Appendix C

Surface Water Impact Assessment

MARINUS LINK

Marinus Link – Tasmania Surface Water Impact Assessment

FINAL

21 November 2024

alluvium

Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for **Tetra Tech Coffey** under the contract titled '**Marinus Link Crossing Assessment**'.

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Cover image:	abstract river image, Shutterstock

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Abbreviations

AEP	Annual Exceedance Probability
ANZG	Australian and New Zealand Governments
ARR	Australian Rainfall and Runoff
CIA	Cumulative Impacts Assessment
cm	Centimetres
CMA	Catchment Management Authority
DCCEEW	Commonwealth Government Department of Climate Change, Energy, the Environment and Water
DELWP	Department of Environment, Land, Water and Planning (Vic)
DEM	Digital Elevation Model
DEP	Derwent Estuary Program
DGV	Default Guideline Values
DNRET	Department of Natural Resources and Environment Tasmania
DPIWE	Tasmanian Department of Primary Industries, Water and Environment
D50	Mean rock size for which 50% of rocks are smaller
EE Act	*Environment Effects Act 1978 (Vic)*
EES	Environmental Effects Statement
EIS	Environmental Impact Statement
EMPCA	*Environmental Management and Pollution Control Act 1994 (Tas)*
EPA	Environment Protection Authority (Tasmania)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cwth)*
ERS	Environmental Reference Standard
GIS	Gas insulated switchgear
GIS	Geographic Information System
HDD	Horizontal direction drilling
HDPE	High density polyethylene
HVAC	High voltage alternating current
HVDC	High voltage direct current
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISC	Index of Stream Condition
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
kVA	Kilo-Volt-Amperes
L	Litre
LGAT	Local Government Association Tasmania
LiDAR	Light Detection and Ranging
LIST	Land Information System Tasmania
LUPAA	*Land Use Planning and Approvals Act 1993*
m	Metres
m^2	Square metres
mm	Millimetres
MERI	Monitoring, Evaluation, Reporting and Improvement
mg	Milligrams
MLPL	Marinus Link Pty Ltd
MNES	Matters of national environmental significance
MW	Megawatt
N	Newtons
NEM	National Electricity Market
NTU	Nephelometric Turbidity Units
NWQMS	National Water Quality Management Strategy
NWTD	North West Transmission Developments
pH	Potential of hydrogen
PEV	Protected environmental values
RCP	Representative Concentration Pathway
RMPS	Resource Management and Planning System
SEPP	State Environment Protection Policies
SPWQM	State Policy on Water Quality Management
TCM	Trenchless Construction Method

TPS	Tasmanian Planning Scheme
VSC	Voltage source converter
W	Watts
WQG	Water Quality Guidelines
WQO	Water Quality Objectives
WSUD	Water sensitive urban design
XLPE	Cross-linked
4WD	Four-wheel drive
μg	Microgram
μS	Micro siemens
°C	Degrees Celsius
%	Percent

Glossary

AEP	Annual Exceedance Probability- The probability that a given flow event will be exceeded in any one year
Aggradation	The deposition of material by a river, stream or current.
Confined	The channel abuts the valley margin along more than 90% of its length and occasional floodplain pockets occur on the inside of bends (discontinuous).
Deposition	Process of sediment being 'dropped' or deposited, generally due to a reduction in transport capacity.
Erosion (fluvial)	Detachment/removal of material on river beds and banks through fluvial (river) processes (e.g. flow conditions)
Floodplain	A relatively flat area, adjacent to a waterway that is likely to be inundated under a maximum flood.
Fluvial	Pertaining to water flow and rivers
Geomorphology (fluvial)	The physical form of the bed and banks of a waterway, including habitat features and physical processes (erosion and deposition)
Hydraulic modelling	Computer models that calculate water flow characteristics (velocity, depth, etc.) using information on channel and floodplain geometry, stream slope, land cover/vegetation, man-made factors (bridges, levees, culverts) and different flow (hydrologic) conditions.
Hydrologic modelling	Computer models designed to estimate the amount of runoff or streamflow generated by individual rainfall (or other precipitation) events or by a combination of various rainfall events over a catchment. These models consider different land cover, soil types and topography.
Hyetograph	A graphical representation of the distribution of rainfall intensity over time.
Incision	A process of channel deepening and widening.
Levees	A natural or human made earthen bank that restricts flooding.
LiDAR	Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure distances to the Earth.
Manning's n	A roughness coefficient used in Manning's equation to represent the resistance to flow in channels and floodplains
Riparian zone	Any land which adjoins, directly influences, or is influenced by a body of water.
Scour	A form of bank erosion caused by sediment being removed from stream banks particle by particle. Scour occurs when the force applied to a bank by flowing water exceeds the resistance of the bank surface to withstand those forces.
Shear stress	The external force acting on an object or surface parallel to the slope or plane in which it lies; the stress tending to produce shear. Measured in Newtons per square metre (N/m^2).
tioxide	Titanium dioxide, a white pigment used mainly in paint.
Topography	The form and features of land surfaces

Executive summary

Marinus Link (the project) is a proposed 1,500-megawatt (MW) HDVC electricity interconnector between Heybridge in northwest Tasmania and the Latrobe Valley in Victoria. The portion of the project alignment covered in this surface water impact assessment is defined as Heybridge in Tasmania.

The project was referred to the Australian Minister for the Environment 5 October 2021. On 4 November 2021, a delegate of the Minister for the Environment determined that the proposed action has the potential to have a significant impact on the environment and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) and will be assessed by an environmental impact statement (EIS) under the EPBC Act.

As the project is proposed to be located within three jurisdictions, the Tasmanian Environment Protection Authority (Tasmanian EPA), Victorian Department of Transport and Planning (DTP), and Australian Department of Climate Change, Energy, Environment and Water (DCCEEW) have agreed to coordinate the administration and documentation of the three assessment processes. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing. A separate EIS/EES is being prepared to address the requirements of DTP and DCCEEW.

Surface water includes any natural water on land that has not infiltrated below the ground, including runoff from rainfall, and waterways and wetlands. As well as providing aquatic and riparian habitat, and recreation and amenity values, surface water also provides a valuable resource for domestic, industrial and agricultural use, and supports Aboriginal cultural heritage values. It is therefore important to consider when assessing the impacts of the project.

This report incorporates the surface water impact assessment relevant to the Heybridge study area located in the Tasmanian jurisdiction. The purpose of this study is to characterise the baseline condition of surface water and assess the potential impacts associated with the project to inform the preparation of the EIS under the Commonwealth (Cwlth) and Tasmanian (Tas) EIS guideline requirements required for the project.

This report also provides recommended mitigation measures to reduce the risk of the project impacting on surface water values to meet the EIS guideline requirements relevant to surface water.

Assessment guidelines overview

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link (EPA Tasmania, 2022)
- Environmental Impact Statement Guidelines Marinus Link Pty Ltd Heybridge shore crossing for Marinus Link (EPA Tasmania, 2022)

The requirement for the EIS guidelines (Tas) includes defining and assessing:

- Existing conditions
- Performance requirements
- Potential impacts
- Avoidance and mitigation measures

- Assessment of residual impacts
- Offsetting unavoidable adverse impacts
- Key issues to be addressed.

The purpose of this report is to assess the potential surface water impacts associated with the Heybridge converter station and shore crossing to inform the two EISs being prepared to address the Tasmanian EPA requirements required for the project.

Study area

This study focuses on the potential surface water impact of the proposed converter station and shore crossing at Heybridge in Tasmania. The site is located northwest of the town of Heybridge on Tasmania's north coast, within the Blythe River catchment. To the south of the proposed site, the Blythe River flows north towards the sea. Smaller tributaries are also located to the west and southwest of the site. The town of Chasm Creek lies to the northwest of the proposed site.

Baseline characterisation (existing conditions)

Desktop assessments were undertaken to identify and document surface water related environmental values relevant to the converter station and shore crossing in Heybridge. Section 6 provides a baseline characterisation to describe existing surface water conditions of the study area. This outlines the existing flooding, water quality and geomorphic conditions, based on available data and information from the desktop assessment. This includes review of available data and literature as well as baseline flood modelling. Baseline conditions include:

- Flooding- Flood mapping of existing conditions in the 0.5 % AEP event indicates that the Blythe River is largely confined to its floodplain and does not interact with the Heybridge converter station development site. Surface flows follow well defined valleys before joining the Blythe River. the proposed development area, the former tioxide plant, is situated outside the Blythe River floodplain, adjacent to the Bass Highway. The existing conditions model highlights significant ponding of water in the northern extent of the converter station footprint, with depths up to 1.6m at the entrance to the outfall culvert that passes beneath the Bass Highway
- Water quality – monitoring data for the site and Blythe River estuary is lacking. Known factors influencing existing water quality in the Blythe catchment, river and estuary include:
    - Forestry, cropping, dairy, and other agricultural activities.
    - Industrial activities such as:
        - The paint pigment factory (tioxide Australia) at the site of the proposed converter station that historically released an iron-rich acid solution into the water until it was closed in 1996.
        - Mineral processing operations with significant discharges of silica sand to the Lower Blythe River
- Geomorphology- the shear stress analysis for the 0.5 % AEP and climate change events indicate that the areas of higher shear stress are concentrated in the confined valleys with surface flows coalescing before joining the low energy, Blythe River. Given the existing land use of the area, the bed material is predominately bare land and sand at the former tioxide plant, erosion is typically expected under the current and climate change scenarios as the values through these areas are subject to 10-20 N/m^2. It is anticipated that this erosion would mobilise sand and transport it over the site from west to east and result in sediment build up at the entrance to the culvert outfall.

Impact assessment

The impact assessment has considered the potential for the construction and operation of the project to influence water quality, geomorphology and flooding. From these key surface water values, a range of potential risks associated, including their respective hazards and impact pathways for these risks were identified, with a risk assessment approach adopted for the purposes of determining these potential effects of the project. Table 11 outlines this risk assessment, prior to development of the mitigation measures. The residual risk assessment takes into account the implementation of the specified mitigation measures, which is summarised in section 7.7.

The risk assessment identified two high risk activities and several moderate risk actives. Identified moderate risk activities centre around excavation or filling to create the converter station fill pad leading to a reduction in the floodplain's capacity to store and or transport flood water. This mechanism risks increasing flood frequency, velocity or flood levels which can affect users, adjacent assets or water quality.

The two identified high risk activities centre around the impacts from potentially contaminated water during construction or from bunded areas during operation. Changes to water quality, such as from spill events has potential to increase sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals leading to degradation in water quality, ecosystem health/reproduction or aesthetics.

It was noted that clean surface water runoff and overflow from the proposed interceptor traps will discharge to the ocean via the existing site drainage culvert under Bass Highway. This introduces the potential that if construction spills or if the interceptor trap is undersized and overwhelmed it may release contaminants to the downstream environment.

Mitigation measures

In order to address the risks posed by the project on surface water, a list of mitigation measures have been developed as presented in Table 12 to Table 14 and are further described in section 7.6. The table groups measures recommended in the two projects phases: construction and operation.

The two identified high-risk activities will be managed through Implementation of mitigation measures SW02 and SW04, which will reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

Identified moderate risks will be managed through implementation of mitigation measures SW01, SW02 and SW03, which will reduce the likelihood of impacting flood conveyance behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.

By implementing these surface water mitigation measures, the project aims to minimise the likelihood of impacts, resulting in a low overall risk rating for surface water values which are flooding, water quality and geomorphology. The assessment of residual risks, considering the implementation of mitigation measures, has been assessed and the outcomes are presented in Table 15, which confirms the low residual risks to surface water during both construction and operation phases of the project.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

Cumulative impacts

This surface water impact assessment includes a Cumulative Impacts Assessment (CIA) of multiple projects occurring at similar times and within proximity to each other. Proposed and reasonably foreseeable projects have been identified based on their potential to contribute to cumulative impacts by overlapping with the proposed project location and timeframe.

An assessment was conducted on the cumulative impact of flooding, water quality, and geomorphology of these projects. Through implementation of the specified mitigation measures proposed in Table 12 to Table 14, the project is not expected to impact water quality, flows, or bed and bank stability within local waterways. The project is also not expected to create adverse flood impacts or pose an increased health and safety risk to workers or operational staff.

Conclusion

This report has been prepared within the limitations and identified data gaps of the work outlined in Section 5.5.

Based on the risks and their associated mechanisms identified above, a series of mitigation measures have been developed to effectively manage these potential risks, including the requirement to develop of an Progressive Erosion and Sediment Management Plan (SW02) that would specify the measures the construction process would be required to adhere to, so that flood risk was minimised. Following the application of these mitigation measures, the residual surface water risks are substantially reduced.

While the flood mapping indicates that the proposed converter station will result in minor increases in flood depth and extent as a result of the works, this is generally limited to less than 100 mm, contained to the immediate area and are considered to be within acceptable change/impacts to flood behaviour. However, additional detailed flood modelling through the design phase should be undertaken to confirm the flood impact of the final design on adjacent infrastructure (such as the existing culvert outfall to the west of the station footprint), refine migration options and seek acceptance from Burnie City Council (as per SW01).

The implementation of the mitigation measures proposed within this report directly address the impacts identified and provide an effectively means manage the identified risks associated with the construction and operation phases to an acceptable level.

1 Introduction

The proposed Marinus Link (the project) comprises a high voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria, to allow for the continued trading and distribution of electricity within the National Energy Market (NEM).

The project was referred to the Australian Minister for the Environment 5 October 2021. On 4 November 2021, a delegate of the Minister for the Environment determined that the proposed action is a controlled action as it has the potential to have a significant impact on the environment and requires assessment and approval under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act) before it can proceed. The delegate determined that the appropriate level of assessment under the EPBC Act is an environmental impact statement (EIS).

In July 2022 a delegate of the Director of the Environment Protection Authority Tasmania determined that the project be subject to environmental impact assessment by the Board of the Environment Protection Authority (the Board) under the Environmental Management and Pollution Control Act 1994 (Tas) (EMPCA).

On 12 December 2021, the former Victorian Minister for Planning under the Environment Effects Act 1978 (Vic) (EE Act) determined that the project requires an environment effects statement (EES) under the EE Act, to describe the project's effects on the environment to inform statutory decision making.

As the project is proposed to be located within three jurisdictions, the Tasmanian Environment Protection Authority (Tasmanian EPA), Victorian Department of Transport and Planning (DTP), and Australian Department of Climate Change, Energy, Environment and Water (DCCEEW) have agreed to coordinate the administration and documentation of the three assessment processes. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing. A separate EIS/EES is being prepared to address the requirements of DTP and DCCEEW.

This report has been prepared by Alluvium Consulting Australia Pty Ltd (Alluvium) for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 Project overview

The project is a proposed 1500-megawatt (MW) HVDC electricity interconnector between Heybridge in North West Tasmania and the Latrobe Valley in Victoria (Figure 1). Marinus Link is proposed to provide a second link between the Tasmanian renewable energy resources and the Victorian electricity grids enabling efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is most needed and will increase energy capacity and security across the National Electricity Market (NEM).

Marinus Link Pty Ltd (MLPL) is the proponent for the project and is a wholly owned subsidiary of Tasmanian Networks Pty Ltd (TasNetworks). TasNetworks is owned by the State of Tasmania and owns, operates and maintains the electricity transmission and distribution network in Tasmania.

Tasmania has significant renewable energy resource potential, particularly hydroelectric power and wind energy. The potential size of the resource exceeds both the Tasmanian demand and the capacity of the existing Basslink interconnector between Tasmania and Victoria. The growth in renewable energy generation in mainland states and territories participating in the NEM, coupled with the retiring of baseload coal-fired generators, is reducing the availability of dispatchable generation that is available on demand.

Tasmania's existing and potential renewable resources are a valuable source of dispatchable generation that could benefit electricity supply in the NEM. Marinus Link will allow for the continued trading, transmission and distribution of electricity within the NEM. It will also manage the risk to Tasmania of a single interconnector across Bass Strait and complement existing and future interconnectors on mainland Australia. Marinus Link is expected to facilitate the reduction in greenhouse gas emissions at a state and national level.

Interconnectors are a key feature of the future energy landscape. They allow power to flow between different regions to enable the efficient transfer of electricity from renewable energy zones to where the electricity is needed. Interconnectors can increase the resilience of the NEM and make energy more secure, affordable and sustainable for customers. Interconnectors are common around the world including in Australia. They play a critical role in supporting Australia's transition to a clean energy future.

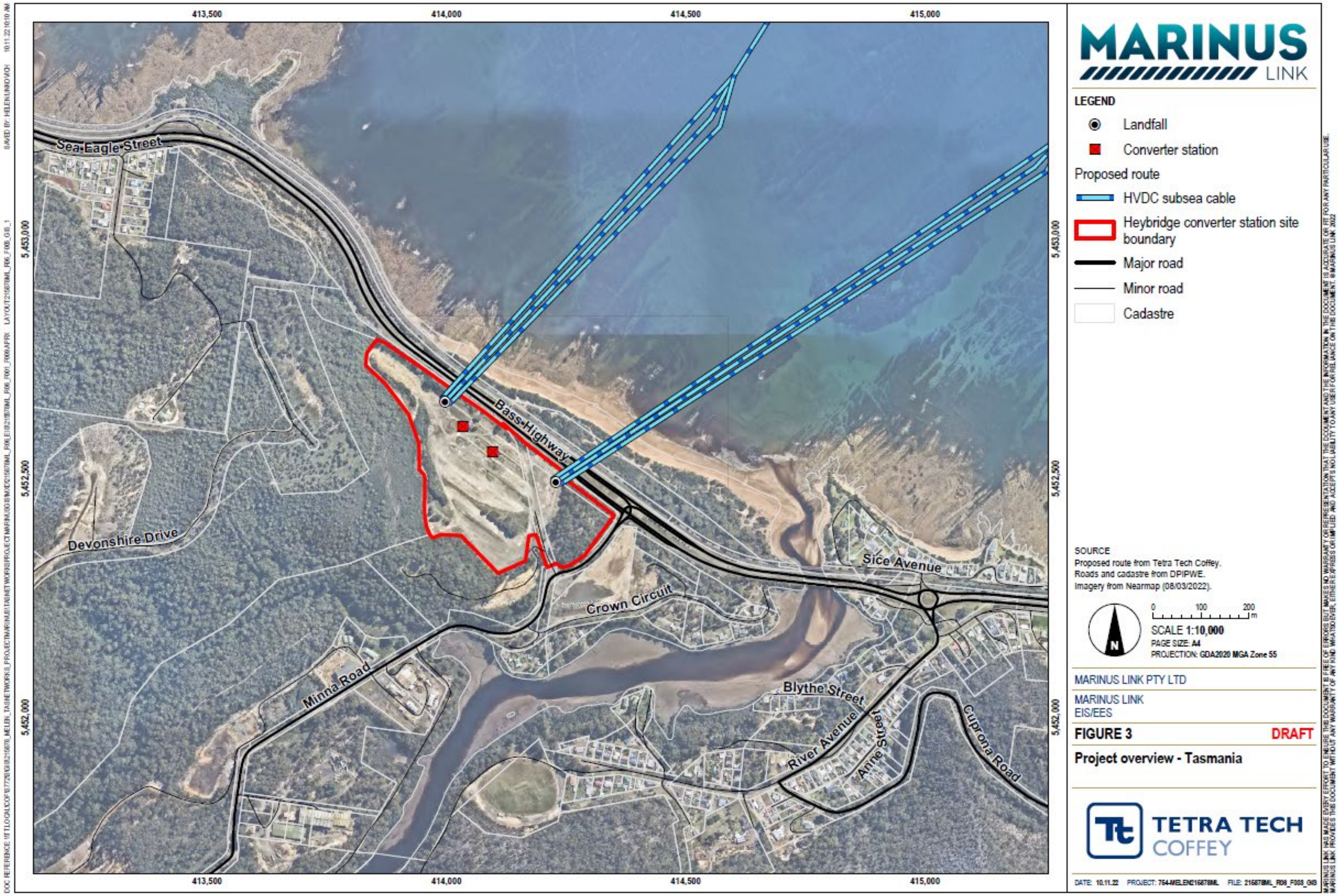

Figure 1. *Project Overview*

1.2 Purpose of this report

The purpose of this study is to characterise the existing surface water conditions and assess the potential surface water impacts associated with Heybridge converter station and shore crossing, to inform the preparation of the two separate EISs under the Tasmanian EIS guideline requirements required for the project.

This report has also defined recommended mitigation measures to limit potential risks of the project on surface water values to meet the Tasmanian EIS guideline requirements relevant to surface water.

Study objectives

This study focuses on the potential surface water impact of the proposed converter station and shore crossing in Heybridge. The study objectives are to identify and evaluate the potential impacts on surface water values that the proposed project may pose and propose appropriate measures to avoid, minimise, mitigate and manage identified impacts, as far as reasonably practicable. This includes development of mitigation measures to be implemented to reduce relevant environmental impacts.

Assessment context

Surface water includes any natural water on land that has not infiltrated below the ground, including runoff from rainfall, and waterways and wetlands. Aside from providing aquatic and riparian habitat, and recreation and amenity values, surface water also provides a valuable resource for domestic, industrial and agricultural use, and supports Aboriginal cultural heritage values. It is therefore important to consider when assessing the impacts of the project.

Healthy waterways can be described in numerous different ways. Key components of waterway health include:

- Flow – the volume, timing, frequency and characteristics (e.g., velocity) of water flow
- Connectivity – both longitudinally up and down a waterway and laterally across the floodplain
- Water quality – parameters such as temperature, dissolved oxygen, pollutants, nutrients and turbidity that support waterway ecosystems.
- Geomorphology – the physical form of the bed and banks of a waterway, including habitat features and physical processes (erosion and deposition)
- Fringing riparian and floodplain vegetation – providing shading, nutrient inputs and physical habitat.

