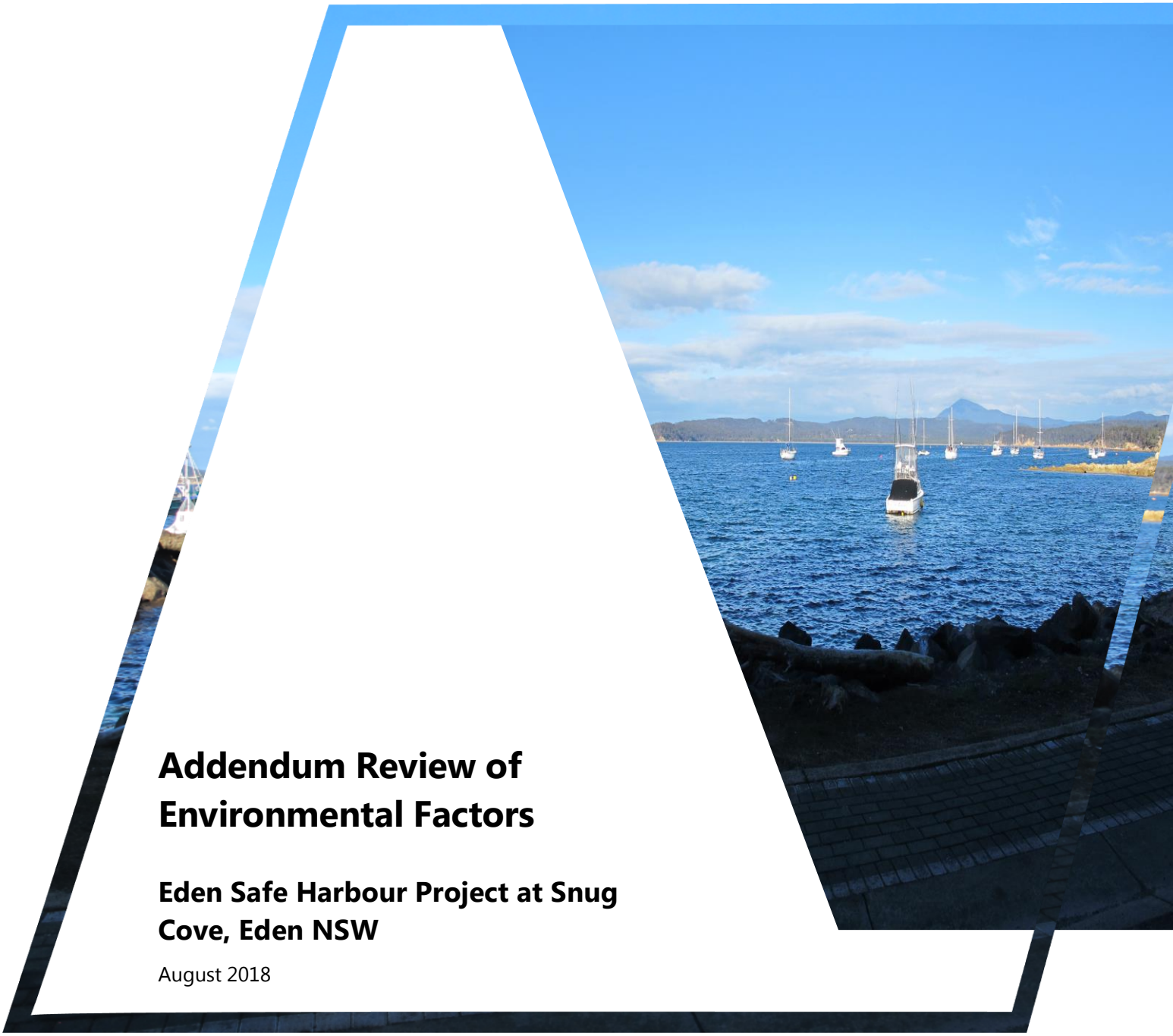

Addendum Review of Environmental Factors

Eden Safe Harbour Project at Snug Cove, Eden NSW

August 2018

Level 17, 141 Walker Street
North Sydney NSW 2060
Australia

www.**advisian**.com

NSW GOVERNMENT

Advisian
WorleyParsons Group

Synopsis

This Addendum Review of Environmental Factors (AREF) has been prepared by Advisian on behalf of NSW Department of Industry (the Department) for a proposed modification to the Eden Safe Harbour Project at Snug Cove, Eden. The purpose of this AREF is to describe the proposed modification, to document and assess the likely impacts on the environment, and to detail mitigation measures to be implemented.

Disclaimer

Project No: 301311-13734-EN-REP-0034-Addendum Review of Environmental Factors: Eden Safe Harbour Project at Snug Cove, Eden NSW

Rev	Description	Authors	Review	Approval	Date
B	Issued for Client Review	C. Jones	S. Wakefield	S. Wakefield	06.08.2018
0	Final	C. Jones	S. Wakefield	S. Wakefield	22.08.2018
1	Revised Final	C. Jones	S. Wakefield	S. Wakefield	23.08.2018

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Executive Summary

Advisian has been commissioned by the NSW Department of Industry (the Department) to prepare an Addendum Review of Environmental Factors (AREF) for a proposed modification to the Eden Safe Harbour Project (the Project).

For the purposes of the proposed modification, the Department is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Project Background, Community and Stakeholder Consultation

The NSW Government has committed $19million for the Project, which will provide a safer harbour for local and visiting vessels and improve the protection of existing maritime infrastructure within Snug Cove, Eden.

A Review of Environmental Factors (REF) was prepared in November 2017 (referred to in this AREF as the Project REF) to assess the potential impacts of the Project, including both a floating and fixed wave attenuator arrangements with the primary purpose to provide a safer harbour for local and visiting vessels and improve the protection to existing maritime infrastructure within Snug Cove at Eden.

The Project REF was placed on public display between 16 November 2017 and 19 January 2018 for community and stakeholder comment. A Response to Submissions (RTS) Report, dated 13 April 2018 was prepared to respond to issues raised.

Expressions of Interest (EOI) were called for the Project in November 2017. The Department has since commenced Early Contractor Involvement (ECI) activities with Waterway Constructions for a fixed panel type of wave attenuator.

In May 2018, the Department commissioned WorleyParsons to undertake a concept design for the Project and develop the basis of design and performance specification for the Project.

A stakeholder workshop was held on 21 May 2018 with representatives from the Department, Port Authority of NSW, WorleyParsons, Port of Eden Marina (POEM) Inc., International Marina Consultants and Waterway Constructions to determine an alignment that would meet the performance requirements for the Project. The agreed alignment was then further developed by Advisian and a concept design finalised.

Stakeholder consultation was undertaken in July 2018 for the final attenuator alignment. This involved a series of individual meetings with businesses and organisations operating in the Port of Eden (the Port) and communication via email with one key stakeholder based in Western Australia. Key issues raised by stakeholders have been identified and addressed in this AREF.

The Proposed Modification

The Project REF considered two options for the wave attenuator structure type, being either a fixed or floating type of structure, approximately 343m in length, commencing from the end of the Multipurpose Jetty and extending into part of Cattle Bay.

At the time of the Project REF, a decision had not been made by the Department on the type of wave attenuator. A floating wave attenuator was costed to be the less expensive option however, uncertainties remained around its performance and durability. Therefore, it was determined that due to

greater certainly around the performance and durability that a fixed panel wave attenuator structure would be adopted.

The Concept Design attenuator alignment modifies the Project REF attenuator alignment as follows:

- Provision of a 55m gap between the western end of the wave attenuator and the Multipurpose Jetty (previously there was no gap).
- Increase in the length of the wave attenuator by 23m from 343m to 366m.
- Extension of wave attenuator approximately 80m further seaward at the southern-most point (Point C).
- Reduction of 27m in the gap between the eastern end of the wave attenuator and the proposed Cattle Bay Marina from 60m to 33m.

This AREF is to be read in conjunction with the Project REF and RTS Report. The purpose of this AREF is to describe the proposed modification, to document and assess the likely impacts of the proposed modification on the environment, and to detail mitigation and management measures to be implemented.

Statutory Considerations, Environmental Impacts and Conclusion

This AREF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed modification. It has included consideration Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and other relevant legislation. It has also considered potential impacts to Matters of National Environmental Significance listed under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*.

The proposed modification remains consistent with the objectives and the intent of the Project as outlined in Project REF. The impacts of the proposed modification are considered to be minor and the mitigation measures listed in the Project REF and this AREF would avoid, minimise or mitigate any impacts such that the benefit of the proposed modification would outweigh any potential impacts. As such the proposed modification is considered justified.

Based on the assessment contained in this AREF and subject to adoption and implementation of the mitigation measures outlined in the Project REF and Section 7.2 of this AREF, it is considered that the proposed modification is not likely to have a significant impact upon the environment or any threatened species, populations or communities and accordingly an EIS is not required under Division 5.1 of the EP&A Act.

The Project is justified to be approved under Part 5 of the EP&A Act as the potential environmental and social impacts would be able to be managed to an acceptable level. In addition, the Project meets specific objectives of providing a safer harbour for local and visiting vessels and improve the protection of existing maritime infrastructure within Snug Cove, Eden.

Terms and Acronyms

Term / Acronym	Definition
AREF	Addendum Review of Environmental Factors
ARI	Average Recurrence Interval
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BVSC	Bega Valley Shire Council
CD	Chart Datum
CEMP	Construction Environmental Management Plan
CLG	Community Liaison Group
Department	Department of Industry (NSW)
DP&E	Department of Planning and Environment (NSW)
DPI	Department of Primary Industries (NSW)
DoEE	Department of the Environment and Energy (Commonwealth)
ECI	Early Contractor Involvement
EIS	Environmental Impact Statement
EOI	Expression of Interest
EP&A Act	*Environmental Planning & Assessment Act 1979* (NSW)
EPA	Environment Protection Authority (NSW)
EP&A Regulation	Environmental Planning & Assessment Regulation 2000 (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994* (NSW)
Hs	Significant wave height
ICNG	Interim Construction Noise Guideline
IMS	Invasive Marine Species
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environmental Plan
MNES	Matter of National Environmental Significance
NTA	*Native Title Act 1993* (Commonwealth)
NSW	New South Wales
OEMP	Operational Environmental Management Plan
PANSW	Port Authority of New South Wales
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Port	Port of Eden
Project	Eden Safe Harbour Project
Project REF	Review of Environmental Factors for the Eden Safe Harbour Project, Advisian (2017)
REF	Review of Environmental Factors
RHDHV	Royal HaskoningDHV

Term / Acronym	Definition
Roads and Maritime	Roads and Maritime Services
RTS	Response to Submissions
SDS	Safety Data Sheet
SEPP	State Environmental Planning Policy
VRA	Vessel Risk Assessment

1 Introduction

Advisian has been commissioned by the NSW Department of Industry (the Department) to prepare an Addendum Review of Environmental Factors (AREF) for a proposed modification to the Eden Safe Harbour Project (the Project).

For the purposes of the proposed modification, the Department is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Project Background

The NSW Government has committed $19million for the Project, which will provide a safer harbour for local and visiting vessels and improve the protection of existing maritime infrastructure within Snug Cove, Eden.

A REF was prepared by Advisian in November 2017 (referred to in this AREF as the Project REF) to assess the potential impacts of the Project, including both a floating and fixed wave attenuator arrangements with the primary purpose to provide a safer harbour for local and visiting vessels and improve the protection to existing maritime infrastructure within Snug Cove at Eden.

The Project REF was placed on public display between 16 November 2017 and 19 January 2018 for community and stakeholder comment. A Response to Submissions (RTS) Report, dated 13 April 2018 was prepared to respond to issues raised.

Expressions of Interest (EOI) were called for the Project in November 2017. The Department has since commenced Early Contractor Involvement (ECI) activities with Waterway Constructions for a fixed panel wave attenuator.

In May 2018, the Department commissioned WorleyParsons to prepare a concept design for the Project and develop the basis of design and performance specification for the Project.

Consultation and engagement has been undertaken to assist in the development of the wave attenuator alignment and communicate the Project to affected stakeholders. Section 5 describes the consultation process in further detail.

1.2 Proposed Modification Overview

As presented in the Project REF, the site is situated within part Lot 2 DP 747363, part Lot 111 DP 839683 and unsurveyed Crown land to the west. The location and site plan of the Project is shown in Figure 1-1.

The Project REF considered two options for the wave attenuator structure type, being either a fixed or floating type of structure, approximately 343m in length, commencing from the end of the Multipurpose Jetty and extending into part of Cattle Bay.

At the time of the Project REF, a decision had not been made by the Department on the type of wave attenuator. A floating wave attenuator was costed to be the less expensive option; however, uncertainties remained around its performance and durability. Therefore, it was determined that due to greater certainly around the performance and durability that a fixed panel wave attenuator structure would be adopted.

A concept design wave attenuator alignment was developed with consideration of the site conditions, performance requirements and outcomes of the stakeholder workshop. The concept design alignment is similar to the wave attenuator alignment presented in the Project REF, with minor adjustments.

The concept design alignment, in comparison to the Project REF wave attenuator alignment, provides a larger area of protected waterway for a potential future marina or other boat storage facility/s. The level of wave protection provided to the Mooring Jetty has reduced for the concept design; however, the existing waterway condition would still be improved upon.

Section 3 describes the proposed modification in more detail. The concept design drawings are contained in Appendix A.

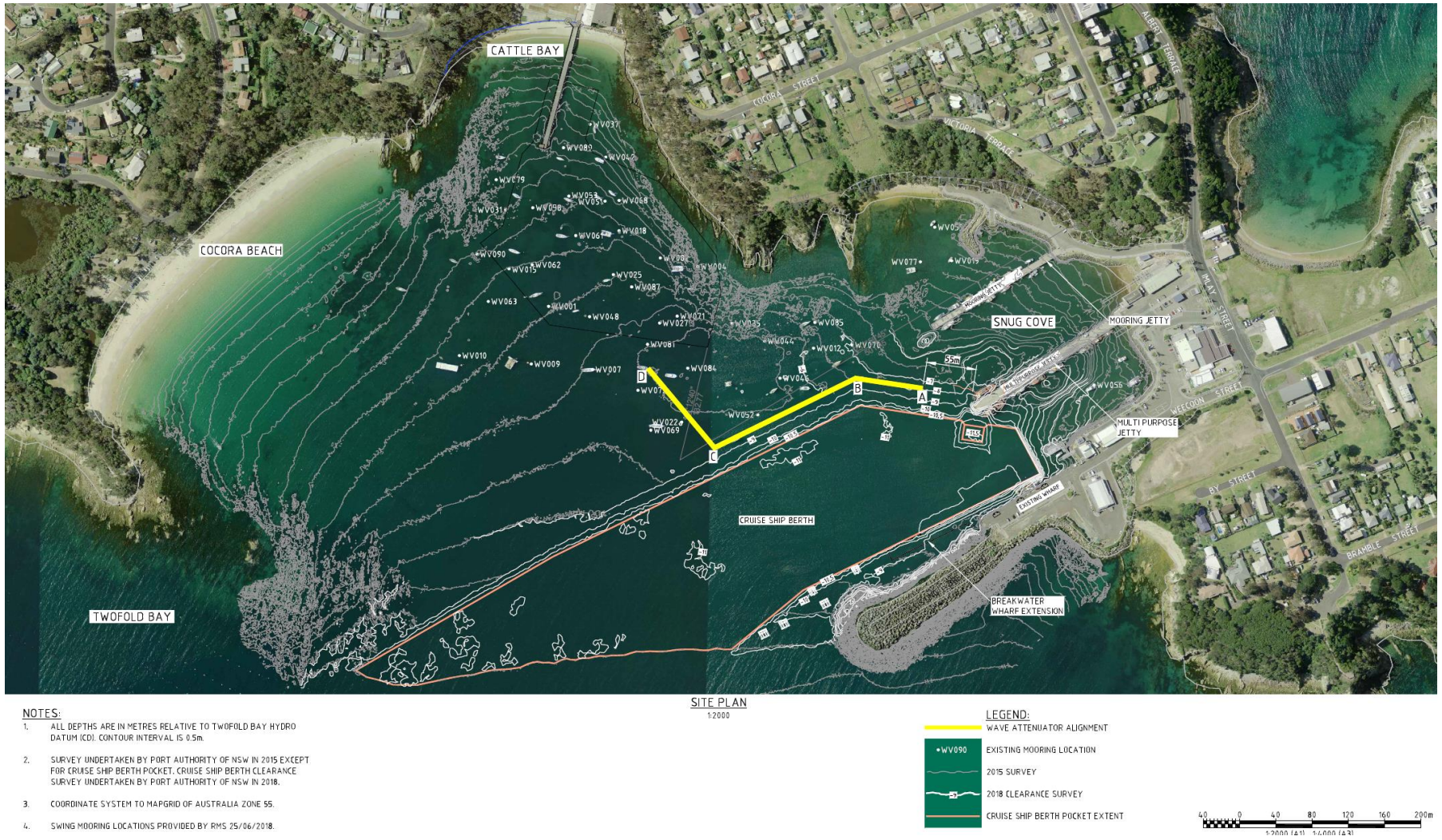


Figure 1-1 Location and site plan of the proposed modification (Source: WorleyParsons, 2018)

1.3 Purpose of the AREF

This AREF is to be read in conjunction with the Project REF and RTS Report. The purpose of this AREF is to describe the proposed modification, to document and assess the potential impacts of the proposed modification on the environment, and to detail mitigation and management measures to be implemented to avoid, reduce or minimise any identified impacts.

The assessment has been prepared having regard to the provisions of Section 5.5 of the EP&A Act and Clause 228 of the Environment Planning and Assessment Regulation 2000 (the EP&A Regulation). This assessment has also considered the relevant provisions of other relevant NSW environmental legislation and environmental planning instruments, including the *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and State Environmental Planning Policy (Infrastructure) 2007 (ISEPP).

Having regard to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), this AREF considers whether there is the potential for the proposed modification to have a significant impact on Matters of National Environmental Significance (MNES) or Commonwealth land, and in turn any need to make a referral to the Commonwealth Department of the Environment and Energy (DoEE) for any necessary approvals under the EPBC Act. Further information regarding statutory considerations is provided in Section 4 of this AREF.

2 Needs and Options Considered

2.1 Strategic Need for the Proposed Modification

Section 2 of the Project REF addresses the strategic need for the Project, the Project objectives and the options that were considered. The proposed modification described and assessed in this AREF is consistent with the strategic need for the Project and the Project specific End User Requirements that were outlined in Section 2.2 of the Project REF.

The proposed modification is needed to provide greater certainly around the performance and durability of the attenuator structure having regard to the site conditions and stakeholders.

2.2 Alternatives and Options Considered

2.2.1 The 'Do Nothing' Scenario

This scenario assumes that there is no wave attenuator installed in Snug Cove. This features lost opportunities to improve the safety of the Snug Cove anchorage for visiting and local vessels, to protect Port infrastructure and for Eden to receive the potential economic benefits from a safer harbour. Further, if no attenuator structure is installed, the existing risk of damage to vessels associated with extreme wind and wave conditions that are occasionally experienced in the Port would not be reduced.

2.2.2 Positioning and Alignment Options

A stakeholder workshop was held on 21 May 2018 with representatives from the Department, Port Authority of NSW, WorleyParsons, Advisian, POEM Inc., International Marina Consultants and Waterway Constructions to discuss and agree an alignment that would meet the performance requirements for the Project.

The Stakeholder Workshop objectives were to:

- Establish a collective understanding of engineering challenges, constraints and opportunities.
- Establishment of a collaborative design process.
- Provide direction to WorleyParsons who has been commissioned to prepare the concept design documentation.

The meeting was considered successful with all parties understanding the Project's design considerations and performance requirements. Several preliminary wave attenuator alignment options prepared by WorleyParsons (Figure 2-1) were presented and collectively discussed.

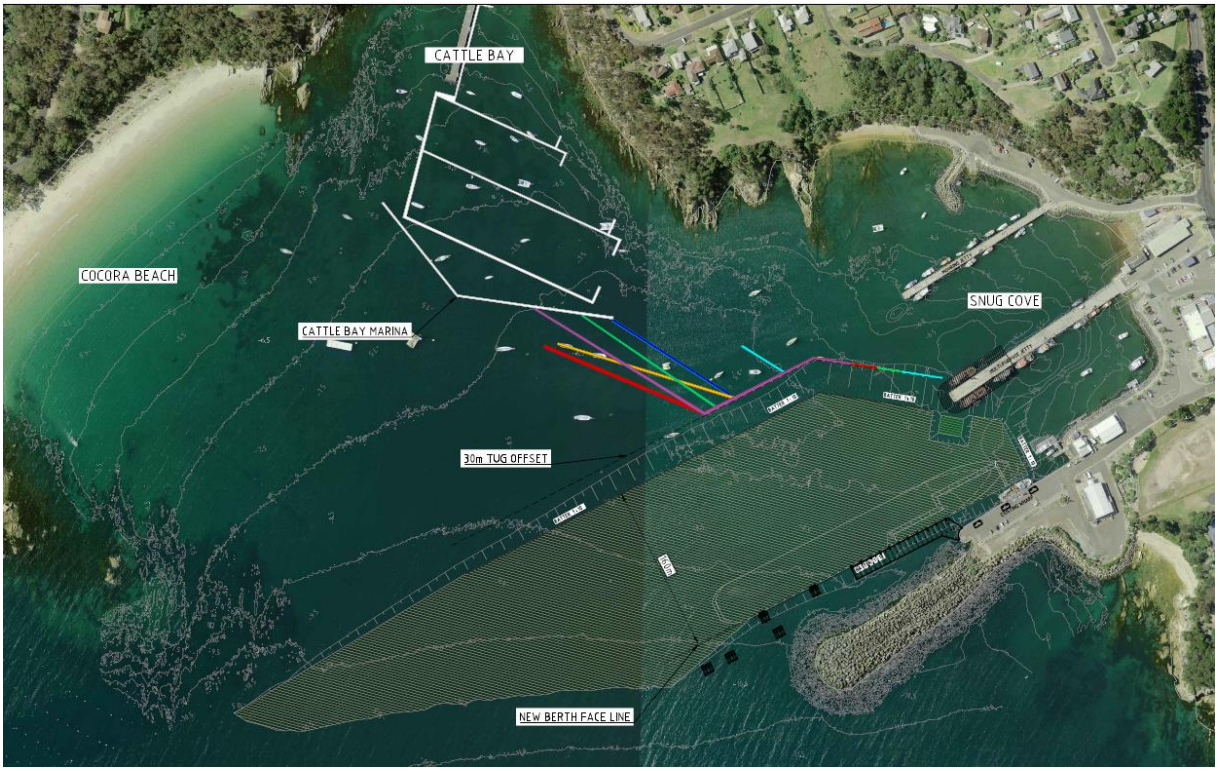


Figure 2-1 Preliminary alignment options that were presented in the stakeholder workshop (Source: WorleyParsons, 2018)

A collaborative brainstorming session was undertaken at the stakeholder workshop to develop and agree on a wave attenuator alignment that would be used as a basis for developing the concept design alignment. Features of the alignment that resulted from the workshop is provided in Figure 2-2 and include:

- A gap of 55m be provided between the western end of the wave attenuator and the Multipurpose Jetty.
- The wave attenuator positioned at least 190m off the fender line of the cruise ship berth at the Breakwater Wharf.
- The wave attenuator be located as far seaward as possible to ensure Cocora Beach is not impacted.
- A gap of more than 30m be provided between the eastern end of the wave attenuator and the proposed Cattle Bay Wave Attenuator and Marina.

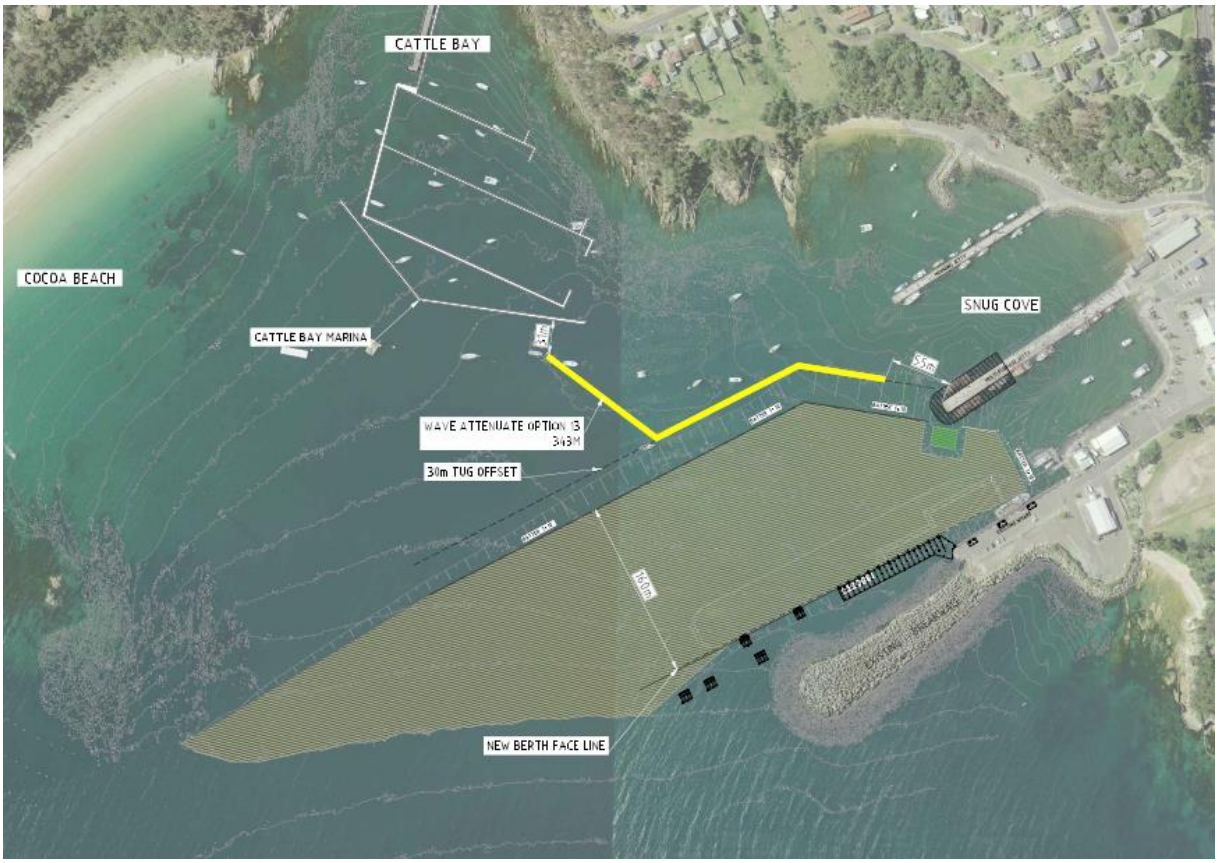


Figure 2-2 Alignment developed in the stakeholder workshop to be used as basis for developing the Concept Design alignment (Source: WorleyParsons, 2018)

The wave attenuator panel levels are critical to achieve the required wave climate in the lee of the structure as a result of waves passing below and overtopping the panel. The impacts of tugs and cruise ships operating the area was also considered in determining the panel levels. It was determined that top panel level of +3.1m Chart Datum (CD) and bottom panel level of -2.5m CD would best meet the performance requirements. It should be noted that the panel levels assume a 20m exclusion zone directly in the lee of the attenuator for moored vessels. This is to allow for overtopping during storm events that may damage vessels.

The length of the wave attenuator is limited by the available Project funding. A staged construction approach is being considered that would allow as much of the wave attenuator length as possible to be built for the available Project funding within the first stage. Subsequent stages may include extension of the wave attenuator to the full 366m length if additional funding becomes available.

2.3 Preferred Option

The preferred option for the Project is a fixed wave attenuator type with an alignment option as shown on Figure 1-1. This option was selected following stakeholder consultation and concept design development. The preferred option would best meet the End User Requirements and provide greater certainly around the performance and durability of the attenuator structure. The structural design of wave attenuator assessed in this AREF would be confirmed following further design development and engagement with industry.

3 Description of the Proposed Modification

3.1 Overview

The Project REF considered two options for the wave attenuator structure type, being either a fixed or floating type of structure, approximately 343m in length, commencing from the end of the Multipurpose Jetty and extending into part of Cattle Bay. As discussed in Section 1.2, the Department determined that due to greater certainly around the performance and durability, a fixed panel wave attenuator structure would be adopted.

A Concept Design wave attenuator alignment was developed with consideration of the site conditions, performance requirements and outcomes of the stakeholder workshop (refer Section 2.2.2). The Concept Design attenuator alignment is similar to the alignment presented in the Project REF.

The Concept Design attenuator alignment modifies the Project REF attenuator alignment as follows:

- Provision of a 55m gap between the western end of the wave attenuator and the Multipurpose Jetty (previously there was no gap).
- Increase in the length of the wave attenuator by 23m from 343m to 366m.
- Extension of wave attenuator approximately 80m further seaward at the southern-most point (Point C).
- Reduction of 27m in the gap between the eastern end of the wave attenuator and the proposed Cattle Bay Marina from 60m to 33m.

