EPBC Act referral

Australian Government
Department of Agriculture, Water and the Environment

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Title of proposal	2020/8765 - Lindsay Island Floodplain Restoration Project

Section 1

Summary of your proposed action

1.1 Project industry type Water Management and Use

1.2 Provide a detailed description of the proposed action, including all proposed activities

The project aims to restore a more natural inundation regime and improve ecological condition across approximately 4,845 ha of high ecological value floodplain in Victoria, mostly located on Lindsay Island and floodplain areas south of the Lindsay River, including Lake Wallawalla. By restoring a more natural inundation regime, the project aims to mimic the impact of prior to river regulation natural flood events, improving the condition of vegetation communities, and providing seasonal aquatic habitat for native fauna. Operation of the project would involve raising water levels in the Lock 7 weir pool by 1.1 mAHD above its normal operating level of 22.1 mAHD, which would raise water levels along the Murray River upstream of Lock 7 as well as inundating some lower-lying billabongs and creeks on the New South Wales (NSW) side of the Murray River. Approximately 263 ha of inundation is currently identified in NSW, mostly along the Murray River.

Murray River flows at Lindsay Island have been altered significantly by storages, regulation and diversions on both the Murray and Darling Rivers. River regulation has reduced the occurrence of high flows and created extended periods of low flows, delayed the onset of floods and reduced the frequency and duration of floods. Operation of the project aims to more closely align the frequency, duration and timing of future flood events, with the natural (pre-regulation) frequency, duration and timing of flood events experienced by targeted water regime classes within the managed inundation area. Using water from both natural flood events and weir pool manipulations, the project is designed to enable managed inundation of six water management areas (WMAs) up to different design water levels (DWL):

- Berribee WMA (DWL 23.2 mAHD, inundation area 3,507 ha in Victoria)
- Crankhandle WMA (Upper Tier DWL 22.6 mAHD, inundation area 299 ha; Lower Tier DWL 21.6 mAHD, inundation area 17 ha)
- Crankhandle West WMA (Upper Tier DWL 22.2 mAHD, inundation area 23 ha; Lower Tier DWL 21.7 mAHD, inundation area 72 ha)
- Lindsay South WMA (DWL 24.4 mAHD, inundation area 140 ha)
- Wallawalla East WMA (DWL 25.2 mAHD, inundation area 164 ha)
- Wallawalla West WMA (DWL 24.7 mAHD, inundation area 623 ha).

Managed inundation of Crankhandle and Crankhandle West WMAs is achieved via gravity releases from Berribee WMA. Managed inundation of the Lindsay South, Wallawalla East and Wallawalla West WMAs is achieved via pumping from Lindsay South Creek, the Lindsay River and Lake Wallawalla respectively.

Attachment 1 maps show the main project components, access plans and water movement during operation. Findings from on-site assessments would continue to be progressively fed into design, with modifications made to avoid and minimise impacts.

Project infrastructure

The design, number and location of project structures and extent of access track upgrades would be refined through the project design process. The current design involves construction of:

- Four large regulators (Regulator BERR_A (Berribee Regulator), Regulators BERR_F, CR_A, CW_B1). Berribee Regulator is the largest regulator and would need to comply with Australian National Committee on Large Dams guidelines.
- Sixteen small regulators (Regulators BERR_B, BERR_C, BERR_D, BERR_E, CR_B, CR_C, CR_D, CR_E, CR_F, CW_A, CW_B2, LS_A, LS_B, WE_A, WW_A1, WW_A2)
- Two box culverts (BERR_G, WE_D)
- Two drop structures into the Lindsay River (CW_A, CW_B1) and one drop structure into the Murray River (CR_D)
- Approximately 9 km of containment banks to retain water at the design water level, and incorporating overflow spillways to enable controlled release of larger flows prior to overtopping of the containment banks. Proposed containment banks are mostly located along existing access tracks. Access tracks would be reinstated on top of the containment banks and surfaced with gravel, with passing bays at necessary locations
- Approximately 1.6 km of new excavated channels (CR_G, CW_D) to improve hydraulic efficiency along existing flow paths by lowering localised high points
- Three hardstands (6 m x 6 m crushed rock pads) for temporary pumping (WE_D, WW_B, LS_C) and one permanent suction line into Lake Wallawalla (WW_B)
- A 50 m x 50 m fenced compound on the northern bank of the Lindsay River at the Berribee Regulator site to provide for storage of equipment and materials during maintenance and operation of the Berribee Regulator.

Pumping

Hardstands at LS_C, WE_D and WW_B would support temporary pump infrastructure, which would include a trailer-mounted pump with bunded fuel storage. Temporary suction pipes would be used for the Lindsay South and Wallawalla East WMAs. A permanent suction pipeline is proposed for the Wallawalla West WMA. The frequency and duration of pumping would depend on natural inundation and the shortfall of water in the floodplain needed to achieve environmental watering targets.

Access tracks

Approximately 5 km of new access track and 82 km of maintenance / upgrades to existing access tracks is currently proposed. A review and rationalisation of track requirements is being undertaken to minimise impacts from track works.

Fish passage

The Berribee Regulator provides fish passage via a vertical slot fishway in the south abutment and is designed to maintain a 1,000 ML/day passing flow to attract fish towards the fishway. The fishway would provide for upstream and downstream passage of small, medium and large fish (30-1400 mm long), along with eggs and larvae, during all hydrological scenarios. The design of other regulators allows for passive fish passage directly through the regulator structure, but no specific fish passage structures. Medium to 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. During watering events, fish would be able to move across submerged areas.

Temporary construction activities

Temporary laydown areas currently identified near the Berribee Regulator would provide the primary location for site offices, vehicle parking, storage of equipment and materials, during construction of the project. Additional laydown areas would be required in proximity to other proposed structures and would be located in existing disturbed areas where practicable. Boat/barge launch and landing areas would be required for construction of the Berribee Regulator, and would likely be located downstream of the regulator, including use of an existing boat ramp.

Borrow pits/quarry sites

Construction of the project would require the import of material (clay/rock). VMFRP is in the process of identifying possible borrow pits to acquire clay/rock material for embankments and tracks, with the objective of selecting locations on cleared private land as close as possible to the project, while also avoiding and minimising impacts. Rock beaching for erosion protection works would be sourced from an existing commercial quarry.

Other

No new power supply connections are required to facilitate operation of the project. Commercially sourced concrete for construction of the proposed works would be transported to the project area with no requirement for on-site concrete batching facilities.

1.3 What is the extent and location of your proposed action?

See Appendix B

1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland)

The project area is centred on Lindsay Island in north west Victoria. Lindsay Island is around 28 km long east to west, is enclosed by the Murray River in the north and Lindsay River anabranch in the south, and is dissected by a number of creeks. Some minor works and inundation would occur in NSW, mostly within the Murray River between Lock 7 and Lock 8, and low-lying creeks and billabongs.

The project area is 75 km west north west of Mildura (Victoria), 60 km west of Wentworth (NSW), 30 km east of Renmark (South Australia) and 10 km east of the Victoria/South Australia border.

The project is mostly in Murray-Sunset National Park, with some works and inundation on Crown land and freehold land in Victoria and NSW. The project is in the Victorian local government area (LGA) of the Rural City of Mildura, with some minor works and inundation in the NSW LGA of Wentworth Shire. The project is in the Murray Scroll Belt bioregion.

1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?

The Section 1.3 action area shows the project location. Due to the project's non-linear nature and file constraints the action area is a simplified shapefile with a buffer around the project area. An area of investigation (AOI) of around 235 ha was established in the action area based on the current design. The inundation area is around 5,108 ha (in Victoria and NSW). These areas are the focus of desktop assessments. The current construction footprint (disturbance footprint) is in the AOI, around 76 ha and used to assess impacts on vegetation. Design is being refined in response to environmental and cultural heritage studies. Where practicable, changes would occur within the AOI. Temporary laydown areas for work sites other than Berribee Regulator, boat/barge launch and landing facility locations are yet to be determined but would be in the AOI where practicable. Borrow pit locations are yet to be determined but would be on private land outside the AOI, but likely within action area.

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1.7 Proposed action location

Address - Murray-Sunset National Park, Old Mail Road, Murray-Sunset, Victoria, 3741, Australia

1.8 Primary jurisdiction Victoria

1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?

☑ Yes ☐ No

1.9.1 Provide detail

The project is being delivered as part of the Victorian Murray Floodplain Restoration Project (VMFRP). VMFRP is a regional partnership model between Lower Murray Water (LMW), Goulburn Murray Water (GMW), the Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority (North Central CMA) and Parks Victoria, set up to deliver the VMFRP works on behalf of the Department of Environment, Land, Water and Planning (DELWP) - Water. LMW is the project proponent.

In early 2019, the VMFRP secured funding from the Australian Government via the Department of Agriculture to progress engagement with communities and the development of detailed designs and approvals for the following nine projects (listed in upstream to downstream order), which are designed to deliver Sustainable Diversion Limits (SDL) offsets and reduce the requirement for water buybacks under the Murray-Darling Basin Plan:

- Gunbower
- Guttrum and Benwell
- Vinifera
- Nyah
- Burra Creek
- Belsar-Yungera
- Hattah Lakes North
- Wallpolla Island
- Lindsay Island.

Australian Government funding of the project was granted following a staged assessment of the following proposals by the Sustainable Diversion Limits Adjustments Assessment Committee:

- Phase 1 Submission – Lindsay Island Floodplain Management Project – SDL Adjustment Supply Measure – submitted by Mallee CMA in 2013.
- Phase 2 Submission – Lindsay Island Floodplain Management Project – Supply Measure Business Case – submitted by Mallee CMA in 2014.

1.10 Is the proposed action subject to local government planning approval?

☑ Yes ☐ No

1.10.1 Is there a local government area and council contact for the proposal?

☑ Yes ☐ No

1.10.1.0 Council contact officer details

1.10.1.1 Name of relevant council contact officer	Damien Sutton, Statutory Planning Coordinator
1.10.1.2 E-mail	damien.sutton@mildura.vic.gov.au
1.10.1.3 Telephone Number	03 5018 8100

1.11 Provide an estimated start and estimated end date for the proposed action

Start Date	01/07/2022
End Date	30/06/2024

1.12 Provide details of the context, planning framework and state and/or local Government requirements

Local government

The project is mostly in the Victorian LGA of the Rural City of Mildura and subject to the provisions of the Mildura Planning Scheme. The following zones and overlays apply:

- Public Conservation and Resource Zone (PCRZ)
- Farming Zone (FZ)
- Environmental Significance Overlay (Schedule 1 – Murray River Corridor) (ESO1)
- Land Subject to Inundation Overlay (LSIO)

- Bushfire Management Overlay (BMO).

Planning approval is required for use, buildings and works (including earthworks), and removal, destruction or lopping of native vegetation.

The following components extend into the NSW LGA of Wentworth Shire:

- Construction of Drop Structure CR_D in the Murray River
- Managed inundation associated with raising the Lock 7 weir pool, including along the Murray River behind Lock 7 and potentially upstream to Lock 8, and inundation of lower-lying billabongs and creeks on the northern side of the Murray River.

Environmental planning instruments identified as relevant for the purpose of the NSW Environmental Planning and Assessment Act 1979 (NSW EP&A Act) include:

- State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP (NSW))
- State Environmental Planning Policy No. 44 – Koala Habitat Protection
- Murray Regional Environmental Plan No.2 – Riverine Land
- Wentworth Local Environmental Plan 2011 (Wentworth LEP).

Drop Structure CR_D is on land zoned W1 Natural Waterways under the Wentworth LEP. The works for Drop Structure CR_D are defined as a 'water reticulation system' under the Wentworth LEP. Review of relevant environmental planning instruments found the project is permissible with consent from Wentworth Shire Council pursuant to Clause 126A of the Infrastructure SEPP (NSW). Land inundated in NSW is zoned W1 Natural Waterways, SP2 – Infrastructure, RU3 – Forestry, and RU1 – Primary Production under the Wentworth LEP. Further assessment and consultation with Wentworth Shire Council is required to determine if consent is required under the Wentworth LEP for managed inundation in NSW.

Commonwealth and state notifications, assessments and approvals likely to be required include:

Commonwealth

- Notification of a 'future act' under the Native Title Act 1993 (Cth) for activities on Crown land that may affect native title rights and interests
- Notification of the MDBA of a proposal which may affect the flow, use, control or quality of any water in the upper River Murray under clause 49 of Schedule 1 of the Water Act 2007.

Victoria

- Referral to the Minister for Planning (via DELWP) under the Environment Effects Act 1978 to determine whether or not an Environment Effects Statement is required
- A planning scheme amendment or planning permit under the Mildura Planning Scheme, pursuant to the Planning and Environment Act 1987
- A Cultural Heritage Management Plan developed in consultation with the First People of the Millewa-Mallee Aboriginal Corporation (including members of the Ngintait peoples) as the Registered Aboriginal Party for the project area and approved by Aboriginal Victoria under the Aboriginal Heritage Act 2006 and Aboriginal Heritage Regulations 2018
- Consent from Parks Victoria under section 27 of the National Parks Act 1975
- A licence or lease from Parks Victoria under section 17 of the Crown Land (Reserves) Act 1978
- Consent from the Reference Areas Advisory Committee to undertake managed inundation within the Lake Wallawalla Reference Area under the Reference Areas Act 1978
- Licence to take and use water (s51) and licence to construct works (s67) from Lower Murray Water under section 51 of the Water Act 1989
- Works on waterways permit from Mallee CMA under section 188 of the Water Act 1989 and Mallee CMA By-law No.1 Waterways Protection 2014
- Permit to take protected flora on Crown land from DELWP under the Flora and Fauna Guarantee Act 1988 (FFG Act)
- Potential need for a Work Plan and/or Work Authority under the Mineral Resources (Sustainable Development) Act 1990 for potential borrow sites – noting location and potential approval requirements for borrow pits are yet to be determined.

New South Wales

- Development consent under Part 4 of the NSW EP&A Act from Wentworth Shire Council. The development application needs to be accompanied by a Statement of Environmental Effects
- A licence to allow use of Crown land under the Crown Lands Management Act 2016
- A permit for 'dredging' or 'reclamation' under section 201 of the Fisheries Management Act 1994 if not deemed exempt.

VMFRP recently received advice from the MDBA around raising of the Lock 7 weir pool. Impacts associated with changes to the operating regime of Lock 7 and the resultant inundation area in NSW have not yet been assessed in detail. Further assessment, including consultation with NSW regulatory authorities, is required to determine approval requirements (if any) for inundation in NSW.

Further details in Attachment 3.

1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders

The Mallee CMA worked with key stakeholders and interested community groups to develop the concept for the Lindsay Island Floodplain Restoration Project over a period from 2012 to current. Communication and engagement activities conducted have included:

- More than 200 face-to-face briefing sessions, meetings, presentations, on-site visits and consultations, engaging more than 500 people, which is reflective of the wide range of project stakeholders
- Fact sheets, media releases, electronic communication (website, emails, newsletters), brochures and correspondence.

This direct approach to engagement has helped capture the views and local knowledge of key stakeholders and community members to directly integrate these into the project, including from:

- Aboriginal stakeholders including the First People of the Millewa-Mallee Aboriginal Corporation (including members of the Ngintait peoples)
- Materially-affected land owners and managers such as Parks Victoria, SA Water, Trust for Nature (Neds Corner), NSW National Parks and Wildlife Service (NPWS) and the owners of Wingille Station in NSW
- Adjacent private landholders (including the sourcing of clay borrow sites)
- Lindsay Point irrigators
- Regional Development Australia, Regional Development Victoria – Loddon Mallee and Mildura Regional Development
- Local government (Mildura Rural City Council and Renmark Paringa Council)
- Community and user groups including: Trust for Nature, Sunraysia Branch Victorian Apiarists Association, Sunraysia Riverwatch, Murray Offroad Adventures, Discover Mildura, Lindsay Point Landcare Group and Meringur Pioneer Settlement.

Targeted, tailored consultation would continue to be conducted with key stakeholders in accordance with VMFRP's Stakeholder Engagement and Communication Plan 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. Broader engagement via traditional and social media, community events and information displays would also continue.

The First People of the Millewa-Mallee Aboriginal Corporation (FPMMAC) are the Registered Aboriginal Party (RAP) for the project area (since December 2018) under the Victorian Aboriginal Heritage Act 2006. FPMMAC identify with the Latji Latij, Ngintait, Nyeri Nyeri and Wergai peoples. A Notice of Intent to commence a Cultural Heritage Management Plan (CHMP) for the project under the Aboriginal Heritage Act 2006 was submitted on 13 June 2017, at which time there was no RAP for the project area. However, FPMMAC were the RAP applicants for the project area. FPMMAC are represented on Lindsay Island by the Ngintait peoples. A draft CHMP was prepared for the project (current at that time) in 2018 under the Aboriginal Heritage Act 2006 in consultation with the Ngintait peoples. The draft CHMP is being updated for the current project and is likely to be complete in mid-2021. The CHMP is being prepared in further consultation with the FPMMAC (including the Ngintait peoples as members of FPMMAC).

The First Peoples of the Millewa-Mallee traditional owner group have lodged a current native title claim (VID630/2015) under the Commonwealth Native Title Act 1993 (NNTT 2020) and a request to negotiate a Recognition and Settlement Agreement with the State of Victoria under the Victorian Traditional Owner Settlement Act 2010 (DoJCS 2020) over all of the project area in Victoria. The location of relevant native title interests is shown in Figure 3.3 of Attachment 3.