Surface water is also important to human values through provision of water for domestic and stock use; social, cultural, and recreational uses of surface water; and minimised flood impacts on property and assets.

Potential impacts

Potential impacts from the project on the surface water environment have been identified in the Commonwealth and Tasmanian EIS guideline requirements and are considered further by this impact assessment. These potential impacts were also identified based on the professional experience of Alluvium's hydrologists and their environmental team on other similar linear infrastructure projects and is informed by the understanding of the existing conditions presented in Section 6.

The project has potential to impact on these waterways during construction and operation through the following processes:

- Changed flood behaviour, either reducing or increasing flood extents (through redirection of flow), increasing risk to property or assets elsewhere.
- Reduced water quality through release of pollutants or sediment to waterways, impacting on surface water ecosystems and human uses.
- Altered geomorphic condition resulting in changes in physical habitat, erosion, or deposition processes.

The loss of water availability or storage is not considered through this assessment, given no dams or water storages are proposed. Impacts associated with decommissioning will need to be assessed at the time of decommissioning.

2 Assessment guidelines

This section outlines the assessment guidelines relevant to the surface water impact assessment and the linkages to other technical studies completed for the project. Two separate EISs are being prepared to address the EIS guidelines published by EPA Tasmania for the Heybridge converter station and shore crossing.

2.1 EPA Tasmania Guidelines

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link, September 2022,* Environment Protection Authority Tasmania (Tas converter station EIS guidelines)
- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Shore Crossing for Marinus Link, September 2022*, Environment Protection Authority Tasmania (Tas shore crossing EIS guidelines)

The requirement for the EIS guidelines (Tas) includes defining and assessing:

- Existing conditions
- Performance requirements
- Potential impacts
- Avoidance and mitigation measures
- Assessment of residual impacts
- Offsetting unavoidable adverse impacts
- Key issues to be addressed.

The sections of the EIS guidelines (Tas) relevant to the surface impact water assessment are provided in Table 1.

Table 1. Guidelines for the EIS relating to the surface water impact assessment.

Requirement	Report section
Existing conditions	
Outline the existing conditions relevant to the impact.	Section 6
Performance requirements	
Identify the mitigation measures to be achieved for each environmental impact and provide evidence to demonstrate that these can be complied with. These may be standards or requirements specified in legislation, codes of practice, state policies, national guidelines (including relevant recovery plans or conservation advice) or as determined by agreement with the assessing agencies. Industry best practice standards should be referred to where appropriate.	Section 5.2 and 7.6
Potential impacts	
Outline the potential environmental, social, and economic impacts of the proposal (positive and negative) through all stages, including construction, operation, and closure, in the absence of special control measures. Any	Section 7

Requirement	Report section
foreseeable variations in impacts during the start-up and operational phases should be identified. Include an analysis of the significance of the relevant impacts.	
Provide an assessment of the potential cumulative impacts of the proposal in the context of existing and approved developments in the region	Section 7.8
Avoidance and mitigation measures	
Describe the measures proposed to avoid or mitigate potential adverse impacts (having regard to best practice environmental management as defined in the EMPC Act) in order to achieve the environmental performance requirements (such as through pollution control technology or management practices).	Section 7.6
Assessment of residual impacts	
Undertake an assessment of the overall impacts of the development on the environment after allowing for the implementation of proposed avoidance and mitigation measures.	Section 7.7
Key issues	
Potential impacts on terrestrial natural values. • Specify, map and discuss impacts on known sites of conservation significance or natural processes (such as fluvial or coastal features) • Describe natural processes of particular importance for the maintenance of the existing environment (e.g., fire, flooding, etc)	Marinus Link Heybridge converter station – Terrestrial ecology baseline and impact assessment (Entura 2024)
Potentially contaminated material and acid sulfate soils	Contaminated Land and Acid Sulfate Soils Impact Assessment – Heybridge Converter Station Tasmania (Tetra Tech Coffey, 2024)
Potential impacts on marine natural values.	Marine Ecology and Resource Use Impact Assessment (EnviroGulf Consulting, 2024)
Water quality (surface and groundwater): Discuss potential impacts of construction and operation of the proposal on surface and groundwater, including: • Results of any baseline water quality, biological and sediment monitoring undertaken of potentially impacted waterways. • Consideration of Protected Environmental Values (PEVs). • Identify any freshwater ecosystems of high conservation management priority using the Conservation of Freshwater Ecosystem Values (CFEV). • Details of potential stormwater management (including during reasonably foreseeable flood events). • Consideration of construction and operational impacts on water quality Discuss proposed avoidance and mitigation measures • Provide a quantitative analysis of any identified risk of impact to groundwaters or surface water quality and aquatic ecosystems as a result of a major hazard event and detail relevant mitigation measures. The analysis should systematically identify all potential major environmental hazards (internal and external) to people and the environment associated with the construction, operation, maintenance and	Section 6 Section 6.2 Heybridge Groundwater Impact Assessment (Tetra Tech Coffey, 2024) Section 4 and 6.1 Section 7.2 and 7.3 Section 7.6 Section 7

Requirement	Report section
decommissioning of the proposal. It is expected that risks to receiving aquatic waterbodies and ecosystems will be considered through emergency management planning (or similar) and that environmental impact mitigation measures will be incorporated into emergency response plans as appropriate.	
• Discuss proposed avoidance and mitigation measures to minimise potential impacts on surface water quality.	Section 7.6 and 7.7

The relevant planning criteria and EIS guidance requirements also states that:

> "It must be demonstrated that the proposal is consistent with the objectives and requirements of relevant water management policies and legislation including the *Water Management Act 1999*, the *State Policy on Water Quality Management 1997*, and the *Tasmanian State Coastal Policy 1996*.
>
> In particular, it must be demonstrated that the proposal will not prejudice the achievement of any water quality objectives set for water bodies under the *State Policy on Water Quality Management 1997*.
>
> Where water quality objectives have not yet been set, EPA Tasmania should be consulted to identify the baseline water quality data required to enable the water quality objectives to be determined."

These requirements are discussed further in Section 3.

2.2 Linkages to other technical studies

This report is informed by or informs the technical studies outlined in Table 2.

Table 2. Relevant technical studies

Technical Study	Relevance to this assessment
Contaminated Land and Acid Sulfate Soils Assessment – Heybridge Converter Station Tasmania **(Tetra Tech Coffey, 2024)**	Disturbance of contaminated land, storage of spoil during the project and disturbance of acid sulfate soils are a potential source of contamination to surface waters. This has been considered in the Contaminated Land and Acid Sulfate Soils Assessment report for the Heybridge converter station prepared by Tetra Tech Coffey (2024).
Heybridge Groundwater Impact Assessment **(Tetra Tech Coffey, 2024)**	Impacts to groundwater environments can impact surface waters (and vice versa) due to the interconnected nature of surface water and groundwater systems. Surface waters are a potential receptor for disposal of groundwater from de-watering activities or seepage during the Project. This has been considered in the Heybridge Groundwater Impact Assessment Report prepared by Tetra Tech Coffey (2024).
Marinus Link Heybridge converter station – Terrestrial ecology baseline and impact assessment **(Entura, 2024)**	Disturbance to surface waters including impacts to water quality or flow regime can impact on aquatic and riparian flora and fauna species that rely on those surface water ecosystems (water-dependent species). This could include EPBC listed species. This has been considered in the ecology baseline and impact assessment for the Heybridge converter station, prepared by Entura (2024).

Technical Study	Relevance to this assessment
Marinus Link: Climate and Climate Change Assessment **(Katestone Environmental, 2024)**	Climate change has potential to impact on rainfall and surface water runoff. The Climate and Climate Change Assessment report outlines these predicted changes and impact on surface water runoff. A climate change scenario has also been modelled for the converter and transition stations in this surface water report.
Marinus Link, Heybridge Tasmania: Terrestrial Geomorphology and Soils Assessment Report **(Environmental GeoSurveys Pty Ltd, 2024)**	The terrestrial geomorphology impact assessment details the potential baseline conditions and potential impacts on geomorphology and soils, including ground stability and hillslope erosion. This surface water impact assessment has considered geomorphology and soils aspects where relevant. Further geomorphology and soil related impacts and management are addressed in the Terrestrial Geomorphology and Soils Assessment Report by Environmental GeoSurveys (2024).

3 Legislation, policy and guidelines

The other legislation, policies and guidelines applicable to this report are described below.

3.1 Tasmania

Resource Management and Planning System

All planning decisions made in Tasmania fall under Tasmania's Resource Management and Planning System (RMPS). The RMPS is a framework to achieve sustainable outcomes from the use or development of Tasmania's natural and physical resources.

There are several pieces of legislation that contribute to the RMPS (Figure 2), which all have five common objectives. These umbrella objectives drive decision making about the use of land and natural resources across the State. The objectives are to:

- Promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity.
- Provide for the fair, orderly and sustainable use and development of air, land, and water.
- Encourage public involvement in resource management and planning.
- Facilitate economic development in accordance with these objectives.
- Promote the sharing of responsibility for resource management and planning between the different spheres of government, the community, and industry in the state.

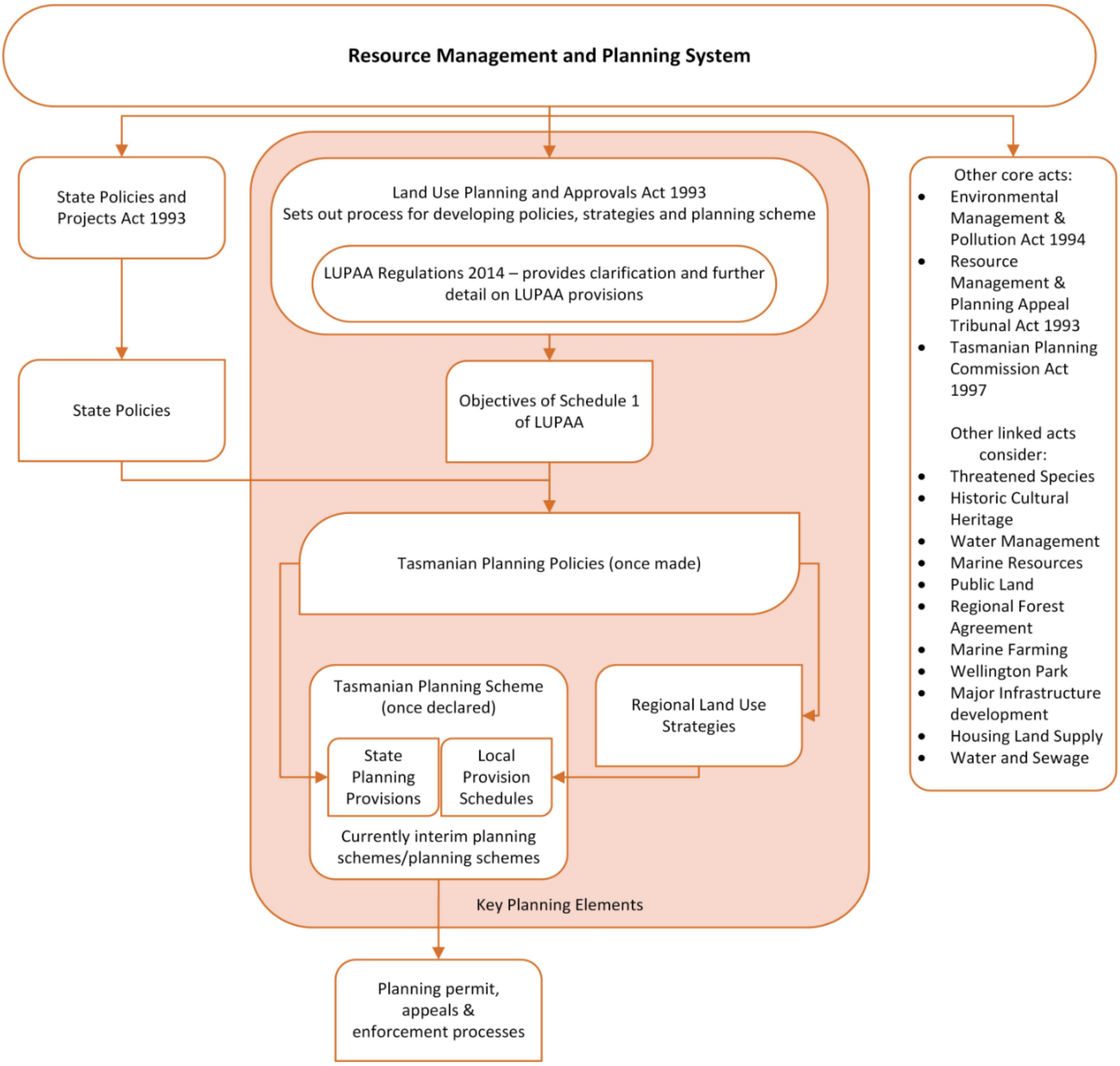

Figure 2. Resource Management and Planning System summary diagram (Tasmanian Government, 2020)

Legislation under the RMPS

Legislation under or linked to the RMPS includes (but is not limited to):

- *Land Use Planning and Approvals Act 1993 (Tas).* This is the primary land use planning legislation in Tasmania, providing the legal framework for the development and operation of planning schemes. It also sets out the requirements and timeframes that apply, for example, for making an application for a permit or requesting an amendment to a planning scheme. In 2015, it was amended to provide for the Tasmanian Planning Scheme (below). Some recent planning schemes specifically incorporate a Wetlands & Waterway Schedule, which specifies the objectives and standards for development near wetlands and waterways. Works in wetlands and waterways may also be subject to council requirements, as detailed in council by-laws and/or abatement notices (the *Local Government Act 1993* established the powers and functions of Tasmanian councils).

- *Environmental Management and Pollution Control Act 1994 (Tas)*. This is the primary environmental protection and pollution control legislation in Tasmania. It is a performance-based style of legislation, with the fundamental basis being the prevention, reduction and remediation of environmental harm. The focus of the Act is on preventing environmental harm from pollution and waste – for example, by setting penalties for causing environmental harm. According to the Tasmanian Stormwater Policy Guidance and Standards for Development (2021), it may be made applicable to stormwater pollution and to erosion and sediment control on building and construction sites.
- *Water Management Act 1999 (Tas)*. This legislation provides for the management of Tasmania's freshwater resources, such as the need to 'Maintain ecological processes and genetic diversity for aquatic and riparian ecosystems.' The focus of the Act is on management of water as a resource. It only mentions erosion in relation to environmental risks associated with licensing and allocation of water, and to Division 4 (dam works) permits. This Act is not being applied to the project.

State policies

At the policy level, the *State Policy on Water Quality Management 1997* provides the overarching principles and objectives for water quality management in Tasmania, and the management framework for the development of protected environmental values (PEVs), water quality guidelines (WQGs) and water quality objectives (WQOs). It details a range of mechanisms for the control of point source and diffuse source pollutants in surface waters and groundwaters.

The *Tasmanian State Coastal Policy 1996* guides coastal planning in Tasmania. Its three guiding principles are that natural and cultural values of the coast shall be protected, the coast shall be used and developed in a sustainable manner and integrated management and protection of the coastal zone is a shared responsibility.

Guidance documents

The *Wetlands and Waterways Works Manual* (Department of Primary Industries, Parks, Water and Environment, 2003) provides environmental best practice guidelines for minimising environmental harm when undertaking works on waterways and wetlands in Tasmania. It covers works that are often undertaken by government, industry, farmers and community groups. It is comprised of eight documents – *Legislative and Policy Requirements for Protecting Waterways and Wetlands when Undertaking Works*, and seven environmental best practice guidelines:

- Construction practices in waterways & wetlands.
- Excavating in waterways.
- Minimising environmental harm from agricultural drainage channels.
- Siting and design stream crossings.
- Managing large woody debris in waterways.
- Managing riparian vegetation.
- Guiding community involvement in works on waterways & wetlands.

The manual has been incorporated into other planning documents. For example, the *Northern Tasmania Regional Land Use Strategy* states that: 'Works undertaken on wetlands and waterways are to be in accordance with the *Wetlands and Waterways Works Manual*'.

The *Tasmanian Stormwater Policy Guidance and Standards for Development* (DEP and LGAT, 2021) is also a useful resource but focused on stormwater management in urban areas. It is a policy guidance document designed to assist any Tasmanian council acting as a planning authority to regulate development under the *Land Use Planning and Approvals Act 1993* and the Tasmanian Planning Scheme (TPS).

Relevance to this assessment

The *State Policy on Water Quality Management 1997* (as introduced above) provides a framework for the identification of protected environmental values (PEVs) of water bodies, development of water quality guidelines (WQGs) and water quality objectives (WQOs) setting process, and the management and regulation of point and diffuse sources of emissions to surface waters and groundwater. The WQOs are the most conservative of the WQGs, for the protection of PEVs such as aquatic ecosystems. Many of the strategies and requirements of the *State Policy on Water Quality Management 1997* rely upon WQOs being set to measure success of water pollution management from point and diffuse sources.

The WQOs are set by the EPA Board, following the methodology set under the *National Water Quality Management Strategy* (1992). The *Technical Guidance for Water Quality Objectives (WQOs) Setting for Tasmania* (EPA Tasmania, 2020) also provides detail on the process for deriving water quality guideline values, and the use of those values in the water quality objective setting process by the EPA Board.

The control of diffuse source pollution is the aspect of the *State Policy on Water Quality Management 1997* most relevant to the erosion and geomorphology component of our risk assessment, and the development and implementation of best practice environmental management strategies are seen under the policy as the key principle for control of such pollution. For roads in particular, the policy states that: 'road construction and maintenance operations will be carried out in accordance with guidelines or a code of practice or employ other measures consistent with best practice environmental management, to prevent erosion and the pollution of streams and waterways by runoff from sites of road construction and maintenance.'

For all aspects of this assessment, this code of practice will be the *Wetlands and Waterways Works Manual* (introduced above). In particular, the 'Construction Practices in Waterways and Wetlands' document sets out measures relevant to the project. Examples under '2.2 Minimise sediment disturbance and control erosion' include:

- 'The works should be scheduled appropriately. For example, works should be timed to coincide with periods of low flow and completed quickly, and works should be stopped if conditions are not suitable, such as during and after heavy rain.'
- 'Damage to the ground cover should be minimised and confined to the works site. Blading and grubbing of the banks and the area adjacent to the works site should be avoided. The width of any access tracks should be minimised. Vegetation on unstable and erodible banks should be cleared by hand. If possible, trees should be felled away from the waterway.'
- 'Surface and sub-surface flows at the site should be managed to minimise erosion and sedimentation of the waterway or wetland. Geo-textile sediment fences should be used to stop sediment entering the water. They should be installed along the bases of fills and cuts, on the downhill side of soil stockpiles, and along stream banks and around wetlands adjacent to cleared areas. They should be installed along a contour and be entrenched and staked. They should extend the full width of the cleared area.'

4 Project Description

This section discusses the key components and details of the Project Description and activities that are relevant to the surface water impact assessment.

4.1 Overview

Marinus Link is proposed to be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria. Each 750 MW circuit will comprise two power cables and a fibre-optic communications cable bundled together in Bass Strait and laid in a horizontal arrangement on land. The two 750 MW circuits will be installed in two stages with the western circuit being laid first as part of stage one, and the easter cable in stage two.

The key project components for each 750 MW circuit are, from south to north are:

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

In Tasmania, a converter station is proposed to be located at Heybridge near Burnie. The converter station would facilitate the connection of Marinus Link to the Tasmanian transmission network. There will be two subsea cable landfalls at Heybridge with the cables extending from the converter station across Bass Strait to Waratah Bay in Victoria. The preferred option for shore crossings is horizontal directional drilling (HDD) to about 10 m water depth where the cables would then be trenched, where geotechnical conditions permit.

Approximately 255 kilometres (km) of subsea HVDC cable would be laid across Bass Strait. The preferred technology for Marinus Link is two 750 megawatt (MW) symmetrical monopoles using ±320 kV, cross-linked polyethylene insulated cables and voltage source converter technology. Each symmetrical monopole is proposed to comprise two identical size power cables and a fibre-optic communications cable bundled together. The cable bundles for each circuit will transition from approximately 300m apart at the HDD (offshore) exit to 2 km apart in offshore waters.

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project's potential environmental effects in accordance with the legislative requirements of the Tasmanian governments (Figure 3).

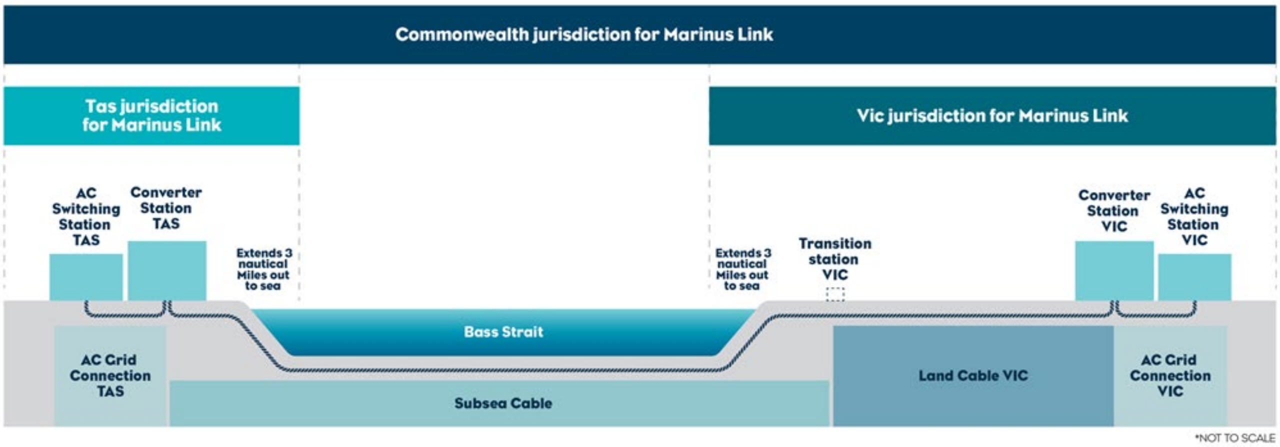

Figure 3. *Project components considered under applicable jurisdictions (Marinus Link Pty Ltd 2022,).*

Marinus Link is proposed to be constructed in two stages over approximately five years following the award of works contracts to construct the project. On this basis, stage one of the project is expected to be operational by 2030 and stage 2 will follow with final timing to be determined by market demand. The project will be designed for an operational life of at least 40 years.