The Concept Design wave attenuator alignment in comparison to the Project REF wave attenuator alignment provides a larger area of protected waterway for a potential future marina or other boat storage facility/s. The level of wave protection provided to the Mooring Jetty has reduced for the Concept Design; however, the existing waterway condition would still be improved.

The location and site plan of the proposed modification is shown in Figure 1-1.

3.2 Construction Activities

Section 3.2 of the Project REF discussed the relocation of swing moorings arranged by Roads and Maritime Services (Roads and Maritime). Further swing moorings may require relocation by Roads and Maritime prior to commencing of geotechnical drilling and installation of the attenuator.

A contractor would mobilise to the site at the commencement of construction activities. Ancillary facilities transported to the site during the mobilisation period are expected to include temporary site offices, ablution facilities, workshops, material storage containers and laydown areas, where required and would be established within the land based contractor work area. This area is likely to be either adjacent to the Breakwater Wharf that is the same area used for the Eden Breakwater Wharf Extension Project, or the carpark area adjacent to the commercial boat ramp, or other foreshore location owned by the Crown in the Snug Cove Port precinct.

Temporary fencing and Project signage would be erected around all ancillary facilities and a gate would be controlled by Contractor personnel in which construction traffic would enter and exit the site. Crew transfer and material load out would also take place within this land based contractor work area. Public access would be restricted where required to ensure that construction activities can be carried

out safely. Access would be maintained to the Multipurpose Jetty and Port commercial businesses during construction of the Project.

The structural design of the fixed attenuator would generally comprise tubular piles supporting pre-cast concrete panels as illustrated in Figure 3-1. Concept design drawings are contained in Appendix A. The structural design of wave attenuator would be confirmed following further design development.

The piles and panels would likely be manufactured and prefabricated offsite and transported to site by road. The units would be lowered from shore onto a barge and transported to the installed piles. A separate barge-mounted crane would lift the pre-cast concrete units into place where they would be fixed to the installed piles. The preferred construction methodology will be further developed by the Contractor.

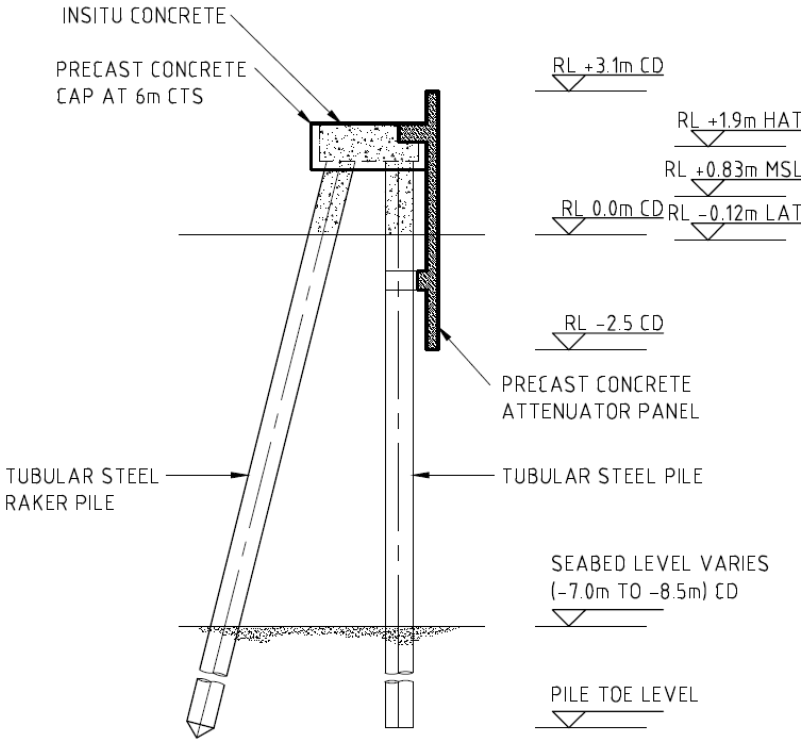


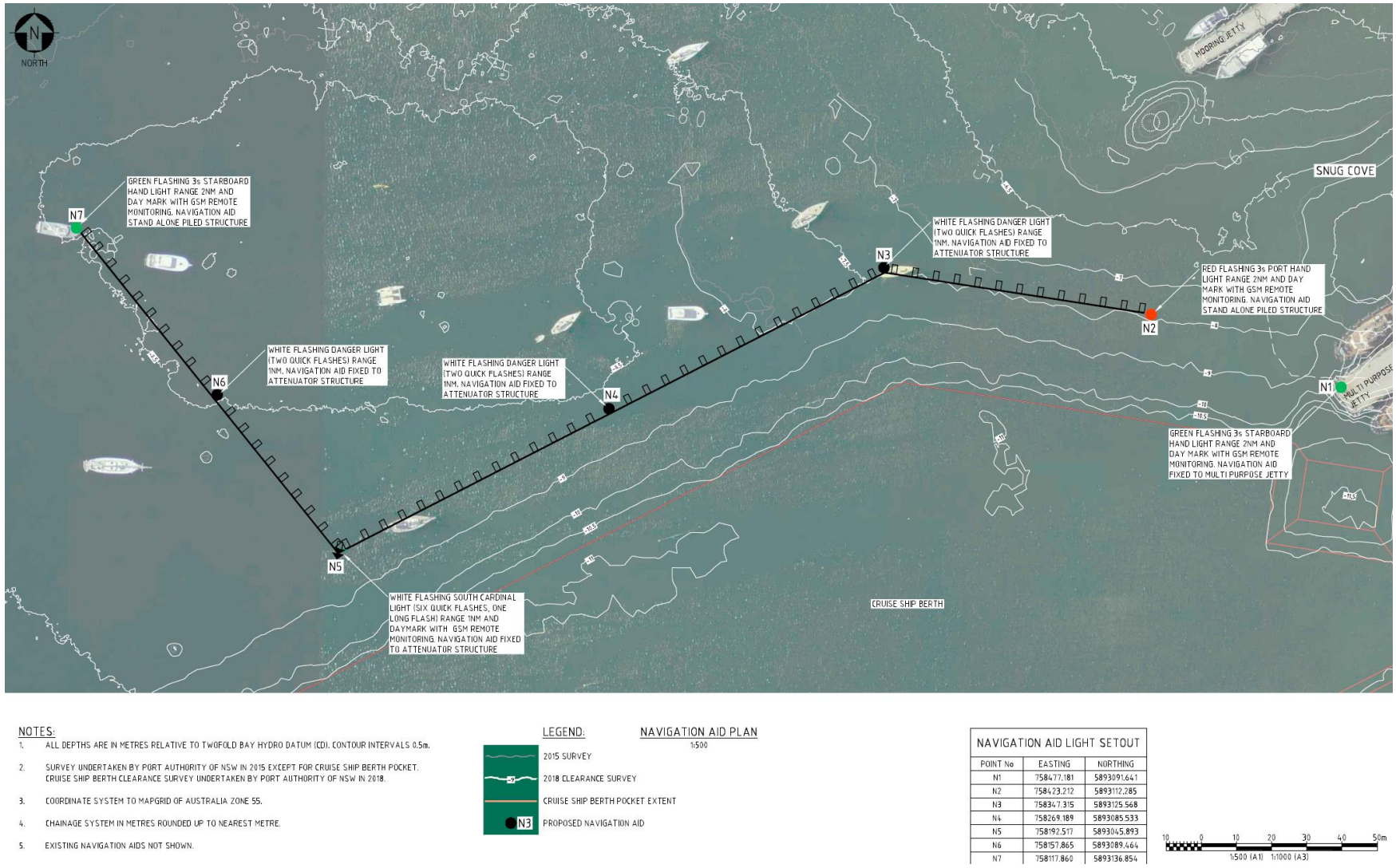
Figure 3-1 Typical attenuator section details (Source: WorleyParsons, 2018)

All piles required would be delivered to site by water by barge and driven to a design toe level (level into the seabed) by a piling hammer lifted by a crane mounted on a barge. Rock anchors may be installed in some piles, depending on pile refusal level, by drilling down through the preinstalled steel tubular pile with a drill rig, installing steel reinforcement and then pouring in-situ concrete within the pile, to ensure there is a strong connection between the pile and the bedrock.

Alternatively, a drill and drive pile installation methodology may be adopted that involves driving the pile until refusal, drilling down through the preinstalled steel tubular pile with a drill rig to break up the harder material that is then removed, and the pile is driven again until refusal. This methodology is repeated until the pile is driven to the design toe level.

It is expected that there would be a limited volume of waste generated during the on-site construction.

Navigational hazard lighting is proposed to be installed to the attenuator as shown in Figure 3-2.



NOTES:

1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD). CONTOUR INTERVALS 0.5m.
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
4. CHAINAGE SYSTEM IN METRES ROUNDED UP TO NEAREST METRE.
5. EXISTING NAVIGATION AIDS NOT SHOWN.

LEGEND:

- 2015 SURVEY
- 2018 CLEARANCE SURVEY
- CRUISE SHIP BERTH POCKET EXTENT
- N3 PROPOSED NAVIGATION AID

NAVIGATION AID PLAN
1:500

NAVIGATION AID LIGHT SETOUT

POINT No	EASTING	NORTHING
N1	758477.181	5893091.641
N2	758423.212	5893112.285
N3	758347.315	5893125.568
N4	758269.189	5893085.533
N5	758192.517	5893045.893
N6	758157.865	5893089.464
N7	758117.860	5893136.854

10 0 10 20 30 40 50m
1:500 (A1) 1:1000 (A3)

Figure 3-2 Concept navigation aids plan (Source: WorleyParsons, 2018)

3.3 Construction Traffic

It is estimated that on average there would be a total of approximately 10 to 20 heavy vehicles for both the mobilisation and demobilisation periods. There is potential delivery of construction materials by road and/or by water.

Road deliveries are estimated to be one to two heavy vehicles per day during the delivery phase. Truck movements would also occur where rubbish/offcuts/waste materials are required to be removed from the site. Truck lengths employed would vary between small rigid (6.4m), medium rigid (8.8m), heavy rigid (12.5m), truck and dog (18m-19m) and/or semi (19m).

It is estimated that on average there would be a total of one to two barge deliveries per day. All water borne vessels are to generally operate within a designated construction and mooring zones. Small work boats would also be active during construction for the transfer of crew, environmental monitoring and related construction activities.

It is proposed that contractor parking would be located within the land based contractor work area; however, there may be a need to allow overflow parking for light vehicles in the area immediately adjacent to the site during periods of peak work.

3.4 Scheduling

The estimated duration of the construction activities is approximately twelve months excluding offsite fabrication. Construction activities are expected to commence in the first quarter of 2019.

3.5 Construction Hours

All construction activities would be undertaken within standard construction hours:

- Weekdays – 7am-6pm.
- Saturdays – 8am-1pm.
- Sundays/Public Holidays – Nil.

3.6 Workforce

The estimated workforce is approximately 18 staff/workers for the construction activities. The workforce would be housed locally, using local services where it benefits the community.

3.7 Utilities

Power, water, sewer and telecommunications for the construction phase of the Project will be procured through existing sources. There are no additional requirements for utilities during the operational phase of the Project.

3.8 Operation

Regular maintenance would be undertaken by the asset owner over the design life (minimum 50 years) of the attenuator and its navigational hazard lighting.

4 Statutory Planning Framework

4.1 Commonwealth Legislation and Regulations

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

Table 4-1 below demonstrates the assessment of the MNES under the EPBC Act undertaken in order to determine whether the proposed modification should be referred to DoEE. Based on this assessment, no EPBC Act Referral to DoEE is considered required.

Table 4-1 Impacts on MNES

Matter of National Environmental Significance	Impacts
Any impact on a World Heritage property? There are no World Heritage properties in the vicinity.	Nil
Any impact on a National Heritage place? There are no National Heritage properties in the vicinity.	Nil
Any impact on a wetland of international importance? There are no wetlands of international significance in the vicinity.	Nil
Any impact on a listed threatened species or communities? It is unlikely that the proposed modification would significantly affect any listed species or communities (refer to Section 6.1).	Nil
Any impacts on listed migratory species? It is unlikely that the proposed modification would significantly affect any listed migratory species (refer to Section 6.1).	Nil
Does the Project involve a nuclear action (including uranium mining)? The proposed modification does not involve a nuclear action.	Nil
Any impact on a Commonwealth marine area? There are no Commonwealth marine areas in the vicinity.	Nil
Does the Proposal involve development of coal seam gas and/or large coal mine that has the potential to impact on water resources? The proposed modification is not related to coal seam gas or mining.	Nil
Additionally, any impact (direct or indirect) on Commonwealth land? The proposed modification would not be undertaken on or near any Commonwealth land.	Nil

4.1.2 Native Title Act 1993

Section 3.5.1 of the RTS Report reported that the results of the Land Status search undertaken in April 2018 was under review by the Department to enable the Native Title status of the site to be confirmed by the Department prior to its determination of the Project.

A land status search reviewed historical records of submerged Crown land within Lot 2 DP747343, Lot 111 DP839683 and unsurveyed submerged Crown land to and west of Lot 2 DP747343 (Relevant Area).

The results of the land status search indicated the Relevant Area is likely to fall within the external boundaries of the South Coast People Native Title claimant application (NSD1331/2017 – NC2017/003) (South Coast People Claim). Importantly, the South Coast People Claim has been registered on the Register of Native Title Claims since 31 January 2018.

The Department sought legal clarification and advice regarding the Safe Harbour Project with respect to the *Native Title Act 1993* (Commonwealth) (NTA). By way of summary, it was advised:

- The construction of the wave attenuator would be considered a future act as defined in the NTA.
- The construction of the wave attenuator would be classified as facility for services to the public, under the NTA
- The non-extinguishment principle will apply to the Project, meaning that the Project will not permanently extinguish any existing native title in the Relevant Area.
- The Department may validly carry out construction of the wave attenuator, even though it is located within the Relevant Area of the South Coast People Claim, provided that the Department complies with the relevant sections of the NTA.

  Note: The above point involves providing notice of the proposed Project to Native Title Services Corp Ltd (NTS Corp) (both in its capacity as the legal representative of the South Coast People Claim and as the body currently funded by the Commonwealth under the NTA to perform the functions of a representative Aboriginal/Torres Islander body for New South Wales) and allowing for suitable time for any comments to be received.

The Department consulted with NTS Corp on the Safe Harbour Project in accordance with relevant sections of the NTA and as a courtesy provided notice of the proposed Project by letter dated 11 May 2018. No comments or submissions have been received by the Department.

4.1.3 Other Commonwealth Legislation and Regulations

The proposed modification is consistent with other Commonwealth legislation and regulations

4.2 NSW Legislation and Regulations

NSW Legislation and Regulations as summarised in Sections 4.1.2 and 4.1.3 of the Project REF. Further information relating to the proposed modification is provided below.

4.2.1 Environmental Planning and Assessment 1979

Under Division 5.1 of the EP&A Act, the Department is the determining authority for the Project. The determining authority in Section 5.5 of the EP&A Act must examine and take into account to the fullest extent possible all matters which are likely to affect the environment if the 'activity' is to proceed. Under Section 5.7 of the EP&A Act, an Environmental Impact Statement (EIS) would be required if an

activity is likely to have a significant effect on the environment. From the assessments undertaken as part of the Project REF and RTS report, it is considered that an EIS is not required for the Project.

Consideration of the proposed modification against the Section 1.3 Objects of the EP&A Act is set out in Table 4-2.

Table 4-2 Objects of the EP&A Act

Object	Comment
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	The proposed fixed wave attenuator would significantly reduce wave energy. This would provide a safer harbour for local and visiting vessels and improve the protection of existing infrastructure. The proposed modification would help conserve structures associated with the port, which promotes the social and economic welfare of the community of Eden.
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	The proposed fixed wave attenuator would significantly reduce wave energy entering the port. This would help conserve marine populations and their habitat within the port.
(c) to promote the orderly and economic use and development of land	The proposed modification is an appropriate use and development of Crown land which would provide a safe harbour for port users.
(d) to promote the delivery and maintenance of affordable housing	Not relevant to the proposed modification.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	The port is on occasion exposed to extreme wind and wave conditions. Not only can such conditions compromise the safety of the port, but also impact marine populations and their habitat within the Port. The proposed wave attenuator would assist in significantly reducing wave energy.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)	Not relevant to the proposed modification.
(g) to promote good design and amenity of the built environment	The proposed modification is of an approximate scale and form for the port.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants	Not relevant to the proposed modification.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State	The Department is the authoritative body under Part 5 of the EP&A Act. This requires the Department to adequately assess the likely

Object	Comment
	environmental impact of the project under the relevant environmental planning pathway.
(j) to provide increased opportunity for community participation in environmental planning and assessment	The Department has undertaken extensive consultation with the community.

4.2.2 Environment Planning and Assessment Regulation 2000

Clause 228 Factors

Clause 228 of the EP&A Regulation defines the factors which must be considered when determining if an activity assessed under Part 5 of the EP&A Act has a significant impact on the environment. Table 4-3 responds to the factors for consideration under Clause 228.

Table 4-3 Consideration of Clause 228 Factors

Factor	Impacts
(a) Any environmental impact on a community?	The proposed modification would result in temporary impacts to the community during construction, particularly in relation to noise and vibration from impact piling, movement of construction marine vessels in an existing port and the use of a part of the Snug Cove foreshore for a land based contractor's work area. Mitigation measures outlined in Section 7.2 would be implemented to manage and minimise adverse impacts. The proposed modification would have a positive benefit to the community by providing a safer harbour for local and visiting vessels and improving the protection of existing maritime infrastructure within Snug Cove.
(b) Any transformation of a locality?	The proposed modification involves the introduction of a new fixed marine structure located within Snug Cove. The structure would be an evident change to the water landscape of Snug Cove; however, the overall visual impact as assessed originally by Clouston Associates (2017) in the Project REF would not be significant nor substantially compromise the existing landscape character of the port or Eden.
(c) Any environmental impact on the ecosystem of the locality?	The proposed modification may result in the generation of turbidity from impact piling, reduction in light availability to nearby marine ecosystems and seafloor habitat disturbance. Impacts are expected to be short lived and highly localised if appropriate mitigation measures are employed.
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	There would be some temporary impacts during construction in relation to noise, traffic, access and visual amenity. The operation of the proposed modification would have a positive impact on the recreational and environmental quality or value of the locality, as the wave attenuator structure will

Factor	Impacts
	significantly enhance the protection of Snug Cove, including marine vessels and foreshore infrastructure.
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	There are no Aboriginal objects in close proximity to the site. The site is greater than 400m in distance from any heritage item. There are no known archaeological relics or historic shipwrecks located in Snug Cove. The proposed modification is not expected to have any impacts to present or future generations.
(f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)?	The Aquatic Ecology Assessment (Advisian, 2017) (Appendix A to the Project REF) assessed that the Project would not remove or fragment any habitat for threatened species with the habitat that is proposed to be impacted is not considered to be of importance to the long term survival of any species or ecological communities in the locality. The proposed modification is consistent with this conclusion.
(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	The Aquatic Ecology Assessment (Advisian, 2017) (Appendix A to the Project REF) assessed the Project in terms of it being a Key Threatening Process (KTP). Advisian (2017) concluded that as a whole, the Project is not considered to be a KTP. However, two potential impacts of construction relating to the Project, being the introduction of marine species and injury / fatality caused by marine debris, are both considered KTPs. These impacts would be managed or minimised with the implementation of mitigation measures outlined in Section 7.2. The proposed modification is consistent with this conclusion.
(h) Any long-term effects on the environment?	The proposed modification is unlikely to have any long term effects on the environment.
(i) Any degradation of the quality of the environment?	During construction there is the potential for noise and vibration impacts. Appropriate mitigation measures would be implemented to minimise the impacts. There would be no operational impacts that degrade the quality of the environment.
(j) Any risk to the safety of the environment?	The proposed modification is unlikely to cause any safety risks to the environment provided the recommended mitigation measures are implemented.
(k) Any reduction in the range of beneficial uses of the environment?	The proposed modification is unlikely to have any reduction in the range of beneficial uses of the environment.
(l) Any pollution of the environment?	The proposed modification is unlikely to cause any significant pollution risks to the environment provided the recommended mitigation measures are implemented.

Factor	Impacts
(m) Any environmental problems associated with the disposal of waste?	The proposed modification is unlikely to cause any environmental problems associated with the disposal of waste provided the recommended mitigation measures are implemented.
(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?	The proposed modification is unlikely to increase demands on resources that are or are likely to become in short supply.
(o) Any cumulative environmental effect with other existing or likely future activities?	Cumulative impacts were considered in Section 6.12 of the Project REF. Where feasible, environmental management measures would be co-ordinated to reduce any cumulative construction impacts. The proposed modification is unlikely to have any significant adverse long term impacts.
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	The proposed modification is not anticipated to have any significant impacts to coastal processes and coastal hazards.

Principles of Ecologically Sustainable Development

Schedule 2 of the EP&A Regulation applies to the preparation of an EIS, however regard to the principles of Ecologically Sustainable Development (ESD) has been considered in this REF as shown in Table 4-4.

Table 4-4 Consideration of the principles of ESD for the Project

ESD principle	Comment
Precautionary principle The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and (ii) an assessment of the risk-weighted consequences of various options	Specialists were engaged to carry out environmental assessments for the Project REF and the AREF (as relevant) and evaluate key impacts. This helped to ensure a thorough understanding of the existing environment within the site, identify the potential impacts associated and develop measures to avoid or mitigate identified impacts. An assessment of 'worst case' impacts was carried out. It is anticipated that through the implementation of mitigation measures and through continuation of detailed design, the identified impacts would be further reduced. The precautionary principle has been implemented in determining the potential impacts of the proposed modification.
Inter-generational equity Inter-generational equity, namely, that the present generation should ensure that the	The proposed modification would contribute to inter-generational equity by providing a safe harbour wave climate that would enhance Eden's

ESD principle	Comment
health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations	reputation as a safe boating destination for both local and visiting vessels with potential flow on investment into Eden. Mitigation measures are proposed to avoid or minimise identified impacts and enhance inter-generational sustainability. The environmental impact assessment carried out has shown that the impacts identified in this AREF would not result in a significant impact on the environment.
Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration	The proposed modification has been designed to minimise impacts to areas of biodiversity significance to conserve biological diversity and ecology integrity. The mitigation measures proposed aim to minimise impacts to biodiversity throughout the lifecycle of the proposed modification.
Improved valuation, pricing and incentive mechanisms Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as: (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	The proposed modification and the Project in general has been in the planning phase over the previous five years. The design and associated environmental issues have been investigated and considered throughout this planning phase. Mitigation measures have been incorporated into the development of the proposed modification to minimise impacts during construction and operation. The environmental and cost implications of the proposed modification have been considered in this AREF.

4.2.3 Other NSW Legislation and Regulations

Table 4-5 considers other relevant NSW legislation and regulations.

Table 4-5 Consideration of other NSW Legislation and Regulations

Applicable legislation	Considerations
Biodiversity Conservation Act 2016	The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future consistent with the principles of ESD. An Aquatic Ecology Assessment was completed for the Project REF with reference to Part 7 of the *Biodiversity Conservation Act 2016*.
Coastal Management Act 2016	The objective of the *Coastal Management Act 2016* is to manage the coastal environment of NSW in a manner consistent with the principles of ESD. The proposed modification is not located within the coastal zone.
Contaminated Land Management Act 1997	The *Contaminated Land Management Act 1997* allows the Environmental Protection Authority (EPA) to investigate and regulate highly contaminated sites that warrant remediation. No known contaminated sediment or water is located in the site of the proposed modification.
Crown Land Management Act 2016	The *Crown Land Management Act 2016* outlines objectives and provisions for the proper management of Crown lands for the benefit of the people of NSW. The proposed modification involves the development of Crown land.
Fisheries Management Act 1994	The objectives of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. A permit under Section 205 of the FM Act will be required for harm to marine vegetation (macroalgae) due to the construction of the proposed wave attenuator.
Heritage Act 1977	The *Heritage Act 1977* encourages the conservation, protection and reuse of the State's heritage including historic shipwrecks. The proposed modification would not impact any items or places subject of an interim heritage order, listed on the State Heritage Register or identified as a historic shipwreck.
Marine Pollution Act 2012	The objective of the *Marine Pollution Act 2012* is to prevent unlawful pollution of State waters and govern emergency pollution plans of vessels. The operation of construction vessels is to comply with the requirements of this Act to prevent pollution during construction of the wave attenuator.
Marine Safety Act 1998	The *Marine Safety Act 1998* ensures the safe operation of vessels in ports and other waterways. All construction vessels associated with the proposed modification would be subject to the safety provisions of this Act.

Applicable legislation	Considerations
National Parks and Wildlife Act 1974	The *National Parks and Wildlife Act 1974* (NPW Act) governs the care, control and management of national parks, historic sites, nature reserves, reserves, Aboriginal areas and State game reserves. The proposed modification is not located within areas protected by the NPW Act.
Protection of the Environment Administration Act 1991	The *Protection of the Environment Administration Act 1991* (PEA Act) gives constitution to the EPA, allowing the EPA to perform asks to ensure protection of the environment. The main objective of the EPA is to protect, restore and enhance the quality of the environment in NSW.
Protection of the Environment Operations Act 1997	The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of environment protection legislation administered by the EPA. The proposed construction of the wave attenuator does not require an Environment Protection Licence under Chapter 3 of the POEO Act.
Water Management Act 2000	The objective of the *Water Management Act 2000* is to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The proposed modification would not adversely impact the State's water sources.

4.3 State Environmental Planning Policies

4.3.1 State Environmental Planning Policy (Infrastructure) 2007

Clause 68 of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) allows development for the purpose of "wharf or boating facilities" by or on behalf of a public authority without consent on any land. Clause 67 defines "wharf or boating facilities" as "a *wharf, or facilities associated with a wharf or boating, that are not port facilities*".

Consequently, development consent is not required for the proposed modification which is classified as a "wharf or boating facilities"; however, the environmental impacts of the proposed modification have been assessed under the provisions of Division 5.1 of the EP&A Act.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other agencies prior to the commencement of certain types of development. Section 5.4 of this AREF discusses the consultation undertaken under the requirements of ISEPP.

4.4 Bega Valley Local Environmental Plan 2013

The proposed modification is permissible without development consent under Clause 68 of ISEPP; therefore, the permissibility and consent provisions of the *Bega Valley Local Environmental Plan 2013* do not apply.

5 Stakeholder and Community Consultation

5.1 Consultation Strategy

Section 5 of the Project REF identified key stakeholders and summarised the range of consultation activities undertaken by the Department in accordance with its Community and Stakeholder Engagement Strategy to inform the community and stakeholders affected by the Project and to seek their comment and input regarding the Project.

The Project REF was placed on public display between 16 November 2017 and 19 January 2018 for community and stakeholder comment. A RTS Report, dated 13 April 2018 was prepared to respond to issues raised.

A stakeholder workshop was held on 21 May 2018 with representatives from the Department, Port Authority of NSW, WorleyParsons, POEM Inc., International Marina Consultants and Waterway Constructions to discuss and agree an alignment that would meet the performance requirements for the Project. The agreed alignment was then further developed by Advisian and a concept design finalised.

Further stakeholder consultation was undertaken in July 2018 for the attenuator alignment. This involved a series of individual meetings with businesses and organisations operating in the Port and communication via email with one key stakeholder based in Western Australia. Sections 5.2 and 5.3 provides a summary of consultation process and the key issues raised. A memorandum was prepared to record the details of the consultation meetings held and is contained at Appendix B.

Consultation with all key stakeholders including meetings of the Community Liaison Group (CLG) remains an ongoing process.

5.2 Key Issues

The majority of stakeholders expressed no concerns with the final alignment and advised that it would not impact upon their existing operations in the Port.

Key issues that were raised by stakeholders were as follows:

- Impact of reflected waves on the NSW Water Police Jetty.
- Increase in accretion of sand due to the new alignment at Eden Slipway Services.
- Increase of wave heights and the impact on Cat Balou pontoon and vessels.
- Impacts to fish populations at Cocora Beach.
- Increase of wave surge on the Multipurpose Jetty.
- Insufficient lighting on wave attenuator which may create a safety issue to vessels.

The AREF has addressed the above key issues in Section 6.

5.3 Summary of Consultation Activities

A summary of consultation activities undertaken by the Department associated with the Project including the alignment and concept design is provided in Table 5-1.