A due diligence assessment under the NSW National Parks and Wildlife Act 1974 (NPW Act) and in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW 2010) is being prepared for the proposed works and inundation within NSW. In the event that the due diligence assessment identifies a requirement for an Aboriginal Heritage Impact Permit (AHIP), consultation would be undertaken in accordance with the requirements of Clause 60 of the NSW National Parks and Wildlife Regulation 2019.

Land in the NSW inundation area was formerly part of the Lake Victoria State Forest. Due to the National Park Estate (Riverina Red Gum Reservations) Act 2010, this land is no longer state forest and ownership of land within the boundaries of the former Lake Victoria State Forest is intended to be transferred to traditional owners. The land is currently being held by the Minister administering the NPW Act. VMFRP has commenced consultation with the NSW NPWS to establish the pathway for commencing consultation with the traditional owners of this land, the Barkindji Maraura.

1.14 Describe any environmental impact assessments that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts of the project

A referral for the project has been submitted to the Victorian Minister for Planning (via DELWP) for a decision on whether or not an Environment Effects Statement is required for the project under the Victorian Environment Effects Act 1978.

A Statement of Environmental Effects would be prepared to support the development application for consent under Part 4 of the NSW EP&A Act and would consider the provisions of relevant environmental planning instruments, including the Infrastructure SEPP (NSW), State Environmental Planning Policy No. 44 – Koala Habitat Protection, Murray Regional Environmental Plan No.2 – Riverine Land and Wentworth Local Environmental Plan 2011.

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1.15 Is this action part of a staged development (or a component of a larger project)?

☐ Yes ☑ No

1.16 Is the proposed action related to other actions or proposals in the region?

☑ Yes ☐ No

1.16.1 Identify the nature/scope and location of the related action (Including under the relevant legislation)

The project is one of nine environmental works projects being undertaken as part of the VMFRP. Relative to the project, the eight other VMFRP projects are located:

- Gunbower - approx. 450 km upstream in Gunbower National Park
- Guttrum-Benwell - approx. 395 km upstream in Guttrum and Benwell State Forests
- Vinifera - approx. 310 km upstream in Nyah-Vinifera Regional Park
- Nyah - approx. 305 km upstream in Nyah-Vinifera Regional Park
- Burra Creek - approx. 285 km upstream in the River Murray Reserve
- Belsar-Yungera - approx. 220 km upstream in the proposed Murray River Regional Park
- Hattah Lakes North - approx. 180 km upstream in Hattah-Kulkyne National Park and Murray-Kulkyne Regional Park
- Wallpolla Island - approx. 50 km upstream in Murray-Sunset National Park.

Further details on the VMFRP can be found at: https://www.vmfrp.com.au/.

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Section 2

Matters of national environmental significance

2.1 Is the proposed action likely to have any direct or indirect impact on the values of any World Heritage properties?

☐ Yes ☑ No

2.2 Is the proposed action likely to have any direct or indirect impact on the values of any National Heritage places?

☐ Yes ☑ No

2.3 Is the proposed action likely to have any direct or indirect impact on the ecological character of a Ramsar wetland?

☑ Yes ☐ No

Wetland

The project area is not located within or adjacent to any wetlands listed under the Ramsar Convention. The Protected Matters Search Tool (PMST) identifies three Ramsar listed wetlands downstream of Lindsay Island: Riverland (50-100 km), Banrock Station Wetland Complex (100-150 km) and The Coorong and Lakes Alexandrina and Albert Wetland (200-300 km).

The Riverland Ramsar site (noted as being between 50-100 km in the PMST search) is the nearest site and is located approximately 10 km downstream of the project area along the Murray River within South Australia (refer to Attachment 2).

Impact

The project would not result in a significant impact on the ecological character of these downstream Ramsar sites. The project does not involve any works within or adjacent to a Ramsar wetland and therefore would not result in any areas of a Ramsar wetland being destroyed or substantially modified, or result in changes to the habitat or lifecycle of native species dependent on a Ramsar wetland, or result in the introduction or spread of an invasive species within a Ramsar wetland. The project is unlikely to result in a substantial or measurable change in the hydrological regime or water quality of downstream Ramsar sites provided the proposed monitoring and management measures are implemented. This is due primarily to the separation distance to the three Ramsar sites located downstream of the project and the relatively small volume of return flows expected from the project compared to the magnitude of flow in the Murray River, assuming appropriately managed drawdown rates and dilution flows are available at the time of discharge.

Potential water quality impacts from construction activities may arise from runoff from work sites and dewatering discharges, but would be minor and localised. These impacts are typical of construction projects in riverine/floodplain environments and would be managed through a Construction Environmental Management Plan (CEMP), including controls for managing erosion and sediment, storage of fuels and chemicals, dewatering and works in waterways. Construction of Berribee Regulator in the Lindsay River would be undertaken to maintain passing flows throughout construction. Dewatering discharges would be undertaken in accordance with EPA requirements.

Discharges from a floodplain after an inundation event (natural or managed) have the potential to contain elevated sediments and/or organic matter, elevated nutrients or salinity. These water quality characteristics can contribute to processes such as blackwater and algae blooms, with high loads of organic matter potentially causing low dissolved oxygen concentrations impacting the health of aquatic species and communities. For the Lindsay Island project, these potential impacts would be managed and avoided through the monitoring of ground and surface water salinity and water quality before, during and after watering events to inform management strategies and real-time operational decision making.

The nearest Ramsar site that could be affected by degraded water quality resulting from insufficiently diluted return flows to the Murray River from the Lindsay Island floodplain is the Riverland Ramsar site. According to the ecological character description (Newall et al., 2009), significant overbank flow does not begin at the Riverland Ramsar site until Murray River flows reach 50,000 ML/d or above. It is understood that recent environmental works enable SA Water to allow managed flows into the Riverland Ramsar site at Murray River flows of 20,000 ML/d, although this would require the opening of regulator gates and SA Water has advised that they would require follow up higher flow rates to enable the environmental water event. Drawdown from managed inundation events at Lindsay Island would be managed to a rate of 0.03 to 0.06 m/d, which equates to a maximum daily return flow volume of approximately 2,900 ML/d assuming the maximum drawdown rate across the whole of the managed inundation area, which is highly unlikely to occur given the differing holding durations required across the

different WMAs. At these flows, it is reasonable to assume that return flows from Lindsay Island could be sufficiently diluted to prevent a substantial or measurable change in the water quality within the Riverland Ramsar site.

Changes to the timing, frequency, duration and magnitude of flows along the Murray River influences flows entering the Ramsar sites along the Murray River. The River Murray Operations Committee (RMOC) would be responsible for managing any upstream or downstream hydrological changes or impacts in the Murray River associated with the delivery of environmental water to the project as part of its responsibility to oversee the operation of the river, which is managed by the MDBA on behalf of the relevant state and commonwealth governments. Delivery of environmental water in the Murray River is undertaken in accordance with a risk-based approach to minimise impact to river users and the Framework for Determining Commonwealth Environmental Water Use (CEWO 2013). This framework requires environmental watering to consider the potential environmental risk that may result from applying environmental water and measures that may be taken to minimise risks. Waterway managers/water authorities work with RMOC to ensure planning/delivery of environmental water is undertaken to achieve ecological objectives and minimise adverse impacts on river hydrology.

2.3.2 Do you consider this impact to be significant?

☐ Yes ☑ No

2.4 Is the proposed action likely to have any direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?

☑ Yes ☐ No

Species or threatened ecological community

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

A PMST search identified one EPBC Act listed threatened ecological community with potential to occur within 10 km of the project area:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions – Endangered (Buloke Woodlands TEC).

There are a number of Victorian Flora and Fauna Guarantee Act 1988 (FFG Act) listed communities that may be synonymous with this EPBC Act listed community: Semi-arid Herbaceous Pine-Buloke Woodland Community, Semi-arid Herbaceous Pine Woodland Community, Semi-arid Northwest Plains Buloke Grassy Woodland Community, and Semi-arid Shrubby Pine-Buloke Woodland Community. These communities have the potential to correspond with one EVC known to occur within the current construction footprint (EVC 98) and two EVCs that had been modelled as occurring within the inundation area by DELWP (EVCs 97 and 98).

Impact

Native vegetation within the construction footprint and adjacent areas has been subject to desktop and field assessment as described in Attachment 4. Some changes to the construction footprint have occurred since the detailed vegetation assessment was undertaken in 2015 such that approximately 8.15 ha of the current construction footprint would require further assessment. Modelled EVC data has been used to assess native vegetation impacts in these areas, which are mostly located along access tracks. Detailed vegetation assessments in 2015 have been supplemented by targeted threatened flora surveys of the construction footprint and adjacent areas in October 2019 and targeted ground-truthing of inundation areas modelled as containing non-flood dependent EVCs such as Semi-arid Woodland (EVC 97) and Semi-arid Chenopod Woodland (EVC 98) in June 2020.

Based on these assessments, a small area (approx. 0.03 ha) of EVC 98 was identified at the CW_B2 regulator and containment bank construction site in the Crankhandle West WMA and has been assessed as corresponding with the EPBC Act listed Buloke Woodlands TEC. This small area of EVC 98 is not within the construction footprint of the proposed regulator or containment bank, and is located on the opposite side of an existing access track to the proposed infrastructure. This small area of EVC 98 is within the current construction footprint for the existing access track, which is only required to be a minor Type 1A access (for construction purposes only). As such, significant track works are not anticipated to be required at this location. It is therefore considered likely that an arborist assessment combined with minor design refinements, would avoid impacts to this small area of EVC 98 that corresponds with the EPBC Act listed Buloke Woodlands TEC.

As described in Attachment 4, targeted ground-truthing in inundation areas modelled as EVC 98 or EVC 97 has confirmed that vegetation in these areas is not consistent with these non-flood dependent EVCs, which are generally only observed at higher elevations above the floodplains where environmental water would not penetrate during periods of inundation. The vegetation present in these areas was usually found to be Riverine Chenopod Woodland (EVC 103), Lignum Shrubland (EVC 808) and occasionally Alluvial Plains Semi-arid Grassland (EVC 806), which are located on alluvial terraces prone to flooding, and fall within the water regime classes expected to benefit from environmental watering. Vegetation identified during the

targeted ground-truthing in inundation areas did not correspond with any EPBC Act listed threatened ecological communities. No other EVCs modelled to occur in the inundation area correspond with any EPBC Act listed threatened ecological communities.

Further vegetation assessments are proposed at targeted sampling locations in the inundation area to reduce uncertainties in relation to potential presence / impacts on threatened species and communities during operation of the project. In addition, further assessment is proposed in some areas of vegetation adjacent to the inundation area that have been identified as potentially impacted through near-surface salinisation (see Attachment 5). These further assessments would inform assessment of the nature and extent of potential impacts from near-surface salinisation on native vegetation, including threatened ecological communities that may occur in these areas. If further assessment identifies that changes to soil or groundwater salinity would adversely impact native vegetation containing threatened ecological communities, then additional mitigation measures would be developed and implemented as a part of the project through the Environmental Water Management Plan (EWMP), Operating Plan and the draft VMFRP Monitoring, Evaluation and Reporting (MER) Framework. A preliminary review of EVCs modelled by DELWP (2019) to occur within identified areas of interest or areas of heightened interest for potential near-surface salinisation in Attachment 5 indicates that some patches of EVC 97 and EVC 98 occur in these areas, mostly along the south eastern and north eastern edges of Lake Wallawalla, and within the western parts of the Berribee WMA.

Under the Significant Impact Guidelines 1.1 (DOTE 2013), an action is likely to have a significant impact on an endangered ecological community if there is a possibility that it would reduce the extent of the ecological community or modify abiotic factors (groundwater, surface water) necessary for the community's survival. If removal of the EPBC Act listed Buloke Woodlands TEC at the CW_B2 regulator and containment bank cannot be avoided, or if further investigations determine a potential for impact on the Buloke Woodlands TEC due to near-surface salinisation that are not able to be avoided, the project may be considered to have a significant impact on the Buloke Woodlands TEC.

Species or threatened ecological community

Two EPBC Act listed flora species were assessed as having a possible occurrence within the project area:

- Eleocharis obicis (Striate Spike-sedge), EPBC Act – Vulnerable
- Lepidium monoplocoides (Winged Peppercress), EPBC Act – Endangered.

Impact

An assessment against the significant impact criteria for these species is included in Appendix G of Attachment 4. The project is not considered likely to have a significant impact on these species.

The proposed construction footprint has been subject to targeted flora surveys in 2015 (GHD 2016a) and October 2019 (R8 2020b). Searches of relevant databases and previous ecological studies were used to inform the species targeted during threatened flora surveys in October 2019.

Incidental observations of threatened flora were also recorded during targeted ground-truthing of inundation areas modelled as containing non-flood dependent EVCs such as Semi-arid Woodland (EVC 97) and Semi-arid Chenopod Woodland (EVC 98) in June 2020. A flora census by Australian Ecosystems (2013) in November 2013, included recording any threatened flora observed within 54 sampling quadrats distributed across the Lindsay Island floodplain, including locations within the proposed inundation area. The only EPBC Act listed flora species recorded during flora surveys in 2013, 2015 and 2019 was Eleocharis obicis (Striate Spike-sedge). No EPBC Act listed flora species are recorded within 10 km of the project area, other than a historic record of Lepidium monoplocoides (Winged Peppercress) in the VBA (1948).

Although targeted flora surveys have not been undertaken throughout the inundation area, targeted ground-truthing of vegetation in areas modelled as containing non-flood dependent EVCs (i.e. Semi-arid Woodland, Semi-arid Chenopod Woodland) in June 2020, has confirmed that no Semi-arid Woodland or Semi-arid Chenopod Woodland was present in the inundation areas surveyed. The vegetation in these areas comprises EVCs associated with alluvial terraces that are prone to flooding. The threatened flora species considered likely to occur within the inundation area are adapted to the floodplain environment, therefore it is anticipated that the reinstatement of a more natural hydrological regime would be beneficial to any listed flora species within the inundation area. Potential impacts could arise in the event that water regimes are not aligned to the requirements of listed threatened species. Further vegetation assessments are proposed at targeted sampling locations within the inundation area to reduce uncertainties in relation to potential presence / impacts on threatened flora species and their habitat during operation of the project.

In addition, further assessment is proposed in some areas of vegetation adjacent to the proposed inundation area that have been identified as potentially impacted through near-surface salinisation (see Attachment 5). These further assessments would inform assessment of the nature and extent of potential impacts from near-surface salinisation on native vegetation,

including threatened flora species that may occur in these areas. If further assessment identifies that changes to soil or groundwater salinity would adversely impact native vegetation containing threatened flora, then additional mitigation measures would be developed and implemented as a part of the project through the EWMP, Operating Plan and the draft VMFRP MER Framework.

Eleocharis obicis (Striate Spike-sedge)

This species was recorded in 2013 (Australian Ecosystems 2013) along the eastern banks of Lake Wallawalla, outside the proposed construction footprint, but potentially within the inundation area. There are no records of this species in the vicinity of the project area on the VBA (nearest registered record is over 150 km away near Manangatang) or the NSW BioNet-Atlas. Although some suitable habitat is present in the construction footprint, this species was not recorded within the construction footprint during targeted flora surveys in 2013, 2015 or 2019, and is therefore unlikely to be impacted during construction of the project. If present in the inundation area, the reinstatement of a more natural wetting / drying regime would result in Lake Wallawalla becoming more reliably ephemeral, which would likely be beneficial to this species persisting in the area, given the survival of this species and potential breeding is dependent on a wetting phase.

Lepidium monoplocoides (Winged Peppercress)

There is a historic record of this species in the VBA to the west of the national park from 1948, however this species has not been recorded within 10 km of the project area since this time. Although some suitable habitat is present within the construction footprint, this species was not recorded within the construction footprint during targeted flora surveys in 2013, 2015 or 2019, and is therefore unlikely to be impacted during construction of the project. Although this species has not been recorded in the area for over 70 years, if it were present in the inundation area, the reinstatement of a more natural wetting / drying regime would likely be beneficial to this species persisting in the area.

Species or threatened ecological community

Silver Perch (Bidyanus bidyanus), EPBC Act – Critically Endangered

Silver Perch is well known from the Lindsay River, Mullaroo Creek and the Murray River. The current operation of Lock 7 and associated weir pool has contributed to creation of modified hydraulic conditions in the Lindsay-Mullaroo system, which supports a significant native fish community, including Silver Perch (ARI 2018). Specifically, this native fish community and the Silver Perch population, is supported by perennial stable flows of approximately 1,000 ML/d from Lock 7 and fast-flowing reaches, particularly in Mullaroo Creek, along with the presence of high quality and abundant snags (ARI 2018).

Impact

An assessment against the significant impact criteria for the Silver Perch is included in Appendix H of Attachment 4. Operation of the project has the potential to have a significant impact on this species.