4.2 Tasmania converter station

Two converter stations and a high voltage alternating current (HVAC) switching station will be located near the coast at Heybridge, on the site of the former tioxide plant near Burnie. The site and all components located on it will be referred to as the Heybridge Converter Station site. The subsea cables will connect directly into the two converter stations which are connected to the HVAC switching station that facilitates Marinus Link connecting to the Tasmanian 220 kV HVAC network. The HVDC voltage will be ±320 kV.

The development footprint of the converter stations and associated HVAC switching station is expected to be 280 m by 220 m. It has been assumed that buildings and infrastructure for the converter station would be designed to a level to be protected from inundation in a 1 in 200-year rainfall event.

Access will be from Minna Road. The site will have internal access roads that will be sealed. There are no high risk contaminating activities proposed during construction or operation of the converter station.

The Heybridge converter station will comprise the following key components and equipment:

- Overhead steel lattice gantries on which the HVAC 220 kV transmission lines (connection to Tasmanian transmission network) will terminate.
- HVAC 220 kV AC switching station with gas insulated switchgear (GIS). Sulfur hexafluoride (SF6) gas will be used in the switchgear. A building will enclose the GIS equipment.
- HVAC 220 kV filter banks, assumed to be housed within a building, however there is potential for open air depending on the visual impacts.
- Converter transformers and coolers. The transformers will be housed in bunds designed in accordance with applicable Australian standards. A spare transformer (without transformer oil) will be stored adjacent to the western transformer bays.
- Main building that will include a phase reactor hall, a valve hall and an HVDC hall. The three halls are separate areas in the one building.

  - HVAC phase reactor hall containing valve reactors.
  - Valve hall containing the converter modules and valves.
  - HVDC hall with HVDC reactors and HVDC land cable terminations.
- Two-storey service and control building containing system control, protection and data acquisition equipment, station services such as UPS systems with batteries, fire suppression systems, control room and amenities.
- Spare parts buildings and workshop (common to both converter stations).
- Telecoms building for purposes of providing control systems for Marinus Link and commercial telecoms services where there is available capacity (common to both converter stations).
- Firefighting systems including 1,000,000 L (estimated) fire water tank.
- Stormwater drainage system. Potentially contaminated water from bunded areas will be directed to and collected in a gross pollutant trap or triple interceptor trap which will be periodically pumped out by a licensed wastewater disposal contractor. Clean surface water runoff and overflow from the traps will discharge to a form of water sensitive urban design (e.g., swale drain), before discharge to the ocean via the existing site drainage culvert. The stormwater drainage design is shown in Figure 4.
- Greywater and sewerage will be managed through a septic tank. The site will also have underground oil separator tanks.
- Security fencing will be weldmesh, 3.2 m high, with barbed wire on top section.
- Onsite temporary fuel storage for backup generators.
- Two 1500 kVA diesel generators with above ground fuel storage of 5000 L (sufficient for 8 hours at full load), (2500 L diesel per converter).
- Building materials: roof and walls will be a standard sheet steel construction; however, alternatives may include adding insulating panels or pre-cast concrete tilt panels if required for acoustic attenuation.

The phase reactor hall, valve hall and HVDC hall will have maximum dimensions (based on ±400 kV design) of approximately 70 m wide, 90 m long and 27 m high, as indicated in Figure 4. The attached control and auxiliaries building will be approximately 40 m long by 25 m wide by 10 m high. The GIS switching station building will be a portal frame building approximately 49 m long, 16 m wide and 10 m high.

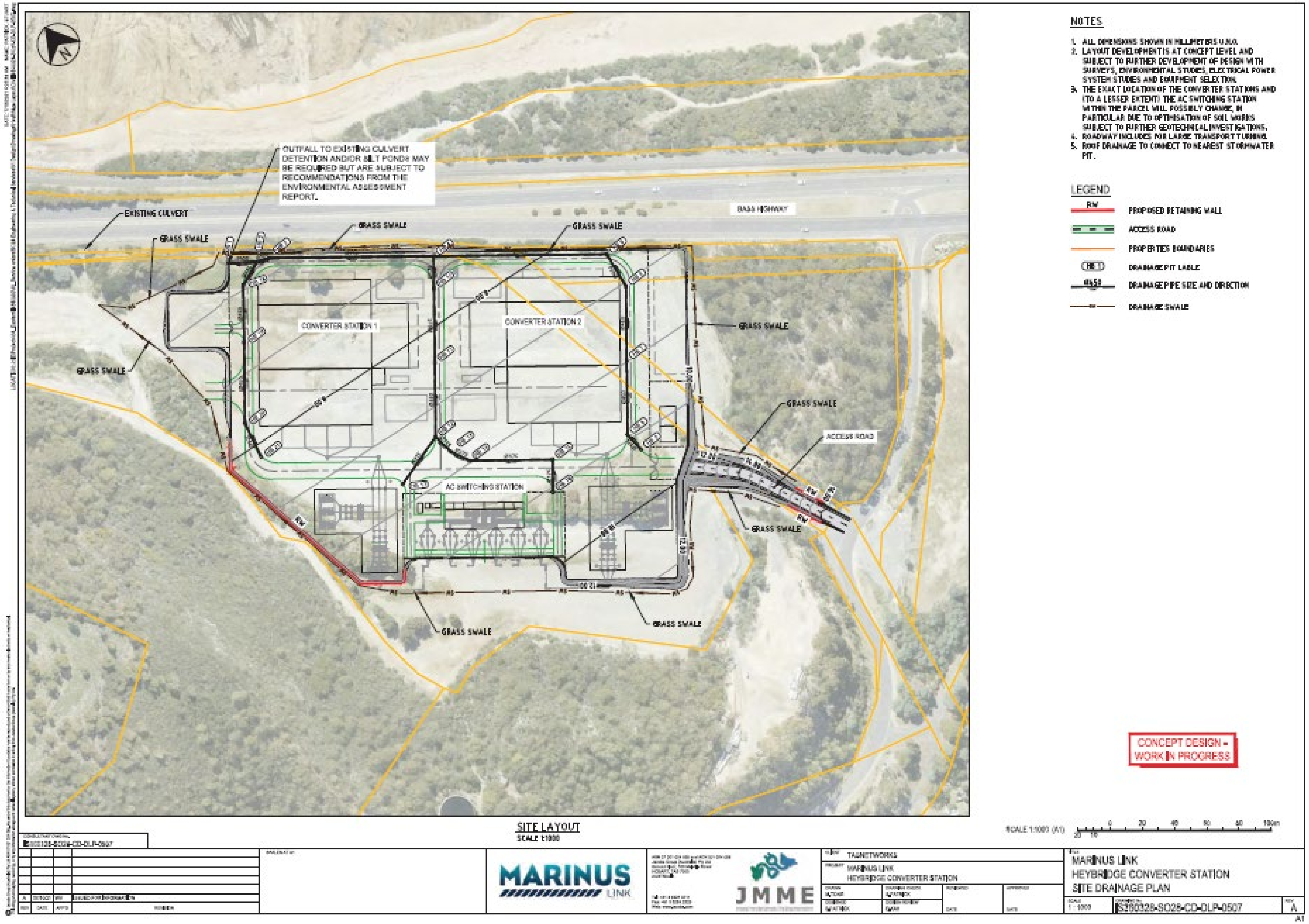

Figure 4. *Heybridge converter station – concept site drainage plan.*

4.3 Construction

A description of elements of the project during the construction phase that have the potential to impact on environmental or surface water values considered within this surface water impact assessment are summarised below.

- Shore crossing – HDD.
- Transition station – Civil works (access road, transition station bench, foundations and hardstand area).
- Land cables – Site establishment, topsoil stripping and stockpiling and haul road construction, construction of joint pits, HDD, excavation of trenches, installation of ducts and backfilling.
- Converter station – Site preparation, earthworks and civil works.

These activities can impact on surface water quality and/or quantity through mechanisms such as:

- Displacement of flood waters that lead to adverse flood impacts to surrounding property, key infrastructure and the environment
- Reducing the volume of temporary storage within the floodplain that leads to adverse flood impacts to surrounding property, key infrastructure and the environment
- Constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks
- Altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline
- Changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics
- Alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences

4.4 Operation

The Marinus Link will be operational 24 hours a day, 365 days per year over a minimum lifespan of 40 years. Operational and maintenance activities in the Tasmanian portion of the Marinus Link are likely to include servicing, testing and repair of the transition station and converter stations equipment and infrastructure including scheduled minor and major outages.

4.5 Decommissioning

The operational lifespan of the project is a minimum 40 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan.

Decommissioning will be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions will be prepared prior to planned end of service and decommissioning of the project.

Requirements at the time will determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure will be removed, the site rehabilitated.

Decommissioning activities required to meet the objective will include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site will be undertaken to provide a self-supporting landform suitable for the end land use.

Decommissioning and demolition of project infrastructure will implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management will accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts would be left in-situ as removal would cause significant environmental impact. Subsea cables would be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan will be prepared to outline how activities would be undertaken and potential impacts managed.

5 Assessment method

To address the EIS guidelines outlined in Section 2 as well as the legislative and policy requirements outlined in Section 3, this assessment seeks to detail the surface water key issues, existing environment, likely effects and mitigation strategies for the project.

This report covers potential risks to the existing surface water environment posed by the project activities. Three main aspects relating to surface water have been considered in this assessment:

- Flooding: the potential for the project to affect waterways and hydrology with respect to flooding and future climate change scenarios
- Water quality: the potential for contaminated runoff or sediment to be transported into surface waters.
- Geomorphology: the study of landforms and their origin. The assessment focused on the banks and beds of waterways, for example, the potential for the project to contribute to or initiate erosion.

Relevant sections of this report for each aspect are:

- Project description – Section 4
- Study area and baseline characterisation (existing conditions) – Section 5.1 and Section 6
- Impact assessment – Section 7, including:
    - Risk assessment – Section 7.5
    - Mitigation measures – Section 7.6
    - Residual risk – Section 7.7
    - Cumulative impacts – Section 7.8

5.1 Study area

The study area for the existing conditions assessment considers the proposed Heybridge converter station and shore crossing, and the surrounding area, with the proposed arrangement presented in Figure 5. The site is located north west of the town of Heybridge on Tasmania's north coast., within the Blythe River catchment. To the south of the proposed site, the Blythe River flows north towards the sea. Smaller tributaries are also located to the west and south west of the site. The town of Chasm Creek lies to the north west of the proposed site.

Section 6 provides the existing conditions of the study area. This outlines the existing flooding, water quality and geomorphic conditions, based on available data and information from the desktop assessment.

Figure 5. *Heybridge proposed converter station and shore crossing.*

Baseline characterisation
A baseline characterisation of the existing surface water conditions within the study area has been conducted based on desktop assessments to identify and document water related environmental values relevant to the proposed project. The following data was used to develop the detailed baseline characterisation modelling:

- Aerial photography from various sources, including:
  - ESRI
  - Google
  - Nearmap
- Topographic (LiDAR) data sourced from Land Information System Tasmania (The LIST) – Tasmania Statewide 2m_DEM (14-08-2021)
- Waterway mapping – based on State waterway layers in The LIST waterway vector mapping.
- State-wide land use, soil and geomorphological mapping
- Australian Rainfall and Runoff (ARR) data hub, rainfall depth and storm temporal patterns
- Tetra Tech Coffey provided data:
  - LiDAR (Date February 2021)
  - Heybridge converter station design lines and design surface, dated 27 October 2022

5.2 Impact assessment

A surface water impact assessment has been completed to identify likely impacts on flood levels and depths, water quality and flow regime from construction and operation of the project. Mitigation measures are proposed where necessary. As the methods used for the flooding impact assessment differed to those used for the water quality and geomorphology impact assessment, the impact assessment approaches are described separately.

An environmental risk assessment has been completed to identify environmental risks associated with construction and operation of the project. The risk assessment identifies and ranks the risk of potential harm, based on likelihood and consequence of harm to the environment. This risk rating is identified for both pre-mitigation and post-mitigation scenarios.

The approach to the risk assessment includes (Figure 6):

1. Identifying existing conditions and values (Section 6, above)
2. Identifying potential hazards and risks
3. Assessing the likelihood of a change to values occurring, prior to implementation of risk controls and measures
4. Assessing the consequence (impact) of identified risks prior to implementation of risk controls and measures.
5. Calculating risk
6. Identifying risk controls and mitigation measures to reduce the residual risk of environmental harm.
7. Assessing residual risk

A qualitative assessment will be used to assess the likelihood, consequence and resulting risk of harm to values from construction and operation / maintenance activities.

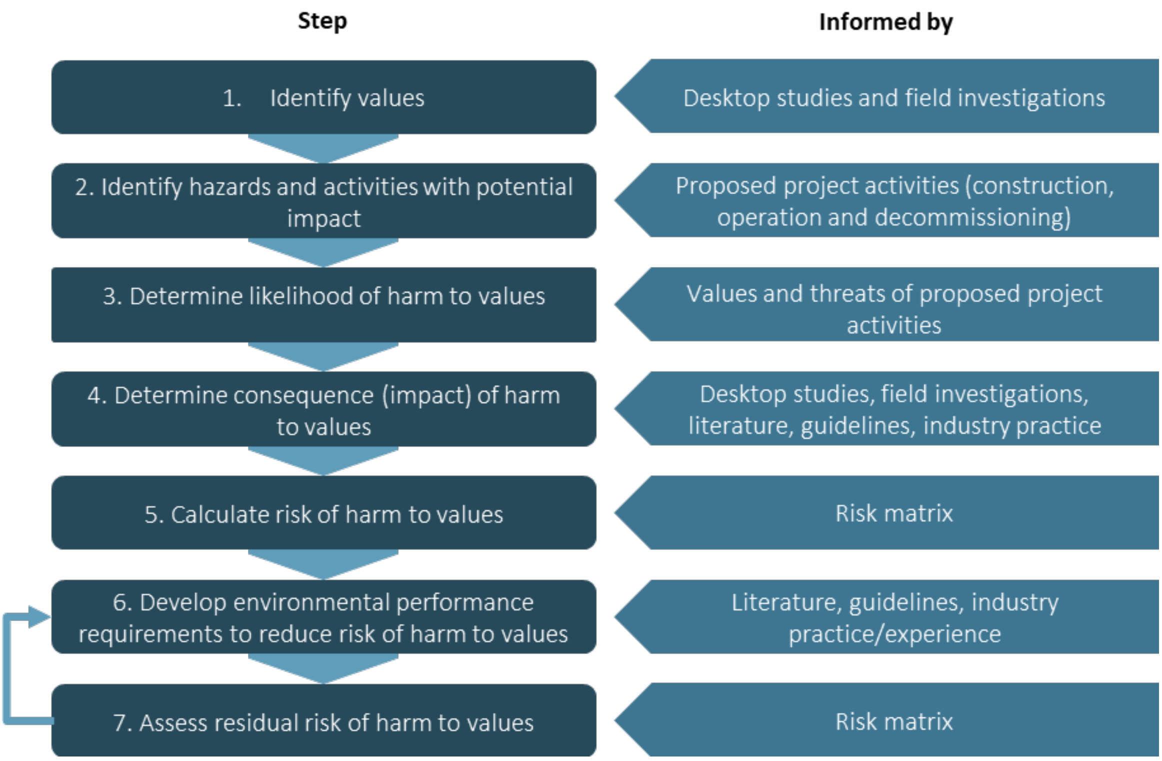

Figure 6. *Risk-based assessment approach*

Works associated with the project have potential to impact on surface water in three main ways: flooding, water quality and geomorphology. A risk assessment approach has been adopted for the purposes of determining these potential effects of the project. The risk assessment addresses the potential impacts on surface water through changed flooding/connectivity, water quality and fluvial geomorphology/physical form.

Flood impact assessment

The flood impact assessment for the converter station location has been based on site specific developed flood models used to undertake a comparison of flood levels and shear stress in the existing and post-development conditions. The resultant changes in water level are herein referred to as 'afflux'. The assessment of afflux has focussed on the 0.5 % AEP and the 0.5 % AEP climate change events.

Potential flooding impact pathways

Potential flooding impact pathways from the project include:

- The design for the converter station and shore crossing locations, causing the displacement of flood waters that lead to adverse flood impacts to surrounding property, key infrastructure and the environment (construction and operation).
- The design for the converter station and shore crossing locations, reducing the volume of temporary storage within the floodplain that leads to adverse flood impacts to surrounding property, key infrastructure and the environment (construction and operation).
- The design for the converter station and shore crossing locations, constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks (construction and operation).

- Floodwaters inundating the critical converter station and shore crossing infrastructure that leads to operational safety hazards or failure of system infrastructure (operation).

Modelling methodology

The impact assessment in the context of surface water and fluvial flooding for the transition station locations has been based on a comparison of flood levels and shear stress in the existing and post-development conditions. The resultant changes in water level are herein referred to as 'afflux'. The assessment of afflux has focussed on the 0.5 % AEP and the 0.5 % AEP + climate change events.

The adopted hydrologic and hydraulic modelling approach for the project has assessed the relevant catchment area for the Heybridge converter station, with its immediate catchment considered for the purposes of assessing the potential impact.

Due to the nature of the upstream catchment, and the location of the proposed infrastructure lying largely outside the Blythe River floodplain, a direct-rainfall (or rain-on-grid) approach has been adopted to simulate flooding in the subject area, rather than the application of hydrographs at the upstream boundary of the model into the Blythe River. With the direct-rainfall approach, rainfall is applied directly to the Digital Elevation Model (DEM) of the entire hydraulic model extent. Under this methodology, hydrologic analysis is limited to the development of the rainfall hyetographs which are used as boundary conditions in the hydraulic model. Rainfall hyetographs have been developed for the 0.5 % AEP and 0.5 % AEP + climate change events only. Noting that the Climate and Climate Change Assessment prepared for the project (Katestone Environmental, 2024) provided details on variability of total precipitation, both seasonal and annual, the surface water impact assessment required further analysis of difference is extreme sub-daily rainfall as a result of climate change.

The Tasmanian Stormwater Policy Guidance and Standards for Development state "*Climate change factors can be taken from the ARR data hub which holds interim climate change factors for RCP (Representative Concentration Pathways) 4.5, 6 and 8.5. It is recommended that Councils use the RCP 8.5 pathway as applicable at 2100* (DEP and LGAT, 2021)*"*

The ARR national guideline document contains a guide for estimating the impacts of climate change on rainfall, leading to changes in streamflow (Ball, et al., 2019). The methodology outlined in Ball et al. (2019) is based on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). The ARR guideline document outlines an approach to develop emissions scenarios, where the prescribed pathways for greenhouse gas and aerosol concentrations over time, or representative concentration pathways (RCPs), combined with land use change, are consistent with a set of broad climate outcomes used by the climate modelling community.

The four RCPs are characterised by the extra heat that the lower atmosphere will retain as a result of additional greenhouse gases (Jubb, et al., 2013) produced by the end of the 21^{st} century relative to pre-industrial values.

These concentration pathways (RCP8.5, RCP6, RCP4.5 or RCP2.6) are then used to simulate how the climate will change around the world using global climate models. The four climate change pathways have been extrapolated to 2100 based on the predicted increases in emissions and are presented in Figure 7. The RCP scenarios are labelled according to their assumed radiative forcing in the year 2100. For example, the RCP8.5 trajectory assumes a radiative forcing of 8.5 W/m^2, while the RCP2.6 trajectory assumes a radiative forcing of 2.6 W/m^2. RCP8.5 is the highest concentration scenarios available (Figure 7) and is broadly described by the IPCC as "a scenario with very high greenhouse gas emissions […] without additional efforts to constrain emissions" (Intergovernmental Panel on Climate Change, 2015).

