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.**

- 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	Couriers
Minister for Planning	**Minister for Planning**
PO Box 500	**Level 16, 8 Nicholson Street**
EAST MELBOURNE VIC 8002	**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: **Position:** **Postal address:** **Email address:** **Phone number:** **Facsimile number:**	Josh White Project Director – VMFRP PO Box 1438, Mildura VIC 3502 Josh.White@vmfrp.vic.gov.au 0400 697 304 n/a
Person who prepared Referral: **Position:** **Organisation:** **Postal address:** **Email address:** **Phone number:** **Facsimile number:**	Josh White Project Director - VMFRP VMFRP PO Box 1438, Mildura VIC 3502 Josh.White@vmfrp.vic.gov.au 0400 697 304 n/a
Available industry & environmental expertise: (areas of 'in-house' expertise & consultancy firms engaged for project)	**VMFRP** 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. **R8** 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. 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 visual, hydrology, geotechnical, survey and spatial amongst other services.

2. Project – brief outline

Project title:

Burra Creek 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)

The Burra Creek Floodplain Restoration Project (the project) is located on the western side of the Murray River between the rural localities of Piangil and Kenley, approximately 25 km north of the township of Nyah, 50 km north west of Swan Hill and 60 km south east of Robinvale in north west Victoria. The project involves works to facilitate managed inundation of approximately 403 ha of high ecological value Murray River floodplain and anabranch habitats at Burra Creek.

Burra Creek is a 54 km long anabranch of the Murray River that diverges from the River near Piangil, Victoria (opposite the township of Tooleybuc, New South Wales (NSW)) and re-joins the Murray River approximately 10 km upstream of its junction with the Wakool River. The area enclosed between Burra Creek and the Murray River is known as Macredie Island. The northern (downstream[1]) third of Burra Creek flows through the River Murray Reserve, which is also known as Burra Forest. The southern (upstream) two thirds of Burra Creek is located within a corridor of reserved public land that is typically 80 m wide, although some sections of creek meander outside this corridor onto adjacent private land.

The project is not located in or near any wetlands listed under the Ramsar Convention or A Directory of Important Wetlands in Australia. The nearest Ramsar-listed wetlands are the Hattah-Kulkyne Lakes (approx. 80 km north west and 150 km downstream) and the Kerang Wetlands (approx. 70 km south). The nearest wetlands listed on A Directory of Important Wetlands in Australia are Major Mitchell Lagoon (approx. 3.3 km north), Heywood's Lake (approx. 13 km north west), Belsar Island (approx. 38 km north west) and Beveridge Island (approx. 36 km south east).

The Burra Creek floodplain is divided into two areas by the Piambie Channel, these being referred to as:

- Burra North – floodplain north of Piambie Channel through to the northern / downstream end of Burra Creek
- Burra South - floodplain south of Piambie Channel through to the southern / upstream end of Burra Creek.

Floodplain areas at Burra North are largely unmodified and comprise wetlands, forest and woodland. Floodplain areas at Burra South are mainly developed for grazing, irrigated agriculture and dryland agriculture. The majority of proposed project infrastructure and the majority of the proposed inundation area (approx. 330 ha) are located in the area referred to as Burra North. A minor component of the proposed inundation area (approx. 73 ha) associated with the Burra Creek channel and one of the proposed regulating structures (Regulator B4) is located in the area referred to as Burra South.

The project is located almost entirely in the Rural City of Swan Hill, with the exception of a small portion of the construction footprint associated with the drop structure, which extends down the bank of the Murray River into NSW and the local government jurisdiction of the Murray River Shire. The project is located in the Mallee Catchment Management Authority (CMA) region and the Murray Fans bioregion.

Throughout this document, the following terms are used to describe the project:

- Development footprint - this is the area that the project infrastructure (e.g. regulators, drop structures, pump hardstands, containment banks, spillways) would occupy based on the current design, along with proposed construction laydown areas. No construction working buffer or access tracks are included in the development footprint.

[1] Use of the term 'downstream' in relation to Burra Creek throughout this document is in reference to the location along the Murray River.

- Construction footprint - this includes the development footprint of the project infrastructure as well as the land required to construct the infrastructure, including access tracks. This is the area that has been used to calculate the extent of native vegetation removal for the project. 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 and construction footprint, as well as a buffer around these areas. This is the area that has been the basis of desktop and field investigations.
- 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.

Refer to Attachment 1 – Project Overview Maps and Attachment 2 – Environmental Features Maps.

Construction footprint

With the exception of works within the Murray River (NSW), some access tracks and one of the two proposed construction laydown areas for Regulator B2 (the area located south east of Regulator B2 referred to as Construction Laydown Regulator B2 SE), the proposed construction footprint is located in the River Murray Reserve and proposed Murray River Park, which are natural features reserves managed by Parks Victoria under the *Crown Land (Reserves) Act 1978*. The remaining sections of access tracks and Construction Laydown Regulator B2 SE are located on various parcels of private land zoned for farming purposes or within road corridor.

Inundation area

The 403 ha inundation area encompasses both floodplain areas and the Burra Creek channel. Floodplain inundation areas are limited to land to the east and west of Burra Creek, north of the Piambie Channel (i.e. Burra North). Creek channel inundation areas extend the full length of Burra Creek, including both north and south of the Piambie Channel.

The proposed inundation areas at Burra North and Burra South are mostly located within the River Murray Reserve and proposed Murray River Park managed by Parks Victoria. Approximately 70.65 ha of proposed inundation area at Burra North is located on private land (across four cadastral parcels). Although currently zoned for farming purposes, the proposed inundation areas on private land are not currently developed for agriculture and support native vegetation communities. Inundation of these areas of private land can be avoided by operating regulating structures to hold water at less than the maximum design level. Approximately 11.67 ha of proposed inundation area at Burra South is located on private land parcels, which contain sections of the Burra Creek channel. Managed flood capture and release of the creek through Burra South is able to be controlled through operation of Regulators B2 and B4. During a temporary pumping event from B4, the flow and height of the water can be controlled by managing the pumping. Managed inundation affecting private land at Burra North and Burra South would only be undertaken if flooding agreements can be established with the affected private landowners.

Access tracks

Access to the project components at Burra North would be from the Murray Valley Highway to the west via Angle Road in the north and River Track (opposite Natya Road) in the south. The project would also use sections of Obree Road, which runs parallel and adjacent to the Murray River. Smaller existing un-named access tracks from Ravens Lane, Obree Road and Angle Road would be used during construction only to remove block banks within Burra Creek with some minor extensions to the existing tracks likely to be required. Access to the project components at Burra South would also be from the Murray Valley Highway to the west via Tooleybuc Road and an un-named road, which runs parallel and adjacent to the Murray River. Access tracks proposed to be used during construction and operation of the project are shown in Attachment 1 – Project Overview Maps.

Short project description (few sentences)**:**

The project aims to restore a more natural inundation regime and improve ecological condition across approximately 330 ha of high ecological value Murray River floodplain at Burra North and a further 73 ha of anabranch habitats at Burra South.

The project involves the construction of three new regulators (B1, B2 and B4), approximately 2.48 km of containment banks (raised access tracks) incorporating four spillways (approx. 400 m), and a drop structure downstream of Regulator B1 to control erosion during the release of managed floodwaters to the Murray River. The project also involves the removal of four existing blockages (Banks 1, 2, 3 and 4), modification of one existing blockage (Bank 5) to flows within Burra Creek at Burra North, and the installation of two 6 m x 6 m hardstand areas to support temporary pump infrastructure at Regulator B4 and at an existing private pump site near Spillway No. 4.

The project is designed to enable managed inundation up to a design water level of 58.7 metres Australian Height Datum (mAHD) at Burra North and up to the top of bank level along Burra Creek at Burra South, using water from both natural flood events and pumping from the Murray River.

3. Project description

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

The project aims to restore a more natural inundation regime and improve ecological condition across approximately 330 ha of high ecological value Murray River floodplain at Burra North and a further 73 ha of anabranch habitats at Burra South, through the construction of new infrastructure, the modification of existing infrastructure and removal of some existing barriers to flow within Burra Creek. The project is designed to enable managed inundation up to a design water level of 58.7 mAHD at Burra North and up to the top of bank level along Burra Creek at Burra South.

Three water regime classes comprised of nine ecological vegetation classes (EVCs), plus non-EVC waterbody, have been specifically identified for restoration through this project as described by Ecological Associates (2014a), Mallee CMA (2014a), Sunraysia Environmental (2015) and VMFRP (2020a), including Seasonal Anabranch and Billabongs, Lignum Shrubland and Woodland, and Black Box and Red Gum Woodland. A summary of water regime classes and constituent EVCs within the managed inundation areas is provided in Table 1.

Ecological Associates (2014a) initially developed ecological objectives for the water regime classes identified for restoration by the project, along with ecological targets to measure progress towards achieving the ecological objectives. These ecological objectives and targets have been refined by Arthur Rylah Institute (ARI) as part of the development of the VMFRP Monitoring Evaluation and Reporting (MER) Framework (ARI, 2020), to provide more specific ecological objectives and targets against which progress can be measured and to support quantification of the degree of environmental benefit expected from the project.

Details of the ecological objectives and targets for the project and an overview of how these have been developed, is provided in Section 4 of the draft Burra Environmental Watering Management Plan (VMFRP, 2020a) contained in Attachment 11 – Environmental Watering Management Plan. The specific ecological objectives for the project can be summarised as:

- Reduce high threat exotic plant cover
- Maintain plant cover and diversity of target vegetation groups

- Maintain threatened native flora presence
- Maintain the health of native trees
- Increase abundance of native woodland birds
- Develop seasonal populations of small-bodied native fish
- Increase the abundance of bats as an indicator species of increased resources resulting from increased floodplain productivity
- Develop seasonal populations of native frogs
- Increase the abundance of reptiles as an indicator species of increased resources resulting from increased floodplain productivity
- Contribute to the carbon requirements of the River Murray channel ecosystem to support system productivity.

To achieve the ecological objectives and targets, the project aims to more closely align the frequency, duration and timing of future flood 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 within the managed inundation area. Analysis presented in the Business Case (Mallee CMA, 2014a), compares the frequency, interval and duration of flood events based on implementation of the proposed operating scenarios for the project ('proposed measure') with flood events under natural, baseline (current) and Basin Plan flows without the measure determined through modelling by Gippel (2014). This analysis shows that the proposed flood frequency, duration and timing of managed inundation events is more consistent with the natural (pre-regulation) flood frequency, duration and timing. A summary of the analysis by Mallee CMA (2014a) is presented in Table 2 and further discussed in the background / rationale section of this referral.

The project aims to achieve the preferred frequency, interval and duration of flood events by using constructed works to harness water from natural high flow events in the Murray River and / or pumped water, to distribute, retain and release floodwaters within the managed inundation areas.

The expected ecological benefits of the project are:

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

In addition to the expected ecological benefits, the project is also expected to contribute to the following socio-economic benefits:

- Enhanced tourism and recreational opportunities by improving the health and condition of riverine landscapes that attract visitors to the region

- Improved health of wetlands and floodplain ecosystems valued by Traditional Owners
- Reduced requirements to buyback water from consumptive users (e.g. 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 purchased 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. The project would contribute to the SDL adjustments under the Murray-Darling Basin Plan.

The River Red Gums Management Plan (Parks Victoria, 2018), which encompasses the parts of the Murray River Reserve and proposed Murray River Park within the project area, recognises the diversity of natural values within the reserve but also recognises that many of these natural values are under serious threat from changing patterns of water flows and use, and suggests that if insufficient flooding continues, further deterioration of the expanse and condition of wetlands and forests, already in poor condition, would have long-term impacts on the plant and animal communities and ecosystems, providing little resilience to the future impacts of climate change. For this reason, improving water regimes and delivering environmental water through the use of regulators and levees, is identified as a priority action in the River Red Gums Management Plan (Parks Victoria, 2018) to halt the decline of the parks and reserves, build resilience and lead to recovery.

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. A summary of the nine projects to be delivered by VMFRP is provided in Table 4. Together, these projects aim to return a more natural inundation regime across more than 14,000 ha 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 seven VMFRP projects located in the Mallee CMA region and to justify the SDL offset mechanism, an environmental benefits assessment was prepared by Ecological Associates (2014a) 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. A copy of the *SDL Floodplain Watering Projects: Rationale and Outcomes Report* (October 2014) prepared by Ecological Associates is available on request. Subsequent to this assessment, which focussed on the proposed environmental watering at Burra North, Sunraysia Environmental (2015) prepared the Burra Environmental Water Management Plan, which

interpolated and applied the ecological objectives and hydrological targets established by Ecological Associates (2014a) to other environmental water management areas at Burra Creek, including environmental watering along Burra Creek at Burra South as proposed by this project.

Further discussion of the floodplain hydrology and ecological objectives for the Burra Creek project is provided below.

Modified floodplain hydrology

Under natural conditions, Murray River flows of about 17,500 ML/day introduced water into Burra Creek at the downstream connection through backflows in most years, providing some permanency of water within the landscape. At flows exceeding 27,500 ML/day, water spilled onto the Burra North floodplain from Burra Creek and floodplain effluents filled low-lying areas dominated by lignum swamp. Major inundation of the Burra North floodplain extending into black box woodlands occurred at Murray River flows of about 30,000 ML/day.

However, Burra Creek has been extensively modified through the construction of blockages created to deliver and store water for irrigation or to facilitate access to pump sites at high river flows, and these blockages have caused the main hydrological impact at Burra Creek by isolating sections of the creek (Ecological Associates, 2006). Thirty-five blockages were identified along the length of Burra Creek by Ecological Associates (2007) (see Figure 2).

These blockages mostly include low level earthen banks (some with small culverts) and open irrigation channels (e.g. Piambie Channel) constructed across the creek. The main purposes of these blockages were identified by Ecological Associates (2007) as: capture flood water; retain water pumped for emergency red gum watering; provide vehicle and stock crossings; deliver irrigation supply water; contain irrigation drainage water; and provide crossings for water supply channels or pipes. In addition to blockages across the creek, other works affecting floodplain hydrology include the construction of levee banks parallel to the creek to prevent the flooding of adjacent private land (Ecological Associates, 2006).

A comparison of the modelled extent of flooding across the Burra Creek floodplain under natural (pre-regulation) and existing conditions by Jacobs (2017) illustrates that floodplain works combined with river regulation have reduced the extent of flooding at Burra Creek and increased the flow threshold required to achieve through flows along the length of Burra Creek (see Attachment 3 – Natural and Existing Flood Extents Map). A copy of the Jacobs (2017) report further describing the effects of river regulation on floodplain hydrology is available on request.

Modelling by Gippel (2014) of the frequency, duration, interval and start dates for Murray River flows of specified thresholds under natural, baseline and Basin Plan without the project scenarios, further illustrates the changes that have occurred to natural flooding regimes due to river regulation (Figure 1).

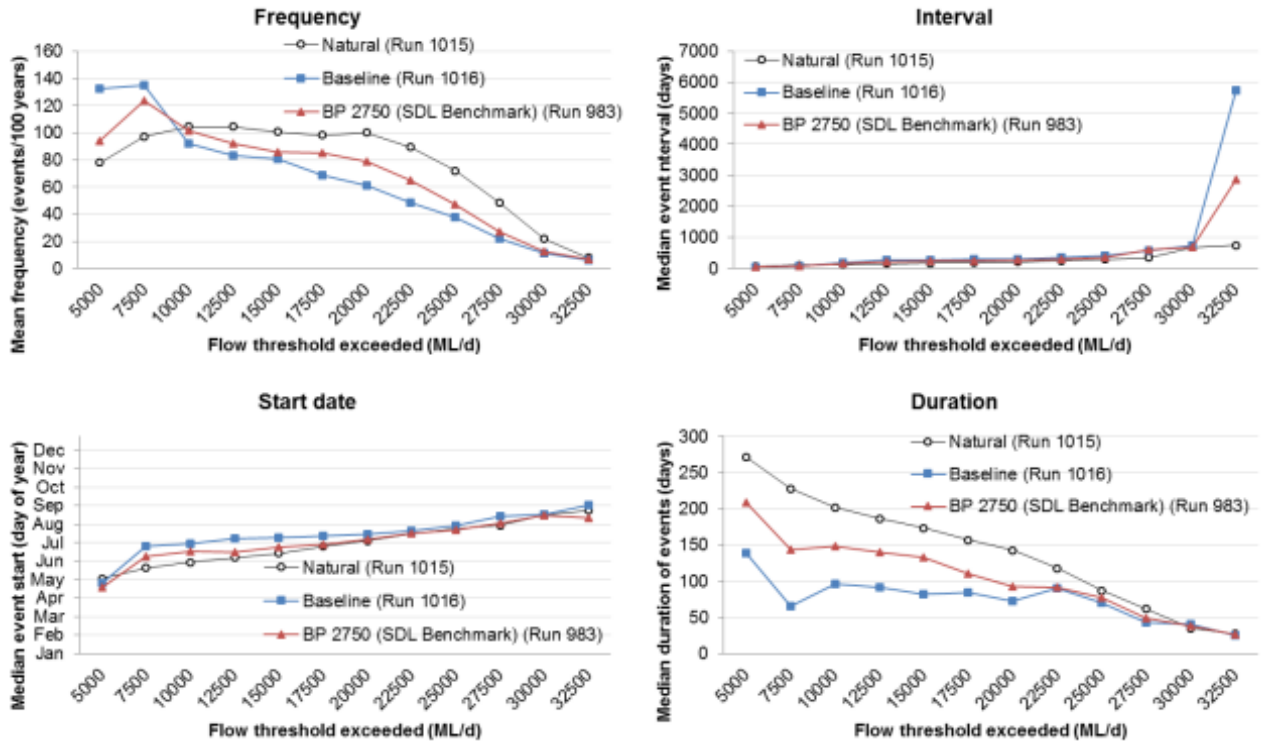

Figure 1: Comparison of frequency, interval, duration and start date at Swan Hill of natural, baseline and Basin Plan 2750 (without measure) flow scenarios, over a 114-year model period[2]

The proposed regulating structures would be constructed at the location of three of the existing blockages, including:

- Regulator B1 (Blockage Site 2) - there is an existing road embankment across Burra Creek, which provides the main access track into the forest and is approximately 1.1 m higher than the creek bed.
- Regulator B2 (Blockage Site 8) - there is an existing embankment across Burra Creek with a 1500 mm diameter pipe culvert. The existing embankment crest level of 58.7 mAHD is equivalent to the design water level to be retained. An irrigation channel running parallel to the bank passes under the creek through a siphon at this location.
- Regulator B4 (Blockage Site 30) - would be located in an existing levee and road embankment, which protects private farmland from Murray River flooding and provides access to private property to the north. A 580 mm diameter steel pipe with a flap gate is installed in the embankment and is assumed to be for the purpose of providing protection against flood flows whilst retaining some drainage outflow capacity (Jacobs, 2014).

The project would also involve removal or modification of a further five of the existing blockages that have impacted flows along Burra Creek at Burra North. The removal or modification of these blockages will support the modelled water movement and overland flood scenarios in Burra North. The removal of blockages in the Burra South area are not part of this project scope, as the targeted water regime classes relate to seasonal anabranch only. These objectives are achievable with in-channel flows, which can be achieved through managed or pumped events at Burra South with the blockages remaining in place. These blockages do not entirely restrict flow through the creek in this area, so the ecological objectives can be achieved without any works occurring.

[2] Gippel, 2014.

Targeted water regime classes

Ecological Associates (2014a) established objectives to restore three specific water regime classes at Burra North: Seasonal Anabranch and Billabongs, Lignum Shrubland and Woodland, and Black Box and Red Gum Woodland. The ecological objectives and targets for Seasonal Anabranches and Billabongs have since been interpolated and applied to Burra South by Mallee CMA (2014a), Sunraysia Environmental (2015) and VMFRP (2020a).

Based on the water regime classes and constituent EVCs described by Ecological Associates (2014a) and Mallee CMA (2014a), the location of each of the targeted water regime classes within the managed inundation areas has been mapped using DELWP's modelled 2005 EVC extents (see Attachment 2 – Environmental Features Maps). A summary of the estimated area of each EVC and water regime class within the proposed inundation areas is provided in Table 1.

Table 1: Summary of EVCs / water regime classes within the Burra Creek managed inundation area[3]

Water Regime Class	EVCs	Modelled 2005 EVC extent within managed inundation area (ha)
Seasonal Anabranch and Billabongs	Waterbody – Fresh	115.97
	EVC 810 - Floodway Pond Herbland (Depleted)	1.82
Lignum Shrubland and Woodland	EVC 808 - Lignum Shrubland (Vulnerable)	26.96
	EVC 104 - Lignum Swamp (Vulnerable)	13.54
	EVC 823 - Lignum Swampy Woodland (Vulnerable)	182.65
Black Box and Red Gum Woodland	EVC 103 - Riverine Chenopod Woodland (Endangered)	23.17
	EVC 818 - Shrubby Riverine Woodland (Least Concern)	34.61
	EVC 295 - Riverine Grassy Woodland (Vulnerable)	3.53
	EVC 106 - Grassy Riverine Forest (Depleted)	0.10
	EVC 811 - Grassy Riverine Forest / Floodway Pond Herbland Complex (Depleted)	0.02
Area not modelled as EVC		0.56
Total		**402.93**

Proposed inundation regime

The hydrological regime experienced by each water regime class identified for restoration through this project, has been compromised due to river regulation and diversions. The project's design water levels have been set based on the ecosystem water requirements of the EVCs / water regime classes targeted for restoration within the Burra Creek managed inundation areas. The ecosystem water requirements have

[3] Based on spatial analysis of modelled 2005 EVCs within managed inundation area and grouping of EVCs into water regime classes as defined by Ecological Associates, 2014a.

been established by VMFRP through the work by Ecological Associates (2006, 2007, 2014a, 2015), Bain (2013) and Sunraysia Environmental (2015).

Analysis presented in the Business Case (Mallee CMA, 2014a), compares the frequency, interval and duration of flood events based on implementation of the proposed operating scenarios for the project ('proposed measure') with flood events under natural, baseline (current) and Basin Plan flows without the measure (i.e. the project) determined through modelling by Gippel (2014). This analysis shows that the proposed flood frequency, duration and timing of managed inundation events is more consistent with the natural (pre-regulation) flood frequency, duration and timing, see Table 2.

Although Basin Plan flows would contribute towards addressing current deficiencies in the environmental water requirements of Burra Creek compared to baseline conditions, the project is required to bridge the gap between Basin Plan flows and the environmental water requirements of Burra Creek.

Table 2: Comparison of water regimes provided by natural, baseline, Basin Plan and the proposed project[4]

Threshold (ML/d)	WRC	Scenario	Frequency Mean (/100 yrs)	Interval Median (days)	Duration Median (days)	Event State Date Median (day of year, 1 Jan = 1)	Prevalence (years with event %)
17,500	Seasonal Anabranch and Billabong	With measure[1]	90	210	120	152	90
		Natural	98.2	191	157	181	94
		Baseline	68.4	290	84	198	65
		Basin Plan 2750 without measure	85.1	344	110	185	81
30,000	Lignum Shrubland and Woodland	With measure[1]	20	685	35	152	20
		Natural	21.9	681	35	234	20
		Baseline	11.4	734	41	234	10
		Basin Plan 2750 without measure	12.3	690	38	233	11
35,000	Black Box and Red Gum Woodland	With measure[1]	3	5000	15	152	3
		Natural	3.5	4203	15	253	3
		Baseline	1.8	17539	23	297	1
		Basin Plan 2750 without measure	1.8	8626	25	297	1

1. Based upon interpretation of the preliminary operations plan adapted from Ecological Associates (2014c) by Mallee CMA (2014a).

[4] Natural, baseline and Basin Plan regimes derived from Gippel (2014), as presented in Mallee CMA (2014).

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

The project is designed to facilitate managed inundation up to a design water level of 58.7 mAHD across approximately 330 ha of floodplain at Burra North, using water from both natural flood events and additional pumping from the Murray River. In addition, the project is designed to facilitate managed inundation of approximately 73 ha of anabranch habitats at Burra South up to the top of bank level along Burra Creek, using water from both natural flood events and pumping from the Murray River.

To achieve this, the project design includes the following main components:

- **Regulator B1** – A large regulator would be installed in Burra Creek at the northern / downstream end of the Burra North managed inundation area, that is designed to enable inflows (backflow) from the Murray River into the creek, the retention of water in the managed inundation area and the return of managed floodwaters to the Murray River on completion of a managed event.

- **Regulator B2** – A small regulator would be installed in Burra Creek at the southern / upstream end of the Burra North managed inundation area, that is designed to enable the retention of water in Burra North and to prevent flows into private land at Burra South during a managed event.

- **Regulator B4** – A small regulator would be installed within an existing containment bank in Burra Creek at the southern / upstream end of the creek near its junction with the Murray River near Tooleybuc, that is designed to allow flow into Burra Creek for supply of water during a natural event and to enable pumping through the regulator when required.

- **Drop structure** - A drop structure would be installed at the northern / downstream confluence of Burra Creek and the Murray River, to control erosion during managed releases from Burra Creek to the river, including some modification of the western bank of the Murray River and placement of 0.3 m thick reno mattress down the river bank to approximately 50 mAHD.

- **Containment banks -** Approximately 2.48 km of containment bank (four sections, Section A, B, C and D) would be constructed by raising existing access tracks at Burra North to a constant level of 59.12 mAHD to facilitate a managed water level of 58.7 mAHD with 300 mm freeboard (clay bank above the design water level) and 120 mm wearing course (gravel road base). Proposed containment banks would supplement the existing river levee to retain water at the design water level. Access tracks would be reinstated on top of the proposed containment banks and surfaced with gravel, with passing bays at necessary locations. Access track dimensions on the containment bank would be consistent with Parks Victoria access track design and maintenance guidelines, with the concept design assuming a total carriageway width of 5 m, including shoulders (from Parks Victoria Class 5D Access Track/Road Design Standard).

- **Spillways** – Four spillways (approx. 400 m total combined length) at an upstream level of 58.8 mAHD would be incorporated into the containment banks to enable controlled release of larger flows prior to overtopping of the containment banks.

