**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](mailto:ees.referrals@delwp.vic.gov.au) is required. This will assist the timely processing of a referral.

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PART 1 PROPONENT DETAILS, PROJECT DESCRIPTION & LOCATION

# Information on proponent and person making Referral

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| **Name of Proponent:** | **Lower Murray Urban and Rural Water Corporation (LMW)** |
| **Authorised person for proponent:** | Josh White |
| **Position:** | Project Director - Victorian Murray Floodplain Restoration Project |
| **Postal address:** | PO Box 1438, Mildura VIC 3502 |
| **Email address:** | Josh.White@vmfrp.vic.gov.au |
| **Phone number:** | 0400 697 304 |
| **Facsimile number:** | n/a |
| **Person who prepared Referral:** | Josh White |
| **Position:** | Project Director - Victorian Murray Floodplain Restoration Project |
| **Organisation:** | Lower Murray Urban and Rural Water Corporation |
| **Postal address:** | PO Box 1438, Mildura VIC 3502 |
| **Email address:** | Josh.White@vmfrp.vic.gov.au |
| **Phone number:** | 0400 697 304 |
| **Facsimile number:** | n/a |
| **Available industry & environmental expertise:** (areas of ‘in-house’ expertise & consultancy firms engaged for project) | **LMW / Victorian Murray Floodplain Restoration 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 DELWP Water.  **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. |

# Project – brief outline

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| **Project title:** |
| Belsar-Yungera 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 Belsar-Yungera Floodplain Restoration Project is located on the Murray River floodplain, approximately 30 kilometres upstream of the Euston weir, near Robinvale in north-west Victoria. The floodplain comprises Belsar and Yungera Islands, which are formed by anabranches of the Murray River including Narcooyia, Bonyaricall and Yungera Creeks, and Tonsing Island. Lake Powell and Lake Carpul, two ephemeral wetlands, are also located on the southern limit of the Belsar-Yungera floodplain (Mallee CMA, 2014) and combined with the Belsar and Yungera Island make a total floodplain complex area of 8,300 hectares. The floodplain complex is situated predominantly in the Robinvale Plains bioregion, with a small area within the western limit of the Murray Fans bioregion. Belsar-Yungera Islands are an integration of two environment types, the central River Red Gum forest and lower Murray floodplain. The project involves works to support inundation of 2,374 hectares of this regionally and internationally significant floodplain.  The project is located almost entirely in the Rural City of Swan Hill and the Mallee Catchment Management Authority (CMA) region, with the exception of the temporary suction line during pumping events which would be located on the bank of the Murray River within the border of NSW, and therefore within Balranald Shire Council. The location of the project is shown in **Attachment 1 – Location of the project**.  The project is designed to facilitate managed inundation by isolating a large section of Narcooyia Creek and Yungera Creek from the Murray River, enabling these creeks to hold a water level of 52.3 m AHD. The key environmental works components of the project (three large regulators, one fishway, a number of small regulators, containment banks, pipelines and temporary pumping) are located within four distinct environmental works areas (**Attachment 1 – Location of the project**):   * Area One – Primary inundation area including Narcooyia Creek and Yungera Creek and surrounding floodplain. * Area Two – Floodrunner off the Murray River, south of middle and upper Narcooyia Creek referred to as Lower J1 Creek area. * Area Three – Floodrunner off the Murray River in upper eastern corner of the project area, south of Narcooyia Creek and the River referred to as Upper J1 Creek area. * Area Four – Lake Powell and Lake Carpul Area.   Throughout this referral, the following terms are used to describe the project:   * Development footprint - this is the area that the project infrastructure will occupy based on the current design. This does not include tracks used for access during construction and operation. * Construction footprint - this includes the project infrastructure as well as the land required to construct the infrastructure based on the current design. This includes access tracks. For the purposes of this referral, this is the ‘disturbance footprint’ and has been used to calculate the extent of native vegetation removal for the project. * Area of investigation - this includes the development footprint, as well as a buffer around the development footprint. This area has been the basis of investigations and extends along the Murray River north of the Murray Valley Highway, with a small section south of the highway between Lakes Powell and Carpul. * Inundation area - area of land subject to flooding during managed events, up to a specific design water level. The inundation area comprises the majority of the proposed Murray River Park on Belsar and Yungera Islands, land north of the Murray Valley Highway, and land surrounding Lakes Powell and Carpul.   *Reference to ‘the project area’ throughout this referral includes both the construction footprint and the inundation area.*  **Construction footprint**  The construction footprint occurs within both Crown Land and freehold land within Victoria, with the exception of the temporary suction pipe associated with the temporary pump stations in Area One and Area Three which are within the Murray River (NSW). Crown Land includes the Lake Powell and Lake Carpul Nature Conservation Reserve and River Murray Reserve, which are natural features reserves managed by Parks Victoria under the *Crown Land (Reserves) Act 1978*. Works on freehold land include containment banks, small regulators, road culverts, laydown area at ER3 and access tracks located on private land parcels. Some of these parcels are currently managed for conservation purposes.  The construction footprint is shown in **Attachment 2 – Project structures, construction and access**.  **Inundation area**  The 2,374 hectare inundation area comprises both floodplain areas (including wetlands), anabranches of the Murray River and two large ephemeral lakes. A large portion of the proposed inundation area lies in public land managed by Parks Victoria and includes Murray River Reserve and Lakes Powell and Carpul Nature Conservation Reserve. Some land in the southern part of the inundation area is private land (736 hectares). A proportion of the private land to be inundated is protected either under conservation covenants or as an offset for land clearing associated with nearby irrigation developments managed for conservation purposes (Mallee CMA, 2014).  The proposed inundation area is shown in **Attachment 3 – Managed Inundation Area**.  **Access tracks**  Access to the project components at the Belsar-Yungera floodplain complex would be via the Murray Valley Highway and connecting public roads. The proposed access arrangements for construction and operation of the project will substantially utilise the existing road and track network throughout the Belsar-Yungera floodplain complex, with minor upgrade works such as grading and applying additional road base proposed as required to maintain access. New works have been designed to best align with this existing track network to minimise the potential impacts from the project. There are short lengths of new tracks required, including access to new regulators, connection between the new works, and re-alignment of tracks to form new access across waterways. The alignment of these new tracks will be refined in detailed design to minimise potential impact. 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. |
| **Short project description** (few sentences)**:** |
| The Belsar-Yungera Floodplain Restoration Project aims to restore a more natural inundation regime across approximately 2,374 hectares of high-ecological-value Murray River floodplain within the Belsar-Yungera floodplain complex. The project design and operation would seek to mimic the impact of natural flood events to improve the ecological condition of the floodplain ecosystems. The project involves the construction of three large regulators (ER1, ER3 and S7), a fishway at ER1, two pipelines, a number of small regulators and a series of containment banks to facilitate managed inundation of the Belsar-Yungera floodplain complex. The proposed works would facilitate an inundation of up to 2,374 hectares of River Red Gum and Black Box forests and woodlands. |