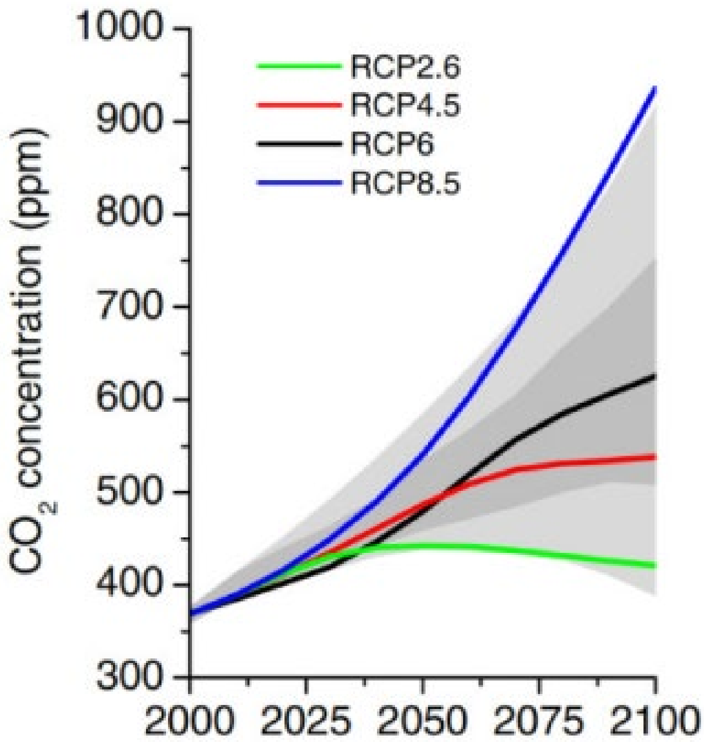

Figure 7. *Four representative concentration pathways and their expected increase in emissions up to 2100. Grey bands indicate the 98th and 90th percentiles (light/dark grey) of an earlier modelling study. Source:* (van Vuuren, et al., 2011).

In line with recommendations for impact assessment contained *within Book 1 – Scope and Philosophy Australian Rainfall and Runoff: A Guide to Flood Estimation* (Ball, et al., 2019) and for the purposes of undertaking a sensitivity analysis on the implications of climate change on the rainfall and flooding expected in the region, the RCP4.5 or RCP8.5 scenarios have been adopted. These scenarios assume a marginal increase to more frequent flood events, while more rare events, such as the 1% AEP, result in an increase in peak rainfall of 7.6 % (RCP 4.5) or 15.4 % (RCP8.5). This scenario represents the current trajectory of increases in greenhouse gas concentrations in the atmosphere without any significant mitigating actions. In the context of this assessment, it represents a conservative assessment of climate change impacts on rainfall over the life of the infrastructure.

Water quality and geomorphology impact assessment

Suitable habitat for watercourse ecosystems relies on water availability and flow characteristics, water quality, and physical habitat characteristics such as the form of watercourse bed and banks. Human social, cultural and economic uses and values also rely on water availability, good water quality and manageable flood risk.

Note: Given this assessment focusses on surface water alone and not aquatic or terrestrial ecology, we have focussed our analysis on watercourse processes, conditions and functions that generally support water-dependent species and healthy watercourse ecosystems. It is understood that analysis of species presence, value and impacts of the project on these will be covered in separate ecological assessments (refer to Entura 2024).

Potential water quality and geomorphology impact pathways

Potential surface water quality and geomorphology impact pathways from the project include:

- Altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline (construction)
    - disturbance to the bed or banks of the drainage outfall under Bass Highway through ground disturbance activities (excavation, trenching, clearing, vehicular traffic etc.) within the riparian zone or instream.
- Changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics through:
    - Spill or release events (construction or operation).
    - Dewatering activities that discharge directly to watercourses (construction and operation).
    - Contaminated surface water runoff following rainfall (construction).
    - Stormwater runoff both concentrated and increased volume from new impervious surfaces (operation).
- Alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences:
    - Reinstatement of drainage lines to alternative shape/form and leading to altered fluvial geomorphic process initiating bed and bank scour (construction or operation)
    - Concentrated discharge of wastewater from de-watering activities initiating bed and bank scour (construction or operation)
    - Concentrated stormwater runoff across disturbed ground (construction) or impervious surfaces (operation) initiating scour/sediment runoff.

Risk assessment

Once the risk pathway has been identified, the risk of harm rating can be assessed. The risk of harm is the change to the identified value as a result of the hazard, mechanism, and pathway.

Likelihood

Likelihood is the chance of a risk and impact to values occurring. Table 3 outlines the qualitative criteria used to define likelihood. Likelihood can be determined both prior to and post implementation of risk controls and measures.

Table 3. Qualitative criteria utilised to define likelihood.

Likelihood	Description
Almost certain	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is expected to occur more than once over the duration of the project activity, project phase or project life.
Likely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is likely to occur at least once over the duration of the project activity, project phase or project life.
Possible	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and may occur over the duration of the project activity, project phase or project life.
Unlikely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere but is unlikely to occur over the duration of the project activity, project phase or project life.
Rare	A hazard, event and pathway are theoretically possible on this project and has occurred once elsewhere, but not anticipated over the duration of the project activity, project phase or project life.

Consequence

Consequence is the impact of identified risks on values. Table 4 outlines the qualitative criteria used to define consequence. Consequence can be determined both prior to and post implementation of risk controls and measures.

Table 4. Qualitative criteria utilised to define consequence.

Consequence	Description
Severe	An effect that causes permanent changes to the environment and irreversible harm to physical, ecological, or social environmental surface water values or consequences of the impact are unknown and management controls are untested. Causes major public outrage, sustained widespread community complaints. Prosecution by regulatory authorities. Avoidance through appropriate design responses is required to address the impact
Major	An effect that is widespread, long lasting and results in substantial change to surface water values either temporary or permanent. Can only be partially rehabilitated or uncertain if it can successfully be rehabilitated. Appropriate design responses are required to address the impact. Causes major public outrage, possible prosecution by regulatory authorities. Receives widespread local community complaints.
Moderate	An effect that extends beyond the operational area to the surrounding area but is contained within the region where the project is being developed. The harm is short term and result in changes that can be ameliorated with specific management controls
Minor	A localised effect that is short term and could be effectively mitigated through standard management controls. Remediation work and follow-up required.
Negligible	A localised effect that is temporary and does not extend beyond operational area. Either unlikely to be detectable or could be effectively mitigated through standard management controls. Full recovery expected.

Risk rating

The risk of harm is determined by combining likelihood and consequence using the matrix in Table 5. The risk assessment guides the avoidance, mitigation and management measures proposed to manage these risks. Higher risks require specific controls or management, whereas lower risks can be managed using standard controls.

Table 5. Risk evaluation matrix

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

Cumulative impact assessment

The EIS guidelines include requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.'

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporary boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with Marinus Link.
- Spatial boundary: the location, scale and nature of the other approved or committed projects expected to occur in the same area of influence as Marinus Link. The area of influence is defined at the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due to their temporal and spatial boundaries. Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment in Tasmania are:

- Remaining North West Transmission Developments
- Guilford Windfarm
- Robbins Island Renewable Energy Park
- Jim's Plain Renewable Energy Park
- Robbins Island Road to Hampshire Transmission Line
- Bass Highway upgrades between Deloraine and Devonport

- Bass Highway upgrades between Cooee and Wynard
- Hellyer Windfarm
- Table Cape Luxury Resort
- Youngmans Road Quarry
- Port Latta Windfarm
- Port of Burnie Shiploader Upgrade
- Quaylink – Devonport East Redevelopment.

The projects relevant to this surface water impact assessment have been determined based on the potential for cumulative impacts to surface water values (flooding, water quality and geomorphology). These projects are occurring concurrently and/or are situated in close proximity to the Marinus Link project.

The assessment of the potential cumulative impacts draws on the findings from the impact assessment (see Section 7) and the identification of where effects from these credible projects and their associated activities may overlap, interact, and accumulate, and therefore result in a cumulative impact on surface water values within the study area.

The projects assessed relevant to this surface water impact assessment are:

- **Guilford Windfarm**: This project, located 7 km northwest of Waratah Bay and 15 km south of Hampshire, is pertinent to the Marinus Link project due to its substantial generation capacity of up to 450 MW of wind energy in close geographic proximity to the proposed converter station and shore crossing at Heybridge.

- **Robbins Island Renewable Energy Park**: With its potential energy generation of up to 900 MW, this project is highly relevant to the cumulative impact assessment of the Marinus Link project due to its substantial project scale and its location on Robbins Island, on the northwest coast of Tasmania.

- **Jim's Plain Renewable Energy Park**: Featuring up to 31 wind turbines and solar generation, with a combined capacity of up to 200 MW of wind energy and up to 40 MW of solar energy, this project is relevant to the Marinus Link project due to its capacity for generating renewable energy and its proximity, situated 23 km west of Smithton.

- **Robbins Island Road to Hampshire Transmission Line**: The construction of a new 220 kV overhead transmission line (OHTL) covering 115 km, with an estimated 245 towers, connecting the Jim's Plain and Robbins Island Renewable Energy Parks' transmission infrastructure to the Tasmanian transmission network, is relevant to the Marinus Link project due to its scale and infrastructure additions within the vicinity of the proposed project alignment, spanning between Robbins Island Road at West Montagu and Hampshire.

- **Bass Highway upgrades between Deloraine and Devonport**: This targeted highway upgrade along the Bass Highway, situated between Deloraine and Devonport and classified as roads of strategic importance, is relevant to the Marinus Link project as it involves significant transportation infrastructure improvements within the vicinity of the Marinus Link project.

- **Remaining North West Transmission Developments, including Staverton to Hampshire Hills and the Sheffield to Staverton upgrades**: This project involves a new 60 km long and modified 18.5 km long sections of the existing 220 kV overhead transmission line between Staverton and Hampshire Hills, and Staverton to Sheffield. It is relevant to the Marinus Link project due to its support for new and existing renewable energy developments, including Marinus Link itself.

- **Hellyer Windfarm**: Comprising up to 48 wind turbines generating up to 300 MW of wind energy and located 8.5 km southwest of Hampshire, this project is relevant to the Marinus Link project due to its potential cumulative effects associated with energy infrastructure on the environment in the region.

- **Table Cape Luxury Resort**: This project is located 4.5 km north of Wynyard, Ransleys Road, which is approximately 37 km from the proposed Heybridge converter station and shore crossing.
- **Youngmans Road Quarry**: Situated 2.5 km northwest of Railton, this project is relevant to the Marinus Link project as both may have potential cumulative impacts on land use in the area.

- **Port Latta Windfarm**: This project is located 2 km southwest of Cowrie Point, near Mawbanna Plain, and is relevant to the Marinus Link project due to its potential cumulative impacts associated with renewable energy infrastructure.

- **Port of Burnie Shiploader Upgrade**: Situated in the Port of Burnie, this project involves the expansion of minerals shiploader and storage facilities. It is relevant to the cumulative impact assessment of the Marinus Link project due to its potential influence on port infrastructure and operations in the region.

- **Bass Highway upgrades between Cooee and Wynard**: This project involves a priority upgrade of the Bass Highway between Cooee and Wynyard, which is relevant to the Marinus Link project due to its potential cumulative impacts associated with freight ferry services in the region.
- **Quarry Link**: Located in the Port of Devonport, this project involves a port terminal upgrade that is relevant to the Marinus Link project due to its potential cumulative impacts associated with freight ferry services in the region.

Other projects, which were not listed above have also been considered relevant to this cumulative impact assessment due to their potential cumulative effects associated with energy infrastructure to the environment. These projects are:

- **Western Plains**: This project, featuring up to 12 wind turbines to generate up to 50.4 MW of wind energy is located 4 to 5 km northwest of Stanley.
  Lake Cethana Pumped Hydro: This project, features up to 600 MW energy capacity, which is located 19 km southwest of Sheffield.

The assessment of cumulative impacts on surface water values at the Heybridge converter station and shore crossing is further detailed in Section 7.8.

5.3 Mitigation measures

Standard mitigation measures have been identified below to help guide the selection of final mitigation measures in Section 7.6.

The risk assessment process was used to identify mitigation measures, minimisation measures and the subsequent final mitigation measures as part of the surface water impact assessment.

Final mitigation measures and their development are presented in Section 7.6.

Flooding mitigation measures

Standard avoidance and mitigation measures to minimise the potential flooding impacts of the project include:

- Implementing appropriate flood mitigation measures in the design of the Heybridge converter station site to minimise adverse flood impacts to surrounding property, key infrastructure and the environment.
- Implementing appropriate erosion control measures in the design for Heybridge converter station site to minimise adverse scour/stability impacts and potential to impact on adjacent property, key infrastructure and the environment.
- Implementing appropriate flood immunity requirements for the Heybridge converter station infrastructure to eliminate impacts and protect the health and safety workers, operational staff, and the public.

Water quality and geomorphology mitigation measures

Standard mitigation measures to minimise the potential water quality and geomorphology impacts of the project include:

- Develop and implement an Progressive Erosion and Sediment Control Plan based on available guidelines including:
  - EPA TAS fact sheets: *Soil and Water Management on Large Building and Construction Sites, Erosion Control Matts and Blankets, Scour Protection – Stormwater Pipe Outfalls and Check Dams, Stabilised Access and Sediment Fences and Fibre Rolls, Bunding and Spill Management Guidelines*.
  - Discharge/runoff to meet the *Tasmanian Stormwater Policy Guidance and Standards for Development* requirements for discharge and run-off from the project.
  - Comply with the *Technical Guidance for Water Quality Objectives Setting for Tasmania, Environmental Effects Report Guidelines (EPA Tasmania)* and relevant EAP Tasmania fact sheets such as *Soil and Water Management Plans.*

5.4 Stakeholder engagement

Stakeholders and the community are being consulted throughout the development of the project and the EIS process. Formal engagement with landholders and stakeholders has not been undertaken specifically for the purposes of the surface water impact assessment. The public engagement process is ongoing with details of the program contained at https://www.marinuslink.com.au/engagement/.

5.5 Assumptions and limitations

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

- Impact and risk assessments are largely qualitative constraints, including, but not limited to lack of complete, long-term, consistent quantitative data and field site access constraints. To overcome this multiple data sets (i.e. repeat aerial photography from multiple data sources to fill in sites unable to be inspected) have been used to help inform the impact assessment process.
- Any use which a third party makes of this document, or any reliance on or decision to be made based on this document, is the responsibility of such third parties. The client and the project team accept no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this document.
- Information and data such as GIS layers, models and other data have been obtained from a range of external sources including Tetra Tech Coffey, The LIST, other authorities and groups. It is only practical to verify or independently review some of this information. The data is sometimes provided with caveats or with missing or obviously inconsistent information. These indicated limitations have been considered, and known limitations addressed and or documented adequately and the data has been considered suitable for the specific purpose of informing the EIS. While care has been taken in interpreting the provided data, neither the original provider nor the project team take any responsibility for incorrect or inaccurate information or make any representation as to its suitability for other purposes.
- Flood modelling developed specifically for the project is assumed to be sufficiently accurate for informing the investigations covered in this impact assessment and in line with TAS EPA assessment guidelines.
- Flood modelling has been undertaken based upon available information including limited feature and topographic survey and incomplete spatial data from third parties (including pit and pipe data). Where adverse pit and pipe gradients and invert inconsistences were encountered, nominal depths were assumed from LiDAR, or gradients were calculated from surface profiles.

The study acknowledges the above limitations for the surface water impact assessment of the project and the level of detail has been considered suitable to support the specific purposes of informing the two EISs.

6 Existing conditions

This section describes the existing conditions and values within the study area based on the information obtained from the baseline assessment.

The study area for the baseline characterisation assessment is concerned with the watercourses and areas surrounding the Heybridge converter station and shore crossing. This section outlines the existing flooding, water quality and geomorphic conditions in these watercourses and areas surrounding the Heybridge converter station and shore crossing, based on available data and information from desktop assessments and targeted field investigations.

6.1 Existing flooding conditions

Flood mapping and subsequent assessment of the Heybridge converter station has been developed from outputs of the flood modelling in accordance with the methodology detailed in Section 5. Figure 8 and Figure 9 highlight the spatial distribution of surface roughness parameters selected.

Flood mapping of existing conditions in the 0.5 % AEP event indicates that the Blythe River is largely confined to its floodplain and does not interact with the Heybridge converter station development site. In both the existing (Figure 10 and Figure 11), and existing climate change scenarios (Figure 12 and Figure 13) surface flows follow well defined valleys before joining the Blythe River. Also evident is that the proposed development area, the former tioxide plant, is situated outside the Blythe River floodplain, adjacent to the Bass Highway. A relatively major tributary can be seen south of the study area that joins the Blythe River approximately 300 m from the site boundary and does not impact the site.

The existing access/haul road that surrounds the western and southern lengths of the site is subject to flood depths up to 0.2 m (Figure 10 and Figure 11), while localised flows move across the site from west to east and accumulate in a settling pond. The existing conditions model highlights significant ponding of water in the northern extent of the converter station and shore crossing, with depths up to 1.6 m at the entrance to the outfall culvert that passes beneath the Bass Highway.

Under the climate change scenario in Figure 12 and Figure 13, depths and extents marginally increased across the site, however, importantly, the Blythe River is still contained within its floodplain, and does not interact with the proposed development site.

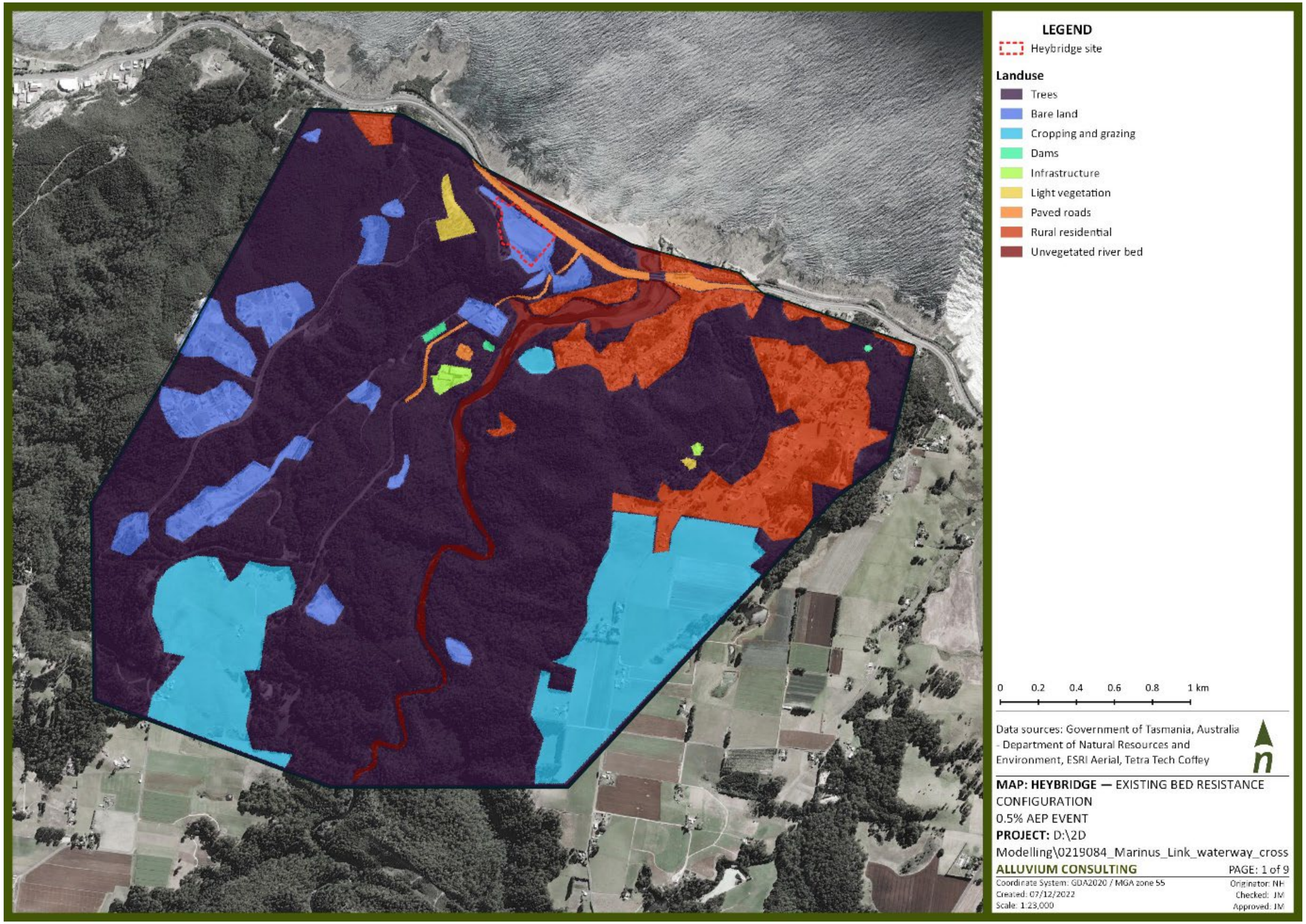

Figure 8. *Heybridge baseline characterisation bed resistance configuration (Manning's n) – full model extent.*