- **Temporary pump hardstands** – A 6 m x 6 m hardstand area would be constructed at Regulator B4 to support temporary pump infrastructure, and an existing private pump station site at Spillway 4 would be modified to make it suitable for temporary pumping by installing a 6 m x 6 m hardstand and rock-lining in the existing pump discharge pool for erosion control. Temporary pump infrastructure would include a trailer-mounted diesel-fueled pump rig with a suction pipe extending into the Murray River, which would be brought onto site as required. Permanent pump infrastructure is not included in the design.

- **Blockage removal** - Four existing blockages (Banks 1, 2, 3 and 4) within Burra Creek at Burra North would be removed and one existing block bank (Bank 5) within Burra Creek at Burra North would be modified. Removal of blockages is proposed where there is considered to be no adverse impact on existing water licence holders, while modification rather than removal of Bank 5 is proposed to enable an existing water licence holder to continue to pump suction water from pooled water in the creek.

The following design philosophy 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, containment banks and overflow spillways 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).

A summary of design specifications for the three new regulators (B1, B2 and B4) is provided in Table 3.

Table 3: Summary of regulator design specifications

Regulator	Open / close / regulate flow	Proposed design (width (W) by height (H) in mm)	Proposed gates
B1	Regulate	Six 1800W x 3600H regulator bays	Split leaf gates
B2	Open/close	Two 1800W x 1800H box culverts	Penstock with manual actuator
B4	Open/close	One 1500 mm diameter reinforced concrete pipe	Penstock with manual actuator

Fish passage

The project provides a combination of approaches for provision of downstream fish passage, including passage directly through regulator bays, at the drop structure, and across spillways, containment banks and natural ground when submerged. No specific requirement for upstream fish passage has been identified due to local hydraulic conditions and low abundance of migratory fish. Each of the regulating structures is designed to provide safe downstream fish passage in accordance with the recommended design criteria for native fish contained in the SDL Fish Management Plan – Burra Creek (ARI, 2018) (see Attachment 4 – Fish Management Plan).

The small regulator structures would be operated either in fully open or fully closed position and are designed to allow for the movement of fish directly through the regulator structure, in both managed release and natural flood scenarios. That is, when water is released with the regulator gate in fully open position, fish would have passage through the regulator as the structures are designed to meet the recommended flow velocities contained in the SDL Fish Management Plan – Burra Creek (ARI, 2018).

Regulator B1 is designed to provide fish passage when fully open and also during regulating events, with design measures including control of flow velocities to be within the swimming tolerances of relevant local native fish species and provision of split leaf gates with overshot functionality and other measures as specified in the SDL Fish Management Plan – Burra Creek (ARI, 2018).

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

Construction laydown areas

Temporary construction work sites would include laydown areas at Regulator B1 (approx. 50 m north east of regulator work site), Regulator B2 (two alternative locations: approx. 15 m north west of regulator work site on public land and 40 m south east of regulator work site on private land) and Bank 5 (approx. 50 m west of work site). These laydown areas are included in the development footprint and construction footprint assessed in this referral.

Access tracks maintenance

The proposed access arrangements for construction and operation of the project are illustrated in Attachment 1 –Project Overview Maps and would involve use of existing access tracks. Maintenance would need to be undertaken to the existing access tracks to ensure they are suitable for use during construction and operation. Track maintenance would involve grading and applying additional road base to the surface. The construction footprint assessed in this referral provides for a 5 m wide corridor along existing access tracks to carry out maintenance works.

Borrow pits / quarry sites

Construction of the project would require the import of material (clay/rock). Approximately 8,400 m^3 of fill material would be required for embankment and regulator construction. VMFRP is in the process of identifying and evaluating potential borrow pit sites to supply this material, with the objective of selecting locations as close as possible to the project, on private land outside of the River Murray Reserve, while also avoiding and minimising environmental and heritage impacts. The location of borrow sites is currently unknown. Once locations are confirmed, necessary assessments would be undertaken, and the permits and approvals required for establishing new quarry/borrow sites or expanding existing sites would be sought. Rock (rock beaching) would be sourced from an existing commercial quarry.

Power supply

No new power supply connections are required to facilitate operation of the project. Regulator structures would be operated manually and / or using truck-mounted hydraulic lifting equipment as required. Temporary pump infrastructure would be powered by self-bunded generator and diesel fuel storage imported to the site as required.

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.

Key construction activities:

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 / block banks where required
- Construction / installation of new structures.

Construction would involve use of vehicles and machinery such as trucks, excavators, and access equipment.

Importation of construction materials, including regulators and imported soils, would comply with Parks Victoria consent under Section 27 of the *National Parks Act 1975* and the future *Environment Protection Act 2017* (due to commence on 1 July 2021).

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 associated works are complete, all waste and spoil would be removed from the sites and disposed of as required by the proposed CEMP.

Construction in the Murray River

Construction of the drop structure requires modifying (re-shaping and re-grading) of the existing Burra Creek outlet channel and extending sections of rock mattress erosion protection into the Murray River. Installation of the rock mattress would involve excavating to 0.3 m deep so that the finished surface of the rock mattress 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. These mattress lengths would then be lifted into place with a purpose-built lifting frame. The top ends of each mattress would be secured to a gabion beam on the bank. Mattresses placed below water would not be tied at the sides. The mattress would be a special order with additional internal baffles, lifting points and geotextile filter incorporated.

A coffer dam would likely 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 coffer dam would not extend across the full width of the river and would therefore allow fish passage to be maintained while works are being undertaken.

Construction in Burra Creek

Works within the bed and banks of Burra Creek would be required for construction of each of the regulators (Regulator B1, B2 and B4), and for removal and modification of existing blockages (Banks 1-5). Works associated with each of the regulating structures would extend across the full width of Burra Creek. While it is intended that in-stream works would be undertaken during low / no flow periods, it is likely that the construction of regulators and possibly the removal / modification of blockages, would require temporary coffer dams to be installed in Burra Creek upstream and/or downstream of the works area to enable dewatering of the work areas. The type and location of coffer dams within Burra Creek would be confirmed through further design stages but would likely comprise of earthen material and would be located within the current area of investigation. A coffer dam would be constructed on the northern (Murray River) side of proposed Regulator B1, and the southern side of proposed Regulator B2 during construction. The design height of the coffer dams is to be determined as part of detailed design but would not be higher than the top of the existing creek bank.

Post-construction rehabilitation

Following completion of works, rehabilitation of construction areas would be undertaken in accordance with Parks Victoria consent under Section 27 of the *National Parks Act 1975*. General principles for site rehabilitation include:

- Use of local indigenous plant species
- Placement of habitat logs

- Retention and reuse of topsoil
- Rock beaching using materials consistent with the local geological settings, where practicable.

Key operational activities:

The sources of water for managed inundation would be:

- Gravity inflow from the Murray River via backflow through Regulator B1
- Gravity inflow from the Murray River through Regulator B4
- Pumped inflow from the Murray River at Spillway 4 (existing private pump site) to supply water to the Burra North floodplain
- Pumped inflow from the Murray River at the B4 Regulator to supply water to the southern section of Burra Creek.

The volume of water required to fill the Burra North managed inundation area to a design water level of 58.7 mAHD across 330 ha was estimated to be 1,550 ML or approximately 2,350 ML if a nominal allowance of 0.3 m is allowed for infiltration and losses (Jacobs, 2018). The volume of water required to fill the Burra South managed inundation area to the top of bank level of Burra Creek across 73 ha is estimated to be 1,276 ML (Mallee CMA, 2014). Allowing for floodplain losses, it is estimated that up to 50% of flows entering the Burra Creek floodplain could potentially return to the Murray River (VMFRP, 2020b).

According to the Draft Operating Plan (VMFRP, 2020b), river flows into Burra Creek can occur at:

- Burra Creek North (east of Regulator B1) – this is the main site of inflows from the Murray River when the river discharge exceeds 20,000 ML/day
- Burra Creek South (east of Regulator B4) – inflows commence at this upstream end of Burra Creek when Murray River discharge exceeds 22,500 ML/d.

Based on these commence to flow levels, a number of operating scenarios have been developed to capture these river inflows to deliver the preferred frequency of targeted flood events, and/or to use pumping to enhance inflows to address deficiencies in the preferred frequency or maximum interval of flood events. Regulators are used to deliver the preferred duration of flood events for natural, pumped and hybrid events.

The following operating scenarios are described for Burra North and Burra South in Attachment 5 – Draft Operating Plan:

Burra North

There are four general operating scenarios proposed for Burra North:

- Capture Low Flood Peaks in Burra Creek – Scenario 1 – Targets inundation of Seasonal Anabranches and Billabongs up to a target water level of 57.70 mAHD (equivalent flow of 22,500 ML/day), at a preferred frequency of 9 events in 10 years with a median duration of 3 months, using water from natural inflows and using regulators to achieve duration targets.
- Capture Large Flood Peaks in Burra Creek – Scenario 2 – Targets inundation of Seasonal Anabranches and Billabongs, and Lignum Shrubland and Woodland up to a target water level of 58.20 mAHD (equivalent flow of 25,000 ML/day), at a preferred frequency of 3 events in 10 years with a median duration of 3 months, using water from natural inflows and using regulators to achieve duration targets.
- Capture Very Large Flood Peaks in Burra Creek – Scenario 3 - Targets inundation of Seasonal Anabranches and Billabongs, Lignum Shrubland and Woodland, and Black Box and Red Gum Woodland up to a target water level of 58.70 mAHD (equivalent flow of 30,000 ML/day), at a preferred

frequency of 0.9 events in 10 years with a median duration of 1 month, using water from natural inflows and using regulators to achieve duration targets.

- Pump to High Floodplain Areas – Scenario 4 - Targets inundation of Seasonal Anabranches and Billabongs, Lignum Shrubland and Woodland, and Black Box and Red Gum Woodland up to a target water level of 58.70 mAHD (equivalent flow of 30,000 ML/day), at an estimated frequency of 0.9 events in 10 years to address a deficiency in natural flows achieving the preferred maximum interval for the 30,000 ML/day flood event, and a median duration of 1 month, using water pumped from the Murray River and using regulators to achieve duration targets.

At flows exceeding 30,000 ML/day, all regulators would be open to allow continuous through flow of natural inflows, which would inundate Seasonal Anabranches and Billabongs, Lignum Shrubland and Woodland, and Black Box and Red Gum Woodland.

Burra South

There are three general operating scenarios for Burra South:

- Capture Large Flood Peaks in Burra Creek – Scenario 2 – Targets inundation of Seasonal Anabranches and Billabongs up to the top of bank level of Burra Creek (approx. 59.9 mAHD at Regulator B4) (equivalent flow of 25,000 ML/day), at a preferred frequency of 9 in 10 years with a median duration of 3 months, using water from natural inflows and using regulators to achieve duration targets.
- Pump to Large Flood Level in Burra Creek – Scenario 4 - Targets inundation of Seasonal Anabranches and Billabongs up to the top of bank level of Burra Creek (approx. 59.9 mAHD at Regulator B4) (equivalent flow of 25,000 ML/day), at a maximum frequency of 9 in 10 years with a median duration of 3 months to address a deficiency in natural flows achieving the preferred frequency for this flood event, using water pumped from the Murray River and using regulators to achieve duration targets.

At flows exceeding 25,000 ML/day, all regulators would be open to allow continuous through flow of natural inflows.

Further details on preferred timing and maximum intervals between events are provided in the Attachment 5 - Draft Operating Plan.

Following completion of a managed inundation event, the floodplain would be drained through managed release from the regulators (primarily the B1 Regulator) at specified/controlled release rates. The Draft Operating Plan indicates that the preferred drawdown period to empty the floodplain is 7 to 10 days (maximum 20 days) for the purpose of drying the access tracks and reopening the park to the public, and to limit the period of operation.

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 would be removed to a practical extent from the site by the operator, and the area rehabilitated to the satisfaction of 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).

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

☐ No ☒ Yes If yes, please identify related proposals.

The Burra Creek Floodplain Restoration Project is one of nine discrete environmental works 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 ha of high ecological value Murray River floodplain in Victoria through the construction of new infrastructure and modification of existing infrastructure.

A summary of the nine VMFRP projects in order from east (upstream) to west (downstream) along the Murray River floodplain is provided in Table 4.

Table 4: Summary of VMFRP projects

Project	Proposed Floodplain Inundation Area*	CMA	LGA	Implementing Authority	Bioregion
Gunbower	704 ha	North Central	Campaspe Gannawarra	GMW	Murray Fans
Guttrum and Benwell	1,149 ha	North Central	Gannawarra	GMW	Murray Fans
Vinifera	350 ha	Mallee	Swan Hill	LMW	Murray Fans
Nyah	476 ha	Mallee	Swan Hill	LMW	Murray Fans
Burra Creek	403 ha	Mallee	Swan Hill	LMW	Murray Fans (small area of Murray Mallee)
Belsar-Yungera	2,374 ha	Mallee	Swan Hill	LMW	Robinvale Plains (small area of Murray Mallee)
Hattah Lakes North	1,130 ha	Mallee	Mildura	LMW	Robinvale Plains (small area of Lowan Mallee & Murray Mallee)
Wallpolla Island	2,672 ha	Mallee	Mildura	LMW	Murray Scroll Belt
Lindsay Island	5,108 ha	Mallee	Mildura	LMW	Murray Scroll Belt

* Proposed floodplain inundation areas may vary subject to the processes of design development and obtaining land owner / manager agreements.

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

Separate referrals are being prepared for these projects under the Victorian *Environment Effects Act 1978* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

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

The estimated capital cost of development, including all development, construction and management activities, is $13.8 million.

4. Project alternatives

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

No project alternative

One project alternative is to not undertake the project (i.e. ' do nothing'). This alternative has not been 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.
- Forego an opportunity to deliver long-term positive impacts to areas that are ecologically significant at a local, regional, and national level.

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 three detailed options assessments and fundamentally underpinned 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 Murray-Darling 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 further 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 Burra Creek and associated floodplain. This optimised design seeks to maximise the ecological benefits of the project, whilst minimising construction impacts. Key investigations that informed and considered project design alternatives are summarised below.

Water Management Options for the River Murray – Nyah to Robinvale Stages 1 and 2 (2006, 2007)

Ecological Associates (2006, 2007) completed a two-staged investigation of water management options for 18 floodplain management units along the Murray River between Nyah / Vinifera and Robinvale, including Burra Creek. The purpose of these investigations was to characterise ecological values; develop objectives for ecological condition; define water regimes required to meet ecological objectives; identify threats to environmental water requirements; and propose management actions to address these threats.

In relation to Burra Creek, the Stage 1 investigation determined that the main hydrological impact at Burra Creek is the isolation of sections of the creek as a result of blockages created to deliver and store water for irrigation or to facilitate access to pump sites at high river flows (Ecological Associates, 2006). The Stage 1

investigation concluded that further assessment of blockages and engagement with private landowners was required in order to develop water management options to rehabilitate flow paths at Burra Creek.

As part of the Stage 2 investigation, Ecological Associates (2007) identified 35 blockages along the length of Burra Creek. The purposes of these blockages were identified as: capture flood water; retain water pumped for emergency red gum watering; provide vehicle and stock crossings; deliver irrigation supply water; contain irrigation drainage water; and provide crossings for water supply channels or pipes.

The rehabilitation strategy developed by Ecological Associates (2007) recommended zone-based, staged removal of blockages in consultation with the relevant landowners and commencing with removal of the most downstream blockages nearest the river first to provide the benefits of rehabilitation works as early as possible.

Specifically, Ecological Associates (2007) recommended starting with removal of blockages in Zone 1 (Sites 1 to 5), which currently raise the threshold required for Murray River flows to enter the creek and reduce the frequency of flooding compared to natural conditions. Removal of these blockages was expected to improve flows along approximately 13 km of Burra Creek. To enhance the benefits of blockage removal, installation of regulators at Site 2 (location of proposed Regulator B1) and Site 8 (location of proposed Regulator B2) was recommended to enable the retention of water in the creek at a greater depth for longer periods.

Removal of blockages in Zone 2 (Sites 6 to 7) was assessed as being problematic due to the function of these blockages in facilitating irrigation water supply to a private consortium, and the large extent of native vegetation removal that would be required to provide an alternative irrigation water supply solution to this private consortium.

Rehabilitation of the flow path through Zone 3 (Sites 8 to 15) was also considered problematic due to the significant blockages associated with the Timbercorp Irrigation Channel at Site 8 (channel siphoned under the creek but access track causes blockage), and Sites 9 and 11 (creek crossing without siphon) (see Figure 3). The blockage at Site 15 is also associated with a levee containing a piped section of irrigation channel. Options considered to remove blockages along this section of creek without impacting irrigation water supplies, included replacing channel and pipe crossings with three new siphons; excavation of an existing cut-off channel to divert the main creek channel and bypass Sites 9 and 11; and installation of culverts or removal of access tracks. All options would involve significant works on private land and / or infrastructure and significant removal of native vegetation.

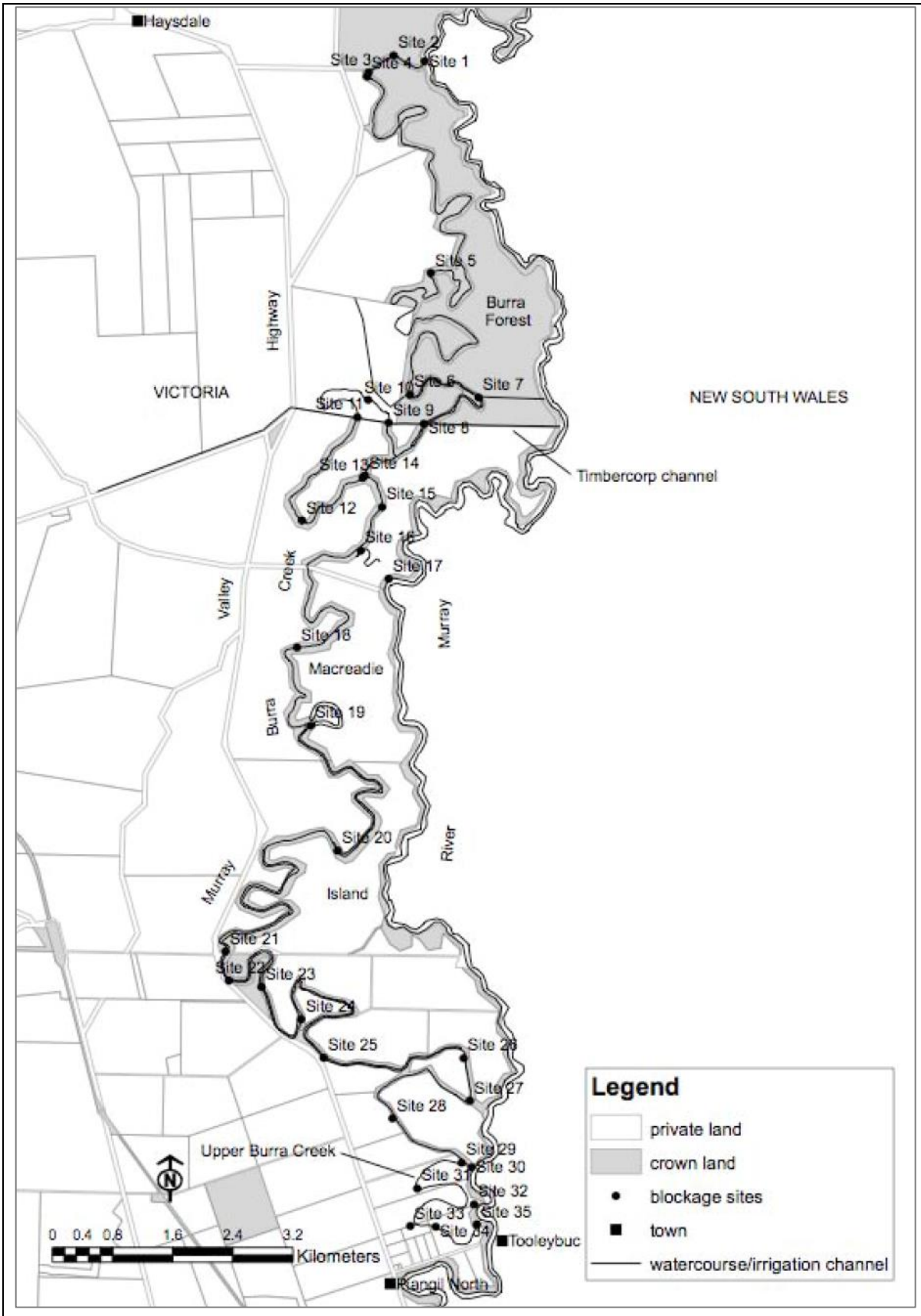

Figure 2: Location of blockages along Burra Creek (Ecological Associates, 2007)

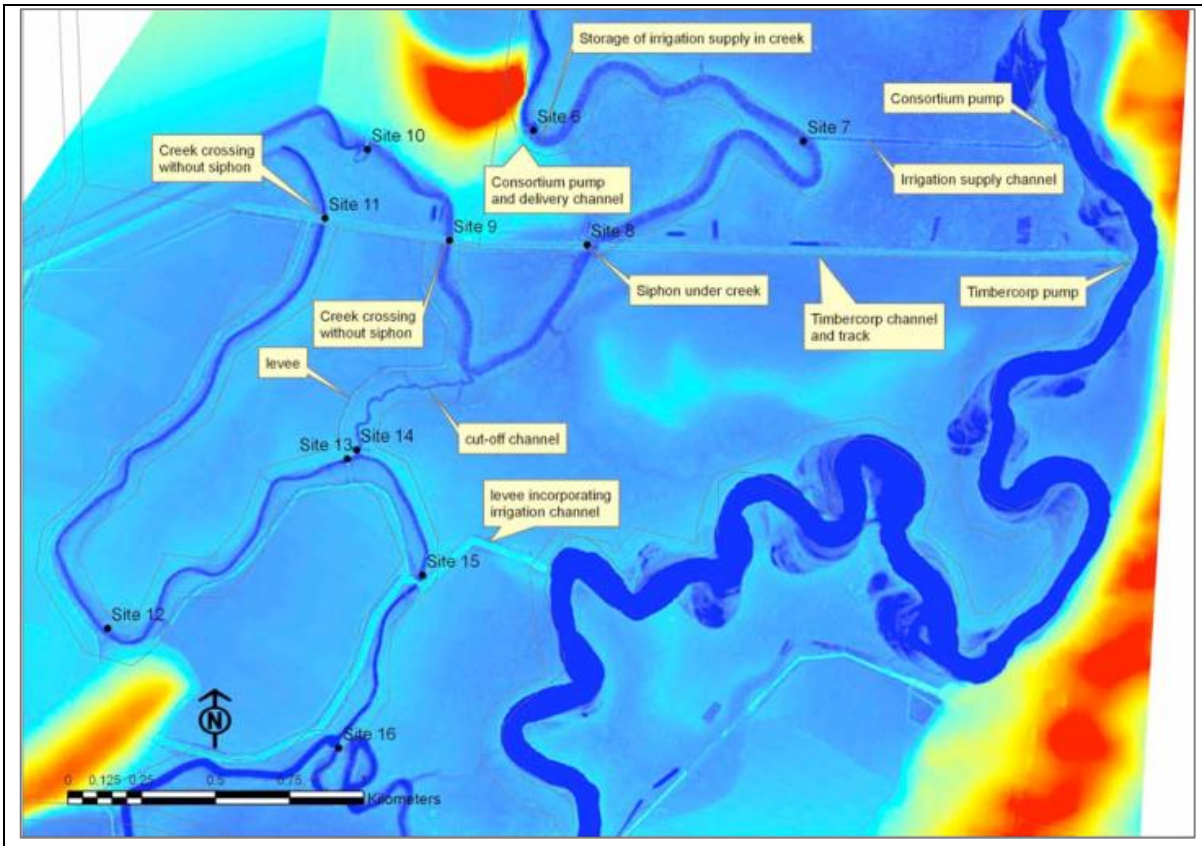

Figure 3: Location of key features influencing options feasibility in Zones 2 and 3 (Ecological Associates, 2007)

Options for removal of blockages in Zone 4 (Sites 17 to 20) were mainly focussed on eliminating or consolidating these mostly road crossings; or installing culverts to allow water to pass. The installation of a regulator at Site 16 was also considered for the purpose of potentially capturing water upstream through to the river connection at Site 30 and / or operating in conjunction with a large regulator at Site 1 to retain water at a greater depth along the 16 km of creek between Sites 1 and 17. These works on private land and / or infrastructure would require the agreement of private landowners.

Options for removal of blockages in Zone 5 (Sites 21 to 28, 30) were also mainly focussed on eliminating or consolidating these mostly road crossings; or installing culverts to allow water to pass. However, two of the road crossings also convey piped irrigation water, which would need to be replaced with an aqueduct or siphon. It was also suggested that these blockages may be part of levee networks that reduce floodplain inundation and if blockages are removed, it may be necessary to build up the banks of the creek if the same level of flood protection is to be maintained. It was identified that Site 30 is a substantial blockage on the River Track and could be restored by converting the crossing to a low ford or installing a culvert (proposed location of Regulator B4).

Zone 6 (Sites 29, 31 to 35) is located on Upper Burra Creek, which is a smaller, shallower subsidiary channel to the main Burra Creek channel that is connected to the river further upstream of Site 30. Removal of blockages on Upper Burra Creek were identified as a low priority because the creek channel is freehold, and Murray River flows only reach this channel in very high flows.

Options for the removal of blockages in Zone 1, and recommendations relating to installation of regulators at Sites 2, 8 and 30 were carried forward and supplemented with consideration of floodplain watering options through subsequent assessments, due primarily to the location of required works on public land.

Burra Creek Water Management Options Project (2013)

The Burra Creek Water Management Options Project investigated water management options for the Burra Creek floodplain, giving separate consideration to watering options for Burra North and Burra South. The watering options considered by Bain (2013) for Burra North and Burra South are illustrated in Figure 4 and Figure 7 and are described below.