# Project description

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| **Aim/objectives of the project** (what is its purpose / intended to achieve?): |
| The Belsar-Yungera Floodplain Restoration Project aims to restore a more natural inundation regime across approximately 2,374 hectares (refer **Attachment 3 – Managed Inundation Area**) of high-ecological-value Murray River floodplain within Belsar-Yungera floodplain complex, through the construction of new infrastructure, the modification of existing infrastructure and removal of some existing barriers to flow (created by existing irrigation and road infrastructure) within the Murray River Reserve. Within the four distinct environmental works areas, the proposed works would:   * Area One – enable water to be held at 52.3 m AHD in the primary inundation area to provide an inundation area of approximately 1,539.71 hectares. The inundation would be equivalent to the flood extent of a Murray River flow of up to 70,000 ML/day. * Area Two – enable water to be held at 52.9 m AHD in the Lower J1 Creek area to provide an inundation area of approximately 526.24 hectares. The inundation would be equivalent to the flood extent of a Murray River flow of 85,000 ML/day. * Area Three – enable water to be held at 53.3 m AHD in the Upper J1 Creek area to provide an inundation area of approximately 35.96 hectares. The inundation would be equivalent to the flood extent of a Murray River flow of 100,000 ML/day. * Area Four – enable water to be held at 52.6 m AHD in the Lake Powell and Lake Carpul area to provide an inundation area of approximately 272.19 hectares. The inundation would be equivalent to the flood extent of a Murray River flow of between 110,000-170,000 ML/day (Mallee CMA, 2014).   These water levels and associated inundation extents are expected to be achieved through either the capture of a natural flooding event, pumping into the creek system over a period of time, or pumping into the creek system on top of a natural flooding event, extending the natural event in size and duration.  **Project aim**  Belsar-Yungera floodplain complex is a network of waterways, wetlands, lakes and floodplain that, under a natural flow regime, was reliably inundated annually from the Murray River. Flows events of 50,000 ML/d in the Murray River previously occurred regularly at the floodplain, with a mean frequency of 7.3 events in 10 years and a median duration of three months in comparison to current conditions where the mean frequency of these flows is 3.8 events in 10 years and a mean duration of 2 months (Gippel, 2014).  Altered flow regimes and floodplain inundation patterns caused by the regulation of the Murray River and Narcooyia Creek, together with extended periods of drought has resulted in a decline in the health of the Belsar-Yungera floodplain.  Index of Wetland Conditions (IWC) assessments found that the current inundation patterns across the floodplain are not sufficient to meet the ecological requirements of the complex’s flora and fauna. This is evident from the poor tree condition in the mid to lower Narcooyia Creek valley and floodplain wetlands (Ecological Associates, 2014).  In response to the evident decline in the ecological health of the Belsar-Yungera floodplain complex, localised environmental watering has already been undertaken using temporary infrastructure, resulting in positive ecological outcomes (Mallee CMA, 2014).  The project aims to mimic the impact of natural flood events by providing inflows from the Murray River and additional pumping when required to support the ecological requirements of the floodplain’s flora and fauna. =  Analysis of the inundation flow equivalences (Jacobs, 2014 and 2017) shows that the proposed works would replicate inundation flows of up to 170,000 ML/ day across the Belsar-Yungera floodplain. A comparison of the modelled extent of flooding across the Belsar-Yungera floodplain under natural (pre-regulation), existing and proposed works conditions by Jacobs (2014) is provided in **Attachment 4 – Natural, Existing and Proposed Flood Extent Maps**.  **Ecological objectives and targets**  Eight water regime classes comprised of ecological vegetation classes (EVCs) and non-EVC waterbody, have been specifically identified for restoration through this project as described by Ecological Associates (2014a), including Watercourses, Semi-permanent Wetlands, Red Gum Forest and Woodland, Lignum Shrubland and Woodland, Black Box Woodland, Floodplain Lake, Mallee and Plains Forest and Woodlands (Ecological Associates, 2014a). A summary of water regime classes and constituent EVCs within the managed inundation area and the Belsar-Yungera floodplain area generally as identified by Ecological Associates (2014a) is provided in **Table 2**.  Ecological Associates (2014a) developed ecological objectives for the water regime classes identified for restoration by project based on:   * Environmental objectives set out in Chapter 5 of the Murray-Darling Basin Plan 2012 (the Basin Plan) * Expected environmental outcomes set out in the Basin-wide Environmental Watering Strategy (MDBA, 2014)[[1]](#footnote-2) * Ecological values identified through desktop and field-based baseline flora and fauna surveys * An ecological objectives workshop with an expert panel comprised of aquatic wildlife and restoration ecologists and key project stakeholders (DELWP, Mallee CMA)   Details of the ecological objectives and targets for the project and an overview of how these have been developed, is provided in **Attachment 6 – Environmental Water Management Plan**. The specific ecological objectives for the project can be summarised as:   * Maintain migration of medium and small-bodied native fish to maintain populations * Maintain seasonal populations of medium and small-bodied native fish * Increase native habitat for local populations of fauna by increasing the extent of wetland and riparian vegetation * Support metapopulations of Growling Grass Frogs * Reduce high threat exotic plant cover * Maintain threatened native flora presence * Maintain successful breeding for platform-building waterbirds * Maintain the health of native trees * Increase abundance of native woodland birds * Increase the abundance of bats as an indicator of increased resources resulting from increased floodplain productivity * Increase the abundance of carpet pythons as an indicator of increased resources resulting from increased floodplain productivity * Provide reliable native foraging and breeding habitat for waterbirds * Provide habitat for hundreds of waterbirds at least once in every five years * Contribute to the carbon requirements of the Murray River channel ecosystem to support system productivity   **Flood frequency and duration**  The project aims to better align the water regime (e.g. frequency, duration and timing of future flood events) within the managed inundation area to achieve the specific ecological objectives and targets. The water regime requirements for the eight target water regime classes identified above reflect river conditions closer to the frequency, duration and timing of flood events experienced pre-regulation (i.e. closer to natural conditions) within the managed inundation area. Hydrological analysis by Gippel (2014) aimed to identify the water regime deficit within the managed inundation area by comparing the frequency, interval and duration of flood events based on implementation of the proposed measure (the project) with flood events under natural, baseline (current) and Basin Plan (2,750 GL) flows without the measure. The hydrological analysis shows that while implementation of the Basin Plan flows does bridge the gap between natural and baseline conditions, it primarily impacts flows in the Murray River which are less than that required for floodplain watering at Belsar-Yungera (Mallee CMA, 2014). Therefore, environmental works are required to deliver water to the managed inundation area to achieve the ecological objectives and targets.  Gippel (2014) modelling found that the proposed works associated with the project can be operated to meet shortfalls in the water required to achieve the frequency and duration across all of the water regime classes (refer to **Table 1** for more detail). The operational changes as a result of the proposed constructed works include harnessing water from natural high flow events in the Murray River and / or flows released from managed events to distribute, retain and in most cases release floodwaters within the managed inundation area and pumping from the river during low flow events. Use of constructed works enables environmental watering of targeted inundation area to be undertaken using smaller volumes of water than would typically be needed in a general overbank flooding event (Jacobs, 2017).  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 * **Frogs:** Flooding promotes a rapid response in frog activity, including calling, spawning, and tadpole development and metamorphosis   **Other benefits**  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.  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 sub-projects designed to deliver water to floodplain ecosystems to directly address environmental water needs. A summary of the nine major projects to be delivered by VMFRP is provided in **Table 5**.  Together, these sub-projects aim to return a more natural inundation regime across more than 14,000 hectares of high ecological value Murray River floodplain in Victoria through the construction of new infrastructure and the modification of existing infrastructure designed and operated to mimic the impact of natural flood events and improve the ecological condition of floodplain ecosystems.  **Rationale**  To support the Business Cases for the seven VMFRP sub-projects located in the Mallee CMA region and to justify the SDL offset mechanism, an environmental benefits assessment was prepared by Ecological Associates (2014) to:   * Describe the ecological character of the floodplain systems * Set objectives for the use of water 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 this assessment *SDL Floodplain Watering Projects: Rationale and Outcomes Report* (October 2014) prepared by Ecological Associates is available on request. In relation to the Belsar-Yungera project in particular, further detail of the floodplain hydrology, ecological conditions and ecological objectives are provided below:  **Floodplain hydrology**  Narcooyia Creek flows over approximately 17 kilometres defining the southern side of Belsar and Yungera Islands. The creek diverges from the Murray River upstream of Yungera Island and returns to the river downstream of Belsar Island. Bonyaricall Creek is six kilometres long and branches from Narcooyia Creek near its downstream end and joins the Murray River to create Tonsing Island. Ephemeral floodplain lakes, Lake Powell and Lake Carpul, are located south of Bonyaricall Creek and are highly dependent on natural inundation from the creek (Ecological Associates, 2014a).  The hydrology of the Murray River and its tributaries at Belsar and Yungera Island has significantly changed as a result of storages, regulation and diversions. Euston Weir on the Murray River influences the river levels in the eastern part of the system, maintaining a normal operating level of 47.6 m AHD which pools water in Bonyaricall Creek and reduces the natural water level fluctuations. Narcooyia Creek has also been significantly modified to allow its use as an irrigation delivery channel. The channel is impounded between a bank where it branches from the Murray River and a weir just above Bonyaricall Creek. Water is pumped from the Murray River into the creek to meet irrigation and to maintain a water level of 48.51 m AHD. Water is extracted from the creek just above the downstream weir (GHD, 2011). Excess water flows over the weir in Narcooyia Creek and enters Bonyaricall Creek rather than the final reach of Narcooyia Creek (Ecological Associates, 2014a).  Due to the effect of Euston Weir, rising river flows inundate upstream areas of the Belsar and Yungera Island floodplain before the downstream areas. Water first enters the floodplain at the downstream connection of Yungera Creek when the Murray River discharge exceeds 16,000 ML/d. Pools and wetlands near the creek, generally greater than two metres deep, fill by small peaks in river flow and can retain water for up to a year. Significant inundation of the surrounding floodplain area occurs at flows exceeding 20,000 ML/d. Higher flows activate upstream connections and create through-flow (Ecological Associates, 2014a). Low floodplain terraces on meander loops of the Murray River commence when river levels exceed 20,000 ML/d with significant inundation occurring at flows over 27,000 ML/d. The shallow basin in central Belsar Island containing Lignum shrubland is significantly inundated by flows exceeding 70,000 ML/d, with inundation largely complete at flows of 120,000 ML/d. Black Box woodland has a similar flooding pattern with flooding initiated at flows over 70,000 ML/d and mostly complete at flows of 120,000 ML/d (Jacobs, 2014).  Lake Powell located south of Bonyaricall Creek naturally fills at its northern end when high flows spill from the creek into a narrow floodway that passes under the Murray Valley Highway. Lake Carpul fills primarily from overflows from Lake Powell (Ecological Associates, 2014a). The flow threshold for significant flooding in Lake Powell is in the order of 140,000 ML/d and 170,000 for Lake Carpul (Jacobs, 2014).  Modelling was undertaken to analyse the flow in the Murray River at Euston under natural and current conditions (Ecological Associates, 2006) to further understand the changes to the hydrology of the river and floodplain at Belsar and Yungera Island floodplain under current (regulated) conditions. The results indicated that the median daily discharge (ML/d) at Euston has declined under current conditions, with the greatest impacts being in the higher flow months from June to December (**Figure 1**). The modelling also showed that regulation has significantly altered the frequency, interval and duration of 50,000 ML/d flow events in this reach, with flows greater than 20,000 ML/d rarely occurring.    **Figure 1 Distribution of median daily flows for each month in the Murray River at Euston for natural and current conditions. Derived from MDBC MSM-Bigmod 114 year data (Ecological Associates, 2006)**  A detailed analysis of the frequency, extent and duration of flows in the Murray River was also undertaken by Gippel (2014) to compare the natural flow regime (pre-regulation) with current (baseline) conditions. The analysis as shown in **Figure 2** illustrates that under regulated conditions:   * The frequency of flow peaks greater than 20,000 ML/d has reduced significantly, 50% to 70% less than pre-regulation frequency, even for flows exceeding 140,000 ML/d  (**Figure 2**). * The duration of flow events of 20,000 to 60,000 ML/d are 50% shorter, however for flow events greater than 90,000 ML/d, the duration is similar (**Figure 2**). * The river is in a low-flow state for a greater proportion of time under current conditions as it is managed to deliver water to downstream irrigation consumers efficiently (**Figure 2**). * Events of 5,000 ML/d occur 1.6 times per year with a median duration of 130 days. Under natural conditions river discharge exceeded 5,000 ML/d for most of the year (**Figure 2**).     **Figure 2 Comparison of frequency, interval, duration and start date of events at Euston under Natural and Baseline modelling flow scenarios, over a 114 year modelled period (Gippel, 2014)**  The changes in hydrology of the Murray River as a result of river regulation (and diversions) have also compromised the water regimes experienced by each water regime class identified for restoration through this project. The hydrological analysis by Gippel (2014) identified a water regime deficit within the managed inundation area by comparing the frequency, interval and duration of flood events under natural (pre-regulation) conditions with baseline (current) and Basin Plan (Commonwealth *Water Act* *2007* s 44 (3) without measure) conditions. **Table 1** provides a summary of the result of the modelling and indicates that although Basin Plan flows would contribute towards addressing current deficiencies in the environmental water requirements of the Belsar and Yungera floodplain complex compared to baseline conditions, the project is required to further bridge the gap between Basin Plan flows and the environmental water requirements of the floodplain. Therefore, the project has been designed to address this water regime deficit, delivering the operational flexibility and maximum design water levels identified as required, through the work by Ecological Associates, to satisfy the ecosystem water requirements of the EVCs / water regime classes targeted for restoration within the Belsar-Yungera floodplain complex. As part of the Business Case (Mallee CMA 2014), additional analysis was undertaken (with measures) to compare the water regime provided by the project based upon interpretation of the preliminary operating plan adapted from Ecological Associates (2014).  **Table 1 Comparison of water regimes provided by natural, baseline, Murray-Darling Basin Plan and the proposed project (table extract from Mallee CMA, 2014)**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Threshold (ML/d) | Water regime class | Scenario | Frequency Mean (/100yrs) | Interval Median (days) | Duration Median (days) | Event start date Median (day of year, 1 Jan = 1) | Prevalence years with event (%) | | **10,000** | Watercourses | With measure\* | 120.2 | 78 | 164 | 146 | 100 | | Natural | 93 | 96 | 243 | 144 | 100 | | Baseline | 135.1 | 91 | 93 | 180 | 99 | | Basin Plan 2750 without measure\* | 120.2 | 78 | 164 | 146 | 100 | | **30,000** | Semi-permanent Wetlands | With measure | 80 | 220 | 120 | 152 | 80 | | Natural | 95.6 | 208 | 162 | 195 | 93 | | Baseline | 60.5 | 303 | 97 | 204 | 59 | | Basin Plan 2750 without measure | 82.5 | 267 | 109 | 195 | 77 | | **40,000** | Red Gum Forest and Woodland | With measure | 80 | 275 | 120 | 152 | 80 | | Natural | 87.7 | 253 | 122 | 215 | 87 | | Baseline | 47.4 | 341 | 81 | 223 | 46 | | Basin Plan 2750 without measure | 59.6 | 308 | 104 | 214 | 60 | | **50,000** | Lignum Shrubland and Woodland | With measure | 70 | 300 | 100 | 152 | 70 | | Natural | 72.8 | 283 | 103 | 225 | 75 | | Baseline | 38.6 | 612 | 62 | 239 | 37 | | Basin Plan 2750 without measure | 45.6 | 401 | 75 | 227 | 45 | | **90,000** | Black Box Woodland | With measure | 60 | 560 | 44 | 152 | 60 | | Natural | 50.9 | 351 | 55 | 252 | 46 | | Baseline | 17.5 | 1049 | 40 | 258 | 15 | | Basin Plan 2750 without measure | 21.9 | 720 | 37 | 259 | 19 | | **170,000** | Floodplain Lake | With measure | 5 | 6000 | 50 | 250 | 5 | | Natural | 6.1 | 4976 | 34 | 246 | 5 | | Baseline | 2.6 | 8136 | 51 | 243 | 2 | | Basin Plan 2750 without measure | 3.5 | 7372 | 57 | 274 | 3 |   \* note that delivery flows through Narcooyia Creek cannot occur at this flow without implementation of the project  **Ecological condition**  The forests and woodlands of the Murray River floodplain have been declining rapidly in condition over the past two decades. The decline is associated with increasing regulation of the Murray River and extended periods of drought (Cunningham et al, 2011).  Regulation of the Murray River and extended drought conditions has resulted in a decline in the ecological condition of the floodplain (as discussed above). Current inundation patterns across the floodplain are not sufficient to meet the ecological requirements of the complex, resulting in impacts to native fish populations, water birds and other fauna (Mallee CMA, 2014). Some wetlands are ephemeral and have not experienced regular wetting, while others are permanently inundated due to the influence of the Euston weir pool (Mallee CMA, 2010).  Lakes Powell and Carpul are known to have previously recorded a high number of inundation-dependent threatened species. Flora surveys conducted in 2009 indicate that up to 26 inundation-dependent threatened species were missing from the beds of Lakes Powell and Carpul and the complex’s other wetlands. While this is not uncommon in the drought conditions experienced at this time, the area was facing a threat of encroachment of a drought-tolerant community if long periods of dry occurred between inundation events (Mallee CMA, 2014). The flora surveys outlined that the health, extent and species diversity of inundation-dependent EVCs was low in areas that had not experienced recent inundation and wetlands contained stressed canopy and the risk of encroachment of a drought tolerant community. The River Red Gum Swamp EVC that once dominated the study area has also been largely displaced by vegetation communities adapted to prolonged flooding (Mallee CMA, 2014).  To address issues noted above, an emergency environmental watering program was initiated in 2005-06 as an immediate response to the floodplain complex’s poor condition. Over three years, environmental water was delivered to low lying wetlands and creeklines on Crown and freehold land via portable pumps and contained with temporary earthen levees (Mallee CMA, 2014).  Environmental watering of Lakes Powell and Carpul in 2011-12 was also undertaken and broke an 18 year absence of inundation in the lakes. The ecological response of the watering was immense; waterbird activity at the lakes was supported for the first time since 1993 and the vegetation surrounding the lakes improved in condition (Mallee CMA, 2014).  A 2009 fish survey also identified numerous impediments (e.g. existing structures in waterways) in the floodplain complex’s waterways that inhibit fish movement between the Murray River and the complex. This restriction of movement of the Narcooyia Creek native fish population (discussed further in Part 2, Section 12 (Native vegetation, flora and fauna)) with the Murray River, prevents the completion of vital life cycles.  In 2010, the Mallee CMA developed an Environmental Water Management Plan (refer to **Attachment 6 – Environmental Water Management Plan**) for Belsar-Yungera identifying ecological objectives and hydrological targets for the complex, recognising the requirement for infrastructure to better manage the inundation regime (Mallee CMA, 2014). These ecological objectives and targets have been refined as part of the VMFRP MER Plan (ARI, 2020) and have been adopted for this project (the Belsar-Yungera Floodplain Management Project) (as outlined in **Attachment 6 – Environmental Water Management Plan**).  **Ecological objectives and extent of project benefits**  As outlined in Section 3 (Aim/objectives of the project), ecological objectives have been established to address the problems outlined above and to restore the eight specific water regime classes on the Belsar-Yungera floodplain: Watercourses, Semi-permanent Wetlands, Red Gum Forest and Woodland, Lignum Shrubland and Woodland, Black Box Woodland, Floodplain Lake, Mallee and Plains Forest and Woodlands. A summary of water regime classes and constituent EVCs within the managed inundation area is provided in **Table 2**. Spatial analysis has confirmed that the areas identified by Ecological Associates (2014) for each water regime class generally align with groupings of the relevant EVCs identified by DELWP’s modelled 2005 EVC extents (see **Table 2**). EVCs modelled to occur within the managed inundation area are presented in Figure 3 of **Attachment 5 – Flora and Fauna Assessment**.  **Table 2 Summary of EVCs / water regime classes modelled to occur within the Belsar-Yungera managed inundation area[[2]](#footnote-3)**   | Water regime class | EVCs | Modelled EVC extent within managed inundation area (ha) | | --- | --- | --- | | **Water courses** | Waterbody - Fresh | 56.36 | | **Semi-permanent Wetlands** | Bare Rock/ Ground | 21.63 | | Floodway Pond Herbland | 21.38 | | Shallow Freshwater Marsh | 8.75 | | Spike Sedge Wetland | 2.04 | | **Red Gum Forest and Woodland** | Grassy Riverine Forest / Floodway Pond Herbland Complex | 9.25 | | Intermittent Swampy Woodland | 116.43 | | Grassy Riverine Forest | - | | **Lignum Shrubland and Woodland** | Lignum Swamp | 152.82 | | Lignum Shrubland | 505.52 | | Lignum Swampy Woodland | 879.37 | | **Black Box Woodland** | Riverine Grassy Woodland | 1.02 | | Riverine Chenopod Woodland | 374.56 | | Shrubby Riverine Woodland | 24.11 | | **Floodplain Lake** | Lake Bed Herbland | 129.78 | | **Mallee\*** | Chenopod Mallee | 0.001 | | Loamy Sands Mallee | 0.002 | | Woorinen Mallee | - | | Woorinen Sands Mallee | - | | **Plains Forest and Woodland\*** | Semi-arid Chenopod Woodland | 0.59 | | Semi-arid Parilla Woodland | - | | Semi-arid Woodland | - | | **Unmapped EVC\*\*** | Inundation dependant - Black Box and River Red-gum communities | 70.49 | | **Total** | | **2,374.08** |   \* non inundation dependent. Ground-truthing surveys have confirmed that this is a mapping error, with these EVCs not present in the mapped locations. EVCs present in this location comprise inundation dependent EVCs only. Details on following page.  \*\* A small area where EVCs have not been mapped which is due to gaps in spatial data. Ground-truthing has confirmed this area contains inundation dependant vegetation communities  The required frequency and duration of flooding for each water regime class targeted for restoration by the project, has been determined through a series of studies undertaken by Ecological Associates (2006, 2007, 2014, 2015) by analysing where each vegetation community associated with the water regime class occurred on the floodplain (mapped extent, elevation range) supported by hydrological modelling (Gippel, 2014; Jacobs, 2017) to determine the Murray River flow threshold that would have flooded these elevation ranges under natural, pre-regulation conditions. Mapping by Jacobs (2014) of the modelled extents of flooding under natural conditions is provided in **Attachment 4 – Natural, Existing and Proposed Flood Extent Maps**.  Previous investigations on the benefits of environmental watering has occurred at the Hattah-Kulkyne National Park. The park had received environmental water in spring–summer 2014-2015, followed by a natural flood in 2016-17 and which was supplemented with an allocation of environmental water. Following the 2017 monitoring, it was concluded that the overarching ecological objective for Hattah Lakes (i.e. “to restore a mosaic of healthy wetland communities”) was being achieved (Wood et al., 2018).  The environmental benefits of watering at the Hattah Lakes were multiple and included (DELWP, 2017a; VEWH 2019):   * Maintenance or improvement in the abundance of native vegetation and water-dependent plant functional groups, particularly on the lakebed, lake edges and the lower floodplain (DELWP, 2017a) * Reduction in abundance of plants favouring terrestrial dry habitats (DELWP 2017a), although this trend was most evident at sites receiving more frequent flooding (whereas rarely flooded sites were still dominated by drought tolerant species) (Wood et al., 2018); and * Improved tree canopy cover (and by extension, health) of River Red Gum and Eumong (DELWP 2017a; Wood et al., 2018)   The EVCs identified in the Belsar-Yungera inundation area (Table 2) are swampy or wetland vegetation communities that require or are tolerant of inundation and therefore are likely to positively respond to the proposed inundation. A small portion of the inundation area (0.593 hectares equating to 0.025% of the total inundation area) was mapped as containing three non-water dependent EVCs; Chenopod Mallee (EVC 158), Loamy Sands Mallee (EVC 91) and Semi-arid Chenopod Woodland (EVC 98). However, the vegetation mapping for the inundation area has been ground-truthed and the on-ground inspection confirmed that these areas had been incorrectly mapped, with Semi-arid Woodland and Mallee vegetation only observed at higher elevations above the floodplain where environmental water will not penetrate during periods of inundation.  On this basis, diverting water into the potential inundation area to enhance the existing flood regime is considered to be the most effective method to improve the ecological condition of the area. To replicate a more natural flood regime, the project must have the flexibility to operate under a range of flow conditions. This flexibility is also required to enable the operational regime to trigger a range of ecological responses across a representative area of flood dependent communities. |
| **Main components of the project** (nature, siting & approx. dimensions; attach A4/A3 plan(s) of site layout if available): |
| The project involves the construction of three new large regulators (ER1, ER3 and S7), a fishway at ER1, a number of small regulators and a series of containment banks to divert, retain and release water within the floodplain and two pipelines and associated hardstands to enable temporary pumping that would transfer environmental water from the Murray River into the Narcooyia Creek system **(Attachment 2 – Project structures, construction and access**).  Under the proposed scheme flows would enter the Belsar-Yungera system from the west along Narcooyia Creek after entering from the Murray River through the ER3 regulator. Structures, ER3, ER1, and S7 are intended to isolate a large section of Narcooyia Creek from the Murray River and hold water up to 52.3 m AHD in Inundation Area One. The downstream regulator at J1a in inundation Area Two would then be used to retain water at an additional higher tier within the J1 creek area up to 52.9 m AHD. At high flows water can pass through J1c and J1g regulars in inundation Area Three into J1 Creek.  Lake Powell and Lake Carpul regulators in Inundation Area Four are designed to retain water within the lakes. Both lakes would be inundated by water pumped from Bonyaricall Creek through a 1.8 kilometre long pipeline between the creek and Lake Powell. Lake Powell and Lake Carpul begin to fill from natural inflows greater than 100,000 ML/d.  **Proposed works**  The proposed works to achieve the inundation are summarised in **Table 3** and are shown in the project drawings (**Attachment 2 – Project structures, construction and access**). More detailed descriptions of the proposed works are provided below.  **Table 3 Summary of proposed works at Belsar-Yungera floodplain complex.**   |  |  |  |  | | --- | --- | --- | --- | | Area | Main components | Area of inundation (hectares) | Water level (m AHD) | | **One** | * Three large regulators and containment banks; ER1 incorporating a fishway, ER3 and S7. * Seven small supporting regulators (ER1 South, ER1 North, S4, S105, S5, S108, S109) and containment banks * A permanent hard stand for temporary pumps and associated underground pipeline at ER3 * Realignment and extension of irrigator pipeline into Narcooyia Creek * Track raising of Belsar Road, including construction of two culverts in embankment | 1,539.71 | 52.3 | | **Two** | * Two small regulators (J1a 1 and 2) at the downstream end of J1 Creek. * Four small supporting regulators (J1b, J1d, J1e, J1f) included in containment banks | 526.24 | 52.9 | | **Three** | * Two small regulators (J1c, J1g) included in containment banks * A permanent hard stand for a temporary pump adjacent to the J1c regulator | 35.96 | 53.3 | | **Four** | * A 1.8 kilometre pipeline between Narcooyia Creek and Lake Powell * A permanent hard stand for a temporary pump on Narcooyia Creek * One small regulator on Lake Powell * One small regulator on the channel between Lake Powell and Lake Carpul * A small cutting in existing stop bank between Lake Powell and Lake Carpul * Pipe culvert beneath the Murray Valley Highway | 272.19 | 52.6 |   **Area One:**   * Regulator ER1 – A large regulator located in the downstream section of Narcooyia Creek, upstream of the confluence with Bonyaricall Creek, that is designed to maintain the weir pool in the creek for irrigators, provide downstream water level control and the return of managed floodwaters to the Murray River on completion of a managed event. Two long containment banks (ER1 South, ER1 North) are required either side of the regulator to enable water to be held at the design inundation level. A vertical slot fishway would be located at this regulator. * The operation of regulator ER1 to a level of 52.3 m AHD would result in the inundation of Belsar Road and restrict access to existing pump sites on the creek, therefore a total length of 1.2 kilometres of road would require upgrade and raising works. Two culverts would also be required to pass flows through the embankment. * Regulator ER3 – A large regulator located in on the upstream end of Narcooyia Creek, at the entry to the Narcooyia Creek anabranch, that is designed to maintain the weir pool in the creek for irrigators, allow flow into the creek for supply of water during a natural large flood event at Murray River and enable retention of water in the Belsar-Yungera Island area (Area One). * Realignment and extension of irrigator pipeline which discharges water into Narcooyia Creek after the ER3 regulator is constructed. The existing pipelines through the structure would be extended and realigned to retain the ability to deliver to the creek. The new pipeline would be located along the existing creek line, resulting in a pipe length of approximately 130 m long and 1200 mm diameter. The pipeline would terminate at an embankment concrete sill located within the ER3 structure. * Permanent pump hardstand and permanent underground pipeline from the hard stand to the downstream side of ER3 to facilitate the pumping of environmental water into Area One. The pump station and suction line into the Murray River would be a temporary installation. * Seven small regulator structures (ER1 South, ER1 North, S4, S105, S5, S108, S109) in Area One to enable smaller breakouts to be contained within the system. These minor regulators would be operated in either a fully opened or fully closed position, with all works designed to minimise the impact on the distribution of natural flood flows. * Regulator S7 – A large regulator located adjacent to the Murray River on a breakout from Yungera Creek, that is designed to enable retention of water in the Belsar-Yungera Island area (Area One). * Potential removal of the existing block bank at the entrance of Narcooyia Creek and the waterway reshaped to enable the ER3 Regulator to be the control point for inflows. These works would permanently cut off access to Yungera Island, with the ER3 Regulator becoming the primary access route onto the island. These works would be confirmed as the project progresses.   **Area Two:**   * Regulators J1a (1) and (2) – Small regulators at the downstream end of J1 Creek, used to retain water within inundation Area Two and regulating passing flows through the system from inundation Area Two to Inundation Area One. * Regulator J1b, J1d, J1e, J1f – Small regulators included in a containment bank that is required to prevent water flowing out through a secondary flood runner and to contain water in Area Two. The regulators allow for inflows from Narcooyia Creek in flood events.   **Area Three:**   * Regulator J1c – Small regulator included in a containment bank to allow for the inundation of Area Three, the release of water to Area Two, whilst also allowing for flood flows through the system. * Regulator J1g – Small regulator included in a containment bank to provide a pump in point for water into Area Three as well as to pass any flood water and contain water into Area Three. * Permanent pump hard stand area to provide a site for a single pump to transfer water from the Murray River.  The hardstand would be located at the site previously used by Mallee CMA for pumping in the past. There are no pipes or other assets at this site. Temporary pumps set up at this location would pump to J1g, where the pipeline would connect to a bulkhead slotted into the headwall of the structure to provide connection through to Area Three.   **Area Four:**   * Lake Powell Regulator – Small regulator on Lake Powell 50 m south of the Murray Valley Highway, designed to retain water within Area Four to a top water level of 52.6 m AHD and avoid impounding water against the embankments of the highway. The natural surface levels on the creek banks near the structure are generally higher than the design level of the structure. Therefore, minor earthworks would be required on each bank of the regulator structure to provide a transition from the surrounding tracks. * Pump hardstand and a 1.8 kilometre long DN900 HDPE pipeline would be constructed between Bonyaricall Creek and Lake Powell. The pipeline, together with a temporary pump installation, provides the ability to inundate Lake Powell and Lake Carpul. * Lake Carpul Regulator – Small regulator located on the channel between Lake Powell and Lake Carpul, designed to improve hydraulic connectivity between the two lakes by lowering the level at which the lakes are connected and allow controlled inundation of Lake Powell prior to Lake Carpul. * To improve hydraulic connectivity between Lake Powell and Lake Carpul, it is proposed for a small cutting to be made in the existing stop bank to lower the level at which the lakes are connected. The proposed cut would extend over a 20 m length and comprises a 1.2 m bed width. * Pipe culvert beneath the Murray Valley Highway to provide a minor increase to the inflow capacity across the highway. The invert of the pipes would be 500 mm below the existing culvert level, allowing the Lakes to commence filling earlier in a natural flood event to make use of the existing levels of the channel between the highway and Bonyaricall Creek.   **Other project works:**   * Containment Banks: Approximately 2.7 kilometres in Area One, 1.4 kilometres in Area Two, 0.2 kilometres in Area Three and 0.7 kilometres in Area Four of containment bank to be constructed by raising existing access tracks to enable water to be held to the design level. Alignment of these containment banks has been selected to utilise existing tracks where possible. * Spillways: Approximately seven spillways 20 m in length to be incorporated in to the construction of small regulators and containment banks. They would include rock beaching with concrete sills and would be trafficable. * A channel between Lake Powell and Lake Carpul was being investigated as part of the design process and has been considered in specialist reports for this referral. Works on this channel are no longer expected to be required and so it has not been included in the proposed area of impact (i.e. construction footprint) however it has been included in the project area of investigation for completeness. In the unlikely event that this were to change further investigations would be carried out to avoid and minimise removal of native vegetation.   **Regulator design**  The following design philosophy for regulators has been applied:   * The regulating structures are designed to allow natural flows to pass unhindered, to and from the floodplain when the structures are not in use (fully open). * The arrangement of regulating structures and containment banks have been developed to minimise the potential for erosion over the whole range of flow conditions. * The regulating structures would be designed to provide safe downstream fish passage in accordance with the recommended design criteria for native fish contained in the project Fish Management Plan   Table 4 summarises the design specifications for the regulators.  **Table 4. Summary of regulator design specifications**   |  |  |  |  | | --- | --- | --- | --- | | Regulator | Open/ close/ regulator flow | Proposed design (number (No.), width (W) x height (H) in mm | Proposed gates | | **ER1** | Regulate | 7 No. 2000W x 6500H 1 No. 1000W x 6500H (adj. fishway) 1 No. 2000W x 3950H | Split Leaf gates | | **ER3** | Open/ close | 6 No. 2000W x 4300H 1 No. 2000W x 3950H | Split Leaf gates | | **S7** | Open/ close | 6 No. 2000W x 3000H | Split Leaf gates | | **J1a (1) (2)** | Open/ close | 4 No. 1800W x 2100H | Penstock | | **J1b** | Open/ close | 2 No. 1200W x 1000H | Penstock | | **J1d** | Open/ close | 2 No. 1800W x 1950H | Penstock | | **J1e** | Open/ close | 2 No. 1200W x 1350H | Penstock | | **J1f** | Open/ close | 2 No. 1200W x 700H | Penstock | | **J1c** | Open/ close | 3 No. 1200W x 1050H | Penstock | | **J1g** | Open/Close | 1 No.1800W x 1200H 1 No. 1200W x 1200Hx | Penstock (Downstream), Bulkhead (Upstream) | | **Lake Powell Regulator** | Open/ close | 5 No. 1800W x 1800H | Penstock | | **Lake Carpul Regulator** | Open/ close | 1 No. 1800W x 100H | Penstock |   **Pumping infrastructure design**  Permanent pump infrastructure is not included in the design. However, as described above three pump hardstand areas are proposed to enable the setup of temporary pumping infrastructure to deliver environmental water. Two on the Murray River (upstream side of Regulator ER3 and J1g) and one on Bonyaricall Creek for delivery of water to Lake Powell. The hard stands would comprise a gravelled surface, which is adjacent to the pipeline inlet arrangement. The hard stands would all be located on Crown Land.  Temporary pump infrastructure would include a trailer-mounted (diesel) rig with a suction pipe extending into the Murray River and Bonyaricall Creek. While the frequency and duration of pumping would depend on actual inundation events and the method to achieve environmental watering targets, it is expected that pumping may be needed at least two years in every 10 years, for a period of several weeks.  **Fish passage**  The project includes provision for fish passage through regulator bays, across the spillways, and across the containment bank and natural ground when submerged. A vertical slot fishway is proposed to provide fish passage at the proposed ER1 regulator at the downstream end of Area One. No fishways are proposed at ER3 and S7 large regulators however, passive fish passage has been provided when the gates are open. A Fish Management Plan has been prepared for the project and was considered in developing the design and operating requirements.  The design of all other regulators allows for movement of fish directly through the regulator structure. Small regulator structures would be operated either in fully open or fully closed position. When water is released with the regulator gate in fully open position, fish have passage through the regulator both in managed release and natural flood scenarios. Structures have been designed to have flow velocities appropriate for fish passage (as determined through O’Connor et. al, 2015).  Water will generally enter the upper reaches of Narcooyia Creek under pumped conditions and so the potential for fish passage under these conditions is low. Under natural flooding conditions there will be unobstructed access for fish across all regulators (as they would be fully open in large floods) (ARI, 2018).  **Structures to be decommissioned**  The project may also include the decommissioning of the existing regulator on Narcooyia Creek. The footprint of the existing structure has been included in the construction footprint as the location is known, however the access track to be used if decommissioning is required has only been included in the area of investigation, as it is likely only minor trimming and vegetation clearance work would be required to provide access. The requirement for decommissioning of this structure and associated access would be confirmed as the project progresses. |
| **Ancillary components of the project** (eg. upgraded access roads, new high-pressure gas pipeline; off-site resource processing): |
| **Containment banks / access tracks**  Almost all of the containment banks would be built on the alignment of existing access tracks. Once the containment bank has been constructed, the tracks would be reinstated on top of the bank with a gravel surface. The containment banks would provide operator access to the regulators. A few short lengths of non-trafficable bank may be required at tie in locations where the bank needs to match the natural creek bank.  Access track dimensions on containment bank crests are still to be confirmed in consultation with Parks Victoria but would generally be consistent with Parks Victoria access track design and maintenance guidelines. For containment bank/access tracks the construction footprint provides a 10 m buffer around containment banks and a 5 m wide corridor along existing access tracks to carry out construction and maintenance works.  The locations of the proposed containment bank and access tracks are shown in **Attachment 2 – Project structures, construction and access**. Some of the existing tracks would need to be upgraded as part of the project and in some cases construction of new, short access tracks are required (access to regulators ER3, S108 and S109). The extent of proposed works would be refined following outcomes from geotechnical investigations, complex cultural heritage assessment (as part of the Cultural Heritage Management Plan) and ground truthing. Section 12 (Native vegetation, flora and fauna) of this referral identifies the extent of vegetation within the access tracks. Design and construction of the final access tracks would need to comply with the mitigation measures as outlined in Part 2, Section 18 (Environmental management) of this referral.  **Maintenance**  Maintenance would need to be undertaken to existing access tracks to ensure they are suitable for use during construction and operation. This would involve grading and applying additional road base to the surface. Where required, maintenance works post construction would be undertaken by Parks Victoria as the land manager.  **Borrow pits/quarry sites**  Construction of the project would require the import of material (clay/rock). 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 cleared private land outside of Belsar and Yungera Islands, while also avoiding and minimising environmental impacts. Once the locations are confirmed, the permits and approvals required for establishing new quarry/borrow sites or expanding existing sites would be sought. |
| **Key construction activities:** |
| Construction activities would occur within the area identified in the construction footprint map (**Attachment 2 – Project structures, construction and access**). Construction activities would include:   * Establishment of construction sites, including lopping or 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* (this was due to commence on 1 July 2020 however has now been postponed until 1 July 2021 (or earlier by proclamation) due to the COVID-19 emergency).  An Environmental Management Plan (EMP) would be prepared for the works and would detail the measures to avoid and minimise impacts during construction. Once the construction of regulators, stop banks and all associated works is complete, all waste and spoil would be removed from the sites and disposed of as required by the EMP.  **Construction in the Murray River**  There would be no construction of works within the Murray River.  A portion of the temporary suction lines associated with the temporary pump stations would be located in the Murray River. The hard stands and temporary pumps would be located above the top of bank of the Murray River and therefore not within the river.  There is also potential for decommissioning works associated with the existing block bank on Narcooyia Creek that separates the creek from the river. The requirement for, and extent of this work would be confirmed during the design process.  **Construction laydown areas**  The proposed construction footprint includes a working area (10 m for proposed structures and 3 m for proposed containment banks, laydown areas and minor work sites) around the development footprint for proposed infrastructure to accommodate movement of vehicles and machinery and some limited storage of equipment and materials.  Temporary construction laydown areas are proposed as follows:   * ER1 – one area located to the north east of ER1, and a second area proposed to the south east of ER1 * ER3 – Located to the South west of ER3   These two sites have been selected to provide the primary location for site offices, vehicle parking, storage of equipment and materials, etc. and have been included in the development and construction footprint assessed in this referral.  **Project area 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 proposed works are designed to facilitate managed inundation of the floodplain over four inundation areas at different operating levels. The proposed works are intended to inundate areas of the Belsar-Yungera floodplain with inflows from the Murray River or with additional pumping when required.  Under the proposed operating regime, water would enter from the west along Narcooyia Creek after entering from the Murray River through the proposed ER3 regulator. Structures ER3, ER1, and S7 isolate a large section of Narcooyia Creek from the Murray River and hold water up to 52.3 m AHD in Inundation Area One. The downstream regulator at J1a in Inundation Area Two is then used to retain water at an additional higher tier within the J1 creek area up to 52.9 m AHD. At high flows, water passes through J1c and J1g regulators in inundation Area Three into J1 Creek. The Lake Powell and Lake Carpul regulators in Inundation Area Four are designed to retain water within the lakes. Both lakes would be inundated by water pumped from Bonyaricall Creek through a 1.8 kilometre long pipeline between the creek and Lake Powell. During natural events and releases from managed events, water then passes through the ER1 regulator, traveling west to re-join the Murray River.  The sources of water for managed inundation are:   * Gravity inflow from the Murray River through the ER3 Regulator * Pumped inflow from the Murray River * Gravity inflow via overland flow.   The method of draining the floodplain would be managed through release from regulators at specified/ controlled release rates. The proposed structures would be operated to achieve environmental watering targets under four scenarios:   * Normal flow conditions (when no environmental watering is occurring) - the water level in Narcooyia Creek would be managed by a fixed crest in one bay of ER1 and ER3 regulators, to maintain a minimum level of 48.35 m AHD to support irrigation diversions. This would be consistent with the existing weir height, to avoid a reduction in level of service and to minimise social impacts. * Minor flood peaks - Narcooyia / Bonyaricall Creek system would be operated as a through-flow system. When river levels exceed ER3 regulator’s capacity, the Narcooyia Creek inlet and outlet regulators would be opened. This would meet the water level requirements of the Narcooyia Creek diverters while increasing channel velocity and providing free movement of aquatic fauna between the creek and the river. * Moderate to large flood peaks - Narcooyia / Bonyaricall Creek system would be operated to increase the duration of wetland floodplain inundation. Regulators at the perimeter of the ponded areas, including ER1, S1, S7 and ER3, would remain open as water levels rise to allow the system to fill. The regulators would be closed when river levels start to fall to store water at the target level, up to limits of the regulators: 52.3 m AHD at Area 1 and 52.9 m AHD and 53.3 m AHD in the J1 Creek system. Water would be detained to meet the duration requirements of environmental targets, then returned to the Murray River by opening ER1 regulators. ER3 regulator would be closed to restore the regulated pool in Narcooyia Creek for irrigation supply. Under these conditions, the fishway at ER1 regulator would be in operation to allow fish to enter and exit the inundation areas. * Pumped events – If peaks in river flow are too infrequent to meet environmental watering targets, part or all of the managed inundation area may be flooded by temporary pumping of water from the Murray River. Temporary pumps would be installed on the river bank to fill the primary inundation area and may be relifted to fill the Lake Powell and Lake Carpul or the J1 Creek system. Pumping rates ranging between 40 ML/ d of 200 ML/d are proposed. |
| **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 or the relevant land owner/manager. |
| **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). |
| As discussed previously, in 2005-2006 an emergency environmental watering program was initiated on the Belsar and Yungera Island over a three year period as an immediate response to the poor condition of the floodplain. Environmental watering of Lake Powell and Lake Carpul was also undertaken in 2011-2012, ending an 18 year dry period for the lakes. The ecological response was significant, with waterbird activity recorded at the lakes for the first time since 1992 and condition of fringing River Red Gum and Black Box improved. Aquatic vegetation establishment in the lake bed was also significant (Mallee CMA, 2014).  An Environmental Water Management Plan (Mallee CMA, 2010) was developed for Belsar and Yungera Islands Floodplain Management Unit in 2010. The plan identified ecological objectives and hydrological targets for the Belsar-Yungera complex consistent with Ecological Associates (2014) and recognised the requirement for infrastructure to better manage the inundation regime. These ecological objectives and targets have been refined as part of the VMFRP MER Plan (ARI, 2020) and have been adopted for the Belsar-Yungera Floodplain Management Project.  No further stages for constructing environmental watering infrastructure are currently proposed at Belsar and Yungera Island floodplain beyond the current project. |
| **Is the project related to any other past, current or mooted proposals in the region?** |
| 🗙 No 🗙Yes If yes, please identify related proposals. |
| The Belsar-Yungera Floodplain Restoration Project is one of nine discrete environmental works sub-projects being undertaken as part of the VMFRP, which is being implemented as part of Victoria’s obligations under the Basin Plan. The VMFRP aims to return a more natural inundation regime across more than 14,000 hectares of high ecological value Murray River floodplain in Victoria through the construction of new infrastructure and modification of existing infrastructure.  A summary of the nine sub-projects in order from east (upstream) to west (downstream) along the Murray River floodplain is provided in**Table 5**.  **Table 5 Summary of VMFRP projects**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Project | Proposed Floodplain Inundation Area | CMA | LGA | Implementing Authority | Bioregion | | Gunbower | 500 hectares | North Central | Campaspe  Gannawarra | GMW | Murray Fans | | Guttrum and Benwell | 1,270 hectares  660 hectares | North Central | Gannawarra | GMW | Murray Fans | | Vinifera | 350 hectares | Mallee | Swan Hill | LMW | Murray Fans | | Nyah | 476 hectares | Mallee | Swan Hill | LMW | Murray Fans | | Burra Creek | 403 hectares | Mallee | Swan Hill | LMW | Murray Fans (small area of Murray Mallee) | | Belsar-Yungera | 2,374 hectares | Mallee | Swan Hill | LMW | Robinvale Plains (small area of Murray Mallee) | | Hattah Lakes North | 1,130 hectares | Mallee | Mildura | LMW | Robinvale Plains (small area of Lowan Mallee & Murray Mallee) | | Wallpolla Island | 2,672 hectares | Mallee | Mildura | LMW | Murray Scroll Belt | | Lindsay Island | 5,108 hectares | Mallee | Mildura | LMW | Murray Scroll Belt |   The VMFRP is being implemented by a partnership between LMW, GMW, Mallee CMA, North Central CMA, Parks Victoria and the DELWP, and is funded by the Commonwealth Department of Agriculture, Water and Environment (DAWE). LMW is the project proponent.  Further details of these projects are available at: <https://www.vmfrp.com.au/>  Separate referrals are being prepared for each of these sub-projects under the *Environment Effects Act 1978* and the *Environment Protection and Biodiversity Conservation Act 1999.* |
| **What is the estimated capital expenditure for development of the project?** |
| $47.6 M, including all development, construction and management activities. |

