Victorian Murray Floodplain Restoration Project

Desktop Groundwater Assessment - Belsar-Yungera

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Lower Murray Urban and Rural Water Corporation

Victorian Murray Floodplain Restoration Project

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Executive Summary

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

This report documents a desktop assessment of groundwater considerations associated with the Belsar – Yungera Floodplain Restoration Project to inform the referral documentation being prepared under the *Environment Effects Act 1978* (EE Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The assessment indicates that the impact from the project on groundwater receptors is likely to be low, with adaptive management of the post-works implementation expected to help limit any negative impacts to ecosystems from changes to groundwater salinity or waterlogging.

The Belsar-Yungera Floodplain Restoration Project area is underlain by shallow groundwater, of varying quality, that is in direct connection to the Murray River though the shallow alluvial aquifer system. There is limited connection to deeper aquifers in the project area, because of the presence of a separating clay layer. Due to the location of the project area, groundwater quality and surrounding land uses, there are no licensed or regulated groundwater users in the vicinity that may be affected. The beneficial uses to be protected are, thus, focussed on groundwater support of the environment and cultural values. This assessment has used available literature and data for the area. There is a good regional spread of monitoring information and the groundwater conceptual model for this site is considered to be well known at the whole of project scale.

Construction of the project may require temporary and limited groundwater dewatering and subsequent disposal of pumped groundwater. Typically banks and surface earthworks will not intersect groundwater and thus are not expected to have a groundwater effect during construction. Temporary removal of groundwater may be required for safe access to excavations associated with the larger structures. If this is the case, then minor, temporary and localised impacts on adjacent vegetation and ecosystems are possible.

The project would develop a strategy for managing project-specific dewatering activities, including disposing of groundwater in accordance with regulatory requirements. Identified mitigation measures would be integrated into construction plans.

Operation of the proposed works will result in periods of elevated groundwater levels, wetting of soils and potentially mobilised salt from the unsaturated soil store into surface water for short periods. These effects could result in the displacement of salt to the Murray River and increased evapotranspiration of water from the floodplain, potentially concentrating salts in the soil. Whilst, a level of uncertainty was identified in the results from the previous analysis on salt load to the Murray River, the conclusion of low risk of impact is considered reasonable given the levels of conservatism built into the analysis. Given the low to moderate salt store in the project area and the generally fresh to moderately saline groundwater, these issues are regarded as being low risk to the identified beneficial uses. Monitoring of flooding patterns and adaptive management of flooding to minimise waterlogging is expected to satisfactorily control this potential risk. Such adaptive management is inherently part of the proposed operation of the project.

Beneficial uses of groundwater are not expected to be adversely affected by operation and there are no registered groundwater users within the extent of expected impacts.

Important note about your report

The purpose of R8's engagement under the Victorian Murray Floodplain Restoration Project (VMFRP) is to design infrastructure for the VMFRP including regulators, levees, roads, access tracks and culverts. The designs are required to be suitable for construction pricing to inform business case prioritisation. The purpose of this infrastructure is to allow floodplains to be watered at the hydraulic design levels nominated by VMFRP. R8 are also engaged to provide Regulatory Approvals and Cultural Heritage Services. The purpose of these services is for VMFRP to lodge the necessary approvals documents for the project with the relevant approval authorities.

The sole purpose of this report and the associated services performed by R8 is to complete a Desktop Groundwater Assessment Report for VMFRP in accordance with the scope of services set out in the contract between R8 and VMFRP. That scope of services, as described in this report, was developed with VMFRP.

R8 has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. However, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

In preparing this report, R8 has relied on the information provided by VMFRP in the data handover pack at the commencement of the project. In particular, the VMFRP has developed ecological objectives and, based on these, has proposed inundation levels and extents. R8 is reliant on VMFRP's prior flood modelling work and has designed the infrastructure in response to the VMFRP defined inundation levels and extents.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by R8 for use of any part of this report in any other context. This report has been prepared on behalf of, and for the exclusive use of VMFRP, and is subject to, and issued in accordance with, the provisions of the contract between R8 and VMFRP. R8 accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Project overview - Victorian Murray Floodplain Restoration Project

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

The VMFRP is being implemented in partnership between Lower Murray Urban and Rural Water Corporation (LMW), Goulburn Murray Rural Water Corporation (GMW), Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority (North Central CMA), Parks Victoria and the Department of Environment, Land, Water and Planning (DELWP), and is funded by the Commonwealth Department of Agriculture, Water and Environment (DAWE). LMW has been nominated by the partnership as the project proponent for the purpose of submitting referrals and approval applications.

R8 is a joint venture formed between Jacobs and GHD, which has engaged by LMW to deliver design, cultural heritage and approvals services for the VMFRP. This desktop land use planning assessment has been prepared for the project to support the preparation of referrals under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Victorian *Environment Effects Act 1978*.

1.2 Belsar - Yungera Floodplain Restoration Project

The project involves the construction of three new large regulators (ER1, ER3 and S7), a fishway at ER1, a number of small regulators and a series of containment banks to divert, retain and release water within the floodplain and two pipelines and associated hardstands to enable temporary pumping that will transfer environmental water from the Murray River into the Narcooyia Creek system.

