

Technical report I: Surface water

Star of the South Offshore Wind Farm

20 March 2026

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Client: Star of the South Wind Farm Pty Ltd as trustee for Star of the South Trust

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Executive Summary

Overview

Star of the South is Australia's most advanced offshore wind farm project. Located off the south coast of central Gippsland, the project comprises an offshore wind farm and supporting transmission infrastructure to transfer energy to the existing electricity network.

A delegate of the Commonwealth Minister for the Environment decided that the project is a controlled action (as set out in notice dated 2 June 2020) and is required to be assessed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) through preparation of an Environmental Impact Statement (EIS) and the Victorian Minister for Planning determined that an Environment Effects Statement (EES) is required (as set out in notice dated 11 May 2020) under the *Environment Effects Act 1978* (EE Act).

Following assessment, all potential risks were able to be appropriately mitigated through the measures outlined in this report. As such, the residual risk profile was deemed to be low.

Existing environment

This surface water impact assessment examined the existing environment of waterways and catchments that will interface with the proposed onshore cable crossing alignment. These waterways and catchments include the shore crossing environment and waterways within the South Gippsland River Basin.

The shore crossing environment is located at Reeves Beach on the southern end of Ninety Mile Beach. The site crosses a small coastal waterway (unnamed waterway - UFI:42824681) and low-lying floodplain that is directly connected to the Bruthen Creek Estuary and the Corner Inlet Ramsar Site. The Corner Inlet Ramsar Site is internationally recognised for its diverse habitat that includes intertidal mudflats, saltmarsh, seagrass meadows and mangroves.

The waterway at the shore crossing location is not considered to be tidally influenced, however, it is located in an area that is at risk of widespread inundation when storm surges combine with high tides. Furthermore, current projections of sea level rise estimate that the waterway of the proposed shore crossing location will most likely become tidal during the operational life of the project.

North of the shore crossing site, the proposed transmission alignment traverses a low-lying coastal plain that is predominantly used for agriculture. The waterways that cross this coastal plain carry runoff from the hills of the Mullungdung State Forest towards the coastal estuaries and wetlands that lay behind Ninety Mile Beach. All of the waterways that cross this coastal plain are ephemeral at the proposed cable crossing locations.

The catchments of Warrigal Creek, Morris Creek and Hoddinott Creek form the majority of the waterways on the coastal plain adjacent to the project alignment, all of which drain into the Jack Smith Lake Wildlife Reserve. This wetland was one of the first game reserves in Victoria and remains a popular camping and walking destination today.

Closer to Giffard West, the alignment travels across open agricultural land that features several unnamed channels and drainage lines that convey runoff in a south-easterly direction towards Darriman H29 Bushland Reserve and Ninety Mile Beach beyond.

Assessment findings

An iterative assessment was undertaken to evaluate potential impacts and risks to surface water associated with the project. The assessment considered the existing surface water environment within the study area and the proposed construction, operational and decommissioning activities.

The assessment found the following impacts and risks:

Construction

- Flooding of the construction site, or construction equipment, potentially leading to poor downstream water quality in the receiving waterways and coastal estuaries.
- Trenching across waterways potentially mobilising sediment and causing downstream pollution.
- Runoff and spills from trenchless crossings causes downstream pollution.
- Disturbance, handling, storage, treatment or disposal of acid sulfate soils potentially resulting in the generation of acidic waters that impact receiving waterways and coastal estuaries.
- Runoff from the construction site, including construction compounds, trenchless crossing sites, storage facilities and site access roads, potentially polluting receiving waterways.
- Groundwater extracted and released to the surface potentially polluting receiving waterways.
- Construction activities potentially blocking or diverting drainage pathways leading to changes in flow regime and downstream uses and environmental values.
- Construction activities changing the flood risk and flood characteristics.

Operational

- Increases in rainfall intensity and sea level rise caused by climate change potentially leading to more frequent and severe flooding of operational infrastructure.
- Operational or permanent infrastructure potentially blocking or diverting drainage pathways leading to changes in flow regime and downstream uses and environmental values.

Decommissioning

- Flooding of the decommissioning sites potentially leading to poor downstream water quality in the receiving waterways and coastal estuaries.
- Runoff from the decommissioning works potentially causing pollution in receiving waterways and coastal estuaries.
- Disturbance, handling, storage, treatment or disposal of acid sulfate soils potentially resulting in the generation of acidic waters that impact receiving waterways and coastal estuaries.
- Decommissioning activities potentially blocking or diverting drainage pathways leading to changes in flow regime and downstream uses and environmental values.

Many of these potential impacts and risks can be addressed through compliance with industry legislation, guidelines and standards. However, some of the proposed construction sites and permanent infrastructure will require additional mitigation strategies due to their location within the floodplain or proximity to designated waterways. The proposed shore crossing site is located on land that is at risk of flooding from surface water and storm tides. Flooding of the construction site could potentially mobilise pollutants and discharge contaminated water directly into the Corner Inlet Ramsar Site if construction works are not well managed.

The transmission alignment will intersect many waterways in the South Gippsland region. All of these waterways are classified as ephemeral with seasonally disrupted flow regimes. Trenching across waterways can release sediment directly into the flow pathway, causing pollution of the waterway and receiving aquatic environment. Sediment pollution can have lasting impacts to aquatic habit that include loss of fish spawning area, covering of aquatic plants and changes to water chemistry.

Project infrastructure, such as joint bays and their associated excavations, will intersect existing drainage and overland flow pathways. This can lead to changes in the existing flow regime. Changes to flow regime can block or alter the natural flows that sustain important downstream habitat.

Similarly, the siting of laydown areas, temporary access roads or fencing in areas that are at risk of flooding, during the construction phase, can change flood characteristics, leading to scour, erosion, increased flood depth and flooding of neighbouring properties.

For the operational phase, permanent infrastructure, such as joint bays or backfilled trenches could potentially alter drainage pathways. These changes to flow regime can disrupt the supply of water for ecological or agricultural use.

The key impact for the decommissioning phase relates to working at sites that are at risk of flooding and the impacts of waterway pollution caused by contaminated floodwater. This includes decommissioning of the shore crossing site that may be vulnerable to flooding caused by future sea level rise and increasing rainfall intensity over the operational life of the project.

Mitigation measures

A broad range of mitigation measures have been developed to reduce potential surface water impacts and risks through the construction, operational and decommissioning phases of the project.

This assessment has identified risks and proportional mitigation measures to address the GED as required under the *Environment Protection Act 2017* (EP Act). An assessment of practicability on control measures not adopted for the project is included in Appendix B.

Many of the water quality impacts associated with contaminated runoff or spills from the construction and demolition phases can be managed through adopting best practice guidelines. These include EPA Victoria's Civil, construction, building and demolition guide (Publication 1834), or IEACA's Best Practice Erosion and Sediment Control document.

The project design shows infrastructure located on land that is subject to flooding or directly across drainage lines. The detailed design phase will optimise the siting of infrastructure and aim to mitigate the risks of surface water impacts by locating infrastructure away from waterways or areas at risk of flooding. However, for some sites, relocation of the proposed construction activities or permanent infrastructure was not considered feasible and additional site-specific mitigation measures would be required to reduce these residual impacts.

For example, the proposed shore crossing site at Reeves Beach is constrained by the mechanical limits of the cables and cannot be relocated outside of the floodplain or areas at risk of storm tides. To mitigate potential surface water impacts, the shore crossing construction site design will be optimised to minimise the footprint of the work area and remove any non-essential materials or operations out of the floodplain. Any remaining sensitive or potentially polluting infrastructure will be protected from the impacts of flooding for all storm events up to the 1% annual exceedance probability (AEP). Similar site optimisation and engineered protection strategies will be applied for other sites that cannot be relocated off the floodplain.

The project design proposes the use of trenchless crossings (e.g. HDD) for waterways that exhibit a perennial flow regime, extensive riparian habitat or direct connections to valuable receptors such as the shore crossing location that is located immediately upstream of the Corner Inlet Ramsar site. Mitigating the risks of waterway crossings will be achieved through the adoption of industry best practice guidelines. These guidelines include a broad range of mitigation measures such as temporary diversion of flows around the active work areas, and programming crossing works to occur during dry or low flow conditions.

It is considered that all of the surface water impacts identified and evaluated by this assessment can be mitigated through the adoption of the mitigation measures presented in this report. Subsequently, significant surface water impacts and risks are not anticipated, and the residual surface water impacts are considered to be negligible or minor, and residual surface water risks considered low.

Abbreviations

AECOM	AECOM Australia Pty Ltd
AEP	Annual exceedance probability
AHD	Australian Height Datum
ASS	Acid sulfate soils
CASS	Coastal acid sulfate soils
CEMP	Construction Environmental Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEECA	Department of Energy, Environment and Climate Action
EES	Environment Effects Statement
EMF	Environmental Management Framework
EPA Victoria	Environment Protection Authority
ERS	Environmental Reference Standards
FO	Floodway Overlay
Ha	Hectare
HAT	Highest astronomical tide
HDD	Horizontal directional drilling
IECA	International Erosion Control Association
LSIO	Land Subject to Inundation Overlay
NTU	Nephelometric turbidity units
RCP	Reinforced concrete pipe
RL	Reduced Level
SLR	Sea level rise
TSS	Total suspended solids
WGCMA	West Gippsland Catchment Management Authority
WQI	Water quality index

Glossary

1% AEP Flood Event	A design flood that has a 1% probability of occurring every year. This is also known as the 100-year average recurrence interval (ARI) flood event.
Annual exceedance probability (AEP)	The probability of a particular sized event being exceeded in any given year.
Designated waterway	A waterway declared under the <i>Water Act 1989 (Vic)</i> that is managed and controlled by the specified authority. Nearly all key waterways in the project area are designated waterways, controlled by the WGCMA.
Ephemeral waterway	A waterway which flows only after rain and has no baseflow or permanent flow component.
Floodway overlay	Applies to land identified as part of an active floodway, or to a high hazard area with high flow velocities, where impediment of flood water can cause significant changes in flood flows and adversely affect other areas. This overlay is typically categorised by depths in excess of one metre in a 1% AEP flood event.
Highest astronomical tide (HAT)	The highest predicted tide that can occur under any normal astronomical (lunar) conditions. HAT does not include the influence of weather events.
Key waterway	For the purpose of this report, a key waterway refers to a waterway that is either mapped on Mapshare Vic or exhibits features that warrant screening or further assessment through this report. This includes major and minor waterways, designated and non-designated waterways, ephemeral and perennial waterways. It excludes minor drainage lines or pathways.
Land Subject to Inundation Overlay (LSIO)	Applies to land in either rural or urban areas that is subject to inundation from mainstream flooding but is not part of the primary floodway. This extent usually represents the 1% Annual Exceedance Probability (AEP) flood extent from open channels. These overlays require a planning permit for buildings and works.
Meander belt	The total area in which channel migration occurs, denoted by the outside bends of the meanders.
Nephelometric turbidity units (NTU)	Unit of measurement for turbidity.
Perennial waterway	A waterway, or specific reach of a waterway, that exhibits continuous baseflow during a typical rainfall year.
Storm surge	A phenomenon caused by low atmospheric pressure, onshore winds and coastally trapped waves that lead to increased water levels at coastal areas.
Storm tide	A phenomenon caused by low atmospheric pressure, onshore winds and coastally trapped waves (storm surge), coinciding with high astronomical tides.
Works on Waterways Permit	A permit issued by the local catchment management authority for any works on, over or near designated waterways and their respective floodplains. Works may include crossings, deviations, stabilisation, vegetation, drainage connections or any other structures in or near designated waterways.

1.0 Introduction

The Star of the South Offshore Wind Farm (the project) is Australia's most advanced offshore wind farm. The project is located in Commonwealth waters off the coast of Gippsland, and will connect to the electricity network via the proposed VicGrid connection hub in Giffard.

The project represents a significant opportunity to diversify Australia's energy resources. As Australia's ageing coal fleet retires, new sources of power are needed to address the anticipated gap in electricity generation. The project will address this gap, by harnessing Bass Strait's strong, consistent winds and delivering significant amounts of clean, reliable power to the grid starting in 2032. With a capacity of up to 2.2 gigawatts (GW), the project can meet approximately 20 per cent of Victoria's current electricity demand, enough to power around 1.2 million homes annually.

The project is located within both Commonwealth and Victorian jurisdictions and is subject to planning and environmental assessment and approval under Commonwealth and Victorian legislation.

A delegate of the Commonwealth Minister for the Environment and Water has determined the project is a controlled action (as set out in a notice dated 2 June 2020) and must be assessed and approved under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) through an Environmental Impact Statement (EIS). The Victorian Minister for Planning has determined the project requires an Environment Effects Statement (EES) (as set out in a notice dated 11 May 2020) under the *Environment Effects Act 1978* (Vic) (EE Act). The purpose of this report is to assess the potential surface water impacts associated with the onshore transmission and shore crossing sections of the project to inform the preparation of the EIS and EES required for the project.

2.0 Project description

Section 2.0 provides a high-level overview of the project in its entirety. Detailed descriptions of project components and construction processes are provided in Chapter 4 – Project description of the EIS for the whole of project assessment across the Commonwealth jurisdiction, and in Chapter 4 – Victorian works project description of the EES for the Victorian jurisdiction. Specific project parameters that have informed the surface water impact assessment are detailed in Section 8.0 of this report.

2.1 Project overview

The offshore wind farm will be installed within a 586-square-kilometre offshore wind farm area, located approximately 10 to 40 kilometres off the coast of Gippsland, as shown in Figure 2-1.

The project comprises an offshore wind farm and supporting transmission infrastructure to generate and transfer power to the grid. The offshore infrastructure extends from the shore crossing at Reeves Beach, to the offshore wind farm area.

The onshore infrastructure primarily comprises of an underground cable system that will connect the project to the proposed VicGrid connection hub in Giffard (also referred to as 'proposed Giffard terminal station area'). The onshore transmission infrastructure is located in Central Gippsland, extending approximately 30 kilometres from Reeves Beach to the proposed VicGrid connection hub in Giffard.

This technical report focusses on construction, operation and decommissioning of the onshore transmission system], within the onshore project area shown in Figure 2-3.

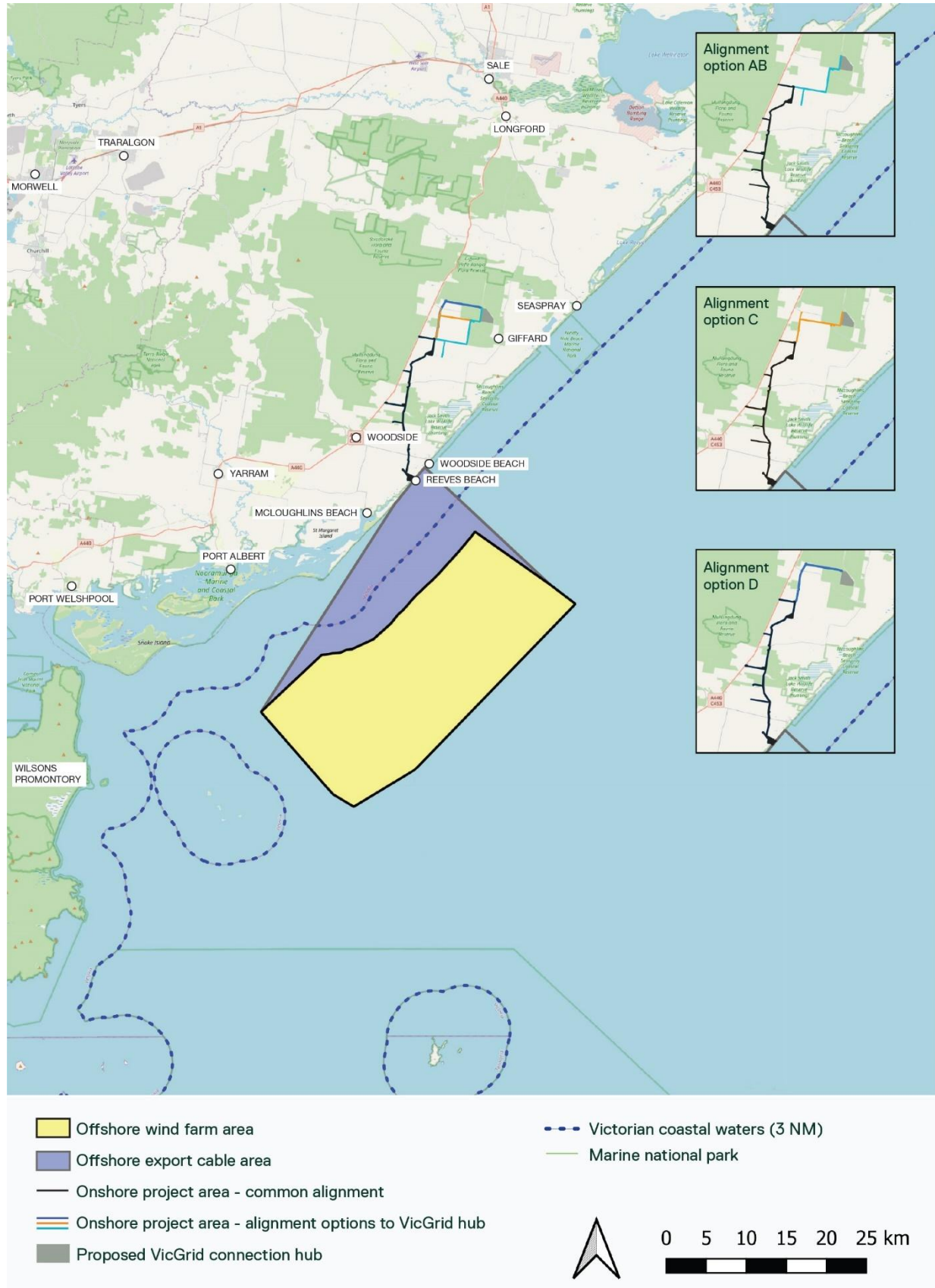


Figure 2-1 Project location

2.2 Project Development

Over several years of project development, opportunities to avoid and minimise environmental impacts have been realised in accordance with the mitigation hierarchy shown in Figure 2-2. The assessment framework has also enabled the identification and adoption of further avoidance and minimisation measures as part of the planning and environmental approvals process. This approach addresses the general environmental duty (GED) as required under the *Environment Protection Act 2017* (EP Act), as it involves minimising risk of harm to human health and the environment from pollution and waste by adopting controls that are proportionate to identified risks.

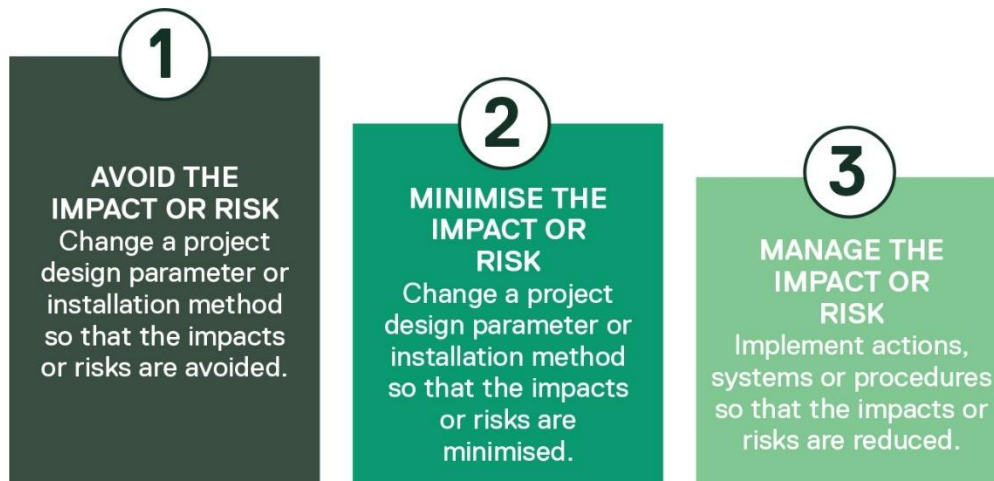


Figure 2-2 Mitigation hierarchy

Avoidance and minimisation of social and environmental impacts is central to the project's decision making and as such, the project will continue to be refined in response to technical requirements and potential environmental and social impacts identified during the development phase.

This was considered in the preparation of a project description which is found in Chapter 4 – Project description of the EIS for the whole of project assessment across the Commonwealth jurisdiction and Chapter 4 – Victorian works project description of the EES for the Victorian jurisdiction. A description of how avoidance of impact has informed the design in relation to **Surface Water** can be found in Section 6.6.

Examples of this include the decision to design the shore crossings without directly impacting coastal areas, utilising existing roads for construction site access wherever possible and adopting construction techniques which avoid impacts on sensitive receptors such as road crossings.

Once avoidance and minimisation measures are exhausted, residual impacts and risks are managed. In the case of risks, mitigation measures can be applied both before and after an event occurs. Residual impacts and risks are then evaluated against the assessment criteria to ensure they are at an acceptable level.

2.3 Project Area

The project area is shown in Figure 4-1 has been broken down into three main sections - offshore, shore crossing, and onshore areas.

- Offshore project area, comprising:
 - Offshore wind farm area: A 586 square kilometre area extending approximately 10 to 40 kilometres offshore from the shore crossing. Includes offshore wind turbines installed on foundations, offshore substations and offshore transmission cables. This area is in Commonwealth waters.
 - Offshore export cable area: A 232 square kilometre area extending from the offshore wind farm area to the shore crossing. Includes offshore export cables to connect the wind farm to land. This area traverses Commonwealth waters and Victorian coastal waters.

2. Shore crossing: Located at Reeves Beach, this is where the offshore export cables will transition to land and connect to the underground cable system onshore.

Onshore project area: An approximately 30 kilometre corridor extending from the shore crossing to the proposed VicGrid connection hub. Includes an underground cable system within a (common) alignment to Giffard West, at which point there are three alignment options (AB, C and D) to reach the proposed VicGrid hub in Giffard.

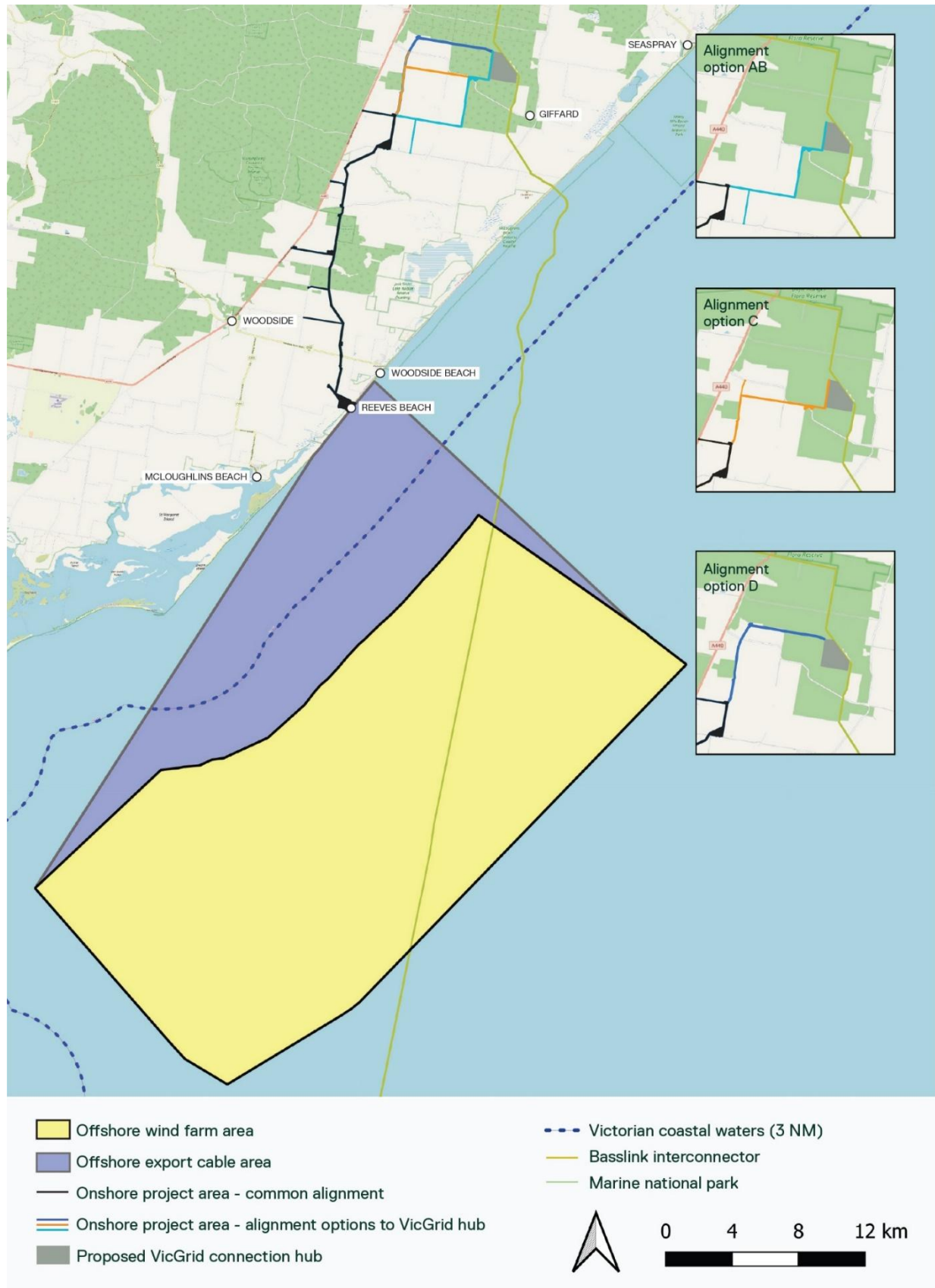


Figure 2-3 Project overview

2.4 Key project components

The key components that make up the project are the offshore wind farm, and transmission infrastructure (inter-array cables, offshore substations and offshore export cables) the shore crossing infrastructure and onshore transmission infrastructure. These are shown in Figure 2-4 and described below.

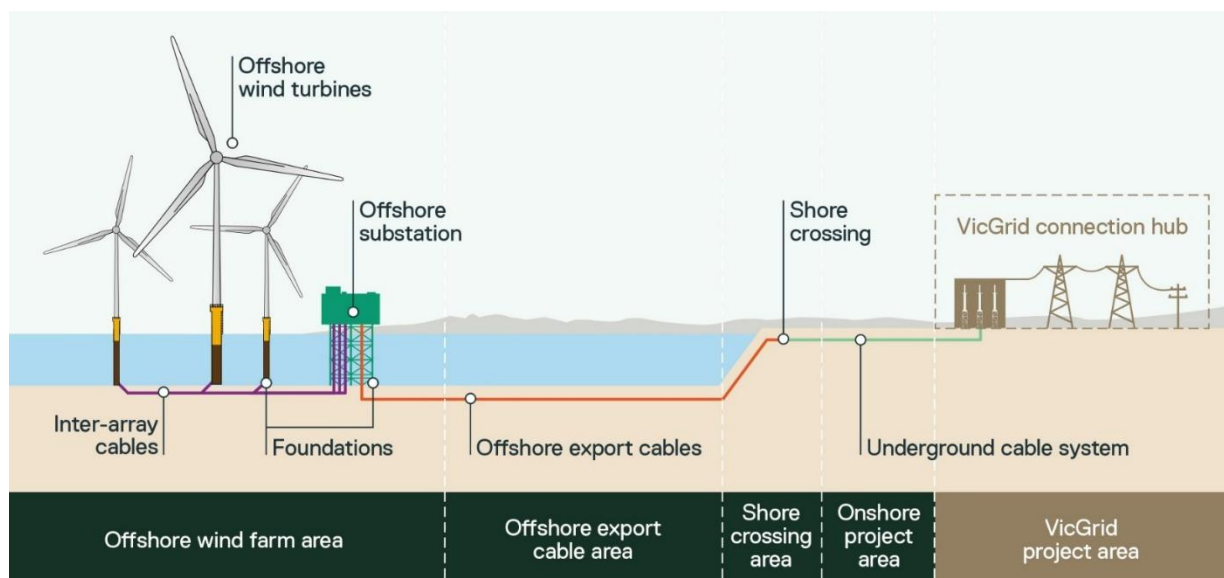


Figure 2-4 Project components

Key components are shown in Figure 2-4 and include:

- Offshore wind farm and transmission infrastructure:
 - Up to 147 offshore wind turbines installed on foundations with connecting inter-array cables
 - Up to five offshore substations and three interlink cables
 - Up to eight offshore export cables.
- Shore crossing infrastructure:
 - Up to eight trenchless crossings containing the offshore export cables.
- Onshore transmission infrastructure, which consists of:
 - An underground cable system connecting to the proposed VicGrid connection hub

2.5 Construction approach

The construction of the shore crossing and onshore transmission system would involve the following key activities:

- Site establishment
- Cable system construction (including trenching, installation and jointing)
- Pre-commissioning and commissioning of the cable system
- Demobilisation and rehabilitation of areas disturbed in construction.