Burra North

Options for watering the Burra North floodplain were developed on the basis of installing two regulating structures (B1 and B2) and supplementing the natural river levees to create a backwater in Burra Creek and subsequent inundation of the floodplain. Bain (2013) proposed a regulating structure (B1) at the downstream end of Burra Creek where it re-joins the Murray River, for the purpose of retaining water in the creek prior to release to the river. Bain (2013) proposed another regulating structure (B2) at the location of an existing culvert on Burra Creek at the Timbercorp Irrigation Channel (Piambie Channel). The aim of the B2 regulating structure was to prevent water backed up behind the B1 regulating structure from moving upstream along Burra Creek beyond the boundary of the River Murray Reserve during a managed flow event.

Bain (2013) considered three design water levels for watering the Burra North floodplain: 58.5 mAHD, 58.7 mAHD and 58.9 mAHD, resulting in different inundation areas and different requirements for raising the existing river track to form a containment bank to retain water within the floodplain at these water levels. Figure 4 shows these levels.

The 58.5 mAHD water level option was ruled out as the inundation area was not adequate to inundate the desired extent of floodplain. The 58.9 mAHD water level was less favourable due to high cost, and/or low environmental benefit. Based on these assessments, a water level of 58.7 mAHD was considered to provide a good balance between the area of inundation achieved (approximately 325 ha) and the extent of containment bank works required (Bain, 2013).

Progress from the 2013 water management options assessment, through the concept and advanced concept designs, to the current functional design has maintained the design water level of 58.7 mAHD and the type set for the B1 and B2 regulating structures. However, during the 2018 advanced concept design, an alternate alignment for the B2 regulating structure was proposed and ultimately adopted to minimise cost and avoid possible damage to an existing privately-owned siphon infrastructure.

The site for the proposed B2 regulator is an existing track crossing of Burra Creek near the southern boundary of Burra Forest and the River Murray Reserve. The track crosses the creek via a non-engineered embankment, which includes an existing 1500 mm diameter pipe culvert, which provides access to the remainder of the channel and private pumps at the river.

The private irrigation channel (Piambie Channel) runs parallel to and to the south of the existing embankment and passes under Burra Creek via an inverted siphon. There is evidence of water leaking from the siphon and its condition appears poor (Jacobs, 2018). Although the existing embankment crest level of 58.7 mAHD is equivalent to the proposed design water level, the existing bank was not found to be suitable as a water retaining structure (Jacobs, 2018).

Despite the poor condition of the siphon, the design intent is that construction should not damage the structure any further and therefore, an alternative arrangement for the B2 regulator (Design Alternative 2) aligned adjacent to the existing track was developed to avoid further damage of the siphon structure (Jacobs, 2018). Figure 5 and Figure 6 show the general arrangement for Design Alternatives 1 and 2 respectively as considered by Jacobs (2018). Design Alternative 2 for the B2 regulator has been confirmed to be the preferred option in the current functional design, in order to minimise cost and avoid possible damage to the existing privately-owned siphon infrastructure.

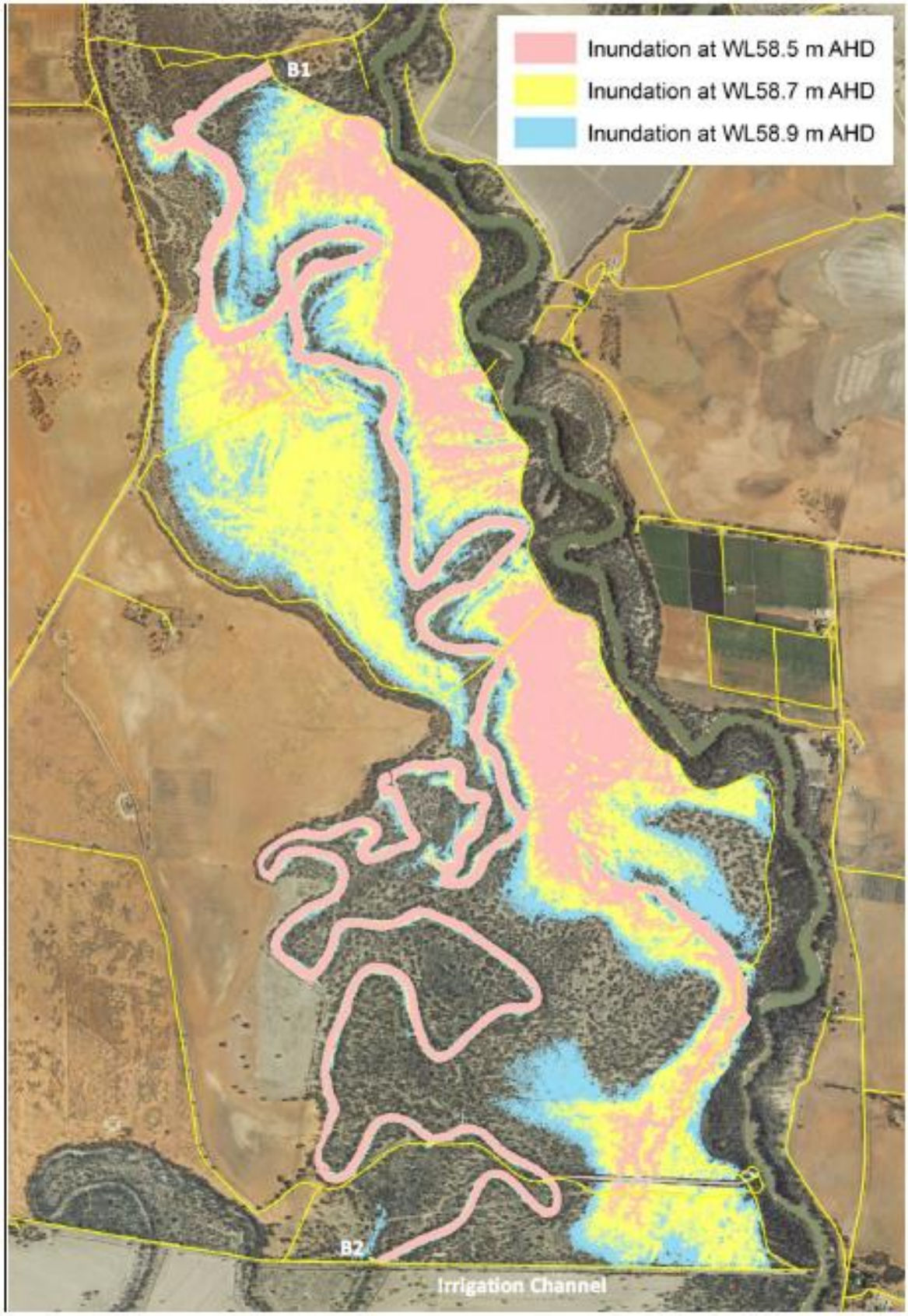

Figure 4: Comparison of inundation levels for water management options - Burra North (Source: Bain, 2013)

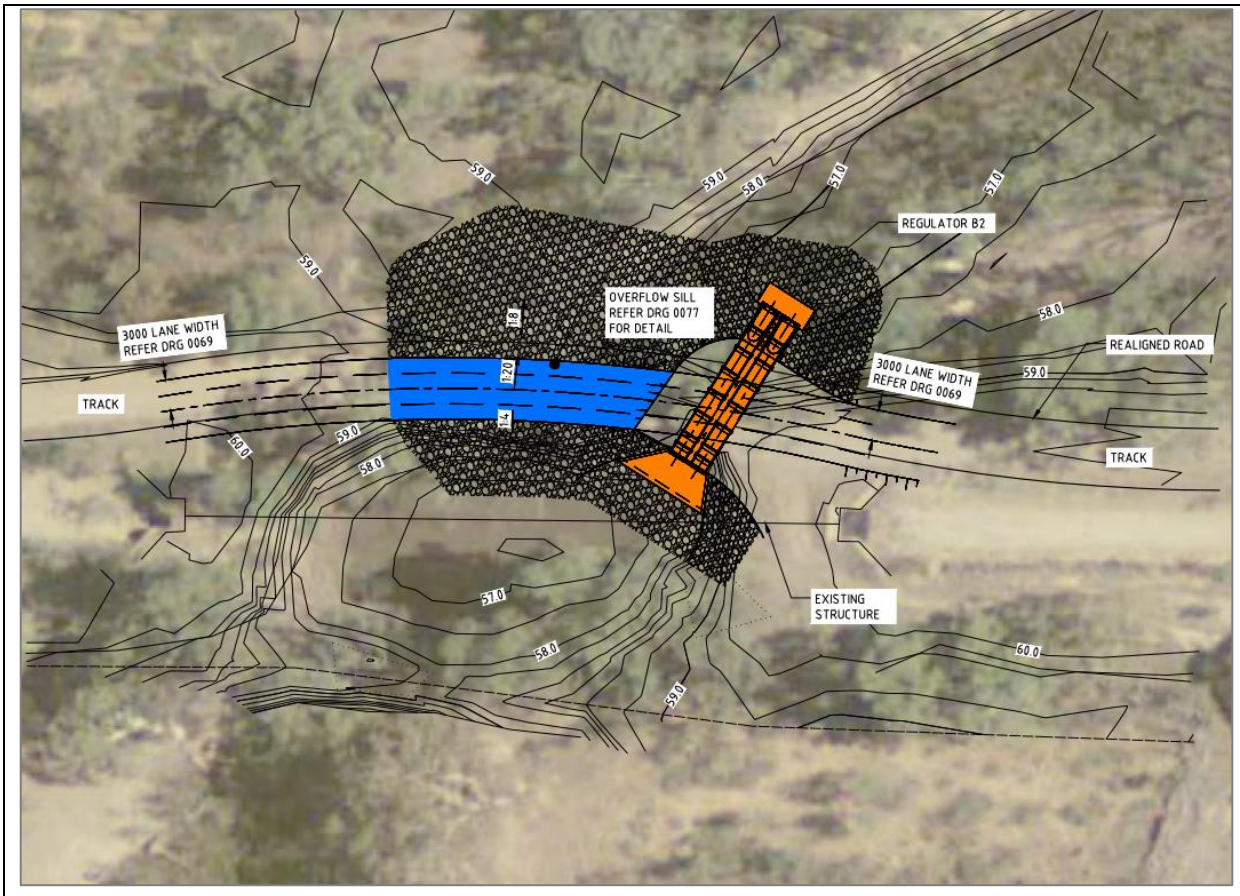

Figure 5: Design Alternative 1 (Pipe Culvert) - General Arrangement (Source: Jacobs, 2018)

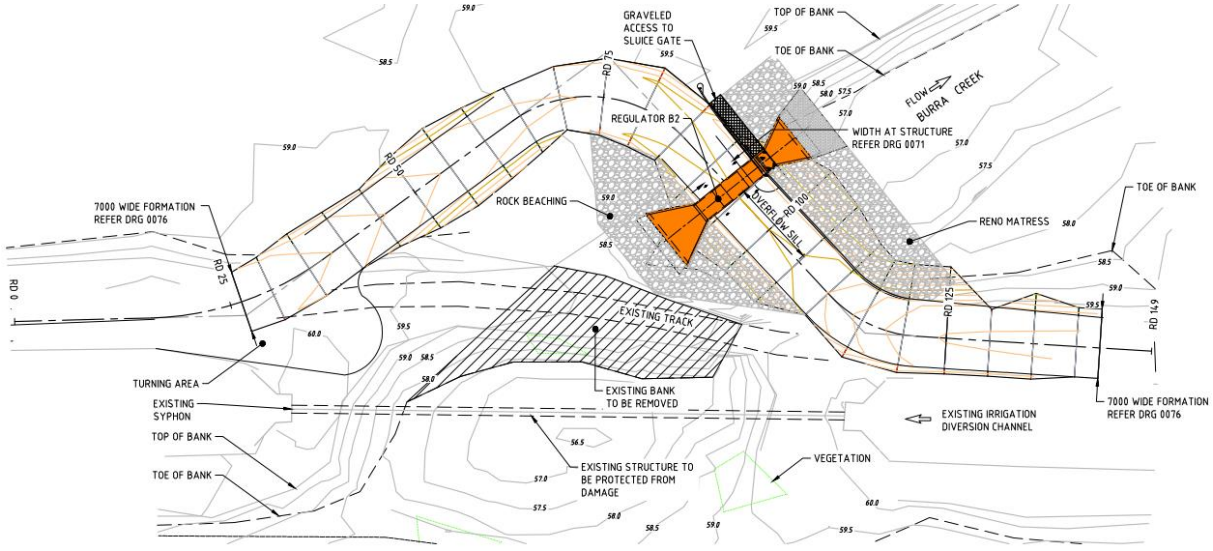

Figure 6: Design Alternative 2 (Box Culvert) - General Arrangement (Source: Jacobs, 2018)

Burra South

Bain (2013) investigated options for watering the Burra South floodplain independent of flow in Burra Creek and considered a range of design water levels. The Burra South floodplain options considered by Bain (2013) were located in the forested middle third of Macredie Island (i.e. south of the Piambie Channel but not all the way south to Tooleybuc). It was proposed that water be pumped directly onto the floodplain from a suitable location at the southern (upstream) end of the investigation area. These options included installation of a few short sections of containment bank at the northern end of the inundation area to prevent losses back to the Murray River or to Burra Creek. A small structure (B3) was also proposed to be constructed in one of the sections of containment bank to allow the floodplain to be drained at the end of the watering period.

As the required sections of containment bank would need to be constructed 'off-track', minimising disturbance to native vegetation and areas potentially containing cultural heritage values, was a major consideration for assessment of the Burra South water management options. The 59.4 mAHD inundation level was not preferred due to the larger extent of containment bank works required and associated potential for environmental and heritage impacts. The 59.1 mAHD was not preferred on the basis of not achieving the desired extent of floodplain inundation. Of the Burra South water management options assessed, the 59.3 mAHD level was recommended by Bain (2013) as it achieved good flooding outcome for a reasonably short length of containment bank and reduced cost compared to the 59.4 mAHD option.

Burra Creek Floodplain Management Project SDL Adjustment Supply Measure Phase 1 (2013)

The Burra Creek Management Project - SDL Adjustment Supply Measure - Phase 1 (Mallee CMA, 2013a) introduced an option to install a structure (B4 regulator) and a pump hardstand at the southern (upstream) end of Burra Creek, to increase the frequency of flows getting into the creek by reducing the commence to flow level to 20,000 ML/d (in the Murray River) throughout Burra Creek.

At the B4 regulator location, the Burra Creek inlet is fed by an existing culvert under an existing access track. The culvert is a single pipe, partially silted up and damaged internally. Options considered for this site were to install either a regulator or a simple box culvert, depending on the desired level of control over the watering regime in Burra Creek. However, a regulator was preferred on the basis that in addition to allowing natural flows to enter the southern section of Burra Creek, it would also enable the retention of water during natural flow/flood recession and managed flooding events.

The purpose of the pump hardstand at the southern (upstream) end of Burra Creek was to enable environmental watering of the southern section of Burra Creek by pumping water from the Murray River into the creek and allowing gravity to pull water towards the B2 regulator location, while being contained within creek top bank levels.

In addition to the Burra Creek water management option, the Burra Creek Management Project - SDL Adjustment Supply Measure - Phase 1 (Mallee CMA, 2013a) also maintained the preferred watering options for Burra North (design water level 58.7 mAHD, 325 ha inundation area) and Burra South (design water level 59.3 mAHD, 123 ha inundation area) determined by Bain (2013).

The Burra North and Burra Creek water management options, including proposed regulators B1, B2 and B4, with temporary pump facilities and containment banks, were carried forward through concept design, advanced concept design and the current functional design. However, the Burra South water management option was not considered for further development in the concept design due to the proposed structure and inundation area being located on private land and access limitations to proposed containment bank locations. In addition, the proposed B3 structure and associated containment banks were located in previously undisturbed areas, which was not preferred due to the requirement for native vegetation removal and probable presence of cultural heritage.

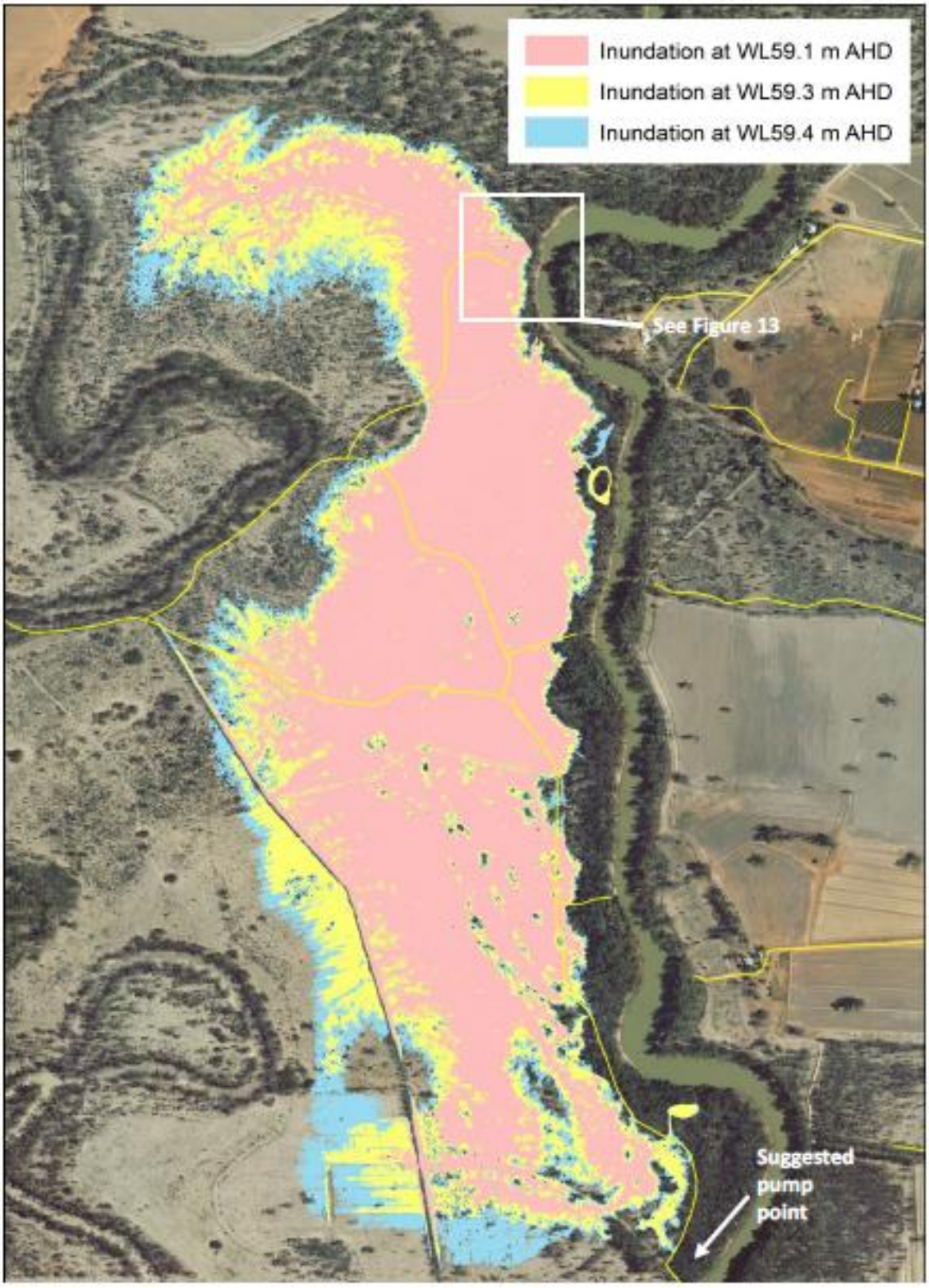

Figure 7: Comparison of inundation levels for water management options - Burra South (Source: Bain, 2013)

Sustainable Diversion Limit Adjustment – Phase 2 Assessment – Supply Measure Business Case: Burra Creek Floodplain Management Project (2014)

The Business Case (Mallee CMA, 2014a) confirmed the Burra Creek option with the B4 regulator and carried the proposal, via the advanced concept design (Jacobs, 2018) through to the current functional design. Concepts for the preferred Burra North option (B1 and B2 regulators) were also confirmed by the Business Case (Mallee CMA, 2014a) and further developed via the advanced concept design (Jacobs, 2018) through to the current functional design.

-

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), Business Case (Phase 2), Concept Designs and Advanced Concept Designs 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 would be the implementing organisation responsible for managing construction of the project.

LMW would also be primarily responsible for operation and maintenance of the environmental watering infrastructure, although it is likely that Parks Victoria staff would assist with operation as required.

In order to minimise potential adverse environmental effects and maximise environmental benefits across the nine projects being undertaken as part of the VMFRP, existing frameworks for collaborative and adaptive environmental water management would 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:

- Commonwealth Environmental Water Holder and the Murray–Darling Basin Authority to access water held on behalf of the Commonwealth Government.

- Water authorities (e.g. LMW, GMW) and waterway managers (e.g. Mallee CMA, 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.

An overview of water management responsibilities illustrating how scientific investigations, monitoring and evaluation feedback into decision-making on environmental watering proposals is provided in Figure 8.

Environmental watering at the Burra Creek site would be undertaken in accordance with the VEWH's annual seasonal watering plan and in partnership between LMW, GMW, the Mallee CMA and Parks Victoria.

Before a watering action can commence, a Seasonal Watering Proposal must be prepared by the Mallee 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 Mallee 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 Mallee CMA with GMW, enabling a diversion to commence.

Figure 8: Overview of water management responsibilities (Source: Parks Victoria, 2018 from VEWH, 2016)

Implementation timeframe:

Construction is currently scheduled to commence in September 2022 and is anticipated to be completed by August 2023.

Proposed staging (if applicable):

No staging is proposed.

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 project area is located along Burra Creek and its northern floodplain, between the Murray River to the east and the Murray Valley Highway to the west. The project area is approximately 25 km north of Nyah, 50 km north west of Swan Hill and 60 km south east of Robinvale and is situated between the rural localities of Piangil in the south and Kenley in the north. The southern end of the project area is adjacent to the town of Tooleybuc, NSW. The surrounding landscape is typical of the Mallee region, with floodplain areas adjacent to the Murray River giving way to farming land, followed by the elevated terraces of Mallee dunes and vegetation (Sunraysia Environmental, 2015).

Geomorphology, topography and landform

The majority of the project area is located in the Murray Basin geological unit, predominantly within the Northern Riverine Plain (NRP) geomorphic division, except for a small portion at the western edge of the project area, which is located within the North Western Dunefields and Plains (NWDP) geomorphic division (see Attachment 2 – Environmental Features Maps).

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 palaeochannels, and broad floodplain areas associated with major river systems and prior streams (Sunraysia Environmental, 2015).

The Burra Creek floodplain is relatively flat with elevations ranging between about 56 m AHD in parts of Burra North to about 61 mAHD in parts of Burra South (see Figure 9). The southern part of the floodplain is partially constrained by the Murray Valley Highway, which stops higher flows breaking out further to the west, while a series of levees and escarpments further to the north, also prevent flows breaking out further to the west (Jacobs, 2014). The bed gradient of Burra Creek falls approximately 3 m from south to north, with the southern section of the creek falling more steeply compared to the northern section of the creek (Sunraysia Environmental, 2015).

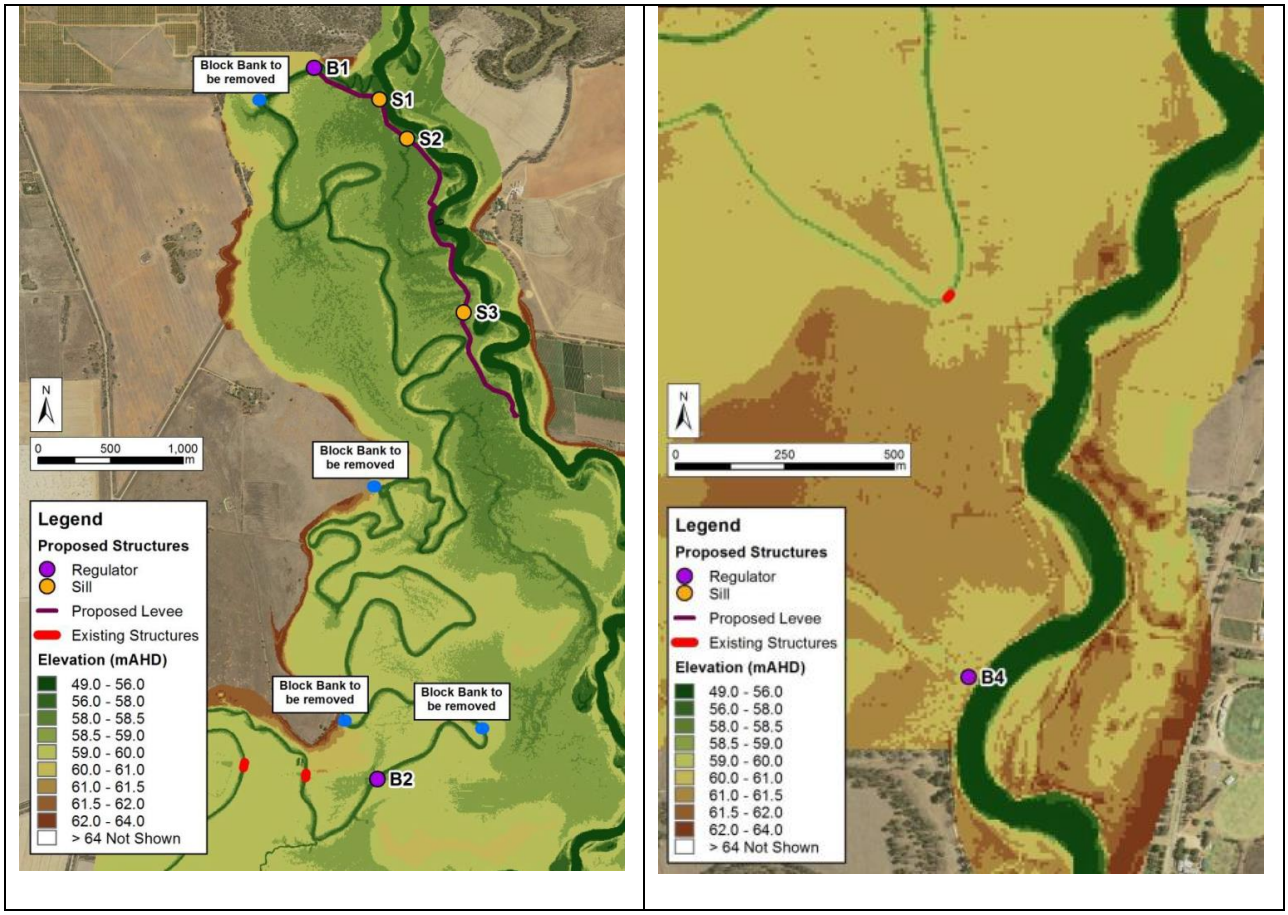

Figure 9: Floodplain elevations in the project area (Source: Jacobs, 2017)

Wetlands, waterways and drainage

Burra Creek is a 54 km long anabranch of the Murray River, which meanders through a low-lying floodplain, generally biased towards the outer / western edge of the floodplain. Burra Creek diverges from the Murray River downstream of Piangil at river chainage 1,320 km and re-joins the river at river chainage 1,296 km (VMFRP, 2020b). Burra Creek is located approximately 10 km upstream of the Murray River's confluence with the Wakool River and 30 km upstream of the Murrumbidgee River. Burra Creek is located about half way between the Euston Weir (Lock 15) downstream and Torrumbarry Weir (Lock 26) upstream, and is not affected by a weir pool or directly impacted by either of these features except by the inferred flow from their operation. Flows in the Murray River at Burra Creek are influenced by the Goulburn River and all upstream Murray River tributaries (Mallee CMA, 2014a).