Table 5-1 Summary of consultation activities

Stakeholder	Date	Communication Tools	Issues Raised
Project CLG	Ongoing	Monthly CLG meetings held to discuss the Project in detail including assessment, alignment and timing.	The wave attenuator alignment was the key concern of some members of the CLG. Resolved by the preferred option.
POEM Inc.	Ongoing	Stakeholder workshop held 21 May 2018 Face to face meetings – individual consultation Monthly CLG meetings, POEM is a member.	The wave attenuator alignment was the key concern of POEM. Resolved by the preferred option.
Eden Cattle Bay Marina Pty Ltd/Eden Resort Hotel Pty Ltd	Ongoing	Face to face meetings – individual consultation Monthly CLG meetings, member of CLG.	No issues.
Port Authority of NSW	Ongoing	Stakeholder workshop held 21 May 2018 Face to face meetings – individual consultation Monthly CLG meetings, Port Authority of NSW is member of CLG Port of Eden Stakeholder Forum.	General comments on the wave attenuator alignment and Project construction and operation Resolved by preferred option. Discussion also commented regarding the
Professional Fishermen	Ongoing	Face to face meetings – individual consultation Port of Eden Stakeholder Forum, three professional fishermen are members of the forum	Concerns with additional wave surge on Multipurpose jetty and impact on fish populations at Cocora Beach.
Mooring Jetty Licence Holders and Professional Fisherman	31 July 2018	Face to face meetings – individual consultation Port of Eden Stakeholder Forum	Concerns with additional wave surge on mooring jetty and impact on fish populations at Cocora Beach.

Stakeholder	Date	Communication Tools	Issues Raised
Bhagwan Marine	25 July 2018	Face to face meetings – individual consultation	Liaison with Commercial and Business Development Manager based in Perth. No issues.
Freedom Charters	6 July 2018	Face to face meetings – individual consultation	No issues.
Eden Sea Farms	5 July 2018	Face to face meetings – individual consultation Port of Eden Stakeholder Forum, Eden Sea Farms is a member.	No issues.
Cat Balou	6 July 2018	Face to face meetings – individual consultation	Concern over increased wave activity at the Pontoon. Further consultation required to resolve any concerns.
Southland Fish Supplies	11 July 2018	Face to face meeting – individual consultation Port of Eden Stakeholder Forum	No issues.
Gotcha Bait	9 July 2018	Face to face meetings – individual consultation Port of Eden Stakeholder Forum	No issues.
Pacific Tug	30 July 2018	Face to face meetings – individual consultation	Noted that there should be additional white flashing danger markers and cardinal markers on the attenuator. There would be potential safety issues with boats moored behind the attenuator that would not be able to be seen at night and there should be a dedicated access route.
Svitzer Cooma, Snug Cove and Sherlock	13 July 2018	Face to face meetings – individual consultation Monthly CLG meetings, member of CLG Port of Eden Stakeholder Forum.	No issues.
Eden Slipway Services	5 July 2018	Face to face meetings – individual consultation Member of Port of Eden Stakeholder Forum.	Concern over sand accretion at Eden slipway site.

Stakeholder	Date	Communication Tools	Issues Raised
Cruise Eden (now part of Port Authority of NSW)	Ongoing	Face to face meeting – individual consultation Monthly CLG meetings, member of CLG Member of Port of Eden Stakeholder Forum.	No issues.
Roads and Maritime	Ongoing	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum.	Roads and Maritime will continue to lead the process for temporary/permanent vessel and swing mooring relocations in consultation with vessel owners.
Marine Rescue	12 July 2018	Face to face meetings – individual consultation Port of Eden Stakeholder Forum	No issues.
NSW Marine Area Command (NSW Water Police)	6 July and 26 July 2018	Face to face meetings – individual consultation Port of Eden Stakeholder Forum.	No issues at first meeting. Second meeting held to discuss the additional modelling undertaken for their jetty.
Australian Border Force Department of Home Affairs	6 July 2018	Face to face meetings – individual consultation Member of Port of Eden Stakeholder Forum	No issues.
Eden Chamber of Commerce	Ongoing	Monthly CLG meetings, member of CLG Port of Eden Stakeholder Forum.	No issues.
Twofold Bay Yacht Club	3 July 2018	Face to face meetings – individual consultation Monthly CLG meetings, member of CLG.	No issues.
Bega Valley Shire Council	Ongoing	Monthly CLG meetings, member of CLG Port of Eden Stakeholder Forum	No issues raised at CLG meetings.

5.4 ISEPP Consultation Requirements

Clause 16 of ISEPP requires a public authority (i.e. the Department) to give written notice to Roads and Maritime of the intention to carry out the development when the "*development comprising a fixed or floating structure in or over navigable waters*". Section 5.5 of the Project REF confirmed that the consultation requirements under Clause 16 of the ISEPP had been satisfied. Further, consultation with Roads and Maritime remains ongoing as noted in Table 5-1.

6 Environmental Assessment

This section of the AREF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposed modification of the Project. All aspects of the environment potentially impacted upon by the proposed modification are considered.

Site-specific mitigation measures are provided to ameliorate the identified potential impacts. Section 6 of the Project REF provides information about the existing environment, potential impacts and mitigation measures relevant to the Project. Any additional requirements based on the proposed modification are included in Sections 6 and 7. In consideration of the scale of the proposed modification, the AREF has focused on key issues associated with the modification only. These include aquatic ecology (including an underwater noise assessment), coastal processes, water quality, traffic and access, land use and property, visual amenity and noise and vibration.

Detailed assessments of socio-economic, air quality, heritage, contamination, soils and geology, cumulative impacts, greenhouse gas and climate change and waste management were not included as the potential impact remains consistent with the Project REF. Notwithstanding, these aspects have been considered in the assessment against Clause 228(2) of the EP&A Regulation in Section 4.2.2.

6.1 Aquatic Ecology

6.1.1 Existing Environment

An Aquatic Ecology Assessment (Appendix A to the Project REF) was prepared by Advisian (2017) to provide an assessment of the Project's feasibility in relation to aquatic ecological issues and determine whether any significant impacts on aquatic ecology are likely to result from the proposed construction and operation of the Project.

Section 6.1 of the Project REF included a summary of the existing aquatic (marine) environment within Twofold Bay, specifically within the study area of Snug Cove. It is considered that the extent of the aquatic ecology field survey undertaken on 14 and 15 August 2017 remains valid for the purposes of the assessment of the proposed modification.

Since the Project REF, the Department commissioned Blue Planet Marine (2018) to assess the actual underwater noise produced by piling operations during construction of the Eden Breakwater Wharf Extension Project and compare it with the active monitoring and shut down zones proposed for the Project to assess and evaluate if these zones have been set appropriately (refer to Appendix C). The key conclusions of the acoustic monitoring research undertaken include the following:

- Noise propagation

  Based on the measured sound levels (for Transect A in particular as shown in Figure 6-1), sound propagation from the piling activity broadly follows generally accepted propagation modelling for such activities. There is good evidence that noise from the piling activities transmits well along Transects A and to a lesser extent along Transect B. The received levels along Transect B are between 5dB and 7dB lower than the levels recorded at equivalent distances along Transect A. This represents a significant reduction with a 5dB and 7dB reduction equating to a more than halving of the sound energy and provides good evidence of the acoustic shadow produced by the Eden Breakwater Wharf.

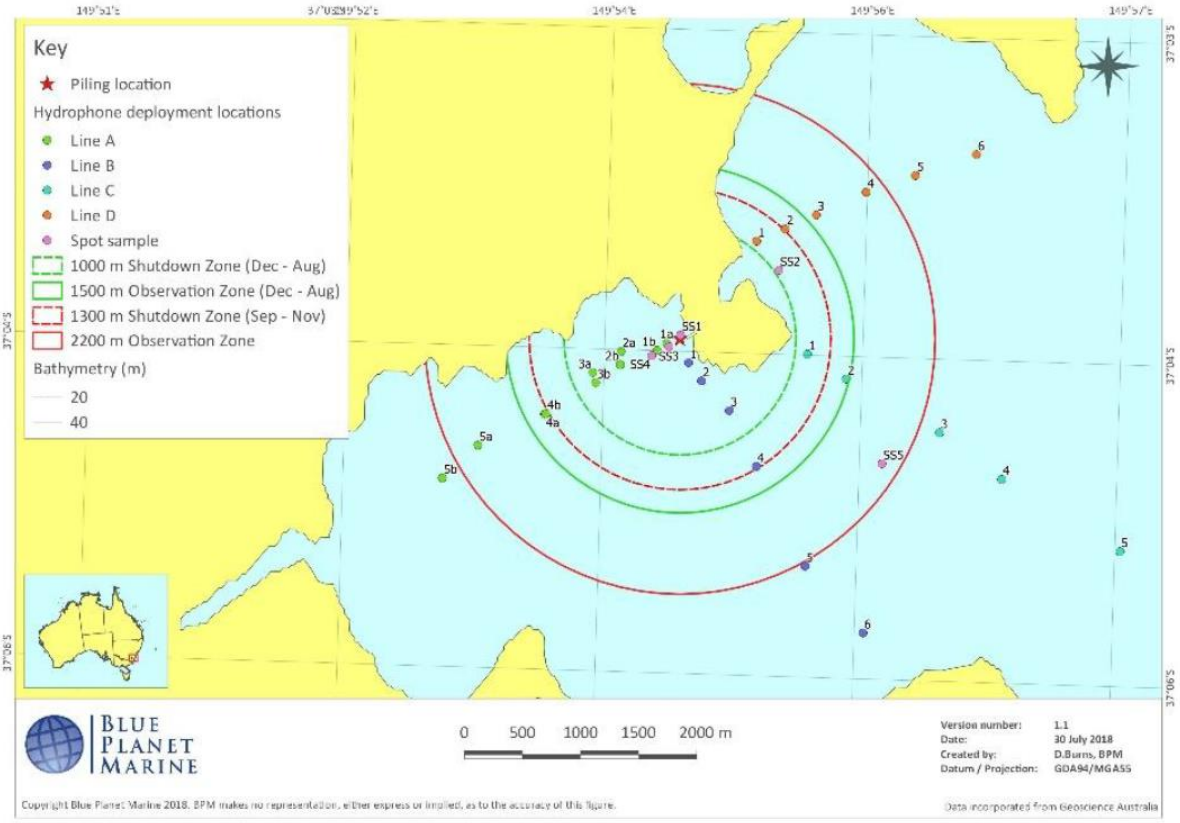


Figure 6-1 Deployment locations for all acoustic recorders in and around the Port of Eden. Colours of points correspond to sampling locations along different Transect Lines (A, B, C, D) and also locations for of short term, spot sampling (Source: Blue Planet Marine, 2018)

- Acoustic shadow from the break water and Middle Head

  There were no detectable levels of piling noise on either Transect C or D although some very faint piling noise was audible on the most offshore recording location (C-5) of Transect C but only after significant amplification of the signal. Given these findings, it provides good evidence that both the Eden Breakwater and, particularly Middle Head, provide a significant acoustic shadow for areas to the east and north of the piling location. Given that there is no detection of piling noise along either Transect C or D, there will be no impact on marine mammals moving through this area and therefore the existing shutdown zone in this area is overly precautionary.

6.1.2 Potential Impacts

The Aquatic Ecology Assessment considered the provisions of Part 7 of the BC Act which concluded that the Project is not likely to significantly affect any identified threatened species if the proposed mitigation measures to protect marine fauna are adopted. The proposed modification is consistent with this conclusion.

Potential construction and operation impacts were identified in Sections 6.1.2 and 6.1.3 of the Project REF, respectively. The proposed modification is consistent with this assessment including any potential impacts to fish populations at Cocora Beach.

6.1.3 Mitigation Measures

Blue Planet Marine (2018) provided the following key recommendations in relation underwater noise:

- Based on the results the study, consideration be given to revising the current observation and shutdown zones, that have been set for Eden Breakwater Wharf Extension Project, for future piling projects within Twofold Bay, such as this Project.
- On the basis of these measurements, and following the South Australian Department of Planning, Transport and Infrastructure, Underwater Piling Noise Guidelines, Report for the SA DPTI (2012) and generally the same as the Eden Breakwater Wharf Extension Project's EPBC Referral Decision conditions, the following distances are recommended (refer to Figure 6-2):
    - Observation zone = 2,000m
    - Shutdown zone = 1,000m
- If there is variation with piling activity in future projects, (e.g. a different location within Twofold Bay not as shielded as Snug Cove by the Eden Breakwater Wharf and/or Middle Head; larger pile driver and/or piles are used; or if piles are driven into a different substrate), then it is recommended that further acoustic validation is undertaken to assess the zones of potential acoustic impact within Twofold Bay.

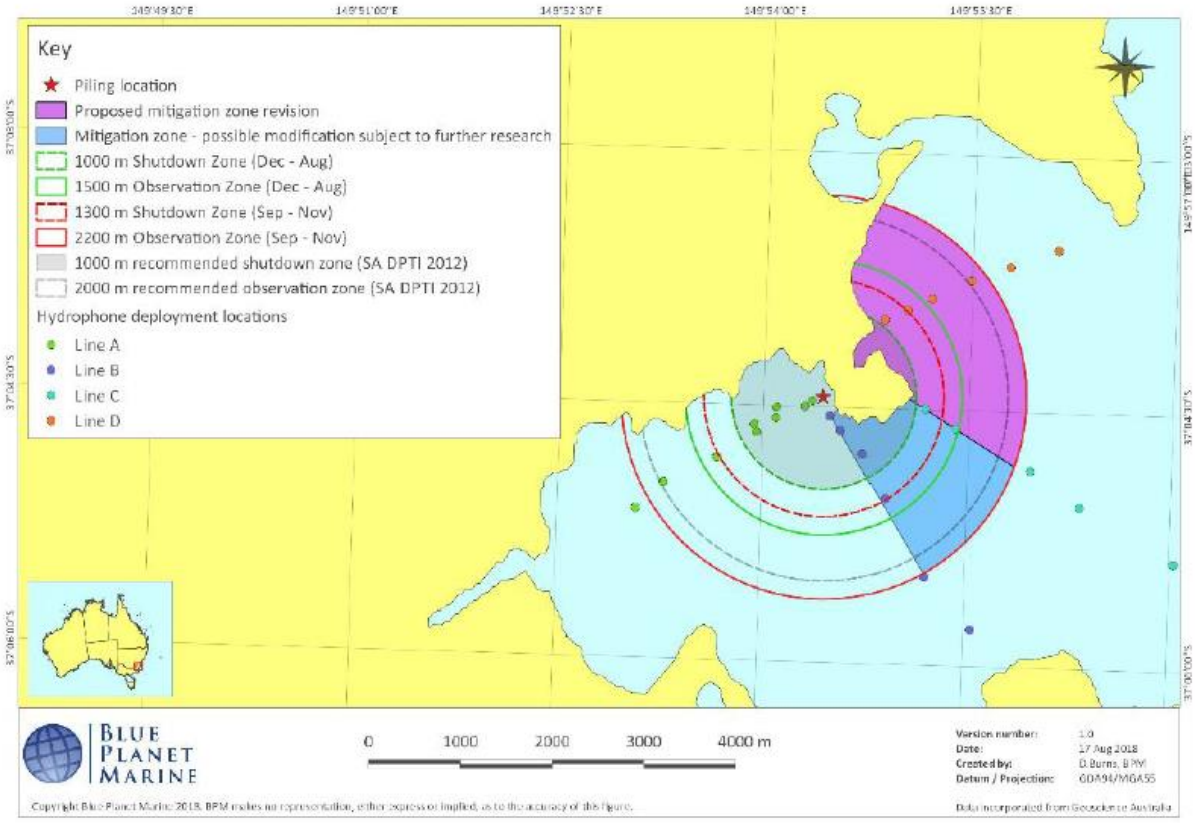


Figure 6-2 Recommended variations in the shutdown zones based on acoustic research (Source: Blue Planet Marine, 2018)

Table 6-1 lists the mitigation measures to be adopted as a minimum to reduce potential impacts. Note: additional measures are included in bold and italicised font and deleted measures are shown in strikethrough.

Table 6-1 Proposed Aquatic Ecology Mitigation Measures

No.	Mitigation Measure	Phase
A1	To minimise damage to sensitive marine habitats (seagrass and subtidal rocky reef) in the immediate site, Snug Cove and Cattle Bay, all vessels will avoid anchoring over areas of sensitive habitat including mapped seagrass beds and areas of subtidal rocky reef, where practicable.	Construction and Operation
A2	To reduce the potential impacts of water quality on marine habitats during construction the following measures will be adopted: • All construction vessels will be well maintained and regularly serviced to ensure they are in proper working order and reduce the likelihood of fuel / oil leaks and spills. • Contractors will ensure their vessels maintain their septic tanks and pumps so that they do not leak. No release of sewage into the waterway will be allowed. • Oil and sewage spill response kits will be readily available on the construction vessels and training should be provided to construction staff on their use. The location of these should be clearly marked. • Any ongoing washing of the wave attenuator following construction will be undertaken with marine environmentally friendly and biodegradable products only. • Contractors will adopt appropriate waste management, with all general waste contained of and disposed of onshore in waste collection devices and all construction waste removed from the site. Post construction a seabed clearance survey will be undertaken to ensure that this has occurred.	Construction
A3	To reduce the spread of suspended sediments generated during piling and the potential for sedimentation / smothering of sensitive habitats and associated flora and fauna, silt curtains or similar will be used wherever possible around the immediate area of piling. Particularly to separate the construction areas from areas of sensitive habitat. If it is possible, the use of sleeves around piles during pile driving will also help to contain the spread of suspended sediment so it does not impact on the nearby areas of macroalgae during piling activities.	Construction
A4	To reduce the potential for lighting related impacts on marine fauna construction activities will not be undertaken during the evening and night time to reduce the overall need for construction related artificial lighting (on vessels and the attenuator) and associated impacts.	Construction and Operation
A5	The risk of vessel strike during construction may be reduced through the adoption of: • All vessels associated with construction will travel at speeds no higher than 10 knots within the port limits unless necessary due to navigational safety.	Construction

No.	Mitigation Measure	Phase
	• Vessels will maintain a 300m exclusion zone with all whales when travelling to site where practicable except for predominately white whales where there is to be a 500m exclusion zone. • Site inductions and training. • Active management, such as regular information exchange on known marine mammal activity (e.g. via local residents, commercial fishers, mussel farmers, NPWS whale watch and Cat Balou Cruises). • Marine fauna awareness in the local waterway by vessel operators so appropriate speeds and clearance can be adopted when cetaceans are nearby.	
A6 *	To reduce the potential for noise impacts on marine fauna (specifically marine mammals) the following ~~should~~ be applied ***and adjusted, as required, based on the Contractor(s) piling methodology and the recommendations of the Blue Planet Marine (2018) acoustic monitoring***: Piling Operation Procedures: a) Pre-start Observation: Marine mammal observers must visually monitor observation and shut-down zones for whales for a minimum of 30 minutes before the commencement of piling. Observation zone is defined as: ~~a) During September, October and November~~ ***A*** horizontal radius determined from the piling equipment of 2~~.2~~km. ~~b) During January, February, March, April, May, June, July, August and December a horizontal radius determined from the piling equipment of 1.5kms.~~ Shut-down zone is defined as: ~~a) During September, October and November~~ ***A*** horizontal radius determined from the piling equipment of 1~~.3~~km. ~~b) During January, February, March, April, May, June, July, August and December a horizontal radius determined from the piling equipment of 1km.~~ b) Soft-Start Procedure: If after the 30 minute pre-start observation no whale/s have been spotted within the observation or shutdown zone a soft start procedure may commence with a gradual increase in piling impact energy of no more than 50% of full impact energy for 10 minutes. The soft start procedure must be implemented after breaks in piling driving of 30 minutes or more. c) Stand by procedure: If a whale is spotted within the observation zone during the soft start procedure the operator of the piling equipment must be placed on standby to shut-down the piling rig and a trained crew member should continuously monitor the whale/s in sight at all times.	Construction

No.	Mitigation Measure	Phase
	d) Normal Piling Procedure: If no whale/s has been sighted during the soft-start procedure full impact piling may commence. The use of bubble curtains around areas of piling could also be adopted to reduce noise impacts on marine fauna. Shut-Down requirements: a) If visibility is poor and the marine mammal observer is unable to clearly identify objects to the full observation zone distance, a vessel or aircraft search must be conducted or the action postponed until visibility has improved. b) Piling is not permitted between 6.00 pm and 7.00 am. c) If any whales are spotted within the shut-down zone, piling must cease immediately or as soon as safe to do so until the whale/s has moved outside of the shut-down zone. d) All piling must cease for a minimum of 1 hour after the last sighting of a whale within the observation zone. Piling must recommence at the prestart observation after the one hour shutdown has elapsed. All standard management and mitigation measures in Section 5.3 of the Underwater Piling Noise Guidelines (Government of South Australia, 2012) are to be implemented during piling.	
A7	The goals of the *NSW Invasive Species Plan 2008 – 2015* (NSW DPI 2008) will be adopted for the Project.	Construction and Operation
A8	All Contractors will undertake a Vessel Risk Assessment (VRA) prior to mobilisation to the site. The VRA may be undertaken by the vessel owner / operator. All vessels, floating plant and equipment mobilised to site from any place inside or outside of Australia will be subject to VRA. Contractor(s) will provide the VRA to the Principal four weeks prior to mobilisation.	Construction
A9	The Contractor(s) will undertake an Invasive Marine Species (IMS) Inspection of all vessels brought to Twofold Bay. The IMS will be undertaken by an appropriately qualified marine scientist with experience in biosecurity of marine vessels, floating plant and equipment. The Contractor(s) is responsible for arranging the IMS inspection and attendance of Fisheries or other suitably qualified personnel. All IMS Reports are to be provided to DPI Fisheries at least 2 weeks prior to the vessel departing its current location en-route to Eden.	Construction
A10	Construction vessel antifouling will be maintained to avoid the attachment and potential translocation of invasive species into and out of Twofold Bay.	Construction
A11	Ballast water management will be implemented: • Ballast water exchange by domestic vessels will be avoided. • Domestic vessels will manage ballast water in accordance with the *Australian Ballast Water Management Requirements*. (Department of Agriculture and Water Resources 2016). • Any ballast water exchange from international vessels will be undertaken in accordance with the *International Convention for*	Construction

No.	Mitigation Measure	Phase
	the Control and Management of Ships' Ballast Water and Sediments (BWM) (IMO 2016).	
A12	Monitoring and inspection / surveillance of the construction vessels and barges will be undertaken in accordance with the *Biosecurity Act* 2015.	Construction
A13	DPI Fisheries (1800 043 536) is to be immediately notified of any fish kills in the vicinity of the works. In such cases, all works other than emergency response procedures are to cease until the issue is rectified and written approval to proceed is provided by DPI Fisheries.	Construction

6.2 Coastal Processes

6.2.1 Existing Environment

A Coastal Processes Assessment (Appendix B to the Project REF) was prepared by Royal Haskoning DHV to provide:

- A description of the existing site conditions relevant to coastal processes.
- An assessment of potential construction and operational impacts of the attenuator on existing key natural features such as Cocora Beach and on existing maritime infrastructure including the jetties and mussel farms.
- Identification of any mitigation measures to reduce the potential impacts.

Section 6.2.1 of the Project REF included a summary of the existing environment.

6.2.2 Potential Impacts

There would be no construction impacts to coastal processes as a result of the proposed modification.

Assessment of Impact on Wave Climate at Sensitive Receptors

Numerical modelling was undertaken by Cardno (2018) to assess the impact of the proposed attenuator options on wave climate. The modelling system used was the SWAN spectral wave model. The purpose of the modelling was to:

- Provide an assessment of the wave attenuation properties of the proposed attenuator.
- Provide the met-ocean design criteria (design wave heights and loads), that will inform the design and construction of the proposed wave attenuator.
- Determine the spatially variable wave climate provided in the lee of the wave attenuator.
- Assess the effects of the implementation of the structure, both for the proposed harbour area, as well as across the wider, northern Twofold Bay region.

The potential effects of the proposed wave attenuator within Snug Cove, including the effects of wave reflections are summarised below, for the following sensitive receptor sites:

- The existing Breakwater Wharf.
- The Water Police Jetty (WPJ).

- The Cat Balou Cruise Pontoon.
- The Multipurpose Jetty (MPJ), the seaward end.
- The Eden Slipway – as depicted in Figure 6-3.

Figure 6-3 Location of sensitive receptor sites within Snug Cove (Source: Cardno 2018)

Wave Attenuation and Reflection

The effect of the proposed attenuator on the 1-year average recurrence interval (ARI) significant wave height (for local sea waves) throughout Snug Cove is presented in Figure 6-4. Results are provided in the form of a wave reduction/amplification factor, where reductions to the design wave height provide a factor of <1 (blue), and increases provide a factor of >1 (red). Superimposed upon this figure are the locations of the sensitive receptor sites.

The results show the degree of protection offered to the region in the lee of the wave attenuator, as indicated by the zones marked in blue. However, the results also show that wave reflections from the attenuator may cause an increase in the 1-year ARI wave heights at other locations within Twofold Bay. Figure 6-4 shows that during periods of southerly to south-westerly winds, wave reflections from the attenuator will be directed towards the Breakwater Wharf and the NSW Water Police Jetty. The wave reflections will increase the 1-year ARI wave heights by between 10% and 30% at these locations. Results for the 50-year ARI significant wave heights are presented in Figure 6-5, and they demonstrate a similar pattern of wave reflections.

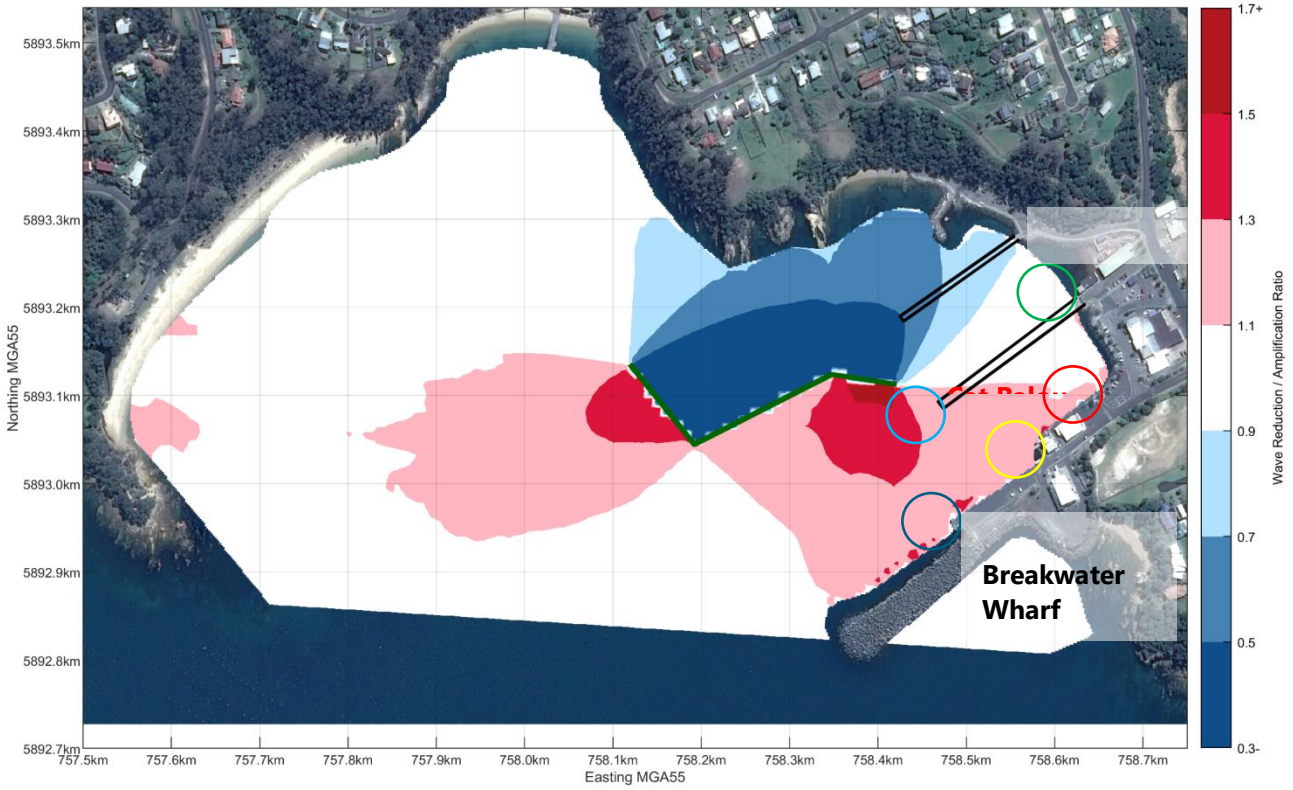


Figure 6-4 Design Wave Impact Plot for 1-year ARI Local Sea Waves (Source: Cardno 2018)

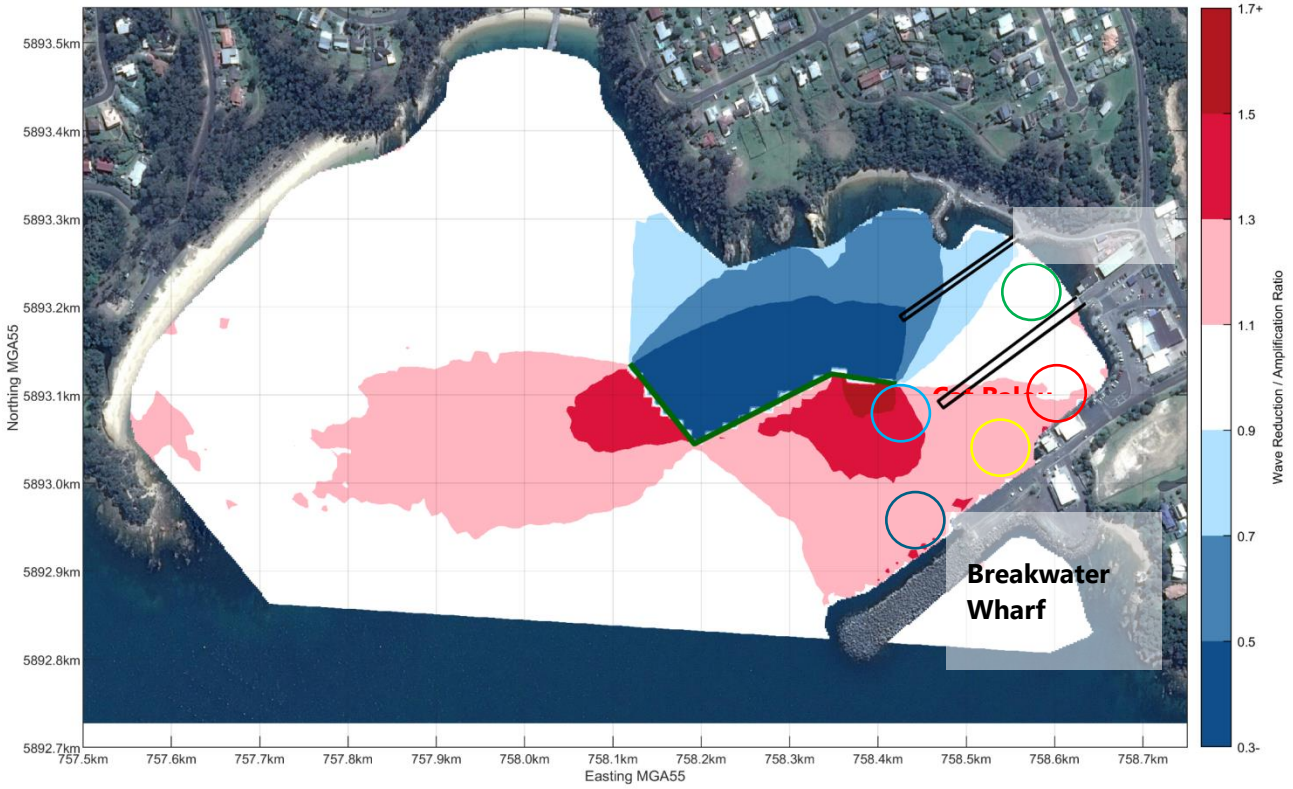


Figure 6-5 Design Wave Impact Plot for 50-year ARI Local Sea Waves (Source: Cardno 2018)

Summary of changes in significant wave heights

Table 6-2 to Table 6-4 below summarise the change in *significant*[1] wave height (Hs) when compared with existing conditions at each of the sensitive receptor sites.

