavy Marshwort and Winged Peppergrass) and a further 10 species listed on the DELWP Advisory list have the potential to occur in the project area.

Guttrum and Benwell Forests Floodplain Restoration Project

- Eight EPBC Act listed threatened fauna species, 30 FFG Act listed and 46 DELWP advisory listed threatened species are known to occur or are possible to occur in the project area. This includes EPBC Act species: South-eastern Long-eared Bat (*Nyctophilus corbeni* Vulnerable), Australasian Bittern (*Botaurus poiciloptilus* Endangered), Australian Painted Snipe (*Rostratula australis*), Painted Honeyeater (*Grantiella picata* Vulnerable), Superb Parrot (*Polytelis swainsonii* Vulnerable), Silver Perch (*Bidyanus* Critically Endangered), Murray Cod (*Maccullochella peelii* Vulnerable) and Growling Grass Frog (*Litoria reniformis* Vulnerable).
- Eleven migratory species listed by the EPBC Act have been identified through a PMST and VBA search of the project area. One additional migratory species (Glossy Ibis *Plegadis falcinellus*) was observed during field assessment. Of these species, there were records and suitable habitat for Marsh Sandpiper (*Tringa stagnatilis*), Common Greenshank (*Tringa nebularia*) and Glossy Ibis.
- The project area is located in an area of Cultural Heritage Sensitivity, with 45 registered Aboriginal Places identified in the vicinity of the project area.
- The project area is not located within any wetlands listed under the Ramsar Convention of A Directory of Important Wetlands (DIWA) in Australia.
- The project area is identified by the Environmental Significance Overlay (Schedule 1 – Murray River Corridor) (ESO1) as having environmental values of state and regional importance.
- The majority of the area of investigation is located within the Public Conservation and Resource Zone, however some Farming Zoned land is also within the area of investigation. The project area is subject to an Environmental Significance Overlay (ESO1 Waterway Environs), Environmental Significance Overlay (ESO4 Areas of Poor Drainage or Potentially Subject to Inundation), Land Subject to Inundation Overlay (LSIO), Vegetation Protection Overlay (VPO1), and Bushfire Management Overlay (BMO) under the Gannawarra Planning Scheme.

9. Land availability and control

Is the proposal on, or partly on, Crown land?

No Yes If yes, please provide details.

The project is predominantly located within State Forests on Crown land, however the project does involve some works on and inundation of freehold land.

Crown land parcels associated with the area of investigation are reserved under the *Crown Land (Reserves) Act 1978* and the *Forests Act 1958*. A number of parcels are reserved as 'Temporary Forest and the remainder of the Crown land is reserved as 'Permanent Public Purpose' for uses such as camping grounds, parks and other public purposes. DELWP and Parks Victoria will need to confirm the most current reservation and the consents required in relation to the appropriate act that applies.

The location of Crown land affected by the project is shown in **Attachment 7 – Land Use Planning Assessment**.

Current land tenure (provide plan, if practicable):

The construction footprint occurs within both Crown land and freehold land within Victoria, with the exception of a small portion of the construction footprint which extends into NSW. Works on freehold land within Victoria includes the construction of access tracks in Guttrum Forest (four land parcels) and the construction of containment banks, laydown area, pipelines, outlets and access tracks in Benwell Forest (seven land

Guttrum and Benwell Forests Floodplain Restoration Project

parcels). Works for the potential levees in Guttrum Forest, if required, would be located on two additional private land parcels.

Works within NSW are associated with three pump stations within the Murray River and two drop structures.

The proposed inundation area is located entirely within Victoria as shown in **Attachment 1, Map 3 – Managed Inundation Area**). The inundation area falls entirely within Crown land.

Further detail on the location and tenure of land parcels within the construction and inundation area is provided in **Attachment 7 – Land Use Planning Assessment**.

Intended land tenure (tenure over or access to project land):

The project does not propose any changes to current land tenure.

Other interests in affected land (eg. easements, native title claims):

A search of the National Native Title Tribunal (NNTT) online register and maps shows:

- No current native title applications under the *Native Title Act 1993* apply over the area of investigation
- No previous native title claims have been determined under the *Native Title Act 1993* (Cth) in relation to land within or adjacent to the area of investigation
- The following two Indigenous Land Use Agreements (ILUA) apply to the whole of the area of investigation and inundation area):
 - Agreement V12004/010, registered in 2006 in response to low impact exploration and mining on land associated with the Wamba Wemba, Barapa Barapa and Wadi Wadi Peoples. This agreement covers a wide area west of the Murray River.
 - Agreement V12011/001, registered in 2011 in response to regional mining and exploration of the ILUA registered land associated with the Wamba Wemba, Barapa, Barapa and Wadi Wadi Peoples. This agreement is localised to the project area.

A search of the Victorian Department of Justice and Community Safety website indicates that no current applications or registered agreements under the *Traditional Owner Settlement Act 2010* (Vic) apply over land within or adjacent to the area of investigation (DoJCS, 2020).

Other relevant features

The region also supports other features that form an important part of the general land use of the project area and surrounds:

- The project is located within the Torrumbarry Irrigation Area (TIA) as defined by the DELWP. The TIA lies directly to the west of the project inundation area and is part of the largest irrigation system in Victoria – the Goulburn-Murray Irrigation District (GMID) managed by Goulburn Murray Water. The GMID accounts for more than 70% of water storages and some 90% of water used in irrigation across the state. Approximately 2000 landowners rely on this system for farming within the area
- Current public data indicates the location of 11 apiary sites located across the Guttrum and Benwell Forests. The hives are part of annual licence agreements that are dependent on seasonal flowering of River Red Gum forests. Bees rely on adequate water source to thrive, and so it is expected that the objectives of the project will increase the regularity and reliability of flowering. Apiary licence holders will be consulted, in conjunction with DELWP and Parks Victoria as the public land manager, to identify opportunities to minimise disruption to apiary activities during managed inundation events.

- The Murray River Reserve is managed by Parks Victoria and the remaining area of Guttrum Forest and Benwell Forest are managed by DELWP. The area is highly valued for recreation activities such as camping, fishing, canoeing, trail-bike riding and horse riding.
- The area also forms part of the Murray River Trail for tourism and recreation purposes and provides direct access to the Murray River for water-based activities and river camping or caravanning. The Gannawarra Shire Council have committed to supporting and promoting nature-based tourism within this area.

10. Required approvals

The following Victorian and Commonwealth referrals, notifications and approvals are likely to be required for the project:

Commonwealth

- Referral to the Minister for the Environment under the EPBC Act to determine whether the project is a controlled action requiring formal assessment and approval under the Act (concurrent to this referral)
- Notification of a 'future act' under the *Native Title Act 1993* for activities on Crown land that may affect native title rights and interests
- Notification of the MDBA of a proposal which may affect the flow, use, control or quality of any water in the upper River Murray under clause 49 of Schedule 1 of the *Water Act 2007*

Victoria

- Referral (this document) to the Minister for Planning (via DELWP) under the *Environment Effects Act 1978* to determine whether or not an Environment Effects Statement is required for the project
- A planning scheme amendment or planning permit under the Gannawarra Planning Scheme, pursuant to the *Planning and Environment Act 1987*
- A Cultural Heritage Management Plan approved by Aboriginal Victoria (there is no Registered Aboriginal Party) under the *Aboriginal Heritage Act 2006* and *Aboriginal Heritage Regulations 2018*
- A license or lease from Parks Victoria and DELWP under the *Forests Act 1958* and section 17 of the *Crown Land (Reserves) Act 1978*
- License to take and use water (s51) and license to construct works (s67) to take water from Goulburn Murray Water under section 51 of the *Water Act 1989*
- Works on waterways permit from North Central CMA of the *Water Act 1989*
- Permit to take protected flora on Crown land from DELWP under the *Flora and Fauna Guarantee Act 1988*
- Potential need for a Work Plan and/or Work Authority under the *Mineral Resources (Sustainable Development) Act 1990* for potential borrow sites / quarry sites – noting the location and therefore potential approval requirements for borrow/quarry sites are yet to be determined.

Other legislation

Other environmental legislation of potential relevance to the project includes, but is not limited to:

Commonwealth

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

Victorian

- *Catchment and Land Protection Act 1994*
- *Environment Protection Act 2007 (and Environment Protection Act 2017)*
- *Fisheries Act 1995*
- *Heritage Act 2017*
- *Land Act 1958*
- *Road Management Act 2004*
- *Wildlife Act 1975.*

NSW

- *Biodiversity Conservation Act 2013*
- *Crown Lands Management Act 2016*
- *Environmental Planning and Assessment Act 1979*
- *Fisheries Management Act 1994*
- *Maritime Safety Act 1998.*
- *National Parks and Wildlife Act 1974*
- *Water Management Act 2000*

Have any applications for approval been lodged?

No Yes If yes, please provide details.

No applications for approval of the project have been lodged to date.

Approval agency consultation (agencies with whom the proposal has been discussed):

The VMFRP is managed by a partnership team comprised of LMW, GMW, North Central CMA, Mallee CMA and Parks Victoria. Each of these agencies are represented on the VMFRP Program Control Group, but also have a separate regulatory approvals function for the VMFRP projects. DELWP Water is the Program Owner. DELWP also has a separate regulatory approvals function for the VMFRP projects.

As part of broad stakeholder engagement activities undertaken between 2012 and 2014 to support the Guttrum and Benwell Forests Floodplain Management SDL Project Business Case, North Central CMA also consulted with Gannawarra Shire Council, GMW, DELWP and Parks Victoria.

During 2015 to 2017, engagement activities were undertaken in the form of monthly Steering Committee meetings with North Central CMA, Murray-Darling Basin Authority, Parks Victoria, GMW and DELWP.

The VMFRP has since established a Technical Advisory Group – Regulatory Approvals Committee (Approvals TAG) to advise on regulatory approval requirements through the planning and design of the

Guttrum and Benwell Forests Floodplain Restoration Project

project. In addition to the partnership agencies, regulatory approval agencies currently represented on the Technical Advisory Group include:

- Aboriginal Victoria
- DELWP (Impact Assessment Unit, Planning, Regional)
- Department of Agriculture, Water and the Environment (DAWE)

An overview of the Project was presented to the TAG at a meeting held on 8 August 2019.

In addition, a Design TAG operates concurrently which has representation from VMFRP and the following agencies:

- DELWP
- GMW
- LMW
- Mallee CMA
- North Central CMA
- Murray-Darling Basin Authority
- Parks Victoria
- SA Water

PART 2 POTENTIAL ENVIRONMENTAL EFFECTS

11. Potentially significant environmental effects

Overview of potentially significant environmental effects (identify key potential effects and comment on their significance and likelihood, as well as key uncertainties):

An assessment of the potential construction and operational impacts of the project has been undertaken and is detailed in Parts 12 – 16 of this Referral Form. Key potential effects are summarised below.

Impacts on native vegetation

Native vegetation within the proposed construction footprint has been subject to desktop and field assessment. Vegetation communities within the inundation area have been identified based on modelled previous field mapping EVC data (Biosis, 2014). Refer **Attachment 3 – Flora and Fauna Assessment**.

Construction

Efforts have been made to avoid and minimise impacts to native vegetation throughout the project planning and design process. Impact avoidance and minimisation measures include:

- Locating infrastructure (for example embankments) on top of existing vehicle tracks and other previously disturbed areas. The embankments would continue to be used as vehicle access tracks.
- Minimisation of bank height (freeboard) to the minimum height required to retain functionality, after considering wear and wave impacts.
- Minimisation of bank crest width to achieve the relevant track design speed.
- Adopting the steepest batter slope which still meets embankment stability and road safety requirements (3H:1V) in order to minimise the footprint of the structure.

Despite the measures taken to avoid and minimise impacts to native vegetation it is not feasible to construct the required infrastructure without removing native vegetation. As the design for the project progresses, there will be opportunity to further refine construction footprints around infrastructure. The current construction footprint does not include power supply and associated poles, stays or cables due to their location being currently unconfirmed. Levees, which are subject to further risk assessment and therefore not confirmed, are also not included in the construction footprint. As such, requirements for vegetation removal would be further assessed and minimised through the design process.

The approach taken to the estimation of vegetation impacts involves two main components, (1) vegetation impacted for project infrastructure, and (2) vegetation impacted for access:

- Up to 7.74 hectares of native vegetation within the construction footprint would potentially require removal as a result of the construction of project infrastructure. However, this is a conservative estimate and has been based on a buffer around the project's development footprint to allow for construction activities. The project's development footprint is 4.64 hectares.
- Up to 5.96 hectares of vegetation has been calculated within the project's access tracks which includes native vegetation surveyed (Biosis, 2014) within the 5 m buffer along the access track (i.e. 2.5 m from centre line of existing road). This total does not include impacts to canopy trees along access tracks, which are considered separately. Part of this area would consist of the existing access tracks, which have been previously cleared. The scope and requirement for works along access tracks is still to be confirmed and would be designed to avoid and minimise native vegetation removal to the extent practicable. Given works are generally proposed to upgrade existing access tracks only (with the exception of a small number of sections of new access tracks between existing access tracks and proposed infrastructure and associated with containment banks), these works will

be limited to minor maintenance and upgrades that require minimal if any vegetation clearance (lopping rather than removal).

The combined estimate of impact on native vegetation is 13.70 hectares (7.74 + 5.96) including 219 large trees (refer to **Table 14**). This does not include native vegetation clearance associated with power supply and levee works which are subject to further risk assessment. If levee works are required, this would involve works along approximately 1.5 to 3 kilometres of the total 16 kilometres (10 kilometres for Guttrum, and 6 kilometres for Benwell) of existing, previously disturbed, levee banks in Guttrum and Benwell Forest. The potential levee works represent between 9 to 18% of the existing levee network in the Forests.

Additional details on the potential vegetation impacts are provided in Section 12, including the vegetation communities proposed to be impacted.

It is noted that there is an area of the vulnerable Riverine Grassy Woodland (EVC295) within the construction footprint of the proposed site office and laydown area, however this area has experienced significant disturbance associated with existing access tracks and therefore not in good condition. Future design will consider avoiding where possible, or minimising impacts on this EVC. The mitigation measures outlined in Part 2 (Environmental management) of this referral would assist in minimising and avoiding impacts to this EVC.

From a landscape perspective, the proposed construction footprint represents a comparatively small area within the ~ 1,930 hectare Guttrum and Benwell Forests, and in comparison to the 1,149 hectare inundation area.

Operation

All EVCs mapped as present within the inundation area are swampy or riverine vegetation communities that require or are tolerant of inundation. The condition of these vegetation communities is expected to improve as a result of environmental water delivery that restores a more natural inundation regime, as demonstrated at the nearby Gunbower Forest TLM site. No obligate dryland communities are mapped as occurring within the inundation area that may be adversely impacted by the proposed inundation.

Potential impacts on listed threatened species and communities

The proposed construction footprint has been subject to targeted flora and fauna surveys. Previous ecological studies (identified in Section 12.2, **Table 15**) were used to inform the additional targeted threatened flora and fauna surveys. Flora surveys were in October and November 2019 and targeted fauna surveys were undertaken in October 2019. A desktop assessment of potential impacts on listed threatened species and communities has been carried out for the inundation area. Refer **Attachment 3 – Flora and Fauna Assessment**.

Listed threatened communities

Vegetation mapped or modelled within the construction footprint and inundation area has been assessed and is not consistent with any EPBC Act or FFG Act listed threatened ecological communities.

One FFG listed fauna community was identified in the desktop assessment as being present (Victorian Temperate Woodland Bird Community) in the project area. Bird species of this FFG-listed fauna community are highly mobile and impacts as a result of the Project are expected to be negligible in the short-term. This is due to the availability of significant River Red Gum open woodland and forest, with an abundance of tree hollows for nesting sites and fallen timber still being available within the forest. Seasonal restrictions will be implemented for removal of hollow-bearing trees to avoid breeding periods when these species are more vulnerable to impacts. Long term, the community is likely to benefit from the project with improvements to its habitat expected from environmental watering.

There is also one FFG listed fish community identified in the desktop assessment as being present (Lowlands Riverine Fish Community of Southern Murray-Darling Basin). Impacts to this community are likely

to be low due to mitigation measures proposed for construction works and operation. Managed inundation will adopt strategies to minimise the likelihood of fish entrainment and colonisation of floodplain environments during managed events (e.g. fish screens on pump stations). Managed drawdown as part of the fish exit strategy (North Central CMA, 2020) proposed provides opportunities for fish that do access the floodplain to return to the Murray River. Potential exposure to poor water quality (from floodplain return flows) will be managed through monitoring of potential hypoxic blackwater and drawdown strategies that maximise dilution potential.

Listed threatened flora species

No EPBC listed flora species were identified at the time of the recent field surveys (2019). However, two species, River Swamp Wallaby-grass and Winged Peppergrass, are considered likely to occur within the project area. The River Swamp Wallaby-grass was previously recorded in the wetland areas outside of the construction footprint in the inundation area (e.g. Reed Bed Swamp, Little Reed Bed Swamp, Benwell Swamp and South West Benwell Swamp), and the Winged Peppergrass, although not recorded in field surveys of the area is considered likely to occur in areas of the upper terrace of the forests. Given these two species have not been recorded in the construction footprint, they are unlikely to be impacted by the project construction. Both species are flood responder species and therefore will benefit from environmental watering.

No FFG Act listed species were identified within the construction footprint during recent field surveys, however a small number of Wavy Marshwort (FFG Act listed and included in the DELWP Advisory List) has previously been recorded (Biosis 2014, VBA 1989) near the proposed regulator site at Benwell Forest (Benwell site B13) included in the Business Case. This area is no longer in the construction footprint as design has progressed and removed the need for this regulator, therefore it is only present in the inundation area. As an obligate wetland species Wavy Marshwort is likely to benefit from the environmental watering. The other FFG Act listed species (Winged Peppergrass) is also considered likely to occur, as described above.

Four flora species included in the DELWP Advisory List for threatened flora were recorded within the construction footprint during the 2019 surveys or previous surveys (Biosis, 2014a); Leek Flax-Lily, Bulging Fireweed and Branching Groundsel, Riverina Bitter-cress (Biosis, 2014a) (**Table 15**) (Section 12.2). Where possible, these four species would be avoided and fenced off during construction. These species are likely to occur within elevated areas of the forests and therefore unlikely to be impacted by environmental watering.

Listed threatened fauna species

Desktop searches identified 60 threatened fauna species that have been recorded or have the potential to occur within 10 kilometres of the project area. Of these species, 49 are considered possible to occur or are known to be present within the project construction footprint or inundation area. These species are identified in **Table 16** (Section 12.2) and includes eight listed under the EPBC Act, 30 listed under the FFG Act, 46 DELWP advisory listed threatened species. Each of these 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 project area.

Fifteen of these threatened fauna species have been assessed as having the potential to be impacted by the project including:

- Bearded Dragon (*Pogona barbata*) – DELWP Advisory Vulnerable
- Broad-shelled Turtle (*Chelodina expansa*) - FFG Act listed, DELWP Advisory Endangered
- Brown Toadlet (*Pseudophryne bibronii*) – FFG Act listed, DELWP Advisory Endangered
- Carpet Python (*Morelia spilota metcalfei*) – FFG Act listed, DELWP Advisory Endangered

Guttrum and Benwell Forests Floodplain Restoration Project

- Freshwater Catfish (*Tandanus tandanus*) – FFG Act listed, DELWP Advisory Endangered
- Golden Perch (*Macquaria ambigua*) - DELWP Advisory Near Threatened
- Lace Monitor (*Varanus varius*) - DELWP Advisory Endangered
- Murray Cod (*Maccullochella peelii peelii*) – EPBC Act Vulnerable, FFG Act listed, DELWP Advisory Vulnerable
- Murray Crayfish (*Euastacus armatus*) – FFG Act listed
- Murray Darling Rainbowfish (*Melanotaenia fluviatilis*) – FFG Act listed, DELWP Advisory Vulnerable
- Murray River Turtle (*Emydura macquarii*) – DELWP Advisory Vulnerable
- Silver Perch (*Bidyanus bidyanus*) – EPBC Act Critically Endangered, FFG Act listed, DELWP Advisory Vulnerable
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) EPBC Act Vulnerable, FFG Act listed, DELWP Advisory Endangered
- Southern Myotis (*Myotis Macropus*) - DELWP Advisory Near Threatened
- Squirrel Glider (*Petaurus norfolkensis*) - FFG Act listed, DELWP Advisory Endangered

Possible impacts to these species are not expected to be significant provided the recommended mitigation measures are implemented (refer to Section 12 – Proposed Mitigation).

Silver Perch, Murray Cod and Golden Perch, were considered unlikely to be significantly impacted by construction and operation of the project. These species are main-channel specialists with suitable habitat limited to the Murray River. Construction along the river is limited to a small section of the overall area of available habitat for the species and the use of partial coffer dams (i.e. does not extend across full width of river) will ensure that fish passage is maintained in the river and water quality impacts from construction activities able to be managed. Any potential for sediment/ contaminant run-off into wet areas from construction footprint would be managed with consideration of these species. A construction specific aquatic fauna management plan (as part of the CEMP) would be developed and implemented to mitigate impacts for all works around waterways.

Potential operational impacts will be also be managed to reduce risk to fish species. Pump stations will be constructed with fine fish screens that minimise entrainment of fish and pumping is timed to occur during periods when eggs and larvae are unlikely to be present in significant numbers in the water column. Potential for poor water quality return flows will also be managed through monitoring the return flows during drawdown, undertaking a blackwater risk assessment (refer to Section 13 for further information), and adaptively managing release rates to ensure that suitable dilution occurs within the Murray River if water quality in return flows is low. Return flow volumes are expected to be small (25 ML/d) and will occur at a time of year when passing flows in the Murray River are typically high even in dry years (i.e. during the irrigation season), therefore the risk is considered low. An operating regime to minimise the risk of stranding of fish that have entered the floodplain during hybrid or natural events during drawdown events will be also adopted (e.g. fish exit strategy), with fish exit cues provided for those fish that have entered the floodplain. This is detailed in the project Operating Plan (**Attachment 8**). Overall, mitigation measures included in the design, construction and operation of the project will manage potential impacts to fish species and reduce risks to low for both construction and operation of the project. The project is likely to have a benefit to fish, through restoration of floodplain and semi-permanent wetland habitat and increase in carbon returning to Murray River, improving the productivity of the river which will benefit native fish species such as Murray Cod, Golden Perch and Silver Perch.