The southern section of Burra Creek commences near proposed Regulator B4 as a narrow (5 m) and relatively deep (3 m) channel, which changes to a wider (17 m) and flatter (2 m deep) channel as it approaches the location of proposed Regulator B2 some 27 km of channel length to the north (Sunraysia Environmental, 2015). The southern section of Burra Creek has a second connection to the Murray River at mid-Burra (river chainage 1308 km). Two meander loops along Burra Creek South are DELWP mapped wetlands, both on private land. The southern mapped wetland has been cut off from the creek channel and is not included in the proposed inundation area. The northern mapped wetland at Burra South is dammed and used as an irrigation storage (Sunraysia Environmental, 2015). This mapped wetland is included in the proposed inundation but would be subject to inundation only if a private flood agreement is obtained.

The southern and northern sections of Burra Creek are physically separated by a large irrigation channel (Piambie Channel). The northern section of Burra Creek meanders for approximately 16 km and is generally

wide (50 – 70 m) and relatively shallow (Sunraysia Environmental, 2015). The floodplain of the western bank of the creek is generally narrow and in some places the creek is adjacent to cropping and grazing land. The floodplain of the eastern bank is wider and is generally separated from the Murray River by a natural levee adjacent to the river. The eastern floodplain at Burra North contains one DELWP mapped wetland known as Macredie Island Wetland, which is included in the proposed inundation area.

The project area is not located in or near any wetlands listed under the Ramsar Convention or A Directory of Important Wetlands in Australia. The nearest Ramsar-listed wetlands are the Hattah-Kulkyne Lakes (approx. 80 km north west and 150 km downstream) and the Kerang Wetlands (approx. 70 km south). The nearest wetlands listed on A Directory of Important Wetlands in Australia are Major Mitchell Lagoon (approx. 3.3 km north), Heywood's Lake (approx. 13 km north west), Belsar Island (approx. 38 km north west) and Beveridge Island (approx. 36 km south east). Refer to Attachment 2 – Environmental Features Maps.

The hydrology of Burra Creek has been extensively modified with 35 blockages identified across Burra Creek isolating flows in sections of the creek (Ecological Associates, 2007). In addition, levees have been constructed parallel to some sections of the creek to confine water in the creek and reduce floodplain inundation (Ecological Associates, 2015).

Reflective of these blockages and levees, modelling by Jacobs (2017) indicates that under natural conditions:

- Flows entered the northern end of Burra Creek at river flows of approx. 17,500 ML/day but under current conditions a river flow of approx. 20,000 ML/day is required
- Flows entered the southern end of Burra Creek South at river flows of approx. 20,000 ML/day, commencing through flow along the length of the creek, but under current conditions, a river flow of 22,500 ML/day is required
- Inundation of the Burra North floodplain commenced at river flows of approx. 27,500 ML/day with inundation of the northernmost areas requiring river flows of more than 30,000 ML/day. These flow thresholds have increased to 30,000 ML/day and 35,000 ML/day under current conditions
- Significant inundation of the southern areas of the Burra South floodplain commenced at river flows of approx. 27,500 ML/day but under current conditions, river flows of approx. 35,000 ML/day are required.

Refer to Attachment 3 – Natural and Existing Flood Extents Map.

Groundwater

The project area is in the Murray Geological Basin, which was infilled with sediments during the Tertiary and Quaternary period. A series of aquifer layers are present at the project area, to a depth of approximately 300 m below ground. The aquifer sequence from the surface downwards comprises:

- The alluvial aquitard (Coonambidgal Formation): Floodplain fine grained silts and clays that are part of the contemporary floodplain and the recent geological past, relatively thin across the project area
- Channel Sands aquifer: An Upper Tertiary, fine to coarse grained sand aquifer in direct connection with the Murray River
- Blanchetown Clay aquitard: A clay sequence of varying thickness that acts to reduce vertical interaction between the Channel Sands and the deeper regional aquifer. The aquitard pinches out close to the river

- Loxton Parilla Sand aquifer: A thick sequence of Tertiary age Marine sediments that underly the river and floodplain sediments. This is the regional aquifer and is typically saline or brackish in water quality.

Regional groundwater flow is generally to the north-west, with some localised flow towards the Murray River. Local flow cells are possible that may change the local flow direction.

Because of the generally saline nature of the regional aquifer, the proximity to fresh water from the Murray River and limited access to floodplain aquifers by private landowners, there are no licenced groundwater users in vicinity of the project area.

Salinity

Groundwater salinity in the watertable aquifer across the project area is interpreted to range from less than around 500 mg/L close to the river to up to 35,000 mg/L inland (see Figure 10). Soil salinity has been mapped over the project area and for the riverine corridor in the area by airborne electromagnetic surveys (AEM). The project area falls in the Robinvale to Boundary Bend AEM survey area (Cullen et al. 2008). Soil salinity in the project area has been mapped as low to moderate (below 200 t/ha/m) (see Figure 11). The risk of salt mobilisation from the project area is considered to be low.

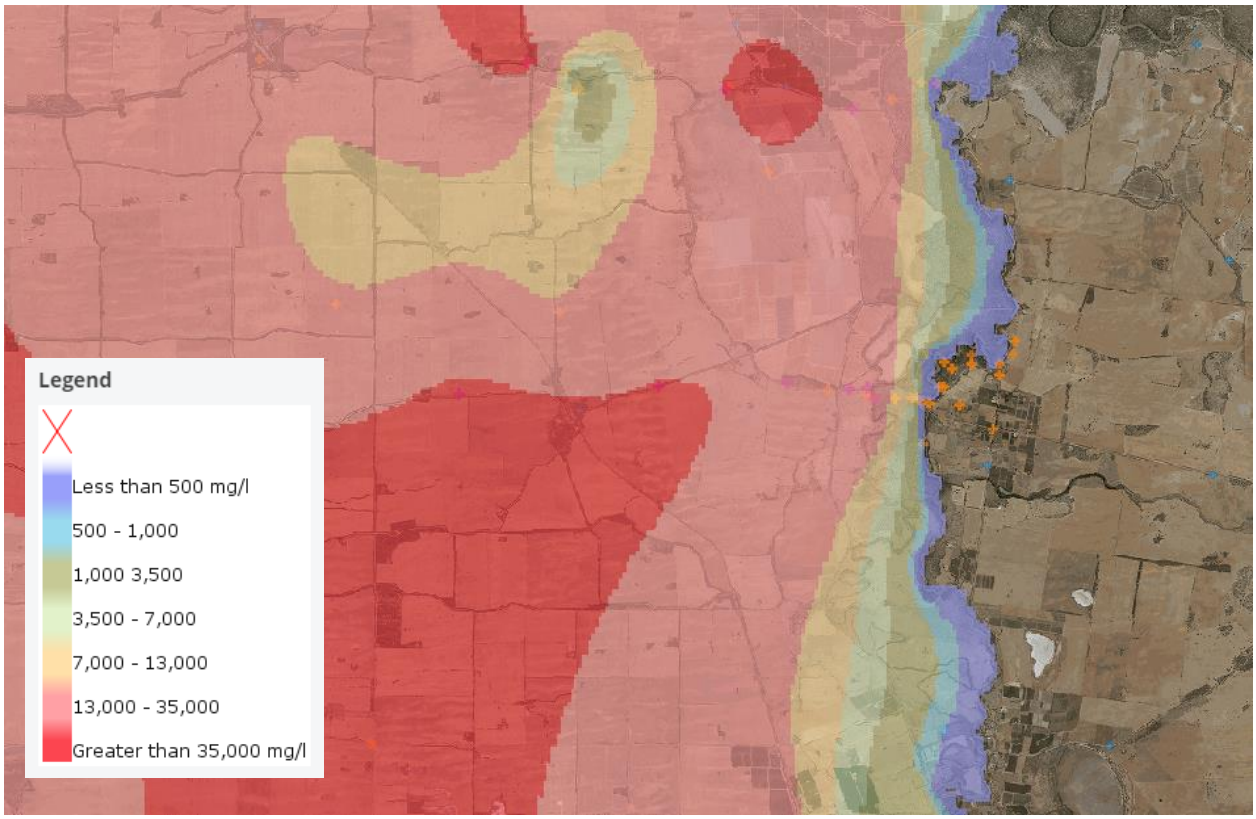

Figure 10: Interpreted groundwater salinity for the project area (FedUni 2015)

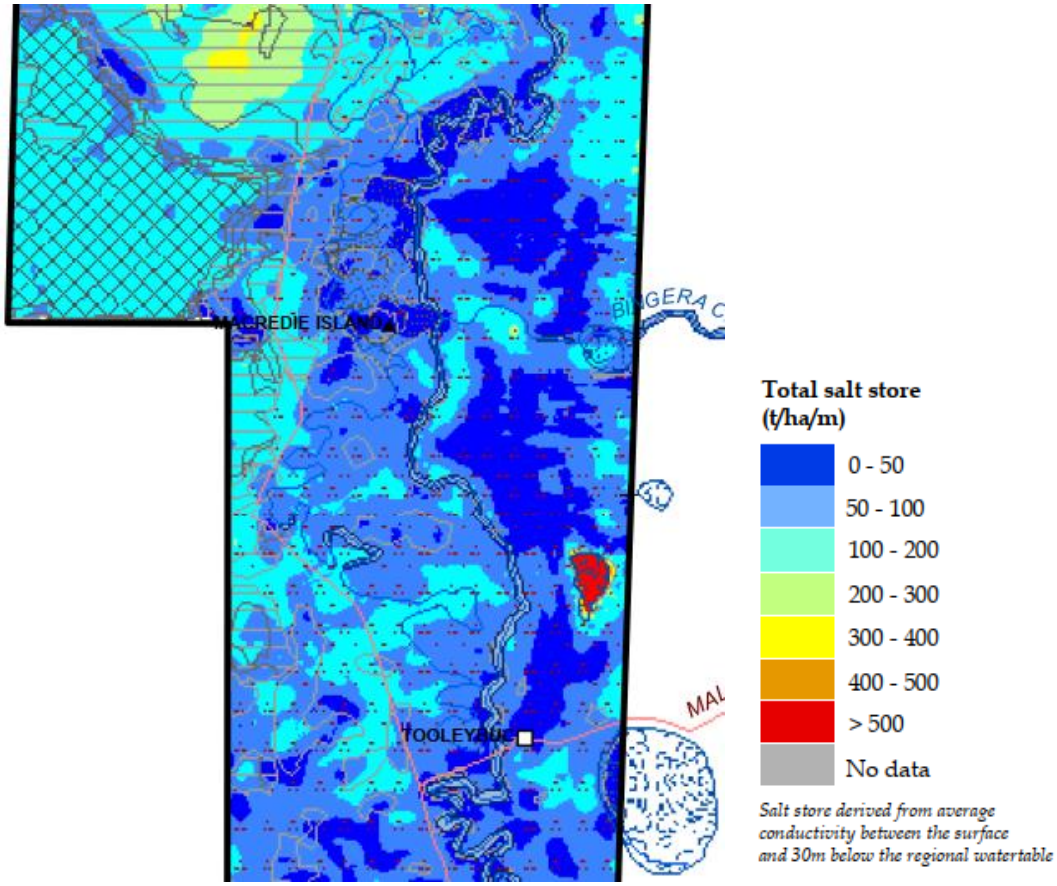

Figure 11: Interpreted salt store in the unsaturated zone for the project area (Cullen et al. 2018)

Vegetation and habitat

Floodplain areas at Burra North are largely unmodified and comprise some of the best preserved floodplain woodland and shrubland communities in the western Murray Fans bioregion (Ecological Associates, 2014a). The vegetation of Burra North is dominated by lignum shrubland and swampy woodland in lower-lying areas of the floodplain. More elevated areas associated with the natural levee along the Murray River, support red gum woodland with a grassy understorey, while more elevated areas on the western Burra Creek floodplain supports black box woodland with a chenopod understorey. About 129 native flora species have been recorded in and around the project area (Ecological Associates, 2014a). The southern section of Burra Creek is fringed with a narrow corridor of river red gum and black box and is surrounded by agricultural land with limited habitat values (Sunraysia Environmental, 2015).

The intact vegetation strata at Burra North, comprising an overstorey of black box, a midstorey of lignum and a complex ground layer with high levels of organic litter, logs and understorey grasses and shrubs (Lumsden, et al. 2007), provides habitat to support diverse communities of birds (over 130 species), bats (12 species) and reptiles (14 species) (Ecological Associates, 2014a). Flooded lignum and woodland provide habitat for a range of small fish that benefit from submerged aquatic vegetation, woody debris and plant, biofilm and invertebrate food sources (Ecological Associates, 2014a).

Burra Creek provides a strongly contrasting habitat to the surrounding floodplain woodlands. Under natural conditions the creek flowed almost every year for about four months. When flowing, the creek would have supported large channel-specialist fish such as Murray Cod. Deep, while permanent pools would have supported resident populations of small fish such as gudgeon species and Murray-darling Rainbowfish

(Ecological Associates, 2014a). However current creek conditions are not considered to support these species.

Further detail on the native vegetation communities, and flora and fauna present within the project area 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):

Design of the project infrastructure is would be refined as part of the design process and in response to environmental and cultural heritage studies. To allow flexibility for future design changes, an area of investigation of approximately 39 ha has been established.

The proposed construction footprint is located within the area of investigation and based on the current design, has an area of approximately 12.95 ha. The construction footprint has provided the basis for native vegetation removal calculations described in Part 2, Section 12 (Native vegetation, flora and fauna) of this referral, and 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.

The location and size of any borrow areas / quarry sites is yet to be determined.

The Burra North inundation area is approximately 330 ha. The Burra South inundation area is approximately 73 ha.

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

Not applicable.

Current land use and development:

The majority of the project area is located within natural features reserves managed by Parks Victoria under the *Crown Land (Reserves) Act 1978* primarily for conservation purposes. Burra North has been managed by Parks Victoria under the River Murray Reserve since the Land Conservation Council's Final Recommendations in 1989. Prior to this and since about 1929, it has been managed as State Forest (Sunraysia Environmental, 2015). Some sections of Burra Creek, including small areas of proposed inundation area, meander outside the natural features reserve onto adjacent private land. Private land adjoining Burra Creek at Burra South is primarily used for agriculture.

The River Murray Reserve at Burra North and the natural features reserve at Burra South are part of the proposed Murray River Park recommended by the Victorian Environmental Assessment Council (2008) to consolidate various areas of existing public land into a single park of more than 35,000 ha extending along the Murray River from Wodonga to Mildura. Land within the proposed Murray River Park is managed by Parks Victoria in accordance with the River Red Gum Parks Management Plan, July 2018 (Parks Victoria, 2018).

The River Red Gum Parks Management Plan (Parks Victoria, 2018) identifies almost all of the area of investigation at Burra North, except for some access tracks and Construction Laydown Area (Regulator B2 SE), as being located in the Burra-Piambie Visitor Experience Area (VEA). The Burra-Piambie VEA is a 30 km stretch of the Murray River east of Piambie that encompasses the River Murray Reserve, and part of the proposed Murray River Park, including Major Mitchell Lagoon Historic Area. The VEA is easily accessible from the Murray Valley Highway, although 2WD drive access is limited to dry weather only. The VEA is rich with Aboriginal and European history, hosting the Wakool Junction and Major Mitchell Lagoons, offers secluded camping along the banks of the Murray River and associated nature-based activities, such as fishing, swimming, canoeing, kayaking, bushwalking, bird watching and hunting.

The proposed drop structure is located in the Gundagai Bend Camping Area (Kenley), which stretches north from the proposed drop structure along the Murray River frontage. Most of the containment banks and proposed works at the existing private pump site (Spillway 4) are located in the Burra Camping Area, which stretches along the Murray River frontage from the existing private pump site north to about Spillway 2. Both camping areas permit dispersed camping and are described as providing only very basic levels of service (Parks Victoria, 2018). The access track to proposed Regulator B4 passes via the Tooleybuc Bridge Day Visitor Area (Parks Victoria, 2018).

No grazing licences currently affect reserved land within the area of investigation or proposed inundation area at Burra North or Burra South (DELWP, 2020). Sections of the River Murray Reserve at Burra North and almost all of the Burra Creek natural features reserve through Burra South are subject to water frontage licences that enable adjoining landowners to access Burra Creek. Sections of Burra Creek at Burra North and Burra South are used for the storage of irrigation water, with blockages such as Bank 5 impounding creek flows to create a pump pool for extracting irrigation water supply.

In total, 35 blockages have been identified along the length of Burra Creek for purposes including capturing flood water; retaining water pumped for emergency red gum watering; providing vehicle and stock crossings; delivering irrigation supply water; containing irrigation drainage water; and providing crossings for water supply channels or pipes (Ecological Associates, 2007). These blockages and associated isolation of sections of the creek were determined to cause the main hydrological impact at Burra Creek (Ecological Associates, 2007).

The Piambie (former Timbercorp) Channel extends from the Murray River in the east, along the southern edge of Burra North to the Murray Valley Highway, which it passes under before continuing further west to supply an extensive area of irrigated farmland. The Piambie Channel runs parallel to and immediately south of the area of investigation associated with the access to the Bank 5, Regulator B2 and existing private pump station work sites. The Piambie Channel crosses Burra Creek and the proposed inundation area at three locations, including a siphon crossing adjacent to proposed Regulator B2 and two non-siphoned crossings further west between Regulator B2 and the Murray Valley Highway. A smaller private irrigation channel is located about 350 m north of Piambie Channel and extends from the Murray River at the private pump station site near proposed Spillway 4 west to Burra Creek near Bank 5.

Four apiary sites (or buffers) are identified within the Burra North inundation area and one apiary site (or buffer) is identified within the Burra South inundation area. One apiary site is located within the area of investigation at Burra North (also within the construction footprint of a containment bank) while four apiary buffers overlap the area of investigation at Burra North.

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

The project is located on the western side of the Murray River approximately 25 km north of the township of Nyah, 50 km north west of Swan Hill and 60 km south east of Robinvale in north west Victoria. Access to the project area is from the Murray Valley Highway via local roads, including Angle Road, Raven Lane, River Track (opposite Natya Road) and Tooleybuc Road.

Floodplain areas, including proposed inundation areas, at Burra North are largely unmodified and comprise wetlands, forest and woodland known as Burra Forest. These areas are popular for bird watching and water related activities such as camping, fishing, barbequing and picnics (Sunraysia Environmental, 2015). Floodplain areas at Burra South are mainly developed for grazing, irrigated agriculture and dryland agriculture.

Surrounding land uses in both Victoria and NSW, are primarily associated with farming, including grazing, irrigated agriculture and dryland agriculture. Although land in the vicinity of the area of investigation and proposed inundation area are used for irrigated agriculture, these areas are not located in a declared

irrigation district. The nearest declared irrigation area is the Nyah-Torrumbarry Irrigation Area (TIA), which is located more than 10 km south of the Burra South inundation area. The TIA is part of the largest irrigation system in Victoria – the Goulburn-Murray Irrigation District (GMID). The GMID accounts for more than 70% of water storages and some 90% of water used in irrigation across the state. Approximately 2,000 landowners rely on this system for farming within the area.

Conservation and nature-based recreational land uses are also common in the surrounding area including along the Murray River and associated reserves. In addition, a series of smaller bushland reserves are located further to the west (Bower Tank, Natya, Coonimur, Possum Flat, Piangil Yungera, Piambie Bushland Reserves), mostly on the western side of the Murray Valley Highway.

Approximately two dwellings are located on farming land between Burra Creek and the Murray Valley Highway at Burra North. A small number of dwellings are also located on farming land between the Murray River and the Murray Valley Highway at Burra South. A small number of farm dwellings are also present along the NSW side of the Murray River adjacent to Burra North and Burra South, with denser settlement associated with the township of Tooleybuc on the NSW side of the river near proposed Regulator B4. The nearest dwellings to the construction footprint of proposed structures are located approximately 400 m from the Spillway 4 and Regulator B4 construction footprints. A small number of dwellings (<5 dwellings) are located in closer proximity to the access tracks, particularly the southern access to Burra North and the access to Regulator B4, with two of these dwellings located within approximately 50 m of the access tracks.

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

A desktop land use planning assessment has been prepared and is provided in Attachment 6 – Land Use Planning Assessment.

Swan Hill Planning Scheme

The project is situated within the Rural City of Swan Hill and is therefore subject to the provisions of the Swan Hill 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 6 – 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)
- Vegetation Protection Overlay (Schedule 1 – Remnant Vegetation)
- Land Subject to Inundation Overlay (LSIO)
- Bushfire Management Overlay (BMO).

Refer to Appendix B of Attachment 6 – Land Use Planning Assessment.

Planning permit triggers

In accordance with the controls identified in Table 5 and considering relevant exemptions known at this time as described in Attachment 6 – Land Use Planning Assessment, the project would require planning approval in relation to:

- Use
- Buildings and works, including earthworks
- Removal, destruction or lopping of native vegetation
- Removal, destruction or lopping of any vegetation, including dead vegetation in ESO1.

Table 5: Summary of potential planning permit triggers

Swan Hill Planning Scheme	**Planning permit triggers**		
Planning control	**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
Clause 36.04 Road Zone, Category 1 (RDZ1)	Y	Y	NA
Overlays			
Clause 42.01 Environmental Significance Overlay (Schedule 1 - Waterway, Wetlands and Lakes Environs) (ESO1)	NA	Y	Y
Clause 42.02 Vegetation Protection Overlay (Schedule 1 – Remnant Vegetation) (VPO1)	NA	N	Y
Clause 44.04 Land Subject to Inundation Overlay (LSIO)	NA	Y	N
Clause 44.06 Bushfire Management Overlay (BMO)	NA	N	N
Particular provisions			
Clause 52.17 Native Vegetation	NA	NA	Y
Clause 52.29 (Land Adjacent to A Road Zone, Category 1, or A Public Acquisition Overlay for A Category 1 Road)	NA	Y	NA

Further discussion of these controlling provisions in provided in Attachment 6 – Land Use Planning Assessment.

Notice and referral requirements

Notice and referral requirements potentially triggered by the project are described in Attachment 6 – Land Use Planning Assessment. The following referral authorities are identified:

- DELWP in relation to the removal of native vegetation under Clause 52.17 (recommending authority) and development in the ESO1 on public land managed by DELWP (determining authority)
- Mallee CMA as the relevant floodplain management authority for development in the LSIO (recommending authority)
- GMW in relation to development in the ESO1 in proximity to GMW assets of waterways (determining authority)
- Regional Roads Victoria as the relevant road authority for development in the Murray Valley Highway under Clause 52.29 (determining authority).

Relevant strategies and management plans

The following Mallee CMA strategies and plans provide land use and planning objectives and action plans associated within the region that includes the project area:

- Mallee Regional Catchment Strategy 2013-2019
- Mallee Waterway Strategy 2014-2022
- Mallee Floodplain Management Strategy 2018-2028
- Mallee Environmental Water Management Plan 2015
- Mallee Region New Irrigation Development Guidelines 2017
- Mallee Dryland Sustainable Agriculture Strategy 2017-2023
- Mallee Natural Resource Management Plan for Climate Change.

NSW planning framework

The following project works would extend into the banks and bed of the Murray River and therefore into the NSW local government area of Murray River Shire:

- Construction of a drop structure downstream of Regulator B1 at the outlet of Burra Creek to the Murray River
- Temporary placement of pump suction lines extending from the temporary pump stations (on hardstands in Victoria) at Regulator B4 and Spillway 4 down 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 key environmental planning instruments identified as relevant to the project are:

- State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP (NSW))
- State Environmental Planning Policy No. 44 – Koala Habitat Protection
- Murray Regional Environmental Plan No.2 – Riverine Land
- Wakool Local Area Plan 2013.

The proposed works are defined as ‘water reticulation system’ and would occur on land that is zoned W1 Natural Waterways under the Wakool Local Environmental Plan 2013 (see Appendix B of Attachment 6 – Land Use Planning Assessment).

A review of these environmental planning instruments has determined that the project is permissible with the consent of the Murray River Council pursuant to Clause 126A of the Infrastructure SEPP (NSW) (see Attachment 6 – Land Use Planning Assessment). As such, the project would require approval under Part 4 of the EP&A Act. A development application would need to be submitted to Murray River Council as the consent authority and would need to be accompanied by a Statement of Environmental Effects addressing the relevant environmental planning instruments.

Local government area(s):

Rural City of Swan Hill

A small part of the project area is in the NSW local government area of Murray River Shire.