# Project alternatives

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| **Brief description of key alternatives considered to date** (eg. locational, scale or design alternatives. If relevant, attach A4/A3 plans):  **Do nothing (maintain status quo)**  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. This deterioration has been well documented and has prompted the emergency watering measures previously described. * Forego an opportunity to deliver long-term positive impacts to areas that are ecologically significant at a local, regional, national, and international 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 Basin. Refinements can be considered in finalising the design to respond to environmental and heritage assessment and any stakeholder or landholder requirements. Alternatives could include minor re-alignments of banks and siting of structures to avoid and minimise impacts. However, consideration of fundamental project alternatives which would result in a lesser area of targeted EVCs being watered would compromise Victoria's ability to achieve the required SDL offset.  **Proposed project** |
| Planning and design of the project over an extended period of time has considered a range of alternatives to achieve the specific ecological objectives described in Section 3 (Project description: Aims/objectives of the project) of this referral. This has involved numerous studies over the last decade to evaluate and refine water management options to identify the most effective and efficient design for environmental watering of the Belsar and Yungera Island floodplain. This optimised design seeks to maximise the benefits of the project, whilst minimising construction impacts. Key investigations that informed and considered project design alternatives (are summarised below.  **2007 Water Management Feasibility Investigations**  Six water management options for the Belsar Yungera floodplain including Lakes Powell and Carpul, were investigated under the *Water Management Feasibility Investigation* (Ecological Associates, 2007). Each option is summarised in Table 6 below.  **Table 6 Summary of investigations by Ecological Associates (2007)**   |  |  |  | | --- | --- | --- | | Option | Description | Evaluation | | **One** | Removal of blockage in Bonyaricall Creek | * Current embankment provides access to pumps, however reducing hydraulic efficiency of creek and fish passage. Proposed to install a box culvert. * Identified as a high priority option * Extent of benefit[[3]](#footnote-4) - 600 hectares * Highest environmental benefit score out of the two high priority options * Not costed | | **Two** | Box culvert and culvert to allow fish passage past the weir on Narcooyia Creek | * Install a box culvert and construct a culvert that allows fish passage past the weir on Narcooyia Creek * The site was not inspected, and the costs were not provided. * Given that the drop over the weir is small and that the creek provides habitat for native fish, it was recommended that this option should be considered. | | **Three** | Decommission Narcooyia Creek as an irrigation supply channel and relocate the pumps to the main river channel. | * Would allow water levels in the system to be regulated so that flow peaks could be held on adjacent terraces and water levels could be lowered intermittently. * Potential to include Bonyaricall Creek in the option | | **Four** | Lower and regulate threshold to Carp Hole wetland | * Would allow the wetland to be inundated at a lower river flow threshold. * Identified as a high priority option * Extent of benefit3 - 57 hectares * Lowest environmental benefit score out of two high priority options | | **Five** | Regulate flood water in the Yungera Creek wetland complex | * A site inspection and review of the LiDAR revealed that this wetland system has more than 4 connections to the Murray River at similar flow thresholds, so that multiple structures would be required to retain water. * Works would be complex and expensive and are disproportionate to the potential benefit to the wetland. Option was recommended to not be considered further. | | **Six** | Promote flooding on Belsar Island | * Inundation of the central depression on the Island could occur at a lower river flow threshold than at present, providing an increase in frequency and duration of inundation for this area. * Review of LiDAR revealed that several connections are active at similar thresholds, making detention of water within this depression complex and costly. Option was recommended to not be considered further. |   In 2010 the Mallee CMA formalised environmental water planning at Belsar and Yungera Islands through the Belsar and Yungera Islands Floodplain Management Unit Environmental Water Management Plan.  Following on from the Ecological Associates (2007) investigations, a fish survey including barrier identification and assessment was also undertaken to inform potential water management options for the site (GHD, 2009 and GHD, 2011).  **Functional Design phase, Preferred Options Paper (GHD 2013a)**  The preferred options paper identified two key options for floodplain management of Belsar and Yungera Islands. The first of these options involved a single tier with flooding options focussing on supply of floodplain and creek flows and flowing habitat in Yungera Island. The second option was for a two-tiered flooding system to include additional floodplain engagement flows on Yungera Island. Option one was selected as the preferred option for further development with recommendation around secondary works focussing on additional impacts to the flooding extent and efficiencies in flow transfer within the system provided.  The Preferred Options Paper included primary and secondary integrated options across the broader floodplain and interconnecting high value wetlands. Primary options developed included two major regulators on Narcooyia Creek and/or Bonyaricall Creek (ER1 and ER3) and one major regulator on Yungera Creek (S7). The option also included a range of associated works to manage breakouts and improve flow efficiency including four regulatory/crossing combination structures, channel works to interconnect Narcooyia Creek overflow into the Lake Powell inflow channel and potentially also Lake Powell to Lake Carpul, and associated levee and track raising works. Six primary options were proposed in this wide scale overview of the floodplain including:   * Three options considering top water levels (51.8 and 52.3 m AHD) * Three options considering the location of ER1, including mid-way along Bonyaricall Creek and two sites on Narcooyia Creek, upstream of the confluence with Bonyaricall Creek.   The preferred primary option from this study targets an inundation level of 52.3 m AHD and results in inundation of an area of 2,093 hectares, by placing a regulators (ER1) just upstream of the confluence of Narcooyia and Bonyaricall Creeks. A number of secondary options we also selected for inclusion in the works. These included complementary works at Lake Carphole, Lake Carpul, Lake Powell and J1 Creek.  **Belsar-Yungera Floodplain Management Project Functional Design Report (GHD 2013b)**  Building on from the preferred primary and secondary options (GHD, 2013a), a functional design was developed for water management opportunities at Belsar and Yungera Island and the surrounding floodplain areas.Development of the functional design was supported by a series of on-ground investigations including survey, geotechnical works, flora and fauna surveys and cultural heritage to provide site design parameters. The designs considered both the ecological benefit and cost effectiveness of each option and focused on minimising impacts of works at the larger structure sites. Prior to the commencement of design, aspects of the primary and secondary options were refined to address identified site specific issues. Table 7 provides a summary of the key primary and secondary options for which functional design was developed.  **Table 7 Summary of proposed infrastructure works for Belsar-Yungera (GHD 2013b)**   |  |  | | --- | --- | | Option | Description | | **Primary option** | * Inundate to 52.3m AHD. * Designed to enable watering of floodplain under low river flows through the use of pumped inflows. * Three large regulators (ER1, ER3 and S7). * ER1 regulator and fishway to be located on Narcooyia Creek directly upstream of Bonyaricall Creek, removing the need for multiple large structures. * Channel works to interconnect Narcooyia Creek overflow into the Lake Powell inflow channel. * Support structures required to enable the primary option to operate. * Option would improve or remove some current flow obstructions. | | **Secondary options** | * Provide for the greatest potential to achieve a mosaic of hydrological regimes, habitat types and efficiencies across Belsar and Yungera Islands and adjacent floodplain areas. * J1 creek lower catchment works provides more extensive outlet works at two existing barriers and additional inundation in the lower to mid J1 Creek area (52.9 m AHD target). * J1 Creek upper catchment works provides opportunities for additional inundation in a small area at the upper end of the J1 Creek (53 m AHD target). * A new two kilometre pipeline from Bonyaricall Creek to Lake Powell to enable independent filling of Lake Powell and Lake Carpul through temporary pumping. * A low-level culvert across the Murray valley Highway with invert level of 50.8m AHD to improve flow connectivity into Lake Powell. * Gating the existing culverts and the Murray Valley Highway to counteract the reduced commence to flow (through the new culvert) and also to provide improvements to control the duration of floods entering the system. * Consideration of lowering the invert of the channel from Lake Powell to Lake Carpul, to assist the filling of Lake Carpul. |   **Fish Passage Workshop (Hames, F. 2014)**  A fish passage workshop was coordinated by Mallee CMA on 16 July 2014. Fish ecologists, land and catchment managers and engineers present agreed on the key opportunities for fish at each site, discussed any issues with respect to fish passage and connectivity and provided guidance on engineering design considerations and development of a Fish Management Plan for the project. The following recommendations were made for the design of the Belsar-Yungera project:   * A vertical slot fishway was recommended for ER1 regulator to manage fish passage during operation of the works through Narcooyia Creek providing connection back to the River Murray * Explicit fish passage was recommended at ER3 * Smaller regulators to be designed to provide passive fish passage.   **SDL Phase 2 Assessment Supply Measures Business Case: Belsar-Yungera Floodplain Management Project (Mallee CMA, 2014)**  As part of the design process for the Business Case, concept design drawings were developed and provided in the *Belsar-Yungera SDL Adjustment Supply Measures Advanced Concept Design Report* (GHD, 2014). The concept design was informed by the preliminary design primary and secondary options and further geotechnical assessment (GHD, 2013c) and Hydraulic Modelling (Jacobs, 2014) that had been undertaken.  The proposed works used natural flow paths to increase the extent, frequency and duration of inundation from either Basin Plan flows or pumping during low flow events. Watering would inundate approximately 2,374 hectares of floodplain mimicking flows of 110,000 to 170,000 ML/ day. For the Business Case, the inundation area was divided into four management areas (**Table 8**) which are consistent with those inundation areas described in Section 2, Project Location.  **Table 8 Summary of inundation areas and design components considered in the Business Case (Mallee CMA, 2014).**   |  |  |  |  | | --- | --- | --- | --- | | Area | Main components | Area of inundation (hectares) | Water level (m AHD) | | **One** | * ER1 incorporating a fishway, ER3 and S7 regulators * Eight supporting structures comprising minor regulators and track raising sections   + Additional works including:   + Two hard stands for temporary pumps * Track raising of Belsar Road to provide access to private pump infrastructure | 1,532 | 52.3 | | **Two** | * Two main regulators at the downstream end of the creek (J1a structure) * Five supporting structures to manage breakout areas. * Two levees either side of the J1a structure | 524 | 52.9 | | **Three** | * One main regulator at the downstream end of the J1 Creek (J1c regulator) * A single regulator/crossing at the upstream end of the creek, adjacent to the River Murray confluence (J1g culvert) * A hard stand for a temporary pump adjacent to the J1c regulator | 36 | 53.3 | | **Four** | * A two kilometre pipeline between Narcooyia Creek and Lake Powell and temporary pump to facilitate inundation of Lake Powell and Lake Carpul * A regulator and levee structure on the southern side of the Murray Valley Highway to retain water and release impounded water * A new culvert across the Murray Valley Highway to increase the flow capacity for natural high flows to enter and exit the lakes | 278 | 52.6 |   **2017 Belsar Yungera SDL Adjustment Supply Measures - Advanced Concept Design Report (GHD, 2017)**  An advanced concept design was developed by GHD (2017) which revised the previous concept design as presented in the Business Case. The revised concept design was based on supplementary design investigations completed throughout 2016 including incorporation of field survey, further geotechnical investigations, revised design requirements from stakeholders such as GMW Murray Water and hydraulic modelling of the fishway.  Where possible, the aim of design criteria was to align new infrastructure with previously cleared areas or existing access tracks, to minimise disturbance to vegetation and areas of potential cultural heritage significance, based on the results of supporting technical studies. Where this was not possible, the design objective was to minimise the design footprint where feasible. Fish passage objectives were also included in the design criteria for the large regulators.  The key revisions made to previous concept designs are summarised in **Table 9**.  **Table 9 Revisions made to previous concept designs for the Advanced concept design (GHD, 2017)**   |  |  | | --- | --- | | Revision to previous concept design | Description | | Containment bank freeboard and crest increase | * Increase of freeboard to include an additional 100 mm for the compacted bank and a 5% (approx.) allowance for crossfall in the width of construction footprint. * Increased crest width from four m to five m to conform with Class 5D track type as per the Parks Victoria Design Manual. | | ER1 containment bank | * Realignment of the southern containment bank at structure ER1 to avoid private property. | | ER1 fishway design | * Incorporate results of fishway hydraulic modelling in required cell geometry and design of the fishway entrance. | | ER3 regulator | * Design of irrigator pipeline and environmental pipeline and pump hard stand. | | J1g regulator | * Design of a hard stand for a temporary pump arrangement, providing a secondary location for delivering water to all four inundation areas. | | Lake Powell pipeline | * A new alignment following route previously used for temporary pumping reducing area of impact. Length refined to 1.8 kilometres. | | Revisions to access tracks | * Minor changes to several locations of access tracks based on ground truthing of site values (e.g. native vegetation) and minimising the impact. | | Lake Carpul regulator | * A small regulator structure would be constructed south of Lake Powell within the cutting to prevent Lake Carpul being drawn down too quickly following an environmental watering event. | | Minor earthworks | * Minor earthworks within the existing drainage line between Lake Powell and Lake Carpul to provide improvement of hydraulic efficiency, therefore reducing the duration to fill Lake Carpul to the target inundation level. |   **2019/2020 Project refinements**  The project design as developed in 2018 is currently being refined further by R8. Findings from on-site assessments particularly ecology fieldwork have progressively fed into the design, with modifications made to avoid and minimise environmental impacts.  The key refinements of the design to date have included:   * Refinement in location and number of small regulators required to enable smaller breakouts to be contained within the system * Minimising containment bank width to reduce the construction footprint * Altering the alignment of some of the containment banks / access tracks to avoid areas of high ecological value * Selecting areas for construction laydown to avoid areas of high ecological value   This work is ongoing and refinements would continue based on the outcomes of the approvals and design process. |
| **Brief description of key alternatives to be further investigated** (if known)**:** |
| No alternatives to the project are being further investigated. Both the Feasibility Assessment and Business Case for this project have been approved by the Commonwealth government and included extensive documentation of the alternatives investigated. These documents drew upon investigations carried out through the options development phase, which were undertaken with a view to minimising impacts on the ecology and heritage values of the sites whilst maximising the area to receive benefit from watering. The project needs to maintain the targeted area of inundation to ensure that Victoria can achieve its required contribution to the SDL offset committed under the Basin Plan.  Design of the proposed structures, access tracks and construction laydown areas would continue to be refined through the design process to respond to environmental and heritage assessments, and stakeholder / landowner requirements. |

# Proposed exclusions

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| **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 this assessment. |

# Project implementation

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| **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 sub-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:   * The Commonwealth Environmental Water Holder and the MDBA 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 below.  **Figure 3 Project implementation, Source: Parks Victoria, 2018 from VEWH, 2016.** |
| **Implementation timeframe:** |
| Construction is anticipated to commence in December 2022 and to be complete by June 2024. |
| **Proposed staging** (if applicable): |
| Not applicable. |

# Description of proposed site or area of investigation

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| **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 Belsar-Yungera floodplain complex is located approximately 30 kilometres upstream of Euston Weir, near Robinvale in north-west Victoria. The floodplain complex comprises Belsar and Yungera Islands, which are formed by anabranches of the Murray River, including Narcooyia, Bonyaricall and Yungera creeks. On the southern limit of the Belsar-Yungera floodplain lie two large ephemeral wetlands, Lake Powell and Lake Carpul.  The floodplain is at the western limit of the Murray Fans bioregion, and consists of a mosaic of aquatic and terrestrial vegetation communities and habitat types, which support a wide variety of flora and fauna species (Mallee CMA, 2014).  **Geomorphology, topography and landform**  The majority of the project area is located in the Murray Basin geological unit, within the Northern Riverine Plain (NRP) geomorphic division. The Northern Riverine Plain is an extensive alluvial plain associated with the Murray River and its tributaries. The Murray River exhibits prominent meander features along its course. This process subsequently results in the formation of areas of sandy beaches or point bars, scroll plains, oxbow lagoons and billabongs which are evident upon the floodplains adjacent to the Murray River (GHD, 2015).  The Belsar-Yungera floodplain complex is relatively flat with elevations ranging between about 51 m AHD near the Murray River to about 60 m AHD in near the Murray Valley Highway.  **Wetlands, waterways and drainage**  Narcooyia Creek defines the southern side of Belsar and Yungera Islands. It diverges from the Murray River upstream of Yungera Island and returns to the river downstream of Belsar Island. Bonyaricall Creek branches from Narcooyia Creek near its downstream end. It is six kilometres in length and joins the Murray River to create Tonsing Island.  Lakes Powell and Carpul are large floodplain lakes located south of Bonyaricall Creek. Lake Powell naturally fills at its northern end when high flows spill from Bonyaricall Creek into along a narrow floodway. Lake Carpul fills primarily from overflows from Lake Powell when water levels exceed 52.3 m AHD.  Due to the effect of Euston Weir, rising river flows inundate upstream areas of the Belsar-Yungera floodplain before the downstream areas. Water first enters the floodplain at the downstream connection of Yungera Creek when river discharge exceeds 16,000 ML/d. Ecological Associates (2006) derived median flows in natural and existing conditions based on 114 year MDBC Bigmod data as summarized in **Figure 1** in Part 1, Section 3 (Project description) of this referral.  The natural pre-regulation hydrology of Murray River was characterised by frequent inundation at Belsar-Yungera, with flooding persisting for an average of three months. Changed river operations has resulted in a decline in the condition and productivity of the floodplain due to the reduced flood frequency and durations.  **Groundwater**  The Belsar-Yungera project is located in the Murray Geological Basin. This basin was infilled with sediments during the Tertiary and Quaternary period. The groundwater environment and current conditions of the shallow aquifer systems shows a series of aquifer layers present at the site, to a depth of approximately 300 m below ground.  The shallow groundwater hydrogeological conditions at the site can be described as:   * The alluvial aquitard: floodplain clays and silts that are part of the contemporary floodplain and the recent geological past. * The Channel Sands Aquifer: an Upper Tertiary, fine to coarse grained sand aquifer in direct connection with the Murray River and likely the Narcooyia, Bonyaricall and Yungera Creeks. * 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 is thinner to the east side of the project area and closer to the Murray 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 (R8, 2020a).   Groundwater salinity at the site is interpreted to range from about 500 mg/L to around 13,000 mg/L. Fresher water is adjacent to the river and saltier water graduating inland and toward Lakes Powell and Carpul. The interpreted distribution of salinity is shown in **Figure 4.**  Groundwater flow is generally to the west and north-west, parallel to the Murray River. In some cases, there would be flow toward the Murray River. Local flow cells are possible that may change the local flow direction.    **Figure 4 Interpreted groundwater salinity for Belsar-Yungera (source - R8, 2020a)**  **Salinity**  Soil and groundwater salinity at the site is at low to moderate levels. Soil salinity has been mapped for the site and for the riverine corridor in the area by airborne electromagnetic surveys (AEM). The project falls in the Robinvale to Boundary Bend AEM survey area (Cullen et al., 2008).  **Figure 4** shows the interpreted salt loads in the area from the AEM survey. It can be seen from this figure that the soil salt store is considered low for this region. The risk of salinity mobilisation from either the soil surface or from shallow groundwater returning to the Murray River is also considered low (R8, 2020a).    **Figure 5 Interpreted salt store in the unsaturated zone for the project area (R8 2020a, originally from Cullen et al. 2008)**  **Vegetation and habitat**  The Belsar-Yungera floodplain complex covers as area of approximately 8,300 hectares of waterways, wetlands, lakes and floodplain boasting a diversity of mammals, reptiles and fish, including some threatened and significant species and more than 630 indigenous plant species.  The Belsar-Yungera floodplain complex comprises a highly diverse natural environment, where the riverine and lower Murray floodplain environments integrate. The mosaic of aquatic and terrestrial vegetation communities support a wide variety of flora and fauna species. The complex also provides important longitudinal connection to the Murray River and its floodplains, creating essential biodiversity corridors to allow species dispersal between environments vital to their life cycles (Mallee CMA, 2014).  The vegetation of Belsar and Yungera Islands is dominated by Lignum Shrublands and Black Box Woodlands EVCs. River Red Gum Woodland and Forest EVC is present along watercourses and in meander loops along the Murray River. The vegetation of Lakes Powell and Carpul is distinctive, supporting Lake Bed Herblands EVC on the lake floor and Mallee and Woodland EVC present at the lake fringes (Ecological Associates, 2014).  Further detail on the flora and fauna present within the Belsa-Yungera floodplain complex 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): |
| The proposed construction footprint has a total area of approximately 17.3 hectares for structures and containment banks and an additional 27.7 hectares for access tracks.  The proposed inundation area is estimated to be approximately 2,374 hectares.  (Refer to **Attachment 2 – Project structures, construction and access** and **Attachment 3 – Managed Inundation Area)**. |
| **Route length** (for linear infrastructure) ……………… (km) **and width** ………………..(m) |
| N/A |
| **Current land use and development:** |
| The project area is comprised of both Crown land and freehold land. Much of the Crown land is associated with Lake Powell and Lake Carpul Nature Conservation Reserve and the Murray Reserve. These are owned and managed by Parks Victoria.  Freehold land within the project area is situated on the floodplain to the north of the Murray Valley Highway. Much of this land (8 allotments) is affected by agreements, caveats or conservation covenants which prevent subdivision and require the land to be used for conservation purposes. The freehold land includes a number of existing access tracks which are proposed to be utilised by the project. Additional information on land ownership and use is provided in **Attachment 7 – Land Use and Planning Assessment**.  The region supports a range of recreational activities such as camping, fishing, canoeing, trail-bike riding and horse riding. The area also forms part of the Murray River Trail which provides direct access to the Murray River for water-based activities and river camping or caravanning.  The project is within the Murray Darling and Swan Hill wine region of Victoria. The industry of the region spans from Lake Charm near Kerang in the southeast all the way to Piangil in northwest Victoria, and across the border to Toolybuc in southern NSW. Almost all vineyards in the Robinvale area are irrigated from the Murray River or its tributaries. |
| **Description of local setting** (eg. adjoining land uses, road access, infrastructure, proximity to residences & urban centres): |
| The project is located approximately 15 kilometres southwest of the township of Robinvale on the Murray River in Victoria. Robinvale has a population of around 3,500 people (ABS, 2016) and is a key recreational area of the region, located on one of the most user-friendly stretches of the Murray River for water activities.  The regional area around Robinvale, extending from Mildura south of the Murray River, is well known for its large irrigated fruit and vegetable farms and vineyards. The Euston Weir and Lock 15 south of the town provide the water storage that supports irrigated farming in the region. Narcooyia Creek and Bonyaricall Creek are managed as irrigation channels for water users in the creeks’ middle and upper reaches to the south of the project area.  Directly north of Robinvale, on the other side of the Murray River, is the town of Euston, NSW. Euston is a small service centre with a population of approximately 840 people. Grape growing and other fruit and nut farming are the main industries for the town and surrounds. Euston is the gateway to Balranald, Yanga National Park, the World Heritage listed Willandra Lakes and Mungo National Park.  The regional towns of Mildura and Swan Hill are both approximately 90 kilometres north-west and south-east of the project.  The project is accessible from the Murray Valley Highway which is the main arterial road running north-south connecting the townships along the Victorian side of the Murray River from as far as Robinvale to Echuca. The road is managed by Regional Roads Victoria. Other significant land use attributes of the investigation area and surrounds include:   * Belsar and Yungera Islands are located within the Mallee / Sunraysia Irrigation Area * Six apiary sites are located on Belsar and Yungera Islands * Murray Darling and Swan Hill wine region Murray River Trail. |
| **Planning context** (eg. strategic planning, zoning & overlays, management plans):  A desktop land use planning assessment has been prepared and is provided in **Attachment 7** – **Land Use Planning Assessment.**  **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 **Attachment 7 – Land Use and Planning Assessment.**  Zones and overlays  The following zones and overlays 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 Projection Overlay (Schedule 1 – Remnant Vegetation (VPO1) * Land Subject to Inundation Overlay (LSIO) * Bushfire Management Overlay (BMO)   Refer to **Attachment 8 – Planning Zones & Overlays Maps.**  Planning permit triggers  In accordance with the controls identified in Table 10 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 10 Summary of potential planning permit triggers**   |  |  |  |  | | --- | --- | --- | --- | | Swan Hill Planning Scheme | Planning approval | | | | **Planning control** | **Use** | **Building and works** | **Vegetation removal** | | ***Zones*** | | | | | 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 (Schedule to the Land Subject to Inundation Overlay) (LSIO) | NA | Y | N | | Clause 44.04 Bushfire Management Overlay (BMO) | NA | N | N | | ***Particular provisions*** | | | | | Clause 52.17 Native Vegetation | NA | NA | Y | | Clause 52.29 Land Adjacent to a Road Zone, Category 1, or a Public Acquisition Overlay for a Category 1 Road | NA | Y | NA |   ***Referral authorities***  Notice and referral requirements potentially triggered by the project are described in **Attachment 7 – Land Use Planning Assessment**. The following referral authorities are identified:   * DELWP in relation to the removal of native vegetation under Clause 52.17 (recommending referral authority), VPO1 and development in the ESO1 on public land managed by DELWP (determining referral authority) * Mallee CMA as the relevant floodplain management authority for development in the LSIO (recommending referral authority) * GMW in relation to development in the ESO1 in proximity to GMW assets on waterways (determining referral authority) * Country Fire Authority for development other than an application to construct a building or carry out works associated with a dwelling, within the BMO (determining referral authority) * Regional Roads Victoria as the relevant road authority for development in the Murray Valley Highway under Clause 52.29 (determining referral authority).   **Relevant strategies and management plans**  The following Mallee CMA strategies and plans provide land use and planning objectives and plans for action associated within the region that includes the project area:   * Mallee Regional Catchment Strategy 2013-2019 * Mallee Waterway Strategy 2014-2022 * Mallee Floodplain Management Strategy 2018-28 * 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 proposed works would involve installing temporary pump stations on the Murray River within Areas One and Three. The permanent hard stands for the pump stations and the temporary pumps would be located in Victoria and the temporary suction lines would extend into the Murray River in NSW.  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 proposed suction lines for the temporary pump stations are defined as part of a ‘water reticulation system’. The works would occur on land that is zoned W1 Natural Waterways under the *Balranald Local Environmental Plan 2010* (Balranald LEP). Environmental protection works are the only activity that is permitted without development consent within the W1 zone (**Attachment 8 – Planning Zones & Overlays Maps**).  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. Review of the key environmental planning instruments (see **Attachment 7 – Land Use Planning Assessment**) that are relevant to the proposed works indicate that the project is permissible with the consent of the Balranald Shire Council under clause 126A of the State Environmental Planning Policy (Infrastructure) 2007. A development application would need to be submitted to the Balranald Shire Council as the consent authority and this would need to be supported by a Statement of Environmental Effects that addresses section 4.15 of the NSW EP&A Act. |
| **Local government area(s):** |
| Swan Hill Rural City Council  A small part of the project area associated with the temporary pumping station (suction line only) is in the NSW local government area of Balranald. |