2.6 Project timeline

The project has been under development for approximately seven years. If approvals are obtained in the next few years, construction could start around 2030 and electricity generation from 2032. The operational life of the project is approximately 30 years, with the possibility of repowering to extend its life, if deemed appropriate by Star of the South and regulators closer to the time (Figure 2-5).



Figure 2-5 Project timeline

2.7 Construction Schedule

The project is expected to take up to seven years to construct, if built to its full capacity in a single stage. The project could also be built in two stages, depending on energy market and government requirements and timing. Figure 2-6 shows the order and maximum duration of construction for key components (Figure 2-6)

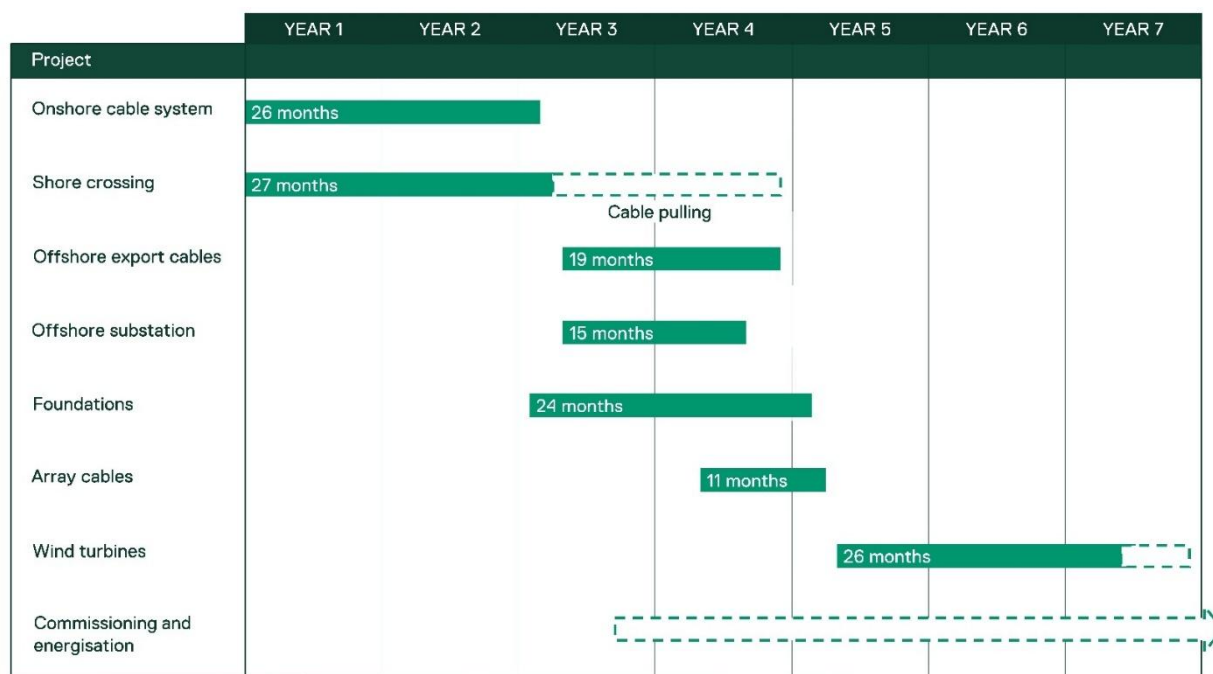


Figure 2-6 Indicative project construction schedule

2.8 Operational requirements

The underground cable system will be remotely monitored through control and condition monitoring systems. Routine access will be minimal, with testing required once or twice a year at the link pits located at each joint bay.

A small workforce will undertake periodic inspections and routine maintenance of the cable system using light service vehicles, including cable easement inspections to monitor and control vegetation and confirm compliance with easement terms.

2.9 Decommissioning

Decommissioning of onshore components will be planned and carried out in accordance with regulatory and landholder requirements current at the time. The decommissioning approach is expected to be

agreed with regulators before project operations cease. The assessment of the project assumes current industry practices will be adopted.

To minimise disturbance, most below-ground infrastructure is expected to be left in place, with cable ends cut, sealed and securely buried. Surface infrastructure such as signage, markers, link and fibre pits may be removed if required by landholders or if environmental impacts arise. .

3.0 Scoping

3.1 Study objective

The objective of this study is:

- To assess, avoid and minimise adverse effects on surface water functions and values, such as water quality, stream flows and beneficial uses.

This objective guides the approach to assessments and the avoidance and minimisation of potential impacts.

It should be noted that ‘beneficial uses’ were replaced with ‘environmental values’ under the EP Act enacted 1st July 2021. This is described further in Section 4.1.

The Environmental Reference Standard (ERS) defines the environmental values of surface water, for each of Victorian geographical segments. The project is located in the Central foothills and Coastal Plains geographical segment. The environmental values documented in the ERS for the Central foothills and Coastal Plains segment are presented in Table 3-1 (EPA, 2021).

Table 3-1 Environmental values of surface water in the Central foothills and Coastal Plains segment (ERS).

Environmental values	Description
Water dependent ecosystems that are slightly to moderately modified	Water quality that is suitable to protect the integrity and biodiversity of water dependent ecosystems.
Agriculture and irrigation	Water quality that is suitable for agricultural activities such as stock watering and irrigation, as well as a range of other uses such as the irrigation of domestic gardens, commercial agriculture, parks and golf courses.
Human consumption of aquatic foods	Surface water quality that is suitable to support the availability and safe human consumption of fish and any other aquatic plant, algae or invertebrate from natural populations, commercial and recreational catch.
Industrial and commercial	Water quality that is suitable for industrial and commercial use.
Water based recreation	Water quality that is suitable for primary contact recreation (for example swimming, diving, water skiing, caving and spas), secondary contact recreation (for example boating and fishing) and for aesthetic enjoyment.
Traditional Owner cultural values	Water quality that protects the cultural values of Traditional Owners, having recognised primary responsibility for protecting the values of water for cultural needs, to ensure that Traditional Owner cultural practices can continue. Values may include traditional aquaculture, fishing, harvesting, cultivation of freshwater and marine foods, fish, grasses, medicines and filtration of water holes.

3.2 EIS guidelines

The Guidelines for the Content of a Draft Environmental Impact Statement for Star of the South Offshore Wind Farm Project (‘the Guidelines’) set out the requirements to allow the Commonwealth Minister for the Environment to make an informed decision on the approval of the project under the EPBC Act.

Section 6 of the Guidelines relates to Relevant Impacts and states that *all relevant impacts of the action must be assessed in accordance with relevant Department of Climate Change, Energy, the Environment and Water (DCCEEW) policies and guidelines, and information provided in the SPRAT Database*. This requirement is summarised in Section 6 of the Guidelines as:

- a. The EIS must include a description of all the relevant impacts of the action.

The guidelines also define relevant impacts as *impacts that the action will have or is likely to have on a matter protected by a controlling provision. Impacts during both the construction, operational and the decommissioning phases of the project should be addressed.*

The assessment has identified limited interactions between surface water and matters of national environmental significance. There is the potential for indirect impacts to the Cornet Inlet Ramsar wetlands (a matter of national environmental significance) which are located downstream of the project.

The aspects of the guidelines relevant to the surface water assessment are shown in Table 3-2 as well as where these items have been addressed in this report.

The potential for impacts to EPBC Act-listed aquatic species (such as Dwarf Galaxias or Growling Grass Frog) are described in Technical report G: Onshore ecology.

Table 3-2 EIS requirements addressed within this surface water assessment

Requirement	Sections addressed
A detailed assessment of the nature, extent and duration of the likely short-term and long-term relevant impacts;	Sections 9.0, 10.0 and 11.0
A statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible;	Sections 9.0, 10.0 and 11.0
Analysis of the significance of the relevant impacts; and	Sections 9.0, 10.0 and 11.0
Any technical data and other information used or needed to make a detailed assessment of the relevant impacts, including: <ul style="list-style-type: none"> Modelling of changes to the physico-chemical status of Corner Inlet and/or Western Port Ramsar sites (including turbidity and suspended sediment changes) during the construction, operation and decommissioning stages of the action; 	Sections 7.0, 9.0, 10.0 and 11.0
Information sources stating: <ol style="list-style-type: none"> the source of the information; and how recent the information is; and how the reliability of the information was tested; and what uncertainties (if any) are in the information. 	Sections 7.0, 9.0, 10.0, 11.0 and 16.0

3.3 EES evaluation objectives and scoping requirements

The Scoping Requirements for Star of the South Offshore Wind Farm Environment Effects Statement ('scoping requirements') by the Minister for Planning, set out the specific environmental matters the project must address in order to satisfy the Victorian assessment and approval requirements.

The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the project in accordance with the *Ministerial guidelines for assessment of environmental effects* under the EE Act.

The following evaluation objective is relevant to the Surface Water Assessment:

- To minimise adverse effects on water (including groundwater, waterway, wetland, estuarine, intertidal and marine) quality and movement.

The aspects from the scoping requirements relevant to the evaluation objective are shown in Table 3-3, as well as the location where these items have been addressed in this report.

Table 3-3 Scoping requirements relevant to surface water

Aspect	Scoping requirement	Section addressed
Key issues	The potential for adverse effects on the functions, values and beneficial uses of surface water environments, such as interception or diversion of flows or changed water quality or flow regimes.	Sections 9.0, 10.0 and 11.0
	The potential for adverse effects on nearby and downstream water environments due to changed flow regimes, floodplain storage, run-off rates, water quality changes, or other waterway conditions, including in the context of climate change projections.	Sections 9.0, 10.0 and 11.0
	The potential for disturbance of contaminated, saline, dispersive or acid sulphate soils	Sections 9.0, 10.0 and 11.0 and Technical report J: Soil and waste
	Potential effects to values through contaminated spills or the introduction of invasive species	Sections 9.0, 10.0 and 11.0
Priorities for characterising the existing environment	Describe marine, estuarine, intertidal and freshwater waters and their beneficial uses that could be affected by the project, such as from changed water quality, or water movement	Section 7.0
Design and mitigation measures	Identify and evaluate aspects of project works and operations, and proposed design refinement options or measures, that could avoid or minimise significant effects on groundwater, waterway, wetland, estuarine, intertidal and marine waters.	Section 13.0
	Describe further potential and proposed design options and measures that could avoid or minimise significant effects on groundwater, waterway, wetland, estuarine, intertidal and marine waters during the project's construction and operation, including response measures for environmental incidents.	Section 13.0
Assessment of likely effects	Identify and evaluate effects of the project on groundwater, waterway, wetland, estuarine, intertidal and marine waters potentially affected by project works, including with appropriate consideration of climate change scenarios and possible cumulative effects	Sections 9.0, 10.0 and 11.0
	Identify and assess potential residual effects of the project on soil stability, erosion and the exposure and disposal of contaminated or hazardous soils (e.g. acid sulphate soils)	Sections 9.0, 10.0, 11.0 and Technical report J: Soil and waste

Aspect	Scoping requirement	Section addressed
	Identify potential residual effects resulting from the generation, storage, treatment, transport and disposal of solid and liquid wastes, including soil and fuel.	Sections 9.0, 10.0 and 11.0
Approach to manage performance	Identify and evaluate aspects of project works and operations, and proposed design refinement options or measures, that could avoid or minimise significant effects on groundwater, waterway, wetland, estuarine, intertidal and marine waters.	Section 13.0
	Describe further potential and proposed design options and measures that could avoid or minimise significant effects on groundwater, waterway, wetland, estuarine, intertidal and marine waters during the project's construction and operation, including response measures for environmental incidents.	Section 13.0
	Describe and evaluate the approach to monitoring and the proposed contingency measures to be implemented in the event of adverse residual effects on groundwater, waterway, wetland, estuarine, intertidal and marine waters requiring further management.	Section 13.0
	Describe contingency measures for responding to unexpected but foreseeable impacts such as disturbance of acid sulphate soils	Section 13.0 and Technical report J: Soil and waste

4.0 Evaluation framework

The assessment will consider legislation, policy and standards relevant to surface water, along with specific assessment criteria that have been derived for the purposes of the study.

4.1 Legislation, policy, guidelines and standards

The legislation, policy, guidelines and standards relevant to this assessment are summarised in Table 4-1.

Table 4-1 Legislation, policy, guidelines and standards relevant to the assessment

Document title	Summary	Relevance to the project
Commonwealth government		
<i>National Water Quality Management Strategy - Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)</i>	The policy sets the water quality objectives required to sustain current environmental values for natural or semi-natural water resources in Australia and New Zealand. The document identifies limits to acceptable change in water quality that would continue to protect the associated environmental value.	Meeting the guidelines would provide a level of certainty that there would be no significant impact on waterways or their uses.
<i>Environmental Protection and Biodiversity Conservation Act 1999 (EPBC)</i>	The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Australian Government's key piece of environmental legislation which provides a national approach to environment and heritage protection and biodiversity conservation. The EPBC Act focuses on the protection of MNES including World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The EPBC Act states that 'controlled' actions (i.e., actions that are determined as likely to have a significant impact on MNES) are subject to assessment and approval under the EPBC Act.	Any significant impacts on these matters require the approval of the Australian Minister for the Environment. Impacts to Ramsar-listed wetlands were of particular concern for this project. This is done through a three-step process: Referral, Assessment and Approval. The project was referred to the Commonwealth under the EPBC Act (EPBC Act referral number 2020/8650) in 2020. On 2nd June 2020 the project was deemed a controlled action and requires assessment and approval under the EPBC Act. This report informs the approval under the EPBC Act.
Victorian government		
<i>Water Act 1989 (Vic)</i>	The <i>Water Act 1989 (Vic)</i> ('Water Act') sets the legal framework for managing and protecting water resources across the State. It seeks the integrated management of all elements of the water cycle and maximises community involvement in the implementation of arrangements relevant to the use, conservation and management of water resources. The Act also establishes the responsible authority for the control and management of waterways. Under the Act, catchment management authorities	Approval from the West Gippsland Catchment Management Authority for any works on, over or under a designated waterway in accordance with WGCMA By-law No. 3: Waterways Protection (2014).

Document title	Summary	Relevance to the project
	prepared a series of By-Laws that made provisions for the protection and control of waterways. This includes the permitting of works and activities in, under, on or over designated waterways, land or works. This is by-law No.3 Waterways Protection (2014) for WGCMA.	
<i>Environment Protection Act 2017 (Vic)</i>	Amendments to the <i>Environment Protection Amendment Act 2017 (Vic)</i> were incorporated on 1 July 2021. The EP Act includes a new approach to tackling environmental issues, focusing on preventing waste and pollution impacts rather than managing those impacts after they have occurred. The legislation will improve the protection of Victoria's environment and human health through a more proportionate, risk-based environment protection framework. Central to the EP Act is the general environmental duty which requires that any person who is engaging in an activity that may give rise to risk of harm to human health or the environment from pollution or waste to minimise those risks so far as reasonably practicable.	Any discharge into a waterway or groundwater during the construction of the Project must be in accordance with the requirements of the <i>Environment Protection Act 2017 (Vic)</i> and subordinate legislation. The general environmental duty has been applied to this surface water impact assessment for the project as shown in the outcomes of the risk assessment process described in Appendix A of this technical report. This process examines residual risk and the potential harm to human health or the environment and describes any additional mitigation measures required to reduce this risk.
<i>Environmental Reference Standard (ERS) 2021.</i>	The ERS identifies the environmental values to be protected or maintained, as well as outlining the indicators and objectives to achieve compliance with the EP Act 2017.	Meeting the environmental quality objectives as set out in Part 5 (Water) of the ERS will help the project minimise the potential for adverse impacts on surface water quality and ensure that existing environmental values are protected.
<i>Planning and Environment Act 1987 (Vic)</i>	The <i>Planning and Environment Act 1987 (Vic)</i> sets the State's framework for planning the use, development and protection of land. It includes the broad planning objectives, principles of the planning system, key planning procedures, key legal instruments and role descriptions.	Development in areas identified with water related planning control overlays will need to comply with this Act.

Document title	Summary	Relevance to the project
<i>Catchment and Land Protection Act 1994 (Vic)</i>	The purpose of the <i>Catchment and Land Protection Act 1994 (Vic)</i> is to establish a framework for the integrated management and protection of catchments, and to encourage community participation in the management of water resources. This Act outlines the establishment of the Catchment Management Authorities (CMA).	The Project should not inhibit the WGCMA's ability to carry out their duties under the Act.
<i>Victorian Planning Provisions</i>	A legal instrument under the <i>Planning and Environment Act 1987 (Vic)</i> that sets the templates for all local government planning schemes.	Development in areas identified with water related planning control overlays will need to comply with this Act.
<i>Victorian Waterway Management Strategy (2013)</i>	The Victorian Waterway Management Strategy provides a framework for the government to maintain or improve the condition of rivers, estuaries and wetlands so that they can continue to provide environmental, social, cultural and economic values for all Victorians. This State Policy framework for managing waterways includes the development of regional water strategies, that identify priority waterways and management activities. The Victorian Waterway Management Strategy was being updated at the time of preparing this assessment report and the DEECA website indicated release of the update during 2024-2025.	The Project should be undertaken so as not to preclude the condition of rivers, estuaries and wetlands from being improved or maintained to provide environmental, social, cultural and economic value for Victorians.
<i>West Gippsland regional Catchment Strategy 2021 – 2027</i>	<p>Launched in 2022 as a 'website strategy', the West Gippsland Regional Strategy sets strategic direction for the region and identifies actions that will achieve a set of regional outcomes.</p> <p>This includes the establishment of priorities for 'landscape scale' programs of management and the coordination of planning, partnerships and delivery at the regional level for better catchment stewardship.</p> <p>The principles of monitoring and evaluating the effectiveness of the Strategy have also been incorporated.</p>	The Project should not inhibit the WGCMA's ability to achieve the strategy.
<i>Marine and Coastal Act 2018 (Vic).</i>	The Marine and Coastal Act provides an integrated and coordinated approach to managing and protecting Victoria's marine and coastal environment and addressing challenges like climate change, population growth, and aging infrastructure, while fostering collaboration among partners. It is supported by the Marine and Coastal	The Project will need to meet the requirements of the Act and not inhibit the key coastal stakeholder groups in their duties to deliver the actions of the Environmental Management Plans.

Document title	Summary	Relevance to the project
	Reforms Final Transition Plan, which outlines actions for implementation.	
<i>Marine and Coastal Policy (2020)</i>	The strategy establishes sea level rise planning benchmarks and replaces the 'policy for decision making' parts of the Victorian Coastal Strategy (2014).	The Project should consider the implications of development relevant to each chapter of the Policy. Chapter 2 outlines the importance of maintaining good surface water quality condition in the coastal environment.
<i>Siting and Design guidelines for structures on the Victorian Coast</i>	Indicates that a person must not use or develop or undertake works on marine and coastal Crown land without consent.	The project interfaces with coastal Crown land and approval from the Victorian Government will be required under the Act.
Local Government		
Local Planning Schemes	Planning Schemes identify potential flood-prone areas and control development through the application of overlays. Overlays are the primary method of managing the development of land within Victoria. Some land will have overlays providing additional development controls for areas in relation to specific features such as heritage, bushfire or flood risk.	The Wellington Shire Council Planning Schemes feature specific development controls for the areas of LSIO and FO. Whilst there are currently no areas identified as LSIO or FO in the project area, the project will need to ensure alignment with water resource and flood risk management objectives of Wellington Shire Council.
Guidelines		
<i>Managing the Floodplain: A guide to best practice in flood risk management in Australia (Australian Emergency Management Handbook Series - Handbook 7). (2017)</i>	These technical guidelines were established by the Australian Emergency Management Program and provides best practice advice on how to understand and manage flood risk. This includes guidance on flood mitigation, land use planning and emergency management.	Adhering to the process and recommendations presented in this handbook will reduce the risks and impacts associated with flooding.
<i>Technical Flood Risk Management Guideline: Flood Hazard. (Australian Institute for Disaster Resilience Guideline 7-3). (2017)</i>	Part of the flood related 'Handbook 7' series, Handbook 7-3 provides specific guidance on the quantification of flood hazard. Flood hazard considers the relationship between flood depth and flow velocity and is particularly important in land development projects.	Adhering to the process and recommendations presented in these guidelines will ensure flood hazard is considered and mitigated for all aspects of the project.

Document title	Summary	Relevance to the project
<i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018</i>	The Australian and New Zealand guidelines for fresh and marine water quality provide authoritative guidance on the management of water quality for the natural and semi-natural water resources. The guidelines identify limits to acceptable change in water quality that would continue to protect the associated environmental value.	These guidelines can support the development of the Project's environmental framework and plans in relation to water quality and protection of waterways and environmental values.
<i>Best Practice Erosion and Sediment Control – Appendix P: Land based Pipeline Construction (IECA 2015)</i>	Whilst primarily aimed at the construction of pipelines, these guidelines are applicable for similar 'strip' or 'linear' construction projects including the construction of cable conduits. The appendix provides specific guidance on the application of best practice erosion and sediment control to the construction of land-based pipelines, and pipeline crossings of waterways. Its purpose is to describe the various temporary drainage, erosion and sediment control measures that are available for use during the construction of land-based pipelines, and where possible, outline the circumstances in which their use is likely to be warranted.	Adopting the methodology and mitigation presented in this guideline will reduce the risks and impacts associated with erosion and sedimentation during construction and decommissioning works.
<i>EPA Victoria Publication 1834: Civil Construction, Building and Demolition Guide. (2023)</i>	This guide covers a broad range of environmental issues associated with land development, construction and decommissioning activities and outlines the recommended and mandatory risk management measures.	Adopting the management framework and mitigation measures presented in these guidelines will reduce the risks of environmental impacts during construction and decommissioning works.
<i>EPA Victoria Publication 1896: Liquid storage and handling guidelines. (2018)</i>	This guide outlines the principles for preventing harm to the environment and human health when storing and handling liquid substances. This guide refers to bulk storage as well as smaller containers or packaged storage of liquid substances, and to liquids that are considered raw materials, product or waste.	Compliance with this guide will reduce the likelihood of pollution caused by the release liquids.
<i>EPA Victoria Publication 1896: Working within or adjacent to waterways. (2020)</i>	This guide highlights the risks of waterway contamination and provides guidance on how to eliminate or reduce the risk of harm from erosion, sediment and dust when working in or adjacent to waterways.	Adopting the principles presented in these guidelines will reduce the risk of waterway pollution when working in and around waterways.
<i>Flood Guidelines: Guidelines for development in flood prone areas (2020)</i>	These guidelines are aimed at property owners, developers, designers or builders seeking development approvals in the West Gippsland region. The guide promotes safe and appropriate developments in flood prone areas and specifies flooding	Following the guidelines and criteria set out in this document will ensure the project does not change existing characteristics or flood risk.

Document title	Summary	Relevance to the project
	objectives around safety, access, flood damage, flood flow and storage, floodplain and waterway condition, and water quality.	
<i>Code of Practice: The storage and handling of dangerous goods. (2022)</i>	The code of practice provides practical guidance on how to comply with the obligations of Victoria's occupational health and safety legislation for the safe storage and handling of dangerous goods.	Compliance with the code of practice will reduce the likelihood of pollution caused by the release of dangerous goods.

4.2 General environmental duty

In Victoria, the EP Act came into effect in 2021 and is designed to prevent harm to human health and the environment from pollution and waste. At the centre of the EP Act is the general environmental duty (GED).

The GED requires that:

any person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.

The GED applies at all times, during construction and operation of the project, for any activities posing a risk of harm to human health and the environment. Meeting regulatory requirements does not mean that the GED has been met.

The following sections of the EP Act apply to the GED:

- Section 25(1) of the EP Act states that a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution (including noise, which includes sound and vibration) must minimise those risks so far as reasonable and practicable.
- Section 6 of the EP Act states that minimising risks of harm to human health and the environment requires the duty holder to eliminate risks of harm to human health and the environment so far as reasonably practicable and, if it is not reasonably practicable to eliminate those risks, then reduce those risks as far as reasonably practicable.
- Section 6(2) of the EP Act states factors to give regard to when determining what is reasonably practicable in relation to the minimising of risks to harm to human health and the environment.

4.3 Reasonably practicable

EPA Victoria Publication 1856 Reasonably Practicable provides guidance as to the factors to consider when defining proportionate controls to minimise harm, as follows:

- Eliminate first: Can you eliminate the risk?
- Likelihood: What's the chance that harm would occur?
- Degree (consequence): How severe could the harm be on human health or the environment?
- Your knowledge about the risks: What do you know, or what can you find out, about the risks your activities pose?
- Availability and suitability: What technology, processes or equipment are available to control the risk? What controls are suitable for use in your circumstances?
- Cost: How much does the control cost to put in place compared to how effective it would be in reducing the risk?

The items above have been considered when assessing the suitability of mitigation measures for the project.

4.4 Assessment criteria

The assessment criteria relevant to this surface water assessment are outlined below.

4.4.1 Water quality

Runoff from the proposed construction works, operational phase and decommissioning activities will aim to meet the water quality indicators and objectives for the downstream receiving waterways, as defined in the ERS (2021).

The ERS (2021) outlines the water quality indicators and objectives for the Victorian Central Foothills and Coastal Plains, including the South Gippsland River basin. These are presented in Table 4-2.

Table 4-2 Water quality indicator and objectives for the receiving waterways as defined in the ERS (2021).

Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Dissolved Oxygen (% saturation)		Turbidity (NTU)	Electrical Conductivity @25°C (µS/cm)	pH (pH units)		Toxicants (Water)
		25th Percentile	Maximum			25th Percentile	75th Percentile	
75 th Percentile	75th Percentile	25th Percentile	Maximum	75th Percentile	75th Percentile	25th Percentile	75th Percentile	% Protection
≤55	≤1,100	≥75	130	≤25	≤250	≥6.7	≤7.7	95

4.4.2 Flood risk

The proposed construction works, operational and decommissioning activities should be assessed for conformance with the following guidelines:

- Managing the Floodplain: A guide to best practice in flood risk management in Australia (Australian Emergency Management Handbook Series - Handbook 7).
- Technical Flood Risk Management Guideline: Flood Hazard. (Australian Institute for Disaster Resilience Guideline 7-3).
- Flood Guidelines: Guidelines for Development in Flood Prone Areas (WGCMA, 2020)

5.0 Consultation and engagement

Star of the South has undertaken extensive engagement with a broad range of stakeholders and communities throughout the project's development phase and preparation of the EIS/EES to communicate project information; obtain, understand and discuss feedback; and identify potential issues and opportunities for consideration in the EIS/EES. A summary of this engagement is documented in Appendix III: EIS/EES Consultation Report.

Consultation specific to 'surface water' has also been undertaken with identified stakeholders to inform this report. A summary of this engagement is provided below.

Engagement activities

Key activities undertaken between 2019 and 2025 to engage with identified stakeholders include:

- Direct engagement with landholders along the project's proposed transmission route; including phone calls, emails and meetings
- Discussions with stakeholders and community members through meetings, phone calls, emails or visits to the Gippsland office
- Sharing of information via the project's website, social media and monthly e-news
- Fact sheet containing information about the project's onshore site investigations
- Presence at community events and pop-up stalls across Gippsland
- Community information sessions.

