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PROJECT

New Bridgewater Bridge Marine Safety Assessment Report

CLIENT

Department of State Growth

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ENGINEERING & PROJECT MANAGEMENT

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This report was prepared for the Department of State Growth for the purposes of preparation of the Major Project Impact Statement (MPIS) for the New Bridgewater Bridge. The report should be read in conjunction with the entire MPIS as well as any other referenced documents noted in the report.

The author, James Burbury, is a Principal Engineer and has over 20 year's experience in the assessment, design and construction of marine and maritime infrastructure including ports, harbours, dredging, reclamation, navigation, coastal impact assessments, shoreline protection and wave studies.

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1. Introduction

1.1 Overview

The Department of State Growth (Department) propose a replacement crossing of the River Derwent at Bridgewater, forming the New Bridgewater Bridge.

The project team are currently preparing the supporting documentation for approval of the new development under the "Major Projects" component of LUPAA.

1.2 Purpose

This report has been prepared to address Assessment Criteria AC4.12 Marine Infrastructure and Safety for the New Bridgewater Bridge Major Project.

Specifically, it requires the provision of

"…an assessment of how development, including during construction, provides for safe navigation of vessels, and use of marine infrastructure, having regard to:

(a) the impact on the existing Bridgewater boat ramp and adjacent jetty.

(b) the impact on the movement of vessels.

(c) the impact on navigation aids and the markings in the channel; and

(d) measures to minimise any adverse effects."

The report outlines the existing marine navigation within the project site as well as key inputs to navigation of the River Derwent including the existing Bridgewater Bridge, Bowen Bridge and proposed New Bridgewater Bridge as it responds to the above assessment.

1.3 References

The following documentation has been referenced in the development of this report:

ID	Title	Author	Date
1	Assessment Criteria New Bridgewater Bridge Major Project	Development Assessment Panel	May 2021
2	Bridgewater Bridge Tasmania	Ian D Cooper	April 2018
3	LIST mapping	Tas Govt	
4	PSTR Appendix 26 – Requirements for Navigation Span	Department of State Growth	Nov 2020
5	Other Gap and Hazard Analysis Reports	Burbury	July 2021
6	Derwent Flood Data Book	DPIPWE	
7	AUS172 Admiralty Chart – Port of Hobart	Australian Hydrographic Office	Current

1.4 Glossary

Australian Height Datum (AHD) is the mean sea level for 1972 at the tide gauges at Hobart. River level heights are benchmarked (marked point in a line of levels) to mean sea level.

Boat ramp means the existing Bridgewater Bridge boat ramp located off Nielsen Esplanade.

Clearance envelope means the clear rectangle opening under the Navigation Span, which is sized by the horizontal clearance and the vertical height above.

Department means Department of State Growth as the proponent of the Project.

ECI means Early Contractor Involvement, process the Department is proceeding with the design and construction of the Project.

Existing Bridgewater Bridge means the existing bridge crossing the River Derwent incorporating rock causeway and steel bridge with mechanical lift span structure.

Highest Astronomical Tide (HAT) is the highest level of water that can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. It is deemed to be 0.86 metres above 0m AHD.

Lowest Astronomical Tide (LAT) is the lowest level of water that can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. It is deemed to be 0.83 metres below 0m AHD.

MAST means Marine and Safety, Tasmania.

MPIS means the Major Project Impact Statement.

Navigation Span means the bridge span of the bridge which commercial and recreational vessels pass under to navigate up or down the River Derwent.

New Bridgewater Bridge means the proposed new bridge crossing the River Derwent and described in the MPIS.

Project is a new river crossing (New Bridgewater Bridge) for motor vehicles between the Brooker Highway and Midland Highway, with connections to the Lyell Highway and other surrounding roads.

PSTR means Project Scope and Technical Requirements which forms part of the Contract and Specification requirements for the design, construction and commissioning of the Project.

Vertical height clearance means the vertical height of the clearance envelope under the Navigation Span. The vertical height is measured from AHD.

Vessels means commercial and recreational vessels, boats and yachts able to navigate on the River Derwent downstream and upstream of the Bridgewater Bridge.

2. Location

The River Derwent is the major freshwater inflow to the Derwent Estuary, a highly stratified, drowned river system. The Estuary extends over 52kms from the Iron Pot in Storm Bay inland to New Norfolk. Tidal influences are notable past New Norfolk up to *The Rocks* just downstream from Lawitta.

Figures 1 & 2 show the location of the Project and its boundaries.