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)**:**

The key environmental assets and sensitivities in the project area and vicinity, include:

- The project area is located on land reserved under the *Crown Land (Reserves) Act 1978* for protection of its natural features (River Murray Reserve, proposed Murray River Park).
- The proposed construction footprint contains approximately 12.6 ha of native vegetation, including 105 large trees and 1.444 ha of endangered EVC (103: Riverine Chenopod Woodland). Under the superseded Native Vegetation Management Framework, the vegetation to be removed comprises 5.626 ha of very high conservation significance, 6.178 ha of high conservation significance and the remainder of medium conservation significance.
- No EPBC Act or FFG Act listed threatened vegetation communities have been mapped or modelled to occur in the project area.
- One FFG Act listed fauna community (Victorian Temperate Woodland Bird Community) is likely to occur in the project area.
- One FFG Act listed flora species has been recorded in the project area: Umbrella Wattle (*Acacia oswaldii*) located adjacent to access tracks, and one FFG Act listed flora species is identified as possible to occur in the project area: Silver Saltbush (*Atriplex rhagodioides*). No EPBC Act listed flora species have been identified as possible to occur in the project area.
- Four EPBC Act listed threatened fauna species are known to occur or are possible to occur in the project area: Regent Parrot (*Polytelus anthopeplus monarchoides*) (Vulnerable), Painted Honeyeater (*Grantiella picta*) (Vulnerable), Silver Perch (*Bidyanus bidyanus*) (Critically Endangered) and Murray Cod (*Maccullochella peelii*) (Vulnerable), with suitable habitat for Silver Perch and Murray Cod only potentially present during inundation.
- Ten FFG Act listed fauna species are known to occur or are possible to occur in the project area, these being:
    - Painted Honeyeater (*Grantiella picta*) (FFG Act - Listed, VicAdv – vulnerable)
    - Regent Parrot (*Polytelus anthopeplus monarchoides*) (FFG Act - Listed, VicAdv – vulnerable)
    - Silver Perch (*Bidyanus bidyanus*) (FFG Act - Listed, VicAdv – vulnerable) – suitable habitat only during inundation
    - Murray Cod (*Maccullochella peelii*) (FFG Act - Listed, VicAdv – vulnerable) – suitable habitat only during inundation.
    - Black Falcon (*Falco subniger*) (FFG Act - Listed, VicAdv – vulnerable)
    - Diamond Dove (*Geopelia cuneata*) (FFG Act - Listed, VicAdv – near threatened)
    - Grey-crowned Babbler (*Pomatostomus temporalis*) (FFG Act - Listed, VicAdv – endangered)
    - Hooded Robin (*Melanodryas cucullata*) (FFG Act - Listed, VicAdv – near threatened)
    - Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) (FFG Act - Listed, VicAdv – vulnerable)
    - Carpet Python (*Morelia spilota metcalfei*) (FFG Act - Listed, VicAdv – endangered).
- Ten listed migratory species have been identified through a PMST search as potentially occurring in the project area (Common Greenshank, Common Sandpiper, Curlew Sandpiper, Fork-tailed Swift, Latham's Snipe, Pectoral Sandpiper, Satin Flycatcher, Sharp-tailed Sandpiper, Yellow Wagtail, Eastern Curlew)

although the proposed construction footprint is not considered to support habitat that would be considered important for migratory species foraging or breeding activity.

- The project area is located in an area of Cultural Heritage Sensitivity, with 15 registered Aboriginal Places identified in the vicinity of the project area, although only one registered Aboriginal Place occurs within the project area.
- The project would involve works in two waterways (Burra Creek, Murray River) and would involve inundation of two DELWP mapped wetlands on the Victorian Wetlands Inventory, but the project area is not located within or adjacent to any wetlands of international or national importance listed under the Ramsar Convention or on A Directory of Important Wetlands in Australia.
- The project area is identified by the Environmental Significance Overlay (Schedule 1 – Waterway, Wetlands and Lakes Environs) (ESO1) as having landscape values of state and regional importance.
- The project area is mostly included in the Public Conservation and Resource Zone and is subject to an Environmental Significance Overlay (ESO1), Vegetation Protection Overlay (Schedule 1 – Remnant Vegetation), Land Subject to Inundation Overlay and Bushfire Management Overlay under the Swan Hill Planning Scheme.
- The project would involve an increase in the frequency and duration of inundation (increased from current to more closely align with natural flood regime) in an area containing a shallow, low to moderately saline, alluvial aquifer as described in Section 13 (Water environments).
- The project would involve construction works in areas containing potentially erosive soils as described in Section 14 (Soils).

9. Land availability and control

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

☐ No ☒ Yes If yes, please provide details.

The majority of the project area at Burra North, including the development footprint of all proposed infrastructure, is located within the River Murray Reserve. The River Murray Reserve is a natural features reserve that is reserved under the *Crown Land (Reserves) Act 1978* and managed by Parks Victoria. The majority of the project area at Burra South, including the development footprint of all proposed infrastructure, is also contained within natural features reserve (partly River Murray Reserve) managed by Parks Victoria under the *Crown Land (Reserves) Act 1978*. Under this Act, natural features reserves are *deemed to be permanently reserved for public purposes, being in particular, the purposes of the protection of natural features*.

The River Murray Reserve at Burra North and the natural features reserve at Burra South are part of the proposed Murray River Park recommended by the Victorian Environmental Assessment Council (2008) to consolidate various areas of existing public land into a single park of more than 35,000 ha extending along the Murray River from Wodonga to Mildura. Land within the proposed Murray River Park is managed by Parks Victoria in accordance with the River Red Gum Parks Management Plan, July 2018 (Parks Victoria, 2018).

Works associated with the proposed drop structure are located on NSW Crown land within the Murray River.

The location of Crown land affected by the project is shown in Figure 3.2 of Attachment 6 – Land Use Planning Assessment. A summary of Crown land parcels affected by the project is provided in Section 3.2 of Attachment 6 – Land Use Planning Assessment.

Current land tenure (provide plan, if practicable):

Current land tenure includes Crown land comprised of natural features reserve (River Murray Reserve and proposed Murray River Park) and government road, and some freehold land parcels. Further details on land tenure, including affected land parcels, including relevant encumbrances on affected land parcels, is provided in Section 3.2 of Attachment 6 – Land Use Planning Assessment. Affected land parcels would be reviewed and updated if needed based on the final design.

The location of land parcels affected by the project and associated tenure is shown in Figure 3.2 of Attachment 6 – 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):

Native title

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* (Cth) 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.
- One Indigenous Land Use Agreement (ILUA VI2004/010) applies to parts of the area of investigation and inundation area (see Figure 3.3 of Attachment 6 – Land Use Planning Assessment). This ILUA does not apply to the development footprint of any proposed project infrastructure except for Construction Laydown Area (Regulator B2 SE). The ILUA is registered with the traditional owners of the Wamba Wamba, Barapa Barapa and Wadi Wadi Peoples in relation to exploration. This ILUA covers a wide area west of the Murray River extending from north of Nyah to around Narrung.

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).

The location of relevant native title interests is shown in Figure 3.3 of Attachment 6 – Land Use Planning Assessment.

Easements

A number of affected land parcels are encumbered with easements, mostly for water supply, drainage, channel or irrigation purposes (see Section 3.2 of Attachment 6 – Land Use Planning Assessment for further details).

Crown licences

No grazing licences currently affect reserved land within the area of investigation or proposed inundation area at Burra North or Burra South (DELWP, 2020).

Sections of the River Murray Reserve at Burra North and almost all of the Burra Creek natural features reserve through Burra South are subject to water frontage licences that enable adjoining landowners to

access Burra Creek. Proposed works have been designed in consultation with potentially affected water frontage licence / water licence holders.

Four licensed apiary sites (or buffers) are identified within the Burra North inundation area and one apiary site (or buffer) is identified within the Burra South inundation area (see Figure 3.1 of the Attachment 6 – Land Use Planning Assessment). One licensed apiary site is located within the area of investigation at Burra North (also within the construction footprint of a containment bank) while four apiary buffers overlap the area of investigation at Burra North.

Other

Most freehold parcels of land affected by the project are subject to a 15.24 m depth limitation and Crown reservation of rights to minerals and petroleum. Two parcels of freehold land (21\PP2296, 20B\PP2296) affected by the project are also subject to conditions of Crown grant requiring the protection of indigenous trees on not less than 3% of total land area.

10. Required approvals

State and Commonwealth approvals required for project components (if known):

The following Victorian State and Commonwealth assessments, 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* (Cth) 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 Swan Hill 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 licence or lease from Parks Victoria under section 17 of the *Crown Land (Reserves) Act 1978*
- Licence to take and use water (s51) and licence to construct works (s67) from Lower Murray Water under section 51 of the *Water Act 1989*
- Works on waterways permit from Mallee CMA under section 188 of the *Water Act 1989* and Mallee CMA By-law No.1 Waterways Protection 2014
- Permit to take protected flora on Crown land from DELWP under the *Flora and Fauna Guarantee Act 1988.*

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.*

Victoria

- *Catchment and Land Protection Act 1994*
- *Environment Protection Act 1970* (or *Environment Protection Act 2017* post 1 July 2021)
- *Fisheries Act 1995*
- *Heritage Act 2017*
- *Land Act 1958*
- *Mineral Resources (Sustainable Development) Act 1990*
- *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.*

Further details on NSW approval requirements for the project are contained in Attachment 6 – Land Use Planning Assessment.

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 SDL Adjustment Burra Creek Floodplain Management Project Business Case, Mallee CMA also consulted with Swan Hill Rural City Council, GMW and Parks Victoria.

During 2015 to 2017, engagement activities were undertaken in the form of monthly Steering Committee meetings with Mallee 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 project. In addition to the partnership agencies, regulatory approval agencies currently represented on the Technical Advisory Group include:

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

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

The Approvals TAG meets regularly to discuss the project / program. In addition, a Design TAG operates concurrently which has representation from the following:

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

Other agencies consulted:

See previous response.

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 and uncertainties 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 EVC data. Refer Attachment 7 – Flora and Fauna Assessment.

Approximately 12.6 ha of native vegetation would potentially require removal, of which 5.482 ha is associated with access tracks. This includes an estimated 1.444 ha of the endangered EVC Riverine Chenopod Woodland (EVC 103) (see Table 6 of Section 12.1 of this referral). As this EVC is mostly located along access tracks, impacts may be able to be reduced to lopping along tracks only. Under the superseded Native Vegetation Framework, the vegetation to be removed comprises 5.626 ha of very high conservation significance, 6.178 ha of high conservation significance and the remainder as medium conservation significance based on the Biodiversity Conservation Status and assessed vegetation quality.

There is uncertainty associated with the extent of native vegetation removal as the scope of works along access tracks is yet to be refined. In general, the vegetation removal estimate is considered conservative, as works along existing access tracks are likely to involve maintenance only (grading existing surface and adding some road base), with associated vegetation impacts likely to involve mostly lopping rather than removal. In addition, there may be opportunity to further refine construction footprints around infrastructure. Requirements for vegetation removal would be further assessed and minimised through the design process. An assessment by an arborist is proposed to assess potentially impacted trees within the construction footprint and along access tracks, to advise on methods by which they could be retained.

All EVCs modelled as present within the inundation area are swampy or riverine vegetation communities that require or are tolerant of inundation and are therefore likely to positively respond to environmental watering that restores a more natural hydrological regime. No obligate dryland communities are modelled to occur within the inundation area that may be adversely impacted by the proposed inundation.

Vegetation communities within the inundation area have been identified based on modelled data only and hence, due to lack of ground-truthing, are subject to some uncertainty. Targeted vegetation assessment would be carried out for representative sample sites within the inundation area to supplement this desktop assessment with field data, and to inform the vegetation condition monitoring program (and offset strategy / conservation exemption). This would be combined with a review of hydromodelling and operational scenarios relative to mapped vegetation communities, and adaptively managed through refinements to the Operating Plan and EWMP in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

Potential impacts on listed threatened species and communities

The proposed construction footprint has been subject to targeted flora and fauna surveys. A desktop assessment of potential impacts on listed threatened species and communities has been carried out for the inundation area. Refer Attachment 7 – Flora and Fauna Assessment.

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 Act listed fauna community (Victorian Temperate Woodland Bird Community) has been identified as likely to occur in the project area. Impacts to this community are likely to be negligible as Burra Creek is comprised

largely of intact vegetation and the proposed construction of environmental watering infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC.

No EPBC Act listed flora species are considered likely to occur or be impacted by either the construction works or proposed inundation. One FFG Act listed flora species, *Acacia oswaldii* (Umbrella Wattle) has been recorded adjacent to existing access tracks proposed to be used for construction and operation of the project. It is not anticipated that any of the identified FFG Act listed plants would require removal for the project. No other FFG Act listed flora species are identified as likely to be impacted by either the construction works or proposed inundation, with only one other FFG Act listed flora species identified as possibly occurring (*Atriplex rhagodioides* (Silver Saltbush), but this species has not been recorded in previous surveys.

Ten FFG Act listed fauna species, including four EPBC Act listed species, were identified as being known to or possibly occurring in the construction footprint and/or inundation area including:

- Black Falcon (*Falco subniger*)
- Diamond Dove (*Geopelia cuneata*)
- Grey-crowned Babbler (*Pomatostomus temporalis*)
- Hooded Robin (*Melanodryas cucullata*)
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)
- Painted Honeyeater (*Grantiella picta*)
- Regent Parrot (*Polytelis anthopeplus monarchoides*)
- Carpet Python (*Morelia spilota metcalfei*)
- Silver Perch (*Bidyanus bidyanus*) – suitable habitat only possible during inundation
- Murray Cod (*Maccullochella peelii*) – suitable habitat only possible during inundation.

Of these, two species listed under both the EPBC Act and FFG Act (*Bidyanus* (Silver Perch), *(Maccullochella peelii* (Murray Cod)) were identified as possibly being impacted by in-stream construction works such as coffer dam construction and dewatering, and sediment or contaminants in runoff associated with construction of the project. These potential impacts are likely to be localised to drop structure works in the Murray River as it is unlikely that these species are present within Burra Creek under existing conditions. 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. Adverse impacts associated with inundation along Burra Creek and its floodplain are unlikely as these species are unlikely to be present within Burra Creek under existing conditions. Floodplain inundation may result in benefit from improved habitat condition following environmental watering.

One other FFG Act listed species (*Morelia spilota metcalfei* (Carpet Python)) was also identified as at risk of direct impacts (injury, stress, mortality) through habitat clearing for construction of the project. This impact is not expected to be significant as suitable habitat is surrounding and widespread, and measures such as pre-clearance fauna surveys would be implemented. Construction impacts on these species are therefore not expected to be significant, while reinstatement of a more natural hydrological regime is likely to benefit this species.

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. Specific to the Regent Parrot, assessments have determined that important breeding habitat is not present within the project area, and this species is likely to utilise habitat within the construction footprints infrequently as non-important foraging habitat.

Ten EPBC Act listed migratory species are predicted to occur or have previously been recorded in the project area, however none of these species were considered likely to be adversely impacted by either the construction works or proposed inundation. 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.

As noted above, an uncertainty is that the inundation area has been assessed at a desktop level only based on modelled EVCs and associated habitat attributes, and general observations of surrounding areas during targeted field flora and fauna assessments within the area of investigation. Targeted vegetation assessment would be carried out for representative sample sites within the inundation area to supplement this desktop assessment with field data and improve understanding of likely presence/absence of species. This would be combined with a review of hydromodelling, and adaptively managed through the Operating Plan and EWMP in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

Impacts on aquatic ecosystems, surface water and groundwater quality

The project aims to reinstate a more natural hydrological regime to Burra Creek and the Burra North floodplain, 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 are able to 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.

Due to the nature of environmental watering, there is less certainty associated with impacts on water environments that relate to risks such as water quality impacts (including saline discharge) 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. Key measures relating to carp include tailoring water regimes to provide competitive advantage to native fish, drying wetlands containing large carp numbers, and developing and implementing a fish exit strategy to manage drawdown to trigger native fish to move off the floodplain, where possible, stranding carp. These practices are currently being implemented by Mallee CMA across other environmental watering sites to manage these risks.

In addition, the nature and extent of changes to groundwater levels and quality during managed inundation would be identified through implementation of a monitoring bore network and adaptively managed through refinement of Operating Plans and EWMPs in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

The nature and extent of impacts associated with hydrological changes in the Murray River upstream and downstream of the project area associated with delivery of environmental water to the project and return flows has not been assessed by VMFRP, although the volume of water required for environmental watering at this site is relatively low compared to passing river flows. This would be assessed through MDBA modelling once the package of proposed SDL measures is confirmed, 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

The project has been designed in consultation with potentially affected private landowners, asset owners and water licence holders to avoid or minimise impacts on existing infrastructure, water access and agricultural land uses.

Temporary restrictions on access and land use activities within the River Murray Reserve and some adjoining properties may occur during construction and managed inundation events. However, no land use activities would be permanently displaced by the project, except possibly one licensed apiary site located within the footprint of a containment bank, which may need to be relocated. Access and use of up to four other licensed apiary sites in the inundation area may be disrupted during construction works and managed inundation events.

The nearest residential dwellings are located approximately 400 m from the construction footprint of proposed structures (Spillway 4 and Regulator B4). A small number of dwellings (<5 dwellings) are located in closer proximity to the access tracks, particularly the southern access to Burra North and the access to Regulator B4, with two dwellings being located within 50 m of the access tracks. These residents may experience some additional noise, dust and traffic during construction, with these effects being typical of construction projects, unlikely to be significant and generally well understood. A CEMP would be developed and implemented containing measures to mitigate amenity impacts such as noise, dust and traffic. Modelling indicates that temporary pumping activities during environmental watering are not likely to exceed relevant Victorian or NSW noise criteria during operation of the project.

Impacts on landscape

The project would involve removal of native vegetation and alteration of constructed landforms within areas supporting state and regional landscape values, specifically the River Murray Reserve and proposed Murray River Park. 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, set in a forested landscape at least 400 metres from the nearest dwellings. Design of proposed structures would be sympathetic to the surrounding landscape and consistent with Parks Victoria infrastructure design guidelines, and no adverse visual amenity impact is expected at existing dwellings. Operation of the project is expected to have a positive effect on the landscape values of surrounding riverine and floodplain environments due to the 403 ha of anabranch and floodplain vegetation communities that are expected to benefit from the project.

Impacts on heritage values

Only one registered Aboriginal Place has been identified in the project area, comprising a low density artefact scatter along an existing access track. The project has potential to impact on both known (one registered place) and previously unregistered Aboriginal heritage places that may exist within the project area. The potential for these impacts is currently being assessed through preparation of a Cultural Heritage Management Plan (CHMP) in accordance with the *Aboriginal Heritage Act 2006.* This includes field survey and consultation with traditional owner (TO) groups. The CHMP would include a detailed assessment of potential impacts associated with altered hydrological and geomorphological conditions as a result of the proposed managed inundation activities (refer Section 15.1 for further details).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.

No places listed on the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), Swan Hill 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. There is however uncertainty and moderate 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 determined through field survey and managed in accordance with the *Heritage Act 2017*.

Borrow sites

VMFRP are currently progressing a site selection process to identify potential borrow pit locations from which to source approximately 8,400 m^3 of fill material. The nature and extent of potential impacts 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. To the extent practicable, borrow pits would be located on private land 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)

Attachment 7 - Flora and Fauna Assessment contains a summary of the methods and findings of the following previous studies undertaken for the project in relation to native vegetation, listed flora and fauna species:

- Lumsden, L., Brown, G., Cheers, G. and Palmer, C. (2007) *Floodplain fauna surveys – Macredie Island and Burra Forest*. In 2007, Lumsden, Brown, Cheers and Palmer were engaged by Mallee CMA to undertake baseline floodplain fauna surveys across a broad area of the Burra Creek area, incorporating trapping methods (pitfall, Harp trapping), infrared motion-activated cameras, Anabat ultrasonic bat recorders and diurnal/nocturnal active searches for birds, frogs and herpetofauna.
- Brown, G., Bryant, D. and Horrocks, G. (2013) *Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria*. In 2013 the Arthur Rylah Institute was engaged by Mallee CMA to undertake terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves incorporating trapping methods (pitfall, funnel traps), infrared motion-activated cameras, Anabat ultrasonic bat recorders, diurnal/nocturnal active searches for birds, frogs and herpetofauna and call playback for owls.
- GHD (2013) *Summary Report for the flora census of Burra, Nyah and Vinifera SDL sites* - Memorandum prepared for Mallee CMA. In 2013 GHD were engaged by Mallee CMA to complete flora surveys including quadrats, cover percentages for litter, logs, bare ground and soil crust, and EVC mapping.
- Australian Ecosystems (2016) *Nyah and Vinifera SDL Project - Flora and Fauna assessment. Detailed Design Stage*. Report prepared for Mallee CMA. In 2015, Australian Ecosystems was engaged by Mallee CMA to undertake baseline flora and fauna surveys across the Burra Creek project area including mapping EVCs and large old trees, Habitat Hectare Assessments, bird surveys and nocturnal spotlighting for arboreal fauna.
- Arthur Rylah Institute (ARI) (Jenkin, A., Stuart, I. and Harrow, S.) (2018) *SDL Fish Management Plan - Burra Creek*. Report prepared for Mallee CMA.

In addition, Attachment 7 - Flora and Fauna Assessment describes the findings of updated searches of the following databases and mapping, which were used to identify native vegetation, and listed flora and fauna species potentially occurring within the project area based on a search radius of 10 km:

- Protected Matters Search Tool (PMST) for the EPBC Act, maintained by DAWE
- Weeds of National Significance database
- Victorian Biodiversity Atlas (VBA), maintained by DELWP

- NatureKit, spatial database for native vegetation (Ecological Vegetation Class) mapping throughout Victoria, maintained by DELWP
- Native Vegetation Information Management tool (NVIM), maintained by DELWP.

Between 28 and 30 October 2019, a field assessment of the area of investigation was undertaken by R8 ecologists 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 all 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.

The findings of these field assessments, along with a desktop assessment of native vegetation within proposed inundation areas is reported in Attachment 7 - Flora and Fauna Assessment.

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

☒ NYD Estimated area ……12.6 hectares

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 6 identifies the EVCs mapped within the construction footprint that would be impacted by the project (all within the Murray Fans bioregion), including the construction footprint of proposed infrastructure and access tracks. These EVCs have been ground-truthed during the field assessment undertaken for the construction footprint as described above.

Approximately 12.6 ha of native vegetation, including 105 large old trees, has the potential to be impacted by the proposed construction activities. This includes 7.129 ha of native vegetation within the construction footprint of proposed structures, containment banks, hardstands and laydown areas, and 5.482 ha of native vegetation within the construction footprint of access tracks. The project would use existing access tracks that have been mapped as native vegetation due to overhanging canopies. Some access tracks would require maintenance works, which may require lopping of adjacent native vegetation. The nature and extent of maintenance works and associated lopping would be confirmed through further design and informed by an arborist assessment.

Table 6: EVCs mapped within the construction footprint

EVC	EVC name	Area (ha) within construction footprint	Biodiversity conservation significance
97	Semi-arid Woodland	0.469	Vulnerable
103	Riverine Chenopod Woodland	1.444	Endangered
104	Lignum Swamp	0.048	Vulnerable
106	Grassy Riverine Forest	4.255	Depleted
810	Floodway Pond Herbland	0.333	Depleted
814	Riverine Swamp Forest	0.089	Depleted
815	Riverine Swampy Woodland	0.139	Vulnerable
818	Shrubby Riverine Woodland	0.098	Least Concern
823	Lignum Swampy Woodland	5.735	Vulnerable

Appendix F in Attachment 7 – Flora and Fauna Assessment shows the location of EVCs mapped within the construction footprint. The majority of the endangered Riverine Chenopod Woodland (EVC103) is mapped along the existing access tracks, where direct impacts are most likely to be limited to lopping of overhanging vegetation to facilitate access of machinery. The mitigation measures outlined in Part 2 (Environmental management) of this referral would assist in avoiding and minimising impacts on mapped native vegetation.

Inundation

Table 7 identifies the EVCs that are modelled to occur within the proposed inundation areas. All EVCs listed below are swampy or riverine vegetation communities that require or are tolerant of inundation and are therefore likely to positively respond to environmental watering that restores a more natural hydrological regime. No obligate dryland communities are modelled to occur within the inundation area that may be adversely impacted by the proposed inundation. The large area of modelled Water Body – Fresh is associated with the channel of Burra Creek, which is likely to comprise Floodway Pond Herbland based on field assessment of creek sections that intersect the construction footprint.

Table 7: EVCs modelled to occur within the inundation areas

EVC	EVC name	Area (ha) within inundation area	Biodiversity conservation significance
103	Riverine Chenopod Woodland	23.168	Endangered
104	Lignum Swamp	13.542	Vulnerable
106	Grassy Riverine Forest	0.099	Depleted
295	Riverine Grassy Woodland	3.533	Vulnerable
808	Lignum Shrubland	26.963	Vulnerable
810	Floodway Pond Herbland	1.817	Depleted
811	Grassy Riverine Forest/Floodway Pond Herbland	0.019	Depleted
818	Shrubby Riverine Woodland	34.608	Least Concern
823	Lignum Swampy Woodland	182.648	Vulnerable
992	Water Body – Fresh	115.969	N/A

Attachment 2 – Environmental Features Maps shows the location of modelled EVCs within the proposed inundation area.

Have potential vegetation offsets been identified as yet?

☒ NYD ☒ Yes If yes, please briefly describe.

A preliminary estimate of offsets has been calculated for the project based on the proposed removal of approximately 12.6 ha of native vegetation, including 105 large trees, and are described in Table 7 of Attachment 7 – Flora and Fauna Assessment.

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 by seeking a conservation exemption from the need to obtain a planning permit under Clause 52.17 of the 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 7 – 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 is provided in Table 8.