Table 6-2 Change in *significant* wave height at Cat Balou and the Water Police Jetty (Cardno 2018)

Output Location	Cat Balou Pontoon			Water Police Jetty		
	Existing	Post Attenuator	Impact	Existing	Post Attenuator	Impact
50-years ARI	0.65	0.72	+0.07 (11%)	0.72	0.84	+0.12 (17%)
1-year ARI	0.50	0.55	+0.05 (10%)	0.55	0.64	+0.09 (16%)
1% Exceedance	0.36	0.40	+0.04 (11%)	0.40	0.47	+0.07 (18%)
10% Exceedance	0.23	0.26	+0.03 (13%)	0.25	0.30	+0.05 (20%)
50% Exceedance	0.05	0.06	+0.01 (20%)	0.07	0.08	+0.01 (14%)

Table 6-3 Change in *significant* wave height at the Breakwater Wharf and Multi-Purpose Jetty (Cardno 2018)

Output Location	Breakwater Wharf			Multi-Purpose Jetty (Seaward End)		
	Existing	Post Attenuator	Impact	Existing	Post Attenuator	Impact
50-years ARI	0.73	0.88	+0.15 (21%)	0.87	1.01	+0.14 (16%)
1-year ARI	0.55	0.67	+0.12 (22%)	0.65	0.76	+0.11 (17%)
1% Exceedance	0.40	0.49	+0.09 (23%)	0.47	0.55	+0.08 (17%)
10% Exceedance	0.25	0.32	+0.07 (28%)	0.30	0.35	+0.05 (17%)
50% Exceedance	0.08	0.11	+0.03 (38%)	0.09	0.10	+0.01 (11%)

[1] *Significant* wave height refers to the average height of the highest one-third of waves in a wave train.

Table 6-4 Change in *significant* wave height at the Slipway (Cardno 2018)

Output Location	Slipway		
	Existing	Post Eden Attenuator	Impact
50-years ARI	0.73	0.72	-0.01 (-1%)
1-year ARI	0.56	0.55	-0.01 (-2%)
1% Exceedance	0.42	0.41	-0.01 (-2%)
10% Exceedance	0.27	0.27	0.00 (0%)
50% Exceedance	0.06	0.06	0.00 (0%)

The design Hs at each location is based on analyses of full hindcast time series that include all prevailing combinations of wind directions and resultant incident and reflected wave directions. The increase in Hs observed at Cat Balou, Water Police Jetty, the Breakwater Wharf and the Multipurpose Jetty is likely due to the fact that presently, these locations are really only exposed to winds and waves from the southwest sectors (noting that there is a limited fetch for westerly waves). However, following construction of the attenuator, these locations will not only remain exposed to those waves, but also to waves from the south or south-southwest that will reflect off the wave attenuator.

Impact at Water Police Jetty

From the results of the modelling, the design Hs at the Water Police Jetty for 1 and 50-years ARI will increase by approximately 17% as summarised in Table 6-2. A similar magnitude of change is expected for the 1% and 10% exceedance Hs parameters (i.e. the wave height expected to be exceeded 1% or 10% of the time over any one year, which is representative of day-to-day conditions). The median Hs is increased by only 1cm.

The increases to the design Hs at the Water Police Jetty can be attributed to wave reflections from the attenuator. Incident waves from the S to SSE sectors are likely to be reflected from the central arm of the attenuator and are directed eastward.

It should be noted that the reflected waves would be likely to affect the WPJ when the incident wave direction is from the south and south-southeast under these conditions at present, the incident wave conditions at the Water Police Jetty would be much lower due to sheltering from the existing breakwater. Reflected waves from the attenuator would approach the Water Police Jetty from the northwest.

When the incident waves approach the Water Police Jetty from the west-southwest, which is currently the most exposed wave direction, it is not expected that the conditions at the Water Police Jetty would be different from today as these waves would not be subject to reflections from the wave attenuator.

It is not likely that the predicted increase in wave heights at the Water Police Jetty would have any adverse impacts on the structural integrity of the jetty, as the increase is relatively minor and should be able to be accommodated by the existing structure.

Impact at Cat Balou

From the results of the modelling, the design Hs at the Cat Balou pontoon for 1 and 50-years ARI will increase by around 10% as summarised in Table 6-2. A similar magnitude of change is expected for the 1% and 10% exceedance Hs parameters. The median Hs is increased by only 1 cm.

As is the case for the Water Police Jetty, the increases to the design Hs at the Cat Balou Pontoon can be attributed to wave reflections from the attenuator. Incident waves from the south to south-southeast sectors are likely to be reflected from the central arm of the Snug Cove attenuator and are directed eastward.

The Cat Balou pontoon is less impacted by the wave reflections than the Water Police Jetty, due to sheltering from the eastern end of the attenuator. Wave height changes at Cat Balou are generally less than 7cm.

Impact at Breakwater Wharf

At the Breakwater Wharf, the design Hs for 1 and 50-years ARI will increase by around 20% as summarised in Table 6-3. A similar magnitude of change is expected for the 1% and 10% exceedance Hs parameters. The median Hs is increased by only 3cm.

As is the case for the Water Police Jetty and Cat Balou, the increases to the design Hs at the Breakwater Wharf can be attributed to wave reflections from the attenuator. Incident waves from the south to south-southeast sectors are likely to be reflected from the central arm of the attenuator and are directed south back onto the Breakwater Wharf. As per the Water Police Jetty and Cat Balou, the Breakwater Wharf is currently sheltered from southerly waves; however, the wharf would now be exposed to southerly waves reflected from the wave attenuator.

The reflection of waves (local seas) towards the Breakwater Wharf would not be expected to impact adversely on vessels using this structure since such vessels are typically large tugs and, in the future, would include cruise ship vessels, which do not respond to the short period local seas. Due to the wave reflections, recreational vessels should not be moored along the Breakwater Wharf during strong winds from the south to west sector.

Impact at Multipurpose Jetty

At the Multipurpose Jetty, the design Hs for 1 and 50-years ARI will increase by around 17% as summarised in Table 6-2. A similar magnitude of change is expected for the 1% and 10% exceedance Hs parameters. The median Hs is increased by only 1cm.

As is the case for the Water Police Jetty and Cat Balou and the Breakwater Wharf, the increases to the design Hs at the Multipurpose Jetty can be attributed to wave reflections from the attenuator.

Impact at Slipway

The modelling indicates that the Slipway would not be significantly affected as it is between the zone that is sheltered and the zone impacted by wave reflections from the attenuator.

Overall Impact

The overall *significant* wave height for the 1-year ARI from the Cardno wave modelling for seas from all directions and water levels between lowest astronomical tide and highest astronomical tide is

illustrated in the sketch provided in Appendix D. It is considered that the attenuator provides sufficient sheltering to provide a wave climate that can be classified as "moderate" or better according to Australian Standards (AS3962), to most of the area covered by the concept footprint of the proposed Snug Cove marina.

6.2.3 Mitigation Measures

Based on the findings of the assessment, no mitigation measures for the construction phase were recommended. Proposed mitigation measures to manage potential impacts are contained in Table 6-5. Note: additional measures are included in bold and italicised font and deleted measures are shown in strikethrough.

Table 6-5 Proposed Coastal Processes Mitigation Measures

No.	Mitigation Measure	Phase
CP1 *	The loading from waves and, to a lesser extent, tidal and wind driven currents as well as propeller wash from tugs and bow thrusters from cruise ships during manoeuvring to and from the Breakwater Wharf extension will need to be considered in the further design of the attenuator ~~with consideration of the difference in magnitude with attenuator type (fixed or floating)~~.	Design
CP2	Cocora Beach is sensitive to wave climate, therefore any wave attenuator must minimise any alteration to the wave climate along the beach, such as alteration to the wave direction (which governs alignment) and wave energy, and impact on the outlook from the beach.	Design
CP3 *	Recreational vessels ~~should~~ ***are*** not ***to*** be moored along the Breakwater Wharf during strong winds from the south to west sector due to expected significant levels of reflected wave energy (local seas) from the attenuator.	Operation
CP4	Monitoring of wave conditions in the vicinity of the Water Police Jetty, Breakwater Wharf and Cocora Beach be considered (visual) to assess the actual extent in practice of wave reflection from the attenuator towards these areas.	Operation

6.3 Other Impacts

A description of other impacts relevant to the proposed modification is included in the Project REF.

6.3.1 Existing Environment and Potential Impacts

Table 6-6 summarises the existing environmental and potential impacts in relation to water quality, traffic and access, land use and property, visual amenity and noise and vibration.

Table 6-6 Existing Environmental and Potential Impacts

Environmental Factor	Existing Environment	Potential Impacts
Water quality	The site is located in Snug Cove within Twofold Bay, open oceanic embayment. Twofold Bay is a significant area for the farming of blue mussels.	The proposed modification will not generate any additional construction or operational water quality impacts outside of Section 6.3.2 of the Project REF.
Traffic and access / Land use and property	Vehicle access to Snug Cove Port infrastructure is primarily by Weecoon Street, Imlay Street and Albert Terrace. Snug Cove is located within Twofold Bay.	Additional swing moorings may relocation by Roads and Maritime. The modified location and alignment of the attenuator will not impact the movements of other marine vessels throughout Snug Cove. An assessment of impact on wave climate at sensitive receptors is set out in Section 6.2.2. Navigational lighting is proposed along the attenuator. No pedestrian access is proposed to the attenuator.
Visual amenity	Snug Cove is a semi enclosed harbour landscape with elevated views across the harbour.	The modified location and alignment will not create any significant visual impacts and is generally consistent with the Project REF.
Noise and vibration	The nearest sensitive receivers are located to the east in the Snug Cove commercial area and along By Street.	The proposed modification will not generate any additional construction or operational noise and vibration impacts outside of Section 6.8.2 of the Project REF.

6.3.2 Mitigation Measures

No additional mitigation measures are required in relation to water quality, traffic and access, land use and property, visual amenity and noise and vibration.

7 Environmental Management

7.1 Environmental Management Plans

A number of mitigation measures have been identified to minimise adverse environmental impacts, which could potentially arise as a result of the proposed modification. Should the proposed modification proceed, these measures would be addressed in a CEMP that would be prepared as outlined in Section 7.1.1 of the Project REF.

7.2 Summary of Mitigation Measures

The mitigation measures identified in the Project REF have been revised to mitigate impacts of the proposed modification and to better align with the Project. Table 7-1 below provides the revised mitigation measures. Note: additional measures identified in this AREF are included in bold and italicised font and deleted measures are shown in strikethrough.

Table 7-1 Summary of Proposed Mitigation Measures

No.	Mitigation Measure	Phase
All	A CEMP and associated Monitoring Plan be developed and implemented for the Project. The CEMP is to be to the satisfaction of the Department and in consultation with relevant agencies.	Pre-construction and Construction
~~All~~	~~An OEMP be developed and implemented for the Project. The OEMP is to be to the satisfaction of the Department and in consultation with relevant agencies.~~	~~Pre-operation and Operation~~
A1	To minimise damage to sensitive marine habitats (seagrass and subtidal rocky reef) in the immediate site, Snug Cove and Cattle Bay, all vessels will avoid anchoring over areas of sensitive habitat including mapped seagrass beds and areas of subtidal rocky reef, where practicable.	Construction and Operation
A2	To reduce the potential impacts of water quality on marine habitats during construction the following measures will be adopted: • All construction vessels will be well maintained and regularly serviced to ensure they are in proper working order and reduce the likelihood of fuel / oil leaks and spills. • Contractors will ensure their vessels maintain their septic tanks and pumps so that they do not leak. No release of sewage into the waterway will be allowed. • Oil and sewage spill response kits will be readily available on the construction vessels and training should be provided to construction staff on their use. The location of these should be clearly marked. • Any ongoing washing of the wave attenuator following construction will be undertaken with marine environmentally friendly and biodegradable products only. Contractors will adopt appropriate waste management, with all general waste contained ~~of~~ and disposed of onshore in waste collection devices and all construction waste removed from the	Construction

No.	Mitigation Measure	Phase
	site. Post construction a seabed clearance survey will be undertaken to ensure that this has occurred.	
A3	To reduce the spread of suspended sediments generated during piling and the potential for sedimentation / smothering of sensitive habitats and associated flora and fauna, silt curtains or similar will be used wherever possible around the immediate area of piling. Particularly to separate the construction areas from areas of sensitive habitat. If it is possible, the use of sleeves around piles during pile driving will also help to contain the spread of suspended sediment so it does not impact on the nearby areas of macroalgae during piling activities.	Construction
A4	To reduce the potential for lighting related impacts on marine fauna construction activities will not be undertaken during the evening and night time to reduce the overall need for construction related artificial lighting (on vessels and the attenuator) and associated impacts.	Construction and Operation
A5	The risk of vessel strike during construction may be reduced through the adoption of: • All vessels associated with construction will travel at speeds no higher than 10 knots within the port limits unless necessary due to navigational safety. • Vessels will maintain a 300m exclusion zone with all whales when travelling to site where practicable except for predominately white whales where there is to be a 500m exclusion zone. • Site inductions and training. • Active management, such as regular information exchange on known marine mammal activity (e.g. via local residents, commercial fishers, mussel farmers, NPWS whale watch and Cat Balou Cruises). • Marine fauna awareness in the local waterway by vessel operators so appropriate speeds and clearance can be adopted when cetaceans are nearby.	Construction
A6 *	To reduce the potential for noise impacts on marine fauna (specifically marine mammals) the following ~~should~~ be applied ***and adjusted, as required, based on the Contractor(s) piling methodology and the recommendations of the Blue Planet Marine (2018) acoustic monitoring***: a) Pre-start Observation: Marine mammal observers must visually monitor observation and shut-down zones for whales for a minimum of 30 minutes before the commencement of piling. Observation zone is defined as: ~~a) During September, October and November~~ ***A*** horizontal radius determined from the piling equipment of 2~~.2~~km.	Construction

No.	Mitigation Measure	Phase
	~~b) During January, February, March, April, May, June, July, August and December a horizontal radius determined from the piling equipment of 1.5kms.~~ Shut-down zone is defined as: ~~a) During September, October and November~~ ***A*** horizontal radius determined from the piling equipment of 1.~~3~~km. ~~b) During January, February, March, April, May, June, July, August and December a horizontal radius determined from the piling equipment of 1km.~~ b) Soft-Start Procedure: If after the 30 minute pre-start observation no whale/s have been spotted within the observation or shutdown zone a soft start procedure may commence with a gradual increase in piling impact energy of no more than 50% of full impact energy for 10 minutes. The soft start procedure must be implemented after breaks in piling driving of 30 minutes or more. c) Stand by procedure: If a whale is spotted within the observation zone during the soft start procedure the operator of the piling equipment must be placed on standby to shut-down the piling rig and a trained crew member should continuously monitor the whale/s in sight at all times. d) Normal Piling Procedure: If no whale/s has been sighted during the soft-start procedure full impact piling may commence. The use of bubble curtains around areas of piling could also be adopted to reduce noise impacts on marine fauna. Shut-Down requirements: a) If visibility is poor and the marine mammal observer is unable to clearly identify objects to the full observation zone distance, a vessel or aircraft search must be conducted or the action postponed until visibility has improved. b) Piling is not permitted between 6.00 pm and 7.00 am. c) If any whales are spotted within the shut-down zone, piling must cease immediately or as soon as safe to do so until the whale/s has moved outside of the shut-down zone. d) All piling must cease for a minimum of 1 hour after the last sighting of a whale within the observation zone. Piling must recommence at the prestart observation after the one hour shutdown has elapsed. All standard management and mitigation measures in Section 5.3 of the Underwater Piling Noise Guidelines (Government of South Australia, 2012) are to be implemented during piling.	
A7	The goals of the *NSW Invasive Species Plan 2008 – 2015* (NSW DPI 2008) will be adopted for the Project.	Construction and Operation
A8	All Contractors will undertake a Vessel Risk Assessment (VRA) prior to mobilisation to the site. The VRA may be undertaken by the vessel owner / operator. All vessels, floating plant and equipment	Construction

No.	Mitigation Measure	Phase
	mobilised to site from any place inside or outside of Australia will be subject to VRA. Contractor(s) will provide the VRA to the Principal four weeks prior to mobilisation.	
A9	The Contractor(s) will undertake an Invasive Marine Species (IMS) Inspection of all vessels brought to Twofold Bay. The IMS will be undertaken by an appropriately qualified marine scientist with experience in biosecurity of marine vessels, floating plant and equipment. The Contractor(s) is responsible for arranging the IMS inspection, reporting and attendance of DPI Fisheries or other suitably qualified personnel. All IMS Reports are to be provided to DPI Fisheries at least 2 weeks prior to the vessel departing its current location en-route to Eden.	Construction
A10	Construction vessel antifouling will be maintained to avoid the attachment and potential translocation of invasive species into and out of Twofold Bay.	Construction
A11	Ballast water management will be implemented: • Ballast water exchange by domestic vessels will be avoided. • Domestic vessels will manage ballast water in accordance with the *Australian Ballast Water Management Requirements*. (Department of Agriculture and Water Resources 2016). • Any ballast water exchange from international vessels will be undertaken in accordance with the *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (BWM) (IMO 2016).	Construction
A12	Monitoring and inspection / surveillance of the construction vessels and barges will be undertaken in accordance with the *Biosecurity Act 2015*.	Construction
A13	DPI Fisheries (1800 043 536) is to be immediately notified of any fish kills in the vicinity of the works. In such cases, all works other than emergency response procedures are to cease until the issue is rectified and written approval to proceed is provided by DPI Fisheries.	Construction
CP1*	The loading from waves and, to a lesser extent, tidal and wind driven currents as well as propeller wash from tugs and bow thrusters from cruise ships during manoeuvring to and from the Breakwater Wharf extension will need to be considered in the further design of the attenuator ~~with consideration of the difference in magnitude with attenuator type (fixed or floating)~~.	Design
CP2	Cocora Beach is sensitive to wave climate, therefore any wave attenuator must minimise any alteration to the wave climate along the beach, such as alteration to the wave direction (which governs alignment) and wave energy, and impact on the outlook from the beach.	Design
CP3*	Recreational vessels ~~should~~ ***are*** not ***to*** be moored along the Breakwater Wharf during strong winds from the south to west sector due to expected significant levels of reflected wave energy (local seas) from the attenuator.	Operation
CP4	Monitoring of wave conditions in the vicinity of the Water Police Jetty, Breakwater Wharf and Cocora Beach be considered (visual)	Operation

No.	Mitigation Measure	Phase
	to assess the actual extent in practice of wave reflection from the attenuator towards these areas.	
WQ1	The following general construction mitigation measures will be adopted by the Contractor(s) to reduce impacts on water quality: • All construction equipment and vessels will be inspected by qualified personnel prior to commencement of work, to reduce the risk of hydrocarbon spills or leaks. • Containment measures will be utilised to minimise spillage associated with pile replacement or repair, grouting and concreting. • A turbidity curtain with a minimum drop of 4m and floating booms will be used locally around the perimeter of pile drilling works to limit the spread of plumes generated by drilling activities. Drilling spoil and cuttings will be deposited at seabed level within the site and contained within the turbidity curtain. • Portable toilets will be emptied on a regular basis using licenced service provider and human waste disposed of to a local sewage treatment plant. • Spill response kits (including hydrocarbon booms) will be located around the construction site and on-board construction vessels to facilitate containment of any water based spills. • The existing dedicated oil spill recovery area at the landward end of the Breakwater Wharf, containing spill containment booms and chemical absorbent materials will be maintained and operated by PANSW. • The Contractor(s) is to consult with the Harbour Master related to any request for additional equipment or services from PANSW relating to the mitigation of spills during construction works. • Environmentally friendly/water based drilling muds will be used for pile drilling activities. • Industry standards, PANSW and pollution prevention regulations will be adhered to during refuelling, transfer, storage and handling of hazardous materials. • The lowest volumes of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site. • Chemical storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS) and AS 1940 on board construction and dredging vessels, and land-based construction areas. • Vessels (self-propelled and unpowered) will have adequate on-board communication, containment, drainage, bunding and monitoring systems to prevent discharges of unauthorised effluents. • Bunkering standard operating procedures will be implemented.	Construction

No.	Mitigation Measure	Phase
	• Spill response strategy and procedures will include the contact details of the relevant authorities to be notified in the event of a spill, including the PANSW. • Appropriate sediment and erosion management controls to minimise water quality impacts from surface runoff are to be implemented by the Contractor(s) in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004). All erosion and sediment controls are to be in place prior to the commencement of any landside works, inspected regularly and maintained throughout construction, and removed only once all disturbed areas have been reinstated. • Weather and tide forecasts will be checked regularly during construction. Where flooding is forecast to the work area, all equipment and materials will be removed from the landside construction zone or appropriately secured above expected flood levels in the area.	
WQ2	The following general mitigation measures will be adopted by the wave attenuator operator to reduce operational impacts on water quality: • Vessels (self-propelled and unpowered) will have adequate on-board communication, containment, drainage, bunding and monitoring systems to prevent discharges of unauthorised effluents. • Appropriate inductions/training will be performed detailing the potential water quality impacts and relevant spill and emergency response procedures. Contractor(s) to perform regular spill response drills. • Spill response strategy and procedures will include the contact details of the relevant authorities to be notified in the event of a spill, including the PANSW.	Operation
T1	The Contractor(s) CEMP is to address construction traffic and access management including the following measures: • Identify roads to be utilised as part of construction and measures to ensure construction vehicles follow the routes. The entry and egress routes for construction vehicles would be selected from the following permitted routes: 1. Princes Highway, Imlay Street (subject to maximum load limits of 20-22 tonnes), Albert Terrace and Weecoon Street. 2. As per 1 above, except for alternative construction routes to detour from use of Imlay Street through Eden Town Centre (between Mitchell Street and Chandos Street), as required. • Identify and implement marine construction and vessel mooring zones and measures to delineate these areas to ensure protection of construction vessels and existing and future port users where may be required by the Harbour Master.	Pre-Construction and Construction

No.	Mitigation Measure	Phase

	• Measures to maintain access to the Multipurpose Jetty or other arrangements for vessels utilising this jetty.
	• Measures for safe passenger access, if cruise ships moor in Twofold Bay and tenders to and from the Port of Eden operating during construction.
	• Measures to minimise disruption to Port businesses including maintenance for pedestrian and vehicle access and parking and provision of directional signage.
	• Measures, where required, to physically separate pedestrian and construction vehicle movements, such as temporary barriers.
	• Minimise traffic associated with construction activities.
	• Whilst construction vehicles use Council local roads:
	  ○ Any Oversize/Overmass or Performance Based Standards permits required during the period of construction will be submitted to the National Heavy Vehicle Regulator (NHVR) for approval.
	  ○ Where any part of the vehicle, including its load or any equipment, exceeds 4.9m in height, approval will be obtained in writing from Essential Energy. This approval will be obtained and complied with in addition to any other clearance requirements in force along the route.
	  ○ Vehicles will remain on the sealed section of carriageway for the entirety of its journey when practical.
	  ○ Trucks will enter and leave the Site in a forward direction where possible.
	  ○ Exhaust brakes will not be used in built up areas.
	  ○ For any over-dimension loads, two additional pilot vehicles will accompany the permit vehicle from the Mitchell Street/Princes Highway Roundabout to the site.
	• Erect direction and speed signage as required.
	• Ensure all vehicles are properly maintained so emissions are within legal limits.
	• Ensure vehicles keep within legal and Site speed limits.
	• Retain access for existing commercial users of the port.
	• Use broadband reversing alarms on all vehicles where reversing alarms are fitted to muffle the noise.
	• Consultation with PANSW during construction to ensure maintenance of safe navigation for shipping.	