The Broad-shelled Turtle and Murray River Turtle, South-eastern Long-eared Bat, Southern Myotis, Squirrel Glider, Bearded Dragon and Lace Monitor may also be impacted during the construction phase by large tree removal and ground disturbance impacts. Removal of potential nesting habitats along the river bank, would be avoided wherever possible and if required, salvage would be undertaken to retain potential habitat. An on-site ecologist with Management Authorisation under the *Wildlife Act 1975* would be present during large tree removal and construction works.

The remaining EPBC Act and FFG Act listed species are birds that are highly mobile and wide ranging and are therefore unlikely to be adversely impacted due to suitable habitat being surrounding and widespread.

There is potential for the introduction of environmental water to lead to an increase in abundance of feral predators (e.g. cats and foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in productivity of the floodplain. Some of the species such as feral cats could potentially prey on 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 and funded within the inundation area, in consultation with DELWP and Parks Victoria, to expand current pest control programs within the park to target these areas during inundation events.

Listed threatened migratory species

Eleven EPBC Act listed migratory species were identified as having the potential to occur within 10 kilometres of the project area. One species (Glossy Ibis *Plegadis falcinellus*), with previous VBA records but not identified on the PMST search was recorded as present during the field survey. There were also records and suitable habitat for Marsh Sandpiper and Common Greenshank. However, none of these species were considered likely to be adversely impacted by construction due to the absence of habitat that would be considered important for these migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species not being present within the construction footprint. Many of these species are more likely to be benefited by the proposed reinstatement of a more natural hydrological regime that aims to improve ecological condition of riverine and floodplain habitats.

Impacts on aquatic ecosystems, surface water and groundwater quality

The project aims to reinstate a more natural hydrological regime to Guttrum and Benwell Forest floodplains, which is expected to deliver a range of ecological benefits to floodplain and riverine communities. The project is designed to have the operational flexibility to vary the timing, depth, duration and extent of inundation so that individual managed events can target specific ecological outcomes.

Nevertheless, potential adverse effects on aquatic ecosystems and water environments could arise due to standard construction risks such as dewatering, sediment and erosion control, and management of chemicals and fuels. Construction risks are well understood and would be managed through a CEMP containing detailed measures for managing works in or near waterway, spoil, sediment and erosion control chemicals and fuels.

Any upstream or downstream hydrological changes or impacts in the Murray River associated with the delivery of environmental water to the Guttrum and Benwell Forests will be assessed and managed by the River Murray Operations Committee (RMOC) as part of their responsibility to oversee the operation of the river which is managed by the Murray Darling Basin Authority on behalf of the relevant State and Commonwealth Governments. It is also proposed that the environmental water requirements for VMFRP sites will be added to the existing river flows and therefore managed to ensure minimal, if any, changes in flows experienced downstream of the project sites.

Due to the nature of environmental watering, risks to water environments could include water quality impacts (including low dissolved oxygen) within and downstream of project areas and spread of pest species (including carp). These risks would be adaptively managed through implementation of a monitoring and evaluation framework, the Operating Plan and EWMP and drawing on experience from previous environmental watering projects such as the TLM Program. Key measures relating to water quality would

include implementing a monitoring program to measure inflows / outflows and water quality during events and releases, to facilitate timely identification of potential water quality issues, which would inform the adaptive management of such events to mitigate potential impacts on beneficial uses.

The nature and extent of changes to groundwater levels and quality during managed inundation would be identified through water level monitoring obtained from the existing monitoring bore network in Guttrum and Benwell Forests and adaptively managed through refinement of Operating Plans and EWMPs in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

Impacts on land use and amenity

Overall, the project supports both state and local planning policy, particularly in relation to the protection and enhancement of biodiversity, waterbodies and wetlands and significant landscapes of the area. The intention of improving the health of these riverine environments will also support the economic development of the region where the Gannawarra Shire Council are encouraging development around nature-based tourism associated with the region's ecological values. The ecological outcomes of the project will also improve the amenity of the forest, which will increase the value of the forest to recreational users.

The project has the potential to generate traffic along local roads and park access tracks during construction of the project relating to haulage of fill/spoil, delivery and removal of plant and workers travelling daily to and from the site. This has the potential for disruptions to recreational access to the Murray River and other parts of Guttrum and Benwell Forests, however given there are multiple points of access in to the forests and river, there will be alternative access tracks available for recreational users.

Engagement would be undertaken with DELWP and Parks Victoria to manage changes in access within both the Murray River Reserve and Guttrum and Benwell Forests during construction and a stakeholder management strategy prepared and implemented so that both DELWP and Parks Victoria is aware of the extent and timing of construction works, and can plan accordingly (e.g. signage, notification to park users). Construction traffic would be managed through standard controls contained in a CEMP and Traffic Management Plan to mitigate impacts.

During managed inundation events dry weather tracks within Guttrum and Benwell Forest will not be accessible due to conditions not suitable for access or to manage public safety risks, which may reduce opportunities for active and passive recreation and could also impact on licensed apiary sites. Whilst there will be some restrictions, access for recreational use will be encouraged during and after the inundation events as they provide significant opportunities for activities such as birdwatching and canoeing. Further assessment would be undertaken in consultation with DELWP and Parks Victoria, to identify opportunities to maintain or provide alternative access, where practicable. It is also the intention to sequence the construction and operation of Guttrum and Benwell Forests with proposed construction and operating in Gunbower Forest to provide an alternative, nearby, location for active and passive recreation.

The nearest residential dwellings are located approximately 300 metres from the construction footprint, north of the Guttrum Main Regulator (including associated spillway and containment bank) and Guttrum West Pump Station. Some of these dwellings may experience some additional noise and dust, these impacts would be managed through standard controls contained in a CEMP and it is expected that construction would only be undertaken during the day time period, which would avoid night time construction noise impacts. Residents and businesses along the Koondrook-Murrabit Road and along smaller public access roads leading to Guttrum (Millary Road, Cassidy Lane, Brays Lane) and Benwell (Hall Road, Watsons Lane) Forests may experience some traffic during construction particularly during construction haulage of fill and spoil along the roads to and from the site. These effects would be temporary and limited to the construction period.

Preliminary noise modelling indicates that pumping activities during environmental watering are not likely to exceed relevant Victorian or NSW noise criteria during operation of the project.

All Pump Stations on the Murray River will have external lighting fitted, however these lights would only be used during maintenance events. It is unlikely that maintenance will occur at night and therefore there is unlikely to be any light impacts to residential dwellings located in close proximity to the Pump Stations or fauna in the area.

Impacts on landscape

The project would involve removal of some native vegetation and alteration of constructed landforms within areas supporting state and regional landscape values, specifically the Guttrum and Benwell Forests. However, these areas of proposed native vegetation removal and landform alteration are mostly sited in areas already modified and degraded through construction of access tracks and embankments. Design of proposed structures would be sympathetic to the surrounding landscape and consistent with DELWP and Parks Victoria infrastructure design guidelines.

The removal of native vegetation for the project would occur in discrete areas totalling approximately 13.7 hectares, in the context of a largely intact expanse of native vegetation within the Guttrum and Benwell Forests floodplain. The areas of proposed vegetation clearing are considered minor when compared to the 1,149 hectares of native vegetation within the proposed inundation areas that would benefit from the project.

Impacts on heritage values

The project has potential to impact on both known and previously unregistered Aboriginal heritage places within the project area. The potential for these impacts is currently being assessed through preparation of a Cultural Heritage Management Plan in accordance with the *Aboriginal Heritage Act 2006*. This includes field survey and consultation with traditional owner (TO) groups. The draft CHMP would be finalised in consultation with the identified TO groups for approval by Aboriginal Victoria and is likely to include specific management conditions for a number of Aboriginal Places along with general management recommendations relating to induction training, salvage methods and stakeholder engagement, and procedures for unexpected 'finds' of potential Aboriginal cultural material.

The outcomes of the cultural heritage assessment (as part of the Cultural Heritage Management Plan) will also be considered during the project design process and therefore the design, number and location of project structures and extent of levees and access track upgrades may be refined to minimise impacts to heritage values.

Hydrological modelling and geomorphological analysis would be carried out to inform an assessment of the potential impact to Aboriginal Ancestral Remains within the inundation area. The results of this assessment would be used to develop impact mitigation measures which will be included as management conditions in the CHMP. Development of management conditions will involve consultation with the Traditional Owners, Aboriginal Victoria, the Victorian Aboriginal Heritage Council, and the Ancestral Remains Unit within the Office of the Victorian Aboriginal Heritage Council.

No places listed on the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), Gannawarra Planning Scheme Heritage Overlay, World Heritage List, National Heritage List or Commonwealth Heritage List are located within or adjacent to the proposed construction footprint or inundation area. Examination of previous historical heritage assessments has identified eight places of potential historical heritage value within the area of investigation and/ or inundation area:

- Benwell Floodgates (the old Murrabit-Benjeroop Irrigation Trust regulator)
- Benwell Bank
- Timber Structure Across Channel
- Smith's Drain
- Artefact: Grating from Firebox of Boiler

Guttrum and Benwell Forests Floodplain Restoration Project

- Benwell Bank
- Smith's Drain
- Spot Mill Site

There is also moderate-high potential for previously unidentified historical heritage items to be present within the project area, from the background history of the area. Site types most likely to be identified in the project area would be heritage places or archaeological sites associated with early agricultural or pastoral activities, logging, and water management practices. The presence of unregistered historic archaeological sites within the project area would be further assessed and managed in accordance with the *Heritage Act 2017*.

Borrow sites / quarry sites

VMFRP are currently progressing a site selection process to identify potential borrow pit locations from which to source fill material for the project. The nature and extent of potential impacts and potential approval requirements (as may be required under the *Mineral Resources Sustainable Development Act 1990*) associated with establishment of borrow pits / quarry sites are yet to be assessed. Environment and heritage values would be evaluated as part of the site selection process to avoid and minimise impacts. Borrow pits would be located on private land, outside of Guttrum and Benwell Forests, and where practicable within previously cleared areas.

12. Native vegetation, flora and fauna

12.1 Native vegetation

Is any native vegetation likely to be cleared or otherwise affected by the project?

NYD No Yes If yes, answer the following questions and attach details.

What investigation of native vegetation in the project area has been done? (briefly describe)

A review of relevant biodiversity databases and previous studies was undertaken as part of the Flora and Fauna Assessment – Guttrum and Benwell Forests (R8, 2020c) (refer to **Attachment 3 – Flora and Fauna Assessment**) to identify native vegetation and listed flora and fauna species with potential to occur in the construction footprint and inundation areas, based on a search within 10 km of the project area. The review considered previous records and predicted occurrences of vegetation communities.

The following databases and previous reports were used:

- Protected Matters Search Tool (PMST) for the Commonwealth EPBC Act 1999, maintained by DAWE
- Victorian Biodiversity Atlas (VBA), maintained by the DELWP
- NatureKit. Spatial database maintained by DELWP, for native vegetation (Ecological Vegetation Class) mapping throughout Victoria
- The Native Vegetation Information Management tool (NVIM), maintained by DELWP
- Weeds of National Significance database
- Previous investigations and reports as identified in **Table 15**

In addition, **Attachment 3 - Flora and Fauna Assessment** reports on the additional field assessment undertaken between October and November 2019, for the purpose of:

- Mapping the extent and condition of native vegetation present within the proposed construction footprint including:
 - Defining and mapping the relevant EVCs
 - Undertaking Habitat Hectare (HabHa) Assessments for each Habitat Zone (HZ) not previously assessed
 - Mapping and measuring Canopy Trees that meet the benchmark for Large Trees not previously measured
- Recording the location of rare or threatened flora or fauna and protected flora where encountered
- Collecting an inventory of incidental observations of both native and non-native flora and fauna encountered during the field assessment, together with their conservation status and origin

A summary of the methods and key findings of the background studies and the recent R8 study is provided in **Table 15** below (Section 12.2).

What is the maximum area of native vegetation that may need to be cleared?

NYD Estimated area13.7 (hectares)

As changes in the construction footprint have occurred since the 2019 field survey, some small areas of native vegetation proposed to be impacted have not yet been assessed, however previous EVC mapping

Guttrum and Benwell Forests Floodplain Restoration Project

data (Biosis, 2014) has been used to fill these gaps. Further changes to the construction footprint are likely to occur in response to design refinements, however these are expected to be minor and within the current area of investigation. Once the design process is complete and the construction footprint has been finalised, a Vegetation Quality Assessment (Habitat Hectares) will be undertaken in these areas to confirm the condition and extent of native vegetation within these areas.

13.7 hectares represents the current estimate of native vegetation needed to be cleared. This includes 219 large trees which have the potential to be impacted. This does not include native vegetation clearance associated with power supply or levee works which are subject to further risk assessment. If levee works are required, this would involve works along approximately 1.5 to 3 kilometres of the total 16 kilometres (10 kilometres for Guttrum, and 6 kilometres for Benwell) of existing, previously disturbed, levee banks in Guttrum and Benwell Forest. The potential levee works represent between 9 to 18% of the existing levee network in the Forests.

As the scope and requirement for levees, power supply and works along access tracks is still to be confirmed and will be designed to avoid and minimise native vegetation removal to the extent practicable. In some instances, works along tracks may be limited to minor maintenance and upgrades that require minimal if any vegetation clearance. As such the current estimate of potential vegetation removal along tracks is potentially conservative but would be confirmed as design is refined.

How much of this clearing would be authorised under a Forest Management Plan or Fire Protection Plan?

N/A approx. percent (if applicable)

Which Ecological Vegetation Classes may be affected? (if not authorised as above)

NYD Preliminary/detailed assessment completed. If assessed, please list.

Construction footprints

Table 14 identifies the EVCs mapped within the construction footprint that would be potentially impacted by the construction of infrastructure. This is a total of 13.7 hectares and includes EVCs mapped within the construction footprint associated with proposed infrastructure, proposed access tracks, as well as existing access tracks (where upgrades may be required and works may extend into the TPZ).

Table 14 EVCs mapped within the project construction footprint

EVC No.	EVC	Biodiversity Conservation Significance	Area (hectares)	
			Infrastructure	Tracks
295	Riverine Grassy Woodland	Vulnerable	2.03	4.13
810	Floodway Pond Herbland	Depleted	0.09	0.01
814	Riverine Swamp Forest	Depleted	3.33	0.13
816	Sedgy Riverine Forest	Depleted	2.31	1.56
945	Floodway Pond Herbland / Riverine Swamp Forest Complex	Depleted		0.13
Total			7.74	5.96

Appendix A in **Attachment 3 – Flora and Fauna Assessment** shows the location of the EVCs within the construction footprint and access tracks. There is an area of the vulnerable Riverine Grassy Woodland (EVC295) within the construction footprint of the proposed site office and laydown area in the south west

Guttrum and Benwell Forests Floodplain Restoration Project

corner of Benwell Forest. Future design will consider avoiding where possible, or minimising impacts on this EVC. The Riverine Grassy Woodland is also located on slightly elevated terraces above the existing levee system within both Guttrum and Benwell Forest. The mitigation measures outlined in Part 2 (Environmental management) of this referral would therefore assist in minimising and avoiding impacts to this EVC.

Inundation

EVCs have been previously mapped (Biosis, 2014) as occurring within the inundation areas (refer to **Table 12**). The EVCs are swampy or wetland vegetation communities that require or are tolerant of inundation and therefore are expected to positively respond to the proposed inundation. The environmental watering is proposed to deliver the preferred hydrological regime for native vegetation communities within the proposed inundation areas, accordingly native vegetation within the proposed inundation areas is expected to benefit from the project rather than be adversely impacted.

Have potential vegetation offsets been identified as yet?

NYD Yes If yes, please briefly describe.

As described above, a total of approximately 13.70 hectares of native vegetation is proposed to be removed within the construction footprint. **Attachment 3 – Flora and Fauna Assessment** contains a preliminary estimate of offset requirements.

Offsets would be sought in accordance with the requirements of the *Guidelines for removal, destruction or lopping of native vegetation* (DELWP 2017b) or through an alternate arrangement agreed with the Secretary to DELWP, such as a conservation works exemption under Clause 52.17 of the Gannawarra Planning Scheme. 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.

Other information/comments? (eg. accuracy of information)

NYD = not yet determined

12.2 Flora and fauna

What investigations of flora and fauna in the project area have been done?

(provide overview here and attach details of method and results of any surveys for the project & describe their accuracy)

As described above, **Attachment 3 – Flora and Fauna Assessment** contains a review of previous ecological studies undertaken for the project and updated database and mapping searches to identify flora and fauna potentially occurring in the project area. A summary of the methods and findings of previous ecological studies, as well as of the studies carried out by R8 (R8 2020b) is provided in **Table 15**.

Table 15 Ecological assessments for the project area

Report	Methods	Key findings
GHD (2017), Guttrum and Benwell State Forests Flora and Fauna Assessment. Report prepared for	<ul style="list-style-type: none"> ▪ Review of existing information ▪ EVC mapping ▪ Habitat Hectare assessment ▪ Large old trees (LOT) mapping ▪ Fauna surveys (February – March 2017) 	Construction footprint contains: <ul style="list-style-type: none"> ▪ 5 EVCs ▪ 866 Large Old Trees (LOTs) ▪ 114 flora species recorded

Guttrum and Benwell Forests Floodplain Restoration Project

<p>the North Central CMA</p>	<ul style="list-style-type: none"> ▪ Diurnal bird surveys ▪ Bat surveys (Bat harp trapping and Anabat recording) ▪ Active searching ▪ Spotlight surveys ▪ Remote sensing fauna cameras ▪ Recording of incidental observations 	<ul style="list-style-type: none"> ▪ 2 species of rare/threatened flora (Branching Groundsel, Pale Flax-lily) ▪ 57 terrestrial fauna species recorded <ul style="list-style-type: none"> ▪ 1 species of rare/threatened fauna (Grey-crowned Babbler) ▪ Victorian Temperate Woodland bird Community (VTWBC).
<p><i>Bennetts (2014), Preliminary Vegetation Assessment of the Benwell and Guttrum Forests. Report prepared for the North Central Catchment Management Authority.</i></p>	<ul style="list-style-type: none"> ▪ Review of existing information ▪ Field surveys (July 2014) 	<p>Guttrum and Benwell Forests support over 2000 hectares of Red Gum Forest and semi-permanent wetlands supporting:</p> <ul style="list-style-type: none"> ▪ 6 EVCs ▪ 6 species of rare/threatened flora: <ul style="list-style-type: none"> ▪ Black Rolypoly Saltbush, Branching Groundsel, Dwarf Bitter-cress, Floodplain Fireweed, Riverina Bitter-cress, Wavy Marshwort ▪ 3 rare/threatened bird species: <ul style="list-style-type: none"> ▪ Brown Treecreeper, Diamond Firetail, Grey-crowned Babbler ▪ Existing impacts: altered flooding regime, cattle grazing, timber harvesting, weed invasion and recreational vehicles
<p><i>Biosis (2014a). Flora and fauna assessment of the Gunbower National Park and Guttrum and Benwell State Forests. Report prepared for the North Central Catchment Management Authority.</i></p>	<ul style="list-style-type: none"> ▪ Review of existing information ▪ Field surveys of Gunbower National Park and Guttrum and Benwell Forests (July 2014) ▪ EVC mapping ▪ Habitat Hectare assessment ▪ Large old trees (LOT) mapping ▪ Fauna surveys <ul style="list-style-type: none"> ▪ Bird surveys ▪ Active searching ▪ Spotlight surveys including the use of call-playback ▪ Recording of incidental observations 	<p>A total of 150 flora species and 70 fauna species were recorded across all three forests. The following ecological values were recorded for Guttrum and Benwell Forests</p> <ul style="list-style-type: none"> ▪ 4 EVCs: ▪ Potential habitat for EPBC-listed species: River Swamp Wallaby-grass, Winged Peppercress, Stiff Groundsel, Growling Grass Frog and Superb Parrot <ul style="list-style-type: none"> ▪ 4 species of rare/threatened flora: Branching Groundsel, Floodplain Fireweed, Riverina Bitter-cress, Wavy Marshwort ▪ 4 species of rare/threatened fauna (Grey-crowned Babbler) ▪ Victorian Temperate Woodland bird Community (VTWBC)
<p><i>Biosis (2014b). Mapping and condition assessment of the Guttrum & Benwell State Forests. Report prepared for the North Central</i></p>	<ul style="list-style-type: none"> ▪ Review of existing information ▪ Field assessment (October 2014) ▪ Mapping the distribution of EVCs ▪ Determining the current condition of wetlands, trees and understorey species ▪ Establishment of long-term monitoring locations (transects and quadrats) for guiding 	<p>Guttrum and Benwell Forests contain:</p> <ul style="list-style-type: none"> ▪ 7 EVCs, 2 EVC aggregates and one EVC complex ▪ These vegetation types have varying hydrological requirements to maintain their characteristic composition

Guttrum and Benwell Forests Floodplain Restoration Project

<p>Catchment Management Authority.</p>	<p>hydrological management and maintaining ecological values.</p>	<ul style="list-style-type: none"> ▪ Baseline vegetation data indicates that vegetation communities are drier than expected ▪ Seven species of rare/threatened flora: <ul style="list-style-type: none"> ▪ Branching Groundsel, Dwarf Bitter-cress, Fuzzy New Holland Daisy, River Swamp Wallaby-grass, Riverina Bitter-cress, Twin-leaf Bedstraw, Wavy Marshwort
<p>North Central Catchment Management Authority (2014c). Guttrum Forest and Benwell Forest Environmental Works Project: Ecological Risks and Mitigation</p>	<ul style="list-style-type: none"> ▪ Summarises the main ecological risks associated with previous studies at nearby Gunbower Forest and how they might apply to the Guttrum Forest and Benwell Forest Environmental Works Project. 	<p>Some of the key ecological risks include:</p> <ul style="list-style-type: none"> ▪ River Red Gum encroachment ▪ Giant rush colonisation ▪ Fish stranding ▪ Pest fish introductions ▪ Waterbirds abandoning nests ▪ Aquatic weeds ▪ Blackwater
<p>Ecological Associates (2013). The Ecological Justification for Works and Measures for the Guttrum and Benwell State Forests. Report prepared for the North Central Catchment Management Authority</p>	<ul style="list-style-type: none"> ▪ Desktop hydrological analysis of Guttrum and Benwell Forests ▪ Flow analysis of the following scenarios: natural, benchmark and Basin Plan 2750 	<ul style="list-style-type: none"> ▪ Flows to inundate the semi-permanent wetlands now occur in 61% of years rather than the recommended 90% of years and last for 1 to 4 months interquartile range at 21,000 ML/d instead of 3 to 6 months. ▪ Reduction in flood duration and frequency and the longer periods between events has made wetlands habitat less persistent and reliable ▪ 16 threatened fauna species and one flora species reported in Guttrum and Benwell Forests ▪ Impacts from grazing and timber harvesting

The review of previous ecological studies and updated database searches was used to inform the additional targeted threatened flora surveys undertaken by R8 in October and November 2019. Targeted fauna surveys were undertaken in October 2019. The results of these surveys are described in **Attachment 3 – Flora and Fauna Assessment**. A summary of the results of updated desktop and field assessments undertaken for the project by R8, is provided in the following sections.

