

HORTON COASTAL ENGINEERING PTY LTD  
18 Reynolds Cres  
Beacon Hill NSW 2100  
+61 (0)407 012 538  
peter@hortoncoastal.com.au  
www.hortoncoastal.com.au  
ABN 31 612 198 731  
ACN 612 198 731

Meraki Developments Pty Limited  
C/- Mark Hurcum Design Practice Pty Limited  
Attention: Martin Tran  
271 Alfred Street North  
North Sydney NSW 2060  
(sent by email only to architects@mhdp.com.au)

10 December 2018

## **Estuarine Risk Management Report on 96-104 Cabarita Road Avalon**

### **1. INTRODUCTION AND BACKGROUND**

It is proposed to subdivide 96-104 Cabarita Road Avalon into 10 Community Title lots (one community lot on Lot 1, and 9 residential lots on Lots 2-10) and one Torrens title lot (Lot 11), for which a Development Application (DA) is to be submitted to Northern Beaches Council. Concurrently, 9 DA's are to be submitted to Council for new individual dwelling houses on each of Lot 2-10. An existing house and two boatsheds (with the western boatshed comprising two buildings) are to be retained on Lot 11, which is to remain as a Torrens title lot, with no works proposed on this Lot.

The community title works on Lot 1 include a driveway, stormwater infrastructure, garbage areas, pedestrian access to the foreshore, and a foreshore access area. There are 4 residential lots with water frontage, namely Lots 6-9, as well as the retained Lot 11. As no works are proposed on Lot 11, the scope of the investigation reported herein was on potential estuarine inundation of Lots 6-9 and the foreshore access area of Lot 1.

As the property (collectively referring to all relevant lots) is potentially affected by estuarine hazards, it is subject to *Pittwater 21 Development Control Plan (DCP)*<sup>1</sup>, in particular Chapter B3.7, and the *Estuarine Risk Management Policy for Development in Pittwater* (hereafter denoted as the Estuarine Policy) which is Appendix 7 of Part D of the DCP. Horton Coastal Engineering was engaged to prepare an Estuarine Risk Management Report to meet Council's requirements, as set out herein.

The report author is Peter Horton [BE (Hons 1) MEngSc MIEAust CPEng NER]. Peter has postgraduate qualifications in coastal engineering and 26 years of coastal engineering experience, including numerous estuarine risk management studies along the Pittwater shoreline and specifically at Avalon. He is a Member of Engineers Australia and Chartered Professional Engineer registered on the National Engineering Register. Peter is also a member of the National Committee on Coastal and Ocean Engineering and NSW Coastal, Ocean and Port Engineering Panel. He has inspected the area in the vicinity of the subject property on several occasions in the last few years, including a specific recent inspection of the property on 2 October 2018.

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<sup>1</sup> The version up to Amendment 23 (effective from 13 January 2018) was considered herein.

Note that all levels given herein are to Australian Height Datum (AHD). Zero metres AHD is approximately equal to mean sea level at present.

## **2. INFORMATION PROVIDED**

Horton Coastal Engineering was provided with 17 site drawings (plus 24 drawings for Lot 10, 25 drawings for each of Lots 2, 3 and 5; and 26 drawings for each of Lots 4 and 6-9) prepared by Mark Hurcum Design Practice, namely Drawing Nos. A000 to A007, N01, and SK201 to SK211, all Revision A and dated November 2018. A site survey prepared by Byrne & Associates was also provided, Plan No. A1-10937D3 (Issue B, dated 22 August 2018, with 10 sheets).

## **3. EXISTING SITE DESCRIPTION**

The subject property is located adjacent to the Pittwater waterway near the south-western corner of Careel Bay, with broad and zoomed aerials view depicted in Figure 1 and Figure 2 respectively. Views of the property are provided in Figure 3 to Figure 5 (all photographs taken on 2 October 2018).