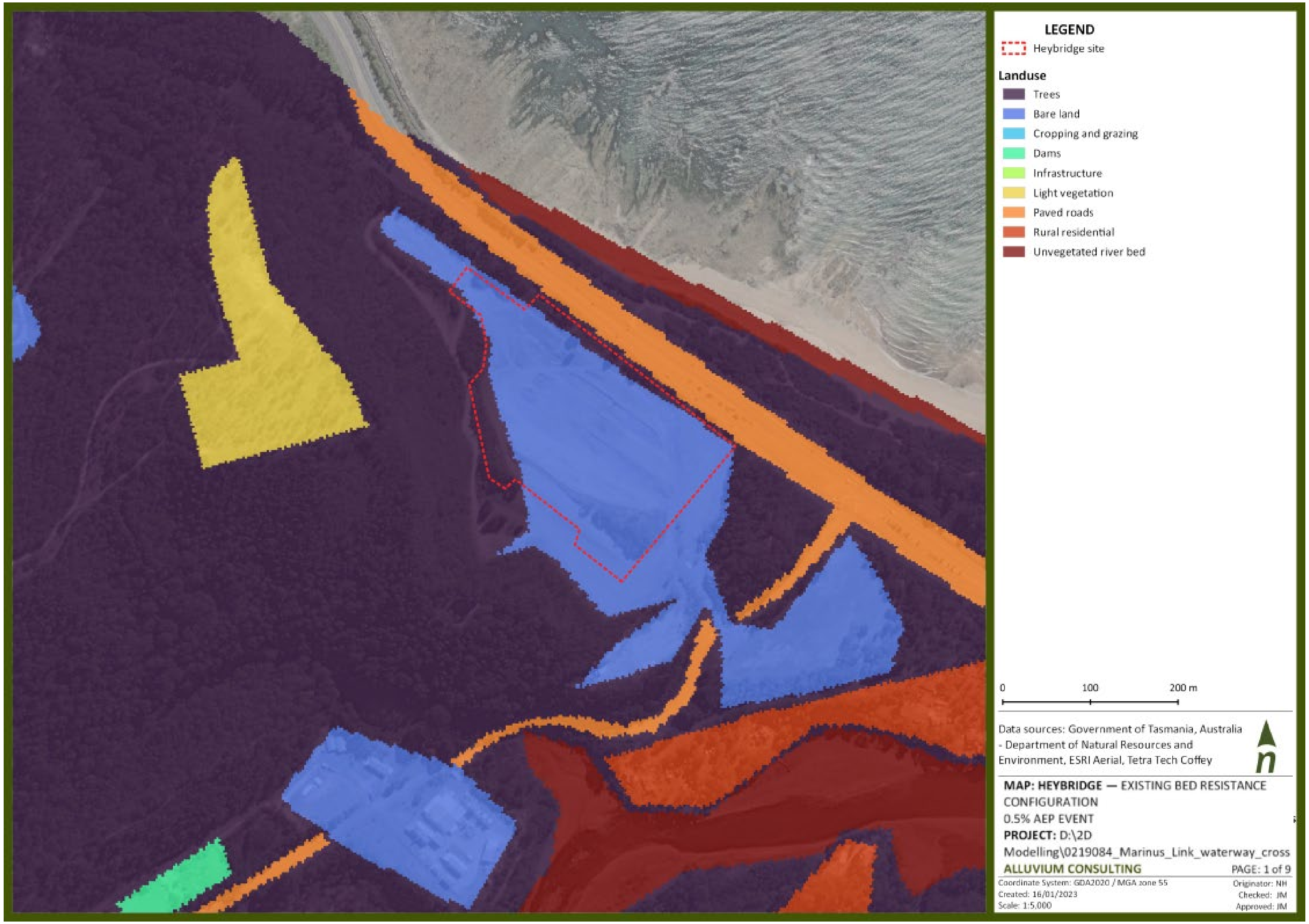

Figure 9. *Heybridge baseline characterisation bed resistance configuration (Manning's n) – Heybridge site.*

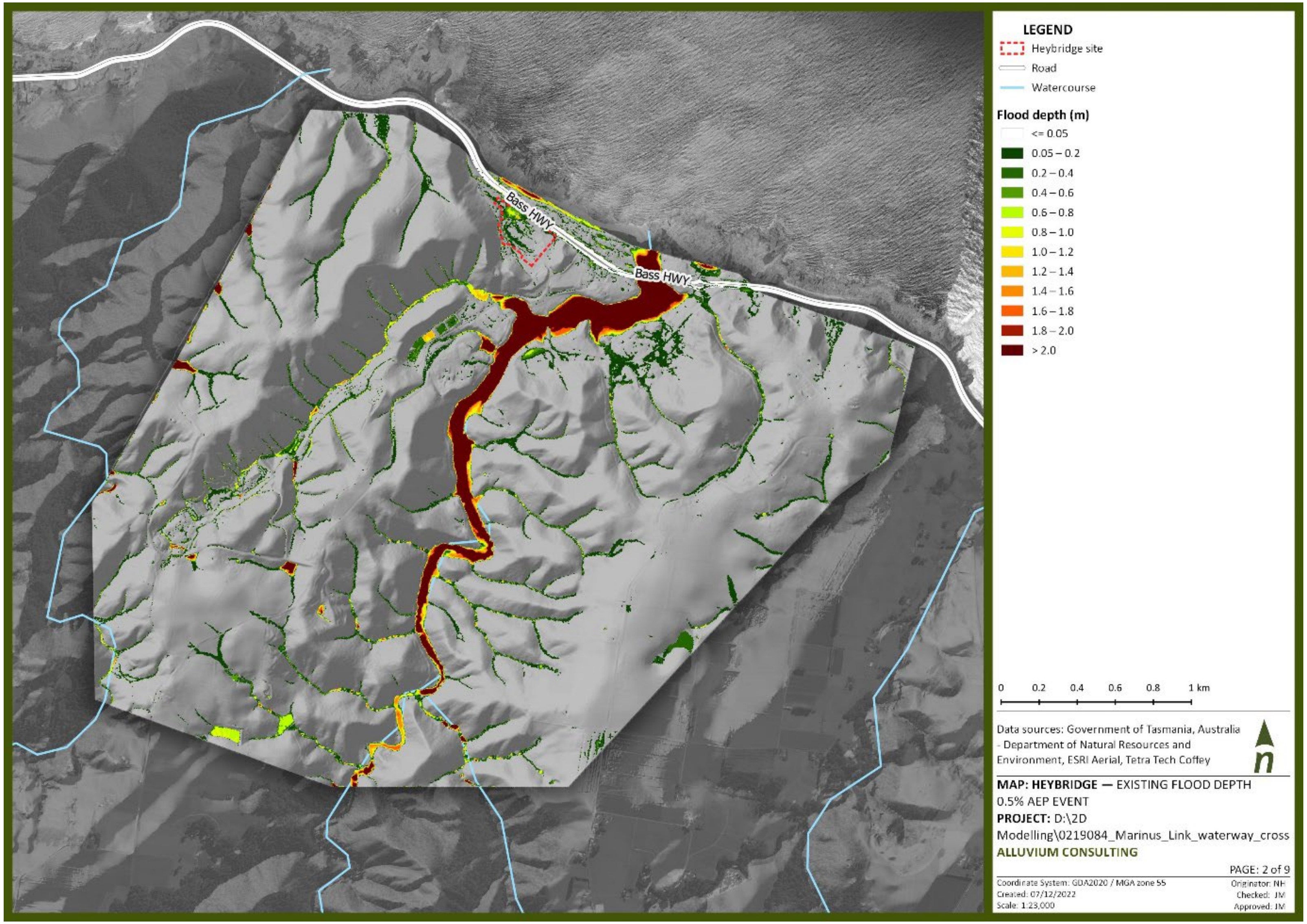

Figure 10. *Heybridge baseline characterisation 0.5% AEP flood depth – full model extent.*

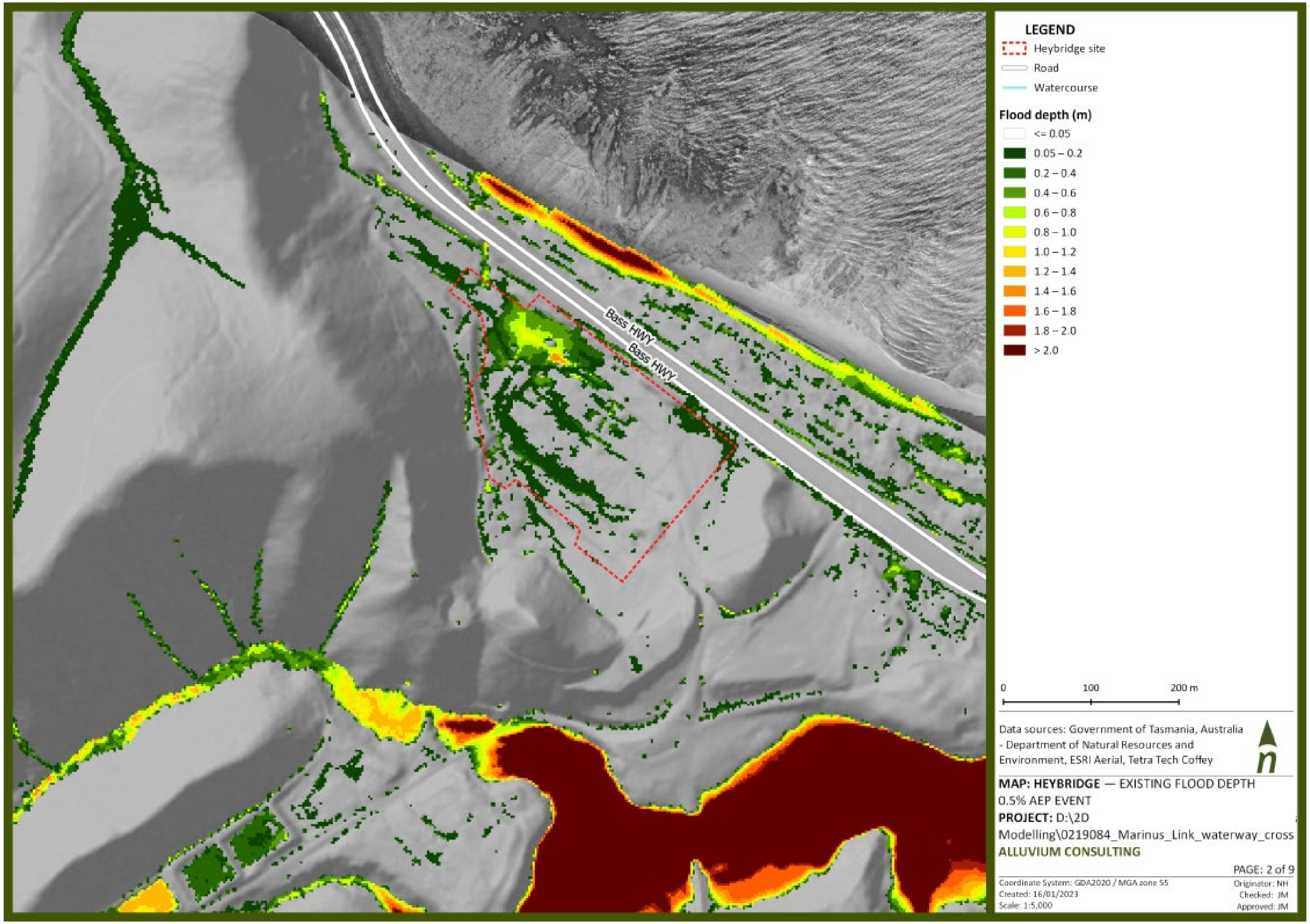

Figure 11. *Heybridge baseline characterisation 0.5% AEP flood depth – Heybridge site.*

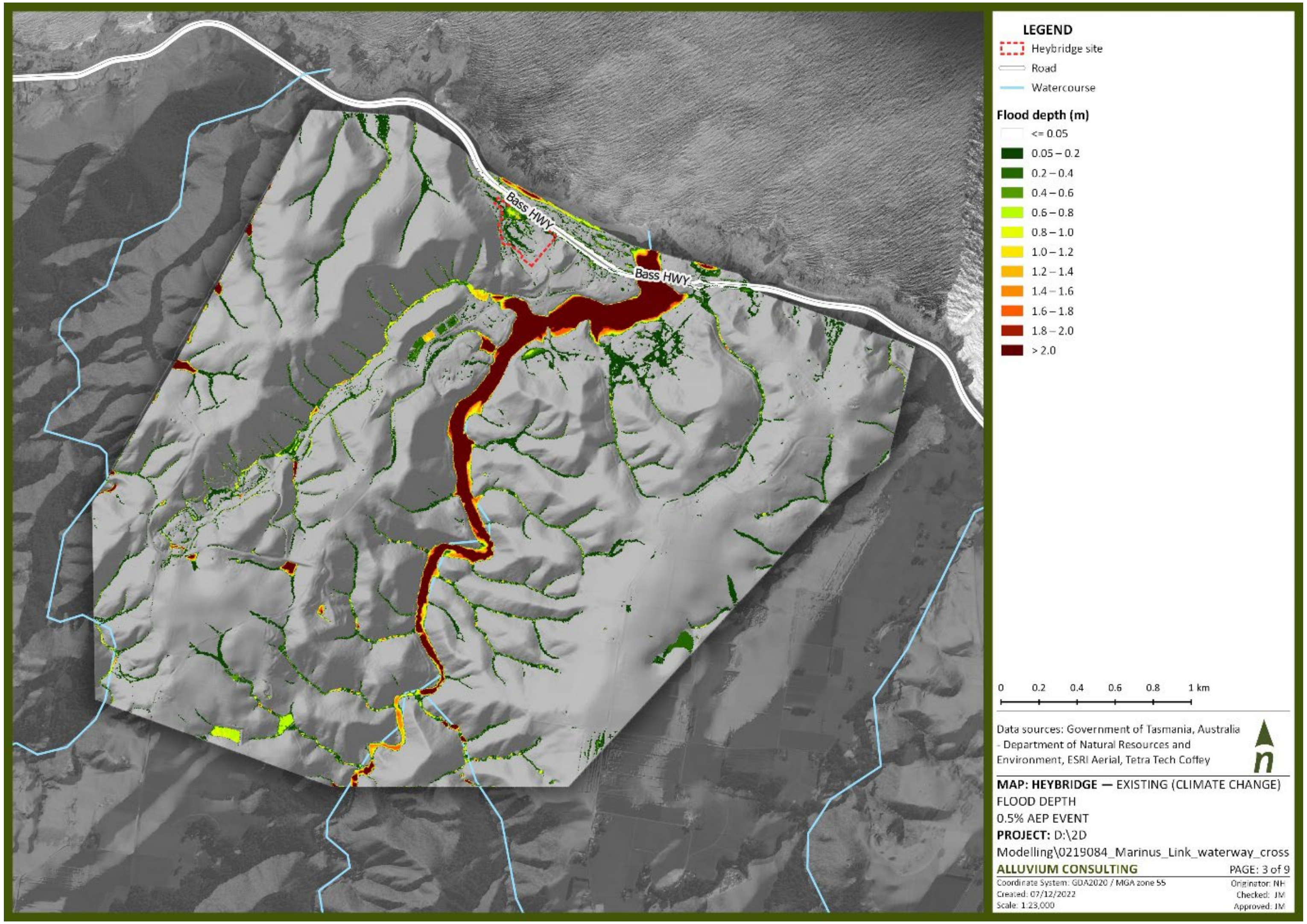

Figure 12. *Heybridge baseline characterisation climate change 0.5% AEP flood depth – full model extent.*

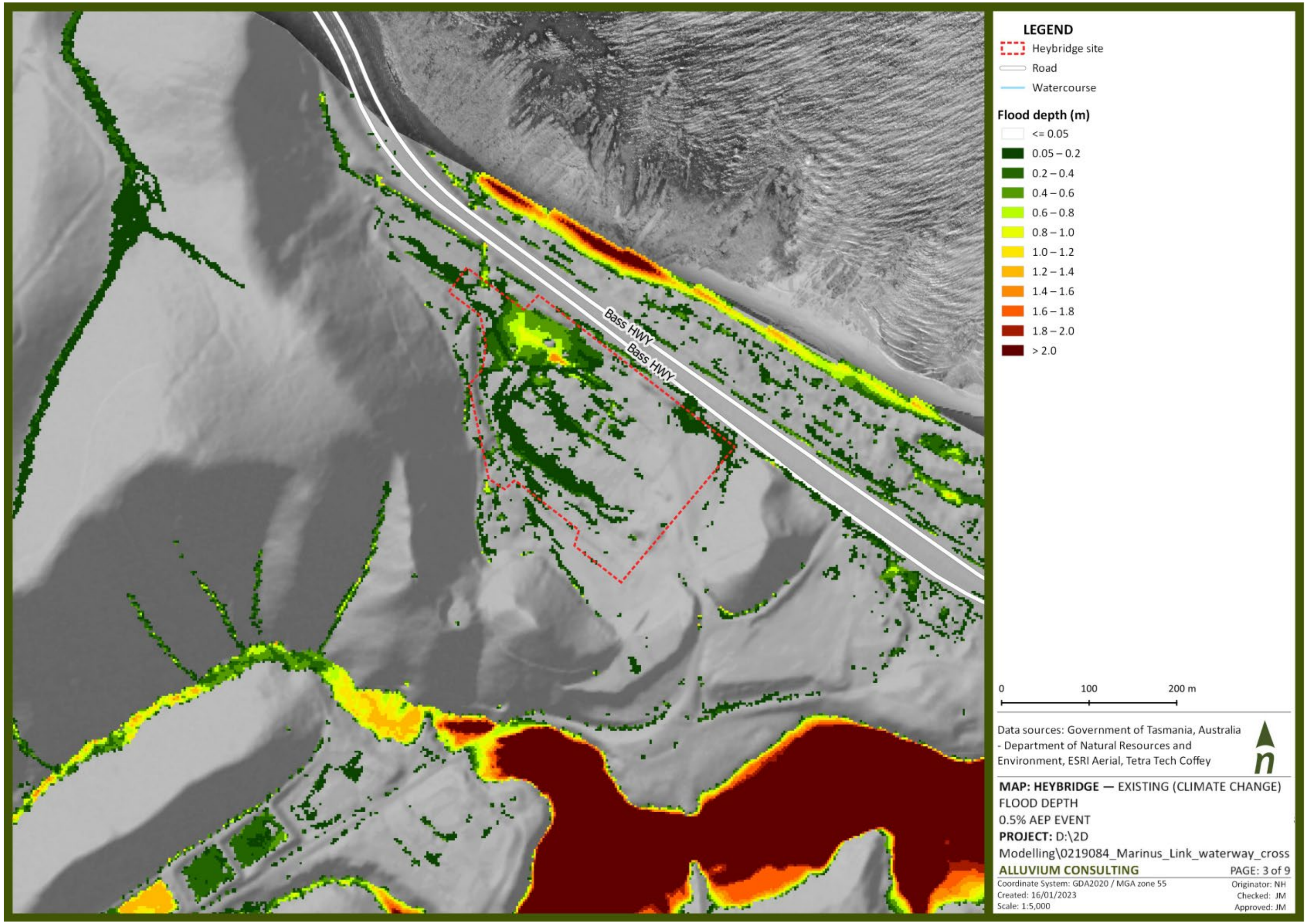

Figure 13. *Heybridge baseline characterisation climate change 0.5% AEP flood depth – Heybridge site.*

6.2 Existing water quality

Stormwater outfall

The current arrangement sees stormwater discharged from the site via a culvert that passes beneath the Bass Highway. Stormwater then makes its way to coastal waters via Tioxide Beach at Heybridge.

The Tasmanian State Policy on Water Quality Management 1997 (SPWQM) establishes a framework that is compatible and consistent with national guidelines including the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (ANZG, 2018) and the National Water Quality Management Strategy 1994 (NWQMS). As part of the implementation of the State Policy, protected environmental values (PEVs) have not been set at a State level for coastal and marine waters, however the Default Guideline Values (DGVs) for Aquatic Ecosystems of Tasmania Coastal and Marine Waters (EPA, 2021) set out interim PEVs. These are:

A. Protection of Aquatic Ecosystems
    i. Coastal waters ecosystems
B. Recreational Water Quality and Aesthetics:
    i. Primary contact water quality;
    ii. Secondary contact water quality; and
    iii. Aesthetic water quality
C. Industrial water supply (Selected areas of aquaculture in Marine Farming Zones)

This requires, at a minimum, water quality management strategies to provide water of a physical and chemical nature to support coastal ecosystems (either pristine or modified) from which edible fish, shellfish and crustacea can be harvested. Allow people to safely engage in recreation activities such as swimming, paddling or fishing in aesthetically pleasing waters; and provide water suitable for marine farming in relevant zones; and suitable for use as industrial water supplies (including for intensive aquaculture).

DGVs for the stormwater discharge location are set by the relevant Provincial and Mesoscale bioregions assigned by the EPA (2021) which is located in the Boags Mesoscale bioregion and are presented below:

Boags Bioregion	Physico-chemical indicators and DGVs for Aquatic Ecosystems											
	Dissolved oxygen (mg/L)		Salinity	pH		Temperature (°C)		Nitrate as N	Orthophosphate as P	Silicate as SI	Fluorescence	PAR
	lower	upper	(PPT)	lower	upper	lower	upper	(µg/L)	(µg/L)	(µg/L)	(unit less)	(µEm-2sec-1)
Annual	7.4	8.3	35.7	8.1	8.4	13.2	17.2	22.0	10.0	56.0	41.7	24.6
Summer	7.3	8.0	35.3	8.1	8.2	14.6	18.8	5.0	5.6	36.4^	22.7	ND
Autumn	7.4	7.8	35.8	8.2	8.4	15.0	17.2	12.6	10.0	59.4	42.1	24.6
Winter	7.9	8.5	35.2	8.1	8.2	11.7	13.4	37.6	12.3	56.0~	13.9^	11.9^
Spring	8.1	8.7	34.8	8.1	8.2	12.5	14.4	15.4	9.0	28.0^	ND	ND

NB: ND= No Data, ~ <95% Confidence, ^ Province derived values

Figure 14. *Physio-chemical indicators and DGVs for Aquatic Ecosystems in the Boags bioregion*

Blythe River

The SPWQM also sets out PEVs for inland and estuarine waters that are determined through extensive stakeholder consultation and identification of community values and uses. The Environmental Management Goals for Tasmanian Surface Waters: The Blythe River Estuary and Minna Creek and Tip Creek Catchments (DPIWE, 2000) states that for the Blythe River Estuary, these PEVs are:

A. Protection of Aquatic Ecosystems
    i. Protection of modified (not pristine) ecosystems from which fish are harvested.