Have any threatened or migratory species or listed communities been recorded from the local area?

NYD No Yes If yes, please:

- List species/communities recorded in recent surveys and/or past observations.
- Indicate which of these have been recorded from the project site or nearby.

Flora

VBA and PMST searches identified 20 listed threatened flora species within 10 kilometres of the project area, 13 of these have either been recorded or have been assessed as having a possible likelihood of occurrence within the project area. These threatened flora species with a possible likelihood of occurrence include two EPBC Act listed species (River Swamp Wallaby-grass and Winged Peppergrass), two FFG Act listed species (Wavy Marshwort and Winged Peppergrass) and a further 10 species listed on the DELWP Advisory list. Some species may be listed under one or more of these. A full list of threatened flora species and assessment of likelihood of occurrence is provided in **Attachment 3 – Flora and Fauna Assessment**.

During the 2019 field surveys, no species listed as threatened under the EPBC Act or FFG Act were recorded within the construction footprint. Three flora species listed as rare or threatened in Victoria (DELWP Advisory List) were recorded in the construction footprint including:

- Leek Flax-lily (*Dianella longifolia* var. *grandis* – formally known as *Dianella sp. cf. longifolia* (Riverina) – three individuals in the east of Guttrum Forest.
- Bulging Fireweed (*Senecio campylocarpus*) – 20 to 50 individuals throughout both Guttrum and Benwell Forests.
- Branching Groundsel (*Senecio cunninghamii* var. *cunninghamii*) – five to 20 individuals near Benwell Pump Station and Guttrum East Pump Station.
- Riverina Bittergrass (*Cardamine moirensis*) – identified during previous surveys of the construction footprint (Biosis 2014a)

Fauna

VBA and PMST searches identified 60 listed threatened fauna species within 10 kilometres of the project area, 48 of these have either been recorded or have been assessed as having a possible likelihood of occurrence within the project area based on factors such as the habitat requirements of each species and comparing those to the habitats encountered within the project area. Of these species, eight are listed under the EPBC Act, 30 are listed under the FFG Act, and 46 are DELWP advisory listed threatened species. Some species may be listed under one or more of these. These species are identified in **Table 16**. A full list of threatened fauna species and assessment of likelihood of occurrence is provided in **Attachment 3 – Flora and Fauna Assessment**.

One FFG Act listed species, White-bellied Sea Eagle (*Haliaeetus leucogaster*), and four DELWP Advisory list species, Brown Treecreeper (*Climacteris picumnus*), Emu (*Dromaius novaehollandiae*), Glossy Ibis (*Plegadis falcinellus*) and Lace Monitor (*Varanus varius*) were recorded from the targeted fauna surveys during the 2019 surveys. It is noted the Glossy Ibis is also EPBC listed as Migratory. Targeted searches for the previously recorded Squirrel Glider (*Petaurus norfolcensis*, FFG Act listed) and Grey-crowned Babbler (*Pomatostomus temporalis*, FFG Act listed) did not locate these species.

Migratory Species

Eleven species listed as migratory under the EPBC Act are predicted to occur, or were historically recorded from a VBA/PMST search of within 10 kilometres of the project area. One species, not highlighted by the PMST, but with previous records was identified (Glossy Ibis) during the 2019 field surveys. There were also records and suitable habitat for Common Greenshank and Marsh Sandpiper (also not in PMST).

An assessment of the likelihood of occurrence of these species was undertaken (refer **Attachment 3 – Flora and Fauna Assessment**) and found that 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 full list of migratory species and assessment of likelihood of occurrence is provided in **Attachment 3 – Flora and Fauna Assessment**.

Ecological communities

The PMST identified five EPBC Act-listed threatened ecological communities with potential to occur within 10 kilometres of the construction footprint; Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions, Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern, Natural Grasslands of the Murray Valley Plains, Weeping Myall Woodlands, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Australia.

None of these communities are consistent with vegetation mapped or modelled within either the construction footprint or inundation area. None of these communities were identified during the field assessment or in previous assessments (Biosis 2014; GHD 2017) within the project area, therefore are not anticipated to be impacted by the project.

One FFG listed fauna community was found to be present within the project area (Victorian Temperate Woodland Bird Community). The VTWBC was identified as occurring throughout the Guttrum and Benwell Forests project area, due to the presence of significant River Red Gum open woodland and forest with an abundance of tree hollows for nesting sites and fallen timber. This determination is consistent with previous assessments within the project area (Biosis 2014; GHD 2017). Bird species of this FFG-listed fauna community are highly mobile, and there is availability of significant River Red Gum open woodland and forest, with an abundance of tree hollows for nesting sites and fallen timber available within the forest.

There is also one FFG listed fish community identified in the desktop assessment as being present (Lowlands Riverine Fish Community of Southern Murray-Darling Basin). This community is characteristic of the geographical area that defines its distribution (broadly defined as lowland river reaches and associated floodplains of the Murray River tributaries in Victoria that drain the northern slopes of the Great Dividing Range, together with the lowland section and floodplain of the Murray River upstream of the South Australian border), and by a selected suite of native fish taxa that is typical of and largely restricted to the area.

If known, what threatening processes affecting these species or communities may be exacerbated by the project? (eg. loss or fragmentation of habitats) Please describe briefly.

Potentially threatening processes are listed in accordance with Section 10 of the FFG Act 1988. Threatening processes that have the potential to be exacerbated by construction and/ or operation of the project include:

Construction

- Degradation of native riparian vegetation along Victorian rivers and streams
- 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
- Increase in sediment input into Victorian rivers and streams due to human activities
- Input of toxic substances into Victorian rivers and streams
- Alteration to the natural flow regimes of rivers and streams

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 1,149 hectares of floodplain vegetation is likely to contribute to the maintenance and development of hollow-bearing trees into the future.

Guttrum and Benwell Forests Floodplain Restoration Project

An Environmental Management 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* and measures to minimise sedimentation inputs or toxic substances (for example, fuel) to waterways and to minimise impacts associated with any works occurring within waterways. A draft of the Environmental Management Framework prepared for the VMFRP program is provided in **Attachment 9**.

Operation

- Predation of native wildlife and destruction of habitat by Rabbits (*Oryctolagus cuniculus*), Feral Pigs (*Sus scrofa*) and the introduced Red Fox (*Vulpes Vulpes*)
- Soil degradation and reduction of biodiversity through browsing and competition by Feral Pigs
- Encroachment of River Red Gum in wetland areas and flood runners
- Giant Rush colonisation in wetland areas and flood runners
- Alteration to the natural flow regimes of rivers and streams

There is potential for the introduction of environmental water to lead to an increase in abundance of pest plants and animals due to the associated increase in productivity. High threat pest plants (e.g. Bridal Creeper, Paterson's Curse, African Boxthorn, Blackberry, Bathurst Burr, Prickly Pear) can displace native species and can provide harbour for invasive animals. Pest animal species such as feral pigs and foxes 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 plant and animal management and control program would need to be implemented within the inundation area. This could involve DELWP, Parks Victoria and North Central CMA applying or expanding current pest control programs within the park to target these areas during inundation events.

There is also potential for the domination of native flora by one species (e.g. Typha) due to favourable hydrological conditions. Variability in environmental water deliveries will be adopted to avoid any one native species being favoured at the expense of others. This will include varying timing, depth, duration and frequency of watering in response to climate conditions and the outcomes of ecological monitoring. A variable water regime will mimic the variability inherent in natural flood events (North Central CMA, 2020).

Measures to manage these impacts are outlined in the 'mitigation' section below and also Part 2, Section 18 (Environmental management).

Are any threatened or migratory species, other species of conservation significance or listed communities potentially affected by the project?

NYD No Yes If yes, please:

- List these species/communities:
- Indicate which species or communities could be subject to a major or extensive impact (including the loss of a genetically important population of a species listed or nominated for listing) Comment on likelihood of effects and associated uncertainties, if practicable.

Flora

Species for which habitat was present or that had previously been located within the Guttrum-Benwell floodplain complex were targeted during the threatened flora surveys (R8 2020c). The survey did not locate any EPBC Act-listed flora species within the construction footprint. However, one EPBC listed species, River Swamp Wallaby-grass (*Amphibromus fluitans*) is known to occur within the inundation area and Winged Peppergrass (*Lepidium monoplacoides*) is considered to have potential to occur within the project area. The species are not considered to be significantly impacted by either the construction works or proposed

inundation. As flood responders, both species are likely to benefit from the restoration of a more natural inundation cycle. Under good conditions, River Swamp Wallaby-grass could be relatively widespread within the specific habitat (elevation / inundation) area it is associated. Winged Peppergrass is only likely to occur within a small area considered potential habitat within the area of investigation where Black Box occurs.

No FFG listed flora species were identified during the most recent field assessment. One species, Wavy Marshwort (*Nymphoides crenata*) has previously been recorded within the inundation area (Biosis 2014, VBA 1989 cited in R8 2020b), however is an obligate wetland species and therefore likely to benefit from the environmental watering. The Winged Peppergrass (also EPBC listed, mentioned above) is also considered to have the potential to occur in the project area. This species is also not considered to be significantly impacted by the proposed works.

Of the 20 listed threatened flora species identified during the desktop assessment, 13 are considered to have the potential to occur in the construction footprint (2 EPBC Act listed species, River Swamp Wallaby-grass and Winged Peppergrass, two FFG Act listed species, Wavy Marshwort and Winged Peppergrass and 10 species listed on the DELWP Advisory list). These same 13 species are also considered to occur within the inundation area and are likely to benefit from a return to a more natural flooding regime. Of these, 5 DELWP Advisory listed species were recorded during 2019 surveys and other previous surveys in the area of investigation, with four species recorded (<10 individuals for each species identified) in the construction footprint likely to be impacted by the proposed works (Riverina Bitter-creed, Leek Flax-lily, Bulging Fireweed and Branching Groundsel).

VBA and PMST searches suggested a further six FFG and/or EPBC Act listed species with potential to occur within the construction and inundation footprint, however impacts to these species were considered unlikely as suitable habitat was absent within the construction and inundation areas. A full assessment of the likelihood of 20 potential rare or threatened species within the project area is provided in Appendix C and Appendix D of **Attachment 3 – Flora and Fauna Assessment**. The location of rare or threatened species identified during surveys at the site are also shown in Appendix A of **Attachment 3 – Flora and Fauna Assessment**.

Fauna species

It is recognised that there is potential for construction activities to have a localised impact to a number of fauna species due to the potential loss of habitat through vegetation removal including the removal of large old trees. However, in the context of the broader Guttrum and Benwell Forests (1,930 hectares), the vegetation removal within the construction footprint (13.7 hectares) represents small but largely marginal areas of habitat within an extensive area of potentially suitable habitat. The vegetation removal will not likely result in the potential loss of critical habitat or potential long-term loss of a significant proportion of known remaining habitat, nor is it likely to lead to the potential loss of a genetically important population. The Guttrum and Benwell Forest construction footprint area does not represent core habitat or range for any of the threatened species listed in **Table 16**.

Of the 49 threatened fauna species identified as having a possible likelihood of occurrence within 10 kilometres of the project area, fifteen threatened fauna species have been assessed as possibly being impacted by the project including Silver Perch, Murray Cod, Golden Perch, Murray Darling Rainbowfish, Freshwater Catfish, Murray Crayfish, Broad-shelled Turtle, Murray River Turtle, Southern Myotis, South-eastern Long-eared Bat, Squirrel Glider, Brown Toadlet, Bearded Dragon, Carpet Python and Lace Monitor.

A search of the PMST, potential modelled habitat and historical records identified the potential for three other fish within 10 km of the project area; Macquarie Perch, Murray Hardyhead and Flat-headed Galaxias. However, these fish were considered unlikely in the project area and therefore unlikely to be impacted by the project (refer to Appendix P in **Attachment 3 – Flora and Fauna Assessment**). Note Macquarie Perch was considered highly unlikely to be present.

Guttrum and Benwell Forests Floodplain Restoration Project

These possible construction impacts are not expected to be significant for the reasons listed above and below in **Table 16** and provided the recommended mitigation measures are implemented (refer to Section 12 – Proposed Mitigation). Significant impacts from the operation of the project have also been assessed as unlikely as fauna species are likely to benefit from environmental water when present or the improvement in habitat as a result of the operation of the project.

Table 16 Fauna listed on the EPBC Act and/or the FFG Act and considered possible or known to occur in the project area (construction footprint and inundation area)

Common name	Scientific name	EPBC	FFG	DELWP Status	Impacts/reasoning
Brolga	<i>Antigone rubicunda</i>		L	vu	<p>Construction Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area Impact unlikely. Species likely to benefit from environmental water when present.</p>
Great Egret	<i>Ardea alba</i>		L	vu	<p>Construction Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area Impact unlikely. Species likely to benefit from environmental water when present.</p>
Intermediate Egret	<i>Ardea intermedia plumifera</i>		L	en	<p>Construction Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area Impact unlikely. Species likely to benefit from environmental water when present.</p>
Hardhead	<i>Aythya australis</i>			vu	<p>Construction Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area Impact unlikely. Species likely to benefit from environmental water when present.</p>
Silver Perch	<i>Bidyanus bidyanus</i>	CR	L	vu	<p>Construction Impact possible. Species is a main-channel specialist with suitable habitat limited to the Murray River.</p> <p>Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p>Inundation Area Impact unlikely. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					is a low likelihood that large numbers of fish will enter the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime should be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy) and release rates of return flows enable suitable mixing to occur with the Murray River if water quality in return water is low.
Musk Duck	<i>Biziura lobata</i>			vu	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area</p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Australasian Bittern	<i>Botaurus poiciloptilus</i>	EN	L	en	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprint</p> <p>Inundation Area</p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Bush Stone-curlew	<i>Burhinus grallarius</i>		L	en	<p>Construction</p> <p>Impact unlikely. Suitable foraging habitat present within construction footprint. Species mobile and wide ranging. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p> <p>Inundation Area</p> <p>Impact unlikely. Suitable surrounding habitat widespread in forest and surrounding area. Species unlikely to be impacted during spring nesting and likely to benefit from improved habitat condition following environmental water.</p>
Azure Kingfisher	<i>Ceyx azureus</i>			nt	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p>Inundation Area</p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Broad-shelled Turtle	<i>Chelodina expansa</i>		L	en	<p>Construction</p> <p>Impact possible. Species uses deep water of Murray River, and may utilise river banks for nesting. Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					<p>construction specific aquatic fauna management plan would be developed for all works around waterways. Consider timing of works to avoid breeding season (spring to summer) where turtles may nest along river banks.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from improved habitat conditions following environmental watering.</p>
Whiskered Tern	<i>Chlidonias hybrida</i>			nt	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p><u>Inundation Area</u> Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Brown Treecreeper	<i>Climacteris picumnus</i>			nt	<p><u>Construction</u> Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees, however the species is highly mobile and wide-ranging, suitable surrounding habitat widespread.</p> <p><u>Inundation Area</u> Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Unspecked Hardyhead	<i>Craterocephalus stercusmuscarum fulvus</i>		L		<p><u>Construction</u> Impact unlikely. No previous records. Suitable floodplain/wetland habitat not present in Construction footprint.</p> <p><u>Inundation Area</u> Impact unlikely. No previous records and limited habitat currently available within inundation area. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there is a low likelihood that large numbers of fish will enter the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime should be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy).</p>
Emu	<i>Dromaius novaehollandiae</i>			nt	<p><u>Construction</u> Impact unlikely. Species observed during surveys, however species is mobile and</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					<p>wide-ranging, suitable surrounding habitat widespread.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Little Egret	<i>Egretta garzetta</i>		L	en	<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Murray River Turtle	<i>Emydura macquarii</i>			vu	<p><u>Construction</u></p> <p>Impact possible. Species uses deep water of Murray River, and may utilise river banks for nesting. Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways. Consider timing of works to avoid breeding season (spring to summer) where turtles may nest along river banks.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from improved habitat conditions following environmental watering.</p>
Painted Honeyeater	<i>Grantiella picta</i>	VU	L	vu	<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		L	vu	<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					<p><u>Inundation Area</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Would likely benefit from environmental water when present and indirectly from improved habitat condition following environmental water.</p>
Australian Little Bittern	<i>Ixobrychus dubius</i>		L	en	<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Growling Grass Frog	<i>Litoria raniformis</i>	VU	L	en	<p><u>Construction</u></p> <p>Impact unlikely. No recent records exist in project area, and no suitable habitat in Construction footprint.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species almost certain to benefit directly from greatly expanded habitat when environmental water is present, and indirectly from improved habitat condition following environmental water.</p>
Square-tailed Kite	<i>Lophoictinia isura</i>		L	vu	<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread, would likely benefit from improved ecological condition of inundation area.</p>
Murray Cod	<i>Maccullochella peelii</i>	VU	L	vu	<p><u>Construction</u></p> <p>Impact possible. Species is a main-channel specialist with suitable habitat limited to the Murray River.</p> <p>Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there is a low likelihood that large numbers of fish will enter</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime would be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy) and release rates of return flows enable suitable mixing to occur with the Murray River if water quality in return water is low.
Golden Perch	<i>Macquaria ambigua</i>			nt	<p><u>Construction</u></p> <p>Impact possible. Species is a main-channel specialist with suitable habitat limited to the Murray River.</p> <p>Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there is a low likelihood that large numbers of fish will enter the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime would be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy) and release rates of return flows enable suitable mixing to occur with the Murray River if water quality in return water is low.</p>
Murray Darling Rainbowfish	<i>Melanotaenia fluviatilis</i>		L	en	<p><u>Construction</u></p> <p>Impact possible. Preferred habitat is margins of slow flowing rivers, backwaters and wetlands</p> <p>Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there is a low likelihood that large numbers of fish will enter the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime would be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy) and release rates of return flows enable suitable mixing to occur with the Murray River if water quality in return water is low.</p>

Guttrum and Benwell Forests Floodplain Restoration Project

Carpet Python	<i>Morelia spilota metcalfei</i>		L	en	<p><u>Construction</u> Impact possible. Localised impacts possible during large tree removal and sub-surface impacts in Construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from improved habitat condition following environmental water.</p>
Southern Myotis	<i>Myotis Macropus</i>			nt	<p><u>Construction</u> Impact possible. Likely widespread along Murray River habitats. Localised impacts possible during large tree removal in construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p><u>Inundation Area</u> Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread.</p>
Barking Owl	<i>Ninox connivens</i>		L	en	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction footprint.</p> <p><u>Inundation Area</u> Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread.</p>
Nankeen Night-Heron	<i>Nycticorax caledonicus</i>			nt	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction footprint.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from improved habitat condition following environmental water.</p>

Guttrum and Benwell Forests Floodplain Restoration Project

South-eastern Long-eared Bat	<i>Nyctophilus corbeni</i>	Vu	L	en	<p><u>Construction</u> Impact possible. Likely widespread along Murray River habitats. Localised impacts possible during large tree removal in construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p><u>Inundation Area</u> Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread.</p>
Squirrel Glider	<i>Petaurus norfolcensis</i>		L	en	<p><u>Construction</u> Impact possible. Species not recorded during targeted surveys. Localised impacts possible during large tree removal in construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p><u>Inundation Area</u> Impact unlikely. No tree removal is expected within inundation area. Species likely to benefit from improved habitat condition following environmental water.</p>
Pied Cormorant	<i>Phalacrocorax varius</i>			nt	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction Footprints</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from environmental water when present.</p>
Royal Spoonbill	<i>Platalea regia</i>			nt	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from environmental water when present.</p>
Glossy Ibis	<i>Plegadis falcinellus</i>	M		nt	<p><u>Construction</u> Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from environmental water when present. Species records in Reed Bed Swamp only.</p>

