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10 January 2020

## **Coastal Engineering Advice on 36 Watkins Road Avalon Beach**

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

It is proposed to undertake minor alterations and additions to a dwelling at 36 Watkins Road Avalon Beach, for which a Development Application (DA) is to be submitted to Northern Beaches Council. The property is located within a "Bluff/Cliff Instability" area designated on the *Coastal Risk Planning Map* (Sheet CHZ\_016) that is referenced in *Pittwater Local Environmental Plan 2014*. Therefore, the property is subject to Chapter B3.4 of *Pittwater 21 Development Control Plan* (DCP)<sup>1</sup>, and the *Geotechnical Risk Management Policy for Development in Pittwater*. Based on Chapter 6.5(i) of this policy, "a coastal engineer's report on the impact of coastal processes on the site and the coastal forces prevailing on the bluff must be incorporated into the geotechnical assessment as an appendix and the Coastal Engineer's assessment must be addressed through the Geotechnical Report and structural specification". Accordingly, this coastal engineering report is set out herein.

The report author, Peter Horton [BE (Hons 1) MEngSc MIEAust CPEng NER], is a professional Coastal Engineer with 27 years of coastal engineering experience. He has postgraduate qualifications in coastal engineering, and is a Member of Engineers Australia (MIEAust) and Chartered Professional Engineer (CPEng) registered on the National Engineering Register (NER). He is also a member of the National Committee on Coastal and Ocean Engineering (NCCOE) and NSW Coastal, Ocean and Port Engineering Panel (COPEP) of Engineers Australia.

Peter has completed coastal engineering reports for numerous cliff/bluff properties in the Avalon Beach area, and 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 cliff face and rock platform adjacent to the property on 3 January 2020.

Note that all levels given herein are to Australian Height Datum (AHD). Zero metres AHD is approximately equal to mean sea level at present. Completed Form No. 1 as given in the *Geotechnical Risk Management Policy for Pittwater* is attached at the end of the document herein.

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<sup>1</sup> The Pittwater 21 DCP up to Amendment No. 25, which came into effect on 1 December 2019, was considered herein.

## **2. INFORMATION PROVIDED**

Horton Coastal Engineering was provided with 12 drawings of the proposed development prepared by Michelle Walker Architects, namely Drawing Nos DA01 to DA11 (all Issue F and dated 17 December 2019), along with a cover sheet. A site survey completed by DP Surveying was also provided, Reference 1832 and dated 14 December 2007 and 30 July 2018.

## **3. EXISTING SITE DESCRIPTION**

The subject property is located landward of a cliff escarpment extending between the sandy Whale Beach in the north and sandy Avalon Beach in the south. Moving north to south, the cliff includes Careel Head, Bangalley Head and Hole in the Wall. The subject property is located immediately south of Bangalley Head.