Details of the final design for New Bridgewater Bridge are pending completion of the Department's ECI process, however it is known that it will be situated downstream of the existing bridge, the existing bridge will be demolished and the constraints to navigation of the existing bridge removed. The existing navigational route will be retained within the design envelope of the Project.

Figure 1 – Location of the Project

Figure 2 – Project Land Extents

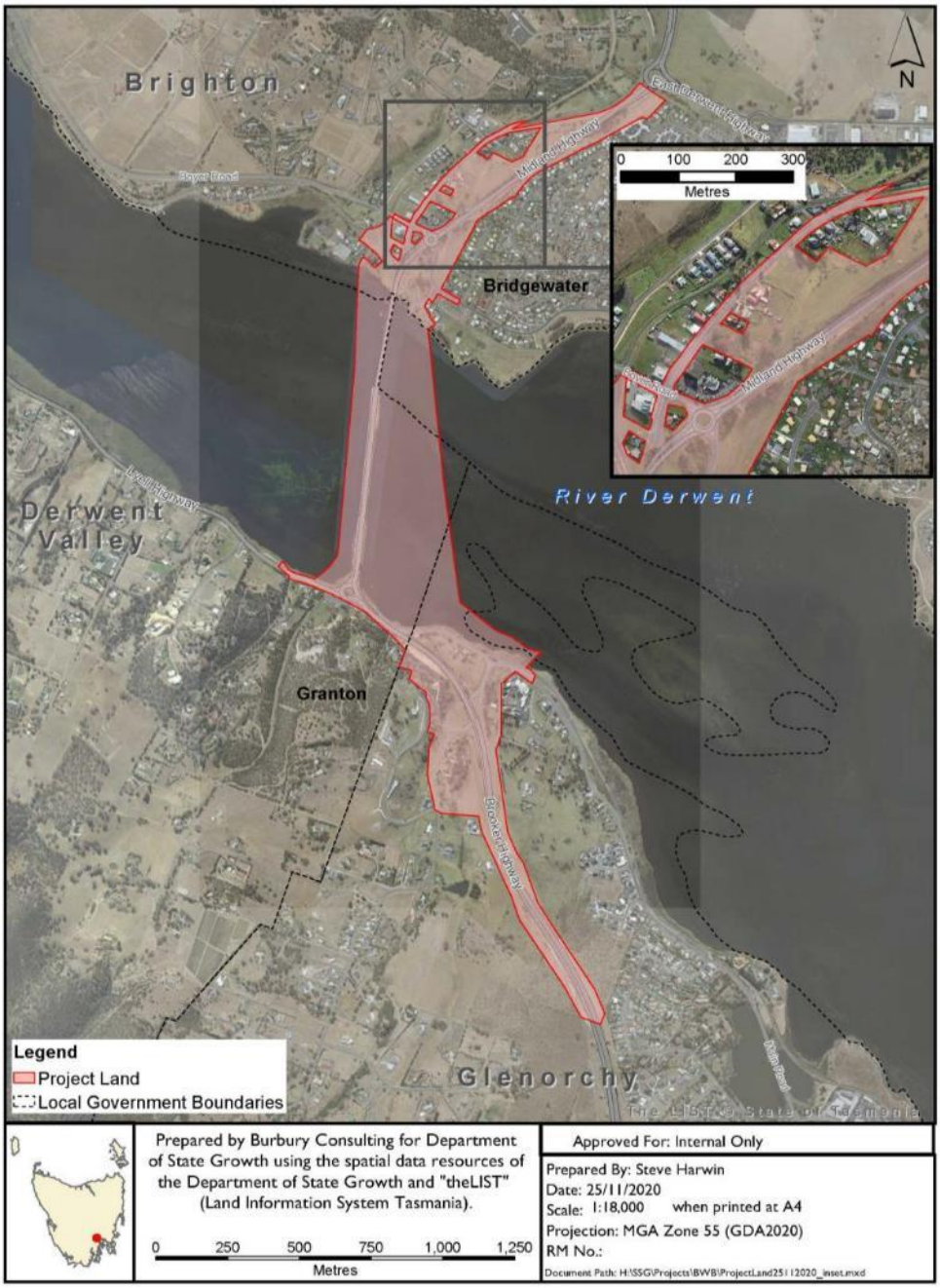


Figure 3 – Bridgewater Navigation (Source: Cruising Tasmania)

The existing Bridgewater bridge is discussed further in the following section.

3. Existing Bridgewater Bridge

The existing Bridgewater Bridge and associated causeway is an important part of Tasmania's strategic National Highway transport network connecting Hobart with Launceston and the northern ports at Bell Bay, Devonport, and Burnie.