Guttrum and Benwell Forests Floodplain Restoration Project

Bearded Dragon	<i>Pogona barbata</i>			vu	<p>Construction</p> <p>Impact possible. Localised impacts possible during large tree removal and sub-surface impacts in Construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p>Inundation Area</p> <p>Impact unlikely. Species likely to benefit from improved habitat condition following environmental water.</p>
Superb Parrot	<i>Polytelis swainsonii</i>	VU	L	en	<p>Construction</p> <p>Impact unlikely. Suitable habitat present within Construction Footprint. Losses to relatively small area of foraging habitat and potential nesting habitat from proposed removal of large trees in comparison with available habitat within forest.</p> <p>Inundation Area.</p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>		L	en	<p>Construction</p> <p>Impact unlikely. Species records and suitable habitat present. Targeted surveys within the Construction footprint did not record any individuals or nests. Losses to relatively small area of foraging and potential nesting habitat proposed from the removal of trees, however the species is highly mobile and wide-ranging, suitable surrounding habitat widespread.</p> <p>Inundation Area</p> <p>Impact unlikely. Suitable surrounding habitat widespread in forest and surrounding area. Species likely to benefit from environmental water when present.</p>
Ballion's Crake	<i>Porzana pusilla</i>		L	vu	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p>Inundation Area</p> <p>Impact unlikely. Species mobile and wide ranging. Species likely to benefit from environmental water when present.</p>
Brown Toadlet	<i>Pseudophryne bibronii</i>		L	en	<p>Construction</p> <p>Impact Possible. Records within study area, and suitable seasonally inundated forest present in construction footprint. Targeted</p>

Guttrum and Benwell Forests Floodplain Restoration Project

					<p>surveys recommended for Brown Toadlet in Autumn (April-May) 2021 in seasonally inundated riparian forest habitat within the construction footprint to identify whether the species is present and to update avoidance and mitigation measures to address impacts to this species.</p> <p><u>Inundation Area</u></p> <p>Impact Unlikely. Species almost certain to benefit directly from greatly expanded habitat when environmental water is present, and indirectly from improved habitat condition following environmental water.</p>
Australian Painted Snipe	<i>Rostratula australis</i>	EN	L	Cr	<p><u>Construction</u></p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Australasian Shoveler	<i>Spatula rhynchotis</i>			vu	<p><u>Construction</u></p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Diamond Firetail	<i>Stagonopleura guttata</i>		L		<p><u>Construction</u></p> <p>Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water</p>
Freckled Duck	<i>Stictonetta naevosa</i>		L	en	<p><u>Construction Areas</u></p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p><u>Inundation Area</u></p> <p>Impact unlikely. Species likely to benefit from environmental water when present.</p>
Apostlebird	<i>Struthidea cinerea</i>		L		<p><u>Construction Areas</u></p> <p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas.</p> <p><u>Inundation Area</u></p>

Guttrum and Benwell Forests Floodplain Restoration Project

					<p>Impact unlikely. Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Freshwater Catfish	<i>Tandanus tandanus</i>		L	en	<p>Construction</p> <p>Impact possible. Preferred habitat is slow flowing rivers, backwaters and vegetated wetlands</p> <p>Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p>Inundation Area</p> <p>Impact unlikely. As the site will receive water via pumping it is unlikely that operation of the project will impact the species as there is a low likelihood that large numbers of fish will enter the floodplain due to fish screens being included on the pump inlets. A staged drawdown regime would be implemented to provide cues for native fish to exit the wetland (e.g. fish exit strategy) and release rates of return flows enable suitable mixing to occurs with the Murray River if water quality in return water is low.</p>
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>			nt	<p>Construction Areas</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p>Inundation Area</p> <p>Impact unlikely. Species mobile and wide-ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water.</p>
Common Greenshank	<i>Tringa nebularia</i>	M		vu	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p>Inundation Area</p> <p>Impact unlikely. Species mobile and wide ranging. Species likely to benefit from environmental water when present.</p>
Marsh Sandpiper	<i>Tringa stagnatilis</i>	M		vu	<p>Construction</p> <p>Impact unlikely. Suitable habitat not present within Construction Footprints.</p> <p>Inundation Area</p> <p>Impact unlikely. Species mobile and wide ranging. Species likely to benefit from environmental water when present.</p>

Guttrum and Benwell Forests Floodplain Restoration Project

Lace Monitor	<i>Varanus varius</i>			en	<p><u>Construction</u> Impact possible. Localised impacts possible during large tree removal and sub-surface impacts in Construction footprint. Losses to relatively small area of habitat in comparison with available habitat within forest and surrounding areas. An on-site ecologist with Management Authorisation under the <i>Wildlife Act 1975</i> must be present during large tree removal and construction works.</p> <p><u>Inundation Area</u> Impact unlikely. Species likely to benefit from improved habitat condition following environmental water.</p>
Murray Crayfish	<i>Euastacus armatus</i>		L		<p><u>Construction</u> Impact Possible. Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprint must consider aquatic fauna. A construction specific aquatic fauna management plan would be developed for all works around waterways.</p> <p><u>Inundation Area</u> Impact Possible. A staged and managed drawdown regime will be implemented to monitor water quality of return flows and provide cues for native fish and invertebrates to exit the wetlands to prevent stranding. Release rates of return flows enable suitable mixing to occur with the Murray River if water quality in return water is low. There is an overall assessment of low likelihood of impact to Murray Crayfish during the operation phase of the project</p>

Key: L – Listed, EN / en – Endangered, VU / vu – Vulnerable, nt – Near Threatened, cr – Critically Endangered, M = Migratory

No EPBC Act listed fauna species were recorded during targeted surveys in 2019 or in previous assessments within the project area (Biosis 2014a; GHD 2017).

Two EPBC Act listed fish species, Murray Cod (*Maccullochella peelii peelii*) and Silver Perch (*Bidyanus bidyanus*) and one fish species under the DELWP Advisory List for threatened flora, Golden Perch (*Macquaria ambigua*) have the potential to be impacted by construction. These species are larger bodied fish and main channel specialists, preferring deeper water habitats such as the Murray River alongside the project area. Construction impacts to these threatened species include loss of habitat and barriers to movement during construction. The use of partial coffer dams that do not extend across the river will ensure fish passage is maintained, and sediment and water quality impacts associated with construction will be managed through a Construction Environmental Management Plan. Significant impacts to these species are considered unlikely provided the recommended mitigation measures are implemented (refer to Section 12 – Proposed Mitigation).

Other threatened small-bodied fish with potential to occur, Unspecked Hardyhead (*Craterocephalus stercusmuscarum fulvus*), Murray-Darling rainbowfish (*Melanotaenia fluviatilis*) and Freshwater catfish (*Tandanus tandanus*) are wetland/floodplain specialists, given their preference for slow-flowing and still

waters, and are unlikely to be impacted from construction as construction activities are limited to floodplain areas that are not critical fish habitat and will be undertaken during dry conditions when no aquatic biota would be present on the floodplain. There is still potential for mobilisation of sediments that may discharge into wetland habitats during rainfall events, however these will be managed under general sediment control measures in the Construction Environmental Management Plan. The Macquarie Perch (*Macquarie australasica*), Murray Hardyhead (*Craterocephalus fluviatilis*), Flat-headed Galaxias (*Galaxias rostratus*) are also unlikely to be impacted from construction due to the species not being recorded in the region for many decades and therefore unlikely to occur in the project area.

There is the potential for threatened fish species to be impacted by operation of the project due to entrainment of fish in pump infrastructure, exposure to poor water quality during inundation events, stranding during managed drawdown events and exposure to poor water quality in return flows to the Murray River during managed drawdown and changes to Murray River flows as a result of pump diversions. Mitigation measures are included in the design, construction and operation of the project to manage potential impacts. These are considered to reduce risks to low for the operation of the project. These measures include design of all pump stations with fish screens on the pipe inlets with a 2 mm hole aperture to minimise likelihood of entrainment of fish, management of inundation and drawdown to minimise the likelihood of fish stranding on the floodplain during hybrid events by providing opportunities for fish movement during managed drawdown (e.g. fish exit strategy) and management of the timing of inundation and drawdown to minimise risks of blackwater and enable entrainment of organic matter during natural flooding events and to ensure appropriate dilution of return flows if low dissolved oxygen is evident. These operational measures will be documented in the Operating Plan. The project also has the potential to improve the productivity of the Murray River which will benefit native fish species such as Murray Cod, Golden Perch and Silver Perch. As the floodplain is inundated, the surface and immediate subsurface floodwaters accumulate carbon in various forms from organic matter and primary productivity within the floodplain. When that water is returned to the Murray River from the floodplain, it transports some volume of carbon with it (ARI, 2020).

The Growling Grass Frog was historically recorded once in the project area, but has not been recorded in the last 30 years and was not recorded during targeted surveys of construction footprints in areas of potentially suitable habitat in 2012 (GHD 2013), 2013 (GHD 2014) or 2019 (the current study). Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this. Whilst direct impacts from works are not predicted for the Growling Grass Frog, given the lack of permanent water, 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 will 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 will be engaged, and employ hygiene protocols identified in Murray et al (2011). This species is not considered likely to be significantly impacted by the proposed construction activities or inundation.

The Broad-shelled Turtle and Murray River Turtle may be impacted from localised impacts as a result of habitat removal and construction works along river banks. Potential nesting habitat is anticipated to be unlikely impacted, as both species of turtle prefer open, sandy environments with lower canopy cover, which are not identified within the construction footprint. Significant impacts to these species are considered unlikely due to the limited construction areas along the Murray River and provided the recommended mitigation measures are implemented (refer to Section 12 – Proposed Mitigation). A construction specific aquatic fauna management plan will be developed (as part of a CEMP) for all works around waterways, which would consider coffer dam construction, dewatering works and any potential for sediment contaminant

run-off. It would also consider the timing of works to where practicable avoid the breeding season of turtles (spring to summer) where turtles may nest along river banks.

One EPBC Act listed species, South-eastern Long-eared Bat has not been recorded in the project area and was not recorded during bat surveys in the construction footprint in 2017. The closest records in Victoria to the project area are in old growth mallee vegetation around the Hattah township and Hattah-Kulkyne National Park, over 150 km to the north/west. It is considered unlikely that this species utilises Red Gum forests and woodland habitats within the Guttrum-Benwell project area, and that if it does occur, it is likely to be in extremely low numbers. Southern Myotis, Squirrel Glider, Bearded Dragon and Lace Monitor may also be impacted during the construction phase by large tree removal and ground disturbance. To minimise impacts to these species the removal of very large old trees (DBH > 150), which are more likely to provide habitat for these species, will be avoided wherever possible. During the removal of large hollow-bearing trees, hollow-salvage will be retained as potential habitat for these species and provide some mitigation against the loss of hollow-bearing trees. An on-site ecologist with Management Authorisation under the *Wildlife Act 1975* will be present during large tree removal and construction works. No Significant impacts are expected for South-eastern Long-eared Bat, particularly given the core 'important population' for the species occurs in the western slopes and plains in NSW.

Further discussion of potential impacts on listed threatened species identified as known to occur or possibly occurring in the project area is provided in **Attachment 3 – Flora and fauna Assessment**. This includes an assessment against the EPBC Act significant impact criteria for each of the EPBC Act listed species identified in **Table 16**, which is provided in Appendix N of **Attachment 3 – Flora and Fauna Assessment**.

Migratory species

Eleven migratory species were identified as having the potential to occur within 10 kilometres of the project area. One species (Glossy Ibis), with previous records but not identified on the PMST search was recorded as present during the field survey. There were also records and suitable habitat for Marsh Sandpiper and Common Greenshank. None of the other eight species were considered 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. It is highly unlikely that the construction footprint supports habitat that would be considered important for these migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. A current assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works for this species is provided in Appendix N of **Attachment 3 - Flora and Fauna Assessment**.

Reinstating historical environmental flows within the Guttrum-Benwell floodplain complex 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 highly mobile listed Migratory species, that have potential to utilise habitat in the area (for example, Curlew Sandpiper, Sharp-tailed Sandpiper, Common Sandpiper, Common Greenshank, Glossy Ibis, and Marsh Sandpiper) (R8, 2020c).

Ecological communities

No EPBC Act or FFG Act listed flora communities have been identified in the project area or are likely to be impacted by the construction operation of the project.

One FFG listed fauna community is present (Victorian Temperate Woodland Bird Community) in the project area. Bird species of this FFG-listed fauna community are highly mobile, and there is availability of significant River Red Gum open woodland and forest, with an abundance of tree hollows for nesting sites and fallen timber still being available within the forest. Proposed vegetation removal (13.7 hectares) represent small areas within an extensive area of potentially suitable habitat within Guttrum and Benwell

Forests (1,930 hectares). Therefore impacts to this community are likely to be negligible and the proposed construction or operation of the project is unlikely to impact on habitat connectivity or remove important habitat for the community. The proposed inundation of floodplain and wetland habitats however, is likely to provide important future benefits to the community particularly under climate change scenarios of longer, dryer conditions.

There is also one FFG listed fish community identified in the desktop assessment as being present (Lowlands Riverine Fish Community of Southern Murray-Darling Basin). Impacts to this community are likely to be low due to mitigation measures are proposed for construction works and operation. Managed inundation will adopt strategies to minimise the likelihood of fish entrainment and colonisation of floodplain environments during managed events (e.g. fish screens on pump stations). Managed drawdown as part of the fish exit strategy proposed provides opportunities for fish that do access the floodplain to return to the Murray River. Potential exposure to poor water quality will be managed through monitoring of potential hypoxic blackwater and drawdown strategies that maximise dilution potential.

Is mitigation of potential effects on indigenous flora and fauna proposed?

NYD No Yes If yes, please briefly describe.

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. Previous disturbance in these areas have resulted in soil compaction, weed invasion (particularly at the outer edges of the forest near surrounding agriculture land), which has reduced the understorey quality and habitat for threatened flora. The following would be considered as the project's design is refined and through construction, and implementation of the project:

Design

The following mitigation measures will be implemented during the design phase to minimise and mitigate impacts to threatened flora and fauna identified in previous ecological surveys within the construction footprint (Biosis 2014, GHD 2017, R8, 2020c):

- Siting of proposed structures primarily along or immediately adjacent to existing access tracks and other previously disturbed areas
- Avoid where possible mapped rare and threatened flora species
- Design project infrastructure to enable fish migration and manipulation to provide fish exit cues
- Design of pump stations to provide appropriately sized fish screens on inlet pipes
- Micro-aligning construction footprint to avoid impacting hollow-bearing trees to reduce impacts to hollow-dependent fauna (such as species within the FFG Act Listed community, VTWBC)
- Refinement of the design and construction methods to minimise the construction footprint (including access track and laydown areas)

Construction phase

The following mitigation measures will be implemented to minimise and avoid impacts upon the identified threatened flora, fauna and community values:

Guttrum and Benwell Forests Floodplain Restoration Project

- Follow the avoid, minimise and offset protocol in Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017) for determining the construction works footprint at each site (i.e. make every effort to avoid threatened flora species loss as a high priority)
- Areas of remnant native vegetation to be retained will be delineated from those areas to be removed as 'no-go zones', to avoid encroachment into areas of retained vegetation
- Use existing disturbed areas or areas of non-native vegetation for lay-downs and stockpiling
- All vehicles and plant must only operate on existing tracks and in areas marked as parking areas or construction zones
- Manage potential impacts to tree root zones during construction
- For the protection of threatened flora:
 - Species listed under the FFG Act and EPBC Act are not permitted to be removed and must be fenced off with temporary 1 metre high orange barrier mesh medium-heavy weight prior to construction commencing
 - Fencing must be checked on a weekly basis and the population monitored on a monthly basis
 - All staff onsite will be made aware through inductions and/ or signage of the presence of threatened species and how to identify the species
- If any threatened flora species additional to those already identified in site plans (i.e. listed as threatened under the EPBC Act, or the FFG Act) are found within the construction area, the Project Ecologist will be notified. The number and location of individuals will be recorded and DELWP will be advised.
- 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, set down 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 (spring to summer) 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 will also include other native hollow-dependent fauna. A protocol will 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 will be conducted prior to (within 24 hours) the hollow-bearing trees being removed. In some cases, fauna may not be able to be removed and staged tree removal may follow. In some instances, DELWP will need to be contacted. Where nocturnal wildlife can be removed, they will be kept in cages and released at dusk. If fauna are located within hollows, or are nesting in a tree the onsite ecologist will follow the Flora and Fauna Management Plan.
- For the protection of fish species:
 - Use only partial coffer dams to isolate small areas of river from construction works.
 - Relocate any habitat within works areas to the same river reach and adoption of sediment control and accidental spill measures.

Guttrum and Benwell Forests Floodplain Restoration Project

- If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities will need to hold the appropriate permit or licence under the *Fisheries Act 1995*. Any capture of fish must be carried out by a qualified aquatic ecologist.
- An initial briefing of construction works crews by a qualified ecologist and subsequent planning of safe work distances and establishment of each site.
- Manage the impact of noise and light pollution for fauna during construction. Where night-time works are unavoidable, measures must be implemented to limit the impact to nocturnal fauna. These could include measures such as:
 - Downward angles or directional lights to avoid unnecessary light spill across a broader area than required.
 - Light wavelengths selected (yellow/orange LED) to avoid insect attraction, and therefore reducing indirect impacts to bat and nocturnal bird behaviour.
 - Works should be undertaken away from known nesting areas or done out of season.
 - Avoiding periods of high insect/bird/bat activity to minimise disturbance to faunal communication.
 - Ensure areas of quiet remain in connected/adjacent habitat that can act as a refuge while other areas are subject to higher temporary noise levels.
 - Avoid where possible equipment which emit noise at known animal communication frequencies (generally higher frequencies above 500Hz).
- Standard vehicle hygiene measures are to be implemented 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), and to prevent the spread or transmission of Chytrid Fungus as per Murray et al (2011).
- Develop and implement a Construction Environmental Management Plan (CEMP) for the construction phase. This CEMP will include measures to avoid or minimise indirect impacts such as erosion, sedimentation and the accidental spill of oils or other chemicals. It will also provide a protocol for minimising impacts in ecologically sensitive areas such as creek lines. Implementation of the EMP will be audited during and following the construction process to ensure works have been conducted appropriately.
- Develop and implement a Flora and Fauna Management Plan as part of the CEMP that contains requirements, including those listed in this section of the referral, to avoid, mitigate and manage impacts to flora and fauna values and particularly threatened species and describing the habitat preclearance and clearance process.
- Develop and implement an Aquatic Fauna Management Plan as part of the CEMP to manage impacts to aquatic values – with emphasis on threatened fish species that may be present in vicinity of construction sites. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) will be considered.
- On completion of works, temporary construction areas are to be rehabilitated to the satisfaction of DELWP and Parks Victoria or the relevant landowner/manager. Site rehabilitation measures may include:
 - Setting aside topsoil to reinstate when works are complete and compacting to original levels

Guttrum and Benwell Forests Floodplain Restoration Project

- 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.
- 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, is to be reinstated.

Operation

The following mitigation measures are recommended to minimise and avoid impacts upon the identified threatened flora, fauna and community values:

- Implement complementary measures to maximise the ecological benefits of environmental watering and assist in achieving project objectives. Measures will include pest animal and plant management and active regeneration and are further discussed in Section 18 Environmental Management. This will require collaboration with DELWP and Parks Victoria and the expansion of current programs (e.g. pest control programs) within the forests and consistent with Parks Victoria River Red Gum Conservation Action Plan.
- Timing water delivery to drown seedling, minimise growth, germination and seed set of pest species. Time water delivery to promote native species
- Management of inundation and drawdown to minimise the likelihood of fish stranding on the floodplain by providing opportunities for fish movement during managed drawdown (e.g. development of fish exit strategy)
- Timing of inundation and drawdown to minimise risks of blackwater and to provide appropriate dilution of return flows if hypoxic blackwater is evident.

Other information/comments? (eg. accuracy of information)

13. Water environments

Will the project require significant volumes of fresh water (eg. > 1 Gl/yr)?

NYD No Yes If yes, indicate approximate volume and likely source.

The Guttrum and Benwell Forests Floodplain Restoration Project would inundate up to 1,148 hectares (668 hectares at Guttrum Forest and 481 hectares at Benwell Forest) of floodplain at a design water level of between 74.60m AHD and 75.80m AHD across the three different areas of the forests; Guttrum East, Guttrum West and Benwell Forest.

Water would be sourced from existing environmental water entitlements¹ via the Victorian Environmental Water Holder. Water use is expected to vary from year to year depending on the environmental water requirements, inundation history and water availability. The volumes of water required to fill Guttrum Forest

¹ Includes environmental water entitlements already held by the Murray Darling Basin Authority, the Commonwealth Environmental Water Holder and the Victorian Environmental Water Holder.

Guttrum and Benwell Forests Floodplain Restoration Project

and Benwell Forest floodplains, returned flows to the River and total net volume of water used is summarised by **Table 17**.

Table 17 Estimated water use under the proposed operating scenarios – fill and maintenance flows (Source: Operating Plan – to be updated once provided)

Scenario	Pumped volume (ML) under the proposed operating scenarios	Return flow to Murray River (ML)*	Net volume used (ML)
Guttrum Forrest			
Forest floodplain watering	9,250	3,079	6,171
Semi-permanent wetland watering	3,317	0	3,317
<i>Sub-Total</i>	<i>12,567</i>	<i>3,079</i>	<i>9,488</i>
Benwell Forest			
Forest floodplain watering	7,000	2,000	5,000
Semi-permanent wetland watering	1,000	0	1,000
<i>Sub-Total</i>	<i>8,000</i>	<i>2,000</i>	<i>6,000</i>
Total (Guttrum and Benwell Forests)	20,567	5,079	15,488

* Does not include return flows to Murray River via Benwell Drainage system (connected to emergency outlet pipeline).

Inflows and outflows to the Guttrum and Benwell Forests would be measured during managed flood events when the proposed works are operated. This would be achieved using flow sensors installed at each of the regulators to measure natural inflows and outflows. These measurements are important to inform calculation of the volume of environmental water used in each event and enable accuracy of water accounting.

Will the project discharge waste water or runoff to water environments?

NYD No Yes If yes, specify types of discharges and which environments.

