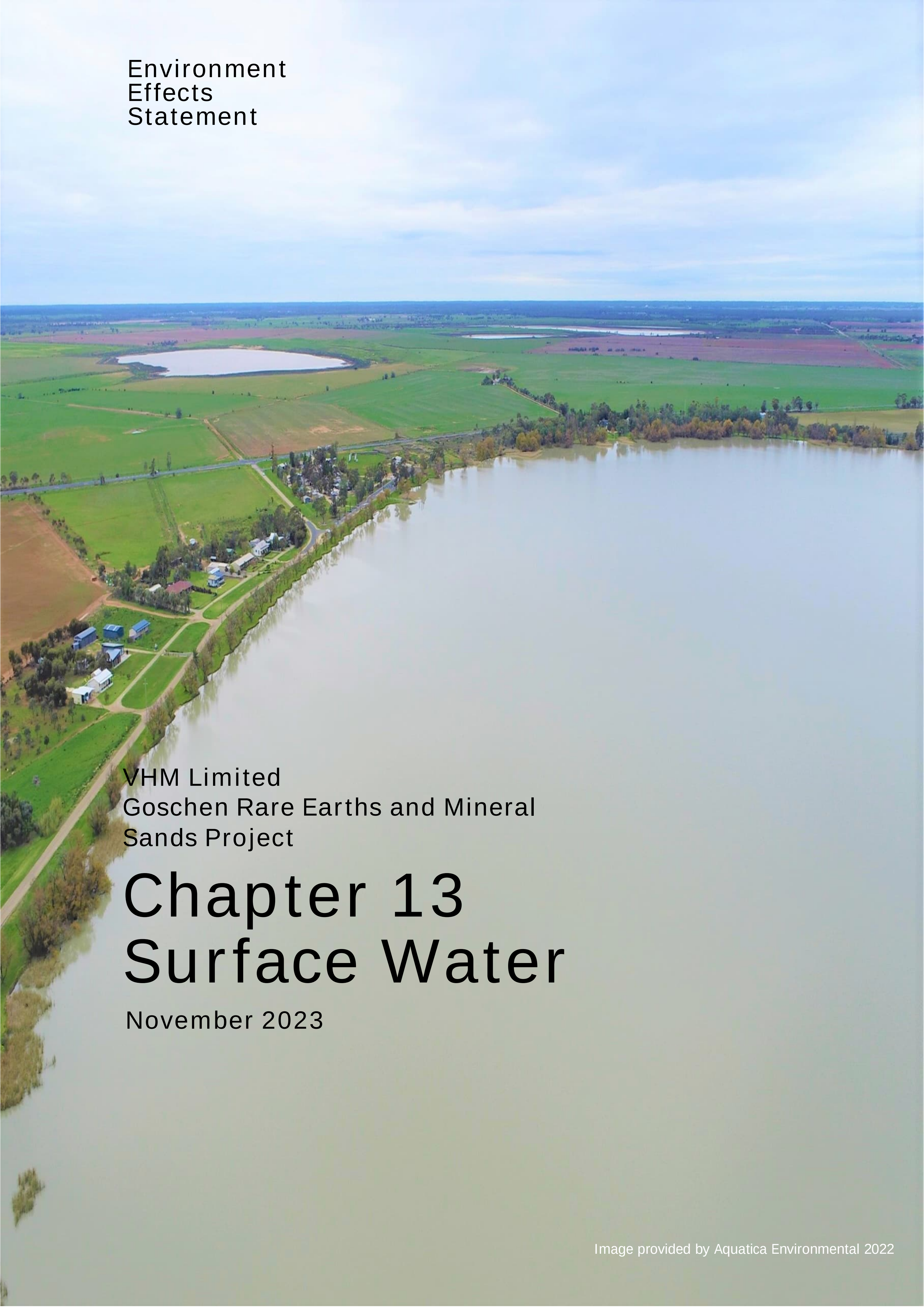

Environment Effects Statement

VHM Limited
Goschen Rare Earths and Mineral Sands Project

Chapter 13 Surface Water

November 2023

Image provided by Aquatica Environmental 2022

Table of Contents

13. Surface water

This chapter provides an assessment of the potential surface water impacts associated with the construction and operation of the Goschen Rare Earths and Mineral Sands Project (the Project). It considers potential impacts both within the Project mine site, as well as regional surface water impacts and sensitive receptors external to the mine site and other Project infrastructure.

More detailed information is provided in Technical Report H1: Surface water impact assessment and Technical Report H2: Mine site surface water impact assessment, prepared in support of the Environment Effects Statement (EES).

Overview

The Project would be located within the North Central Catchment Management Authority (CMA) management area and is close in proximity to the Mallee CMA management area. There are no significant waterways in proximity to the Project mining areas. Back Creek flows in an easterly direction into Avoca River system. Additionally, the pumpstation would be located on the bank of Kangaroo Lake.

Historically, there were many stock and domestic channels that bisected the study area delivering water to the region. The channels have mostly been decommissioned via infill, however some remain and may be blocked at road crossings, or do not receive any stock and domestic water supply.

Modelling was undertaken as part of the surface water impact assessment (EES Technical Report H1: Surface water impact assessment) to understand existing surface water flow paths in addition to flood behaviour. The Project mine site is generally not affected by riverine flooding. A 1% Annual Exceedance Probability (AEP) inundation (i.e. a 1 in 100 year rainfall event) occurs in the southwest and southeast, away from Area 1 and Area 3 mining operations. It was determined that a 1% AEP event does not produce major external overland flow paths entering or exiting the Project area, with most inundation caused by relatively minor overland flow or a series of discontinuous depressions. There are no major overland flow paths leading directly from the Project area to downstream water environments (including the Murray River, Avoca River and Kerang Wetlands Ramsar site). No overall change to inundation patterns or runoff pathways were observed following climate change modelling.

Regional catchment inundation modelling determined that Area 1 would be located within an overland flow path and has the potential to reduce surface water runoff to depressions to the east. Area 3 does not have any impact to runoff and overall the potential for impacts to nearby receptors are limited. When considering that the Project would capture all surface water runoff within its boundaries, the modelled 1% AEP water levels indicated that there would be an accumulation of water east of Area 1 and a 12 centimetre (cm) decrease in water depth west of Area 1, where two patches of vegetation occur.

Mine site surface water modelling determined that containing surface water for 5% AEP events (i.e. a 1 in 20 year rainfall event) would be practical, even with large catchment areas and low loss values. The calculated mine site surface water balance suggested that only 3.5% of the Project's nominated water re-use demand would be met from surface water harvested in onsite storage basins. This means that there would be limited economic benefit to reusing surface water within the processing operation, however any captured surface water could be reused for purposes such as dust suppression and as part of revegetation and rehabilitation.

While the water supply pipeline would interact with the Back Creek floodplain the waterway is ephemeral and only flows during Avoca River flood events. The proposed pump station works are in proximity to Kangaroo Lake and works would need to ensure no runoff or disturbed water can enter Kangaroo Lake. No other significant waterways are located in proximity to the Project area, therefore construction activities are not expected to impact riverbeds, riverbanks and existing drainage paths and impacts as a result of erosion and sediment runoff are considered to be unlikely. Additionally, mine site water storage basins would be designed to capture surface water runoff from 5% AEP events, with any runoff generated above this to be directed to the active mine pit, ensuring that that stormwater runoff could not leave the site and impact downstream water quality.

Measures to mitigate potential impacts associated with the discharge of stormwater include the development of a Surface Water Management Plan (SWMP), Construction Environmental Management Plan (CEMP) and a sediment erosion and water quality management plan. While there is no risk of riverine inundation of the Project area in a 1% AEP flood event, inundation of the Project area could be caused by surface water runoff within the local catchment. This could be mitigated by designing access routes to maintain access to mine sites and associated infrastructure with flood depths below 300 millimetres (mm) and designing any infrastructure within the 1% AEP storm extent to withstand potential flooding.

With the implementation of mitigation measures, residual surface water impacts would be limited to a 12 cm reduction in 1% AEP flood depths to two patches of vegetation west of Area 1. The decrease in depth is considered minor and is expected to be temporary. There may also be a change in surface water contribution to remnant patches of vegetation within Area 3.

EES evaluation objective

The scoping requirements provided by the Minister for Planning for the Project set out the specific environmental matters to be investigated and documented in the Project's EES. The scoping requirements inform the extent and scope of the EES technical studies. The following EES evaluation objective is relevant to both the surface water impact assessment and mine site surface water impact assessment:

To minimise effects on water resources and on beneficial and licensed uses of surface water, groundwater and related catchment values (including the Kerang Wetlands Ramsar site) over the short and long-term.

Technical Report H1: Surface water impact assessment and Technical Report H2: Mine site surface water impact assessment were prepared in support of the Project EES. The technical reports provide more detailed information on the investigation and impact assessment conducted in response to the EES scoping requirements.

13.1 Methodology

The following approach was adopted for the surface water impact assessment and mine site surface water impact assessment:

- Review of the scoping requirements and evaluation criteria to define the key technical components of the study.
- Establishment of the study area.
- Review of relevant policy and legislation.
- Identification of the existing surface water environment, sensitive receptors and environmental values, including through consultation with landowners.
- Desktop review of relevant databases and a review of previous assessments.
- Assessment of impacts to surface water during construction, operation and decommissioning / closure of the Project.
- Development of mitigation measures in response to identified impacts.
- Evaluating the residual environmental impacts once mitigation has been implemented.

13.2 Study area

The study area for the surface water impact assessment comprised all local catchment drainage pathways leading to or from the Project mine site (referred to as Project area). Based on the local topography and catchments, there are no flow paths connecting the Project mining areas to the Murray or Avoca River floodplains, or to the Kerang Wetlands Ramsar site. Water from the Project areas flows to the west down to the Lalbert Creek floodplain and to the northeast towards a channel draining to Lake Boga. The Project is therefore unlikely to have any adverse impacts on downstream water environments (including the Murray and Avoca Rivers and Kerang Wetlands Ramsar site) and, therefore these have not been included in the regional surface water model extent and study area. Impacts to surface waters associated with the Project water supply pipeline and pumpstation at Kangaroo Lake would be limited and managed by the mitigation measures proposed (refer to Section 13.4 and Section 13.5). Although assessed as part of this EES, the water supply pipeline is not proposed to be constructed in the section of the route identified as 'alternative water pipeline route'.

The study area for the mine site surface water impact assessment comprised of all areas within the Project boundary, namely mining Area 1 and mining Area 3 (refer to Figure 13-1).