T2	The Contractor(s) will prepare and implement any management plan(s) that may be required in a Harbour Master Approval for the Project.	Pre-Construction and Construction
T4	Movement of vessels will be in accordance with Harbour Masters directions.	Construction and Operation
V1	A standard grey Portland Cement will be employed for all concrete elements, which will eventually weather to more muted tones to blend with the background landscape.	Design
V2	The wave attenuator structure is constructed with minimal use of reflective materials. Where painted finishes are to be applied, it is	Design

No.	Mitigation Measure	Phase
	recommended that these are of a matt finish where practical, including for white caps to pile heads, if these are required.	
L1	The CEMP will be prepared and implemented to manage the impacts of the construction works.	Pre-Construction and Construction
L2	Relocation of impacted swing moorings will be managed by Roads and Maritime within the designated timeframe.	Pre-Construction
L3	The defined "Marine Construction Zone" and "Construction Vessel Mooring Zone" will be implemented to ensure protection of construction vessels, aquatic habitats, marine fauna and other port users.	Construction
S2	PANSW will be consulted during construction and operation to ensure maintenance of safe navigation for vessels.	Construction
S3	Opportunities for local and Aboriginal workforce participation will be enhanced during the construction.	Construction
NV1	The Contractor(s) CEMP is to address construction noise and vibration management including detail for a targeted range of management and monitoring options of noise from construction activities.	Pre-Construction and Construction
NV2	The Contractor(s) will provide respite periods where noise exceeds the Highly Affected Noise level of 75dB $L_{Aeq,\ 15\ minute}$. The timing of respite is to be determined by the Principal in consultation with the Community Liaison Group.	Pre-Construction and Construction
NV3	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce the impacts on noise amenity through source controls: • Where possible, plant and equipment will be selected that can be fitted with options to minimise noise such as covers, mufflers, shrouds and other noise suppression equipment. • Plant and equipment will be turned off and not left idling when not in use. Anchorages and moorings are to be used for boats or other water craft if necessary. • Plant and equipment will be operated in accordance with industry standards and have been serviced as per manufacturer specifications. • Noisy plant and equipment will be oriented away from sensitive receivers where possible. • Temporary screens or other items that provide a noise buffer (including plant and equipment) will be used proximate to noise sources. • Low noise emission plant and equipment will be selected where available. • Broadband reversing alarms or similar will be used as an alternative to a traditional beeper reversing alarm for vehicles permanently on-site. • Plant and equipment will be well maintained and serviced regularly to ensure it is not generating excessive noise. • Tools will not to be dropped from a height onto hard surfaces.	Construction

No.	Mitigation Measure	Phase
NV4	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce the impacts on noise amenity through administration controls: • The use of horns and alarms will be minimised. • The staff and visitor induction protocols will include awareness of noise generating activities and mitigation measures and techniques that should be implemented. • Training will be conducted for appropriate community behaviours when access/egress the site.	Construction
NV5	The following general construction mitigation measures will be implemented by the Principal to reduce the impacts on noise amenity through community management: • The community will be notified by the Principal one week prior to noise intensive activities commencing, such as piling. • The community will be informed by the Principal one week prior to any planned out of hours work commencing. • A complaints procedure will be implemented by the Principal and contact details provided to potentially affected residents and businesses in the area. • The Principal complaints procedure will include a record of complaints indicating cause and measures taken to resolve/minimise cause.	Construction
NV6	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce the impacts on noise amenity through site controls: • Works will be scheduled to minimise the number of noisy plant and equipment operating at any one time. • Construction activities will be planned to minimise vehicular movements around the site. • Arrange worksites will avoid or minimise reversing movements and where possible, ensure vehicles enter and exit work sites in a forward direction.	Construction
NV7	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce the impacts of vibration: • High vibration methods will be substituted with lower vibration methods where possible. • Alternatives to high vibration plant and equipment will be used where possible.	Construction
NV8	The following general construction monitoring will be implemented by the Contractor(s) to reduce the impacts of vibration due to piling: • The Contractor(s) will monitor the piling-induced vibration at the nearest receivers at the commencement of piling works to ensure the actual vibration is within the limits in the *Assessing Vibration: A Technical Guideline* and the *German Standard DIN 4150-3-1999 Structural Vibration – Part 3 Effects of Vibration on Structures*.	Construction

No.	Mitigation Measure	Phase
AQ1	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce the impacts to air quality: • All plant and equipment used during the construction works will be regularly maintained to comply with the relevant exhaust guidelines. • Any visible and persistent dark emissions from vessel exhausts will be reported and the equipment repaired or replaced as soon as practicable. • All operations and activities occurring at the premises will be carried out in a manner that will minimise the emission of dust from the premises.	Construction
AQ2	Comprehensive vessel/ship refuelling procedures will be implemented by the Contractor(s) to avoid or reduce the possibility of release. As a minimum, these procedures will include: • Adhering to all PANSW Port Safety Operating Licence requirements. • Refuelling during daylight hours where possible, depending on sea conditions. • Training personnel involved with refuelling or fuel transfer in their roles, functions and responsibility, including emergency response. • Maintaining open communication channels. • Deploying spill prevention systems in accordance with established procedures and regulatory requirements. • Maintaining emergency response equipment to ensure that it is readily available.	Construction
H1	Project staff and Contractor(s) will be made aware of their statutory obligations for heritage under the *National Parks and Wildlife Act 1974* through the site induction and toolbox talks. The Contractor(s) are to include an Aboriginal Culture Awareness module in its induction training in which the local Aboriginal community will be invited to present.	Construction
H2	In the event that any Aboriginal objects are disturbed and identified within the area of works, works within the immediate vicinity of the Aboriginal object will cease forthwith and the OEH contacted so that appropriate management strategies can be identified and followed.	Construction
H3	In the event that skeletal remains are uncovered, works in the immediate area will cease, the area will be cordoned off and the NSW Police Coroner will be contacted to determine if the material is of Aboriginal origin. If determined to be Aboriginal, the OEH Enviroline 131 555 and relevant Aboriginal stakeholders will be contacted to determine an action plan for the management of the skeletal remains prior to works re-commencing.	Construction
H4	All relevant staff and contractors will be trained regarding their statutory obligations and responsibilities under the *Heritage Act 1977* and best practice outlined in The Burra Charter 2013, through	Construction

No.	Mitigation Measure	Phase
	the site induction and toolbox talks in the event suspected historical cultural material is uncovered.	
H5	In the event that any potential archaeological 'relics' or 'historic shipwrecks' are disturbed and identified within the site during construction works, all work in the area will cease forthwith and the Heritage Division and a qualified archaeologist will be consulted to determine an appropriate course of action prior to the recommencement of work in the area of the 'relic' or 'historic shipwrecks'.	Construction
~~C1~~	~~Table C1 in Appendix C of the Geotechnical Investigation Interpretive Report for the Wave Attenuator (Tectonic, 2015) provides geotechnical design parameters based upon the results of borehole and laboratory testing. Design of either a fixed or floating wave attenuator will be completed according to geotechnical design parameters outlined by Tectonic (2015).~~	~~Design~~
CI1	Preparation and implementation of a CEMP to manage the impacts of the construction works.	Pre-Construction and Construction
CI2	Implementation and adherence to the defined "Marine Construction Zone" and "Construction Vessel Mooring Zone" to ensure protection of construction vessels, aquatic habitats, marine fauna and other port users.	Construction
CI3	Navigational hazard lighting *is to be* fitted to the wave attenuator. The Department will consult with PANSW regarding the responsibility for maintaining the navigational lighting once installed.	Operation
CI4	Speed limits for vessels transiting Snug Cove will take into consideration boating hazards and will be enforced as deemed necessary by the relevant authority, being RMS or Water Police.	Operation
G1	Sustainable practices will be implemented during the construction of the proposed wave attenuator, including: • Recycled construction materials will be used where possible. • Locally sourced construction material that is low maintenance and durable will be used where possible. • PVC plastic will only be used, as required. • Equipment and construction vehicles and marine vessels will not be left idling and switched off when not in use. • Equipment and construction vehicles and marine vessels will be regularly serviced (including preventative maintenance) and removed from site if not working properly (emitting excessive smoke). • Construction works will be planned to ensure minimal movement of equipment and construction vehicles and marine vessels. • Resource use and waste generation will be minimised and all waste will be reused, recycled or disposed of in accordance with best practice and relevant legislation.	Construction
G2	Navigational hazard lighting fitted to the wave attenuator will be solar powered LED light types, where practicable.	Operation

No.	Mitigation Measure	Phase
WM1	The following general construction mitigation measures will be implemented by the Contractor(s) to reduce waste impacts: • All waste will be classified in accordance with the Waste Classification Guidelines (NSW EPA 2014). • No wastes will be disposed of off-shore. • Construction materials will be procured to minimise cut-off and wastage. • Excess construction material suitable for reuse will be returned to the supplier, or recycled, where practicable. • Waste streams will be kept separate onsite to reduce cross-contamination and ensure the wastes are handled and treated appropriately. • Vehicles used for the transportation of waste will be covered to prevent loss of waste. • Waste to be disposed offsite will be disposed to a waste facility that is licenced to receive that type of waste stream. • Waste to be transported offsite would be recorded including type, quantity and destination. • Hazardous waste such as waste oil and lubricating oil will be recycled at an appropriately licenced recycling waste depot. • Portable toilets would be emptied on a regular basis and human waste disposed of to a local sewage treatment plant. • Recycling facilities (garbage bins or other suitable receptacles) would be provided to maximise recycling of waste materials such as plastic, glass, aluminium cans, and paper/cardboard.	Construction
WM2	The following general mitigation measures are to be adopted by the Contractor(s) to reduce operational impacts on waste management: • Vessels (self-propelled and unpowered) will have adequate on-board communication, containment, drainage, bunding and monitoring systems to prevent discharges of unauthorised effluents. • Maintenance materials including waste oil and lubricants would be disposed at an appropriately licenced facility.	Operation

Notes:

A = Aquatic ecology
CP = Coastal processes
WQ = Water quality
T = Traffic and access
L = Land use and property
S = Socio-economic
NV = Noise and vibration
AQ = Air quality
H = Heritage
CI = Cumulative impacts
G = Greenhouse gas and climate change
WM = Waste management

7.3 Permits and Approvals

Prior to the commencement of construction, the Department is required to obtain:

- A Harbour Master Approval from Port Authority of New South Wales (PANSW) under Clause 67ZN of the *Ports and Maritime Administration Regulation 2012* where disturbance of the bed of the port is proposed.
- A Part 7 permit from NSW Department of Primary Industries (DPI) for harm to marine vegetation (macroalgae) under Section 205 of the *Fisheries Management Act 1994*.

8 Conclusion

This AREF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed modification. It has included consideration Clause 228 of the EP&A Regulation and other relevant legislation. It has also considered potential impacts to MNES listed under the EPBC Act.

The proposed modification remains consistent with the objectives of the Project and the intent of the Project REF. The impacts of the proposed modification are considered to be minor and the mitigation measures listed in this AREF would avoid, minimise or mitigate any impacts such that the benefit of the proposed modification would outweigh any potential impacts. As such the proposed modification is considered justified.

Based on the assessment contained in this AREF and subject to adoption and implementation of the mitigation measures outlined in Section 7.2 of this REF, it is considered that the proposed modification is not likely to have a significant impact upon the environment or any threatened species, populations or communities and accordingly an EIS is not required under Division 5.1 of the EP&A Act.

The Project is justified to be approved under Part 5 of the EP&A Act as the potential environmental and social impacts would be able to be managed to an acceptable level. In addition, the Project meets specific objectives of providing a safer harbour for local and visiting vessels and improve the protection of existing maritime infrastructure within Snug Cove, Eden.

9 References

Advisian (2017). Aquatic Ecology Assessment Eden Wave Attenuator.

Advisian (2017). Review of Environmental Factors.

Advisian (2018). Response to Submissions Report.

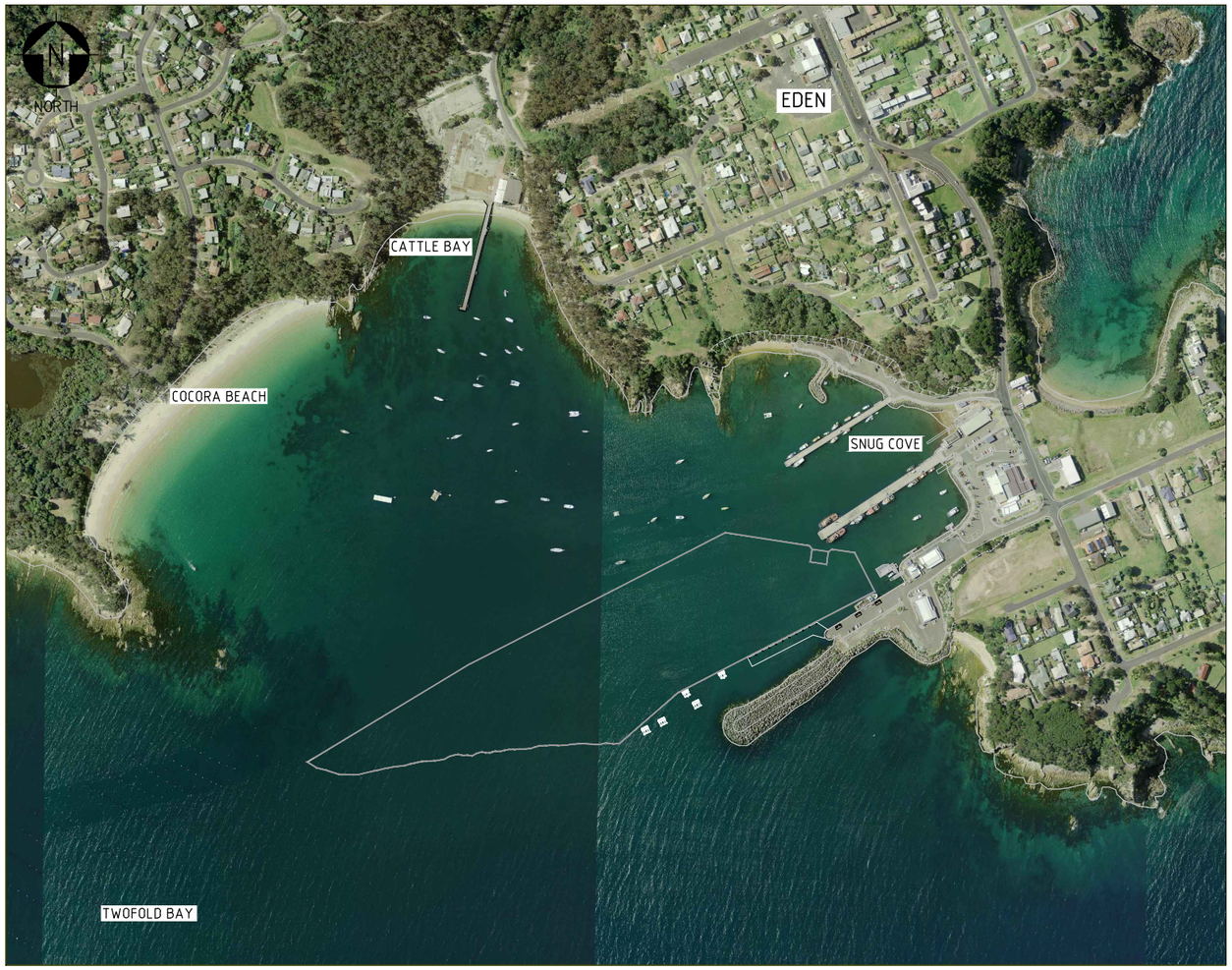
Blue Planet Marine (2018). FINAL REPORT: Assessment of Underwater Sound Levels from Pile Driving at Twofold Bay.

Cardno (2018). Design Basis Report – Revised Draft Revision B.

Royal Haskoning DHV (2017). Eden Safe Harbour Project Coastal Processes Assessment Report.

Appendix A: Concept Design Drawings

EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN
for
NSW DEPARTMENT OF INDUSTRY



LOCALITY PLAN
NTS

DRAWING LIST

DRAWING No	DRAWING TITLE
301311-13734-MA-DWG-0001	WAVE ATTENUATOR CONCEPT DESIGN - COVER SHEET AND DRAWING LIST
301311-13734-MA-DWG-0002	WAVE ATTENUATOR CONCEPT DESIGN - SITE PLAN
301311-13734-MA-DWG-0003	WAVE ATTENUATOR CONCEPT DESIGN - BOREHOLE PLAN
301311-13734-MA-DWG-0004	WAVE ATTENUATOR CONCEPT DESIGN - CONTRACTORS WORK AREA AND CONSTRUCTION ZONES (TO BE PROVIDED)
301311-13734-MA-DWG-0010	WAVE ATTENUATOR CONCEPT DESIGN - GENERAL ARRANGEMENT PLAN
301311-13734-MA-DWG-0020	WAVE ATTENUATOR CONCEPT DESIGN - ELEVATION AND TYPICAL SECTION
301311-13734-MA-DWG-0030	WAVE ATTENUATOR CONCEPT DESIGN - NAVIGATION AIDS PLAN

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A	28.06.18	ISSUED FOR CLIENT REVIEW	VIP	ARG	BSM	CA	PMcC			

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No.
301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

ISSUED FOR TENDER
NOT FOR CONSTRUCTION

CUSTOMER

NSW GOVERNMENT Department of Industry

WorleyParsons resources & energy

EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN

COVER SHEET AND DRAWING LIST

DRG No 301311-13734-MA-DWG-0001 REV B

WORLEYPARSONS_A1_REV2

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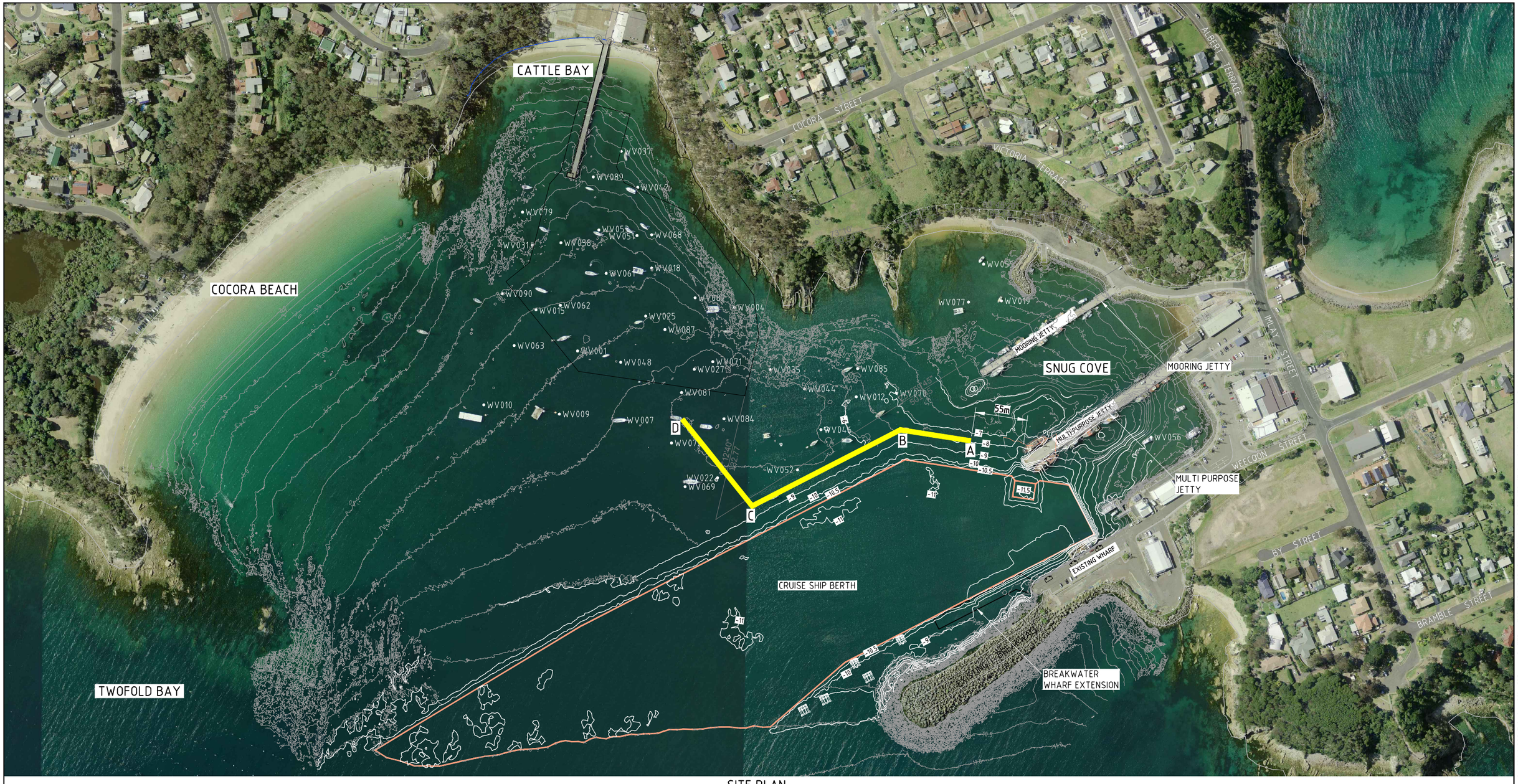

SITE PLAN
1:2000

NOTES:
1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD). CONTOUR INTERVAL IS 0.5m.
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
4. SWING MOORING LOCATIONS PROVIDED BY RMS 25/06/2018.

LEGEND:
- WAVE ATTENUATOR ALIGNMENT
- •WV090 EXISTING MOORING LOCATION
- 2015 SURVEY
- -5 2018 CLEARANCE SURVEY
- CRUISE SHIP BERTH POCKET EXTENT

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B	28.06.18	ISSUED FOR CLIENT REVIEW	VIP	ARG	BSM	CA	PMcC			
A	26.06.18	DRAFT	VIP		BSM					

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No.
301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

ISSUED FOR TENDER
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CUSTOMER

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EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN

SITE PLAN

DRG No 301311-13734-MA-DWG-0002
REV C

WORLEYPARSONS_A1_REV2

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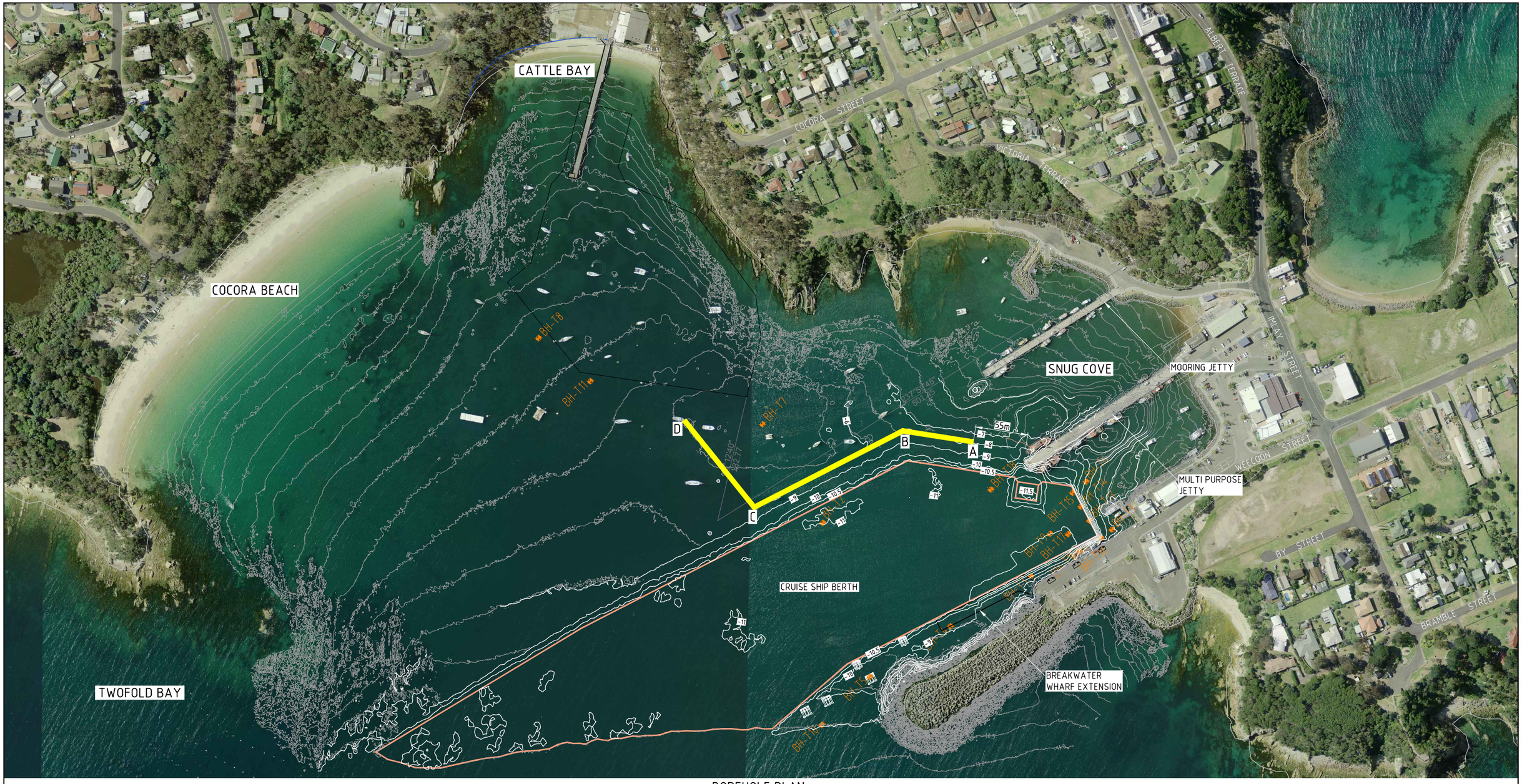

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1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD). CONTOUR INTERVAL IS 0.5m.
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
4. BOREHOLES UNDERTAKEN BY TECTONIC MARCH 2015, REFER TECTONIC REPORT No 15001-005-REV 3 AND No 15001-004-REV 3.

BOREHOLE PLAN

1:2000

LEGEND:

- WAVE ATTENUATOR ALIGNMENT
- 2015 SURVEY
- 2018 CLEARANCE SURVEY
- CRUISE SHIP BERTH POCKET EXTENT
- TECTONIC BOREHOLE LOCATION

SEAWARD FACE OF ATTENUATOR SETOUT TABLE

POINT No	EASTING	NORTHING
A	758421.236	5893112.593
B	758347.561	5893125.177
C	758192.190	5893044.355
D	758119.113	5893135.295

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1:2000 (A1) 1:4000 (A3)

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REF DRAWING No | REFERENCE DRAWING TITLE

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No. 301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

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EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN

BOREHOLE PLAN

DRG No 301311-13734-MA-DWG-0003 REV A

WORLEYPARSONS_A1_REV2

NOTES:

1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD). CONTOUR INTERVAL IS 0.5m.
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. THE SEAWARD FACE OF THE WAVE ATTENUATOR ALIGNMENT IS SUPPLIED BY THE PRINCIPAL AND ARE TO BE ADOPTED BY THE CONTRACTOR.
4. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
5. CHAINAGE SYSTEM IN METRES ROUNDED UP TO NEAREST METRE.
6. NAVIGATION AIDS NOT SHOWN, REFER DRAWING 301311-13734-MA- DWG-0030.

GENERAL ARRANGEMENT PLAN

1:500

LEGEND:

-9 2015 SURVEY

2018 CLEARANCE SURVEY

CRUISE SHIP BERTH POCKET EXTENT

SEAWARD FACE OF ATTENUATOR SETOUT TABLE

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B	758347.561	5893125.177
C	758192.190	5893044.355
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A	28.06.18	ISSUED FOR CLIENT REVIEW	VIP	ARG	BSM	CA	PMcC			

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No.
301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

ISSUED FOR TENDER
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CUSTOMER

NSW GOVERNMENT Department of Industry

WorleyParsons resources & energy

EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN
GENERAL ARRAGEMENT PLAN

DRG No 301311-13734-MA-DWG-0010 REV B

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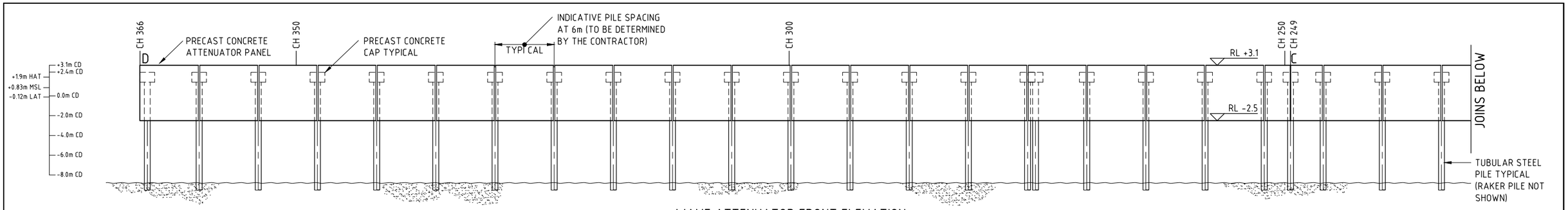
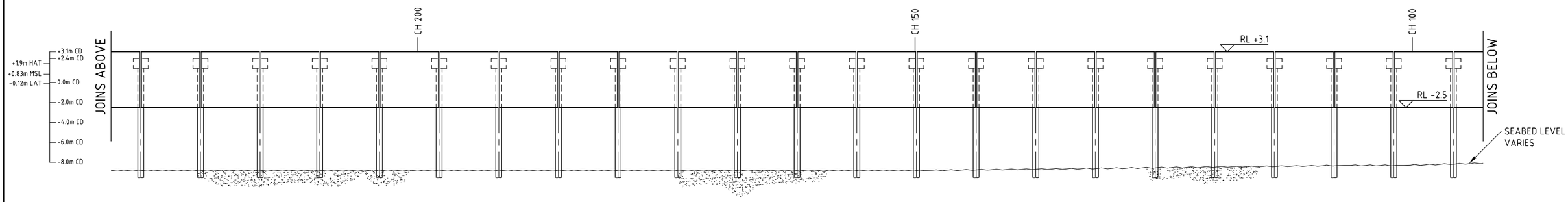
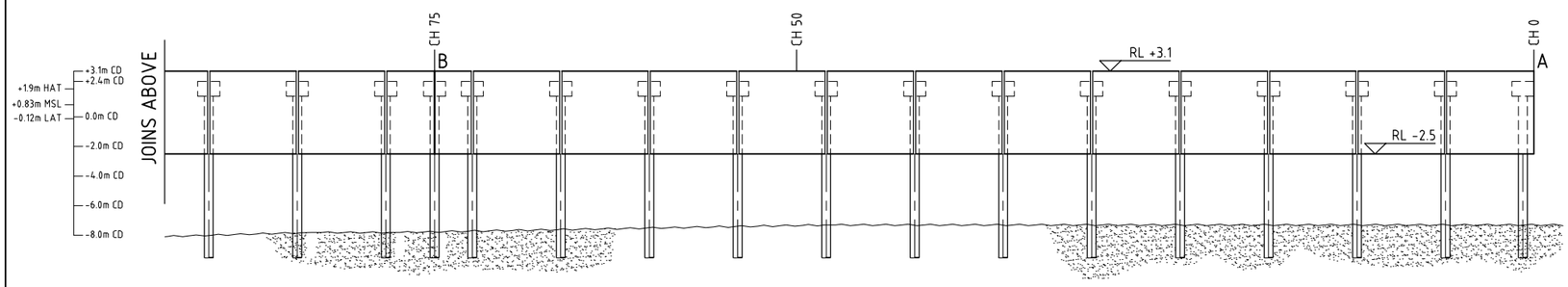
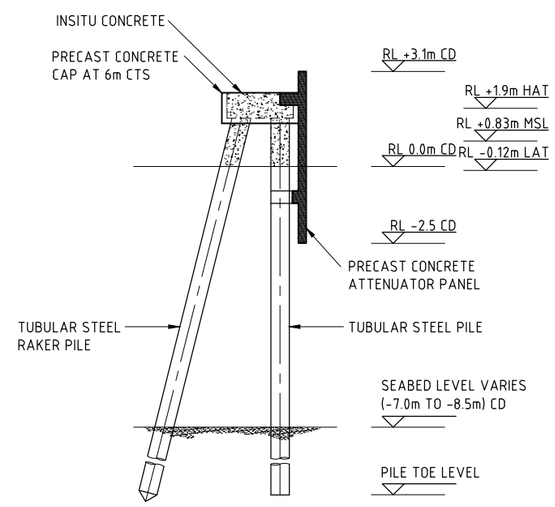


WAVE ATTENUATOR FRONT ELEVATION

SCALE 1:200







INDICATIVE TYPICAL WAVE ATTENUATOR SECTION (TO BE DETERMINED BY THE CONTRACTOR)

SCALE 1:100

NOTES:

1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD)
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. WAVE ATTENUATOR ALIGNMENT SHOWN ON DRAWING 301311-13734-MA-DWG-0010.
4. CHAINAGE SYSTEM IN METRES ROUNDED UP TO NEAREST METRE.
5. THE SEAWARD FACE OF THE WAVE ATTENUATOR ALIGNMENT AND THE TOP AND BOTTOM OF THE PRECAST CONCRETE PANEL LEVELS ARE SUPPLIED BY THE PRINCIPAL AND ARE TO BE ADOPTED BY THE CONTRACTOR
6. TYPICAL WAVE ATTENUATOR SECTION AND PILE SPACING SHOWN ARE INDICATIVE AND BASED ON WATERWAY CONSTRUCTIONS EOI SUBMISSION DATED 19/01/18. THE CONTRACTOR IS RESPONSIBLE FOR DEVELOPING THE CONCEPT DESIGN AND UNDERTAKING DETAILED DESIGN.