Stakeholders

Key stakeholders identified and engaged on this report include:

- General community
- Landholders along the project's proposed transmission route
- Wellington Shire Council
- West Gippsland Catchment Management Authority

Table 5-1 lists relevant issues raised by stakeholders and how feedback on these issues have been applied to the assessment of impacts on surface water.

Table 5-1 Summary of consultation issues raised relevant to surface water

Stakeholder/partner and type of response	Issues raised	Response to issues raised and/or where considered within this report or associated appendices
General community	Potential construction impacts to waterways and wetlands, including Corner Inlet and Bruthen Creek.	This surface water assessment identified the potential impacts and risks of construction, operation and decommissioning works on surface water quality and flow regimes in Sections 9.0, 10.0 and 11.0. A broad range of mitigation and control measures have been developed to manage these risks and mitigate the identified impacts.
	Potential for construction to interfere with flow into water courses and local dams.	
West Gippsland Catchment Management Authority	Potential for open trenches across waterways to require rehabilitation.	The surface water assessment team met with the WGCMA to discuss waterway crossing methodology, flood risks and regulatory requirements associated with the proposed works. The feedback provided by
	Development in areas that are susceptible to flooding and compliance with requirements including setbacks from	

Stakeholder/partner and type of response	Issues raised	Response to issues raised and/or where considered within this report or associated appendices
	waterways and elevation of infrastructure above predicted flood levels.	the WGCMA was directly applied into the assessment and subsequent reporting.
	Potential impacts of flooding or changed flood characteristics.	

6.0 Methodology

As context to the assessment approach, the Star of the South Offshore Wind Farm is a large project that covers a wide geographic area and has the potential for significant influence across Commonwealth waters and Victorian coastal waters, the state of Victoria and in particular the central Gippsland region. Accordingly, the impacts (both positive and negative) of the project are assessed in terms of their materiality at the scale of Commonwealth waters and Victorian coastal waters, the state of Victoria and the central Gippsland region.

6.1 Overview of assessment framework

This section describes the framework used to assess potential environmental impacts and risks associated with the proposed project.

The assessment has been guided by an evaluation framework that comprises applicable legislation, policy, guidelines and standards, the Commonwealth EIS guidelines and the EES scoping requirements and study-specific assessment criteria. The approach generally aligns with guidance issued by the Australian National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for the Environmental Assessment of Major Offshore Infrastructure (NOPSEMA, 2024) and the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (OPGGs Regulations).

An overview of the assessment framework is presented in Figure 6-1.

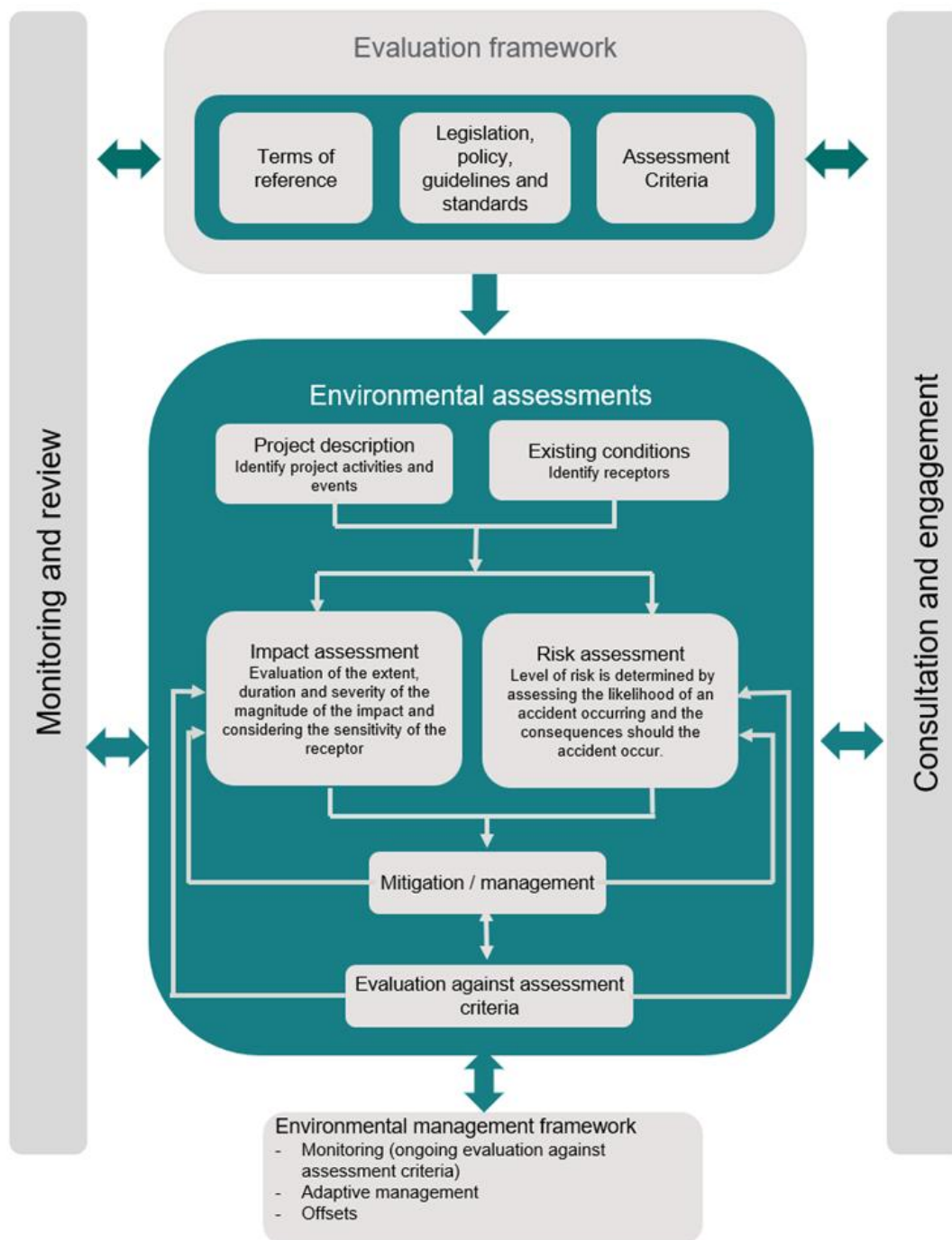


Figure 6-1 Overview of assessment framework

The environmental assessment in relation to SOTS was undertaken according to the following steps:

- **Existing conditions:** Characterisation of existing (baseline) environmental conditions and identification of sensitive assets, values and uses that may be affected by construction, operation and decommissioning of the project.
- **Project description:** Review of the key project components and proposed construction, operation and decommissioning activities to identify potential project interactions with sensitive receptors (i.e. events). This includes identification of the maximum design scenario for the purposes of impact and risk assessment, taking into account the parameter range within the project design envelope as outlined in Chapter 4 – Project description of the EIS for the whole of project assessment across the Commonwealth jurisdiction and Chapter 4 – Victorian

works project description of the EES for the Victorian jurisdiction and selection of the parameter value with potentially greatest impact or risk.

- **Impact assessment:** Assessment of consequences based on the predicted magnitude of the impacts and the sensitivity of potentially affected receptors, taking into account proposed mitigation measures and their likely effectiveness. The impact assessment methodology is described in Section 6.4.
- **Risk assessment:** Assessment of likelihood and consequences of accidents (i.e. events that are not certain to occur). The risk assessment methodology is described in Section 6.5.
- **Avoid, mitigate and manage:** Identification of mitigation measures to avoid, minimise and manage impacts or risks and to address the GED as required under the EP Act is described in Section 4.4.
- **Evaluation against assessment criteria:** Evaluation of predicted residual impacts or risks against assessment criteria set out in Section 4.4. If the impact or risk assessment indicates that the criteria are not met, then changes to the project design are made or further mitigation measures are introduced. Residual impacts and risks are those that remain following the implementation of all mitigation measures committed to by the project, taking into account their expected effectiveness.
- **Monitoring and review:** Continual checking for changes to legislation, policy, guidelines and standards and the project description and subsequent refinement and updating of assessments as required.
- **Consultation and engagement:** Consideration of feedback from community, stakeholders and regulators to ensure that concerns and expectations are met. Stakeholder consultation and engagement will continue throughout the life of the project.

For impacts (expected events) the likelihood of the event is considered to be certain, therefore only an evaluation of consequence is required. For risks (accidental events) both likelihood and consequences need to be considered. The evaluation of consequences for both impacts and risks takes into consideration the nature and scale of the effects, the predicted extent, severity and duration, the likely effectiveness of mitigation measures to reduce consequences as well as the sensitivity of the receptor.

An example, 'project activity' is construction piling, and in this case the 'event' is underwater noise, and the 'consequence' would be injury or disturbance to marine mammals. Underwater noise is an expected event as the generation of underwater noise is a planned part of construction that cannot be avoided as part of the activity. Underwater noise would be detectable within and beyond the activity area. It is expected that marine fauna would encounter the underwater noise due to their known presence in the activity area. An example of an accidental event is where the 'project activity' is vessel presence, and in this case the 'event' is 'collision with marine fauna' and the 'consequence' would be injury or disturbance to marine mammals. This event unlikely to occur but is still possible.

6.2 Study area

The surface water assessment investigated the potential impacts of the onshore cable alignment between the proposed shore crossing site at Reeves Beach and the proposed VicGrid connection hub at Giffard. This study area did not include the marine environment, the coastal dunes system or the McLoughlins Beach-Seaspray Coastal Reserve.

The study area was broken down into two distinct project areas for assessment. These were defined as, Reeves Beach coastal shore crossing site and Reeves Beach to Giffard West. The study area of Reeves Beach to Giffard West features three route options that each provides an alternative alignment between Giffard Road and the future VicGrid connection hub. All of these alternative alignments cross agricultural land that feature minor drainage pathways.

6.3 Methods to determine the existing environment

A comprehensive literature review and an extensive field program were undertaken to identify relevant receptor groups to inform the environmental impact assessment of the Project on surface water, including:

- A desktop assessment to identify the key waterways that will interface with the proposed alignment.

- A desktop review of regional environmental and water related policy frameworks and action plans.
- A desktop assessment of hydrological and meteorological datasets.
- A desktop review of existing flood risk including assessment of planning related flood controls.
- A desktop assessment of predicted sea level rise over the life of the project and preparation of a GIS model to illustrate potential flood impact across the proposed shore crossing location.
- A desktop assessment of water quality data.
- A desktop review of regional geomorphological data and published literature.
- Field assessments of the key waterways to confirm desktop findings relating to hydrological behaviour, channel geometry, receiving environments and sensitive receptors.
- Consultation with the WGCMA to confirm existing flood risks, policy direction and regulatory requirements.

6.4 Impact assessment method

An impact is where a project activity or activities in any of the project phases (construction, operation or decommissioning) results in a change in the existing environment.

The impact assessment has been based on a maximum design scenario which enables a realistic and conservative approach to considering possible impacts that could occur due to the construction, operation or decommissioning of the project. Impacts can be positive or negative, direct or indirect. Impacts are described following the application of mitigation measures (residual impact).

Whether an impact results in a consequence to environmental receptors depends on the sensitivity of receptors and the magnitude of the impact.

- **Sensitivity:** the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery
- **Magnitude:** the severity, extent and duration of an impact.

As environmental assets, values and uses are interconnected, sometimes an impact will give rise to a follow-on (secondary or indirect) impact which has also been considered as part of the assessment.

The impact assessments have involved identifying the magnitude of changes to the environment, positive or negative, that the project may have on the existing conditions. The method used has been specific to each individual technical study in accordance with relevant guidelines and standards. The technical reports each contain a section that describes their impact assessment method in detail, in particular the modelling or analysis that has been undertaken to predict the changes that may occur due to the implementation of the project.

The factors that have been considered when assessing the consequences of the project are as follows:

- Severity, extent, and duration
- Sensitivity of the affected receptors
- Assessment criteria
- The principles of ecologically sustainable development as defined in the Ministerial guidelines for assessment of environmental effects (DTP, 2023) and in section 3A of the EPBC Act.
- Stakeholder input and feedback
- The likely effectiveness of measures to avoid, minimise and manage impacts
- Assumptions and uncertainties associated with the assessment

The impact assessments have considered the potential for combined impacts generated by the project on the one receptor but resulting from different actions. For example, construction works can increase the risk of sediment loss through open trenching across waterways, as well as through land clearance

associated with early works and establishment of work sites. The approach to cumulative impact assessment is outlined in Section 6.8 below.

For the purposes of the impact assessment the project description defined a project design envelope (PDE). The PDE comprises ranges for certain design parameters (for example, an upper and lower limit for wind turbine generator heights). This allows for flexibility in the eventual design for the project that is necessary within an evolving industry where technology is rapidly changing. The impact and risk assessment has been based on a Maximum Design Scenario (MDS) which enables a realistic and conservative approach to considering possible impacts and risks that could occur due to the construction, operation or decommissioning of the project. The MDS consists of a defined set of project parameters from within the PDE that represent the greatest potential impact to an identified sensitive receptor or receptor group. As the MDS is defined based on specific impacts, the MDS assessed will vary between the impacts and risks assessed. See Section 9.0, Section 10.0 and Section 11.0 for the MDS used for this assessment.

The assessment was carried out as a qualitative desktop assessment and used publicly available data and information to determine the significance of all waterways that would be crossed by the transmission alignment. The findings of this desktop assessment helped screen minor drainage pathways from the existing conditions assessment and identified key waterways that required further investigations (e.g. a site visit to ground truth assumptions).

This assessment also took a qualitative approach in determining the potential water quality and hydrological impacts that the project could have on any key receptor, including Jack Smith Lake, Freshwater Swamp and the Corner Inlet Ramsar site.

Water quality modelling has not been carried out during this EES because the proposed construction activities are mostly short term and located on minor, ephemeral waterways. These activities will be conducted in a manner that avoids direct waterway contact and manages surface water runoff. This will also include a water quality monitoring program.

Flood modelling was also not considered necessary for this stage of assessment due to the nature of the project (e.g. underground transmission alignment with limited above ground infrastructure). However, flood modelling and hydraulic assessments may be required to support future design stages, such as construction site layout or for designing drainage culvert crossings.

The following considerations were used to determine the impacts of construction, operation and decommissioning of the project on surface water assets, values and uses to be protected:

- Potential for long term changes to the aquatic habitat of the receiving waterways, including Bruthen Creek Estuary, Jack Smith Lake Wildlife Reserve and the Corner Inlet Ramsar Site.
- The 1% AEP flood extent was considered the likely area of impact. All references to the 1% AEP flood extent relate to the predicted flood conditions at the time of that project phase (i.e. construction, operation or decommissioning).
- Sea level rise was based on the IPCC's Representative Concentration Pathway (RCP) 8.5 scenario.
- Cumulative impacts were considered in the assessment of sea level rise on the Reeves Beach shore crossing site. This included the coincidence of storm surge with the highest astronomical tide for existing and future climate scenarios.
- The mitigation measures presented in this assessment are accepted standard industry controls developed to achieve compliance with the relevant legislation. Full implementation of these controls would mean compliance with the required legislation and mitigation of the risks.

6.4.1 Assigning a sensitivity level

To assign a sensitivity level, the existing environment is described and 'receptors' are identified. For example, a receptor in the marine environment could include whales and on land, residential areas or native vegetation.

A sensitivity level of high, medium or low is assigned to the receptors based on specific criteria developed by the specialist undertaking the assessment.

A sensitivity level is assigned to the receptors that have been identified in the baseline characterisation presented in Section 7.0. The sensitivity of each of the receptors has been determined to be either high, medium or low, according to the descriptions relevant to surface water presented in Table 6-1.

Assigning receptor sensitivity includes consideration of the following factors:

- Adaptability to changes in hydrology and surface water quality.
- Tolerance to changes in hydrology and surface water quality.
- Recoverability from impacts caused by changes in hydrology and surface water quality.
- Protection status or significance of receptors.

Table 6-1 Receptor Sensitivity

Sensitivity (to impact)	Description
High	Limited ability to adapt to changes in hydrology and surface water quality, therefore habitat and communities are affected. Limited tolerance to changes in hydrology and surface water quality, therefore habitat and communities are affected. Limited ability for habitat and communities to recover from impacts caused by changes in hydrology and surface water quality. Surface waters have direct or indirect connection to receptors of national or state significance.
Medium	Some ability to adapt to changes in hydrology and surface water quality, therefore habitat and communities are affected but with limited impacts. Some tolerance to changes in hydrology and surface water quality, therefore habitat and communities are affected but with limited impacts. Some ability for habitat and communities to recover from impacts caused by changes in hydrology and surface water quality. Surface waters have direct or indirect connection to receptors of regional or local significance.
Low	Ability to adapt to changes in hydrology and surface water quality, therefore habitat and communities are not affected. Tolerance to changes in hydrology and surface water quality, therefore habitat and communities are not affected. Ability for habitat and communities to recover from impacts caused by changes in hydrology and surface water quality. Surface waters have direct or indirect connection to receptors of low protection status.

6.4.2 Assigning a magnitude level

The magnitude of the impact on the environment includes consideration of the following factors:

- Extent – site, local, regional, or widespread.
- Duration – short, medium or long term (also considering frequency and permanence).
- Severity – degree of change from existing condition.

The magnitude of a specific impact is based on clear criteria determined by the specialist undertaking the assessment and are defined relevant to surface water in Table 6-2. Magnitude is assigned for the maximum credible consequence with consideration of mitigation and management measures according to the levels presented in Table 6-3

Table 6-2 Magnitude criteria

Terms		Description
Extent	Localised	Within 100 metres of the Onshore Project Area
	Medium scale	Within one kilometre of the Onshore Project Area
	Large scale	Within the local catchment
	Regional	Drainage basin scale
Duration	Short-term	Days to weeks
	Medium-term	Less than 5 years
	Long-term	Greater than 5 years
Severity	Unlikely to be detectable	Changes are within natural variability
	Reversible	Changes are reversible once the activity has ceased
	Permanent	Irreversible change, substantial change to the value

Table 6-3 Magnitude description

Magnitude	Description
Negligible	The impact is within the Onshore Project Area, short-term, and changes to the receptor are unlikely to be detectable above natural conditions.
Low	The impact is within 100 metres of the Onshore Project Area, is short-term, and results in reversible changes to the receptor once the activity has ceased.
Medium	The impact is within one kilometre of the Onshore Project Area, is short-term, and results in reversible changes to the receptor once the activity has ceased.
High	The impact extends the local catchment, is short or medium term, and results in reversible changes to the receptor once the activity has ceased.
Very high	The impact extends throughout the drainage basin, is short or medium term, and results in substantial and possibly irreversible change (permanent) to the receptor.

6.4.3 Assigning a consequence level

Consequence is the potential outcome of an event affecting a receptor. It is determined by combining magnitude of the impact and sensitivity of the receptor. The consequence level is assigned based on the receptor sensitivity level and magnitude level using the matrix in Table 6-4.

Consequences are assigned based on the maximum credible impact for each pathway. Where uncertainty exists, a conservative approach to assessing consequence is adopted.

Table 6-4 Consequence level matrix

Magnitude	Sensitivity		
	Low	Medium	High
Negligible	Negligible (E)	Negligible (E)	Minor (D)
Low	Negligible (E)	Minor (D)	Moderate (C)
Medium	Minor (D)	Moderate (C)	Major (B)

Magnitude	Sensitivity		
	Low	Medium	High
High	Moderate (C)	Major (B)	Severe (A)
Very high	Major (B)	Severe (A)	Severe (A)

6.4.4 Residual impacts

While there are clear steps in the assessment process, it may not always follow a linear progression. Typically, assessment requires multiple iterations of impact evaluation considering the assessment criteria and application of mitigation measures as the technical studies progress and additional information becomes available. The completed impact assessments are based on the final mitigation measures that will be implemented, and therefore describe the residual impacts. The residual impacts constitute the predicted consequences following the implementation of the mitigation measures and also taking into account the expected effectiveness of these measures.

6.5 Risk assessment method

A risk is where a project activity or activities could result in an unexpected (accidental) event in any of the project phases (construction, operation or decommissioning) that causes a change to the existing environment.

The level of risk is determined by combining the likelihood of an accident occurring and the consequences should the accident occur. The assignment of consequence level follows the process outlined above.

The following steps were undertaken to identify, analyse and evaluate risks:

- Develop a risk matrix based on the likelihood of an accident occurring and the consequences, should the accident occur
- Identify controls and requirements to mitigate identified risks
- Assign likelihood and consequence ratings for each risk to determine risk ratings considering design, proposed activities and mitigation.

6.5.1 Assigning a likelihood level

Likelihood is the probability of an unexpected (accidental) event occurring. The likelihood criteria range from 'rare' where the event may occur only in exceptional circumstances to 'almost certain' where the event is expected to occur in most circumstances.

Likelihoods are assigned with consideration of mitigation and management measures according to the levels presented in Table 6-5.

Table 6-5 Guide to likelihood levels

Level	Description
Rare	The event may occur only in exceptional circumstances
Unlikely	The event could occur but is not expected
Possible	The event could occur
Likely	The event will probably occur in most circumstances
Almost Certain	The event is expected to occur in most circumstances

6.5.2 Risk matrix

Risk is defined as a combination of the likelihood of an event occurring (using Table 6-5) and the consequence of that event occurring (Table 6-4).

A risk rating is then determined by these factors using the risk matrix, presented in Table 6-6.

The level of detail of the assessment undertaken for each risk pathway is proportionate to the identified level of risk (i.e. risk ranking).

Table 6-6 Risk matrix

Likelihood rating	Consequence				
	Negligible	Minor	Moderate	Major	Severe
Rare	Very low	Very low	Low	Medium	Medium
Unlikely	Very low	Low	Low	Medium	High
Possible	Low	Low	Medium	High	High
Likely	Low	Medium	Medium	High	Very high
Almost certain	Low	Medium	High	Very high	Very high

6.6 Avoidance and minimisation through design

The impact assessment process is iterative, and the design of the transmission alignment has been informed by earlier versions of environmental assessments in order to avoid and minimise potential impacts, including during:

- Selection of one onshore transmission corridor
- Formation of the onshore transmission corridor route
- Modification to the onshore transmission corridor route

Relevant to this topic, the following measures have been adopted in relation to the design, construction and operation of the project to avoid and minimise impacts:

- It is intended that trenchless crossings will be used to avoid key values considering a range of sensitivities such as ecology, aboriginal cultural heritage and surface water. The project has committed to trenchless crossings beneath the waterway of the shore crossing site at Reeves Beach and coastal dune system. This will avoid direct impacts to this waterway and the connected receptors of the Bruthen Creek estuary and Corner Inlet Ramsar site.
- Changes to hydrological processes will be minimised through design optimisation that avoids and minimises the siting of infrastructure on the floodplain.

6.7 Avoidance, mitigation, and management

Once avoidance and minimisation measures have been exhausted, the next step is management of the residual impacts and risks. In the case of risks, the mitigation measures can be applied prior to the event occurring and/or after the event. The residual impacts and risks are evaluated against the assessment criteria to ensure impacts and risk are of an acceptable level.

The assessments describe the impacts and risks with all the mitigation measures implemented i.e. with both initial and final mitigations. Initial mitigation measures are defined as the standard suite of mitigation measures that will be implemented by the project such as measures required under legislation, national or international standards and standard measures implemented on similar projects. Final mitigation measures are any additional mitigation measures adopted to address the findings of impact/risk assessments to further reduce impacts and risks to acceptable levels. The completed impact and risk registers for this technical report are presented in Appendix A and show the reduction in impact/ risk that occurs between the initial rating and final rating due to the application of final mitigation measures.

6.8 Cumulative impact assessment

Cumulative impacts arise when the effects of a single project on a single receptor are considered alongside the effect of other projects on the same receptor. The project has considered the potential for

cumulative impacts associated with other proposed projects. It is noted that projects that are operational are considered as part of the baseline environment, and the cumulative impact assessment focuses on proposed or future actions.

A staged approach to cumulative impact assessment has been adopted. This approach is split into four stages:

- Stage 1 Identifying potentially cumulative projects or actions.
- Stage 2 Shortlisting identified projects or actions.
- Stage 3 Gathering information.
- Stage 4 Assessment.

This approach is focused on the assessment of potential adverse cumulative effects on receptors or similar groups of receptors, as relevant. The availability of information necessary to conduct a cumulative impact assessment depends on the status of the proposed project or action within the planning and approval regulatory steps. Therefore, a level of certainty reflecting the availability of detail and information necessary for the assessment is assigned to each proposal:

- Tier 1 High certainty – Project planning application/EIS/EES has been submitted to regulators, or the project has been approved, or the project is under construction.
- Tier 2 Medium certainty – Project referrals have been submitted to the regulators.
- Tier 3 Low certainty – Project is in the proposal stage and little information is publicly available.

The cumulative impact assessment has followed a staged approach (as shown in Figure 6-2) and described in detail in EIS Chapter 6 - Assessment Framework and EES Chapter 6 - Assessment Framework).

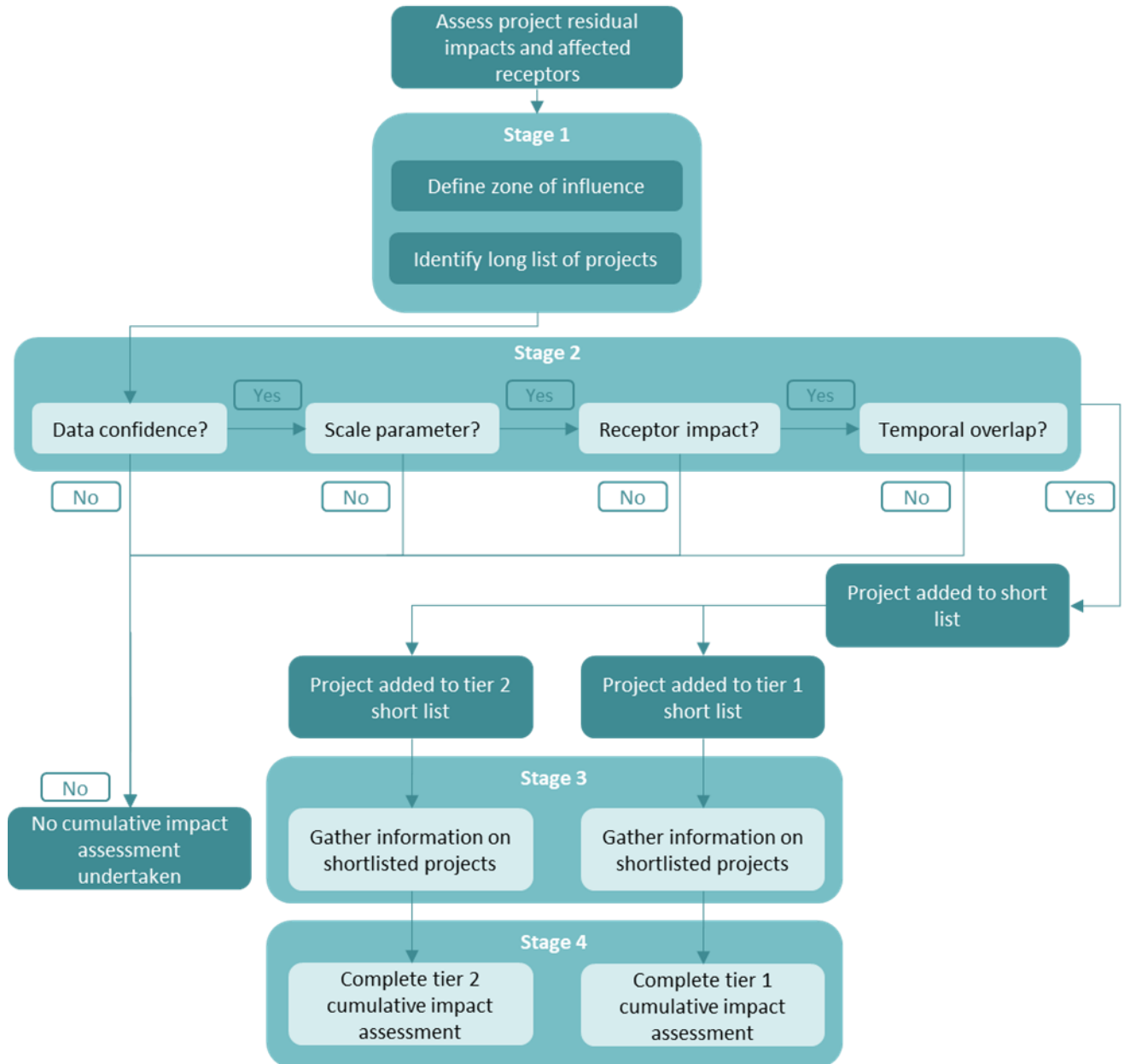


Figure 6-2 Cumulative impact assessment process

6.9 Limitations, uncertainties and assumptions

The following limitations, uncertainties and assumptions apply to this assessment:

- This assessment has been completed as a desktop study and supported by a field visit to visually inspect the key waterways at the proposed crossing locations.
- Surface water impacts were based on the Star of the South project area at the time of writing the report.
- No additional modelling, monitoring, sample collection or data collection was undertaken for the purpose of this assessment.
- Surface water data was not available for the waterways in the study area. These data gaps included:
 - Water quality data
 - Flow data
 - Flood data
 - Flood overlays
 - Topographic data.