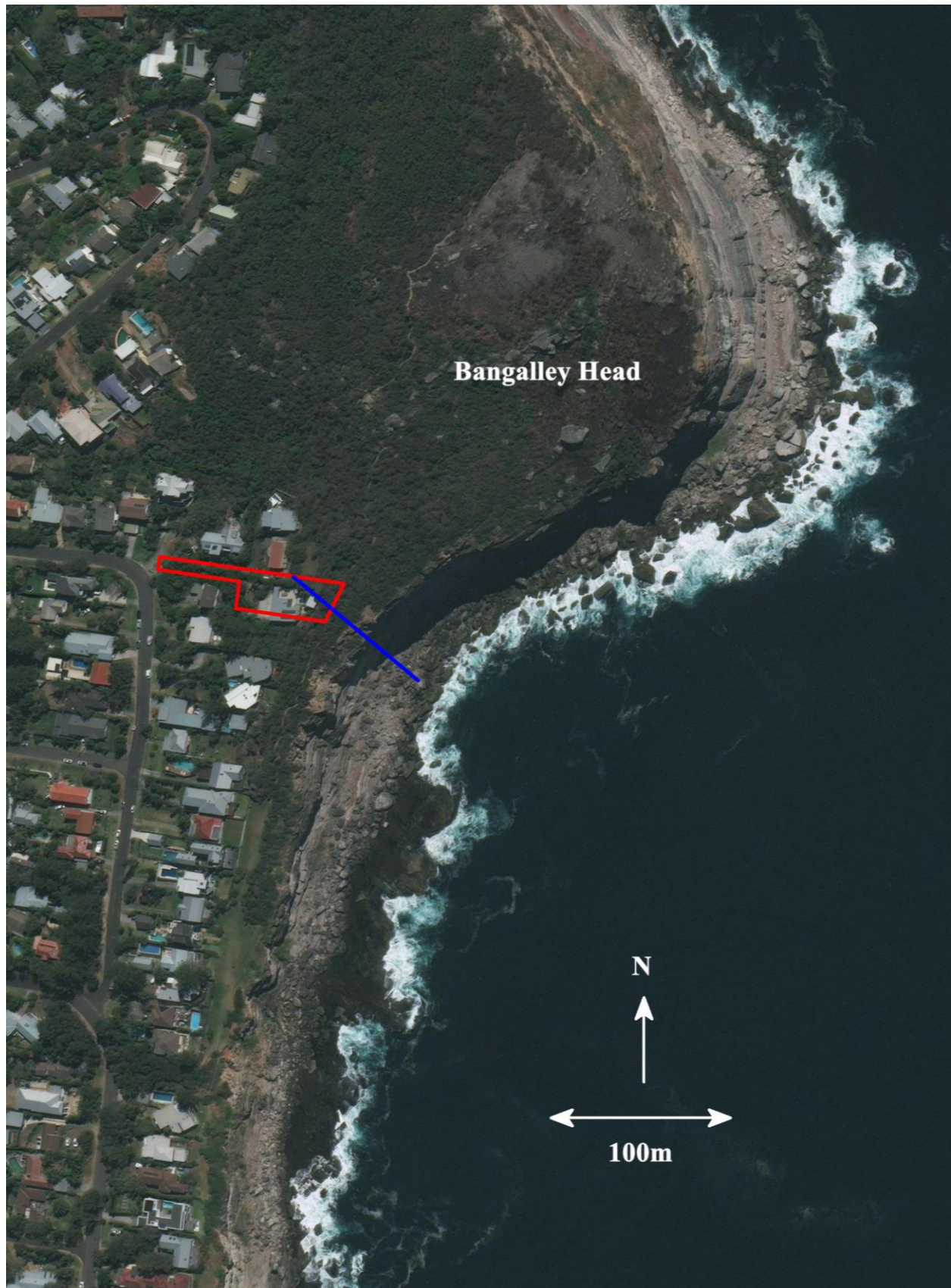
An aerial view of the property is provided in Figure 1, along with a section location (denoted as Section A) drawn approximately perpendicular to the cliff line<sup>2</sup>. A photograph of the cliff seaward of the property from the rock platform seaward of the cliff is provided in Figure 2.

Based on 2011 Airborne Laser Scanning (ALS) data held by Horton Coastal Engineering, Section A is as depicted in Figure 3. It is evident that the subject property rises from a level of about 57.6m AHD at the landward edge of Section A, to a maximum elevation of about 66.7m AHD at around 17m seaward of the seaward boundary, then falls to about 55.4m AHD at the top of the near-vertical cliff about 28m seaward of the property. The base of the exposed near-vertical cliff is at a level of about 8.7m AHD. The average slope of the exposed near-vertical cliff is 87°.

Seaward of the cliff face, the rock platform is covered with boulders. Coffey & Partners (1987) noted that the Avalon Beach to Careel Head cliff was composed of massive sandstone and interbedded siltstone / sandstone beds with slope angles of 80°. Undercutting in the sandstone units was found to have produced local overhangs and slope angles as low as 45° in the interbedded units. Cliff formation was seen to be primarily controlled by jointing, with undercutting in the less resistant interlaminated beds and toppling of large blocks of sandstone which line the cliff base. The boulders at the base of the cliff have fallen from the cliff over the last few thousand years due to this weathering and undercutting process.

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<sup>2</sup> Note that the property boundary depicted in Figure 1 is not survey accurate, being derived from approximate NSW Government GIS cadastral data.