Potential impacts to Silver Perch during construction would be localised and associated with cofferdam construction (potential barriers to fish passage, noise and vibration), dewatering works (drawdown, saline water management), and potential for sediment/contaminant runoff from work sites into wet areas. The potential for impacts is highest during construction of Berribee Regulator across the Lindsay River, which is likely to extend over at least 18 months. Construction of the project is unlikely to have a significant adverse impact on Silver Perch provided the recommended mitigation measures are implemented to maintain adequate fish passage during construction, avoid high impact in-stream construction activities (i. e. sheet piling) during spawning season, and manage water quality risks associated with dewatering, erosion and sediment runoff from work sites (see Section 4). Constructability investigations to date indicate that Berribee Regulator is able to be constructed in two parts to enable the Lindsay River to remain open to provide for passing flows throughout construction. Further assessment is proposed to confirm that these passing flows would provide for fish passage in terms of resulting depth and flow velocity.

Operation of the project has the potential to cause a significant impact on a population of Silver Perch through operation of the Berribee Regulator to retain water within the Berribee WMA at levels that would reduce flow velocities in Mullaroo Creek and the upper Lindsay River to below the flow velocities preferred by Silver Perch. Hydrodynamic modelling under a range of operating scenarios was undertaken by Water Technology (2016) and analysed by ARI (2018) to identify operating conditions that would reduce flow velocities below the thresholds required to support Silver Perch. Scenarios analysed by ARI in 2018 included a ‘Berribee Maximum’ scenario of 23.2 mAHD (at Berribee Regulator) and a ‘Berribee Intermediate’ scenario of 21.7 mAHD (at Berribee Regulator). The current draft operating regimes include a Berribee Maximum scenario of 23.2 mAHD and a Berribee Intermediate scenario ranging from 22.1 mAHD to 23.1m AHD.

ARI (2018) identified that operation of the Berribee Maximum scenario posed a very high risk to hydraulic habitat in the Lindsay-Mullaroo system and provided recommendations to limit operation of this scenario to reduce the level of risk, although the residual risk was considered as high. ARI (2018) identified that operation of the Berribee Intermediate scenario posed a

high risk to hydraulic habitat in the Lindsay-Mullaroo system and provided recommendations to modify operation of this scenario, which was considered to reduce this to a low residual risk.

Based on this analysis, the current draft operating regime's Berribee Maximum and higher level Berribee Intermediate events are considered likely to present a very high risk to habitat for Silver Perch if unmitigated. Refinement of the draft operating scenarios and/or alternative measures are required to avoid or mitigate potential impacts on Silver Perch. Further analysis of ecological and hydrological investigations, and the recommendations contained in the Lindsay Island SDL Fish Management Plan (ARI 2018), is proposed in order to optimise the draft operating scenarios. Further discussion of the key findings and recommendations by ARI (2018) are contained in Attachment 4.

Provision of fish passage at the Berribee Regulator fishway and passive fish passage at other regulators would allow for fish to exit to the Murray and Lindsay Rivers, provided a suitable drawdown regime is implemented and regulators/fishways are operated to an appropriate standard. Retention of water on the floodplain at locations where drawdown is not proposed (Wallawalla West, Lake Wallawalla and Crankhandle Lower Tier) has the potential to impact fish that cannot escape during drying of the wetlands, although it is unlikely that significant numbers of Silver Perch would inhabit these wetland locations.

Raising of the Lock 7 weir pool by up to 1.1 m above normal operating level may affect operation of the Lock 7 fishway. Further assessment is required to determine Lock 7 fishway functionality under proposed operating scenarios and potential for impacts on Silver Perch.

Species or threatened ecological community

Murray Cod (Maccullochella peelii peelii), EPBC Act – Vulnerable

Murray Cod is well known to be located in the Lindsay River, Mullaroo Creek and the Murray River. Mullaroo Creek is recognised as one of the most valuable Murray Cod populations in the southern Murray-Darling Basin, due to it being a self-sustaining population with a broad size range and a relatively high abundance of large, mature Murray Cod (ARI 2018). Mullaroo Creek retains a relatively high snag density and water velocities are significantly faster and stage heights less variable than would occur under natural conditions, providing the ideal conditions for Murray Cod, which would once have been present in the lower 800 km of the Murray River but following river regulation and de-snagging are now found predominantly in anabranches (ARI 2018).

Impact

An assessment against the significant impact criteria for Murray Cod is included in Appendix H of Attachment 4. Operation of the project has the potential to have a significant impact on this species.

Potential impacts to Murray Cod during construction would be localised and associated with cofferdam construction (potential barriers to fish passage, noise and vibration), dewatering works (drawdown, saline water management), and potential for sediment/contaminant runoff from work sites into wet areas. The potential for impacts is highest during construction of Berribee Regulator across the Lindsay River, which is likely to extend over at least 18 months. Construction of the project is unlikely to have a significant adverse impact on Murray Cod provided the recommended mitigation measures are implemented to maintain adequate fish passage during construction, avoid high impact in-stream construction activities (i.e. sheet piling) during spawning season, and manage water quality risks associated with dewatering, erosion and sediment runoff from work sites (see Section 4). Constructability investigations to date indicate that Berribee Regulator is able to be constructed in two parts to enable the Lindsay River to remain open to provide for passing flows throughout construction. Further assessment is proposed to confirm that these passing flows would provide for fish passage in terms of resulting depth and flow velocity.

Operation of the project has the potential to cause a significant impact on an important population of Murray Cod through operation of the Berribee Regulator to retain water within the Berribee WMA at levels that would reduce flow velocities in Mullaroo Creek and the upper Lindsay River to below the flow velocities preferred by Murray Cod. Hydrodynamic modelling under a range of operating scenarios was undertaken by Water Technology (2016) and analysed by ARI (2018) to identify operating conditions that would reduce flow velocities below the thresholds required to support Murray Cod. Scenarios analysed by ARI in 2018 included a 'Berribee Maximum' scenario of 23.2mAHD (at Berribee Regulator) and a 'Berribee Intermediate' scenario of 21.7mAHD (at Berribee Regulator). The current draft operating regimes include a Berribee Maximum scenario of 23.2mAHD and a Berribee Intermediate scenario ranging from 22.1mAHD to 23.1mAHD.

ARI (2018) identified that operation of the Berribee Maximum scenario posed a very high risk to hydraulic habitat in the Lindsay-Mullaroo system and provided recommendations to limit operation of this scenario to reduce the level of risk, although the residual risk was still considered high. ARI (2018) identified that operation of the Berribee Intermediate scenario posed a high risk to hydraulic habitat in the Lindsay-Mullaroo system and provided recommendations to modify operation of this scenario, which was considered to reduce this residual risk to low.

Based on this analysis, the current draft operating regime's Berribee Maximum and higher level Berribee Intermediate events are considered likely to present a very high risk to habitat for Murray Cod if unmitigated. Refinement of the draft

operating scenarios and/or alternative measures are required to avoid or mitigate potential impacts on Murray Cod. Further analysis of ecological and hydrological investigations, and the recommendations contained in the Lindsay Island SDL Fish Management Plan (ARI 2018) is proposed in order to optimise the draft operating scenarios. Key recommendations for refinement of operating scenarios to enhance outcomes for threatened fish by ARI (2018) include: Reduce frequency of Berribee Maximum inundation scenario (e.g. to 1 in 10 years), do not implement after an anoxic blackwater event, limit duration (e.g. 6 weeks), and avoid overlap with spawning season; and reduce frequency of higher level Berribee Intermediate inundation scenario (e.g. to 4 in 10 years), do not implement after an anoxic blackwater event, limit duration (e.g. 8 weeks), and avoid overlap with spawning season, avoid consecutive year operation.

Provision of fish passage at the Berribee Regulator fishway and passive fish passage at other regulators would allow for fish to exit to the Murray and Lindsay Rivers, provided a suitable drawdown regime is implemented and regulators/fishways are operated to an appropriate standard. Retention of water on the floodplain at locations where drawdown is not proposed (Wallawalla West, Lake Wallawalla and Crankhandle Lower Tier) has the potential to impact fish that cannot escape during drying of the wetlands, although it is unlikely that significant numbers of Murray Cod would inhabit these wetland locations.

Raising of the Lock 7 weir pool by up to 1.1m above normal operating level may affect operation of the Lock 7 fishway. Further assessment is required to determine Lock 7 fishway functionality under proposed operating scenarios and potential for impacts on Murray Cod.

Species or threatened ecological community

Growling Grass Frog (Litoria raniformis), EPBC Act – Vulnerable

The Growling Grass Frog (GGF) is widespread throughout Victoria and is known to occur along the Murray River (Seran BL&A 2018). There are 25 previous records of this species within 10 km of the project area in the VBA. This species was recorded once during fauna surveys in 2012 at the BERR_D containment bank construction footprint while minor flooding was occurring, but has the potential to occur at any construction footprints and across the inundation area when water is present. Potential aquatic habitat suitable for this species is present along the Murray and Lindsay Rivers, Mullaroo and Little Mullaroo Creeks and across the floodplain when wet from localised rain or river flows.

Impact

An assessment against the significant impact criteria for GGF is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

This species is mostly found amongst emergent vegetation, including Typha sp. (Bullrush), Phragmites sp. (reeds) and Eleocharis sp.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams. GGF can also occur in clays or well-watered sandy soils; open grassland, open forest, and ephemeral and permanent non-saline marshes and swamps. GGF require areas of basking habitat (such as emergent aquatic vegetation or logs), breeding habitat (shallow freshwater lagoons) and refuge habitat (typically soil cracks, fallen timber and dense low vegetation). Submerged vegetation is important habitat for breeding success as it provides egg-laying sites, calling stages for males, and food and shelter for tadpoles. Grassland provides habitat for foraging, dispersal and shelter, and may also provide overwintering sites for GGF.

Based on the relatively low number of GGF records from the project area, despite numerous targeted surveys in the last 10 years, it is probable that any permanent population of this species in the project area would be small and confined to permanent wetlands when there is no flooding. The GGF population at Lindsay Island is close to the northern/north western limit of the species distribution, and may be considered an important population as discussed in the 'National Recovery Plan for the Growling Grass Frog'. Other nearby populations are known from Mulcra Island (approximately 10 km east of the project area).

According to the National Recovery Plan, within the broad distribution of the GGF there are two distinct biogeographical groups, differentiated by differences in biology and ecology. Populations at Lindsay Island align with those in the northern and western parts of its range (NSW, parts of Victoria and South Australia along the Murray River), where breeding is triggered by flooding of ephemeral waterbodies during spring or summer. In this area, frogs are concentrated in refugia prior to flooding, then disperse across the landscape during flooding / breeding events. Much of the habitat for this species has been isolated or fragmented, restricting the opportunity for important population processes such dispersal and colonisation.

Populations of GGF persisting in the Mallee region along the Murray River (e.g. at Lindsay Island) are likely to have become limited, isolated and fragmented through the lack of regular floodplain inundation and provision of suitable areas of habitat between sites, in the form of shallow waterbodies. Operation of the project to more regularly inundate typically dry floodplain areas, is likely to promote breeding and potentially re-connect isolated populations of this species by facilitating recolonisation of otherwise dry areas, potentially increasing the size and connectivity of populations across the Mallee region.

The proposed construction footprints are in predominantly dry areas (except the Lindsay River and Murray River), with the few wet areas generally not containing emergent vegetation. Construction would not impact known breeding areas or areas considered high quality habitat. Construction in ephemerally wet areas would occur during dry periods, where practicable, and therefore construction of the project is not likely to disrupt the breeding cycle of any populations of this species within these areas.

A broad analysis of possible GGF habitat was undertaken in Attachment 4, specifically assessing the extent of Lignum Swamp (EVC 104), Shallower Freshwater Marsh (EVC 200), Lignum Shrubland (EVC 808), Floodway Pond Herbland (EVC 810), Intermittent Swampy Woodland (EVC 813), Shrubby Riverine Woodland (818), Lignum Swampy Woodland (EVC 823) and Waterbody (EVC 992) within the project area. The analysis identified 51.04 ha of potential low quality habitat loss in construction footprints and 3,008.67 ha of potential habitat in the inundation areas that are likely to benefit from reinstatement of a more natural flooding regime. The project would therefore result in the loss of only a relatively small proportion (1.7%) of potential habitat able to support this species when appropriate wetland conditions occur, compared to the extent of habitat expected to be created and maintained through an increased frequency of flooding from environmental watering.

Localised impacts on this species may occur during construction within or adjacent to waterways, including through cofferdam construction, dewatering works, and sediment/contaminant runoff into wet areas from work sites. Indirect impacts from the proposed works could include the introduction or spread of Chytrid Fungus.

Provided the proposed mitigation measures are implemented (Section 4), these impacts are not likely to be significant.

Species or threatened ecological community

Regent Parrot (Polytelis anthopeplus monarchoides), EPBC Act – Vulnerable

The Regent Parrot is known to occur in the project area, with suitable foraging habitat present in the construction footprints and inundation areas. The Regent Parrot has been regularly recorded but in low numbers across the project area during fauna surveys in 2012 (GHD 2013a), 2013 (GHD 2014a) and 2019 (R8, 2020b), with 34 records in 10 km of the project area currently in the VBA. One Regent Parrot was recorded during the 2019 surveys approximately 100 m north east of the proposed Berribee Regulator. Potential Regent Parrot breeding habitat (large, old River Red Gums) was identified close to the construction footprint for Berribee Regulator, BERR_D containment bank, BERR_E regulator and BERR_F regulator. Across the Murray-Darling Basin of South Australia, New South Wales and Victoria, Regent Parrots are considered to form a single population estimated at approximately 1,500 individuals (Seran BL&A 2018).

Impact

An assessment against the significant impact criteria for Regent Parrot is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

Construction footprints have been sited to avoid removal of large, hollow-bearing River Red Gums within preferred nesting areas. Detection and avoidance of potential Regent Parrot nest trees and colonies has been a key consideration of the Lindsay Island project from its inception, and prompted the initial targeted surveys using the Two Hour Point Survey (THPS) method for this species in 2012. Breeding activity by this species has only been confirmed within the broader Lindsay Island area on two previous occasions with two records of nesting by Regent Parrots close to Lock 7 (near the mouth of Mullaroo Creek) in 1983 and 1984 (VBA), which are likely the same birds in the same tree as Regent Parrots are known to exhibit site fidelity.

Surveys conducted during breeding season in areas of suitable habitat within the construction footprints using the THPS method in 2012 (GHD 2013a) and 2019 (R8 2020b), did not observe any breeding activity. Based on surveys undertaken to date, no known Regent Parrot nesting trees would be removed for the project and there are currently no known nesting colonies within or adjacent to the construction footprint or access tracks. An additional repeat nesting survey within potential habitat surrounding proposed infrastructure is planned for September/October 2020. Based on the results of the targeted nest surveys, it is considered highly unlikely that the removal of vegetation in proposed construction footprints would remove preferred nesting habitat, or adversely affect habitat critical to the survival of this species.

A broad analysis of possible Regent Parrot habitat (i.e. EVCs likely to support suitable large hollow-bearing River Red Gums) was undertaken in Attachment 4, specifically assessing the extent of Grassy Riverine Forest (EVC 106), Intermittent Swampy Woodland (EVC 813), Shrubby Riverine Woodland (818) and Lignum Swampy Woodland (EVC 823) within the project area. The analysis identified 46.84 ha of potential habitat loss in construction footprints and 1,343.12 ha of potential habitat in the inundation areas that is likely to benefit from reinstatement of a more natural flooding regime. The project would therefore result in the loss of only a relatively small proportion of sub-optimal potential foraging and dispersal habitat compared to the extent of habitat expected to benefit through improved tree health and condition from environmental watering.

Furthermore, from a landscape perspective, the proposed removal of approximately 46.84 ha of vegetation communities providing potentially suitable feeding and breeding habitat represents less than 0.31% of the potential habitat for this species within the 15,000+ hectares of high quality native vegetation within Lindsay Island. Proposed vegetation removal is mostly centred on existing tracks and degraded areas, and is generally of lower quality than surrounding vegetation to be retained. The project would therefore not significantly reduce the area of occupancy for the Regent Parrot population in this locality.

Proposed vegetation removal would be scattered across 30 relatively small, discrete sites or along the edge of mostly existing tracks. In the context of the extensive areas of largely intact native vegetation at Lindsay Island and the even more extensive Murray-Sunset National Park (665,400 ha), the proposed vegetation removal in these discrete areas would not cause fragmentation of the existing population of this highly mobile species.

Potentially important breeding habitat comprising large, old River Red Gums is present within the inundation area. Operation of the project to reinstate a more natural hydrological regime would likely benefit this species by improving the health and condition of floodplain vegetation, particularly large, hollow-bearing River Red Gum trees relied on by Regent Parrot for breeding, and would improve the resilience of Regent Parrot habitat under climate change scenarios, river regulation and drought conditions by reducing reliance on naturally large river flows. This is reflected in the National Recovery Plan (Baker-Gabb and Hurley 2011), which mentions that “the use of environmental water to initially rescue River Red Gum from drought was first undertaken in Victoria in 2002” and that this continued under The Living Murray (TLM) initiative in which important breeding sites for Regent Parrot, such as those at the upstream Hattah-Kulkyne National Park, were targeted for the construction of water regulation structures to provide a more natural watering regime to wetland ecosystems, similar to the objectives of this project.

Species or threatened ecological community

Painted Honeyeater (Grantiella picta), EPBC Act – Vulnerable

The Painted Honeyeater has not been previously recorded within 10 km of the project area. The nearest record is from 70 km to the east (in 2006) and there are very few records across the broader landscape. However, the Painted Honeyeater is a highly mobile species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts, and is therefore considered to have potential to utilise habitats within the proposed construction footprint and inundation area, albeit on a very infrequent basis.