# Existing environment

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| **Overview of key environmental assets/sensitivities in project area and vicinity** (cf. general description of project site/study area under section 7)**:** |
| Key environmental assets of the project and broader area relate to ecological assets supported within the Belsar-Yungera floodplain complex.  The Belsar-Yungera floodplain complex comprises 8,300 hectares, dominated by low-lying River Red Gum forest and woodland and semi-permanent wetland habitat. It supports an array of flora and fauna array of flora and fauna as the site has complex and diverse habitat; due to the integration of two environment types, the central River Red Gum forest and the lower Murray floodplain. Among the most important values at the site are the intact remnants of River red gum (*Eucalyptus camaldulensis*) and Black Box (*Eucalyptus largiflorens*) communities associated with Lakes Powell and Carpul and the Narcooyia and Bonyaricall Creeks (Mallee CMA 2014).  The Belsar-Yungera floodplain complex contains, or has the potential to contain, the following fauna species of conservation significance:   * 29 species listed on the DEPI advisory list of rare or threatened fauna in Victoria. * 31 species listed under the FFG Act including fish, bushbirds, waterbirds, bats and reptiles. * 21 species listed under the EPBC Act – 16 of these are also listed under the FFG Act. Yungera Island and adjacent Peacock Creek (NSW) is one of the largest known breeding locations for the Regent Parrot (*Polytelis anthopeplus monarchioides*) (vulnerable EPBC) (Ecological Associates, 2014)   The vegetation communities of the Belsar-Yungera floodplain are distributed across the floodplain according to hydrological conditions, soil types and salinity gradients. A total of 15 EVCs, plus non-EVC waterbody, have been modelled within the inundation area and of these 12 are water dependant and therefore would be targeted for restoration through this project:   * Floodway Pond Herbland * Shallow Freshwater Marsh * Spike-sedge Wetland * Grassy Riverine Forest / Floodway Pond Herbland Complex * Intermittent Swampy Woodland * Lignum Swamp * Lignum Shrubland * Lignum Swampy Woodland * Riverine Grassy Woodland * Riverine Chenopod Woodland * Shrubby Riverine Woodland * Lake Bed Herbland   One of these water dependent EVCs, Riverine Chenopod Woodland, is endangered and a further six vulnerable in the Murray Fans Bioregion: Lake Bed Herbland, Lignum Swamp, Lignum Swampy Woodland, Riverine Grassy Woodland and Shallow Freshwater Marsh (Ecological Associates, 2014). Lignum Swampy Woodland is the most widespread EVC within the floodplain complex.  The three remaining EVCs modelled within the inundation area are dryland communities and include Chenopod Mallee, Loamy Sands Mallee and Semi-arid Chenopod Woodland. However, the vegetation mapping for the Inundation Area has been ground-truthed and the on-ground inspection confirmed that these areas had been incorrectly mapped, with Semi-arid Woodland and Mallee vegetation only observed at higher elevations above the floodplain where environmental water will not penetrate during periods of inundation.  In addition, the EVC mapping includes area classed as Bare Rock/Ground, which is neither inundation or non-inundation dependent.  Part 2, Section 12 (Native vegetation, flora and fauna) of this referral provides further information on the ecological values of the project area.  In addition to its ecological values, the Belsar-Yungera floodplain also contains the following social and cultural values:   * Cultural and historical values: Numerous archaeological investigations on the Belsar-Yungera floodplain have been conducted since 1966, all recording significant Aboriginal archaeological sites (Jo Bell Heritage Services Pty Ltd, 2013). The Belsar and Yungera Islands and the associated floodplain form part of a highly sensitive region for Aboriginal cultural heritage values, including evidence of past Aboriginal occupation. Archaeological occurrences commonly include stone artefact scatters, hearths and earth ovens, shell middens, scarred trees, and burial sites, some of which regularly occur in association with each other (e.g. hearths and artefact scatters). * Social and recreational values: The Belsar-Yungera floodplain forms part of the River Murray Reserve, which is highly valued for recreational activities including camping, fishing, canoeing, trail-bike riding and horse riding (Mallee CMA, 2014).   Part 1, Section 15 (Social environments) of this referral provides further information on social and cultural values of the project area. |

# Land availability and control

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| **Is the proposal on, or partly on, Crown land?** |
| 🗙 No 🗙Yes If yes, please provide details. |
| The proposed construction and inundation areas are located on Crown land within Lake Powell, Lake Carpul Nature Conservation and the River Murray Reserve.  Crown land parcels associated with the area of investigation are reserved under the *Crown Land (Reserves) Act 1978*. All parcels, with the exception of one, are reserved as ‘Permanent Public Purpose’. One parcel is also reserved as ‘Temporary Forest’. Another Crown land parcel is reserved only for the ‘Permanent Management of Wildlife’.  Licences for a purpose other than what the land is reserved may be required under the Act.  Existing access roads and access tracks to be used by the project are located on Crown land comprised of either Government Road or land managed under the *National Parks Act 1975*.  The location of Crown land affected by the project is shown in **Attachment 9 – Land Tenure Map**. |
| **Current land tenure** (provide plan, if practicable): |
| Current land tenure includes Crown land comprised of natural features reserve (River Murray Reserve) and government road, and some freehold parcels. Further details on land tenure, including affected land parcels is provided in **Attachment 7 - Land use and Planning Assessment**. Affected parcels would be reviewed and updated if needed based on final design. |
| **Intended land tenure** (tenure over or access to project land): |
| The project does not propose any changes to current land tenure. |
| **Other interests in affected land** (eg. easements, native title claims): |
| A search of the National Native Title Tribunal online register and maps shows:   * No current native title applications under the *Native Title Act 1993* (Cwth) apply over the area of investigation. * No previous native title claims have been determined under the *Native Title Act 1993* (Cwth) in relation to land within or adjacent to the area of investigation. * No current applications or registered agreements under the *Traditional Owner Settlement Act 2010* (Vic) apply over land within the area of investigation. * No Indigenous Land Use Agreements cover the area of investigation and inundation area.   **Other Interests**  Belsar-Yungera Island and the Murray River in this region support other land use and activities as described below.   * The project is located within the Mallee/Sunraysia Irrigation area as defined by the DELWP. * Narcooyia Creek and Bonyaricall Creek that span across the Belsar - Yungera floodplain complex are managed as irrigation channels for water users in its middle and upper reaches to the south of the project site (GHD, 2012). This irrigation supports the extensive viticulture and fruit and vegetable farming within this area of the Sunraysia region. * Current public data indicates the location of six apiary sites located across the Belsar and Yungera Islands. The hives are part of annual licence agreements that are dependent on seasonal flowing of River Red Gum forests. * The project is within the Murray Darling and Swan Hill wine region of Victoria. The industry of the region spans from Lake Charm near Kerang in the southeast all the way to Piangil in northwest Victoria, and across the border to Toolybuc in southern NSW. Almost all vineyards in the Robinvale area are irrigated from the Murray River or its tributaries. * The Murray River Reserve and Lake Powell and Lake Carpul Nature Reserves, along with surrounding Crown land is managed by Parks Victoria. The area is highly valued for recreation activities such as camping, fishing, canoeing, trail-bike riding and horse riding. * The Belsar-Yungera floodplain complex also forms part of the Murray River Trail for tourism and recreation purposes. It provides direct access to the Murray River for water-based activities and river camping or caravanning. |

# Required approvals

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| **State and Commonwealth approvals required for project components** (if known):  The following Victorian State and Commonwealth referrals, notifications and approvals are likely to be required for the project:  **Commonwealth**   * Referral to the Minister for the Environment under the EPBC Act to determine whether the project is a controlled action requiring formal assessment and approval under the Act (concurrent to this referral). * Notification of a ‘future act’ under the *Native Title Act 1993* for activities on Crown land that may affect native title rights and interests. * Notification of the MDBA of a proposal which may affect the flow, use, control or quality of any water in the upper Murray River 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 (this is happening concurrent to the referral). * Planning approval 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.* * Approval from Parks Victoria / Minister for Environment, Energy and Climate Change under section 27 of the *National Parks Act 1975.* * Licence to take and use water (s51) and licence to construct works (s67) to take water from Lower Murray Water under section 51 of the *Water Act 1989.* * Works on waterways permit from Mallee CMA under the *Water Act 1989.* * 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* * *Water* Act *2007*   ***Victorian***   * *Catchment and Land Protection Act 1994* * *Crown Land (Reserves) Act 1978* * *Environment Protection Act 1970 (or Environment Protection Act 2017 post 1 July 2021)* * *Fisheries Act 1995* * *Heritage Act 2017* * *Land Act 1958* * *Parks Victoria Act 2018* * *Roads Management Act 2006* * *Wildlife Act 1975*   ***NSW***   * *Aboriginal Land Rights Act 1983* * *Biodiversity Conservation Act 2016* * *Crown Lands Management Act 2016* * *Environmental Planning and Assessment Act 1979* * *Fisheries Management Act 1994* * *Heritage Act 1977* * *Local Land Services Act 2013* * *Maritime Safety Act 1998* * *NSW Vegetation SEPP* * *National Parks and Wildlife Act 1974* * *Protection of the Environment Operations Act 1997* * *Water Management Act 2000* |
| **Have any applications for approval been lodged?** |
| 🗙 No 🗙Yes If yes, please provide details. |
| No applications for approval of the project have been lodged to date. |
| **Approval agency consultation** (agencies with whom the proposal has been discussed): |
| The VMFRP is managed by a partnership team comprised of LMW, GMW, North Central CMA, Mallee CMA and Parks Victoria. Each of these agencies are represented on the VMFRP Program Control Group, but also have a separate regulatory approvals function for the VMFRP projects. DELWP Water is the Program Owner. DELWP also has a separate regulatory approvals function for the VMFRP sub-projects.  As part of broad stakeholder engagement activities undertaken between 2012 and 2014 to support the Belsar-Yungera Floodplain Management SDL 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 Project was presented to the TAG at a meeting held on 8 August 2019.  The Approvals TAG meets regularly to discuss the VMFRP program and provides strategic advice and reviews across the entire program. In addition, a Design TAG operates concurrently which has representation from the following:   * VMFRP * GMW * Parks Victoria * North Central CMA * Murray-Darling Basin Authority * DELWP * LMW * SA Water * Mallee CMA |

PART 2 POTENTIAL ENVIRONMENTAL EFFECTS

# Potentially significant environmental effects

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| **Overview of potentially significant environmental effects** (identify key potential effects and comment on their significance and likelihood, as well as key uncertainties): |
| An assessment of the potential construction and operational impacts of the project has been undertaken and is detailed in Parts 12 – 16 of this referral form. Key potential effects are summarised below in accordance with the *Ministerial guidelines for assessment of environment effects under the Environment Effects Act 1978* (Department of Sustainability and Environment, 2006).  **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 and targeted ground-truthing. Refer **Attachment 5 – Flora and Fauna Assessment**.  Construction  Efforts have been made to avoid and minimise impacts to native vegetation throughout the project planning and design process. Impact avoidance and minimisation measures include:   * Locating infrastructure (for example embankments) on top of existing vehicle tracks and other previously disturbed areas. The embankments would continue to be used as vehicle access tracks. * Minimisation of bank height (freeboard) to the minimum height required to retain functionality, after considering wear and wave impacts. This minimises the size of the embankment footprint. * Minimisation of bank crest width to achieve the relevant track design speed. * Adopting the steepest batter slope which still meets embankment stability and road safety requirements (3H:1V) in order to minimise the footprint of the structure   Locating potential temporary construction laydown areas in previously disturbed areas and areas of lower habitat quality. As part of the detailed design and approvals process, the project will undertake micro-siting of all containment banks and structures to determine the least impact siting of the works in order to minimise native vegetation and heritage impacts.  Despite the measures taken to avoid and minimise impacts to native vegetation it is not feasible to construct the required infrastructure without removing native vegetation. Requirements for vegetation removal would be further assessed and minimised through the detailed design process.  The approach taken to the estimation of vegetation impacts is conservative and involves two main components, (1) vegetation impacted for project infrastructure, and (2) vegetation impacted for access:   * Up to 25.54 hectares of vegetation (including an allowance for tree protection zones (TPZ) may be impacted by the 17.3 hectare construction footprint for project infrastructure (including structures, containment banks, hardstands and laydown areas). These areas have been subject to ecological field investigation. The actual development footprint of infrastructure is approximately 10 hectares (without any buffer areas applied) and hence it is expected there will be further opportunity to avoid and minimise vegetation clearance associated with construction, and to rehabilitate areas of the construction footprint following completion of construction. The current area estimate for native vegetation impact includes tree protection zones (tree canopies). These extend beyond the construction footprint boundary – especially along the containment banks. Some trees (and the associated area of canopy) outside of the construction footprint are also currently included in the impact area estimate based on potential encroachment within the TPZ. Actual impacts on TPZs would be determined in the subsequent design phase following arborist advice. * Up to 24.81 hectares of native vegetation may be impacted including to make existing access tracks suitable for construction access. This area has been derived assuming a 5 m wide track with vegetation loss calculated using modelled EVC data. Part of this area would consist of the existing access tracks, which have been previously cleared. The nature of works and the extent of impact on native vegetation will vary. The specific scope and requirement for works along access tracks is still to be confirmed. Works are expected to include maintenance activities such as grading and drainage, road base placement and formation of access tracks, lopping of trees, and tree removal where necessary. An assessment by an arborist is proposed to assess potentially impacted trees within the construction footprint and along access tracks, and to advise on methods by which they could be retained.   The combined estimate of impact on native vegetation is up to 50.35 hectares (25.54 + 24.81) including 368 large trees (refer to **Table 11**).  Additional details on the potential vegetation impacts are provided in section 12, including the vegetation communities proposed to be impacted.  It is noted that the vegetation communities to be impacted by construction are water dependant (refer to **Table 11**). Infrastructure construction and access related impacts on these communities are small when weighed against the significant benefits that these vegetation communities will derive from environmental watering. For example, the construction of infrastructure would require impacts to an estimated 0.33 hectares of vulnerable EVC Spike-sedge Wetland (EVC 819). Approximately 2.04 hectares of this EVC is modelled to occur within the inundation area and, as a water dependant EVC, is expected to receive long term benefits from the proposed inundation.  From a landscape perspective the proposed construction footprints represent a comparatively small area within the ~ 8,300 hectares of floodplain complex at Belsar-Yungera, and compared to the 2,374 hectare inundation area.  Operation  The proposed inundation targets eight specific water regime classes on the Belsar-Yungera floodplain: Watercourses, Semi-permanent Wetlands, Red Gum Forest and Woodland, Lignum Shrubland and Woodland, Black Box Woodland, Floodplain Lake, Mallee and Plains Forest and Woodlands. The required frequency and duration of flooding for each water regime class targeted for restoration by the project, has been determined through a series of studies undertaken by Ecological Associates (2006, 2007, 2014, 2015) by analysing where each vegetation community associated with the water regime class occurred on the floodplain (mapped extent, elevation range) supported by hydrological modelling (Gippel, 2014; Jacobs, 2017) to determine the Murray River flow threshold that would have flooded these elevation ranges under natural, pre-regulation conditions.  EVCs modelled as present within the inundation area are mostly swampy or riverine vegetation communities that require or are tolerant of inundation and would therefore benefit from the project. Two non-inundation dependent communities are mapped as receiving environmental water comprising three EVCs: Chenopod Mallee (EVC 158), Loamy Sands Mallee (EVC 91) and Semi-arid Chenopod Woodland (EVC 98). However, targeted ground-truthing of vegetation mapping in this part of the inundation areas has confirmed that these communities have been incorrectly mapped, with Semi-arid Woodland and Mallee vegetation only observed at higher elevations above the floodplains where environmental water will not penetrate during periods of inundation.  The Arthur Rylah Institute (ARI) is currently developing a Monitoring, Evaluation and Reporting (MER) Plan designed to collect baseline condition data that will enable ongoing condition monitoring to be undertaken across the site to confirm the gains in the health and condition of native vegetation within the inundation area that are expected from the proposed environmental watering, and inform adaptive management.  **Potential impacts on listed threatened species and communities and migratory species**  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 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. Refer **to Attachment 5 – Flora and Fauna Assessment**.  Listed threatened communities  One EPBC Act-listed threatened ecological community, *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions*, is consistent with EVC 98 Semi-arid Chenopod Woodland which has been modelled as occurring within the inundation area. This community is also associated with the FFG Act-listed flora community Semi-arid Shrubby Pine-Buloke Woodland Community. A field assessment conducted in June 2020 confirmed that there is no Semi-arid Chenopod Woodland present within the inundation area (where modelled by DELWP), and no vegetation present in the construction footprint is consistent with the EPBC listed community: *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions.* Therefore it is considered unlikely that the construction or operation phases of the project will impact any EPBC or FFG Act listed flora community.  Listed threatened flora species  Construction  No EPBC Act-listed flora species are considered likely to occur or be impacted by either the construction works or proposed inundation. The inundation area has been assessed at a desktop level only, however, it considered unlikely that flora species listed under the EPBC Act would be present within the inundation area (refer to likelihood of occurrence assessment in Appendix D of **Attachment 5 – Flora and Fauna Assessment**)  Five species listed as threatened under the FFG Act are located within the construction footprint and may be directly impacted during construction:   * Yarran(*Acacia melvillei*) * Umbrella Wattle(*Acacia oswaldii*) * Woolly Scurf-pea(*Cullen pallidum*) * Tough Scurf-pea(*Cullen tenax*) * Spotted Emu-bush(*Eremophila maculata subsp. maculata*).   Twenty-two flora species listed under the DELWP advisory list for threatened flora were identified during the recent surveys and have the potential to be impacted by the proposed works.  Operation  The VBA search identified 101 flora species listed under the EPBC Act, FFG Act and/or the DELWP Advisory list for rare or threatened species within the area of inundation. Altering the hydrological regimes in the project area may cause minor negative impacts to some terrestrial species, particularly for flora that have adapted to drying conditions. However, impacts are likely to be short term during inundation events, or through changes in water quality, and it is considered unlikely that the proposed environmental watering will have a negative impact on the ongoing survival of any populations of listed flora that may be present in (or that may colonise) the area of inundation. It has been illustrated in recent studies within Hattah-Kulkyne National Park that re-instating the natural flooding regime has positively influenced flora and fauna species, including rare and threatened species. It is expected that if these species were present, any impacts resulting from the operational phase of the project would be positive to neutral.  Listed threatened fauna species  Twenty-three FFG Act and/or EPBC Act listed fauna species have the potential to occur within the construction footprint and or inundation area. Of these, one EPBC and FFG Act listed species was observed within the area of investigation during recent surveys; the Regent Parrot (*Polytelis anthopeplus monarchoides*), and one other species is known to occur; Murray Cod (*Maccullochella peelii peelii*). An additional three EPBC Act listed species are considered possible to occur within the construction footprints and be impacted: the Painted Honeyeater (*Grantiella picta*), Growling Grass Frog (*Litoria reniformis*) and Silver Perch (*Bidyanus bidyanus*).  The Regent Parrot, is known to breed in the Belsar-Yungera area of investigation, and was regularly observed at many sites and was identified as potentially nesting within the construction footprint of five sites (ER3, S108, S7, ER1 and Bonyaricall Creek hard stand). These sites were targeted during the peak breeding season for specific surveys using tailored methods for the detection of nesting of this species. A total of 37 surveys were completed in 2019, and despite much general activity by this species in these areas, no breeding was detected. It is likely that Regent Parrot nesting colonies exist within 150 m of the construction footprint at S108 on the Gearbox Loop Trail, however none of these sites would be directly impacted by the proposed works. Impacts to Regent Parrots are expected to be non-significant, and would include losses or modification to a relatively small area (a maximum of 50.35 ha) of low quality potential foraging habitat located in disturbed areas and centred on existing tracks, compared to the broader ~8,300 ha of potential feeding habitat across the Belsar-Yungera floodplain complex habitat. Indirect impacts through disturbance at this and the other four sites containing potential Regent Parrot nesting habitat (ER3, S7, ER1 and Bonyaricall Creek hard stand) is possible, however based on previous experience during the Hattah Lakes TLM project (where works occurred at sites within two well-known Regent Parrot breeding colonies and involved vegetation clearing including large hollow-bearing tree removal), it is highly unlikely that the proposed works would impact on the any nearby nesting Regent Parrots should they occur. Where practicable construction activities at these sites would be completed outside of the breeding season.  Murray Cod have also been recorded previously in the area of investigation and Silver Perch have the potential to occur. It is noted that current conditions are likely to allow for entry to the waterways of the Belsar-Yungera complex but without a fishway their ability to exit to the Murray River is limited; fish that currently enter the system can only re-enter the Murray River during over-bank flows. A key mitigation measure to minimise this risk is to develop a native fish exit strategy. These species have the potential to occur at any of the wetland sites on the Murray River or major creeks, and localised impacts are possible. A construction specific aquatic fauna management plan would be developed for all works around waterways and contain measures to address potential impacts associated with coffer dam construction, dewatering works and potential for sediment/contaminant run-off. With these mitigation measures, impacts are considered unlikely.  The proposed inundation is likely to be beneficial to both the Murray Cod and Silver Perch with the degree of benefit depending on the inundation scenario and operational regime. Inundation of floodplain habitat during the operational phase has a high likelihood of increasing carp populations within wetland habitat and also in aquatic habitat that remains following flood events. Increasing carp populations can be detrimental to native fish, including Murray Cod and Silver Perch, as they compete for habitat and food sources favoured by large-bodied native fish. Key mitigation measures relating to carp could 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. Water quality risks associated with return flows wold be managed through the EWMP and Operatiing Plan including water quality monitoring to be carried out before, during and after watering events to inform adaptive management strategies and real-time operational decision making.  Painted Honeyeater is considered to have potential to utilise habitats within the proposed construction area and broader inundation area. This species has not been previously recorded within 10 km of the construction footprints, but may occasionally forage in these woodland areas. The proposed construction footprints are however not likely to significantly impact any areas of important habitat to this extremely mobile nomadic species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts.  Growling Grass Frog was last recorded within 10 km of the construction footprint in 1959 and was not recorded in targeted surveys of potential habitat in 2012, 2013 and 2019. Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this.  None of these species are considered likely to be significantly impacted by the proposed construction activities or inundation.  Migratory species  Reinstating historical environmental flows within the Belsar-Yungera floodplain complex would improve the quality of habitat present. Such enhancements correspond to increased productivity of the swamp forest communities, increased vegetation diversity and structure from more dominant drought-tolerant species and increase the overall health and integrity of the area, which will likely improve breeding, foraging and refuge resources for listed Migratory species, such as the Curlew Sandpiper (*Calidris ferruginea*) and Sharp-tailed Sandpiper (*Calidris acuminata*).  Eleven species listed as migratory under the EPBC Act were identified as having the potential to occur within the construction footprint, and inundation area. Most of these species are either highly unlikely to occur (e.g. Eastern Curlew) or would very rarely use airspace over these footprints (e.g. Fork-tailed Swift). 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. Long-term effects on the habitat 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.  **Impacts on aquatic ecosystems, surface water and groundwater quality**  Belsar Island is listed under the Directory of Important Wetlands of Australia. The project aims to reinstate a more natural inundation regime to the Belsar-Yungera floodplain complex, which is expected to deliver a range of ecological benefits to the floodplain environment. 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. Direct impacts to the wetland associated with construction works would relate to a comparatively small area (50.42 hectares / 0.61%) of the broader floodplain complex of 8,300 hectares.  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 waterways, spoil, sediment and erosion control chemicals and fuels.  Water quality risks (including saline discharge) associated with operation of the project, including return flows 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 TLM Program. Key measures relating to water quality would include implementing a monitoring program to measure inflows / outflows and water quality during events and releases, to facilitate timely identification of potential water quality issues, which would inform the adaptive management of such events to mitigate potential impacts on beneficial uses.  The nature and extent of changes to groundwater levels and quality during managed inundation would be identified through implementation of a monitoring bore network and adaptively managed through refinement of Operating Plans and EWMPs and in consultation with MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria. It is noted that as the project area has a low to moderate salt store and generally fresh to moderately saline groundwater, salinity issues are regarded as being low risk to the identified beneficial uses.  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. To minimise potential effects, the project is designed to prioritise use of natural flood inflows rather than additional pumping of water directly from the Murray River. On completion of a managed inundation event, the project would release managed floodwaters back to the Murray River via Bonyaricall Creek, except for water losses due to infiltration and evaporative processes during retention on the floodplain.  **Impacts on land use and amenity**  The project supports both state and local planning policy, particularly in relation to the protection and enhancement of biodiversity, waterbodies and wetlands and significant landscapes of the area. The project intention of improving the health of these riverine environments will also support the economic development of the region which is already focused on tourism-based nature-based activities associated with ecological values.  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 public access along O’Connor Lane at the north of the site through to the intersection of the Murray Valley Highway, and Paul Lane which would be impacted during construction. These impacts are only temporary in nature, and access would be re-opened to the public following construction.  The nearest residences are located 100 m from the southern extent of the construction footprint (Lake Powell Pipeline), off the Murray Valley Highway and also along Belsar Road in the vicinity of the proposed Belsar Road raising. These residents may experience some additional noise, dust and traffic during construction, with these effects being typical of construction projects and well understood. Modelling indicates that temporary pumping activities are not likely to exceed relevant Victorian or NSW noise criteria during operation of the project.  The project provides the opportunity for improved amenity and recreational opportunities either during or following inundation events. VMFRP would work with project partner Parks Victoria to evaluate the impacts and opportunities associated with site access and visitor use for varying levels of inundation.  **Impacts on landscape**  The project would involve some removal of native vegetation and alteration of landforms within areas supporting state and regional landscape values, specifically in 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 access tracks and embankments. These are discrete areas total around 0.6% (50.35 hectares) of the largely intact expanse of native vegetation occurring within ~ 8,300 hectares of floodplain complex at Belsar-Yungera. The construction footprint accounts for 25.54 hectares of this vegetation, but as the development footprint of the infrastructure is only around 10 ha there are opportunities to further avoid and minimise vegetation clearance and to rehabilitate the construction footprint following completion of construction. The remaining 24.81 hectares is located along existing tracks, where in some instances track works may only require lopping or trimming to enable construction vehicle access.  Design of proposed structures would be sympathetic to the surrounding landscape and consistent with Parks Victoria infrastructure design guidelines. Operation of the project is expected to have a positive effect on the landscape values of surrounding riverine and floodplain environments due to the 2,374 hectares of the floodplain complex and floodplain vegetation communities that are expected to benefit from the project.  **Impacts on heritage values**  The project has potential to impact on both known and previously unregistered Aboriginal heritage places within the project area. The potential for these impacts (both direct and indirect), including those associated with inundation, 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 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 Traditional Owner 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), World Heritage List, National Heritage List, Commonwealth Heritage List or Swan Hill Heritage Overlay are located within or adjacent to the proposed construction footprint or inundation area. 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. The presence of unregistered historic archaeological sites that may be directly impacted by construction would be determined through field survey and managed in accordance with the *Heritage Act 2017*.  **Borrow sites**  VMFRP is in the process of identifying and evaluating possible borrow pits to source required construction materials. The nature and extent of potential impacts associated with establishment or expansion 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 as close as possible to the project, on private land within previously cleared areas. |