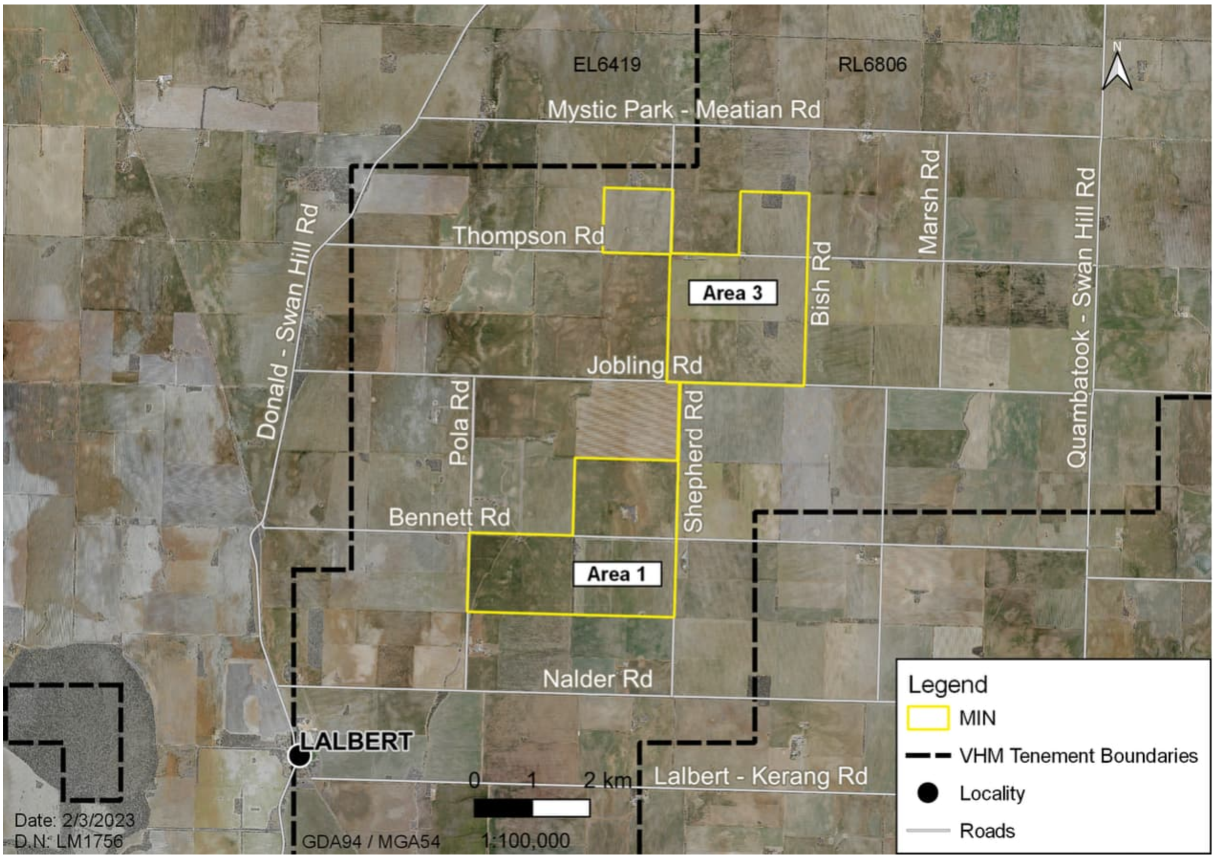

Figure 13-1 Study area for the mine site surface water impact assessment

13.3 Existing environment

A comprehensive assessment was undertaken to understand the existing environment of the study area to inform the regional surface water impact assessment and mine site surface water impact assessment. These assessments included database searches, a review of previous assessments and hydrological modelling. Further information is provided in EES Technical Report H1: Surface water impact assessment and EES Technical Report H2: Mine site surface water impact assessment.

The Project would be located within in the North Central Catchment Management Authority (CMA) management area and is close in proximity to the Mallee CMA management area (refer to Figure 13-2).

There are no designated waterways within the Project mine area (refer to Figure 13-2). A small section of the Kunat Channel intersects the north east corner of the retention licence boundary, annotated as a watercourse on Figure 13-2 between Quambatook Road and Cumnock Road. The Kunat channel does not intersect the Project area (including the proposed pipeline alignment).

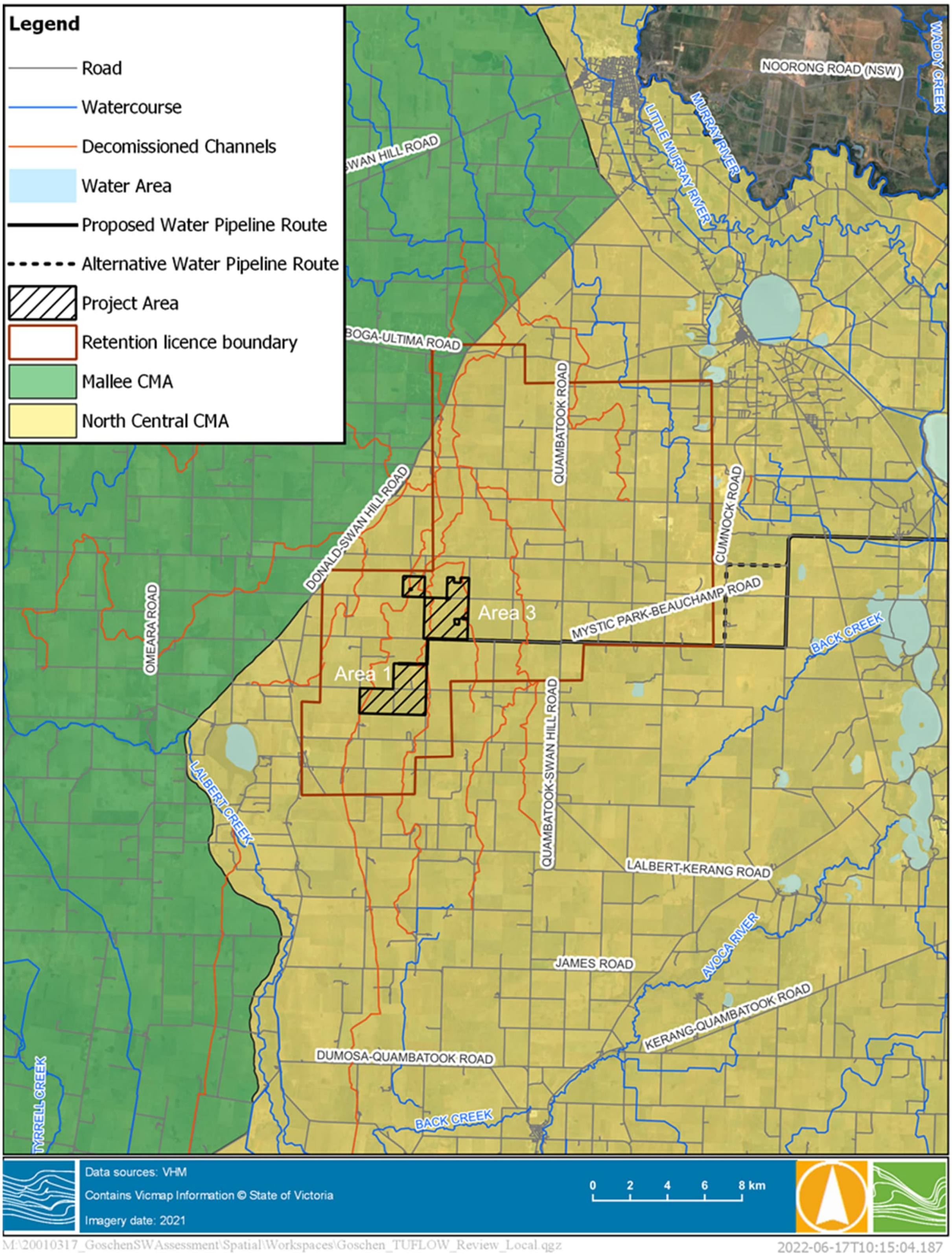

Figure 13-2 Local catchment management authority and hydrological setting

The four primary waterways located within the regional study area include the Murray River, Avoca River, Back Creek and Lalbert Creek.

Located north of the Project area, the Murray River forms part of the Murray–Darling basin river system, which drains most of the northern Victorian and southern New South Wales waterways.

The Avoca River has a history of flooding, with significant events occurring in September 2010 and January 2011. These events filled the Avoca Marshes and flowed through to Lake Boga. The Avoca River is an anabranching system, with the majority of floodwater leaving the river downstream of Charlton and spreading across the floodplain and through various anabranching waterways. Anabranching waterways are those which divert from the main waterbody and re-join downstream.

Part of the Avoca floodplain, Back Creek is one of its anabranching waterways. Back Creek also drains a large local catchment to the west of the Avoca River and flows back into the Avoca River system at the Avoca Marshes. Back Creek originates to the east of the Project mine site and flows in an easterly direction into the Avoca River system. Due to the low rainfall, sandy soils with high infiltration and gradually sloping land surface, the formation of natural waterways appears to be inhibited.

Lalbert Creek is an effluent stream of the Avoca River, carrying flood flows to the terminal lake systems of Lake Lalbert, west of the Project near the township of Lalbert, and Lake Timboram, north west of Ultima. Lalbert Creek also drains a large local catchment.

Additionally, Kangaroo Lake lies on the western side of the Murray Valley Highway approximately 18 kilometres (km) north of Kerang. It is one of 23 named lakes, marshes and swamps that form the Kerang Wetlands Ramsar site. With a surface area of approximately 984 hectares and maximum depth of 8.4 metres (m), Kangaroo Lake is one of the largest and deepest permanent freshwater lakes in the Murray-Loddon region of the Murray-Darling Drainage Division. It is located within the Torrumbarry Irrigation Area. Kangaroo Lake is a major irrigation supply storage basin and high operational water levels in the lake are required to optimise water supply for regional irrigators.

Historically, there were many stock and domestic channels that bisected the study area delivering water to the region. The larger of them included the Wychitella, Harpers, Nullawil, Kings and Kalpienung channels, all with small spur channels which were used to connect to farm dams. Most of these have been decommissioned, with water presently supplied to the area via pipelines (as part of the Northern Mallee Pipeline). The channels have mostly been decommissioned via infill, however some remain and may be blocked at road crossings, or do not receive any stock and domestic water supply. These channels were fed from the Grampians Wimmera Mallee Water (GWMWater) storages, as well as runoff from the nearby tributaries during flooding events. The channels were typically distribution channels and although they covered a large area, they did not have their own catchments.

13.3.1 Hydrological data

Hydrological data used to inform the impact assessments, as well as the modelling described in Section 13.3.2 and Section 13.3.3 include rainfall data, intensity frequency data, streamflow data and topographical data.

Further information is provided in EES Technical Report H1: Surface water impact assessment and EES Technical Report H2: Mine site surface water impact assessment.

Rainfall data

The study area is characterised by a semi-arid climate with low rainfall (365 mm/year) and high evaporation (1600 mm/year). The annual mean minimum temperature is 9.4 degrees Celsius (°C) and the annual mean maximum temperature is 24 °C.

Daily and sub-daily rainfall data was accessed via the Bureau of Meteorology (BoM). Daily rainfall gauges exist across Australia at relatively high densities, however the number of sub-daily gauges is limited. The following gauges are located in proximity to the Project.

Daily gauges:

- Lake Boga (Kunat) (077021) - located 7 km north east of the Project area.
- Swan Hill Aerodrome (077094) - located 23 km north of the Project area.
- Lake Boga (077025) - located 20 km north east of the Project area.
- Ultima (Post office) (077048) - located 20 km north west of the Project area.
- Lalbert (077023) - located 4 km south west of the Project area.
- Pira Wild Horse Plains (076050) - located 36 km north west of the Project area.
- Nyah (076044) - located 45 km north west of the Project area.
- Nyah (Yarraby tank) - located 47 km north west of the Project area.
- Quambatook (077056) - located 22 km south of the Project area.

Sub-daily gauges:

- Swan Hill Aerodrome – Automatic weather station (AWS) (077094) - located 23 km north of the Project area.

Intensity frequency data

Intensity frequency duration (IFD) curves and underpinning data was accessed via BoM for the Project area. The IFD curves are presented in Figure 13-3 below. The IFD curves show the relationship between rainfall duration and intensity for each Annual Exceedance Probability (AEP) event. Each AEP is represented as a % probability of exceedance. For example, a 1% AEP event is an event that has a probability of 1% of occurring in any given year. It is equivalent to a 1 in 100 year event.

For the study area, rainfall intensity reaches 95 millimetres per hour (mm/hr) for a 1% AEP, 12 hour storm event. This is represented by the green IFD curve in Figure 13-3 below.

