From:	Andrew Wilson
To:	Fowler, Mark
Cc:	Tull, Keith; Hancock, Cecily; Heinrich Roxas; Michael Jarvin; Greg Britton
Subject:	Eden Cattle Bay Marina DA 2019.208 (PPSSTH-2)
Date:	Wednesday, 20 May 2020 1:51:50 PM
Attachments:	Record of deferral PPSSTH-2.pdf Royal Haskoning DHV Statement 190520.pdf Cattle Bay Attenuator MSL.PDF Cattle Bay Attenuator MLLW.PDF Cattle Bay Attenuator MHHW.PDF Part 3A Approved Concept Plan.pdf Part 3A Conditioned Approval Plan.pdf

Mark,

I refer to the attached resolution of the Southern Regional Planning Panel on DA 2019.208 for Eden Cattle Bay Marina (PPSSTH-2) at its meeting on 1 April 2020 to defer its decision on the DA pending receipt of an additional report from Council on 12 items, and to your request for information from the applicant on these matters.

Please find attached a statement from the project engineers Royal Haskoning DHV on behalf of the applicant addressing the following items in the Panel's deferral notice:

- Item 1 - Additional details and information on the wave attenuator
- Item 2 - Plan of the marina with dimensions confirming location
- Item 3 - Details on marina berth sizes
- Item 4 - Coastal Management Act and Cattle Bay beach
- Item 5 - Assessment of concrete seawall
- Item 6 - Independent peer review of marina and wave attenuator design and construction
- Item 7 - Floor heights and materials for portable buildings
- Item 11 - Adequacy of emergency management arrangements from accidental contamination event

I have also attached some drawings of the proposed wave attenuator and drawings of the approved concept plan for the tourist facility if needed to assist the Panel with visualising.

The following addresses Items 7, 8, 9, 10 and 12 in the Panel's deferral notice.

Feel free to give me a call if you have any queries or want to discuss. Thank you.

Item 7 - Area to be occupied by portable buildings and maximum height of buildings, setbacks to the reserve, flood compatible building materials and floor heights

The area to be occupied by the portable building is shown in the plans in Appendix 5 of the EIS. The buildings are setback between 3.7m to 4m from the Lot 4 foreshore reserve.

The height of the portable building above the slab is single storey of no more than 3.5m to the main roof line. Any ancillary roof elements such as building ventilation elements

and/or airconditioning units which may also be included on the roof would be no more than 1.5m in height above the roof line.

The flood compatible floor heights and materials are addressed in the attached statement from the project engineers Royal Haskoning DHV.

Item 8 - Compatibility with Concept Plan Approval for Tourist and Residential Development

The Part 3A Concept Plan Approval includes a tourist accommodation facility on the Lot 2 land base of the marina. A copy of an approved concept plan is attached. The marina development is a catalyst and complementary use for the tourist facility development.

The land based components of the marina development (office, amenities, parking and utility services connections) are proposed as temporary facilities until the tourist facility is developed.

The future development of the tourist facility on the land base will include new replacement facilities for the marina including office, amenities, parking, utility services and access for the marina which will need to be subject to a future DA consent. The tourist facility is a use that is compatible with the land based elements of the marina and has a development form with capacity to accommodate these elements for the marina. The tourist facility and marina are complementary uses.

Item 9 - Bundian Way

The Bundian Way is understood to be located generally around the foreshore of Twofold Bay with trails established on certain parts of the foreshore and possibly still in development on other parts of the foreshore.

The Cattle Bay foreshore (Lot 4) has previously been dedicated by the applicant to Council as a public foreshore reserve as part of the Part 3A Concept Plan Approval for the tourist facility on the land base. The landscape rehabilitation of the foreshore is required as part of the first stage of the tourist development in a condition of the approval, and is required to be carried out in consultation with Council and the Local Aboriginal Land Council to address any heritage significance including that associated with the Bundian Way at Cattle Bay. In the interim, Council has conducted and required the applicant to carry out some earlier rehabilitation and landscaping work on Council's foreshore reserve for public access, safety and amenity.

Item 10 - Monitoring regime (eg. annual report) addressing status and compliance with DA conditions of consent

The monitoring regime is included in a number of sections in the Operational Environmental Management Plan (OEMP) for the marina including the following:

- Section 3.2: Environmental and safety incident reports, site walkover check completed during regular site inspections, site personnel register completed at induction.
- Section 4: Independent environmental audit after 12 months and again after 3 years operation and thereafter at 5 yearly intervals. Berthed vessel details and owner details. Marina Manager and Dockmaster Reports recording incidents and site conditions.
- Section 6: Annual safety review of the site and identification of hazards.
- Section 8: Reporting on medical emergencies.
- Section 14: Records of the use of the mobile sewage pump-out unit.
- Section 16: Water quality monitoring program.
- Section 19: Monitoring of surface sediments.
- Section 22: Monitoring of Cocora Beach.

Item 12 - Revised set of conditions

We request Council to please consult us on the drafting of any additional conditions of consent.

Thank you.

Regards
Andrew Wilson
Project Planner
Eden Cattle Bay Marina Pty Ltd
Ph.0412 575 942

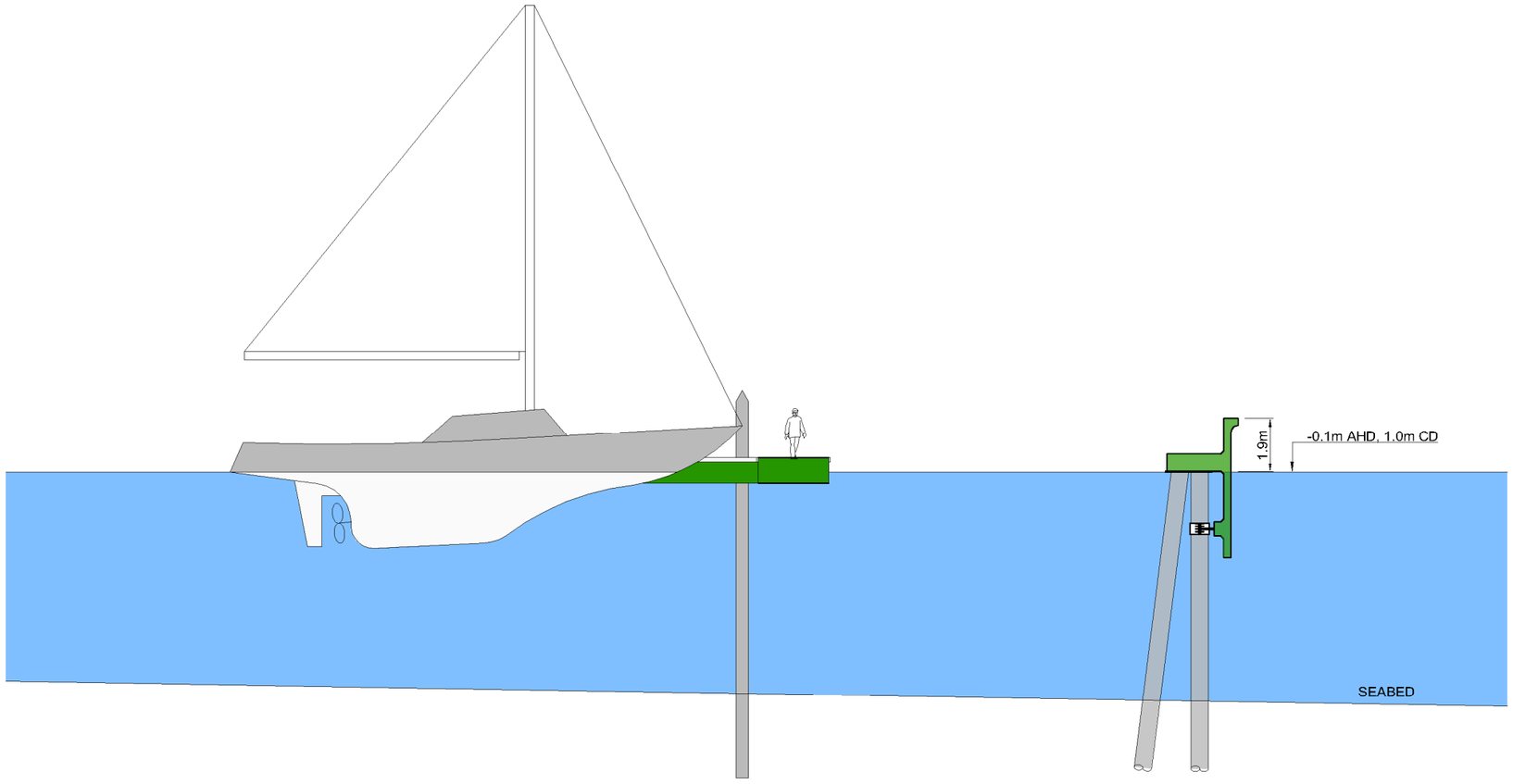
Royal HaskoningDHV
Enhancing Society Together

CATTLE BAY MARINA AND WAVE ATTENUATOR

ELEVATION OF WAVE ATTENUATOR AT MEAN SEA LEVEL (MSL)

PERCENTAGE OF TIME WATER LEVEL IS ABOVE MSL 50%

PERCENTAGE OF TIME WATER LEVEL IS BELOW MSL 50%



NOTE

AUSTRALIAN HEIGHT DATUM (AHD) = APPROXIMATELY MEAN SEA LEVEL.

CHART DATUM (CD) = APPROXIMATELY LOWEST ASTRONOMICAL TIDE

CHART DATUM = -1.0m AHD

SHEET 1 OF 3

2 0 2 4 6 8 10m

1:200 (A3)

SAVED: 27-Nov-15

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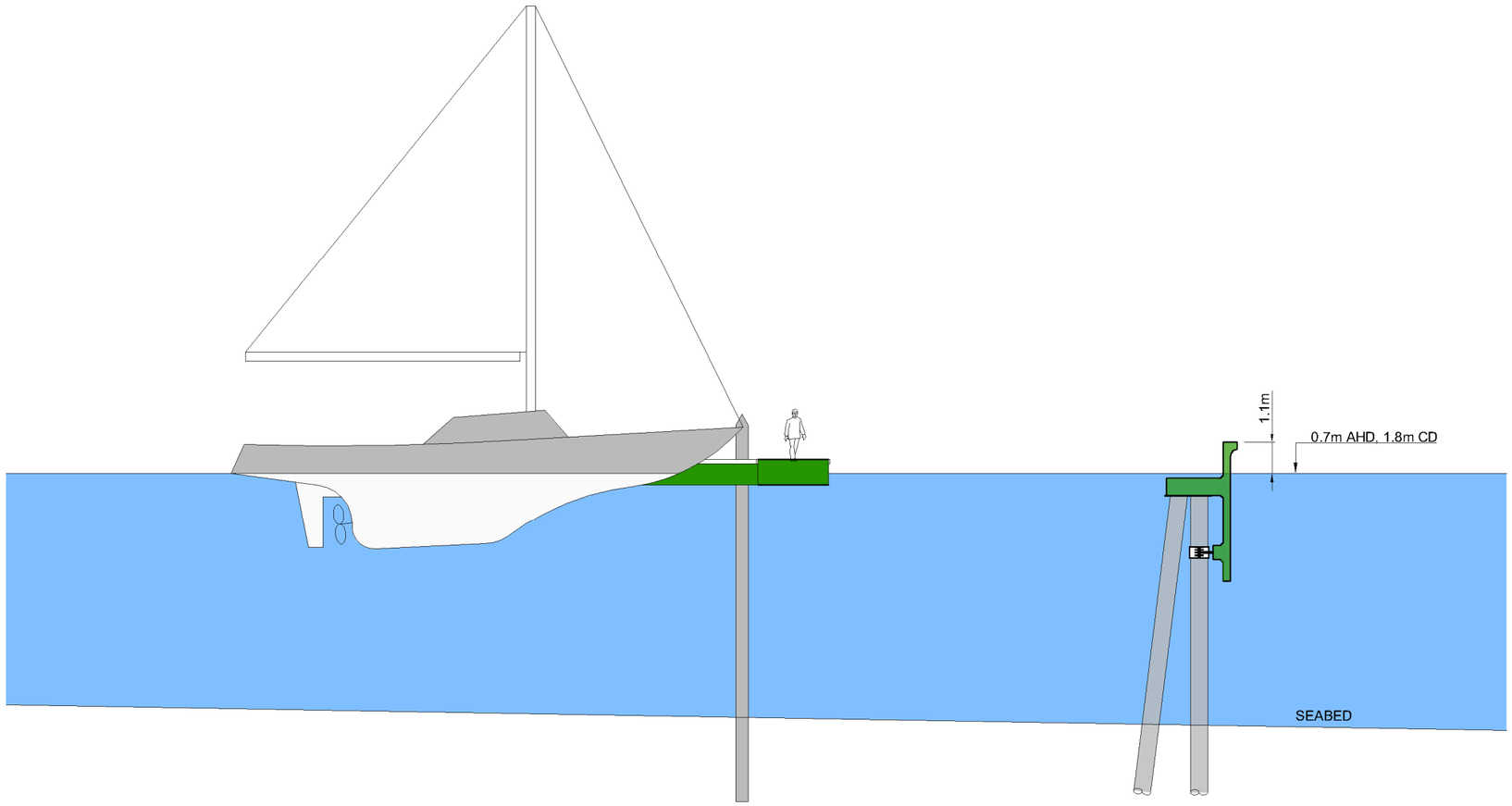
Royal HaskoningDHV
Enhancing Society Together

CATTLE BAY MARINA AND WAVE ATTENUATOR

ELEVATION OF WAVE ATTENUATOR AT MEAN HIGHER HIGH WATER (MHHW)

PERCENTAGE OF TIME WATER LEVEL IS ABOVE MHHW 4%

PERCENTAGE OF TIME WATER LEVEL IS BELOW MHHW 96%



NOTE

AUSTRALIAN HEIGHT DATUM (AHD) = APPROXIMATELY MEAN SEA LEVEL.

CHART DATUM (CD) = APPROXIMATELY LOWEST ASTRONOMICAL TIDE

CHART DATUM = -1.0m AHD

SHEET 2 OF 3

2 0 2 4 6 8 10m

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SAVED: 27-Nov-15

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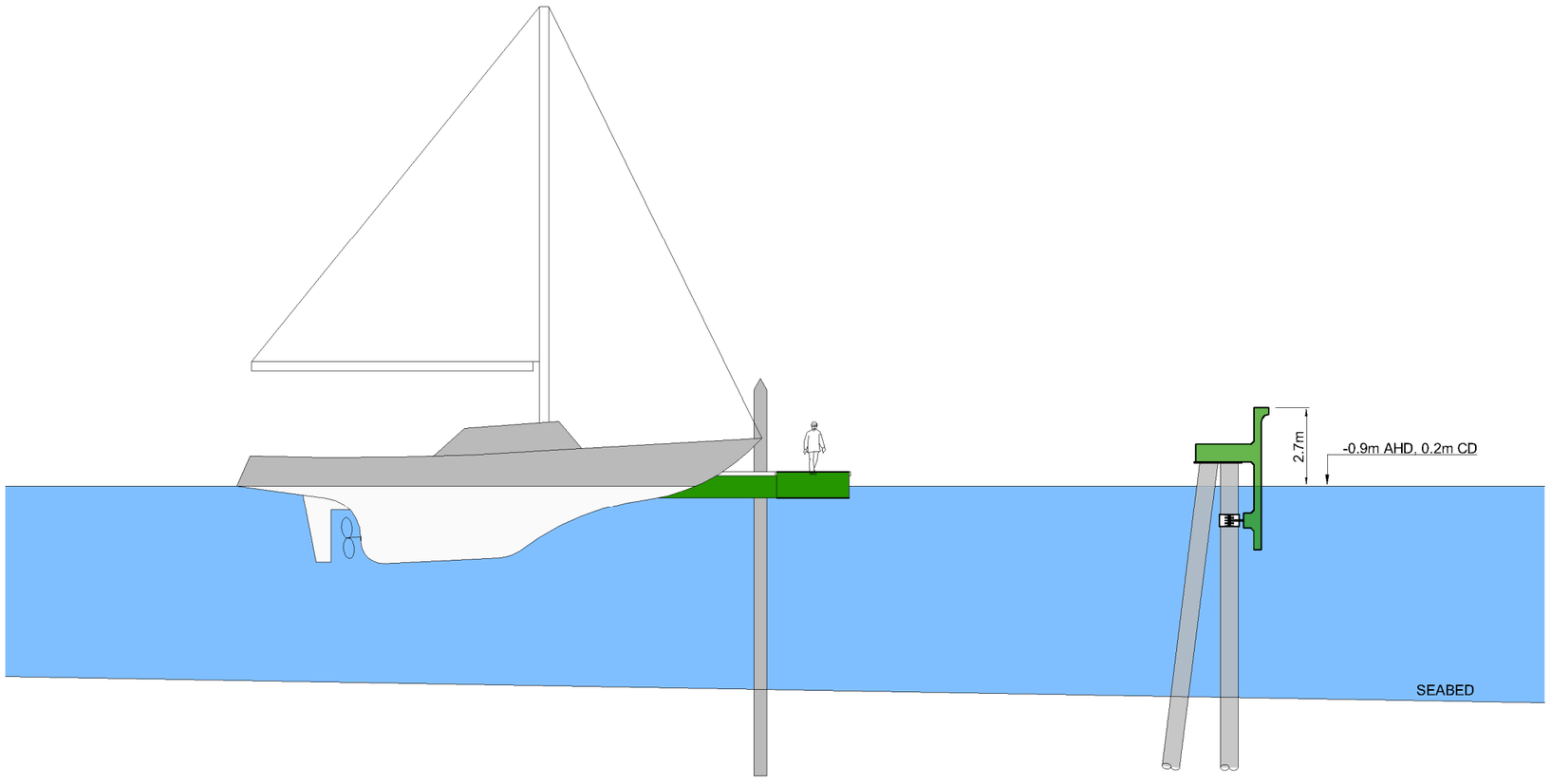
Royal HaskoningDHV
Enhancing Society Together

CATTLE BAY MARINA AND WAVE ATTENUATOR

ELEVATION OF WAVE ATTENUATOR AT MEAN LOWER LOW WATER (MLLW)

PERCENTAGE OF TIME WATER LEVEL IS ABOVE MLLW 99%

PERCENTAGE OF TIME WATER LEVEL IS BELOW MLLW 1%



NOTE

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CHART DATUM (CD) = APPROXIMATELY LOWEST ASTRONOMICAL TIDE

CHART DATUM = -1.0m AHD

2 0 2 4 6 8 10m

1:200 (A3)

LEGEND:

- PROPERTY BOUNDARY
- 1 — 1 STOREY
- 2 — 2 STOREY
- 3 — 3 STOREY
- 4 — 4 STOREY

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Oct 31, 2007 - 1:15pm

Metres
0 100 200 400 Scale A1@1:1000
0 200 400 800 Scale A3@1:2000

Date: 02 August 2007

Date	Revision	
30-03-07	A	CONCEPT PLAN
01-08-07	B	CONCEPT PLAN

Project: Eden Resort Hotel Pty Ltd
Cattle Bay Concept Plan - Option 4

Drawing Title: INDICATIVE - BUILDING HEIGHT
Drawing No.: B. 1.05/C

context
52-58 William Street East Sydney NSW 2011
PO Box A866 Sydney South NSW 1235
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99 York Street, Sydney NSW 2000 Australia
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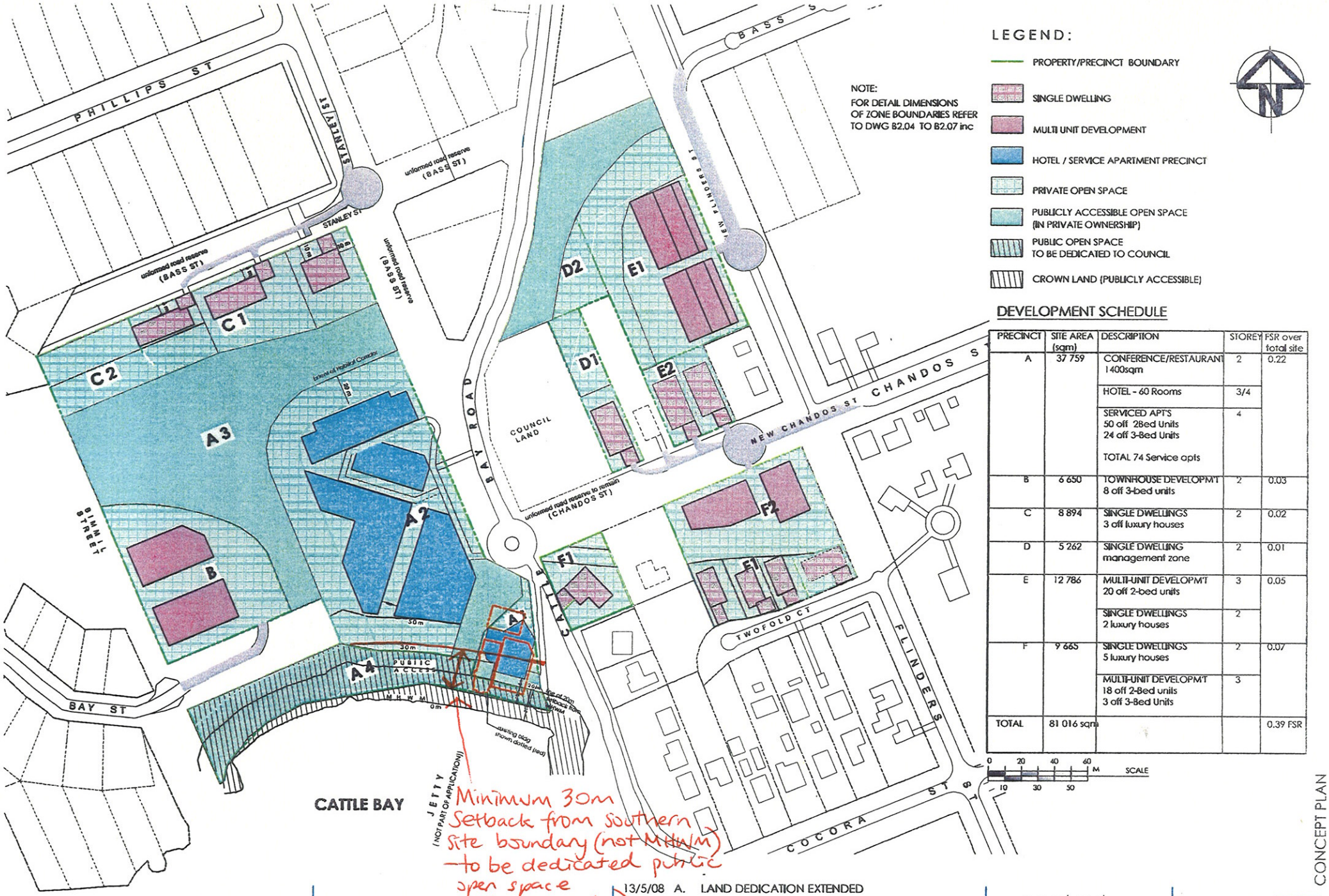
Brewster Murray

CONCEPT PLAN



LEGEND:

- PROPERTY/PRECINCT BOUNDARY
- SINGLE DWELLING
- MULTI UNIT DEVELOPMENT
- HOTEL / SERVICE APARTMENT PRECINCT
- PRIVATE OPEN SPACE
- PUBLICLY ACCESSIBLE OPEN SPACE (IN PRIVATE OWNERSHIP)
- PUBLIC OPEN SPACE TO BE DEDICATED TO COUNCIL
- CROWN LAND (PUBLICLY ACCESSIBLE)

NOTE:
FOR DETAIL DIMENSIONS OF ZONE BOUNDARIES REFER TO DWG B2.04 TO B2.07 inc

DEVELOPMENT SCHEDULE

PRECINCT	SITE AREA (sqm)	DESCRIPTION	STOREY	FSR over total site
A	37 759	CONFERENCE/RESTAURANT 1400sqm	2	0.22
		HOTEL - 60 Rooms	3/4	
		SERVICED APT'S 50 off 2Bed Units 24 off 3-Bed Units TOTAL 74 Service apts	4	
B	6 650	TOWNHOUSE DEVELOPM'T 8 off 3-bed units	2	0.03
C	8 894	SINGLE DWELLINGS 3 off luxury houses	2	0.02
D	5 262	SINGLE DWELLING management zone	2	0.01
E	12 786	MULTI-UNIT DEVELOPM'T 20 off 2-bed units	3	0.05
		SINGLE DWELLINGS 2 luxury houses	2	
F	9 665	SINGLE DWELLINGS 5 luxury houses	2	0.07
		MULTI-UNIT DEVELOPM'T 18 off 2-Bed units 3 off 3-Bed Units	3	
TOTAL	81 016 sqm			0.39 FSR

0 20 40 60 M SCALE
10 30 50

CONCEPT PLAN

13/5/08 A. LAND DEDICATION EXTENDED

Date: 02 August 2007
Scale A1@1:1000
Scale A3@1:2000

Eden Resort Hotel Pty Ltd

Cattle Bay Concept Plan - Option 4

LAND USE PLAN

B. 2.01/A

context

Architect

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Mr Mark Fowler
Senior Town Planner
Bega Valley Shire Council
Zingel Place
BEGA NSW 2550

Date:	03 June 2020	Contact name:	Greg Britton
Your reference:		Telephone:	02 8854 5002
Our reference:	PA1042-105_DA2019.208	Email:	greg.britton@rhdhv.com
Classification:	Project related		

Dear Mark

PPSSTH-2-BEGA VALLEY-DA2019.208 AT CATTLE BAY ROAD, EDEN - CATTLE BAY MARINA

I refer to the above matter and the public meeting held by teleconference on Wednesday 1 April 2020 at which the Planning Panel agreed to defer determination of Cattle Bay Marina pending receipt of a supplementary report from Council addressing a range of matters.

I have been requested by Andrew Wilson to address those particular matters raised by the Planning Panel within the areas of my expertise, namely matters 1a, 1b, 2, 3, 4, 5, 6, 7 and 11. Each of these matters is reproduced below, followed by a response. Some of the responses refer to Attachments, which are included at the end of this letter.

1. **Further detail on design of the wave attenuator including representative, dimensioned cross section(s) of the structure, proposed final length and dimensioned location**:

   Representative dimensioned cross section(s) of the structure

   A dimensioned typical cross section of the wave attenuator is shown on Drawing PA1042-MA-SK01 Rev A (refer **Attachment A**). In summary the attenuator comprises a fixed wave attenuator (wave screen), consisting of a series of vertical and raked piles (or possibly pairs of vertical piles) with an insitu or precast concrete cap, supporting precast concrete panels that span between the sets of piles. The spacing of the sets of piles would be approximately 6m.

The top of the wave panel would be at approximately 2.9m above Chart Datum (2.9m CD)[1] and the bottom of the wave panel would be at approximately -2.0m CD. A wave deflector would be incorporated at the top of the precast panel to mitigate wave overtopping.

The dimensions shown on Drawing PA1042-MA-SK01 Rev A are subject to detailed design but would not be expected to change significantly from the values shown.

Proposed final length and dimensioned location of wave attenuator

The proposed final length of the wave attenuator is approximately 260m. The location of the attenuator is shown on Drawing 8A0458 Cattle Bay Marina and Attenuator – General Arrangement Rev A dated 21/08/2015 superimposed on a vertical aerial photograph of Cattle Bay (refer **Attachment B**). The coordinates of the western and eastern ends of the attenuator and the turn point of the 'crank' in the attenuator are provided in Mapping Grid of Australia (MGA) Eastings and Northings.

The above Drawing is the basis for the wave attenuator shown on the Drawings in Appendix 5 of the EIS and in Figures 6 and 7 within the EIS.

The proposed overall area to be occupied by the marina and wave attenuator (Lot 1, DP1242690) is shown on a plan prepared for purposes of a lease application to NSW Crown Lands by Surveyor Colin Robert Hunter dated 01/05/2018 (refer **Attachment C**).

a. Further assessment of whether wave reduction will be sufficient to enable the marina to meet Australian Standard AS3962-2001 "Guidelines for design of marinas"; Australian Standard AS4997-2005 "guidelines for design of maritime structures" and NSW Maritime Authority Guidance Note 8.3.02;

Introduction and background

The Planning Panel has referred to three particular standards/guidelines. Firstly, the following can be stated:

- AS4997:2005 'Guidelines for design of maritime structures' specifically states the Standard is not intended to cover the design of marinas and refers the reader to AS3962 'Guidelines for design of marinas' (refer to AS4997:2005, Section 1.1 Scope); and
- NSW Maritime Authority Guidance Note 8.3.02 covers four topics: 'General', 'Water Depths', 'Berth Sizes' and 'Floating Structures'. The Guidance Note does not specifically refer to wave climate within marinas but does note under 'General' that the Authority will generally apply the guidelines set out in AS3962:2001.

[1] *Chart Datum is the datum displayed on nautical charts for purpose of navigation. At Eden, Chart Datum is equal to Lowest Astronomical Tide (LAT), which is approximately 1.0m below Australian Height Datum (AHD). Hence in terms of AHD:*
• top of wave panel would be approximately 1.9m AHD;
• bottom of wave panel would be approximately -3.0m AHD.

It follows from the above that it is only necessary to consider AS3962. The Planning Panel refers to the version of AS3962 issued in 2001, ie. AS3962:2001. The Standard was recently revised (March 2020) and the current version is AS3962:2020 'Marina design'. The required limitation on wave height in marinas set out in AS3962:2020 is the same as that previously set out in AS3962:2001.

The Planning Panel also makes the following statement ….. 'the applicants consultants have indicated the model testing shows that the tested concept did not achieve the level of wave reduction required to achieve the wave conditions within the marina as required by the Standards quoted and that the length may need to be increased.'

The Planning Panel did not identify where this statement is made in the information which was reviewed but it probably relates to the discussion in Section 8.3.2 of Cardno (2014) where the following is stated:

- ' ….. not all of the marina locations had 1-year ARI[2] and 50-year ARI design wave heights within the 'moderate' wave climate criteria in AS3962, particularly Points R and T, indicating the eastern and western extents of the marina are affected by local sea waves that are diffracted around the ends of the wave attenuator'; and
- ' ….. satisfaction of the 'moderate' wave climate could be achieved through a number of means ….. the most suitable method would be to block the diffracted local sea waves by extending the attenuator at each end. Due to the short period nature of the design local sea waves this extension need only be relatively minor.'

The location of Points R and T, and other wave output locations reported in the Cardno (2014) modelling, are shown in **Figure 1**. This figure also shows the initial straight wave attenuator (not pursued) and the original cranked wave attenuator (in green) which the above discussion of model results pertained to.

[2] *ARI means Average Recurrence Interval.*

Figure 1 Image showing location of wave modelling output locations and cranked wave attenuator adopted in the Cardno (2014) modelling

Following the results of modelling for the original 'green' cranked attenuator in Cardno (2014), subsequent modelling was undertaken by Cardno in May 2015, on behalf of Royal HaskoningDHV, for a revised cranked attenuator in which the original attenuator was extended at its eastern and western ends. This revised attenuator is the current adopted proposal and is that shown in Appendix 5 of the EIS, in Figures 6 and 7 within the EIS, and in **Attachment B** to this letter. The modelling results for the revised cranked attenuator are outlined below.

Assessment of wave reduction for proposed attenuator

The results of the May 2015 modelling of the revised cranked wave attenuator are shown in **Figure 2**. The output locations for wave height are shown by the circles and correspond to the output locations and letter references R, S, T etc. in **Figure 1**. In addition, a further output location was added referred to as 'Inshore', located just seaward of the inner-most marina berths located adjacent to the existing jetty. Note that the modelling considered the wave attenuator only, it did not factor in the additional attenuation that would be achieved due to the floating marina structure.

The recommended criteria for 'moderate' wave climate in a marina to satisfy AS3962:2020 are listed in Table 1. The predicted wave heights at each of the wave output locations are listed in Table 2. The following can be stated from a comparison of the information in Table 1 and Table 2:

- the wave heights at all locations R, S, T, U, V and W satisfy AS3962:2020 noting that the direction of the waves at these locations relative to the berths are either 'head seas' or 'oblique seas' and that peak wave period is greater than 2 seconds for both the

50-year ARI and 1-year ARI events (peak wave periods lie in the range 2.3 to 3.4 seconds); and

- the wave heights at the Inshore location due to the wave attenuator only (no factoring of additional wave attenuation from the floating marina structure), do not satisfy the criteria in AS3962:2020 for beam seas (these berths are beam-on). However the modelling ignores the attenuation effect of the multiple floating marina arms which would be located seaward of the Inshore location (in addition, vessels seaward of the Inshore location would provide attenuation of the waves). It can be shown that a transmission coefficient of around 0.6 and 0.7 would be required from the multiple floating marina arms, combined, for the wave climate at the beam-on berths to satisfy AS3962:2020. It can be concluded this would be achieved by reference to design charts for transmission coefficients for individual pontoon systems, as proposed for the marina arms, established from small scale physical model testing, eg. as shown in **Figure 3**[3].

It follows from the above that the wave reduction achieved by the proposed wave attenuator and floating marina outlined in the EIS would be sufficient to enable the marina berths to meet AS3962:2020.

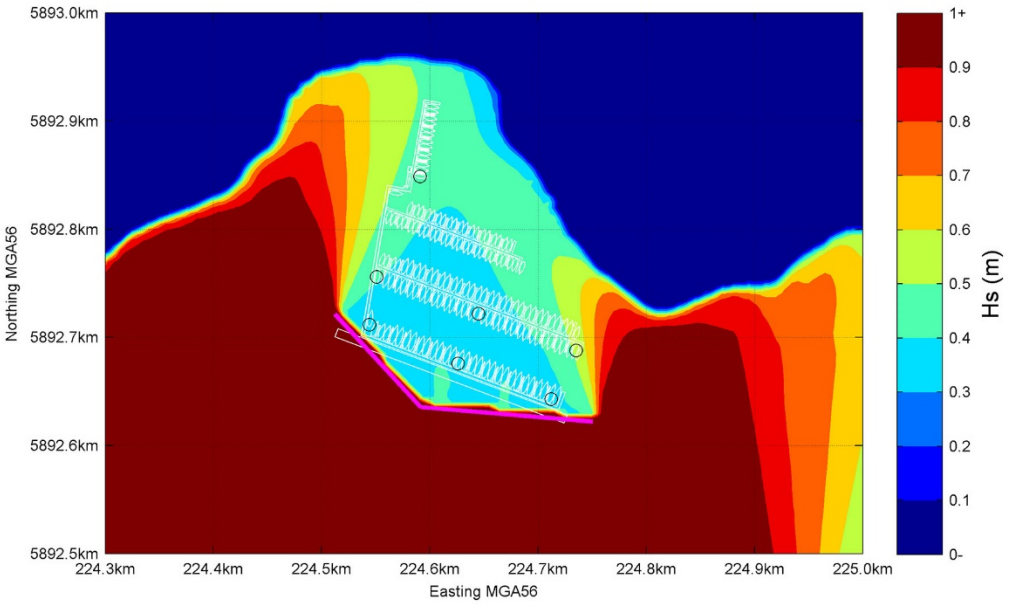


Figure 2 Results of wave modelling for cranked wave attenuator, by Cardno in May 2015

[3] *Pontoon widths in the proposed marina vary from 2.0 to 2.6m as shown in Drawing 810458-MA-SK1 Rev A (refer Attachment H). The local seas would encounter, and be attenuated by, a succession of typically three floating marina arms before reaching the beam-on marina berths.*

Table 1 Criteria for a 'Moderate' wave climate (AS3962:2020)

Direction and peak period of design harbour wave	Significant wave height (H_s)	
	wave event exceeded once in 50 years	**wave event exceeded once a year**
Head seas less than 2s	Conditions not likely to occur during this event	Less than 0.38m wave height
Head seas greater than 2s	Less than 0.75m wave height	Less than 0.38m wave height
Oblique seas greater than 2s	Less than 0.5m wave height	Less than 0.38m wave height
Beam seas less than 2s	Conditions not likely to occur during this event	Less than 0.38m wave height
Beam seas greater than 2s	Less than 0.31m wave height	Less than 0.19m wave height

Note:

The criteria for 'moderate' wave climate has been determined by multiplying the criteria for 'good' wave climate by 1.25 in accordance with AS3962:2020.

Table 2 Significant wave height (H_s, m) at output locations

Output location	**50-year ARI**	1-year ARI
R	0.54	0.38
S	0.39	0.27
T	0.41	0.28
U	0.38	0.27
V	0.40	0.28
W	0.39	0.27
Inshore	0.44	0.31

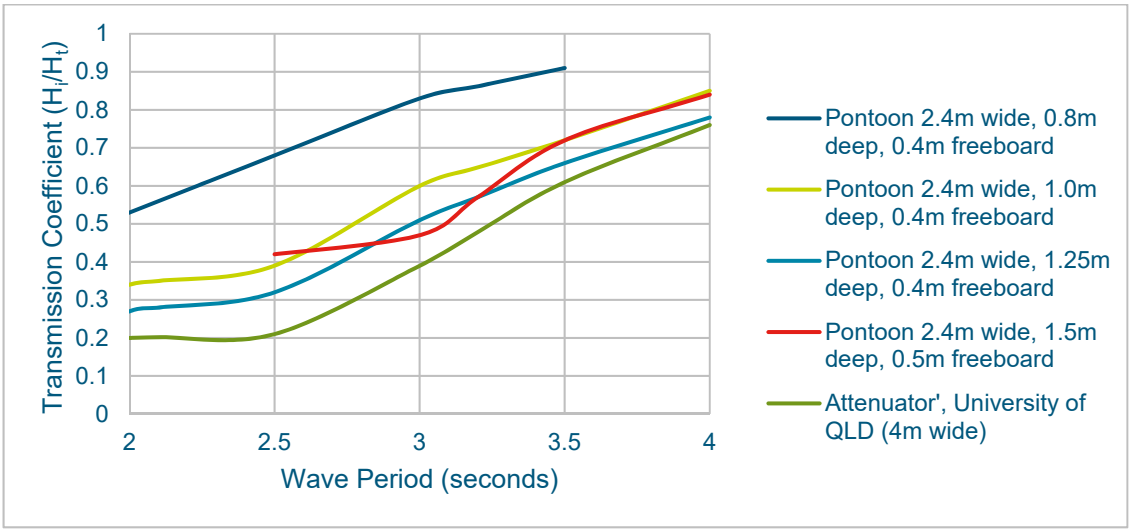


Figure 3 Transmission coefficient K_T versus wave period for individual pontoon systems based on small scale physical model testing (after Patterson et al, 1997; Gary Blumberg & Associates, 2004)

b. Further assessment of potential impacts on Cattle Bay and Cocora Beaches, the likelihood of overtopping and inundation of the land based aspects of the development, safe navigation, the competency of the existing sea wall, and changes to public access along the beach.

Potential impacts on Cattle Bay and Cocora Beaches

It is not clear what information the Planning Panel had available to it for review in respect of the potential impacts of the proposed Cattle Bay wave attenuator on Cattle Bay and Cocora Beaches.

Royal HaskoningDHV (RHDHV) has prepared three specific pieces of correspondence in relation to this matter in response to submissions on the original 2014 EIS and in response to submissions on the re-submitted 2019 EIS. This correspondence comprises:

- RHDHV (April 2015), Cattle Bay Marina – Response to Submissions on EIS – Supplementary Statement on Wave Attenuator and Potential Impacts, dated 8 April 2015.

  This correspondence may not have been included within Appendices in the 2019 EIS. It is included here as **Attachment D;**
- RHDHV (February 2019), Cattle Bay Marina – Environmental Impact Statement – Supplementary Wave Impact Statement, dated 21 February 2019.

  This correspondence was included as Appendix 13 Part 2 in the 2019 EIS and presumably would have been reviewed by the Planning Panel;
- RHDHV (September 2019), Cattle Bay Marina – DA2019.208: Response to Submission by Department of Planning Industry & Environment (Biodiversity and Conservation Division), dated 10 September 2019.

  This correspondence is included here as **Attachment E**.