Based on the survey provided:

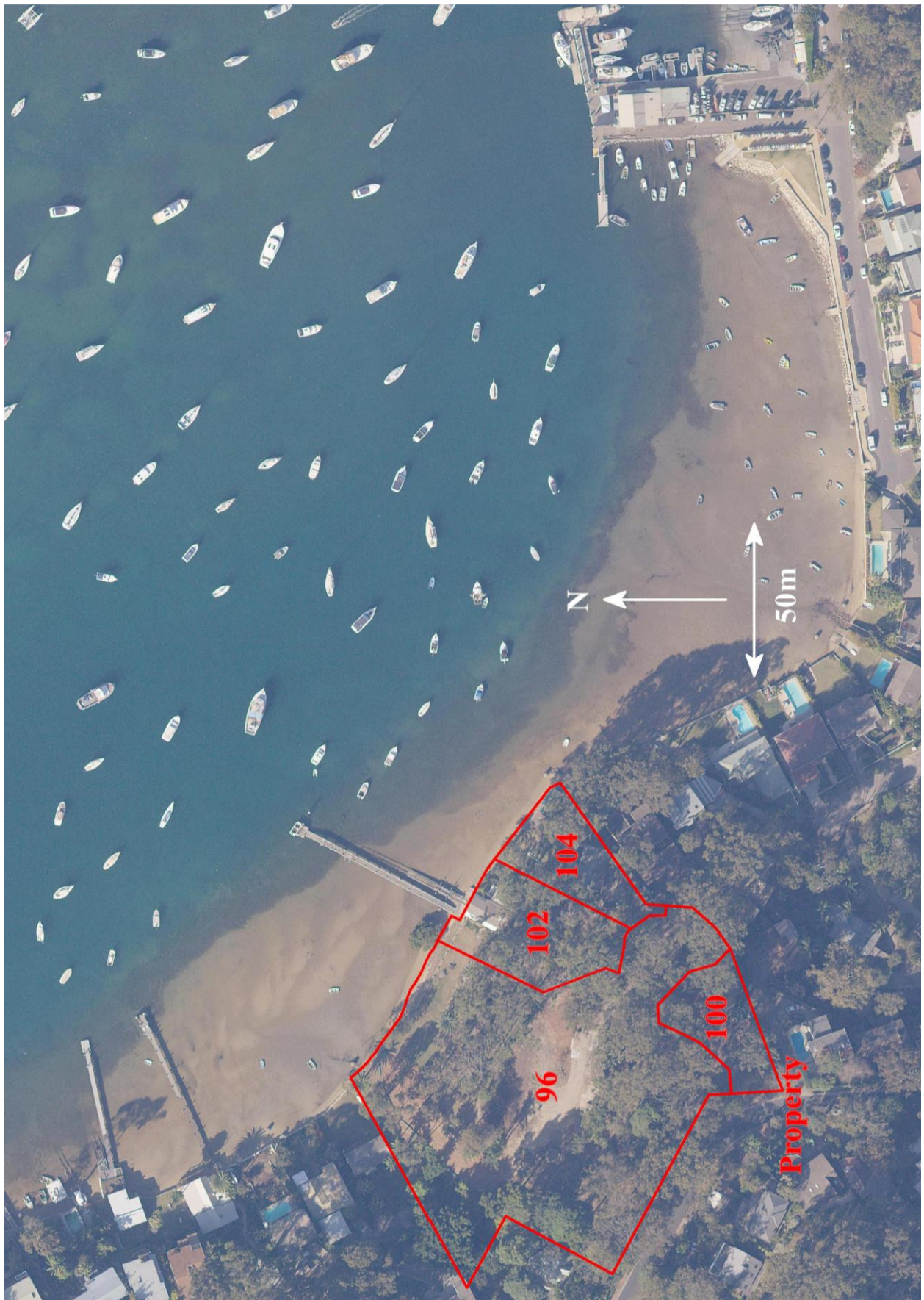
- a sandstone seawall extending over the western portion of the property (west of the jetty) has a crest level of between about 1.4m and 1.8m AHD (average of 1.6m AHD), generally increasing moving east;
- adjacent ground levels immediately landward of the western seawall are about 1.5 to 1.6m AHD;
- adjacent sand levels immediately seaward of the western seawall increase from about 0.4m AHD at the western end, to about 1.3m to 1.5m AHD where the wall kinks and there is a grassed area seaward of the wall;
- a concrete seawall at the jetty has a crest level of about 1.3m AHD;
- a sandstone seawall extending from east of the jetty to a timber boat ramp has a crest level of between about 1.4m and 1.6m AHD (average of 1.5m AHD);
- a sandstone seawall extending to the east of the boat ramp has a crest level of about 2.0m AHD;
- ground levels generally increase moving landward of the seawall, to 3m AHD within about 10m (except at the western end where this distance increases to about 17m), and increasing moving SE to about 30m AHD at Cabarita Road (at the SE corner of the property); and
- there are 3 main stormwater outlets that can discharge through the seawall, namely at the NW and NE corners of the property, and midway between the jetty and boat ramp.