# Native vegetation, flora and fauna

## Native vegetation

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| **Is any native vegetation likely to be cleared or otherwise affected by the project?**  🗙 NYD 🗙 No 🗙 Yes If yes, answer the following questions and attach details. |
| **What investigation of native vegetation in the project area has been done?** (briefly describe) |
| A review of relevant databases and previous studies was undertaken as part of the Flora and Fauna Assessment – Belsar-Yungera (R8, 2020b) (refer to **Attachment 5 – Flora and Fauna Assessment**) to identify native vegetation and listed flora and fauna species with potential to occur in the construction footprint and inundation areas. The review considered previous records and predicted occurrences of vegetation communities.  The following databases and previous reports were used:   * Protected Matters Search Tool (PMST) for the Commonwealth EPBC Act 1999, maintained by DAWE * Victorian Biodiversity Atlas (VBA), maintained by the DELWP * NatureKit. Spatial database maintained by DELWP, for native vegetation (Ecological Vegetation Class) mapping throughout Victoria * The Native Vegetation Information Management tool (NVIM), maintained by DELWP * Weeds of National Significance database, * Hattah North and Belsar Yungera Islands Flora Census (Australian Ecosystems 2013) * Preliminary Ecological Investigations. Belsar and Yungera Island Water Management Functional Design Phase GHD (2013) * Fauna Survey. Hattah North & Belsar Yungera GHD (2014) * Mallee Sustainable Diversion Limit: Belsar & Yungera Islands - Flora & Fauna Assessment, Ecology Australia (2016) * SDL Fish Management Plan – Belsar-Yungera – Management plan prepared by DELWP (2018)   In addition, **Attachment 5 – Flora and Fauna Assessment** also describes additional work completed by R8 in late 2019 to early 2020:   * Additional field surveys in October and November 2019, and January 2020, including mapping of the extent and condition of native vegetation and targeted surveys to assess the presence of threatened flora and fauna species listed under the Commonwealth EPBC Act and/or Victorian FFG Act within the construction footprint. Fieldwork was based on the proposed construction footprint at the time of these investigations. As design has evolved in some areas since this date, some areas have been subject to desktop assessment only. Modelled EVC and habitat data has been used to inform assessment of impacts in these areas. Further fieldwork is proposed to address these gaps in vegetation mapping. * Desktop assessment of flora and fauna values within the inundation area and targeted ground-truthing of areas mapped as non-water dependent EVCs and gaps in mapped vegetation. |
| **What is the maximum area of native vegetation that may need to be cleared?**  🗙 NYD Estimated area …………50.35 (hectares) |
| The proposed native vegetation impact for the project is up to 50.35 hectares (inclusive of the tree protection zone for each large tree within the construction footprint), within an extensive (approximately 8,300 hectares) surrounding area of high-quality native vegetation.  Of this 50.35 hectares, 25.54 hectares (including allowance for tree protection zones) is potentially impacted by the 17.3 hectare construction footprint for proposed structures, containment banks, hardstands and laydown areas. The actual development footprint of infrastructure is approximately 10 hectares and hence it is expected there will be further opportunity to avoid and minimise vegetation clearance associated with construction and to rehabilitate areas of the construction footprint following completion of construction.  The remaining 24.81 hectares are associated with potential upgrade and maintenance works along existing access tracks, which have been estimated based on a 5 m wide corridor. The project would utilise some existing access tracks which have been mapped as native vegetation due to overhanging canopies. Some access tracks would require upgrading involving removal, lopping and/or trimming of adjacent native vegetation to facilitate the proposed construction. The proposed overall loss of vegetation, 50.35 ha, equates to approximately 2% of the area proposed to benefit from environmental watering.  Some potential minor project works associated with access to the small regulator on Narcooyia Creek have been considered in the area of investigation but not within the construction footprint as the need for any works is not known. If required, these works would have a footprint of around 0.02 ha. Potential works on the channel between Lake Carpul and Lake Powell were assessed in the area of investigation as part of an earlier design, but are now not expected to be required and so have not been included in this estimate. |
| **How much of this clearing would be authorised under a Forest Management Plan or Fire Protection Plan?**  🗙 N/A …………… …………. approx. percent (if applicable) |
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| **Which Ecological Vegetation Classes may be affected?** (if not authorised as above)  🗙 NYD 🗙 Preliminary/detailed assessment completed. If assessed, please list. |
| **Construction footprints**  **Table 11** identifies the EVCs mapped within the construction footprint and along access tracks that would be potentially impacted by the construction of infrastructure (all within the Robinvale Plains Bioregion).  Vegetation within infrastructure areas has been ground-truthed during the field surveys, however this did not include an on-ground assessment of the vegetation and fauna habitat present along all proposed access tracks. As impacts to existing access tracks have not been confirmed, an assumed track width of five metres was applied and the modelled vegetation condition data has been used to generate an estimate of vegetation proposed to be impacted along tracks.  In addition, 368 large old trees have the potential to be impacted by the proposed construction activities. Impacts to these trees may range from no, or minor impact, through to lopping or removal to allow for access (to be confirmed via arborist assessment).  **Table 11 EVCs to be impacted by the project within the project construction footprint**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **EVC No.** | **EVC** | **Conservation Significance** | **Area (hectares)** | | | Infrastructure | Existing Tracks | | 106 | Grassy Riverine Forest | Depleted | - | 0.06 | | 813 | Intermittent Swampy Woodland | Depleted | 4.57 | 12.22 | | 808 | Lignum Shrubland | Least Concern | 5.40 | 2.32 | | 823 | Lignum Swampy Woodland | Depleted | 2.80 | 0.50 | | 103 | Riverine Chenopod Woodland | Depleted | 0.94 | 0.63 | | 295 | Riverine Grassy Woodland | Depleted | 0.78 | 0.62 | | 818 | Shrubby Riverine Woodland | Least Concern | 0.56 | 0.56 | | 819 | Spike-sedge Wetland | Vulnerable | 0.33 | - | | 086 | Woorinen Sands Mallee | Depleted | 10.16 | 7.90 | | Total | | | 25.54 | 24.81 |   The proposed works would impact up to 0.33 hectares of vegetation classified as vulnerable (Spike-sedge Wetland (EVC817)), 47.33 hectares of vegetation classified as depleted and 2.69 ha of vegetation classified as least concern. However it is anticipated that any impacts to EVCs associated with the proposed works, will be greatly outweighed by the benefits and improvements that EVCs will achieve through environmental watering within the Inundation Area. The Inundation Area is expected to cover 2,374 hectares of Belsar-Yungera and will directly benefit 155.45 hectares of vegetation classified as vulnerable, 1,531.79 hectares of vegetation classified as depleted and 529.63 hectares of vegetation classified as least concern. The proposed overall loss of vegetation, 50.35 hectares, equates to approximately 2% of the area proposed to benefit from environmental watering.  Figure 4 in **Attachment 5 – Flora and Fauna Assessment** shows the location of the EVCs within the construction footprint and access tracks.  The mitigation measures outlined in Part 2 (Environmental management) of this referral would therefore assist in minimising and avoiding impacts to this EVC.  **Inundation**  The following EVCs are modelled to occur within the inundation areas. The environmental watering is proposed to deliver the preferred hydrological regime for native vegetation communities within the proposed inundation areas, accordingly native vegetation within the proposed inundation areas is expected to benefit from the project rather than be adversely impacted.  Two non-water dependent communities are mapped as receiving environmental water. These comprise three EVCs: Chenopod Mallee (EVC 158), Loamy Sands Mallee (EVC 91) and Semi-arid Chenopod Woodland (EVC 98). Vegetation mapping for the inundation areas was ground-truthed in June 2020, which confirmed that these areas had been incorrectly mapped, with Semi-arid Woodland and Mallee vegetation only observed at higher elevations above the floodplain where environmental water will not penetrate during periods of inundation. An area of 70.49 hectares with no EVC data available within the inundation area (refer **Table 12**) was also ground-truthed during this field assessment. The surveys found no non-water dependent EVCs within the unmapped area.  **Table 12 EVCs modelled by DELWP as occuring within the inundation area**   |  |  |  |  | | --- | --- | --- | --- | | EVC number | EVCs | Conservation significance | Modelled EVC extent within inundation area (hectares) | | N/A | Waterbody - Fresh | N/A | 56.36 | | N/A | Bare Rock/ Ground | N/A | 21.63 | | 200 | Floodway Pond Herbland | Vulnerable | 21.38 | | 810 | Shallow Freshwater Marsh | Depleted | 8.75 | | 819 | Spike Sedge Wetland | Vulnerable | 2.04 | | 106/810 | Grassy Riverine Forest / Floodway Pond Herbland Complex | Depleted | 9.25 | | 813 | Intermittent Swampy Woodland | Depleted | 116.43 | | 104 | Lignum Swamp | Vulnerable | 152.82 | | 808 | Lignum Shrubland | Least Concern | 505.52 | | 823 | Lignum Swampy Woodland | Depleted | 879.37 | | 295 | Riverine Grassy Woodland | Depleted | 1.02 | | 103 | Riverine Chenopod Woodland | Depleted | 374.56 | | 818 | Shrubby Riverine Woodland | Least Concern | 24.11 | | 107 | Lake Bed Herbland | Depleted | 129.78 | | 158 | Chenopod Mallee | Vulnerable | 0.001 | | 91 | Loamy Sands Mallee | Least Concern | 0.002 | | 98 | Semi-arid Chenopod Woodland | Vulnerable | 0.59 | |  | Area of unmapped EVC\* (water dependent) | N/A | 70.49 | | **TOTAL** | | | **2,374.08** | |
| \* An area where EVCs have not been mapped is due to gaps in spatial data on a state-wide scale. This area was ground truthed in June 2020 and no non-water dependant EVCs were identified.  **Have potential vegetation offsets been identified as yet?**  🗙 NYD 🗙 Yes If yes, please briefly describe. |
| As described above, a total of up to 50.35 hectares of native vegetation is proposed to be removed within the construction footprint. **Attachment 5 – Flora and Fauna Assessment** contains a preliminary estimate of offset requirements.  Offsets would be sought in accordance with the requirements of the *Guidelines for removal, destruction or lopping of native vegetation* (DELWP, 2017b) or through an alternate arrangement agreed with the Secretary to DELWP, such as 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 seeking a conservation exemption or confirming this offset approach 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) |
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NYD = not yet determined