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A	28.06.18	ISSUED FOR CLIENT REVIEW	VIP	ARG	BSM	CA	PMcC			

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No. 301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

ISSUED FOR TENDER
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NSW GOVERNMENT Department of Industry

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WorleyParsons resources & energy

EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN

ELEVATION AND TYPICAL SECTION

DRG No 301311-13734-MA-DWG-0020 REV C

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NORTH

GREEN FLASHING 3s STARBOARD HAND LIGHT RANGE 2NM AND DAY MARK WITH GSM REMOTE MONITORING. NAVIGATION AID STAND ALONE PILED STRUCTURE

N7

WHITE FLASHING DANGER LIGHT (TWO QUICK FLASHES) RANGE 1NM. NAVIGATION AID FIXED TO ATTENUATOR STRUCTURE

N6

WHITE FLASHING DANGER LIGHT (TWO QUICK FLASHES) RANGE 1NM. NAVIGATION AID FIXED TO ATTENUATOR STRUCTURE

N4

WHITE FLASHING DANGER LIGHT (TWO QUICK FLASHES) RANGE 1NM. NAVIGATION AID FIXED TO ATTENUATOR STRUCTURE

N3

RED FLASHING 3s PORT HAND LIGHT RANGE 2NM AND DAY MARK WITH GSM REMOTE MONITORING. NAVIGATION AID STAND ALONE PILED STRUCTURE

N2

GREEN FLASHING 3s STARBOARD HAND LIGHT RANGE 2NM AND DAY MARK WITH GSM REMOTE MONITORING. NAVIGATION AID FIXED TO MULTI PURPOSE JETTY

N1

N5

WHITE FLASHING SOUTH CARDINAL LIGHT (SIX QUICK FLASHES, ONE LONG FLASH) RANGE 1NM AND DAYMARK WITH GSM REMOTE MONITORING. NAVIGATION AID FIXED TO ATTENUATOR STRUCTURE

MOORING JETTY

SNUG COVE

MULTI PURPOSE JETTY

CRUISE SHIP BERTH

-5.5 -7 -7.5 -8 -8.5 -9 -10 -10.5 -11 -11.5

NOTES:

1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD). CONTOUR INTERVALS 0.5m.
2. SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2015 EXCEPT FOR CRUISE SHIP BERTH POCKET. CRUISE SHIP BERTH CLEARANCE SURVEY UNDERTAKEN BY PORT AUTHORITY OF NSW IN 2018.
3. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
4. CHAINAGE SYSTEM IN METRES ROUNDED UP TO NEAREST METRE.
5. EXISTING NAVIGATION AIDS NOT SHOWN.

LEGEND:

2015 SURVEY

-9- 2018 CLEARANCE SURVEY

CRUISE SHIP BERTH POCKET EXTENT

N3 PROPOSED NAVIGATION AID

NAVIGATION AID PLAN

1:500

NAVIGATION AID LIGHT SETOUT

POINT No	EASTING	NORTHING
N1	758477.181	5893091.641
N2	758423.212	5893112.285
N3	758347.315	5893125.568
N4	758269.189	5893085.533
N5	758192.517	5893045.893
N6	758157.865	5893089.464
N7	758117.860	5893136.854

10 0 10 20 30 40 50m

1:500 (A1) 1:1000 (A3)

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	17.07.18	ISSUED FOR TENDER	VIP	BW	BSM	PM	PMcC			
A	28.06.18	ISSUED FOR CLIENT REVIEW	VIP	ARG	BSM	CA	PMcC			

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No. 301311-13734

ENGINEERING AND PERMIT STAMPS (As Required)

ISSUED FOR TENDER
NOT FOR CONSTRUCTION

CUSTOMER

NSW GOVERNMENT Department of Industry

WorleyParsons resources & energy

EDEN SAFE HARBOUR PROJECT
WAVE ATTENUATOR CONCEPT DESIGN

NAVIGATION AIDS PLAN

DRG No 301311-13734-MA-DWG-0030 REV B

WORLEYPARSONS_A1_REV2

Appendix B: Stakeholder Consultation Memo Eden Safe Harbour Project July 2018

Stakeholder Consultation Memo

Eden Safe Harbour Project

July 2018

Document Distribution List

Date: 31 July 2018

Title: Stakeholder Consultation Memo, Eden Safe Harbour Project

Company / Organisation	Name Individual and Position or Location	Copy
Comacon	Coral Reynolds – Communication Advisor Eden Port Development	1
NSW Department of Industry/Crown Lands & Water	Andrew Dooley – Senior Project Manager Coastal Infrastructure	2
NSW Department of Industry/Crown Lands & Water	Isaac Smith- Project Engineer Eden Port Development	3
Advisian	Simon Wakefield – Environmental Advisor	4
Advisian	Ben Morgan – Design Manager	5

Rev.	Date	Description	Prepared	Reviewed	Approved
Draft	31 July 2018	Version 1 – draft for review	CR, IS		
1.0	2 August 2018	Final		CR	CR

Overview

The purpose of this memorandum is to record details of consultation meetings held with Stakeholders operating within the Port of Eden on the Eden Safe Harbour Project final alignment and concept design.

Background

In June 2014, the then NSW Treasurer and Member for Bega, The Hon. Andrew Constance MP and Former Minister for Roads, Maritime and Freight, The Hon. Duncan Gay, announced the $10 Million Eden Safe Harbour Project.

The $10 Million project is funded by Transport for NSW (TfNSW) and being delivered by NSW Department of Industry (DoI) – Lands & Water, Crown Lands Division.

The purpose of the Safe Harbour Project is to construct a wave attenuator in Snug Cove to provide a safer anchorage for visiting and local vessels and improve protection of existing infrastructure.

Concept Design Development

Expressions of Interest were called for the Eden Safe Harbour Project in November 2017. DoI has since commenced Early Contractor Involvement (ECI) activities with Waterway Constructions for a fixed panel type of wave attenuator.

In May 2018, DoI commissioned WorleyParsons to undertake a concept design for the Eden Safe Harbour Project and develop the basis of design and performance specification for the Project.

A workshop was held on 21 May 2018 with representatives from the Port of Eden Marina (POEM) Inc., NSW Port Authority, WorleyParsons and DoI Project personnel to determine an alignment that would meet the performance requirements for the Eden Safe Harbour Project.

The agreed alignment was then further developed by Advisian and a concept design finalised.

Stakeholder consultation

Stakeholder consultation was undertaken in July 2018 in relation to Option 21, the final attenuator alignment. The Project Engineer and Project's Communication Advisor held individual meetings with businesses and organisations operating in the Port of Eden, and communicated via email with one key stakeholder based in Western Australia.

Stakeholders were provided with a project update, overview of site and engineering constraints, advised of the role of local and federal government agencies pertaining to port responsibilities, review of the final alignment and concept design drawings, provided with an opportunity to ask questions and raise any concerns and an explanation of the approval process and project stages.

Details of stakeholder consultations are contained in the following table.

Stakeholder consultation – Final Alignment and Concept Design.

Stakeholder	Consultation date	Contact details	Communications tool	Notes
Safe Harbour Community Liaison Group	Ongoing	Membership details in stakeholder database	Monthly meeting	Resolved by Option 21
POEM	Ongoing	Rob Bain Secretary bainr4@bigpond.com 0418 622 791	Technical workshop 21/05 Face to face meeting – individual consultation Member of CLG - monthly CLG meeting	Resolved by Option 21
Eden Cattle Bay Marina Pty Ltd/Eden Resort Hotel Pty Ltd	Ongoing	Henri Ruiz de Roxas Director ruizde@ozemail.com.au 0425 265 686 Mike Skitt 27 Bramble St Eden 6496 3637 mikeskitt@southernphone.com.au	Face to face meeting – individual consultation Mike Skitt member of the CLG - monthly CLG meeting	No issues
Port Authority of NSW	Ongoing	Capt Paul Webster Harbour Master / Pilot / PSO pwebster@portauthoritynsw.com.au 02 6496 1719 0438 374034	Technical workshop 21/05 Face to face meeting – individual consultation Member of CLG – monthly CLG meeting Member of Port of Eden Stakeholder Forum	Resolved by Option 21

Stakeholder	Consultation date	Contact details	Communications tool	Notes
Professional Fishermen:	Ongoing	• John Jarvis – 0488 963 350 • Paul Bell – 0427 009 558 • Michael Kelly (Southland) – 0427 963 139 (Steve Buckless consulting with) • Shannon Fantham - 0429 946 546 • Michael Ballantyne – 0428 603 554 • Monty Thomsen – 0429 961 097 • Grant Ipsen – 0418 936 847 • Garry Warren –- 0427 009 558	Face to face meeting – individual consultation Troy and Annie Nammensma and Garry Warren are Members of Port of Eden Stakeholder Forum	Concerns with additional wave surge on multi-purpose jetty and impact on fish populations at Cocora Beach
Mooring Jetty Licence Holder and Professional Fisherman - Roger and Julie Fourter	4.30pm 31 July	rfourter@bigpond.net.au 6496 3573	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	Concerns with additional wave surge on mooring jetty and impact on fish populations at Cocora Beach
Bhagwan Marine	25 July	ben.shuttleworth@bhagwanmarine.com 08 9424 230	Face to face meeting – individual consultation	Liaison with Ben Shuttleworth Commercial and Business Development Manager based in Perth No issues
Freedom Charters	10am 6 July	Mark Cavanagh Owner 0429 350 868	Face to face meeting – individual consultation	No issues

Stakeholder	Consultation date	Contact details	Communications tool	Notes
Eden Sea Farms	10am 5 July	Chris Boyton Director ciboyton@gmail.com 6495 6605 / 0427 270 943	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues
Cat Balou	12pm 6 July	Brad and Larna Willis 27 Bramble St Eden info@catbalou.com.au 0427 962 027	Face to face meeting – individual consultation	Concern over increased wave activity at Pontoon Advisian to prepare memo regarding changes to wave climate. Further consultation required to resolve concerns
Southland Fish Supplies	10am 11 July	Steve Buckless fish@southlandfish.com.au 6496 3350	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues Stephen consulted with the crews of the company's own fishing vessels (Imlay, Melisa, Rubicon)and other fishermen at the port
Gotcha Bait	2pm 9 July	Ron and Julie Lambourn twofoldbait@bigpond.com 6496 3296 0409 223 828	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues

Stakeholder	Consultation date	Contact details	Communications tool	Notes
Pacific Tug	4.30pm 30 July	pacifictug@pacifictug.com 07 3207 7377	Face to face meeting – individual consultation	Noted that there should be additional white flashing danger markers and cardinal markers on the attenuator. Believes there would be safety issues with boats moored behind the attenuator that wouldn't be able to be seen at night and there should be a dedicated route in
Svitzer Cooma, Snug Cove and Sherlock	11.30am 3 July	Steve Heffernan Marine Manager – Port Kembla & Eden Operations steve.heffernan@svitzer.com 6496 1111 0418 195 088	Face to face meeting – individual consultation Member of CLG Member of Port of Eden Stakeholder Forum	No issues
Eden Slipway Services	9am 5 July	Greg Dunne Director office@edenslipway.com.au greg@edenslipway.com.au 02 6496 1711 0428 956 576	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	Concern over sand accretion Advisian to prepare memo regarding changes to wave climate and any likely impacts on existing accretion at the Eden Slipway site
Cruise Eden (now part of Port Authority)	Ongoing	Nat Godward Sapphire Coast Tourism natalie@sapphirecoast.com.au 0434 058 871	Face to face meeting – individual consultation Member of CLG Member of Port of Eden Stakeholder Forum	No issues

Stakeholder	Consultation date	Contact details	Communications tool	Notes
RMS	Ongoing	Darren Hulm Senior Boating Safety Officer Monaro darren.hulm@rms.nsw.gov.au 8874 7981 0419 751 856	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	RMS will lead the process for temporary/ permanent vessel and swing mooring relocations in consultation with vessel owners
Marine Rescue	10am 12 July	John McKinnon Commander Uc.eden@marinerescuensw.com.au 6496 2167 0400 814 274	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues
NSW Marine Area Command (NSW Water Police)	11am 6 July 10am 26 July	Steven Judd Sergeant Coordinator Eden Water Police judd1ste@police.nsw.gov.au 6496 0699 0427 903 950	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues Second meeting held due to additional modelling undertaken for their jetty
Australian Border Force Department of Home Affairs	11am 6 July	Tracy Bennett Eden District Manager dmeden@border.gov.au 6496 8000 0417 213 070	Face to face meeting – individual consultation Member of Port of Eden Stakeholder Forum	No issues
Eden Chamber of Commerce	Ongoing	Jenny Robb President jenny.robb22@gmail.com 0429 961 047	Member of CLG Member of Port of Eden Stakeholder Forum	No issues

Stakeholder	Consultation date	Contact details	Communications tool	Notes
Twofold Bay Yacht Club	Spoke to Robin Arthur on 3 July.	Robin Arthur svtiga@gmail.com 0425803570	Face to face meeting – individual consultation Robin is a Member of the CLG	No issues
Bega Valley Shire Council	Ongoing	Graham Stubbs Director Strategy & Business Services | CFO gstubbs@begavalley.nsw.gov.au 6499 2241 0415 957 210	Member of the CLG Member of Port of Eden Stakeholder Forum	No issues raised at CLG meetings

Key Issues

The majority of stakeholders expressed no concerns with the final alignment and that it would not impact upon their existing operations in the Port.

Key issues that were raised by stakeholders were as follows:

- Impact of reflected waves on Jetty (NSW Water Police).
- Increase in accretion of sand due to the new alignment (Eden Slipway Services).
- Increased wave heights and the impact on their pontoon and vessels (Cat Balou).
- Impact of fish populations at Cocora Beach (Garry Warren and Roger Fourter, professional fishermen).
- Increased wave surge on the multipurpose jetty (Michael Ballantyne, professional fisherman).
- Insufficient lighting on wave attenuator which may create a safety issue to vessels (Pacific Tugs).

Appendix C: Assessment of Underwater Sound Levels from Pile Driving at Twofold Bay

FINAL REPORT:
Assessment of Underwater Sound Levels from Pile Driving at Twofold Bay

BPM-18-NSW DPI-Acoustic Monitoring at Twofold Bay-v1.2

22/08/2018

BLUE PLANET MARINE

Document Distribution List

Date: 22/08/2018

Title: FINAL REPORT: Assessment of Underwater Sound Levels from Pile Driving at Twofold Bay

Company/Organisation	Name of individual and Position or Location	Copy No.
NSW Department of Industry / Crown Lands & Water	Greg Thomson - Project Engineer Eden Port Development	1
NSW Department of Industry / Crown Lands & Water	Isaac Smith - Project Engineer Eden Port Development	2
Blue Planet Marine	Dr David Paton - Managing Director	3
Blue Planet Marine	Dr Simon Childerhouse - Operations Manager	4
Blue Planet Marine	Dr Matt Pine - Senior Acoustician	5
Blue Planet Marine	Alicia Forbes – Technical Assistant	5
University of Queensland	Associate Professor Mike Noad - Acoustic Advisor	6

Document Revision Record

Rev	Date	Description	Prepared	Reviewed	Approved
1.0	30/07/18	Version 1 – draft for client review	DP, MP, DB, AF, SC	LD	DP
1.1	02/08/18	Version 1.1 – final following client review	SC	LD	DP
1.2	22/08/2018	Version 1.2 – FINAL	SC, DB	LD	DP

Document Reference Number: BPM-18-NSW DPI-Acoustic Monitoring at Twofold Bay-v1.2

Prepared by: David Paton, Matt Pine, Dan Burns, Alicia Forbes and Simon Childerhouse
Last updated: 22/08/2018

www.blueplanetmarine.com

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Appendices

1. Introduction

Blue Planet Marine (BPM) was contracted by the NSW Department of Industry / Crown Lands & Water (DoI) for the assessment of underwater noise levels during piling operations within Twofold Bay, Eden.

The Port of Eden is an active working port on the Far South Coast of NSW and supports a variety of recreational, commercial and port vessel operations. It is also an increasingly popular cruise destination, popular whale watching location and has a growing tourism industry. The Eden Port Development Project aims to drive economic growth in the region and includes the $44 million Eden Breakwater Wharf Extension (EBWE) Project and $10 million Eden Safe Harbour Project.

The EBWE works include the extension of the existing wharf by up to 100m and the installation of mooring and berthing dolphins and new onshore bollards. The new 100m long wharf structure will consist of a composite concrete deck, at the same height as the existing wharf, suspended on steel tubular piles. The steel piles will be driven to a design toe level by a piling hammer lifted by a crane mounted either on a floating barge or from the existing wharf. Rock anchors may be installed in some piles, depending on pile refusal level by drilling down through the preinstalled steel tubular pile with a drill rig, installing steel reinforcement and then pouring in-situ concrete within the pile, to ensure there is a strong connection between the pile and the bedrock.

The Eden Safe Harbour Project consists of the installation of a fixed panel wave attenuator in Snug Cove, Eden. The final concept design includes a 366m long alignment, with precast concrete facing panels attached to concrete headstock with one vertical and one raked pile at an estimated 6m spacing. In the absence of a final detailed design for the Eden Safe Harbour Project wave attenuator, it is anticipated construction techniques, pile foundations and total number of piles will be comparative to the EBWE.

Both projects will require extensive piling operations to build the new infrastructure. Piling has the potential to impact on marine mammals and therefore a precautionary approach has been taken with the establishment of marine mammal monitoring zones and shut down zones if marine mammals approach too closely to active piling operations.

The aim of this project is to assess the actual underwater noise produced by piling operations during construction of the EBWE Project and compare it with the active monitoring and shut down zones proposed for the Eden Safe Harbour Project to assess and evaluate if these zones have been set appropriately.

2. Scope of Work

2.1 Project objectives

The research goals in order of priority are:

1. Design a study to validate the actual received sound levels from pile driving operations within the shut down and observation zone within Twofold Bay (**Figure 1**);
2. Collect empirical acoustic data throughout the shut down and observation zone during pile driving operations associated with the construction activities for the Eden Breakwater Wharf Extension; and
3. Undertake an assessment of received sound levels within the shut down and observation zone including recommendations about the proposed shut down and observation zone for the Eden Safe Harbour Project and impact mitigation on whales.

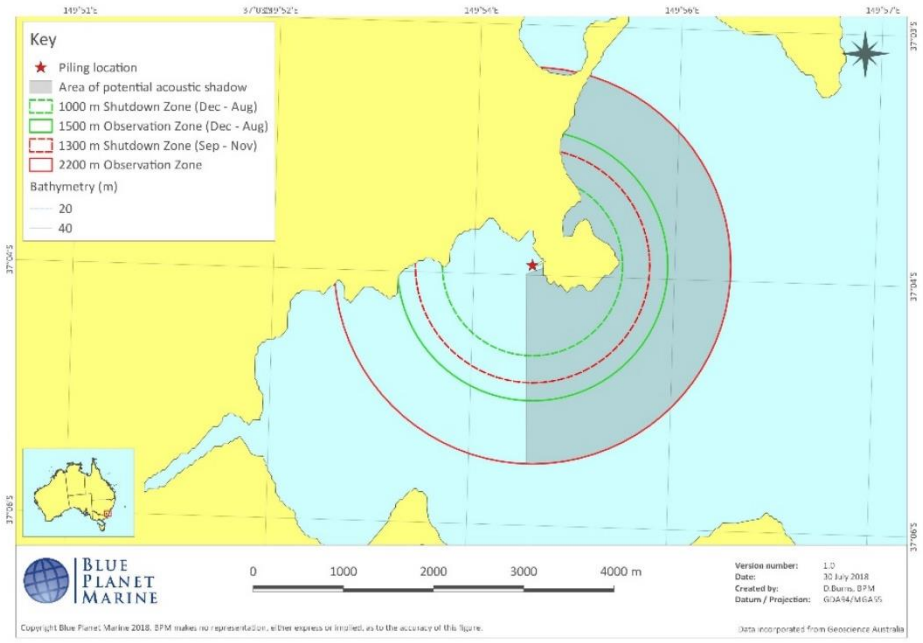


Figure 1: Identified Observation (1.5 & 2.2kms) and Shutdown Zones (1.3 & 1.0kms) from the construction site based on requirements identified under Eden Breakwater Wharf Extension Project EPBC Referral decision (2016/7828). The shaded area is the area within which acoustic shielding is possible and where reduced levels of noise from piling activities are likely.

3. Methodology

3.1 Underwater Acoustic Sensors

Twelve Underwater Acoustic Sensors (UAS) were used to ensure complete coverage of the frequency spectra of pile driving operations, and to provide redundancy in the unlikely event of the failure of one UAS.

The UAS units used were Ocean Instruments SoundTrap 300STD with 256GB of memory. The 300STD had a sensitivity range of 20 Hz to 60 kHz, this allowed a high proportion of the broadband range of frequencies produced by the pile driving to be covered.

SoundTraps were set up to constantly record at a sampling rate of 48kHz. All SoundTraps were set up with high gain selected with the exception of SoundTrap A-1 which was located within 100m of the pile driving source and was set up to collect near-field sound output (particularly the collection of high frequency data). The gain was set to low gain on this unit to prevent any clipping of the recording as the location was very close to the sound source and there was the possible of overloading the UAS due to a high received level at this location. Reducing the gain of the recorder does not impact the sensitivity of the hydrophone element and therefore measurements from all the UAS' across the wider array are still directly comparable. Each UAS unit was installed in the morning prior to the start of piling operations. They were left in situ throughout the day and collected at the end of the day, with each unit recording constantly. All units were recording simultaneously during piling operations.

In addition to using the SoundTrap 300STD UAS units, a HiTech hydrophone (HTI-96-Min hydrophone) connected to an external speaker was used to monitor underwater received sound

levels in real time. This allowed for confirmation of whether underwater noise from pile driving operations was audible at these locations, however this data was not used for further analysis.

The SoundTraps were calibrated by the manufacturer and calibration certificates are available upon request to ensure accuracy with the manufactures calibration, each unit was re-calibrated prior to deployment and after recording events using a GRAS piston phone and a Brüel & Kjaer Type 2270 sound level meter to ensure accuracy in recordings of received levels. This is a key step in ensuring accuracy of measurements. In addition, each UAS unit includes automatic calibration of the electronics through automated tones of known peak amplitude and frequency providing further quality assurance of highly accurate data.

3.2 Deployment locations

Eleven of the twelve UAS units were deployed in four transects at set distances from the piling location over a two-day sampling period. The units were placed on moorings at set distances from the piling operations. Specifically (**Figure 2**):

- Transect A ran in an approximately south-westerly direction;
- Transect B in an approximately south-easterly direction;
- Transect C in an approximately easterly direction; and
- Transect D in an approximately north-easterly direction.

Deployment location were recorded using a handheld GPS including depth and water temperature recorded off the research vessel's sounder.

SoundTraps on Transects A, B and D were deployed in static locations at fixed distances along each transect (e.g. *static sampling*). An additional SoundTrap was deployed from the research vessel on a floating buoy at various locations along transect C as well as a range of other locations away from the transect lines during the piling operation (e.g. *spot sampling*). This allowed short recordings to be made concurrently with recordings from the static units.

3.3 Moorings

A standard mooring was deployed at each static sample location along the transect lines. The mooring comprised the SoundTrap suspended from a subsurface buoy weighted down by a 10kg weight which sat on the sea floor. A ground line from 10kg weight was connected to a 20kg weight with a vertical line to a surface marker buoy. The UAS units were attached between the weight and a subsurface buoy set approximately 2-3m off the substrate to reduce vertical movements of UAS units in the water column associated with wave action. One UAS was deployed from each mooring with each unit moored at the same depth off the substrate for consistency in data collection.

One SoundTrap was deployed directly from the research vessel to make spot measurements at various locations around the study area. This UAS was attached between a small weight suspended from a subsurface buoy with the UAS maintained at approximately 5m below the water surface. This mooring was attached to the research vessel it could be quickly recovered.

Due to the temporal inconsistency in the piling operations, Transect C was not measured with a static mooring as for Transects A, B and D but rather was measured using a spot measurement approach.

3.4 Vessels

BPM supplied a suitable AMSA commercially registered vessel with all safety gear required by AMSA for operations within Partially Smooth Waters within Twofold Bay, for the deployment and retrieval of the equipment. This vessel was operated by a qualified vessel master (David Paton) and experienced crew (Alicia Forbes).

3.5 Analysis

Noise levels from each UAS were calculated with BPM's custom acoustic analysis software that runs in MATLAB. An automated impulse signal detector was run and identified periods of piling activity. For each period of piling noise detected, the loudest 60 second interval was selected and each strike within that 60 second interval were analysed. The broadband (up to 24 kHz) RMS sound pressure level (RMS SPL), sound exposure level (SEL) and peak (Lpk) sound levels were calculated. The RMS SPL and the SEL are time-dependent metrics, that is, they are calculated over the strike's duration and reflect the total amount of sound energy received within that period. The exact start and end times of each strike can be difficult to accurately determine. Therefore, the duration of the impulse, *T*, is often the interval in which the cumulative energy rises from 5% to 95% and therefore contains 90% of the energy. This interval is referred to as T_{90}. The RMS SPL calculated over the T_{90} is the 90% RMS SPL (L_{90}), while the SEL is the total sound energy contained in one or more strikes, and was calculated herein using:

$$SEL = L_{90} + 10*log10(T_{90}) + 0.458$$

where the added 0.458 is to account for the lost energy either side of the 5% and 95% during the calculation of T_{90}.

4. Results

4.1 Deployments

Acoustic recorders were deployed on 25 and 26 of June 2018 at pre-determined locations around the Port of Eden and surrounding area. Full details of these deployments are shown in **Figure 2**, **Figure 3** and **Table 2**. Recordings were made at a total of 34 different sampling locations for a total of 192.8 hours of acoustic recordings. These locations were selected to provide a representative set of received sound levels from in and around the Port of Eden.

4.2 Acoustic data

Overall, an average of 5.8 hours of acoustic recordings were completed at each sampling site. On average, this worked out 7.7 hours for the static sampling locations (e.g. Transects A, B and D) and 2.2 hours for the spot sampling locations (e.g. SS1 to SS6, Transect C). The depth of deployments ranged from 8.8m to 36.2m.

Table 3 provides a summary of the received level of sound at the locations with acoustic recorders. A range of different acoustic metrics are provided as they measure different aspects of sound energy and potentially different mechanisms for impact. Specifically, we have reported on:

- Lt90_av = averaged RMS level based on the T90 (time duration containing 90% of the energy) over all strikes within 60 seconds;
- SEL_av = averaged SEL level based on the Lt90+10*log10(T90)+0.458 = SEL over all strikes within the 60 sec; and
- Lpk = peak level averaged over all strikes within the 60 sec.

Figures showing both the Spectrograms and Waveforms of the acoustic data at each location are shown in **Appendix 1**.

There was an interesting observation on the 25 June 2018 when a vocalising humpback whale was acoustically detected (**Figure 4**) providing evidence that at least one humpback was in the area at this time.

Distances from the pile driving activity were estimated as the linear straight-line distance from the centre of pile driving activities (defined as the point at -37.074050°S, 149.907271°E) to the location of the UAS.