IFD curves are used to determine the likelihood of rainfall and therefore, inundation. They are typically used to identify the level of inundation risk for a certain area, or to provide a design benchmark.

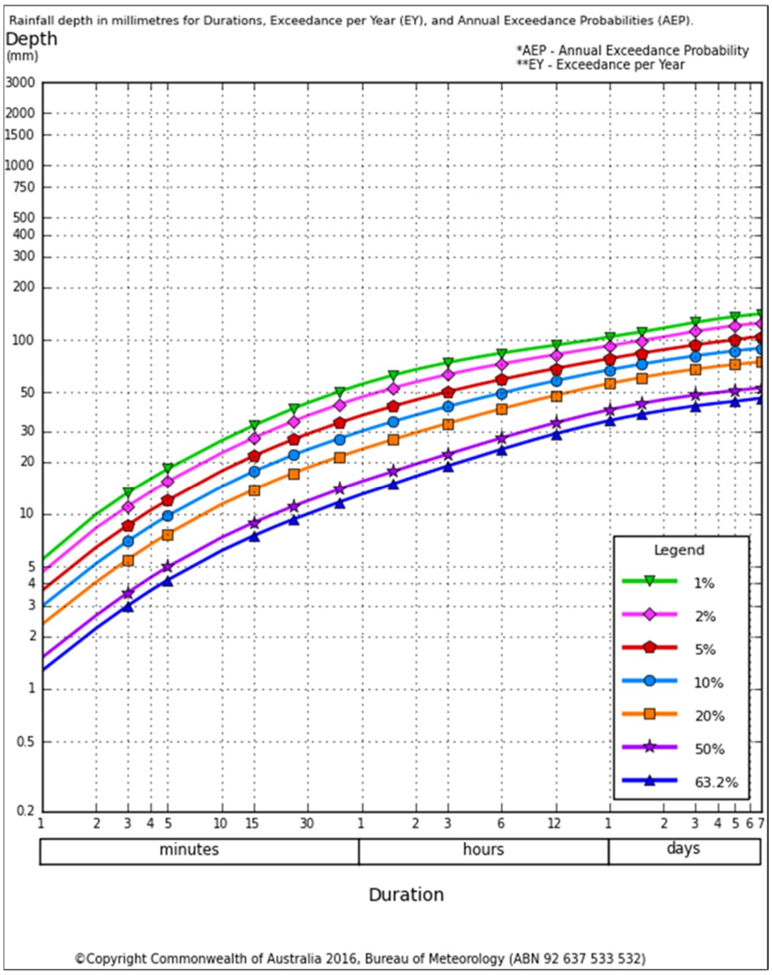

Figure 13-3 IFD curves at the Project

Streamflow data

No streamflow gauges are located within the Project area, however the following nearby gauges can be used as flow indications for waterways within the study area:

- Little Murray River (409399B) - located 7.3 km north east of the Project area.
- Avoca River at Outfall Tresco Pumphouse (408213A) - located 5.8 km south of the Project area.
- Avoca River at Sandhill Lake Road (408209A) – located 18.0 km east of the Project area.
- Avoca River at Quambatook (408203B) – located 25.4 km south of the Project area.

Topographical data

VicMap elevation data with a resolution of 10 m was accessed via the Department of Energy, Environment and Climate Action (DEECA) for the study area. The data provides a digital representation of the study area, capturing natural relief features across the catchment as presented in Figure 13-4. The vertical and horizontal accuracy is ±5 m and ±12.5 m, respectively, relative to the Australian Height Datum (AHD). More detailed light detection and ranging (LiDAR) data sets were not available for the study area.

The topography within the Project boundary ranges from approximately 75 m to 125 m AHD and is characterised by a north–south-orientated ridge (Cannie Ridge) elevated around 100 to 125 m AHD that can be seen transecting the proposed mine areas.

The area surrounding the Project area is characterised by an undulating topography with depressions in the landscape. There is a peak in topography generally in Area 1 and Area 3 of the mine which distributes surface water flows to the northeast and west portions of the site down to the Lalbert Creek floodplain and towards Lake Boga.

In general however, the local topography prevents the Project from having surface water links to the Murray River, Avoca River and Kerang Wetlands Ramsar site.

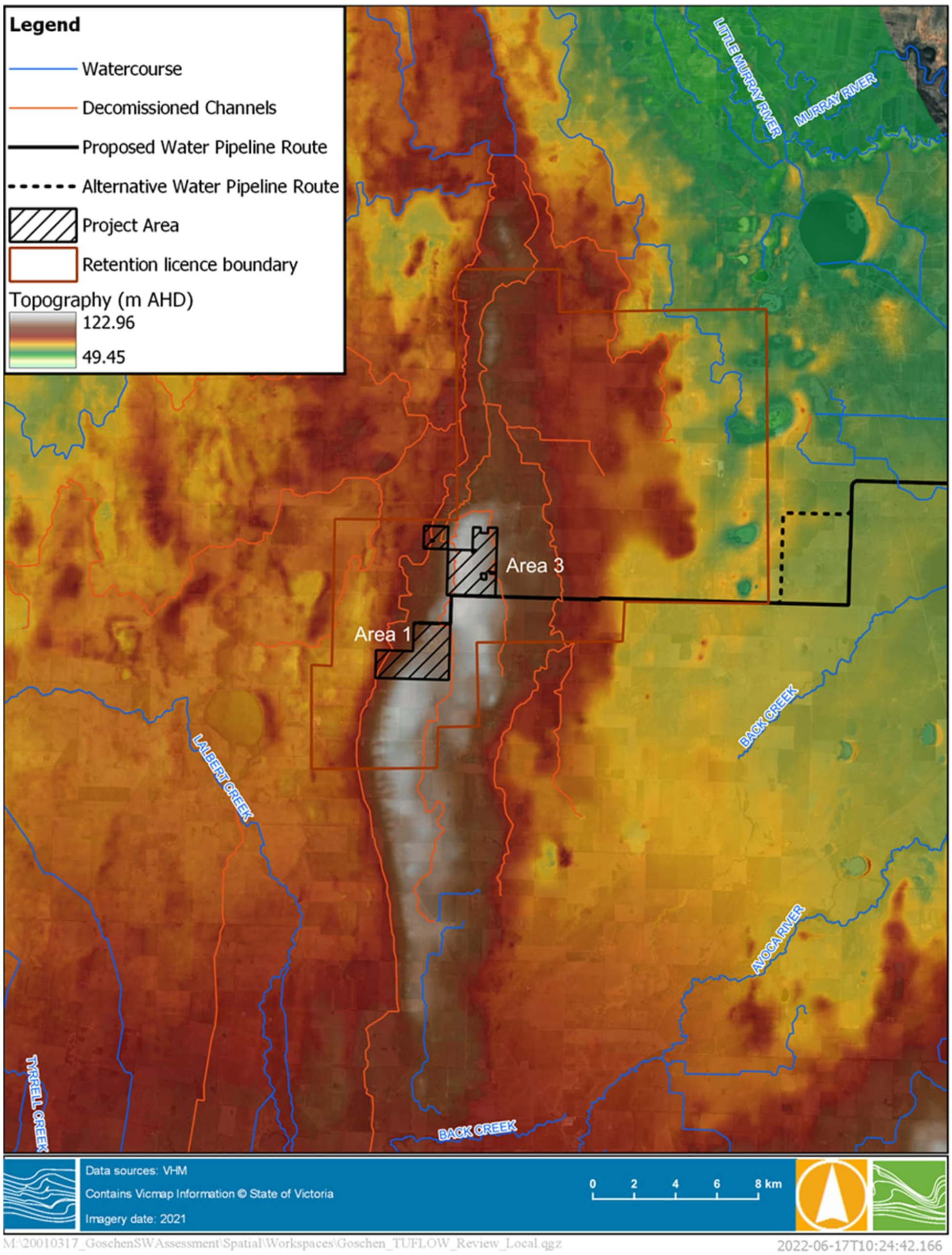

Figure 13-4 Topographic data for the study area

Soils and erosion hazard

Soil erosion and subsequent offsite transport of sediment in stormwater runoff is a significant risk for this Project.

The soil profile within the Project area is described as having:

- Neutral to moderately alkaline, non-saline, non sodic topsoils.
- Moderately to strongly alkaline, slightly to moderately saline, marginally to strongly sodic.

Further information is provided in EES Chapter 16 Agriculture and soils.

The Revised Universal Soil Loss Equation (RUSLE) procedure was used to assess erosion risk at the mine site and the erosion risk was determined to be very low. Two main factors influence the very low erosion hazard at the mine site. These are climate and the landform. The Project area experiences a relatively dry climate and low rainfall erosivity (R-factor value of 450) and is not prone to frequent high intensity rainfall.

Groundwater

Groundwater levels range from a high of 67.1 m AHD in the east of the Project mine site, to a low of 59.31 m AHD north of the Project mine site. The inferred depth to groundwater at the proposed mining locations is approximately 48 metres below ground level (m bgl). There are no known permanent surface expressions of groundwater that interact with surface water within 10 km of the Project mine site and interaction between groundwater and surface water is considered unlikely. In all proposed mining areas, the designed mine pit floor is above the modelled groundwater level.

Further information is provided in EES Chapter 14 Groundwater.

Sensitive Receptors

A number of sensitive receptors were identified within a 5 km buffer of the Project area (refer to Figure 13-5). These receptors are generally associated with agricultural uses and include the following:

- 25 farm dams, including one decommissioned dam at the north east corner of Project Area 1.
- Six agricultural sheds.
- Eight monitoring wells.
- 24 residential buildings, excluding the residences in Lalbert town.
- One groundwater investigation bore. This groundwater bore is not used for groundwater extraction.
- One park/reserve – Talgitcha Bushland Reserve.

It is noted that receptor R0014 will be vacated for the duration of the entire project and receptor R0009 will be vacated when works commence in Area 3. Farm dams located within Area 1 and Area 3 will be backfilled prior to the commencement of the Project.

Sensitive receptors surrounding the underground water supply pipeline and pumpstation (refer to Figure 13-6) include:

- Kangaroo Lake.
- Back Creek.