Through the construction of new infrastructure the project aims to provide pumped inflows of up to 125 ML/d of water from the Murray River at each of the three proposed pump stations into the forests. The pumping will result in inundation of approximately 668 hectares of Guttrum Forest and 481 hectares of Benwell Forest.

Flows will be diverted from the River, pumped on to the floodplain and a number of swamps across the forests, through the selective operation of one large and six small regulators, five pipelines, two drop structures, three pump stations, and a series of containment banks to divert, retain and release water. Allowing for floodplain losses, it is estimated that approximately 5,079 ML (detailed in **Table 17**) of flows entering the Guttrum and Benwell Forest could potentially return to the Murray River at the completion of a watering event. Any water quality impacts associated with return flows will be managed under the MDBA Basin Plan statutory water quality requirements including compliance with the State Environment Protection Policy (Waters) (DELWP, 2018) and the Basin Salinity Management 2030 – BSM2030 (Murray-Darling Basin Ministerial Council, 2015). Return flows to the Murray River would be managed as part of the Operating Plan and measures to reduce water quality impacts will be included in the Environmental Water Management Plan including monitoring water quality and water temperature and dilution flows.

Construction works would be managed in accordance with a CEMP including controls for managing sediment, erosion, and rainfall runoff and management of activities such as works in waterways and dewatering, where required.

Guttrum and Benwell Forests Floodplain Restoration Project

Potential impacts to water environments, including those associated with wastewater or runoff are described in the response below.

Are any waterways, wetlands, estuaries or marine environments likely to be affected?

NYD No Yes If yes, specify which water environments, answer the following questions and attach any relevant details.

There are no designated waterways within the Guttrum and Benwell Forest. The Murray River forms the northern border of the forests with construction of the three pump stations and two drop structures proposed on the banks of the Murray River.

No Ramsar or DIWA listed wetlands are located within the project area or within the broader Guttrum and Benwell Forests. Eleven wetlands listed on the Victorian Wetland Inventory occur within the Guttrum and Benwell Forest system, with three of these directly impacted by construction of the project, Guttrum State Forest (ID 45221) Benwell State Forest (ID 45208) and Benwell Swamp (ID 45202).

Potential impact pathways of the project during construction and operation are listed below. These potential impact pathways will be monitored and managed to reduce and avoid impacts under the project's environmental management documentation (Section 18 Environmental Management) including Environmental Management Framework, Construction Environmental Management Plan, Operating Plan and Environmental Water Management Plan:

Potential impacts of the project during construction

Construction impacts are temporary and generally localised in nature. The implementation of appropriate construction methodologies and measures documented within a project CEMP would address the following identified risks:

- Erosion and loss of topsoil causing water quality impacts
- Construction works and structures causing bed and bank erosion and instability
- Rainfall and flood events causing a pollution event and runoff
- Discharging/dewatering poor quality water into receiving waters (high turbidity, EC)
- Spills, leaks, poor handling of fuels, oils and other chemicals causing soil/water contamination
- Increased weed growth following construction, due to ground disturbance

Potential impacts of the project during operation

An Operating Plan (**Attachment 8**) has been drafted for the project. This document, together with the Environmental Water Management Plans for the Forests would be updated on an ongoing basis in order to assist with the management of the operational risks to water quality associated with watering events.

Identified water quality related risks are:

- Hypoxic blackwater in the floodplain environment may develop following the delivery of environmental water, particularly during warm conditions and where high loads of organic matter exist on the floodplain, which could impact on the health of aquatic species and communities through compromising foraging habitat and causing wetland biota deaths.
- Suspended solids, turbidity and organic matter may cause poor water quality (including groundwater) impacting the health of aquatic species and communities, and indirectly waterbird species (through reduced food availability).
- The release of poor quality water into the Murray River may impact water quality downstream.

Guttrum and Benwell Forests Floodplain Restoration Project

- Inability to release poor quality water back to the Murray River may impact floodplain health and vegetation.
- Carp may breed in response to natural floods and/ or hybrid events within the forest, excessive numbers of carp can adversely affect aquatic ecosystems, impacting aquatic macrophytes through disturbance and increasing turbidity.

Measures to manage the construction related impacts are outlined in the 'mitigation' section below and also Section 18 (Environmental management). In particular a CEMP would be developed containing measures to avoid and mitigate impacts associated with construction works.

Potential impacts to DELWP mapped wetlands are predominately associated with vegetation removal associated with construction, however noting that the construction of works allows for the restoration of the wetland hydrology. Reinstating a more natural wetting and drying regime to these wetlands will provide significant ecological benefits to the whole wetland area, particularly to wetland vegetation, therefore benefits to native vegetation will be much larger compared to the small area of impact associated with construction.

Any upstream or downstream hydrological changes or impacts in the Murray River associated with the delivery of environmental water to the Guttrum and Benwell Forests will be assessed and managed by the River Murray Operations Committee (RMOC) as part of their responsibility to oversee the operation of the river which is managed by the Murray Darling Basin Authority on behalf of the relevant State and Commonwealth Governments. It is also proposed that the environmental water requirements for VMFRP sites will be added to the existing river flows and therefore managed to ensure minimal, if any, changes in flows experienced downstream of the project sites.

Delivery of environmental water in the Murray River system is undertaken by the RMOC in accordance with a risk based approach to minimise impact to river users and the Commonwealth Environmental Water Holder's Framework for Determining Commonwealth Environmental Water Use (CEWO 2013) which requires environmental watering to consider the potential environmental risk, including downstream environmental risk, which may result from applying environmental water; and measures that may be taken to minimise those risks. The waterway managers and water authority will also work with the RMOC to ensure that the planning and delivery of environmental water delivery is undertaken to achieve ecological objectives and minimise adverse impacts on river hydrology and incorporate which will be informed by a monitoring program.

Further modelling of the cumulative change to flows in the Murray River as a result of the VMFRP (all sites) will be undertaken by the RMOC once all VMFRP projects are confirmed to either proceed or not based on the outcomes of the approvals process.

An Environmental Watering Management Plan and Operating Plan would be developed and contain measures to manage and mitigate water quality risks associated with environmental watering events. This would include monitoring of ground and surface water quality before, during and after watering events to inform management and measures which may include: diluting return flows with sufficient river flows; diluting poor quality water on the floodplain by delivering more fresh water to these areas; or reducing the frequency and/or extent of planned watering events if sufficient volumes not available. The draft Operating Plan is provided in **Attachment 8**. Interim Environmental Watering Management Plans for the Forests have been developed for the Forests (North Central CMA, 2014 d,e) and will be updated to incorporate the project once the project has been fully approved.

A blackwater risk assessment (i.e. using the blackwater risk assessment tool developed for Gunbower Forest) would also be undertaken prior to environmental water deliveries. If there is a large build up of carbon on the floodplain (i.e. long time period between floods) and a significant risk of hypoxic blackwater developing, then water deliveries will be managed to target the release of return flows to the Murray River during cooler conditions when the risk of hypoxic blackwater is lower. The volume and quality of return water

Guttrum and Benwell Forests Floodplain Restoration Project

would be monitored during the event and the release of anoxic blackwater from the floodplain only allowed if the volume of fresh passing flows in the Murray River is sufficient to dilute the hypoxic return flows. This approach is similar to risk assessment and management undertaken for the Gunbower TLM Icon Site. In 2018, a return flow trial was undertaken during a large-scale environmental water managed flood event at Gunbower Forest (approx. 4,500 ha inundation extent and 18,000 ML return flows). As part of the trial, the water quality risk to Gunbower Creek was assessed, and showed that the DO of return flows did not fall below 4 mg/L at any time and mixing occurred quickly with passing flows, causing a rapid increase in DO within the Gunbower Creek channel (Baldwin 2019).

Are any of these water environments likely to support threatened or migratory species?

NYD No Yes If yes, specify which water environments.

The Murray River and Guttrum and Benwell Forest floodplain and wetlands are likely to at least intermittently support listed threatened and migratory species. These species are generally expected to benefit from the anticipated improvements in ecological condition of floodplain vegetation and associated habitats that the project aims to deliver through the proposed reinstatement of a more natural hydrological regime. Further discussion of listed threatened species and migratory species identified as possibly or likely to occur in the project area is provided in Part 2, Section 12 (Native vegetation, flora and fauna) and **Attachment 3 – Fauna and Flora Assessment** of this referral.

Are any potentially affected wetlands listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'?

NYD No Yes If yes, please specify.

The project is not located within any wetlands listed under the Ramsar Convention or A Directory of Important Wetlands in Australia (DIWA). However, there are two wetlands listed under the Ramsar Convention and nine wetlands listed in DIWA in Australia which, due to their location downstream of the Project, have the potential to be impacted by hydrological and water quality changes due to return flows to the Murray River from the Project Area during a managed inundation event. These wetlands are summarised in **Table 18**.

Table 18 Ramsar and DIWA listed wetlands downstream of Guttrum-Benwell Forests

Ramsar site	DIWA site	Distance downstream*
NSW Central Murray State Forests	Koondrook and Perricoota Forests	Adjacent to the Project Area, across the Murray River
-	Beveridge Island	>50 km
-	Major Mitchell Lagoon	>150 km
-	Belsar Island	>200 km
Hattah-Kulkyne Lakes	Hattah Lakes	>300 km
-	Kings Billabong Wetlands	>400 km
-	Lake Ranfurly	>350 km
-	Walpolla Island	>400 km
-	Lindsay Island	>450 km

*Distances are approximate only and are likely to be greater than these values due to the sinuosity of the Murray River

Guttrum and Benwell Forests Floodplain Restoration Project

The potential impacts to the Ramsar and DIWA listed sites downstream of the project site include hydrological and/or water quality impacts to floodplain wetlands as a result of return flows to the river from Guttrum and Benwell Forests during and following a managed inundation event.

If the volume of change in Murray River flows as a result of return flows was significant, unseasonal or excessive inundation of downstream wetland could occur. Return flows may also change the water quality (e.g. low Dissolved Oxygen levels) in the river resulting in an impact to biota in downstream wetlands.

Modelling of the hydrological impact on Murray River flows as a result of return flows entering the river from Guttrum and Benwell Forests is required to be undertaken to assess the potential for hydrological and water quality impacts to downstream Ramsar and DIWA wetlands. Early estimates of return flow rates from Guttrum and Benwell Forests are in the order of 25 ML/d for both sites during early stages of the project (DHI 2013, cited in North Central CMA 2014a), small volumes in relation to daily flows down the Murray River, which have ranged between 1300 – 59,905 ML/d downstream of the Torrumbarry weir during the period 1974 – 2020 (MDBA 2020). Therefore, downstream impacts from the Guttrum and Benwell Floodplain Restoration Project in isolation are expected to be small/ low risk.

Any potential impacts to downstream wetlands would be adaptively managed through implementation of a monitoring and evaluation framework and Operating Plan and draw on experience from previous environmental watering projects such as the TLM Program.

Could the project affect streamflows?

NYD No Yes If yes, briefly describe implications for streamflows.

The purpose of the project is to reinstate a more natural hydrological regime to the Murray River floodplain within Guttrum and Benwell Forests through pumping from the Murray River. On completion of a managed inundation event, the project would release managed environmental water back to the Murray River except for water losses due to infiltration and evaporative processes during retention on the floodplain. As detailed in **Table 17**, approximately 5,079 ML will be returned to the Murray River under the proposed operating scenarios at Guttrum (3,079 ML) and Benwell (2,000 ML) Forests. These return flows will only occur during floodplain watering scenarios, all water delivered during semi-permanent wetland watering will be retained within the wetland areas.

Potential effects on Murray River flows would be assessed and managed through existing environmental water accounting frameworks under the Basin Plan, with which the current project would need to comply. These frameworks require that any water pumped from the Murray River is debited against environmental watering accounts, along with any additional evaporation and seepage losses caused by impounding natural inflows on the floodplain beyond the peak of floodwaters passing. To minimise potential effects, the project is designed to prioritise use of natural flood inflows rather than additional pumping of water directly from the Murray River.

Could regional groundwater resources be affected by the project?

NYD No Yes If yes, describe in what way.

The groundwater environment of the project area is described in Section 7 of this referral. A desktop groundwater assessment has been prepared and is provided in **Attachment 6 – Groundwater Assessment**.

The potential groundwater effects of the proposed construction and operation of the works are:

- Temporary and limited drawdown of groundwater levels during construction
- Increased groundwater level as a result of flood recharge
- Reduced groundwater salinity immediately following flood events

Guttrum and Benwell Forests Floodplain Restoration Project

- Modified groundwater quality of the watertable during and after flood events
- Mobilisation of salt from either the soil surface or from shallow groundwater to return to the Murray River
- Shallow groundwater in the vicinity of vegetation may occur for extended periods of time during and immediately after flooding.

Ideally, construction would occur during low flow, low rainfall periods (e.g. Summer and Autumn) and therefore all sites within the Guttrum and Benwell Forests would be dry and therefore not require dewatering. Construction of the pump stations and drop structures in the Murray River is likely to require construction of coffer dams and therefore dewatering may be required as well as subsequent disposal of pumped groundwater. If this is the case, then minor impacts on adjacent vegetation and ecosystems are possible. This can be mitigated by planning construction to minimise dewatering and, if required, providing watering for any ecosystems that may experience and be impacted by lowered groundwater levels.

Operation of the proposed works will result in elevated groundwater levels, wetting of soils and potentially mobilised salt from the unsaturated soil store. This could potentially result in the displacement of salt to the Murray River and increased evapotranspiration of water from the floodplain, potentially concentrating salts in the soil. However, given the low salt store in the project area and the generally fresh to moderately saline groundwater, these issues are regarded as being negligible (estimated salinity impact at Morgan <0.01 $\mu\text{S/cm EC}$) (Jacobs 2014) (Jacobs, 2014).

Existing monitoring bores are located across the project area, established in 2014 by the North Central CMA. These bores are already incorporated in to the CMA's groundwater monitoring network and monitoring program and have water level loggers continuously tracking groundwater levels, and therefore monitoring and ongoing assessment of salinity risks will occur consistent with the BSM2030 (Murray Darling Basin Ministerial Council, 2015).

Could environmental values (beneficial uses) of water environments be affected?

NYD No Yes If yes, identify waterways/water bodies and beneficial uses (as recognised by State Environment Protection Policies)

The waterways and water bodies within the project area are located with the State Environment Protection Policy (Waters) (SEPP (Waters)) Murray and Western Plains surface water segment. Wetlands within the project area are located within the SEPP (Waters) Lakes and Swamps surface water segment. Schedule 2, Table 3 of SEPP (Waters) identifies beneficial uses of inland waters within the Murray and Western Plains and the Lakes and Swamps segments as including:

- Water dependent ecosystems and species that are slightly to moderately modified (or largely unmodified in Aquatic Reserves)
- Human consumption after appropriate treatment where water is sourced for supply in accordance with the special water supply catchments area set out in Schedule 5 of the *Catchment and Land Protection Act 1994* or the *Safe Drinking Water Act 2003*
- Agriculture and irrigation
- Human consumption of aquatic foods
- Aquaculture where the environmental quality is suitable, and an aquaculture licence has been approved in accordance with the *Fisheries Act 1995*
- Industrial and commercial (applies to the Murray and Western Plains segment only)
- Water-based recreation (primary, secondary contact and aesthetic enjoyment)

Guttrum and Benwell Forests Floodplain Restoration Project

- Traditional Owner Groups cultural values
- Cultural and spiritual values

The SEPP (Waters) identifies beneficial uses of groundwater based on Total Dissolved Solids (TDS) concentrations. The interpreted groundwater salinity at the project area indicates that the following groundwater beneficial uses are protected in the project area under the SEPP(Waters):

- Water dependent ecosystems and species
- Potable water supply (acceptable)
- Potable mineral water supply
- Agriculture and irrigation (irrigation)
- Agriculture and irrigation (stock watering)
- Industrial and commercial
- Water-based recreation (primary contact recreation)
- Traditional Owner cultural values
- Cultural and spiritual values
- Buildings and structures
- Geothermal properties

Due to the generally saline nature of the deeper regional aquifer and the proximity to fresh water from the Murray River, there is only one registered user close to the project area (600m south of Benwell Forest, bore ID WRK951262, FedUni, 2015). The inundation of the Guttrum and Benwell Forest (Benwell Forest in particular) beyond current patterns has the potential to generate an increase in local groundwater levels (mounding) under the forest which may cause a (lesser) rise in the elevation of groundwater in the adjacent areas. The potential impact to this user is a slightly elevated groundwater level with little to no change to groundwater quality. Potential effects on regional groundwater are discussed in the preceding section and in more detail in **Attachment 6 – Groundwater Assessment**.

Groundwater Dependant Ecosystems (GDEs)

Groundwater plays an important role in sustaining aquatic and terrestrial ecosystems. A number of Ecological Vegetation Classes (EVCs) are mapped across the project area as identified in **Table 12**, some of which are thought to contain species are at least partially reliant on groundwater (R8 2020c).

As identified in the Flora and Fauna Assessment prepared for the project (R8, 2020c), of the EVCs previously mapped as occurring within the project's managed inundation area, all are wetland, flood-dependent or flood-tolerant vegetation communities and are likely to benefit from the proposed watering regime.

Could aquatic, estuarine or marine ecosystems be affected by the project?

NYD No Yes If yes, describe in what way.

The project aims to reinstate a more natural hydrological regime to the Guttrum and Benwell Forest floodplain, which is expected to deliver a range of ecological benefits to floodplain and wetland communities. The project is designed to have the operational flexibility to vary the timing, depth, duration and extent of inundation so that individual managed events can target specific ecological outcomes.

Guttrum and Benwell Forests Floodplain Restoration Project

A risk assessment was completed to identify and assess risks during project development (North Central CMA 2014f). This involved identifying potential undesirable outcomes, determining their root causes, assessing likely consequences and significance; and developing relevant mitigation measures to reduce any residual risk to an acceptable level (very low to moderate). Experience gained from previous works and measures, and environmental watering projects of similar scale and complexity, including The Living Murray Program, informed this process.

The risk assessment (North Central CMA 2014f) identified the following potential threats to aquatic ecosystems:

- If the water regime provides shallow water or damp soil over late spring and summer, River Red Gum germination and establishment may occur in the wetland areas and flood runners, causing wetland plant diversity to be suppressed and the habitat value for fish and waterbirds to be altered. Evidence of River Red Gum encroachment is also evident in the Guttrum and Benwell Forests, indicating they are susceptible.
- If the forest drains quickly after watering, native fish may not have adequate cues or time to leave the floodplain and may become stranded, resulting in lowered recruitment and population decline for some species (e.g. channel specialists). This would only present as a risk during a hybrid or natural inundation events where fish can access the floodplain from the Murray River. It is also recognised that opportunistic use of the floodplain by native fish has many benefits regarding access to food and habitat resources (Mallen Cooper *et al.* 2014).
- If environmental watering is not of appropriate duration this may lead nesting birds to abandon their nests leading to poor recruitment and reduced local diversity and abundance.
- If environmental water carries reproductive parts of Lippia and Arrowhead (e.g. seed, roots) into the forest wetlands, the weed may establish and expand, causing wetland plant species to be outcompeted, reduced plant diversity and degraded fauna habitat.
- If warm water and high litter levels create high organic and microbial load, blackwater with low dissolved oxygen and pH (and possibly toxic solutes) may kill wetland biota, reduce food sources, cause toxic algal blooms and may threaten wetland community health, threatened species, fish and other aquatic fauna communities and waterbird communities.

In addition to the risks highlighted by North Central CMA (2014f), the inability to discharge water of poor water quality during a managed flow event, due to downstream impacts, could also result in impacts on floodplain vegetation (due to extended inundation) or formation of blackwater / algal blooms.

Construction of the project also has the potential to affect aquatic ecosystems through:

- Erosion and loss of topsoil causing water quality impacts
- Construction works and structures causing bed and bank erosion and instability
- Rainfall and flood events during construction causing a pollution event and runoff
- Discharging/ dewatering poor quality water into receiving water
- Spills, leaks, poor handling of fuels, oils and other chemicals causing soil/ water contamination

Planning and design of the project continues to address these identified risks, including design of pump stations to reduce pest fish entering the floodplain and design regulating structures to satisfy fish passage requirements. Other measures to reduce the threats identified above are outlined in the 'mitigation' section below and also in **Attachment 9 – Draft Environmental Management Framework**.

Is there a potential for extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems over the long-term?

Guttrum and Benwell Forests Floodplain Restoration Project

No Yes If yes, please describe. Comment on likelihood of effects and associated uncertainties, if practicable.

Major and long-term effects on the health and biodiversity of aquatic ecosystems associated with the project are expected to be mostly positive and are defined through the specific ecological objectives for the project set out in Section 3 of this referral. The project is designed to have the operational flexibility to vary the timing, depth, duration and extent of inundation so that individual managed events are able to target specific ecological outcomes.

Is mitigation of potential effects on water environments proposed?

NYD No Yes If yes, please briefly describe.

Construction

The following mitigation measures are proposed to minimise and avoid impacts on water environments during construction of the project:

- Develop and implement a CEMP, including erosion and sediment control plans, dewatering and water quality management plans, weed and pest hygiene protocols to minimise potential impacts on wetlands and other aquatic ecosystems
- Rehabilitate construction areas following completion of works to the satisfaction of Parks Victoria and DELWP
- Minimise the total volume and rate of groundwater extracted for construction purposes - plan construction to minimise dewatering, provide make-up of offset water for affected vegetation during construction.
- Do not dispose of groundwater from construction activities to land.