The existing Bridgewater Bridge was constructed in 1946, while the causeway was initially constructed in the 1830s and is Heritage Listed.

The existing Bridgewater Bridge has reached the end of its design life and the Department propose to replace the bridge with a new River Derwent crossing, the New Bridgewater Bridge.

The existing bridge has a vertical lift span that is required to be lifted for any vessel higher than 2.2m on an average tide level. Vessel masters need to book bridge openings with the operator at least 2hrs in advance. The lift span can be lifted to a 30m height clearance according to the original engineering drawing, but the lifts appear to be restricted to 15.2m height clearance based on the reference from Cruising South Tasmania. It is understood that the current lift height is restricted because there is no need to lift the span higher than the navigation span on the Bowen Bridge and the restricted height will lessen the wind load on the bridge structure for safe operations.

The lift span equipment is complex, exposed to marine corrosion and degradation, limited to booked passing and in generally poor condition for reliable operation.

The Department's public information (as noted on MASTs website for use of waterways) on the Bridgewater Bridge notes:

- Bridge transits are restricted between 9.15am to 4pm 7 days per week.
- Minimum 2 hour's notice is required for lift (but anecdotally preference is 24 hours).
- Bridge will not operate over 25 knot breezes.
- Clearances of the bridge when down are:
  - Low tide: 2.9m
  - Medium tide: 2.5m and
  - High tide: 2.1m.

The lift span is on the eastern end of the river crossing where the natural river channel is located. The water depth in the channel varies but is estimated to be about 5m at low tide. The channel depth is shallower in the downstream reach between Bowen Bridge and Bridgewater Bridge.

Figure 4 – Existing Bridge with lift span elevated (photo by Ian D Cooper)

The waterway opening has a clear distance of 36.5m between piers, a clear navigable width of 30.29m with the timber fender guide walls alongside the bridge opening to support single way marine traffic through the bridge.

As highlighted in Reference 2, construction of Bridge No.4 with the existing bridges in place created navigation difficulties and hence the old bridges were removed with the caisson of the old bridge retained upstream of the lift span.

Navigation leads (piles and marks) are provided on upstream (marks No 15 and 16 off Mason Point) and downstream (mark No. 12 off Woods Point) of the bridge navigation span to direct vessels within the navigable channel. The bridge opening is also marked with navigation lights.

Further details of the existing bridge and its intended removal is provided in the Section 2 of the MPIS.

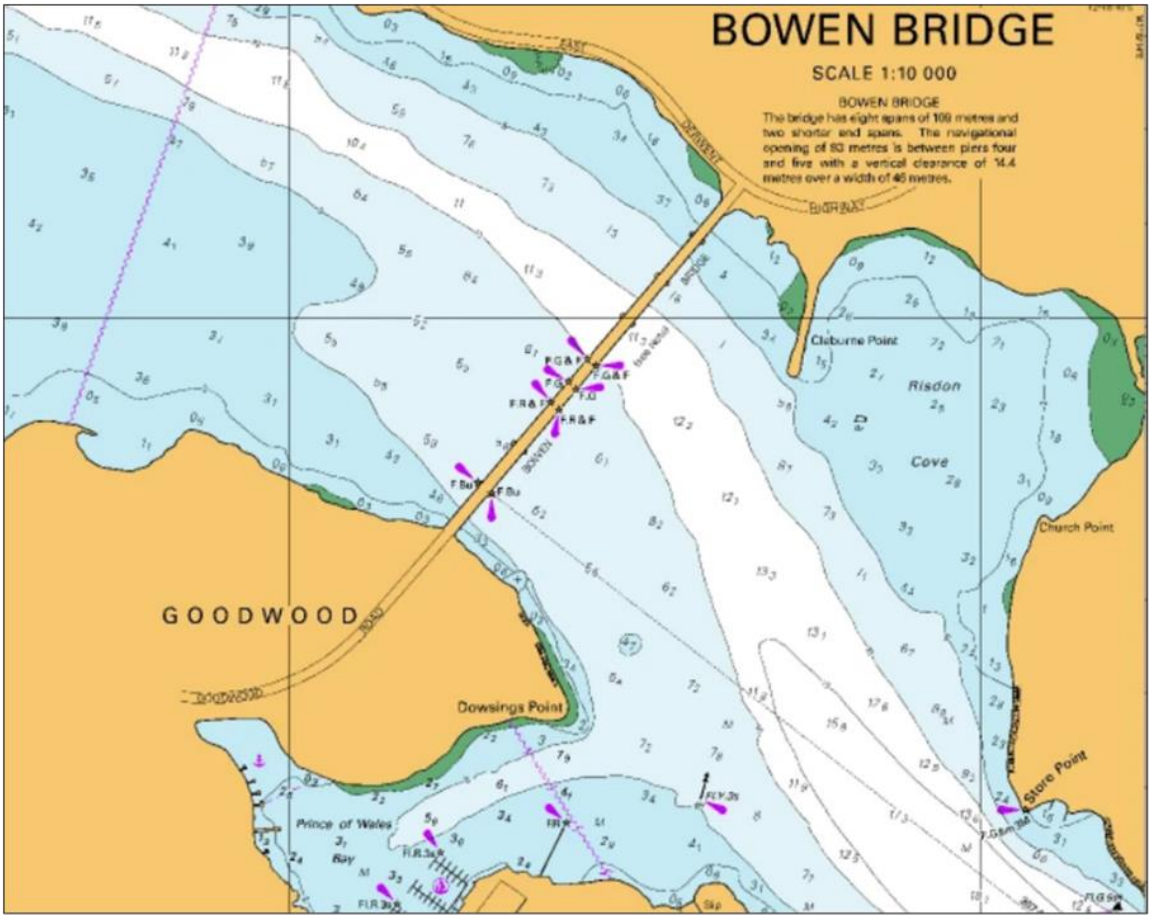
The accessibility to Bridgewater Bridge from downstream is through the Tasman and Bowen Bridge which is discussed further in the following section.