## Flora and fauna

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| **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 5 – Flora and Fauna Assessment** contains a review of previous ecological studies undertaken for the project and updated database and mapping searches to identify flora and fauna potentially occurring in the project area. A summary of the methods and findings of previous ecological studies, as well as of the studies carried out by R8 (R8, 2020b) is provided in **Table 13**.  **Table 13 Ecological assessments for the study area**   |  |  |  | | --- | --- | --- | | Report | Methods | Key findings | | **DELWP (2018) SDL Fish Management Plan – Belsar-Yungera. Plan for Mallee CMA** | * Review of existing information. * Review of proposed SDL infrastructure and operation. * Review of existing ecological objectives and targets for the site. * Provision of recommended fish-related opportunities for the site. | * Site has potential to support up to 11 native fish species. * Potential for EPBC-listed Murray Cod and Silver Perch. * Floodplain currently not utilised often by fish. * Fish in the upper reaches of Narcooyia Creek currently have no clear floodplain exit strategy except during over-bank flooding. * Current waterway condition in the lower reaches of Narcooyia and Bonyaricall Creeks is likely to inhibit fish passage from the Murray River due to Cumbungi encroachment and silt deposition. | | **Australian Ecosystems (2013) *Hattah North and Belsar Yungera Islands Flora Census*. Report prepared for Mallee CMA** | * Review of existing information * Field surveys: * November 2013 * 27 sites (30m x 30m vegetation quadrats) surveyed * Projected foliage cover recorded for all overstorey and understorey species * Photographs of each quadrat | * 15 Ecological Vegetation Classes EVCs sampled * 252 flora species recorded (207 indigenous, 45 exotic) * 29 flora species listed as rare or threatened under the DELWP advisory list of rare or threatened plants in Victoria recorded during surveys. * Including one FFG threatened flora species recorded, Woolly Scurf-pea. | | **GHD (2013*) Preliminary Ecological Investigations. Belsar and Yungera Island Water Management Functional Design Phase.* Report prepared for Mallee CMA** | * Review of existing information * Field surveys: * Over seven days at 14 sites, November 2012 - January 2014: * Targeted threatened species surveys * Two Hour Point Counts (THPC) for Regent Parrot nesting at sites containing suitable habitat * Ground dwelling vertebrates * Active searches for reptiles, amphibians and mammals * Nocturnal surveys for amphibians, mammals and reptiles * Bird surveys: * Each site surveyed once in early morning and late afternoon * Standard 20 minute 2 hectare area search * Nocturnal spotlight surveys: * Owl call-playback, targeted survey for arboreal mammals and nocturnal birds * Recording of incidental observations. * Flora Surveys: * Identification and recording dominant indigenous and introduced plant species present at each site * Identification of the EVC present at each site * Recording the location of LOTs, where practicable * Assessment of the broad condition of native vegetation at each site and the sites’ likely conservation significance * Identification of rare or threatened flora species at each site and the potential for additional species to occur * Determination of whether a Net Gain assessment is likely to be required. | * 78 native fauna species recorded * 72 native bird species * One native amphibian species * Two native and three exotic terrestrial mammal species * Three native reptile species   Significant and listed species included:   * EPBC Act listed Regent Parrot recorded at 20 locations * Four bird and reptile species listed as threatened under FFG Act * Five species of bird listed under the DEPI Advisory List of Threatened Vertebrate Fauna in Victoria 2013 | | **GHD (2014). *SDL Offsets - Fauna Survey. Hattah North and Belsar Yungera.* Report prepared for Mallee CMA.** | * Review of existing information * Field surveys: * Over five days/ four nights, November 2013 * 12 intensive fauna survey sites * Pitfall trapping using T-array * Funnel and Elliot traps at each site. * Infrared motion-activated fauna camera traps. * Anabat ultrasonic bat recordings of each site, complemented by harp trapping of microbats at a selection of subsites. * Targeted Threatened species surveys: * Two hour point counts for Regent Parrot nesting at sites containing suitable habitat. * Ground dwelling vertebrates * Active searches for reptiles, amphibians and mammals. * Nocturnal surveys for amphibians, mammals and reptiles * Bird surveys: * Each site surveyed once in early morning and late afternoon * Standard 20 minute 2 hectare area search * Nocturnal spotlight surveys: * Owl call-playback, * Targeted survey for arboreal mammals and nocturnal birds * Recording of incidental observations. | * 114 native fauna species recorded * 87 native bird species * Five native amphibian species * Five native and four exotic terrestrial mammal species * Six bat species * 11 native reptile species * Significant and listed species included: * 105 records of the EPBC Act listed Regent Parrot. * Three bird and reptile species listed as threatened under FFG Act * Seven species of bird and 1 reptile listed under the DEPI Advisory List of Threatened Vertebrate Fauna in Victoria 2013 | | **Ecology Australia (2016) *Mallee Sustainable Diversion Limit: Belsar & Yungera Islands – Flora & Fauna Assessment*. Report prepared for Mallee CMA.** | * Desktop review * Flora site assessment: * December 2015 * Potential footprint traversed * Comprehensive observed flora list recorded * Habitat Hectare assessed * EVC's assigned * Fauna site assessment: * December 2015 * Incidental observations. | Vegetation values recorded:   * Nine EVC’s recorded over the site (23 habitat zones) * 221 vascular plant species recorded (177 indigenous, 51 exotic) * 22 rare or threatened flora species under the DELWP advisory list recorded during surveys * Three FFG listed threatened flora species recorded   Fauna values recorded:   * 92 vertebrate species recorded * 82 bird species (2 exotic) * Four mammal species (2 exotic) * One reptile species * Three amphibian species   Threatened fauna recorded:   * Regent Parrot (eastern subspecies) (EPBC and FFG listed). 18 recorded in five separate groups. * Hooded Robin (FFG listed) * Grey-crowned Babbler (FFG listed) | | **R8 (2020b) Flora and Fauna Assessment – Belsar-Yungera R8 2020** | * Desktop Review: * Flora site assessment: * 7th – 11 October 2019 * Walking transects of construction footprint * Targeted surveys for rare or threatened flora * Rare and threatened flora encountered were GPS marked and details recorded. * Fauna site assessment (9, 17, 22 and 19 November 2019): * Targeted surveys for the Nationally and State listed Regent Parrot and its potential breeding habitat, including using the prescribed Two Hour Point Survey (THPS) technique in areas of suitable habitat; * Recording all identified fauna, and their observed behaviour (e.g. feeding, roosting, breeding), abundance and conservation status. * Pest fauna posing a threat to native vegetation and/or fauna. * Active searching of appropriate habitats (logs, tree hollows, tussocks, deep litter etc.) and food plants (i.e. fruit and/or nectar bearing) for mammals, birds, reptiles and frogs and habitat assessments for threatened fauna. * Assessments of potentially suitable habitat for threatened fauna. * Migratory terrestrial or migratory wetland species were considered as part of this assessment. * GPS position of suspected breeding activity recorded, based on criteria used to confirm an active Regent Parrot nest, as outlined in **Attachment 5 –Flora and Fauna Assessment**. | Vegetation values   * 15 EVCs within the construction footprint and inundation area * Five FFG Act listed flora species identified within construction footprint * 22 flora species listed as rare or threatened in Victoria (DELWP Advisory List) recorded within the construction footprint   Fauna values:   * 23 FFG Act and/or EPBC Act listed fauna species have the potential to occur within the construction footprint and inundation area * 102 individual Regent Parrot recorded * The FFG Act listed Major Mitchell's Cockatoo and Square-tailed Kite recorded. | |
| **Have any threatened or migratory species or listed communities been recorded from the local area?**  🗙 NYD 🗙 No 🗙 Yes If yes, please:   * List species/communities recorded in recent surveys and/or past observations. |
| * Indicate which of these have been recorded from the project site or nearby. |
| **Flora**  VBA and PMST searches identified seven EPBC Act listed flora species and 20 FFG Act listed threatened flora species that have been recorded or have a possible likelihood of occurrence within 10 kilometres of the study area[[4]](#footnote-5). A further 97 species listed as rare or threatened in Victoria (DELWP Advisory) (DEPI, 2014) were also identified. Some species may be listed under one or more of these.  During the R8 2019 field surveys, 22 flora species listed as rare or threatened in Victoria (DELWP Advisory List), including five species listed as threatened under the FFG Act, were recorded within the construction footprint. These species are identified in **Table 14**. No EPBC Act listed species were recorded within the study area during the survey.  **Fauna**  VBA and PMST searches identified 51 listed threatened fauna species that have been recorded or have the potential to occur within 10 kilometres of the study area or recorded from previous studies conducted within the construction footprint. Of these species, 21 are listed under the EPBC Act, 31 are listed under the FFG Act, and 29 are DELWP advisory listed threatened species. Some species may be listed under one or more of these.  Each of these species was then assessed for their likelihood of occurrence, taking into account factors such as the habitat requirements of each species and comparing those to the habitats encountered within the study area. Of the 51 terrestrial fauna identified by VBA and PMST as previously recorded or having the potential to occur within 10 kilometres of the project area, 22 of these are considered possible to occur or present within the project construction footprint or inundation area. These species are identified in **Table 15**.  One EPBC Act Listed species (Regent Parrot) and two additional FFG Act listed species (Major Mitchell's Cockatoo and Square-tailed Kite) were recorded from the targeted fauna surveys during the 2019 survey.  **Migratory species**  Eleven species listed as migratory under the EPBC Act are predicted to occur or were previously recorded from a VBA/PMST search. None of these species were considered as likely to occur within the construction footprint during the time of the survey, mostly due to the lack of recent records within the construction footprint and/or a lack of suitable habitat present at the time of the survey.  The migratory species are listed in Appendix K of theFlora and Fauna Assessment 2020 – Belsar-Yungera (R8, 2020b) (**Attachment 5 – Flora and Fauna Assessment**).  **Ecological communities**  The PMST identified one EPBC Act-listed threatened ecological communities with potential to occur within 10 kilometres of the construction footprint; *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions.*  This community was not present within the construction footprint during the time of the survey, and is not consistent with vegetation mapped or modelled within either the construction footprint. This community is consistent with one EVC modelled to occur within the inundation area; EVC 98: Semi-arid Chenopod Woodland.  The ground-truthing field assessment conducted in June 2020 confirmed that Semi-arid Chenopod Woodland (EVC 98) was not present in any areas where it had been modelled as occurring, or in any areas where modelled EVC data were not available. No vegetation identified within the inundation areas surveyed met the criteria to be considered a listed community under the EPBC or FFG Act. Whilst the full extent of the inundation area was not assessed as a part of the EVC ground-truthing exercise, based on a desktop review of the available information and observations made during the fieldwork, it is considered unlikely that any listed communities are present within the proposed area of inundation. |
| **If known, what threatening processes affecting these species or communities may be exacerbated by the project?** (eg. loss or fragmentation of habitats) Please describe briefly. |
| Potentially threatening processes are listed in accordance with Section 10 of the FFG Act 1988. Threatening processes from this list that are considered relevant to the Belsar-Yungera project (construction and/or operation) 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.   A qualified ecologist would be on-site to manage the removal of any fauna habitat and capture and translocate fauna observed within the construction area. It is still possible that hollow-bearing trees would be removed as part of the project, however the broader objective to inundate 2,374 hectares of floodplain vegetation is likely to contribute to the maintenance of hollow-bearing trees into the future.  An EMF would be prepared as part of the project that would include measures such as vehicle hygiene protocols to mitigate the potential spread of weeds and *Phytophthora cinnamomi* and measures to minimise sedimentation inputs or toxic substances (e.g. fuel) to waterways and to minimise impacts associated with any works occurring within waterways.  **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). |
| **Are any threatened or migratory species, other species of conservation significance or listed communities potentially affected by the project?**  🗙 NYD 🗙 No 🗙 Yes If yes, please:   * List these species/communities: |
| * Indicate which species or communities could be subject to a major or extensive impact (including the loss of a genetically important population of a species listed or nominated for listing) Comment on likelihood of effects and associated uncertainties, if practicable. |
| **Flora**  Construction footprint  Species for which habitat was present or that had previously been located within the Belsar-Yungera floodplain complex were targeted during the threatened flora surveys (R8 2020b). The survey did not locate any EPBC Act-listed flora species within the construction footprint, nor are they considered likely to occur or be impacted by either the construction works.  The following five species listed as threatened under the FFG Act 1988 were identified during the recent surveys and are likely to be impacted by the construction footprint:   * *Acacia melvillei* (Yarran) (none recorded in construction footprints in 2019 spring surveys) * *Acacia oswaldii* (Umbrella Wattle) (16 plants recorded in construction footprint in 2019 spring surveys) * *Cullen pallidum* (Woolly Scurf-pea) (none recorded in construction footprints in 2019 spring surveys) * *Cullen tenax* (Tough Scurf-pea) (two plants recorded in construction footprint in 2019 spring surveys) ; and * *Eremophila maculata subsp. maculata* (Spotted Emu-bush) (one plant recorded in construction footprint in 2019 spring surveys).   The location of flora species listed as threatened under the FFG Act would be taken in to consideration when finalising the construction footprints and efforts would be made to avoid and minimise impacts to listed species where possible.  Twenty-two flora species listed under the DELWP Advisory List for threatened flora were identified during the recent surveys and have the potential to be impacted by the proposed works in the construction footprint. These species are considered rare or threatened, however they are common in suitable habitat under the correct conditions, and it is considered that impacts to these species’ would be minor and localised, and that the proposed works would be unlikely to impact a significant population of these species or impact the range/distribution of any of these species.  Threatened flora species recorded during the 2019 surveys are presented in Table 14.  VBA and PMST searches identified a further 21 FFG and/or EPBC Act listed species with potential to occur within the construction and inundation footprint, however impacts to these species were considered unlikely as they were not recorded during 2019/2020 surveys and/or suitable habitat was absent within the construction and inundation areas. A full assessment of the likelihood of rare or threatened species within the project area is provided in Appendix D of **Attachment 5 – Flora and Fauna Assessment.** The location of significant populations of rare or threatened species identified during surveys at the site are also shown in Appendix H of **Attachment 5 – Flora and Fauna Assessment**.  **Table 14 Threatened flora species recorded in the area of investigation during 2019 surveys**   | **Common Name** | **Scientific Name** | ***EPBC Act 1999*** | ***FFG Act 1988*** | **DELWP Advisory** | **Number of individuals** | | --- | --- | --- | --- | --- | --- | | Yarran | *Acacia melvillei* |  | **P, L** | **v** | 3 individuals/clusters | | Umbrella Wattle | *Acacia oswaldii* |  | **P, L** | **v** | >30 individals/clusters scattered within the investigation area | | Twin-leaf Bedstraw | *Asperula gemella* |  |  | **r** | >10 individuals/clusters | | Asperula | *Asperula wimmerana* |  |  | **r** | 3 individuals/clusters | | Saltbush | *Atriplex lindleyi* subsp*. conduplicata* |  |  | **r** | >15 individuals/clusters | | Fan Saltbush | *Atriplex pseudocampanulata* |  |  | r | >10 individuals/clusters scattered within the investigation area | | Frosted Goosefoot | *Chenopodium desertorum* subsp. *rectum* |  |  | **v** | 5 individuals/clusters | | Woolly Scurf-pea | *Cullen pallidum* |  | **P, L** | **e** | 3 individuals/clusters | | Tough Scurf-pea | *Cullen tenax* |  | **P, L** | **e** | 7 individuals/clusters | | Spiny Lignum | *Duma horrida* subsp. *horrida* |  |  | **r** | >15 individuals/clusters | | Spreading Emu-bush | *Eremophila divaricata* subsp. *divaricata* |  | **P** | **r** | >30 individals/clusters scattered within the investigation area | | Spotted Emu-bush | *Eremophila maculata* subsp. *maculata* |  | **P, L** | **r** | >10 individuals/clusters scattered within the investigation area | | Bristly Sea-heath | *Frankenia serpyllifolia* |  |  | **r** | >20 individuals/clusters | | Goat-head | *Malacocera tricornis* |  |  | **r** | >15 individuals/clusters scattered within the investigation area | | Woolly Minuria | *Minuria denticulata* |  | **P** | **r** | 1 individual/cluster | | Smooth Minuria | *Minuria integerrima* |  | **P** | **r** | 3 individuals/clusters | | Picris | *Picris squarrosa* |  | **P** | **r** | >1 individual/cluster | | Copperburr | *Sclerolaena patenticuspis* |  |  | **r** | >5 individuals/clusters scattered within the investigation area |   Inundation Area  A desktop assessment of the likelihood of occurrence and impact for threatened flora in the inundation area identified 63 flora species listed under the FFG Act and/or listed as VROTS as possibly occurring within the Inundation Area (refer to Appendix D of **Attachment 5 – Flora and Fauna Assessment**).  Altering the hydrological regimes in the project area may cause minor negative impacts to some terrestrial species, e.g. flora that have adapted to drying conditions. However, these impacts are likely to be short term through the retention of surface water during inundation events, or through changes in water quality, and it is considered unlikely that the proposed environmental watering will have a negative impact on the ongoing survival of any populations of listed flora that may be present in (or that may colonise) the area of inundation. It has been illustrated in recent studies within Hattah-Kulkyne National Park that re-instating the natural flooding regime has positively influenced flora and fauna species, including rare and threatened species. It is expected that if these species were present, any impacts resulting from the operational phase of the project would be positive to neutral.  Based on the likelihood of occurrence assessment (refer to Appendix D of **Attachment 5 – Flora and Fauna Assessment**), it is considered unlikely that flora species listed under the EPBC Act would be present within the inundation area.  **Fauna species**  Of the 51 terrestrial fauna identified by VBA and PMST as previously recorded or having the potential to occur within 10 kilometres of the project area, twenty-two of these are considered possible to occur within the construction footprint and/or the inundation area. A full assessment of the likelihood of rare or threatened species within the project area is provided in Appendix E and Appendix F of **Attachment 5 – Flora and Fauna Assessment** and asummary provided in **Table 15**.  **Table 15 Fauna listed on the EPBC Act and/or the FFG Act and considered possible or known to occur in the project area (construction footprint and inundation area)**   | Common name | Scientific name | EPBC | FFG | Status | Impacts/reasoning | | --- | --- | --- | --- | --- | --- | | Eastern Great Egret | *Ardea alba modesta* |  | L | vu | **Construction**  **Unlikely.** Suitable habitat not present within construction footprint.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Plumed Egret | *Ardea intermedia plumifera* |  | L | en | **Construction**  **Unlikely.** Suitable habitat not present within construction footprint.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Silver Perch | *Bidyanus* | CR | L | vu | **Construction**  **Impact Possible.** Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprints must consider aquatic fauna. A construction specific aquatic fauna management plan (as part of the CEMP) would be developed for all works around waterways.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from improved habitat conditions following environmental watering. Under minor flood peaks the operation of Narcooyia and Bonyaricall Creeks as flow-through systems would provide seasonal flowing conditions that are likely to be suitable for the species. Larger flood events would lead to a loss of flowing conditions but allow for foraging in wetland habitat. The provision of fish passage at the ER1 regulator and passive fish passage at other regulators would allow for fish to exit to the Murray River, provided a suitable drawdown regime is implemented. | | Broad-shelled Turtle | *Chelodina expansa* |  | L | en | **Construction**  **Impact Possible.** Localised impacts possible, consideration of coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction fopotprint must consider aquatic fauna. A construction specific aquatic fauna management plan should be developed for all works around waterways and include consideration of turtles.  **Inundation Area**  **Impact Possible.** Species almost certain to benefit directly from greatly expanded habitat when environmental water is present and flowing habitat and connectivity is improved through the Narcooyia and Bonyaricall Creeks, and indirectly from improved habitat condition following environmental watering. | | Black Falcon | *Falco subniger* |  | L | vu | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Diamond Dove | *Geopelia cuneata* |  | L |  | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Painted Honeyeater | *Grantiella picta* | VU | L | vu | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | White-bellied Sea-Eagle | *Haliaeetus leucogaster* |  | L | vu | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Would likely benefit from environmental water when present and indirectly from improved habitat condition following environmental water. | | Caspian Tern | *Hydroprogne caspia* |  | L | nt | **Construction**  **Impact Unlikely.** Suitable habitat not present within the construction footprint.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Growling Grass Frog | *Litoria raniformis* | VU | L | en | **Construction**  **Impact Possible.** Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprints must consider aquatic fauna. A construction specific aquatic fauna management plan (as part of the CEMP) would be developed for all works around waterways.  **Inundation Area**  **Impact Unlikely.** If present, species almost certain to benefit directly from greatly expanded habitat when environmental water is present, and indirectly from improved habitat condition following environmental water. | | Major Mitchell's Cockatoo | *Lophochroa leadbeateri* |  | L | vu | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Square-tailed Kite | *Lophoictinia isura* |  | L | vu | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread, would likely benefit from improved ecological condition of inundation area. | | Murray Cod | *Maccullochella peelii peelii* | VU | L | vu | **Construction**  **Impact Possible.** Species is known from area and suitable habitat present in wetland and waterways.  Localised impacts possible, coffer dam construction, dewatering works, and any potential for sediment/ contaminant run-off into wet areas from construction footprints must consider aquatic fauna. A construction specific aquatic fauna management plan (as part of the CEMP would be developed for all works around waterways.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from improved habitat conditions following environmental watering. Under minor flood peaks the operation of Narcooyia and Bonyaricall Creeks as flow-through systems would provide seasonal flowing conditions that are likely to be suitable for the species. Larger flood events would lead to a loss of flowing conditions but allow for foraging in wetland habitat. The provision of fish passage at the ER1 regulator and passive fish passage at other regulators would allow for fish to exit to the Murray River, provided a suitable drawdown regime is implemented. | | Hooded Robin | *Melanodryas cucullata* |  | L |  | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Carpet Python | *Morelia spilota metcalfei* |  | L | en | **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 Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present, and indirectly from improved habitat condition following environmental water. | | Blue-billed Duck | *Oxyura australis* |  | L | en | **Construction**  **Unlikely.** Suitable habitat not present within Construction Footprints.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Regent Parrot | *Polytelis anthopeplus* | V | L | vu | **Construction**  **Impact Unlikely.** Targeted surveys for nesting birds during breeding season at construction footprints containing potential nest trees did not record any breeding activity. Losses to relatively small area of foraging habitat proposed, however the species is highly mobile and wide ranging, suitable surrounding habitat widespread. Environmental water is essential to sustain the River Red Gums this species requires for breeding habitat.  **Inundation Area**  **Impact Unlikely.** Species is highly mobile and wide ranging, suitable surrounding habitat widespread. Important breeding habitat is present within the inundation area, this breeding habitat (large old River Red Gums) likely to have condition improved, and future breeding habitat sustained by environmental watering. Species likely to benefit from broadly improved habitat condition following environmental water. Environmental water is essential to sustain the River Red Gums this species requires for breeding habitat. | | Grey-crowned Babbler | *Pomatostomus temporalis* |  | L | en | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Baillon's Crake | *Porzana pusilla* |  | L | vu | **Construction Areas**  **Unlikely.** Suitable habitat not present within Construction Footprints.  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Diamond Firetail | *Stagonopleura guttata* |  | L |  | **Construction**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. | | Freckled Duck | *Stictonetta naevosa* |  | L | en | **Construction**  **Unlikely.** Suitable habitat not present within Construction Footprints  **Inundation Area**  **Impact Unlikely.** Species likely to benefit from environmental water when present. | | Apostlebird | *Struthidea cinerea* |  | L |  | **Construction Areas**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread.  **Inundation Area**  **Impact Unlikely.** Species mobile and wide ranging, suitable surrounding habitat widespread. Species likely to benefit from improved habitat condition following environmental water. |   **Key  L – Listed EN / en – Endangered VU / vu – Vulnerable nt – Near Threatened cr – Critically Endangered Rx – Regionally Extinct**  Regent Parrot  The National Recovery Plan for the Regent Parrot *Polytelis anthopeplus monarchoides* (Baker-Gabb and Hurley, 2011) lists a range of threatening processes including disturbance around nesting colonies of the Regent Parrot. Targeted surveys for the species conducted in 2019 recorded much Regent Parrot activity within the study area. However, no behaviour conducive to breeding was observed, nor were any young Regent Parrots (notable due to their short tails and drab plumage) observed within the survey areas during all surveys.  Based on current and previous assessment of Regent Parrot habitat in the area of investigation, construction impacts to Regent Parrots are expected to be marginal, and would include losses or impacts to a relatively small area (~ 50.15 hectares) of low quality potential foraging habitat located in disturbed areas and/or centred on existing access tracks, compared to the broader ~8,300 hectares of the Belsar-Yungera floodplain complex habitat.  Based on previous experience during the Hattah Lakes TLM project, (where works occurred at sites within two well-known Regent Parrot breeding colonies and involved vegetation clearing (with eight known Regent Parrot nests removed by that project) for large hollow-bearing tree removal and construction of two large regulators and a pump station), it is highly unlikely that the proposed works for the Belsar project would impact on the nearby (~100-300 m from construction footprint) Regent Parrot nesting colony. Surveys of Hattah TLM sites following the nest tree removal and construction found Regent Parrots nesting in these areas immediately after construction and over five subsequent years, with no significant change observed in breeding numbers and the peak in active nests recorded the year following construction (refer to **Attachment 5 – Flora and Fauna Assessment**).  Important breeding habitat for Regent Parrot is present within the inundation area (large old River Red Gums). The recovery plan recognises the importance of environmental watering in supporting River Red Gum habitat and breeding sites for Regent Parrot. The Belsar project will not result in the fragmentation of important Regent Parrot habitat as the Belsar-Yungera floodplain complex supports over 8,300 hectares of contiguous habitat, most of which is suitable for Regent Parrot foraging. Important nesting habitat will not be adversely impacted by the project. The proposed construction footprint areas will not adversely affect habitat critical to the survival of this species, as construction footprints represent very small, isolated and discrete areas of habitat within an extensive area of suitable habitat for this highly mobile species. The proposal does not plan to remove any potential nesting habitat.  The VMFRP sub-project aims to maintain and enhance the condition of River Red Gum habitats and broader floodplain and wetland habitats which are likely to assist with the recovery of the Regent Parrot. Based on the full assessment of the EPBC Act significant impact criteria and an assessment of the potential for significant effect on FFG Act 1988 listed fauna under the *Environment Effects Act 1978* to this species from the proposed works (provided in Appendix J and Appendix L of **Attachment 5 – Flora and fauna Assessment**),it is not considered likely that this species would be significantly impacted by the proposed construction activities or inundation.  Murray Cod and Silver Perch  Two EPBC Act listed fish species, Murray Cod *Maccullochella peelii peelii* and Silver Perch *Bidyanus bidyanus* have the potential to be impacted by construction and inundation events. Under current conditions (i.e. without project) entry to the waterways of the Belsar-Yungera floodplain complex is provided for these species but without a fishway their ability to exit to the Murray River is limited, with over-bank flows the only mechanism by which they can re-enter the Murray River. These species have the potential to occur at any of the wet sites on the Murray River or major creeks, and localised impacts are therefore possible. During the construction phase, 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 would consider these species. Specific measures for aquatic fauna management would be developed and implemented as part of a Construction Environmental Management Plan for all works around waterways.  Impacts from the proposed inundation are likely to be beneficial to both the Murray Cod and Silver Perch. but the degree of benefit would depend on the inundation scenario and operational regime. Under the minor flood peak scenario both Narcooyia and Bonyaricall Creeks would operate as a flow-through system – providing lotic (flowing) habitat that both species prefer. During larger inundation events (moderate to large flood peaks) there would be a loss of lotic habitat when regulators are closed. The subsequent inundation of the floodplain would provide foraging opportunities for these large-bodied species. The ability for fish to exit the floodplain is of importance to avoid impacts to the species. A Fish Management Plan has been prepared for the site (DELWP 2018) and provides recommendations for the operational regime to minimise the risk of stranding during drawdown events. Additional impacts due to operation were identified by DELWP (2018) and included the risk that floodplain inundation would increase carp populations, which may impact native fish species present within the complex. Mitigation measures would be developed to these risks and could include:   * Implementing a winter fill regime * Develop a native fish exit strategy to strand carp * Drying of wetlands with high carp density.   Mallee and North Central CMAs have operational experience through the TLM projects in managing water quality risks associated with return flows, including from suspended sediment, nutrients and dissolved oxygen levels. Water quality monitoring would be carried out before, during and after watering events to inform adaptive management strategies and real-time operational decision making. A range of measures could be implemented to manage poor water quality including timing of watering for when temperatures are low, scheduling watering events and releases to make use of dilution flows, and delaying outflows if river flows are too low. More frequent inundation through managed watering events will reduce the accumulation of organic matter on the floodplain between inundation events, thus reducing the risk of anoxic blackwater events.  Overall, neither of these species are considered likely to be significantly impacted by the proposed construction activities or inundation. A full assessment of the EPBC Act significant impact criteria to these species from the proposed works for these species is provided in Appendix J of **Attachment 5 – Flora and fauna Assessment**.  Painted Honeyeater and Growling Grass Frog  Two additional EPBC Act listed species are considered possible to occur within the construction footprints and to be potentially impacted: the Painted Honeyeater *Grantiella picta* and Growling Grass Frog *Litoria raniformis*. The Painted Honeyeater is considered to have potential to utilise habitats within the proposed construction area and broader inundation area. This species has not been previously recorded within 10 km of the construction footprints, but may occasionally forage in these woodland areas. The proposed construction footprints are however not likely to significantly impact any areas of important habitat to this extremely mobile nomadic species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts.  The Growling Grass Frog was last recorded within 10 km of the construction footprint in 1959, and was not recorded during targeted surveys of construction footprints in areas of potentially suitable habitat in 2012 (GHD 2013), 2013 (GHD 2014) or 2019 (the current study). Despite the long absence of records of this species, the presence of suitable habitat, and the ability of this species to recolonise areas suggest that it has potential to occur in the area, and a reintroduction of more suitable ecological watering regimes may help facilitate this. Whilst direct impacts from works are not predicted for the Growling Grass Frog, indirect impacts from the proposed works may include the introduction or spread of Chytrid Fungus. Transmission of the disease from vehicle is unlikely, if vehicles traverse between sites and result in water and mud being transferred to/from other water bodies, hygiene protocols for Chytrid Fungus would be included in a site specific EMP (Murray et al 2011). Additionally if the handling of frogs is required during the proposed works (i.e. during salvage), a suitably qualified and experienced ecologist would be engaged, and employ hygiene protocols identified in Murray et al (2011).This species is not considered likely to be significantly impacted by the proposed construction activities or inundation. A full assessment of the EPBC Act significant impact criteria to this species from the proposed works for these species are provided in Appendix J of **Attachment 5 – Flora and Fauna Assessment**.  **Migratory species**  Eleven migratory species were identified as having the potential to occur within 10 kilometres of the construction footprint (PMST and VBA). None of these species were considered as likely to occur within the construction footprint during the time of the survey, mostly due to the lack of recent records within the construction footprint and/or a lack of suitable habitat present. It is highly unlikely that the construction footprint supports habitat that would be considered important for migratory species foraging or breeding activity or support an ecologically significant proportion of a population of migratory species. A current assessment of the EPBC Act significant impact criteria to Migratory listed species from the proposed works for this species is provided in Appendix K of **Attachment 5 - Flora and Fauna Assessment** (R8 2020b).  Reinstating historical environmental flows within the Belsar-Yungera floodplain complex would improve the quality of habitat present. Such enhancements correspond to increased productivity of the swamp forest communities, increased vegetation diversity and structure from more dominant drought-tolerant species and increase the overall health and integrity of the area, which will likely improve breeding, foraging and refuge resources for listed Migratory species, such as the Curlew Sandpiper (*Calidris ferruginea*) and Sharp-tailed Sandpiper (*Calidris acuminata*). |
| **Is mitigation of potential effects on indigenous flora and fauna proposed?**  🗙 NYD 🗙 No 🗙 Yes If yes, please briefly describe. |
| Efforts have been made throughout the planning and design phases for the proposed construction to avoid and minimise impacts to ecological values including native vegetation and fauna habitat, threatened flora, fauna and communities. All areas of native vegetation that are proposed to be impacted are adjacent to existing vehicle tracks and areas of previous disturbance and represent inferior areas of habitat to those which surround them. From a landscape perspective, the proposed construction footprints represent a comparatively small area within a much larger intact area of high quality native vegetation.  The following would be considered as the project’s design is refined and through construction, and implementation of the project:  **Design**  The following mitigation measures 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 (Australian Ecosystems 2013, GHD 2013, GHD 2014, Ecology Australia 2016):   * Through refinement of the detailed design, the project would to the extent practicable, minimise the construction footprint and impacts on the environment through:   + Siting of proposed structures primarily along or immediately adjacent to existing access tracks and other previously disturbed areas.   + Avoid where practical, the removal of hollow bearing trees and large old trees within the construction footprint.   + Avoid where possible, areas of native vegetation that support rare and threatened flora species   + Designing containment banks and batters in consultation with Parks Victoria to minimise extent of native vegetation removal and other construction impacts.   **Construction phase**  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 and offset protocol in the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017) for determining the construction works footprint at each site (i.e. make every effort to avoid threatened flora species loss as a high priority). * Areas of remnant native vegetation to be retained would be delineated from those areas to be removed as ‘no-go zones’, to avoid encroachment into areas of retained vegetation. * Use existing disturbed areas or areas of non-native vegetation for lay-downs and stockpiling * All vehicles and plant would only operate on existing tracks and in areas marked as parking areas or construction zones. * Manage potential impacts to tree root zones during construction. * For the protection of threatened flora:   + Species listed under the FFG Act and EPBC Act are not permitted to be removed and would be fenced off with temporary 1 metre high orange barrier mesh medium-heavy weight prior to construction commencing.   + Fencing would be checked on a weekly basis and the population monitored on a monthly basis.   + All staff onsite would 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 would be notified. The number and location of individuals would be recorded and DELWP would be advised. * Manage the removal of hollow-bearing trees within the construction footprint (if required, based on final footprints and potential impacts to tree root zones from track establishment, set down areas) where construction may impact habitat trees of native fauna, particularly FFG Act listed fauna species and communities:   + Avoiding the breeding season of hollow-dependant species is recommended, however where this is not practical an assessment would include surveys undertaken by a suitably qualified ecologist of the hollow-bearing trees being removed during the breeding season. The survey would also include other native hollow-dependent fauna. A protocol would be developed prior to/during construction.   + Where clearing is proposed outside the breeding season, complete pre-clearance surveys for any remnant hollow-bearing trees to be removed. These trees could harbour one or more species of native hollow-dependent fauna. Pre-clearance surveys would be conducted prior to (within 24 hours) the hollow-bearing trees being removed. * Manage the removal of hollow-bearing trees at all sites identified as potential Regent Parrot nesting area (ER3, S108, S7, ER1 and Bonyaricall Creek hard stand sites) and if required, based on final footprints and potential impacts to tree root zones from track establishment, set down areas, or where construction may impact nest trees of EPBC Act – listed Regent Parrot:   + Scenario 1 – Where clearing of hollow-bearing trees is proposed during the Regent Parrot breeding period (September through end of January, DoEE, 2017). Avoiding the breeding season is recommended, however where this is not practicable an assessment would be undertaken to determine if impacts from construction would impact trees identified as Regent Parrot nest trees prior to clearing or modification of the tree. The assessment would include surveys undertaken by a suitably qualified person of the hollow-bearing trees being removed during the breeding season (September and January). The survey would also include other native hollow-dependent fauna. A protocol would be developed/refined from the previous Threatened Species Management Plan for ‘The Living Murray Hattah Lakes Environmental Flows Project’ (2011) in the event that a Regent Parrot nest is identified just prior to/during construction.   + Scenario 2 – Where clearing is proposed outside the Regent Parrot breeding season. Complete pre-clearance surveys for any remnant hollow-bearing trees to be removed. These trees could harbour one or more species of native hollow-dependent fauna. Pre-clearance surveys would be conducted prior to (within 24 hours) the hollow-bearing trees being removed. * An initial briefing of construction works crews by a qualified ecologist and subsequent planning of safe work distances and establishment of each site. * If the capture, handling or translocation of fish is required during construction (e.g. dewatering work sites) or operation of the project, persons undertaking these activities would need to hold the appropriate permit or licence under the *Fisheries Act 1995*. Any capture of fish would be carried out by a qualified aquatic ecologist. * Standard vehicle hygiene measures are to be implemented to prevent the spread and introduction of weed species, particularly the weeds of national significance and noxious weeds listed under the *Catchment and Land Protection Act 1994* (CaLP Act), and to prevent the spread or transmission of Chytrid Fungus as per Murray et al (2011). * Develop and implement a Construction Environmental Management Plan (CEMP) for the construction phase. This CEMP would include measures to avoid or minimise indirect impacts such as erosion, sedimentation and the accidental spill of oils or other chemicals. It would also provide a protocol for minimising impacts in ecologically sensitive areas such as creek lines. Implementation of the EMP would be audited during and following the construction process to ensure works have been conducted appropriately. * Develop and implement a Flora and Fauna Management Plan as part of the CEMP that contains requirements, including those listed in this section of the referral, to avoid, mitigate and manage impacts to flora and fauna values and particularly threatened species and describing the habitat preclearance and clearance process. * Develop and implement an Aquatic Fauna Management Plan as part of the CEMP to manage impacts to aquatic values – with emphasis on threatened fish species that may be present in vicinity of construction sites. Any construction activities that could lead to entrapment of fauna or temporary loss of habitat (e.g. due to the use of coffer dams and dewatering) would be considered. * 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:   + Setting aside topsoil to reinstate when works are complete and compacting to original levels.   + If native vegetation must be removed, re-spreading of stored topsoil should occur, followed by monitoring to assess germination in the following year.   + Appropriate weed control measures at the site following the works.   + If the site is not naturally recolonised by locally indigenous species, planting of locally indigenous species appropriate to that particular position in the landscape may be undertaken in the following year.   + Ground debris that is temporarily removed to allow construction activities, is to be reinstated.   **Operation**  The following mitigation measures would be implemented to minimise and avoid impacts upon the identified threatened flora, fauna and community values):   * Implement pest animal and environmental weed management and control within the inundation area and surrounding areas. * Implement operational regimes and mitigation measures informed by the Fish Management Plan for the site (DELWP, 2018) to enhance outcomes for threatened fish species.   Section 13 lists the measures that would be implemented to minimise water quality risks. |
| **Other information/comments?** (eg. accuracy of information) |
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# Water environments