The various correspondence above addressed the following range of matters:

- potential impacts on Cocora Beach;
- potential impacts on Cattle Bay Beach;
- potential impacts on commercial mussel farm;
- effect of reflected waves on existing vessels at swing moorings;
- implications of dredging within Snug Cove for the Eden Breakwater Extension Project;
- implications of Eden Safe Harbour (Snug Cove) wave attenuator for the Cattle Bay wave attenuator;
- incorporation of both the proposed Eden Safe Harbour wave attenuator and the proposed Cattle Bay wave attenuator in the wave modelling;
- extreme coastal events at Cocora Beach;
- impacts of coastal hazards on land based component of the proposal;

- impacts of coastal erosion on beach amenity and assets at Cattle Bay;
- longer term monitoring program at Cocora Beach[4].

In terms of potential impacts of the proposal on Cattle Bay and Cocora Beaches, the above correspondence concluded that the proposal:

- would create more sheltered wave conditions along Cattle Bay Beach and a clockwise rotation of the beach (while retaining a sandy beach); and
- would not cause significant changes to swell wave direction and energy along Cocora Beach.

It is suggested the Planning Panel considers the various correspondence referred to above and either confirms that the matter has been satisfactorily addressed or provides more specific detail as to what is meant by 'further assessment'.

Likelihood of overtopping and inundation of the land based aspects of the development

Certain aspects of this matter are addressed in the letter prepared by RHDHV dated 22 August 2019 in response to the submission from DPIE (Biodiversity and Conservation Division) and included here as **Attachment E**. For clarity, a specific response to the matter is set out below.

The Bega Valley Shire Council's 'Coastal Processes and Hazards Definition Study' (2015), prepared for Council by BMT WBM, considers the erosion and recession hazard, and coastal inundation hazard, for Cattle Bay. In Table 4.9 of that report the present day (2015) design 2% wave runup level for Cattle Bay in the 1% Annual Exceedance Probability (AEP) storm event is given as 2.6m AHD. A reasonable estimate of the design 2% wave runup level in the future 2050 and 2100 (not provided by BMT WBM) is considered to be approximately 3.0m AHD and 3.5m AHD respectively (adding nominally 0.4m and 0.9m for sea level rise projections).

The land based components of the development comprise a temporary (portable) building to house marina administration and toilets, a temporary carpark and temporary services arrangements. The temporary facilities on the land base would be replaced by a tourist facility which is the subject of a Part 3A Concept Plan Approval, when developed in the future.

For assessment purposes it is considered conservative to adopt a wave runup level of 3.0m AHD (the 2050 estimated value) since:

- it is likely the land based component of the project would be redeveloped in accordance with the Part 3A Concept Plan Approval, and hence the temporary facilities upgraded, prior to 2050;
- the wave climate at the foreshore would be attenuated following construction of the marina and wave attenuator hence the wave setup and wave runup components of the elevated oceanic water level calculated for existing and future conditions would be overestimates; and

[4] *Further to this point, an email was provided by the writer to Andrew Wilson, the Planner for the Applicant, dated 18 February 2020, setting out matters for consideration for a joint monitoring program with the Department of Industry (DoI) to assess potential changes to Cocora Beach. These matters were included with the finalised Operational Environmental Management Plan (OEMP) for the Cattle Bay Marina project.*

- it is arguable in practice whether a wave runup level should be adopted for assessment of inundation of building structures as it is a transient phenomenon.

In any case, adopting a wave runup level of 3.0m AHD, the following can be stated:

- the crest level of the seawall is at approximately 2m AHD and hence would be overtopped in a severe ocean storm. Overtopping would comprise some vertical spray and a bore or sheet flow propagating landward in pulses corresponding to the wave period;
- the proposed land based components of the development, eg. the temporary (portable) building to house marina administration and toilets, are situated 30m from the seawall beyond the Public Reserve (refer Appendix 5 of EIS). At this location the land level is approximately 2.5m AHD. The proposed floor level of the temporary building is situated four steps above the ground level (refer plan in Appendix 5 of EIS), ie. approximately 0.7m above the ground level or at approximately 3.2m AHD; and
- a floor level of 3.2m AHD (freeboard of 200mm) is considered reasonable in the circumstances having regard to the conservative factors referred to above. Having said that, the Applicant would be prepared to work with Council staff to revise the floor level upwards if required, for example by including one or two additional steps from ground level.

Safe navigation

It is not clear if the Planning Panel has a specific concern in relation to navigation. In any case the following can be stated:

- proposed internal channels, fairways and the like for Cattle Bay Marina comply with AS3962:2020;
- consultation with the Port Authority of NSW (PANSW), Roads and Maritime Services (now Transport for NSW), and NSW Department of Industry took place during preparation of the EIS. Correspondence prepared by RHDHV dated 29 March 2019 outlining this consultation is included here as **Attachment F**;
- PANSW made a submission in relation to the EIS. A response to this submission was prepared by RHDHV dated 9 September 2019 and addressed a number of matters as listed below. A copy of this submission is included here as **Attachment G**:
  - cumulative impacts[5],
  - marine traffic, navigation and safety[6],
  - hazards[7],
  - first port of entry requirements.

Key outcomes from a safe navigation perspective, advised by RHDHV based on consultation with the agencies and information provided to the agencies, can be summarised as follows:

- the two wave attenuator projects can be undertaken compatibly;

[5] *This matter related to the interaction between the Cattle Bay Marina wave attenuator project and the Eden Safe Harbour wave attenuator project.*
[6] *PANSW did not object to the proposal in relation to these matters, but noted that if the DA is approved, further consultation with the Harbour Master will be required in relation to the matters.*
[7] *This matter related to the potential impacts of prop wash from cruise ships and tugs on vessels moored at Cattle Bay Marina.*

- the requirements of PANSW have been included in the Construction Environmental Management Plan (CEMP) and Operational Environmental Plan (OEMP); and
- the proposed Cattle Bay Marina is sufficiently distant from the source of the prop wash for it to be able to be satisfactorily designed.

RHDHV is not aware of any outstanding matters in relation to safe navigation raised by any government agency or other party.

Competency of the existing seawall

The existing seawall at the back of Cattle Bay Beach comprises a rock revetment structure in the eastern section and a masonry gravity structure in the western section (refer **Figure 4**). The seawall is thought to have been constructed in the 1940s/1950s associated with development of industry at the site.

Figure 4 View looking landward from the jetty showing the rock revetment structure on the right of the image and the masonry gravity structure on the left of the image

Even though the seawall is now some 70 years of age, there is no known history of failure of the seawall or erosion of the land beyond the seawall. The seawall would have endured some significant ocean storms during its life including the storms of May-June 1974 and June 2016.

Based on inspections of Cattle Bay Beach by the writer over the past 15 years and the sheltered nature of the site, there is considered to be currently no immediate or near term concern regarding the competency of the seawall.

It is also reasonable to expect that a seawall would continue to exist at the back of Cattle Bay Beach into the foreseeable future having regard to:

- the Part 3A Concept Plan Approval for the tourist facility (see below); and

- the dedication which took place some years ago of a 30m wide Public Reserve to Bega Valley Shire Council (refer Lot 4 in **Attachment C**).

It is relevant that Condition C9 of the Part 3A Concept Plan Approval for the tourist facility requires the structural soundness of the seawall to be examined and if needed repaired as part of the first stage of the development, as follows:

C9 Seawall and associated structures
As part of the future development application for Stage 1 application for Precinct A4, the proponent shall provide engineering certification of the structural soundness of the seawall and associated structures. Should the engineering assessment find that works are required, the proponent is required to fund and undertake the necessary repairs. Future applications shall incorporate suitable mitigation works for the seawall to ensure adequate protection of public foreshore infrastructure from the 1-in-100 year coastal inundation event. This may include potential raising of the seawall.

It is our understanding that the seawall is located within the Public Reserve (Lot 4), the seaward boundary of which is defined as Mean High Water Mark (refer **Attachment C**). In any case, the seawall is not situated on land owned or proposed to be leased for the marina by the Applicant.

There is a question that arises, however, as to whether the predicted clockwise rotation of Cattle Bay Beach due to the proposed works (as noted earlier) would potentially place the integrity of the seawall at greater risk in storms events and, if so, what mitigation measures could be undertaken.

The predicted change in beach alignment (clockwise rotation), representing a new equilibrium for Cattle Bay Beach, was illustrated in Figure 8.9 of Cardno (2014) and is shown in **Figure 5** of this letter (under the response to matter 4). The white line in the figure depicts the existing beach alignment and the red line depicts the predicted new alignment, assuming no change to the sub-aerial beach volume which is realistic for this closed embayment.

The landward movement of the beach alignment at the western end is the relevant consideration, as it would reduce beach width and hence the sand volume available seaward of the seawall to accommodate storm erosion.

The following points are relevant:

- the predicted maximum landward movement at the western end of the beach is approximately 8m, however the seawall does not extend fully to the western end of the beach, terminating approximately 108m west of the base of the jetty as shown in **Attachment C**. At this point the predicted landward movement is approximately 2.5m;
- the wave energy along Cattle Bay Beach would be reduced due to the proposed works, hence there would be a reduction in the erosion potential during storm events. A measure of the reduction in wave energy in the western section of the beach can be determined from the pre and post development wave heights at Location B (refer **Figure 1**) in the 50 year Average Recurrence Interval (ARI) storm event, available from Table 8.4 of Cardno (2014), and noting that wave energy is a function of wave height squared (H^2). This information indicates a reduction in ocean swell wave height from

0.25m to 0.19m and therefore a reduction in ocean storm wave energy of approximately 40%[8];

- over the majority of the seawall length (approximately 70% of its length), the beach would be both wider and the wave energy would be lower, hence the erosion risk to the seawall would be improved over this length.

The remaining question is to what extent is there a balance, at the western end of the seawall, between the reduction in beach width of 2.5m and the lesser erosion potential due to the lower wave energy. A guide to this matter can be found in published storm erosion demand[9] relationships for the open coast (Gordon, 1987) and comparisons between open coast and Cattle Bay Beach incident wave energies.

Cattle Bay Beach is very sheltered (50 year ARI swell wave height 0.25m at Location B) compared to the open coast. Based on energy considerations, existing storm erosion demand at Cattle Bay Beach would not be expected to exceed 5 to 10m^3/m in a 100 year ARI event. As such, the reduction in storm erosion demand due to the proposed works (say 30 to 40%) would be of a similar magnitude to the loss of available sand volume due to narrowing of the beach, based on a beach berm height of approximately of 1.5 to 2m AHD.

On balance, it is therefore considered unlikely that the risk to the western section of the seawall in storm events would change materially as a result of the proposed works. A mitigation measure could be to initiate a monitoring program to record the behaviour of Cattle Bay Beach to inform any future action regarding the seawall. The ongoing need for a monitoring program could be re-evaluated following operation of Condition C9 of the Part 3A Concept Plan Approval for the tourist facility.

Changes to public access along the beach

It is understood the beach referred to here is Cattle Bay Beach.

There will be no changes to public access along the beach as a result of the proposed development. Public access will also be retained to the existing jetty.

It is also noted that a 30m wide Public Reserve along the foreshore has been previously dedicated to Bega Valley Shire Council.

Furthermore, public access will be provided to the floating marina during the hours of 7am to 6pm (Summer daylight saving) and 7am to 5pm (non daylight saving), to Council's satisfaction unless closure is in the interest of public safety and/or security.

2. A plan with dimensions confirming the location of the marina envelope within Cattle Bay

The information included in **Attachment B** (Drawing 8A0458-Cattle Bay Marina and Attenuator – General Arrangement Rev A) and in **Attachment C** (Plan of Crown Land creating Lot 1) should be sufficient to confirm the location of the marina envelope within Cattle Bay.

[8] *There would also be a reduction in local sea wave energy of approximately 25%.*

[9] *Storm erosion demand is the quantity of sand removed from the subaerial beach, measured above 0m AHD, in the design storm, usually expressed in cubic metres per metre length of beach (m^3/m).*

3. **Further detail on the proposed marina layout that shows how the nominated range of berth sizes can be accommodated within the marina footprint including sufficient information to demonstrate that the berth dimensions can meet the Marina Standards in terms of navigability and wave conditions at all berths.**

Firstly, the ability of the marina layout and attenuator design to meet wave conditions in accordance with AS3962:2020 has been addressed under Item 1a above.

The proposed marina layout including the nominated range of berth sizes within the marina footprint is shown on Drawing 8A0458-MA-SK10 Rev A (refer **Attachment H**). This marina layout drawing was included in Appendix 5 of the EIS.

The berth dimensions (double berth) adopted compared to the recommended berth dimensions in AS3962:2001, which was the applicable Standard at the time of the concept design, are set out in Table 3. Also shown are the berth dimensions now recommended in AS3962:2020. It can be seen that the adopted berth widths complied with AS3962:2001 and also generally comply with AS3962:2020 (the adopted berth widths slightly exceed the minimum requirements for 12m and 15m vessels, and are slightly less than the minimum requirement for an 18m vessel).

The above dimensional differences are small and can be accommodated during progress of the marina design from concept to detail to ensure compliance with AS3962:2020 and not affect the proposed marina envelope.

Tale 3 Berth dimensions

Vessel length (m)	Adopted berth width (m)	Minimum berth width (m) (AS3962:2001)	Minimum berth width (m) (AS3962:2020)
12	9.8	9.8	9.6
15	11.0	11.0	10.8
18	11.8	11.8	12.0

4. **An assessment of the application against the requirements of the Coastal Management Act 2016, and in particular the changes modelled for Cattle Bay Beach of erosion and recession at its western and, including options and responsibilities for remedial action**

As noted earlier, the proposed development would create more sheltered wave conditions along Cattle Bay Beach and a predicted clockwise rotation of the beach in response to the change in mean energy-weighted wave direction for combined sea and swell.

The predicted change in beach alignment (new equilibrium) was illustrated in Figure 8.9 of Cardno (2014) which is reproduced below in **Figure 5**. The white line depicts the existing beach alignment and the red line depicts the predicted new alignment, assuming no change to the sub-aerial beach volume which is realistic for this closed embayment.

The predicted landward movement at the western end of the beach is approximately 8m and the predicted seaward movement at the eastern end of the beach is approximately 7m. Importantly, a sandy beach is predicted to be sustained along the full beach length.

The Coastal Management Act 2016 has provisions for ‘coastal management programs’ to be prepared by local Councils for the coastal zone and provisions applying to ‘coastal protection works’.

There is no Coastal Management Program in effect in Bega Valley Shire under the Coastal Management Act 2016 and the development application for Cattle Bay Marina does not include 'coastal protection works'.

There are thirteen objects of the Coastal Management Act 2016, of which two are particularly relevant to the matter at Cattle Bay Beach, namely:

(a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and

(b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety.

The predicted changes to beach alignment represent a new equilibrium for Cattle Bay Beach. Given the sandy beach would be retained along its full length with the same sub-aerial volume, it is considered that the above objects of the Act have not been impacted. The additional sheltering of the beach from sea and swell would be of some benefit in reducing erosion of the beach during strong wind events from the southerly sector and during ocean storms.

Having regard to the above, remediation of the beach as a result of the application is not considered to be necessary.

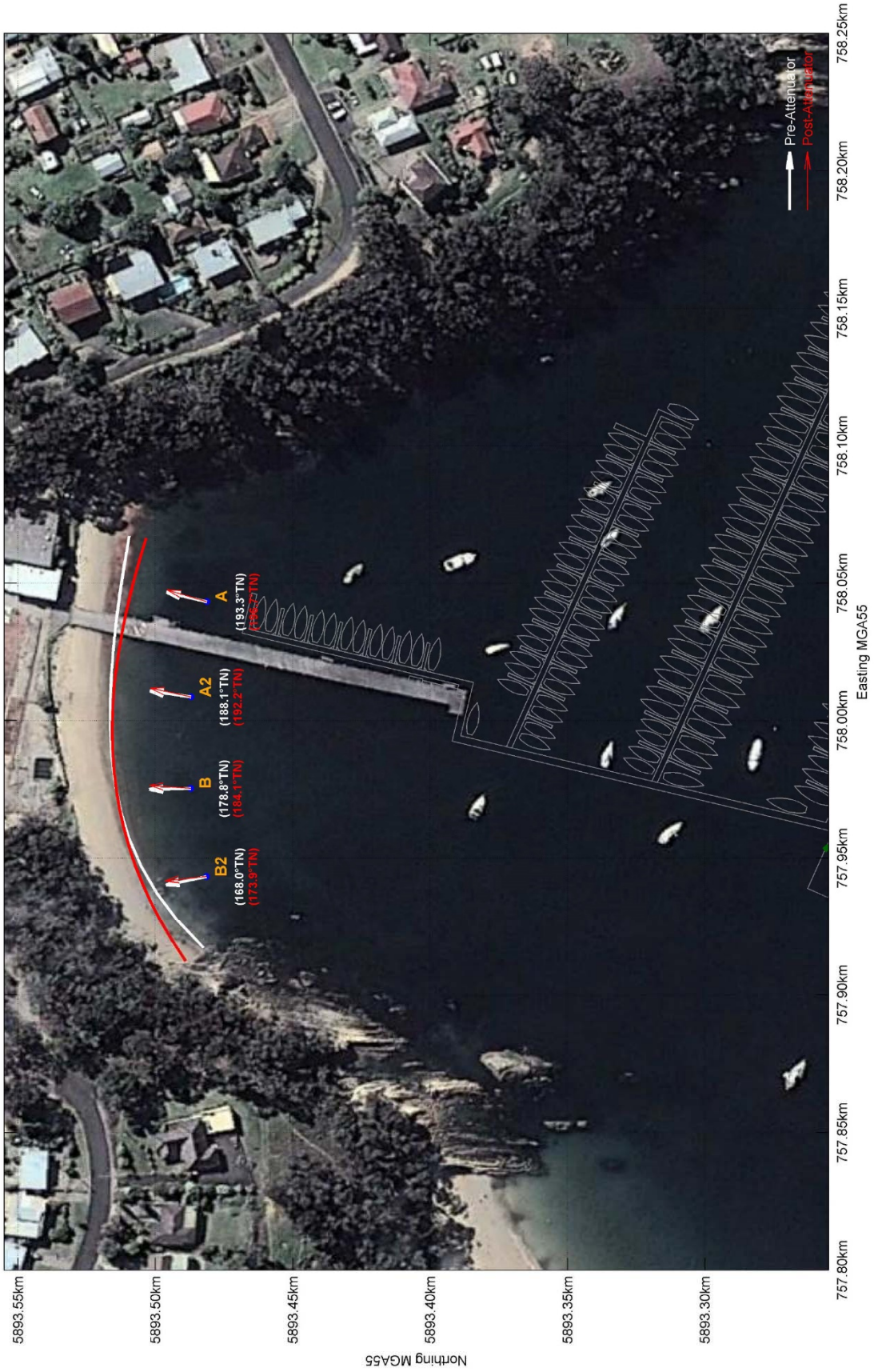


Figure 5 The predicted change in beach alignment (new equilibrium) at Cattle Bay Beach

5 An assessment of the condition of the existing concrete sea wall backing Cattle Bay Beach noting:

a. the assessment of flood/inundation impacts on the land based components of the development relies on the integrity of the sea wall

The condition of the existing seawall has been referred to in the response to Item 1b above, noting that there is considered to be currently no immediate or near term concern regarding the condition of the seawall in so far as flooding/inundation impacts, or erosion impacts, on the land based components of the development.

b. the wave conditions and sea level rise projected in the application documentation

Sea level rise projections adopted in the application documentation were nominally 0.4m at 2050 and 0.9m at 2100, relative to 1990, as noted in Cardno (2014) (refer Section 8.3.3 of that document, included in Appendix 13 Part 1 of the EIS) and in the response to Item 1b above.

Cardno (2014) has noted that model results for the 2050 (0.4m) and 2100 (0.9m) sea level rise scenarios show that the design wave heights are unlikely to change significantly for these sea level rise projections[10].

The risk of greater overtopping of the existing seawall and inundation of the proposed temporary structures with sea level rise to 2050 has been considered in the response to Item 1b. Potential raising of the seawall is also contemplated as an adaptive measure for the seawall in Condition C9 of the Concept Plan Approval for the tourist facility.

c. the potential impact on public access and safety

In the interim prior to operation of Condition C9 of the Concept Plan Approval for the tourist facility, management of the condition of the seawall for public access and safety would be the responsibility of the asset owner, understood to be Council.

6. Options for appropriate independent peer review of both the final design of the wave attenuator and of the marina prior to certification that enable construction to take place, and a further independent peer of the completed works, prior to final certification of the project.