**Figure 1: Broad aerial view of subject property (aerial photograph taken 30 August 2018)**





**Figure 2: Zoomed aerial view of subject property (aerial photograph taken 30 August 2018)**





**Figure 3: View of eastern foreshore portion of property, looking south (buildings at arrows to be retained)**



**Figure 4: View of western foreshore portion of property, looking WNW**





**Figure 5: View of NW corner of property, looking south**

#### **4. PROPOSED DEVELOPMENT**

It is proposed to subdivide the area generally covered by No. 96 and 100 (and the western portion of No. 102) into 9 lots. Along the foreshore, moving west to east, there is to be Lot 6, Lot 7, Lot 8 and Lot 9. Lot 11, covering the eastern foreshore area, is to contain the 4 buildings to be retained. Proposed ground floor levels for the dwellings on Lots 6-9 are as follows:

- Lot 6: 5.2m AHD;
- Lot 7: 7.4m AHD;
- Lot 8: 9.5m AHD; and
- Lot 9: 12.2m AHD.

Lots 2-5 and Lot 10, located landward of Lots 6-9 and Lot 11, are elevated above 12m AHD and would not credibly be affected by estuarine processes over a design life of 100 years, and hence are not considered herein. As the retained buildings on Lot 11 are not part of the DA's to be submitted, nor the waterway structures (jetty, slipway, and boat ramp), they are not considered herein.

Immediately west of the boatshed to be retained that is landward of the jetty, a community title foreshore access area is to be located. This is to include boat storage racks at a base level of around 2m AHD, with timber stairs leading landward.

No works are proposed below Mean High Water Mark, except as required for connection of sewage lines below the seabed, to existing sewage infrastructure seaward of the subject property. Given that these works are to be below the seabed, it has been assumed that they would not affect coastal/estuarine processes and are not considered further herein.

## **5. ESTUARINE PROCESSES**

In Cardno (2015), the 100-year Average Recurrence Interval (ARI) present day water level in the region covering the subject property is reported as 1.52m AHD. This includes the effects of astronomical tide and storm surge (combined level of 1.44m AHD), and local wind setup (0.08m). Wave action would temporarily and periodically increase water levels above this level, with Cardno (2015) estimating a present day Estuarine Planning Level (EPL) of 2.2m to 2.4m AHD. This EPL includes wave runup and overtopping effects, and a freeboard of 0.3m.

To put the 100-year ARI astronomical tide and storm surge level of 1.44m AHD in context, Mean High Water is approximately 0.5m AHD and Mean High Water Springs is about 0.6m AHD at the subject property. The combined astronomical tide and storm surge level for a monthly and bi-annual event is about 1.0m and 1.2m AHD respectively. Corresponding water levels only increase slightly for rarer events, eg 1 year ARI level of 1.24m AHD, 10 year ARI level of 1.34m AHD and 50 year ARI water level of 1.41m AHD (Department of Environment, Climate Change and Water [DECCW] (2010).

In Cardno (2015), sea level rise values of 0.4m at 2050 and 0.9m at 2100 were applied relative to 2010, which is not strictly correct as those benchmarks were derived relative to 1990, and historical sea level rise has not been discounted. Appropriate sea level rise values (relative to 2010) using that methodology would be 0.34m at 2050 and 0.84m at 2100 (DECCW, 2010). That stated, applying the Cardno (2015) values as is for convenience, foreshore EPL values (including wave runup effects and incorporating a 0.3m freeboard<sup>2</sup>) of 2.6m AHD and 3.1m AHD were determined at 2050 and 2100 respectively.