6.10 Linkages to other technical reports

This report has interdependencies with Technical report G: Onshore ecology in relation to the assessment of impacts associated with potential changes to water quality impacting aquatic species and other environments.

There are also interdependencies with Technical report H: Groundwater, to assess the potential for impacts to groundwater dependent ecosystems and mitigations including the development of an acid sulfate soils management plan Technical report J: Soil and Waste for potential interactions with acid sulfate soils and contamination, and Technical Report X: Land Use Planning Impact Assessment for potential works within LSIO or FO.

The surface water specialists undertaking this assessment worked collaboratively to evaluate these potential impacts and design suitable mitigation measures to be adopted by the project.

7.0 Existing environment

The onshore transmission cable alignment would travel across West Gippsland, connecting the offshore wind farm to the proposed VicGrid electricity transmission network.

The alignment will interface with multiple named and unnamed waterways between the Reeves Beach shore crossing site and the proposed VicGrid connection hub at Giffard. The following existing conditions assessment characterises this hydrological context and considers the alignment over two distinct phases. These are the Reeves Beach coastal shore crossing site and the Reeves Beach to Giffard West alignment.

7.1 Reeves Beach coastal shore crossing site

The offshore transmission export cables will make landfall through a trenchless shore crossing, close to Reeves Beach, at the southern end of Ninety Mile Beach (see Figure 7-1).

The area around Reeves Beach is largely undeveloped and consists of low-lying agricultural land that is protected from the ocean by a linear, vegetated coastal dune system. This coastal dune system is approximately 220 metres wide at Reeves Beach and forms part of the McLoughlins Beach-Seaspray Coastal Reserve. Behind the coastal reserve, agricultural land occupies low lying coastal plains that extend several kilometres inland to the South Gippsland Highway and foothills of the Eastern Uplands.

The shore crossing site is recognised for its important, yet fragmented habitat. These habitat areas include the Estuarine Wetlands and Coast Banksia Woodland of Ninety Mile Beach.

The importance of this landscape is recognised by the WGCMA as the foundation for environmental, social, cultural and economic health of the region. Subsequently, there are many collaborative objectives and management measures that aim to protect and improve the environment of the coastal environment and adjacent coastal plains. Examples of these measures include minimising disturbance of acid sulfate soils in the landscape, minimising flood damage to the floodplain and improving the environmental condition of waterways, estuaries and wetlands.

To the south of the site lies the internationally significant Nooramunga Marine and Coastal Park and Corner Inlet Ramsar Site. This extensive natural area features intertidal mudflats, saltmarsh, seagrass meadows and mangroves. The parks are recognised for their important bird habitat and protected under the Ramsar Convention on Wetlands.



Figure 7-1 The proposed shore crossing site at Reeves Beach

7.1.1 Waterways

A key feature of the proposed Reeves Beach site location is a small unnamed waterway (UFI:42824679) located approximately 250 metres inland from the coastal reserve boundary, as shown in Figure 7-2.

The waterway forms a connection between Freshwater Swamp, approximately 1.2 kilometres north of the site, and the Corner Inlet Ramsar Site located approximately three kilometres to the south of the site at the mouth of Bruthen Creek estuary.



Figure 7-2 Unnamed waterway (UFI:42824679) located approximately 250 metres inland from the coastal reserve boundary, facing north-east, close to Reeves Beach Road (Photo taken 14/11/2023)

The waterway is fed by runoff from the adjacent paddocks and Freshwater Swamp. Aerial imagery suggests the channel bed is seasonally dry, particularly in the northern reaches toward Freshwater Swamp. This was evident during the site visit of the 12th December 2024 (see Figure 7-3).

The central reaches of the waterway appear to hold water for extended periods (see Figure 7-4) and anecdotal information provided at the time of the site visit indicated that water levels through the central and lower reaches of the waterway were not sensitive to rainfall events.

The mechanism for water retention through the central and lower reaches of the waterway is likely to be the tail water effect caused by the fence and culvert crossing beneath Reeves Beach Road. However, anecdotal information collected during the site visit of the 12th December 2024 also suggested that water levels could be influenced by local groundwater conditions.



Figure 7-3 Dry channel bed (UFI:42824679) at the northern site boundary, facing south-west (Photo taken 12/12/2024)



Figure 7-4 Standing water through the central reaches of the waterway (UFI:42824679), facing south-west (Photo taken 12/12/2024)

The unnamed waterway discharges from the site beneath Reeves Beach Road. At this location, the waterway is crossed by a wooden panel fence that potentially causes water to pond on the upstream side of Reeves Beach Road. This was evidenced during the field visit on 14 July 2021 (see Figure 7-5).



Figure 7-5 Wooden panel fence on the unnamed waterway (UFI:42824679) adjacent to Reeves Beach Road (looking south) (Photo taken 14/07/2021)

South of the wooden fence, the waterway enters a small wetland before discharging from the site through two 375 millimetre (mm) diameter reinforced concrete pipe (RCP) culverts beneath Reeves Beach Road (see Figure 7-6).



Figure 7-6 Piped culverts crossing under Reeves Beach Road (looking north) (Photo taken 14/07/2021)

South of Reeves Beach Road, the waterway enters an area of extensive estuarine saltmarsh close to its confluence with Bruthen Creek, two kilometres downstream of the site.

In addition to the unnamed waterway, the site is crossed by a small, constructed drainage channel (UFI:18401649) that discharges into the unnamed waterway on the south-western side of the agricultural shed. Features and level survey data show this drainage channel is graded towards the waterway and probably acts as an overflow for the farm dams that are situated approximately one kilometre to the west of the site on the elevated plain. This drainage channel is shown in Figure 7-7.



Figure 7-7 Constructed drainage channel (UFI: 18401649) connecting to the unnamed waterway (UFI:42824679) at the shore crossing site (Photo taken 12/12/2024).

7.1.2 Wetlands

Several mapped wetland systems are proximal to the shore crossing location. Corner Inlet is located approximately three kilometres downstream of the shore crossing site. Covering over 50,000 ha, it contains a wide array of wetland types, primarily comprising intertidal mudflats and marshes in addition to subtidal aquatic beds and shallow marine environments. This system is considered an internationally important wetland under the Ramsar convention, as it provides largely unmodified and representative examples of several wetland types, and plays a critical role in habitat provision and hydrologic processes (Ramsar Sites Information Service, 2020).

Freshwater swamp (DEECA Wetland ID 83479) is located approximately 2.4 kilometres upstream of the shore crossing, and 1.3 kilometres downstream of the project alignment on unnamed waterway UFI:42806331. Covering 13.5 ha, it is listed by DEECA (DEECA, 2021) as a mesosaline seasonal or episodic palustrine system. Immediately west (at a distance of 20 m) sits an additional unnamed wetland (DEECA Wetland ID 83502). This wetland is an episodically inundated freshwater system with and covers 3.8 ha.

There is also an additional small (2.6 ha) wetland (DEECA Wetland ID 83488) that is intersected on its western edge by the project alignment, close to the shore crossing. Limited information is available on this wetland, aside from it being an artificial ephemeral wetland (DEECA, 2021). Inspection of aerial imagery indicate that this wetland is most likely a farm dam.

Immediately south of Reeves Beach Road, there is a large coastal saltmarsh (ID 83478) that runs parallel with the coastal dune system and forms a natural habitat connection between the site's

discharge point at Reeves Beach Road and the Corner Inlet and Bruthen Creek estuary sites beyond. (Figure 7-8).



Figure 7-8 Unnamed waterway (UFI 42824679) looking south-west from Reeves Beach Road towards the coastal saltmarsh and Bruthen Creek Estuary.

7.1.3 Flooding

There are no flood related planning controls such as Land Subject to Inundation Overlays (LSIO) or Floodway Overlays (FO) across the proposed shore crossing facility site.

Anecdotal information obtained in discussions during the site visit of 12th December 2024 indicated that flood events were rare for this waterway and flooding had not occurred there for many years. However, the floodplain of the unnamed waterway does cover the proposed shore crossing site and it is possible these low-lying paddocks could experience widespread inundation during major storm events or extreme storm tides. To this end, publicly available data from the West Gippsland Catchment Management authority (WGCMA) shows the predicted 1% AEP flood event to cover most of the proposed shore crossing site (WGCMA, 2025) (see Figure 7-9).



Figure 7-9 Estimated flood extent for a 1% AEP flood event at the shore crossing site (Source WGCMA Community Flood Portal, 2025)

The elevation of the proposed shore crossing drilling site and transition joint bay location typically ranges between 1.1 and 1.4 metres above Australian Height Datum (AHD) with some low-lying areas of just below 1.0 metre AHD. A review of available tide data for Port Welshpool and McLoughlin's Beach suggests the unnamed waterway of the shore crossing site is not influenced by astronomical tides under current climate conditions. However, the low-lying areas of the proposed shore crossing site create natural sag points that could be susceptible to waterlogging following prolonged rainfall (see Figure 7-10).



Figure 7-10 Waterlogging of the low-lying shore crossing site (Photo taken 09/04/21).

The wooden panel fence and culverts under Reeves Beach Road could also impede flows during storm events and increase the depth of floodwater across the site. These features may also be vulnerable to sedimentation and blockages caused by debris which could increase the depth of floodwater across the site.

As noted above, the waterway is considered to be unaffected by astronomical tides under typical flow conditions in the current climate. However, storm tides from Corner Inlet Ramsar Site and the Bruthen Creek estuary could cause widespread inundation over the site.

Storm tides occur when storm surges, a phenomenon caused by low atmospheric pressure, onshore winds and coastally trapped waves, coincide with high astronomical tides.

In 2009, the CSIRO investigated the effect of climate change on extreme sea levels along Victoria's coast. The report documented a 1% AEP storm tide estimation of 1.63 metre AHD at Port Welshpool for 2009 climatic conditions (McInnes, Macadam, & O'Grady, 2009).

The Intergovernmental Panel on Climate Change (IPCC) Synthesis Report of the sixth Assessment Report (IPCC, 2021) published likely mean sea level rise predictions of around 0.7 metre by 2100 for the south-eastern Australian coastline, under a high emissions scenario (Shared Socioeconomic Pathway (SSP) 8.5).

Additionally, the Victorian Environmental Assessment Council (VEAC) Marine Coastal Environment Report (VEAC, 2019) referenced sea level rise predictions of between 0.4 to 1.0 metres by 2100, under a high emissions scenario (AR5, Representative Concentration Pathway (RCP) 8.5). The report also documented sea surface temperatures estimation of between 1.9 and 3.8 degrees Celsius before 2090 which would result in more frequent, more intense storm surges.

Interpolation of the future sea level rise allowances (CoastAdapt, 2021), under a high emissions scenario, provided a sea level rise of 0.36 metres by the end of the project lifecycle in 2060 for the Gippsland coastline.

Based on this allowance, the 2060 1% AEP storm tide for Corner Inlet was estimated to be 1.99 metres AHD (Table 7-1).

Table 7-1 Port Welshpool 1% AEP Storm tide estimation for 2060

Scenario	1% Storm Surge Magnitude	Sea level rise allowance	Total 1% AEP Storm tide level
1% AEP storm tide estimation under current climatic conditions (McInnes, 2009)	0.72m	0m	1.63m AHD
1% AEP storm tide estimation for 2060 (RCP 8.5 SLR)	0.72m	0.36m	1.99m AHD

Corner Inlet, including the Bruthen Creek estuary, is directly connected to the waterway at the proposed shore crossing site. In these extreme events, it is likely that the shore crossing location will be inundated by water from the Bruthen Creek estuary. Figure 7-11 illustrates the extent of inundation for the estimated 1% AEP storm tide under current and future climate conditions. This was mapped using publicly available LiDAR contours and the 1% AEP storm tide level was projected across the surface for existing and future climates.

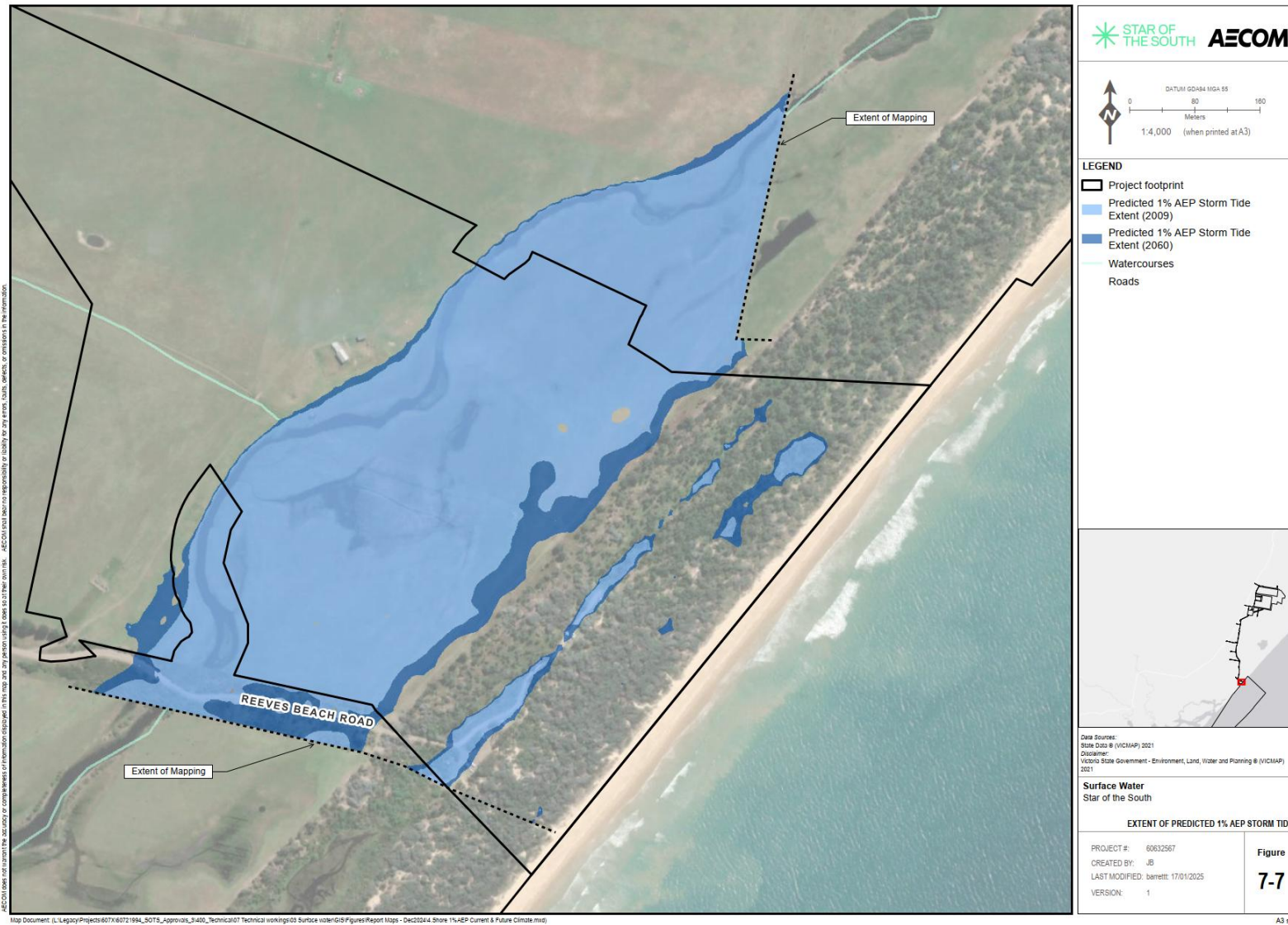


Figure 7-11 Extent of predicted 1% AEP storm tide for current and future climatic conditions

7.1.4 Water quality

Limited water quality data exists for the waterway by Reeves Beach, however, it is likely that water quality is influenced by both natural and anthropogenic processes.

The catchment north of Reeves Beach Road is mostly agricultural and consists of wide-open paddocks with little remnant, indigenous vegetation. The Victorian Government's Third Index of Stream Condition report (DEPI, 2010) identifies agricultural runoff as a key contributor to poor water quality in the South Gippsland Basin. These agricultural impacts can also be further exacerbated by landowners allowing livestock to access the waterway channels, which can increase nutrient loads and mobilise sediment. Evidence of livestock accessing the unnamed waterway was observed during each of the site visits.

South of Freshwater Swamp, the unnamed waterway is devoid of any natural, riparian vegetation and the presence of large meanders indicates the waterway is slowly responding to changes in flow and sediment load. These localised geomorphological changes can mobilise fine alluvial deposits which remain in suspension. The transport of fine suspended solids, downstream of Reeves Beach Road, was evident during the site visit on 14 July 2021 (see Figure 7-6).

As the waterway nears Reeves Beach Road, water quality may also be influenced by the neighbouring salt marsh, leading to brackish water immediately upstream of the estuary.

7.1.5 Geomorphology

The shore crossing site is a dynamic environment that is continually adapting to changes in sea levels, weather patterns and land use.

Historically, the Gippsland coast was shaped through a combination of Holocene submergence and the subsequent formation of sand spits, barriers and wetlands. However, contemporary land use has changed local catchment characteristics with implications on stream geomorphology at the proposed shore crossing site. Some of these changes include the removal of vegetation, leading to more catchment runoff, higher peak flows and more sediment entering the waterway.

Evidence of erosion and sedimentation is visible in the waterway through geomorphological features that include wide meanders with asymmetric channel geometry. The extent of old meanders can also be seen to the north-east side of the waterway where a short bank rises steeply from the floodplain, close to the existing sheds (see Figure 7-12). This bank is probably the remnant of a past shoreline, however, the steeper embankments adjacent to the outside of the meanders provides evidence of more recent fluvial erosion, as well as denoting the full width of the active meander belt.

In addition to these fluvial geomorphological features, the steeper embankments on the eastern side of the waterway are susceptible to erosion from livestock and rain. The impacts of these processes were visible during the site visit on 14 July 2021 (see Figure 7-12).



Figure 7-12 Localised erosion on top of the waterway embankment (Photo taken 14/07/2021)

Potential acid-sulfate soils have been identified in coastal lagoon deposits adjacent to the shore crossing location. However, further testing is required to characterise the exact nature and extent of potentially problematic soils in the region. Refer to Technical Report J: Soils and Waste for more details.

7.2 Reeves Beach to Giffard West

7.2.1 Climate

Rainfall varies across Gippsland and is typically higher in the Strzelecki ranges, south-western and south-eastern areas of the region. Average annual rainfall totals for these areas are typically around 1,000 to 1,400 millimetres a year making Gippsland the wettest region in Victoria.

The catchments that interface with proposed alignment experience significantly less rainfall due to the rain shadow effect of Wilson's Promontory and the Strzelecki ranges to the west. The closest active rain gauge, is located approximately 2 kilometres west of the proposed alignment at Darriman and provides a good example of this effect. The mean annual rainfall at Darriman is 665 millimetres a year which is less than half the mean annual rainfall of 1,441 millimetres experienced in Balook, located approximately 35 kilometres from the proposed alignment, close to Mount Tassie (see Table 7-2). These rain gauges are shown in Figure 7-13.

Table 7-2 Mean monthly and annual rainfall totals in mm for the Strzelecki Ranges and the South Gippsland Basin. Light green shading indicates drier months and dark green shading indicates wetter months. (Source: BOM 2024)

Station	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
085160	Darriman	48	41	53	46	55	57	52	54	56	60	67	62	665
085007	Balook	77	76	97	123	121	159	143	142	126	126	124	109	1441

These rain gauges indicate drier months occur between January and February (shown light green) for both rain gauges, and the wettest months occur between November and December at Darriman and between June and August at Balook (shown dark green).

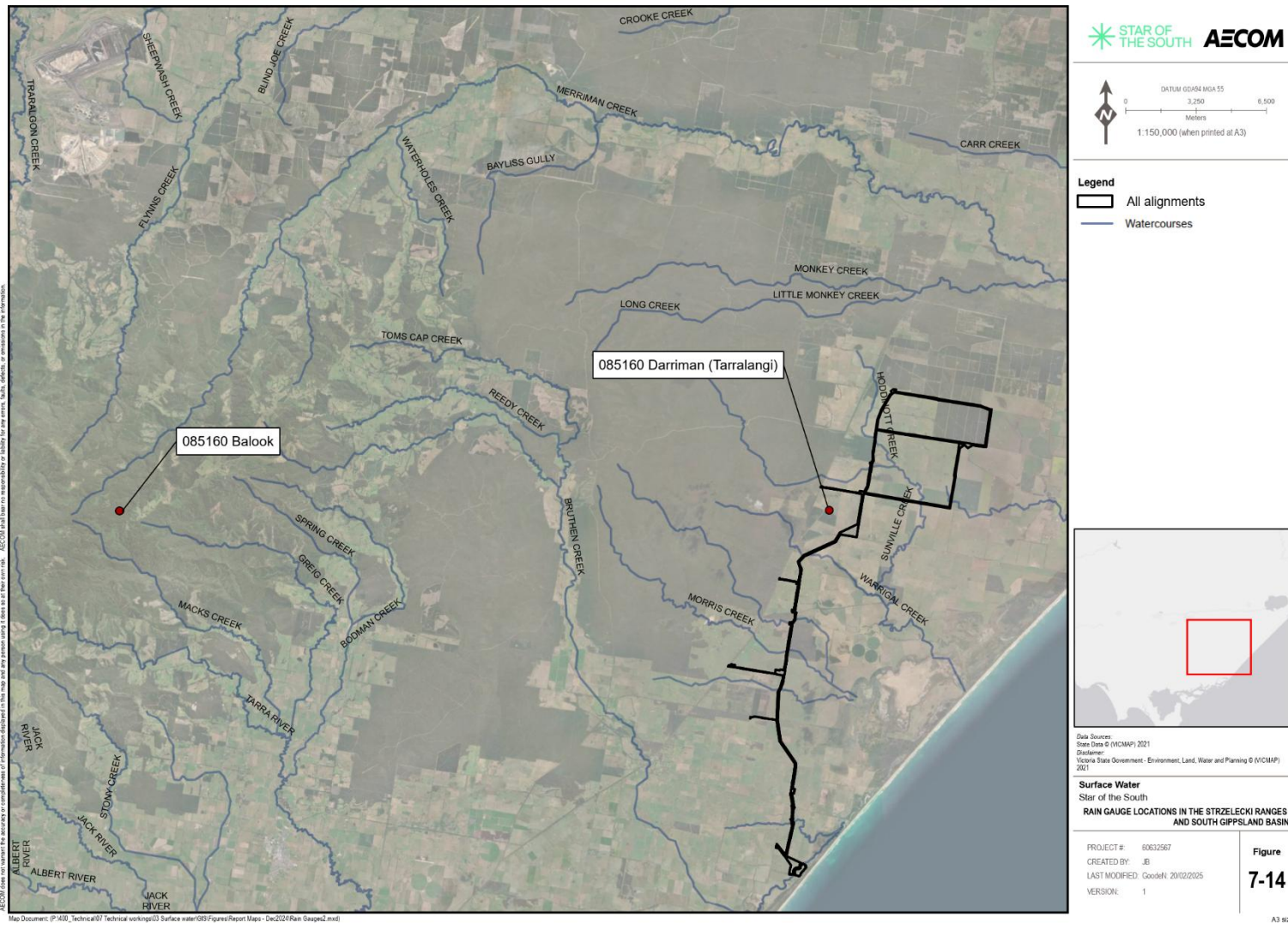


Figure 7-13 Rain gauges proximal to the project

7.2.2 Waterways

The proposed land-based cable alignment will cross around 20 designated waterways, depending on the selected alignment. Several of these waterways are minor drainage pathways that lack clearly defined channels and only flow during or after storm events during the wetter months of the year. These waterways are unlikely to represent water quality and flood risks where they intersect with the project. Subsequently, some of these minor waterways were considered low risk and not considered in the impact assessment.

The waterways of the catchments that cross the alignment between Reeves Beach and Giffard West that were considered for the assessment included all of the named waterways and several unnamed waterways that featured well defined channel profiles or extensive riparian vegetation, as determined from publicly available aerial imagery provided by Bing, Google, and VicMap. All of these waterways are ephemeral with seasonally episodic flow characteristics.

These waterways and their approximate distance from the shore crossing site are presented in Table 7-3, and shown in Figure 7-14 and Figure 7-15. In addition to these waterways, the existing conditions assessment also considered locations where farm dams, minor drainage channels or wetlands could be crossed by the project, including the access roads.

Table 7-3 Key waterways that intersect with the project between Reeves Beach and Giffard West (excluding shore crossing).