An option for the independent peer reviews noted above would be to include such a requirement in a condition of development consent. The independent peer reviewer should be a 'suitably qualified and experienced independent coastal/maritime engineer'.

7. Further detail on the area to be occupied by the portable buildings, specifically the maximum height of the buildings and setbacks to the reserve, and on the flood compatible building materials and appropriate floor heights to be used in the context of localised flood risk including oceanic inundation.

In so far as an appropriate floor height is concerned, it has been outlined in response to Item 1b that the proposed floor height of the temporary building is approximately 3.2m AHD compared to an

[10] *It is also relevant to note that the attenuation performance of the wave attenuator would become greater over time as a result of sea level rise since the degree of submergence of the wave panels would increase.*

estimated wave runup level in the 1% AEP storm event in 2050 of, conservatively, 3.0m AHD. It has been further noted that the Applicant would be prepared to work with Council staff to revise the floor level upwards, if required, for example by including one or two additional steps from ground level.

The matter of flood compatible building materials does not arise with the exception of the steps leading to the temporary building. This is not regarded as a significant issue noting for, example, that:

- the chance of a 1% AEP storm event occurring in, say, the next 10 to 30 years is 10 to 25%;
- during the 1% AEP storm event, inundation would comprise transient wave runup occurring only for a limited period around high tide.

11. Adequacy of emergency management arrangements should an accidental contamination event occur, for example from spill of sewage or bilge water pump out.

Emergency management arrangements are included in the Operational Environmental Management Plan (OEMP) for Cattle Bay Marina prepared by Advanced Marina Management and RHDHV (February 2020).

The relevant requirements are listed below:

- marina management, marina staff, marina tenants and marina users would be provided with appropriate training and instruction in the safe use and management of the marina facility, in particular this includes:
  - environmental management,
  - fuel and oil spillage response,
  - solid and liquid waste management,
  - sewage pollution control,
  - water quality,

- fuel/oil spills or leaks from berthed vessels:
  - the Marina Manager shall conduct daily inspections to monitor the site for leaks and spills,
  - a spill kit clearly labelled and easily accessible shall be in place. This spill kit shall consist of absorbent booms to prevent further waterway pollution. The booms will be adequate to fit around spills and all adjacent drains,
  - marina staff and users shall be trained in the correct procedures and correct usage of the spill kit,
  - marina staff shall undergo hazardous materials handling training and be trained to a high level of competency,
  - bilge absorbent pads would be issued to marina users and would be subject to certified collection,
  - all bunded and covered storage areas for chemicals and oils would be inspected and maintained,

- discharge of sewage and waste:
  - procedures shall be established for the users of the mobile sewage pumpout unit so they are adequately trained in the correct use of the equipment,

- the site shall be monitored on a daily basis to prevent discharges of bilge water and grey water from sinks, showers or other sources,

- weekly maintenance inspections:
  - fuel spill containment booms,
  - mobile sewage pump out unit,

- liquid waste management:
  - daily inspections of waterways for detection of waste, debris, oil slicks and the like,
  - minimum of two mobile sewage pump out units,
  - active engagement with marina users to regularly pump out sewage holding tanks and keeping of records,
  - waste storage facility would be provided, serviced by a commercial waste collector,
  - waste storage would be contained in double lined bin,

- waterway pollution:
  - in-water hull cleaning prohibited,
  - daily inspections
  - deployment of booms in the event of an emergency.

References

Cardno (2014), 'Cattle Bay Marina, Eden – Wave Modelling',
prepared for Royal HaskoningDHV, 28 July 2014

Gary Blumberg & Associates (2004), RSYS Floating Breakwater Upgrade 'Desktop' Wave Study,
prepared for Docker Smith Pty Ltd

Gordon, AD (1987), 'Beach Fluctuations and Shoreline Change – NSW', 8th Australasian Conference on Coastal and Ocean Engineering, Launceston

Patterson, AH, Blumberg, GP, Couriel ED, Groskop, M (1997),
'Model and Prototype Behaviour of Effective Floating Breakwaters'

Greg Britton

Technical Director
Maritime & Aviation

LIST OF ATTACHMENTS

Attachment A : Drawing PA1042-MA-SK01 Rev A – Fixed Wave Attenuator

Attachment B : Drawing 8A0458 – Cattle Bay Marina and Attenuator – General Arrangement Rev A

Attachment C : Plan of Crown Land Creating Lot 1, DP1242690

Attachment D : RHDHV letter dated 8 April 2015, Cattle Bay Marina – Response to Submissions on EIS – Supplementary Statement on Wave Attenuator and Potential Impacts

Attachment E : RHDHV letter dated 10 September 2019, Cattle Bay Marina – DA 2019.08: Response to Submission by Department of Planning Industry & Environment (Biodiversity and Conservation Division)

Attachment F : RHDHV letter dated 29 March 2019, Cattle Bay Marina – Environmental Impact Statement – Consultation with Port Authority of NSW, Roads and Maritime Services, and NSW Department of Industry

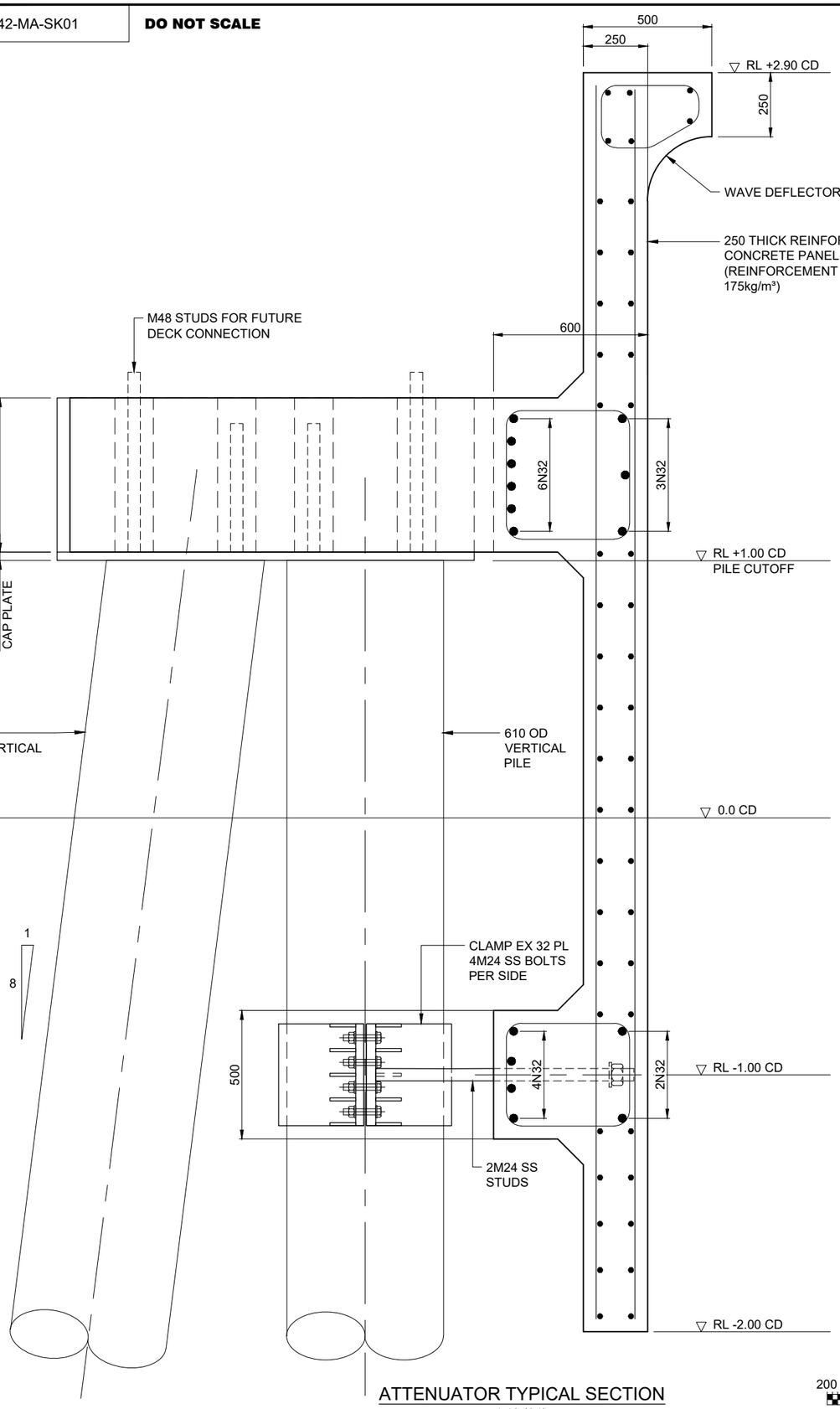
Attachment G : RHDHV letter dated 9 September 2019, Cattle Bay Marina – DA2019.208 – Response to Port Authority of NSW Submission

Attachment H : Drawing 8A0458-MA-SK10 Rev A – Proposed Cattle Bay Marina and Wave Attenuator – Detail General Arrangement Stage 2 (Ultimate)

Attachment A

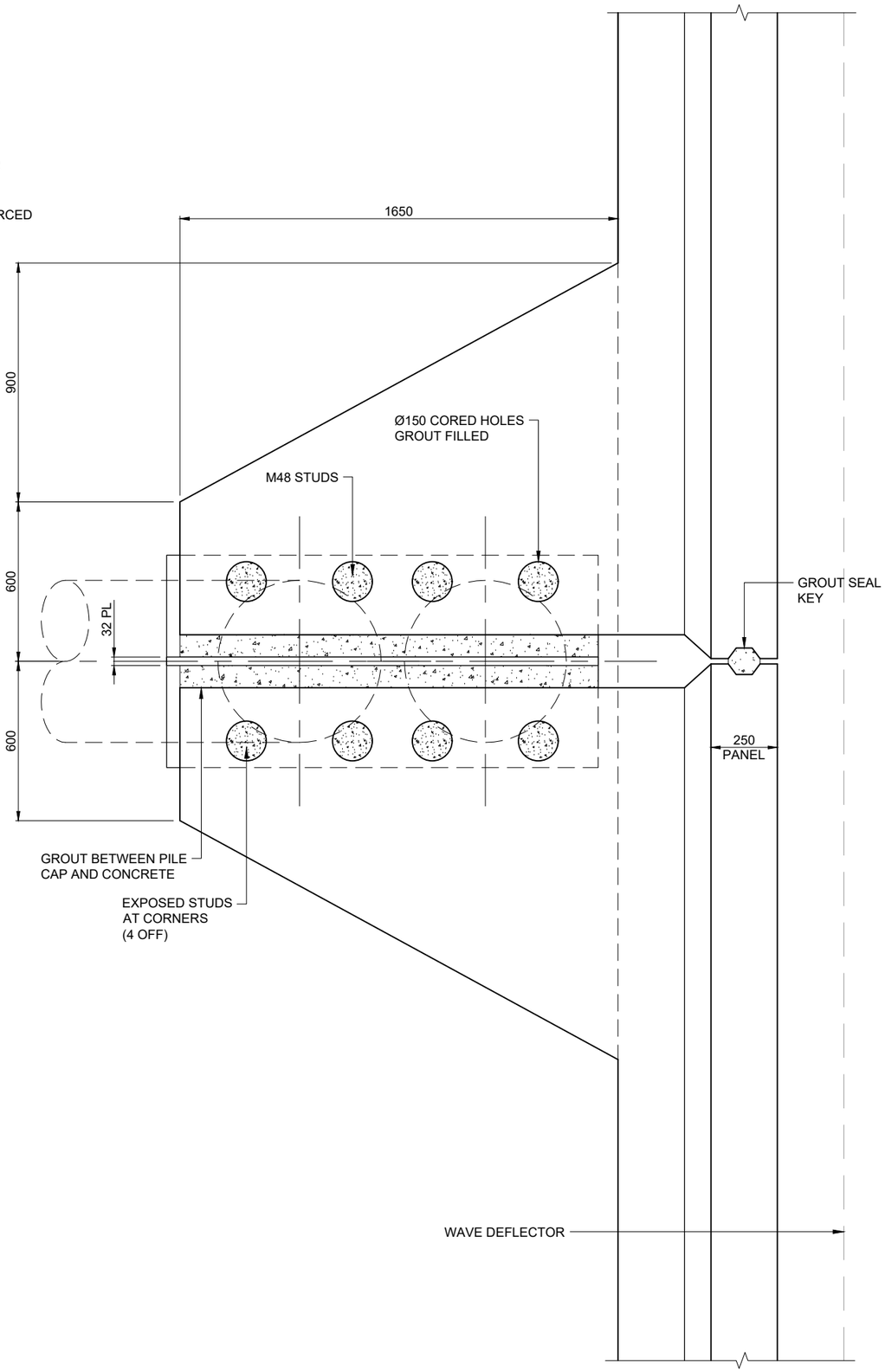
DRAWING No.
PA1042-MA-SK01

DO NOT SCALE



ATTENUATOR TYPICAL SECTION
1:10 (A1)

200 0 200 400 600 800 1000mm
1:20 (A3) 1:10 (A1)



PLAN AT PILE BENT
1:10 (A1)

NOTES

1. ALL LEVELS ARE TO CHART DATUM (CD) WHICH IS 1.0m BELOW AHD.
2. SUBJECT TO DETAILED DESIGN

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	BY	CHK	APPD
A	22.04.2020	ISSUED FOR INFORMATION	SGB	---	---

REVISIONS

CLIENT
EDEN CATTLE BAY MARINA PTY LTD

PROJECT:
CATTLE BAY MARINA AND WAVE ATTENUATOR

DRAWING TITLE:
FIXED WAVE ATTENUATOR

HASKONING AUSTRALIA PTY LTD
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56 Berry Street
North Sydney NSW 2060
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+61 2 99290960 Fax
www.royalhaskoningDHV.com Internet

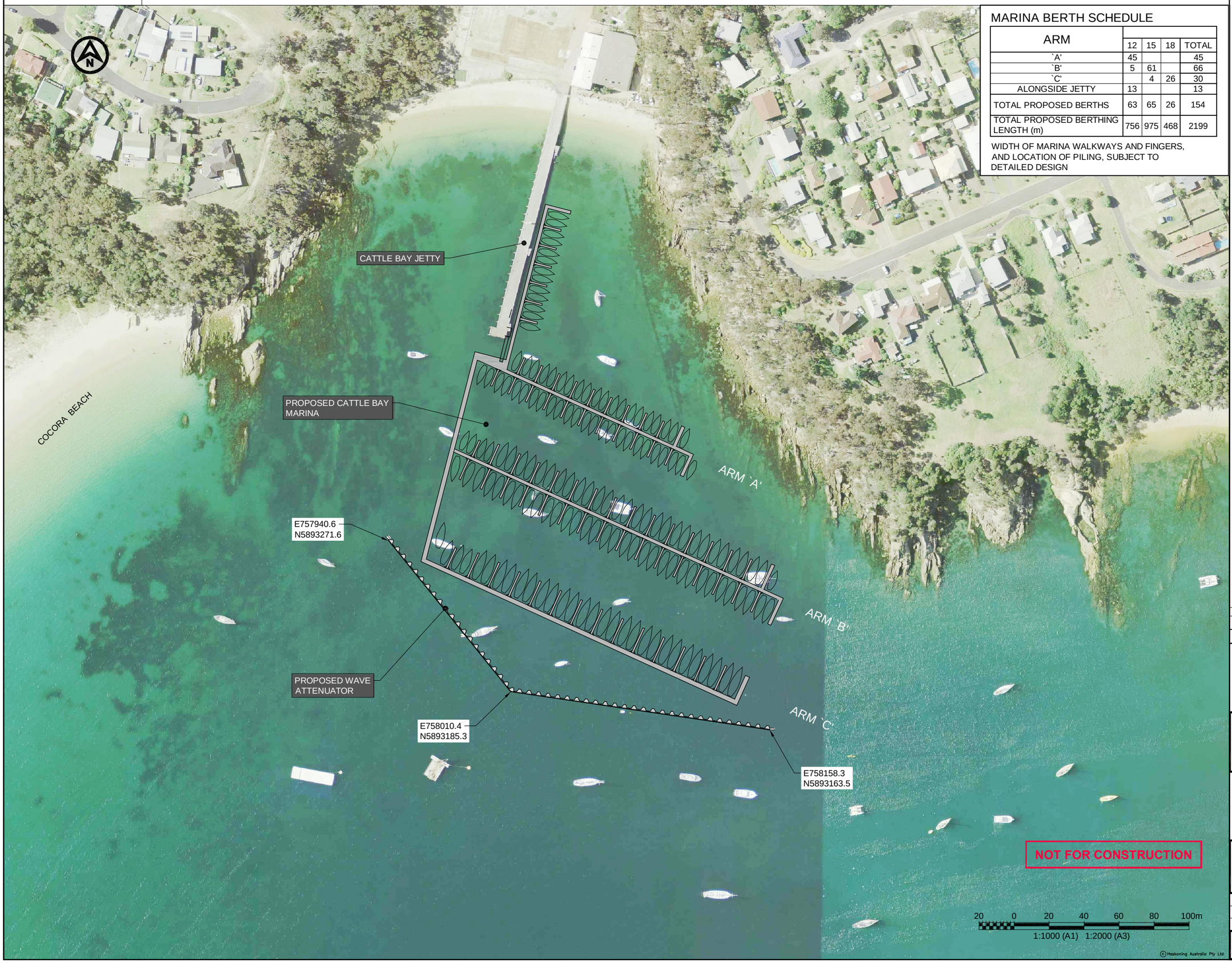
DRAWN SC	DATE 22/04/2020	JOB No. 8A0548
AUTOCAD REF. PA1042-MA-SK01[A]		
SCALE AT A1 AS SHOWN		
DRAWING No. PA1042-MA-SK01		REVISION A

C:\Users\220000\Documents\Drawings\PA0458 Cattle Bay Marina\PA1042-MA-SK01[A].dwg 22-Apr-20

Attachment B

DRAWING No.

DO NOT SCALE



MARINA BERTH SCHEDULE

ARM				
	12	15	18	TOTAL
`A'	45			45
`B'	5	61		66
`C'		4	26	30
ALONGSIDE JETTY	13			13
TOTAL PROPOSED BERTHS	63	65	26	154
TOTAL PROPOSED BERTHING LENGTH (m)	756	975	468	2199

WIDTH OF MARINA WALKWAYS AND FINGERS, AND LOCATION OF PILING, SUBJECT TO DETAILED DESIGN

REV	DATE	DESCRIPTION	BY	CHK	APPD
A	21.08.2015	ISSUED FOR INFORMATION	SGB	GWB	

REVISIONS

CLIENT

EDEN CATTLE BAY MARINA PTY LTD

PROJECT:

CATTLE BAY MARINA AND ATTENUATOR

DRAWING TITLE:

GENERAL ARRANGEMENT

HASKONING AUSTRALIA PTY LTD
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Internet

DRAWN	DATE	JOB No.
SGB	21/08/2015	8A0458

AUTOCAD REF. 8A0458–ATTENUATOR–SERIES

SCALE AT A1 AS SHOWN

DRAWING No.