B. Recreational Water Quality and Aesthetics:
    i. Primary contact water quality (between bridge and estuary mouth);
    ii. Secondary contact water quality; and
    iii. Aesthetic water quality

That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that allows people to safely engage in primary contact recreational activities such as swimming (between the Blythe Bridge and the estuary mouth) and secondary recreational activities such as paddling, boating and fishing in aesthetically pleasing waters (DPIWE, 2000).

DGVs apply to key indicators and are numerical concentrations or descriptive statements recommended for the support and maintenance of the designated water use or value, i.e. the PEVs. DGVs are set for High Ecological Value ecosystems and Slightly to Moderately Disturbed ecosystems for the Blythe catchment. These DGVs are outlined in Table 6, below.

Water quality monitoring data is lacking in the Blythe River estuary, with monitoring stations largely located further up the catchment.

Known factors influencing existing water quality in the Blythe catchment, river and estuary include:

- Forestry, cropping, dairy, and other agricultural activities (Crawford & White, 2007)
- Industrial activities such as:
    - The paint pigment factory (Tioxide Australia) at the site of the proposed converter station that historically released an iron-rich acid solution into the water until it was closed in 1996 (Crawford & White, 2007).
    - Mineral processing operations with significant discharges of silica sand to the Lower Blythe River (Green, 2001)

A classification of Tasmanian estuaries classified the Blythe estuary as a degraded estuary of low conservation significance (Class D), meaning the estuary and associated catchment have been moderately degraded by human impacts (Edgar, et al., 1999).

Table 6. Physio-chemical indicators and water quality DGVs for Aquatic Ecosystems of the Blythe Catchment (EPA Tasmania, 2021)

		High Ecological Value ecosystem					Slightly to Moderately Disturbed				
		Annual	Summer	Autumn	Winter	Spring	Annual	Summer	Autumn	Winter	Spring
Dissolved oxygen (mg/L)	lower	8.7	7.6	8.3	9.7	8.9	9.0	8.5~	9.5~	10.5~	9.1~
	upper	10.9	10.0	10.6	11.6	10.9	10.6	9.2~	10.3~	11.1~	10.3~
Dissolved oxygen (% saturation)	lower	78.4	89.7	64.2	77.0	79.7	88.0	85.2	88.1	86.8	90.7
	upper	100.4	104.5	101.3	95.3	98.5	100.0	105.0	99.8	98.0	100.0
Electrical conductivity (µs/cm)		178.6	172.3	187.6	216.6	170.8	80.7	80.0~	114~	75.0~	73.5~
pH	lower	5.3	5.6	5.6	4.8	5.2	6.7	6.7~	6.4~	6.5~	7.0~
	upper	7.2	7.4	7.2	6.8	7.0	7.1	7.2~	7.1~	7.2~	7.1~
Turbidity (NTU)		8.8	7.1	7.3	11.0	11.7	3.8	2.8~	4.6~	5.6~	2.5~
Temperature (°C)	lower	8.7	12.7	9.2	7.0	8.9	8.9	13.5~	9.2~	7.1~	11.1~
	upper	14.0	16.6	13.1	9.9	12.6	16.2	17.5~	15.3~	8.8~	17.0~
Total ammonia nitrogen (Nitrogen mg/L)		0.051	0.048~	0.070~	0.055~	0.043~	0.038	0.030	0.044	0.023	0.055
NO_3 (Nitrogen mg/L)		0.136	0.172	0.130	0.091~	0.087	0.187	0.136	0.125	0.353	0.299
NO_2 (Nitrogen mg/L)		0.008	0.007~	0.007~	0.008~	0.009~	0.004	0.004	0.003	0.003	0.004
Total Nitrogen (mg/L)		0.706	0.662	0.643	0.825	0.717	0.663	0.591	0.525	0.742	0.780
Dissolved reactive phosphorus (Phosphorus mg/L)		0.004	0.005~	0.004~	0.004~	0.004~	0.005	0.005	0.005	0.005	0.005
Total Phosphorus (mg/L)		0.025	0.024	0.029	0.065	0.018	0.025	0.024	0.027	0.026	0.025
Total suspended solids (1.5 µm) (mg/L)		5.00	5.00~	5.00~	5.00~	5.00~	5.00	5.00	5.00~	8.00	11.20~
Total suspended solids (0.45 µm) (mg/L)		3.00	3.00	5.00	3.00	3.00	11.00	15.20	12.00	7.00	8.20

Figures shown above are based on data from 8 High Ecological Value sites across the H4 Hydrological region and 1 Slightly Modified Ecological Value site within the Blythe Catchment unless noted otherwise as below:

Green = Hydrological region values

Blue = State derived values

~ = <95% confidence

6.3 Existing geomorphic conditions

Fluvial geomorphology describes the size, shape and diversity of the river channel and the processes by which these elements of the stream system form and change through time. Fluvial geomorphology shapes river channels, sediment dynamics, floodplain development, bank erosion, riparian vegetation, and instream features to create a variety of habitats. The variety of habitat types create distinct ecological niches, contributing to the ecological health and functioning of a fluvial system.

Streams and waterways adjust dynamically over time in response to the temporal sequence of sediment and water flows delivered from the upstream catchment (Bledsoe, 2002). Erosion occurs when the shear stress associated with water movement is greater than the shear resistance of the bed and bank materials. In general, disturbance in the mobilisation of sediments can often result in waterway instability and erosion and is typically assessed and represented through shear stress assessments and modelling.

Shear stress is calculated as the multiple of the unit weight of water, hydraulic radius and friction slope. These values are described in further detail in *Technical Guidelines for Waterway Management* (Department of Sustainability and Environment (DSE), 2007). Typical values for various channel boundary materials have been selected to provide a representation of the shear stress required to initiate erosion in Table 7.

Table 7. Maximum shear stress for various channel boundary materials (Fischenich, 2001).

Parameter	Shear stress (N/m^2)
Sand	1.44
Gravel	3.59
Grass	4.55
Clay	12.45
Cobble	32.08
Wattle	47.88
Long native grasses	81.40
Gravels (D50 = 150 mm)	95.76
Structurally diverse hardwood and understory planting	150.00
Rock (D50 = 300 mm)	244.19
Concrete	598.50

Existing geomorphic conditions and relative erosion potential at the site have been established through hydraulic modelling, with the methodology described in Section 5.2. Hydraulic modelling was used to establish typical shear stress values across the site.

The shear stress analysis for the 0.5 % AEP (Figure 15 and Figure 16) and the 0.5 % AEP climate change (Figure 17 and Figure 18) events indicate that the areas of higher shear stress are concentrated in the confined valleys with surface flows coalescing before joining the low energy Blythe River. Given the existing land use of the area, the bed material is predominately bare land and sand at the former tioxide plant, erosion is typically expected under the current and climate change scenarios as the values through these areas are subject to 10-20 Newtons per square metre (N/m^2). From the aerial imagery, the surrounding area appears to be sand, which from Table 7, has a shear resistance value of 1.44 N/m^2. Under the current and climate change scenarios, it is anticipated that this erosion would mobilise sand and transport it over the site from west to east and result in sediment build up at the entrance to the culvert outfall.

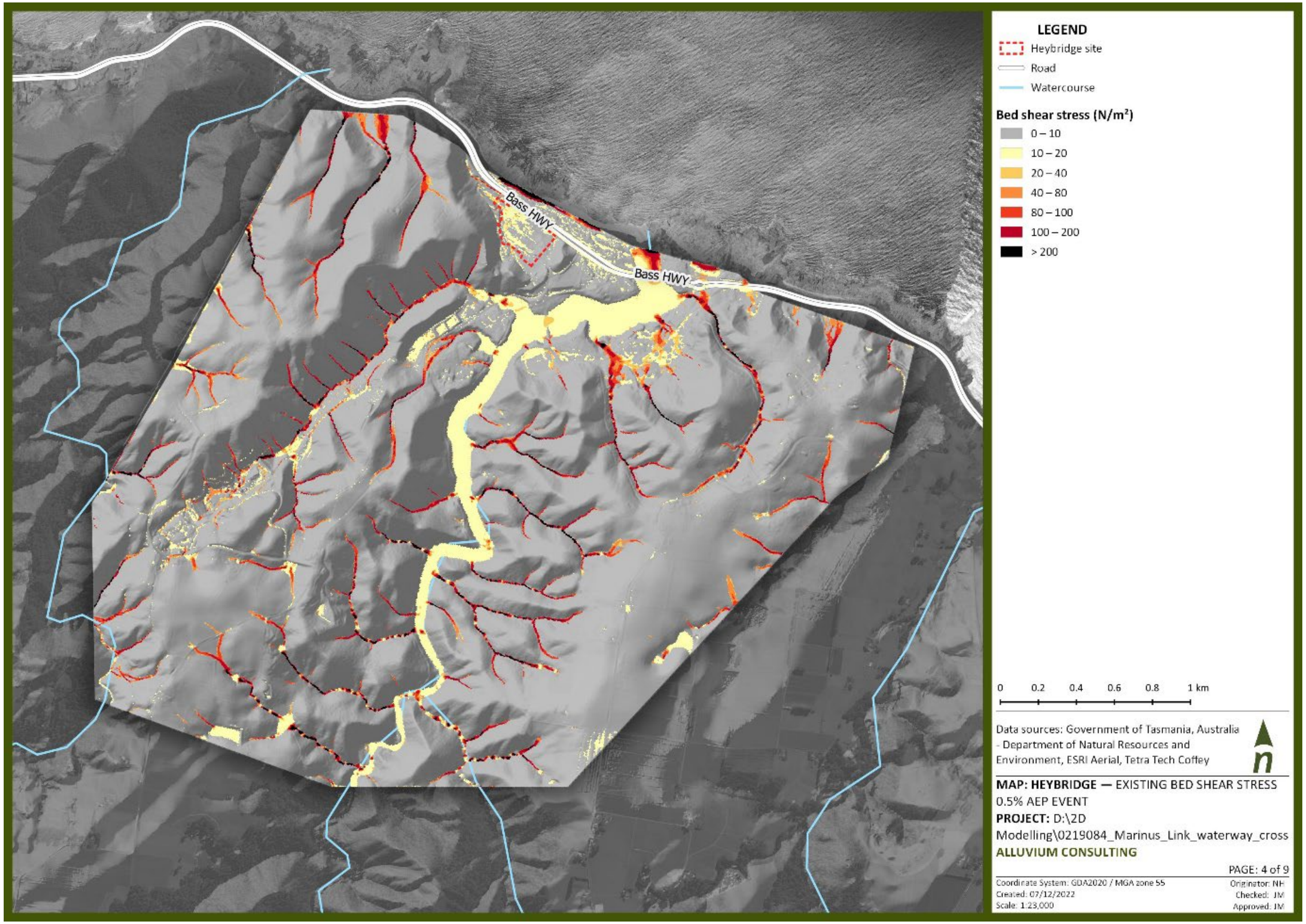

Figure 15. *Heybridge baseline characterisation bed shear stress for 0.5% AEP – full model extent.*

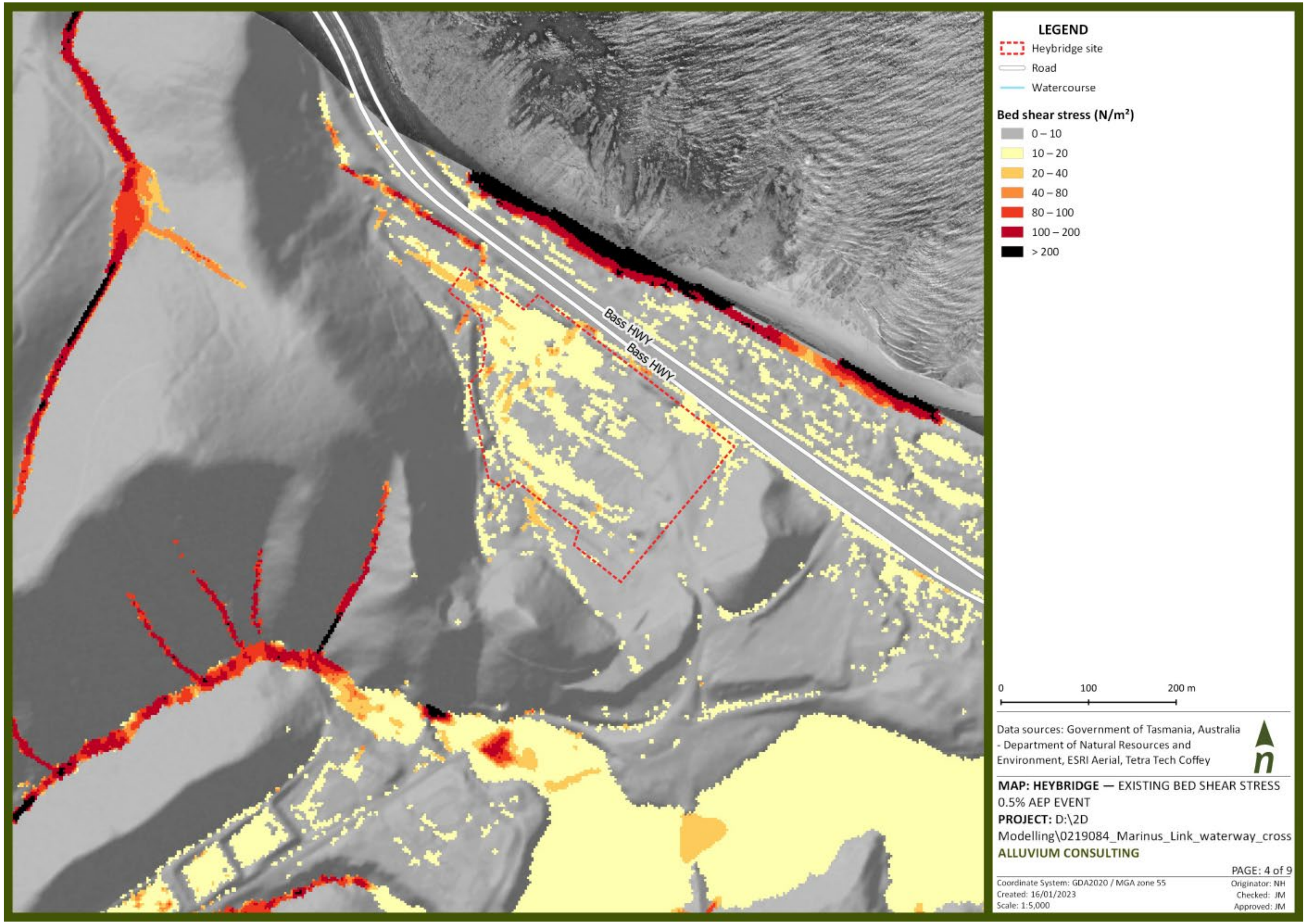

Figure 16. *Heybridge baseline characterisation bed shear stress for 0.5% AEP – Heybridge site.*

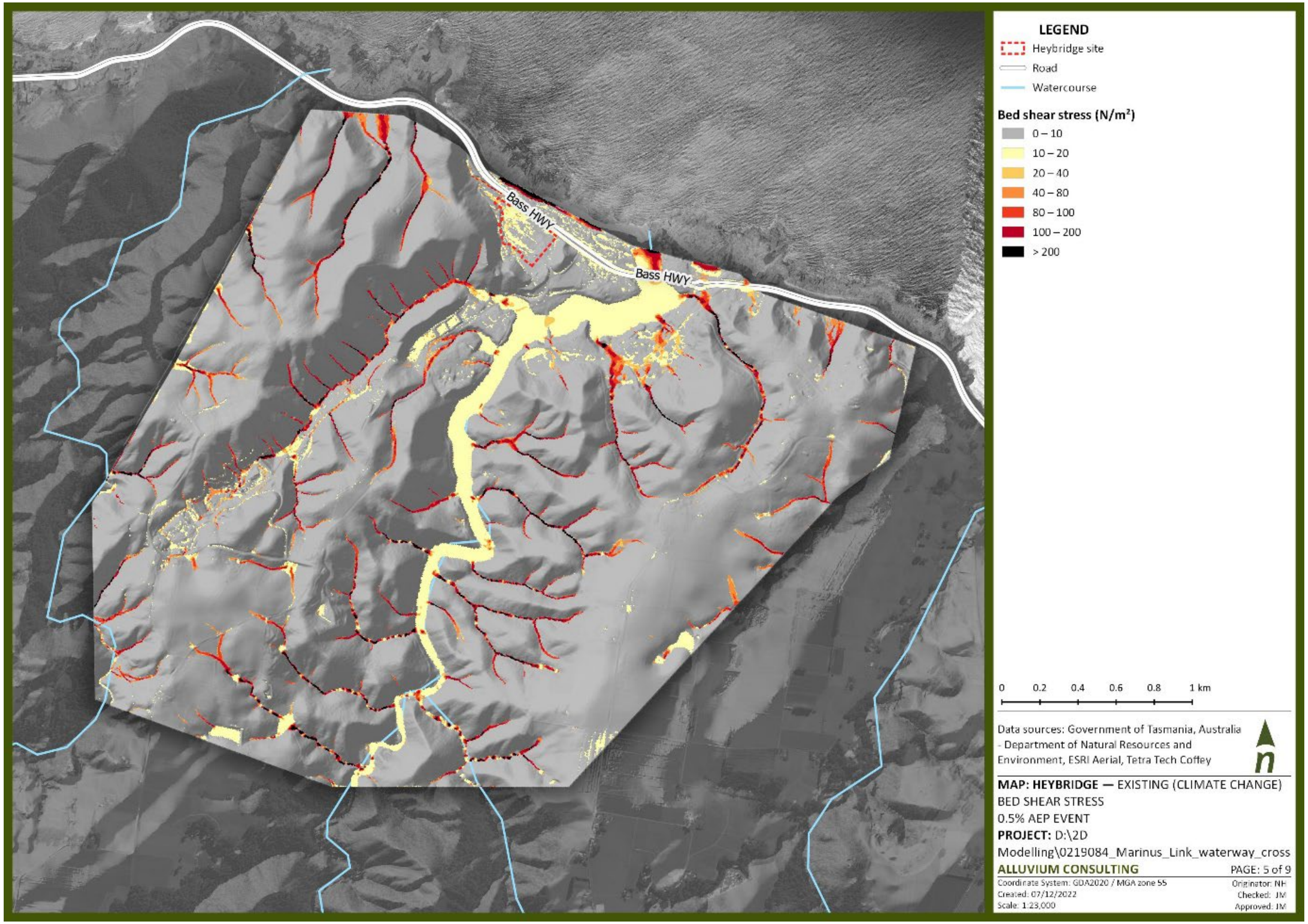

Figure 17. *Heybridge baseline characterisation bed shear stress for climate change 0.5% AEP – full model extent.*

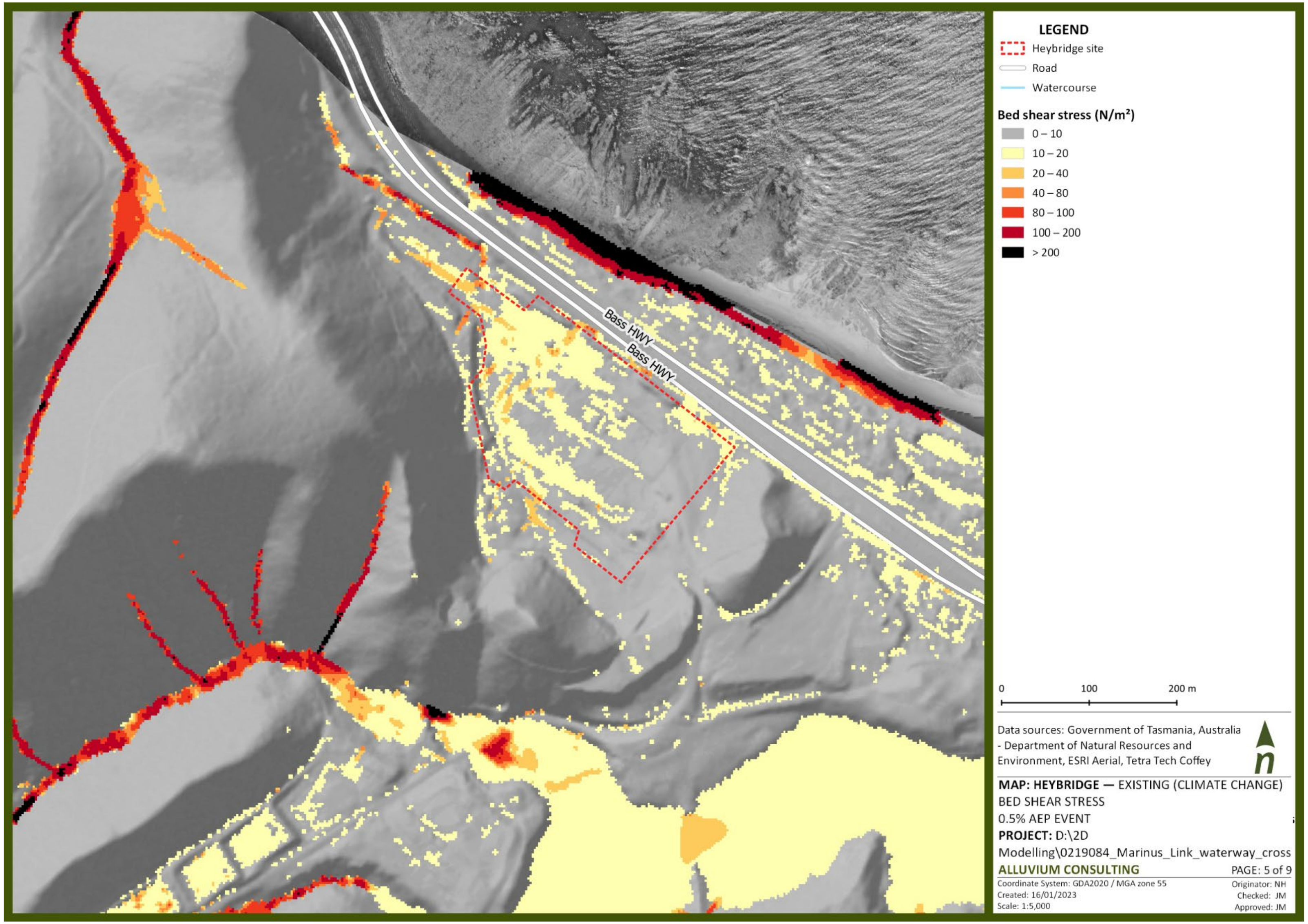

Figure 18. *Heybridge baseline characterisation bed shear stress for climate change 0.5% AEP – Heybridge site.*

7 Impact assessment

The following sections present the surface water impact assessment for the project.