Waterway	Distance from shore crossing (approx.)	Key Receptor
Unnamed waterway UFI:42824679	0.5 kilometres	Bruthen Creek Estuary
Unnamed waterway UFI:18401649	1.0 kilometres	Bruthen Creek Estuary
Unnamed waterway UFI:42806331	3.0 kilometres	Freshwater Swamp
Unnamed waterway UFI:3598071	9.5 kilometres	Jack Smith Lake
Morris Creek	11.0 kilometres	Jack Smith Lake
Unnamed waterway UFI:3596727	11.5 kilometres	Jack Smith Lake
Unnamed waterway UFI:3593740	12.5 kilometres	Jack Smith Lake
Unnamed waterway UFI:43045959	13.5 kilometres	Jack Smith Lake
Warrigal Creek	16.0 kilometres	Jack Smith Lake
Unnamed waterway UFI:3588292	18.0 kilometres	Jack Smith Lake
Sunville Creek	21.5 kilometres	Jack Smith Lake
Unnamed waterway UFI:3585299	22.5 kilometres	McLoughlins Beach – Seaspray Reserve
Unnamed waterway UFI:3582535	21.0 kilometres	Jack Smith Lake
Hoddinott Creek	22.5 kilometres	Jack Smith Lake
Unnamed waterway UFI:3581253	26.0 kilometres	McLoughlins Beach – Seaspray Reserve
Unnamed waterway UFI:3582535	21.0 kilometres	Jack Smith Lake
Hoddinott Creek	22.5 kilometres	Jack Smith Lake
Unnamed waterway UFI:43042004	26.5 kilometres	McLoughlins Beach – Seaspray Reserve

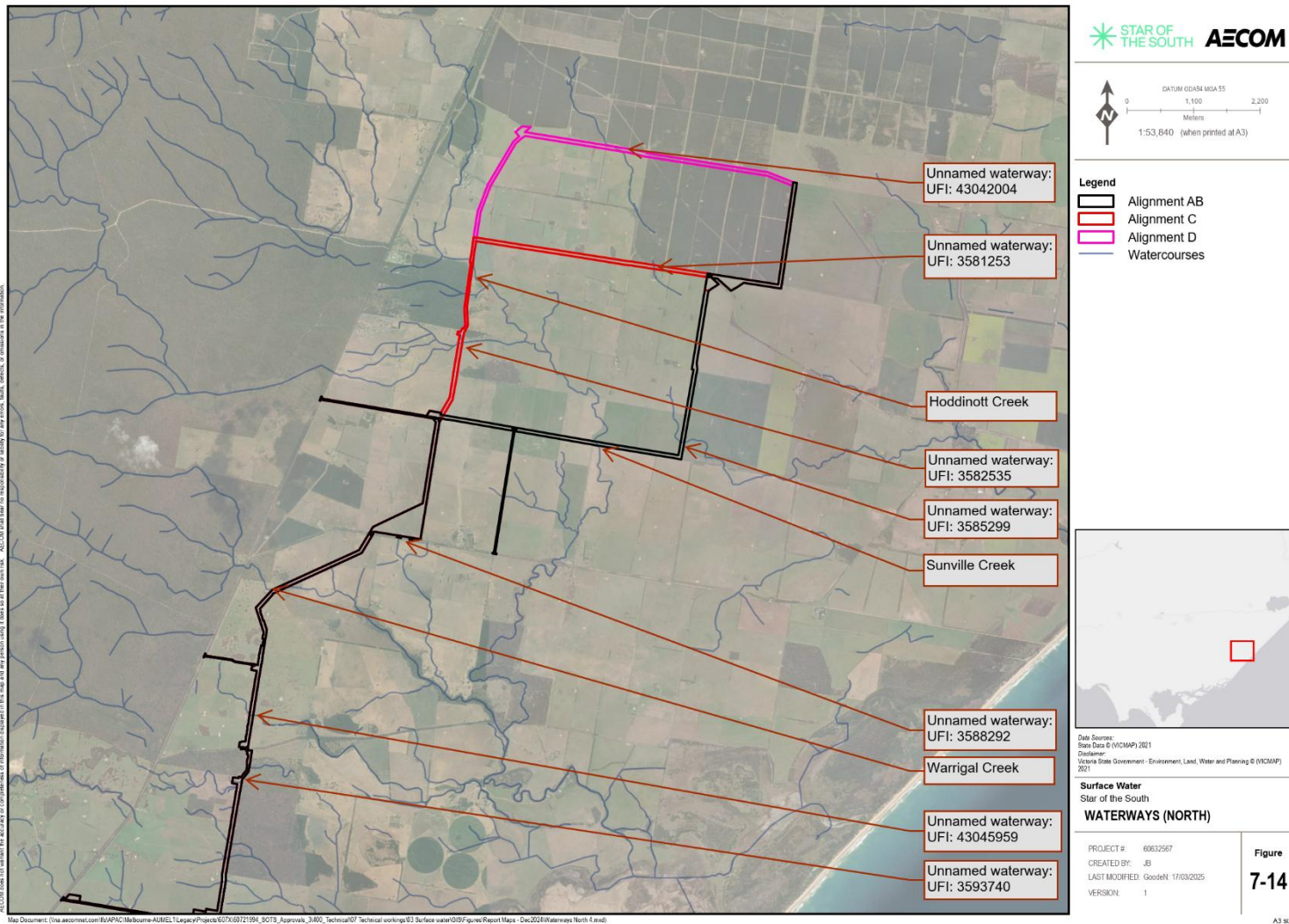


Figure 7-14 Waterways interfacing with the project alignment (North)



Figure 7-15 Waterways interfacing with the project alignment (South)

The majority of the waterways and catchments between Reeves Beach and Giffard West have headwaters in the Mullungdung State Forest. These include Morris Creek, Warrigal Creek, Hoddinott Creek, and Sunville Creek. The WGRCS identifies the Mullungdung State Forest as important habitat with remnant open forests and areas of natural swamps along streams (WGCMA, 2012).

As these waterways cross the South Gippsland Highway, towards the south-east, the landscape changes from natural forest to open farmland with sporadic timber plantations and isolated bushland reserves. The topography of the catchment also changes downstream of the South Gippsland Highway from elevated foothills to gently sloping coastal plains.

The key waterways that drain these coastal plains discharge into wetlands and coastal estuaries that occupy low lying land behind the sand dunes of Ninety Mile Beach. These estuaries and wetlands were identified as important areas of habitat in the WGRCS.

It should be noted that Sunville Creek and several unnamed waterways were not assessed during the site visits of 11th and 12th December 2024, due to land access. Therefore, these waterways have only been assessed through desktop assessment.

There are no river gauging sites for any of the waterways that flow from the Mullungdung State Forest, and aerial imagery indicates these waterways are ephemeral where they interface with the proposed alignment. This assumption was confirmed during the site visits that were carried out between 14th and 15th July 2021 and 11th and 12th December 2024.

Warrigal Creek, and the key tributaries of Morris Creek have natural, or near natural, forested catchments upstream of the proposed alignment. Conversely, Hoddinott Creek, and the unnamed waterways that lie south of Morris Creek drain agricultural catchments that largely consist of wide-open paddocks. Six of these waterways, including Morris Creek, Hoddinott Creek and Warrigal Creek, flow into the large shallow wetland of Jack Smith Lake Wildlife Reserve.

Many of the waterways and drainage lines that intersect with the project alignment lacked prominent channels and had been cleared of natural riparian vegetation. Unnamed waterways UFI:42824679 and UFI:42806331 were two channels visited that showed more developed channel features (e.g. meanders and an eroded channel profile) at the project crossing locations. Standing water and channel vegetation were observed in these waterways during site visits.

The water supply and farming uses have had a major influence on stream flows and this is recognised in the Index of Stream Condition Report hydrology assessment (DEPI, 2010). The report states that Merriman Creek, north of the project area, experiences significant summer stress, resulting in low scores for hydrology and an overall condition rating of 'poor' and 'very poor' for the three assessed reaches.

Nearly all of the waterways that interface with the project feature farm dams on their alignments through the agricultural catchment areas. Subsequently, it is likely these farm dams have impacted the local hydrological regime and contribute to flow reductions in these waterways during the dryer months.

7.2.3 Wetlands

The proposed cable alignment passes several wetlands. Jack Smith Lake is a supratidal coastal saltmarsh system, with several associated ephemeral saline lakes, covering approximately 3,000 hectares (DEECA, 2021). Located approximately 2.5 kilometres east of the project alignment at its nearest point, it is hydraulically connected to proposed construction areas through several ephemeral waterways, including Morris, Warragul, and Sunville Creeks. This wetland is listed as a nationally important wetland by DCCEE, due to it containing high quality examples of brackish and saline lagoons and marshes, as well as for the role the system plays in habitat provision for vulnerable taxa (DCCEE, 2005).

An unnamed wetland (DEECA Wetland ID 87225) is located on Warrigal Creek approximately 2.5 kilometres downstream of the project alignment. Categorised as a temporary freshwater swamp by DEECA (DEECA, 2021), this wetland is ephemeral and palustrine.

Two mapped current wetlands are present on the Hoddinott / Sunville Creek catchment, downstream of the project alignment, specifically options C and D. Each current wetland has a unique identification number provided by DEECA. Mapped wetland ID91772 is listed by DEECA as a palustrine temporary freshwater swamp, while wetland ID91773 has limited details, aside from being freshwater and ephemeral. These wetlands were attended during site visits on 11th December 2024, where it was observed that they are located within depressions on the floodplain of the adjacent channel. Both wetlands appeared to be modified and influenced by agricultural processes, and are likely subject to waterlogging. The western ephemeral wetland (DEECA Wetland ID 91773) is shown in Figure 7-16.

In addition to these natural wetlands, the agricultural catchment areas feature many farm dams that are located close to the project area. However, these farm dams are not mapped under the Victorian Wetland Inventory.



Figure 7-16 Shallow ephemeral wetland (DEECA Wetland ID 91773) located close to the project alignment (Photo taken 11/12/24)

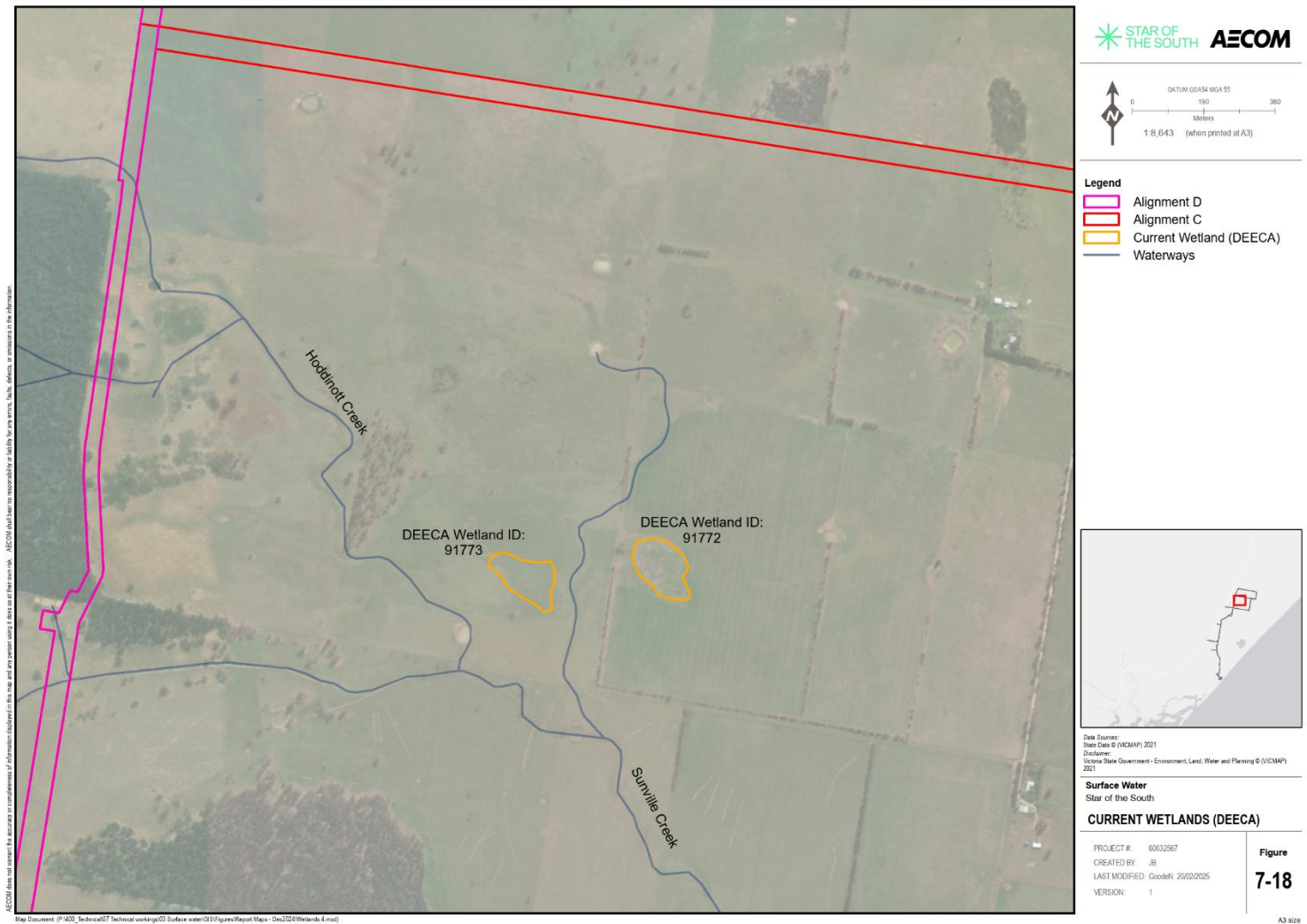


Figure 7-17 Wetlands

7.2.4 Flooding

There are no areas identified as LSIO or FO on any of the waterways that interface with the project alignment between Reeves Beach and Giffard West. However, publicly available flood modelling from WGCMA (WGCMA, 2025) shows some degree of flooding at waterway UFI:42806331 during the 1% AEP event (see Figure 7-18). However, it is likely that the flood extent during of this event is contained within the incised channel at this location (see Figure 7-23).



Figure 7-18 1% AEP flood extent along waterway UFI:42806331 (WGCMA, 2025)

Additionally, the broader region has historically been subject to floods. The nearby Merriman Creek has a documented history of flooding and records can be traced back as far as 1880. The coastal settlement of Seaspray is particularly flood prone and experienced its worst flooding in September 1993 when 44 homes and 140 built on allotments were inundated by floodwater (SES, 2019). Similarly, the settlement of Woodside experienced severe flooding in 2021 when Bruthen Creek overtopped its banks (Field & Somerville, 2021)

7.2.5 Water quality

The majority of waterways that feed into the coastal estuaries of Ninety Mile Beach have headwaters in areas of natural bushland. As the waterways migrate downstream, the landscape transitions from bushland to agricultural land with potential impacts on water quality from the different land uses.

Many of the waterways that cross agricultural land have been modified and stripped of their natural riparian vegetation (see Figure 7-19). Waterways without riparian vegetation are more susceptible to erosion and causing turbidity and sedimentation downstream.



Figure 7-19 The upper reaches of Hoddinot Creek show a typical example of a natural waterway that has been modified by agriculture and land use change (Photo taken 12/12/24).

There is no publicly available water quality monitoring data for the waterways that intersect the proposed alignment between Reeves Beach and Giffard West. However, there are two historical surface water quality monitoring sites on Merriman Creek to the north of the project (see Figure 7-20). These sites are located at the extreme upstream and downstream ends of the catchment and only recorded turbidity for a limited time between June 1997 and January 1998. Although dated, these monitoring results provide a historical snapshot of waterway health for the Merriman Creek that could be typical of waterways for this region.

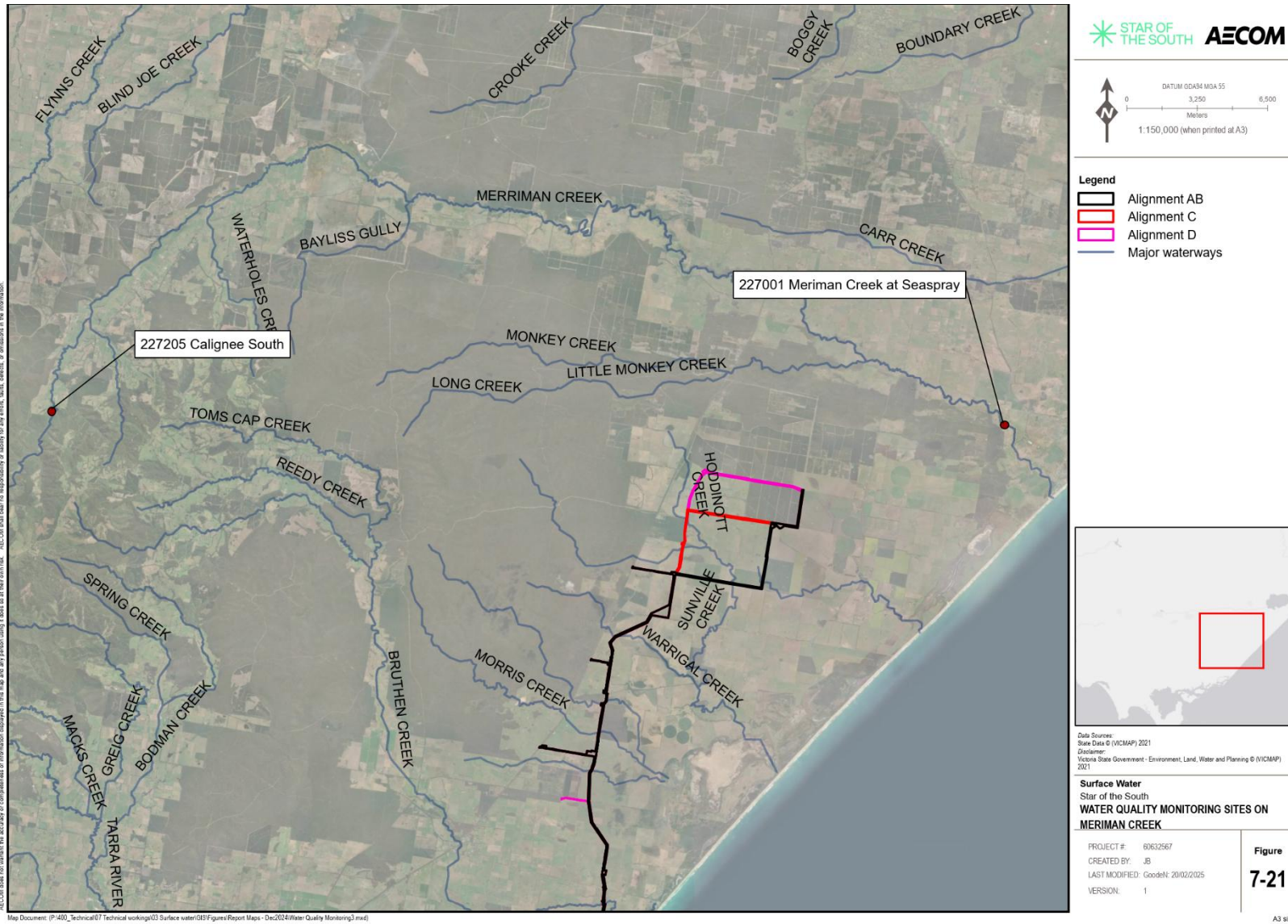


Figure 7-20 Water quality monitoring sites on the Merriman Creek

The Victorian ERS define the environmental quality indicators and objectives that aim to protect the environmental values of Victorian rivers and streams. Table 5.8 of the ERS states the 75th Percentile turbidity objective for the Central Foothills and Coastal Plains, incorporating South Gippsland Basin, is 25 Nephelometric Turbidity Units (NTU).

The mean monthly turbidity levels for Callignee South were all below 25 NTU, indicating that background turbidity levels in the upper catchment were generally in line with the ERS guidelines.

At Seaspray, the mean monthly turbidity levels were generally higher than those recorded at Callignee South, however, the majority of these results still achieved the objectives of the ERS.

Both data sets showed a correlation in the timing of elevated turbidity results with turbid water being present throughout the creek. These findings suggest that the turbidity was more likely caused by rainfall events, instead of localised, point sources of contamination.

Table 7-4 Summary of turbidity monitoring on the Merriman Creek, with values above 25 NTU shown light green.

Year	Month	Callignee South (227205) 75 th percentile turbidity level (NTU)	Merriman Creek Seaspray (227001) 75 th percentile turbidity level (NTU)
1997	June	No Data	111.0
	July	36.1	37.1
	August	34.3	29.9
	September	30.5	21.7
	October	15.9	14.2
	November	24.2	22.5
	December	8.4	13.1
1998	January	7.7	13.4
	February	9.8	14.5
	March	11.1	10.0
	April	9.6	6.6
	May	7.5	14.8
	June	58.1	35.4
	July	14.9	15.0
	August	18.3	20.2
	September	23.2	20.9
	October	20.9	21.3
	November	19.2	30.1
	December	32.7	49.3
1999	January	24.0	23.8

7.2.6 Geomorphology

Agriculture Victoria's Victorian Resources Online (Agriculture Victoria, 2021) describes four key geomorphological units for the project area that falls within the Warragul region (see Figure 7-21).

All of these units fall under the Eastern Plains (EP) region. Table 7-5 shows the relevant geomorphological unit at each waterway crossing along the proposed alignment.

Table 7-5 Geomorphological Units of the Eastern Plains at the waterway crossings

Geomorphological Unit	Reference Number	Waterway at project location
Higher level plains without dunes	7.3.1	UFI:42806331 (freshwater swamp) UFI:3596727 Warrigal Creek UFI:3588292 UFI:3586256 UFI:3586255 Sunville Creek UFI:3585299 UFI:3582535 Hoddinott Creek UFI:3581253 UFI:43042004
Higher level plains with dunes	7.3.2	UFI:3598071 Morris Creek UFI:3593740 UFI:43045959
Riverine floodplains and morasses	7.2.1	UFI:18401649 (shore crossing drainage channel)
Low coasts: Tidal	8.6.1	UFI:3610660 (shore crossing)

These low relief plains and riverine floodplains of the South Gippsland River Basin are generally considered low risk for surface erosion due to their relatively gentle slopes and extensive topsoils.

The West Gippsland Soil Erosion Management Plan (WGCMA, 2008) categorised much of the proposed alignment in areas of very low risk of sheet or rill erosion (see Figure 7-22). The plan also summarised the project area as low risk of gully or tunnel erosion.

The alluvial terrace deposits and dune deposits between the shore crossing and the VicGrid connection hub in Giffard West have been identified as an area of potential acid-sulfate soils. However, further testing is required to characterise the exact nature and extent of potentially problematic soils in the region. Technical Report J: Soils and Waste provides further information on the location and risks associated with acid-sulfate soils.

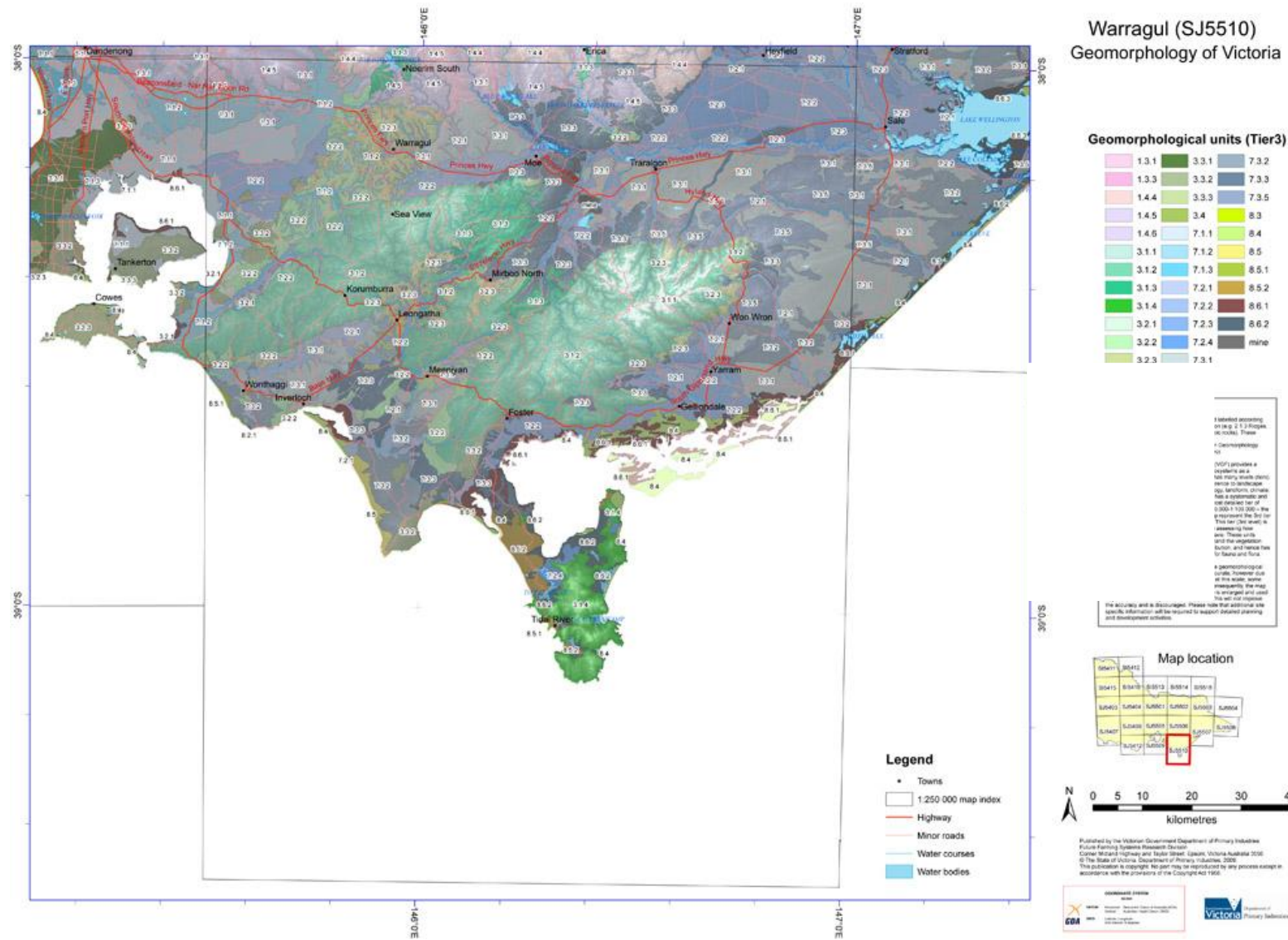


Figure 7-21 Geomorphological units of the Warragul region (Source: VRO Resources Online, 2021)

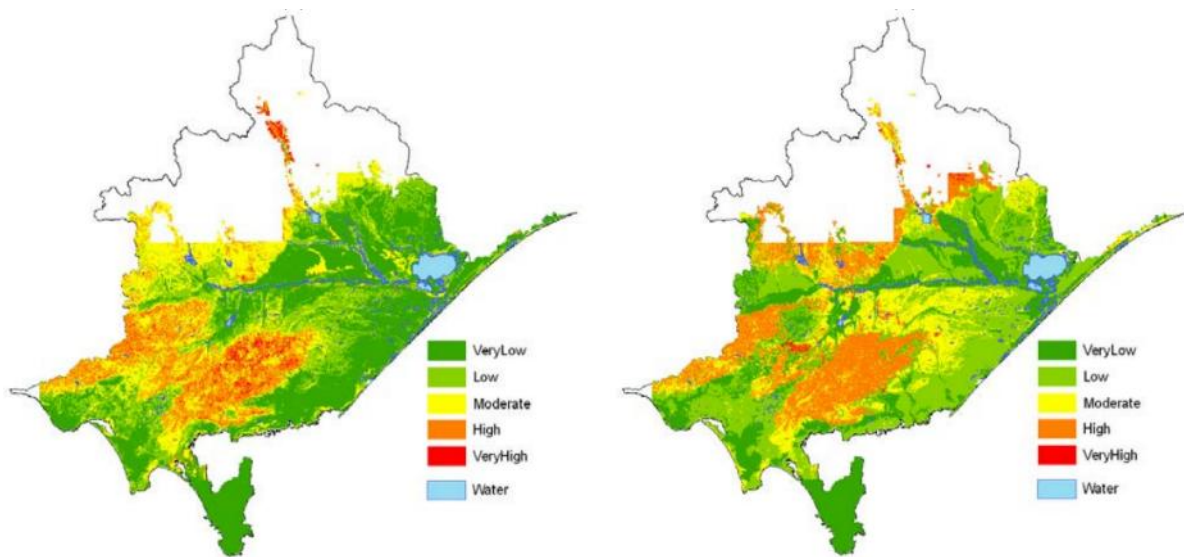


Figure 7-22 Susceptibility to sheet rill erosion (left), and susceptibility to gully or tunnel erosion (right) (Source: WGCMA Soil Erosion Management Plan)

The site visits carried out during the course of the surface water assessment confirmed the presence of gentle slopes in the low lying coastal areas and coastal plain. The site visits also found that many of the waterways that drain towards the coast generally exhibited poorly defined channels with limited geomorphological features, with just a few exceptions. For example, the unnamed waterway (UFI:42806331) close to the shore crossing site featured a well-defined channel with dense riparian vegetation through the creek corridor (see Figure 7-23). This channel widens through the proposed crossing point location and has steep banks on either side of the waterway. The creek at this crossing location is also covered with dense reed growth and it may be a wetland or permanent pool, created by sedimentation processes (see Figure 7-24).



Figure 7-23 Small tributary with a well defined channel leading to the vegetated channel of the unnamed waterway near the shore crossing location (UFI:42806331). (Photo taken 15/07/2021)



Figure 7-24 Wide channel with dense reed growth and wetland characteristics at the proposed crossing point on the unnamed waterway, close to the shore crossing location (UFI: 42806331). (Photo taken 15/07/2021)

8.0 Issues for assessment

The issues for assessment were identified by reviewing the project description for interactions between the key project components and the proposed construction, operations and decommissioning activities and sensitive receptors. These cause and effect pathways were designated as either impacts or risks based on whether the issues relate to situations that are expected or accidental.

The identified issues are presented in Table 8-1 and for each, a maximum design scenario has been defined as the basis for the assessments presented in Section 9.0, Section 10.0 and Section 11.0. The table also includes the residual impact and risk levels arising from the assessment undertaken, following incorporation of mitigation measures.