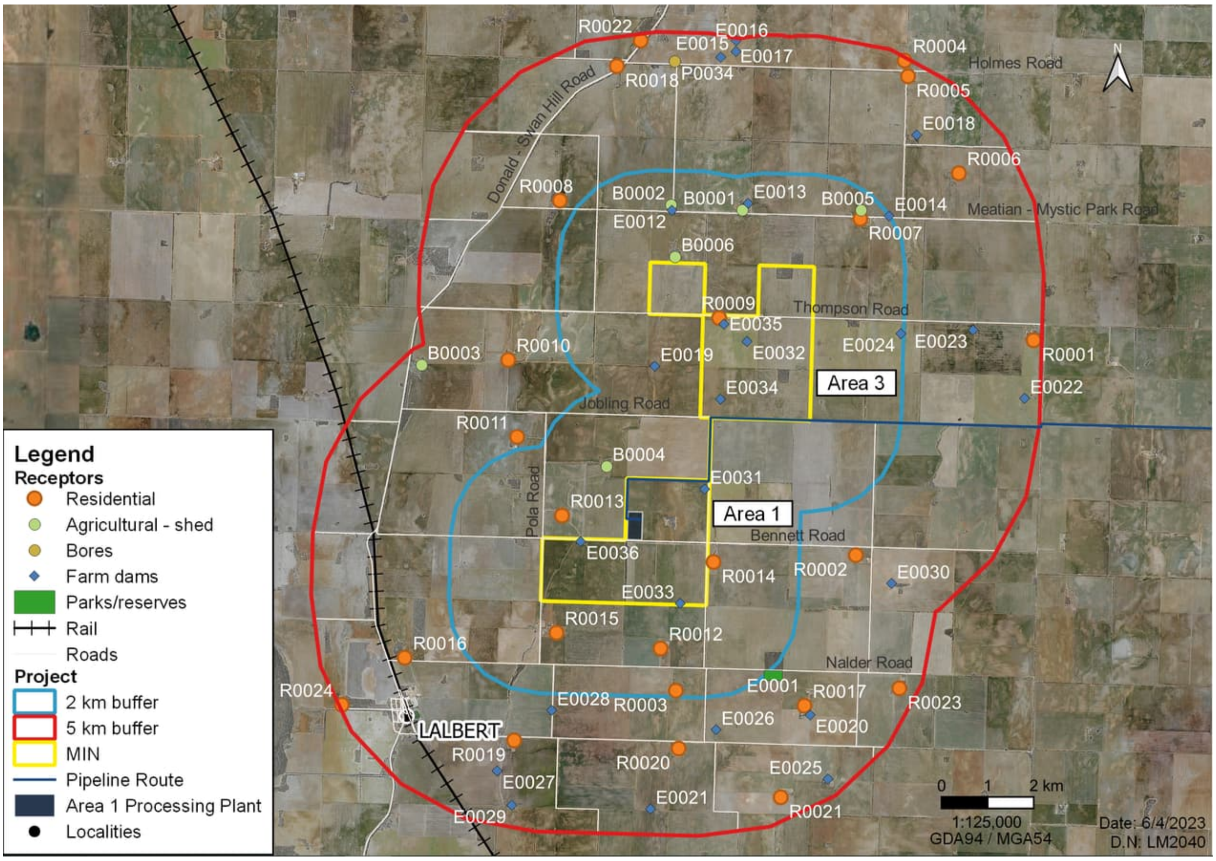

Figure 13-5 Sensitive receptors surrounding the Project mine site

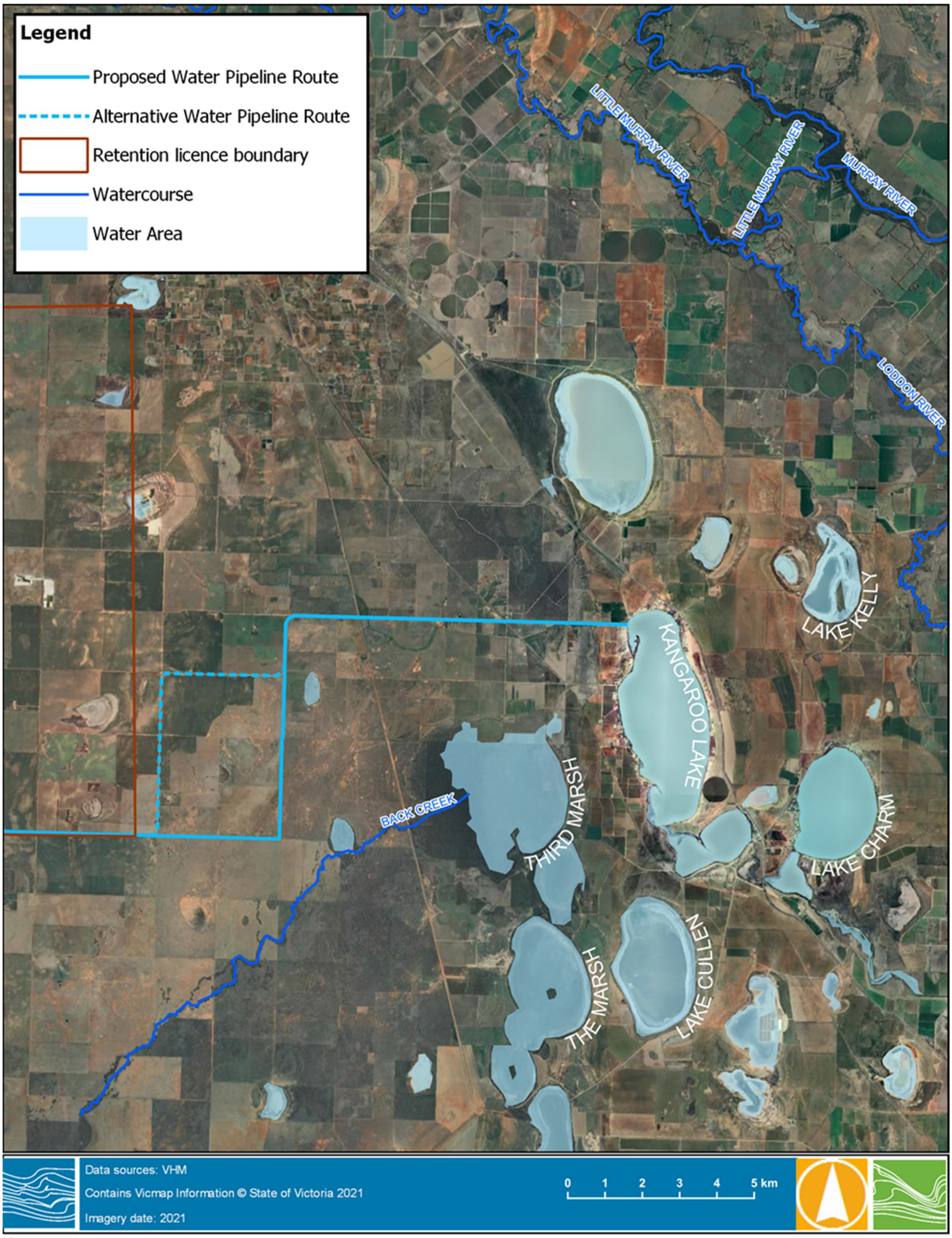

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Figure 13-6 Kangaroo Lake and Back Creek

13.3.2 Characterisation of the hydrological environment

Characterisation of the existing regional surface water environment was based around two key aspects. Namely, understanding the current quantity of water available and the current quality of that water. EES Technical Report H1: Surface water impact assessment developed and implemented hydrological models to help understand the following:

- Riverine flooding.
- Direct/localised catchment inundation.
- Regional surface water contributions to downstream environments and the size of the required mine infrastructure to retain all surface water runoff from disturbed areas.
- Existing water quality.
- The potential impact of climate change.

Further detail on the modelling undertaken as part of the characterisation of the hydrological environment, including model methodology, is found in EES Technical Report H1: Surface water impact assessment.

Characterisation of the hydrological environment forms a crucial part of the existing conditions assessment and provides the basis for the regional surface water impact assessment.

Riverine flooding

Modelling was undertaken to understand flooding within the study area. The September 2010 and January 2011 flooding events were used as part of the model to improve its accuracy. A range of magnitudes were modelled, from 20% AEP up to 0.5% AEP, determining the likelihood of flooding along the Avoca River, Back Creek, Lalbert Creek and their associated floodplains.

The modelled 1% AEP flood depth from nearby waterways close to the retention licence area is shown in Figure 13-7. The Project area is generally not affected by riverine flooding. A 1% AEP inundation occurs to the southwest and southeast of the Project area. Depths greater than 1 m are generally within the creeks, overland flow above 0.3 m is shown to the west of the retention licence area, as shown in Figure 13-7.

The water supply pipeline interacts with riverine flooding along Back Creek, a distributary of the Avoca River, crossing the floodplain of Back Creek.

There was significant flooding in Victoria and New South Wales through October and November 2022 which coincided with the completion of the surface water impact assessment. This flooding impacted central Victoria, including the Avoca River and consequently Tyrell Creek, Lalbert Creek and Back Creek. Anecdotally (based on comments by the community, Mallee CMA and North Central CMA in conversations and Incident Control Centre deployments), the October 2022 flood event was around a 2% AEP in these waterways. Neither Area 1 or Area 3 were impacted.

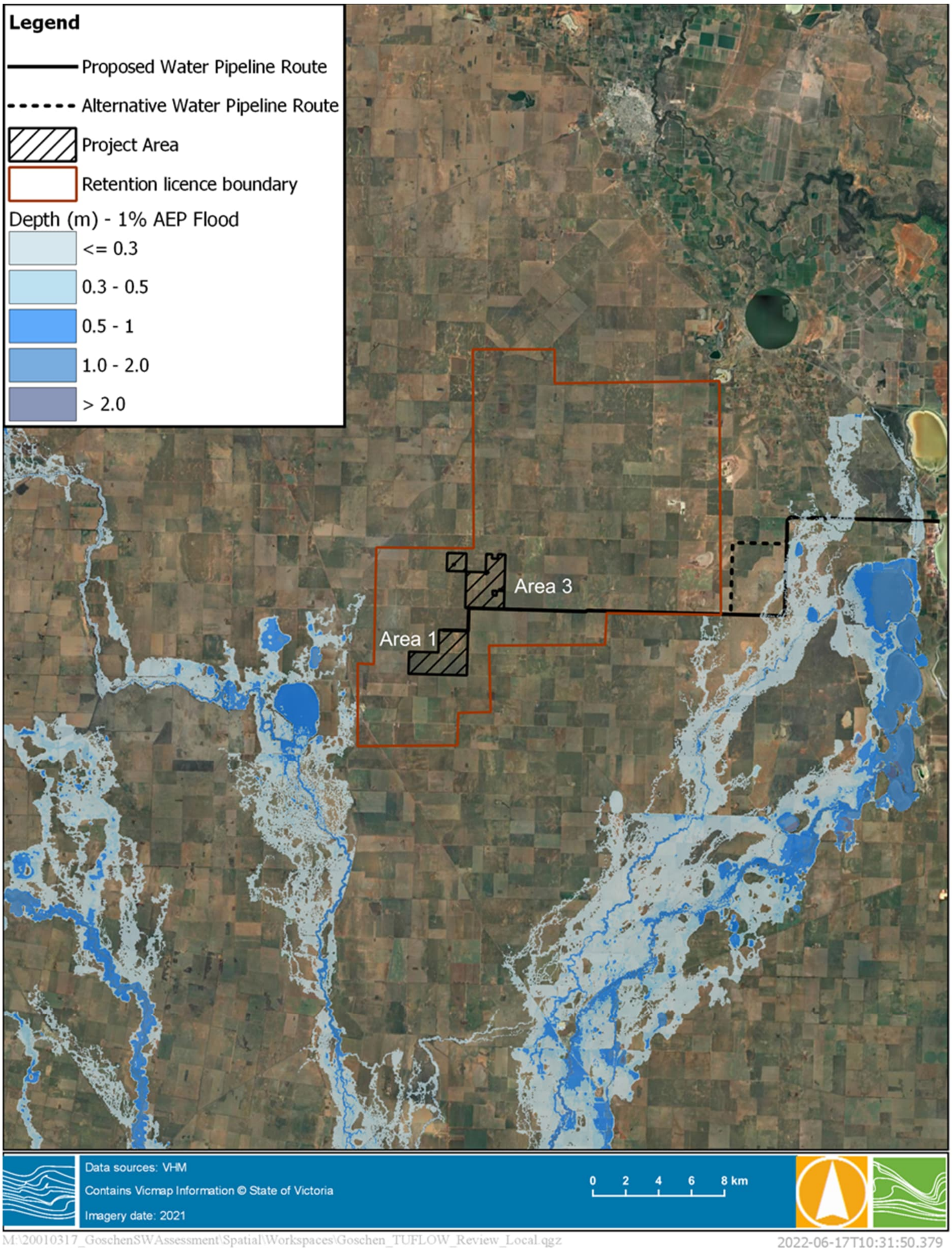

Figure 13-7 Modelled 1% AEP riverine flooding

Catchment inundation

Further modelling was undertaken to determine runoff volumes, peak flow rates and areas of high flood risk in areas of complex topography. This type of modelling is able to identify major flow paths, depressions/wetlands and the complex interactions of overland flow.