Table 8: Summary methods and findings of previous ecological studies

Previous study title	Methods	Key findings
Lumsden et. al. (2007) *Floodplain fauna surveys – Macredie Island and Burra Forest*.	• Review of existing information • Field surveys November-December 2006: - 20 sites Ground dwelling vertebrates - Pitfall trapping using ten buckets in Y-array. - Targeted searches for frogs and reptiles - Baited infrared motion-activated fauna camera traps Bird surveys:	• 148 fauna species recorded: 100 native bird species (2 exotic bird species), 6 native amphibian species, 7 native and 7 exotic terrestrial mammal species, 11 bat species, 15 native reptile species. • Significant and listed species included: - 2 records of EPBC Act listed Regent Parrot - 12 bird and 2 reptile species listed as threatened under FFG Act

	- Each site surveyed once in early morning and late afternoon - Standard 20 minute 2 hectare area search Bat surveys - Anabat detectors for micro-bat calls - Harp-traps Nocturnal spotlight surveys: - Owl call-playback, targeted survey for arboreal mammals and nocturnal birds • Recording of incidental observations.	- 8 bird species and 4 reptile species listed under the DEPI Advisory List of Threatened Vertebrate Fauna in Victoria 2013. • Discussions with local landholders and stakeholders provided records of a number of less commonly encountered species such as the Carpet Python, Platypus, Water Rat, Feathertail Glider and Bush Stone-curlew.
Brown et. al. (2013) *Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria.*	• Review of existing information • Field surveys November-December 2013: - 4 sites Ground dwelling vertebrates - Pitfall trapping using T-array and funnel traps. - Baited infrared motion-activated fauna camera traps Bird surveys: - Each site surveyed once in early morning and late afternoon - Standard 20-minute, 2-hectare area search Bat surveys - Anabat detectors for micro-bat calls Nocturnal spotlight surveys: - Owl call-playback, targeted survey for arboreal mammals and nocturnal birds • Recording of incidental observations	• 186 fauna species recorded: 140 native bird species, 6 native amphibian species, 7 native and 3 exotic terrestrial mammal species, 11 bat species, 19 native reptile species. • Significant and listed species included: - The EPBC Act listed Regent Parrot - 11 bird and 2 reptile species listed as threatened under FFG Act - 8 bird and 4 reptile species listed under the DEPI Advisory List of Threatened Vertebrate Fauna in Victoria 2013
GHD (2013) *Summary Report for the flora census of Burra, Nyah and Vinifera SDL sites*.	• Review of existing information • Field flora survey November 2013 – 8 sites: - 30 m x 30 m quadrats - Position considered distribution, extent and relative uniformity of each EVC - Projected foliage cover recorded for all overstorey and understorey species - Photographs of each quadrat - Representative photographs of each rare and threatened flora	• 5 EVCs sampled, most widespread were: Semi-arid Woodland, Lignum Swampy Woodland Floodway Pond Herbland • 79 flora species recorded: 64 indigenous species, 15 exotic species, 2 rare or threated flora species. • 2 species listed under DELWP Advisory List: *Senecio cunninghamii var. cunninghamii* (Branching Groundsel), *Eremophila divaricata subsp. divaricata* (Spreading Emu-bush).

	- Recording of incidental fauna species • Plant taxonomy: - Flora Information System (DSE, 2012) • Consideration of the Census of Victoria Vascular Plants (Walsh and Stajsic, 2007)	
Australian Ecosystems (2016) *Nyah and Vinifera SDL Project - Flora and Fauna Assessment (includes Burra Creek)*.	• Desktop review • Flora site assessment (November 2015): - Potential footprint traversed - Comprehensive observed flora list recorded - LOTs mapped - Habitat Hectare Assessment - EVCs assigned • Fauna site assessment (November 2015): - 20 min bird census - Nocturnal spotlight surveys (arboreal fauna) • Incidental observations.	• SDL footprint areas: 507 LOTs recorded and eight EVCs: Riverine Swamp Forest (EVC 814); Semi-Arid Woodland (EVC 97); Flood Pondway Herbland (810); Grassy Riverine Forest (106); Shrubby Riverine Woodland (EVC 818); Lignum Swamp (EVC 104); Lignum Swampy Woodland (EVC 823); Riverine Chenopod Woodland (EVC 103). • 9 rare or threatened flora: *Alternanthera sp. 1* (Plains) (Plains Joyweed) (pk), *Haloragis glauca f. glauca* (Bluish Raspwort) (pk), *Tetragonia moorei* (Annual Spinach) (pk), *Picris squarrosa* (Squat Picris) (r), *Senecio cunninghamii var. cunninghamii* (Branching Groundsel) (r), *Dianella sp. aff. longifolia* (Riverina) (Pale Flax-lily) (vu), *Asperula wimmerana* (Wimmera Woodruff) (r), *Eremophila divaricata subsp. divaricata* (Spreading Emu-bush) (r), *Cynodon dactylon var. pulchellus* (Native Couch) (pk) • 77 fauna species recorded: 69 native bird species, 3 native and 1 exotic terrestrial mammal species, 3 native reptile species. • No conservation significant fauna species, two bird species which form part of the Victorian Woodland Bird Community.
ARI (2018) SDL *Fish Management Plan - Burra Creek.*	• Review of existing information. • Provide the necessary fish ecology criteria to be incorporated into SDL detailed designs. • Provide the operational requirements that benefit native fish for the SDL site Operating Plans. • Establish prioritised ecological objectives and targets for native fish at the site. • Develop understanding of the context of site operations and to maximise the ecological outcomes on a broader reach scale.	• Current conditions for fish are limited to episodic seasonal opportunities following larger River Murray flooding events. • Managed flooding of the forest carries some opportunities for native fish restoration at a local wetland scale

The review of previous ecological studies and updated database searches was used to inform the additional targeted threatened flora and fauna surveys undertaken by R8 in October, November and December 2019 for which the results are described in Attachment 7 – 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.

Threatened flora

A desktop assessment identified 48 listed threatened flora species that have been recorded or are modelled to potentially occur within 10 km of the project area, including nine FFG Act listed species, five EPBC Act listed species, and 46 species listed as rare or threatened on the DELWP Advisory List.

Each of these species was 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.

Of these listed flora species, two FFG Act listed species and no EPBC Act listed species have been recorded or assessed as having a possible or higher likelihood of occurrence in the project area (see Table 9).

Threatened fauna

A desktop assessment identified 27 listed threatened fauna species that have been recorded or are modelled to potentially occur within 10 km of the project area, including 25 FFG Act listed species, 17 EPBC Act listed species, and 27 species listed as rare or threatened on the DELWP Advisory Lists.

Each of these species was 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.

Of these listed fauna species, ten FFG Act listed species, including four EPBC Act listed species have been recorded or assessed as having a possible or higher likelihood of occurrence in the project area (see Table 10).

Migratory species

Ten EPBC Act listed migratory species were identified through a desktop assessment as previously recorded or predicted to occur within 10 km of the project area. Most of these species were assessed as either highly unlikely to occur due to the lack of recent records and/or a lack of suitable habitat present, or are expected to only very rarely use airspace over these footprints. One listed migratory species (Fork-tailed Swift (*Apus pacificus*)) was assessed as having a possible occurrence in the project area.

Threatened ecological communities

The PMST identified three EPBC Act listed threatened ecological communities with potential to occur within 10 km of the project area.

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions - Endangered

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia - Endangered
- Weeping Myall Woodlands – Endangered.

None of these communities is consistent with vegetation mapped or modelled within either the construction footprint or inundation area.

The EVCs mapped or modelled to occur within the project area also do not correspond with the descriptions of any threatened communities listed under the FFG Act.

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

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. Threatening processes from this list that have the potential to be exacerbated by construction and/or operation of the project include:

Construction

- 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
- Prevention of passage of aquatic biota as a result of the presence of instream structures.

Operation

- Predation of native wildlife by the introduced Cat, *Felis catus*.
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*.
- Soil degradation and reduction of biodiversity through browsing and competition by Feral Goats (*Capra hircus*)
- Alteration to the natural flow regimes of rivers and streams
- Introduction of environmental weeds.

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

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.

Threatened and protected flora

One FFG Act listed species (*Acacia oswaldii* (Umbrella Wattle)) was recorded as present adjacent to the construction footprint (access tracks) and assessed as possibly occurring in the inundation area, and one FFG Act listed species was identified as possibly occurring in the construction footprint and inundation area (*Atriplex rhagodioides* (Silver Saltbush)) but has not been recorded in any previous surveys (see Table 9). Neither of these species was assessed as being likely to be impacted by construction or operation of the project provided the proposed mitigation measures are implemented.

No EPBC Act listed flora species were assessed as possibly occurring in the construction footprint or inundation area, or likely to be impacted by construction or operation of the project.

Table 9: EPBC Act and/or FFG Act listed flora species considered possible or known to occur in the project area

Scientific name	Common name	EPBC Act	FFG Act	DELWP Advisory	Occurrence / Impact
Acacia oswaldii	Umbrella Wattle		L	vu	**Present**. Detected next to access tracks proposed to be used. **Impact – Unlikely.** No removal based on assessed construction footprint. This species is likely to have a positive to neutral response to inundation.
Atriplex rhagodioides	Silver Saltbush		L	vu	**Possible -** Species with potential habitat through the construction footprint. **Impact – Unlikely.** Potential for impact is likely to be low given lack of detection in any previous surveys. This species is likely to have a positive to neutral response to inundation.

Key:
L – Listed under FFG Act
EN / en – Endangered under EPBC Act / DELWP Advisory List
VU / vu – Vulnerable under EPBC Act / DELWP Advisory List
CR / cr – Critically Endangered under EPBC Act / DELWP Advisory List
r – Rare under DELWP Advisory List
nt – Near Threatened under DELWP Advisory List

Fourteen FFG Act protected flora species occur within the construction footprint and are likely to be impacted by the works. All of these are common with the exception of one rare species, Branching Groundsel (*Senecio cunninghamii var. cunninghamii*). Eight flora species considered rare or threatened in Victoria (DELWP Advisory List) have been recorded within or adjacent to the construction footprint:

- *Acacia oswaldii* (Umbrella Wattle) – vulnerable (approx. 2 plants, likely to be avoidable)
- *Asperula wimmerana* (Wimmera Woodruff) – rare (approx. 50 plants, likely to be unavoidable)
- *Atriplex pseudocampanulata* (Mealy Saltbush) – rare (previous (2015) records not in current construction footprints, not found in 2019 surveys)
- *Dianella poracea* (Pale Flax-lily) – rare (approx. 1 plant, likely to be avoidable)

- *Eremophila divaricata subsp. divaricata* (Spreading Emu-bush) – rare (previous (2015) records not in current construction footprints, not found in 2019 surveys)
- *Picris squarrosa* (Squat Picris) – rare (approx. 1 plant, likely to be unavoidable)
- *Senecio cunninghamii var. cunninghamii* (Branching Groundsel) – rare (approx. 5 plants, likely to be unavoidable)
- *Sida intricata* (Twiggy Sida) – vulnerable (approx. 1 plant, likely to be unavoidable).

With the exception of *Sida intricata*, each of these species are relatively common throughout the project area and although some will be removed, this will not result in the loss of the species from the local area or region, of the loss of any genetically important populations. Although less common, the removal of such a small number of *Sida intricata* is also not likely to result in the long-term loss of a significant proportion of the local population or result in the loss of a genetically important population.

Threatened fauna

Ten FFG Act listed species, including four EPBC Act listed species were identified as having a possible or higher likelihood of occurrence in the construction footprint and/or inundation area (see Table 10). Of these, two species listed under both the EPBC Act and FFG Act (*Bidyanus bidyanus* (Silver Perch) and *(Maccullochella peelii* (Murray Cod)) were identified as possibly being impacted by the project, although these impacts are not expected to be significant provided the recommended mitigation measures are implemented. In addition, one FFG Act listed species (*Morelia spilota metcalfei* (Carpet Python)) was identified as possibly being impacted by the project, although these impacts are not expected to be significant provided the recommended mitigation measures are implemented.

Table 10: EPBC Act and/or FFG Act listed fauna species considered possible or known to occur in the project area

Scientific name	Common name	EPBC Act	FFG Act	DELWP Advisory	Occurrence / Impact
Falco subniger	Black Falcon		L	vu	**Occurrence: Possible.** This species may utilise habitats in the construction footprints and inundation areas for foraging. **Impact: Unlikely.** This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Geopelia cuneata	Diamond Dove		L	nt	**Occurrence: Possible.** This species may utilise habitats in the construction footprints and inundation areas for foraging. **Impact: Unlikely.** This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Pomatostomus temporalis	Grey-crowned Babbler		L	en	**Occurrence: Possible.** This species may utilise habitats in the construction footprints and inundation areas for foraging. **Impact: Unlikely.** This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Melanodryas cucullata	Hooded Robin		L	nt	**Occurrence: Possible.** This species may utilise habitats in the construction footprints and inundation areas for foraging.

					Impact: Unlikely. This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Lophochroa leadbeateri	Major Mitchell's Cockatoo		L	vu	**Occurrence: Possible.** Suitable habitat at all construction footprints and across the inundation areas. **Impact: Unlikely.** Impact areas do not include trees suitable for nesting. This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Grantiella picta	Painted Honeyeater	VU	L	vu	**Occurrence: Possible.** Species not recorded previously but may occasionally utilise habitats in construction footprints and inundation areas for foraging. **Impact: Unlikely.** This species is mobile and wide ranging, and suitable surrounding habitat is widespread. Species likely to benefit from improved habitat condition following environmental water.
Polytelis anthopeplus monarchoides	Regent Parrot	VU	L	vu	**Occurrence: Present.** Recent previous records within the project area, with suitable foraging habitat within the construction footprints and inundation areas. Suitable breeding habitat does not occur within the construction footprints or inundation areas. **Construction Impact: Unlikely.** Losses to small area (12.6 ha) of foraging habitat proposed. Species is highly mobile and wide ranging, and suitable surrounding habitat widespread. Important breeding habitat not present within the construction footprints, no species breeding habitat within 30km. **Inundation Impact: Unlikely**. Species is highly mobile and wide ranging, suitable surrounding habitat widespread. Important breeding habitat not present within the inundation area, species likely to benefit from improved habitat condition following environmental water.
Morelia spilota metcalfei	Carpet Python		L	en	**Occurrence: Possible.** Suitable habitat at all sites and across inundation areas. **Construction Impact: Possible.** Localised impacts possible, consideration of finalised footprint required, direct impacts (injury, stress, mortality) through habitat clearing should be mitigated. Suitable habitat surrounding and widespread. **Inundation Impact: Unlikely.** Species likely to benefit from environmental water when present, and indirectly from improved habitat condition following environmental water.
Bidyanus bidyanus	Silver Perch	CR	L	vu	**Occurrence: Possible.** Suitable habitat present within Murray River but suitable habitat unlikely in Burra Creek. No previous records. Silver Perch are a main-channel specialist which is known from the Murray River but unlikely to be present in Burra

					Creek under existing conditions. May use inundated floodplain wetland for short-term foraging. **Construction Impact: Possible.** Localised impacts possible, associated with any in-stream works such as coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprints. A construction specific aquatic fauna management plan (as part of the CEMP) would be developed and implemented to mitigate these impacts for all works around waterways. **Inundation Impact: Unlikely.** It is unlikely that the species is present within Burra Creek under existing conditions and as such negative impacts are unlikely. Floodplain inundation may result in benefit from improved habitat condition following environmental watering.
Maccullochella peelii	Murray Cod	VU	L	vu	**Construction Footprint Occurrence: Possible.** Suitable habitat present within Murray River but suitable habitat unlikely in Burra Creek. No previous records. Suitable habitat present within Murray River, unlikely to inhabit Burra Creek. May use inundated floodplain wetland for short-term foraging. **Construction Impact: Possible.** Localised impacts possible associated with any in-stream works such as coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprints. A construction specific aquatic fauna management plan (as part of the CEMP) would be developed and implemented for all works around waterways. **Inundation Impact: Unlikely.** It is unlikely that the species is present within Burra Creek under existing conditions and as such negative impacts are unlikely. Floodplain inundation may result in benefit from improved habitat condition following environmental watering.

Key:
L – Listed under FFG Act
EN / en – Endangered under EPBC Act / DELWP Advisory List
VU / vu – Vulnerable under EPBC Act / DELWP Advisory List
CR / cr – Critically Endangered under EPBC Act / DELWP Advisory List
r – Rare under DELWP Advisory List
nt – Near Threatened under DELWP Advisory List

Of the threatened fauna species listed above, only one was observed during field assessments by R8 in 2019, this being the EPBC Act and FFG Act listed Regent Parrot (*Polytelis anthopeplus monarchoides*), with six Regent Parrots recorded 2 km north-west of the most northerly construction footprint (Regulator B1). Although this species is known to occur within the project area, based on the species distribution and habitat suitability at the time of the survey, the project area falls outside the distribution of important breeding (nesting and foraging) habitat. According to the National Recovery Plan for Regent Parrots (eastern subspecies) (Baker and Hurley 2011), the most easterly distribution of breeding habitat is mapped as likely to occur (or may occur) adjacent to Windomal, which is ~10 km north of the project area. Additionally, Baker and Hurley (2011) state that important foraging habitat during the breeding season occurs within 20 km of nests sites in Mallee Woodlands (Baker and Hurley 2011). Given the small number of records within 10 km of the project area, and the lack of suitable breeding habitat surveyed during targeted surveys, this species

is considered likely to be an occasional visitor, and likely to utilise habitat within the project area infrequently as non-important foraging habitat.

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 7 – Flora and Fauna Assessment, including an assessment against the EPBC Act significant impact criteria for each of the EPBC Act listed species identified in Table 10, which is contained in Appendix G of Attachment 7 - Flora and Fauna Assessment.

Migratory species

Ten migratory species were identified as having the potential to occur within the project area. Most of these species are either highly unlikely to occur or would very rarely use airspace over these footprints. Although one listed migratory species (Fork-tailed Swift) was identified as having a possible occurrence (fly-over during foraging), 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. An assessment of the EPBC Act significant impact criteria for listed migratory species in relation to potential impacts from the proposed works is provided in Appendix H of Attachment 7 - Flora and Fauna Assessment.

Threatened 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 or operation of the project.

One FFG Act listed fauna community (i.e. VTWBC) is considered to have potential to occur within the construction footprints and inundation area. Eight bird species characteristic to the VTWBC have been identified as potentially occurring in the project area in the Flora and Fauna Assessment (R8, 2020). However, impacts to this community are likely to be negligible as Burra Creek is comprised largely of intact vegetation and the proposed construction of environmental watering infrastructure is unlikely to impact on habitat connectivity or remove important habitat for the VTWBC.

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 project 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 access tracks and other areas of previous disturbance, and represent inferior areas of habitat to those which surround them. From a landscape perspective, the proposed construction footprints represent a small area (approx. 12.6 ha) within a much larger intact area of high quality native vegetation that is encompassed by the River Murray Reserve in the vicinity of Burra Creek (approx. 1,000 ha).

The following measures are proposed to be implemented during the further design, construction and operation of the project:

Design

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

- Avoid where possible mapped rare and threatened flora species
- Micro- siting infrastructure within construction footprints to avoid impacting hollow-bearing trees to reduce impacts to hollow-dependant fauna (such as species within the FFG Act listed fauna community, VTWBC)

- Refinement of the design and construction methods to further minimise the construction footprints (including access track and laydown areas).

In addition, proposed regulating structures have been designed to satisfy the fish passage requirements described in Attachment 4 - Fish Management Plan.

Construction

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

- Follow the avoid, minimise protocol in determining the construction area 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 are to be delineated from those areas to be removed as 'no-go zones', to avoid encroachment into areas of retained vegetation.
- Locations for stockpiles are to be within existing cleared or areas of non-native vegetation where practicable.
- Manage potential impacts to tree root zones during construction.
- For the protection of threatened flora:
  - Species listed under the FFG Act and EPBC Act not permitted to be removed, are to be fenced off with temporary one metre high orange barrier mesh medium-heavy weight prior to construction commencing
  - Fencing is to be checked on a weekly basis and the population monitored on a monthly basis
  - All staff onsite are to 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 is to be notified. The number and location of individuals is to be recorded and DELWP is to be advised.
- Pre-clearance surveys are to be undertaken 24 hrs prior to removal of any patch of native vegetation or hollow-bearing tree.
- Avoid hollow bearing tree removal during the breeding season of hollow-dependant species where possible. Where this is not practical, pre-clearance surveys are to be undertaken by a suitably qualified ecologist during the breeding season.
- 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. The CEMP would include an aquatic fauna management plan containing specific management measures to minimise risks to aquatic fauna, including listed threatened species, during in-stream works such as coffer dam construction, dewatering works, and any works near waterways. This would include a protocol for capture, handling and release of aquatic fauna during any dewatering activities.
- 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).
- On completion of works, temporary construction areas are to be rehabilitated to the satisfaction of Parks Victoria or the relevant landowner/manager. Site rehabilitation measures may include:
  - Re-spreading of stored topsoil 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 following construction, 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.

- All vehicles and plant must only operate on existing tracks and in areas marked as parking areas or construction zones.

Operation phase

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

- Implement pest management and control within the inundation area (and ideally surrounding areas), however this may require Parks Victoria to expand current pest control programs within the reserve to target these areas during inundation events
- Timing water manipulations to drown seedlings, minimise growth, germination and seed set of pest species. Time water manipulations to promote native species
- Regulating structures are to be operated in accordance with the fish passage requirements described in Attachment 4 - Fish Management Plan**.**

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 volume of water required to fill the Burra North managed inundation area to a design water level of 58.7 mAHD was estimated to be 1,550 ML or approximately 2,350 ML if a nominal allowance of 0.3 m is allowed for infiltration and evaporation losses (Jacobs, 2018). The volume of water required to fill the Burra South managed inundation area to the top of bank level of Burra Creek is estimated to be 1,276 ML (Mallee CMA, 2014).

This water would be sourced from existing environmental water entitlements[5] via the VEWH. Water use would vary from year to year depending on natural inflows and previous flooding history.

Inflows and outflows to Burra Creek and associated floodplain 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 inflows and outflows, and flow meters on temporary pumps. 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?

[5] Includes environmental water entitlements already held by the Murray Darling Basin Authority, The Living Murray Program, the Commonwealth Environmental Water Holder and the Victorian Environmental Water Holder.

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

Although construction works are proposed to be undertaken during dry or low flow / rainfall periods where practicable, potential exists for dewatering and runoff from construction areas to enter waterways including Burra Creek and the Murray River. Construction works would be managed in accordance with a CEMP, including controls for managing erosion and sediment, storage of fuels and chemicals, dewatering and works in waterways, where required.

On completion of a managed inundation event, regulators would be opened and managed floodwaters (not including infiltration and evaporation losses) would drain back to the Murray River, via Burra Creek and the proposed Regulator B1 and associated drop structure. Allowing for floodplain losses, it is estimated that up to 50% of flows entering the Burra Creek floodplain could potentially return to the Murray River (VMFRP, 2020b).

The Draft Operating Plan (VMFRP, 2020b) indicates that drawdown of the floodplain is expected to occur over a period of 7 to 10 days (maximum 20 days), with drawdown rates managed to minimise erosion and maintain velocities for fish passage through the regulators.

Potential effects on water environments, including those associated with wastewater or runoff, are described in the responses 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.

Waterways likely to be affected by the project include Burra Creek and the Murray River. Wetlands likely to be affected by the project include three wetlands on the Victorian Wetland Inventory within or adjacent to the project area. No wetlands of international or national importance as listed under the Ramsar Convention or A Directory of Important Wetlands in Australia are located within or adjacent to the project area and are therefore not likely to be affected. Attachment 2 – Environmental Features Map shows the location of mapped waterways and wetlands in the vicinity of the project area.

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, Burra Creek and surrounding floodplain communities and nearby significant 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 7 – Flora and Fauna 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 or adjacent to any wetlands listed under the Ramsar Convention or A Directory of Important Wetlands in Australia.

The nearest Ramsar-listed wetlands are the Hattah-Kulkyne Lakes (approx. 80 km north west and 150 km downstream) and the Kerang Wetlands (approx. 70 km south, upstream). The nearest wetlands listed on A Directory of Important Wetlands in Australia are Major Mitchell Lagoon (approx. 3.3 km north), Heywood's

Lake (approx. 13 km north west), Belsar Island (approx. 38 km north west) and Beveridge Island (approx. 36 km south east).

An additional three Ramsar wetlands have been identified 250-500 km downstream of the project area (Banrock Station Wetland Complex, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland).

The project is not likely to adversely impact on the ecological character of any of these wetlands provided the mitigation measures described in Attachment 10 – Draft Environmental Management Framework are implemented, particularly those relating to potential risks to water quality (including saline discharge), spread of pest species (including carp), and erosion and sedimentation.

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 Burra Creek and associated floodplains. It is intended that this would be achieved in part, by installing regulating structures to regulate the flow of water to and from the Murray River (Regulator B1 and Regulator B4), and temporary pump sites to enable pumping from the Murray River. On completion of a managed inundation event, the project would release managed floodwaters back to the Murray River via Burra Creek, except for water losses due to infiltration and evaporative processes during retention on the floodplain.

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 extracted 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 utilise natural flood inflows and to re-use water released from other upstream environmental watering works where appropriate.

Could regional groundwater resources be affected by the project?

☐ NYD ☐ No ☒ Yes If yes, describe in what way.

A desktop groundwater assessment has been undertaken for the project (Attachment 8 – Groundwater Assessment) and describes the aquifer sequence in the project area as follows:

- The alluvial aquitard (Coonambidgal Formation): Floodplain fine grained silts and clays that are part of the contemporary floodplain and the recent geological past, relatively thin across the project area
- Channel Sands aquifer: An Upper Tertiary, fine to coarse grained sand aquifer in direct connection with the Murray River
- Blanchetown Clay aquitard: A clay sequence of varying thickness that acts to reduce vertical interaction between the Channel Sands and the deeper regional aquifer. The aquitard pinches out close to the river
- Loxton Parilla Sand aquifer: A thick sequence of Tertiary age marine sediments that underlie the river and floodplain sediments. This is the regional aquifer and is typically saline or brackish in water quality.

Regional groundwater flow is generally to the north west, although in some cases, there would be localised flow toward the Murray River. Local flow cells are possible that may change the local flow direction from the regional flow pattern.

Groundwater salinity in the watertable aquifer across the project area is interpreted to range widely, from less than around 500 mg/L close to the river to up to 35,000 mg/L inland. Fresher water is adjacent to the river with salinity increasing moving inland. Soil salinity has been mapped over the site and for the riverine

corridor in the area by airborne electromagnetic surveys (AEM) by Cullen et al. (2008) and indicates that soil salinity in the project area has been mapped as low to moderate (below 200 t/ha/m).