Under the proposed scheme there are three distinct environmental works areas. Flows would enter the Belsar-Yungera system from the west along Narcooyia Creek after entering from the Murray River through the ER3 regulator. Structures, ER3, ER1, and S7 are intended to isolate a large section of Narcooyia Creek from the Murray River and hold water up to 52.3 mAHD in inundation Area 1. The downstream regulator at J1a in inundation Area 2 would then be used to retain water at an additional higher tier within the J1 creek area up to 52.9 m AHD. At high flows water can pass through J1c and J1g regulars in inundation Area 3 into J1 Creek.

Lake Powell and Lake Carpul regulators located in inundation Area 4 are designed to retain water within the lakes. Both lakes would be inundated by water pumped from Bonyaricall Creek through a two-kilometre long pipeline between the creek and Lake Powell. Lake Powell and Lake Carpul begin to fill from River Murray flows greater than 100,000 ML/d.

The main components of the project include:

- Area 1 – Three large regulators (ER3, ER1 and S7) and eight small regulators and a series of containment banks to inundate an area of floodplain. A permanent pump hard stand area and supporting pipeline at ER3 is also proposed to provide a site for temporary pumping from the Murray River.
- Area 2 – Six small regulators and a series of containment banks to inundate an area of floodplain around Lower J1 Creek.
- Area 3 – Two small regulators and a series of containment banks to inundate a smaller area of floodplain around Upper J1 Creek. A permanent pump hard stand site at J1 Creek is also proposed to provide a site for temporary pumping from the Murray River.
- Area 4 – Two small regulators, a culvert on the Murray Valley Highway, a permanent pipeline from Bonyaricall Creek and a permanent pump stand to provide a site for temporary pumping to inundate the floodplain area between Lake Powell and Lake Carpul.

For the purposes of this desktop assessment of groundwater considerations, the development footprint, construction footprint and inundation footprints have all been considered (see definitions in Section 1.3 below).

In addition to the physical structures and works noted above, the project will inundate areas of the floodplain during operation.

1.3 Project area

This assessment covers the hydrogeology of the floodplain of the Murray River along Narcooyia Creek, including Belsar and Yungera Islands and Lake Powell and Lake Carpul, around 15 km south-east of Robinvale, Vic.

The following terms are used to describe the project area:

- Development footprint - this is the area that the project infrastructure will occupy. This does not include tracks used for access during construction and operation.
- Construction footprint - this includes the project infrastructure as well as the land required to construct the infrastructure. This includes access tracks.
- Inundation area - area of land subject to flooding during managed events, up to a specific design water level. The inundation area comprises the majority of the proposed Murray River Park on Belsar and Yungera Islands, land north of the Murray Valley Highway, and land surrounding Lakes Powell and Carpul.

The hydrogeological layering and other information in the area has been reviewed considering the proposed floodplain works. The focus of this assessment is the hydrogeology on the Victorian side of the Murray River, whilst recognising that the aquifers in question have some limited hydraulic connection to the aquifer within NSW.

1.4 Purpose of this report

This report documents a desktop assessment of groundwater considerations associated with the Belsar – Yungera Floodplain Restoration Project and will feed into the referral documentation being prepared under the *Environment Effects Act 1978* (EE Act) and *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

1.5 Limitations

The following limitations apply to the assessment contained in this report:

- No site visit has been undertaken;
- Reports and records available on the public record have been used;
- Capability and experience of R8 staff have informed the assessment, which may not always be linked to a referenceable source; and,
- Detailed groundwater investigation and monitoring at the precise sites for the proposed works and area of inundation are not available and so general understanding of the hydrogeology and sites has been used to inform this assessment. Future detailed studies may revise the findings presented here, once in possession of site-specific information. VMFRP has developed a program of groundwater monitoring bores for the project area and installation of the bores took place in April 2020. This will assist in setting the pre-scheme baseline.

2. Key legislation

The following are the key legislation for this groundwater assessment. Other legislation may also apply:

- *Water Act 1989* – sets requirements for groundwater bore approval and licencing and regulates groundwater take and use from aquifers in Victoria. Groundwater users are regulated by this act and impacts on users and the environmental are also controlled. This act will control groundwater monitoring works undertaken by the project.
- *Catchment and Land Protection Act 1994* – deals with diffuse source effects in catchment, such as recharge and water quality changes.
- *Water Act 2007* (Cwth) – deals with the management of salinity in the Murray River and sets the requirements for the Basin Plan, which includes groundwater management and sustainable diversion limits for aquifers (SDL).