Impact

An assessment against the significant impact criteria for the Painted Honeyeater is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The species is sparsely distributed from south-eastern Australia to north-western Queensland and the eastern Northern Territory. The largest concentrations and almost all records of breeding are from south of 26ºS, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland. During winter, this species is more likely to be found in the north of its distribution. This species generally uses the following habitats:

- Inhabits Boree/Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests
- A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten
- Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.

The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched. Many birds move after breeding to semi-arid regions such as north eastern South Australia, central and western Queensland, and central Northern Territory. Considering its dispersive habits, this species is considered to have a single population.

A broad analysis of potential Painted Honeyeater foraging habitat (i.e. EVCs that may support occasional foraging habitat which includes open woodland) was undertaken in Attachment 4, specifically assessing the extent of Riverine Chenopod Woodland (EVC 103), Intermittent Swampy Woodland (EVC 813), Shrubby Riverine Woodland (EVC 818) and Lignum Swampy Woodland (EVC 823) within the project area. The analysis identified 76.79 ha of potential habitat loss in construction footprints and 1,915.13 ha of potential habitat in the inundation areas that are likely to benefit from reinstatement of a more natural flooding regime (Note: The inundation area estimate includes 19.14 ha of modelled Semi-arid Chenopod Woodland (EVC 98) which was instead confirmed through ground-truthing to commonly comprise Riverine Chenopod Woodland (EVC

103)). The project would therefore result in the loss of only a relatively small proportion of potential foraging habitat when appropriate episodic conditions for mistletoe flowering and fruiting occur, compared to the extent of habitat expected to benefit through improved productivity of woodland vegetation communities from environmental watering.

From a landscape perspective, the proposed removal of approximately 76.79 ha of vegetation communities providing potentially suitable foraging habitat represents less than 0.51% of the potential habitat for this species within the 15,000+ hectares of high quality native vegetation within the surrounding Lindsay Island component of the Murray-Sunset National Park. Furthermore, proposed vegetation removal is mostly centred on existing tracks and degraded areas, and is generally of lower quality than surrounding vegetation to be retained. The proposed works are not likely to significantly impact areas of habitat important to this species, which forages widely over large areas in pursuit of mistletoe and flowering eucalypts.

The project is unlikely to result in fragmentation of important Painted Honeyeater habitat as proposed vegetation removal would be scattered across 30 relatively small, discrete sites or along the edge of mostly existing tracks, within an unbroken canopy of open woodland vegetation, in the context of an extensive area of contiguous floodplain habitat on Lindsay Island (15,000 ha), surrounded by a much larger area of remnant mallee and non-eucalypt semi-arid woodland in the Murray-Sunset National Park (665,400 ha).

Species or threatened ecological community

Australasian Bittern (Botaurus poiciloptilus), EPBC Act – Endangered

This species was assessed as having a possible occurrence within the inundation areas when water is present although there are no previous records of this species within 10 km of the project area. The nearest record of this species in the VBA is from 50 km to the east (2010). All other records in the VBA are over 20 years old. Nearer records exist on the ebird database at Chowilla Game Reserve in South Australia approximately 30 km to the north west (2005) and Lake Cullulleraine Recreation Reserve in Victoria approximately 35 km to the south west (2018). Each of these records are of a single individual. Whilst there are sporadic records in the area, there is a distinct paucity of records for an area so heavily surveyed. This species has not been detected during targeted fauna surveys for the project.

Impact

An assessment against the significant impact criteria for the Australasian Bittern is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

In Australia, this species occurs from south east Queensland to south east South Australia, Tasmania and in the south west of Western Australia. Based on survey data from 2010, the total population of the Australasian Bittern in Australia is estimated to be between 250 and 800 individuals. The population can be divided into two sub–populations, the south eastern and south western sub–populations.

The Australasian Bittern occurs in terrestrial freshwater wetlands and rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over muddy or peaty substrate. In Victoria, this species is recorded mostly in the southern coastal areas and in the Murray River region of central northern Victoria. The ebird database identifies three main hotspots for this species in Victoria: along the south coast between Port Fairy and Portland, around Port Phillip Bay between Geelong and Carrum Downs, and along the Murray River between Swan Hill and Yarrawonga.

The likelihood of this species using the construction footprints as anything more than an occasional visitor is considered very low given the majority of the construction footprint lacks the required habitat features for this species (tall, dense aquatic vegetation) and is comprised predominantly of woodland and shrubland. Based on the paucity of records surrounding the project area, it is considered highly unlikely that a permanent population of this species exists at Lindsay Island. It is therefore considered unlikely that the project would adversely impact on an important population of this species.

A broad analysis of potential Australasian Bittern habitat was undertaken in Attachment 4, specifically assessing the extent of Lignum Swamp (EVC 104), Shallower Freshwater Marsh (EVC 200), Lignum Shrubland (EVC 808), Floodway Pond Herbland (EVC 810), Intermittent Swampy Woodland (EVC 813), Shrubby Riverine Woodland (818), Lignum Swampy Woodland (EVC 823) and Waterbody (EVC 992) within the project area. The analysis identified 51.04 ha of potential habitat loss in construction footprints compared to 3,008.67 ha of potential habitat in the inundation areas that is likely to benefit from reinstatement of a more natural flooding regime. The project would therefore result in the loss of only a relatively small proportion (1.7%) of potential habitat able to support this species when appropriate episodic wetland conditions occur, compared to the extent of habitat expected to be created and maintained through an increased frequency of flooding from

environmental watering.

Species or threatened ecological community

Australian Painted Snipe (Rostratula australis), EPBC Act – Endangered

This species was assessed as having a possible occurrence within the inundation areas when water is present although there are no previous records of this species within 10 km of the project area. The nearest record of this species in the VBA is from approximately 25 km to the south. The ebird database shows a vast area largely unoccupied by this species for 250 km or more in every direction with the exception of a single record at Merbein Common near Mildura from 2011. These results are reflective of the rarity of this species in the region, and across Australia. This species has not been detected during targeted fauna surveys for the project.

Impact

An assessment against the significant impact criteria for the Australian Painted Snipe is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

The Australian Painted Snipe is a rare, nomadic bird species that may turn up at any suitable wetland across Australia, when conditions are favourable. This species is widespread but rare throughout most of eastern Australia. The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. This species also utilises inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum (Muehlenbeckia) or canegrass or sometimes tea-tree (Melaleuca). The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber.

The likelihood of this species using the construction footprints as anything more than an occasional visitor is considered very low given the majority of the construction footprint lacks the required habitat features for this species (rank emergent tussocks of grass, sedges, rushes or reeds) and is comprised predominantly of woodland and shrubland. Based on the paucity of records surrounding the project area and the extreme vagrancy of this species, it is considered highly unlikely that a permanent population of this species exists at Lindsay Island. It is therefore considered unlikely that the project would adversely impact on an important population of this species.

A broad analysis of potential Australian Painted Snipe habitat was undertaken in Attachment 4, specifically assessing the extent of Lignum Swamp (EVC 104), Shallower Freshwater Marsh (EVC 200), Lignum Shrubland (EVC 808), Floodway Pond Herbland (EVC 810), Intermittent Swampy Woodland (EVC 813), Shrubby Riverine Woodland (818), Lignum Swampy Woodland (EVC 823) and Waterbody (EVC 992) within the project area. The analysis identified 51.04 ha of potential habitat loss in construction footprints compared to 3,008.67 ha of potential habitat in the inundation areas that is likely to benefit from reinstatement of a more natural flooding regime.

The project would therefore result in the loss of only a relatively small proportion (1.7%) of potential habitat able to support this species when appropriate episodic wetland conditions occur, compared to the extent of habitat expected to be created and maintained through an increased frequency of flooding from environmental watering.

The potential benefits of the project for this species are demonstrated by previous condition monitoring at Hattah-Kulkyne National Park where floodplain environmental watering has been undertaken for over 15 years. These monitoring results have shown that the introduction of environmental water has had positive benefits for listed threatened and migratory water birds, including observations of the EPBC Act listed Australian Painted Snipe (Rostratula australis) (Endangered) responding to watering events (Wood et al. 2018).

Species or threatened ecological community

Curlew Sandpiper (Calidris ferruginea), EPBC Act – Critically Endangered

This species was assessed as having a possible occurrence within the inundation areas when water is present although there are no previous records of this species within 10 km of the project area. The nearest record is directly to the north in NSW, with the second nearest record being approximately 35 km to the west in South Australia (Atlas of Living Australia). This species has not been detected during targeted fauna surveys for the project.

Impact

An assessment against the significant impact criteria for the Curlew Sandpiper is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

The Curlew Sandpiper is a migratory species that breeds outside of Australia. The non-breeding population is estimated at 115,000 individuals. In Australia, the Curlew Sandpiper primarily occurs in sand flats, estuaries, brackish lagoons saltmarshes, and less often inland Australia. Non-breeding individuals may remain in Australian during the breeding period. Throughout its Victorian distribution, the Curlew Sandpiper was once commonly seen through inlets and coastal bays, and sporadically in inland wetlands. Preferred foraging habitat includes shallows areas of intertidal mudflats and proximate shallow water. Non-breeding birds of this species occur predominantly in coastal areas.

The likelihood of this species using the construction footprints as anything more than an occasional visitor is considered very low given the majority of the construction footprint lacks the required habitat features for this species (e.g. brackish lagoons and salt marshes) and is comprised predominantly of woodland and shrubland. Based on the paucity of records surrounding the project area and the extreme vagrancy of this species, it is considered highly unlikely that a permanent population of this species exists at Lindsay Island. It is therefore considered unlikely that the project would adversely impact on an important population of this species.

The project is likely to sustain and enhance large areas of potential habitat for this species, by promoting healthy wetlands for foraging (Seran BL&A 2018).

Species or threatened ecological community

Eastern Curlew (Numenius madagascariensis), EPBC Act – Critically Endangered

This species was assessed as having a possible occurrence within the inundation areas when water is present although there are no previous records of this species within 10 km of the project area. The nearest record of this species in the VBA is from approximately 40 km to the south east, with the second nearest record being from approximately 60 km to the east of the project area and recorded in 1961. This species has not been detected during targeted fauna surveys for the project.

Impact

An assessment against the significant impact criteria for the Eastern Curlew is included in Appendix H of Attachment 4. The project is not considered likely to have a significant impact on this species.

The Eastern Curlew is a migratory species that breeds outside of Australia. The non-breeding population is estimated at 28,000 individuals. In Australia, the Eastern Curlew primarily inhabits estuaries, mangroves and intertidal flats, primarily throughout coastal areas within every state. Non-breeding birds of this species occur predominantly in coastal areas.

The likelihood of this species using the construction footprints as anything more than an occasional visitor is considered very low given that the construction footprint lacks the required habitat features for this species (estuaries, intertidal etc.) and is comprised predominantly of woodland and shrubland. Based on the paucity of records surrounding the project area and the extreme vagrancy of this species, it is considered highly unlikely that a permanent population of this species exists at Lindsay Island. It is therefore considered unlikely that the project would adversely impact on an important population of this species.

The project is likely to sustain and enhance large areas of potential habitat for this species, by promoting healthy wetlands for foraging (Seran BL&A 2018).

Species or threatened ecological community

South-eastern Long-eared Bat (Nyctophilus corbeni), EPBC Act – Vulnerable

The South-eastern Long-eared Bat is not considered likely to occur within the project area and has not been recorded previously within 10 km of the project area. This species has been considered further due to its relatively poorly understood status in Victoria with regards to its habitat preferences and use.

Impact

The South-eastern Long-eared Bat has a scattered distribution, mostly within the Murray-Darling Basin, but with some records outside of this area. This species is typically recorded in mallee, Buloke (Allocasuarina luehmannii) and box-eucalypt dominated communities, and is most common in box/ironbark/cypress-pine vegetation. In central Victoria, it has been recorded in areas of Black Box along creek lines in an agricultural landscape (at Bullock Creek near Terrick Terrick National Park). This species roosts in tree hollows, crevices and under loose bark, and is a slow flying agile bat that hunts for non-flying prey, especially caterpillars and beetles. Within Victoria, research indicates that the South-eastern Long-eared Bat roosts in

mallee eucalypts in areas of long-unburnt mallee vegetation. Some roosting occurs under bark and in fissures/cracks of Belah trees. Threats to the species include habitat loss and fragmentation, fire and reduction of hollow availability.

The nearest records of this species to the project area are from over 30-40 km to the east near Moorna in NSW, where this species has been recorded twice, both records in 1999. These records, and others in south western NSW are all from mallee and belah vegetation communities. In Victoria, the nearest known records are in the southern part of the Murray-Sunset National Park (approximately 86 km to the south east, in 1962) and in Hattah-Kulkyne National Park (approximately 106 km to the south east, most recently in 2008). The nearest records in Victoria are in mallee vegetation.

It is considered unlikely that this species utilises habitats within the project area, and that if it does occur, it is likely to be in extremely low numbers. This species was identified as potentially present by GHD (2014a) due to Nyctophlius spp. calls being recorded via Anabat, but the presence of the specific species Nyctophilius corbeni was not confirmed. Targeted bat trapping surveys on Lindsay Island in 2018/19 (GHD 2019) did not detect this species. The project would not result in the loss of preferred habitat for the South-eastern Long-eared Bat and would result in the loss of a relatively small area of low-value potential habitat only.

Potential impacts on this species are unlikely and would be further mitigated through implementation of pre-clearance surveys and hollow-bearing tree management protocols in the unlikely event that a South-eastern Long-eared Bat is encountered prior to or during construction. If this species is present in the inundation area, there is potential for microbats to benefit from environmental water, with recent studies showing an increase in abundance and diversity due to an increase in insect productivity, particularly in arid environments (Threlfall et al. 2012 and Leigh et al. 2010).

2.4.2 Do you consider this impact to be significant?

☑ Yes ☐ No

2.5 Is the proposed action likely to have any direct or indirect impact on the members of any listed migratory species or their habitat?

☑ Yes ☐ No

Migratory species

Eleven listed migratory species have been identified through a PMST search as potentially occurring within 10 km of the project area:

- Common Greenshank (Tringa nebularia)
- Common Sandpiper (Actitis hypoleucos)
- Curlew Sandpiper (Calidris ferruginea)
- Eastern Curlew (Numenius madagascariensis).
- Fork-tailed Swift (Apus pacificus)
- Grey Wagtail (Motacilla cinerea)
- Latham's Snipe (Gallinago hardwickii)
- Osprey (Pandion haliaetus)
- Pectoral Sandpiper (Calidris melanotos)
- Sharp-tailed Sandpiper (Calidris acuminata)
- Yellow Wagtail (Motacilla flava).

All eleven of these species were assessed as having a possible likelihood of occurrence within the inundation area but only the Fork-tailed Swift and Osprey were assessed as having a possible likelihood of occurrence within the construction footprint (see Appendix D of Attachment 4).

Impact

An assessment against the significant impact criteria for listed migratory species is included in Appendix J of Attachment 4 and determined that the project would not have a significant adverse impact on listed migratory species.

Two listed migratory species (Fork-tailed Swift and Osprey) were assessed as potentially occurring within the construction footprints as these species may fly over the construction footprint whilst foraging and may potentially utilise wetland habitats within the construction footprints for foraging. These species are considered unlikely to be impacted, as both species are highly mobile, wide-ranging, and suitable habitat is surrounding and widespread. The other listed migratory species identified on the PMST were considered unlikely to occur within the construction footprints during the time of the survey, mostly due to the lack of recent records and/or a lack of suitable habitat present. While suitable habitat for these mostly migratory wading shore-birds may be present in some construction footprints (e.g. Lake Wallawalla) when water is present, where practicable construction works would be undertaken during dry periods when sufficient water to attract these species is unlikely to be present and therefore direct impacts on these species are unlikely to occur during construction. Furthermore, it was

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determined to be unlikely that the construction footprints support 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. Construction works have the potential to introduce invasive species that might be harmful to migratory species, however works would be undertaken in accordance with a CEMP, including measures such as vehicle hygiene protocols to mitigate the potential spread of weeds.

Eight of the listed migratory species assessed as potentially occurring in the inundation areas are wading shore-birds (Common Greenshank, Common Sandpiper, Curlew Sandpiper, Eastern Curlew, Pectoral Sandpiper, Sharp-tailed Sandpiper, Fork-tailed Swift, Latham's Snipe) and along with the two species of Wagtail (Grey and Yellow), are likely to benefit from the reinstatement of more frequent inundation of their preferred wetland and mudflat habitats in areas such as Lake Wallawalla.

There is potential for the introduction of environmental water to lead to an increase in feral predators (cats, foxes), herbivores (e.g. goats) and omnivores (e.g. pigs) due to the associated increase in floodplain productivity. Some of these species, such as feral cats, could potentially prey on waterbirds, as well as woodland birds, small mammals, reptiles and frogs, that may respond to environmental watering of wetlands and floodplain habitats. A pest animal management and control program, developed in consultation with Parks Victoria as a project partner, would need to be implemented and funded to support current pest control programs within the Murray-Sunset National Park and target potential increases in pest species during and following inundation events.