4. Bowen Bridge

North of Hobart and downstream of the Bridgewater Bridge is the Bowen Bridge, which was opened in 1984 to provide a second river crossing for Hobart and an alternative crossing after the Tasman Bridge disaster in the 1970s.

Historically the River Derwent was the principle means of transport access to the upper reaches (including the paper mill) but as the road network developed, it has become less heavily navigated. It is now used for small commercial and recreational purposes only and future vessels are anticipated to be small ferries and pleasure craft. All vessels must access the area via the Bowen Bridge which limits their size and, particularly, air-draft.

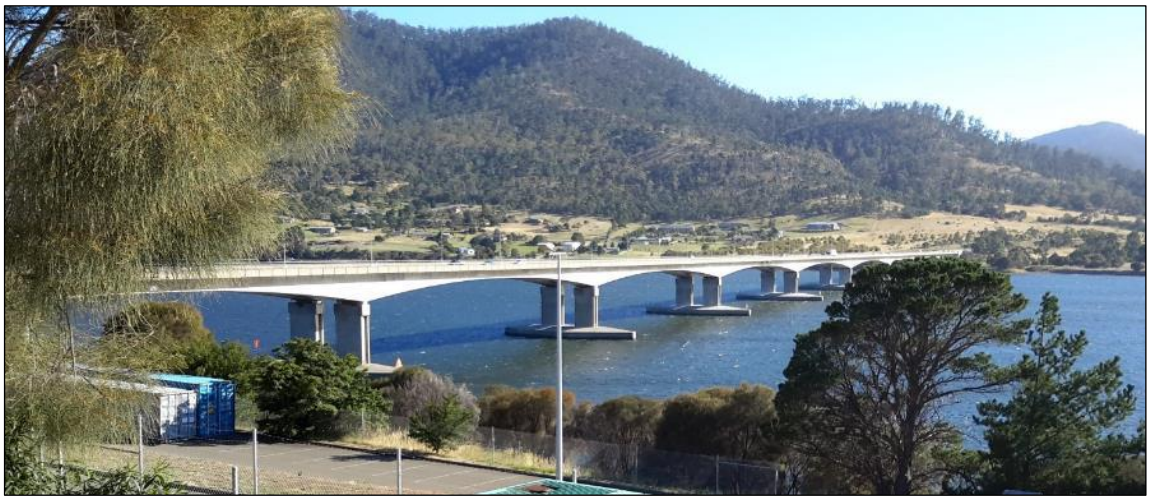
Figure 5 – Excerpt from Aus 172 Chart (Australian Navigation Admiralty Chart)



The designated navigation span for commercial vessels is the fourth major span from the western end (Goodwood), between Piers 4 and 5 (refer Figure 5 above). This span does not correspond with the natural river channel location due to the design of the bridges natural grade from western abutment (high) to the eastern abutment (low point) but provides the closest alignment to the natural channel. The Nautical Chart AUS 172 Port of Hobart indicates that the navigation span has a 45m wide with 14.4m clear height. The datum from which the height clearance is measured is not confirmed, but the highest astronomical tide (HAT) is assumed level. The Cruising South Tasmania reference advises that the height clearance is 14.6m above HAT.