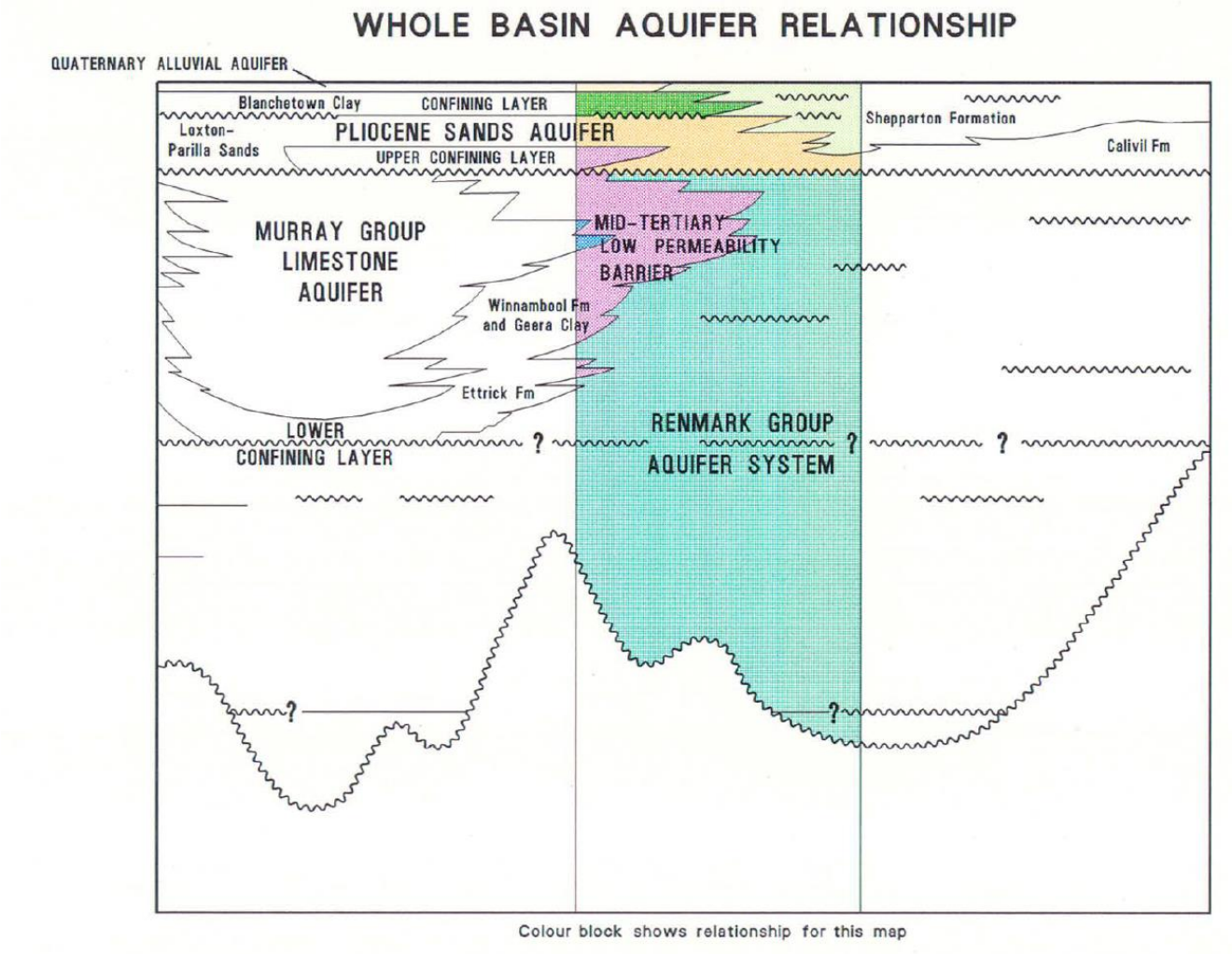
In addition to the relevant acts, regulations under these acts are also important. Specifically, for groundwater, the protocols and agreements made under the Basin Salinity Management Plan 2030 (BSM2030) are important as they define the conditions and controls relating to salt discharge to the Murray River and anabranches.

3. Existing conditions

3.1 Regional hydrogeology

The Belsar – Yungera project area is in the Murray Geological Basin. This basin was infilled with sediments during the Tertiary and Quaternary period. The regional hydrogeology is laid out in the Balranald 1:250,000 scale hydrogeological map (Kellett, 1994). Figure 1 shows a generalised hydrogeological cross section for this area, identifying the main units and their relationships. For this assessment, it is only the upper units that are of interest.

Figure 1: Regional hydrogeological units and thier relationship within the Belsar-Yungera project area (Source: Balranald 1:250,000 Hydrogeological Map)



The project area is located within the Murray Geological Basin and sediments of the basin underlie the project area. The geology and hydrogeology of shallow sediments in the area have been best described by Thorne *et al.* (1990). Other studies of the Murray River corridor on the Mallee have occurred but have not materially changed the understanding in the Belsar-Yungera project area since the 1990 work.

For this assessment, the focus is on the groundwater environment and current conditions off the shallow aquifer systems. A series of aquifer layers are present in this project area, to a depth of approximately 300 m below ground. Of these layers, only the upper layers are relevant. The presence of a clay aquitard beneath the shallow aquifer has a strong isolating influence on the aquifer sequence. This focusses the effect on the shallow alluvial layers. The full geological sequence is published by the Government of Victoria through the Victorian Aquifer Framework and the 3D Groundwater Atlas of Victoria (see GHD & AWE, 2012).

3.2 Project area hydrogeology

The shallow groundwater hydrogeological conditions in the project area are described in Thorne *et al*. (1990) and a cross section of hydrogeological conditions from this report is presented in Figure 2. The key features of these sections are as follows:

- Across the floodplain is a sequence of alluvial sediments comprising an aquitard at the surface and aquifer unit below;
- The alluvial sediments are hydraulically connected to the Murray River;
- Underlying the alluvial sediments across the floodplain is the regional aquitard of varying thickness;
- Underlying the aquitard is the regional aquifer which has no direct contact to the alluvial sediments in this area;
- The groundwater levels are very similar in elevation to the river level in the alluvial sediments across the floodplain.