Overall, restoring a more natural flooding regime to the Lindsay Island floodplain, including Lake Wallawalla, as proposed by the project, is likely to improve the quality of habitat present for water dependent avifauna. Such habitat enhancements include increased productivity of floodplain vegetation communities, increased floral diversity and structure by reducing more dominant drought-tolerant species, and increased overall health and integrity of the area to improve breeding, foraging and refuge resources for listed migratory species, and other wetland-dependent bird species. Previous condition monitoring at Hattah-Kulkyne National Park where floodplain environmental watering has been undertaken for over 15 years has shown that the introduction of environmental water has had positive benefits for listed threatened and migratory water birds, including observations of the EPBC Act listed Australian Painted Snipe (Rostratula australis) (Endangered) and Glossy Ibis (Plegadis falcinellus) (migratory) (Wood et al. 2018).

2.5.2 Do you consider this impact to be significant?

☐ Yes ☑ No

2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?

☐ Yes ☑ No

2.7 Is the proposed action likely to be taken on or near Commonwealth land?

☐ Yes ☑ No

2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?

☐ Yes ☑ No

2.9 Is the proposed action likely to have any direct or indirect impact on a water resource from coal seam gas or large coal mining development?

☐ Yes ☑ No

2.10 Is the proposed action a nuclear action?

☐ Yes ☑ No

2.11 Is the proposed action to be taken by a Commonwealth agency?

☐ Yes ☑ No

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2.12 Is the proposed action to be undertaken in a Commonwealth Heritage place overseas?

☐ Yes ☑ No

2.13 Is the proposed action likely to have any direct or indirect impact on any part of the environment in the Commonwealth marine area?

☐ Yes ☑ No

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Section 3

Description of the project area

3.1 Describe the flora and fauna relevant to the project area

A review of relevant databases (Protected Matters Search Tool (PMST), Victorian Biodiversity Atlas (VBA), NSW BioNet Atlas, Atlas of Living Australia) and previous studies was undertaken as part of the Flora and Fauna Assessment for the project (refer to Attachment 4) to identify native vegetation, listed flora and fauna species and communities, with potential to occur in the construction footprint and inundation area. Attachment 4 contains a summary of the methods and findings of the previous ecological studies undertaken for the project, and also describes the findings of targeted threatened flora and fauna surveys, and vegetation survey and mapping undertaken by R8 between October 2019 and January 2020, and in June 2020.

Threatened flora species

Desktop searches identified four EPBC Act listed and 27 FFG Act listed flora species that have been recorded or are modelled to potentially occur within 10 km of the project area. Of these listed flora species, two EPBC Act listed species and 22 FFG Act listed species were assessed as having a possible or higher likelihood of occurrence in the construction footprint and inundation area.

The two EPBC Act listed flora species assessed as having a possible occurrence in the construction footprint and inundation area due to the presence of suitable habitat are: Eleocharis obicis (Striate Spike-sedge) (Vulnerable), and Lepidium monoplocoides (Winged Peppercress) (Endangered). These two species are further discussed in Section 2.4 of this referral. No EPBC Act listed flora species were recorded within or adjacent to the construction footprint during targeted surveys in 2013, 2015 and 2019. Striate Spike-sedge was recorded in 2013 along the eastern banks of Lake Wallawalla, outside the proposed construction footprint but possibly within the inundation area. There are no records of this species in the vicinity of the project area on the VBA (nearest registered record is over 150 km away near Manangatang).

Four FFG Act listed species were recorded within or adjacent to the construction footprint during targeted surveys in 2019: Acacia oswaldii (Umbrella Wattle), Crinum flaccidum (Darling Lily), Eremophila bignoniiflora (Bignonia Emu-bush) and Eremophila maculata subsp. maculata (Spotted Emu-bush). A further 7 flora species considered rare or threatened in Victoria (DELWP Advisory List) were recorded within or adjacent to the construction footprint during targeted surveys in 2019.

Threatened fauna species

Desktop searches identified 18 EPBC Act listed and 52 FFG Act listed fauna species that have been recorded or are modelled to potentially occur within 10 km of the project area. Of these listed fauna species, 27 FFG Act listed species, including five EPBC Act listed species were assessed as having a possible or higher likelihood of occurrence in the construction footprint, and 38 FFG Act listed species, including nine EPBC Act listed species were assessed as having a possible or higher likelihood of occurrence in the inundation area.

The five EPBC Act listed fauna assessed as having a possible occurrence in the construction footprint are: Regent Parrot (Polytelis anthopeplus monarchoides) (Vulnerable), Painted Honeyeater (Grantiella picta) (Vulnerable), Growling Grass Frog (Litoria raniformis) (Vulnerable) , Silver Perch (Bidyanus bidyanus) (Critically Endangered) and Murray Cod (Maccullochella peelii peelii) (Vulnerable). The four additional EPBC Act listed fauna assessed as having a possible occurrence in the inundation area are: Australasian Bittern (Botaurus poiciloptilus) (Endangered), Australian Painted Snipe (Rostratula australis) (Endangered), Curlew Sandpiper (Calidris ferruginea) (Critically Endangered) and Eastern Curlew (Numenius madagascariensis) (Critically Endangered). These nine species are further discussed in Section 2.4 of this referral.

Thirteen listed fauna species have been recorded within the project area during surveys between 2012 and 2020 or are otherwise known to occur in the project area, including four EPBC Act / FFG Act listed species (Regent Parrot, Growling Grass Frog, Murray Cod, Silver Perch), eight additional FFG Act listed species (Giles' Planigale, Apostlebird, Great Egret, Ground Cuckoo-shrike, Hooded Robin, Murray-Darling Rainbowfish, Unspecked Hardyhead and Freshwater Catfish) and one species listed on the DELWP Advisory List only (Inland Dotterel). Regent Parrot was the only EPBC Act listed fauna species recorded during targeted surveys by R8 between October 2019 and January 2020, and was observed flying to the north east of the proposed Berribee Regulator.

Listed migratory species

Eleven EPBC Act listed migratory species were predicted to occur within 10 km of the project area. These species are discussed in Section 2.4. Lake Wallawalla is known to attract a regionally significant number of waterbirds when flooded, including the Common Greenshank and other listed migratory and threatened waterbirds (MDBC 2006).

3.2 Describe the hydrology relevant to the project area (including water flows)

Waterways and wetlands within or adjacent to the project area include: the Lindsay River, Toupnein Creek, Mullaroo Creek, Little Mullaroo Creek, Lindsay South Creek, Lake Wallawalla and various wetlands across the Lindsay Island floodplain in Victoria; the Murray River, an anabranch of the Murray River, Lock 7 Billabong and Horseshoe Billabong in NSW.

The Lindsay Island floodplain is situated along a heavily regulated reach of the Murray River, being located between Lock

8 upstream and Lock 6 downstream, with Lock 7 located on the Murray River adjacent to Lindsay Island. These regulation structures strongly influence the current hydrology of Lindsay Island and have done so for almost 100 years since Lake Victoria (NSW) commenced being used for regulation and storage to control flows into South Australia.

Lake Victoria is a major balancing storage on the NSW side of the Murray River, which stores water diverted from the Murray River above Lock 9 and releases water to the river just downstream of Lock 7. Releases can be up to 9,000 ML/d and can create a significantly higher flow below Lock 7 than above, which can cause inundation in the west of Lindsay Island (Ecological Associates 2014). Lake Victoria is located approximately 3.5 km north of Lock 7 and drains into the Murray River via Rufus River.

The lower reaches of the Lindsay River, within approximately 30 km upstream of Lock 6, are significantly influenced by the Lock 6 weir pool. The Lock 6 weir pool has a normal operating level of 19.25 mAHD resulting in a backwater effect extending beyond the confluence of Mullaroo Creek with the Lindsay River, including the location of the proposed Berribee Regulator. The weir pool ponds water in the channels in the west of the island, particularly affecting the western parts of Lindsay River, Toupnein Creek and lower Mullaroo Creek (Ecological Associates 2014).

Lock 7, located adjacent to Lindsay Island and two river kilometres downstream of the Mullaroo Creek inlet, is pivotal to the hydrology of the local area because it controls the flow into Mullaroo Creek and the eastern part of Lindsay Island upstream of the Lock 7, as well as providing the hydraulic conditions that enable Lake Victoria to drain into the Murray River downstream of Lock 7 (ARI 2018). Lock 7 has a normal operating full supply level of 22.1 mAHD, with a normal operating range between 21.9 – 22.2 mAHD, and a normal weir pool extending 29 km upstream to Lock 8 (ARI 2018).

Modelling of natural (pre-regulation) and current (post-regulation) hydrological conditions at the Lindsay Island floodplain was undertaken by Water Technology (2014) and is described in Section 3.7.

Attachment 5 describes that regional groundwater flow across the Victorian floodplain is to the south west away from the Murray River, whereas in the vicinity of the NSW inundation areas, groundwater flow is south towards the Murray River due to the hydraulic head from Lake Victoria driving groundwater flows. Most waterways in the project area are thought to be losing streams (i.e. lose water into local groundwater system) except for sections of the Murray River and Rufus River (NSW), which are thought to be gaining streams.

The project area is underlain by shallow groundwater, typically between 3-6 m below ground level, and is influenced by Murray River lock levels close to the river and evapotranspiration processes in the floodplain. Watertable elevations range between around 21.5 mAHD in the east to 18.5 mAHD in the west of Lindsay Island, and around 19.5-20 mAHD at Lake Wallawalla. Groundwater levels in the NSW inundation areas would be very similar to the Murray River weir pool level at Lock 7, given the proximity of these areas to the river, with groundwater elevation likely to increase away from the Murray River into NSW.

Groundwater across most of the floodplain has very high groundwater salinity (i.e. 50,000 to 90,000 µS/cm). Flush zones close to waterways where there is regular flow, record much fresher water quality, from close to river quality (typically <200 µS/cm) to around 5,000 µS/cm. Groundwater salinity in the NSW inundation areas is mapped at between 35,000 to 50,000 µS/cm, but is likely to be heavily impacted by the river flush zone.

3.3 Describe the soil and vegetation characteristics relevant to the project area

The project area is located in the Murray Basin geological unit. The Geological Survey of Victoria Mildura 1:250,000 map sheet identifies the following geological units for the project area (GHD, 2017):

- Coonambidgal Formation – Fine-grained recent Quaternary sedimentary deposit in the Murray Trench, consisting of silts and clays
- Monoman Formation – Fine to medium-coarse grained Quaternary sedimentary deposit in the Murray Trench, consisting predominantly of sand
- Woorinen Formation – Aeolian fine dune sand, that can be locally remobilised / reworked to cover younger formations
- Blanchetown Clay – Quaternary clay unit, acting as a confining layer where present
- Parilla Sand – Pliocene sands, predominantly sand with minor silt and clay. Localised cemented layers.

The Lindsay River is underlain by the Parilla Sand unit, which forms a hard, ferruginous surface at river bed level and underlies the river banks at depth. Above the Parilla Sands are younger Quaternary-aged sediments, which form the banks of the river and differ on each side.

The project area is predominantly within the Northern Riverine Plain geomorphic division and the sub-unit consisting of modern floodplains of the meander belt below plain level, with some parts of the Wallawalla East and Wallawalla West WMAs

extending onto older alluvial plains without leveed channels (Attachment 2). The project area is located in the Murray Scroll Belt bioregion, which is characterised by an entrenched river valley and associated floodplain, including lake complexes of numerous oxbow lakes, billabongs, ephemeral lakes, swamps and active meander belts, in which the Murray River forms a narrow valley where fluvial processes predominate within an otherwise aeolian-dominated landscape (DELWP 2020a). Alluvium deposits from the Cainozoic period gave rise to the red brown earths, cracking clays and texture contrast soils (Dermosols, Vertosols, Chromosols and Sodosols) which support Alluvial-Plain Shrubland, Riverine Grassy Chenopod Woodland and Riverine Grassy Forest ecosystems.

Highly variable and dispersive soils occur throughout the project area. One of the main geotechnical issues requiring design consideration, as identified through geotechnical investigations undertaken for the project to date, is seepage control under and around the large regulators. Sheet-pile cutoffs are included in the design for these structures to mitigate the risk of piping under and around the regulators.

No site-specific acid sulphate soil (ASS) investigations have been undertaken for the project at this stage. CSIRO's Australian Soil Resource Information System (ASRIS) mapping indicates that the project is located within an area of 'extremely low probability of ASS occurring', with a level 4 confidence (provisional classification, inferred from surrogate data with no ground verification) (CSIRO 2008). Although the MDBA's regional hazard assessment of ASS throughout the Murray-Darling Basin (MDBA 2011) does not show results specifically for the project area, the assessment shows that that floodplain sediments in the Mildura to Wentworth area (nearest to and approximately 70 km east of the area of investigation) have a high to moderate potential of exhibiting an ASS hazard. A high-level review of geomorphological, vegetation and groundwater conditions in the area of investigation based on data from BOM (2020) and VVG (2020) suggests that ASS materials may be present due to the presence of wetlands and waterlogged areas, vegetation tolerant of salt, acid and/or waterlogged conditions, and groundwater levels <3 m below ground surface.

The project area is characterised by very high soil salinity in the saturated and unsaturated zones (see Section 3.5 of Attachment 5). Interpreted soil salt loads in the unsaturated soil profile across most of the inundation area are very high (over 100 t/ha/m) and over 200 t/ha/m in areas of central Lindsay Island, Crankhandle, Wallawalla West and Wallawalla East. Small sections of central-south Lindsay Island and Lindsay South areas have a very significant salt store in the saturated zone (above 200 t/ha/m). The proposed inundation area has been identified as having a moderate to very high surface salinity hazard rating (Cullen et al., 2008).

Section 3.5 describes vegetation characteristics.

3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area

The project area is mostly located within the Murray-Sunset National Park gazetted under the Victorian National Parks Act 1975 and managed primarily for conservation and some recreational purposes. The River Red Gum Parks Management Plan, July 2018 (Parks Victoria 2018) applies to management of that part of the Murray-Sunset National Park containing the project area. The River Red Gum Parks Management Plan indicates that Lindsay Island, along with Mulcra and Wallpolla Islands, have been assessed as supporting visually significant landscapes and views, and nationally significant geological and geomorphological features (scroll plains, anabranch and channels). Part of the Wallawalla West WMA inundation area is located within the Lake Wallawalla Reference Area under the Victorian Reference Areas Act 1978, while the area of investigation for the BERR_D containment bank and regulator is adjacent to the Toupnein Creek Reference Area. These reference areas are part of the Murray-Sunset National Park and are managed to retain their 'natural state'.

The majority of the project area is subject to Environmental Significance Overlay (Schedule 1 – Murray River Corridor) (ESO1) under the Mildura Planning Scheme. The ESO1 affects public and private land in non-urban areas associated with the Murray River floodplain. The ESO1 identifies the Murray River as 'an asset of national and state significance' and recognises that the 'Murray River (on the Victorian side) is one of the few major rivers in the world retaining unimpeded access for most of its length'. The ESO1 recognises the Murray River's contribution to 'environmental, economic, social, recreational and tourist functions' and that 'the remaining native riverine forests, woodlands and wetlands that adjoin the waterway of the Murray River are critically important for the maintenance of water quality, biodiversity, wildlife habitat and scenic beauty' and that 'it is the visual and landscape qualities of this environment that are the basis for the demand for tourist and recreation development'.

The majority of the project area is located within the Lindsay Island and Lake Wallawalla wetlands listed on A Directory of Important Wetlands in Australia (DIWA). When flooded, Lake Wallawalla is known to attract a regionally significant number of waterbirds, with listed migratory species known to utilise the lake including the Great Egret and Common Greenshank, both listed under both the Japan–Australia Migratory Bird Agreement (JAMBA) and China– Australia Migratory Bird Agreement (CAMBA), and the White-bellied Sea-eagle and Caspian Tern, both listed under the CAMBA (MDBC 2006). Lindsay Island is part of the Chowilla-Lindsay-Wallpolla Icon Site, one of six icon sites identified under the MDBC's TLM initiative.

Lindsay Island, specifically Mullaroo Creek and the Lindsay River, supports a nationally significant native fish community, with up to 12 native species present, including the threatened species Murray Cod, Silver Perch, Freshwater Catfish and a range of small-bodied native fish. Mullaroo Creek is recognised as one of the most valuable Murray Cod populations in the southern Murray-Darling Basin, due to it being a self-sustaining population with a broad size range and a relatively high abundance of large, mature Murray Cod. Mullaroo Creek retains a relatively high snag density and water velocities are significantly faster and stage heights less variable than would occur under natural conditions, providing the ideal conditions for Murray Cod, which would once have been present in the lower 800 km of the Murray River but following river regulation and de-snagging are now found predominantly within anabranches (ARI 2018).

The project area has a long history of Aboriginal occupation and has been assessed as having high archaeological sensitivity due to its largely unaltered natural state and the density of Aboriginal Places previously recorded within the geographic region. Culturally scarred trees are often a living remnant of traditional life of the first peoples and frequently occur along the edges of waterways and wetlands, with many of these trees occurring on Lindsay Island (MDBA 2012). Many of these trees are often stressed because of lack of flooding and may die without intervention (MDBA 2012). Refer to Section 3.9 for further information on the Aboriginal cultural heritage values of the project area.