REVISION A

Attachment C

MARK	EASTING	NORTHING	CLASS	ORDER	METHOD	ORIGIN
PM 28455	757 866.691	5 893 524.458	B	3		SCIMS
PM 28463	758 170.164	5 893 421.357	B	3		SCIMS
SSM 101445	758 365.799	5 893 479.386	B	3		SCIMS
PM 28464	758 041.535	5 893 680.232	U	N/A	CAD. TRAVERSE	FOUND

MGA CO-ORDINATES ADOPTED FROM SCIMS AS AT 20/04/2018. C.S.F = 1.000416 ZONE 55

PM 28455 'X'- PM 28463 'Y' - 108°45'52" - 320.373 BY ME
- 108°45'52" - 320.375 MGA GROUND

PM 28463 'Y'- SSM 101445 - 73°28'47" - 203.979 BY ME
- 73°28'43" - 203.975 MGA GROUND

PM 28463 'Y'- PM 28464 - 333°34'43" - 288.948 BY ME

SCHEDULE OF SHORT OR CURVED LINES

Number	Bearing	Distance	Number	Bearing	Distance	Arc	Radius	Number	Bearing	Distance	Arc	Radius
1	286°30'30"	7.445	13	254°03'	9.43	N/A	N/A	25	184°17'30"	2.285	N/A	N/A
2	284°30'	7.985	14	252°21'30"	4.32	N/A	N/A	26	*217°49'30"	*4.97	5.185	5.15
3	282°45'	4.84	15	246°21'	6.355	N/A	N/A	27	*81°14'30"	*36.675	36.70	278.34
4	277°01'30"	5.065	16	241°17'	8.9	N/A	N/A	28	*90°37'40"	*32.37	32.42	166.32
5	271°58'	7.05	17	237°08'	5.78	N/A	N/A	29	*102°41'	*15.955	15.96	153.26
6	270°00'	5.295	18	225°28'30"	3.565	N/A	N/A	30	*107°31'	*9.875	9.88	153.26
7	266°30'	9.91	19	232°43'30"	3.51	N/A	N/A	31	319°12'	8.27	N/A	N/A
8	264°15'30"	5.95	20	226°58'30"	7.62	N/A	N/A	32	197°58'45"	4.955	N/A	N/A
9	262°02'30"	7.24	21	221°41'	9.27	N/A	N/A	33	106°22'40"	2.155	N/A	N/A
10	259°37'	8.34	22	218°24'	3.605	N/A	N/A	34	196°22'40"	9.46	N/A	N/A
11	262°26'	5.155	23	212°11'	6.005	N/A	N/A	35	284°37'35"	1.865	N/A	N/A
12	257°34'30"	26.045	24	*197°34'	*6.41	6.42	34.95	36	194°37'35"	5.40	N/A	N/A

NOTE: * DENOTES CHORD BEARING & DISTANCE

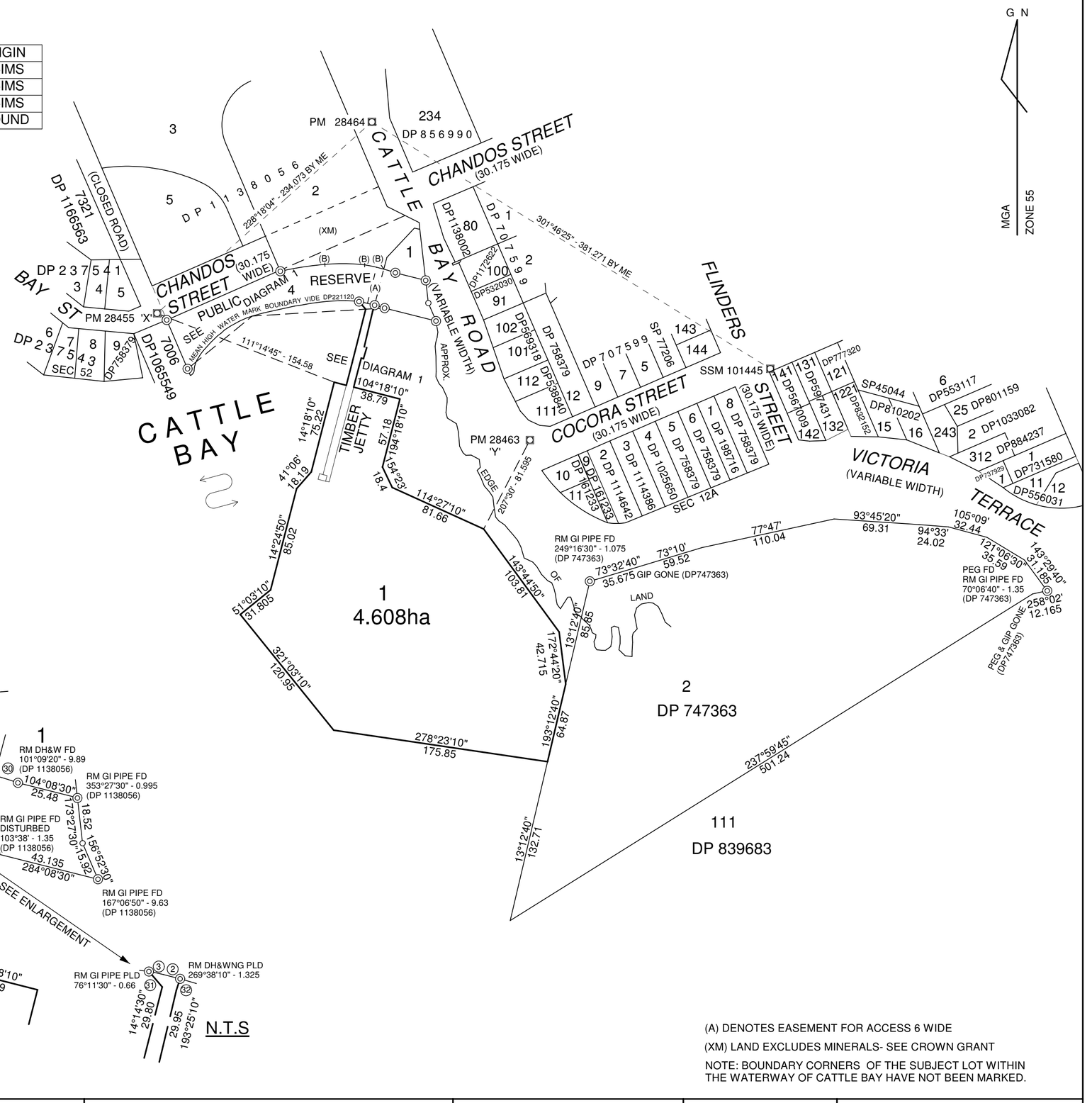
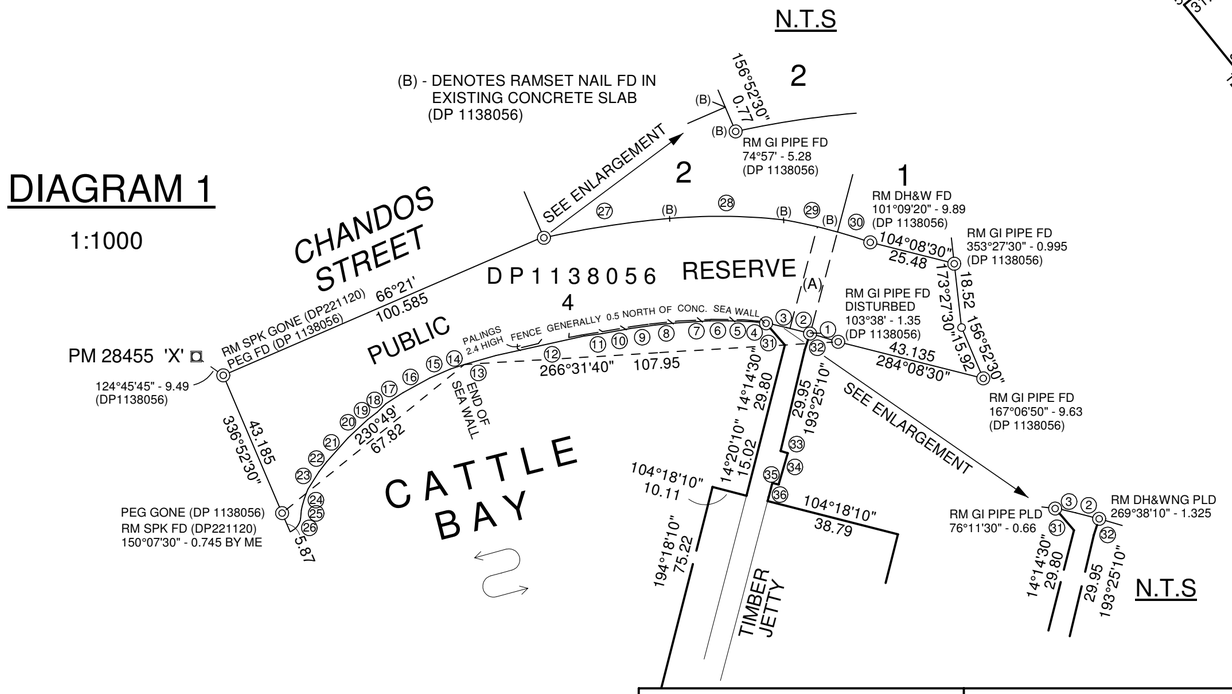


DIAGRAM 1

1:000



(A) DENOTES EASEMENT FOR ACCESS 6 WIDE

(XM) LAND EXCLUDES MINERALS- SEE CROWN GRANT

NOTE: BOUNDARY CORNERS OF THE SUBJECT LOT WITHIN THE WATERWAY OF CATTLE BAY HAVE NOT BEEN MARKED.

Surveyor: COLIN ROBERT HUNTER 35 FLINDERS STREET, EDEN Date of Survey: 01/05/2018 Surveyor's Ref: E16184-B	PLAN OF CROWN LAND CREATING LOT 1 FOR FIRST TITLE CREATION	LGA: BEGA VALLEY Locality: EDEN Reduction Ratio: 1:2000 Lengths are in metres.	Registered	DP 1242690

10 20 30 40 50 Table of mm 90 100 110 120 130 140

Attachment D

HASKONING AUSTRALIA PTY LTD
ARITI AT R AYS
RI RS AND AT R ANAG NT

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ABN 66 153 656 252

Mr Andrew Wilson
AW Planning

email: awplanning@outlook.com

Our reference: PA1042-100-100_gwb300315-wave annuator.docx
Date: 8 April 2015

Subject: **CATTLE BAY MARINA – RESPONSE TO SUBMISSIONS ON EIS SUPPLEMENTARY STATEMENT ON WAVE ATTENUATOR AND POTENTIAL IMPACTS**

Dear Andrew

A number of submissions raised the issue of the proposed wave attenuator, including its final alignment, its potential impacts on adjacent shorelines, particularly Cocora Beach, and its potential impacts on the commercial mussel farm south and west of Cocora Point.

The following sections address the above matters.

1 FINAL ALIGNMENT OF WAVE ATTENUATOR

The proposed final alignment of the attenuator is 'cranked' rather than straight. The cranked alignment is shown in **Figure 1** and is the alignment modelled in the Cardno report 'Cattle Bay Marina, Eden – Wave Modelling' (Cardno, 28 July 2014). Accordingly, the modelling results in Cardno (2014) pertain to the wave attenuator proposed. It is not proposed or considered necessary to modify the alignment further[1].

The cranked alignment has been adopted to avoid adverse impacts on Cocora Beach, as discussed further below. It is noted that a cranked alignment is preferred by Council for this reason (Council letter to Eden Resort Hotel, 18 February 2015).

[1] A number of the Figures in the EIS showed a wave attenuator with a straight alignment. The design evolved through the EIS process to ultimately comprise the cranked alignment now proposed.

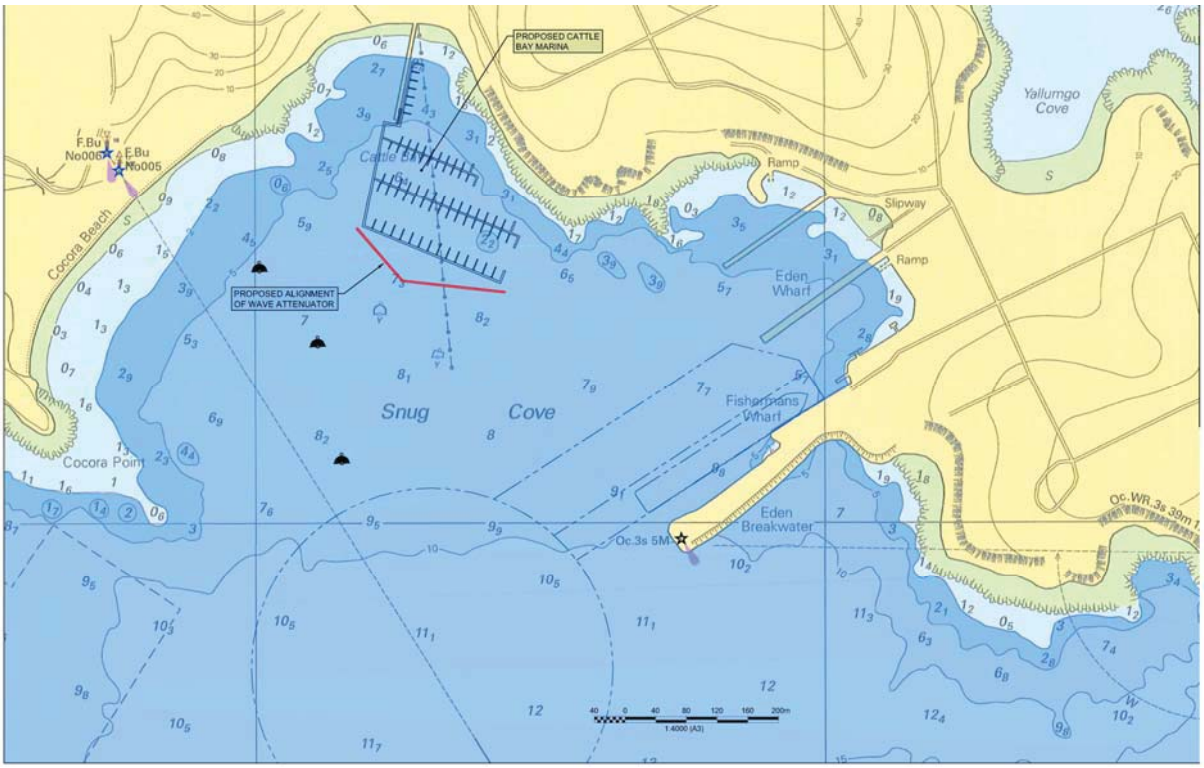

Figure 1 Proposed Alignment of Wave Attenuator

2 POTENTIAL IMPACTS OF WAVE ATTENUATOR

2.1 General

The primary purpose of the wave attenuator is to moderate the local wind waves (seas) generated across Twofold Bay by strong winds from the south/south-south-west in order that the wave climate at the floating marina satisfies acceptable wave climate criteria in Australia Standard AS 3962-2001 'Guidelines for Design of Marinas'.

An attenuator designed principally to achieve the required reduction in the local seas will also, to an extent, attenuate the swell wave climate from the ocean. In addition, the attenuator will reflect some of the swell wave energy to other adjacent areas. The effects of these reflections must also be considered.

2.2 Wave Modelling

2.2.1 General

An assessment of the potential impacts of the cranked wave attenuator has been undertaken utilising modelling techniques. The modelling was undertaken by Cardno on behalf of Royal HaskoningDHV. The results are set out in Cardno (2014) which was included as Appendix 16 of the EIS.

Cardno applied their calibrated SWAN wave model system of the region for much of the modelling, but also applied the MIKE-21 Boussinesq Wave (BW) system for verification. These wave modelling systems represent latest technology and best practice, and are briefly described below. The calibration and verification procedures adopted provide certainty for the modelling results.

It is also noted that the calibrated SWAN model adopted in this study was that developed by Cardno for Bega Valley Shire Council and the then Lands and Property Management Authority (LPMA), now NSW Trade & Investment Crown Lands, for the Eden Harbour Wave Modelling study undertaken in 2011 (Cardno, 2011).

2.2.2 SWAN Model

SWAN was developed at the Delft Technical University in The Netherlands and includes wind input, (local sea cases), combined sea and swell, offshore wave parameters (swell cases), refraction, shoaling, non-linear wave-wave interaction, a full directional spectral description of wave propagation, bed friction, white capping, currents and wave breaking. It also includes a nested grid capacity to facilitate computation by having fine grids at inshore locations where bathymetric and structure details vary significantly and coarser offshore grids where a larger model extent is required, but seabed bathymetric changes are generally smaller. This procedure allows efficient modelling to be undertaken without sacrificing resolution where it is needed.

Cardno have verified the SWAN model system for local sea conditions in Eden Harbour (as noted above), as well as for Botany Bay and Port Jackson. Swell calibration has been undertaken in Botany Bay, Port Kembla and Port Hedland, for example.

2.2.3 MIKE-21 Boussinesq Wave Model

The MIKE21 Boussinesq Wave (BW) is a state of the art numerical wave model developed by the Danish Hydraulics Institute (DHI), and generally used for the modelling of wave disturbance in ports, harbours and coastal areas. MIKE21 BW is based on the numerical solution of the time domain formulations of Boussinesq type equations, Madsen et al (1991, 1992, 1997a, b), Sorensen and Sorensen (2001) and Sorensen et al (2004).

MIKE21 BW is capable of reproducing the combined effects of all important wave phenomena of interest in ports, harbours and coastal engineering, including, shoaling, refraction, diffraction, wave breaking, bottom dissipation, moving shoreline, partial reflection, wave transmission, non-linear wave-wave interactions, frequency spreading and directional spreading,

The two dimensional wave model solves the Boussinesq type equations using a flux-formulation with improved frequency dispersion characteristics. The enhanced Boussinesq type equations make the models suitable for the simulation of the propagation of non-linear directional waves from deep to shallow water.

The MIKE21 BW model was used to conduct a more detailed investigation of swell wave propagation into Cattle Bay and Cocora Beaches and to validate the SWAN swell wave modelling.

2.3 Cocora Beach

Cocora Beach is situated to the west of Cattle Bay. It is approximately 460m long, faces south-east, and is exposed to a low energy swell. The beach is backed by a foreshore reserve and car park. It is a very popular recreational area for the local community.

The alignment of Cocora Beach is controlled, or driven, by the approach direction of swell waves from the ocean. The low energy of the swell contributes to the beach being a safe area for swimming. It is very important that the proposed wave attenuator for Cattle Bay Marina does not impact adversely on Cocora Beach by possibly reflecting swell waves towards the beach which could affect swell wave direction along the beach (thus beach alignment) and/or swell wave energy along the beach.

The modelling by Cardno confirmed that the wave attenuator would not cause significant changes to the swell wave direction and energy along Cocora Beach since:

- the eastern section of the attenuator is aligned such that reflected swell wave energy is directed south of Cocora Beach[2];
- the western section of the attenuator is well aligned with the incoming swell direction and does not cause reflection of swell waves.

Figure 2 is a copy of Figure 8.6 from Cardno (2014) and shows the mean energy-weighted wave direction for swell waves along Cocora Beach pre and post the wave attenuator. The alignment of the wave attenuator is shown in green. **Table 1** summarises the mean energy-weighted swell wave directions along Cocora Beach pre and post the attenuator. It is apparent that there is no predicted change to swell wave direction as a result of the proposed wave attenuator.

[2] The potential for this reflected swell to impact on the commercial mussel farm south and west of Cocora Point is discussed in **Section 2.5**.