The complete impact and risk register for this study is presented in Appendix A.

Table 8-1 Surface water assessment issues

Impact or risk ID	Impact risk or pathway	Residual impact rating	Residual risk rating
Construction			
SUM-I001	Flooding of the construction site, or construction equipment, leads to poor downstream water quality in the receiving waterways and coastal estuaries	Minor	-
SUM-I002	Trenching across waterways mobilises sediment and causes downstream pollution	Minor	-
SUM-R003	Runoff and spills from trenchless crossings causes downstream pollution	-	Low
SUM-R004	Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries.	-	Low
SUM-I005	Runoff from the construction site, including construction compounds, trenchless crossing sites, batching plants, storage facilities and site access roads, pollute receiving waterways	Minor	-
SUM-I006	Groundwater is extracted and released to the surface where it can enter and pollute receiving waterways.	Negligible	-
SUM-I007	Construction activities block or divert drainage pathways leading to changes in flow regime and downstream uses and environmental values.	Negligible	-
SUM-I008	Construction activities change the flood risk and flood characteristics	Minor	-
Operation			
SUM-I009	Increases in rainfall intensity and sea level rise caused by climate change lead to more frequent and severe flooding of operational infrastructure.	Minor	-
SUM-I010	Operational or permanent infrastructure blocks or diverts drainage pathways leading to	Minor	-

Impact or risk ID	Impact risk or pathway	Residual impact rating	Residual risk rating
	changes in flow regime and downstream uses and environmental values		
	Decommissioning		
SUM-I011	Flooding of the decommissioning sites leads to poor downstream water quality in the receiving waterways and coastal estuaries.	Minor	-
SUM-I012	Runoff from the decommissioning works cause pollution in receiving waterways and coastal estuaries.	Minor	-
SUM-R013	Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries.	-	Low
SUM-I014	Decommissioning activities block or divert drainage pathways leading to changes in flow regime and downstream water dependent habitats.	Negligible	-
SUM-I015	Decommissioning activities change the hydrological conditions leading to increased flood levels and flooding of adjacent property.	Minor	-

9.0 Construction assessment

This section discusses the potential impacts of the project as a result of construction activities and the associated mitigation measures that aim to reduce impacts to as low a level as possible. Mitigation measures referred to are summarised in section 13.0.

9.1 Project parameters that form the basis of impact assessment

Table 9-1 specifies the maximum design scenario that has been assessed for construction. These represent the values of project parameters from ranges specified in the project design envelope that represent the greatest potential impact to an identified sensitive receptor or receptor group.

Table 9-1 Maximum design scenario - construction

Risk	Key parameter values	Justification
All construction risks	<p>The works and infrastructure are located within the onshore construction project area, which is defined by the area required for construction of the following:</p> <ul style="list-style-type: none"> • Onshore Wind Farm transmission system infrastructure: <ul style="list-style-type: none"> ○ Up to eight underground cable circuits with the following upper limit footprints: <ul style="list-style-type: none"> ▪ Temporary construction corridor width between shore crossing and VicGrid connection hub: 60 m width (note the actual shore crossing area is likely to be wider than this). ○ Joints and bays at one-kilometre (approx.) intervals with upper limit joint footprints of 5 m x 15 m x 3 m (W/L/D) ○ Other temporary construction infrastructure including access roads • Shore crossing infrastructure: <ul style="list-style-type: none"> ○ Trenchless shore crossing approaches with maximum length of 1400 m and depth of up to 35 m ○ Transition joints and bays with upper limit footprints of 10 m x 30 m x 5 m (W/L/D) • Temporary construction compounds with an upper limit footprint of 100 m x 100 m (W/L) 	The onshore construction project area defines the maximum land area to be directly impacted by construction of the project.

To assess potential impacts associated with the project, the assessment has also considered the following assumptions and indicative construction techniques:

- Trenching construction techniques across each waterway that will take approximately seven days to complete and could be constructed during dry periods with minimal impacts on flow regime.
- Trenching depths will be based on the cable burial depths that may vary along the alignment but are expected to maintain approximately one metre of cover above the cables.
- Temporary construction areas are likely to be required in the floodplain (for example, the shore crossing location).
- Dewatering of excavations will be required where shallow groundwater depths are encountered.

9.2 Water quality impacts and risks

The proposed project alignment would cross a number of waterways that discharge into waters which are recognised for their environmental values and uses.

These include the waterways of the low-lying coastal plains that discharge directly into Jack Smith Lake Wildlife Reserve, the estuarine wetlands of Ninety Mile beach and the Corner Inlet Ramsar Site, south of the Bruthen Creek. All of these wetlands need water to sustain the existing valuable habitat for native plants, animals, migratory birds, fish and other aquatic animals.

In addition to their important habitat function, all of the waterways that interface with the project provide water for uses that include potable water supplies, agricultural water supplies as well as providing opportunities for recreational activities such as a fishing or birdwatching.

The proposed construction activities could increase the risk of waterway pollution with lasting impacts to the receiving aquatic environment and the ecosystem services it provides.

Pollutants such as soluble chemicals can have immediate impacts on aquatic environments leading to fish kills and loss of invertebrates. Recovery from changes in water chemistry caused by chemical spills can take years.

Other pollutants, such as high sediment loads and increased turbidity can smother aquatic habitats, disrupt fish spawning areas and reduce plant photosynthesis. Impacts of sedimentation may also increase nutrients such as phosphorous, leading to eutrophication and algal blooms in slow moving or shallow waterways.

Contamination from hydrocarbon spillages are often more visible than other sources of contamination. Once oils and fuels have entered waterways, the floating product quickly dissipates over a wide area, coating riparian vegetation and impacting animals that use the water. If left in situ, hydrocarbons eventually emulsify and sink through the water column where they contaminate the bed of the waterway. Depending on the severity of a spill, recovery from hydrocarbon contamination can take months, even years.

The following sections highlight the potential mechanisms by which these pollutants could be mobilised during construction as well as their proposed mitigation measures.

9.2.1 Flooding of the construction site, or construction equipment, leads to poor downstream water quality in the receiving waterways and coastal estuaries (SUM-I001).

Contamination can occur when floodwater inundates a construction site and mobilises pollutants, releasing them to the downstream waterway. The sources of contamination can include sediment from exposed soils and excavations, oils from plant and equipment, litter from waste storage areas, and construction materials from processes sites such as concrete batching plants or trenchless crossing compounds.

Typically, most of the waterways along the proposed cable alignment feature active floodplains or adjacent surface areas that become inundated when stream channel capacity is exceeded. The depth, extent and duration of flooding will vary at each waterway, however, it is important to understand the risk pathways and adopt the necessary mitigation measures to prevent floodwater mobilising pollutants from the proposed construction sites.

At Reeves Beach, the unnamed waterway of the shore crossing location has a floodplain of around 250 metres wide. This floodplain is not referenced as LSIO, however, it is likely to be inundated during storm events and could be impacted by extreme storm tides. Storm tides occur when storm surges combine with high astronomical tides. For the shore crossing location, an extreme storm tide at the southern end of Ninety Mile Beach would raise water levels in the estuaries of Corner Inlet and Bruthen Creek, causing water to fill the low lying land behind the dunes.

Flooding of construction sites can lead to poor downstream water quality in the receiving waterways and coastal estuaries. At Reeves Beach, contaminated floodwater from the proposed shore crossing location could cause long term impacts to the Corner Inlet Ramsar Site, downstream of the project area.

Mitigation

To mitigate these impacts, lay down areas, batching plants, construction compounds, trenchless crossing sites and materials storage areas, such as those located near the Reeves Beach shore crossing will, wherever possible, be located outside of the 1% AEP flood extent or any land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain has not been formally identified through the planning scheme or flood studies (SUM-M001).

For some sites, relocation of the proposed construction activities outside of the 1% AEP flood extent is not considered feasible and additional site-specific mitigation measures will be adopted to reduce the residual impacts. For example, the proposed shore crossing site at Reeves Beach is constrained by the mechanical limits of the cables and cannot be relocated outside of the floodplain or areas at risk of inundation.

For these sites, a range of mitigation strategies will be utilised to prevent floodwater from mobilising pollutants into receiving waterways, including the following measures:

- Site optimisation during the detailed design phase to minimise works in the floodplain. This will include locating soil stockpiles, fuel storage facilities, equipment laydown areas and all non-essential plant and equipment outside of the floodplain (SUM-M001)
- A Construction Environmental Management Plan (CEMP) would include surface water management measures and will be developed in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to manage stormwater and flood risks across the project. The plan could include, but is not limited to the following (SUM-M001):
 - Elevating temporary buildings and containerised equipment above the 1% AEP flood level wherever practical.
 - Minimising soil disturbance within the floodplain.
 - Bunding or other appropriate barriers to reduce the risk of inundation from a 1% AEP flood event or storm tide. These should be designed to maintain conveyance of floodwater around the bunded area.
 - A staged response to potential flood and storm events.
 - The CEMP will be implemented and include measures and procedures for the appropriate storage, handling and transportation of chemicals and fuels (SUM-M003).
 - Water quality monitoring of surface water discharges from construction sites and active, receiving waterways (SUM-M015).

The WGCMA will also be consulted before works commence on the floodplain or adjacent to waterways. This engagement would inform decisions on site layout, protection works and contingencies during flood events.

Residual Impact

Full implementation of the mitigation measures defined above will address the water quality impacts associated with flooding of the construction site. Where flooding of the construction site does occur, the impacts are considered to be minor and localised following implementation of these measures.

9.2.2 Trenching across waterways mobilises sediment and causes downstream pollution (SUM-I002).

The project would cross or interface with many key waterways over the proposed alignment. All of these waterways are considered ephemeral. It is anticipated that trenching across each waterway would take approximately seven days to complete. This includes trench excavation, laying the conduits, pouring the thermally stable backfill and reinstating with backfill material.

Excavating across waterways can mobilise contaminants directly into the flow pathway and is a significant risk for the receiving waters. The principal mechanism for downstream contamination is the mobilisation of sediment from works on the bed or banks of the waterway.

Mitigation

To mitigate these impacts, surface water flows should not interface with the construction work areas.

Crossings of the ephemeral waterways will be conducted when the waterways are dry and when weather forecasts indicate the low likelihood of rain whenever practicable (SUM-M004).

Waterways that feature standing water, swamps, baseflows or are at risk of increasing flows, will be managed so that the water does not impact the proposed works. These waterways include the unnamed waterways with UFI numbers 42806331 and 3598071.

All of these mitigation measures will be carried out in accordance with the relevant regulatory requirements and industry best practice guidelines such as the IECA Best Practice Erosion and Sediment Control Appendix P; Land Based Pipeline Construction Guidelines (2015) and EPA Publication 1896: Working within or adjacent to waterways (2020) (SUM-M004). These mitigations will include the following measures where appropriate:

- Compliance with the Project CEMP
- Establishment of temporary, upstream clean surface water diversion systems
- Programming works when water levels or flow are at their lowest
- Erosion controls at vehicle crossing points
- Minimising riparian vegetation removal
- Collection and treatment of dirty water
- Sediment controls in the drainage pathway
- Water quality monitoring of discharges from trenching works and active, receiving waterways (SUM-M015)

A works on waterways permit will be required for all waterway crossings and the WGCMA will be consulted at the time of application. All waterway crossing works will be carried out in accordance with the conditions of this permit and the guidance of the WGCMA (SUM-M004).

These impacts would be avoided at waterways where the project has committed to trenchless crossings (e.g. HDD). This is relevant to the shore crossing site at Reeves Beach and the unnamed waterway behind the dune system.

All trenched waterway crossings will be assessed for constructability and suitability during subsequent design stages. Where trenching is not considered feasible (e.g. waterways with significant baseflows, deep or steep sided gullies, or where bank stabilisation and rehabilitation works are not feasible) further consideration of opportunities to utilise trenchless crossing construction methodologies (including HDD) beneath waterway crossings will be explored (SUM-M004). This could include the identified unnamed waterways with standing water or riparian habitat (UFI 42806331 and 3598071) and the waterways located in the plantation that are yet to be assessed by a site visit (e.g. UFI 43042004).

Residual Impact

Full implementation of the mitigation measures defined above will address the water quality impacts associated with trenching across waterways and would make the residual impact minor.

9.2.3 Runoff and spills from trenchless crossing causes downstream pollution (SUM-R003)

Trenchless crossing (e.g. HDD) presents a risk of stormwater contamination and impacts to the receiving waterways. This can occur through the mobilisation of contaminants from drilling compounds (e.g. sediment from disturbed ground and excavations) or from drilling fluids returning to surface during the drilling operation, known as ‘frac-out’.

Managing excavation water, runoff and spills associated with trenchless crossing operations (e.g. from the drilling compounds) are addressed in Sections 9.2.2 and 9.2.3 of this report. This section specifically relates to the risks associated with frac-out during trenchless crossing drilling operations.

Frac-out generally happens when drilling pressure exceeds the overburden pressure, causing the drilling fluids to migrate through the overlying material and discharge to the surface. This can happen if the overburden is shallow or made of loose material.

In most instances of frac-out, drilling fluid can be recovered and managed to prevent it from entering the stormwater pathway. However, frac-out that occurs beneath a waterway channel may cause drilling fluids to discharge directly into water, causing downstream contamination.

Mitigation

Preventing frac-out can be achieved by a number of mitigation measures that include site specific risk assessments (e.g. pressure calculations), adjustment of drilling profiles to suit existing conditions, appropriate drill configuration (e.g. bit size, hole assemblies) and monitoring of drilling fluids during the drilling operation. These measures include:

- The proposed drilling profile design and the work method statement should also be submitted to the WGCMA and approved prior to the commencement of trenchless waterway crossings (SUM-M005).
- The risk of frac-out should be assessed in accordance with industry best practice guidelines to determine likelihood of occurrence (e.g. modelling) (SUM-M005).
- Drilling fluid properties should be monitored during trenchless crossing operations to reduce the risk of frac-outs (e.g. mud weight, viscosity, pressure) (SUM-M005).
- Earth bunds/or and drainage channels should be placed around the upper edges of drill sites and work areas to divert natural runoff around and away from the site and prevent mixing with drilling compound runoff (SUM-M005).
- Sump pits should be constructed at the bottom of the drill site. The sump pit will be positioned to capture runoff from the drilling compound. Materials collected in the sump pit will be assessed and managed in accordance with industry best practice guidelines for trenchless crossing operations (SUM-005).

All facilities utilised in the surface mud handling (mixing, cleaning and pumping) during the trenchless crossing activities should be bunded (SUM-M005).

Residual Risk

Full implementation of the mitigation measures defined above and in Section 13.0 would make waterway pollution from trenchless crossing operations unlikely. Additionally, should frac-out occur during a waterway crossing, the impacts are considered to be minor and localised. The residual risk rating for this risk is low.

9.2.4 Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries (SUM-R004).

Naturally occurring ASS may be present along the low-lying coastal plains, or areas once occupied by saltmarsh and waterlogged coastal sediments. Disturbance and dewatering of ASS introduces oxygen into the soil, causing a chemical reaction that leads to the formation of sulphuric acid.

Once formed, this acidic leachate must be stored, handled or treated in ways that prevent its release to surface water and downstream receiving environments. ASS is most likely to occur in the proposed shore crossing location at Reeves Beach as described in Technical report J: Soil and waste.

Mitigation

For any area identified as containing potential ASS, an ASS management plan will be developed and all mitigation works will be carried in out in accordance with the relevant industry legislation and guidelines including (SUM-M006);

- Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999
- EPA Victoria - Publication IWRG655.1 Acid Sulfate Soil and Rock
- Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (CASS BPMG 2010).

Technical Report H: Groundwater also makes recommendations for the development of an ASS Management Plan (e.g. through mitigation measure GWM-M003).

The WGCMA and EPA Victoria will be consulted before works commence in areas suspected of containing ASS. This engagement would inform decisions on the storage, handling, treatment and disposal of ASS that are documented in the plan.

Construction sites that are identified as containing ASS will be programmed and staged to minimise the extent and duration of exposure of these soils to air and surface water (SUM-M006).

Residual Risk

Full implementation of the mitigation measures defined above will address the water quality impacts associated with the management ASS and would make the residual impact unlikely to occur. Where unexpected incidents in the storage, handling or treatment of ASS do occur, the impacts are considered to be low and very localised following implementation of these measures.

9.2.5 Runoff from the construction site, including construction compounds, trenchless crossing sites, batching plants, storage facilities and site access roads, pollute receiving waterways (SUM-I005).

Soils and materials are susceptible to mobilisation when exposed to wind and rain. Exposed construction surfaces typically include unvegetated or disturbed ground, temporary access roads, laydown areas, batching plants, topsoil windrows and trench spoil.

Construction works associated with the proposed temporary waterway crossing at Reeves Beach, to allow conduits to be drawn into the trenchless crossing entry points, could also increase the risk of polluted runoff entering the waterway at this location. This includes mud and soil that could be mobilised by vehicles onto the causeway crossing structure.

Sediment that becomes mobilised by rain or wind can easily be transported in runoff and discharge into a waterway leading to downstream water quality impacts. This risk can also be exacerbated in areas identified with problematic soils, such as dispersive or slaking soils.

Fine sediments are difficult to control once suspended in water and may impact receiving waterways in a number of ways. These impacts include sedimentation, covering of fish spawning habitat, damage to fish gills, reduced plant photosynthesis and changes in water chemistry.

Similarly, coarse sediments may also smother sensitive habitats and change channel hydrology through sedimentation and blockage.

In addition to sediment runoff, poor management of fuels, chemicals and wastes may also expose contaminants to areas where they can be mobilised by runoff. This includes the mobilisation of lubricants, swarf and filings from works associated with conduit movements over the proposed causeway and waterway crossing at Reeves Beach.

Mitigation

Erosion and sediment control measures will be applied to all areas of the construction project that drain to local waterways. These mitigation measures are described in multiple best practice guidelines including (SUM-M007):

- IECA Best Practice Erosion and Sediment Control Guidelines.
- EPA Victoria Publication 1834; Civil Construction, Building and Demolition Guide.
- EPA Victoria Publication 1806; Reducing Risk in the Premixed Concrete Industry.

Typical erosion and sediment control measures include:

- Clean water catch-drains
- Vegetated buffer areas
- Positioning, stabilisation or covering of stockpiles
- Silt traps
- Sediment basins
- Sediment fencing.

A project wide, CEMP will be developed including a surface water management plan (SWMP). The SWMP will outline the site-specific surface water management measures that will be applicable across the project. These mitigation measures will typically include erosion and sediment controls and management of wastes and materials, particularly for works in close proximity to waterways and drainage pathways.

The CEMP will also include requirements for appropriate soil testing at each site to identify any potentially problematic soils (e.g. dispersive soils). Where identified, the CEMP will outline the necessary control measures to ensure problematic soils are managed to prevent runoff from impacting receiving waterways and wetlands. The CEMP will also reference the water quality monitoring program for the duration of the construction works (SUM-M008, SUM-M015). In addition to erosion and sediment controls, the CEMP will be implemented and include measures and procedures for batching plants and the appropriate storage, handling and transportation of chemicals and fuels (SUM-M003).

Residual Impact

Full implementation of the mitigation measures defined above would make waterway pollution from construction site runoff unlikely. Where runoff from the construction site does occur, the impacts are considered to be minor and localised following implementation of these measures.

9.2.6 Groundwater is extracted and released to the surface where it can enter and pollute receiving waterways (SUM-I006).

Excavations are required for the proposed onshore infrastructure including cable trenches, joint bays and drillings sites.

At Reeves Beach, the shore crossing site will require a transition joint bay for every duct that passes beneath the dunes. The total number of transmission joint bays at the Reeves Beach site may be up to eight, depending on the eventual design.

Technical Report H: Groundwater references the presence of shallow groundwater in this area, indicating that groundwater dewatering would be required during the construction phase.

Due to the high water table at the shore crossing location and surrounding area, there is a high likelihood of dewatering activity being required to support the crossing installation and ground works associated with cable, joint bay, and transition joint bay installation.

Beyond the shore crossing site, joint bays will be constructed at one-kilometre (approx.) intervals along the proposed alignment. Some of these joint bay excavations are also likely to require dewatering during construction from sources including groundwater and direct rainfall.

Water quality in these excavations is likely to be contaminated with high concentrations of solids, and could contain other contaminants generated by the construction activities including hydrocarbons and drilling mud at the drilling site pit excavations.

Mitigation

Dewatering activities will be managed as part of the CEMP to minimise the impacts associated with groundwater dewatering for the project (SUM-M008). Technical Report H: Groundwater also provides additional details on groundwater dewatering and specifies the need for an Acid sulfate Management Plan (e.g. through mitigation measure GWM-M003).

The CEMP will adopt a management hierarchy that prioritises the prevention of discharges into surface waters as far as is reasonably practicable. Any groundwater that is released to surface waters should meet the water quality objectives as defined in Section 4.4, Table 4-2. The CEMP will also describe the water quality monitoring program for construction site discharges and active, receiving waterways. The water quality parameters for dewatering activities will be discussed and agreed with EPA Victoria and the WGCMA prior to commencement of the construction works (SUM-M008, SUM-M013).

Residual Impact

Full implementation of the mitigation measures defined above will address the water quality impacts associated with groundwater and dewatering. Any residual impacts following implementation of these measures are considered negligible.

9.3 Hydrological impacts and risks

Changes to flow characteristics in minor waterways and tributaries can disrupt flows that are necessary to sustain downstream uses or environmental values. These ephemeral waterways include Morris Creek, Warrigal Creek, Sunville Creek, and many of the unnamed waterways that cross the coastal plains of the South Gippsland Basin.

Conversely, modifications to a floodplain can change flood characteristics including flood depth, extent, velocity and duration during larger flood events. The impacts of these changes can include flooding of private property, increased scour and erosion and damage to construction sites and equipment.

Flood risks for waterways, including the unnamed waterway at Reeves Beach and Warrigal Creek are less understood, however, the presence of floodplains or low-lying riparian ground suggests many of these minor waterways experience flooding. Additionally, publicly available 1% AEP flood information indicates that some waterways, particularly those in the vicinity of the shore crossing, fall within the flood extent for this event.

The following sections define the key hydrological impacts for the construction phase and the necessary mitigation measures.

9.3.1 Construction activities block or divert drainage pathways leading to changes in flow regime and downstream beneficial uses and environmental values (SUM-I007).

All of the waterways crossed by the general alignment are categorised as ephemeral, although some of these may feature standing water for extended periods. Works associated with trenching across waterways can disrupt or alter the existing hydrology leading to changes in the volume, velocity or discharge location.

Longer term construction activities and site infrastructure can also change drainage pathways, impacting uses such as agricultural water supplies or cutting off natural flows to important areas of habitat. These include laydown areas, temporary access roads, batching compounds, trenchless crossing compounds, construction compounds and materials storage areas which can act as obstructions to overland hydrological flow.

Mitigation

To mitigate these impacts, crossings of ephemeral waterways would be conducted when the waterways are dry, and when weather forecasts indicate the low likelihood of rain, whenever these considerations are practicable. Trenching across waterways would be carried out in accordance with the IECA Best Practice Erosion and Sediment Control Guidelines to maintain any flow of the waterways and would therefore avoid downstream hydrological impacts (SUM-M005).

All construction compounds, drilling compounds, batching plants, laydown areas, access roads and material storage areas including spoil rows and topsoil windrows should, where reasonably practicable, be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain is not formally identified through the planning scheme (SUM-M002).

For some sites, relocation of construction activities outside of the floodplain may not be feasible and additional mitigations will be required to allow the uninterrupted flow of water through the catchment.

These mitigation measures will include (SUM-M002);

- Site optimisation during the detailed design phase to minimise works and infrastructure around waterways. This will include locating soil stockpiles, equipment laydown areas and all non-essential plant and equipment outside of the floodplain, as far as is reasonably practicable.
- A project wide, CEMP will be developed, including surface water management measures outlined in the SWMP, in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to maintain the existing flow regime including:
 - All works and associated construction facilities to be set back from designated waterways and drainage pathways.

- Diversion of minor drainage pathways around construction sites to maintain the existing flow regime, to the satisfaction of the WGCMA.
- Crossings of designated waterways and drainage pathways will be designed to meet the requirements of the WGCMA

The WGCMA will also be consulted before works commence on the floodplain or adjacent to waterways. This engagement would inform decisions on site layout protection works and contingencies during flood events.

Residual Impact

With these mitigation measures in place, the impacts to uses and environmental values brought about by changes to flow regime are considered negligible.

9.3.2 Construction activities change the flood risk and flood characteristics (SUM-I008).

Project construction activities in the floodplain can increase flood risk in a number of ways. Large stockpiles of material or elevated laydown areas can use up valuable floodplain storage leading to an increase in flood depth upstream of the works. Similarly, changes to the surface of a floodplain can also change flow characteristics by creating blockages, flow constrictions and areas of turbulence. These changes can increase the depth of floodwater on the upstream side of the impacted section. Project structures that could potentially increase flood depth include temporary access roads, trench spoil, soil windrows, site fencing, site compounds, drilling compounds, laydown areas and batching plants.

Changes to flood depth and flood extent are also likely to increase the velocity of floodwater around these structures. This can create areas of scour and increase existing areas of erosion. Fast moving floodwater is also a recognised hazard and increases in velocity, especially when considered with flood depth, may make conditions unsafe for people or damage the construction site.

Mitigation

To mitigate these impacts, long term construction facilities should, wherever possible, be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain is not formally identified through the planning scheme (SUM-M001).

For some sites, relocation of the proposed construction activities outside of the 1% AEP flood extent is not considered feasible, such as the proposed conduit stringing area and associated conduit causeway and waterway crossing. In these scenarios, additional site-specific mitigation measures will be adopted to prevent changes to flood risk or flood characteristics (SUM-M001). These measures will include:

- Site optimisation during the detailed design phase to minimise works in the floodplain. This will include locating soil stockpiles, equipment laydown areas and all non-essential plant and equipment outside of the floodplain, as far as is reasonably practicable.
- A project wide, CEMP will be developed, including surface water management measures outlined in the SWMP, in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to manage stormwater and flood risks within the construction site and the wider catchment. The plan could include, but is not limited to the following:
 - Elevating temporary buildings and containerised equipment above the 1% AEP flood level wherever practical.
 - Bunding or other appropriate barriers to divert flood flows and ensure there are no changes to flood risk off site and to neighbouring properties
 - A staged response to potential flood and storm events.

A works on waterways permit will be required for all waterway crossings and the WGCMA will be consulted at the time of application. All waterway crossing works will be carried out in accordance with the conditions of this permit and the guidance of the WGCMA.

The WGCMA will also be consulted before works commence on the floodplain or adjacent to waterways. This engagement would inform decisions on site layout, protection works and contingencies during flood events.

Residual Impact

Full implementation of the mitigation measures defined above will reduce the risks of construction activities causing changes to flood risk or flood characteristics. Any residual impacts are considered to be minor and localised with no change to the flood risk on adjacent property.

9.4 Summary of residual impacts and risks.

Adopting the mitigation and management measures described above will reduce the magnitude and therefore the consequence of impacts during the construction. Similarly, these mitigation measures and strategies will also reduce the likelihood and consequence of the associated risks. Residual impacts and risks are those that remain once mitigation and management measures have been implemented.

It is considered that all of the construction surface water impacts and risk identified and evaluated by this assessment can be mitigated through the adoption of the mitigation measures presented in this report. Subsequently, the residual surface water impacts are considered to be negligible or minor, and residual surface water risks considered low.

10.0 Operation assessment

This section discusses the potential impacts of the project as a result of operation of the project and the associated mitigation measures that aim to reduce impacts to as low a level as possible. Mitigation measures referred to are defined in section 13.0.

10.1 Project parameters that form the basis of impact assessment

Table 10-1 specifies the maximum design scenario that has been assessed for operation.

Table 10-1 Maximum design scenario – operation

Risk	Key parameter values	Justification
All	<p>The works and infrastructure are located within the onshore operation project area, which is defined by the area required for the following:</p> <ul style="list-style-type: none"> ○ Up to 8 underground cable circuits with the following upper limit footprints: <ul style="list-style-type: none"> ▪ Operation easement width between shore crossing and VicGrid Connection hub: 40 m width. 	The onshore operation project area defines the maximum land area to be utilised by the operation of the project.