3.5 Describe the status of native vegetation relevant to the project area

Approximately 105.89 ha of native vegetation, including 1,071 large trees, is potentially impacted based on the current construction footprint, including:

- 0.03 ha of Semi-arid Chenopod Woodland (EVC 98) (Depleted (D))
- 2.62 ha of Samphire Shrubland (EVC 101) (Least Concern (LC))
- 13.30 ha of Low Chenopod Scrubland (EVC 102) (D)
- 33.71 ha of Riverine Chenopod Woodland (EVC 103) (D)
- 7.21 ha of Lignum Swamp (EVC 104) (Vulnerable (V))
- 4.79 ha of Grassy Riverine Forest (EVC 106) (D)
- 0.39 ha of Alluvial Plains Semi-arid Grassland (EVC 806) (V)
- 1.03 ha of Lignum Shrubland (EVC 808) (LC)
- 0.75 ha of Floodway Pond Herbland (EVC 810) (D)
- 14.11 ha of Intermittent Swampy Woodland (EVC 813) (D)
- 7.30 ha of Shrubby Riverine Woodland (EVC 818) (LC)
- 20.64 ha of Lignum Swampy Woodland (EVC 823) (D).

64.26 ha of native vegetation is within or has tree protection zones (TPZs) potentially impacted by, the construction footprint of proposed infrastructure. The development footprint of permanent infrastructure for the current design is 13.47 ha, so there is scope to minimise impacts and reinstate areas following construction. 41.63 ha of native vegetation is potentially impacted by access tracks. The final scope of access tracks is still to be confirmed, with some tracks to be limited to minor upgrades requiring tree lopping only.

EVCs modelled to occur within the inundation area are:

- 2.24 ha of Semi-arid Woodland (EVC 97) (V)
- 19.14 ha of Semi-arid Chenopod Woodland (EVC 98) (D)
- 181.83 ha of Low Chenopod Shrubland (EVC 102) (D)
- 716.67 ha of Riverine Chenopod Woodland (EVC 103) (D)
- 163.80 ha of Lignum Swamp (EVC 104) (V)
- 5.72 ha of Grassy Riverine Forest (EVC 106) (D)
- 197.50 ha of Lake Bed Herbland (EVC 107) (V)
- 19.34 ha of Shallow Freshwater Marsh (EVC 200) (V)
- 656.80 ha of Alluvial Plains Semi-arid Grassland (EVC 806) (V)
- 7.91 ha of Disused Floodway Shrubby Herbland (EVC 807) (Endangered)
- 1,413.89 ha of Lignum Shrubland (EVC 808) (LC)
- 23.80 ha of Floodway Pond Herbland (EVC 810) (D)
- 10.01 ha of Grassy Riverine Forest/Floodway Pond Herbland (EVC 811) (D)
- 814.72 ha of Intermittent Swampy Woodland (EVC 813) (D)
- 237.36 ha of Shrubby Riverine Woodland (EVC 818) (LC)
- 127.24 ha of Lignum Swampy Woodland (EVC 823) (D)
- 190.52 ha of Water Body-Fresh (EVC 992) (no Biodiversity Conservation Status (BCS))
- 31.35 ha of Bare Rock/Ground (EVC 993) (no BCS).

Two non-flood dependent EVCs are modelled to occur within the inundation area (i.e. EVC 97, EVC 98). Ground-truthing undertaken in these modelled locations found no EVC 97 or EVC 98. In addition to the modelled EVCs listed above, modelling identified 270.22 ha as unmapped EVC. The majority of this 270.22 ha was found to be located in NSW with small

areas in Victoria deemed to be waterbody. 8.52 ha of unmapped EVC was modelled to occur in areas containing vegetation in Victoria and was usually Riverine Chenopod Woodland (EVC 103), Lignum Shrubland (EVC 808) and occasionally Alluvial Plains Semi-arid Grassland (EVC 806), which are located on alluvial terraces and are prone to flooding. The remaining EVCs modelled to occur in the inundation area are flood-dependent EVCs that are expected to benefit rather than be adversely impacted by the delivery of environmental watering that meets their preferred hydrological regime.

While detailed assessment of the NSW inundation areas is yet to be completed, desktop assessment indicates that of the approximately 263 ha of inundation area within NSW (mostly within the Murray River), there is approximately 129.2 ha of land modelled as containing native vegetation based on NSW State Vegetation Type Mapping (Western Region). Two vegetation communities are modelled in these areas:

- River Red Gum – Lignum very tall open forest or woodland wetland on floodplains of semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion), Benson Class 11 (LM143) (128 ha)
- Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion), Benson Class 13 (1.2 ha).

Each of these communities consist of flood-dependent vegetation. A small area (0.0002 ha) of 'no native vegetation' (PCTID0) is modelled to occur in the NSW inundation area.

The PMST identified one EPBC Act listed threatened ecological community with potential to occur within 10 km of the project area: Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (Endangered). Refer to Section 2.4 for further information about this community.

3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area

Based on LiDAR derived digital elevation models used in the hydrological modelling for the project (Water Technology, 2014 & 2016), the topography of the Lindsay Island floodplain is relatively flat with levels ranging around 24 to 26 m AHD in the eastern parts of Lindsay Island, around 22 to 24 mAHD in the central and western parts of the island, and around 20 to 22 mAHD at Lake Wallawalla. See Figure 2 of Attachment 2).

3.7 Describe the current condition of the environment relevant to the project area

Modelling of natural (pre-regulation) by Water Technology (2014) indicates that flows onto the floodplain began to engage at Murray River flows of 40,000 ML/d (see Figure 1 of Attachment 2). Below this flow threshold, only major channels and cutoff meanders are inundated. At 40,000 ML/d Lake Wallawalla and the Crankhandle complex began to fill, with widespread floodplain inundation within Lindsay Island and Lake Wallawalla commencing at 60,000 ML/d (including much of Crankhandle and Crankhandle West WMAs, and the area just upstream of the Berribee Regulator). Lindsay South and Wallawalla West WMAs began to be inundated at 80,000 ML/d, with inundation continuing to increase with flow until the majority of floodplain is engaged at about 120,000 ML/d. Modelling of current (post-regulation) conditions by Water Technology (2014) indicates that flood behaviour and inundation extents are very similar to natural conditions. The major difference between the natural and current condition scenarios is that the presence of Lock 7 and Lock 8 increase upstream water levels and flow through the Lindsay system at low Murray River flows up to around 40,000-50,000 ML/d. At these flows, little of the floodplain is engaged and therefore there is little difference visible in the inundation mapping and these extents are therefore not included in Attachment 2. Above this flow, the locks are fully opened and do not present a significant barrier to flows, therefore the flood behaviour at high flows is very similar to the natural condition scenario.

Although the extent of flooding across the Lindsay Island floodplain under different Murray River flow thresholds is quite similar under natural and current conditions, analysis by Gippel (2014) has shown that the frequency, duration, timing and intervals of relevant flood events has been substantially altered by river regulation as illustrated in Figure 3 and Table 1 of Attachment 2. This analysis shows that for current conditions:

- The frequency of river flows of 10,000 ML/day has significantly increased from natural conditions
- The frequency of flood events associated with a river flow of 20,000 ML/day or more has significantly decreased from natural conditions
- The duration of flood events associated with river flows between 10,000 ML/day and 80,000 ML/day has decreased from natural conditions with minimal change to the duration of flood events above 80,000 ML/day
- The interval between flood events associated with river flows greater than 90,000 ML/day has significantly increased.

These alterations to flow and flooding regimes are having significant impacts on biodiversity and ecosystem processes in the rivers, wetlands and floodplains that require periodic inundation to maintain the health of flood-dependent ecosystems, particularly in providing suitable habitat conditions (Parks Victoria 2018). Alterations to waterways and localised flows, together with climate change, have resulted in most rivers in the River Red Gum Parks now being in poor condition (Parks Victoria 2018), with the 2010 stream condition scores for the project area being mostly rated very poor (see Figure 4 of Attachment 2). Flood-dependent vegetation communities that now receive only infrequent seasonal flooding are showing significant signs of stress, including reduced canopy condition in the river red gum forests and black box woodlands, and

limited regeneration of the aquatic understorey, allowing terrestrial plant species to dominate (Parks Victoria 2018). Inappropriate hydrological regimes are identified as a key threat to conservation assets in the River Red Gum Parks (Parks Victoria 2020).

Six restricted weeds listed under the Victorian Catchment and Land Protection Act 1994 were detected in the area of investigation during field surveys in 2019: Carthamus lanatus (Saffron Thistle); Chondrilla juncea (Skeleton Weed), Cirsium vulgare (Spear Thistle), Cuscuta campestris (Field Dodder), Dittrichia graveolens (Stinkwort) and Xanthium spinosum (Bathurst Burr). Introduced herbivores identified by Parks Victoria (2020) as present and a threat to conservation assets within the Murray-Sunset National Park, including Lindsay Island, include rabbits, goats and pigs, along with a small population of feral cattle that remains on Lindsay Island as a legacy of previous grazing use. Other pest species prioritised for management action in the Murray-Sunset National Park are introduced predators (cats, foxes), aquatic pests (carp) and emerging weeds (Thornapple, Willows, Buffel Grass) (Parks Victoria 2019).

3.8 Describe any Commonwealth Heritage places or other places recognised as having heritage values relevant to the project

There are no Commonwealth Heritage Places within or adjoining the project area. According to the PMST, the nearest Commonwealth Heritage Place is the Murray Mallee – Calperum Station and Taylorville Station, which is listed on the Commonwealth Heritage List (CHL) and is located approximately 35 km downstream of the project of in South Australia.

A desktop historical heritage assessment was undertaken by R8 in July 2020 (R8, 2020e). No places listed on the World Heritage List (WHL), National Heritage List (NHL),CHL, Victorian Heritage Register (VHR), Victorian Heritage Inventory (VHI) or NSW Heritage Register, or places of local significance listed under the Mildura Planning Scheme Heritage Overlay (HO) or the Wentworth Local Environmental Plan 2011 (Wentworth LEP) are located within or adjoining the area or investigation. One unlisted potential historical heritage place (Berribee Homestead Complex) is located in the area of investigation. While not listed on any heritage registers/lists, the Berribee Homestead Complex has been assessed as having high local significance and was recommended for inclusion on the Mildura Planning Scheme HO (Bell 2013). A review of construction laydown requirements for the Berribee Regulator has determined that use of the area containing the Berribee Homestead Complex is not likely to be required and as such, this area is likely to be excluded from the final construction footprint to avoid direct impacts on this unlisted historical heritage place.

There are no places listed on the WHL, NHL, CHL, VHR, HO, NSW Heritage Register or the Wentworth LEP located within the inundation area. Three listed historical heritage places have been identified within the inundation area, including two places listed on the VHI (Lindsay Creek North Ferry Crossing (VHI H7129-0001), Lindsay Creek South Ferry Crossing (VHI H7129-0002)) and one place listed on the non-statutory Register of the National Estate (RNE) (Lock and Weir No 7 (RNE101494)). An additional two unlisted potential historical heritage places (Berribee Station Barge and Baggot's Cattle Station) have also been identified in the inundation area. A number of heritage places listed under the Wentworth LEP are located in the vicinity of the project area, including Kulkurna Homestead, Kulkurna Lock-Up, Kulkurna Woolshed, Cal Lal Police Station and Courthouse, Cal Lal Post Office, and Warakoo Homestead. These heritage places are located on the NSW side of the Murray River and are not located within the NSW inundation areas.

Assessment of aerial imagery and a review of relevant historical heritage assessments indicates there is moderate potential for previously unidentified historical heritage to be present within the project area. Site types most likely to be found in the project area include places or archaeological sites associated with early agricultural or pastoral activities, logging, river shipping, and water management practices.

3.9 Describe any Indigenous heritage values relevant to the project area

As noted in Section 1.13, a draft CHMP was prepared for the project (current at that time) under the Victorian Aboriginal Heritage Act 2006 in 2018. The draft CHMP involved both standard and complex assessment of the activity area, which was based on the concept design for the project as at 2016/17. Since then, the project design has changed and the draft CHMP prepared in 2018 is being updated to reflect the current design for the project. Update of the draft CHMP is likely to be complete in mid-2021 and is being prepared in consultation with the FPMMAC (including the Ngintait peoples as members of FPMMAC). A summary of key findings from the 2018 draft CHMP is provided below.

The desktop assessment identified that the activity area (similar to current area of investigation) is located in the Murray Basin geographic area and has a long history of Aboriginal occupation and use, with 541 Aboriginal Places previously recorded in the geographic region. The activity area is located in the Murray-Sunset National Park, which remains largely intact, and has only been slightly disturbed through past grazing use and present day recreational activities, mainly track construction. The desktop assessment identified 33 previously recorded Aboriginal Places within 50 m of the activity area, including artefact scatters, burials, shell middens, earth features (both mounds and hearths), scarred trees and low density artefact distributions (or LDADs, formerly called isolated artefacts). The desktop assessment found that some Aboriginal Places are represented by a complex of features (containing multiple cultural components). The desktop assessment indicated that the activity area had high archaeological sensitivity due to its largely unaltered natural state and the density of

Aboriginal Places previously recorded within the geographic region. The desktop assessment found that Aboriginal Places are expected anywhere along the watercourses (ephemeral and permanent) on Lindsay Island, and that a wide range of Aboriginal Place types are likely to be found (Jacobs, 2018). Dunes and lunettes within the Riverine Floodplain land system are highly sensitive areas likely to contain a wide range of Aboriginal Place types, and are especially sensitive for ancestral human remains. Remnant mature native eucalypt species, especially along the internal watercourses, are highly sensitive for cultural scarring (Jacobs, 2018).

During the standard assessment, ground surface visibility was deemed good, with 613 individual Aboriginal objects recorded: 513 stone artefacts, 51 earth features, 46 scarred trees and 3 shell middens. This resulted in 79 new Aboriginal Places recorded and 25 re-inspected Aboriginal Places (already recorded). The results of the desktop and standard identified the need for complex assessment, with the standard assessment identifying the Aboriginal cultural material mostly likely to be discovered during excavations as: shell midden material, hearths (burnt clay), chert or silcrete stone artefacts and ancestral human remains.

During the complex assessment a total of 30 mechanical test pits, 15 test pits, and 215 shovel test pits were excavated. Additional cultural material from Aboriginal Places recorded or re-inspected during the standard assessment was discovered during the complex assessment, indicating sub-surface contexts for these Aboriginal Places, however, no additional Aboriginal Place registrations resulted from the complex assessment. The complex assessment found 104 Aboriginal Places within the activity area (based on the area of investigation current at the time), consisting of stone artefacts, scarred trees, earth features (hearths), shell middens and ancestral remains.

No Aboriginal cultural heritage assessment has yet been undertaken for the NSW inundation area and minor NSW construction footprint at Drop Structure CR_D. A due diligence assessment under the NSW NPW Act and in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010) is proposed to be undertaken for the works and inundation within NSW to identify if there is a requirement for an Aboriginal Heritage Impact Permit (AHIP). If an AHIP is required, the assessment would include consultation in accordance with the requirements of Clause 60 of the NSW National Parks and Wildlife Regulation 2019.

Further assessment is proposed to identify potential impacts to cultural heritage in both the Victorian and NSW project areas, including consideration of potential impacts from hydrological, hydrogeological and geomorphological change associated with the project.

3.10 Describe the tenure of the action area (e.g. freehold, leasehold) relevant to the project area

Most of the works and inundation are located on Victorian Crown land within Murray-Sunset National Park. Most of the works and inundation associated with the Lindsay South WMA are on Victorian freehold land known as Neds Corner. A small area of inundation and existing access track works are located on Victorian Crown land reserved for public purposes (water management) adjacent to Lock 7, which contains SA Water facilities. A section of existing Berribee Homestead Track to be used by the project, traverses a parcel of private freehold land in Victoria. Drop Structure CR_D and most of the NSW inundation area is on NSW Crown land within the Murray River. The remaining NSW inundation area is mostly located on NSW Crown land within the former Lake Victoria State Forest, which is no longer state forest and is intended to be transferred to traditional owners. One parcel of private freehold land is in the NSW inundation area. Land tenure is described in Section 3.2 of Attachment 3.

3.11 Describe any existing or any proposed uses relevant to the project area

The project area is located in the rural localities of Lindsay Point, Murray-Sunset and Neds Corner in Victoria and Rufus in NSW. There is no township in these rural localities. There are a number of dwellings at Lindsay Point to the west. The nearest town to the project area is Paringa, a small town in the Riverland of South Australia, which supports vineyards, almonds, citrus and stone fruit orchards, and tourism acting as a base for houseboats and paddlesteamers. The nearest settlement in NSW to the project is the rural city of Wentworth located around 60 km to the east, however a number of rural dwellings / stations within the NSW rural locality of Rufus are scattered along the northern side of the Murray River opposite Lindsay Island.

The project area lies between 10 km and 20 km north of the Sturt Highway and extends north to the Murray River. The Sturt Highway is the national highway of the area and major road network link between Victoria and South Australia. Land to the east and south west of the Murray-Sunset National Park (including Lindsay Point) are in a Farming Zone. These areas support orchard farming of nuts (mostly almonds and pistachios). The Lindsay River downstream of the Berribee Regulator provides irrigation water supply to the Lindsay Point irrigation area. No licensed pump sites are located within the construction footprint or inundation area. The Berribee State Forest is located south west of the area of investigation. In NSW, land surrounding the inundation area consists of rural zoned land. Lake Victoria is a dominant feature of the surrounding area in NSW and is located approximately 3.5 km north of Lock 7.