It was determined that a 1% AEP event does not produce major external overland flow paths entering or exiting the Project area, with most inundation caused by relatively minor overland flow or a series of discontinuous depressions. There are no major overland flow paths leading directly from the Project mine site to downstream water environments (including the Murray River, Avoca River and Kerang Wetlands Ramsar site). Impacts to surface waters associated with the Project water supply pipeline and pumpstation at Kangaroo Lake would be limited and managed by the mitigation measures proposed and are discussed in Section 13.4 and Section 13.5.

The eastern half of the retention licence area is at a lower elevation, with the modelling showing larger areas of water pooling, where velocities remain slow. The inundated area in the east is noticeably different than the western area. This observation in the modelling is exaggerated due to the lower quality of available elevation data.

The modelling identifies localised ponding across the study area, characterised as the lowland ecological niches observed in depressions in the topography and lakes in the region with depths of 0.3 metres up to over 2 metres. The mean flood depth across the retention licence area is 0.17 metres, with greater depths of inundation within the various depressions across the site.

Figure 13-8 shows that Area 1 is partially inundated at the proposed mine pit site by up to 0.2 metres as a result of a local depression. Water exits Area 1 along two overland flow paths formed by the relatively steep slope with a modelled peak flow rate of 2.7 cubic metres per second (m^3/s) which contributes to downstream receptors. Area 3 is not affected by local inundation for a 1% AEP event due to very shallow depths (i.e. less than 0.05 metres).

The largest area of inundation occurs near the western boundary of the retention licence area, near Lake Lalbert. Velocities are generally low (less than 0.3 m/s), with higher velocities observed in the steeper sections of the topography. The highest velocity (approximately 0.7 m/s) is identified at the north west of Area 1, south of Jobling Road.

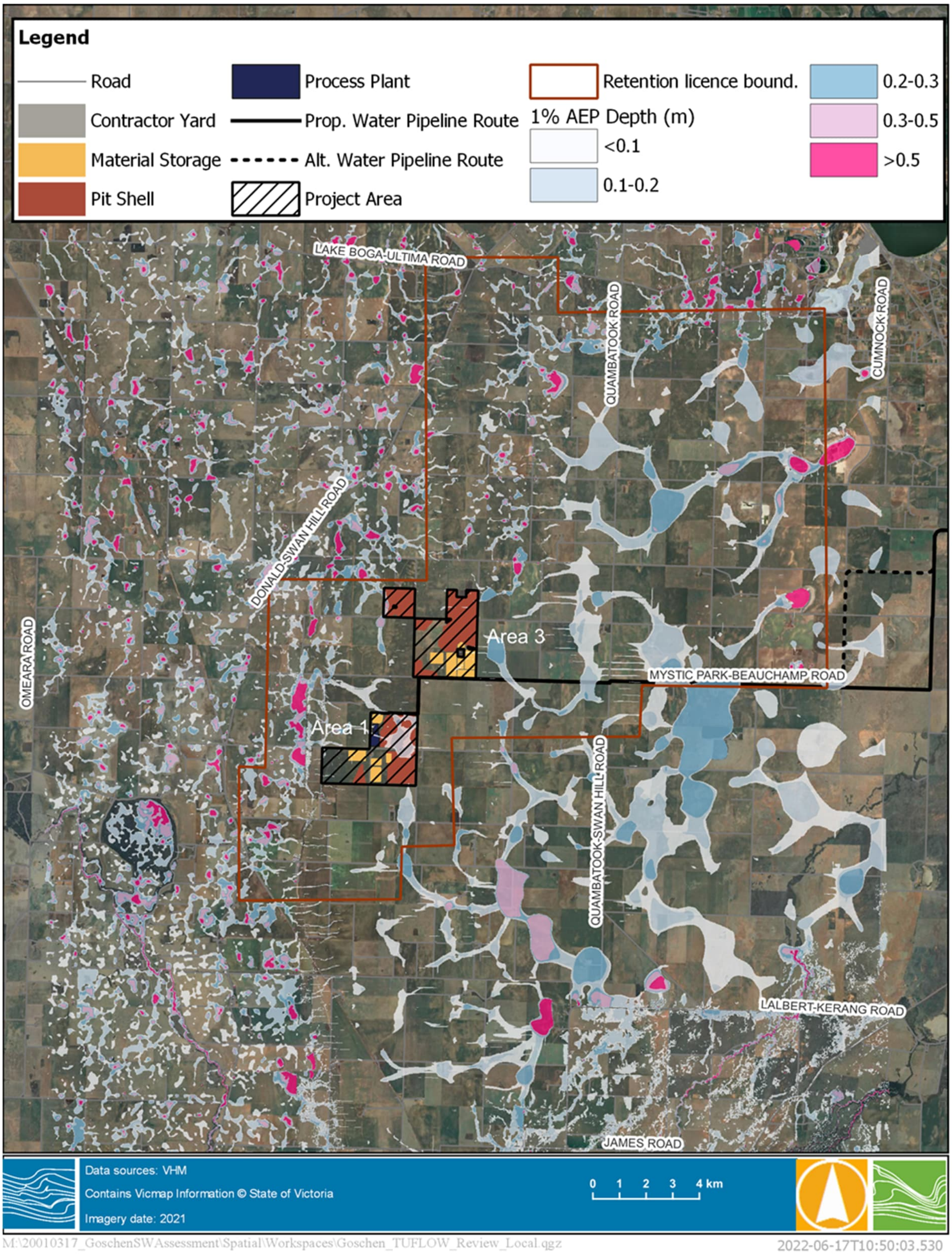

Figure 13-8 Modelled 1% AEP catchment inundation

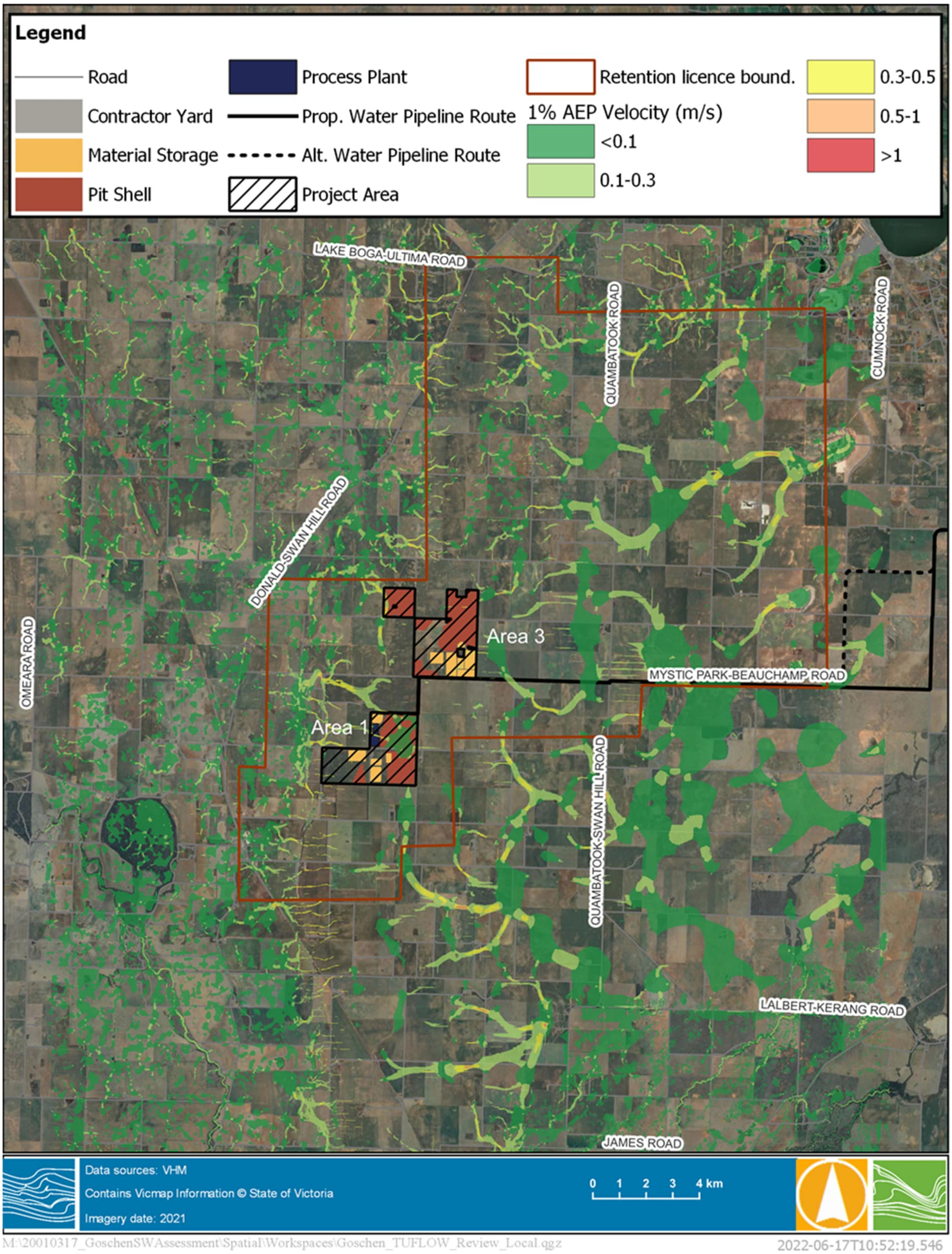

Figure 13-9 Modelled 1% AEP flow velocity

Water quality

The study area is located near several environmentally sensitive areas: Lalbert Creek, Lake Lalbert, Back Creek, the Avoca Marshes and a number of smaller depressions of potentially high biodiversity value. There is limited data on water quality for the region, particularly within the lakes system. Much of the data is historical and may be used as a guideline for typical water quality parameters in the study area and can be accessed on the DEECA Water Measurement Information System (WMIS) website.

Water quality gauges of greatest interest to the Project include:

- Lake Bael Bael (408602A) – 26 km from the Project area.
- Kangaroo Lake at Mystic Park (407601A) – 28 km from the Project area.
- Sand Hills Lake (408604A) – 21.5 km from the Project area.
- Lake Lookout at Bael Bael (408603A) – 18.5 km from the Project area.

The Project area has no surface water linkages to these gauges and has very different catchment characteristics. The Project area largely comprises of isolated depressions in an agricultural setting. This means the water quality at the gauges is unlikely to be representative of that which would occur within the Project area.

To establish an understanding of the baseline water quality, a water quality monitoring program within the Project area would be established throughout the mine's progressive development. Given the very infrequent flows, this would be opportunistic sampling post rainfall and will form part of a Surface Water Management Plan. The baseline data would be compared to that of runoff from around the development (no water would be exiting the development given it would be a 'zero discharge' mine) to identify if any trends in water quality occur during and post development.

Climate change modelling

The Project is located in the "Murray Basin Climate Zone" according to BoM and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) classifications. There are a set of 40 global climate projection models used to assist in the analysis and representation of future temperature, evaporation, and rainfall. These models relate results to the Representative Concentration Pathway (RCP) projections and the specific locations throughout Australia. There are predictions for four RCPs, these are as follows:

- RCP8.5 - a future with little curbing of emissions, with a CO_2 concentration continuing to rapidly rise, reaching 940 ppm by 2100.
- RCP6.0 – lower emissions, achieved by application of some mitigation strategies and technologies. CO_2 concentration rising less rapidly (than RCP8.5), but still reaching 660 ppm by 2100 and total radiative forcing stabilising shortly after 2100.
- RCP4.5 - CO_2 concentrations are slightly above those of RCP6.0 until after mid-century, but emissions peak earlier (around 2040), and the CO_2 concentration reaches 540 ppm by 2100.
- RCP2.6 - the most ambitious mitigation scenario, with emissions peaking early in the century (around 2020), then rapidly declining. Such a pathway would require early participation from all emitters, including developing countries, as well as the application of technologies for actively removing carbon dioxide from the atmosphere. The CO_2 concentration reaches 440 ppm by 2040 then slowly declines to 420 ppm by 2100) (Detlef P van Vuuren et al (2011), The representative concentration pathways: An Overview).