Operation

The following mitigation measures are proposed to minimise and avoid impacts on water environments during operation of the project:

- Continue to undertake water quality monitoring before, during and after watering events to inform adaptive management strategies and real-time operational decision making.
- Commence watering as early as possible to move organic matter off the floodplain while temperatures are low. Maintain a through-flow where possible in other areas to maximise exchange rates and movement of organic material. Monitor dissolved oxygen and water temperature to identify hypoxic areas to inform consequence management.
- Planning and monitoring of flooding events to avoid prolonged periods of inundation that could lead to waterlogging (to avoid vegetation impacts). Avoid extended periods of shallow watertable < 3m below surface to avoid waterlogging of vegetation.
- Integrate water management with other sites in seasonal water planning process. Maintain good relationships with other water managers.
- Tailor watering regimes to provide competitive advantage for native fish over carp. Dry wetlands that contain carp. Manage drawdown following managed events to provide triggers for native fish to move off the floodplain, and where possible, strand carp.
- Monitor the ground and surface water quality before, during and after watering events to inform management and ensure sufficient volumes are available for mitigation such as:

Guttrum and Benwell Forests Floodplain Restoration Project

- Diluting poor quality return flows with sufficient river flows
- Diluting poor quality water on the floodplain by delivering more fresh water to these areas
- Schedule watering events to make use of dilution flows where possible and optimise timing of releases
- Reduce the frequency and/or extent of planned watering events if sufficient volumes not available.

Mitigation measures would be implemented to minimise risks associated with pest plants, including:

- Timing water delivery to drown seedlings, minimise growth, germination and seed set. Time water delivery to promote native species.
- Controlling current populations and eradicate/control new infestations via existing management strategies (e.g. DELWP and Parks Victoria pest management action plans/strategies). Support partner agencies to seek further funding for targeted weed control programs if necessary.

Mitigation measures would be implemented to minimise risks associated with barriers to fish passage, including:

- Design of regulating structures to satisfy fish passage requirements
- Continuing to build on knowledge and understanding through current studies relating to fish movement in response to environmental watering and cues to further develop and refine a fish exit strategy.

Other information/comments? (eg. accuracy of information)

14. Landscape and soils

14.1 Landscape

Has a preliminary landscape assessment been prepared?

No Yes If yes, please attach.

Is the project to be located either within or near an area that is:

- **Subject to a Landscape Significance Overlay or Environmental Significance Overlay?**

NYD No Yes If yes, provide plan showing footprint relative to overlay.

The area of the project adjacent to the Murray River is located within an Environmental Significance Overlay (Schedule 1 – Waterway Environs) (ESO1) (Refer **Attachment 7 – Land Use Planning Assessment**).

The ESO1 covers the length of the Murray River Reserve on land immediately adjoining the Murray River. Project components that occur within the ESO1 include:

- Guttrum West pump station, Guttrum main outfall channel, Guttrum East Pump Station
- Benwell pump station, Benwell drop structure

Guttrum and Benwell Forests Floodplain Restoration Project

The ESO1 recognises the *importance of the Murray River and its environs, being of local, regional, state, national and international significance* and notes that the Murray River is an *important water supply, tourism, recreation, landscape, cultural and environmental asset*.

The environmental objectives of the ESO1 seek to, amongst other things, *protect the visual and environmental qualities of waterways, wetlands and lakes, restricting the use and development of land in these areas to maintain these qualities*.

The project area is not subject to a Significant Landscape Overlay.

- **Identified as of regional or State significance in a reputable study of landscape values?**

NYD No Yes If yes, please specify.

As noted in the response above, the project area is located within the ESO1 which identifies the Murray River and its environs as being of local, regional, state, national and potentially international significance.

- **Within or adjoining land reserved under the *National Parks Act 1975*?**

NYD No Yes If yes, please specify.

The proposed construction footprint is adjacent and within the Murray River Reserve which is managed and classified under the *Crown Land Reserves Act 1978* and the *Forest Act 1958*. The project is not within or adjoining land reserved under the *National Parks Act 1975*.

- **Within or adjoining other public land used for conservation or recreational purposes?**

NYD No Yes If yes, please specify.

The Murray River Reserve and the Guttrum Forest and Benwell Forest are used for a range of recreational activities such as camping, fishing, canoeing, trail-bike riding and horse riding. Part 2, Section 15 (Social environments) provides further details of the recreational activities undertaken within this area.

Is any clearing vegetation or alteration of landforms likely to affect landscape values?

NYD No Yes If yes, please briefly describe.

The project would involve the removal of approximately 13.70 hectares of native vegetation as described in Section 12 (Native vegetation, flora and fauna) and **Attachment 3 – Fauna and Flora Assessment**, to raise existing access tracks and to construct new infrastructure (regulators, drop structures, pump stations) to retain water during managed inundation events.

Each of the three pump stations are located adjacent to the Murray River, north of River Track where some occasional recreational use (e.g. camping) is known to occur. Guttrum West Pump Station is located on the alignment of the existing River Track, 100m south of the Guttrum Main Outfall channel and therefore within a previously disturbed area (**Figure 3**). The Guttrum East Pump Station is located approximately 40m from River Track in an unofficial camping area just off River Track (**Figure 4**), close to the Reed Bed Swamp complex of wetlands. The proposed Benwell Pump Station Site is located close to River Track at the far north-western end of the forest, adjacent to open space (likely informal forest user areas) with some cleared tracks amongst established treelines (**Figure 6**).

The drop structures will also be located on outfalls to the Murray River. The Guttrum Main Drop Structure is located below the existing bridge on River Track to the outlet in to the Murray River (**Figure 5**). The Benwell Main Drop Structure is located on the existing track and containment bank which extends from River Track in the north west corner of Benwell Forest - where the main floodrunner meets the Murray River (**Figure 7**). Whilst all three pump stations and the two drop structures would be visible to park visitors (both along the

Guttrum and Benwell Forests Floodplain Restoration Project

access track and within the Murray River), it is expected that visibility would be partly screened by existing retained vegetation with views generally confined to areas in proximity to the pump stations.

The Benwell Main Regulator (large regulator) and containment bank are located along a segment of existing track at the western end of the Benwell Main Wetland and forest area (**Figure 8**). A number of other structures (e.g. Benwell East Regulator, Guttrum Main Regulator, Little Reed Bed Swamp Regulator, Reed Bed Swamp North and South Regulators) are also located, along or adjacent to publicly accessible tracks. These locations have been selected at previously disturbed sites to minimise works and vegetation removal and whilst will be visible to public in close proximity of the structures, the densely vegetated forest will partly screen the sites.



Figure 3 Guttrum West Pump Station Site



Figure 4 - Guttrum East Pump Station Site



Figure 5 - Guttrum Main Outfall Drop Structure Site



Figure 6 - Benwell Pump Station Site



Figure 7 - Benwell Main Outfall Drop Structure Site



Figure 8 - Benwell Main Regulator Site

The removal of native vegetation for the project would be in discrete areas totalling up to 13.70 hectares in the context of a largely intact expanse of native vegetation occurring within approximately 1,930 hectares of floodplain complex at Guttrum-Benwell. The areas of proposed vegetation clearing are also minor when compared to the 1,149 hectares of native vegetation within the proposed inundation areas that would benefit from the project.

Overall, the project is expected to have a positive effect on the landscape values of the surrounding floodplains and forests. This is expected due to the project's objective of restoring a more natural inundation regime to approximately 1,149 hectares of the Guttrum-Benwell floodplain. For this reason, it is considered that the project is consistent with the management strategies outlined in the Interim Guttrum and Benwell Water Management Plans (North Central CMA, 2014d, e) and the ESO1 that affects the project area. These documents recognise the importance of hydrological regimes in protecting the scenic landscapes that maintain recreational and tourism values of the area. Parks Victoria and DELWP are part of the VMFRP partnership and are responsible for management of the Guttrum and Benwell Forests.

Is there a potential for effects on landscape values of regional or State importance?

NYD No Yes Please briefly explain response.

As described above, the project would involve removal of native vegetation and alteration of constructed landforms within areas supporting state and regional landscape values related to the Murray River and its floodplain. The extent of vegetation removal and landform alteration, will be limited to approximately 13.7 hectares and generally within areas that have been modified by the construction and use of trails and tracks. From a landscape perspective, the proposed 13.7 hectares represents a comparatively small area within the ~ 1,930 hectare Guttrum and Benwell Forests, and when compared to the 1,149 hectare inundation area.

On balance, in the context of the proposed areas of disturbance and vegetation removal when measured against the 1,149 hectares of floodplain vegetation communities that is expected to benefit from the project, it is considered that the project would not have a significant adverse effect on landscape values of state or regional importance.

Is mitigation of potential landscape effects proposed?

NYD No Yes If yes, please briefly describe.

The following measures are proposed to mitigate potential landscape effects:

Design measures

- Siting of proposed structures primarily along or immediately adjacent to existing access tracks and other previously disturbed areas to minimise the removal of native vegetation and other construction impacts
- Limit the extent of ground disturbance and native vegetation removal, particularly large old trees, to the minimum extent necessary
- Design of proposed structures is to be sympathetic to the surrounding landscape and consistent with DELWP and Parks Victoria infrastructure design guidelines

Site re-establishment

- Following construction works, soil is to be reinstated to mimic the contours of the site prior to construction, unless the aim of construction was to alter the land profile (for example creek bed excavations). The following methods should be followed:
 - Photographs of the site taken prior to works should be consulted
 - Where soil has been compacted due to construction works, and is not required to maintain structural integrity of works, then the soil should be ripped with narrow tynes to a depth of 50 mm. Ripping that involves the mixing of soil profiles is to be avoided
 - Subsoil is to be reinstated first, with separate horizons restored in layers consistent with the surrounding soil profile. Any remaining subsoil should be removed and disposed of off-site, or at a site within the Forests under direction from Parks Victoria and DELWP / the land managers.
 - Vegetation (through natural regeneration) should be established as soon as possible after soil reinstatement to prevent risks of erosion
- Topsoil shall not be compacted when reinstated. All top soil should be used in site reinstatement.

Operation

- During the operational phase, inundation events would be managed in accordance with operational guidelines (provided in Guttrum and Benwell Forests Operating Plan – **Attachment 8 – Draft Operating Plan**) informed by detailed hydrodynamic modelling and ecological investigations and adapted as required in response to proposed monitoring and evaluation frameworks to support achievement of the identified ecological objectives for the project (detailed in the Guttrum and Benwell Forests Ecological Objectives and Hydrological Requirements Justification Papers - **Attachment 2**).

Other information/comments? (eg. accuracy of information)

Note: A preliminary landscape assessment is a specific requirement for a referral of a wind energy facility. This should provide a description of:

- The landscape character of the site and surrounding areas including landform, vegetation types and coverage, water features, any other notable features and current land use

Guttrum and Benwell Forests Floodplain Restoration Project

- The location of nearby dwellings, townships, recreation areas, major roads, above-ground utilities, tourist routes and walking tracks
- Views to the site and to the proposed location of wind turbines from key vantage points (including views showing existing nearby dwellings and views from major roads, walking tracks and tourist routes) sufficient to give a sense of the overall site in its setting

14.2 Soils

Is there a potential for effects on land stability, acid sulphate soils or highly erodible soils?

NYD No Yes If yes, please briefly describe.

A number of geotechnical investigations have been undertaken for the project area and proposed structure locations, with key findings summarised by URS (2014) and outlined below. Additional geotechnical works are proposed by VMFRP to supplement these previous investigations. The results of these investigations will inform the detailed design of the project.

Geology and soils of the area

Feasibility stage geotechnical investigations were undertaken by URS in 2014, followed by subsequent investigations as part of the advanced concept design (URS, 2015) and found that the materials encountered at the site were generally consistent with the published geology for the area.

URS (2015) identifies that the project area geology consists of alluvial, fluvial and lacustrine deposits associated with the Murray River floodplain (inclusive of the Coonamibidgal Formation and Shepparton Formation. Fine grained clays (sandy clay and clay) were the dominant soil types encountered and sands and clayey sands were encountered as interbedded layers.

URS (2015) summarised ground conditions at the proposed project infrastructure included in the Business Case (North Central CMA 2014a) (e.g. environmental watering through irrigation supply) and therefore did not cover the current locations of key pumping infrastructure. As such additional onsite geotechnical Investigations are currently being undertaken as part of the design phase and include boreholes and test pits including key asset sites such as the pump stations which were not included in URS (2015).

The soils encountered on site by URS (2015), were generally found to be dispersive. It is anticipated that locally sourced borrow material may also be dispersive. Treatment measures to minimise the potential for embankment erosion would be determined as the detailed design progresses. Erosion protection measures may include (1) compaction of the fill to 98% of standard compaction and wet of the optimum moisture content prior to topsoiling and revegetation, (2) lime stabilisation treatment of the outer layers, (3) targeted use of geofabric or rock armour.

A hydrological assessment to evaluate change resulting from the operation of the infrastructure, relative to how the area currently floods and the benefits and risks that are associated with the changes in flooding regime is proposed to be undertaken. The hydrological change assessment would consider each of the operating phases; filling, holding and emptying. The assessment would focus on changes in velocity, shear stress, water depths and inundation extents across the floodplain areas and would provide information on the likelihood and location of soil erosion in the project area.

Acid sulphate soils

A review of CSIRO's Australian Soil Resource Information System (ASRIS) mapping identified that the project is located generally within an area of 'extremely low probably of occurrence' of potential acid sulphate soils, however with a very low level (A4) of confidence (provisional classification, inferred from surrogate data with no ground verification) (CSIRO, 2020). A number of smaller areas where potential acid

Guttrum and Benwell Forests Floodplain Restoration Project

sulphate soils have a high probability of occurrence were also identified, but again with a very low confidence level (A4).

Screening and testing of soils at the proposed project infrastructure included in the Business Case (North Central CMA 2014a) was undertaken as part of the geotechnical investigations (URS, 2015).

In general, the bulk of soils encountered were not assessed as potential acid sulphate soils based on the screening criteria. Site samples were also taken and analysed by a NATA accredited laboratory. The assessment based on laboratory testing was that some soils within the project area do classify as potential acid sulphate soils. Potential acid sulphate soils with predominantly low levels of acidity were found in the soils within the invert of the ephemeral creek within the Benwell Forest, within recently deposited silts and clays. This includes areas where fill has been deposited over possible former creek areas such as the levee banks in Benwell Forest. Below the upper soil zone, the soils did not classify as potential acid sulphate soils (URS, 2015).

Re-wetting of dried soils (lowering then raising of water tables) or excavation works / soil disturbance within areas of potential acid sulphate soils could result in the formation of actual acid sulphate soils. Prior to commencement of construction, and once excavation depths, extents and volumes are confirmed, the contractor would be required to undertake an acid sulfate soil investigation and if potential acid sulfate soils are identified and disturbance cannot be avoided, an acid sulfate soil management plan will be developed to minimise potential effects on surrounding soils, vegetation and water environments.

Are there geotechnical hazards that may either affect the project or be affected by it?

NYD No Yes If yes, please briefly describe.

Recommendations for design of structures in response to geotechnical conditions identified at the site (URS, 2015) were considered in the detailed design of the project. Additional geotechnical work is proposed by VMFRP and would further inform detailed design.

Geotechnical hazards and mitigation measures proposed include:

Construction

- Soil erosion – mitigated by construction planning and implementation of a sediment and erosion control plan (part of the CEMP)

Operation

- Soil erosion in waterways and in the vicinity of regulating structures – mitigated through the use of rock armouring and drop structures
- Piping through embankments and around structures – mitigated by appropriate material selection and construction techniques, 'keying in' of structures, cutoff drains
- Settlement of structures – mitigated by appropriate foundation design (eg. piles), removal of inferior foundation material

In addition, prior to commencing works the contractor will be required to prepare a CEMP outlining measures to identify and avoid or manage disturbance of potential ASS, an erosion and sediment control plan and a dewatering management plan (if required).

Other information/comments? (eg. accuracy of information)

15. Social environments

Is the project likely to generate significant volumes of road traffic, during construction or operation?

NYD No Yes If yes, provide estimate of traffic volume(s) if practicable.

Construction

An increase in traffic along access roads and park access tracks would occur during construction and is expected to involve:

- Haulage of fill / spoil to the proposed construction sites via new and existing containment banks and tracks from the Koondrook-Murrabit Road
- Access to proposed infrastructure via:
 - Millar Road and River Track until a new track / containment bank is available
 - Cassidy Lane, Brays Lane and River Track
 - Hall Road, River Track and Regulator Track
 - Watsons Lane and Grasses Track
- Delivery and removal of plant as required, including excavators, truck and trailers, graders, rollers and forklifts
- Workers travelling daily to and from site, anticipated to mostly be from Koondrook or Barham to the south east

During construction, public and recreational access along the main access tracks would be restricted, however there are a number of access routes through and around the forests to provide alternative access to maintain access to the Forest throughout the construction period. Engagement would be undertaken with DELWP and Parks Victoria to manage access disruptions and a stakeholder management strategy prepared and implemented so that they are aware of the extent and timing of construction works, and can plan accordingly (e.g. signage, notification to park users).

New or upgraded / raised access tracks may be required where water pools against the existing levee. Access track dimensions on levee crest would be consistent with Parks Victoria and DELWP access track design and maintenance requirements.

While traffic volumes have not yet been estimated, construction traffic would be managed through standard controls contained in a CEMP and Traffic Management Plan to mitigate impacts. In addition, it is expected that construction would only be undertaken during the day time period, which would avoid night time construction traffic noise impacts.

Operation

Traffic generated during operation of the project would be minimal and limited to maintenance vehicles (e.g. mostly 4WDs). Access to Guttrum West infrastructure would be via Millar Road and the new proposed containment bank (and track) linking Millar Road and River Track. It would be at the discretion of the land manager (DELWP and Parks Victoria) and system operators (e.g. GMW and North Central CMA) as to whether the new section of access track (joining Millar Road to River Track) would become open to public use. Access to Guttrum East infrastructure during operation would be the same as during construction phase (Cassidy Lane, Brays Lane and River Track). Access to Benwell West infrastructure during operation would be via Hall Road, River Track and an unnamed track to the Benwell South West Regulator and access to Benwell East infrastructure would be via Watsons Lane and Grasses Track.

During managed inundation events areas and some tracks (e.g. dry weather tracks) within Guttrum and Benwell State Forest may not be accessible due to conditions not suitable for access or to manage public

safety risks. These restrictions may reduce opportunities for active and passive recreation. Whilst there will be some restrictions, access for recreational use will be encouraged during and after the inundation events as they provide significant opportunities for activities such as birdwatching and canoeing. The restrictions may also impact on access to licensed apiary sites, however licence holders will be notified prior to commencement of a managed inundation event, providing them with the opportunity to move sites to higher ground if required. Therefore, there is a low risk of impacting licensed apiary sites. Further assessment would be undertaken in consultation with DELWP and Parks Victoria, to identify opportunities to maintain or provide alternative access to forest users, where practicable.

Is there a potential for significant effects on the amenity of residents, due to emissions of dust or odours or changes in visual, noise or traffic conditions?

NYD No Yes If yes, briefly describe the nature of the changes in amenity conditions and the possible areas affected.

The regulating and pump station structures are proposed within the Guttrum and Benwell Forests and are well separated from residential dwellings. The nearest dwellings are greater than 300 meters from the proposed infrastructure, with the closest receiver north of the Guttrum Main Regulator (including associated spillway and containment bank) and Guttrum West Pump Station.

Construction

A small number of dwellings and businesses along the Koondrook-Murrabit Road and along smaller public access roads leading to Guttrum (Millary Road, Cassidy Lane, Brays Lane) and Benwell (Hall Road, Watsons Lane) Forests may potentially experience some additional noise, dust and traffic during construction, particularly during haulage of fill and spoil.

The potential effects on the relatively small number of residents are typical of construction projects. As such, potential effects are well understood and able to be managed through standard controls contained in a CEMP and Traffic Management Plan. In addition, it is expected that construction would only be undertaken during the day time period, which would avoid night time construction noise impacts.

It is not expected that vibration would be a significant impact during construction of the project as all assessed sensitive receivers are greater than 300 meters away from the construction activities. The most likely areas where significant vibration impacts may occur would be during the construction of any areas, roads and embankments and sheet piling.

Operation

The project design includes the use of electric pumps simultaneously at three separate pumping stations; Guttrum West, Guttrum East, and Benwell. The pumps would operate on a 24 hour basis for several days/weeks or months at a time with pumping occurring for three times in every 10 years for full forest watering (including River Red Gum flood dependent understorey and semi-permanent wetland watering) depending on natural inflows, and seven times in every 10 years for top up semi-permanent wetland watering.

Preliminary noise modelling was undertaken using Computer Aided Noise Abatement (CadnaA) Version 2020-MR1 noise modelling software to predict the effects of operational related noise from the pumping site. Findings are provided below:

- Predicted noise levels from electric pump operations at the nearest sensitive receiver locations are predicted to comply with the strictest noise criteria of 35 dB(A) at all sensitive Victorian receiver locations and at all NSW sensitive receiver locations with the highest predicted value of 30 dB(A) being noted at the closest sensitive receiver to the north west of the Guttrum West pumping station

Guttrum and Benwell Forests Floodplain Restoration Project

- General measures to avoid exceedance of the noise criteria would be employed during pumping (such as adjusting the equipment used)

As the exact pumps to be used have not yet been selected, this would need to be confirmed and, if required, mitigation measures adopted to comply with noise criteria for the actual type and capacity of pumps to be used.

All Pump Stations on the Murray River will have external lighting fitted, however these lights would only be used during maintenance events. It is unlikely that maintenance will occur at night and therefore there is unlikely to be any light impacts to resident dwellings located in close proximity to the Pump Stations or fauna in the area.

Is there a potential for exposure of a human community to health or safety hazards, due to emissions to air or water or noise or chemical hazards or associated transport?

NYD No Yes If yes, briefly describe the hazards and possible implications.

The proposed construction activities are located within the Guttrum and Benwell Forests and are greater than 300 meters away from residential dwellings. Potential adverse effects on local communities during the construction phase would most likely be limited to increases in noise, dust and traffic associated with transport of fill / spoil along the Koondrook-Murrabit Road and smaller public access roads leading to Guttrum (Millary Road, Cassidy Lane, Brays Lane) and Benwell (Hall Road, Watsons Lane) Forests.