The aquifer sequence at the project area is summarised by the following hydrogeomorphic units (from the surface downward; numbers refer to Aquifers as defined in the Victorian Aquifer Framework):

- The alluvial aquitard (Coonambidgal Formation: 100): Floodplain fine grained silts and clays that are part of the contemporary floodplain and the recent geological past, relatively thin across the project area;
- Channel Sands aquifer (100): An Upper Tertiary, fine to coarse grained sand aquifer in direct connection with the Murray River and likely the Narcooyia, Bonyaricall and Yungera Creeks;
- Blanchetown Clay aquitard (103): A clay sequence of varying thickness that acts to reduce vertical interaction between the Channel Sands and the deeper regional aquifer. The aquitard is thinner to the east side of the project area and closer to the River
- Loxton Parilla Sand aquifer (104): A thick sequence of Tertiary age Marine sediments that underly the river and floodplain sediments. This is the regional aquifer and is typically saline or brackish in water quality.

Regional groundwater flow is to the west and north-west, parallel with the Murray River in this area, but towards the river further west of the project area. In some cases, there will be localised flow toward the Murray River. Local flow cells that may change the local flow direction from the general pattern described above are possible.

3.3 Groundwater salinity

Salt inflow to the Murray River in the Mallee tract (that is, downstream of Swan Hill) is a major source of salt load in the river. Accordingly, there is considerable concern about soil and shallow groundwater salinity in the vicinity of the VMFRP sites and salinity risk is an aspect that requires consideration.

Groundwater salinity in the aquifer across the project area is expected to range widely, from about 500 mg/L to 13,000 mg/L. Fresher water occurs adjacent to the river, with saltier water graduating inland and toward Lakes Powell and Carpul. The interpreted distribution of salinity is shown in Figure 3.

Soil salinity has been mapped over the project area and for the riverine corridor in the area by airborne electromagnetic surveys (AEM). The project area falls in the Robinvale to Boundary Bend AEM survey area (Cullen *et al*. 2008). Saturated soil zone salinity mapping indicates that salinity of the top 30 m of the watertable is significantly lower than what the groundwater quality mapping would suggest, with salt store in the saturated zone mapped at predominantly less than 200 t/ha/m (Cullen *et al*. 2008). The Mallee landscape in Victoria is naturally high in salt compared with more southern regions and the effect of transpiration over thousands of years has left a salt signature in the soils. This is part of the natural condition of the area.

Figure 4 shows the interpreted salt loads in the area from the AEM survey. It can be seen from this figure that soil salinity in the project area has been mapped as low to moderate (below 200 t/ha/m).

Figure 2: Cross section showing key shallow hydrogeological layers bisecting the Belsar-Yungera project area (Thorne et al. 1990)