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

- Temporary and limited drawdown of groundwater levels during construction, particularly for structures excavated into the subsurface where dewatering of excavations may be required
- Increased groundwater level as a result of flood recharge across the inundation area
- Reduced groundwater salinity immediately following flood events due to flood recharge by lower salinity surface water
- 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
- Potential for waterlogging of vegetation where the level of shallow groundwater is held in the vicinity of vegetation for extended periods of time during and immediately after flooding.

Construction of the project works may require groundwater dewatering and 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 to provide watering for any ecosystems that may experience and be impacted by lowered groundwater levels.

Operation of the proposed works would result in elevated groundwater levels, wetting of soils and potentially mobilised salt from the unsaturated soil store. This may result in displacement of salt to the Murray River and increased evapotranspiration of water from the floodplain, potentially concentrating salts in the soil. Given the low to moderate salt store in the project area and the generally fresh to moderately saline groundwater, these are regarded as being low risk. A classification of the overall risk of salt mobilisation being low is considered reasonable, because of the levels of conservatism of parameters used in the analysis, which would be expected to over-estimate the results, and the relatively low salt store in the soil profile across the project area (Cullen et al. 2008). Monitoring of flooding patterns and adaptive management of flooding to minimise waterlogging would further reduce this risk.

To assist in the monitoring of salinity impacts, VMFRP, with assessment and recommendations from SKM (2014) and Jacobs (2019) has proposed new monitoring bores within the proposed inundation area (VMFRP, 2020b). These monitoring bores would be integrated into the existing Mallee CMA monitoring network and monitoring program, with monitoring and ongoing assessment of risks to occur consistent with the Basin Salinity Management Strategy (MDBA, 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 within 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. In addition to these segments, surface waters within the River Murray Reserve and other natural features reserves are included in the Aquatic Reserves 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 (not in Aquatic Reserves)
- 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, and not in Aquatic Reserves)
- Water-based recreation (primary, secondary contact and aesthetic enjoyment)
- Traditional Owner cultural values
- Cultural and spiritual values.

The SEPP(Waters) identifies beneficial uses of groundwater based on Total Dissolved Solids 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 (desirable)
- 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.

Because of the generally saline nature of the regional aquifer, the proximity to fresh water from the Murray River and limited access to floodplain aquifers by private landowners, there are no licenced groundwater users in vicinity of the project area. There are also no registered stock and domestic bores in the vicinity. The groundwater bores in the area are groundwater observation bores. The primary use of groundwater at the project area is environmental use associated with floodplain vegetation and ecosystems.

The National Groundwater Dependent Ecosystems (GDE) Atlas (the Atlas) identifies terrestrial vegetation with a high potential for groundwater interaction within and surrounding the inundation area, including lignum swampy woodland, riverine chenopod woodland and grassy/shrubby riverine forest. A wetland in the southern portion of the reserve near Obree Road is identified as a potential aquatic GDE on the Atlas. The wetland is also identified in the Victorian Wetland Inventory as having moderate potential for groundwater dependence (DELWP, 2020). The Murray River is mapped as a low potential aquatic GDE (BoM, 2020).

Potential effects on beneficial uses of groundwater, including GDEs, are expected to be either beneficial or negligible (see Table 1 of Attachment 8 – Groundwater Assessment).

Potential effects on surface water environments are discussed in the following sections.

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

☐ NYD ☐ No ☒ Yes If yes, describe in what way.

Potential effects on surface water environments associated with the waterways and wetlands described in this section are most likely to be associated with changes in stream flows (e.g. reinstatement of a more natural hydrological regime in Burra Creek) and water quality. This includes a potential for saline discharge, noting that salt inflow to the Murray River along the Mallee reaches (that is, downstream of Swan Hill) is a major source of salt load in the river that may be exacerbated by increased floodplain watering if not managed appropriately. However, given the low salt store in the project area and the generally fresh to moderately saline groundwater, these issues are regarded as being relatively low risk for this project as further described in relation to groundwater effects in this referral.

Lloyd Environmental (2014) completed a risk assessment during project development that identified and assessed potential risks to surface water environments. 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 TLM Program, informed this process and the development of the Draft Burra Operating Plan and Draft Burra Environmental Watering Management Plan (VMFRP, 2020a, 2020b). The Operating Plan and Environmental Watering Plan are the key mechanisms for managing these risks and would include a requirement for water quality monitoring before, during and after watering events to inform adaptive management strategies and real-time operational decision-making.

The risk assessment by Lloyd Environmental (2014) identified the following potential threats to aquatic ecosystems during operation of the project:

- Water manipulations may lead to suspension of sediments and / or organic matter causing elevated nutrients, high turbidity and / or low dissolved oxygen (DO) levels, which may reduce food sources and result in toxic algal blooms impacting on wetland community health, threatened species, fish and other aquatic fauna communities, and waterbird communities.
- Inability to discharge water of poor water quality during a managed flow event, due to downstream impacts (e.g. increases in instream salinity), could result in impacts on floodplain vegetation (due to extended inundation) or formation of blackwater / algal blooms.
- Low DO concentrations created through processes such as blackwater events, algal and cyanobacterial blooms, high organic matter loadings and stratification, can impact aquatic fauna and the health of wetland communities.
- Development of saline mounds under wetlands and displacement of saline groundwater to surface waters, including the Murray River. Shallow saline groundwater can also impact on the health of floodplain vegetation and wetland communities.
- Increased carp populations through more frequent flooding that creates enhanced carp recruitment conditions, potentially impacting the health and diversity of wetland vegetation, affecting native fish and other aquatic fauna.
- Stranding and isolation of fish on floodplains can occur through sudden changes in water levels and/or new barriers preventing native fish from escaping drying areas during flood recessions, which may result in the death of a portion of the native fish population.
- Installation of regulators in waterways and wetlands creates barriers to the movement of fish and other aquatic fauna, which can reduce access to feeding and breeding habitat, and limit migration or spawning opportunities.

In addition to these operational risks, construction of the project 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 causing a pollution event and runoff
- Discharging/dewatering poor quality water into receiving water waters (high turbidity or salinity)
- Spills, leaks, poor handling of fuels, oils and other chemicals causing soil/water contamination
- Installation of temporary coffer dams in-stream during construction may interfere with through flows and fish passage.

Planning and design of the project continues to address these identified risks, including through design of regulating structures to satisfy fish passage requirements including those described in Attachment 4 - Fish Management Plan to mitigate the potential effects of creating barriers to fish movement. Other measures to reduce the potential impacts identified above are outlined in the 'mitigation' section below and also Part 2, Section 18 (Environmental management).

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

☒ 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 as defined through the specific ecological objectives and targets for the project set out in Attachment 11 – Environmental Watering Management Plan. 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
- Minimise the total volume and rate of groundwater extracted for construction purposes.

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

- Schedule watering events to make use of dilution flows where possible and optimise timing of releases. Ensure dilution of low DO water by managing outflow rates and river flows: delay outflows if river flows are too low; dispose of hypoxic water by pumping to higher wetlands where possible; agitate water using infrastructure to increase aeration
- 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 ground and surface water salinity before, during and after watering events to inform management and ensure sufficient volumes are available for mitigation such as:
  - Diluting saline groundwater discharge with sufficient river flows
  - Diluting saline water on the floodplain by delivering more fresh water to these areas
  - 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 manipulations to drown seedlings, minimise growth, germination and seed set. Time water manipulations to promote native species
- Controlling current populations and eradicate/control new infestations via existing management strategies (e.g. 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 including those described in Attachment 4 - Fish Management Plan
- 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.

Parts of the project area, mostly those areas along Burra Creek and adjacent to the Murray River, are located within an Environmental Significance Overlay (Schedule 1 – Waterway, Wetlands and Lakes Environs) (ESO1) (see Appendix B of Attachment 6 – Land Use Planning Assessment).

The ESO1 affects public and private land in non-urban areas. The ESO1 recognises the *importance of the Murray River and its environs, being of local, regional, state, national and even 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 in the ESO1, which identifies environs of local, regional, state, national and potentially even international significance.

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

  ☐ NYD ☒ No ☐ Yes If yes, please specify.

The project is located within and adjoining land reserved under the *Crown Land (Reserves) Act 1978* as natural features reserve, including parts of the River Murray Reserve.

The River Murray Reserve at Burra North and the natural features reserve at Burra South are part of the proposed Murray River Park recommended by the Victorian Environmental Assessment Council (2008) to consolidate various areas of existing public land into a single park of more than 35,000 ha extending along the Murray River from Wodonga to Mildura. It was recommended that the proposed Murray River Park would be declared as national park under the *National Parks Act 1975*, however this has not yet occurred.

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

  ☐ NYD ☐ No ☒ Yes If yes, please specify.

Public land within the project area is managed by Parks Victoria in accordance with the River Red Gum Parks Management Plan, July 2018 (Parks Victoria, 2018), which identifies almost all of the area of investigation at Burra North, as being located in the Burra-Piambie Visitor Experience Area (VEA). The Burra-Piambie VEA is a 30 km stretch of the Murray River east of Piambie that encompasses the River Murray Reserve, and part of the proposed Murray River Park, including Major Mitchell Lagoon Historic Area. The VEA offers secluded camping along the banks of the Murray River and associated nature-based activities, such as fishing, swimming, canoeing, kayaking, bushwalking, bird watching and hunting.

The proposed drop structure is located in the Gundagai Bend Camping Area (Kenley), which stretches north from the proposed drop structure along the Murray River frontage. Most of the containment banks and proposed works at the existing private pump site (Spillway 4) are located in the Burra Camping Area, which stretches along the Murray River frontage from the existing private pump site north to about Spillway 2. Both camping areas permit dispersed camping and are described as providing only very basic levels of service

(Parks Victoria, 2018). The access track to proposed Regulator B4 passes via the Tooleybuc Bridge Day Visitor Area (Parks Victoria, 2018).

The Murray River runs along the eastern boundary of the project area and is used for a range of water-based recreational purposes.

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 12.6 ha of native vegetation as described in Section 12 (Native vegetation, flora and fauna) and Attachment 7 – Flora and Fauna Assessment, localised raising of existing access tracks (approx. 2.5 km length) to create regulating structures, and contribute to retention of floodwaters during managed inundation events.

Each of the proposed regulators (Regulators B1, B2 and B4) are located on the alignment of existing access track embankments built across Burra Creek. The existing embankment at the Regulator B1 site is 1.1 m higher than the creek bed (see Figure 12). The existing embankment at the Regulator B2 site has a crest level equivalent to the proposed design water level and contains a 1500 mm diameter pipe culvert. A private irrigation diversion channel (Piambie Channel) runs parallel to the existing embankment and passes under the creek via an inverted siphon. The existing embankment at the Regulator B4 site contains a 580 mm diameter pipe culvert and has a crest level equivalent to the crest level of the proposed regulator embankment (see Figure 13).

Being located along publicly accessible tracks, the proposed regulating structures would be visible by recreational visitors and private landowners accessing existing irrigation diversion channels and pumping infrastructure. Proposed Regulator B4 may also be visible from the Murray River. However, it is expected that visibility of these structures would be partly screened by existing retained vegetation with views generally confined to areas in proximity to the structures. Furthermore, the proposed regulating structures are located at sites containing established embankments and water management infrastructure.

The main containment bank is located along an existing access track adjacent to the Murray River (Obree Road / River Track) to minimise vegetation removal and to supplement the natural river levee as a means of retaining managed floodwaters in the Burra North inundation area. The containment bank generally requires raising of the existing access track by less than about 0.5 m with a maximum height of less than 1.0 m (except immediately adjacent to the regulator).

The proposed drop structure would be constructed at the confluence of Burra Creek and the Murray River (see Figure 14). The proposed temporary pump hardstand and Spillway 4 works are located adjacent to an existing private pump station on the Murray River that discharges into an existing irrigation diversion channel connecting to Burra Creek.

Locations along the Murray River adjacent to the existing access track at Burra North are publicly available for dispersed camping and other recreational activities (e.g. fishing). The proposed containment bank, drop structure, and proposed works associated with temporary pumping near Spillway 4, would be visible from the main river track and associated camping areas, and from the Murray River. With the exception of the drop structure, these works are located at sites containing established embankments and water management infrastructure, including existing pump infrastructure. The proposed drop structure (gabion cut off beam/weir and rock mattress) would mostly be exposed when river levels are low and is therefore not expected to be visually intrusive in this environment.

Each of the five block banks to be removed / modified are located within Burra Creek and comprise small earthen banks (see Figure 16 and Figure 17) that are accessible only via relatively minor access tracks. The removal and modification of these blockages is designed to improve flow connectivity along the Burra Creek anabranch and therefore aims to restore natural ecosystem functioning and landscapes.

The removal of native vegetation for the project would occur in discrete areas totalling approximately 12.6 ha in the context of a largely intact expanse of native vegetation occurring within the approximately 1,000 ha of River Murray Reserve in the vicinity of Burra Creek. The areas of proposed vegetation removal are also minor when compared to the 403 ha of native vegetation within the proposed inundation areas that are expected to benefit from the project.

Figure 12: Proposed location of Regulator B1 along existing access track across Burra Creek

Figure 13: Proposed location of Regulator B4 along existing access track embankment across Burra Creek

Figure 14: Downstream outlet of Burra Creek to Murray River (proposed drop structure location)

Figure 15: Existing private pump station adjacent to proposed temporary pump hardstand and Spillway 4

Figure 16: Existing block Bank 2 to be removed by the project

Figure 17: Existing pump diversion block Bank 5 to be modified by the project

Overall, the project is expected to have a positive effect on the landscape values of surrounding riverine and floodplain environments. By aiming to restore a more natural inundation regime to approximately 403 ha of the Burra Creek anabranch and floodplain vegetation communities and habitats, the project is considered to be consistent with the environmental objectives of ESO1 and the management strategies of the River Red Gum Parks Management Plan, which recognise the importance of hydrological regimes in protecting the scenic landscapes that maintain the recreational and tourism values of these parks and reserves. Parks Victoria is part of the VMFRP partnership and is responsible for management of the River Murray Reserve and proposed Murray River Park at Burra Creek.

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, specifically the River Murray Reserve and proposed Murray River Park. 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. On balance, in the context of the 403 ha of anabranch and floodplain vegetation communities that are 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.

Further, it is recognised that the project seeks to restore a more natural inundation regime consistent with the management strategies outlined in the River Red Gum Parks Management Plan, which recognise that ensuring appropriate hydrological regimes is critical to protecting the scenic landscapes that maintain the recreational and tourism values of these parks and reserves.

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 Parks Victoria infrastructure design guidelines.

Site reinstatement

- 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 (e.g. creek bed excavations). The following methods are proposed to 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 reserve under direction from Parks Victoria / the land manager.
- Vegetation (through natural regeneration) should be established as soon as possible after soil reinstatement to prevent risks of erosion

- Topsoil should not be compacted when reinstated. All topsoil should be used in site reinstatement.

Operation

During the operational phase, inundation events would be managed in accordance with operational guidelines 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.

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;
- 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 Jacobs (2016) and outlined below. The results of these investigations have informed the detailed design of the project.

The natural soil profile across the Burra Creek work sites generally comprises topsoil to about 0.35 m deep, overlying stiff to hard, medium to high plasticity clay soils (silty/ sandy clays), with layers of dense clayey sand in some areas. Natural clay soils at the site exhibit dispersive characteristics (Emerson Class 2 to 5), which may need to be managed to avoid erosion piping under regulators and containment banks. Existing access track embankments consist of variable and mostly unconsolidated fill material, which would be removed as part of construction.

Jacobs (2016) has summarised ground conditions at the proposed project infrastructure and determined that:

- Regulator B1 – the soil profile at this site comprises 0.3 m of very stiff silty clay (fill), which would be removed, over stiff to very stiff, intermediate to high plasticity silty clay to sandy clay, which would provide the regulator foundation material. Sheet piles were recommended to provide seepage cut-off and minimise the risk of erosion piping in the layer of clayey sand to sand with clay that underlies the foundation layer.

- Drop structure - the soil profile at this site is approximately 4.5 m deep and generally consists of low to intermediate plasticity stiff sandy clay / silty clay, overlying variable layers of soft to firm silty clay and loose wet sand encountered below the water table at 5.6 m depth (RL 50.4). A laboratory test taken on a sample at 1.0-1.45 m depth had an Emerson Class 5, which indicates less erodible characteristics.

- Regulator B2 – the soil profile at this site comprises uncontrolled embankment fill (silty sandy clay) to at least 2.8 m, overlying a natural profile of very stiff, high plasticity silty clay.

- Regulator B4 – the soil profile at this site comprises very stiff to hard, medium plasticity silty clay overlain by 0.3 m of uncontrolled fill (clayey silt). An upper profile of potentially sandy material (fill/natural) to an approximate depth of 1.5m is also present at some locations.

- Containment bank – the main containment bank would be founded on natural clay soils (stiff to very stiff, medium to high plasticity silty/sandy clay). Some fill material, typically road base or embankment fill up to 0.3 m deep and topsoil material (silty sand) up to 0.35 m deep, was encountered at several locations.

Acid sulphate soils

No site-specific acid sulphate soil (ASS) investigations have been undertaken for the project at this stage. A review of CSIRO's Australian Soil Resource Information System (ASRIS) mapping identified that the project is located within an area of 'extremely low probability of occurrence' with a level 4 confidence (provisional classification, inferred from surrogate data with no ground verification) (CSIRO, 2020).

Re-wetting of dried soils (lowering then raising of water tables) or excavation works / soil disturbance within areas of potential ASS could result in the formation of actual ASS. Prior to commencement of construction, the contractor would be required to undertake an ASS investigation and if potential ASS are identified and disturbance cannot be avoided, an ASS management plan would 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 are contained in Jacobs (2016) and were considered in the detailed design of the project. Additional geotechnical investigations are proposed by VMFRP and would further inform detailed design.

Geotechnical hazards (and mitigation measures) 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, cut-off drains
- Settlement of structures – mitigated by appropriate foundation design, removal of inferior foundation material.

In addition, prior to commencing works the contractor would 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 local roads and existing tracks from the Murray Valley Highway
- Delivery and removal of approximately 10-15 pieces 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 Swan Hill or Tooleybuc to the south.

During construction, public access along Obree Road in the River Murray Reserve would be closed between at least Regulator B1 and Spillway 4. River Track (connecting Murray Valley Highway to Obree Road) would also be closed for public access at Regulator B2 while this structure was being constructed (approximately two months) but could then be re-opened. Alternative access is available to private pumps into the Piambie Channel and at Spillway 4 via a track crossing Burra Creek at Bank 6. Access across Burra Creek at proposed Regulator B4 would also be closed during construction (approximately two weeks). This closure would temporarily prevent truck access to a private property on the northern side, however alternative access from the Murray Valley Highway to this private property would remain available for light vehicles during construction. 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).

Prior to commencement of a temporary pumping event at Regulator B4 or Spillway 4, trucks, including a fuel truck, would be required to access the site to deliver the temporary pumps and bunded fuel storage. During a managed inundation event, access to the Spillway 4 site by fuel trucks and other large vehicles would be restricted.

During managed inundation events, sections of Obree Road may not be accessible due to water restricting access or to manage public safety risks, which may limit access to dispersed camping sites and licensed apiary sites. However, access to private pump sites adjacent to the Murray River at Spillway 4 and the Piambie Channel, would remain accessible. During managed inundation events, access to private pumps along Burra Creek at Bank 5 would also remain accessible.

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 nearest residential dwellings to the project are located on rural properties between the Murray Valley Highway and Burra Creek, rural properties on the NSW side of the Murray River, and within the township of Tooleybuc, NSW at the southern end of the project area. The nearest residential dwellings are located approximately 400 m from the construction footprint of proposed structures (Spillway 4 and Regulator B4) with both of these dwellings being in NSW. However, some dwellings are located in closer proximity to the access tracks particularly the southern access to Burra North and the access track to Regulator B4 where there are a small number of adjacent dwellings (<5 dwellings).

Construction

A small number of dwellings along proposed access roads and tracks may experience some additional noise, dust and traffic during construction, particularly during construction haulage of fill and spoil along the Murray Valley Highway. These effects would be temporary and limited to the construction period.

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 50 m from the construction activities. The most likely areas where significant vibration impacts may occur would be during the construction of sheet piles and compaction of any road base or concrete hardstand areas for the project. These activities would be managed in accordance with a CEMP.

Operation

Temporary pumping would be required for the project approximately as follows:

- Burra North - once every 10 years at a rate of approximately 230 ML/day over about 7 days per pumping event
- Burra South – up to 9 in 10 years at a rate of approximately 20 ML/day over about 2-3 months per pumping event.

The temporary pumps would be located adjacent to Spillway 4 (Burra North) and adjacent to Regulator B4 (Burra South). Preliminary noise modelling was undertaken using Computer Aided Noise Abatement (CadnaA) Version 2019-MR2 noise modelling software to predict the effects of operational related noise from the temporary pumping activities. Findings are provided below:

- Predicted noise levels from the proposed pump operation 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 35 dB(A) being noted at two locations to the east in NSW.

Due to these modelled noise levels, no specific mitigation has been recommended. 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.

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 mostly located within the River Murray Reserve and proposed Murray River Park and at a minimum of approximately 400 m 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 between the Murray Valley Highway and the construction areas.

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 would also continue through the construction phase to manage 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 River Murray Reserve and proposed Murray River Park. Although public access along the main river track (Obree Road) in the River Murray Reserve would be temporarily closed during construction, these impacts would be 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 River Murray Reserve is managed for multiple uses, including conservation, recreation, apiary and indigenous values. Recreational uses include dispersed camping (including camp fires and associated firewood collection), fishing, boating, four wheel driving, horse riding, trail bike riding and walking. Parts of the River Murray Reserve and sections of Burra Creek that would be subject to managed inundation contain existing private pump sites and other irrigation infrastructure, and associated access tracks. Parts of the project area are located on land zoned for farming purposes (inundation area and one construction laydown area), with a small section of Burra Creek inundation area located within the Murray Valley Highway road corridor.

No land use activities are expected to be permanently displaced by the project, except for possibly one licensed apiary site located within the construction footprint in the River Murray Reserve, although consideration may also need to be given to relocation of four licensed apiary sites within the managed inundation area.

The proposed removal or modification of existing blockages in Burra Creek as part of the project has been designed in consultation with potentially affected adjoining landowners and/or water licence holders, and would not result in permanent loss of any existing licenced water access points, pump sites or irrigation infrastructure.

No designated camping areas or other recreational facilities are located within the permanent footprint of proposed infrastructure.

Temporary restrictions on access and land use activities within and adjoining the River Murray Reserve and proposed Murray River Park may occur during construction and managed inundation events as described in the 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.

Potential effects on non-residential land use activities are not expected to be significant but may include:

- Temporary loss of land for farming on a small area (i.e. approx. 610 sqm) of private land for establishment of Construction Laydown Area (Regulator B2 SE) during construction
- Possible disruptions to access to private infrastructure (e.g. irrigation pump sites and channels) during construction and managed inundation events, but able to be managed to maintain continual access to this irrigation infrastructure through alternative access arrangements
- Possible disruptions to recreational access to the Murray River and other parts of the River Murray Reserve during construction and managed inundation events
- Possible disruptions to access to water along some sections of Burra Creek during construction of in-stream works (including existing pump sites for water licence holders)
- Possible disruption to up to five licensed apiary sites during construction and managed inundation events
- Inundation of approximately 82.32 ha of private land (over 16 land parcels) zoned for farming purposes (less than 12 ha currently used for farming purposes) and reserved land subject to water licences during managed inundation events causing possible damage or loss of crops, or property improvements, including possible damage to private pump infrastructure within or adjacent to Burra Creek
- Potential for an increase in the frequency and / or duration of flooding within sections of Burra Creek located in the Murray Valley Highway road reserve (Road Zone, Category 1) compared to existing conditions during managed 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.

Any impacts on private land associated with managed inundation would only occur if the necessary flood easements / agreements are obtained with affected landowners, in which case it would be considered that appropriate measures have been agreed with the landowners to mitigate potential impacts to their satisfaction.

Although temporary disruptions to access and activities within the River Murray Reserve 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 visitor 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 Parks Victoria and other interested groups to minimise disruption to recreational 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 recreational facility closures in a timely and readily available manner to interested parties to minimise disruption. The stakeholder and community engagement strategy is to specifically include:

- Continued engagement with potentially affected private landowners regarding planned environmental watering events and outcomes, to obtain flood easements or agreements prior to commencing operations that may involve managed flooding of private land
- Engaging with Regional Roads Victoria to ascertain potential effects of managed inundation (if any) on the Murray Valley Highway
- Engaging with potentially affected private land and asset owners, water frontage licence and water licence holders to determine potential impacts and associated mitigations required during construction and operation of the project
- Engaging with apiary licence holders in conjunction with Parks Victoria as the public land manager, 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 would 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 with operational flexibility to restrict access to parts of the reserves, where deemed necessary to provide rest and recovery from visitation
- Further planning and refinement of operating scenarios is to be undertaken to refine the extent, frequency and duration of managed inundation, particularly in relation to potential effects on private land and the Murray Valley Highway road corridor.

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 and Regional Roads Victoria 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

- Prepare and implement a Noise Management Plan as part of the CEMP that includes appropriate measures to minimise noise 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
    - Consultation with affected residents
    - Scheduling 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
    - Ensuring all construction plant and equipment used on the works is:
        - Fitted with properly maintained noise suppression devices in accordance with the manufacturer's recommendations
        - 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.

Temporary pumping

- Measures to avoid exceedance of the noise criteria are to be employed during pumping (such as adjusting the equipment used) to achieve compliance with the criteria in *Noise from Industry in Regional Victoria (NIRV): Recommended maximum noise levels from commerce, industry and trade premises in regional Victoria* (EPA Victoria, 2011).

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:

- Dadi Dadi Weki Weki Aboriginal Corporation
- Wadi Wadi Land and Water Indigenous Corporation

- Wamba Wamba Barapa Barapa Wadi Wadi
- Tati Tati Land and Water Indigenous Corporation
- Gilbie Aboriginal Corporation
- Wadi Wadi Nation.