7.1 Key issues on environmental values

Key issues relevant to project impacts on surface water have been identified through an assessment of the effects on surface water as a result of construction and operation activities of the project. In relation to the EIS guideline requirements these key issues have considered the potential for adverse effects on:

- The functions and environmental values of surface water environments, such as interception or diversion of flows or changed water quality or flow regimes.
- Nearby and downstream water environment due to changes in flow regimes, floodplain storage, run-off rates, water quality changes, or other watercourse conditions, including in the context of climate change projections.

Sections 7.2, 7.3 and 7.4 provides an assessment of the key potential impacts and risks on surface water in regards to flooding, water quality and geomorphology as a result of construction and operational activities of the project.

7.2 Flooding impacts

This section identifies the potential flooding impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Impacts to flooding from the construction and operation of the converter station at Heybridge was assessed as part of detailed, site-specific flood modelling. Results from the flood modelling indicate as a result of the proposed converter station, flood levels are expected to increase by 0.05-0.1 m at the location of the existing culvert outfall to the west of the station footprint under the current 0.5 % AEP scenario (Figure 19). A significant reduction in areas that “were wet, now dry” were identified in the development footprint associated with the proposed site contouring works (utilising the existing outfall arrangement under Bass Highway) in both the design condition and under climate change conditions. Both scenarios demonstrate a reduction in pooling on the site due to the proposed cut and fill site design. Under climate change projections, the increase in flood depths is also concentrated at the existing culvert outfall (Figure 20) with increases typically in the order of 0.05-0.1 m increases.

It is understood that clean surface water runoff and overflow from the site interceptor trap will discharge to a form of water sensitive urban design (WSUD) such as a swale drain, before discharging to the ocean via the existing site drainage culvert. Details on the interceptor trap or swale drain was not available at the time of assessment and was not incorporated into the modelling. This is important to note as and WSUD features are typically bypassed or drowned-out under a 0.5 % AEP streamflow event.

Figure 19. *Heybridge 0.5% AEP afflux.*

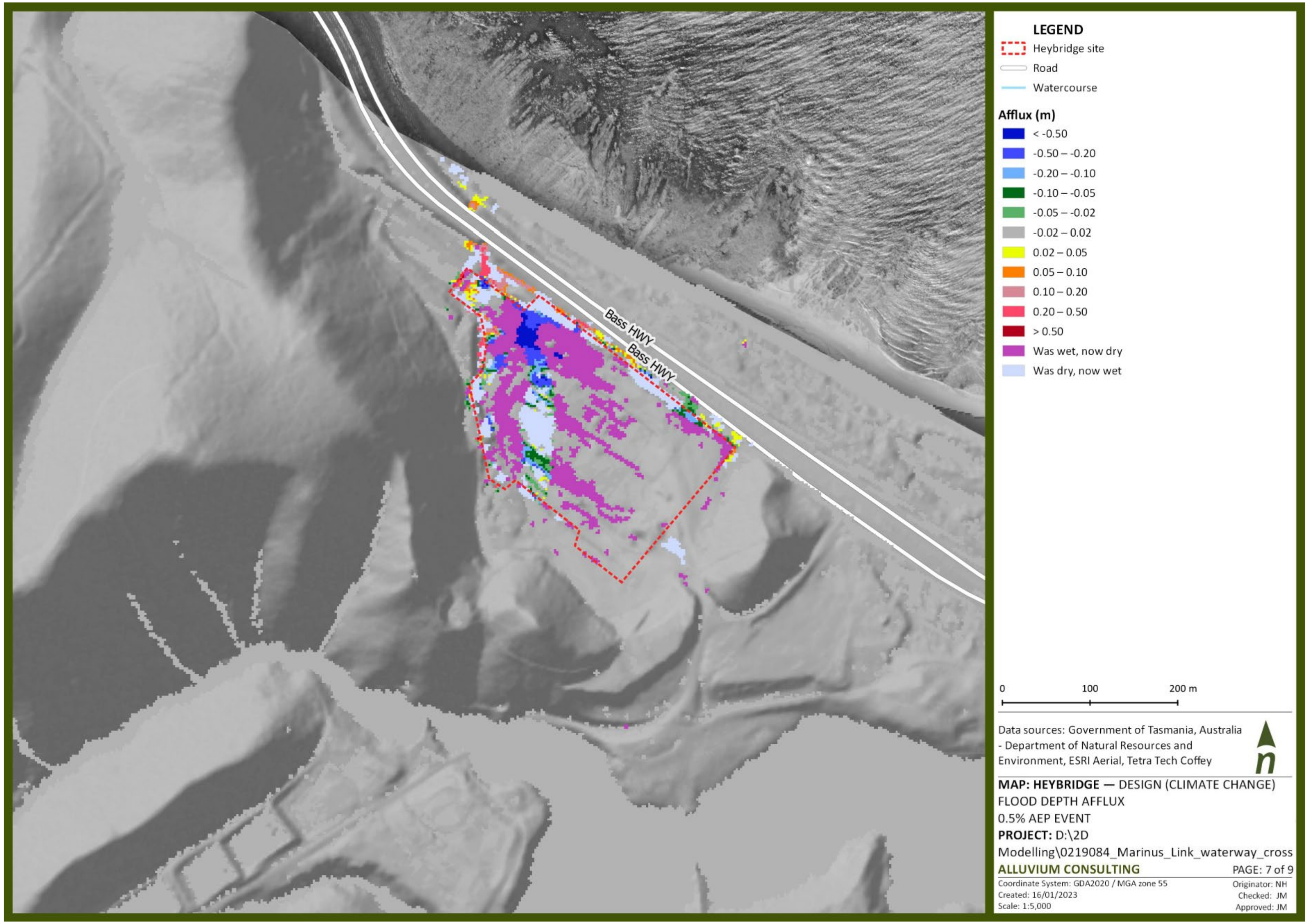

Figure 20. *Heybridge climate change 0.5% AEP afflux.*

Flooding risks identified

Based on the flooding assessment several risks were identified, the hazard and pathways/mechanism for these risks are outlined in Table 8.

Table 8. Identified risks associated with flood behaviour and associated functions, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.1	Construction activities	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.
C.2	Construction activities	Excavation, filling or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.
C.3	Construction activities	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.
O.1	Operation/ permanent assets	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks and hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to the drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of watercourses and liberation of sediment travelling in surface water to watercourses.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.

ID	Hazard	Pathway/mechanism	Risk
O.4	Operation/ permanent assets	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.

7.3 Water quality impacts

This section identifies the potential water quality impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Soil washed from land development or construction sites has potential to deposit as sediment in outfall drainage channels, culvert outfalls and watercourses. This process can greatly increase the concentration of materials suspended and dissolved in streams and coastal waters and the durations and frequencies for which downstream waters, including coastal remain turbid. Water pollution can also include contaminants such as suspended, dissolved, floatable and settleable soil, oils, cements materials and other chemicals.

Increased sediment supply and pollutants from construction activities can impact on waterways and coastal waters in the following ways:

- Reduce visibility for aquatic fauna to hunt for prey.
- Reduce growth of aquatic vegetation through lack of light due to increased turbidity.
- Increase turbidity such that it impacts on aesthetic values.
- Impact on safe water uses such as stock and domestic supply, recreation, consumption of fish and other human water uses.

The pathway for sediment and pollutants to impact on watercourses and drainage lines is either through travelling in runoff as a result of rainfall or interacting with floodwaters in flood events. An appreciation of the impacts on water quality has been gathered through understanding the area of disturbance within the 0.5 % flood extent across the Heybridge site. For the construction phase, this provides an appreciation of the disturbed area (assumed to be exposed soil) that could be inundated in a flood event, with sediment liberated. After construction, it is understood that exposed soil will be rehabilitated and/or covered, meaning sediment liberation during the operation phase would likely be minimal and not of a scale that could impact on surface water values.

It is understood that potentially contaminated water from bunded areas will be directed to and collected in a gross pollutant trap or triple interceptor trap which will be periodically pumped out by a licensed wastewater disposal contractor. Further, clean surface water runoff and overflow from the traps will discharge to the ocean via the existing site drainage culvert under Bass Highway. This introduces the potential that if the interceptor trap is undersized and overwhelmed it may release contaminants to the downstream environment.

Water quality risks identified

Based on the water quality assessment several risks were identified, the hazard and pathways/ mechanism for these risks are outlined in Table 9.

Table 9. Identified risks associated with water quality, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.4	Construction activities	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).
C.5	Construction activities	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).
C.6	Construction activities	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.
C.7	Construction activities	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.
C.8	Construction activities	Horizonal directional drilling results in frac out-where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials and potential contamination of land and acid sulfate soils during construction of the project being released into the waterways.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of bed/bank erosion and increased sediment supply to drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion causing instability of assets adjacent to the drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.

ID	Hazard	Pathway/mechanism	Risk
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and system stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.
O.5	Operation/ permanent assets	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.
O.6	Operation/ permanent assets	Spill of hazardous or potentially polluting chemicals or materials used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	Hazardous materials during operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)

7.4 Geomorphology impacts

This section identifies the potential geomorphology related impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Analysis of the shear stress results from the detailed flood modelling for the proposed works at the Heybridge converter station indicates that shear stress is expected to increase in both the current, and climate change scenarios. Figure 21 and Figure 22 indicate that the magnitude of increases is up to 5 N/m^2 at the existing culvert outfall to the northwest of the proposed development footprint. Results indicate that the proposed development will also result in some isolated increases in shear stress of up 10 N/m^2 to the northern outfall of the existing culvert that passes beneath the Bass Highway under the existing and climate change scenarios. Increases of this magnitude have the potential to initiate erosion beyond existing conditions as bed substrate is likely sand, with an erosion threshold of less than 2 N/m^2. Erosion control works at the outfall would be required to mitigate the impact of the development on the stability of the culvert outfall.

The marginal increases across the development footprint are not anticipated to be subject to erosion, given concrete has an erosion threshold of almost 600 N/m^2.

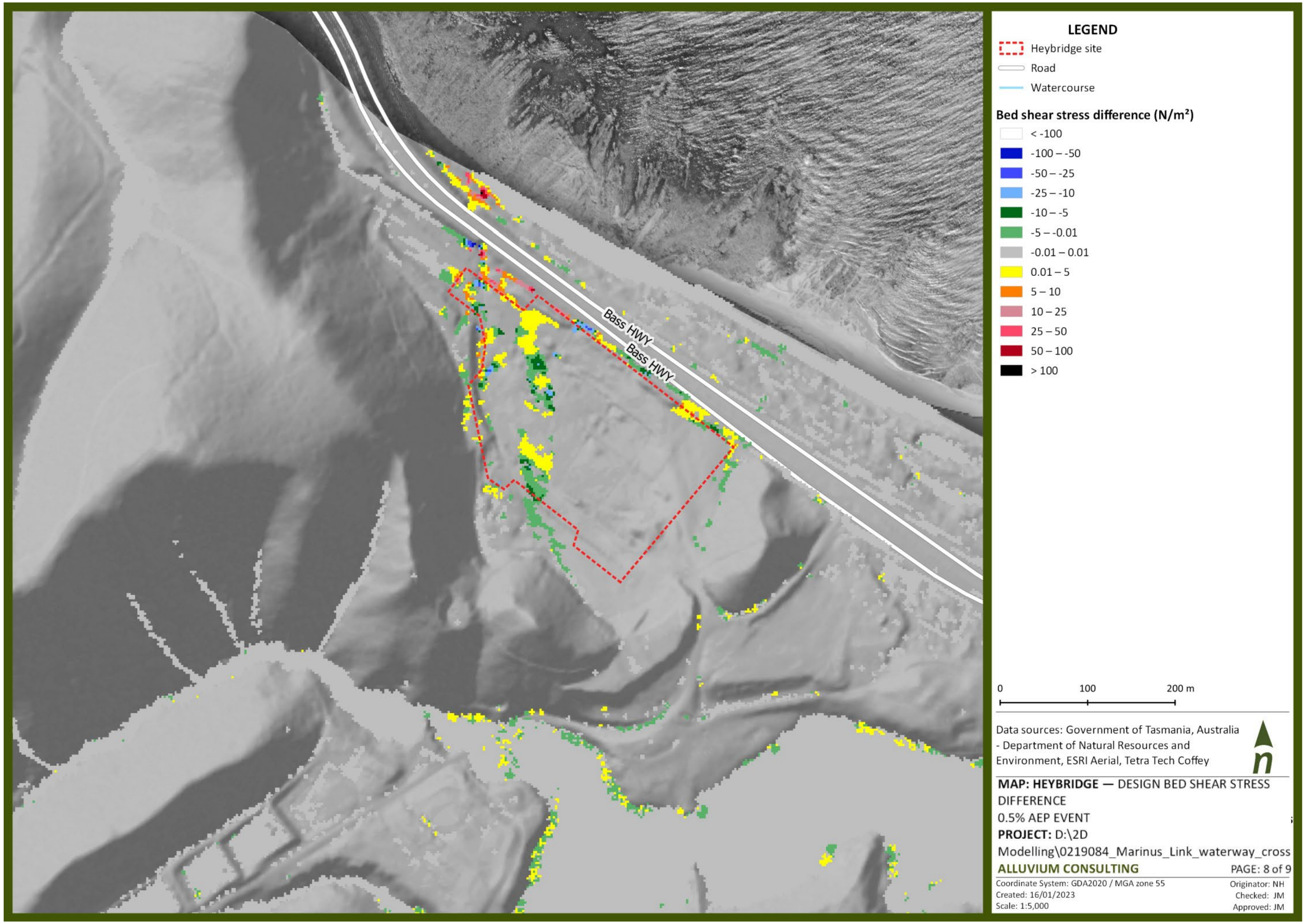

Figure 21. *Heybridge 0.5% AEP shear stress difference to design case.*

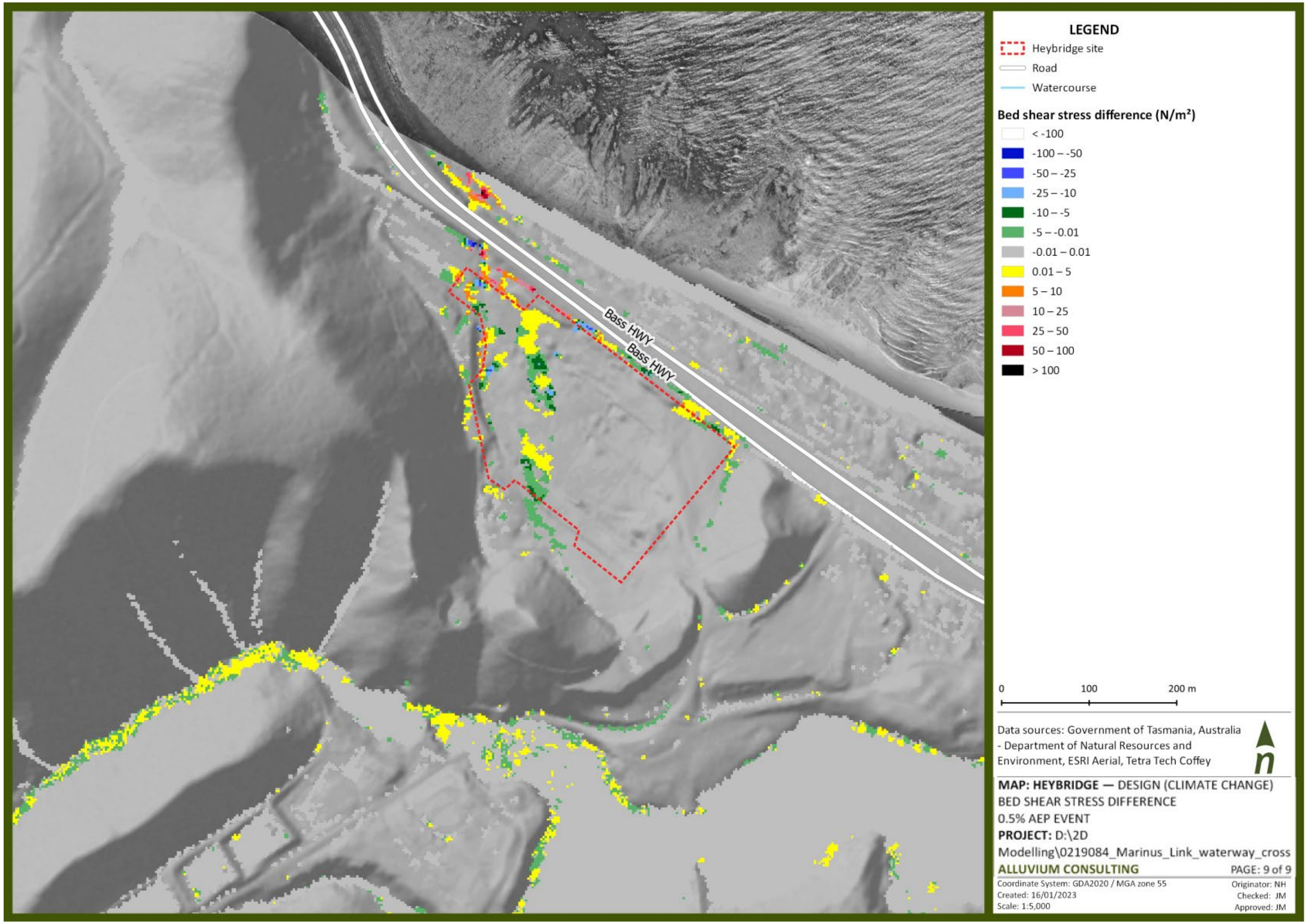

Figure 22. *Heybridge climate change 0.5% AEP shear stress difference to design case.*

Geomorphology risks identified

Based on the geomorphology assessment several risks were identified, the hazard and pathways/ mechanism for these risks are outlined in Table 10.

Table 10. Identified risks associated with geomorphology, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.3	Construction activities	Direct alteration of drainage assets (including existing drainage channels (discharging under Bass Highway directly to Tioxide Beach) that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to drainage assets resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.
C.5	Construction activities	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into drainage channels (discharging under Bass Highway directly to Tioxide Beach).
C.6	Construction activities	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into the drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	A flood event occurring during construction causing inundation of assets and sediment liberation.
C.7	Construction activities	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks, joint pits, or other hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.

ID	Hazard	Pathway/mechanism	Risk
O.4	Operation/ permanent assets	Diversion of stormwater, drainage alignment or flow pathways to ongoing, leading to bed or bank erosion, causing instability of assets and/or increased sediment supply to receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the drainage channel (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.

7.5 Summary of risk assessment

Based on the risks identified in Sections 7.2, 7.3 and 7.4, a combined risk assessment for surface water values was undertaken with respect to the construction and operation project stages. Table 11 outlines this risk assessment, prior to development of the mitigation measures. The residual risk assessment takes into account the implementation of the specified mitigation measures, which is summarised in section 7.7.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

Table 11. Surface water risk assessment prior to implementation of mitigation measures.

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
Construction							
C.1	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.	Flood storage behaviour and associated functions (flooding)	Possible	Moderate	Moderate	Through increases in impervious areas and changes to existing surface levels.
C.2	Excavation, filling or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.	Flood conveyance behaviour and associated functions (flooding)	Possible	Moderate	Moderate	
C.3	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.	Flood conveyance behaviour (flooding), water quality and site/drainage channel stability (geomorphology)	Unlikely	Moderate	Low	
C.4	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Water quality	Possible	Major	High	

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
C.5	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Water quality, waterway stability (geomorphology), flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	Sediment or contaminant release in major flood event during construction.
C.6	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	
C.7	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.	Water quality, waterway stability (geomorphology).	Possible	Moderate	Moderate	
C.8	Horizonal directional drilling results in frac out- where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials during construction of the project being released into the waterways.	Water quality	Possible	Moderate	Moderate	
Operation							

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
O.1	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.	Flood conveyance behaviour and associated functions (flooding)	Possible	Moderate	Moderate	
O.2	Changes to current land use from permanent project assets such as access tracks and hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to the drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.	Flood behaviour and associated functions (flooding), water quality	Possible	Moderate	Moderate	
O.3	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of watercourses and liberation of sediment travelling in surface water to watercourses	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	
O.4	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.	Water quality	Possible	Moderate	Moderate	

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
O.5	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Unlikely	Moderate	Low	
O.6	Spill of hazardous or potentially polluting chemicals or materials used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	Hazardous materials during operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)	Water quality	Possible	Major	High	Potential for interceptor trap to overflow and spills

7.6 Mitigation measures

In order to reduce the risks posed by the project on surface water, mitigation measures have been developed to reduce the risk of harm.