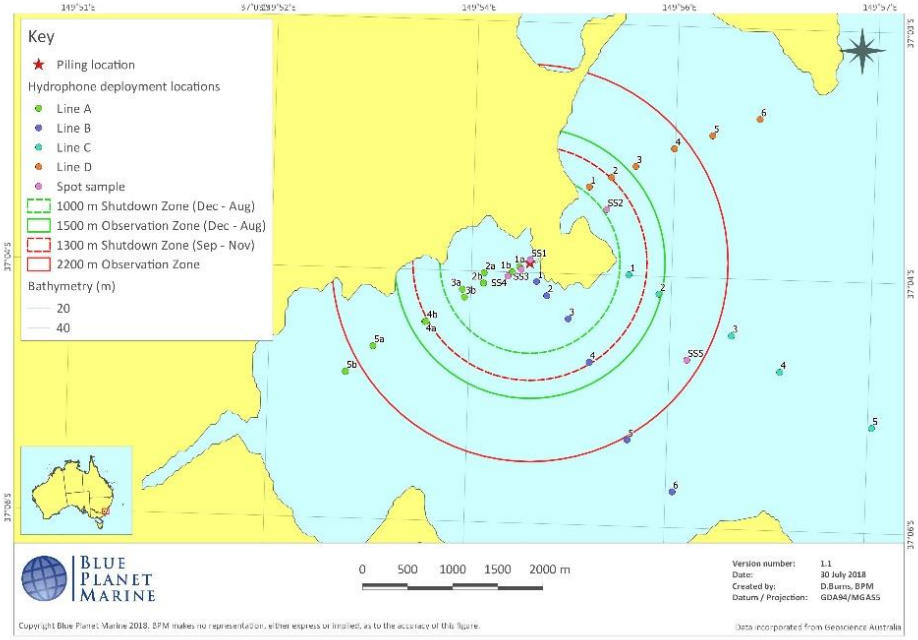


Figure 2: Deployment locations for all acoustic recorders in and around the Port of Eden. Colours of points correspond to sampling locations along different Transect Lines (A, B, C, D) and also locations of short term, spot sampling (SS).

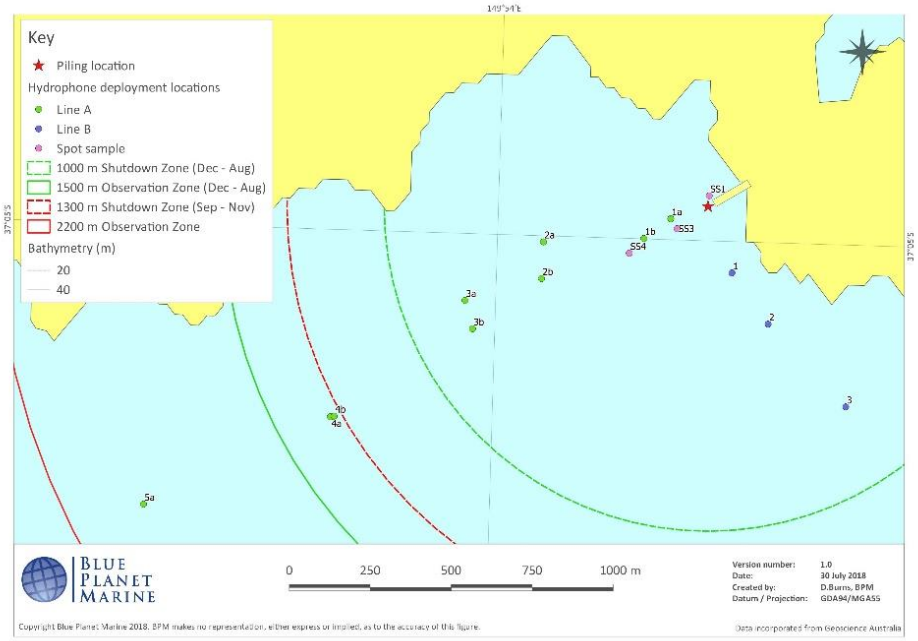


Figure 3: Fine scale map of deployment locations for acoustic recorders close to the Port of Eden. Colours of points correspond to sampling locations along different Transect Lines (A, B, C, D) and also locations of short term, spot sampling (SS).

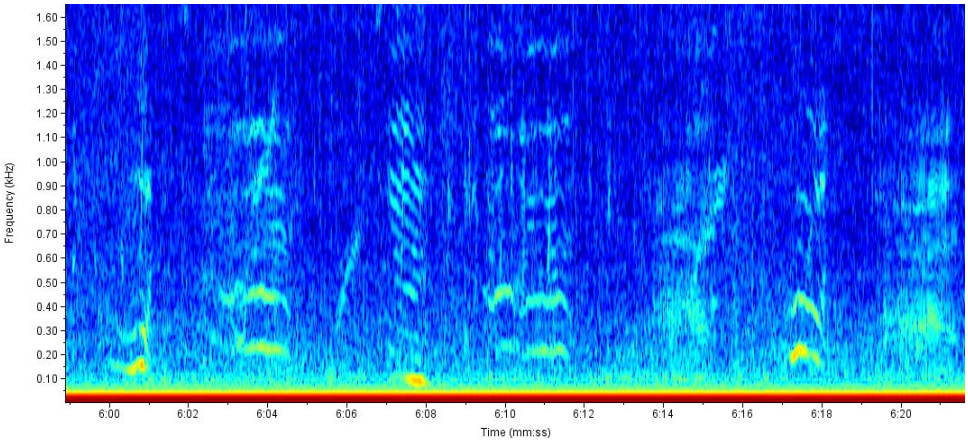


Figure 4: Spectrogram of humpback whale vocalisations detected on the acoustic recorder deployed at location D-3 on 25 June 2018.

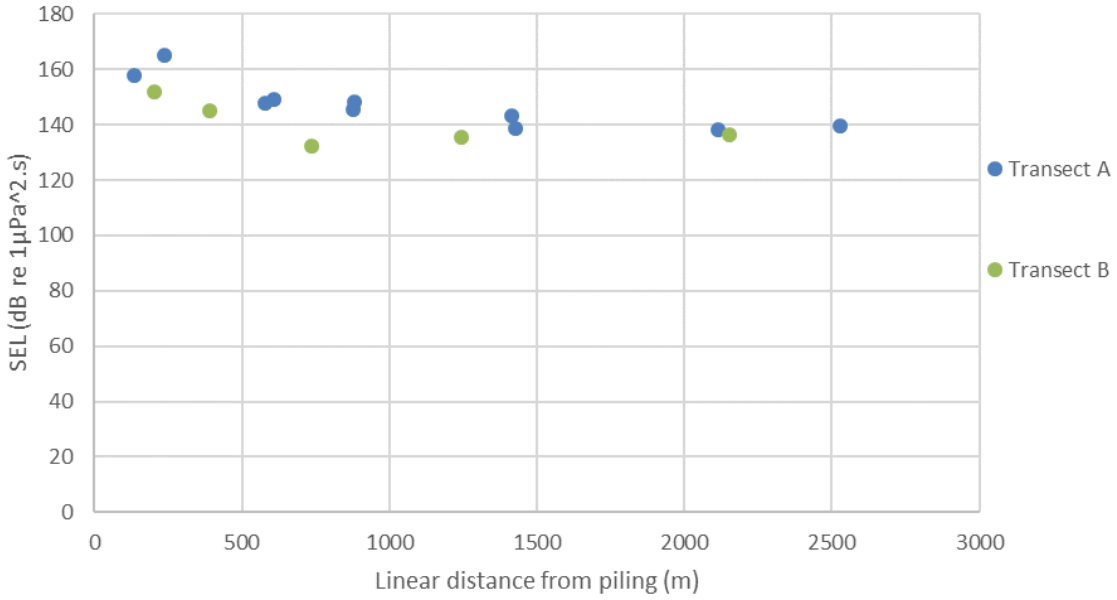


Figure 5: Plot of estimated Sound Exposure Level (SEL) by linear straight-line distance (m) from pile driving activities in Port of Eden.

ransect	Estimated SEL (dB re 1µPa^2.s) at distance from piling		
	1,000m (Summer shut-down zone)	1,300m (Winter shut down zone)	2,200m (Observation zone)
A	144	142	137
B	137	135	132
C	*	*	*
D	*	*	*

* RMS sound pressure level over 60 seconds of the same time period as during (10 Hz - 24 kHz). No piling was detected and therefore SELs, Lpk and L90s were not measurable for Transects C and D. Instead, the level here is the 60 second RMS sound pressure level. Note humpback whale vocalisations were present during some of these measurements.

Table 1: Summary of estimated received Sound Exposure Level (SEL) at known distances from the piling source by transect line.

Table 2: Summary of acoustic recorder deployments in Eden in June 2018

Date	Mooring type	Location	Sea state	Swell height	Water temp	Waypoint of piling	Hydrophone no.	Latitude (S)	Longitude (E)	Waypoint of hydrophone	Water depth (m) at hydrophone location	Distance of hydrophone off sea floor (m)	Distance of hydrophone off sea surface (m)	Record start	Record stop	Distance of hydrophone from piling (m)
25/06/2018	Static	A-1a	2	1.1	12.9	WP71	1	-37.07442	149.90599	77	11.5	2.5	9.0	08:30	17:11	133
25/06/2018	Static	A-2a	2	1.1	12.9	WP71	2	-37.07517	149.9016	75	11.6	2.5	9.1	08:30	17:07	578
25/06/2018	Static	A-3a	2	1.1	12.9	WP71	3	-37.07686	149.89894	74	11.3	2.5	8.8	08:30	17:04	879
25/06/2018	Static	A-4a	2	1.1	12.9	WP71	4	-37.0802	149.89439	73	10.3	2.5	7.8	08:30	17:00	1427
25/06/2018	Static	A-5a	2	1.1	12.9	WP71	5	-37.08278	149.888	72	9.2	2.5	6.7	08:30	16:57	2116
25/06/2018	Static	D-1	2	1.1	14.2	WP71	6	-37.06628	149.9144	83	12.5	2.5	10.0	08:30	16:42	1054
25/06/2018	Static	D-2	2	1.1	14.2	WP71	7	-37.06527	149.91714	82	14.6	2.5	12.1	08:30	16:38	1321
25/06/2018	Static	D-3	2	1.1	14.2	WP71	8	-37.0641	149.9201	81	16.4	2.5	13.9	08:30	16:34	1624
25/06/2018	Static	D-4	2	1.1	14.2	WP71	9	-37.06222	149.92487	80	19.3	2.5	16.8	08:30	16:30	2121
25/06/2018	Static	D-5	2	1.1	14.2	WP71	10	-37.0608	149.9296	79	23.0	2.5	20.5	08:30	16:26	2596
25/06/2018	Static	D-6	2	1.1	14.2	WP71	11	-37.05904	149.93544	78	26.2	2.5	23.7	08:30	16:21	3192
25/06/2018	Spot	SS1	2	1.1	12.9	WP71	12	-37.07375	149.9073	76	11.7	6.7	5.0	08:30	17:11	30
25/06/2018	Spot	SS2	2	1.1	14	WP71	12	-37.06849	149.91663	84	13.0	8.0	5.0	08:30	14:33	1089
26/06/2018	Static	A-1b	1	1.2	12.8	WP91	1	-37.07499	149.90508	102	11.2	2.5	8.7	14:18	17:13	238
26/06/2018	Static	A-2b	1	1.2	12.8	WP91	2	-37.07619	149.90157	90	11.6	2.5	9.1	08:34	17:09	609
26/06/2018	Static	A-3b	1	1.2	12.8	WP91	3	-37.07764	149.89923	89	11.8	2.5	9.3	08:17	17:06	881
26/06/2018	Static	A-4b	1	1.2	12.8	WP91	4	-37.08018	149.89452	88	10.7	2.5	8.2	08:06	17:02	1415
26/06/2018	Static	A-5b	1	1.2	12.8	WP91	5	-37.0854	149.88466	87	8.8	2.5	6.3	07:53	16:58	2530
26/06/2018	Static	B-1	2	1.2	13.5	WP91	6	-37.07587	149.90817	93	12.2	2.5	9.7	08:56	16:50	203
26/06/2018	Static	B-2	2	1.2	13.5	WP91	7	-37.07726	149.90948	99	13.1	2.5	10.6	11:20	16:44	390
26/06/2018	Static	B-3	2	1.2	13.5	WP91	8	-37.07949	149.91226	94	19.1	2.5	16.6	09:09	16:35	738
26/06/2018	Static	B-4	2	1.2	13.5	WP91	9	-37.08377	149.91504	95	20.2	2.5	17.7	09:29	16:30	1244
26/06/2018	Static	B-5	2	1.2	13.5	WP91	10	-37.09138	149.92007	96	21.0	2.5	18.5	09:38	16:22	2154
26/06/2018	Static	B-6	2	1.2	13.5	WP91	11	-37.09643	149.92587	98	20.1	2.5	17.6	11:38	16:14	2910
26/06/2018	Spot	C-1	2	1.2	~14.0	WP91	12	-37.07493	149.91966	103	20.0	15.0	5.0	14:25	14:34	1242
26/06/2018	Spot	C-2	2	1.2	~14.0	WP91	12	-37.07492	149.9196	105	19.8	14.8	5.0	14:49	15:00	1236
26/06/2018	Spot	C-3	2	1.2	~14.0	WP91	12	-37.07676	149.92349	107	24.8	19.8	5.0	15:03	15:07	1644
26/06/2018	Spot	C-4	2	1.2	~14.0	WP91	12	-37.08072	149.93269	109	29.8	24.8	5.0	15:12	15:23	2628
26/06/2018	Spot	C-5	2	1.2	~14.0	WP91	12	-37.08418	149.93884	111	32.8	27.8	5.0	15:27	15:37	3315
26/06/2018	Spot	C-6	2	1.2	~14.0	WP91	12	-37.0895	149.95052	113	36.2	31.2	5.0	15:42	15:52	4593
26/06/2018	Spot	SS3	1	1.2	12.8	WP91	12	-37.07469	149.90622	92	11.2	6.2	5.0	08:48	14:16	123
26/06/2018	Spot	SS4	2	1.2	~14.0	WP91	12	-37.07541	149.90459	100	11.5	6.1	5.4	14:02	17:13	301
26/06/2018	Spot	SS5	2	1.2	~14.0	WP91	12	-37.08325	149.9272	115	20.0	15.0	5.0	15:59	16:02	2195

Table 3: Summary of acoustic recorder deployments in Eden in June 2018. Notation: Lt90_av = averaged RMS level based on the T90 (time duration containing 90% of the energy) over all strikes within the 60 seconds; SEL_av = averaged SEL level based on the Lt90+10*log10(T90)+0.458 = SEL over all strikes within the 60 seconds; Lpk = peak level averaged over all strikes within the 60 seconds; SD = standard deviation.

Location	Date	Distance from piling (m)	Lt90_av	SEL_av	Lpk_av	Lt90_SD	SEL_SD	Lpk_SD	RMS_{60SECS}	Notes
A-1a	25/06/2018	133	166.55	157.76	182.91	1.86	0.46	0.61		
A-2a	25/06/2018	578	158.97	147.82	171.35	0.79	0.44	0.12		
A-3a	25/06/2018	879	153.27	145.77	169.48	2.25	0.54	0.72		
A-4a	25/06/2018	1427	144.08	138.61	161.78	1.08	0.32	0.81		
A-5a	25/06/2018	2116	140.47	138.07	158.87	0.72	0.53	0.57		
D-1	25/06/2018	1054	PILING UNDETECTABLE						105.3	No whales acoustically detected
D-2	25/06/2018	1321	PILING UNDETECTABLE						102.6	No whales acoustically detected
D-3	25/06/2018	1624	PILING UNDETECTABLE						98	No whales acoustically detected
D-4	25/06/2018	2121	PILING UNDETECTABLE						96.9	No whales acoustically detected
D-5	25/06/2018	2596	PILING UNDETECTABLE						97.3	No whales acoustically detected
D-6	25/06/2018	3192	PILING UNDETECTABLE						97.3	No whales acoustically detected
A-1b	26/06/2018	238	167.95	165.08	183.87	0.68	0.47	0.05		
A-2b	26/06/2018	609	152.49	149.35	171.50	0.57	0.52	0.07		
A-3b	26/06/2018	881	151.29	148.38	170.78	0.84	0.61	0.66		
A-4b	26/06/2018	1415	146.31	143.27	166.26	0.70	0.57	0.91		
A-5b	26/06/2018	2530	140.20	139.42	160.19	0.58	0.37	0.93		
B-1	26/06/2018	203	154.18	152.01	172.00	0.23	0.20	0.01		
B-2	26/06/2018	390	147.64	145.21	165.65	0.72	0.30	0.44		
B-3	26/06/2018	738	132.17	132.32	149.53	0.35	0.42	0.67		
B-4	26/06/2018	1244	135.19	135.34	150.30	0.24	0.57	0.45		
B-5	26/06/2018	2154	136.06	136.46	149.85	0.17	0.40	0.47		
C-1	26/06/2018	1242	PILING UNDETECTABLE						115.4	WHALES PRESENT
C-2	26/06/2018	1236	PILING UNDETECTABLE						114.4	WHALES PRESENT
C-3	26/06/2018	1644	PILING UNDETECTABLE						117.7	WHALES PRESENT
C-4	26/06/2018	2628	PILING UNDETECTABLE						117.7	WHALES PRESENT
C-5	26/06/2018	3315	PILING UNDETECTABLE BUT JUST AUDIBLE - VESSEL NOISE AND WHALES PRESENT PREVENTING FILTERING						113.2	WHALES PRESENT

5. General discussion and conclusions

The key conclusions of the acoustic monitoring research are summarised below.

Noise propagation

Based on the measured sound levels (for Transect A in particular), sound propagation from the piling activity broadly follows generally accepted propagation modelling for such activities. There is good evidence that noise from the piling activities transmits well along Transects A and to a lesser extent along Transect B. The received levels along Transect B are between 5 and 7 dB lower than the levels recorded at equivalent distances along Transect A. This represents a significant reduction with a 5 to 7 dB reduction equating to a more than halving of the sound energy and provides good evidence of the acoustic shadow produced by the Eden Breakwater.

Acoustic shadow from the break water and Middle Head

There were no detectable levels of piling noise on either Transect C or D although some very faint piling noise was audible on the most offshore recording location (C-5) of Transect C but only after significant amplification of the signal. Given these findings, it provides good evidence that both the Eden Breakwater and, particularly Middle Head, provide a significant acoustic shadow for areas to the east and north of the piling location. Given that there is no detection of piling noise along either Transect C or D, there will be no impact on marine mammals moving through this area and therefore the shutdown zone in this area is overly precautionary.

Mitigation and shutdown zones

The referral sets both shut down and observation zone distances on a seasonal basis. Specifically:

- December to August – shut down zone of 1,000m and observation zone of 1,500m; and
- September to November – shut down zone of 1,300m and observation zone of 2,200m.

While the rationale for the establishment of the distances for the observation and shut-down zones are not clearly articulated in the referral or project application, it is reasonable to assume that they follow national and international best practice guidelines. The two most relevant guides for assessing noise impacts from piling are:

- US National guidelines (NOAA 2016)
    - Physiological noise exposure criteria
        - Permanent Threshold Shift (PTS)
            - Peak 230 dB re 1µPa
            - SEL 198 dB re 1µPa^2.s
    - Temporary Threshold Shift (TTS)
        - Peak 224 dB re 1µPa
        - SEL 183 dB re 1µPa^2.s
    - Behavioural noise exposure criteria
        - SPL 160 dB re 1µPa
- SA DPTI Underwater Piling Noise Guidelines (2012)
    - The key measurement from these guidelines is that the noise exposure threshold is set at SEL 150 dB(M) re 1 µPa^{2}s for a single impact at either 100 m or 300 m.

While neither the NOAA (2011) nor the SA DPTI (2012) guidelines appear to strictly match the referral criteria, it is likely that the levels in the referral have been set with a more precautionary view which leads to a higher level of the protection that you may get from strictly following either of the two sets of guidelines with the net result being a positive outcome for the marine mammals.

What is clear from the empirical measurement of noise from the piling operations is that the received levels at the distances of the shutdown zones along both transect A and B, both fall well

within the threshold levels from the NOAA (2016) and SA DPTI (2012) criteria. Based on the measured noise data from Transect A, it shows that noise levels reach a SEL of 150 dB re 1µPa^2.s (i.e., the recommended level in the SA DPTI (2012) guidelines) somewhere between 133 m (158 dB SEL) and 578 m (147 dB SEL) from piling operations. Based on standard propagation models, this means that the noise from these piling activities are likely to reach 150 SEL at around 450-500m from the source. On the basis of these measurements, and following the SA DPTI (2012) guidelines[1], the following distances would be recommended:

- Observation zone = 2,000m;
- Shutdown zone = 1,000m; and
- Zone of behaviour response ≤ 3,000m.

In the absence of available measurements of received noise levels, it may be appropriate to set precautionary shutdown zones given that the exact noise profile from an operation is not known and therefore, the zone of impact is also unknown. However, the SA DPTI (2012) guidelines[2] note that, "*Compliance with the noise exposure thresholds may be demonstrated through noise modelling or empirical measurements of a similar piling activity, i.e. similar piling rig and marine environment*". Given that empirical measurements have been undertaken for this activity *in situ*, we can accurately and robustly characterise the noise profile of this activity.

Given this increased knowledge of the operational noise, it is appropriate to follow the SA DPTI (2012) guidelines and implement a shut down zone of 1,000m and an observation zone of 2,000m for this activity. This recommendation is consistent with the shutdown zone proposed for most of the year (e.g., December to August) but is slightly smaller than the zone set for the period of the southern migration (e.g. September to November) of 1,300m. We believe that the implementation of these zones would still provide a high level of protection to marine mammals moving through the area and is consistent with international best practice. A good example of this is that the acoustic threshold identified in the SA DPTI (2012) guideline is reached at 450-500m from the piling operation but the shutdown zone is set at 1,000m from the source providing a large buffer around the operation and leading to a very precautionary shutdown zone.

6. Recommendations

The key recommendations of the acoustic monitoring are:

1. The results from this research were based on piling operations undertaken for the Eden Breakwater Wharf Extension Project (i.e., the location of the star in **Figure 2**). Observation and Shutdown zones for the separate Eden Safe Harbour Project should be measured from Wave Attenuator Point C (refer **Appendix 2**) which is the most south-western point of the proposed future piling operations. This location is likely to have the smallest acoustic shadow arising from the breakwater and therefore the estimated received sound levels in this study are likely to represent maximum levels. Any piling operations inshore of this site will have lower received levels than those measured.
2. We note that neither the NOAA (2011) nor the SA DPTI (2012) guidelines for acoustic impacts on marine mammals appear to strictly match the referral criteria. Therefore, it is likely that the referral criteria have been set with a more precautionary view which leads to a higher level of the protection that you may get from strictly following either set of

[1] South Australian Department of Planning, Transport and Infrastructure (2012) Underwater Piling Noise Guidelines. Report for the SA DPTI. 21 November 2012. Table 5.
[2] South Australian Department of Planning, Transport and Infrastructure (2012) Underwater Piling Noise Guidelines. Report for the SA DPTI. 21 November 2012. Page 21.

guidelines with the net result being a positive outcome for the marine mammals. What is clear from the empirical measurement of noise from the piling operations is that the received levels measured along transect A and B both fall well within the threshold levels and/or mitigation distances outlined in both the NOAA (2016) and SA DPTI (2012) criteria.

3. Based on the results from this research, consideration should be given for revising the observation and shutdown zones for future piling projects within Twofold Bay (e.g., Eden Safe Harbour Project). Specifically, we recommend that the requirement for an observation and shutdown zone on the northern and eastern side of Middle Head (i.e., the purple zone[3] shown in **Figure 6**) should be removed based on our data demonstrating that no received noise from piling operations in Snug Cove were recorded in this area.
4. There were no acoustic measurements taken between Transect B and C (e.g. the blue zone in **Figure 6**) and therefore it has not been possible to determine where the northern most limit of the observation and shutdown zone should be set within this zone. However, if additional acoustic monitoring was undertaken within this zone, it would potentially be possible to set an empirically based northern limit based on received noise levels. In the absence of this information, we have recommended a precautionary approach and set the northern limit of the zone as described above.
5. Given that the exact rationale for the setting of shutdown distances in the referral have not been explained, it is difficult to assess to exact purpose of these zones. The SA DPTI (2012) guidelines for pile driving are the most relevant guidelines for the setting of mitigation zones for minimising impacts on marine mammals. While it may be appropriate to set more a precautionary mitigation zone when the noise profile from an activity is not known, in this instance, there are empirical measures of received sound levels *in situ*, which allows us to accurately and robustly characterise the noise from the operation. On the basis of these sound measurements, and following the SA DPTI (2012) guidelines, the following distances would be recommended: Observation zone = 2,000m and Shutdown zone = 1,000m.
6. This recommendation is consistent with the existing shutdown zone proposed for most of the year (e.g., December to August) but is slightly smaller than the zone set for the period of the southern migration (e.g. September to November) of 1,300m. We recommend that the distances in the SA DPTI (2012) guidelines are implemented and believe that the establishment of these zones would still provide a high level of protection to marine mammals moving through the area and, furthermore, is consistent with international best practice.
7. If there is variation with piling activity in future projects, (e.g. a different location within Twofold Bay not as shielded as Snug Cove by the Eden Breakwater and/or Middle Head; larger pile driver and/or piles are used; or if piles are driven into a different substrate), then it is recommended that further acoustic validation is undertaken to assess the zones of potential acoustic impact within Twofold Bay.

[3] The northern boundary for the observation and shutdown zone should be set from the point on Middle Head define as 37.073420°S and 149.916559°E and a bearing of 121°T.

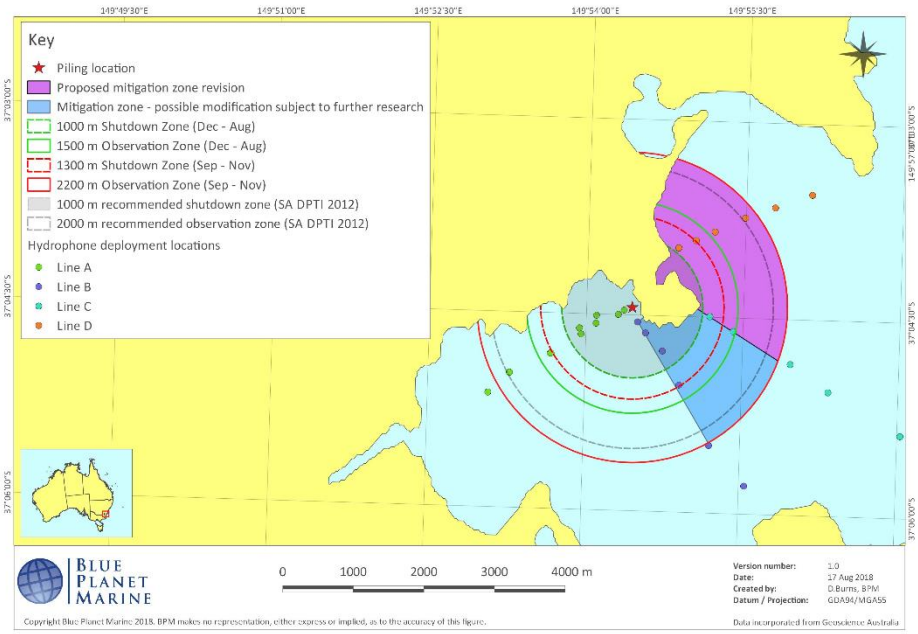


Figure 6: Deployment locations for all acoustic recorders in and around the Port of Eden include recommended variations in the shutdown zones based on acoustic research.

7. References

NOAA (2016) National Marine Fisheries Service (NMFS): Technical Guidance for Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts.

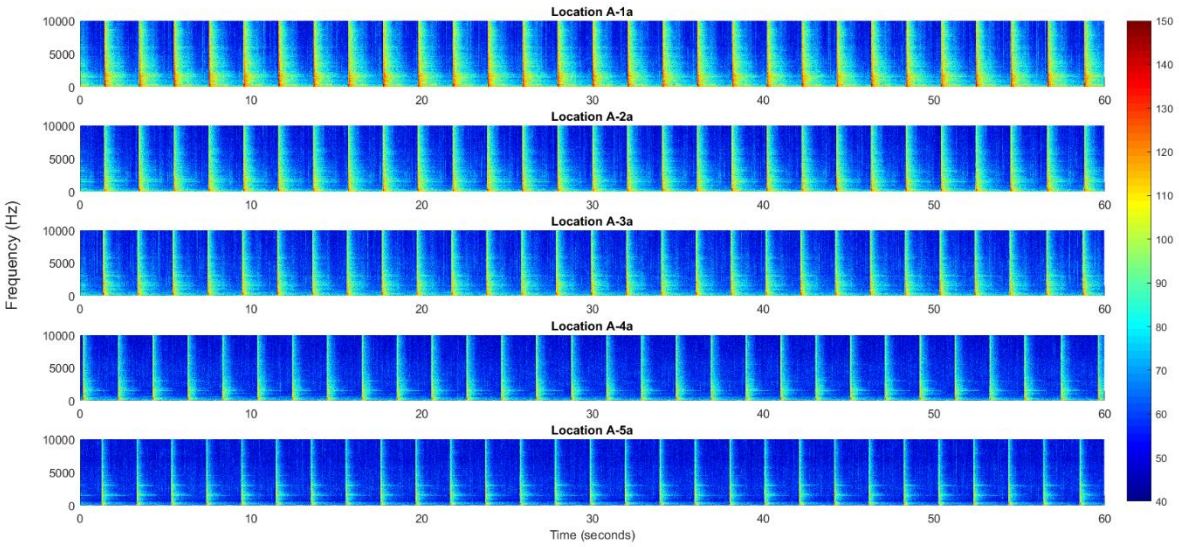
South Australian Department of Planning, Transport and Infrastructure (2012) Underwater Piling Noise Guidelines. Report for the SA DPTI. 21 November 2012. 35 p.