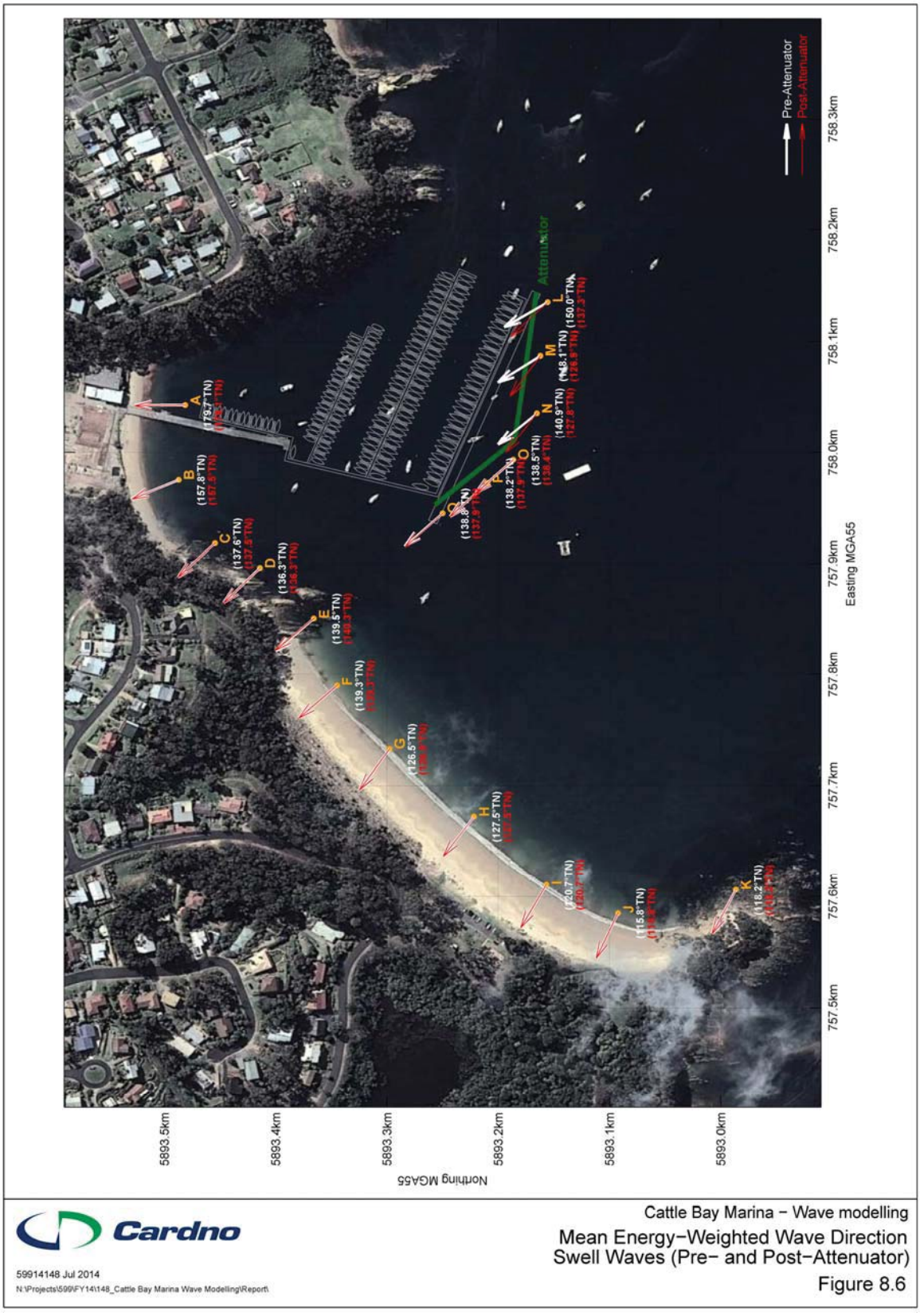

Figure 2 Mean Energy – Weighted Wave Direction Swell Waves

Table 1 Mean Energy-weighted Wave Direction for Swell Waves Pre and Post the Attenuator for Cocora Beach

Location	Mean energy-weighted swell wave direction	
	Pre-attenuator	Post-attenuator
F	139.3° TN	139.3° TN
G	126.5° TN	126.5° TN
H	127.5° TN	127.5° TN
I	120.7° TN	120.7° TN
J	115.8° TN	115.8° TN

Figures 3 and **4** are copies of Figures 9.6 and 9.7 from Cardno (2014) and show the wave energy at two locations along Cocora Beach (Location G and Location I) pre and post the wave attenuator for two swell wave periods T_p (T_p = 10 seconds and T_p = 15 seconds).

Figures 3 and **4** show there is minimal change to swell wave energy along Cocora Beach as a result of the proposed wave attenuator.

2.4 Cattle Bay Beach

Cattle Bay Beach is the name which has been given for reporting purposes to the sandy beach at Cattle Bay in front of the old cannery site. It is situated in the lee of the proposed wave attenuator.

The alignment of Cattle Bay Beach is driven by both swell and local sea waves. For these reasons and given it is situated in the lee of the proposed wave attenuator, it can be expected that the alignment of the beach and the wave energy conditions along it would be affected by the wave attenuator.

In terms of wave energy, the beach will become more sheltered and fluctuate less in response to ocean storms and episodes of strong wind waves from the south/south-south-west. This is not viewed as necessarily an adverse impact.

In terms of beach alignment, **Figure 5** (a copy of Figure 8.9 from Cardno, 2014) shows the predicted change in alignment as a result of the wave attenuator. It is expected that over time the beach would rotate in a clockwise direction, with a 8.5m landward movement at the western end and a 7m seaward movement at the eastern end, ie. a sandy beach would be retained (not lost) but it would be narrower at the western end and wider at the eastern end.

2.5 Commercial Mussel Farm

A submission to Bega Valley Shire Council by the NSW Cultured Mussel Growers Association (February 2015) has noted that too little weight has been given in the EIS to the potential impacts on mussel farm infrastructure of swell waves reflected off the wave attenuator. This infrastructure is located to the west of Cocora Point approximately 470m south-west of the proposed wave attenuator. The point made by the Association is reasonable, accordingly a specific examination has been made of this issue.

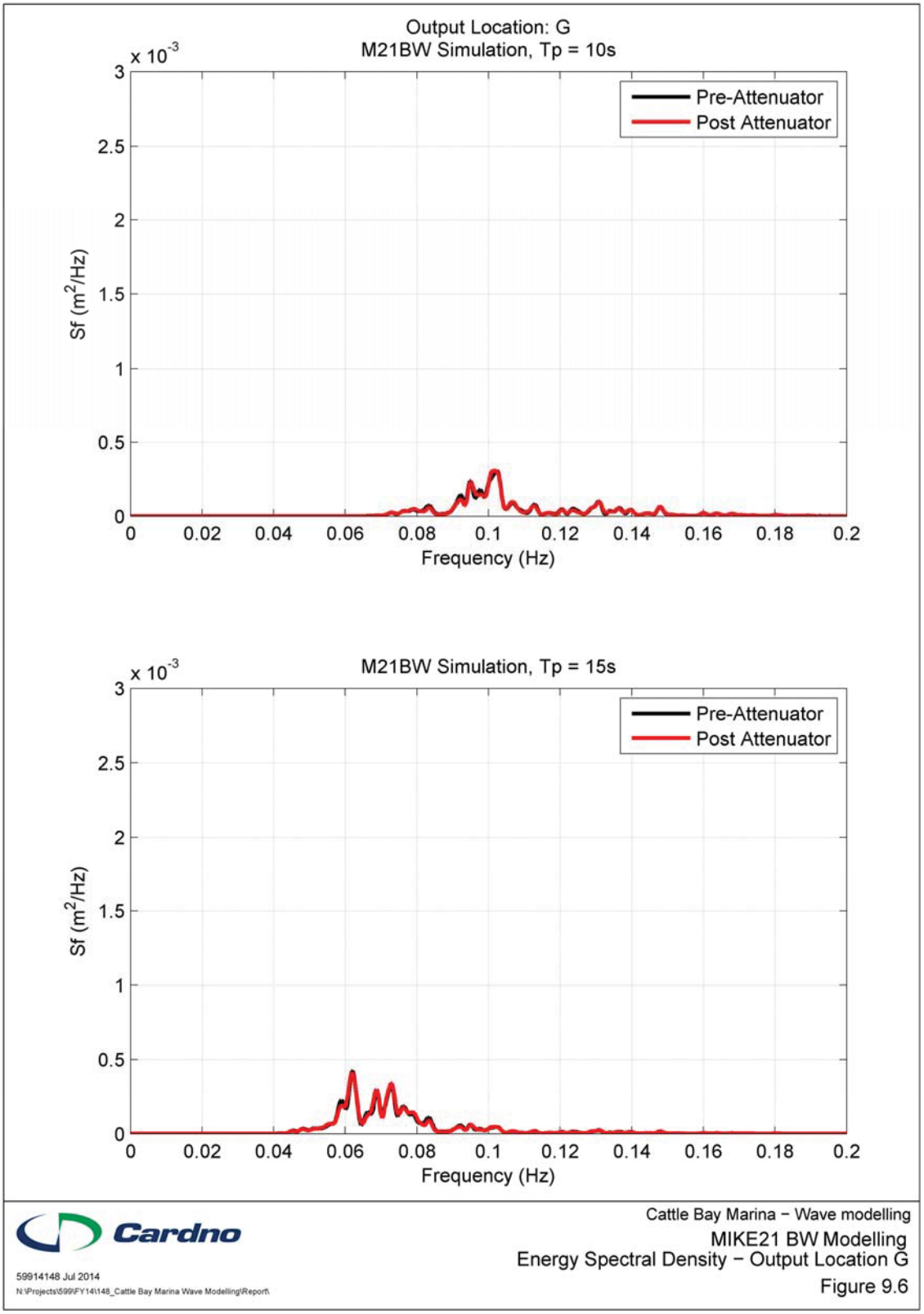

Figure 3 Energy Spectral Density – Output Location G

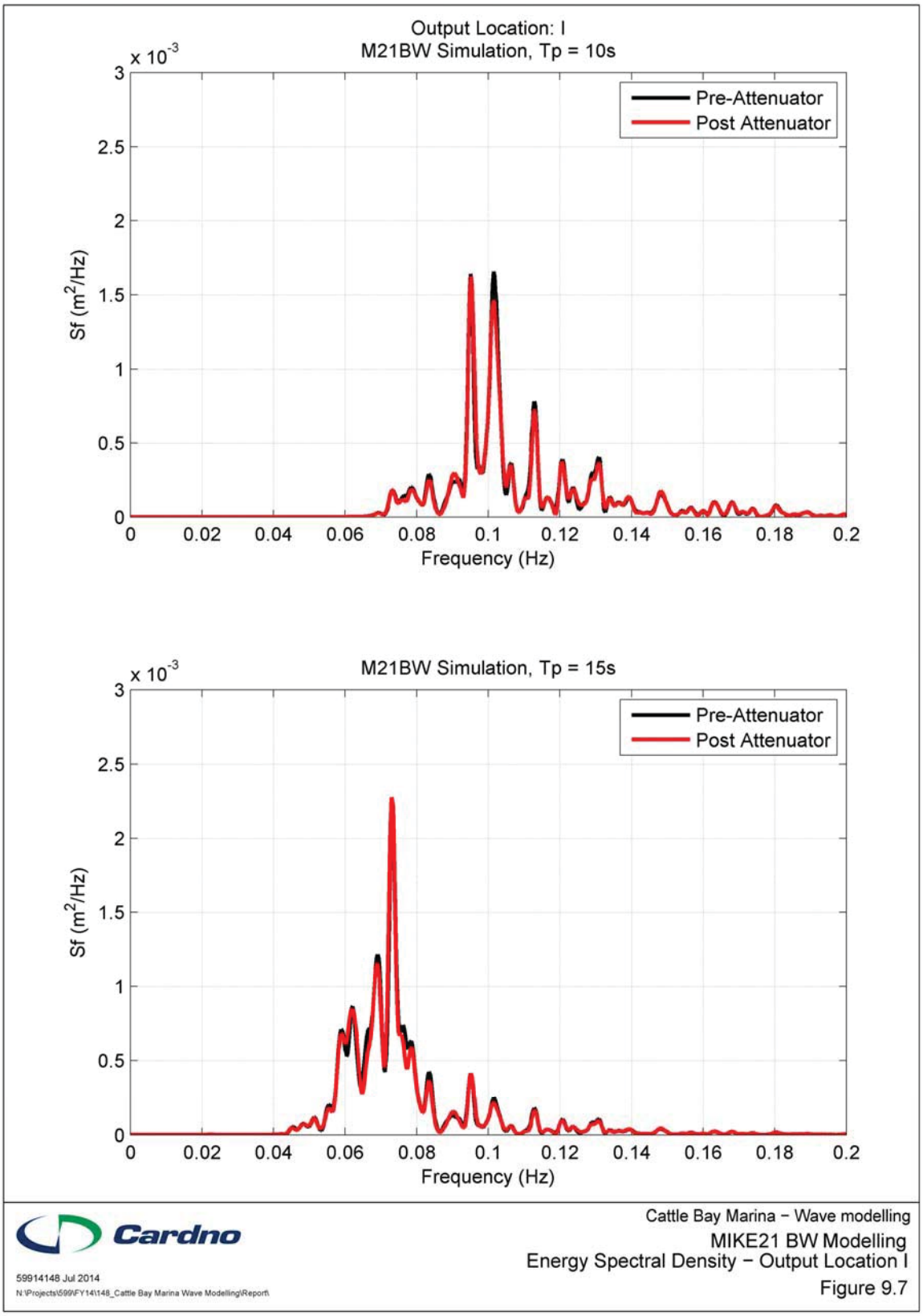

Figure 4 Energy Spectral Density – Output Location I

Figure 5 Beach Alignment Change Cattle Bay Beach

Cardno, on behalf of Royal HaskoningDHV, has extracted and analysed wave modelling results from the modelling undertaken for the EIS but at new locations in the vicinity of the mussel farm. The outcome of this work is included in a Cardno letter dated 16 March 2015, a copy of which is included in **Attachment A**.

The examination of the modelling results by Cardno has shown that the proposed wave attenuator would have only minimal effects on wave heights, wave directions and wave energy at the location of the mussel farm. The reason is that the mussel farm is sufficiently distant from the proposed attenuator (470m) that reflected waves off the attenuator would be able to disperse over the intervening and surrounding waterway area.

2.6 Effect of Reflected Waves on Existing Vessels at Swing Moorings

Roads & Maritime Services (RMS) has raised concerns at the potential impacts of waves reflected from the proposed wave attenuator on existing vessels at swing moorings located offshore from the attenuator (letter to Bega Valley Shire Council 11 December 2014).

The above issue was recognised in the EIS where it was noted that a section of waterway some 50 to 100m wide offshore from the attenuator may be unsuitable for moorings and that provision of swing moorings in the general area should be subject to a trial (refer Section 6.9.1 of EIS).

In more recent discussions with RMS (March 2015) as part of the development of a Swing Mooring Relocation Strategy, RMS has advised that all existing swing moorings located in the reflection zone seaward of the wave attenuator must be relocated. This requirement has been adopted in the preparation of the Swing Mooring Relocation Strategy (refer separate response) hence this issue has been addressed.

3 REFERENCES

Cardno (2014): Cattle Bay Marina, Eden. Report 59914148
Prepared for Royal HaskoningDHV

Cardno (2011): Eden Harbour Wave Modelling. Report LJ2916/R2685
Prepared for the Land and Property Management Authority – Crown Lands NSW and Bega Valley Shire Council.

Madsen, P.A., Murray, R and Sorensen, O.R. (1991)
A new form of the Boussinesq Equations with improved Linear Dispersion Characteristics (Part 1)
Coastal Eng., 15, 371-388.

Madsen, P.A., Murray, R and Sorensen, O.R. (1992)
A new form of the Boussinesq Equations with improved Linear Dispersion Characteristics (Part 2)
Coastal Eng., 18, 183-204.

Madsen, P.A. and Sorensen, O.R. and Schaffer, H.A. (1997a)
Surf Zone Dynamics Simulated by a Boussinesq type model. Part 1: Model description and cross shore motion of regular waves. Coastal Eng., 32, 255-288.

Madsen, P.A. and Sorensen, O.R. and Schaffer, H.A. (1997b)
Surf Zone Dynamics Simulated by a Boussinesq type model. Part 2: Surf beat swash zone oscillations for wave groups and irregular waves. Coastal Eng., 32, 289-320.

Sorensen, O.R., Schaffer, H.A. and Sorensen, L.S. (2001).
Boussinesq type modelling using an unstructured finite element technique.
In Proc.I 27th Coastal Eng Conf. 190-202.

Sorensen, O.R., Schaffer, H.A. and Sorensen, L.S. (2004).
Boussinesq type modelling using an unstructured finite element technique.
Coastal Eng., 50, 181-198.

Please contact the undersigned should you require any clarification or additional information.

Yours faithfully
Haskoning Australia Pty Ltd

G W Britton
Resident Director

Attachment A – Cardno letter (16 March 2015)

Our Ref 59914148/L001: CJB

Contact Chris Beadle

16 March 2015

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Attention: Mr Greg Britton

CATTLE BAY MARINA – MUSSELL FARM IMPACT ASSESSMENT

Dear Sir,

Introduction

In 2014, Cardno was commissioned by Royal Haskoning DHV (RHDHV) to undertake numerical wave and current modelling for a proposed marina layout at Cattle Bay, situated in northern Twofold Bay, NSW (Cardno, 2014) – see **Figure 1**. The proposed marina layout included a cranked wave attenuator which was designed to reflect some swell wave energy to the south of Cocora Point in order to obviate adverse impacts at Cocora Beach. Cardno (2014) concluded that the cranked wave attenuator successfully achieved this design aim.

RHDHV has advised that the NSW Mussel Growers Association has prepared a submission expressing concern that the proposed wave attenuator will result in increased swell energy at the site of the Twofold Bay mussel farm, which is situated to the south of Cocora Point, and approximately 470 m south-west of the proposed wave attenuator. Consequently there is a need to undertake an assessment of the effects of the wave attenuator on the wave climate in the vicinity of the mussel farm. In March 2015 Cardno was commissioned by RHDHV to undertake this study, utilising the results of wave modelling conducted as part of the previous investigation (Cardno, 2014).

The aim of the study is to assess the wave climate in the vicinity of the mussel farm before and after the installation of the proposed wave attenuator, and highlight any potential changes.

Methodology

The work was comprised of the following tasks, as outlined below.

Wave Climate

As part of Cardno (2014), Cardno conducted wave hindcast modelling for both sea and swell waves. As the SWAN model implemented for this task also covered the mussel farm region, results from the previous modelling exercise were extracted and analysed - but at new locations in the vicinity of the Mussel Farm. These locations are depicted in **Figure 1**.

Using these model results, an assessment of the design wave heights and directions for local sea waves, swell waves and a combined sea and swell case were determined in the study area for both pre and post wave attenuator scenarios.

Figure 1 – Approximate Extent of Mussel Farm (red outline) and most relevant SWAN Model output locations.

Further details of the SWAN Wave modelling conducted previously can be found in Section 7 of Cardno (2014).

Wave Spectra

As part of Cardno (2014), MIKE21 Boussinesq Wave (BW) modelling was conducted in order to validate the SWAN swell modelling results, and assess potential changes to swell wave spectra in the study area. Figure 9.1 of Cardno (2014) shows that the MIKE21 BW model set-up doesn't cover the mussel farm in its entirety, with the western and south-western extent of the mussel farm buoys outside the model domain. However, as the eastern and north-eastern extents of the mussel farm are within the model domain, wave spectra can be assessed for these regions. Theoretically, if the results show that the effects of the attenuator in these regions are minimal, then it would be reasonable to assume that the regions outside the model domain would be similarly or less affected.

Further details of the MIKE21 BW modelling conducted previously can be found in Section 9 of Cardno (2014).

Results

Wave Climate

The effects of the wave attenuator on design wave criteria were assessed by estimating ARI wave heights from the modelled inshore wave data, for both the pre- and post-attenuator situations. This was achieved by fitting a Weibull distribution to independent peak storm wave heights exceeding the 98th percentile. **Table 1** shows the estimated 1-year ARI and 50-years ARI wave heights at the nominated output locations (see **Figure 1**).

Table 1 - Design Wave Heights for Local Sea and Swell (Pre- and Post-Attenuator)

Significant Wave Height, Hs (m)	Local Sea Waves				Swell Waves			
	Pre-Attenuator		Post- Attenuator		Pre-Attenuator		Post-Attenuator	
Output Location	1 year ARI	50 years ARI	1 year ARI	50 years ARI	1 year ARI	50 years ARI	1 years ARI	50 years ARI
MF1	0.76	1.07	0.78	1.09	1.75	2.33	1.75	2.33
MF2	0.79	1.10	0.80	1.11	2.20	3.32	2.20	3.32

These results show that the presence of the attenuator has only a minimal impact on the design significant wave heights in the mussel farm region. Design local sea wave heights post-attenuator are slightly higher for both output locations, in the order of 1 to 2%. This is beyond what could reasonably be discerned in the field through observation. The presence of the attenuator has little to no effects on the design swell wave heights, as is shown in **Table 1**.

Figures 2 to **4** present energy-weighted mean wave directions for swell waves, local sea waves and combined swell/local sea for both the pre- and post-attenuator situation. These figures show that the effect on energy-weighted mean wave directions is minimal, with changes of the order of half a degree, or less.

These results confirm that any reflected swell wave energy largely disperses before reaching the mussel farm region so that changes in wave conditions are minimal.

Figure 2 – Mean Energy-Weighted Wave Direction – Swell Waves

Figure 3 – Mean Energy-Weighted Wave Direction – Local Sea Waves

Figure 4 – Mean Energy-Weighted Wave Direction – Combined Swell and Local Sea Waves

Wave Spectra

The results of the previous MIKE21 BW modelling were extracted and the energy spectral density functions were assessed for the output locations depicted in **Figure 1,** for wave periods of both Tp =10s and Tp = 15s. These functions are depicted in **Figures 5** and **6**, and show that there is minimal observed change to the energy spectral densities at these locations. This is consistent with Figures 9.3 and 9.5 of Cardno (2014), which showed that there was only minimal change to wave coefficients for the penetration of Tasman Sea swell. These figures also indicate that only minor changes to swell wave energy in the mussel farm region would be caused by the proposed wave attenuator.