Given the uncertainty about which RCP scenario would be relevant in the future it was determined that RCP 8.5 would be modelled for this Project. Modelling of the RCP 8.5 demonstrates the worst case of the four options.

Climate change modelling indicated that increased rainfall under the climate change scenario generally brought about greater flooding depths and a greater inundation extent, but no overall change to inundation patterns or runoff pathways were observed.

13.3.3 Mine site surface water and overland flows

Hydraulic assessment

Hydrologic and hydraulic modelling was undertaken to suitably size the stormwater infrastructure on the mine site as part of the mine site surface water impact assessment. The model considered the various stockpiles and mine operation facilities which would drain into nearby detention ponds.

The mine site would be located in a generally arid region of Australia, with relatively low rainfall and subject to droughts. It was determined that containing rainfall from 5% AEP events would be practical at Area 1 and Area 3, even with large catchment areas and low loss values. The modelled duration was 24 hours, however it was identified during modelling that during the 5% AEP event, the continuing loss was controlling in events longer than nine hours, meaning that the additional depth of rainfall during these events is cancelled out by the continuing loss. There would be the added benefit of being able to reuse captured water in the mining process which reduces the size of the basins. In a higher rainfall region this may not be a feasible approach. Any runoff generated in more extreme rainfall events would be directed to active mine pits, ensuring that there would be no stormwater discharge from disturbed areas of the Project mine site. Water storage basins would be located within non-mined areas of Area 1 and Area 3, such as adjacent to stockpile locations and the plant processing area.

Further information is provided in EES Technical Report H2: Mine site surface water impact assessment.

Mine Site Surface Water balance

A mine site surface water balance was modelled as part of the mine site surface water impact assessment. The water balance assumes that all surface water from Area 1 and Area 3 can be captured and pumped back to the processing plant within Area 1 and that all surface water runoff generated can be reused in the mining process.

A reuse demand of 11,400 kL/day for surface water harvested within the mine site area was selected based on matching the water decanted from the mining process. Considering this, the water balance suggests that only 3.5% of the nominated reuse demand would be met from surface water harvested in onsite storage basins. This means that there would be limited economic benefit to reusing surface water within the processing operation, however captured water could be reused in other ways, such as for dust suppression and as part of revegetation and rehabilitation operations. The Project water balance is presented in Table 13-1 below.

The model assumptions made in relation to proposed mining activity include zero infiltration to groundwater from diversion of storm events into the pit voids. The reasoning being that it is understood that any stormwater that collects within the pits will be extracted and used therefore, and infiltration will be negligible and not sensitive to other recharge mechanisms.

Further information is provided in EES Technical Report H2: Mine site surface water impact assessment.

Table 13-1 Modelled mine site surface water balance

Description	Flow (ML/year)
Flow in	318
Evapotranspiration loss	30.5
Infiltration loss	0
Low flow bypass out	0
High flow bypass out	0
Pipe out	2.2
Weir out	9.5
Transfer function out	0
Reuse supplied	147.8
Reuse requested	4165.4
% Reuse demand met	3.5
% Load reduction	96.3

13.4 Construction impact assessment

Construction activities have the potential to impact regional surface water bodies surrounding the Project, particularly as a result of earth works, if not managed appropriately.

13.4.1 Modifications to drainage lines

As presented in Section 13.3, no significant waterways are located in proximity to the Project mining areas and therefore mine site construction activities are not expected to impact riverbeds, riverbanks and existing drainage paths.

Earth works associated with the construction of the Project water supply pipeline could modify existing drainage paths within the study area, particularly the Back Creek floodplain, and may cause direct damage to stream beds, banks and associated flora and fauna. Any modification of existing drainage paths would redistribute existing flows, potentially impacting neighbouring properties, road infrastructure and/or preventing water from entering natural systems. The construction of the water supply pipeline crosses the Back Creek floodplain, however Back Creek is an ephemeral stream generally only flowing when flooding in the Avoca River is occurring.

For pipeline and pump station construction work in the vicinity of Back Creek and Kangaroo Lake, designated waterway compliance with specific requirements in the works on waterways permits is required, along with specific inclusion in the Surface Water Management Plan (SWMP). This permit would be sought from the North Central CMA. Any runoff from the work areas should be captured in water treatment infrastructure such as sedimentation ponds (see mitigation measure MM-SW02). It is also noted that the construction and operation of the pump station will require a s67 works licence from Goulburn-Murray Water.

Where necessary, appropriately sized culverts on drainage lines crossed by access roads, should be included as stipulated in any works on waterways permits (see mitigation measure MM-SW05). Where surface water diversions are created, it should be ensured that discharge occurs via the natural downstream discharge point, or via the same discharge point as prior to the commencement of construction activities (see mitigation measure MM-SW06).

A summary of mitigation measures, as well as monitoring and contingency measures is provided in Section 13.7.

13.5 Operation impact assessment

Operation of the Project has the potential to impact regional surface water bodies through a reduction in downstream water contribution to receptors, the discharge of contaminated and turbid stormwater runoff and via increased erosion if not managed appropriately. Additionally, surface waters, flooding and changes in the climate may impact the Project.

13.5.1 Reduced water contribution to downstream receptors

During Project operation, surface water runoff from disturbed areas within the Project boundary (mining areas) would be captured and there would be zero discharge offsite. Therefore, there would be a reduction in the volume and flow rate of surface waters discharging offsite to downstream receptors. Key receptors in proximity to the Project include residential buildings, agricultural sheds and farm dams, as well as patches of remnant vegetation west of Area 1 and within Area 3. There are no significant waterways in proximity to the Project mining areas.

Modelling of catchment inundation was undertaken as part of the existing conditions assessment (refer to Section 13.3.2) to help understand overland flow during flood events. The modelling demonstrated that Project Area 1 would be located within an overland flow path and Project operation has the potential to reduce the runoff to depressions to the east. Area 3 would not be located within an overland flow path and would be unlikely to have any impact to surface runoff. As only Project Area 1 would reduce the runoff to depressions to the east and Area 3 does not have any impact to surface runoff, the potential for impacts to nearby receptors are limited.

Additional catchment inundation modelling was undertaken assuming that bunds would be located around the total mined area. This conservative approach, preventing discharge from entering or leaving the Project area, was used to assess a worst-case scenario. The reality is that mining would occur progressively with a staged approach over the mine's life. This additional modelling was undertaken to demonstrate the changes in water levels and inundation extents for the 1% AEP event as a result of the operation of the Project.

The change in 1% AEP water levels due to bunds around the total mined area is shown in Figure 13-10. The modelling indicated that changes to 1% AEP water levels would mostly be isolated to the areas immediately surrounding the boundaries of the Project area. There would be a slight reduction in flood levels in the overland flow paths leaving Area 1 and Area 3 and in downstream depressions. There would be no major increases in water level external to the mining footprint, however some pooling of water both inside and outside of Area 1 and Area 3 is observed. These results can be used to determine location of storages and diversion drains within the mine site.

The most significant decrease in water levels occurs to the west of Area 1, where there is a maximum 12 cm decrease in depth during a 1% AEP flood event. There are two patches of vegetation in this area (refer to Figure 13-10). There may also be a change in surface water contribution to remnant patches of vegetation within Area 3.

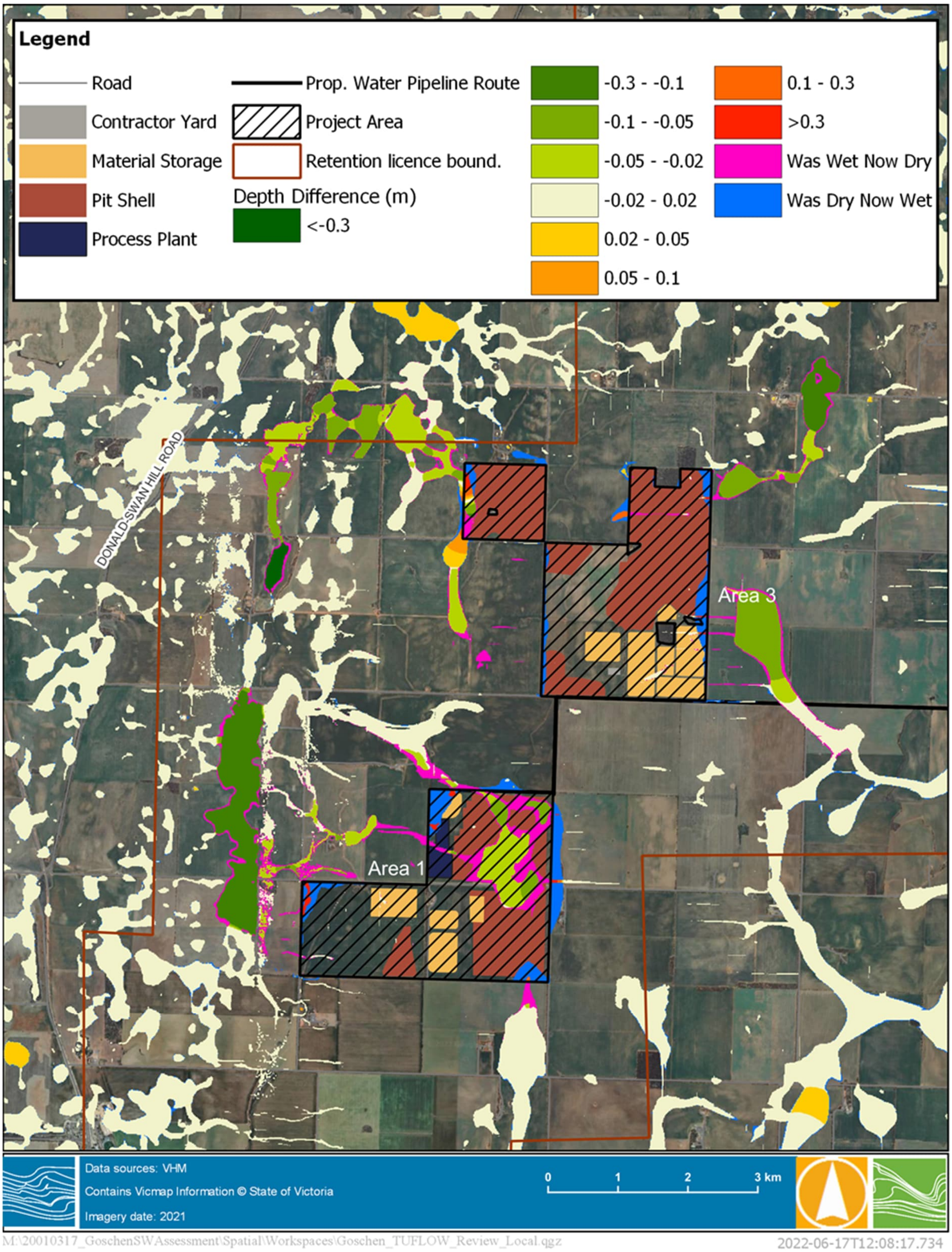

Figure 13-10 Modelled change in 1% AEP catchment inundation following project bunding

A completely bunded scenario was also modelled for climate change scenario RCP 8.5, initially modelled as part of the existing conditions assessment (refer to Section 13.3.2). Results of the additional climate change modelling indicated that the changes in water level between existing topographic conditions and a completely bunded scenario would be the same under current day climatic conditions and under a climate change scenario (refer to Figure 13-11). Climate change (or rainfall intensities greater than a current climatic conditions for a 1% AEP event) would have little impact on the outcomes of the existing conditions modelling.