There is no Registered Aboriginal Party (RAP) for the project area. A Cultural Heritage Management Plan (CHMP) is 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:

- An initial desktop cultural heritage assessment to determine the requirement for a CHMP for the project and inform preparation of the CHMP was undertaken by R8 in October 2019:
    - Desktop assessment of Aboriginal cultural heritage values in proximity to the project area, including review of three cultural heritage assessments and two CHMPs that have been undertaken in the geographic region of the project area (one of these cultural heritage assessments intersected with the project area) and one cultural heritage assessment undertaken outside the geographic region but in proximity to the project area
    - Review of the Victorian Aboriginal Heritage Register (VAHR) identified 15 Aboriginal Places containing 18 individual components recorded in proximity to the project area. Only one of these registered Aboriginal Places is located within the project area, this being a low density artefact scatter located along an existing access track / road adjacent to the Tooleybuc Bridge visitor area.
    - Determined that a CHMP is required as the project is a high impact activity (utility installation) within an area of cultural heritage sensitivity.
- Victorian Murray Floodplain Restoration Project, Burra Creek Draft Complex Cultural Heritage Management Plan No. 16902 (currently in preparation by R8):
    - A Notice of Intent (NOI) to prepare a CHMP was lodged with Aboriginal Victoria on 24 October 2019
    - There is no Registered Aboriginal Party (RAP) for the activity area
    - The following Aboriginal stakeholder groups would be consulted with prior to submitting the CHMP for approval:
        - TO groups: Dadi Dadi Weki Weki Aboriginal Corporation, Wadi Wadi Land and Water Indigenous Corporation, Wamba Wamba Barapa Barapa Wadi Wadi, Tati Tati Land and Water Indigenous Corporation, Gilbie Aboriginal Corporation, and Wadi Wadi Nation.
        - Aboriginal Victoria (as part of the project's Technical Advisory Group)
    - The CHMP is scheduled to be completed in Q3 2020.
- Victorian Murray Floodplain Restoration Project, Desktop Historical Heritage Assessment – Burra Creek prepared by R8 in April 2020 (see Attachment 9 – Historic Heritage Assessment):

- Desktop assessment to identify known heritage places both in the area of investigation and within the inundation area, and areas with potential for previously unidentified heritage places.
- Assessment based on a review of register searches, previous heritage reports and local heritage studies, site cards and other site information, background historical research including historical maps and plans, and synthesis of background information.
- No places listed on the Swan Hill Heritage Overlay, Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), World Heritage List, National Heritage List or Commonwealth Heritage List identified within or immediately adjacent to the area of investigation and inundation area.
- Identified moderate potential for previously unidentified historical heritage items or archaeological items to be present within the project area, with site types most likely associated with early agricultural or pastoral activities, logging, and water management practices.
- Recommended that a Heritage Impact Assessment should be undertaken for the project which should include field survey to identify further historical archaeological sites and unidentified historical heritage places.

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

An initial desktop assessment undertaken by R8 to inform the draft CHMP indicates that:

- The project area is located within the Murray River floodplain, which would have been a favourable location for Aboriginal occupation and resource procurement given the availability of food and fresh water.
- Remnant mature River Red Gum and Black Box, especially along the Murray River, have potential for cultural scarring with scarred trees being the most commonly recorded Aboriginal Place type within the region and the Aboriginal Place type most likely to be located within the project area.
- Earth mounds are the second most commonly recorded Aboriginal Place type recorded within the region and are also likely to be located within the project area.
- Aboriginal Place type, density and distribution away from the watercourses is likely to be lower than along the watercourses.
- Parts of the project area on Macredie Island at Burra North incorporates land that has been designated State Forest since at least 1929, and there is less likely to be ground disturbance in this part of the project area compared to land west of Burra Creek and at Burra South.
- A search of the VAHR in August 2019 identified 15 Aboriginal Places containing 18 individual components recorded in proximity to the project area. A summary of these registered Aboriginal Places is provided in Table 11. Only one of these registered Aboriginal Places (7527-0367-2) is

located within the project area, this being the Tooleybuc Bridge LDAD 1 comprising a low density artefact scatter located along an existing access track / road adjacent to the Tooleybuc Bridge visitor area.

Table 11: Aboriginal places located within proximity to the project area

Aboriginal Place name	VAHR and component number	Aboriginal Place type
Tooleybuc Bridge LDAD 1	7527-0367-1	Low Density Artefact Distribution
Tooleybuc Bridge LDAD 1	7527-0367-2	Low Density Artefact Distribution
Tooleybuc Bridge Earth Mound 1	7527-0368-1	Earth Feature (Mound)
Murray River ST 1	7527-0369-1	Scarred Tree
Tooleybuc Bridge Scarred Tree 1	7527-0370-1	Scarred Tree
Piambie State Forest	7528-0061-1	Earth Feature (Hearth)
Narrung State Forest 001	7528-0062-1	Scarred Tree
Narrung State Forest 002	7528-0063-1	Scarred Tree
Piambie State Forest 1	7528-0065-1	Artefact Scatter
Piambie State Forest 1	7528-0065-2	Earth Feature (Hearth)
Narrung 1	7528-0075-1	Scarred Tree
Narrung 5	7528-0079	Scarred Tree
Piambie FCA2	7528-0116-1	Scarred Tree
Piambie FCA3	7528-0117-1	Scarred Tree
Kenley Earth Feature – Hearth 1	7528-0120-1	Earth Feature (Hearth)
Piambie FCA1	7528-0121-1	Scarred Tree
Piambie FCA 4	7528-0122-2	Object Collection
Piambie FCA 4	7528-0122-1	Scarred Tree

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 historical heritage assessment has been prepared and is provided in Attachment 9 – Historic 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 project area.

The nearest historical heritage place to the project area at Burra North comprises Menegezzo's 2 (D7528-0002), which is located approximately 60 m to the north of the area of investigation (access track) and is an archaeological site of local significance categorised under 'farming and grazing'. This heritage place is not listed on the Swan Hill Heritage Overlay but is identified as a delisted place on the VHI (D7528-0002).

The nearest historical heritage place to the project area at Burra South is the Tooleybuc Bridge, which is listed on the VHR (H0765), VHI (H7527-0001), Swan Hill Heritage Overlay (HO215) and the Wakool Local Environmental Plan 2013 (LEP I13)[6]. Each of these heritage registers propose a slightly different heritage curtilage for the Tooleybuc Bridge, but the bridge itself is physically located approximately 40 m to the east of the area of investigation (access track).

Examination of the *Rural City of Swan Hill Heritage Study Stage II* in combination with a review of the parish maps and aerial imagery review has not identified any potential historical heritage places or archaeological sites within the project area. However, there is moderate 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.

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 TO groups for approval by Aboriginal Victoria and is likely to 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. This would inform the assessment of impacts to Aboriginal cultural heritage as a result of inundation activities. The 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.

[6] The Wakool Local Environmental Plan 2013 applies to land in the NSW local government area of Murray River Council.

- 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. The development of CHMP 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

The following general mitigation measures are proposed:

Further historical heritage investigations

- Further historical heritage investigations are to be undertaken to identify risks to potentially unrecorded historical heritage features within the project area. A copy of this report (once completed) is to be kept on site and on file with the project records. All contractors and/or project staff are to be made aware of the heritage status of the heritage places in and adjacent to 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. 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 another suitable barrier.

  ADVISE

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

  MANAGE

- Heritage Victoria, the onsite heritage consultant or supervisor would 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 a consent to damage under the *Heritage Act 2017* from Heritage Victoria.

Heritage induction training

- 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.

A copy of this report 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.

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.

No power is required to operate the proposed environmental watering works, with the exception of the temporary diesel pumps to be located near Spillway 4 at Burra North and near Regulator B4 at Burra South, when required.

The frequency and duration of water pumping at each site would depend on actual inundation events and the method to achieve environmental watering targets. A summary of the estimated temporary pumping frequency, duration and water volumes for the project is provided in Table 12.

Table 12: Summary of estimated pumping requirements for Burra North and Burra South

Pumping parameters	Burra North	Burra South
Volume of water to be pumped from the Murray River	1,610 ML	1,276 ML
Frequency of pumping events	1 in 10 years	9 in 10 years
Duration of pumping events	7 days	2 – 3 months
Pumping rate (approximate)	230 ML/day	20 ML/day

Source: VMFRP, 2020b

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
- Worker's 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.

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 Parks Victoria or the land manager, and managed in accordance with the *Environment Protection Act 1970* and other relevant legislation.

Subject to approval from 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 CO_2 equivalent per annum

☒ Between 50,000 and 100,000 tonnes of CO_2 equivalent per annum

☒ Between 100,000 and 200,000 tonnes of CO_2 equivalent per annum

☒ More than 200,000 tonnes of CO_2 equivalent per annum

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

The estimated Scope 1 GHG emissions[7] for each pump event are approximately 140 t CO_2-e for Burra North and 109 t CO_2-e for Burra South. For Burra North, these emissions are expected to occur over a single one week period, in one year over a 10-year period. For Burra South, emissions are expected to occur over a single two to three month period, in nine years over a 10-year period.

The estimated combined GHG emissions for operation of the project at Burra North and Burra South 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 CO_2-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 CO_2-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.

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

[7] 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.

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 10 – 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)
- 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.

Draft Burra Environmental Watering Management Plan (April 2020) (Burra EWMP)

The Draft Burra EWMP:

- Aligns with the Environmental Watering Plan prepared by the MDBA in accordance with Chapter 8 of the Murray-Darling Basin Plan
- Provides the framework for water planning, monitoring and consultation processes
- Identifies environmental objectives and targets, water delivery options and regimes
- Has undergone an external review process with key stakeholders including, MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

A draft Burra EWMP Addendum (VMFRP, 2020a) prepared to integrate the proposed environmental watering works into the current EWMP (Sunraysia Environmental, 2015) is provided in Attachment 11 – Environmental Watering Management Plan.

Draft Burra Operating Plan (April 2020)

The Operating Plan provides the framework for operation of the Burra Creek 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:

- Governance arrangements for managed inundation activities
- Roles and responsibilities of partner agencies
- Decision-making protocols for prior to, during, and after watering events
- Operational risks and mitigation strategies
- Water measurement arrangements
- Communication and consultation requirements
- Links to related documents
- Has undergone an external review process with key stakeholders including, MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria.

A copy of the draft Burra Operating Plan (VMFRP, 2020b) is provided in Attachment 5 – 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.

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.

For the purpose of this referral, cumulative impacts have primarily been considered at this stage associated with other VMFRP projects due to the similar nature of their activities and potential impacts. The potential for cumulative effects is generally associated with:

- Salinity impacts associated with saline water discharge to the Murray River and compliance with the Basin Salinity Management Strategy targets for Morgan.
- 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, including consultation with Swan Hill Rural City Council around other projects proposed in the vicinity, would be carried out as design development and environmental investigations are advanced at other VMFRP sites.

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:

Arthur Rylah Institute (ARI) (Jenkin, A., Stuart, I. and Harrow, S.) (2018). *SDL Fish Management Plan: Burra Creek, November 2018*. Report prepared for Mallee Catchment Management Authority.

Arthur Rylah Institute. (2020). *Preliminary Draft VMFRP Ecological Monitoring Evaluation & Reporting Plan, January 2020*. Report currently being prepared for Mallee Catchment Management Authority.

Australian Ecosystems (2016). *Nyah and Vinifera SDL Project - Flora and Fauna assessment. Detailed Design Stage* (includes Burra SDL Project). Report prepared for Mallee Catchment Management Authority.

Bain, M. (2013). *Burra Creek Water Management Options, May 2013*. Report prepared for Mallee Catchment Management Authority.

Brown, G., Bryant, D. and Horrocks, G. (2013). *Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria*. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2006). *Investigation of Water Management Options for the Murray River – Nyah to Robinvale: Final Report, August 2006*. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2007). *Investigation of Water Management Options for the Murray River – Nyah to Robinvale: Stage II, February 2007*. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2014a). *SDL Rationale and Outcomes*. Ecological Associates report AL040-1D. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2014b). *SDL Floodplain Watering Projects: Monitoring and Evaluation*. Report AL045-1-B. Prepared for Mallee Catchment Management Authority.

Ecological Associates (2015). *SDL Floodplain Watering Projects: Operating Plans*. Ecological Associates report AL048-1-B prepared for Mallee Catchment Management Authority.

GHD (2013). *Summary Report for the flora census of Burra, Nyah and Vinifera SDL sites – Memorandum.* Prepared for Mallee Catchment Management Authority.

Jo Bell Heritage Services Pty Ltd (2013a). *Watering the River Red Gum Sites – Burra Creek, Northwest Victoria, Due Diligence Assessment,* dated 20 September 2013. Prepared for the Mallee Catchment Management Authority.

Jo Bell Heritage Services Pty Ltd (2013b). *Watering the River Red Gum Sites – Burra Creek, Northwest Victoria, Due Diligence Assessment, Historical Archaeology*, dated 20 September 2013. Prepared for the Mallee Catchment Management Authority.

Lloyd Environmental (2014). *SDL Offsets Projects - Risks investigation, assessment and management strategy, dated 14 July 2014*. Report No. LE1409 prepared for Mallee Catchment Management Authority.

Lumsden, L., Brown, G., Cheers, G. and Palmer, C. (2007). *Floodplain fauna surveys – Macredie Island and Burra Forest*. Report prepared for Mallee Catchment Management Authority.

R8 (2020). Victorian Murray Floodplain Restoration Project -Lower Murray Urban and Rural Water Corporation – Flora and Fauna Assessment Report – Burra Creek. Prepared for the Victorian Murray Floodplain Restoration Project. April 2020.

SKM (2014). *Preliminary Salinity Impact Assessment for Mallee Environmental Watering Projects Wallpolla, Hattah Lakes, Belsar-Yungera, Burra Creek, Nyah and Vinifera, Final Report* 3. Report for Mallee Catchment Management Authority.

Sunraysia Environmental (2015). *Burra Environmental Water Management Plan.* Report prepared for Mallee Catchment Management Authority.

Has a program for future environmental studies been developed?

☐ No ☒ Yes If yes, briefly describe.

Further investigations proposed for the project as described in this referral include:

- Preparation of a Cultural Heritage Management Plan in accordance with the *Aboriginal Heritage Act 2006* and *Aboriginal Heritage Regulations 2018*, including desktop and field assessments, consultation with Traditional Owners, and an inundation assessment, informed by hydrological and geomorphological modelling, as described in Section 15.1 of this referral.

- A historical heritage assessment, including desktop and field assessment, to identify risks to potentially unrecorded historical heritage features within the project area, including archaeological sites under the *Heritage Act 2017*, with a heritage impact assessment undertaken where historical heritage features are identified.

- An arborist assessment to assess potentially impacted large trees within the construction footprint and along access tracks, to advise on methods by which they could be retained.

- Targeted vegetation assessment at representative sample sites within the inundation area to supplement the current desktop assessments with field data, to enhance understanding of likely presence/absence of species and to inform the vegetation condition monitoring program (and offset strategy / conservation exemption). This would be combined with a review of hydromodelling and operational scenarios relative to mapped vegetation communities, and adaptively managed through refinements to the Operating Plan and EWMP in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria, to maximise ecological benefits and minimise ecological impacts.

- Prior to commencement of construction, the contractor would be required to undertake an ASS investigation and if potential ASS are identified and disturbance cannot be avoided, an ASS management plan would be developed to minimise potential effects on surrounding soils, vegetation and water environments.

In addition to these investigations, hydrological changes in the Murray River upstream and downstream of the project area associated with delivery of environmental water to the project and return flows would be assessed through MDBA modelling once the package of proposed SDL measures is confirmed, and adaptively managed through refinement of Operating Plans and EWMPs as well as through the existing environmental water accounting frameworks under the Basin Plan.

The effectiveness of the proposed supply measure and its operation would primarily be monitored and reported on through the Mallee 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 The Living Murray (TLM) program, which includes condition and intervention monitoring across several sites in the Mallee region. The Mallee CMA has been implementing and coordinating the local, annual TLM Monitoring, Evaluation and Reporting Framework process since 2006.

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;

- 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.

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 monitoring and evaluation plan was previously developed for the project by Ecological Associates (2014b). 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 Monitoring, Evaluation and Reporting Framework is currently being funded by the project and is due to be completed by June 2020. This framework would aim to establish a social, heritage and environmental benchmark and monitoring programme to demonstrate the ongoing benefits of the project.

Initial monitoring would provide a baseline of the existing status of the ecological objectives and outcome monitoring would measure progress towards these objectives and their targets. This information would inform the ongoing operations at the site. Over time, the results of the outcome monitoring would test assumptions and assist with refining conceptual models and ecological objectives. Monitoring data would 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 Monitoring, Evaluation and Reporting Framework approach for this project would 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 would 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 would 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.

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 Mallee CMA worked with key stakeholders and interested community groups to develop the concept for the Burra Creek Floodplain Restoration Project over a period from 2012 to current. Consultation activities would continue throughout the duration of the project.

Communication and engagement activities conducted have included:

- More than 200 face-to-face briefing sessions, meetings, presentations, on-site visits and consultations, engaging more than 500 people, which is reflective of the wide range of project stakeholders.

- Fact sheets, media releases, electronic communication (website, emails, newsletters), brochures and correspondence.

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, resulting in broad community support from:

- Materially-affected land managers such as Parks Victoria
- Adjacent private landholders
- Aboriginal stakeholders
- Regional Development Australia and Regional Development Victoria – Loddon Mallee
- Local government (Swan Hill Rural City Council)
- Community and user groups including: Apiarists, Sustainable Living in the Mallee, Mid-Murray Field Naturalists Club and Kooloonong Natya Landcare Group.

Broad community support for the project is further evidenced by the sustained interest in the proposal as illustrated by on-going requests from key stakeholders to provide briefings, presentations and updates.

Information regarding the project is published on the VMFRP website:

https://www.vmfrp.com.au/wp-content/uploads/2019/07/VMFRP_FactSheet_A4_Burra_0319_03.pdf

Has a program for future consultation been developed?

☒ NYD ☒ No ☒ Yes If yes, briefly describe.

Targeted, tailored consultation would continue to be conducted 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.

In particular, VMFRP would develop and implement a Consultation Plan outlining the approach to engagement through the planning approvals process. This plan would identify the range of interested stakeholders, outline the mechanisms to inform individuals and groups who could be affected and provide opportunities for input to identify issues of concern and potential effects, as well as get feedback from stakeholders on project construction options and/or potential mitigation measures.

Broader engagement via traditional and social media, community events and information displays would also continue.

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 26/06/20

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 26/06/20

21. References

Arthur Rylah Institute (ARI) (Jenkin, A., Stuart, I. and Harrow, S.) (2018). *SDL Fish Management Plan: Burra Creek, November 2018*. Report prepared for Mallee Catchment Management Authority.

Arthur Rylah Institute (2020). *Preliminary Draft VMFRP Ecological Monitoring Evaluation & Reporting Plan, January 2020*. Report currently being prepared for Mallee Catchment Management Authority.

Australian Ecosystems (2016). *Nyah and Vinifera SDL Project - Flora and Fauna assessment. Detailed Design Stage* (includes Burra SDL Project). Report prepared for Mallee Catchment Management Authority.

Bain, M. (2013). *Burra Creek Water Management Options, May 2013*. Report prepared for Mallee Catchment Management Authority.

Brown, G., Bryant, D. and Horrocks, G. (2013). *Terrestrial vertebrate fauna surveys of the Burra Creek and Nyah-Vinifera reserves, northern Victoria*. Report prepared for Mallee Catchment Management Authority.

Cullen, K., Apps H., Halas, L., Tan, K.P., Pain, C., Lawrie, K., Clarke, J., Gibson, D., Brodie, R.C. and Wong, V. (2008). *Atlas – Boundary Bend to Speewa, River Murray Corridor AEM Salinity Mapping Project*. Geoscience Australia, GEOCAT 68790.

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

Department of Environment, Land, Water and Planning (2017). *Guidelines for the removal, destruction or lopping of native vegetation*. Available: https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/91146/Guidelines-for-the-removal,-destruction-or-lopping-of-native-vegetation,-2017.pdf

Department of Environment, Land, Water and Planning (2020). *Interactive maps online*. Available: https://www2.delwp.vic.gov.au/maps/maps-and-services/interactive-maps. Accessed: 6 April 2020.

Department of Justice and Community Safety (2020). *Native Title*. Available: https://www.justice.vic.gov.au/your-rights/native-title. Accessed: 6 April 2020.

Department of Sustainability and Environment (2006). *Ministerial guidelines for assessment of environment effects under the Environment Effects Act 1978*. Victorian Government, Melbourne.

Ecological Associates (2006). *Investigation of Water Management Options for the Murray River – Nyah to Robinvale: Final Report, August 2006*. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2007). *Investigation of Water Management Options for the Murray River – Nyah to Robinvale: Stage II, February 2007*. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2014a). *SDL Rationale and Outcomes*. Ecological Associates report AL040-1D. Report prepared for Mallee Catchment Management Authority.

Ecological Associates (2014b). *SDL Floodplain Watering Projects: Monitoring and Evaluation*. Report AL045-1-B. Prepared for Mallee Catchment Management Authority.

Ecological Associates (2015). *SDL Floodplain Watering Projects: Operating Plans*. Ecological Associates report AL048-1-B prepared for Mallee Catchment Management Authority.

GHD (2013). *Summary Report for the flora census of Burra, Nyah and Vinifera SDL sites – Memorandum.* Prepared for Mallee Catchment Management Authority.

Gippel, C.J. (2014). *Spells analysis of modelled flow for the River Murray from Swan Hill to the South Australia Border*. Fluvial Systems Pty Ltd, Stockton. Prepared for Mallee Catchment Management Authority.

Hames, F. (2014). *Fish Passage Workshop, July 2014.* Arthur Rylah Institute for Environmental Research, Unpublished Client Report for Mallee Catchment Management Authority, Department of Environment and Primary Industries, Heidelberg, Victoria.

Jacobs (2014). *SDL Adjustment Supply Measures – Concept Design – Burra Creek.* Report prepared for the Mallee Catchment Management Authority dated 11 December 2014.

Jacobs (2016). *SDL Adjustment Supply Measures Concept Design – Geotechnical Investigation Report*. Report prepared for Mallee Catchment Management Authority dated September 2016.

Jacobs (2017). *Hydrodynamic Modelling of SDL Sites – Burra Creek Final Report*. Report prepared for the Mallee Catchment Management Authority dated 24 January 2017.

Jacobs (2018). *Advanced Concept Design – Burra*. Report prepared for Mallee Catchment Management Authority dated 27 June 2018.

Jacobs (2019). *Groundwater salinity monitoring bore specification for SDL projects*. Report prepared for Mallee Catchment Management Authority.

Lloyd Environmental (2014). *SDL Offsets Projects - Risks investigation, assessment and management strategy, dated 14 July 2014*. Report No. LE1409 prepared for Mallee Catchment Management Authority.

Lumsden, L., Brown, G., Cheers, G. and Palmer, C. (2007). *Floodplain fauna surveys – Macredie Island and Burra Forest*. Report prepared for Mallee Catchment Management Authority.

Mallee Catchment Management Authority (2008). *Mallee Native Vegetation Plan*. Available: http://www.malleecma.com.au/strategies/.

Mallee Catchment Management Authority (2013a). *Burra Creek Management Project – SDL Adjustment Supply Measure - Phase 1 Assessment*.

Mallee Catchment Management Authority (2013b). *Mallee Regional Catchment Strategy 2013-2019.* Available: http://www.malleecma.com.au/strategies/.

Mallee Catchment Management Authority (2014a). *Sustainable Diversion Limit Adjustment – Phase 2 Assessment – Supply Measure Business Case: Burra Creek Floodplain Management Project*.

Mallee Catchment Management Authority (2014b). *Mallee Waterway Strategy 2014-2022*. Available: http://www.malleecma.com.au/strategies/.

Mallee Catchment Management Authority (2016). *Mallee Natural Resource Management Plan for Climate Change*. Available: http://www.malleecma.com.au/strategies/.

Mallee Catchment Management Authority (2018). *Mallee Floodplain Management Strategy 2018-2028*. Available: http://www.malleecma.com.au/strategies/.

Murray-Darling Basin Authority (MDBA) (2014). *Basin-wide Environmental Watering Strategy, Second edition, 24 November 2014*. Available:https://www.mdba.gov.au/sites/default/files/pubs/Basin-wide-e-watering-strategy-Nov14.pdf.

Murray-Darling Basin Authority (MDBA) (2015). *Basin Salinity Management Strategy 2030 (BSM2030).* Canberra: Murray-Darling Basin Ministerial Council.

Murray-Darling Basin Authority (MDBA) (2019). *Basin-wide Environmental Watering Strategy, Second edition, 22 November 2019*. Available: https://www.mdba.gov.au/sites/default/files/pubs/basin-wide%20environmental%20watering%20strategy%20November%202019.pdf.

National Murray Cod Recovery Team (NMCRT) (2010). *National Recovery Plan for the Murray Cod Maccullochella peelii peelii.* Department of Sustainability and Environment, Melbourne.

Parks Victoria (2018). *River Red Gum Parks Management Plan (July 2018)*. Available: https://parkweb.vic.gov.au/explore/parks/hattah-kulkyne-national-park/plans-and-projects/river-red-gum-parks-management-plan.

R8 (2020). Victorian Murray Floodplain Restoration Project -Lower Murray Urban and Rural Water Corporation – Flora and Fauna Assessment Report – Burra Creek. Prepared for the Victorian Murray Floodplain Restoration Project. April 2020.

SKM (2014). *Preliminary Salinity Impact Assessment for Mallee Environmental Watering Projects Wallpolla, Hattah Lakes, Belsar-Yungera, Burra Creek, Nyah and Vinifera, Final Report* 3. Report for Mallee Catchment Management Authority.

Sunraysia Environmental (2015). *Burra Environmental Water Management Plan.* Report prepared for Mallee Catchment Management Authority.

Victorian Environmental Assessment Council (2008). *River Red Gum Forests Investigation – Final Report*. Available: http://www.veac.vic.gov.au/investigation/river-red-gum-forests-investigation-veac-/reports

VMFRP (2020a). *Draft Burra Environmental Watering Plan Addendum to the Burra Environmental Watering Plan, April 2020*.

VMFRP (2020b*). Draft Operating Plan – Burra Environmental Works and Measure Program, April 2020.*