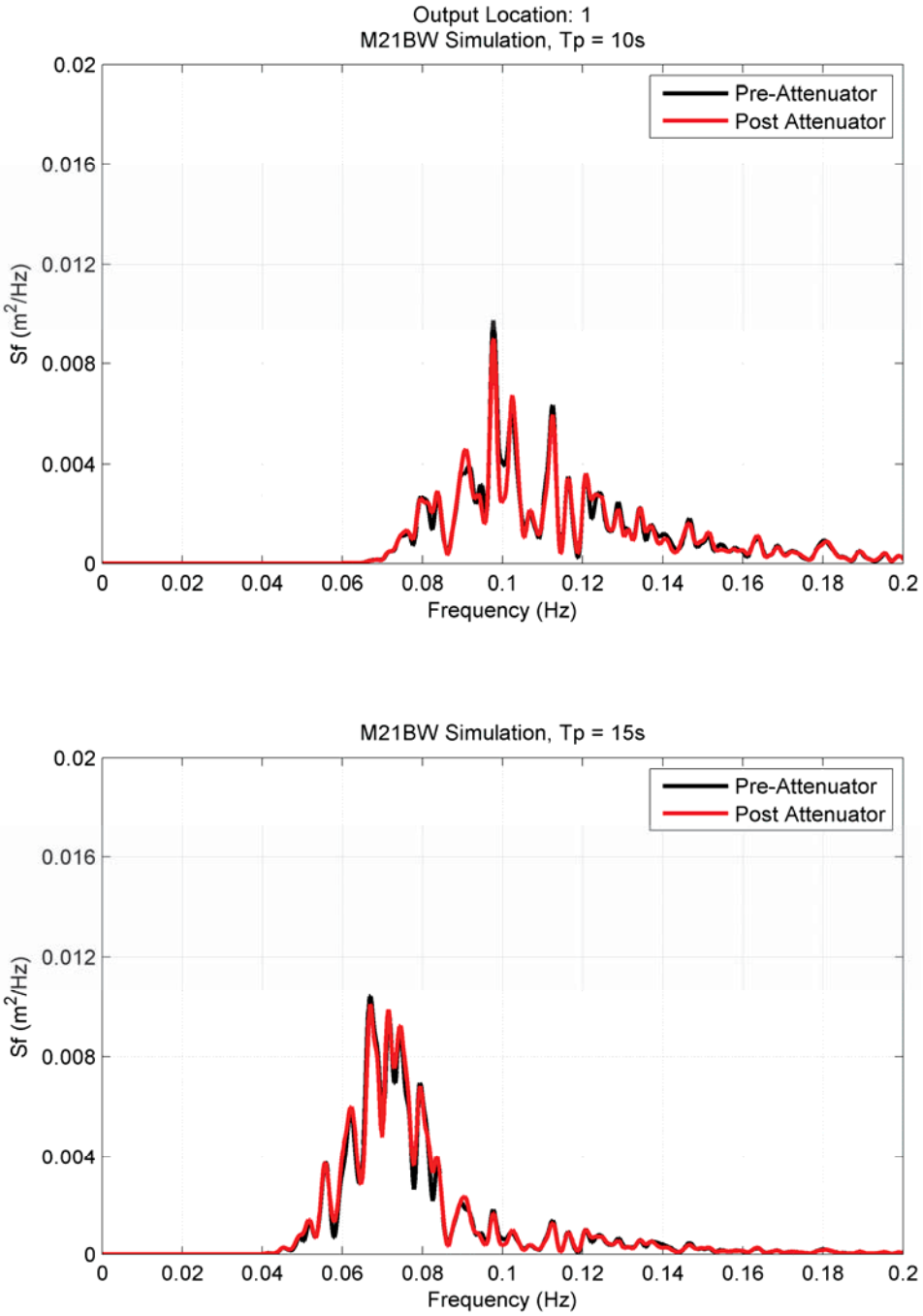

Figure 5 – Energy Spectral Density - Output Location MF1

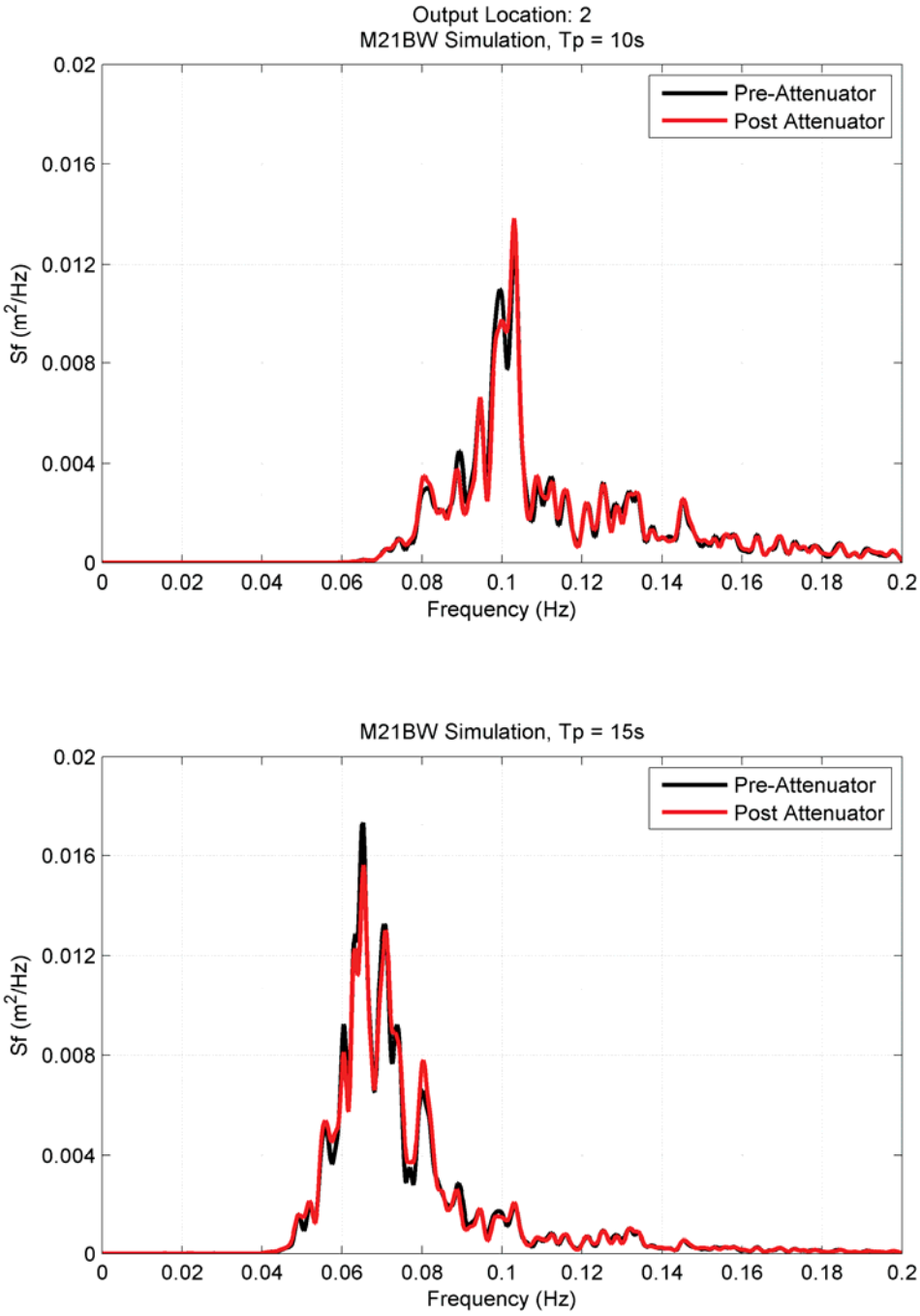

Figure 6 – Energy Spectral Density - Output Location MF2

Discussion Concluding Remarks

The SWAN and MIKE21 BW modelling results showed that the implementation of the wave attenuator would have only minimal effect on wave heights, directions and energy spectral density at the locations depicted in **Figure 1**. It should be noted that one of the output locations is situated outside of the mussel farm region, but *closer* to the attenuator. Consequently, it is then reasonable to purport that other locations within the mussel farm that are either as close, or farther, from the wave attenuator would be either equally or less affected.

The reason that the influence is minimal is likely to be the distance of the mussel farm from the attenuator structure. The northern extent of the mussel farm is over 470 m south-west of the proposed wave attenuator, and it is likely that a significant amount of reflected wave energy is dispersed over this expanse. Generally, wave heights diminish in proportion to the inverse square of distance from a finite-length, reflecting surface.

If you have any questions or comments regarding this project or the content of this letter please do not hesitate to contact Chris Beadle on (02) 9496 7851, or christopher.beadle@cardno.com.au.

Yours faithfully,

Christopher Beadle

Coastal Engineer – Water and Environment

For **Cardno (NSW/ACT) Pty Ltd**

References:

Cardno (2014). Cattle Bay Marina, Eden – Wave Modelling. *Prepared for Royal HaskoningDHV*

Attachment E

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Mr Andrew Wilson
Eden Cattle Bay Marina Pty Ltd

email: awplanning@outlook.com

Date:	10 September 2019	Contact name:	Greg Britton
Your reference:		Telephone:	02 8854 5000
Our reference:	PA1042-104_lp20190823-DPIE	Email:	greg.britton@rhdhv.com
Classification:	Project related		

Dear Andrew

CATTLE BAY MARINA – DA 2019.208
SUBMISSION BY DEPARTMENT OF PLANNING INDUSTRY & ENVIRONMENT (BIODIVERSITY AND CONSERVATION DIVISION)

I refer to your email of 18 August 2019 which included a submission on the proposed Cattle Bay Marina by the Department of Planning Industry & Environment (Biodiversity and Conservation Division) (DPIE[BCD]) dated 5 August 2019 and a request that I respond to that section of the submission dealing with coastal processes and hazards. I am pleased to provide a response, details of which are set out below.

DPIE (BCD) raise the following matters under coastal processes and hazards:

- both the Eden Safe Harbour wave attenuator and the Cattle Bay Marina wave attenuator should be incorporated in the wave modelling;
- extreme coastal events have not been considered for Cocora Beach;
- the impacts of coastal hazards on the land based component of the proposal have not been considered, noting Bega Valley Shire Council's Coastal Processes and Hazards Definition Study (2015);
- further investigations are required on the impact of coastal erosion on beach amenity and assets at Cattle Bay;
- a longer term monitoring program should be established at Cocora Beach to determine if impact predictions are accurate and how any negative impacts shown by the monitoring would be mitigated.

The above matters are addressed in turn in the following sections.

Incorporation of both the Eden Safe Harbour wave attenuator and the proposed Cattle Bay wave attenuator in the wave modelling

DPIE (BCD) made the following specific points:

- wave modelling for the Cattle Bay wave attenuator should incorporate the adjacent approved Eden Safe Harbour wave attenuator to identify impacts on coastal erosion and how they should be managed; and
- both wave attenuators should be incorporated into the modelling to determine any interaction on coastal processes and impacts on the surrounding area.

Response
A wave impact statement for the proposed Cattle Bay wave attenuator for purposes of the EIS was prepared by the writer in a letter dated 21 February 2019, which was included as Appendix 13 to the EIS. This statement took into account wave modelling for the Cattle Bay wave attenuator and the Eden Safe Harbour wave attenuator as presented in the following three documents:

- Cattle Bay Marina, Eden – Wave Modelling, report prepared for RHDHV by Cardno, dated 28 July 2014;
- Cattle Bay Marina – Response to Submissions on EIS, Supplementary Statement on Wave Attenuator and Potential Impacts, letter prepared for AW Planning by RHDHV dated 8 April 2015; and
- the Addendum Review of Environmental Factors (AREF) prepared for the Department of Industry (DoI) by Advisian (2018), which set out the alignment and selected results of wave modelling for the currently approved Eden Safe Harbour Wave attenuator, being so-called Option 21.

The wave impact statement concluded, based on review of the above documents, that the proposed Cattle Bay wave attenuator:

- would not cause significant changes to swell wave direction and energy along Cocora Beach;
- would create more sheltered wave conditions along Cattle Bay Beach and a clockwise rotation of the beach (while retaining a sandy beach); and
- would have only minimal effects on wave heights, wave directions and wave energy at the location of the mussel farm.

As part of the preparation of this response to the submission from DPIE (BCD), I have made further contact with Mr Andrew Dooley of DoI who, as you know, has been responsible for the Eden Safe Harbour project. Mr Dooley has kindly made available to me the wave modelling report prepared by Cardno (2018) that supports the AREF for the currently approved Eden Safe Harbour wave attenuator, Option 21. It is evident from this report that:

- wave modelling included a scenario that incorporated both the approved Eden Safe Harbour attenuator and the proposed Cattle Bay wave attenuator, ie. addressed the matter raised by DPIE (BCD);
- wave modelling was undertaken for both local sea waves generated by winds blowing across Twofold Bay, as well as for the propagation of Tasman Sea swell waves into the study area;

- the energy-weighted mean wave directions for local sea and swell waves on Cocora Beach show minimal change due to the combined Eden Safe Harbour wave attenuator and Cattle Bay wave attenuator, thus supporting the conclusions made by the writer in the wave impact statement dated 21 February 2019 included as Appendix 13 in the EIS.

Extreme coastal events at Cocora Beach

DPIE (BCD) made the following specific points:

- extreme coastal events have not been included in the wave modelling report;
- the wave modelling has only considered up to a 50 year ARI event. To understand the impacts from larger coastal events, particularly for Cocora Beach, the model should be run for larger events, such a 100 year ARI.

Response
Wave modelling studies by Cardno (2014), Cardno (2017) and Cardno (2018) have demonstrated that:

- the behaviour of Cocora Beach such as beach alignment and incident wave conditions is predominantly a result of ocean swell;
- the eastern section of the Cattle Bay wave attenuator is aligned (purposely) such that reflected swell wave energy is directed away from (south of) Cocora Beach;
- the western section of the Cattle Bay wave attenuator is aligned (purposely) such that there is no reflection of swell waves as they travel towards Cocora Beach;
- the position of the Eden Safe Harbour wave attenuator is such that it is largely protected from swell by the existing Eden Harbour breakwater and consequently swell wave reflection towards Cocora Beach is minimal; and
- the implementation of the Cattle Bay wave attenuator and Eden Safe Harbour wave attenuator would have minimal impact on Cocora Beach up to the modelled 50 year ARI wave conditions.

There is no reason to believe that implementation of the Cattle Bay wave attenuator and Eden Safe Harbour wave attenuator would introduce significant impacts to Cocora Beach for coastal events larger than 50 year ARI. This is because the extreme coastal storm waves that potentially impact on Cocora Beach emanate from the south east sector, the direction and energy of these waves as they enter Twofold Bay and Snug Cove and approach Cocora Beach are controlled by existing natural features (headlands and water depth) and man-made features (Eden Breakwater), , and the particular alignment and positioning adopted for the two attenuators do not significantly affect wave energy and wave direction approaching Cocora Beach.

It is evident that the Eden Safe Harbour wave attenuator, which was modelled in combination with the Cattle Bay wave attenuator, and which was the subject of an AREF distributed to agencies by DoI for review, was subsequently approved based on consideration of wave modelling up to 50 year ARI only, which is considered reasonable.

Impacts of coastal hazards on land based component of the proposal

DPIE (BCD) made the following points:

- the EIS has not considered the impacts of coastal hazards on the land based component of the Cattle Bay marina development;
- Bega Valley Shire Council's Coastal Processes and Hazards Definition Study (2015) identifies hazard lines at Cattle Bay that indicate both immediate and longer team risks but the EIS has not considered the effects of coastal hazards including beach erosion and coastal inundation on the land based component of the proposal. The EIS should outline why it has not been considered, for example if the proponent is using a short term temporary structure prior to approval being sought for a tourist facility.

Response

Firstly, it can be stated that the proposed land based facilities are temporary in nature. They comprise a temporary (portable) building to house marina administration and toilets, a temporary car park, and temporary services arrangements. The temporary facilities on the land base will be replaced by a tourist facility which is the subject of a Part 3A Concept Plan Approval, when developed in the future.

The Bega Valley Shire Council's Coastal Processes and Hazards Definition Study (2015), prepared by BMT WBM, has been examined, specifically to identify the Erosion Map and Inundation Map for Cattle Bay Beach.

Figure 1 is a copy of the Erosion Map for Cattle Bay Beach. It shows the predicted position of the crest of the erosion escarpment for three planning periods; namely 'immediate' (over the next few years) which is plotted for 2010, and at years 2050 and 2100. The predicted position of the immediate erosion escarpment following the design 'storm bite' is shown to be more than 50m landward of the seawall at the back of Cattle Bay Beach.

Figure 1 Erosion Map for Cattle Bay Beach

The Erosion Map for Cattle Bay Beach cannot be relied upon, in my view. The erosion escarpment is not known to have extended landward of the seawall, which is understood to date from the late 1940s, even though a number of severe coastal storms have occurred over this time, including the June 2016 East Coast Low which is referred to in the submission by DPIE (BCD).

The problem with the Erosion Map is that it has adopted too high a value for storm bite having regard to the limited wave energy that can actually reach Cattle Bay Beach[1]. Furthermore, the Erosion Map ignores the existence of the seawall, which is contradictory to the BMT WBM report itself which states in Section 4.6.13 (page 121) that ….. 'It is noted that the erosion hazards along Cattle Bay are based on the assumption that seawalls along the embayment are of a sufficient standard to limit shoreline erosion along this section of the shoreline'.

Further commentary could be included if required in relation to the conservative values also adopted for future shoreline recession, eg. the underlying recession rate, where there would appear to be no strong evidence for net sediment loss in the historical record or a physical mechanism to explain such a loss.

A seawall can be expected to exist along Cattle Bay into the foreseeable future to protect the foreshore reserve owned by Bega Valley Shire Council. This seawall will thereby provide adequate protection for the proposed temporary land based component of the development.

[1] *A value of 120 -150m^3/m was adopted, corresponding to an estimated value (based on photogrammetry) for Aslings Beach, which is situated in a much more exposed semi open coast area.*

There would not appear to be an Inundation Map for Cattle Bay Beach within the BMT WBM report. Table 4.9 of the report sets out an estimated inundation level (wave runup level) for the immediate planning period equal to 2.6mAHD. This estimate is considered reasonable.

Notwithstanding the estimated wave runup level is considered reasonable, the level would not be realised in practice due to the existence of the seawall (crest level approximately 2mAHD) and the relatively flat land behind the seawall. The wave runup would 'fold over' the crest of the seawall and proceed as a shallow sheet flow across the foreshore reserve, spreading and infiltrating thereby diminishing in elevation.

The proposed temporary (portable) marina building is located landward of the foreshore reserve, some 30m behind the seawall crest, at which distance the effects of wave runup would be expected to have fully dissipated. The floor of the temporary building is also elevated around 700mm above the existing ground level, accessed via steps and a ramp.

It is considered there is no significant risk to the temporary land based component of the proposal due to oceanic inundation. Well accepted adaption strategies exist to mitigate wave overtopping in the event the risk of inundation of the temporary structure becomes significant at a future time.

Impacts of coastal erosion on beach amenity and assets at Cattle Bay

DPIE (BCD) made the following point:

- in terms of coastal erosion, the modelling suggests there will be erosion associated with the reported clockwise rotation of Cattle Bay Beach. As such, further investigations are required on the impact of the coastal erosion on beach amenity and assets at Cattle Bay.

Response

The alignment of Cattle Bay Beach is driven by both swell and local sea waves. Given the beach is situated within the lee of the proposed Cattle Bay wave attenuator and marina, the wave energy conditions along the beach and the alignment of the beach would be affected by the proposal, as set out in the current EIS and in a previous letter dated 7 April 2015 I prepared in response to submissions on the original EIS. In summary:

- in terms of wave energy, the beach will become more sheltered and fluctuate less in response to ocean storms and episodes of strong wind waves from the south and south-south-west (reduced 'storm bite'). This is not viewed necessarily as an adverse impact, eg. there would be less risk to assets at Cattle Bay such as the old jetty and existing seawall; and
- in terms of beach alignment, a clockwise rotation of the beach is predicted as shown in Figure 2 (a copy of Figure 8.9 from Cardno, 2014). Importantly, no net erosion is predicted, a sandy beach width is expected to be retained (not lost), however it would be narrower at the western end and wider at the eastern end, evolving over time. As such, while there will be a change to Cattle Bay Beach the impact on beach amenity is not expected to be significant.