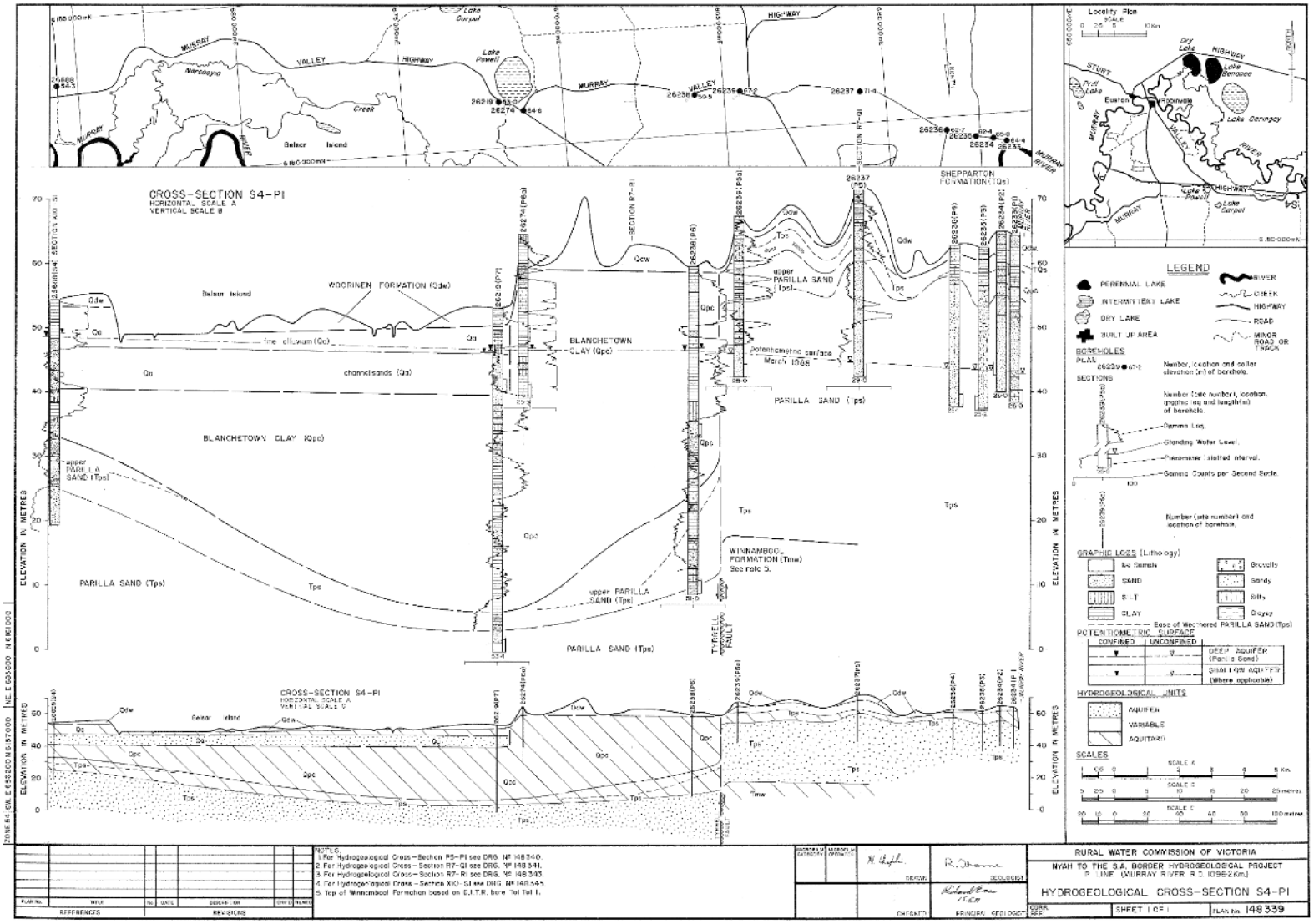


Figure 3: Interpreted groundwater salinity for the Belsar-Yungera project, overlain with