Marine and Safety Tasmania (MAST) has installed a bridge height clearance sign on the first major span from the western end. The bridge gradient from the western end allows for the western most major span to be the tallest clear span for recreational vessels. The advised height clearance at the centre of the span is 17.30m above HAT. It is believed that this height clearance is intended for recreational boats and particularly masted vessels.

Figure 6 – Bowen Bridge (elevation from southern bank upstream)



5. Project Design and Construction Requirements

Reference 4 (PSTR) outlines that the design and construction of the Navigation Span for the New Bridgewater Bridge which must have as a minimum the equivalent vertical height clearance as the navigation span at Bowen Bridge, which is located downstream of the New Bridgewater Bridge.

The vertical height and width clearance requirements of the New Bridgewater Bridge structure at the Navigation Span shall be equivalent to a Reduced Level of 16.2m AHD across a minimum 45m wide navigable clearance envelope.

The New Bridgewater Bridge will also include:

- A navigation span aligned with the natural channel and route of vessels that navigate the River Derwent within the Project site.
- Navigation lights that shall be added to the Navigation Span.
- Water Reference Level and clearance heights that shall be added to the piers to reference clear span through the new Navigation Span.
- Capacity for the bridge to withstand vessel impact for a maximum design vessel at a transit speed of 6 knots.

The design and construction contractor must obtain approval from MAST for the proposal of the navigation span including all navigation lighting.

6. Vessel Characteristics

While historically commercial freight vessels used the upper Derwent River, this is no longer the case. Only the following types of vessels are expected to navigate the River Derwent upstream of the Bridgewater Bridge once the navigation restriction of the existing bridge is removed:

- Commercial vessels (for example, the Mona ferries as shown in Figure 7).
- Hobart tourist excursion vessels. The vessels which can pass the Bowen bridge are all smaller than the Mona ferries.
- Recreational power vessels and sailing yachts.

Most private powered vessels will be able to transit through the bridges on the River Derwent and are smaller than the Mona ferries. The maximum size of sailing yachts with an air draft less than 16 metres is 12-15 metres with a maximum displacement of 20 tonnes and a draft of less than 2.5 metres.

Figure 7 – Mona Ferry

At present, the largest vessels expected to travel up-river will be something similar to the Mona Ferries, as shown in Figure 7. The critical dimensions for navigation assessment are:

- Length overall 28.9 metres
- Beam 9.0 metres
- Draft 1.3 metres
- Displacement (fully Loaded) 103 tonnes

It is recognised that improved navigation access of the river for night travel may be required in the future which would be developed in conjunction with MAST.

7. Impacts on the Existing Boat Ramp and Jetty

The construction of the New Bridgewater Bridge will require a range of in-water construction techniques to facilitate construction of the sub-structure of the bridge over the River Derwent.

During scoping of the project, it was identified that access to the water will likely be a key requirement for the construction contractor and thus the Project Land was defined to include the existing Bridgewater Boat Ramp (owned by Brighton Council) as a potential interface between the land and water.

It is expected that the ramp would need to be adapted to suit the requirements for large equipment access and materials handling during construction and then as required reinstated at the completion of construction.

7.1 Existing Boat Ramp

The ramp is a single lane ramp with a small adjacent timber jetty.

The ramp provides all tide access for boat launching and retrieving via a structure made of permeable concrete segmented pavers, interspersed with gravel.

The ramp appears not to have had any significant investment in capital or maintenance for some time.

A review of other ramps in the vicinity of the Project was assessed and there are two ramps downstream of the site just outside of a 5km radius, one each on either side of the river, and another single ramp within 7km of the site upstream on the western bank that can all be accessed during the construction of the New Bridgewater Bridge.

7.2 Existing Jetty Structure

The jetty structure adjacent to the ramp is of a timber construction on timber piles, with some steel sub-structure components visible.

The jetty consists of multiple landing levels for tide access but would appear to be high deck level for most small craft using the jetty, particularly at lower tides.

As with the ramp, the jetty has not had any significant investment in capital or maintenance for some time.

There are signs located near the parking/entrance to the jetty and at the jetty providing advice/warnings to water users.

Figure 8 – Ramp and Jetty

7.3 Existing Ramp Usage Monitoring

The Department of State Growth, through Burbury Consulting engaged Coverall Security to install a CCTV surveillance camera at the ramp site within the existing compound of the bridge maintenance contractor, including installation of a pole to mount the equipment for the purposes of monitoring the public use of the ramp.