To assess potential impacts associated with the project, the operational assessment has also considered the following assumptions:

- All operational and permanent infrastructure will, where possible, be located outside of the 1% AEP flood extent or land that is subject to inundation.
- Following construction, all cable trenches will be covered with topsoil and seeded with appropriate groundcover. Similarly, all joint bays will be covered with topsoil and seeded, leaving just the link pit lids above ground.
- All operational and permanent infrastructure will be managed in accordance with the Operations Environmental Management Plan (OEMP), industry standards, guidelines and technical requirements.

10.2 Water quality impacts and risks

Permanent, operational infrastructure will consist of cable trenching, link pits and joint bays. All of these assets will be constructed below existing ground level with only the link pit covers remaining visible above ground. All areas of ground disturbance caused by the construction works will be rehabilitated and revegetated with appropriate low-level plants (e.g. grass).

There are no permanent hardstand or access roads proposed for the operational phase. Subsequently, there are no anticipated water quality impacts associated with the permanent infrastructure.

10.3 Hydrological impacts and risks

The siting of permanent, operational infrastructure across waterways and floodplains can permanently change the flow regime leading to adverse effects on the environmental values and uses of the receiving waters. The following sections describe the mechanisms that can impact flow regimes, as well the necessary mitigation measures to reduce these impacts.

10.3.1 Increases in rainfall intensity and sea level rise caused by climate change lead to more frequent and severe flooding of operational infrastructure (SUM-I009).

The operational life of Star of the South is expected to be approximately 30 years, beginning in the early 2030s and running through to around 2060. During this time, greenhouse gas emissions are expected to continue to push global temperatures higher, with consequences on marine and hydrological cycles.

The Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report (IPCC, 2021) presented a range of greenhouse gas emissions scenarios and the impacts associated with climate inaction. These scenarios are termed Representative Concentration Pathways (RCPs). The high emissions concentration scenario combined low climate action is known as RCP 8.5 and is commonly used as the base case for climate modelling and climate change adaptation planning.

Under the RCP 8.5 scenario, global temperatures are predicted to rise by 3.7 degrees Celsius between 2081 and 2100. The key hydrological impacts of climate change, for the proposed onshore cable alignment, will be sea level rise and increased rainfall intensity.

Sea level rise will have implications for the proposed shore crossing location. At present, the waterway at Reeves Beach is not influenced by astronomical tides. However, predictions in sea level rise, associated with RCP 8.5, will result in the waterway at Reeves beach becoming tidal at the proposed shore crossing location, during the lifetime of the project.

Additionally, the 1% AEP storm tide at the shore crossing site will be 1.99 metres AHD by 2060, inundating the floodplain and transition joint bay locations.

Storm intensity will also increase, resulting in more frequent flooding, sedimentation and erosion across the proposed shore crossing location.

Mitigation

To mitigate these impacts, the detailed design process for all permanent and operational infrastructure, including joint bays, will consider the impacts of climate change in their design (SUM-M009). Typical measures would include designing drainage infrastructure for the predicted future climate and locating infrastructure outside of the predicted future flood extents.

Residual Impact

Making allowances for climate change in the design process will ensure the impacts of sea level rise and increasing storm intensity can be managed with minor impacts on the receiving waterways or natural flow regime.

10.3.2 Operational or permanent infrastructure blocks or diverts drainage pathways leading to changes in flow regime and downstream uses and environmental values (SUM-I010).

Operational and permanent infrastructure can change or block drainage pathways along the proposed alignment. This can occur through the construction of joint bays or through settlement and subsidence of trench backfill material across the general alignment and at waterway crossings.

Changes to the flow regime can have significant impacts on the uses of water as well as areas of habitat that have established around specific hydrological conditions.

Mitigation

All operational and permanent infrastructure, including joint bays will, where reasonably practicable, be located outside of the 1% AEP flood extent or land that is subject to inundation (SUM-M010).

For some sites, the relocation of permanent infrastructure outside of the floodplain may not be feasible and additional mitigations will be required to allow the uninterrupted flow of water through the catchment.

These mitigation measures will include the following where required (SUM-M010):

- Site optimisation during the detailed design phase to ensure all permanent infrastructure, wherever practicable, is set back from designated waterways and drainage pathways.
- Design of waterway crossings of designated waterways and drainage pathways to meet the requirements of the WGCMA.
- Diversion of minor drainage pathways around structures to maintain the existing flow regime, to the satisfaction of the WGCMA.

- Reinstatement of trenches and excavations to ensure existing surface topography and grades are maintained. This includes monitoring of backfilled excavations and remedial corrective works as required.

Residual Impact

With these mitigation measures in place, the impacts to the uses and environmental values brought about by changes to flow regime are considered minor.

10.4 Summary of residual impacts and risks

Adopting the mitigation measures described above will reduce the magnitude and therefore the consequence for all identified operational phase surface water impacts. Residual impacts are those that remain once mitigation measures have been implemented. All residual impacts associated with operational phase works on water quality and flow regime are considered to be minor.

11.0 Decommissioning assessment

This section discusses the potential impacts of the project as a result of decommissioning activities and the associated mitigation measures that aim to reduce impacts to as low a level as possible. Mitigation measures referred to are summarised in Section 13.0.

11.1 Water quality impacts and risks

The key decommissioning activities are likely to include the disassembling and removal of permanent surface infrastructure (e.g. signage and markers) with most below-ground infrastructure expected to be left in place (e.g. cable ends cut, sealed and securely buried).

Link and fibre pits may be removed in some locations, if requested by landholders or if potential environmental impacts are identified.

Potential surface water quality impacts associated with the Star of the South decommissioning activities will be largely confined to discrete locations, such as specific pits and work compounds. The following sections define the key water quality risks associated with these decommissioning works.

11.1.1 Flooding of the decommissioning sites leads to poor downstream water quality in the receiving waterways and coastal estuaries (SUM-I011).

Decommissioning sites located in the 1% AEP flood extent could be impacted by floodwater during the decommissioning works. Once inundated, floodwater can carry pollutants downstream into the receiving waterways including Jack Smith Lake Wildlife Reserve.

The severity of flooding during the anticipated decommissioning phase (2060), including flood extent, flood depth and duration will be greater than current flood levels.

Mitigation

To mitigate these risks, decommissioned infrastructure including site compounds, laydown areas, wastes and materials storage areas will, wherever possible, be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain is not formally identified through the planning scheme (SUM-M011).

For some sites, relocation of the proposed decommissioning activities outside of the 1% AEP flood extent may not be feasible and additional site-specific mitigation measures will be adopted to reduce the residual impacts.

These controls will include the development of surface water management measures, outlined in the SWMP, within the project CEMP that will set out the engineering controls and management strategies required to manage stormwater and flood risks within the decommissioning site (SUM-M014).

Residual Impact

Full implementation of the mitigation measures defined above will address the water quality impacts associated with flooding of the decommissioning sites with only localised, short term residual impacts remaining and therefore the residual impact is considered to be minor.

11.1.2 Runoff from the decommissioning works cause pollution in receiving waterways and coastal estuaries (SUM-I012).

Decommissioning works present similar water quality risks to those associated with runoff during the construction phase. These risks primarily include discharges of sediment from exposed soils, disturbed ground or unsealed surfaces and pollution caused by poor management of fuels, chemicals and wastes.

Mitigation

All decommissioning activities will be carried out in accordance with the relevant industry standard best practice guidelines at the time of decommissioning. At the minimum, these will include guidelines that relate to the following best practice management measures (SUM-M012):

- Erosion and sediment controls.

- Environmental guidelines for major construction sites.
- Storage and handling of fuels, chemicals, and wastes.

Site-specific surface water management measures will be included in the project CEMP, setting out the engineering controls and management strategies required to manage stormwater runoff and water quality impacts (SUM-M012).

Residual Impact

Full implementation of the mitigation measures defined above will address the residual water quality impacts associated with decommissioning site runoff and therefore the residual impact is considered to be minor.

11.1.3 Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries (SUM-R013).

Decommissioning works in the low-lying coastal areas may disturb ASS. The impacts remain the same as those identified with the construction phase, however, sea level rise may increase the extent of ASS in low lying coastal areas.

Mitigation

The management of ASS during the decommissioning phase will be carried out in accordance with the relevant legislation and best practice guidelines at the time of decommissioning (SUM-M013).

All decommissioning works will be staged and programmed to minimise the duration and exposure of excavations in areas identified as containing ASS (SUM-M013).

Residual Risk

Full implementation of the mitigation measures defined above will address the water quality impacts associated with the management ASS and would make the residual risk low.

11.2 Hydrological impacts and risks

Hydrological impacts associated with the Star of the South decommissioning activities will be much the same as those associated with construction. The following describes the mechanisms that impact local and external flows, as well the necessary mitigation measures to reduce these impacts.

11.2.1 Decommissioning activities block or divert drainage pathways leading to changes in flow regime and downstream uses and environmental values (SUM-I014).

As described in the construction phase assessment, changes to the flow regime, including ephemeral waterways, can have a significant impact on flow regime and the associated downstream uses and environmental values.

Mitigation

To mitigate these risks, decommissioning infrastructure including site compounds, laydown areas, wastes and materials storage areas will be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain is not formally identified through the planning scheme (SUM-M014).

For some sites, relocation of decommissioning infrastructure outside of the 1% AEP flood extent may not be feasible and additional site-specific mitigation measures will be adopted to prevent changes to flood risk or flood characteristics

These measures will be developed to meet the requirements of the relevant authorities and guidelines at the time of decommissioning and could include set backs from designated waterways and the elevation of decommissioning facilities and above the 1% AEP flood level (SUM-M014).

Residual Impact

Full implementation of the mitigation measures defined above will address the impacts associated with changes in flow regime and make the residual impacts to downstream uses and environmental values negligible.

11.2.2 Decommissioning activities change the hydrological conditions leading to increased flood levels and flooding of adjacent property (SUM-I015).

Climate change will increase the severity of flooding across the proposed site by 2060. Areas that are currently impacted by flooding will see an increase in flood extent. This includes the shore crossing site at Reeves Beach.

The placement and siting of decommissioning infrastructure, such as compounds and storage areas have the potential to exacerbate these future flood risks and create flow conditions that impact property, downstream waterways and important habitat.

Mitigation

To mitigate these risks, decommissioning infrastructure including site compounds, fencing, laydown areas, wastes and materials storage areas will be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as LSIO, as well as other waterways where the floodplain is not formally identified through the planning scheme (SUM-M014).

For some sites, relocation of decommissioning infrastructure outside of the 1% AEP flood extent may not be feasible and additional site-specific mitigation measures will be adopted to prevent changes to flood risk or flood characteristics.

These measures will be developed to meet the requirements of the relevant authorities at the time of decommissioning and could include setbacks from designated waterways and the elevation of decommissioning facilities and above the 1% AEP flood level (SUM-M014).

Residual Impact

Full implementation of the mitigation measures defined above will reduce the risks of operational facilities and associated infrastructure causing changes to flood risk or flood characteristics. Any residual impacts are considered to be minor and localised with no impact to adjacent property.

12.0 Cumulative impacts with other projects

This section provides an assessment of cumulative impacts with other proposed developments in the region. The method to consider cumulative impacts has been described in Section 6.8 and Chapter 6 - Assessment Framework within both the EIS and EES.

12.1 Projects within zone of influence

For the purpose of evaluating cumulative impacts, this assessment has identified other projects that are located within the zone of influence of this study. The zone of influence for this study has been defined as the project area and areas within one kilometre of the project area.

The initial list of projects that fall within the zone of influence for surface water are presented in Table 12-1 and are shown in Figure 12-1. Each of the projects in Table 12-1 have been evaluated against the cumulative assessment criteria to determine whether there is the potential for cumulative impacts with the project and sufficient information available to undertake a meaningful assessment.

In assessing the potential cumulative impacts for Star of the South it is important to consider that some developments, predominately those 'proposed' (referred) or identified in development plans, may not actually be taken forward, or fully built out. There is therefore a need to build in some certainty (or uncertainty) with respect to the potential impacts that may arise from such proposals, which is done by allocating projects into 'tiers'. This approach allows appropriate weight to be given to each tier when considering the potential cumulative impacts.

The Gippsland Offshore Wind Transmission 2GW Project (VicGrid) and Great Eastern Offshore Wind Farm project were identified as falling within the zone of influence for Star of the South. These were assessed as a Tier 2 (medium certainty) project. The potential for the project to result in cumulative impacts, when combined with these projects, has been considered in the following sections with respect to severity, extent and duration.

Several projects were screened out of the cumulative impact assessment because their zone of influence is >1km outside of the Star of the South zone of influence. Table 12-2 describes the projects screened in to be taken forward for the cumulative impact assessment.

Table 12-1 Cumulative impacts – projects in zone of influence

Project or action	Data confidence	Scale parameter	Receptor impact	Temporal overlap	Conclusion
(within the zone of influence)	Certainty tier	Are the potential impacts associated with the project considered material in the context of SOTS?	Will the project / action adversely affect the same receptors as the project, and have a spatial overlap? (e.g. located in the same catchment).	Will the project / action result in adverse impacts to the same receptors as the project at the same time or on a timescale that could result in a cumulative impact?	Is the long list project / action shortlisted for assessment of cumulative impacts?
Loy Yang Battery	Tier 1 – approved	No – the potential impacts are considered to be immaterial in the context of SOTS.	No – Located in a different catchment and more than 60km from the SOTS transmission Route.	Yes - operational impacts in the same period	Screened out
Greater Gippsland Offshore Wind Project	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No – Located in a different catchment and more than 60km from the SOTS transmission Route.	Yes - operational impacts in the same period	Screened out
Hazelwood Rehabilitation Project	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No – Located in a different catchment and more than 60km from the SOTS transmission Route	Yes - operational impacts in the same period	Screened out
Golden Beach-2 Gas Project	Tier 1 – approved	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No - Located in a different catchment and approx. 50 kilometres north along Ninety Mile Beach	Yes - operational impacts in the same period	Screened out
Hazelwood Battery Energy Storage System (BESS)	Tier 1 – approved / operational	No – the potential impacts are considered to be immaterial in the context of SOTS.	No – Located in a different catchment and Hazelwood BESS is operational and there are no perceived impacts from the project.	No – Hazelwood BESS is operational and there are no perceived impacts from the project.	Screened out

Project or action	Data confidence	Scale parameter	Receptor impact	Temporal overlap	Conclusion
Marinus Link	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No – Located in a different catchment and more than 60km west of SOTS transmission line	Yes - operational impacts in the same period	Screened out
Delburn wind farm	Tier 1 – approved	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No – Located in a different catchment and more than 10km west of SOTS transmission line	Yes - operational impacts in the same period	Screened out
Gippsland Regional Port Project	Tier 2 – seeking approval	No – the potential impacts are considered to be immaterial in the context of SOTS.	No – Located in a different catchment and more than 50km west of SOTS transmission line	Yes - operational impacts in the same period	Screened out
Gelliondale wind farm	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No - Located in a different catchment and 30km west of Reeves Beach	Unknown	Screened out
Seaspray Solar Farm	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	No - Located in a different catchment and approximately 6 kilometres from project	No – construction 2023	Screened out
Gippsland Offshore Wind Transmission 2GW Project (VicGrid)	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	Yes – located only a few kilometres from the SOTS transmission route	Yes - operational impacts in the same period	Screened in
Great Eastern Offshore Wind Farm	Tier 2 – seeking approval	Yes – the potential impacts are considered to be similar in nature and important in the context of SOTS.	Yes – The project areas overlap around Giffard and discharge to the same catchment.	Yes - operational impacts in the same period	Screened in

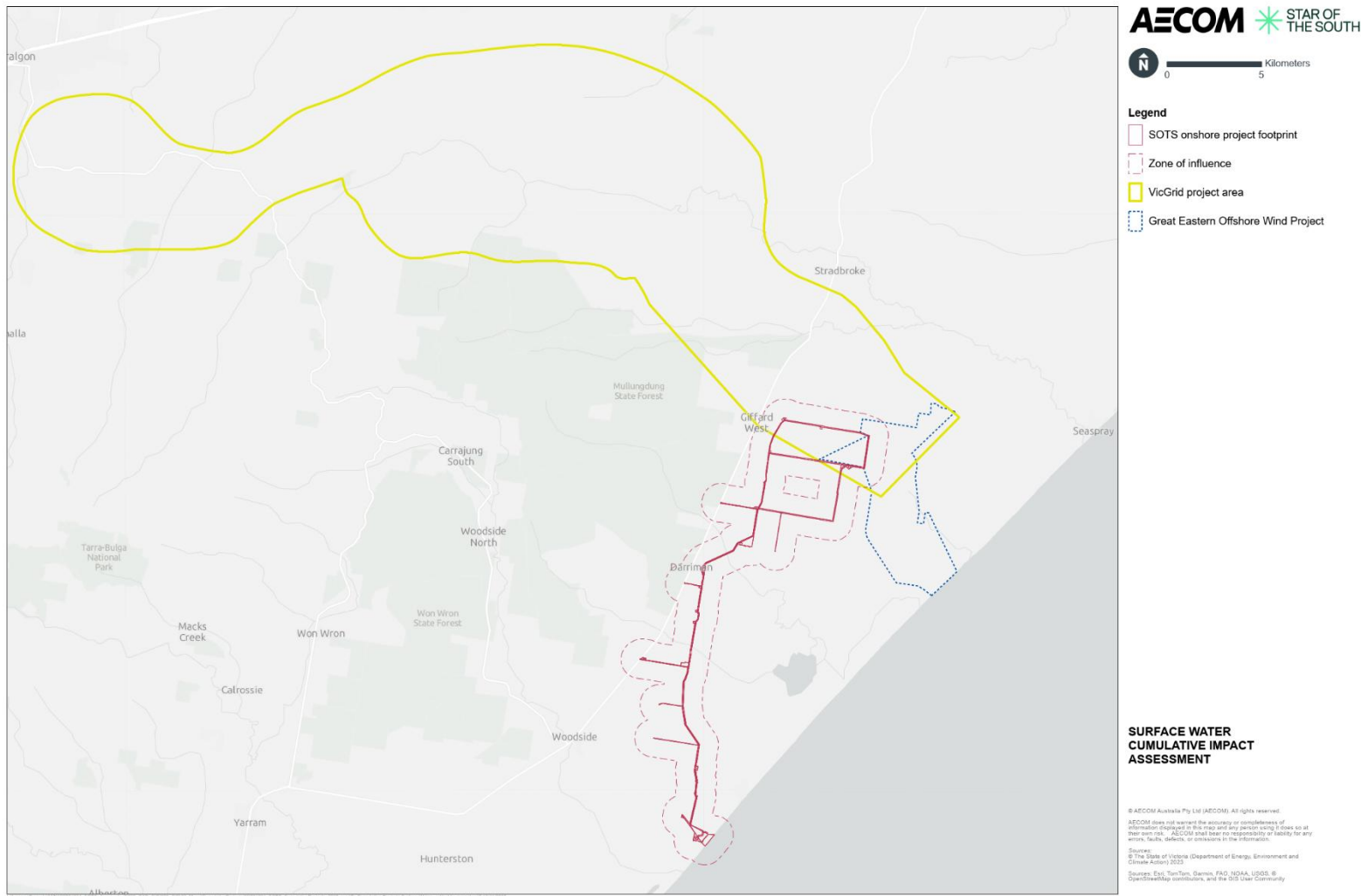


Figure 12-1 Cumulative impact zone of influence and projects further assessed

Table 12-2 Projects assessed for cumulative impacts

Project or action	Stage	Project description	Relevance to this assessment	Certainty	Assessment assumptions
Gippsland Offshore Wind Transmission 2GW Project (VicGrid)	Seeking approval	<p>Proposed 2GW transmission line from the La Trobe valley connecting to a shared terminal station (being named a connection hub) in Giffard.</p> <p>Area of investigation has been identified and follows SOTS's previously proposed route - next steps is further consultation before announcing a connection hub location along with a refined route for environmental investigations.</p> <p>The proposal for the project includes an option for an onshore transmission corridor with a similar alignment to the SOTS onshore transmission corridor.</p> <p>The construction period is indicated as Q3 2027 to Q1 2030.</p>	<p>Spatial relevance: transmission corridor runs through the same catchments in Giffard West.</p> <p>Temporal relevance: It is possible that the construction and operational phase may overlap with those of the project.</p> <p>Potential cumulative risk pathway: The potential that the surface water impacts will increase if the project construction occurs nearby concurrently. Refer to section 12.1.1 for further details</p>	Tier 2 (Medium)	Assumptions made that transmission alignments will impact the same waterways.
Great Eastern Offshore Wind Farm	Seeking approval	<p>Proposed offshore windfarm located approximately 24 kilometres off the central Gippsland coast. The project anticipates generating up to 2.4 GW using fixed bottom turbines.</p> <p>The key project components proposed within Victoria include: offshore export cables from the 3 nautical mile limit to a shore crossing at McGuarans Beach; a transition Joint Bay near the coast at McGuarans Beach; and underground cables continuing approximately 9 km northwards to VicGrid's proposed coordinated connection point near Giffard.</p> <p>The project is planned to commence construction in 2028 and begin operations in 2032.</p>	<p>Spatial relevance: transmission corridor runs through the same catchments in Giffard West.</p> <p>Temporal relevance: It is possible that the construction and operational phase may overlap with those of the project.</p> <p>Potential cumulative risk pathway: The potential that the surface water impacts will increase if the project construction occurs nearby concurrently. Refer to section 12.1.1 for further details.</p>	Tier 2 (Medium)	Assumptions made that transmission alignments will impact the same waterways.

12.1.1 Cumulative surface water impacts

The VicGrid and Great Eastern Offshore Wind projects involve transmission lines and connections to the terminal station in Giffard West. Only an approximate alignment and location was known at the time of this Surface Water Assessment, with proposed routes and terminal hub location still in development. Therefore, a limited qualitative evaluation of potential impacts is provided for the cumulative assessment.

The alignments for both of these projects potentially interface with the Star of the South Project around Giffard West. As such, there could be a risk of cumulative impacts for a small number of ephemeral unnamed waterways, particularly those flowing in to the Darriman H29 Bushland Reserve and Ninety Mile Beach beyond.. These cumulative impacts could result in changes to water quality or existing flow regime.

However, the surface water impact mitigation measures that will be adopted by the Star of the South project will result in low potential for impacts of surface water contamination or changes to flow regime, resulting in low potential for cumulative surface water impacts. It is assumed that both the VicGrid Great Eastern Offshore Wind projects will have similar mitigation measures to Star of the South and therefore the potential for cumulative impacts will be further reduced.

With these mitigation measures in place, the operation of these assets in the vicinity of Star of the South is unlikely to result in a cumulative impact on receptors.

13.0 Summary of mitigation, monitoring and contingency measures

13.1 Mitigation measures

The mitigation measures that are proposed to avoid, mitigate or manage surface water impacts associated with the project are summarised in Table 13-1. In addition to the proposed mitigation measures, additional controls were considered and assessed for practicability. An assessment of practicability of additional control measures not adopted for the project is included in Appendix B.

Table 13-1 Mitigation measures relevant to surface water.

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
SUM-M001	<p>Managing flood risk at construction sites Locate construction compounds, drilling compounds, batching plants, laydown areas and material storage areas outside of the 1% Annual Exceedance Probability (AEP) flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay.</p> <p>Where relocation is not considered feasible the following measures will be adopted: Site optimisation during the detailed design phase to minimise works in the floodplain. This will include locating soil stockpiles, equipment laydown areas and all non-essential plant and equipment outside of the floodplain.</p> <p>The Construction Environmental Management Plan (CEMP) will include a surface water management plan (SWMP) that sets out the engineering controls and management strategies required to manage stormwater and flood risks within the construction site. The plan will include, but not be limited to the following: Elevating temporary buildings and containerised equipment above the 1% AEP flood level wherever practical. Minimising soil disturbance within the floodplain. Bunding to reduce the risk of inundation from a 1% AEP flood event or storm tide. This will be designed to maintain conveyance of floodwater around the bunded area. A staged response to potential flood and storm events.</p>	Construction	SUM-I001 SUM-I008
SUM-M002	<p>Managing changes to flow regime Locate construction compounds, drilling compounds, batching plants, laydown areas and material storage areas outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay.</p>	Construction	SUM-I007

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
	<p>Where relocation is not considered feasible the following measures will be adopted: The Construction Environmental Management Plan (CEMP) will be developed in consultation with the relevant authorities. The CEMP will include a surface water management plan (SWMP) that sets out the engineering controls and management strategies required to maintain the exiting flow regime including: Set backs of works and associated construction facilities from designated waterways and drainage pathways Crossings of designated waterways and drainage pathways will be designed to meet the requirements of the West Gippsland Catchment Management Authority (WGCMA).</p>		
SUM-M003	<p>Preventing fuel and chemical spills The CEMP will be implemented and include measures and procedures for the appropriate storage, handling and transportation of chemicals and fuels, including: Store bulk fuel in self-bunded tanks in accordance with relevant Australian standards (AS1940-2017 and AS1692-2006) Refuelling or maintenance of equipment, machinery and vehicles will be conducted at least 50 m or as far away as is reasonably practical from any waterway with appropriate measures to contain spills Store hazardous materials in ventilated, self-bunded and secured containers in accordance with the Occupational Health and Safety Act 2004 (OHS Act) and Occupational Health and Safety Regulations 2007 (OHS Regulations) Store dangerous goods in accordance with the Dangerous Goods (Storage and Handling) Regulations 2012 and the code of practice for the storage and handling of dangerous goods Undertake routine and scheduled maintenance of vehicles and plant/machinery/equipment to minimise the potential for leaks/spills to occur Supply spill kits and firefighting equipment with the chemicals required by legislation Maintain dangerous goods and hazardous materials register and current safety data sheets (SDSs). Transformers to be filled only following installation of bunds to prevent discharge of oils during filling process.</p>	Construction	SUM-I001 SUM-I005
SUM-M004	<p>Preventing pollution from trenched waterway crossings All trench crossing works will be carried out in accordance with relevant regulatory</p>	Construction	SUM-I002

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
	<p>requirements and industry best practice guidelines including: International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Appendix P; Land Based Pipeline Construction Guidelines (2015). EPA Publication 1896: Working within or adjacent to waterways (2020) The conditions of any WGCMA Works on Waterways Permit. The WGCMA will be consulted for all waterway crossing works. Trench crossing works will be programmed for dry or low flow conditions, where practicable. The trenched waterway crossing excavation staging strategy will include staging the program to minimise the length of time excavations remain open, to the extent practicable. Alternative construction methodologies, such as trenchless crossings (e.g. HDD) will be considered for waterways with significant baseflows, deep or steep sided gullies, or where bank stabilisation and rehabilitation works are not feasible.</p>		
SUM-M005	<p>Preventing pollution from trenchless waterway crossings The proposed drilling profile design and the work method statement shall be submitted to the WGCMA and approved prior to the commencement of trenchless waterway crossings. Risk of frac-out will be assessed in accordance with industry best practice guidelines to determine likelihood of occurrence (e.g. modelling). Drilling profiles will be adjusted where the risk of frac-out is considered likely. Drilling fluid properties will be monitored during trenchless crossing operations to reduce the risk of frac-outs (e.g. mud weight, viscosity, pressure). Drilling equipment and configuration will be appropriate for the proposed trenchless crossing operation to prevent frac-out. Pollution prevention strategies will be in accordance with EPA Publication 1834; Civil Construction, Building and Demolition Guide, IECA Best Practice Erosion and Sediment Control Appendix P; Land Based Pipeline Construction Guidelines and EPA Publication 1896: Working within or adjacent to waterways.</p>	Construction	SUM-R003