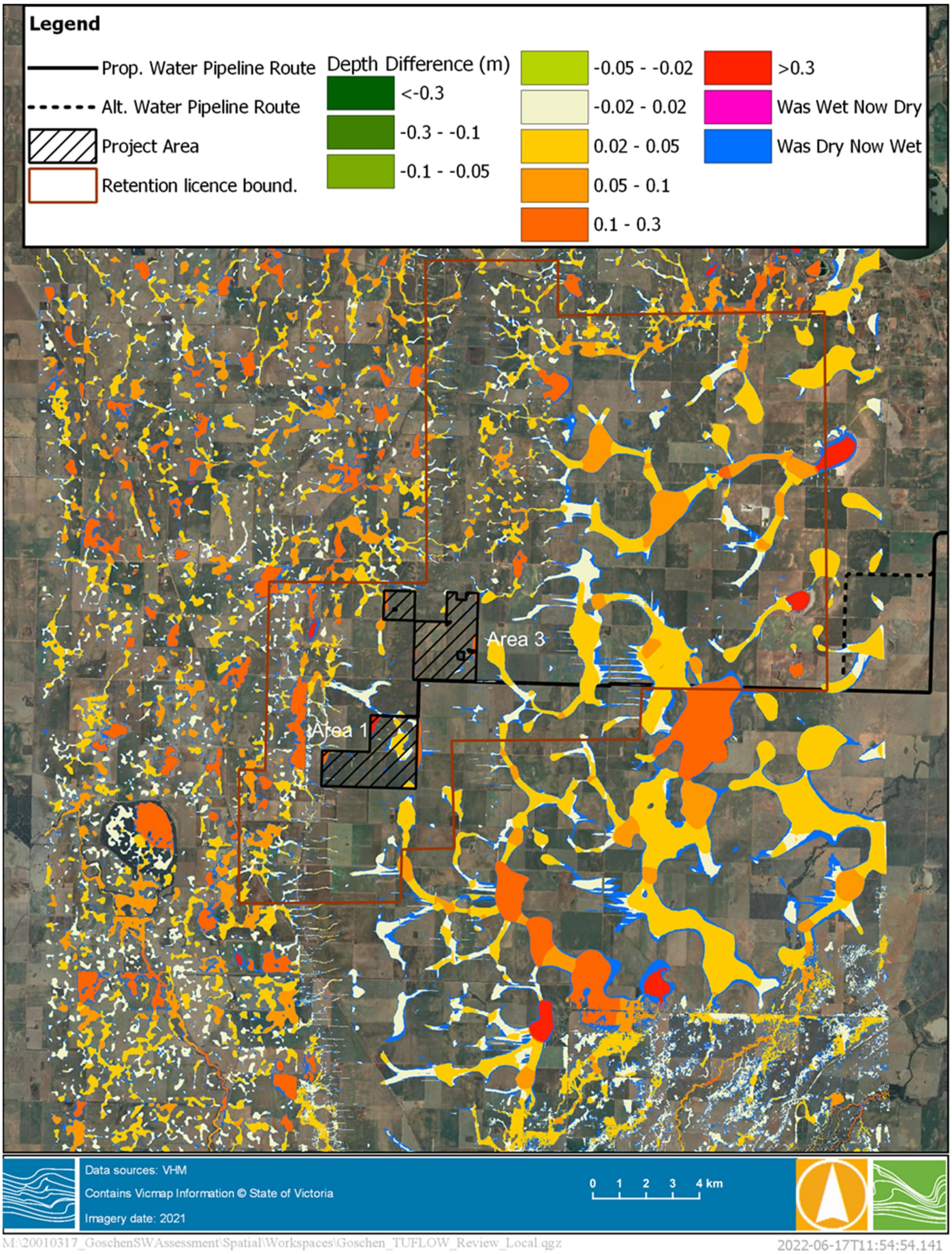

Figure 13-11 Modelled change in 1% AEP catchment inundation due to climate change and following project bunding

Surface water runoff captured and contained onsite accounts for variations in rainfall intensity and frequency, including scenarios involving extreme weather events or changes due to climate change. The mine site is located in a generally arid region of Australia, with relatively low rainfall and subject to droughts. Notwithstanding, containing rainfall from 5% AEP events would be practical at Area 1 and Area 3, even with large catchment areas and low loss values. Modelling indicated that during the 5% AEP event, the continuing loss was controlling in events longer than 9 hours, meaning that the additional depth of rainfall during these events is cancelled out by the continuing loss.

Any runoff generated in more extreme rainfall events (i.e. greater than 5% AEP) would be directed to active mine pits, ensuring that there would be no stormwater discharge from disturbed areas of the Project mine site.

Modelling also determined that there would be an accumulation of water on the eastern (upstream) side of Area 1 (refer to Figure 13-10). Therefore, the construction of a drain would be required to enable free flow of surface water and to prevent water logging of agricultural farmland east of the Project. It is recommended to route the drain around the northeast corner of Project Area 1 to return the surface water flow to its natural downstream discharge point (refer to mitigation measure MM-SW06).

The management of surface water through the operational life of the mine should be undertaken through a Surface Water Management Plan (SWMP) (refer to mitigation measure MM-SW01). The SWMP will provide a management framework to mitigate potential impacts over the life of mine. It would be developed in consultation with relevant stakeholders and would be subject to approval by the relevant Authority. The SWMP would:

- Summarise the baseline data and existing environment.
- Explain the relevant statutory requirements and context (including any relevant approvals).
- Identify specific performance standards/criteria to be achieved with mitigation measures in place. This would specifically include:
  - Monitoring programs for water quantity, controlling the among of water stored across the site with relation to expected use, purchase, long and short term weather predictions with particular reference to the two patches of trees highlighted.
  - Monitoring programs for surface water quality, sampling for mine storages, diverted overland flow paths and rehabilitated mine areas. Water quality sampling and testing would be in accordance with the Environment Reference Standard (ERS). Water quality sampling would need to be adaptive given the limited presence of surface water and progressive nature of the mine (i.e. areas are continuously mined/rehabilitated).
  - Monitoring programs for surface water diversions, ensuring any surface water diverted by drains is not pooling or impacting adjacent property.
- Describe the mitigation measures to be implemented to minimise surface water impacts to as low as reasonably practicable and meet the project specific performance standards/criteria.
- Detail the monitoring to be undertaken for all phases of the Project to assess environmental performance and effectiveness of the mitigation measures.
- Describe mechanisms to assess the effectiveness of the SWMP and to determine when/if or contingency measures are required.
- Detail a program to investigate and implement ways to improve the environmental performance of the Project over time.
- Establish procedures to manage:
  - Incidents and any non-compliance.
  - Stakeholder and community complaints.
  - Failure to comply with statutory requirements and/or performance standards.
  - Roles and responsibilities for implementing the plan.
  - A protocol for periodic review of the plan.
- Include a community engagement strategy which would include a complaints handling system.

The level of impact to other surrounding areas largely consisted of minor decreases in water depth to the west, impacting two patches of vegetation. The decrease in water availability is considered relatively minor, a maximum 12 cm reduction in depth for a 1% AEP event and no mitigation for this reduction is proposed.

A summary of mitigation measures, as well as monitoring and contingency measures is provided in Section 13.7.

13.5.2 Discharge of stormwater runoff

During storm events, there is the potential that stormwater runoff from the Project area could spill from the site if there is not enough drainage and storage infrastructure to contain runoff within the site.

The discharge of stormwater runoff containing sediment and other contaminants from mine activities can lead to the degradation of downstream water quality. This could occur via increases in turbidity, sedimentation of downstream waterways and hydrocarbon and chemical contamination from onsite re-fuelling stations and chemical storage facilities. Clearing vegetated land would also increase the potential for erosion and sediment runoff.

Water storage basins located within non-mined areas of Area 1 and Area 3, such as adjacent to stockpile locations and the plant processing area, should be designed to accommodate a sufficient volume to prevent discharge from the Project mine site (see mitigation measure MM-SW02). Water storage basins would be designed to capture surface water runoff from 5% AEP events during operation of the Project, with further allowance for surface water from more extreme events to be contained locally and directed to the active mine pit. This would ensure that stormwater runoff could not leave the site and impact downstream water quality.

In addition, appropriate sediment and erosion control measures should be implemented prior to any ground-disturbance works and appropriate spill-control and bunding measures should be implemented to control and contain spills during construction and operation activities as necessary (see mitigation measure MM-SW04). Where construction works are to occur within the riverbed or riverbank of a designated waterway, they are to be undertaken in accordance with a works on waterways permit from the catchment management authority and the necessary vegetation removal permits.

To reduce the risk of contamination from fuels and chemicals during construction and operation of the Project, the amounts stored on site should be minimised and if stored on site, placed in facilities designed in accordance with EPA Victoria Publication 1698 – *Liquid storage and handling guidelines* and AS 1940:2004 – *The storage and handling of flammable and combustible liquids* (see mitigation measure MM-SW04). Contingency plans for clean-up and management of spills should be implemented.

Additionally, the following measures should be implemented (see mitigation measure MM-SW01):

- A water quality monitoring program.
- Construction environmental management plan (CEMP).
- A sediment, erosion and water quality management plan.

Where appropriate, these plans should regard the Environment Reference Standard (ERS), EPA Victoria Publication 1834 – *Civil construction, building and demolition guide* and EPA Victoria Publication 275: *Construction techniques for sediment pollution control* and IECA Best Practice Erosion and Sediment Control guidelines. The sediment, erosion and water quality management plan should be developed in consultation with the CMA and approved by the responsible authority before the commencement of project activities.

Through the implementation of these mitigation measures, it is expected that there would be no impact as a result of stormwater discharge from the Project area. A summary of mitigation measures, as well as monitoring and contingency measures is provided in Section 13.7.

13.5.3 Project location in flood prone area

The location of the Project would avoid inundation from waterways and local catchment flow, however inundation may still occur as a result of under dimensioned external diversion drains and bunds preventing water from entering the mine site via overland flow paths. Beyond the Project mine site, the pump station and water supply pipeline would interact with Kangaroo Lake and the Back Creek floodplain.

Inundation of the Project area could cause damage to infrastructure and disrupt mining operations, which could be halted during dewatering and recovery works. Inundation could also lead to the transport of contaminated stormwater offsite, similar to the risks described in Section 13.5.2.

As described in Section 13.3.2, 1% AEP inundation occurs south west and south east, away from Area 1 and Area 3 mining operations. There is no risk of riverine inundation of the Project mine area in a 1% AEP flood event (refer to Figure 13-7). Inundation of the Project area could be caused by surface water runoff within the local catchment. The pipeline alignment may be inundated via flooding of the Avoca River and Back Creek.

To reduce the risk of contamination from fuels and chemicals the amounts stored on site should be minimised and if stored on site, placed in facilities designed in accordance with EPA Victoria Publication 1698 – *Liquid storage and handling guidelines* and AS 1940:2004 – *The storage and handling of flammable and combustible liquids*. Contingency plans for clean-up and management of spills should be implemented.

A water quality monitoring program complying with applicable legislation and guidelines should be developed, together with development and implementation of a construction environmental management plan in accordance with EPA Victoria Publication 1834 – *Civil construction, building and demolition guide*, including a sediment, erosion and water quality management plan and EPA Publication 275: *Construction Techniques for Sediment Pollution Control* and IECA Best Practice Erosion and Sediment Control guidelines (see mitigation MM-SW01). The sediment, erosion and water quality management plan should be developed in consultation with the CMA and approved by the responsible authority before development commences.