The nearest dwellings to the proposed works include three SA Water managed caretaker's dwellings located adjacent to Lock 7 in the north eastern part of the project area (2.2 km east of BERR_F), a dwelling at Kulkurna Homestead on the northern bank of the Murray River (1.0 km north of CR_D), a dwelling at Lindsay Point (1.7 km west of CW_B1). The nearest dwelling to Berribee Regulator is located around 5 km to the west. Two unoccupied buildings are located at Berribee Homestead (150 m upstream of Berribee Regulator). These buildings may be used infrequently by Parks Victoria staff/contactors during their works on Lindsay Island.

Most of the project area is in the Murray-Sunset National Park, which is one of the largest national parks in Australia, having an area of approximately 665,400 ha. The project is located within the Lindsay Island Visitor Experience Area, which is managed by Parks Victoria to enable 'visitors to enjoy a remote river-based experience with minimal impact on natural and cultural values'. Recreational activities include fishing, kayaking and canoeing, and bird watching. Designated camping areas are dispersed across Lindsay Island and around Lake Wallawalla, with most camping areas being located along the Murray River, Lindsay River or Mullaroo Creek. Two camping areas fall partly within the area of investigation, and 11 camping areas fall within the inundation area.

Part of the Wallawalla West WMA inundation area is located in the Lake Wallawalla Reference Area under the Victorian Reference Areas Act 1978, while the area of investigation for the BERR_D containment bank and regulator adjoins the Toupnein Creek Reference Area. These reference areas are managed to retain their 'natural state' and are part of the Murray-Sunset National Park. Also within the national park are a number of licenced apiary sites, with approximately 27 of these sites located within the project area. A small part of the inundation area and existing track works extend onto land reserved for water management purposes located on the Victorian side of the Murray River adjacent to Lock 7 and surrounded by national park. This land is managed by DELWP and contains SA Water facilities associated with operation of Lock 7 and the existing Mullaroo Regulator.

The main parcel of private land within the project area, is located to the south of Lindsay River and is known as Neds Corner. Although included in the Farming Zone, this former grazing property is currently owned by Trust for Nature and managed for conservation purposes. A large parcel of private land is located in the central northern part of Lindsay Island between the Murray River in the north and Sandford Track in the south. This property does not contain any dwellings or other notable development (contains a caravan and shed) and is not in the area of investigation or inundation area.

Most of the land in the NSW inundation area was formerly part of the Lake Victoria State Forest. Due to the NSW National Park Estate (Riverina Red Gum Reservations) Act 2010, this land is no longer state forest and ownership of land within the boundaries of the former Lake Victoria State Forest is intended to be transferred to traditional owners. The land is currently being held by the Minister administering the NSW NPW Act.

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Section 4

Measures to avoid or reduce impacts

4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action

Design

A number of design options were considered (Attachment 7). Design would be further refined including:

- Refine footprints, to the minimum extent practicable, to avoid the Buloke Woodlands TEC
- Qualified arborist to assist in micro-siting infrastructure to minimise impacts on large, hollow-bearing trees
- Regulator designs to include provision for fish passage
- Assess proposed Lock 7 operation including extent of inundation and fishway functionality at proposed weir pool levels to identify and mitigate potential impacts
- Targeted vegetation assessment at sample sites in the inundation area and areas potentially impacted by near-surface salinisation to inform further impact assessments and mitigation.

Construction

Implement a CEMP including:

- A flora and fauna management plan that includes a pre-clearance and clearance process and requires:
- Areas of retained Buloke Woodlands TEC to be fenced and delineated as no-go zones. Fencing to be checked weekly and condition of vegetation monitored by a qualified ecologist monthly
- Avoidance of hollow-bearing tree removal during breeding season of hollow-dependent species, including Regent Parrot, where practicable
- A tree removal protocol requiring pre-clearance surveys prior to (within 24 hours) hollow-bearing tree removal
- An aquatic fauna management plan including requirements for Berribee Regulator construction:
- Plan construction to minimise length of time barriers to aquatic fauna movement are in place
- Construct temporary cofferdams in the Lindsay River at Berribee Regulator by sheet-piling using barges, with selection of pile-driving placement, timing and method to minimise impacts to threatened fish
- Where practicable avoid sheet-piling or other high impact construction activities in Lindsay River during the spawning season for threatened fish (generally October to February). If high impact in-water activities such as sheet-piling are required during the spawning season, assess noise and vibration impacts to identify potential impacts and required mitigation measures
- Complete regulator construction in two parts so Lindsay River retains passing flows during construction. Assess construction methodology to check depth and velocity of passing flows provides fish passage
- Avoid submerged woody habitat removal where practicable; place any submerged woody habitat removed back in the same waterway as close to its original location as practicable
- Weed and pest hygiene protocols, including for Chytrid Fungus as per Murray et al (2011). If handling of frogs is required (i.e. during salvage), a suitably qualified ecologist is to be engaged
- A dewatering strategy that minimises duration of dewatering, rate/volume of groundwater extracted and potentially saline groundwater requiring disposal; provides for use of offset water for affected vegetation where required; and precludes disposal of saline groundwater to land. Saline groundwater disposal would need to comply with SEPP (Waters) and EPA discharge requirements.

Operation

In addition to the EWMP and Operating Plan (see Section 6.3.1):

- Draft operating regime to be refined and/or alternative measures implemented to avoid or mitigate potential impacts on threatened fish species of the Lindsay-Mullaroo system (e.g. Murray Cod and Silver Perch), while also optimising benefits to floodplain vegetation communities and habitats. ARI (2018) recommendations to be considered, include: Reduce frequency of Berribee Maximum scenario (e.g. to 1 in 10 years), do not implement after an anoxic blackwater event, limit duration (e.g. 6 weeks), avoid overlap with spawning season; and Reduce frequency of higher level Berribee Intermediate scenario (e.g. to 4 in 10 years), do not implement after an anoxic blackwater event, limit duration (e.g. 8 weeks), avoid overlap with spawning season, avoid consecutive year operation
- Pest animal management and control program in partnership with Parks Victoria
- Blackwater management measures and a water quality monitoring program to manage risks to downstream environments, including Riverland Ramsar site. This would include requirements for operation of fishways to allow timely escape of fish from blackwater events
- Assess potential for native vegetation to be impacted by changes in groundwater levels or groundwater/soil salinity. If potential adverse impacts are identified, additional monitoring and mitigation measures would be developed and implemented through the EWMP and VMFRP MER Framework
- Measures to reduce carp proliferation, including tailoring water regimes to provide competitive advantage to native fish, and a fish exit strategy to manage drawdown to trigger native fish to move off the floodplain, where possible, stranding carp
- Plan watering events to avoid peak groundwater mound salt outflow coinciding with irrigation season; engage with MDBA to determine how to account for potential salt load impact on the Murray River.

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4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved

The project aims to restore a more natural inundation regime and improve ecological condition across approximately 4,845 ha of high ecological value Victorian Murray River floodplain at Lindsay Island, which forms part of the Murray-Sunset National Park. Seven water regime classes, comprising 17 EVCs, have been identified for restoration through this project as described by Ecological Associates (2014), Mallee CMA (2014):

- Watercourses
- Temporary wetlands
- Semi-permanent wetlands
- Red Gum Forest and Woodland
- Lignum Shrubland and Woodland
- Black Box Woodland
- Alluvial Plains.

Specific ecological objectives have been developed for the project as part of the VMFRP MER Framework (ARI 2020). These ecological objectives align with the environmental objectives set out in Chapter 5 of the Basin Plan 2012 and the expected environmental outcomes set out in the Basin-wide Environmental Watering Strategy (MDBA 2019). The specific ecological objectives of the project are to:

- Reduce high threat exotic plant cover
- Maintain plant cover and diversity of target native vegetation groups
- Maintain threatened native flora presence
- Maintain the health of native trees
- Increase native habitat for local populations of fauna by increasing the extent of wetland and riparian vegetation
- Increase the abundance of bats as an indicator species of increased resources resulting from increased floodplain productivity
- Protect and restore mammal populations
- Increase the abundance of reptiles as an indicator species of increased resources resulting from increased floodplain productivity
- Develop seasonal populations of small-bodied native fish
- Maintain local populations of large-bodied native fish
- Maintain migration of medium and small-bodied native fish to maintain populations.
- Provide suitable habitat conditions for large-bodied native fish spawning.
- Maintain successful breeding for target waterbird species
- Provide suitable habitat for thousands of waterbirds
- Develop seasonal populations of native frogs
- Contribute to the carbon requirements of the River Murray channel ecosystem to support system productivity.

Some of the currently identified ecological objectives are potentially competing. Further refinement of ecological objectives may be required as the design and draft operating scenarios are refined as discussed in this referral. To measure progress towards achieving the identified ecological objectives and to support quantification of the degree of environmental benefit expected from the project., specific ecological targets have also been developed as part of the VMFRP MER Framework (ARI 2020). These ecological targets along with the final ecological objectives would be included in the Lindsay Island EWMP and Operating Plan which would be submitted for approval by the MDBA prior to environmental watering being undertaken.

Implementation of the project is expected to have a net environmental benefit to the majority of EPBC Act listed threatened species and listed migratory species assessed as potentially occurring in the project area as described in this referral. Birds and bat species (Regent Parrot, Painted Honeyeater, Australasian Bittern, Australian Painted Snipe, Curlew Sandpiper, Eastern Curlew, South-eastern Long-eared Bat and the eleven listed migratory species) are likely to be benefitted through the proposed reinstatement of a more natural hydrological regime to Lindsay Island floodplain, and associated improvements in the health, condition and productivity of floodplain vegetation communities, which provide potential foraging habitat for these species, and would sustain large, hollow-bearing trees potentially utilised for breeding by species such as Regent Parrot. The Growling Grass Frog is also likely to be benefitted through the proposed reinstatement of a more natural hydrological regime to Lindsay Island floodplain, through the expansion and improvement of short-term foraging and breeding habitat in floodplain wetlands likely to be created during inundation events.

However, operation of the Berribee Regulator for larger inundation events (Berribee Maximum, higher level Berribee Intermediate) would reduce fast-flowing habitat in the Lindsay-Mullaroo system that supports a nationally important population of the vulnerable Murray Cod as well as the critically endangered Silver Perch, and is likely to have a significant impact on these species without further mitigation. The extent of impacts on these listed fish species would depend on the frequency, duration, timing and magnitude of reduced flow velocities in the Lindsay-Mullaroo system. This in turn would depend on the outcomes of proposed refinements to the operating regime to mitigate impacts on threatened fish species while also

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optimising inundation benefits to floodplain vegetation communities and habitats, and the threatened species that utilise these habitats.

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Section 5

Conclusion on the likelihood of significant impacts

5.1 You indicated the below ticked items to be of significant impact and therefore you consider the action to be a controlled action

- ☐ World Heritage properties
- ☐ National Heritage places
- ☐ Wetlands of international importance (declared Ramsar wetlands)
- ☑ Listed threatened species or any threatened ecological community
- ☐ Listed migratory species
- ☐ Marine environment outside Commonwealth marine areas
- ☐ Protection of the environment from actions involving Commonwealth land
- ☐ Great Barrier Reef Marine Park
- ☐ A water resource, in relation to coal seam gas development and large coal mining development
- ☐ Protection of the environment from nuclear actions
- ☐ Protection of the environment from Commonwealth actions
- ☐ Commonwealth Heritage places overseas
- ☐ Commonwealth marine areas

5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action

The project is unlikely to have a significant impact on the following protected matters:

Ramsar wetlands

No works are within or adjacent to a Ramsar wetland. Due to separation distances and the relatively small volume of return flows compared to Murray River flows, the project is unlikely to result in a substantial or measurable change in the hydrological regime or water quality of downstream Ramsar sites. Works would not result in any areas of a Ramsar wetland being destroyed or substantially modified; changes to the habitat or lifecycle of native species dependent on a Ramsar wetland; or the introduction or spread of an invasive species in a Ramsar wetland.

Threatened species and communities

Buloke Woodlands TEC

Removal of 0.03 ha of Buloke Woodlands TEC identified in the construction footprint is likely avoidable through design refinements. Buloke Woodlands TEC was not identified during targeted ground-truthing in the inundation area. Further assessment is proposed in areas adjacent to the inundation area where near-surface salinisation may occur; if Buloke Woodlands is present, potential impacts would be assessed and operation of the project adaptively managed to avoid a significant impact.

Striate Spike-Sedge, Winged Peppercress

No EPBC Act listed flora species are recorded within 10 km of the project area based on relevant databases, other than one historic record of Winged Peppercress from 1948. No EPBC Act listed flora have been recorded within or adjacent to the construction footprint during surveys in 2013, 2015 and 2019. Striate Spike-sedge was recorded along the eastern bank of Lake Wallawalla in 2013, outside the construction footprint but potentially within the inundation area. No EPBC Act listed species are likely to be impacted by construction. If present in the inundation area, reinstatement of a more natural wetting/drying regime would likely benefit Winged Peppercress and Striate Spike-sedge.

Regent Parrot

Based on targeted nesting surveys in 2012 and 2019, no known Regent Parrot nesting trees would be removed and there are currently no known nesting colonies within or adjacent to the construction footprint/access tracks. Construction footprints were sited to avoid removal of large, hollow-bearing River Red Gums within preferred nesting areas. Reinstatement of a more natural inundation regime would likely benefit this species by improving the health and condition of trees relied on by Regent Parrot for breeding, and improve the resilience of Regent Parrot habitat under climate change scenarios, river regulation and drought conditions. A relatively small area of sub-optimal potential foraging/dispersal habitat (47 ha) would be removed compared to the extent of habitat expected to benefit from environmental watering (1,343 ha).

Painted Honeyeater, Australasian Bittern, Australian Painted Snipe, Curlew Sandpiper, Eastern Curlew, South-eastern Long-eared Bat

These species are highly mobile, only occasional visitors, and the project area is unlikely to support an important population. Potential habitat removal would be in small, discrete areas compared to the much larger areas of potential habitats benefitted by a more natural inundation regime and the extensive area of contiguous vegetation within the 665,400 ha Murray-Sunset National Park.

Growling Grass Frog

Localised impacts are possible due to habitat clearance and works in waterways, however suitable habitat is abundant in surrounding area and works in ephemerally wet areas, would occur in dry periods where practicable. Impacts would be managed through a CEMP, including preclearance/clearance protocols, controls for managing erosion and sediment, storage of fuels/chemicals, dewatering and works in waterways. This species is likely to benefit from expanded and improved breeding and foraging habitat due to reinstatement of a more natural inundation regime.

Migratory species

Construction footprints do not support important habitat for migratory species foraging or breeding activity, or support an ecologically significant proportion of a population of migratory species. Most species assessed as potentially occurring are wading shore-birds, which along with the two species of Wagtail (Grey and Yellow), are likely to benefit from reinstatement of more frequent inundation of their preferred wetland and mudflat habitats in areas such as Lake Wallawalla.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 6

Environmental record of the person proposing to take the action

6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Explain in further detail

Lower Murray Urban and Rural Water Corporation (LMW) is an urban and rural water authority operating in north west Victoria in accordance with its function and powers established under the Victorian Water Act 1989. LMW oversees a substantial capital works program additional to the ongoing operations and maintenance of their urban and rural water networks. As detailed further in Section 6.2, LMW does not have any past or present proceedings under law for any capital works programs delivered in the rural water sector.

6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application

Pollution Abatement Notice (PAN) 90007586 – revoked on 3 March 2017.

No other past or present proceedings are known at this time.

6.3 If it is a corporation undertaking the action will the action be taken in accordance with the corporation's environmental policy and framework?

☑ Yes ☐ No

6.3.1 If the person taking the action is a corporation, provide details of the corporation's environmental policy and planning framework

Due to the scale and complexity of VMFRP, LMW has developed a project-specific Environmental Management Plan (EMP) that reflects the principles of ISO 14001 to guide delivery of the VMFRP projects.

The VMFRP EMP describes the principles and process for environmental management to be applied during the delivery of detailed design and approvals for the VMFRP projects, and would be amended following approvals of the projects to address environmental management requirements during construction and commissioning of the projects.

Specifically, the purpose of the current VMFRP EMP is to detail the methods for achieving the key environmental objectives of the projects, including:

- Establishing and implementing management strategies that address the environmental risks, safeguards and issues
- Managing the design to comply with relevant Commonwealth, Victorian, New South Wales, and local government requirements, statutory approvals/licences and project requirements
- Implementing environmental planning procedures and practices as required.

To complement the VMFRP EMP and to support referrals for the projects under the Victorian Environment Effects Act 1978 and Commonwealth Environment Protection Biodiversity and Conservation Act 1999, a draft Environmental Management Framework (draft EMF) has been prepared. The draft EMF provides an overview of the governance framework, processes and procedures that would be applied to manage environmental risks and impacts during construction and operation of VMFRP, including specific environmental management documentation to be prepared for construction and operation of the VMFRP.

The draft EMF (see Attachment 6) is a 'live' document and would be updated throughout the design and approvals phase of the program to:

- Incorporate findings from technical studies and design
- Capture statutory requirements and approval conditions
- Reflect environmental values and continuously improve protection measures through adaptive management
- Address the needs and expectations of interested parties (including stakeholders, regulators and the community).

The draft EMF contains general mitigation measures for the construction phase of the VMFRP.