A Traffic Management Plan would be developed to minimise potential risks to communities along haulage routes associated with a temporary increase in heavy vehicle traffic during construction. Stakeholder engagement activities will also continue through the construction phase to manage any issues raised by local communities.

Is there a potential for displacement of residences or severance of residential access to community resources due to the proposed development?

NYD No Yes If yes, briefly describe potential effects.

The project would not displace any residences or sever residential access to community resources as the works are located within discrete sites within the park. Although public access would be temporarily closed from the north extent of the project area from Murray Valley Highway within the construction sites, impacts are only temporary in nature, and access would be reopened to the public following construction.

Are non-residential land use activities likely to be displaced as a result of the project??

NYD No Yes If yes, briefly describe the likely effects.

The Guttrum and Benwell Forests are managed for multi-use values, including, recreation, timber production and collection, apiary and indigenous values. Recreational uses include dispersed camping, horse riding, hunting, four-wheel driving, bird-watching, sightseeing pursuits. Given the area also forms part of the Murray River Trail for tourism, caravanning, fishing, canoeing and trail-bike riding also occur (North Central CMA, 2014a, R8, 2020d). There are no designated camping areas or other recreational facilities located within the permanent footprint of proposed infrastructure.

There are currently eleven active apiary sites across the Guttrum-Benwell Floodplain complex which are dependent on seasonal flowering of River Red Gums. Although bees rely on an adequate water source to thrive and it is expected that the objectives of the project would increase the regularity and reliability of flowering, further consultation with potentially affected apiary licence holders would occur to inform management of potential impacts.

Guttrum and Benwell Forests Floodplain Restoration Project

No land use activities are expected to be permanently displaced by the project. Construction impacts on the floodplain would be temporary only and would be rehabilitated following construction in accordance with management measures outlined in the project CEMP.

Temporary restrictions to some access tracks (e.g. dry weather tracks) within the Guttrum and Benwell Forests may occur during construction and managed inundation events as described in the previous and following section.

Do any expected changes in non-residential land use activities have a potential to cause adverse effects on local residents/communities, social groups or industries?

NYD No Yes If yes, briefly describe the potential effects.

Temporary disruptions to access and activities within the project area are likely to occur during construction and inundation events, including:

- Temporary loss of land for farming on a small area (1.7 hectares) of private land for establishment of project structures and access tracks
- Possible disruptions to some recreational access to the Murray River and other parts of the Murray River Reserve and Guttrum and Benwell Forests during construction and managed inundation events
- Access along some existing access tracks would also be closed to the public during managed inundation events. This may reduce opportunities for active and passive recreation, and possibly tourism during these inundation events.

These potential impacts are likely to be either temporary and/or undertaken subject to agreements with the potentially affected landowners/managers or asset owners.

The project would not involve any permanent closure of existing access tracks or other facilities that are currently available for public use.

Although temporary disruptions to access and activities within the Guttrum and Benwell Forests would likely occur during construction and managed inundation events, implementation of the project is expected to improve the condition of vegetation communities and associated habitats within the proposed inundation areas, which would contribute to improved park user experiences in the longer term.

Is mitigation of potential social effects proposed?

NYD No Yes If yes, please briefly describe.

The constructing authority (LMW) would work closely with DELWP and Parks Victoria and other interested groups to minimise disruption to park users and commercial operations during construction and managed inundation events. A stakeholder and community engagement strategy would be developed and implemented during the construction and operation phases to disseminate information regarding proposed road, track or park facility closures in a timely and readily available manner to interested parties to minimise disruption.

The stakeholder and community engagement strategy is to include requirements for:

- Engaging with potentially affected private land and asset owners, to determine potential impacts and associated mitigations required during construction and operation of the project

Guttrum and Benwell Forests Floodplain Restoration Project

- Engaging with apiary licence holders in conjunction with DELWP and Parks Victoria as the public land manager for the Guttrum and Benwell Forests, to identify opportunities to temporarily or permanently relocate the affected apiary site/s if it cannot be avoided during construction, and to minimise disruption to apiary activities during managed inundation events

In addition, the following mitigation measures will apply to the project:

Design measures

- Provision for infrastructure (e.g. gates) where suitable to facilitate temporary restrictions on public access along certain access tracks during higher risk periods (e.g. flooding) and to provide Parks Victoria and/ or DELWP with operational flexibility to restrict access to parts of the Reserve where deemed necessary to provide rest and recovery from visitation.

Traffic management plan

- A Traffic Management Plan must be prepared and approved in accordance with the *Road Management Act 2004* and implemented. The plan must be prepared by a suitably qualified and experienced traffic engineer.
- The Contractor must liaise with the land manager and the relevant Council in the preparation of the Traffic Management Plan. Evidence of this consultation must form part of the plan.
- Site access points and roads are to be located so as to minimise the impact on nearby residences, cultural heritage sites and flora and fauna habitat.
- All vehicles and plant must only operate on existing tracks and in areas marked as parking areas or construction zones.
- Deliveries to the site are to be scheduled to minimise disruptions to local amenity and traffic.

Nearby residents and landholder notifications

- Notify affected residents and landholders of changes to traffic conditions and access to property for duration of the works. Nearby residents are to be notified at least seven days in advance of works commencing of the nature, duration, and hours of work if they are likely to be impacted by construction activities (i.e., due to noise, vibration, access, traffic).

Noise management plan

- Prepare and implement a Noise Management Plan as part of the CEMP that includes appropriate measures to minimise noise and vibration consistent with EPA publications: Noise Control Guidelines (EPA Publication 1254,) and Environmental Guidelines for Major Construction Sites (EPA Publication 480) and AS 2436 Guide to Noise Control on Construction Maintenance and Demolition Sites. The Noise Management Plan should consider controls such as:

- Substituting noisy activities with an alternative process where available;
- Restricting times when noisy work is carried out; and
- Consultation with affected residents
- Schedule deliveries to the site so that disruption to local amenity is minimised

Notifying the land owner/manager and nearby residences of any planned and unavoidable out of hours works at least five days in advance.

- All construction plant and equipment used on the works must, in addition to other requirements, be:
 - Fitted with properly maintained noise suppression devices in accordance with the manufacturer's recommendations

Guttrum and Benwell Forests Floodplain Restoration Project

- Be maintained and operated in accordance with manufacturer's recommendations
- Switched off when not in use

All noise and vibration complaints are to be investigated and corrective actions implemented as required

Pumping

No mitigation is predicted to be required based on the current design of electric pumps for the Project.

Other information/comments? (eg. Accuracy of information)

15.1 Cultural heritage

Have relevant Indigenous organisations been consulted on the occurrence of Aboriginal cultural heritage within the project area?

- No If no, list any organisations that it is proposed to consult.
- Yes If yes, list the organisations so far consulted.

Consultation to date with Traditional Owner (TO) groups has included engagement with the following groups:

- Barapa Barapa
- Wamba Wemba

Barapa Barapa and Wamba Wemba have been engaged through the Barapa Wamba Water for Country Steering Committee and also through the Barapa Wamba Native Title Working Group. The Barapa Wamba Native Title Working Group is made up of 10 to 12 Barapa Barapa and Wamba Wemba Traditional Owners which includes Elders. This group represents the full group of Barapa Barapa and Wamba Wemba members that have a Native Title claim in progress with First Nations Legal and Research Services. The Barapa Wamba Water for Country Steering Committee is made up of 10-12 Traditional Owners from both Mobs who govern a North Central CMA project, The Barapa Wamba Water for Country Project.

Engagement initially has been through both groups until a decision at the first CHMP inception meeting where both the Barapa Wamba Water for Country Steering Committee and the Barapa Wamba Native Title Working Group attended. The decision was to engage with the Steering Committee in future and to ensure that any on ground works are shared between all Barapa Barapa Wamba Wemba Traditional Owners.

There is no Registered Aboriginal Party (RAP) for the project area. A Cultural Heritage Management Plan (CHMP) is currently being prepared for the project in consultation with the above TO groups.

What investigations of cultural heritage in the project area have been done?

(attach details of method and results of any surveys for the project & describe their accuracy)

The following cultural heritage investigations and studies have been undertaken for the project to date, focussing on the construction footprint:

- Desktop assessment by R8 to determine the requirement for a Cultural Heritage Management Plan for the project. This included identification of Aboriginal cultural heritage values within 50 m of the construction footprint and 10 m of relevant access tracks. Key findings included:

Guttrum and Benwell Forests Floodplain Restoration Project

- Three previous cultural heritage investigations have been undertaken within the project area, and one additional assessment within the geographic region
- A review of the Victorian Aboriginal Heritage Register (VAHR) identified 45 Aboriginal Places totalling 46 individual components, and of these 13 Aboriginal Places located within 50 m of the project area. A total of 11 Aboriginal Places are entirely within the activity area
- A CHMP is required as the proposed activity is a high impact activity (utility installation) within an area of cultural heritage sensitivity
- Aboriginal Cultural Heritage Standard Assessment; Guttrum and Benwell State Forests (2014) prepared by Australian Cultural Heritage Management. A preliminary cultural heritage assessment including a desktop assessment and site inspection of Aboriginal cultural heritage values was undertaken within and in proximity to the project. The key project findings include:
 - The desktop assessment noted scarred trees may occur anywhere in the project area where there are remnant native trees of an appropriate age, undisturbed (insitu) earth features are likely to be present, surface artefact scatters are unlikely to be present due to flood damage, and human burials may be found in silty / sandy locations
 - No new Aboriginal archaeological sites were recorded within the immediate project area, one new site was recorded within 46 m of the southern tip of the northern section of the proposed G1 channel, and an existing site reconfirmed 41 m from the new road to the proposed G2 regulator.
 - A Complex Assessment was identified as being required over the entire project area
- Victorian Murray Floodplain Restoration Project, Guttrum-Benwell Draft Complex Cultural Heritage Management Plan No. 16903 (currently being prepared by R8). The current status of the preparation of the CHMP includes:
 - A Notice of Intent (NOI) to prepare a CHMP was lodged with Aboriginal Victoria on 24 October 2019
 - VMFRP are currently undertaking stakeholder consultation prior to the commencement of field work and development of the CHMP
 - The CHMP is scheduled to be completed in late 2020. VMFRP to confirm timing based on consultation program

Is any Aboriginal cultural heritage known from the project area?

NYD No Yes If yes, briefly describe:

- Any sites listed on the AAV Site Register
- Sites or areas of sensitivity recorded in recent surveys from the project site or nearby
- Sites or areas of sensitivity identified by representatives of Indigenous organisations

The floodplain of the Murray River has significant cultural heritage values for the local indigenous communities. It is well recognised as a traditional meeting place providing water, food and materials for medicines, shelter, clothing and tools. The area contains numerous scar trees, middens, mounds, burial sites, surface scatters and other artefacts (North Central CMA, 2014a).

A search of the VAHR identified 45 registered cultural heritage places (Aboriginal Places) containing a total of 46 individual components, located within the activity area². The majority of Aboriginal Places were recorded in Guttrum Forest and typically within 200 m of the Murray River or other waterbody. There are 13 Aboriginal Places located within 50 m of the project activity area. Of these, 11 Aboriginal Places are located

² The CHMP activity area is the same extent as the project area of investigation

Guttrum and Benwell Forests Floodplain Restoration Project

entirely within the activity area. As such, there is a moderate-high potential for further undiscovered Aboriginal heritage to be present in the activity area.

This assessment was based on the activity area associated with the current design for the project. As the design process progresses, further assessment will be undertaken for any locations not contained within the current activity area. This assessment will be included as part of the development of the CHMP.

The CHMP currently being prepared for the project is the mechanism for managing impacts to Aboriginal cultural heritage within both the construction footprint and inundation area. As a part of the CHMP process, consultation with the traditional owner groups is ongoing. The CHMP will include a desktop assessment, standard assessment (field survey) and complex assessment (sub-surface testing).

The CHMP currently being prepared for the project will identify the impact on the Aboriginal heritage places identified above and others found during the standard and complex investigations. The outcomes of the cultural heritage assessment (as part of the CHMP) will also be considered during the project design process and therefore the design, number and location of project structures and extent of levees and access track upgrades may be refined to minimise impacts to heritage values.

Are there any cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the *Heritage Act 1995* within the project area?

NYD No Yes If yes, please list.

A desktop heritage assessment has been prepared and is provided in **Attachment 10 – Historical Heritage Assessment**.

No places listed on the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), World Heritage List, National Heritage List or Commonwealth Heritage List are located within or adjoining the area of investigation.

Similarly, there are no historical heritage places listed on the Gannawarra Planning Scheme Heritage Overlay (HO) within or adjacent to the area of investigation.

Refer to **Attachment 10 – Historical Heritage Assessment** for further detail regarding the historical and heritage context of Guttrum and Benwell Forests.

Examination of previous historical heritage assessments has identified several places of potential historical heritage value within the area of investigation. The location and an assessment of the potential impacts to these places from proposed works is detailed in **Attachment 10 – Historical Heritage Assessment**. The development footprint of the proposed works does not directly intersect these potential historical places, however areas of the construction footprint do. The design process, including development of construction methods and laydown areas, will consider the location of these potential historical places and where possible avoid and minimise potential impacts:

- Benwell Floodgates (the old Murrabit-Benjeroop Irrigation Trust regulator) – located within the area of investigation at the intersection of River Track, Regulator Track and the Murray River
- Benwell Bank – located within the area of investigation near where River Track and Hall Road meet, and then eastwards across the southern edge of Benwell Forest to allotment 2\LP209485 at the end of Millar Road
- Timber Structure Across Channel – located within the area of investigation where River Track meets the Murray River, to the northeast of Benwell Floodgates
- Smith's Drain – intersects with the current area of investigation along Millar Road to the north of Smiths Drain Track

Guttrum and Benwell Forests Floodplain Restoration Project

- Artefact: Grating from Firebox of Boiler – an isolated artefact that was located within the area of investigation near the intersection of Millar Road, River Track and the Murray River.

The following places of potential historical heritage value are also within the inundation area:

- Benwell Bank – immediately adjacent to the inundation area in the Benwell State Forest
- Smith's Drain – intersects with the inundation area in the Guttrum State Forest
- Spot Mill Site – intersects with the inundation area in the Guttrum State Forest.

As such, there is moderate potential for previously unidentified historical heritage items to be present within the area of investigation and the inundation area, from the background history of the area. Site types most likely to be identified in the area of investigation and the inundation area would be heritage places or archaeological sites associated with early agricultural or pastoral activities, logging and milling, river shipping, sand quarries, and water management practices.

Is mitigation of potential cultural heritage effects proposed?

NYD No Yes If yes, please briefly describe.

Aboriginal Cultural Heritage

- A CHMP is being developed for the project in consultation with the identified Traditional Owner groups for approval by AV and will include specific management conditions for identified Aboriginal Places where required, along with general management recommendations relating to induction training, salvage methods and stakeholder engagement, and procedures for unexpected 'finds' of potential Aboriginal cultural material.
- As part of the CHMP altered hydrological conditions within the inundation areas would be assessed as part of a detailed inundation assessment. This would inform the assessment of impacts to Aboriginal cultural heritage as a result of inundation activities. The detailed inundation assessment would be staged to assess:
 - Hydrological change resulting from the operation of the infrastructure, relative to how the area currently floods and the benefits and risks that are associated with the changes in flooding regime. Hydrological change assessment would consider each of the operating phases; filling, holding and emptying. The assessment would focus on changes in velocity, shear stress, water depths and inundation extents across the floodplain areas.
 - Geomorphological change which would include assessment of possible erosion risk areas and capacity of soil types to withstand shear stresses.
 - Aboriginal cultural heritage impacts which may result from the hydrological and geomorphological changes. This would include review of the high impact areas (if any) resulting from these changes and review of the cultural heritage values which may be impacted.
- The detailed inundation assessment would include a discussion on whether the impacts are considered significant in terms of scale, extent, duration and intensity (magnitude) of change in values, and the results of this assessment would inform the development of management conditions in the CHMP.
- The potential impact to Aboriginal cultural heritage values, including Aboriginal Ancestral Remains within the inundation area would be assessed with the results of the hydrological and geomorphological modelling, detailed above. The results of the modelling would be used to develop impact mitigation measures which would be included as management conditions in the CHMP. Development of management conditions would involve consultation with the Traditional Owners,

Aboriginal Victoria, the Victorian Aboriginal Heritage Council and the Ancestral Remains Unit within the Office of the Victorian Aboriginal Heritage Council.

Historical Heritage

- Further historical heritage investigations are to be undertaken to identify risks to registered and potentially unrecorded historical heritage features within the project area. A copy of this report (once completed) would be kept onsite and on file with the project records. All contractors and/or project staff should be made aware of the heritage status of the heritage places in the project area prior to works taking place.

Unexpected discoveries of archaeological sites

- All historical archaeological sites in Victoria older than 75 years are protected by the *Heritage Act 2017*, whether they are recorded on the VHI or not. It is an offence to knowingly or negligently deface, damage, or otherwise interfere with an archaeological site without obtaining the appropriate consent from the Executive Director of Heritage Victoria (HV). Under Section 127 of the *Heritage Act 2017*, if an archaeological site is discovered during construction or excavation on any land, the person in charge of the construction or excavation must as soon as practicable report the discovery to HV. If any unexpected archaeological sites are uncovered during construction works, the following procedure must be followed:

STOP

- Stop any activity which may impact on the discovery
- Ensure that other people working in the area are aware of it and have also stopped work in the area
- Protect the artefacts or site by erecting temporary fencing or other suitable barrier

ADVISE

- A supervisor or the cultural heritage consultant must be consulted if they are on site
- Supervisors are to advise HV where the discovery was made and provide a description or photograph of the discovery

MANAGE

- HV, the onsite heritage consultant or supervisor will advise on how to manage the discovery
- Management of the discovery may involve protection, recovery, recording or removal of the artefacts or features and is likely to require Consent to Damage from HV

Historical Heritage induction training

General mitigations measures include:

- Historical heritage awareness training should be completed as part of the site induction for all personnel and/or contractors prior to the commencement of construction works to ensure:
 - An understanding of where all heritage places are located within the project area
 - An understanding of the potential heritage places that may be impacted during the project
 - The procedures required to be undertaken in the event of discovery of historical heritage material, features or deposits, or the discovery of human remains
- If an archaeological site is discovered during construction or excavation, the person in charge of the construction or excavation must as soon as practicable report the discovery to HV.

Guttrum and Benwell Forests Floodplain Restoration Project

- A copy of the Historical Heritage Assessment (**Attachment 10**) should be kept onsite and on file with the project records. All contractors and/or project staff should be made aware of the heritage status of the heritage places in the project area prior to works taking place.

Mitigation measures specific to the eight places of potential historical heritage value identified during previous assessments within the area of investigation and inundation area include:

- Avoidance of the heritage places should be undertaken, if possible:
 - Prior to any works, including any vegetation clearance, site establishment or construction works in the area, protective barrier fencing will be erected between the historical structures and the works area, to fence them and thereby avoid inadvertent impact; the fencing would be installed for the duration of works for the project and removed following completion.
- Should impact to the heritage places be unavoidable:
 - Prior to the start of works, an archival photographic recording of the sections of the heritage places to be impacted should be carried out, in accordance with the guidelines, Photographic Recording for Heritage Places and Objects (Heritage Victoria, 2006)
 - Works are to be undertaken in such a way as to minimise direct contact by construction vehicles or machinery with the historical structures. Prior to any works, including any vegetation clearance, site establishment or construction works in the area, where the historical structures will not be impacted, protective barrier fencing will be erected between the remaining historical structures outside the works area, to fence them and thereby avoid inadvertent impact; the fencing would be installed for the duration of works for the project and removed following completion.

Other information/comments? (eg. Accuracy of information)

16. Energy, wastes & greenhouse gas emissions

What are the main sources of energy that the project facility would consume/generate?

- Electricity network. If possible, estimate power requirement/output
- Natural gas network. If possible, estimate gas requirement/output
- Generated on-site. If possible, estimate power capacity/output
- Other. Please describe.

Please add any relevant additional information.

Power is required to operate the electric pumps at three sites within the project area, when required. The pump locations, rates of pumping, pumping days and volumes for the Guttrum and Benwell Forests Floodplain Restoration Project are presented in **Table 19** and **Table 20**.

The frequency and duration of water pumping at each site will depend on actual inundation events and the method to achieve environmental watering targets. The pumps would likely operate on a 24 hours basis for several days/weeks or months at a time with pumping occurring for either forest floodplain watering events (including River Red Gum forest flood dependent understorey and semi-permanent wetlands) for three in every 10 years, and for targeted semi-permanent wetland top up events for seven in every 10 years (in addition to forest floodplain watering events) under Basin Plan 2750 flows.

Guttrum and Benwell Forests Floodplain Restoration Project

The estimated water quantities to be transferred into Guttrum and Benwell Forests are provided below for each watering strategy; River Red Gum (**Table 19**) and Semi-Permanent Wetland (**Table 20**).

Table 19 Summary of pumping events for forest floodplain watering based on Basin Plan 2750 flows (Source: North Central CMA, 2020)

Pumping parameters	Guttrum West Pump Station	Guttrum East Pump Station	Benwell Pump Station
Water quantity to be pumped from the Murray River	2,000 ML	11,900 ML	10,200 ML
Frequency of pumping events	3 in 10 years	3 in 10 years	3 in 10 years
Duration of pumping events	16 days (fill)	16 days (fill) 110 days (maintenance)	20 days (fill) 110 days (maintenance)
Pumping rate (approximate)	125 ML/day (fill)	125 ML/day (fill) 90 ML/day (maintenance)	125 ML/day (fill) 70 ML/day (maintenance)

Table 20 Summary of pumping events for semi-permanent wetland top up watering based on Basin Plan 2750 flows (Source: North Central CMA, 2020)

Pumping parameters	Guttrum West Pump Station	Guttrum East Pump Station	Benwell Pump Station
Water quantity to be pumped from the Murray River	2,115 ML	791 ML	1,016 ML
Frequency of pumping events	7 in 10 years	7 in 10 years	7 in 10 years
Duration of pumping events	141 days (maintenance)	113 days (maintenance)	127 days (maintenance)
Pumping rate (approximate)	0 ML/day (fill) 15 ML/day (fill)	0 ML/day (fill) 7 ML/day (maintenance)	0 ML/day (fill) 8 ML/day (maintenance)

What are the main forms of waste that would be generated by the project facility?