External diversion drains and bunds should be designed to prevent water from entering the site via overland flow paths and internal surface water drainage systems should be designed to prevent localised flooding within the Project. Any infrastructure within the 1% AEP flood extent is to be designed to withstand potential flooding and would be subject to compliance with the specific requirements of the North Central and Mallee CMA's floodplain works approval process (see mitigation measure MM-SW07). Compliance with specific requirements of the CMA floodplain works approval process is required.

Surface water management plans should be implemented during construction and operation to manage the probability of surface water interaction and its potential impact (see mitigation measure MM-SW01).

13.5.4 Project's water requirements and usage at the catchment level

All water requirements for the Project are proposed to be met by surface water extraction from Kangaroo Lake. The lake is related to many beneficial surface water uses, both environmental/recreational and as an agricultural water supply, and consideration has been given to the Project's use on lake water levels and change in the availability of surface water for beneficial uses. Additionally, it is noted that a significant change to water levels may impact upon the salinity of Kangaroo Lake.

The water requirements for the Project include those for construction earthworks, processing, dust suppression and rehabilitation. Up to 4.5 gigalitres (GL) a year will be needed for the start-up of the Project, with the general annual water demand for the operational phase between approximately 2.9 and 3.1 G/L.

Water will be sourced from Kangaroo Lake via the open water market by water deed with Goulburn Murray Water (GMW) and a 38km underground pipeline proposed beneath existing local road easements to connect to the mine site.

Kangaroo Lake is one of the largest and deepest permanent freshwater lakes in the Murray-Loddon region of the Murray-Darling Drainage Division and is located within the Torrumbarry Irrigation System (TIS) area of the Loddon-Campaspe irrigation region. It is managed by GMW as a multipurpose use waterbody and serves recreation and irrigation uses. It is a major irrigation supply storage basin with high operational water levels in the lake maintained to optimise water supply for regional irrigators with downstream water user demands on the Murray River, with a peak daily offtake capacity from the Murry River into the TIS through the National Channel of 4,400ML/day, meaning the Project will represent approximately 0.3%. Water levels in the lake are also managed to both reduce downstream flooding impacts on the Loddon River and prevent foreshore erosion.

Kangaroo Lake has a capacity of 39.7 GL and is generally maintained at greater than 36 GL. With a surface area of approximately 984 hectares, a maximum depth of 8.4 m, maximum operating height of 73.9 m AHD and minimum of 73.12 m AHD, the lake water level is maintained within 0.78 m of its maximum (VFA 2013). Water levels in Kangaroo Lake are maintained by GMW within Limits of Acceptable Change, meaning that GMW minimises any fluctuation of lake levels and thus there will be negligible variation to Kangaroo Lake's water height beyond that already controlled in the lake. At a catchment level, there would be negligible impact to the changes to the availability of surface water for beneficial uses or licenced users, including salinity of Kangaroo Lake, from Project operations.

It is concluded the Project would have negligible impact to Kangaroo Lake's water level given GMW maintains the water level in the lake by adjusting inflows to manage the outflows and allocations. This was also proven to be the case during the previous millennium drought (2001-2009), and thus given the degree of operability it is not foreseen that the Project will cause a reduction in water availability in Kangaroo Lake. If there is a general reduction in water availability GMW manage the water allocation process accordingly to manage the competing beneficial water users.

No flow on effects at a catchment level are expected and no mitigation measures are needed or proposed including during times of drought.

The potential for impacts of the Project's water requirements on ecosystems and biodiversity values relevant to Matters of National Environmental Significance is covered in EES Chapter 20.

13.6 Residual impacts

Residual impacts refer to those impacts that remain once mitigation measures have been implemented. Residual impacts on catchment and mine site surface water associated with the construction and operation of the project will be managed with the implementation of mitigation measures.

Mitigation measures, such as designing water management basins to capture surface water runoff from 5% AEP events, developing a Surface Water Management Plan (SWMP), Construction Environmental Management Plan (CEMP) and a sediment erosion and water quality management plan, would ensure that potential impacts are managed and that there would be limited residual impacts.

No residual impacts to Kangaroo Lake water levels are anticipated as a result of Project operations on the lake water levels, over the short term (days) or long term (months).

Following the implementation of mitigation measures, the only remaining residual impact would be associated with the reduction of water availability to two patches of vegetation west of Area 1, where a 12 cm reduction in 1% AEP flood depths is observed. Despite this, the decrease in water depth is considered to be minor and the impact is expected to be temporary. There may also be a change in surface water contribution to remnant patches of vegetation within Area 3. Ecological and water quantity monitoring has been proposed (refer to Table 13-3).

13.7 Summary of mitigation measures

The mitigation measures to manage potential impacts surface water are presented in Table 13-2.

Table 13-2 Surface water mitigation measures

Mitigation measure ID	Mitigation measure	Project phase implementation
MM-SW01	Develop a Surface Water Management Plan for construction, operation and closure activities. Plans should be updated during the life of the project to reflect changes to site layout and risk profile. Any SWMP will include as a minimum the following: • Spill containment and treatment measures, such as: - Minimising chemical and fuel storage on-site where possible and storing hazardous materials and dangerous good in accordance with AS1940 Storage of flammable and combustible liquids and EPA Publication 1698 Liquid storage and handling guidelines. - Avoiding the storage of liquid material within 50 m of waterways. - The design of first flush systems or gross pollutant traps. - Response procedures in the event of a spill, including the availability of spill kits. • Spill management /responses part of wider Trigger Action Response Plan (TARP). • Erosion and sediment controls, including in regard to geotechnical stability. The construction environmental management plan would be developed in accordance with EPA Victoria Publication 1834 – *Civil construction, building and demolition guide.* The sediment, erosion and water quality management plan would address the requirements of the Environment Reference Standard and EPA Victoria Publication 275: *Construction Techniques for Sediment Pollution Control*. Erosion and Sediment Control Plans (ESCP) to be designed in accordance with IECA best practice guidelines and comply with local and state requirements. A survey of the mine site will be undertaken prior to construction works commencing, which will identify key topographical features to ensure that any decommissioned channels do not become a conduit for runoff or contamination from the site.	All phases
MM-SW02	Final design of mine site water storages and drainage infrastructure to ensure they can accommodate nominated storm events. This includes mitigation of overtopping/losses risk from following: • Wave action • Incident rainfall • Seepage (liner specification)	Construction

Mitigation measure ID	Mitigation measure	Project phase implementation
	The on-site process water pond (PWP) would be lined with a low permeability high density polyethylene (HDPE) liner, or with other comparable materials, in accordance with EPA Publication 1588.1 (Section 6.1.1). Internal drainage infrastructure should be designed with capacity to prevent overflow. Bunds of sufficient height should be designed to prevent surface water intrusion from disturbed catchments.	
MM-SW03	Revegetate disturbed areas as quickly as practicable on completion of construction and/or mining as part of progressive rehabilitation to minimise erosion and impacts to surface water quality and restoration of surface water flows to pre-development levels.	All phases
MM-SW04	Implement appropriate spill control and bunding measures to control and contain spills. All hydrocarbons and hazardous substances are to be stored in facilities designed in accordance with EPA Victoria Publication 1698 – *Liquid storage and handling guidelines* and AS 1940:2004 – *The storage and handling of flammable and combustible liquids*.	All phases
MM-SW05	Include appropriately sized culverts on drainage lines crossed by access roads with the capacity to accommodate surface water run-off, as stipulated in works on waterways permits.	Construction
MM-SW06	Ensure that any surface water diversions that are implemented discharge into the natural downstream discharge point or the same discharge point as prior to works commencement.	Construction
MM-SW07	Ensure any Project installed infrastructure within the 1% AEP storm extent (e.g Pipeline) is to be designed to withstand potential flooding and would be subject to compliance with the specific requirements of the North Central and Mallee CMA's floodplain works approval process.	Construction

13.7.1 Monitoring and contingency measures

Monitoring will be conducted to measure project performance during construction, operations and closure (including rehabilitation and post-closure). Table 13-3 describes the monitoring commitments to be implemented for the Project.

Table 13-3 Monitoring and contingency measures

Environmental aspect	Monitoring program / measure	Project phase
Clean up of spills	Implement contingency plan(s) to clean up and manage spills.	All phases
Water quality monitoring plan	Develop and maintain a water quality monitoring program that will comply with applicable legislation and guidelines. The SWMP will define the exact monitoring locations, frequency and parameters. Water quality sampling external to the mine site will be undertaken in conjunction with the internal mine site water quality monitoring program, noting that the external sampling will be event-based, given the lack of permanent streams or flow paths impacted by the Project. The potential water sampling locations are shown in Figure 8-5 of Technical Report H1 Surface Water Impact Assessment. The water quality indicators to be included in the monitoring corresponds to the environmental quality indicators and objectives for rivers and streams as outlined in the ERS 2021.	All phases
Surface water monitoring	Ecological and water quantity monitoring of any surface water diversions to ensure they have no impact on downstream ecosystems. If change is detected, remedial actions will be implemented to rectify the problem immediately to avoid irreversible damage to downstream ecosystems.	All phases

13.8 Conclusion

The surface water impact assessment has shown that the construction, operation and closure of the Project can be managed such that the objective of minimising the effects on water resources, and on the beneficial and licensed uses of surface water, can be met.

Activities associated with the construction and operation of the Project have the potential to impact regional surface water bodies by modifying existing drainage lines, increasing erosion and sediment runoff, reducing water to downstream receptors and through the discharge of stormwater runoff. While the water supply pipeline would interact with the Back Creek floodplain, the waterway is ephemeral and only flows during Avoca River flood events. The proposed pump station works are in proximity to Kangaroo Lake and works would need to ensure no runoff or disturbed water can enter Kangaroo Lake. No other significant waterways are located in proximity to the Project, therefore construction activities are not expected to impact riverbeds, riverbanks and existing drainage paths and impacts as a result of erosion and sediment runoff are considered to be unlikely.

Mine site surface water modelling determined that containing runoff for 5% AEP rainfall events would be practical, even with large catchment areas and low loss values. Considering an assumed reuse demand of 11,400kL/day, the modelled mine site surface water balance calculates that only 3.5% of the nominated reuse demand would be met during Project operation. This means that there would be limited economic benefit to reusing surface water within the processing operation, however captured water could be reused in other ways, such as for dust suppression and as part of revegetation and rehabilitation operations. Any runoff generated in rainfall events greater than 5% AEP would be directed to the active mine pits ensuring that that stormwater runoff could not leave the site.

Catchment inundation modelling determined that Project mining Area 1 would be located within an overland flow path and has the potential to reduce surface water runoff to depressions to the east, however given that Area 3 does not have any impact to runoff, the potential for impacts to nearby receptors are limited. When considering bunding around the total mined area and the Project capturing all surface runoff within its boundaries, the modelled 1% AEP water levels indicate that there would be an accumulation of water east of mining Area 1 and a 12 cm decrease in water depth west of Area 1, where two patches of vegetation occur.

Following the implementation of mitigation measures, residual impacts would be limited to this 12 cm reduction in 1% AEP flood depths to two patches of vegetation west of Area 1. The decrease in depth is considered minor and is expected to be temporary. There may also be a change in surface water contribution to remnant patches of vegetation within Area 3.

In response to the EES evaluation objective described at the beginning of this chapter, impacts of the Project on surface waters have been assessed and mitigation measures have been identified to avoid and minimise adverse effects on water resources, and on the beneficial and licensed uses of surface water.