EPL values reduce moving landward, with development over 10m landward of the seawall. Applying a reduction factor as per Cardno (2015) that reduces the EPL to the still water level (plus freeboard) at a distance of 40m from the foreshore, the EPL values at 10m from the foreshore were determined to be 2.2, 2.5 and 3.0m AHD for present, 2050 and 2100 planning periods respectively. With the lowest proposed ground floor level being 5.2m AHD, estuarine inundation is not a significant risk to the proposed development to beyond 2100.

## **6. DESIGN LIFE**

In the Estuarine Policy, it is noted that a design project life of 100 years should be adopted unless otherwise justified. For a 100 year life (at 2118), the EPL value at 10m from the foreshore would increase to about 3.2m AHD<sup>3</sup>. That is, estuarine inundation is not a significant risk to the proposed development (with a minimum floor level of 5.2m AHD) for a 100 year life.

## **7. RISKS OF DAMAGE TO PROPOSED DEVELOPMENT AND MITIGATION OF THOSE RISKS**

With a minimum floor level of 5.2m AHD, which is above the 2118 EPL of 3.2m AHD at 10m from the seawall, the proposed dwellings are considered to be at an acceptably low risk of damage without any further risk mitigation measures, as long as the following recommendations are adopted as relevant:

1. all structural elements below 3.2m AHD (if any) shall be of flood compatible materials, that is, should tolerate getting wet;

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<sup>2</sup> Although use of a freeboard is not considered to be necessary.

<sup>3</sup> Considering median sea level rise projections from Intergovernmental Panel on Climate Change (2013) and extrapolating at the same rate as the sea level rise from 2090 to 2100.

2. storage of toxic or potentially polluting goods, chemicals or materials, which may be hazardous or pollute the waterway, shall be above 3.2m AHD; and
3. electrical equipment, wiring, fuel lines or any other service pipes and connections (if any) must be located either above 3.2m AHD or waterproofed to this level.

The existing seawall may be overtopped at times of severe storms, which may cause erosion of landscaped areas landward of the wall. Reinstatement and repair of these areas may thus be required at times, but this potential damage is not considered to be a concern to overall site stability.

It is evident that the existing seawall is in poor condition at some locations, particularly towards to the western end of the site, with voids in the seawall face and migration of soil occurring through the wall. It is recommended that the seawall in these areas is repaired.

The proposed boat storage racks, to be functional, need to be located near the foreshore. The proposed position at the landward edge of the community title foreshore access area is considered to be acceptable from an estuarine processes perspective. Boats will be need to be chained to the racks, or relocated to higher ground, to prevent them floating away at times of elevated water levels

The lower portion of the timber stairs leading landward of the foreshore access area may be subject to inundation at times. It is recommended that timber species suitable for the marine environment are used in the lower portion of the stairs below 3.2m AHD. Open risers would assist in reducing wave forces on the stairs. To not be damaged in a severe storm, the stairs should be designed to resist buoyancy and wave forces.

## **8. CONTROLS IN PITTWATER 21 DCP**

Based on Section B3.7 of the DCP:

1. All development or activities must be designed and constructed such that they will not increase the level of risk from estuarine processes for any people, assets or infrastructure in surrounding properties; they will not adversely affect estuarine processes; they will not be adversely affected by estuarine processes; and
2. All structural elements below the Estuarine Planning Level shall be constructed from flood compatible materials; and
3. All structures must be designed and constructed so that they will have a low risk of damage and instability due to wave action and tidal inundation; and
4. All electrical equipment, wiring, fuel lines or any other service pipes and connections must be waterproofed to the Estuarine Planning Level; and
5. The storage of toxic or potentially polluting goods, materials or other products, which may be hazardous or pollute the waterway, is not permitted to be stored below the Estuarine Planning Level; and
6. For existing structures, a tolerance of up to minus 100mm may be applied to the Estuarine Planning Level in respect of compliance with these controls.
7. To ensure Council's recommended flood evacuation strategy of 'shelter in place' it will need to be demonstrated that there is safe pedestrian access to a 'safe haven' above the Estuarine Planning Level.