the indicative inudation extent (FedUni 2015)

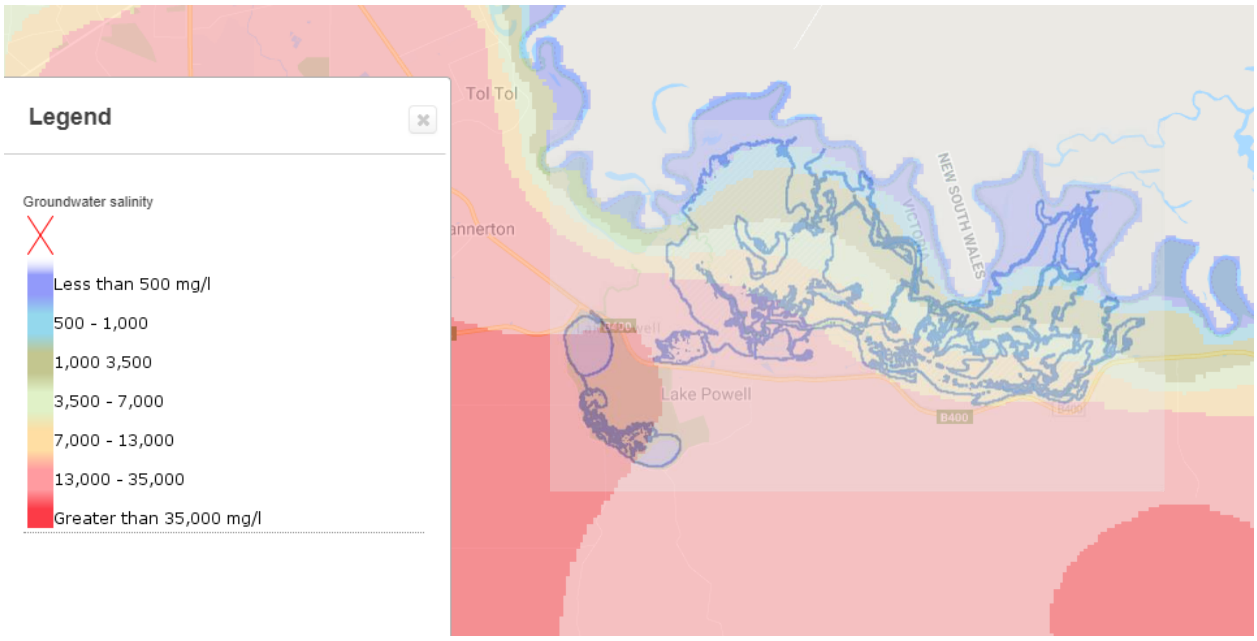
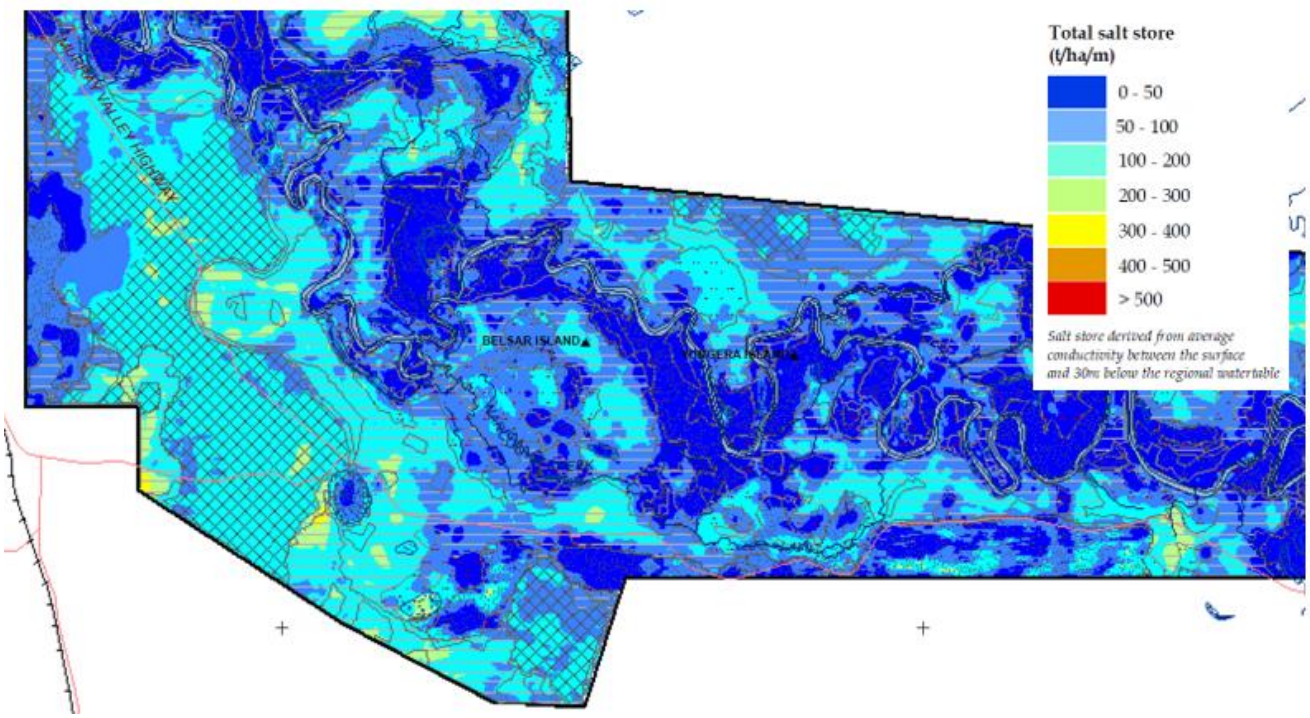