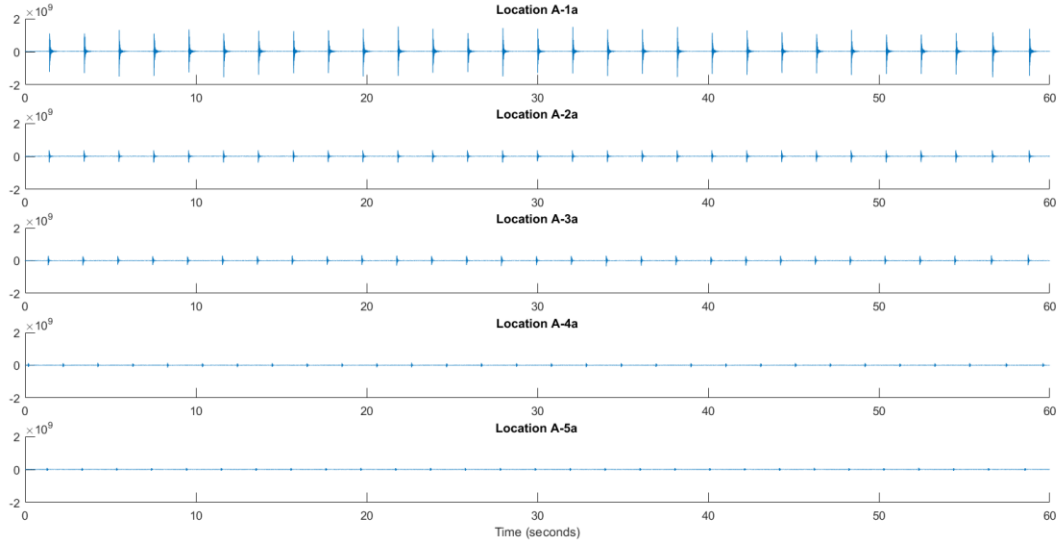
Advisian (2017) Review of Environmental Factors Eden Safe Harbour Project at Snug Cove, Eden NSW. Report for NSW Department of Industry. November 2017.

WorleyParsons Pty Ltd (2018) Eden Safe Harbour Project Wave Attenuator Concept Design Site Plan Dwg No. 301311-13734-MA-DWG-0002, Rev C. July 2018.

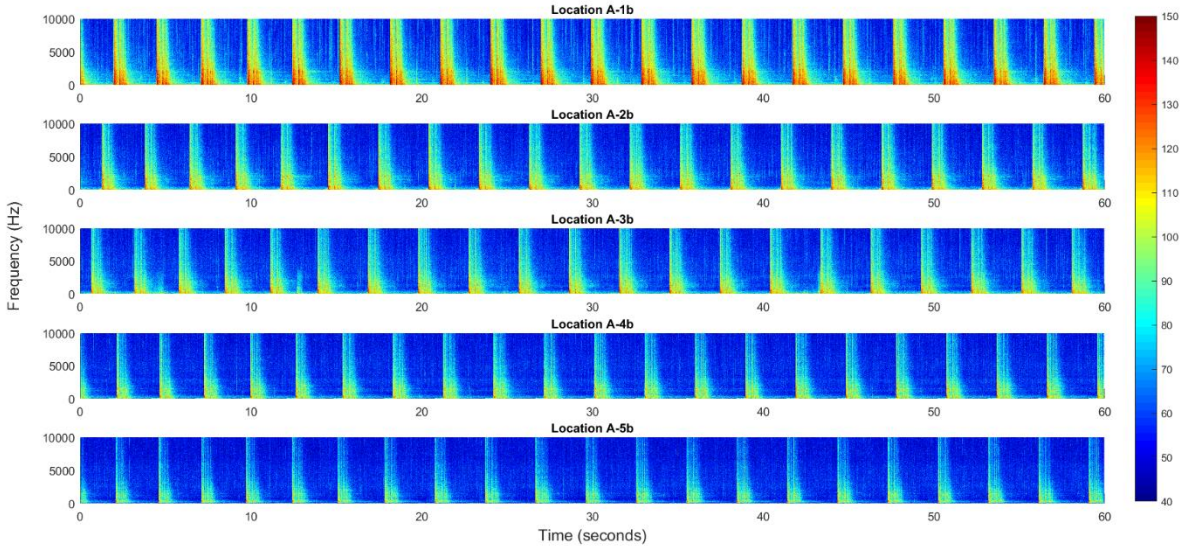
Appendix 1: Spectrograms and Waveforms for received sound at each of the sampling locations

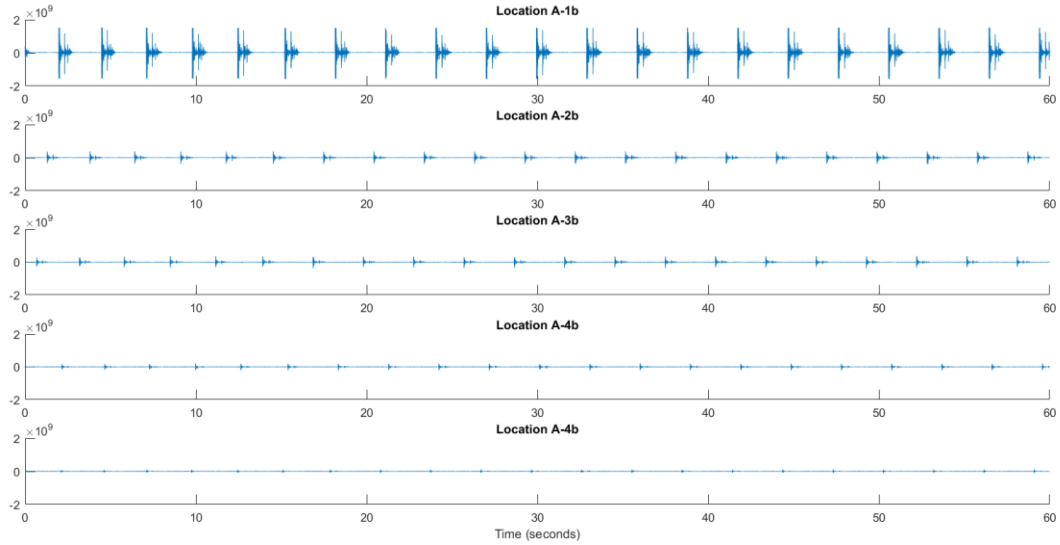
TRANSECT A (25 June 2018)





TRANSECT A (26 JUNE 2018)





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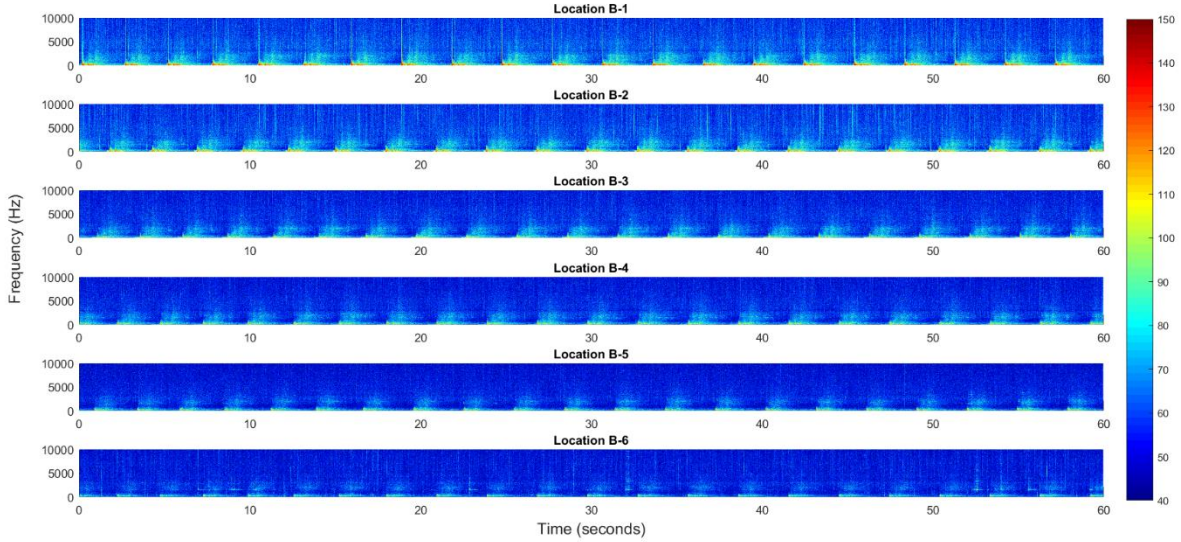
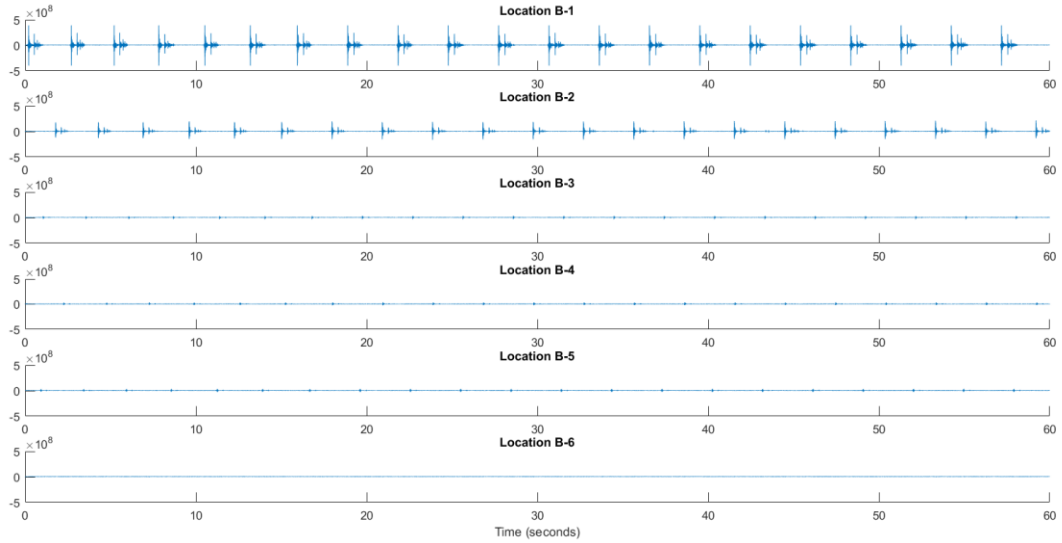
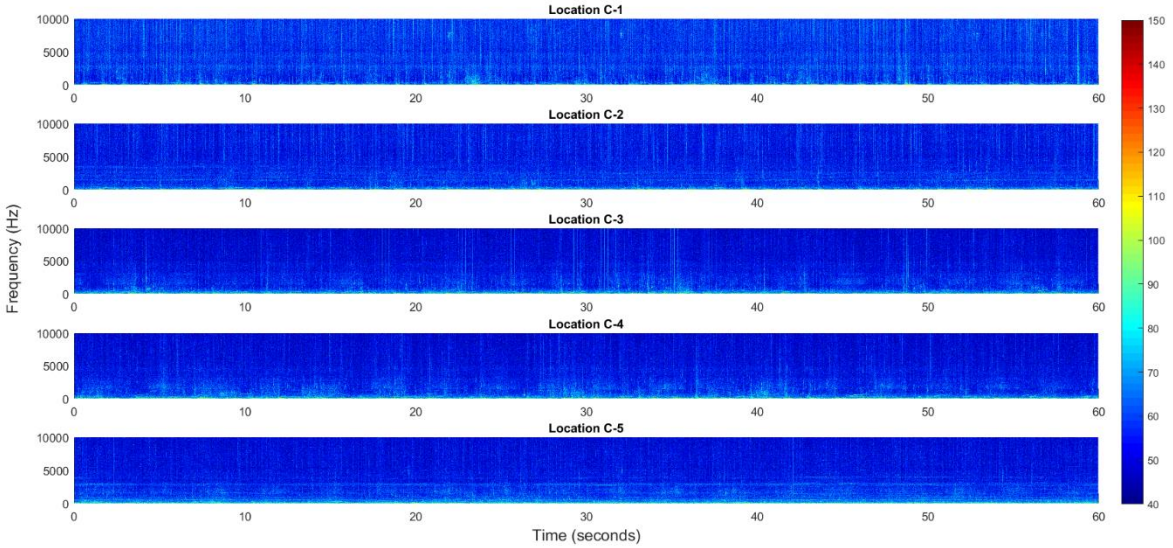
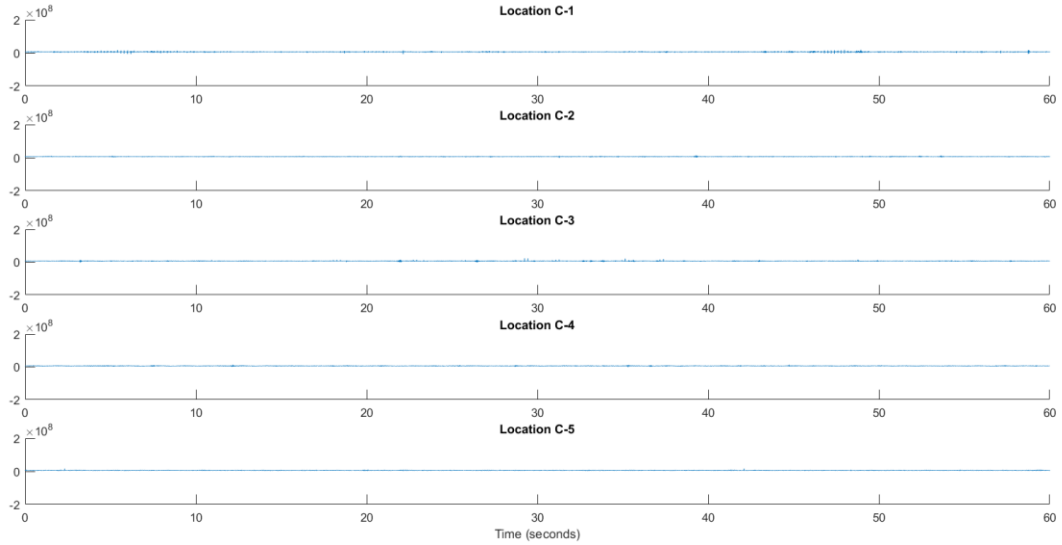


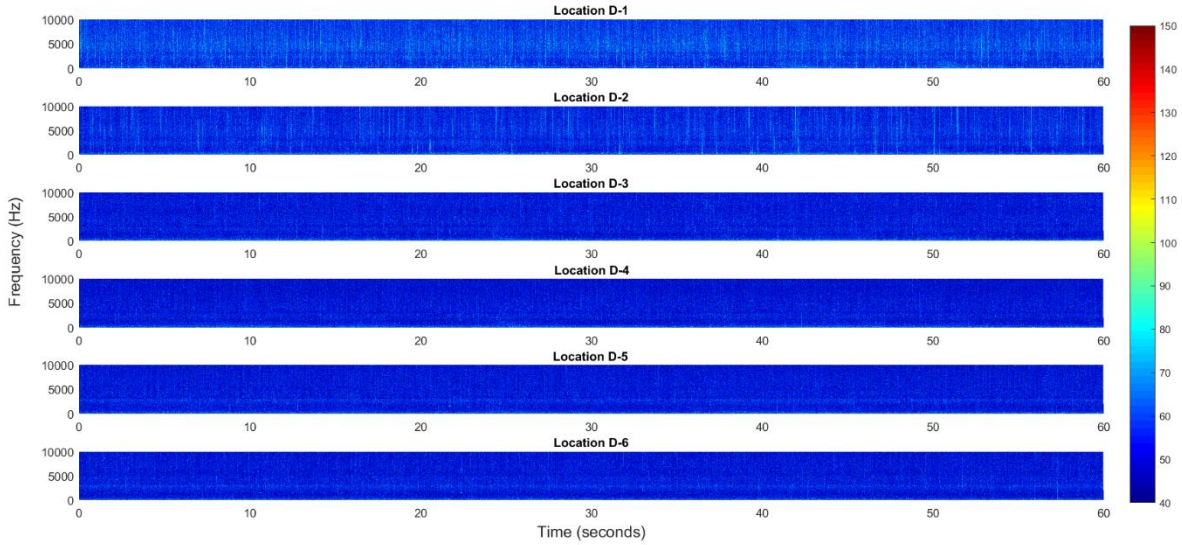


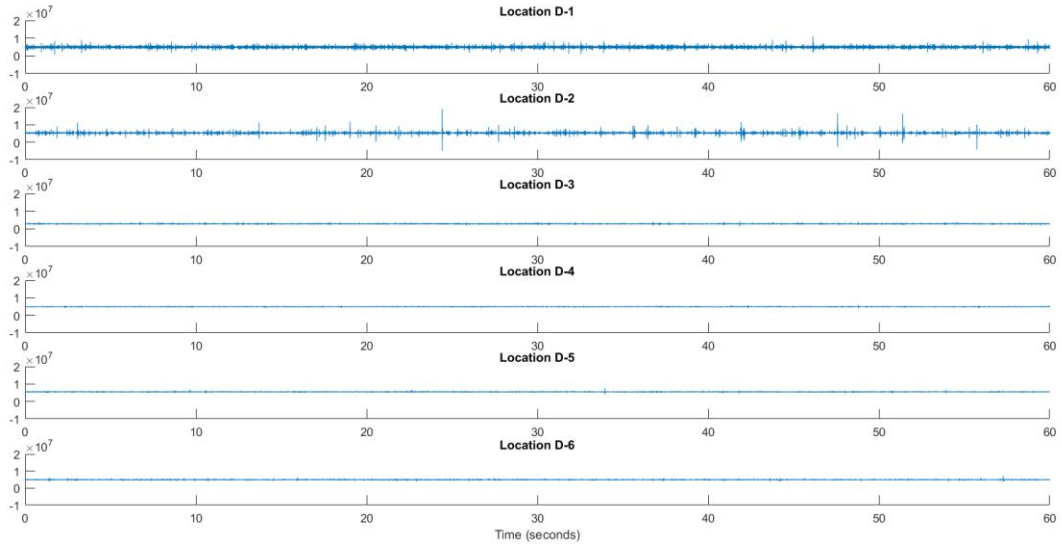
TRANSECT C (26 JUNE 2018)



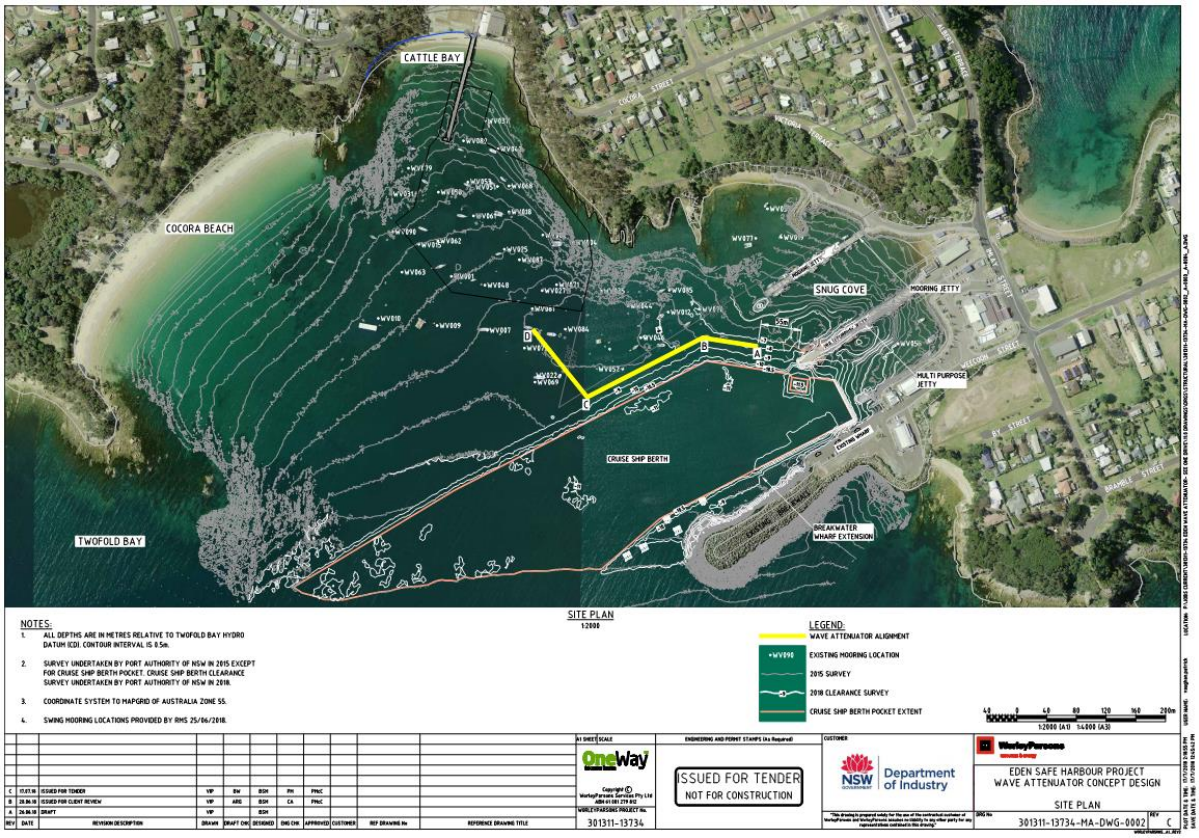


TRANSECT D (25 JUNE 2018)

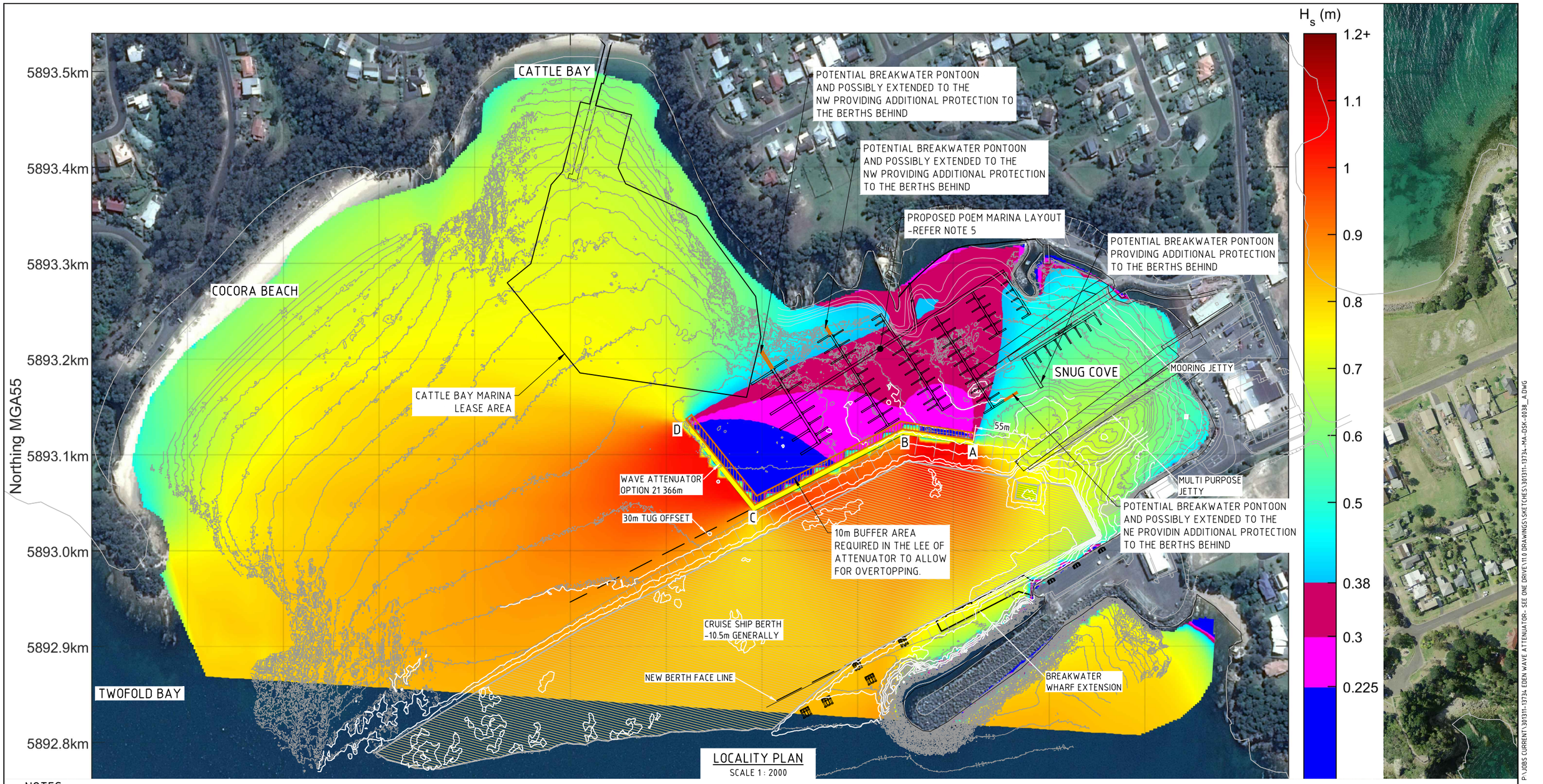




Appendix 2: Eden Safe harbour Project – Site Plan (Worley Parsons 2018)



Appendix D: Significant Wave Height Sketch



LOCALITY PLAN
SCALE 1 : 2000

NOTES:

1. ALL DEPTHS ARE IN METRES RELATIVE TO TWOFOLD BAY HYDRO DATUM (CD).
2. SURVEY BY PORT AUTHORITY OF NSW 2015.
3. COORDINATE SYSTEM TO MAPGRID OF AUSTRALIA ZONE 55.
4. NUMERICAL WAVE MODELLING (UNDERTAKEN BY CARDNO 12/07/2018 USING SWAN) PRESENTS THE SIGNIFICANT WAVE HEIGHT (Hs) FOR THE 1 YEAR ARI FOR SEAS FROM ALL DIRECTIONS AND WATER LEVELS (LAT, MSL AND HAT).
5. MARINA LAYOUT PROVIDED BY POEM (PREPARED BY IMC, 31/05/2018). THIS SKETCH HAS BEEN DEVELOPED TO DEMONSTRATE THE WAVE ATTENUATOR IS FUTURE PROOFED FOR A POTENTIAL MARINA OR OTHER BOAT STORAGE FACILITY/S.

   MARINA LAYOUT PROVIDED BY POEM IS ILLUSTRATIVE ONLY AND NOT INCLUDED IN WAVE MODELLING ASSESSMENT.

   INSTALLATION OF ANY FUTURE MARINA OR OTHER BOAT STORAGE FACILITY/S MAY ALTER THE WAVE CLIMATE RESULTS SHOWN ON THIS DRAWING.
6. POTENTIAL MARINA AMENDMENTS ARE FOR DISCUSSION PURPOSES ONLY AND HAVE NOT BEEN ASSESSED IN ACCORDANCE WITH AS3962.

SEAWARD FACE OF ATTENUATOR SETOUT

POINT No	EASTING	NORTHING
A	758421.236	5893112.593
B	758347.561	5893125.177
C	758192.190	5893044.355
D	758119.113	5893135.295

LEGEND:

PROPOSED WAVE ATTENUATOR ALIGNMENT

40 0 40 80 120 160 200m

1:2000 (A1) 1:4000 (A3)

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
A	22.08.18	ISSUED FOR INFORMATION	KM		BSM					

A1 SHEET SCALE

OneWay to zero harm

WORLEYPARSONS PROJECT No. 301311-13374

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
NOT FOR CONSTRUCTION

CUSTOMER

NSW GOVERNMENT Department of Industry

WorleyParsons resources & energy

EDEN WAVE ATTENUATOR
WAVE ATTENUATOR OPTION 21 LAYOUT
FUTURE PROOFING CONSIDERATIONS

DRG No 301311-13734-MA-DSK-0038 REV A

WORLEYPARSONS_A1_REV2

LOCATION: P:\JOBS\CURRENT\301311-13734 EDEN WAVE ATTENUATOR - SEE ONE DRIVE\11.0 DRAWINGS\SKETCHES\301311-13734-MA-DSK-0038_A.DWG
USER NAME: kannan.manickam
PLOT DATE & TIME: 22/8/2018 3:56:15 PM
SAVE DATE & TIME: 22/8/2018 3:55:57 PM