Longer term monitoring program at Cocora Beach

DPIE (BCD) made the following points:

- a longer term monitoring program should be established to determine if impact predictions from the modelling to Cocora Beach are accurate;
- the EIS should outline how the proponent will mitigate any negative impacts if shown by the longer term monitoring.

Response
It is noted that DoI has committed to a monitoring program for Cocora Beach in response to the submission from the then Office of Environment and Heritage (OEH) on the proposed Eden Safe Harbour wave attenuator – refer Mitigation Measure CP4 outlined in the Response to Submissions report prepared for DoI by Advisian (2018).

The proponent for Cattle Bay Marina should consult with DoI to establish a suitable joint monitoring program. In the event the monitoring identifies a negative impact (not predicted) it would be necessary to confirm the cause of the impact, eg.:

- recent dredging carried out for the cruise ship operations;
- Eden Safe Harbour wave attenuator;
- Cattle Bay wave attenuator;
- climate change.

Mitigation measures would depend on the nature of the impact and could be reasonably outlined in a final Operational Environmental Management Plan (OEMP) or the like, as a condition of any approval of the development application.

Figure 2 Beach Alignment Change Cattle Bay Beach

References

Advisian (2018), 'Response to Submissions Report – Eden Safe Harbour Project at Snug Cove, Eden NSW', prepared for the NSW Department of Industry, 13 April 2018

Cardno (2014), 'Cattle Bay Marina Wave Modelling', Report 59914148/R002, prepared for Royal HaskoningDHV, July 2014

Cardno (2017), 'Eden Wave Attenuator Wave Climate Study', Report 59914148/R003, prepared for Royal HaskoningDHV, October 2017

Cardno (2018), 'Design Basis Report – Final Report, Eden Wave Attenuator', Report 59918186/R001, prepared for Advisian, August 2018

I trust the above meets with your requirements. Please contact me should you require any clarification or additional information.

Yours faithfully

Greg Britton

Technical Director
Maritime & Aviation

Attachment F

Mr Andrew Wilson
AW Planning

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Your reference:		Telephone:	02 8854 5000
Our reference:	PA1042_L02-EIS consultation_2019-03-29	Email:	greg.britton@rhdhv.com
Classification:	Project related		

Dear Andrew

CATTLE BAY MARINA ENVIRONMENTAL IMPACT STATEMENT
CONSULTATION WITH PORT AUTHORITY OF NSW, ROADS AND MARITIME SERVICES, AND NSW DEPARTMENT OF INDUSTRY

I refer to our recent discussions in which you requested we provide a brief statement regarding the consultation we have undertaken on behalf of AW Planning and Eden Cattle Bay Marina Pty Ltd with the Port Authority of NSW, Roads and Maritime Services and the NSW Department of Industry. This statement is set out below.

Port Authority of NSW

The Port Authority of NSW (PANSW) set out their input to the Secretary's Environmental Assessment Requirements (SEARs) in correspondence to the Department of Planning and Environment (DPE) dated 7 December 2018. The correspondence requested that the Applicant specifically consult with the Harbour Master of PANSW during preparation of the EIS.

The Harbour Master of PANSW (Mr Paul Webster) was contacted on 18 March 2019. Mr Webster responded on 20 March 2019 advising that he had no further comments in addition to the matters outlined in the PANSW letter dated 7 December 2018.

The matters raised by PANSW have been addressed in the EIS, particularly within the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP). Matters around marine traffic, navigation and safety are largely resolved by the location of the proposed Cattle Bay Marina and wave attenuator, and navigation entry to the marina, relative to existing and future operations in Snug Cove, eg.:

- the Cattle Bay Marina and wave attenuator, at its closest point, is some 150m from the cruise ship dredged channel (cruise ships cannot encroach closer to the marina and wave attenuator than 150m due to restricted water depth outside the shipping channel); and

- navigation traffic to the existing Eden Breakwater Wharf, Multi-Purpose Jetty and Mooring Jetty, and any future marina development in the lee of the Eden Safe

Harbour wave attenuator, would follow the existing main channel past Eden Breakwater Wharf and through a gap between the Eden Safe Harbour wave attenuator and the Multi-Purpose Jetty, thus remote from the navigation entrance to Cattle Bay Marina.

PANSW raised the potential effects of prop wash from cruise ships and tugs on vessels moored at the Cattle Bay Marina. Vessels within Cattle Bay Marina would be located a minimum of 170m from the edge of the cruise ship dredged channel. It is noted that the Eden Safe Harbour wave attenuator is located only some 30m from the edge of the cruise ship dredged channel and is understood to have been satisfactorily designed to mitigate prop wash. It follows that a wave attenuator at Cattle Bay, some 140m further distant, could be similarly designed and thus provide protection to moored vessels from prop wash.

Roads and Maritime Services

Roads and Maritime Services set out their input to the SEARs in correspondence to DPE dated 23 November 2018. The correspondence requested that the Applicant demonstrate it has consulted with Roads and Maritime Services, and the Department of Industry (DoI), on the issues raised and that the proposal has been informed by the outcomes of these consultations[1].

Mr Andrew Mogg of Roads and Maritime Services (Director, Maritime Infrastructure Delivery Office) was contacted on 18 March 2019. At the time of preparing this letter, a response from Mr Mogg had not been received. This is not considered critical as the issues raised by Roads and Maritime Services have been addressed in the EIS and, in addition, discussions have been held directly with DoI regarding the Eden Safe Harbour Project, as noted below.

Department of Industry

A number of discussions have been held with Mr Andrew Dooley of DoI during March 2019 regarding the Eden Safe Harbour Project, specifically the Safe Harbour wave attenuator, and its relationship to the proposed Cattle Bay Marina and wave attenuator. Mr Dooley is a Senior Project Manager – Coastal Infrastructure at DoI and responsible for the Eden Safe Harbour project.

Mr Dooley confirmed that:

- the alignment of the Eden Safe Harbour Project wave attenuator set out in the Amended Review of Environmental Factors (AREF) prepared for DoI by Advisian (August, 2018) and illustrated in the Community update – fourth quarter 2018, took into account the location of the original approved Cattle Bay Marina and wave attenuator which is unchanged;

- the EIS for Cattle Bay Marina should be prepared on the basis of the alignment of the Eden Safe Harbour Project wave attenuator as shown in the AREF;

- an entrance channel to Cattle Bay Marina approximately 30m wide has been retained by the alignment of the Safe Harbour wave attenuator; and

[1] *The issues raised comprised the impact of the Eden Safe Harbour Project on the Cattle Bay Marina proposal, the arrangement of swing moorings in Snug Cove and Cattle Bay, and the availability of sufficient detail on the Cattle Bay Marina proposal for Roads and Maritime Services to undertake a navigation assessment.*

- in due course DoI and Eden Cattle Bay Marina Pty Ltd could enter discussions as to how design details of the respective structures are arranged where they are immediately adjacent to ensure a satisfactory final outcome is achieved for each party.

Please do not hesitate to contact me should you require any clarification or additional information.

Yours faithfully

Greg Britton

Technical Director
Maritime & Aviation

Attachment G

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Mr Andrew Wilson
Eden Cattle Bay Marina Pty Ltd

email: awplanning@outlook.com

Date:	09 September 2019	Contact name:	Greg Britton
Your reference:		Telephone:	02 8854 5000
Our reference:	PA1042-104_lp20190922-cattle bay new da	Email:	greg.britton@rhdhv.com
Classification:	Project related		

Dear Andrew

CATTLE BAY MARINA – DA 2019.208
PORT AUTHORITY OF NSW SUBMISSION

I refer to your email of 9 August 2019 which included a submission on the proposed Cattle Bay Marina by the Port Authority of NSW (PANSW) dated 2 August 2019 and a request that I respond to the matters raised by PANSW. I am pleased to provide a response, details of which are set out below.

PANSW has made comments in four areas:

- Cumulative Impacts;
- Marine Traffic, Navigation and Safety;
- Hazards;
- First Port of Entry Requirements.

A number of matters raised by PANSW were addressed in a letter I prepared dated 29 March 2019 confirming pre-lodgement consultations carried out with Crown Lands and Port Authority of NSW which would not appear to have been included in the EIS.

Comments made by PANSW are addressed in turn under the separate headings below. In places, statements made in my letter of 29 March 2019 are reiterated, with updates where appropriate.

Cumulative Impacts

PANSW has noted that it understands the design of the proposed Eden Safe Harbour Project wave attenuator may change from what has been considered in the Cattle Bay development application's EIS. PANSW therefore recommended that the Cattle Bay Marina applicant consult further with Crown Lands and/or RMS, as the proponent of the Safe Harbour Project.

This particular matter was the subject of discussions held with Mr Andrew Dooley of the then Department of Industry (DoI) back in March 2019. The outcome of these discussions were included in my letter of 29 March 2019. To reiterate, Mr Dooley advised at that time the following:

- the alignment of the Eden Safe Harbour Project wave attenuator set out in the Amended Review of Environmental Factors (AREF) prepared for DoI by Advisian (August, 2018) and illustrated in the Community update – fourth quarter 2018 (so-called Option 21) took into account the location of the original approved Cattle Bay Marina wave attenuator;
- the EIS for Cattle Bay Marina should be prepared on the basis of the alignment of the Eden Safe Harbour Project wave attenuator as shown in the AREF, ie. Option 21; and
- an entrance channel to Cattle Bay Marina approximately 30m wide is retained by the Option 21 alignment.

As part of preparation of this letter I consulted again with Mr Dooley on 21 August 2019. Mr Dooley advised that:

- the published position of the Eden Safe Harbour Project wave attenuator remains that shown in the AREF, ie Option 21, and includes the approximately 30m wide gap to the proposed Cattle Bay Marina wave attenuator;
- consideration is being given to alternative alignments for the Eden Safe Harbour Project wave attenuator, however those currently under consideration would not encroach closer to the Cattle Bay Marina wave attenuator than Option 21;
- it is the intention that any finalised alignment for the Eden Safe Harbour Project wave attenuator would allow for safe navigation to the proposed Cattle Bay Marina.

It is considered that consultation with the proponent of the Eden Safe Harbour Project wave attenuator has currently been taken as far as practicable and has re-confirmed that the two wave attenuator projects can be undertaken compatibly.

Marine Traffic, Navigation and Safety

PANSW has noted that approval under Section 67ZN of the *Ports and Maritime Administration Regulation 2012* is required prior to any disturbance of the seabed from construction works. This is understood. An application for approval would be made following any approval of the development application for Cattle Bay Marina and prior to disturbance of the seabed from construction works.

PANSW has also noted that if the development application is approved, further consultation with the Harbour Master will be required in relation to marina construction and operation including, but not necessarily limited to:

- the relocation of swing moorings;
- the appropriate marking out and lighting of moored construction vessels and the delineation of construction areas;
- installation of required aids to navigation; and
- the development of appropriate information on safe navigation in the Port of Eden.

Again the above matters are understood. As indicated by PANSW the appropriate time for the required further consultation is following any approval of the development application. As such, the above

requirements could be included in the conditions of any approval. It is noted that discussion of some of the above matters is included in the EIS, eg:

- discussion of a swing mooring relocation strategy is included in Appendix 8 of the EIS;
- reference to appropriate marking out and lighting of moored construction vessels and delineation of construction areas is included in the Construction Environmental Management Plan (CEMP) in Appendix 10 of the EIS;
- reference to the introduction of a network of Aids to Navigation is included in the Operational Environmental Management Plan (OEMP) in Appendix 9 of the EIS;
- information relating to safe navigation is included in the OEMP.

Hazards

PANSW has noted that the assessment for the proposed marina should consider the potential effects of the significant prop wash that can be generated by cruise ships and tugs on vessels moored at the marina, and that PANSW did not see any evidence in the assessment that this matter has been adequately assessed and considered.

The above comment by PANSW is likely to be due to the fact that my letter of 29 March 2019 would not appear to have been included in the EIS. In any case, the following points can be made in regard to the potential hazard to vessels moored at the proposed Cattle Bay Marina due to prop wash generated by cruise ships and tugs:

- the prop wash from cruise ships and tugs can potentially be an issue for vessels moored at a marina, subject mainly to the separation distance between the cruise ship or tug and the marina, all other things being equal, eg. orientation of the propeller jet and applied power[1];
- the existence of a wave attenuator assists in the attenuation of propeller wash;
- the Cattle Bay Marina wave attenuator would be located a minimum of 150m from the edge of the cruise ship channel compared to 30m in the case of the proposed Eden Safe Harbour Project wave attenuator, ie. there is 5 times more separation distance to the Cattle Bay Marina wave attenuator from the source of the wash[2];
- the proposed Eden Safe Harbour Project wave attenuator and proposed Cattle Bay Marina wave attenuator are of similar design;
- extensive assessments of propeller wash impacts on the Eden Safe Harbour Project wave attenuator have been undertaken on behalf of government including ship simulation studies, two dimensional and three dimensional computational fluid dynamics (CFD) modelling of propeller wash, and a risk analysis in consultation with PANSW (Morgan et al, 2019). It is also well known that it is proposed to develop a marina behind this attenuator;
- the government has committed to development of the Eden Safe Harbour Project wave attenuator having considered the prop wash risk to the attenuator, and to future marina vessels behind it, associated with cruise ship and tug operations;

[1] *The greater the separation distance the greater the attenuation of the propeller jet velocities as ambient surrounding water is entrained into the jet.*

[2] *Further, it is physically possible in the case of the Eden Safe Harbour Project wave attenuator that a working tug can be positioned immediately adjacent to this attenuator (zero distance) and at full power propelling wash towards the attenuator, albeit this would be an 'unplanned' operation.*

- it should be self evident that the hazard to the Cattle Bay Marina project due to prop wash is substantially less than that associated with the government's Eden Safe Harbour Project.

In my opinion, the Cattle Bay Marina project could be satisfactorily designed so as not to be adversely affected by cruise ship and tug prop wash, mainly by virtue of the separation distance between the project and the source of the wash.

First Port of Entry Requirements

PANSW has noted that the Applicant may need to apply to the Department of Agriculture to extend a Biodiversity Point of Entry Determination to the proposed Cattle Bay Marina, beyond that already held by the Port of Eden for Breakwater Wharf and soon to be extended to the New Breakwater Wharf Extension.

Such an application could be made by the Applicant in the evident it is required.

Reference

Morgan, B, Adamantidis, C and Gan, J 'Assessment of Cruise Ship and Tug Propeller Wash Impacts on the Eden Wave Attenuator', Australasian Coasts & Ports 2019 Conference, Hobart, 10-13 September 2019

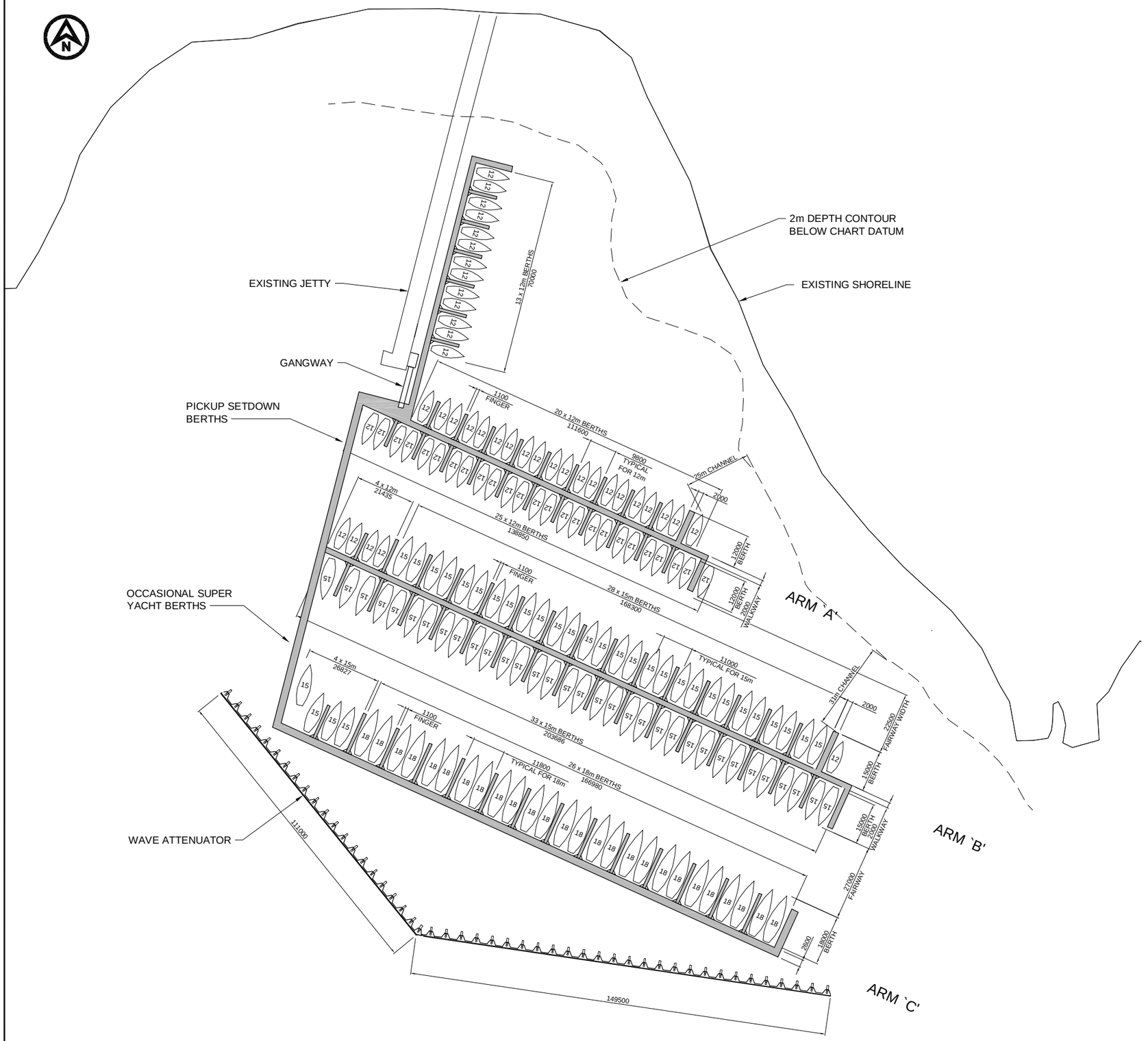
I trust the above meets with your requirements. Please contact me should you require any clarification or additional information.

Greg Britton
Technical Director
Maritime & Aviation

Attachment H

DRAWING No.
8A0458/MA/SK10

DO NOT SCALE



NOTES

1. 2m DEPTH CONTOUR IS FROM AUS 192
2. CHART DATUM IS APPROXIMATELY THE LEVEL OF LOWEST ASTRONOMICAL TIDE (LAT)

MARINA BERTH SCHEDULE

ARM	12	15	18	TOTAL
`A'	45			45
`B'	5	61		66
`C'		4	26	30
ALONGSIDE JETTY	13			13
TOTAL PROPOSED BERTHS	63	65	26	154
TOTAL PROPOSED BERTHING LENGTH (m)	756	975	468	2199

WIDTH OF MARINA WALKWAYS AND FINGERS, AND LOCATION OF PILING, SUBJECT TO DETAILED DESIGN

NOT FOR CONSTRUCTION

15 0 15 30 45 60 75m

1:750 (A1) 1:1500 (A3)

REV	DATE	DESCRIPTION	BY	CHK	APPD
A	dd.mm.yy	ISSUED FOR REVIEW	SGB	–	

REVISIONS

CLIENT

PROJECT:
–

DRAWING TITLE:
PROPOSED CATTLE BAY MARINA AND WAVE ATTENUATOR
DETAIL GENERAL ARRANGEMENT
STAGE 2 (ULTIMATE)

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DRAWN	DATE	JOB No.
SGB	07/08/2015	8A0458

AUTOCAD REF. 8A0458–MA–SK10

SCALE AT A1 1:750 (A1)

DRAWING No.	REVISION
8A0458/MA/SK10	A