An analysis of the CCTV was undertaken for the period 23 January to 14 February 2021 by scanning the video footage in 6 to 9 minute intervals between the period ~6.30am to ~9pm (when light was favourable) to determine the accurate usage of the ramp.

Only an average of one trailer used the ramp each day and other activity included fishing from the jetty and pedestrian activity. As other nearby ramps are available, both upstream and downstream, the temporary closing of the facility during the construction is not expected to limit access to the river.

7.3.1 General Usage Observations

General observations of the use of the site are:

- The site is a large public open space and services a variety of uses for the public. It is difficult to differentiate between uses across the site.

- The majority of usage of the space is simply enjoying the public open space. This is presumably driven by the proximity to the water and the adjacent view field provided by the River Derwent and the existing Bridgewater Bridge.
- There is consistent use of the public boat ramp with typical single launch and deployment daily and higher on weekends.
- Vehicles and Pedestrians would be observed at this location for the following uses:
  - parking to enjoy the view/location (while on a break, to eat, socialise, fill in time etc)
  - parking to use the public open space (e.g. the adjacent park)
  - to walk / exercise
  - to come to the jetty to fish
  - to utilise the boat ramp to launch a boat (trailer mounted), and
  - to utilise the boat ramp for access to the water (to launch a paddle board etc).

During construction of the New Bridgewater Bridge the public boat ramp and jetty off Nielsen Esplanade are expected to be used by the bridge contractor for construction laydown and access to the waterway for marine construction. The majority of this area on the northern riverbank, within the project land, will be used for this purpose.

In addition, the construction of the New Bridgewater Bridge and demolition of the old bridge will require restrictions to the public from accessing land and marine areas of construction. Keeping the boat ramp and jetty accessible to the public during the project would present a major safety hazard to the community and the project construction team.

Any closure or temporary restrictions to the site will be managed by request from the contractor, approved by the Department of State Growth and then notified to the public through Notices to Mariners and public notices to inform users and the local community to changes of the site and restrictions for the duration of the works.

Following completion of the bridge the Contractor will be responsible for reinstatement of the ramp and jetty to an equivalent or current compliant standard unless otherwise agreed by Brighton Council and Parks and Wildlife Services.

As highlighted above, the Project has undertaken monitoring around the usage of the boat ramp and jetty, which has identified that they receive limited community use. Given this, and the proximity of other boat ramps in the area, a temporary replacement during the project is not considered necessary.

Further, given water depth and access for boats within the Project Land is only possible via the northern shore, and that this area will be utilised for the duration of construction, no alternative location for a boat ramp is feasible within the Project Land.

Figure 9 – Aerial of the existing bridge and boat ramp (Google Maps)

8. Construction Operations

During construction restrictions to navigation of small vessels will be necessary for safety and operational reasons. Signage and buoys will need to be placed to satisfy MAST and the Department, to clearly indicate the location of safe passage and any restricted use of the bridge lift span.

After completion of the New Bridgewater Bridge and demolition of the existing bridge transit will be possible at any time and will be safer as the navigation envelope will be larger.

The risk of marine accident is increased during construction and a safe procedure must be developed by the Contractor and agreed with Marine and Safety, Tasmania (MAST) for vessel navigation of the public within the Project site. All construction vessels employed by the Contractor will adhere to the Contractors construction requirements and procedures for transit and access with the Project site.

The following aspects will be addressed for the Construction:

- Notices to Mariners will be issued by MAST announcing the new works and defining procedures for transit by vessels. Updates will be issued as necessary.
- It is noted that while the lifting bridge is in place vessels may have to wait for transit. A waiting area, downstream of the site area, should be specified and marker buoys placed defining it. Buoys and signs must also be placed to define the transit channel and restricted work areas.
- Vessels should not proceed through the Construction area without clearance from the bridge operator **and** Contractor. A simple procedure should be developed by the Department and selected Contractor for the bridge operations, particularly in times when possible.
- The Contractor should have a workboat available to assist any vessel suffering a breakdown or navigation issue. The Contractor will be responsible for the Project work area which includes the river areas and should be aware of vessels navigating the area and that may require assistance.
- Permanent navigation markers and signage will be installed during the construction on the new Bridgewater Bridge, similar to those for the Bowen Bridge and as approved by MAST to note clearances and tide levels for safe passage as well as new navigation lights and marks.

It would be recommended that one way marine traffic is maintained during construction to minimise the risk of marine incidents.