Figure 4: Interpreted Salt Store in the unsaturated zone for the project area (Cullen et al. 2008)



3.4 Beneficial uses of groundwater

In accordance with the SEPP (Waters) the following groundwater beneficial uses are protected in the project area:

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

Water quality standards are described for most of these beneficial uses and are provided in the SEPP (Waters).

3.4.1 Groundwater bore use

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

The primary use of groundwater at the project area is environmental use associated with floodplain vegetation and ecosystems.

Historically, irrigation drainage water was disposed to disposal bores (caissons) in this area. This practice was ceased in the early 2000's following a program of works led by Lower Murray Water on behalf of the Mallee Catchment Management Authority. Legacy impacts of drainage disposal in groundwater may be present, but these are all understood to be outside of the floodplain.

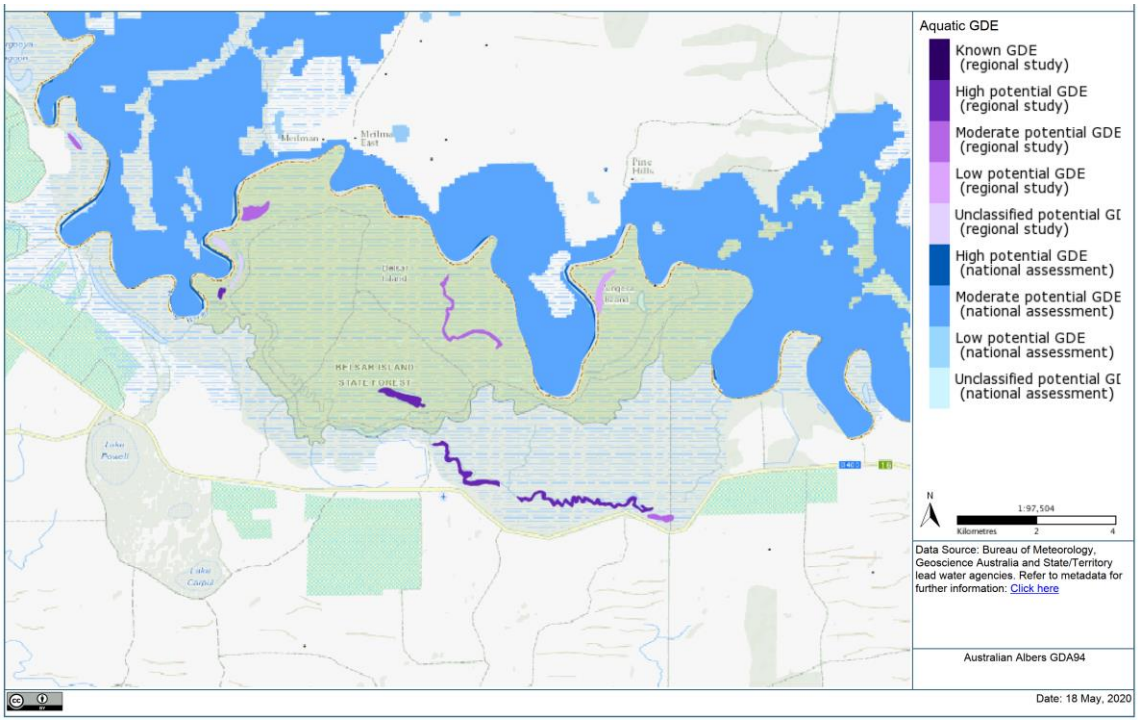
3.4.2 Groundwater Dependent Ecosystems

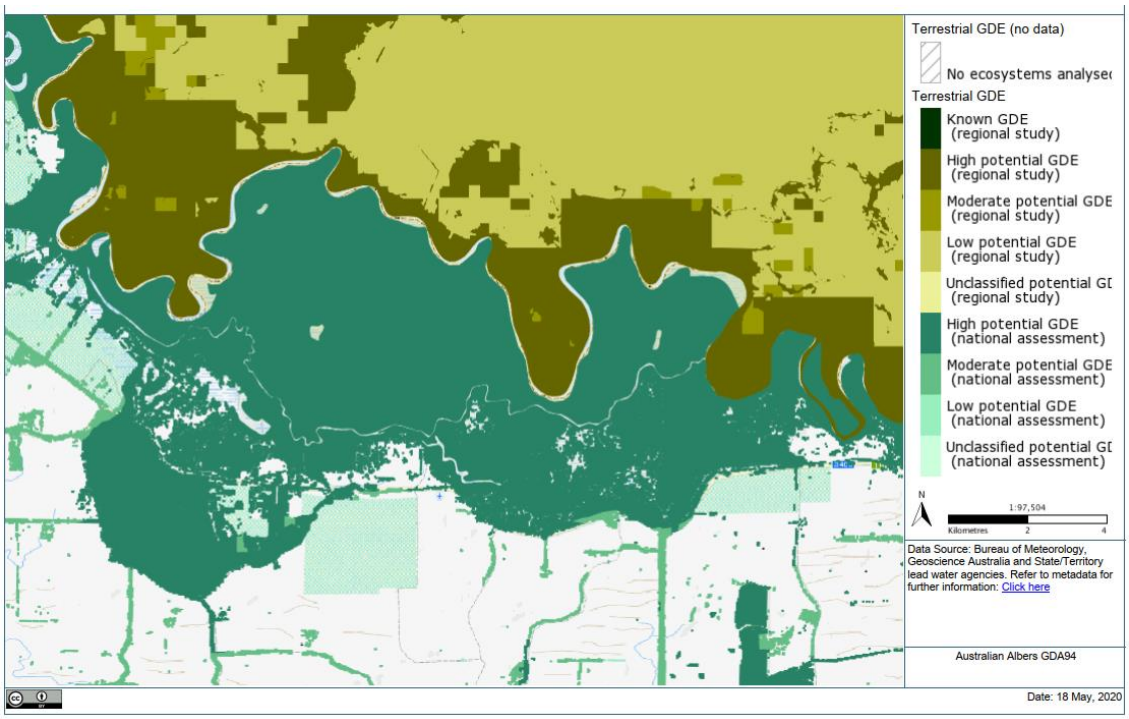
Groundwater plays an important role in sustaining aquatic and terrestrial ecosystems including wetlands and rivers. For example, groundwater can contribute to river baseflow during low rainfall periods. Groundwater Dependent Ecosystems (GDEs) can vary in nature, ranging from partially or infrequently reliant on groundwater to continually and wholly dependent (BoM, 2020). The National GDE Atlas (the Atlas) maps the potential for groundwater dependence across Australia based on national and regional studies. The Atlas classes potential GDEs into two groups: aquatic, which rely on the surface discharge of groundwater; and terrestrial, which rely on the subsurface presence of groundwater.

Figure 5 presents the potential aquatic and terrestrial GDEs mapped in the project area from the Atlas. Within and surrounding the inundation area, terrestrial vegetation with a high potential for groundwater interaction is identified. This includes Lignum Swampy Woodland/Shrubland, Riverine Forest/Shrubland and Riverine Chenopod Woodlands. A number of wetlands are identified within the project area as potential aquatic GDEs on the Atlas. The wetlands in the southern portion of the project area are largely associated with Narcooyia Creek and are identified as having high potential for groundwater dependence. The remainder of aquatic GDEs mapped within Belsar Island area are identified as having moderate potential for groundwater dependence (DELWP, 2020). The wetlands in the northern part of the Yungera Island are identified as having low potential for groundwater dependence and therefore, are not considered GDEs. The Murray River is mapped as a high potential aquatic GDE (BoM, 2020).

It is anticipated that the project will have a beneficial impact on potential GDEs within the project area. This report focuses on the potential for changes to groundwater levels and quality. A separate report has been prepared that assesses the potential for impacts to vegetation and ecological systems from the Belsar-Yungera Floodplain Restoration Project; *Flora and Fauna Assessment Report – Belsar and Yungera* (R8, 2020).

Figure 5 Potential Groundwater Dependent Ecosystems mapped in the project area for terrestrial GDEs and aquatic GDEs (BoM 2020).





4. Potential effects

The potential groundwater effects of the proposed construction and operation of the works are listed below.