With regard to Item 1, the proposed development would not impact on surrounding properties in terms of estuarine processes, with the existing seawall location unaltered by the development and the proposed dwellings well above the 2118 EPL. If the recommendations



given in Section 7 are followed, the risk of the proposed development being adversely affected by estuarine processes would be suitably mitigated.

With regard to Item 2, this was recommended in Section 7. With regard to Item 3, recommendations were provided in Section 7, which if followed, would mean that all structures have a low risk of damage and instability due to wave action and tidal inundation. With regard to Item 4 and Item 5, it was noted in Section 7 that this should apply.

Item 6 has not been applied herein.

With regard to Item 7, the dwellings in their entirety are above the 2118 EPL. It would thus be possible to 'shelter in place' in a severe storm, without significant risk to safety of people.

## **9. STATE ENVIRONMENTAL PLANNING POLICY (COASTAL MANAGEMENT) 2018**

Based on *State Environmental Planning Policy (Coastal Management) 2018* (SEPP Coastal) and its associated mapping, the subject property is within a “coastal environment area” and “coastal use area”.

Based on Clause 13(1) of SEPP Coastal, development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

- (a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,
- (b) coastal environmental values and natural coastal processes,
- (c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,
- (d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,
- (e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
- (f) Aboriginal cultural heritage, practices and places,
- (g) the use of the surf zone.

Based on Clause 13(2) of SEPP Coastal, development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- (a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or
- (b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
- (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

Most of the items in Clause 13(1) are not coastal engineering matters, so are not considered herein. That stated, the proposed development would not adversely impact on coastal processes as per (b), with the existing seawall location unaltered by the development and the proposed dwellings well above the 2118 EPL. Furthermore, the development would not affect public open space and safe access as per (e), as the works are entirely on private property.

There is not a typical surf zone offshore of the property, but it can be noted that the proposed development would not impact on breaking wave processes, so would not affect use of the surf zone as per (g).

Given that the proposed development has an acceptably low risk of damage from estuarine inundation for a sufficiently long design life, if the recommendations given in Section 7 are followed, the development can be considered to have been designed and sited (and managed in the future) to avoid an adverse impact, as per Clause 13(2).

Based on Clause 14(1) of SEPP Coastal, development consent must not be granted to development on land that is within the coastal use area unless the consent authority:

- (a) has considered whether the proposed development is likely to cause an adverse impact on the following:
  - (i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
  - (ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,
  - (iii) the visual amenity and scenic qualities of the coast, including coastal headlands,
  - (iv) Aboriginal cultural heritage, practices and places,
  - (v) cultural and built environment heritage, and
- (b) is satisfied that:
  - (i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or
  - (ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
  - (iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and
- (c) has taken into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development.

Clause 14(1) does not address coastal engineering matters so is not considered herein, although it can be noted that it would not affect existing safe access as per (i), as it is entirely on private property.

Based on Clause 15 of SEPP Coastal, development consent must not be granted to development on land within the coastal zone unless the consent authority is satisfied that the proposed development is not likely to cause increased risk of coastal hazards on that land or other land. The proposed development would not impact on surrounding properties in terms of estuarine processes (that is, would not cause significant impact on coastal hazards or increase the risk of coastal hazards in relation to any other land), with the existing seawall location unaltered by the development and the proposed dwellings well above the 2118 EPL.

Based on Clause 16 of SEPP Coastal, development consent must not be granted to development on land within the coastal zone unless the consent authority has taken into consideration the relevant provisions of any certified coastal management program that applies to the land. No coastal management program applies at the subject property.

## **10. CONCLUSIONS**

At 2118, the EPL at 10m landward of the existing seawall at the proposed development is 3.2m AHD. With a minimum floor level of 5.2m AHD, the proposed dwellings are considered to be at



an acceptably low risk of damage without any further risk mitigation measures, as long as the recommendations listed in Section 7 are adopted as relevant.

The proposed development complies with Section B3.7 of the Pittwater 21 DCP, and the coastal engineering matters in *State Environmental Planning Policy (Coastal Management) 2018* as described.