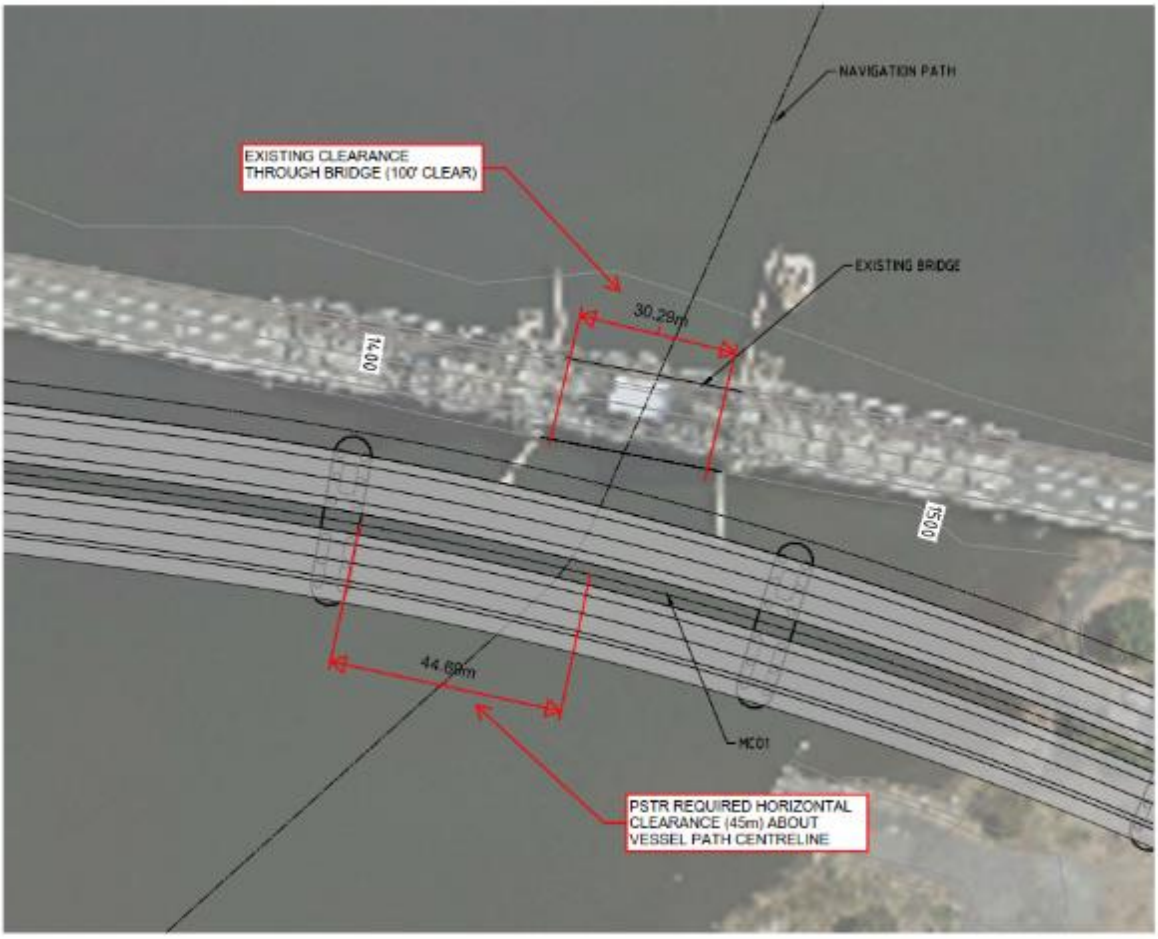
9. Navigation Clearance and Safety Risk

The following figure shows the existing bridge position relative to (a likely) new bridge position. The Project Specification and Technical Requirements (PSTR) prepared for the ECI requires a 45.0m horizontal clearance through the new bridge crossing for navigating vessels.

The figure illustrates the navigation path for vessels through the crossing of the dual bridges in the current channel alignment (maximum draft) assuming the existing bridge is retained during construction or for a period after construction. This navigation alignment illustrated considers the bathymetry and relatively narrow deep-water channel at the site and the current navigation path of vessels. A new bridge has been superimposed over the site aerial and irrespective of final span arrangement it shows the likely pier position on the navigation path.

The figure shows that the proposed New Bridgewater Bridge will not impact the Vessel Captain's view through the bridge crossing with the existing bridge in place. The existing bridge does reduce a vessels view of oncoming vessels.