- Temporary and limited drawdown of groundwater levels during construction, specifically this may be required for the regulators and inflow structure, as these may need to be dug into the subsurface. Typically banks and surface earthworks will not intersect groundwater and thus are not expected to have a groundwater effect during construction. Temporary removal of groundwater may be required for safe access to excavations associated with the larger structures.
- Increased groundwater level, as a result of flood recharge, across the inundated area.
- Reduced groundwater salinity immediately following flood events, as a result of flood recharge (of river water) that is generally lower salinity than groundwater. This phenomenon is also observed during natural floods, so is not an unusual occurrence in the floodplain. What is different with respect to the application is that the recharge is augmented beyond the current 'natural' level for a given event. It is unknown at this stage what reliance ecosystems present in the project have to current groundwater salinities, however it would be expected that a slight freshening of the water quality would not have a negative impact on ecosystem health, as the near river environment is one where vegetation has evolved with the presence of flood water. There are no identified high salinity groundwater systems in this area, and this is believed to indicate that the vegetation is adaptable within the salinity range expected in this project. It is not possible to control this effect for a given level and duration of flooding, however adaptive management, for example by timing managed events to avoid closely following natural floods, may help to reduce the impact. The likely impact to groundwater receptors from this effect, in any case, would be expected to be negligible to minor.
- Modified groundwater quality of the watertable during and after flood events. This is an analogous response to the salinity change noted above. Trace amounts of contaminants (such as nutrients) that are present in the flood water may enter groundwater during inundation. This process naturally occurs but will be augmented by the operation of the works. There is little published information on the impact of this in groundwater and it has generally been considered that the impact is minor.
- Mobilisation of salt from either the soil surface or from shallow groundwater to return to the Murray River. Salt on the soil surface may be dissolved and entrained by flood water and then held in solution until the release of the flood water, which then discharges salts to the Murray River. This process has been extensively considered by SKM (2014) and the assessment of the possibility of salinity impacts is considered low for this area. The assessment did note a number of uncertainties around these estimates, primarily related to limited available background information to confirm hydrogeological conditions particularly relating to the salt wash-off conditions. These reports did not identify ecologically concerning levels of salinity, rather they were focussed on the downstream effects of salt in the Murray River overall. A classification of the over-all risk of salt mobilisation being low is considered reasonable, because of the levels of conservatism of parameters used in the analysis, which would be expected to over-estimate the results, and the relatively low salt store in the soil profile across the project area (Cullen et al. 2008).
- Shallow groundwater in the vicinity of vegetation may occur for extended periods of time during and immediately after flooding. Vegetation that that is exposed to shallow groundwater level for extended periods of time can become waterlogged. It is noted that the majority of vegetation communities within the project area are flood dependant and capable of withstanding some degree of waterlogging. Potential implications of inundation would be investigated and ongoing monitoring of vegetation would be undertaken in accordance with the project's operational guidelines and adapted as required to support achievement of the identified ecological objectives for the project.

The following table describes the potential effects on the beneficial use of groundwater as a result of the construction and operation of the project.

Table 1: Expected effect on groundwater beneficial uses

Beneficial Use	Potential Effect
Water dependent ecosystems and species;	Beneficial effect expected Water dependent ecosystems use soil water and shallow groundwater as a water source during dry periods. The intent of the project is to provide additional reserves of shallow soil water to enhance vegetation health and to support the ecology dependent on soil water and shallow groundwater.
Potable water supply (desirable);	Negligible effect expected River water is of similar character to the shallow groundwater in areas where this beneficial use would be protected (i.e. close to the Murray River). Regular flooding of this area already occurs and an increase in frequency of flooding is expected to have negligible impact on water quality in the project area.
Potable mineral water supply;	Not applicable The water does not classify as mineral water.
Agriculture and irrigation (irrigation);	No effect expected The water quality and availability for this beneficial use will not alter.
Agriculture and irrigation (stock watering);	No effect expected The water quality and availability for this beneficial use will not alter.
Industrial and commercial;	No effect expected The water quality and availability for this beneficial use will not alter.
Water-based recreation (primary contact recreation);	No effect expected The water quality and availability for this beneficial use will not alter.
Traditional Owner cultural values;	No specific cultural requirements have been identified for this assessment. The Desktop Historical Heritage Assessment and the Cultural Heritage Management Plan deal with potential impacts of the project on historical and cultural values. Given that the water quality is not expected to change and the effect on reliant ecosystems is expected to be beneficial, it is expected that there is minimal risk to cultural values due to groundwater impacts.
Cultural and spiritual values;	Limited information – no significant effect expected No specific cultural requirements have been identified for this assessment but given that the water quality is expected not to significantly change and that the effect on reliant ecosystems is expected to be beneficial, it is expected that there is minimal risk to cultural and spiritual values as a result of groundwater impacts.
Buildings and structures;	No effect expected The water quality and availability for this beneficial use will not alter.
Geothermal properties;	No effect expected The water temperature at the surface is below the threshold for geothermal water and no effects are expected at depth.

5. Recommended mitigation measures

The following management measures are recommended during the construction and operation of the project:

- Seek to minimise the total volume and rate of groundwater extraction for construction purposes;
- Develop a strategy for managing project-specific dewatering activities, including disposing of groundwater in accordance with regulatory requirements. Identified mitigation measures would be integrated into construction plans
- Avoid disposal of groundwater from construction activities to land.

Additional environmental mitigation measures relating to dewatering activities are provided in the VMFRP Environmental Management Framework.

5.1 Further work

Specific groundwater level and quality information is required for the area to form a baseline for the potential construction and operation impacts, as well as to monitor the effects of inundation outside of the inundated area. It is understood that a program of groundwater monitoring bores has been developed for the project area and installation of the bores took place in April 2020. This will assist in setting the pre-scheme baseline.

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