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
	<p>Sediment control devices such as silt fences will be used to remove suspended solids and dissipate flow where required.</p> <p>Earth bunds/or and drainage channels will be placed around the upper edges of drill sites and work areas to divert natural runoff around and away from the site and prevent mixing with drilling compound runoff.</p> <p>Sump pits will be constructed at the bottom of the drill site. The sump pit will be positioned to capture runoff from the drilling compound.</p> <p>Materials collected in the sump pit will be assessed and managed in accordance with industry best practice guidelines for trenchless crossing operations.</p> <p>An earth bund or silt fence will be placed around the sump pit to contain any spillage.</p> <p>All facilities utilised in the surface mud handling (mixing, cleaning and pumping) during trenchless crossing activities will be banded.</p>		
SUM-M006	<p>Managing acid sulfate soils during construction</p> <p>All works in areas identified as containing potential ASS, an ASS management plan will be developed (also refer to mitigation GWM-M003) and all mitigation works will be carried in out in accordance with the relevant industry legislation and guidelines, including:</p> <p>Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999. EPA Victoria - Publication IWRG655.1 Acid Sulfate Soil and Rock. Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (CASS BPMG 2010).</p> <p>Construction works will be staged and programmed to minimise the duration and exposure of excavations in areas identified as containing ASS to the extent practicable.</p>	Construction	SUM-R004
SUM-M007	<p>Managing runoff from construction sites</p> <p>All construction activities will be carried out in accordance with industry standard best practice guidelines including:</p> <p>IECA Best Practice Erosion and Sediment Control Guidelines. EPA Publication 1834; Civil Construction, Building and Demolition Guide EPA Victoria Publication 1806; Reducing Risk in the Premixed Concrete Industry.</p> <p>The Construction Environmental Management Plan (CEMP) will include a surface water management plan (SWMP) that sets out the engineering controls and management</p>	Construction	SUM-I005

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
	strategies required to manage runoff during construction. The CEMP will also include requirements for appropriate soil testing at each site to identify any potentially problematic soils (e.g. dispersive soils). Where identified, the CEMP will outline the necessary control measures to ensure problematic soils are managed to prevent runoff from impacting receiving waterways and wetlands.		
SUM-M008	<p>Preventing discharges from dewatering activities</p> <p>The CEMP will adopt a management hierarchy that prioritises the prevention of discharges into surface waters as far as is reasonably practicable. Any groundwater released to surface waters will meet the water quality objectives as defined in the Environmental Reference Standards 2021.</p>	Construction	SUM-I006
SUM-M009	<p>Managing climate change impacts</p> <p>Design of the onshore operational facilities will make allowances for the impacts of climate change on surface water, including risk of inundation.</p>	Operation	SUM-I009
SUM-M010	<p>Preventing changes to flow regime from permanent infrastructure</p> <p>Locate all operational and permanent infrastructure, including joint bays, outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay.</p> <p>Where relocation is not considered feasible the following measures will be adopted:</p> <p>Site optimisation during the detailed design phase to ensure all permanent infrastructure is set back from designated waterways and drainage pathways.</p> <p>Design of waterway crossings of designated waterways and drainage pathways to meet the requirements of the WGCMA.</p> <p>Diversion of minor drainage pathways around structures to the satisfaction of the WGCMA.</p> <p>Reinstatement of trenches and excavations to ensure existing surface topography and grades are maintained. This includes monitoring of backfilled excavations and remedial corrective works as required.</p>	Operation	SUM-I010
SUM-M011	<p>Managing flood risk at decommissioning sites</p> <p>Decommissioning infrastructure including site compounds, laydown areas, wastes and materials storage areas will be located outside of the 1% AEP flood extent (2060), floodplains and areas identified as land subject to</p>	Decommissioning	SUM-I011 SUM-I014 SUM-I015

Measure ID	Mitigation measure	Phase	Related Impact/Risk ID
	inundation overlay or floodway overlay to the extent practicable. Where relocation of works outside of the floodplain is not considered feasible, a Surface Water Management Plan will be developed to set out the engineering controls and management strategies required to manage flood risks within the decommissioning site.		
SUM-M012	Managing runoff from decommissioning sites All decommissioning activities will be carried out in accordance with the relevant industry standard best practice guidelines at the time of decommissioning. At the minimum, these will include guidelines that relate to best practice: Erosion and sediment controls Environmental guidelines for major construction sites Storage and handling of fuels, chemicals, and wastes A site-specific Surface Water Management Plan will also be developed, setting out the engineering controls and management strategies required to manage stormwater runoff and water quality impacts.	Decommissioning	SUM-I012
SUM-M013	Managing acid sulfate soils The management of ASS during the decommissioning phase will be carried out in accordance with the relevant legislation and best practice guidelines at the time of decommissioning. All decommissioning works will be staged and programmed to minimise the duration and exposure of excavations in areas identified as containing ASS to the extent practicable.	Decommissioning	SUM-R013
SUM-M014	Preventing fuel and chemical spills The storage and handling of chemicals, fuels, oils and wastes will be carried out in accordance with the relevant industry standard best practice guidelines at the time of decommissioning.	Decommissioning	SUM-I012

13.2 Monitoring and contingency measures

The monitoring and contingency measures that are proposed to assess surface water impacts associated with the project are summarised in Table 13-2.

Table 13-2 Monitoring and contingency measures relevant to surface water

Measure ID	Monitoring or contingency measure	Phase	Impact/Risk ID
SUM-M015	Water quality monitoring	Construction	SUM-I001

Measure ID	Monitoring or contingency measure	Phase	Impact/Risk ID
	<p>Implement a water quality monitoring program during the construction phase to monitor changes in water quality and ensure all discharges from the proposed works are in accordance with the legislative requirements. Where feasible, baseline water quality assessments will be carried out at key project locations. This will include sampling upstream and downstream of an identified discharge point and, where feasible, real time monitoring of turbidity in surface water runoff.</p> <p>The water quality monitoring program will be documented in the CEMP, with more specific details contained in the Surface Water Management Plan, including water quality parameters, locations (including at least one location between the shore crossing and the Corner Inlet Ramsar Site) and frequency.</p> <p>The Surface Water Management Plan will also outline additional and/or improved measures that would be implemented should those controls fail or are not effective to eliminate or minimise risks of harm to surface waters</p> <p>The water quality monitoring program will be guided by multiple references and guidelines including the ERS, baseline water quality assessment results, and soil assessments reports conducted as part of geotechnical investigations.</p> <p>The water quality monitoring program will also be conducted in line with EPA Publication IWRG701: Sampling and analysis of waters, wastewaters, soils and wastes.</p>		<p>SUM-I002 SUM-R003 SUM-I005 SUM-I006</p>
SUM-M016	<p>Planned inspections</p> <p>Implement a program of periodic inspections of the easements to ensure reinstated earthworks continue to maintain existing flow characteristics and water quality.</p>	Operation	SUM-I010

14.0 Summary of implications under relevant legislation

This study has assessed the impacts of construction and operation of the project on surface water assets and values to be protected.

The significance of the impacts has been assessed in accordance with the evaluation framework, based on applicable legislation, policy and standards and the evaluation objectives and environmental significance guidelines arising from the government terms of reference established to guide the assessments.

The following sections summarise these identified impacts under the relevant Commonwealth and Victorian legislation.

14.1 Commonwealth

In relation to the evaluation objectives set out in the Star of the South EIS Guidelines, the project would not have significant impacts on surface water for the following reasons:

- The design for the shore crossing site will be optimised to remove potential sources of contamination from the floodplain and protect any remaining sensitive or potentially polluting infrastructure from the impacts of flooding.
- Best practice pollution prevention controls and guidelines will be used during construction to prevent pollution of the receiving waterway and the Corner Inlet Ramsar Site.

14.2 Victorian

In relation to the evaluation objectives set out in the Star of the South EES Scoping Requirements, the project would not have significant impacts on surface water for the following reasons:

- The project will meet the legislative requirements that relate to surface waters and the protection of the existing environment. These requirements include gaining approvals under the *Water Act (1989)* (e.g. works on waterways) and the obligations under the *Environment Protection Act (2017)* (e.g. GED).
- The proposed alignment will be optimised through the detailed design process to reduce the impacts associated with flooding and changes to flow regime.
- Best practice pollution prevention controls and guidelines will be used during construction to prevent pollution of the nearby waterways including the coastal estuaries of Ninety Mile Beach.

15.0 Conclusion

The purpose of this report is to assess the potential surface water impacts and risks associated with Star of the South Offshore Wind Farm to inform the preparation of the EIS/EES required for the project. This assessment has identified risks and proportional mitigation measures to address the GED as required under the *Environment Protection Act 2017* (EP Act). An assessment of practicability on control measures not adopted for the project is included in Appendix B.

A summary of the key assets, values or uses potentially affected by the project, and an associated assessment of surface water impacts, risks and recommended mitigation measures, are summarised below.

15.1 Existing environment

The proposed alignment will cross a number of waterways and floodplains within the South Gippsland Basin. Many of these waterways are minor ephemeral streams with poorly defined channels, small upstream catchments or modified riparian habitat. Some of these may discharge into areas of valuable habitat.

In the South Gippsland River Basin, the proposed shore crossing site is located on a low-lying floodplain of a waterway that is directly connected to the internationally recognised Corner Inlet Ramsar Site. Similarly, most of the waterways of the low-lying coastal plains of the South Gippsland River Basin drain into Jack Smith Lake Wildlife Reserve and the coastal estuaries behind Ninety Mile Beach.

Beyond environmental values, the waterways of the South Gippsland Basin provided a raft of uses including water supplies for domestic and agricultural use, as well supporting regional recreational activities such as kayaking, fishing and birdwatching.

15.2 Impact and risk assessment findings

The assessment reviewed the potential surface water impacts and risks of the proposed construction, operational, and decommissioning phases.

It was concluded that construction phase works were likely to have the greatest impact and risk on existing surface water assets. Long term construction activities in areas that are subject to inundation, such as the shore crossing facility at Reeves Beach, were considered the greatest risk due to the proximity of sensitive receptors downstream of the site. These receptors include the Corner Inlet Ramsar Site and Jack Smith Lake Wildlife Reserve.

Inundation of these sites may mobilise pollutants such as sediment, fuels and chemicals, causing pollution of surface waters and downstream environments. Some of the long-term construction facilities may also change flow characteristics through the creation of access roads, construction compounds or batching plants. Changes in the flow regime may impact uses, alter natural flows or exacerbate flooding across the site and neighbouring properties.

Runoff from construction areas was also identified as a key impact for of the project. Excavations, access roads, vegetation clearance and land disturbance may expose soils to rainfall and runoff pathways that discharge into surface waters and downstream environments. Once sediment has entered waterways, it may disrupt natural processes and change flow characteristics. Chemicals, fuels, and wastes may also be mobilised into waterways through the same pathways.

The shore crossing site at Reeves Beach is located in an area identified as potentially containing acid sulfate soils. Disturbance, exposure or mismanagement of these soils may increase the risk of acidification in groundwater. This can pollute surface waters through poor storage and handling of excavation water or through direct leaching into the waterway.

Once constructed, the permanent infrastructure poses little risk of water quality or flood impact to the receiving waterways. However, some aspects of the project, such as joint bays or reinstated ground could have the potential to change existing drainage pathways.

Decommissioning of the project will present similar risks and surface water impacts to those in the construction phase. These include runoff from the decommissioning areas, disturbance of acid sulfate soils, dewatering and spills from the storage and handling of liquids.

15.3 Mitigation and contingency measures

For many aspects of the project, the impacts and risks to surface water will be mitigated through compliance with best practice guidance for construction and environmental management. These include the adoption of controls that are described in International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control document series.

Similarly, the storage and handling of fuels, chemicals and wastes, or the management of acid sulfate soils will be carried out in accordance with legislative requirements and industry standard best practice guidelines. Consideration of the construction and operational facility locations during the design phase will further reduce the impacts of infrastructure over or adjacent to waterways. This includes the avoidance of waterway crossings and relocation of infrastructure outside of areas that are potentially impacted by current and future flooding.

Using trenchless crossings (e.g. HDD) at the waterway adjacent to the proposed shore crossing location will avoid the potential water quality impacts that are associated with trenching across perennial waterways.

All other waterway crossings on the transmission alignment will be assessed for feasibility of using open cut trenching and carried out to the satisfaction of the WGCMA and in accordance with industry best practice guidelines. These guidelines include risk mitigation measures such as upstream flow diversion and programming of works to coincide with dry or low flow conditions.

For some areas of the project, the preliminary design places infrastructure directly onto land that is subject to flooding and directly across drainage lines. These include the general alignment, joint bays, and the shore crossing site at Reeves Beach.

All of these sites will be optimised through the detailed design process to minimise impacts to the existing flow regime.

The potential for waterway pollution to impact the Corner Inlet Ramsar Site were considered significant for this internationally recognised environmental asset. Subsequently, optimisation of this site will remove potential sources of contamination from the floodplain and protect the remaining active work areas from flooding.

Optimisation of the current preliminary design, combined with the adoption of best practice management standards and regulatory requirements, will mitigate surface water impacts and risks associated with the Star of the South onshore transmission alignment. Following the implementation of mitigation measures, residual risk ratings for all identified impacts will be low or negligible.

16.0 References

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Appendix A

Risk Register

Appendix A Risk Register

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
Construction													
SUM-I001	Flooding of the construction site, or construction equipment, leads to poor downstream water quality in the receiving waterways and coastal estuaries.	<ul style="list-style-type: none"> Locate construction compounds, drilling compounds, batching plants, laydown areas and material storage areas outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay. Where relocation is not considered feasible the following measures will be adopted; <ul style="list-style-type: none"> Site optimisation during the detailed design phase to minimise works in the floodplain. This will include locating soil stockpiles, equipment laydown areas and all non-essential plant and equipment outside of the floodplain. The CEMP will be developed in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to manage stormwater and flood risks within the construction site. The plan could include, but is not limited to the following; <ul style="list-style-type: none"> Elevating temporary buildings and containerised equipment above the 1% AEP flood level wherever practical. Minimising soil disturbance within the floodplain. Bunding to reduce the risk of inundation from a 1% AEP flood event or storm tide. These will be designed to maintain conveyance of floodwater around the bunded area. A staged response to potential flood and storm events. The storage and handling of fuels, chemicals and wastes will be carried out in accordance with the Dangerous Goods (Storage and Handling) Amendment Regulations (2021), Dangerous Goods (Explosives) Interim Regulations (2021), EPA Guideline 1698; Liquid Storage and Handling Guidelines, EPA Guideline 1806. The CEMP will be implemented and include measures and procedures for the appropriate storage, handling and transportation of chemicals and fuels: <ul style="list-style-type: none"> Water quality monitoring of surface water discharges from construction sites and active, receiving waterways. Consultation with the WGCMA before commencing works on the floodplain or adjacent to waterways. 	Low	Medium	Minor	,	,	No additional project specific mitigation measures proposed	Low	Medium	Minor	,	,

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-I002	Trenching across waterways mobilises sediment and causes downstream pollution	<ul style="list-style-type: none"> All trench crossing works will be carried out in accordance with relevant regulatory requirements and industry best practice guidelines including; <ul style="list-style-type: none"> IECA Best Practice Erosion and Sediment Control Appendix P; Land Based Pipeline Construction Guidelines (2015) and EPA Publication 1896: Working within or adjacent to waterways (2020) The conditions of any WGCMA Works on Waterways Permit. The WGCMA will be consulted for all waterway crossing works. Trench crossing works will be programmed for dry or low flow conditions. Alternative construction methodologies, such as trenchless crossings, will be considered for waterways with significant baseflows, deep or steep sided gullies, or where bank stabilisation and rehabilitation works are not feasible. 	Low	Medium	Minor			No additional project specific mitigation measures proposed	Low	Medium	Minor		

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-R003	Runoff and spills from trenchless crossing causes downstream pollution	<ul style="list-style-type: none"> The proposed drilling profile design and the work method statement shall be submitted to the WGCMA and approved prior to the commencement of trenchless waterway crossings. Risk of frac-out will be assessed in accordance with industry best practice guidelines to determine likelihood of occurrence (e.g. modelling). Drilling profiles will be adjusted where the risk of frac-out is considered likely. Drilling fluid properties will be monitored during trenchless waterway crossings operations to reduce the risk of frac-outs (e.g. mud weight, viscosity, pressure). Drilling equipment and configuration will be appropriate for the proposed trenchless crossing operation to prevent frac-out. Pollution prevention strategies will be in accordance with EPA Publication 1834; Civil Construction, Building and Demolition Guide, IECA Best Practice Erosion and Sediment Control Appendix P; Land Based Pipeline Construction Guidelines and EPA Publication 1896: Working within or adjacent to waterways. Sediment control devices such as silt fences will be used to remove suspended solids and dissipate flow where required. Earth bunds/or and drainage channels will be placed around the upper edges of drill sites and work areas to divert natural runoff around and away from the site and prevent mixing with drilling compound runoff. Sump pits will be constructed at the bottom of the drill site. The sump pit will be positioned to capture runoff from the drilling compound. Materials collected in the sump pit will be assessed and managed in accordance with industry best practice guidelines for trenchless waterway crossing operations. An earth bund or silt fence will be placed around the sump pit to contain any spillage. All facilities utilised in the surface mud handling (mixing, cleaning and pumping) during drilling activities will be bunded. 	Low	Medium	Minor	Unlikely	Low	No additional project specific mitigation measures proposed	Low	Medium	Minor	Unlikely	Low
SUM-R004	Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries.	<ul style="list-style-type: none"> All works in areas identified as containing potential ASS will be carried in out in accordance with the relevant industry legislation and guidelines including; <ul style="list-style-type: none"> Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999 EPA Victoria - Publication IWRG655.1 Acid Sulfate Soil and Rock Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (CASS BPMG 2010) Construction works will be staged and programmed to minimise the duration and exposure of excavations in areas identified as containing ASS. Consultation with the WGCMA and EPA Victoria before commencing works in areas suspected of containing ASS. 	Low	Low	Negligible	Possible	Low	No additional project specific mitigation measures proposed	Low	Low	Negligible	Possible	Low

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-I005	Runoff from the construction site, including construction compounds, trenchless crossing sites, batching plants, storage facilities and site access roads, pollute receiving waterways	<ul style="list-style-type: none"> All construction activities will be carried out in accordance with industry standard best practice guidelines including; <ul style="list-style-type: none"> IECA Best Practice Erosion and Sediment Control Guidelines. EPA Publication 1834; Civil Construction, Building and Demolition Guide EPA Publication 1806; Reducing Risk in the Premixed Concrete Industry (2019). A project wide, CEMP will be developed, incorporating a Surface Water Management Plan that will outline the erosion and sediment mitigation measures for the project. The CEMP and Surface Water Management Plan will also reference the water quality monitoring program for the duration of the construction works. In addition to erosion and sediment controls, the storage and handling of fuels, chemicals and wastes will be carried out in accordance with the following; <ul style="list-style-type: none"> The Dangerous Goods (Storage and Handling) Amendment Regulations (2021). Dangerous Goods (Explosives) Interim Regulations (2021). EPA Guideline 1698; Liquid Storage and Handling Guidelines. 	Low	Medium	Minor			No additional project specific mitigation measures proposed	Low	Medium	Minor		
SUM-I006	Groundwater is extracted and released to the surface where it can enter and pollute receiving waterways	<ul style="list-style-type: none"> The CEMP will adopt a management hierarchy that prioritises the prevention of discharges into surface waters as far as is reasonably practicable. Any groundwater released to surface waters will meet the water quality objectives as defined in the Environmental Reference Standards 2021 A Dewatering Plan will be developed as part of the CEMP to manage the impacts associated with groundwater dewatering for the project. The CEMP will also reference the water quality monitoring program for the duration of the construction works. 	Low	Low	Negligible			No additional project specific mitigation measures proposed	Low	Low	Negligible		

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-I007	Construction activities block or divert drainage pathways leading to changes in flow regime and downstream uses and environmental values.	<ul style="list-style-type: none"> Locate construction compounds, drilling compounds, batching plants, laydown areas and material storage areas outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay. <p>Where relocation is not considered feasible the following measures will be adopted;</p> <ul style="list-style-type: none"> A Surface Water Management Plan will be developed as part of the project wide CEMP. The Surface Water Management Plan will be developed in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to maintain the exiting flow regime including; <ul style="list-style-type: none"> Set backs of works and associated construction facilities from designated waterways and drainage pathways Diversion of minor drainage pathways around construction sites to maintain the existing flow regime, to the satisfaction of the WGCMA. Crossings of designated waterways and drainage pathways will be designed to meet the requirements of the WGCMA. Consultation with the WGCMA before commencing works on the floodplain or adjacent to waterways. 	Low	Negligible	Negligible			No additional project specific mitigation measures proposed	Low	Negligible	Negligible		

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-I008	Construction activities change the hydrological conditions leading to increased flood levels and flooding of adjacent property.	<p>Locate construction compounds, drilling compounds, batching plants, laydown areas and material storage areas outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay. Where relocation is not considered feasible the following measures will be adopted:</p> <ul style="list-style-type: none"> • Site optimisation during the detailed design phase to minimise works in the floodplain. This will include locating soil stockpiles, equipment laydown areas and all non-essential plant and equipment outside of the floodplain. • A Surface Water Management Plan will be developed as part of the project wide CEMP. The Surface Water Management Plan will be developed in consultation with the relevant authorities. The plan will set out the engineering controls and management strategies required to manage stormwater and flood risks within the construction site. The plan could include, but is not limited to the following: <ul style="list-style-type: none"> - Elevating temporary buildings and containerised equipment above the 1% AEP flood level wherever practical. - A staged response to potential flood and - Bunding or other appropriate barriers to divert flood flows and ensure there are no changes to flood risk off site and to neighbouring properties - A staged response to potential flood and storm events. • Consultation with the WGCMA before commencing works on the floodplain or adjacent to waterways. • A works on waterways permit will be required for all waterway crossings and the WGCMA will be consulted at the time of application. All waterway crossing works will be carried out in accordance with the conditions of this permit and the guidance of the WGCMA. 	Low	Low	Minor			No additional project specific mitigation measures proposed	Low	Low	Minor		
Operation													
SUM-I009	Increases in rainfall intensity and sea level rise caused by climate change lead to more frequent and severe flooding of operational infrastructure	<ul style="list-style-type: none"> • Design of the onshore operational facilities will make allowances for the impacts of climate change on surface water. 	Low	Low	Minor			No additional project specific mitigation measures proposed	Low	Low	Minor		

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-I010	Operational or permanent infrastructure blocks or diverts drainage pathways leading to changes in flow regime and downstream water dependent habitats.	<ul style="list-style-type: none"> Locate all operational and permanent infrastructure outside of the 1% AEP flood extent, floodplains and areas identified as land subject to inundation overlay or floodway overlay. <p>Where relocation is not considered feasible the following measures will be adopted:</p> <ul style="list-style-type: none"> Site optimisation during the detailed design phase to ensure all permanent infrastructure is set back from designated waterways and drainage pathways. Design of waterway crossings of designated waterways and drainage pathways to meet the requirements of the WGCMA. Diversion of minor drainage pathways around structures to maintain the existing flow regime, to the satisfaction of the WGCMA. Reinstatement of trenches and excavations to ensure existing surface topography and grades are maintained. This includes monitoring of backfilled excavations and remedial corrective works as required. 	Medium	Low	Minor			No additional project specific mitigation measures proposed	Medium	Low	Minor		
Decommissioning													
SUM-I011	Flooding of the decommissioning sites leads to poor downstream water quality in the receiving waterways and coastal estuaries.	<ul style="list-style-type: none"> To mitigate these risks, decommissioned infrastructure including site compounds, laydown areas, wastes and materials storage areas will, wherever possible, be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as land subject to inundation overlay, as well as other waterways where the floodplain is not formally identified through the planning scheme. For some sites, relocation of the proposed decommissioning activities outside of the 1% AEP flood extent may not be feasible and additional site-specific mitigation measures will be adopted to reduce the residual impacts. These controls will include the development of a site-specific Surface Water Management Plan that will set out the engineering controls and management strategies required to manage stormwater and flood risks within the decommissioning site. 	Low	Medium	Minor			No additional project specific mitigation measures proposed.	Low	Medium	Minor		
SUM-I012	Runoff from the decommissioning works cause pollution in receiving waterways and coastal estuaries	<ul style="list-style-type: none"> All decommissioning activities will be carried out in accordance with the relevant industry standard best practice guidelines at the time of decommissioning. At the minimum, these will include guidelines that relate to best practice: <ul style="list-style-type: none"> Erosion and sediment controls Environmental guidelines for major construction sites Storage and handling of fuels, chemicals, and wastes The storage and handling of chemicals, fuels, oils and wastes will be carried out in accordance with the relevant industry standard best practice guidelines at the time of decommissioning. <p>A site-specific Surface Water Management Plan will also be developed, setting out the engineering controls and management strategies required to manage stormwater runoff and water quality impacts.</p>	Low	Medium	Minor			No additional project specific mitigation measures proposed	Low	Medium	Minor		

Impact or risk ID	Impact or risk pathway	Initial mitigation	Initial Impact or risk level					Final mitigation	Residual impact or risk level				
			Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level		Receptor sensitivity	Magnitude	Consequence level	Likelihood	Risk level
SUM-R013	Disturbance, handling, storage, treatment or disposal of acid sulfate soils results in the generation of acidic waters that impact receiving waterways and coastal estuaries.	<ul style="list-style-type: none"> The management of ASS during the decommissioning phase will be carried out in accordance with the relevant legislation and best practice guidelines at the time of decommissioning. All decommissioning works will be staged and programmed to minimise the duration and exposure of excavations in areas identified as containing ASS. 	Low	Low	Negligible	Possible	Low	No additional project specific mitigation measures proposed	Low	Low	Negligible	Possible	Low
SUM-I014	Decommissioning activities block or divert drainage pathways leading to changes in flow regime and downstream water dependent habitats.	<ul style="list-style-type: none"> All decommissioning infrastructure including site compounds, laydown areas, wastes and materials storage areas will be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as land subject to inundation overlay, as well as other waterways where the floodplain is not formally identified through the planning scheme. <p>Where relocation is not considered feasible the following measures will be adopted:</p> <ul style="list-style-type: none"> Consultation with the WGCMA before commencing works on the floodplain or adjacent to waterways. Development of measures that meet the requirements of the relevant authorities at the time of decommissioning (e.g. setbacks from designated waterways and the elevation of decommissioning facilities and above the 1% AEP flood level). 	Low	Negligible	Negligible			No additional project specific mitigation measures proposed	Low	Negligible	Negligible		
SUM-I015	Decommissioning activities change the hydrological conditions leading to increased flood levels and flooding of adjacent property.	<ul style="list-style-type: none"> All decommissioning infrastructure including site compounds, fencing, laydown areas, wastes and materials storage areas will be located outside of the 1% AEP flood extent or land that is subject to inundation. This includes areas formally identified as land subject to inundation overlay, as well as other waterways where the floodplain is not formally identified through the planning scheme. <p>Where relocation is not considered feasible the following measures will be adopted:</p> <ul style="list-style-type: none"> Consultation with the WGCMA before commencing works on the floodplain or adjacent to waterways. Development of measures that meet the requirements of the relevant authorities at the time of decommissioning (e.g. setbacks from designated waterways and the elevation of decommissioning facilities and above the 1% AEP flood level). 	Low	Low	Minor			No additional project specific mitigation measures proposed	Low	Low	Minor		

Appendix B

Assessment of Practicability

Appendix B Assessment of practicability

Mitigation measure	Location	Factor to consider (EPA Victoria Publication 1856)	Commentary on practicability	Effectiveness	Adopted?
Relocation of shore crossing site to the western side of the unnamed coastal waterway.	Shore crossing facility.	Elimination	Not possible.	Low. Relocation of the shore crossing site is constrained by the physical limitations of the cables. Therefore, it is not considered feasible to move the shore crossing site to the western side of the adjacent unnamed waterway.	No
		Likelihood	Low. The proposed mitigation measures presented in section 13 of this assessment will reduce the likelihood of harm occurring.		
		Degree / Consequence	Low. The proposed mitigation measures presented in section 13 of this assessment will reduce the severity of environmental harm leaving only minor, localised and short-term impacts.		
		Knowledge	High		
		Availability	High		
		Cost	Moderate		