Figure 10 – Proposed Navigation Path through Crossing



NAVIGATION SPAN PLAN

SCALE 1:1000

10. Mitigation of Risks

Following completion of the New Bridgewater Bridge and subsequent demolition of the existing lifting bridge, navigation risks will be reduced as the clear envelope for navigation will be larger and there will be no restriction to navigating the bridge like the current bridge.

During construction, there will be increased navigational risk, as is expected on such projects.

This risk must be managed and minimised and the following are suggested to be appropriate measures to achieve this:

- Close co-ordination between the Contractor, Department and MAST to ensure that relevant Notices to Mariners are issued and updated as construction requires.
- The existing bridge operator, or other nominated contact, should be retained as a primary contact to respond to queries regarding closures and other related issues. It is expected that the operator or other nominated contact would assist with day-to-day liaison with the Contractor and be in phone or radio contact with vessels wishing to transit.
- Temporary signage and marker buoys should be placed by the Contractor, after consultation with the Department and MAST to indicate a safe passage and mark restricted areas.
- A work boat should be available and manned to assist vessels in difficulty and to maintain a watch on vessels which transit through the work site during construction.

Following completion of the new bridge the existing bridge is to be demolished, including removal of the piles and other sub-marine structures.

After completion of the New Bridgewater Bridge the existing bridge lifting span will be raised, allowing unrestricted transit through the dual bridges except during planned demolition.

During demolition temporary buoys and signage will be required, together with transit restrictions as already noted.

After all works are complete transit under the New Bridgewater Bridge will be possible at any time and as the navigation envelope is larger and no waiting is required, risk of navigation accident is significantly reduced.

11. Summary and Conclusions

This report addresses the navigation of vessels utilising the River Derwent and navigating through the proposed New Bridgewater Bridge during its' construction and operation.

Specifically, it addresses:

- *"(a) the impact on the existing Bridgewater boat ramp and adjacent jetty"*
  - The Project will require a range of in-water construction techniques to facilitate the construction of the new bridge.
  - The land on the Bridgewater foreshore at Nielsen Esplanade will likely be used as a construction laydown area, and construction access to the waterway will be required for the duration of the project.
  - This will require the closure and removal of the existing boat ramp and jetty for the construction period of the Project. Keeping the boat ramp and jetty accessible to the public during the project would present a major safety hazard to the community and the project construction team.
  - The Project has undertaken monitoring around the usage of the boat ramp and jetty, which has identified that they receive limited community use. Given this, and the proximity of other boat ramps in the area, a temporary replacement during the project is not considered necessary. As the Project area will be a worksite the Contractor shall be responsible for the safety and security of the site and maintain management of navigation of work vessels as well as any vessel wishing to transit through the work site or the existing bridge. This may be possible at times during the construction however there will be times during the construction of the new bridge that this will be limited for longer periods of time.
  - Recreational users of the boat ramp will be advised by a Notice to Mariners issued through MAST of the boat ramp closure in advance of its closure date.
  - After the completion of the project, a jetty and boat ramp of an equivalent or superior standard and functionality as the existing facility will be reinstated at the existing location, unless agreed otherwise by Brighton Council and Parks and Wildlife Service.
- *"(b) the impact on the movement of vessels"*
  - Vessels will be restricted during construction to ensure the safety of the public.
  - Access through the site and existing bridge will also be limited and controlled by the Contractor with Notices to Mariners provided to advise the public and vessels of restriction that are in place for the period or duration of the Project.
  - Vessel navigation will be enhanced with the new bridge in place, as improved clearance width and removal of transit limitations.
  - Vessel navigation restrictions will be removed with the demolition of the existing bridge, meaning any vessel that can pass under the Bowen Bridge will be able to pass the New Bridgewater Bridge.
- *"(c) the impact on navigation aids and the markings in the channel"*
  - Navigation signage and markers will be installed, similarly to the Bowen Bridge, and as approved with MAST.
  - The lighting of the New Bridgewater Bridge clear span and navigation aids and leads will be assessed during the design to aid in upgrades for navigation of vessels.
  - The Project will improve navigation for vessels on the River Derwent at the site.
- *"(d) measures to minimise any adverse effects."*

- Measures are required to be put in place to minimise the impacts to water way users throughout construction.
- These will be controlled through coordination of the Department, the Contractor and MAST to ensure safe and suitable access of the waterway during construction.

Further, it is noted that following construction of the new bridge and demolition of the existing bridge transit through the bridge will become easier and risk will be reduced.

During construction transit may be restricted and must be controlled. Temporary navigation markers and signage will be installed as necessary.