- Wastewater. Describe briefly.
- Solid chemical wastes. Describe briefly.
- Excavated material. Describe briefly.
- Other. Describe briefly.

Please provide relevant further information, including proposed management of wastes.

The main waste streams as a result of the construction works include:

- Excess spoil
- Cleared vegetation
- General building and miscellaneous wastes such as packaging, off cuts, excess materials
- Workers' waste such as packaging, containers, food scraps, etc

As part of the CEMP, the contractor would be required to prepare a spoil and waste management plan demonstrating compliance with the *Environment Protection Act 1970* (and *Environment Protection Act 2017*) and EPA Publication 480: *Environmental Guidelines for Major Construction Sites*.

Guttrum and Benwell Forests Floodplain Restoration Project

Excavated materials which are unsuitable for use or which are excess to the needs of construction (i.e. spoil) would be disposed of off-site unless otherwise approved by the land manager (DELWP/ Parks Victoria), and managed in accordance with the *Environment Protection Act 1970* and other relevant legislation.

Subject to approval from DELWP and Parks Victoria, cleared native vegetation not containing pest plant propagules would be mulched and stockpiled within the designated construction footprint for reuse in rehabilitation of construction or extraction areas. Where directed by Park Victoria, cleared vegetation containing hollows would be salvaged and placed in appropriate locations within the national parks.

No significant volumes of waste would be generated during operation of the project.

What level of greenhouse gas emissions is expected to result directly from operation of the project facility?

- Less than 50,000 tonnes of CO₂ equivalent per annum
- Between 50,000 and 100,000 tonnes of CO₂ equivalent per annum
- Between 100,000 and 200,000 tonnes of CO₂ equivalent per annum
- More than 200,000 tonnes of CO₂ equivalent per annum

Please add any relevant additional information, including any identified mitigation options.

The estimated Scope 1 GHG³ emissions for each pump event are approximately 90 t CO₂-e to 400 t CO₂-e for each of the three pumps stations, with an estimated combined GHG emission of approximately 700 t CO₂-e.

The estimated combined GHG emissions for the project are significantly less than the 200,000 t CO₂-e per annum trigger for a referral as set out in the *Ministerial Guidelines for Assessment of Environment Effects under the Environment Effects Act 1978* (Department of Sustainability and Environment, 2006). The 200,000 t CO₂-e per annum referral trigger is for emissions directly attributable to operation of the project (i.e. Scope 1 emissions).

The estimated emissions are also significantly less than the annual reporting threshold of 25,000 t CO₂-e for individual facilities under the *National Greenhouse and Energy Reporting Act 2007* (Cth).

17. Other environmental issues

Are there any other environmental issues arising from the proposed project?

- No Yes If yes, briefly describe.

³ Any Scope 1 emissions associated with the construction phase of the project (e.g. fuel use from site vehicles) were excluded from this calculation. Similarly, embodied emissions of construction materials (e.g. embodied emissions from the construction of concrete and steel), are Scope 3 emissions and were excluded from the calculation. This section of the referral requires consideration of the potential for the project to exceed the annual NGERs reporting thresholds which incorporate Scope 1 and 2 emissions only.

18. Environmental management

What measures are currently proposed to avoid, minimise or manage the main potential adverse environmental effects? (if not already described above)

- Siting: Please describe briefly
- Design: Please describe briefly
- Environmental management: Please describe briefly.
- Other: Please describe briefly

Add any relevant additional information.

Draft Environmental Management Framework

A draft Environmental Management Framework (EMF) has been prepared for the VMFRP program containing an overview of:

- Project description – location, environmental context, project objectives, construction and operational activities
- Roles and responsibilities for implementation of environmental management during construction and operation of the program
- An overview of related environmental management documentation and associated approval processes (e.g. CEMP, CHMP, EWMP, Operating Plans, etc)
- An overview of relevant legislation and statutory approval requirements
- The approach to identifying and evaluating potential risks to environmental values during construction and operation of the project
- Environmental management measures to avoid or mitigate environmental impacts
- Monitoring, reporting and auditing requirements to inform adaptive management

A copy of the draft EMF is provided in **Attachment 9 – Draft Environmental Management Framework**. The draft EMF includes the general mitigation measures for construction and operation of the project that would be undertaken to avoid and minimise impacts on the environment. The draft EMF would evolve as the project assessment and approvals process progresses.

Design and construction

The project has undergone a comprehensive design process, with a number of design options considered. During this process, measures (as identified in this referral and contained in the draft EMF) to mitigate impacts on environment and heritage values have been integrated into the design and would continue to be as further design refinements are made.

In accordance with the draft EMF, the contractor would be required to prepare a Construction Environmental Management Plan (CEMP) for the project, including:

- The project's environmental management system, procedures and processes, including all project forms and registers
- A project environmental risk assessment and control program
- Clear delegation of responsibilities (i.e. within the contractor's project team)

Guttrum and Benwell Forests Floodplain Restoration Project

- Project legislative requirements
- Details of approvals, permits, agreements and/or licences for the various stages of work
- Relevant environmental procedures and work instructions
- An environmental inspection/monitoring program and inspection checklist
- Worksite specific plans

A checklist that demonstrates that each requirement of the draft EMF has been addressed in the preparation of the CEMP.

Operation

The primary environmental management documentation for managing adverse environmental effects and maximising environmental benefits during operation of the project would be the:

- Environmental Watering Management Plan
- Operating Plan

Environmental Watering Management Plan

The Interim Guttrum and Benwell Forests EWMPs (North Central CMA 2014 d, e) will be updated to include the project once the project is fully approved. The EWMP will include:

- Long-term management objectives and water regime requirements for the Forests. These have already been developed as part of the Ecological Objectives and Hydrological Requirements Justification Papers for Guttrum and Benwell Forests (North Central CMA, 2014 d,e) and have been described in Section 3 – ecological objectives.
- Management measures to manage the risk associated with achieving the project's ecological objectives (i.e. factors outside delivery of environmental water inhibiting ability to achieve objective) and delivery of environmental water.
- Complementary actions to enhance the outcomes of environmental watering (e.g. pest plant and animal control)
- A summary of environmental monitoring (long term and intervention) included in the VMFRP Ecological MER Plan (ARI, 2020).
- Summary of consultation that has been undertaken as part of the EWMP development.
- Roles and responsibilities for environmental water delivery and associated management of Guttrum and Benwell Forest. These will be assigned as part of process for developing the EWMP.

The EWMPs will be used to inform the development of Seasonal Watering Proposals and Seasonal Watering Plans for the Guttrum and Benwell Forests and Long-term Watering Plans that will be developed by the State under the Basin Plan Chapter 8 (DEPI, 2014a).

Guttrum and Benwell Forest Operating Plan (North Central CMA – Updated Draft, July 2020)

The Operating Plan provides the framework for operation of the Guttrum and Benwell Forests environmental watering works to meet key ecological objectives and comply with relevant legislative requirements (e.g. *Water Act 2007* (Cth), s52-54 of Murray-Darling Basin Agreement), and outlines:

- Description of those parts of the forests (ecological components) that are relevant to the operating scenario.
- Intention of the operating scenario from an ecological perspective.

Guttrum and Benwell Forests Floodplain Restoration Project

- Water regime requirements for the ecological components in order to achieve the objectives.
- Infrastructure operations to achieve the water regime requirements.
- Other important considerations for operating the works including:
 - Fish exit strategy
 - Climate and water availability conditions.

A copy of the draft Guttrum and Benwell Forest Operating Plan (North Central CMA, 2020) is provided in **Attachment 8 – Draft Operating Plan**. The Operating Plan is not intended to prescribe particular watering events and is a 'living document' that would be further refined and updated over time if legislation changes or operations in the major river systems require it. As the asset owner, Lower Murray Water would adopt their own Operating Plan on completion of construction.

Complementary management activities

It is acknowledged that to achieve the targeted ecological objectives at Guttrum and Benwell Forests, more than just environmental watering regimes and inundation regimes closer to natural conditions are required. Complementary management activities will need to be delivered to maximise the ecological, social and cultural benefits of environmental watering and assist in achieving project objectives. These activities will be undertaken in partnership with PV, DELWP, North Central CMA, the local council and communities.

Potential complementary management activities include, but are not limited to:

- Culturally sensitive invasive animal management: monitor pest animal activity (e.g. European Fox, Rabbit and Feral Pig) and employ appropriate management techniques (e.g. baiting, fumigation).
- Invasive plant control: target high threat weeds (e.g. Weeds of National Significance: - Bridal Creeper, Paterson's Curse, African Boxthorn, Blackberry, Bathurst Burr, Prickly Pear) particularly weed infested areas.
- Active revegetation (seeding and/or pugging) of flora species representative of the targeted EVCs if passive revegetation is not successful due to lack of soil stored seed bank or species unable to disperse into the inundation area from adjacent areas.
- Measures to address off-farm impacts such as stock access (point source) and fertilizer runoff (diffuse source).
- Rationalisation of access tracks. Four wheel driving off-track during wet weather has led to significant damage to soils, roads and vegetation.
- Improved facilities at camping sites.
- Improvement of visitor facilities to enhance recreational opportunities e.g. walking, bird watching and fishing.

19. Other activities

Are there any other activities in the vicinity of the proposed project that have a potential for cumulative effects?

NYD No Yes If yes, briefly describe.

The project has some potential for cumulative effects in relation to other VMFRP projects. The potential for cumulative effects is generally associated with:

Guttrum and Benwell Forests Floodplain Restoration Project

- Water quality impacts associated with water discharge to the Murray River during and following an environmental watering event
- Removal of large, hollow-bearing trees and associated habitat for threatened species such as Regent Parrot, Carpet Python, and Lace Monitor from river red gum and black box communities along the Murray River floodplain
- Removal of native vegetation and associated habitat from similar EVCs across multiple sites due to the need to locate proposed infrastructure at certain elevations on the floodplain and potential impacts on bioregional conservation status of particular EVCs

Further assessment of potential cumulative effects will be carried out as design development and environmental investigations are advanced at other VMFRP sites and with consideration to other activities in the vicinity of the proposed project.

20. Investigation program

20.1 Study program

Have any environmental studies not referred to above been conducted for the project?

No Yes If yes, please list here and attach if relevant.

Environmental investigations completed for the project to date include:

ACHM (Australian Cultural Heritage Management) (2014). Aboriginal Cultural Heritage Standard Assessment. Guttrum and Benwell State Forests. Report prepared for North Central Catchment Management Authority.

Aither (2020). VMFRP MER Plan for Cultural and Socio-Economic components. Monitoring, Evaluation and Reporting Plan. Report prepared for the Mallee Catchment Management Authority.

Australian Water Environments (2014). Expert Review Salinity Impacts SDL Offsets. Revised Guttrum and Benwell Forests. Department of Environment and Primary Industry.

Bennetts, K. (2014). Preliminary Vegetation Assessment of Benwell and Guttrum Forests. Fire Flood and Flora. Report prepared for North Central Catchment Management Authority.

Biosis (2014). Flora and fauna assessment of the Gunbower National Park and Guttrum and Benwell State Forests. FINAL REPORT V3. Report prepared for North Central Catchment Management Authority.

Biosis (2014). Mapping and Condition Assessment of the Guttrum & Benwell State Forests. Report prepared for North Central Catchment Management Authority.

Corr, C. (2016). Guttrum and Benwell Forests Pumped Environmental Watering Inflows Final Pumped Inflow Option.

Cunningham, S.C., P. Griffioen, M. White, and R. MacNally. Mapping the condition of river red gum (*Eucalyptus camaldulensis* Dehnh.) and black box (*Eucalyptus largiflorens* F. Muell.) stands in The Living Murray Icon Sites. Stand condition report 2010. Canberra: Murray-Darling Basin Authority, 2011.

DELWP (2018). Socio-economic impacts in the southern Murray-Darling Basin. Implications for additional Basin Plan water recovery.

Guttrum and Benwell Forests Floodplain Restoration Project

DHI (2014). Applying Modelling Tools to investigate Water Management in the Guttrum Benwell State Forests. Calibration Report. Project task 3. Report prepared for North Central Catchment Management Authority.

DHI (2014). Applying Modelling Tools to Investigate Water Management in the Guttrum and Benwell State Forests. Water Management Option Modelling 2014. Report prepared for North Central Catchment Management Authority.

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Has a program for future environmental studies been developed?

No Yes If yes, briefly describe.

The effectiveness of the proposed supply measure and its operation would primarily be monitored and reported on through the North Central CMA’s well-established monitoring, evaluation and reporting (MER) strategies and protocols. These strategies and protocols build upon experience and lessons learned through the ongoing, long-term ecological monitoring programs undertaken within the SDL project area, including TLM, which includes condition and intervention monitoring across several sites along the Murray River including Gunbower Forest in the North Central CMA region. The North Central CMA has been implementing and coordinating the local, annual TLM Monitoring, Evaluation and Reporting Framework process since 2005.

These strategies and protocols provide a routine process to:

- Establish a robust program logic to define the correlation between works and other inputs and identified outputs and ecosystem outcomes. This provides the basis for a suite of quantifiable ecological targets that are relevant to the specific site
- Monitor progress against those targets on a regular basis
- Evaluate the implications of the results for the operational parameters of the scheme
- Amend and adjust the operational arrangements to optimise performance and outcomes

Guttrum and Benwell Forests Floodplain Restoration Project

- Utilise monitoring data to plan watering events, optimise water delivery, manage risks and refine ecological objectives. The evaluation process involves analysing collected data and improving operations accordingly.

Ecological Monitoring and evaluation would focus on the effects of local watering actions and include:

- Evaluating water use
- Measuring ecological outcomes
- Refining conceptual models and improving knowledge
- Managing risks

A detailed ecological monitoring and evaluation plan was previously developed for the project by North Central CMA (2014). The monitoring and evaluation plan identifies the agencies responsible for commissioning, reviewing and acting on monitoring data. The linkages back to decision-making are described in the detailed plan. A new Ecological Monitoring, Evaluation and Reporting Framework is currently being funded by the project and is due for completion in July 2020. This framework aims to establish a social, heritage and environmental benchmark and monitoring programme to demonstrate the ongoing benefits of the project.

Initial monitoring will provide a baseline of the existing status of the ecological objectives and outcome monitoring will measure progress towards these objectives and their targets. This information will inform the ongoing operations at the site. Over time, the results of the outcome monitoring will test assumptions and assist with refining conceptual models and ecological objectives. Monitoring data will identify emerging hazards and enable operational decisions to minimise risk through the adaptive management framework incorporated into Operating Plans and Environmental Water Management Plans.

The final Ecological Monitoring, Evaluation and Reporting Framework approach for this project will be informed by broader intergovernmental arrangements for Basin-wide monitoring and evaluation under the Basin Plan. This project is expected to contribute to the achievement of outcomes under two key Chapters of the Plan, namely: (i) the delivery of ecological outcomes under Chapter 8; and (ii) meeting the relevant SDLs under Chapter 10, which must be complied with under the relevant State water resource plan/s (WRPs) from 1 July 2019.

Both Chapter 8 and Chapter 10 of the Basin Plan are captured under the MDBA's own monitoring and evaluation framework. Once specific Basin Plan Chapters commence within a State, the State must report to the MDBA on relevant matters. This will include five yearly reporting on the achievement of environmental outcomes at an asset scale in relation to Chapter 8, and annually reporting on WRP compliance in relation to Chapter 10.

VMFRP is satisfied that its participation in the MDBA's reporting and evaluation framework will effectively allow for progress in relation to this project to be monitored, and for success in meeting associated ecological objectives and targets to be assessed.

This approach closely aligns with agreed arrangements under the Basin Plan Implementation Agreement, where implementation tasks are to be as streamlined and as cost-effective as possible.

A Monitoring, Evaluation and Reporting Plan for Cultural and Socio-Economic components of the VMFRP Program of works is also being developed by VMFRP (Aither, 2020). This plan will guide the monitoring and evaluating of the delivery and achievement of cultural and socio-economic outcomes from environmental watering and the project works themselves. The program logic associated with the plan identifies how activities that will be undertaken at each of the VMFRP sites will collectively contribute to the program-level cultural and socio-economic outcomes. It also considers that the project works, and environmental watering

Guttrum and Benwell Forests Floodplain Restoration Project

may also result in negative outcomes or disbenefits to stakeholders and that the project outcomes can also be influenced by a range of circumstances outside of the projects control.

20.2 Consultation program

Has a consultation program been conducted to date for the project?

No Yes If yes, outline the consultation activities and the stakeholder groups or organisations consulted.

The North Central CMA worked with key stakeholders, community groups and landowners to develop and refine the Sustainable Diversion Limits (SDL) Business Case for the Guttrum and Benwell Forest project over a period from 2014 to early 2019.

The project was then rebranded and funded as the Victorian Murray Floodplain Restoration Project with additional engagement occurring from early 2019 to current. Consultation activities are ongoing and will continue throughout the duration of the project.

Government stakeholders and project partners are involved through participation in various project governance and technical review groups, or alternatively have been briefed directly about the project, including:

- A Project Control Group, consisting of members from Goulburn Murray Water (GMW), Lower Murray Water (LMW), Mallee CMA (MCMA), North Central CMA (NCCMA) and Parks Victoria;
- A Regulatory Approvals Group, consisting of members from the Victorian Department of Environment, Land, Water and Planning (DELWP), and Department of Premier and Cabinet, the Commonwealth Department of Agriculture, Water and the Environment, and Parks Victoria;
- An Asset Design Group, consisting of members from GMW, DELWP, Parks Victoria and the Murray Darling Basin Authority;
- A newly formed Guttrum and Benwell Forests Community Reference Group, which includes participation of local and on-ground DELWP and PV officers, as well as Gannawarra Shire Council economic development staff;
- Project briefings to Campaspe Shire Council, Gannawarra Shire Council and Murray River Council; and
- Via various direct consultation activities with local officers and key contacts e.g. project briefings and site tours.

Recent communication and engagement activities conducted with non-government stakeholders have been undertaken in accordance with VMFRP's Stakeholder Engagement and Communication Plan (for all sites) and have included:

- Face-to-face briefing sessions with all adjacent landowners providing project updates and discussing potential impacts and opportunities for private landowners;
- Presentations, onsite visits and information sharing with the Barapa Barapa Wamba Wamba Water for Country Committee; and,
- Project briefings to other interested stakeholders including – VicForests, Murray River Trails, Koondrook Progress Association, Arbutnot Sawmills, and the Koondrook-Barham Bridge Newspaper.

Guttrum and Benwell Forests Floodplain Restoration Project

This engagement has been supported with tailored Guttrum and Benwell Forests Project documentation, including:

- Fact sheets, media releases, electronic communication (website, emails, newsletters), brochures, correspondence and individual maps of landowner properties showing how project infrastructure interfaces with private properties.

This direct approach to engagement has helped capture the views and local knowledge of key stakeholders and community members to directly integrate these into the project designs, resulting in avoided or minimised impacts to private property and industry operations.

Broad community awareness of the project is further evidenced by the sustained interest in the proposal as illustrated by ongoing requests to provide briefings, presentations and updates as project designs further progress.

Information regarding the Guttrum and Benwell Forest Floodplain Restoration Project is published on the VMFRP website:

https://www.vmfrp.com.au/wp-content/uploads/2019/07/VMFRP_FactSheet_A4_Guttrum_Benwell_0319_07-003.pdf

Has a program for future consultation been developed?

NYD No Yes If yes, briefly describe.

Targeted, tailored consultation will continue to be conducted in accordance with VMFRP's Stakeholder Engagement and Communication Plan with key stakeholders throughout the project, aligning to project milestones, assessments and approvals processes where necessary and/or appropriate. This includes further face-to-face briefings, presentations, site visits and regular project updates via mail-outs and newsletters.

Primary consultation will occur with affected government and non-government stakeholders, including:


- Government land managers (DELWP and Parks Victoria)
- Environmental water managers (NCCMA, VEWH, CEWH)
- Environmental water infrastructure operators (GMW, MDBA)
- Directly affected private landowners
- Traditional Owner groups
- Directly affected industry stakeholders (VicForests, Apiary licensees)
- Local government economic development teams
- Special interest groups (Koondrook Development Committee, Murray River Trails, local tourism operators, VR Fish, and local angling clubs)

Broader engagement via traditional methods and social media, community events and information displays will also continue to provide general project awareness and rolling updates. Dedicated project engagement staff are available to accommodate face-to-face meetings for any individuals or groups wanting further information.

Authorised person for proponent:

I, Josh White(full name),

..... Project Director - VMFRP(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.


Signature  _____

Date 31 July 2020

Person who prepared this referral:

I, Josh White(full name),

.....Project Director - VMFRP(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.

Signature  _____

Date 31 July 2020

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Appendix A. List of attachments

Attachment 1 – Project Overview Maps

Attachment 1.1 – Project Location Map

Attachment 1.2 – Project Infrastructure and Access Map

Attachment 1.3 – Managed Inundation Area Map

Attachment 2 – Ecological Objectives and Hydrological Requirements Justification Papers (Guttrum and Benwell Forests)

Attachment 3 – Flora and Fauna Assessment

Attachment 4 – Distribution of water through Guttrum and Benwell Forest

Attachment 5 – Waterways and Wetlands Map

Attachment 6 – Groundwater Assessment

Attachment 7 – Land Use Planning Assessment

Attachment 8 – Draft Operating Plan

Attachment 9 – Draft Environmental Management Framework

Attachment 10 – Historic Heritage Assessment