The primary environmental management documentation for managing environmental and heritage risks and impacts during construction of the project would be:

- Project-specific Construction Environmental Management Plan
- Project-specific Cultural Heritage Management Plan.

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

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

- Environmental Watering Management Plan (EWMP)
- Operating Plan.

An EWMP would be developed for the project that:

- 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.

The EWMP would be subject to an external review process with key stakeholders including, MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria. The EWMP for the project would update the current Lindsay-Wallpolla Environmental Water Management Plan, February 2012 (MDBA, 2012) to facilitate integrated planning and management of environmental watering activities delivered by existing (TLM) and proposed (VMFRP) works across the whole of the Lindsay-Wallpolla icon site (Note: Although the Chowilla Floodplain in South Australia is part of the same icon site, a separate EWMP applies to that component due to the different jurisdiction).

An Operating Plan would be developed to provide the framework for operation of the Lindsay Island environmental watering works to meet key ecological objectives and comply with relevant legislative requirements (e.g. Water Act 2007 (Cth), s52-54 of Murray-Darling Basin Agreement). The Operating Plan would outline:

- 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.

The Operating Plan would be subject to an external review process with key stakeholders including, MDBA, LMW, VEWH, CEWH, GMW, DELWP and Parks Victoria. The Operating Plan would not prescribe particular watering events and would be a 'living document' that would be further refined and updated over time if legislation changes or operations in the major river systems require it. As the asset owner, Lower Murray Water would be responsible for developing an Operating Plan prior to commencing operation of the project.

6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

☑ Yes ☐ No

6.4.1 EPBC Act No and/or Name of Proposal

2020/8754 - Lower Murray Urban and Rural Water Corporation/Water Management and Use/located entirely in the Shire of Gannawarra, within the Murray-Darling Basin, River Track, Myall/Victoria/Guttrum and Benwell Floodplain Restoration Project, VIC

2020/8686 - Lower Murray Urban and Rural Water Corporation/Water Management and Use/Murray River anabranch near Natya, Nyah, Swan Hill and Robinvale/Victoria/Burra Creek Floodplain Restoration Project

2020/8648 - Lower Murray Urban and Rural Water Corporation/Water Management and Use/Nyah-Vinifera Park/Victoria/Nyah Floodplain Restoration Project

2020/8647 – Lower Murray Urban and Rural Water Corporation/Water Management and Use/Nyah-Vinifera Park, Vinifera, Victoria, 3594, Australia/Victoria/Vinifera Floodplain Restoration Project

2020/8632 – Lower Murray Urban and Rural Water Corporation/Water Management and Use/Kulkyne Way, Red Cliffs/Victoria/Hattah Lakes North Floodplain Restoration Project

2002/693 - Lower Murray Water/Waste Management (sewerage)/Lake Boga/Victoria/Construction of wastewater treatment lagoons at Lake Boga, Victoria.

In addition to the above, LMW has submitted EPBC Act referrals for the Belsar-Yungera Floodplain Restoration Project and Wallpolla Island Floodplain Restoration Project, which at the time of preparing this referral, were being processed through the gateway review.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 7

Information sources

Reference source

Arthur Rylah Institute (ARI) (2018). SDL Fish Management Plan: Lindsay Island, November 2018. Report prepared for Mallee CMA.

Arthur Rylah Institute (ARI). (2020). Draft VMFRP Ecological Monitoring Evaluation & Reporting Plan, June 2020. Report currently being prepared for Mallee CMA.

Reliability

Prepared by research institute

Uncertainties

Research paper based on information current at time of preparation.

Reference source

Australian Ecosystems (2013). Lindsay Island Flora Census 2013. Report for the Mallee CMA.

Reliability

Prepared by consultant

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

Baker-Gabb, D and Hurley, VG (2011). National Recovery Plan for the Regent Parrot (eastern subspecies) Polytelis anthopeplus monarchoides. Department of Sustainability and Environment, Melbourne. Available: https://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-regent-parrot-eastern-subspecies-polytelis-anthopeplus-monarchoides

Reliability

Government publication

Uncertainties

Government publication based on information current at time of preparation.

Reference source

Bell (2013). Mallee Environmental Watering Projects, Lindsay Island Floodplain, Northwest Victoria: Due Diligence Assessment, Historical Archaeology. Report prepared for the Mallee CMA.

Reliability

Prepared by consultant

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

BOM (2020). Groundwater Dependent Ecosystems Atlas. Bureau of Meteorology, Canberra ACT, Australia. Available: http://www.bom.gov.au/water/groundwater/gde/map.shtml

Reliability

Government database

Uncertainties

Government database based on information current at time of preparation.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Reference source

CSIRO (2008) Atlas of Australian Acid Sulphate Soils. CSIRO Land & Water. Available: https://www.asris.csiro.au/themes/AcidSulfateSoils.html

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Reference source

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

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Reference source

DECCW (2010). Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales. Department of Environment, Climate Change & Water, New South Wales Government. Available: https://www.environment.nsw.gov.au/research-and-publications/publications-search/due-diligence-code-of-practice-for-the-protection-of-aboriginal-objects-in-new-south-wales

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Reference source

DELWP (2019). NatureKit Online Biodiversity Maps. Department of Environment, Land, Water and Planning, East Melbourne, Victoria. Available: https://www.environment.vic.gov.au/biodiversity/naturekit. Accessed: August 2019.

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Reference source

DELWP (2020a). Bioregions and EVC Benchmarks. Department of Environment, Land, Water and Planning, East Melbourne, Victoria. Available: https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks.

Reliability

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Uncertainties

Government publication based on information current at time of preparation.

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Reference source

DELWP (2020b). MapShareVic Interactive Maps Version 3.4. Department of Environment, Land, Water and Planning, East Melbourne, Victoria. Available: https://www2.delwp.vic.gov.au/maps/maps-and-services/interactive-maps. Accessed: July 2020.

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Reliability

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DOTE (2013). Significant Impact Guidelines 1.1 - Matters of National Environmental Significance under the Environment Protection and Biodiversity Conservation Act 1999. Available: https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Reliability

Government guidelines

Uncertainties

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Reference source

Ecological Associates (2006). Floodplain Investigation: Lindsay, Mulcra and Wallpolla Islands. Water Management Options. Report prepared for Mallee CMA.

Ecological Associates (2007). Floodplain Investigation: Lindsay, Mulcra and Wallpolla Islands. Final Report. Report prepared for Mallee CMA.

Ecological Associates (2014). SDL Floodplain Watering Projects: Rationale and Outcomes, Report AL040-1-D. Report prepared for Mallee CMA.

Reliability

Prepared by consultant

Uncertainties

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Reference source

GHD (2013a). Preliminary Ecological Investigations and Targeted Regent Parrot Surveys. Report prepared for Mallee CMA.

GHD (2014a). SDL Offsets Fauna Survey Lindsay Island. Report prepared for Mallee CMA.

GHD (2016a). Lindsay Island SDL Project, Ecological Assessment. Report prepared for Mallee CMA.

GHD (2019). Floodplain Bat Study. Lindsay & Wallpolla Islands – October-December 2018. Report prepared for Mallee CMA.

Reliability

Prepared by consultant

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

GHD (2012). Lindsay Island Water Management Options Investigation – Part A Options Assessment. Report prepared for Mallee CMA.

GHD (2013b). Lindsay Island Water Management Options Investigation – Part B Concept Development and Design. Report prepared for Mallee CMA.

GHD (2014b). Lindsay Island Sustainable Diversion Limit Adjustment Supply Measures, Advanced Concept Design Report. Report prepared for SA Water.

GHD (2016b). Lindsay Island Sustainable Diversion Limit Adjustment Supply Measures, Supplementary Advanced Concept Design, Berribee Regulator Construction Options Assessment Report. Report prepared for SA Water.

GHD (2017). Lindsay Island Sustainable Diversion Limit Adjustment Supply Measures, Supplementary Advanced Concept Design Report. Report prepared for SA Water.

Reliability

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Uncertainties

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Reference source

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

Reliability

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Uncertainties

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Reference source

Jacobs (2018). Lindsay Island Sustainable Diversion Limits, Draft Complex Cultural Heritage Management Plan No. 15083. Prepared for the Mallee CMA.

Reliability

Prepared by consultant

Uncertainties

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Reference source

Mallee Catchment Management Authority (2014). Sustainable Diversion Limit Adjustment – Phase 2 Assessment – Supply Measure Business Case: Lindsay Island Floodplain Management Project.

Reliability

Government publication

Uncertainties

Government publication based on information current at time of preparation.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

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Murray-Darling Basin Authority (2011). Acid Sulfate Soils in the Murray Darling Basin. MDBA Publication No. 147/11, CSIRO Land and Water and the Murray–Darling Freshwater Research Centre.

Murray-Darling Basin Authority (2012). Lindsay-Wallpolla Islands Environmental Water Management Plan, February 2012. Murray-Darling Basin Authority, Canberra ACT, Australia. Available: https://www.mdba.gov.au/publications/mdba-reports/lindsay-wallpolla-islands-environmental-water-management-plan

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

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Murray-Darling Basin Commission (2006). The Chowilla Floodplain (Including Lindsay-Wallpolla): Icon Site Environmental Management Plan 2006 – 2007. Available: https://www.mdba.gov.au/sites/default/files/archived/mdbc-tlm-reports/2089_Env_Watering_Plan_TLM_2006-07.pdf

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National Murray Cod Recovery Team (NMCRT) (2010). National Recovery Plan for the Murray Cod Maccullochella peelii peelii. Department of Sustainability and Environment, Melbourne. Available: https://www.environment.gov.au/resource/national-recovery-plan-murray-cod-maccullochella-peelii-peelii

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Parks Victoria (2019). Conservation Action Plan for River Red Gum Parks and Reserves managed by Parks Victoria, December 2019. Available: https://www.parks.vic.gov.au/get-into-nature/conservation-and-science/conserving-our-parks/conservation-action-plans.

Reliability

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Reference source

R8 (2020a). Victorian Murray Floodplain Restoration Project – Detailed Design Report – Lindsay Island Floodplain Management Project. Prepared for Lower Murray Urban and Rural Water Corporation, April 2020.

R8 (2020b). Victorian Murray Floodplain Restoration Project – Flora and Fauna Assessment Report – Lindsay Island. Prepared for Lower Murray Urban and Rural Water Corporation, August 2020.

R8 (2020c). Victorian Murray Floodplain Restoration Project – Desktop Groundwater Assessment – Lindsay Island. Prepared for Lower Murray Urban and Rural Water Corporation, July 2020.

R8 (2020d). Victorian Murray Floodplain Restoration Project – Desktop Land Use Planning Assessment – Lindsay Island. Prepared for Lower Murray Urban and Rural Water Corporation, August 2020.

R8 (2020e). Victorian Murray Floodplain Restoration Project – Historical Heritage Desktop Assessment – Lindsay Island. Prepared for Lower Murray Urban and Rural Water Corporation, July 2020.

Reliability

Prepared by consultant

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

Seran BL&A (2018). Basin Environmental Works – Screening of the potential impacts on threatened species and communities associated with the construction and operation of Victoria's nine Basin Plan environmental works projects. Report prepared for Department of Environment, Land, Water and Planning.

Reliability

Prepared by consultant

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

VMFRP (2020a). Preliminary Draft Lindsay Environmental Watering Management Plan, June 2020. Victorian Murray Floodplain Restoration Project, Irymple, Victoria.

VMFRP (2020b). Preliminary Draft Lindsay Operating Plan, June 2020. Victorian Murray Floodplain Restoration Project, Irymple, Victoria.

Reliability

Government publication

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Uncertainties

Draft subject to further refinement and MDBA approval.

Reference source

VVG (2020). Visualising Victoria Groundwater. Available: https://www.vvg.org.au/

Reliability

Government database

Uncertainties

Government database based on information current at time of preparation.

Reference source

Water Technology (2014). Lindsay Island Hydrodynamic Modelling Report, November 2014. Report prepared for Mallee CMA.
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Reliability

Prepared by consultant

Uncertainties

Consultant report based on information current at time of preparation.

Reference source

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

Reliability

Prepared by research institute

Uncertainties

Research paper based on information current at time of preparation.

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 8

Proposed alternatives

Do you have any feasible alternatives to taking the proposed action?

Yes ☑ No

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Section 9

Person proposing the action

9.1.1 Is the person proposing the action a member of an organisation?

☑ Yes ☐ No

Organisation

Organisation name	LOWER MURRAY URBAN AND RURAL WATER CORPORATION
Business name	Lower Murray Water
ABN	18475808826
ACN	
Business address	741 Fourteenth St, Mildura, 3500, VIC, Australia
Postal address	
Main Phone number	03 5051 3400
Fax	
Primary email address	contactus@lmw.vic.gov.au
Secondary email address	

9.1.2 I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

☐ Small business
☑ Not applicable

9.1.2.2 I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations *

☐ Yes ☑ No

9.1.3 Contact

First name	Josh
Last name	White
Job title	Project Director – VMFRP
Phone	0400 697 304
Mobile	
Fax	
Email	Josh.White@vmfrp.vic.gov.au
Primary address	PO Box 1438, Mildura, 3502, Victoria, Australia
Address	

Declaration: Person proposing the action

I, Josh White **, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf or for the benefit of any other person or entity.**

Signature: ..... Date: 25/08/2020

I, Josh White **, the person proposing the action, consent to the designation of** Josh White **as the proponent for the purposes of the action described in this EPBC Act Referral.**

Signature:.....Date: 25/08/2020

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Proposed designated proponent

9.2.1 Is the proposed designated proponent a member of an organisation?

☑ Yes ☐ No

Organisation

Organisation name	LOWER MURRAY URBAN AND RURAL WATER CORPORATION
Business name	Lower Murray Water
ABN	18475808826
ACN	
Business address	741 Fourteenth St, Mildura, 3500, VIC, Australia
Postal address	
Main Phone number	03 5051 3400
Fax	
Primary email address	contactus@lmw.vic.gov.au
Secondary email address	

9.2.2 Contact

First name	Josh
Last name	White
Job title	Project Director – VMFRP
Phone	0400 697 304
Mobile	
Fax	
Email	Josh.White@vmfrp.vic.gov.au
Primary address	PO Box 1438, Mildura, 3502, Victoria, Australia
Address	

Declaration: Proposed Designated Proponent

I, ___Josh White_ on behalf of Lower Murray Urban and Rural Water Corporation_____,the proposed designated proponent, consent to the designation of myself as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature: ... . **Date:** 25/08/2020 .....

Australian Government
Department of Agriculture, Water and the Environment

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Referring party (person preparing the information)

9.3.1 Is the referring party (person preparing the information) a member of an organisation?

☑ Yes ☐ No

Organisation

Organisation name	LOWER MURRAY URBAN AND RURAL WATER CORPORATION
Business name	Lower Murray Water
ABN	18475808826
ACN	
Business address	741 Fourteenth St, Mildura, 3500, VIC, Australia
Postal address	
Main Phone number	03 5051 3400
Fax	
Primary email address	contactus@lmw.vic.gov.au
Secondary email address	

9.3.2 Contact

First name	Josh
Last name	White
Job title	Project Director – VMFRP
Phone	0400 697 304
Mobile	
Fax	
Email	Josh.White@vmfrp.vic.gov.au
Primary address	PO Box 1438, Mildura, 3502, Victoria, Australia
Address	

Declaration: Referring party (person preparing the information)

I, Josh White **, declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence.**

Signature: ..... Date: 25/08/2020

Note: PDF may contain fields not relevant to your application. These fields will appear blank or unticked. Please disregard these fields.

Appendix A

Attachment

Document Type	File Name
action_area_images	ATT_1_Project Overview Maps_1.zip
action_area_images	ATT_1_Project Overview Maps_2.zip
action_area_images	ATT_1_Project Overview Maps_3.zip
action_area_images	ATT_1_Project Overview Maps_4.zip
action_area_images	ATT_2_Environmental Features Maps.pdf
action_area_images	ATT_3_Land Use Planning Assessment_1.pdf
action_area_images	ATT_3_Land Use Planning Assessment_2.pdf
action_area_images	ATT_3_Land Use Planning Assessment_3.pdf
action_area_images	ATT_3_Land Use Planning Assessment_4.pdf
action_area_images	ATT_3_Land Use Planning Assessment_5.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part1.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part2.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part3.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part4.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part5.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part6.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part7.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part8.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part9.pdf
supporting_tech_reports	ATT_4_Flora and Fauna Assessment_Part10.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part11.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part12.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part13.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part14.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part15.pdf
flora_fauna_investigation	ATT_4_Flora and Fauna Assessment_Part16.pdf
hydro_investigation_files	ATT_5_Groundwater Assessment.pdf
impact_reduction_docs	ATT_6_Draft Environmental Management Framework.pdf
impact_reduction_docs	ATT_7_Design Development Summary.pdf
corp_env_policy_docs	ATT_8_LMW Environmental Policy.pdf

Appendix B

Coordinates

Area 1
-34.052340461194,141.06438534559
-34.096413635379,141.16293151736
-34.066315425669,141.21471727392
-34.065989353659,141.26065138117
-34.110145077602,141.3398018606
-34.139574607957,141.34628766419
-34.149829599941,141.29246611771
-34.204156239054,141.19816989686
-34.201551677878,141.12506355232
-34.159087074262,141.12003598219
-34.115573069658,141.04908380261
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