## **11. REFERENCES**

Cardno (2015), *Pittwater Estuary Mapping of Sea Level Rise Impacts*, LJ2882/R2658v7, Revised Draft, for Pittwater Council, February

Department of Environment, Climate Change and Water [DECCW] (2010), *Coastal Risk Management Guide: Incorporating sea level rise benchmarks in coastal risk assessments*, DECCW 2010/760, August, ISBN 978 1 74232 922 2

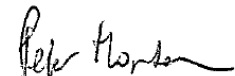
Intergovernmental Panel on Climate Change [IPCC] (2013), *Climate Change 2013, The Physical Science Basis, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, [Stocker, TF; Qin, D; Plattner, G-K; Tignor, M; Allen, SK; Boschung, J; Nauels, A; Xia, Y; Bex, V and PM Midgley (editors)], Cambridge University Press, Cambridge, United Kingdom and New York, New York, USA

## **12. SALUTATION**

If you have any further queries, please do not hesitate to contact Peter Horton via email at [peter@hortoncoastal.com.au](mailto:peter@hortoncoastal.com.au) or via mobile on 0407 012 538. Although the current Estuarine Policy does not have a form that is required to be filled in, Council has in practice recently requested that a form provided in a former Estuarine Policy be filled in, as provided overleaf.

Yours faithfully

HORTON COASTAL ENGINEERING PTY LTD



Peter Horton

Director and Principal Coastal Engineer

This report has been prepared by Horton Coastal Engineering Pty Ltd on behalf of and for the exclusive use of Meraki Developments Pty Limited (the client), and is subject to and issued in accordance with an agreement between the client and Horton Coastal Engineering Pty Ltd. Horton Coastal Engineering Pty Ltd accepts no liability or responsibility whatsoever for the report in respect of any use of or reliance upon it by any third party. Copying this report without the permission of the client or Horton Coastal Engineering Pty Ltd is not permitted.

*Estuarine Risk Management Policy for Pittwater Form No. 1 is provided overleaf*

FORM NO. 1

**To be submitted with Estuarine Risk Management Report**

**Development Application for** Meraki Developments Pty Limited / Mark Hurcum Design Practice

Name of Applicant

**Address of site** 96-104 Cabarita Road Avalon

***Declaration made by a Coastal Engineer as part of an Estuarine Risk Management Report***

I, Peter Horton on behalf of Horton Coastal Engineering Pty Ltd  
(Insert Name) (Trading or Company Name)

on this the 10<sup>th</sup> December 2018 (date)

certify that I am a Coastal Engineer as defined by the Estuarine Risk Management Policy for Development in Pittwater and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least \$2 million.

**Please mark appropriate box**

- ☒ I have prepared the detailed Estuarine Risk Management Report referenced below in accordance with the Estuarine Risk Management Policy for Development in Pittwater
- ☐ I am willing to technically verify that the detailed Estuarine Risk Management Report referenced below has been prepared in accordance with the Estuarine Risk Management Policy for Development in Pittwater
- ☐ I have examined the site and the proposed development/alteration in detail and, as detailed in my report, am of the opinion that the Development Application only involves Minor Development/Alterations or is sited such that a detailed Estuarine Risk Management Report is not required.

**Estuarine Risk Management Report Details:**

Report Title:

Estuarine Risk Management Report on 96-104 Cabarita Road Avalon

Report Date:

10 December 2018

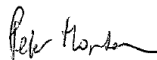
Author: Horton Coastal Engineering Pty Ltd

**Documentation which relate to or are relied upon in report preparation:**

See Section 2 and Section 11 of report

I am aware that the above Estuarine Risk Management Report, prepared for the above mentioned site is to be submitted in support of a Development Application for this site and will be relied on by Northern Beaches Council as the basis for ensuring that the estuarine risk management aspects of the proposed development have been adequately addressed to achieve an acceptable risk management level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that all reasonable and practical measures have been identified to remove foreseeable risk.

Signature



Name

Peter Horton

Chartered Professional Status

MIEAust CPEng

Membership No.

452980