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| **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 project would inundate 2,374 hectares of the Belsar-Yungera floodplain complex to a water level of between 52.3 m AHD to 53.3 m AHD, replicating the flood extent of the Murray River of between 70,000 ML/day to 170,000 ML/day (Mallee CMA). This water would be sourced from existing environmental water entitlements[[5]](#footnote-6) via the Victorian Environmental Water Holder. Water use would vary from year to year depending on natural inflows and previous flooding history. The volume of water required to fill Belsar-Yungera floodplain complex to the proposed design water levels is approximately:   * Area One – 13,283 ML * Area Two – 3,297 ML * Area Three – 70 ML * Area Four – 4,777 ML (Mallee CMA, 2014).   Inflows and outflows to the Belsar-Yungera floodplain would be measured during managed flood events when the proposed works are utilised. This may be achieved using flow sensors installed at each of the regulators to measure natural inflows and outflows and, where temporary pumps are used, to introduce environmental water to the site through flow meters accredited to national measurement institute (NMI) standards. These measurements are important to inform calculation of the volume of environmental water used in each event and to enable accuracy of water accounting. |
| **Will the project discharge waste water or runoff to water environments?**  🗙 NYD 🗙 No 🗙 Yes If yes, specify types of discharges and which environments. |
| The Belsar-Yungera floodplain is located 30 kilometres upstream of Euston Weir on the Murray River floodplain and connects to the Murray River at a variety of river flows. In the east, the floodplain is understood to fill from Narcooyia Creek as Murray River levels commence to rise (Mallee CMA, 2014) and return to the Murray River downstream of Belsar Island (Ecological Associates, 2014). Narcooyia Creek has been highly modified to allow its use as a delivery channel for irrigation water. In the western part of the system, Euston Weir influences Murray River levels, and maintains a normal operating level of 47.6 m AHD, which pools water in Bonyaricall Creek and reduces the variation in water level as river discharge rises and falls (Ecological Associates, 2014).  Through the construction of new infrastructure, the modification of existing infrastructure and removal of some existing barriers to flow, the project aims to restore a more natural inundation regime across approximately 2,374 hectares of high-ecological-value Murray River floodplain adjacent to Belsar and Yungera Islands.  Flow would be diverted from the Murray River into the Belsar-Yungera floodplain complex and be held at the target water level by isolating a large section of Narcooyia Creek and Yungera Creek from the Murray River and delivering water directly to Lake Powell. A portion of the inundation volume would be returned to the Murray River at the end of a watering event. Return water quality and quantity would be monitored as part of the Operating Plan.  Construction works would be managed in accordance with a CEMP including controls for managing sediment, erosion, and rainfall runoff and management of activities such as works in waterways and dewatering, where required.  Potential impacts to water environments, including those associated with wastewater or runoff are described in the response below. |
| **Are any waterways, wetlands, estuaries or marine environments likely to be affected?**  🗙 NYD 🗙 No 🗙 Yes If yes, specify which water environments, answer the following questions and attach any relevant details. |
| Waterways likely to be affected by the project include Narcooyia Creek, Bonyaricall Creek and the Murray River. Wetlands and lakes likely to be affected by the project include Lake Powell and Lake Carpul and the floodplain wetlands located across the floodplain complex including Belsar Island which is listed under the Directory of Important Wetlands of Australia. Planning and operational procedures to mitigate risk and to maximise the expected environmental benefits of the project are documented in the project EWMP (**Attachment 6**) and Operating Plan (**Attachment 13**).  Salt inflow to the Murray River in the Mallee tract (that is, downstream of Swan Hill) is a major source of salt load in the river. As discussed in Part 1, section 3, soil and groundwater salinity in the project area are at low to moderate levels. A network of groundwater monitoring bores was installed in April 2020 to allow pre-scheme site specific baselines for groundwater depth and quality to be established, and to support future project monitoring and management.  Potential impact pathways are listed below.  **Potential impacts of the project during construction**  Construction impacts are temporary and generally localised in nature. The implementation of appropriate construction methodologies and measures documented within a project CEMP would address the following identified risks:   * Erosion and loss of topsoil causing water quality impacts. * Construction works and structures causing bed and bank erosion and instability. * Rainfall and flood events causing a pollution event and runoff. * Discharging/dewatering poor quality water into receiving water waters (high turbidity, EC). * Spills, leaks, poor handling of fuels, oils and other chemicals causing soil/water contamination.   **Potential impacts of the project during operation**  A EWMP (**Attachment 6**) and Operating Plan (**Attachment 13**) have been drafted for the project. These documents would be updated on an ongoing basis in order to assist with the management of the operational risks to water quality associated with watering events. Identified water quality related risks are:   * Blackwater may eventuate from environmental water after a dry period or warm water and excessive litter, which compromises foraging habitat and kills wetland biota. * Potential for poor quality as a result of high organic matter, warm temperatures, low DO and anoxic conditions, particularly if water stagnates in areas which would naturally have moving water. * Possible processes such as blackwater, algae blooms, high loads of organic matter etc. can cause low DO concentrations impacting the health of aquatic species and communities. * Suspended solids, turbidity, organic matter may cause poor water quality impacting the health of aquatic species and communities, also waterbird species. * The release of poor quality water into the Murray River may impact water quality downstream. * Inability to release poor quality water back to the Murray River may impact floodplain health and vegetation. * Discharge of saline groundwater may marginally increase the salinity of the water in the Murray River and may require acceptance under the Murray Darling Basin Salinity Management Strategy. The protocol for achieving this acceptance is not yet defined. The project would seek to conform with these requirements when they are known. The project salinity impact is expected to be less than 1 EC unit in the river (and at Morgan) (SKM, 2014). Existing groundwater salinity levels are considered to be low to moderate (refer **Attachment 10 – Desktop Groundwater Assessment**). * Shallow saline groundwater (if developed and persistent) has a possibility of creating an impact on floodplain soil health and vegetation at the site. As the site has low to moderate levels of groundwater salinity, impacts to floodplain health and vegetation via elevated groundwater are not considered to be likely and are thus not identified as a significant concern (i.e. a low potential for adverse effect). * Carp may breed in response to floods within the forest, excessive numbers of carp can adversely affect aquatic ecosystems.   Measures to manage these impacts are outlined in the ‘mitigation’ section below and also Part 2, Section 18 (Environmental management). |
| **Are any of these water environments likely to support threatened or migratory species?**  🗙 NYD 🗙 No 🗙 Yes If yes, specify which water environments. |
| The Belsar-Yungera floodplain complex including surrounding floodplain communities and nearby significant wetlands are likely to 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. Refer to Part 2, Section 12 (Native vegetation, flora and fauna) and **Attachment 5 – Fauna and Flora Assessment** of this referral.  The project has the potential to provide a number of water regime classes that would largely benefit native fish at a local scale. However, floodplain inundation has the potential to impact native fish communities by providing conditions that are suitable for invasive species, especially Carp. Key mitigation measures relating to carp could 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.  There have been numerous studies carried out in the region that provide an understanding of fish species that are likely to currently inhabit the complex. Surveys have been completed in Narcooyia and Bonyaricall Creeks, which indicated that seven species were present, including the listed Murray cod, Golden perch and Murray-Darling rainbowfish. Surveys of the Murray River in the vicinity of Belsar Island indicated that five native fish species were present, including Murray-Darling rainbowfish. In total, 14 native fish species inhabit, or have the potential to inhabit, the waterways and wetlands of the Belsar-Yungera floodplain complex (ARI, 2019).  **Table 16 Likelihood of occurrence of listed native fish species at Belsar-Yungera complex (source Fish Management Plan (DELWP, 2018))**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Common name | Scientific name | EPBC Act status | FFG Act status | DELWP advisory | Likelihood of occurrence | | Flathead galaxias | *Galaxias rostratus* | CR | N | V | Unlikely | | Freshwater catfish | *Tandanus tandanus* | - | L | EN | Certain | | Golden perch | *Macquaria ambigua* | - | L | NT | Certain | | Macquarie perch | *Macquaria australasica* | EN | L | EN | Unlikely | | Murray cod | *Maccullocella peelii* | VU | L | V | Certain | | Murray hardyhead | *Craterocephalus fluviatilis* | EN | L | CR | Unlikely | | Murray-Darling rainbowfish | *Melanotaenia fluviatilis* | - | L | V | Certain | | Silver perch | *Bidyanus bidyanus* | CR | L | V | Certain | | Unspecked hardyhead | *Craterocephalus stercusmuscarum fulvus* | - | - | - | Certain | | Carp gudgeon | *Hypseleotris klunzingeri* | - | - | - | Certain | | Bony herring | *Nematalosa erebi* | - | - | - | Certain | | Flathead gudgeon | *Philypnodon grandiceps* | - | - | - | Certain | | Dwarf flat-headed gudgeon | *Philypnodon macrostomus* | - | - | - | Certain | | Australian smelt | *Retropinna semoni* | - | - | - | Certain |   **Key**  **CR Listed as Critically Endangered under the EPBC Act**  **EN Listed as Endangered under the EPBC Act**  **VU Listed as Vulnerable under the EPBC Act**  **N Nominated under the FFG Act**  **L Listed under the FFG Act**  **V Listed as Vulnerable under the DELWP Advisory List**  **CR Listed as Critically Endangered under the DELWP Advisory List**  **EN Listed as Endangered under the DELWP Advisory List**  **NT Listed as Near Threatened under the DELWP Advisory List** |
| **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 Ramsar Wetland Hattah-Kulkyne National Park is located approximately 30-40 kilometres downstream of the project. Whilst impacts to the Hattah-Kulkyne National Park are expected to be negligible (Seran BL&A 2018), a CEMP would be prepared and implemented to address potential environmental risks (such as sediment runoff) and put in place mitigation strategies to avoid or minimise these risks. A EWMP and Operating Plan have been drafted for the project. These would assist in managing the operational risks to water quality associated with return flows.  An additional three Ramsar Wetlands were identified 150-400 kilometres downstream of the Belsar-Yungera project area (Banrock Station Wetland Complex, Riverland and the Coorong, and Lakes Alexandrina and Albert Wetland). These are not expected to be affected by the project.  Belsar Island is listed under the Directory of Important Wetlands of Australia. This area would be impacted by construction works for Belsar-Yungera project, although as discussed, the footprint of the proposed impacts is comparatively small (50.42 ha / 0.61%) in relation to the broader floodplain complex (8,300 hectares). The construction of the proposed infrastructure is critical to the long term maintenance of this wetland system, which through lack of natural flooding over several decades has become dominated by mesic (water tolerant) flora species. |
| **Could the project affect streamflows?**  🗙 NYD 🗙 No 🗙 Yes If yes, briefly describe implications for streamflows. |
| The purpose of the project is to reinstate a more natural hydrological regime to the Murray River floodplain adjacent to Belsar and Yungera Islands. It is intended that this would be achieved in part, through the construction of new infrastructure, the modification of existing infrastructure and removal of some existing barriers to flow (created by existing irrigation and road infrastructure). On completion of a managed inundation event, the project would release managed floodwaters back to the Murray River via Bonyaricall 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 pumped from the Murray River is debited against environmental watering accounts, together with any additional evaporation and seepage losses caused by impounding natural inflows on the floodplain beyond the peak of floodwaters passing. To minimise potential effects, the project is designed to prioritise use of natural flood inflows rather than undertake additional pumping of water directly from the Murray River.  Any upstream or downstream hydrological changes or impacts in the Murray River associated with the delivery of environmental water to the Wallpolla Island floodplain will be assessed and managed by the River Murray Operations Committee (RMOC) as part of their responsibility to oversee the operation of the river which is managed by the Murray Darling Basin Authority on behalf of the relevant State and Commonwealth Governments. |
| **Could regional groundwater resources be affected by the project?**  🗙 NYD 🗙 No 🗙 Yes If yes, describe in what way. |
| A desktop groundwater assessment has been prepared and is provided in **Attachment 10 – Desktop Groundwater Assessment.**  There are no licenced groundwater users and no registered stock and domestic bores in the vicinity of the project area. This is because of the generally saline nature (approximately 500 mg/L to 13,000 mg/L) of the regional aquifer, the proximity to fresh water from the Murray River and limited access to floodplain aquifers by private landowners. The primary use of groundwater at the Belsar-Yungera floodplain complex is environmental use associated with floodplain vegetation and ecosystems.  The Belsar-Yungera project is located in the Murray Geological Basin. A series of aquifer layers are present at the site, to a depth of approximately 300 m below ground. Of these layers, only the upper layers are relevant.  The shallow groundwater hydrogeological conditions at the site are described in Thorne et al. (1990). The key hydrogeological features of this area are as follows:   * Across the floodplain is a sequence of alluvial sediments comprising an aquitard at the surface and aquifer unit below * The alluvial sediments are hydraulically connected to the river * Underlying the alluvial sediments across the floodplain is the regional aquitard of varying thickness * Underlying the aquitard is the regional aquifer which has no direct contact to the alluvial sediments in this area * The groundwater levels are very similar in elevation to the river level in the alluvial sediments across the floodplain.   The potential groundwater effects of the proposed construction and operation of the works are:   * Temporary and limited drawdown of groundwater levels during construction * Increased groundwater level as a result of flood recharge * Reduced groundwater salinity immediately following flood events * 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 (noting that current salinity levels are low to moderate) * Shallow groundwater in the vicinity of vegetation may occur for extended periods of time during and immediately after flooding.   Construction of the project works may require temporary and limited groundwater dewatering in order to provide safe access for excavations of larger structures, and subsequent disposal of pumped groundwater. Specifically, this may be required for the regulators and inflow structure, as these may need to be dug into the subsurface. Typically banks and surface earthworks will not intersect groundwater and are not expected to have a groundwater impact during construction.  If dewatering is required , then minor, temporary and localised impacts on adjacent vegetation and ecosystems are possible. This can be mitigated by planning construction to minimise dewatering and to avoid discharge to land.  Operation of the proposed works would result in elevated groundwater levels, wetting of soils and potential for mobilisation of salt from the unsaturated soil store. This could result in the displacement of salt to the Murray River and increased evapotranspiration of water from the floodplain, potentially concentrating salts in the soil. However, given the current low to moderate salt store in the project area and the generally fresh to moderately saline groundwater, these issues are regarded as being low risk. The classification of the overall potential risk of salt mobilisation is low because of the inherently low salt store in the soil profile in the project area. The classification as ‘low’ is considered reasonable based on measured salinity and the levels of conservatism of parameters used in the analysis, which would be expected to over-estimate the results (Cullen et al., 2008). Monitoring of flooding patterns and adaptive management of flooding to minimise waterlogging would further reduce this risk.  A program of groundwater monitoring bores has been developed for the project area and would be incorporated into the Operating plan. Installation of additional bores took place in April 2020. This would assist in setting the pre-scheme baseline for groundwater levels and quality. |
| **Could environmental values (beneficial uses) of water environments be affected?**  🗙 NYD 🗙 No 🗙 Yes If yes, identify waterways/water bodies and beneficial uses (as recognised by State Environment Protection Policies) |
| The waterways and water bodies within the project area are located with the State Environment Protection Policy (Waters) (SEPP (Waters)) Murray and Western Plains surface water segment. Wetlands within the project area are located within the SEPP (Waters) Lakes and Swamps surface water segment. Schedule 2, Table 3 of SEPP (Waters) identifies beneficial uses of inland waters within the Murray and Western Plains and the Lakes and Swamps segments as including:   * Water dependent ecosystems and species that are slightly to moderately modified * Human consumption after appropriate treatment where water is sourced for supply in accordance with the special water supply catchments area set out in Schedule 5 of the *Catchment and Land Protection Act 1994* or the *Safe Drinking Water Act 2003* * Agriculture and irrigation * Human consumption of aquatic foods * Aquaculture where the environmental quality is suitable and an aquaculture licence has been approved in accordance with the *Fisheries Act 1995* * Industrial and commercial (applies to the Murray and Western Plains segment only) * Water-based recreation (primary, secondary contact and aesthetic enjoyment) * Traditional Owner Group cultural values * Cultural and spiritual values   Potential effects on surface water environments are discussed in the following sections.  The SEPP (Waters) identifies beneficial uses of groundwater based on Total Dissolved Solids concentrations, these include:   * Water dependent ecosystems and species * Potable water supply (acceptable) * Potable mineral water supply * Agriculture and irrigation (irrigation) * Agriculture and irrigation (stock watering)Industrial and commercial; * Water-based recreation (primary contact recreation) * Traditional Owner cultural values * Cultural and spiritual values * Buildings and structures * Geothermal properties   As noted above, there are no groundwater users within the extent of the project area. Potential effects on groundwater are discussed in more detail in **Attachment 10 – Desktop Groundwater Assessment**.  Within and surrounding the inundation area, terrestrial vegetation with a high potential for groundwater interaction is identified. This includes Lignum Swampy Woodland/Shrubland, Riverine Forest/Shrubland and Riverine Chenopod Woodlands. A number of wetlands are identified within the project area as potential aquatic Groundwater Dependent Ecosystems (GDEs) on the Atlas. The wetlands in the southern portion of the project area are largely associated with Narcooyia Creek and are identified as having high potential for groundwater dependence. The remainder of aquatic GDEs mapped within Belsar Island area are identified as having moderate potential for groundwater dependence (DELWP, 2020). The wetlands in the northern part of the Yungera Island are identified as having low potential for groundwater dependence and therefore, are not considered GDEs. The Murray River is mapped as a high potential aquatic GDE (BoM, 2020).  It is anticipated that the project will have a beneficial impact on potential GDEs within the project area (**Attachment 10 – Desktop Groundwater Assessment.** . |
| **Could aquatic, estuarine or marine ecosystems be affected by the project?**  🗙 NYD 🗙 No 🗙 Yes If yes, describe in what way. |
| The project aims to reinstate a more natural hydrological regime to the Belsar-Yungera floodplain, which is expected to deliver a range of ecological benefits to floodplain and wetland communities. The project is designed to have the operational flexibility to vary the timing, depth, duration and extent of inundation so that individual managed events are able to target specific ecological outcomes.  A risk assessment was completed during project development (Newall et al, 2014). The risk assessment process 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.  The risk assessment by Newall et al (2014) identified the following potential threats [and residual risk rating] to aquatic ecosystems:   * 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[low residual risk with mitigation measures applied].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 residual risk with mitigation measures applied]. * 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 [low residual risk with mitigation measures applied]. * 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 [moderate residual risk with mitigation measures applied]. * 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 [very low residual risk with mitigation measures applied]. * 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 [very low residual risk with mitigation measures applied].   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 –the Fish Management Plan to mitigate the potential effects of creating barriers to fish movement. Other measures to reduce the threats 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 Part 1 of this referral. The project is designed to have the operational flexibility to vary the timing, depth, duration and extent of inundation so that individual managed events are able to target specific ecological outcomes. |
| **Is mitigation of potential effects on water environments proposed?**  🗙 NYD 🗙 No 🗙 Yes If yes, please briefly describe. |
| **Construction**  The following mitigation measures are proposed to minimise and avoid impacts on water environments during construction of the project:   * Develop and implement a CEMP, including erosion and sediment control plans, dewatering and water quality management plans, weed and pest hygiene protocols to minimise potential impacts on wetlands and other aquatic ecosystems * Rehabilitate construction areas following completion of works to the satisfaction of Parks Victoria or the relevant landowner/manager * 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. * Planning and monitoring of flooding events to avoid prolonged periods of inundation that could lead to waterlogging (to avoid vegetation impacts). Avoid extended periods of shallow watertable < 3m below surface to avoid waterlogging of vegetation. * 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. * Integrate water management with other watering sites in the seasonal water planning process. Maintain good communication with other water managers. * Tailor watering regimes to provide competitive advantage for native fish over carp. Dry wetlands that contain carp. Manage drawdown following managed events to provide triggers for native fish to move off the floodplain, and where possible, strand carp. * Monitor the salinity of 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 of water are 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 –the 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) |
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# Landscape and soils

## Landscape

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| **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. |
| As shown in **Attachment 8 – Planning Zones & Overlays Maps,** the area of the project adjacent to the Murray River is located within an Environmental Significance Overlay (ESO1).  The ESO1 covers the length of the Murray River Reserve on land immediately adjoining the Murray River. Some proposed works associated with construction banks, proposed regulators, temporary pump hardstands, and some access tracks would occur within the ESO1.  The ESO1 recognises the *importance of the Murray River and its environs, being of local, regional, state, national and international significance* and notes that the Murray River is an *important water supply, tourism, recreation, landscape, cultural and environmental asset*.  The purpose of the ESO1, amongst a range of other things, is to protect the scenic landscape qualities of the Murray River environs.  The project area is not subject to a Significant Landscape Overlay. |
| * **Identified as of regional or State significance in a reputable study of landscape values?**   🗙 NYD 🗙 No 🗙 Yes If yes, please specify. |
| As noted in the response above, the project area is located within the ESO1 which identifies the Murray River and its environs as being of local, regional, state, national and potentially international significance. |
| * **Within or adjoining land reserved under the *National Parks Act 1975*?**   🗙 NYD 🗙 No 🗙 Yes If yes, please specify. |
| A large area of the proposed construction footprint is within a Regional Park classified as ‘other park, Schedule 3’ under the *National Parks Act 1975*. The Regional Park is managed in accordance with section 18(2)(a) of *National Parks Act 1975*, to:   * *preserve, protect and re-establish indigenous flora and fauna in the park;* * *preserve and protect features in the park of scenic, archaeological, ecological, geological, historic or other scientific interest;* * *enable the park to be used by the public for the enjoyment, observation and study of the countryside and its pursuits, its flora and fauna, its ecology and geology and other features; and* * *control exotic flora and fauna in the park.* |
| * **Within or adjoining other public land used for conservation or recreational purposes?**   🗙 NYD 🗙 No 🗙 Yes If yes, please specify. |
| As shown in **Attachment 8 – Planning Zones & Overlays Maps,** the Murray River runs along the northern boundary of the Belsar-Yugera floodplain complex and is used for a range of recreational purposes.  Part 2, Section 15 (Social environments) provides further details of the recreational activities undertaken within this area. |
| **Is any clearing vegetation or alteration of landforms likely to affect landscape values?**  🗙 NYD 🗙 No 🗙 Yes If yes, please briefly describe. |
| The project would potentially involve impacts of up to 50.35 hectares of native vegetation as described in Section 12 (Native vegetation, flora and fauna) and **Attachment 5 – Fauna and Flora Assessment**,to raise existing access tracks, create new access tracks and to create regulating structures which contribute to retention of floodwaters during managed inundation events.  Two of the large regulator structures (ER3 and S7) would be located adjacent to the Murray River. These structures are located, along or adjacent to publicly accessible tracks to minimise works and vegetation removal. These regulating structures would be visible to visitors (both along the access track and within the Murray River), however it is expected that visibility would be partly screened by existing retained vegetation with views generally confined to areas in proximity to the structures.  The Lake Powell regulator would be located 50 m south of the Murray Valley Highway and may be visible from the Murray Valley Highway. It is expected that existing vegetation would partially screen the regulator and the structure would not significantly impact the view of road users. It is however, not expected that this structure would be visible from surrounding residential dwellings which are approximately 200-300 metres away. The Lake Powell pipeline is approximately 100 m from the nearest residence, however the proposed route would follow existing access tracks and would be buried. No alteration of landform is anticipated following completion of construction activities for the pipeline. Construction works would be partially screened by existing retained vegetation between the pipeline alignment and the nearest residence.  Whilst some of the remaining regulator structures are also located along existing access tracks to minimise works and vegetation removal and therefore would be visible by visitors, it is expected that visibility would be partly screened by existing retained vegetation with views generally confined to areas in proximity to the structures.  The removal of native vegetation for the project would occur in discrete areas totalling up to 50.35 hectares in the context of a largely intact expanse of native vegetation occurring within ~ 8,300 hectares of floodplain complex at Belsar-Yungera. The areas of proposed vegetation clearing are also minor when compared to the 2,374 hectares of native vegetation within the proposed inundation areas that would benefit from the project. The construction footprint around infrastructure (excluding tracks) is 25.54 hectares, but the development footprint of the infrastructure is approximately 10 ha. Following construction, areas of the construction footprint surrounding this infrastructure would be rehabilitated.  Overall, the project is expected to have a positive effect on the landscape values of the surrounding floodplains and parks. This is expected due to the project’s objective of restoring a more natural inundation regime to approximately 2,374 hectares of the Belsar-Yungera floodplain. For this reason, it is considered that the project is consistent with the management strategies outlined in the Mallee Parks Water Management Plan and the ESO1 that affects the project area. These documents recognise the importance of hydrological regimes in protecting the scenic landscapes that maintain recreational and tourism values. Parks Victoria is part of the VMFRP partnership and DELWP and is responsible for management of the Belsar-Yungera floodplain complex. |
| **Is there a potential for effects on landscape values of regional or State importance?**  🗙 NYD 🗙 No 🗙 Yes Please briefly explain response. |
| As described above, the project would involve removal of native vegetation and alteration of constructed landforms within areas supporting state and regional landscape values related to the Murray River and its floodplain. The extent of vegetation impact and landform alteration would be limited to approximately 50.35 hectares and generally within areas that have been previously modified by the construction and use of trails and tracks. On balance, in the context of the proposed areas of disturbance and vegetation removal when measured against the 2,374 hectares of 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 Park’s recreational and tourism values. |
| **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. * Limiting to height and width of embankment structures to the minimum dimensions required for long term structural stability and effective functioning * 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 rehabilitation**   * 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 should be followed:   + Photographs of the site taken prior to works should be consulted   + Where soil has been compacted due to construction works, and is not required to maintain structural integrity of works, then the soil should be ripped with narrow types 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 project area 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 shall not be compacted when reinstated. All top soil should be used in site reinstatement.   **Operation**  During the operational phase, inundation events would be managed in accordance with operational guidelines (provided in Belsar-Yungera Operating Plan – **Attachment 13 – Draft Operating Plan**) informed by detailed hydrodynamic modelling and ecological investigations and adapted as required in response to proposed monitoring and evaluation frameworks to support achievement of the identified ecological objectives for the project (detailed in the Belsar-Yungera Environmental Water Management Plan – **Attachment 6 – Draft Environmental Water Management Plan**). |
| **Other information/comments?** (eg. accuracy of information) |
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**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.

## Soils

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| **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 GHD (2015) and outlined below. Additional geotechnical works are proposed by VMFRP to supplement these previous investigations. The results of these investigations would inform the detailed design of the project.  **Geology and soils of the area**  Feasibility stage geotechnical investigations were undertaken by GHD in 2013, followed by subsequent investigations as part of the advanced concept design (GHD, 2015) and found that the materials encountered at the site were generally consistent with the published geology for the area.  GHD (2015) identifies that the project area is located within the geomorphic region of the Northern Riverine Plain, and more broadly the Murray Basin, which was formed by the subsidence of the basement rock which has been infilled by a sequence of Cenozoic or Palaeogene and Neogene (Tertiary) and Quaternary age sediments. In general, the ground conditions at the proposed project infrastructure considered in GHD (2015) are:   * ER1 regulator and fishway – for a piled foundation, the ER1 regulator is likely to be founded on medium dense sands. Alternatively, should shallow foundations prove suitable the structure is likely to be founded on medium dense sands with stiff to hard, low to high plasticity clay at the abutments. * E3 and S7 regulator structure – Stiff to very stiff clays and medium dense sands were encountered within the proposed structure footprints. there may be some discrete locations where additional excavation is required to remove small volumes of organics, sand, uncontrolled fill or soft material from the foundations. Within river channels excavation of soft, loose or other unsuitable material may be required to greater depths, anticipated to be <1.5 m. * Minor structures and levees – It is anticipated that minor structures and levees would be founded on shallow foundations within stiff to hard, low to high plasticity clay which was generally encountered at the surface across the site.   The soils encountered on site were found to be dispersive. It is anticipated that locally sourced borrow material may also be dispersive. Treatment measures to minimise the potential for embankment erosion would be determined as the detailed design progresses. Erosion protection measures may include (1) compaction of the fill to 98% of standard compaction and wet of the optimum moisture content prior to topsoiling and revegetation, (2) lime stabilisation treatment of the outer layers, (3) targeted use of geofabric or rock armour.  A hydrological assessment to evaluate change resulting from the operation of the infrastructure, relative to how the area currently floods and the benefits and risks that are associated with the changes in flooding regime is proposed to be undertaken. The hydrological change assessment would consider each of the operating phases; filling, holding and emptying. The assessment would focus on changes in velocity, shear stress, water depths and inundation extents across the floodplain areas and would provide information on the likelihood and location of soil erosion in the project area.  **Acid sulphate soils**  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 probably 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 were considered in the design of the project. Additional geotechnical work is 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, cutoff drains   + Settlement of structures – mitigated by appropriate foundation design (eg. piles), removal of inferior foundation material   In addition, prior to commencing works the contractor 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) |
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# Social environments