The following final mitigation measures have been informed by the example mitigation measures discussed in the impact assessment (Section 5.2). The mitigation measures have also been developed with consideration of industry standards and relevant legislation, guidelines and policies.

The recommended mitigation measures for design, construction and operation phases of the project are presented in Table 12.

In addition to the surface water mitigation measures outlined in Table 12, the other mitigation measures that would reduce the potential impacts due to surface water resulting from the project, include:

- Groundwater; and
- Contaminated land.

A decommissioning management plan will be prepared to outline how decommissioning activities would be undertaken and potential surface water impacts managed, including risks and addressing the items outlined in these surface water mitigation measures.

Table 12. Design: Management, mitigation or monitoring measure

ID	Design: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW01	**Minimise flood risk due to permanent infrastructure** The following key design measures will be applied to the project and will be fully documented in the final Marinus Link Design Report, to be submitted to the EPA for review and approval prior to construction: • All permanent infrastructure will be designed to take flood risk into account, the requirements outlined in the Floodplain Risk Assessment Guidelines for Municipal Councils in Tasmania (White CJ, 2019). • Roads/access ways will be designed with suitable drainage, including appropriate camber and natural drainage swales, and any concentrated discharges will pass through water mitigation infrastructure such as rock filters. • All permanent infrastructure will be designed to take storage locations of all environmentally hazardous materials into account, as is required by the building code.
Monitoring	
There is no surface water quality monitoring proposed during the design phase.	

Table 13. Construction: Management, mitigation or monitoring measure

ID	Construction: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW02	Develop and implement a Progressive Sediment and Erosion Control Plan

ID	Construction: Management, mitigation or monitoring measure
Management and mitigation (MM)	
	Prior to construction commencing, a Progressive Sediment and Erosion Control Plan for the Project will be developed (either as a standalone document or part of the CEMP) and submitted to the EPA for approval prior to commencement of construction. The plan will then be implemented throughout construction. The plan will identify all major drainage lines and waterways and site-specific management and mitigation to be implemented, including controls such as sandbags, sediment fences, sediment traps and diffusion paths to ensure stormwater is suitably contained, managed and released to avoid and minimise sediment release, pollution and erosion. The plan must describe sediment and erosion controls and monitoring requirements in accordance with EPA TAS fact sheets: *Soil and Water Management on Large Building and Construction Site (EPA Tasmania, 2008), Erosion Control Matts and Blankets (EPA Tasmania, 2008), Scour Protection – Stormwater Pipe Outfalls and Check Dams (EPA Tasmania, 2008), Stabilised Access and Sediment Fences and Fibre Rolls (EPA Tasmania, 2008), and with reference to the IECA Best Practice Erosion and Sediment Control Guidelines 2008 and EPA TAS (Bunding and Spill Management Guidelines) (EPA Tasmania, 2015).*
SW03	**Minimise impacts due to flooding during construction** Prior to construction commencing, a Flood Risk Management Plan for the Project will be developed (either as a standalone document or part of the CEMP) in line with the requirements outlined in the Floodplain Risk Assessment Guidelines for Municipal Councils in Tasmania (White CJ, 2019).
Monitoring	
SW04	**Develop and implement a surface water monitoring program** Prior to construction commencing, a Surface Water Monitoring Program for the Project will be developed (either as a standalone document or part of the CEMP) to assess surface water quality during construction. The monitoring program must, as a minimum: • Be developed in consultation with the EPA Tasmania. • Include parameters, frequency, durations of water quality monitoring, and flow paths and drainage channels condition inspections. • Daily visual monitoring of active construction areas for visible water quality issues including high sediment loads or erosion. • Fortnightly audits of the physical site construction controls (including sediment and erosion control measures). Additional audits will be undertaken after extreme weather events. • Monthly audits of all management measures set out in the CEMP. • Any non-conformance identified during inspections and audits will be documented, investigated and resolved. • Audits to be made available to the EPA on request. • Any non-conformance or incident with the potential for serious or material environmental harm to be reported to the Director, EPA within 24 hours. • Include monitoring locations at suitable distances both upstream and downstream of works to establish baseline conditions prior to construction, where required.

Table 14. Operation: Management, mitigation or monitoring measure

ID	Operation: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW05	**Develop and implement measures to manage potential impacts to surface water in operation** As part of the OEMP, develop and implement measures to avoid or minimise impacts to surface water during the operation in accordance with requirements from EPA Tasmania. These measures must include: • Controls for management of sites and materials to prevent erosion, runoff of contamination and sediments entering flow paths and drainage channels. • Ongoing surface water quality monitoring program requirements, as outlined in the surface water monitoring program (SW04).
Monitoring	
There is no surface water quality monitoring proposed during the operational phase.	

7.7 Residual risk assessment summary

The surface water mitigation measures, developed in section 7.6 have been designed to effectively reduce the likelihood of impacts on various impact pathways and mechanisms. These surface water mitigation measures incorporate specific management measures to target the risks to waterways associated with construction and operation activities of the project.

By implementing these surface water mitigation measures, the project aims to minimise the likelihood of impacts, resulting in a low overall risk rating for surface water values which are flooding, water quality and geomorphology.

The assessment of residual risks, considering the implementation of surface water mitigation measures, has been assessed and the outcomes are presented in Table 15, which confirms the low residual risks to surface water during both construction and operation phases of the project.

Table 15. Residual risk assessment

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
Construction											
C.1	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02 and SW03	Unlikely	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood storage behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include locating stockpiles outside floodplains, earthwork cut/fill balance to maintain floodplain storage.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.2	Excavation, filling, or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02 and SW03	Unlikely	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood conveyance behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.3	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.	Flood behaviour (flooding), water quality and site/drainage channel stability (geomorphology)	Unlikely	Moderate	Low	SW02 and SW03	Rare	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood conveyance behaviour and waterway stability over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway alignment and protect/reinstate physical waterway habitat where required.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.4	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Water quality	Possible	Major	Major	SW02, SW04	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.5	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Water quality, waterway stability (geomorphology), flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02, SW04,	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of direct or indirect activities casing damage to the bed or bank of the waterway over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include limiting machinery movement to designated areas, sediment controls, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.6	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW02, SW03 and SW04	Unlikely	Moderate	Low	Implementation of SW02, SW03 and SW04 can reduce the likelihood of sediment liberation from open excavation/bare soils over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include sediment controls, limiting bare soil exposure, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.7	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW02, SW03 and SW04	Unlikely	Moderate	Low	Implementation of SW02, SW03 and SW04 can reduce the likelihood of sediment liberation from stockpiles over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include sediment controls, limiting bare soil exposure, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.8	Horizonal directional drilling results in frac out- where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials and potential contamination of land and acid sulfate soils during construction of the project being released into the waterways.		Possible	Moderate	Moderate	SW02 and SW04	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of frac out over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls may include emergency response procedures, monitoring.
Operation											

O.1	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW01, SW04 and SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood conveyance behaviour and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.
O.2	Changes to current land use from permanent	Land use changes, where	Flood behaviour and associated	Possible	Moderate	Moderate	SW01, SW04, SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
	project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of bed/bank erosion and increased sediment supply to drainage channels (discharging under Bass Highway directly to Tioxide Beach).	an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion causing instability of assets adjacent to the drainage channels (discharging under Bass Highway directly to the Tioxide Beach) and/or increased sediment loads.	functions (flooding), water quality								and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road, hard surface areas design to minimise change surface flow discharge rates and volumes.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
O.3	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and system stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW01, SW04, SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include road/access track drainage design to consider climate change scenarios.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
O.4	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.	Water quality	Possible	Moderate	Moderate	SW01, SW05	Unlikely	Moderate	Low	Implementation of SW01 and SW05 can reduce the likelihood of impacting flood storage behaviour and waterway stability over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include road/access track drainage design and earthwork cut/fill balance to maintain floodplain storage.

O.5	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Unlikely	Moderate	Low	SW01, SW04, SW05	Rare	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road, hard surface areas design to maintain flow pathways and consider outfall arrangements that minimise erosion potential.
O.6	Spill of hazardous or potentially polluting chemicals or materials	Hazardous materials during	Water quality	Possible	Major	High	SW01, SW04 and SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
	used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)									reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls to be implemented during construction and design phases include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

7.8 Cumulative impacts

A cumulative impact assessment has been completed for the project in line with the impact assessment method outlined in Section 5.2. Several credible projects were identified that each might have potential the potential to affect surface water values in close proximity to the and/or within the Heybridge converter station and shore crossing A summary of these projects is outlined in Table 17 below.

Table 16. CIA potential projects for assessment

	Proposal / proponent	Description	Location	Timing
1	Guilford Wind Farm / Epuron Pty Ltd Guildford | Ark Energy Ark Energy Projects Pty Ltd, Guildford Wind Farm, North West Tasmania | EPA Tasmania EPBC Act referral (environment.gov.au)	Wind farm in Guildford with up to 80 wind turbines Generation of up to 450 megawatts (MW) of wind energy Estimated capital: $50 million	7 km northeast of Waratah and 15 km south of Hampshire	Current status: Notice of intent submitted September 2020 Deemed a controlled action by DAWE in September 2021 Construction to commence: 2024
2	Robbins Island Renewable Energy Park / UPC Robbins Island Pty Ltd Robbins Island | Robbins Island and Jim's Plain Wind (robbinsislandwind.com.au) ACEN Robbins Island Pty Ltd, Robbins Island Renewable Energy Park, Northwest Tasmania | EPA Tasmania ACEN Robbins Island Pty Ltd, Robbins Island Renewable Energy Park, Northwest Tasmania | EPA Tasmania	Wind farm on Robbins Island with up to 122 wind turbines Generation of up to 900 MW of wind energy Estimated construction value: $1.2 billion Construction workforce: 250 personnel	Robbins Island, northwest coast of Tasmania	Current status: Approved by the Commonwealth Government and the EPA Project approvals currently under appeal. Construction to commence: 2023-2025
3	Jim's Plain Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm in Jim's Plain with up to 31 wind turbines and possible solar generation	23 km west of Smithton	Current status: Approved by the Council and State and Commonwealth governments in 2020 Construction to commence: 2023

	Proposal / proponent	Description	Location	Timing
	Jims Plain and Robbins Island Renewable Energy Park - Infrastructure Pipeline ACEN Robbins Island Pty Ltd, Jim's Plain Renewable Energy Park, North West Tasmania	EPA Tasmania	Generation of up to 200 MW of wind energy and up to 40 MW of solar energy Capital investment: $350 million. Construction workforce: over 150 personnel Operations workforce: 15 personnel		
4	Robbins Island Road to Hampshire Transmission Line / UPC Robbins Island Pty Ltd ACEN Robbins Island Pty Ltd, Robbins Island Road to Hampshire Transmission Line	EPA Tasmania	A new 220 kV overhead transmission line (OHTL) spanning 115 km, estimated to have 245 towers. Connects Jim's Plain and Robbins Island Renewable Energy Parks transmission infrastructure to Tasmanian transmission network. Construction workforce: up to 100 personnel over 24 months	Between Robbins Island Rd at West Montagu and Hampshire	Current status: Detailed planning/environmental approvals phase underway. Commonwealth Government determined the project to be a controlled action under the EPBC Act (Cwlth) in September 2020. Construction to commence: 2023
5	Bass Highway, targeted upgrades between Deloraine and Devonport / Department of State Growth Project Details (infrastructure.gov.au)	Targeted highway upgrades between Deloraine and Devonport. Roads of strategic importance Estimated project cost: $50 million	Targeted areas along Bass Highway between Deloraine and Devonport	Current status: In planning Construction expected to commence late 2023 Expected completion: 2027

	Proposal / proponent	Description	Location	Timing
6	Remaining North West Transmission Development (Staverton to Hampshire Hills Transmission Line) / TasNetworks timelinemay2022.pdf (tasnetworks.com.au) Staverton to Hampshire Hills - TasNetworks	A component of the North West Transmission Developments, comprising a new 60-km-long new 220 kV OHTL between a new switching station at Staverton and Hampshire Hills Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link. Estimated project cost: $220 million	Between Staverton and Hampshire Hills	Current status: Planning and approvals phase in progress Construction expected to commence: 2024
8	Hellyer Wind Farm / Epuron Pty Ltd Epuron | Hellyer Wind Farm | Ark Energy Ark Energy Projects Pty Ltd, Hellyer Wind Farm, Hampshire | EPA Tasmania	Wind farm with up to 48 wind turbines Generation of up to 300 MW of wind energy	8.5km southwest of Hampshire	Current status: Design phase. Notice of intent issued. Tasmanian EPA -EIS Guidelines issued in November 2022
9	Western Plains / Epuron Pty Ltd WesternPlainsWindFarm_Update (arkenergy.com.au)	Wind farm with up to 12 wind turbines Generation of up to 50.4 MW of wind energy	4 to 5 km northwest of Stanley	Current status: Work on the Development Proposal and Environmental Management Plan (DPEMP) is continuing. The DPEMP has been drafted in accordance with the Project Specific Guidelines issued for the project by the Environment Protection Authority (EPA Tasmania). The EPA Tasmania recently extended the timeframe for

	Proposal / proponent	Description	Location	Timing
				submission to enable completion of the required documentation.
10	Table Cape Luxury Resort / Table Cape Enterprises	Proposed accommodation	Table Cape, 4.5 km north of Wynyard, Ransleys Road	Current status: Approved by Waratah-Wynyard Council
11	Lake Cethana Pumped Hydro / Hydro Tasmania Pumped hydro Lake Cethana selected as first pumped hydro project	Storage and underground pumped hydro power station with associated infrastructure, with up to 600 MW capacity Estimated construction cost: $900 million	19 km southwest of Sheffield	Current status: Hydro Tasmania will progress with the final feasibility stage Construction likely to commence: 2027
12	Youngmans Road Quarry / Railton Agricultural Lime Pty Ltd Railton Agricultural Lime Pty Ltd, Youngmans Road Quarry, Railton | EPA Tasmania	Limestone quarry development on old quarry site Average annual production of 72,000 tonnes of limestone	2.5km northwest of Railton	Current status: EPA approved the development in February 2021. Kentish Council is reviewing the land permit for the proposed development
13	Port Latta Wind Farm / Nekon Pty Ltd's Port Latta Wind Farm	Wind farm with up to 7 wind turbines Generation of up to 25 MW of wind energy Construction workforce: 15 people over six months Estimated capital: $50 million	Mawbanna Plain, 2 km southwest of Cowrie Point	Current status: Environmental Assessment Report and EPA decision issued October 2018 Website states intent to start construction late 2020, no further updates available

	Proposal / proponent	Description	Location	Timing
14	Port of Burnie Shiploader Upgrade / TasRail Shiploader Project - TasRail	Minerals shiploader and storage expansion at TasRail's existing Bulk Minerals Export Facility Estimated cost: $64 million Design and construction workforce: 140 personnel	Port of Burnie	Current status: onsite works and detailed design (commenced in April 2022). Commissioning expected to commence: 2023
15	Bass Highway – Cooee to Wynyard / Department of State Growth Bass Highway - Cooee to Wynyard – Transport Services Project Details (infrastructure.gov.au)	Priority works upgrade along the Bass Highway between Cooee and Wynyard to realign and upgrade approximately 3.2 km of road Estimated cost: $50 million	Bass Highway from the intersection of Brickport Road in Cooee, across the Cam River Bridge, to the intersection of the Old Bass Highway at Doctors Rocks near Wynyard	Current status: Construction (commenced late 2021) Expected completion:2025.
16	Sheffield to Staverton Upgrades / TasNetworks North West Transmission Developments - TasNetworks	A component of the North West Transmission Developments, comprising modifications to two 18.5-km-long sections of existing 220 kV OHTLs between Staverton and Sheffield. Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link.	Between Staverton and Sheffield	Current status: Planning and approvals phase Construction expected to commence: 2025

	Proposal / proponent	Description	Location	Timing
17	QuayLink - Devonport East Redevelopment / TasPorts Devonport Quaylink (tasports.com.au) Devonport East Redevelopment (tasports.com.au)	Port terminal upgrade project to support TasPorts in increasing capacity of both freight and passenger ferry services across Bass Strait. Estimated cost: $240 million Design and construction workforce: 1060 direct and indirect jobs in North West Tasmania, and a further 655 broader Tasmanian jobs during construction.	Port of Devonport	Current status: Early works/construction (commenced 2022); approvals phase ongoing. Expected completion: 2027

Proposed and reasonably foreseeable projects have been identified based on their potential to contribute to cumulative impacts by overlapping with the proposed project location and timeframe. An assessment of these in regard to its cumulative impact on flooding, water quality and geomorphology is outlined below.

CIA – Flooding, water quality and geomorphology

Of the proposed Initial Works, activities such as site establishment, ground improvement or site levelling works could of themselves create adverse flooding impacts. The other Initial Works would have a negligible impact due to the nominal change to existing conditions as a result of the works. These impacts have been considered in the impact assessments for the individual project components.

Potential pathways through which the identified projects in Table 16 could impact flooding, water quality and geomorphology have been analysed in below.

Table 17. CIA potential project impact pathway assessment

Impact pathway assessment
These major projects are likely to have similar impacts to surface water quality, geomorphology and flooding as identified in this impact assessment (Sections 7.2, 7.3 and 7.4). As an example, these include: • displacement of flood waters/volume that led to adverse flood impacts to surrounding property, key infrastructure and the environment. • constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks. • altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline. • disturbance to the bed or banks of waterways through ground disturbance activities (excavation, trenching, clearing, vehicular traffic etc.) within the riparian zone or instream. • changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics. • alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences

Through implementation of mitigation measures such as those outlined in Section 7.6, the project is not expected to impact water quality, flows or bed and bank stability within local waterways, or create adverse flood impacts or pose an increased health and safety risk to tunnel workers or operational staff.

As such, any significant cumulative impact to water quality and flow regime from the project to other major projects is unlikely.

7.9 Inspection, Monitoring and review

The proposed mitigation measures should be accompanied by the establishment of a monitoring and maintenance program (as per MM SW04 in section 7.6).

A specific surface water monitoring program for the site should be developed that can be used to monitor condition across all the works which can:

- Prior to construction: characterise the baseline condition of receiving waters.
- During construction: monitor water quality changes in receiving waters due to project activities.

The monitoring program should, as a minimum:

- Be developed in consultation with EPA Tasmania and DNRET (as the waterway manager) and asset owners (where applicable)
- Specify locations, parameters, and frequency of monitoring (refer to MM SW04)
- Specify length of monitoring pre and post construction
- Reference applicable policies and guidelines, including *Technical Guidance for Water Quality Objectives* (WQOs) *Setting for Tasmania* (EPA Tasmania, 2020), *Environmental Effects Report Guidelines* (EPA Tasmania, 2019) and relevant EPA Tasmania fact sheets such as *Soil and Water Management Plans* (EPA Tasmania, 2008).

The monitoring program must outline conditions under which changes to water quality parameters need to be investigated, when works on-site need to be stopped in response to changes in parameters and what action is required to rectify changes in water quality if they are attributable to the site construction.

The monitoring program should include sufficient detail to ensure that information on target metrics can be routinely assessed and progress towards the project objectives can be tracked.

8 Conclusion

This report presents the results of the surface water impact assessment for the portion of the Marinus Link project at Heybridge in Tasmania.

Three key surface water values were identified that the proposed works may have adverse effects on: flooding, water quality and geomorphology. In assessing the potential impacts on these three values, the report has considered the impact under existing conditions and those posed by climate change. The risk assessment has included the development of recommended mitigation measures to avoid and minimise adverse effects on surface water.

The Marinus Link has the potential to impact the drainage channels downstream of the proposed converter station and shore crossing at Heybridge. The impact assessment has considered the risk of construction and operation of the project, adversely impacting flooding of the site, adjoining waterways and their floodplains and impacts to their water quality and geomorphology.

Based on the identified risks and their associated mechanisms, a series of mitigation measures have been developed to effectively manage these potential risks, including the requirement to develop of a Progressive Sediment and Erosion Control Plan (SW02 and SW03) that would specify the measures the construction process would be required to adhere to, so that flood risk was minimised. Following the application of these mitigation measures, the residual surface water risks are substantially reduced.

With the mitigation measures in place there are no remaining high risks, and a small number of risks require additional flood modelling during the design phase to confirm impacts can be mitigated. These are summarised below.

8.1 Construction

Residual construction risk ratings that are subject to final design detailed modelling as per SW03 include:

- Construction activities causing an increase in flood frequency, velocity or level which affects users or assets within the floodplain.
- Construction activities causing unintended damage to drainage assets (including waterways and drainage channels) resulting in changed flow behaviour, bed, or bank erosion, and/or physical habitat.

8.2 Operation

Residual construction risk ratings that are subject to final design detailed modelling as per SW01 include:

- Diversion of stormwater, drainage alignment or flow pathways causing a change in flow to downstream.
- Increase in impervious area resulting in an increase in flow discharge leading to bed or bank erosion.
- Increase in impervious area leading to an increase in sediment or contaminants released into the waterways.

While the flood mapping indicates that the proposed converter station will result in minor increases in flood depth and extent as a result of the works, this is generally limited to less than 100 mm, contained to the immediate area and are considered to be within acceptable change/impacts to flood behaviour. However, additional detailed flood modelling through the design phase should be undertaken to confirm the flood impact of the final design on adjacent infrastructure (such as the existing culvert outfall to the west of the station footprint), refine migration options and seek acceptance from Burnie City Council (as per SW01 and SW05).

The implementation of the mitigation measures proposed within this report directly address the impacts identified and provide an effectively means manage the identified risks associated with the construction and operation phases to an acceptable level.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

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