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| **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**  Planning for construction activities (including the temporary closure of tracks, camp sites and/or traffic management controls of access tracks) would be undertaken by LMW and the construction contractor in conjunction with Parks Victoria prior to any works being undertaken.  Construction traffic would be associated with the following activities:   * Haulage of fill / spoil to the proposed construction sites via new and existing containment banks and tracks from the Murray Valley Highway. * Delivery and removal of approximately 20 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 Robinvale or Mildura to the north.   The main access point to the western half of the site would be from Belsar Road, which would be upgraded for the project. Access to ER3, S108 and S109 would be via temporary tracks to be used for construction only and would be via the shortest route, from Murray Valley Highway. Temporary access during construction would also be provided to ER1 from Belsar Road.During construction, public access along the main access tracks would be closed from O’Connor Lane at the north of the site through to the intersection of the Murray Valley Highway and Paul Lane.  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 daytime, which would avoid night time construction traffic noise or lighting 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 ER3, J1g and Lake Powell, a fuel truck would be required to access the site to deliver the temporary pumps and bunded fuel (diesel) storage. Access to the site by fuel trucks and other large vehicles would be restricted during a managed inundation event. Access would be via the shortest route, from Murray Valley Highway. |
| **Is there a potential for significant effects on the amenity of residents, due to emissions of dust or odours or changes in visual, noise or traffic conditions?**  🗙 NYD 🗙 No 🗙 Yes If yes, briefly describe the nature of the changes in amenity conditions and the possible areas affected. |
| The regulating structures are proposed within the Belsar-Yungera floodplain complex and are well separated from residences.  The nearest residences to the project are located on rural properties along the Murray Valley Highway, approximately 100 m from the southern extent of the construction footprint (Lake Powell Pipeline).  **Construction**  A small number of residences and businesses along the Murray Valley Highway may experience some additional noise, dust and traffic during construction, particularly during the haulage of fill and spoil material along the Murray Valley Highway, Lake Powell pipeline and Belsar Road upgrade. These effects would be temporary and limited to the construction period.  The potential effects on the relatively small number of residents are typical of construction projects. As such, potential effects are well understood and able to be managed through standard controls contained in a CEMP and Traffic Management Plan. In addition, it is expected that construction would only be undertaken during the daytime period, which would avoid night time construction noise, traffic and lighting 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 100 m from the construction activities. The most likely areas where significant vibration impacts may occur would be during the construction of any road base or concrete hard stand areas for the project.  Noise and vibration impacts as a result of sheet piling for cofferdams, should this construction method be required, are not expected as the nearest receivers to these locations (ER3, ER1 and S7) are a minimum of 2.4 km from the proposed works.  **Operation**  Temporary pumping would be required in approximately two or three years in every 10 years, for a period of 60-90 days. Three temporary pump areas would be required to operate continuously, and would be located on the downstream side of ER3, adjacent to J1g regulator, and on Bonyaricall Creek at the pipeline between the creek and Lake Powell. 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 pumping site. Findings are provided below:   * Predicted noise levels from the operation of the three temporary pumps running simultaneously during a pumped inundation event are predicted to comply with the strictest noise criteria under the relevant noise standards (*Noise from Industry in Regional Victoria (NIRV): Recommended maximum noise levels from commerce, industry and trade premises in regional Victoria* (EPA Victoria, 2011) of 32 dB(A) (for sensitive land uses in the rural land zoning during the night) at all sensitive receiver locations. * General measures to avoid exceedance of the noise criteria would be employed during pumping (such as adjusting the equipment 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 located within the Belsar-Yungera floodplain complex and at a minimum of approximately 100 m away from residences. Potential adverse effects on local communities during the construction phase would most likely be limited to noise, dust and traffic associated with transport of fill / spoil between the Murray Valley Highway and the construction areas. These impacts are well understood, typical of civil construction works and would be managed through a CEMP.  A Traffic Management Plan would also 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 continue through the construction phase to manage and respond to any issues raised by local communities. |
| **Is there a potential for displacement of residences or severance of residential access to community resources due to the proposed development?**  🗙 NYD 🗙 No 🗙 Yes If yes, briefly describe potential effects. |
| The project would not displace any residences or sever residential access to community resources as the works are located within discrete sites within the park. Although public access would be temporarily closed from the north extent of the project area from Murray Valley Highway within the construction sites, impacts are only temporary in nature, and access would be reopened to the public following construction. Depending on the construction methodology, access to Yungera Island may not be disrupted for the entire construction period. |
| **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. |
| Crown land associated with the Belsar-Yungera floodplain complex is managed for multi-use values, including conservation, recreation, apiary and indigenous values. Recreational uses include fishing, boating, four wheel driving, hunting and camping including associated firewood collection. No campgrounds are designated at Belsar-Yungera, and no toilet amenities are provided, however dispersed bush camping does occur with more than 10 sites across the area (Aither 2014).  There are currently six active apiary sites across the Belsar-Yungera floodplain complex which are dependent on seasonal flowering of River Red Gums. The project would increase the regularity and reliability of flowering due to the direct benefits of increased flooding on River Red Gum.  There are also nine active private pump systems that extract from Narcooyia Creek weir pool that are below the proposed inundation level. Therefore, Belsar Road would be raised to reinstate access to the pumping infrastructure. Assessments (including surveys) are currently being undertaken to identify potential impacts to private pumps and consultation with private owners is currently being undertaken to confirm and agree on solutions. Access would be maintained, in collaboration with the construction contractor/s and relevant safety provisions, to allow the private owners to operate and maintain their pumps during construction of the project.  No freehold or Crown land use activities would be permanently displaced by the project. Construction impacts on the floodplain would be temporary only and would be rehabilitated following construction in accordance with management measures outlined in the project CEMP.  Temporary restrictions on access and land use activities within the Belsar-Yungera floodplain complex 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. |
| Temporary disruptions to access and activities within the project area are likely to occur during construction and planned inundation events.  The project would work closely with Parks Victoria, as a project partner, to minimise the impact on park visitors during the construction of the works.  Specifically, the project would look to maintain park user access to the Belsar and Yungera Island from Belsar Road and Centre Track, which would allow access to a majority of the Park for most of the construction timeframe. This access would be restricted to the public during the Belsar Road raising works however.  The project would work with local stakeholders who operate and maintain private infrastructure within the Park to ensure they have uninterrupted access. This would require some coordination with the construction contractor and additional safety provisions and controls.  Planning for construction or watering activities would be undertaken by LMW and Parks Victoria prior to any activities being undertaken. Temporary disruptions may include:   * Access to the project area from O’Connor Lane to the intersection of Murray Valley Highway and Pauls Lane would be closed to the public during construction * Access along some existing access tracks would also be closed to the public during managed inundation events.   It is anticipated that the opportunities for active and passive recreation, and tourism may be temporarily affected in some specific locations during these inundation events, however these activities are on the whole likely to be facilitated and encouraged by inundation events.  The project would not involve any permanent closure of existing access tracks or other facilities that are currently available for public use.  Although temporary disruptions to access and activities within the Belsar-Yungera floodplain complex 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 River Murray Reserve user experiences in the longer term.  Impacts on freehold land use are not anticipated to be significant. Freehold land in the project area has a number of existing restrictions on its use and development potential. Much of it is inherently flood prone and therefore has limited commercial use or development opportunitiy. Opportunistic grazing occurs on some parcels. Managed inundation events would temporarily affect the use of some freehold land for farming purposes. No permanent dwellings are known to be in the area of planned inundation, as they are typically constructed on areas of higher ground.  A range of preliminary discussions have been undertaken with the owners of the potentially affected freehold land. Formal agreements with private landholders relating to access, infrastructure and planned inundation activities would be sought as the project progresses, and operating scenarios (and associated flood extent, frequency and duration) are confirmed.. As part of VMFRP, Lower Murray Water will engage with the private landholders with the intention of securing an easement over the land proposed to be inundated. If easements are not granted, the CMA will look to enter into a deed of agreement with affected landholders prior to any managed events occurring. |
| **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 identify and confirm potential issues and user impacts, minimise disruption to reserve 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 reserve facility closures in a timely and readily available manner to interested parties to minimise disruption.  The project has considerable potential to provide amenity and social benefits through recreational activities during or following inundation events. The improved quality of vegetation post inundation is expected to improve the visitor experience in the River Murray Reserve.  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 and/ or DELWP with operational flexibility to restrict access to parts of the Reserve where deemed necessary to provide rest and recovery from visitation.   **Traffic management plan**   * A Traffic Management Plan would be prepared and approved in accordance with the *Road Management Act 2004* and implemented. The plan would be prepared by a suitably qualified and experienced traffic engineer. * The Contractor would liaise with the land manager and the relevant Council in the preparation of the Traffic Management Plan. Evidence of this consultation would 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 would 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 the duration of the works. Nearby residents are to be notified at least seven days in advance of works commencing, and of the nature, duration, and hours of work if they are likely to be impacted by construction activities (i.e., due to noise, vibration, access, traffic).   **Noise management plan**   * Prepare and implement a Noise Management Plan as part of the CEMP that includes appropriate measures to minimise noise and vibration consistent with EPA publications: *Noise Control Guidelines* (EPA Publication 1254) and *Environmental Guidelines for Major Construction Sites* (EPA Publication 480) and *AS 2436 Guide to Noise Control on Construction Maintenance and Demolition Sites*. The Noise Management Plan would 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   + Schedule deliveries to the site so that disruption to local amenity is minimised   + Notifying the landowner/manager and nearby residences of any planned and unavoidable out of hours works at least five days in advance. * All construction plant and equipment used on the works would, in addition to other requirements, be:   + Fitted with properly maintained noise suppression devices in accordance with the manufacturer’s recommendations   + Be maintained and operated in accordance with manufacturer’s recommendations   + Switched off when not in use * All noise and vibration complaints are to be investigated and corrective actions implemented as required   **Temporary pumping**   * Measures to avoid exceedance of the noise criteria would 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) |
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## Cultural heritage

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| **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 groups has included engagement with the following groups:   * Murray Valley Aboriginal Cooperative * Latji Latji Mumthelang Aboriginal Corporation * Dadi Dadi Weki Weki Aboriginal Corporation * Wadi Wadi Land and Water Indigenous Corporation * Tati Tati Land and Water Indigenous Corporation * Gilbie Aboriginal Corporation   There is no Registered Aboriginal Party (RAP) for the project area. A Cultural Heritage Management Plan (CHMP) would be prepared for the project in consultation with the above Traditional Owner groups.  To date, the VMFRP Cultural Heritage Engagement team has held one-on-one discussions with the nominated representatives between February and April 2020. During these meetings, the representatives confirmed they would either participate in cultural heritage field work at Belsar-Yungera or nominate their preferred person from their group (and trainees where applicable) to take part in rostered fieldwork and other planning meetings. VMFRP has continued to be in touch with these key representatives through email and phone to advise them that planned meetings were put on hold due to COVID-19 restrictions. An inception meeting and fieldwork are planned to re-commence from mid-2020. |
| **What investigations of cultural heritage in the project area have been done?**  (attach details of method and results of any surveys for the project & describe their accuracy) |
| The following cultural heritage investigations and studies have been undertaken for the project to date, focussing on the construction footprint:   * Mallee Environmental Watering projects, Belsar-Yungera Floodplain Northwest Victoria Cultural Heritage Due Diligence Assessment (2013) prepared by Jo Bell Heritage Services Pty. Ltd:   + Desktop assessment of Aboriginal cultural heritage values within an approximate 100 m radius of proposed structures.   + Found that the general project area has been subject to a number of previous investigations. A Cultural Heritage Permit (CHP) was obtained approximately 500 m north west of ER1 in 2010.   + Included a review of the Victorian Aboriginal Heritage Register (VAHR) and identified 21 registered Aboriginal places on Belsar and Yungera Islands. * R8 Assessment to determine the requirement of a CHMP for the project. This was based on an ‘activity area’ that was initially defined based on the advanced concept design construction footprint (August 2019). This included:   + Desktop assessment of Aboriginal cultural heritage values within 50 m of the advanced concept design construction footprint (activity area) and 10 m of relevant access tracks.   + There have been five previous cultural heritage investigations within the activity area, and an additional six assessments within the geographic region.   + A review of the Victorian Aboriginal Heritage Register (VAHR) identified 64 Aboriginal Places totalling 75 individual components located within 50 m of the activity area. A total of six Aboriginal Places are entirely within the activity area.   + A CHMP is required as the proposed activity is a high impact activity (utility installation) within an area of cultural heritage sensitivity. * Victorian Murray Floodplain Restoration Project, Belsar-Yungera Draft Complex Cultural Heritage Management Plan No. 16898 (to be prepared by R8):   + A Notice of Intent (NOI) to prepare a CHMP was lodged with Aboriginal Victoria on 24 October 2019   + VMFRP are currently undertaking stakeholder consultation prior to the commencement of field work and development of the CHMP   + The CHMP would assess potential impacts to cultural heritage within the construction footprint and area of inundation.   + The CHMP is scheduled to be completed in late 2020. * Mallee Environmental Watering projects, Belsar-Yungera Floodplain Northwest Victoria Historical Due Diligence Assessment (2013) prepared by Jo Bell Heritage Services Pty. Ltd:   + Desktop assessment and site inspection of cultural heritage values within an approximate 100 m radius of proposed structures.   + No previously recorded historic archaeological sites within 100 metres of proposed structures were identified based on a review of the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), Australian Heritage Places Inventory (the National Heritage List, Commonwealth Heritage List and World Heritage List) and the Swan Hill Planning Scheme Heritage Overlay.   + No historic archaeological sites were identified within 100 m of the proposed structures and no further areas of potential sensitivity for historic archaeological sites were identified within the activity area during the site inspection * Victorian Murray Floodplain Restoration Project, Belsar-Yungera Historical Heritage Desktop Assessment (2020) prepared by R8:   + Assessment of historic archaeological values within the area of investigation and inundation area at Belsar-Yungera.   + The desktop review did not identify any historical heritage places within or adjacent to the construction footprint or inundation area.   + Yungera Homestead (HO207) is located approximately 813 m to the east of the northern part of the area of investigation.   + There is moderate potential for previously unidentified historical heritage to be present within the project area.   + Recommended that a Historical Heritage Assessment should be undertaken for the project which should include field survey to identify any further historical archaeological sites and any 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 |
| The floodplain of the Murray River has significant cultural heritage values for the local indigenous communities. It is well recognised as a traditional meeting place providing water, food and materials for medicines, shelter, clothing and tools. The area contains numerous scar trees, middens, mounds, burial sites, surface scatters and other artefacts (Mallee CMA, 2014).  The assessments undertaken to date were based on the activity area associated with the advanced concept design for the project. There have been some minor changes to the proposed construction footprint since this time, typically associated with existing access tracks. As the design process progresses, further assessment of the project area would be undertaken. This assessment would be included as part of the development of the CHMP.  A search of the VAHR (27 August 2019) identified 64 total registered cultural heritage places (Aboriginal Places), containing a total of 75 individual components, located within the activity area. There are six components of Aboriginal Places located within the activity area, and 13 additional areas of Cultural Heritage Sensitivity (CHS) associated with Aboriginal Place components located with the activity area. A background review of relevant information and VAHR search results indicated that Aboriginal Places would most commonly be found within 100 m of an existing or prior hydrological feature such as the margins of the Murray River, Bonyaricall Creek, Narcooyia Creek, Yungera Creek, Lake Powell and Lake Carpul. As six Aboriginal Place components were identified within the activity area, there is a moderate potential for Aboriginal cultural heritage to be present in the activity area.  A summary of Aboriginal Place components located within proximity to the activity area is provided in **Table 17**.  **Table 17 Aboriginal Places located within proximity to the activity area**   |  |  |  |  | | --- | --- | --- | --- | | Aboriginal Place name | VAHR and component no. | Aboriginal Place Type | Distance from the activity area | | Narcooyia 1 | 7428-0954-1 | Earth Feature (Hearth) | Within 50 m | | Narcooyia 2 | 7428-0955-1 | Earth Feature (Hearth) | Within 50 m | | Narcooyia 3 | 7428-0956-1 | Earth Feature (Hearth) | Within 50 m | | Narcooyia 4 | 7428-0957-1 | Earth Feature (Hearth) | Within | | Narcooyia 5 | 7428-0958-1 | Earth Feature (Hearth) | Within 50 m | | Narcooyia 6 | 7428-0959-1 | Earth Feature (Hearth) | Within 50 m | | Narcooyia 2 Mound 2 | 7428-1010-1 | Earth Feature (Mound) | Within 50 m | | Yungera 2 | 7428-1020-1 | Aboriginal Ancestral Remains (Burial) | Within 50 m | | Lake Carpul Earth Features | 7428-1027-1 | Earth Feature (Hearth) | Within | | Lake Carpul Earth Features | 7428-1027-2 | Earth Feature (Hearth) | Within | | Lake Carpul Earth Features | 7428-1027-3 | Earth Feature (Hearth) | Within | | Lake Carpul Earth Features | 7428-1027-4 | Earth Feature (Hearth) | Within | | Yungera Island 1 | 7528-0066-3 | Scarred Tree | Within 50 m | | Yungera Island 1 | 7528-0066-2 | Scarred Tree | Within 50 m | | Yungera Island 1 | 7528-0066-1 | Shell Midden | Within 50 m | | Yungera Island 2 | 7528-0067-1 | Scarred Tree | Within 50 m | | Yungera Island 3 | 7528-0068-1 | Scarred Tree | Within 50 m | | Yungera Island 4 | 7528-0070-1 | Scarred Tree | Within 50 m |   The CHMP currently being prepared for the project is the mechanism for managing impacts to Aboriginal cultural heritage. As a part of the CHMP process, consultation with the Traditional Owner groups is ongoing. The CHMP would include a desktop assessment, standard assessment (field survey) and complex assessment (sub-surface testing).  The CHMP currently being prepared for the project would identify the impact on the Aboriginal heritage places listed in **Table 17** and any others found during the standard and complex investigations. |
| **Are there any cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the *Heritage Act 1995* within** **the project area?**  🗙 NYD 🗙 No 🗙 Yes If yes, please list. |
| A desktop heritage assessment has been prepared and is provided in **Attachment 11 –Historical Heritage Desktop Assessment.**  No places listed on the Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI), World Heritage List, National Heritage List or Commonwealth Heritage List are located within or adjoining the area of investigation.  Similarly, there are no historical heritage places listed on the Swan Hill Planning Scheme Heritage Overlay (HO) within or adjacent to the area of investigation.  The closest historical heritage place to the construction footprint and inundation areas is Yungera Homestead (HO207), located approximately 813 m to the east of the northern part of the area of investigation.  Refer to **Attachment 11 - Historical Heritage Desktop Assessment** for further detail regarding the historical and heritage context of Belsar-Yungera.  In addition, based on an assessment of aerial imagery and a review of relevant historical heritage assessments, there is moderate potential for previously unidentified historical heritage to be present within the area of investigation and the inundation area. Site types which may be identified in the area of investigation would be places associated with early agricultural or pastoral activities 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 would be prepared in consultation with the identified Traditional Owner groups for approval by AV and would include specific management conditions for a number of Aboriginal Places together 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. * 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. The CHMP would include management conditions for contractor induction/training and for unexpected discoveries.   **Historical Heritage**   * Further historical heritage investigations would be undertaken to identify risks to registered and potentially unrecorded historical heritage features within the project area. This would be informed by the findings of the detailed inundation assessment carried out for the CHMP. A copy of this report (once completed) would be kept onsite and on file with the project records. All contractors and/or project staff should be made aware of the heritage status of the heritage places in the project area prior to works taking place.   **Unexpected discoveries of archaeological sites**   * All historical archaeological sites in Victoria older than 75 years are protected by the *Heritage Act 2017*, whether they are recorded on the VHI or not. It is an offence to knowingly or negligently deface, damage, or otherwise interfere with an archaeological site without obtaining the appropriate consent from the Executive Director of Heritage Victoria). 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 would as soon as practicable report the discovery to HV. If any unexpected archaeological sites are uncovered during construction works, the following procedure would be followed:   STOP   * Stop any activity which may impact on the discovery * Ensure that other people working in the area are aware of it and have also stopped work in the area * Protect the artefacts or site by erecting temporary fencing or other suitable barrier   ADVISE   * A supervisor or the cultural heritage consultant would be consulted if they are on site * Supervisors are to advise HV where the discovery was made and provide a description or photograph of the discovery   MANAGE   * HV, the onsite heritage consultant or supervisor 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 Consent to Damage from HV   **Heritage induction training**   * Historical heritage awareness training would 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 would as soon as practicable report the discovery to HV. * A copy of the heritage report would be kept onsite and on file with the project records. All contractors and/or project staff would 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) |
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# Energy, wastes & greenhouse gas emissions

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| **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 at three sites within the project area, when required. Details of the proposed temporary pump locations for Belsar-Yungera are presented in **Table 18**.  The frequency and duration of water pumping at each site would depend on actual inundation events and the method to achieve environmental watering targets. For each Belsar-Yungera temporary pumping site, it is estimated that pumping may be needed in approximately two or three years in a 10-year period, and for a duration of approximately 60 to 90 days for each event.  The estimated water quantities to be transferred for the Belsar-Yungera project are provided in **Table 18** as detailed in the advanced concept design report (GHD 2017) and the detailed design report (R8 2020).  **Table 18** **Summary of pumping events at Belsar-Yungera**   |  |  |  |  | | --- | --- | --- | --- | | Pumping parameters | ER3 Temporary pump site (Murray River) | J1g temporary pumps site (Murray River) | Lake Powell temporary pump site (Bonyaricall Creek) | | Water quantity to be pumped from the Murray River/ Bonyaricall Creek | 12,000 ML | 2,400 ML | 3,900 ML | | Frequency of pumping events | 2 – 3 in 10 years | 2 – 3 in 10 years | 2 – 3 in 10 years | | Duration of pumping events | 60 – 90 days | 60 days | 60 days | | Pumping rate (approximate) | 200 ML/day | 40 ML/day | 65 - 80 ML/day | |
| **What are the main forms of waste that would be generated by the project facility?** |
| 🗙 Wastewater. Describe briefly. |
| 🗙 Solid chemical wastes. Describe briefly. |
| 🗙 Excavated material. Describe briefly. |
| 🗙 Other. Describe briefly. |
| Please provide relevant further information, including proposed management of wastes. |
| The main waste streams as a result of the construction works include:   * Excess spoil * Cleared vegetation * General building and miscellaneous wastes such as packaging, off cuts, excess materials * Workers’ waste such as packaging, containers, food scraps, etc.   As part of the CEMP, the contractor would be required to prepare a 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 the land manager, and managed in accordance with the *Environment Protection Act 1970* (and *Environment Protection Act 2017*) and other relevant legislation.  Subject to approval from Parks Victoria and/or DELWP, 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 reserve.  No significant volumes of waste would be generated during operation of the project. |
| **What level of greenhouse gas emissions is expected to result directly from operation of the project facility?**  🗙 Less than 50,000 tonnes of CO2 equivalent per annum  🗙 Between 50,000 and 100,000 tonnes of CO2 equivalent per annum  🗙 Between 100,000 and 200,000 tonnes of CO2 equivalent per annum  🗙 More than 200,000 tonnes of CO2 equivalent per annum |
| Please add any relevant additional information, including any identified mitigation options. |
| The estimated Scope 1 GHG emissions[[6]](#footnote-7) for each pump event range between approximately 208 t CO2-e for the J1g temporary pump station and 1,040 t CO2-e for ER3 temporary pump station. In each event, these emissions are expected to occur for a duration of 60 – 90 days, with 2 to 3 events in a 10-year period.  The estimated GHG emissions are significantly less than the 200,000 t CO2-e per annum trigger for a referral under the *Environment Effects Act 1978* as set out in *the Ministerial Guidelines for Assessment of Environment Effects* *under the Environment Effects Act 1978* (Department of Sustainability and Environment, 2006). The 200,000 t CO2-e per annum trigger is for emissions directly attributable to the project, i.e. Scope 1 emissions.  The emissions are also significantly less than the NGER annual reporting threshold of 25,000 t CO2-e for individual facilities. |

# Other environmental issues

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| **Are there any other environmental issues arising from the proposed project?**  🗙 No 🗙 Yes If yes, briefly describe. |
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# Environmental management

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| **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. |
| **Environmental Management**  A draft Environmental Management Framework (EMF) has been prepared for the VMFRP program containing an overview of:   * Project description – location, environmental context, project objectives, construction and operational activities * Roles and responsibilities for implementation of environmental management during construction and operation of the program * An overview of related environmental management documentation and associated approval processes (e.g. CEMP, CHMP, EWMP, Operating Plans, etc) * An overview of relevant legislation and statutory approval requirements * The approach to identifying and evaluating potential risks to environmental values during construction and operation of the project * Environmental management measures to avoid or mitigate environmental impacts, including the measures outlined in the previous sections to avoid, minimise or manage potential adverse environmental effects associated with the project. * Monitoring, reporting and auditing requirements to inform adaptive management.   A copy of the draft EMF is provided in **Attachment 12 – 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 processes progress.  **Design and construction**  The Project has undergone a comprehensive and iterative design process to maximise the environmental benefits associated with watering, and to minimise any unavoidable impacts. A number of design options have been considered. Measures to mitigate impacts on the environmental values of the Belsar-Yungera floodplain have been integrated into the design process and would continue to be applied as further design refinements are made.  In accordance with the draft EMF, the contractor would be required to prepare a 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   General mitigation measures to be implemented during construction are outlined in the Draft EMF (**Attachment 12 – Draft Environmental Management Framework)**.  **Operation**  The primary environmental management documentation for managing adverse environmental effects and maximising environmental benefits during operation of the project would be the:   * Belsar-Yungera Environmental Water Management Plan (EWMP) * Belsar-Yungera Operating Plan   These are discussed below.  ***Belsar-Yungera Environmental Water Management Plan***  The Belsar-Yungera Environmental Water Management Plan:   * 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 copy of the current Belsar-Yungera Environmental Water Management Plan (MCMA, 2012) and a draft addendum (VMFRP, 2020) prepared to integrate the proposed Belsar-Yungera environmental watering works into the current EWMP is provided in **Attachment 6 – Draft Environmental Water Management Plan**.  ***Belsar-Yungera Operating Plan***  The Operating Plan provides the framework for operation of the Belsar-Yungera water management structures 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 current Belsar- Yungera Operating Plan (VMFRP, 2020) is provided **in Attachment 13 – 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, LMW would adopt their own Operating Plan on completion of construction.  In addition to implementation of these documents and the general mitigation measures to be implemented during the operation of the project are provided in outlined in the Draft EMF (**Attachment 12 – Draft Environmental Management Framework)**. |

# Other activities

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| **Are there any other activities in the vicinity of the proposed project that have a potential for cumulative effects?**  🗙 NYD 🗙 No 🗙 Yes If yes, briefly describe. |
| The project has some potential for cumulative effects in relation to other VMFRP projects. The potential for cumulative effects is generally associated with:   * Salinity impacts associated with saline water discharge to the Murray River and compliance with the Basin Salinity Management Strategy targets (noting that the salinity in soils and groundwater in this project area is low to moderate). * 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 would be carried out as design development and environmental investigations are advanced at this and other VMFRP sites. Cumulative impacts associated with the VMFRP sites have not been considered in detail, as it has not yet been determined which projects will proceed.  VMFRP is not aware of any potential cumulative impacts associated with existing or proposed third party projects in the area. The potential for cumulative impacts associated with third party projects would be confirmed via consultation with Swan Hill Rural City Council and Balranald Shire Council as the project progresses. |

# Investigation program

## Study program

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| **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 (not already discussed in Part 2 of this referral) to date include:  Aither (2014) Social and Economic Assessment – Belsar Yungera Water Management Works: Benefits for the Basin Plan Sustainable Diversion Limits offset program business case. Report for the Mallee CMA.  ARI (Arthur Rylah Institute for Environmental Research) (2020) Victorian Murray Floodplain Restoration Project Ecological Monitoring, Evaluation and Reporting Plan. Prepared for VMFRP.  Australian Ecosystems (2009). Belsar and Yungera Floodplain Complex Flora Survey, Final Report. Report for Mallee Catchment Management Authority.  DSE (2010). Belsar and Yungera Islands Floodplain Management Unit Environmental Water Management Plan. Report for the Mallee CMA  Ecological Associates (2006) Investigation of water management options for the Murray River – Nyah to Robinvale. 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| **Has a program for future environmental studies been developed?**  🗙 No 🗙 Yes If yes, briefly describe. |
| The effectiveness of the proposed supply measure and its operation would primarily be monitored and reported on through the 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 TLM program, which provides watering of approximately 6,000 hectares of the central and southern Hattah Lakes floodplain. 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 (ARI, 2020) is currently being funded by the project and is due to be completed by mid-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 any 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. |

## Consultation program

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| **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 Belsar-Yungera project over a period from 2012 to current. Consultation activities would continue for the duration of the project.  Communication and engagement activities conducted have been undertaken in accordance with VMFRP’s Stakeholder Engagement and Communication Plan (for all sites) and have included:   * More than 250 face-to-face briefing sessions, meetings, presentations and on-site visits, engaging more than 600 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 and DELWP * Adjacent private landholders * Narcooyia Creek irrigators * Aboriginal stakeholders * Regional Development Australia, Regional Development Victoria – Loddon Mallee * Local government (Swan Hill Rural City Council) * Community groups including the Mid Murray Field Naturalists and Sustainable Living in the Mallee   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 Belsar-Yungera floodplain project is published on the VMFRP website:  <https://www.vmfrp.com.au/wp-content/uploads/2019/07/VMFRP_FactSheet_A4_Belsar_Yungera_0319_01.pdf> |
| **Has a program for future consultation been developed?**  🗙 NYD 🗙 No 🗙 Yes If yes, briefly describe. |
| Targeted, tailored consultation would continue to be conducted in accordance with VMFRP’s Stakeholder Engagement and Communication Plan with key stakeholders throughout the project, aligning to project milestones, assessments and approvals processes where necessary and/or appropriate. This includes further face-to-face briefings, presentations, site visits and regular project updates via mail-outs and newsletters.  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, …………………………………………………(full name),

……………………………………………………(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.

**Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Date

**Person who prepared this referral:**

I, …………………………………………………(full name),

……………………………………………………(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.

**Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Date

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1. Expected environmental outcomes contained in the recently updated Basin-wide Environmental Watering Strategy (November 2019) (MDBA, 2019) are unchanged from the 2014 strategy. [↑](#footnote-ref-2)
2. 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, 2014. [↑](#footnote-ref-3)
3. Area affected by the project and, presumably provide benefit to plant and animal communities. [↑](#footnote-ref-4)
4. For the purposes of the Flora and Fauna Assessment, study area refers to the proposed construction footprint and a 10 km radium around it. The study area provides context for the significance of any ecological features recorded in proximity to the project. [↑](#footnote-ref-5)
5. Includes environmental water entitlements already held by the Murray Darling Basin Authority, the Commonwealth Environmental Water Holder and the Victorian Environmental Water Holder. [↑](#footnote-ref-6)
6. 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. [↑](#footnote-ref-7)