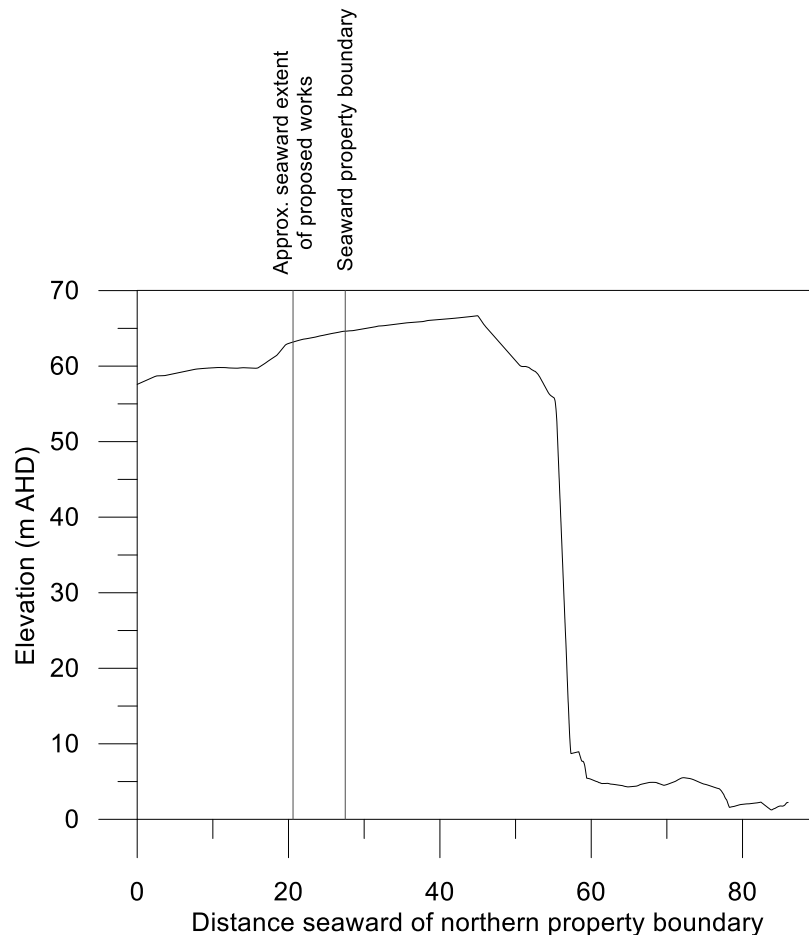


**Figure 1: Aerial view of subject property (red) on 29 September 2017, with Section A location (blue) also shown**





**Figure 2: View of cliff face seaward of subject property (approximate extent between arrows) from rock platform on 3 January 2020, looking north**



**Figure 3: Section A through subject property**

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

It is proposed to undertake minor alterations and additions to the dwelling at the subject property, including:

- new tiling and stairs to an outdoor dining area, with a vergola over;
- replacing an existing deck and stairs near the pool;
- replacing a portion of the northern boundary fence near the pool; and
- replacing existing retaining walls located east of the pool.

The approximate seaward (eastern) extent of the proposed works is depicted in Figure 3.

#### **5. MECHANISMS FOR CLIFF EROSION**

##### **5.1 Preamble**

Erosion of sheer cliffs can occur in two forms (Public Works Department, 1985), either:

- a slow, relatively gradual attrition of cliff material due to the effects of weathering; or
- relatively infrequent but sudden collapse of large portions of cliff face, due to undercutting, wave impact forces, changed groundwater conditions, rock shattering or increased loadings related to construction, and other processes.

Weathering may induce undercutting and toppling failure of overhanging blocks if the rate of weathering is highest near the base of the cliff or at other levels below the top of the cliff. Erosion of steep slopes tends to occur suddenly in association with heavy rainfall or changes to drainage patterns, slope undercutting, and increases in load on the slope.

## **5.2 Weathering and Erosion**

Both chemical and mechanical weathering can reduce the strength of cliff material (Sunamura, 1983). Chemical weathering includes hydration and solution, caused by the interaction between cliff material and sea water. Mechanical weathering comprises:

- the wetting and drying process in the intertidal zone;
- generation of repeated stresses in cliff material by periodic wave action (particularly waves that break on the cliff); and
- frost effects in cold latitudes.

The base of the cliff seaward of the subject property is unlikely to be impacted by wave runup during coastal storms with large waves and elevated water levels, as it is at a relatively high elevation of about 8.7m AHD and landward of a boulder slope that would be relatively effective in dissipating wave energy. Therefore, wave-induced mechanical weathering would not be expected to be significant at this cliff line.

An average rate of recession for Sydney Northern Beaches coastline mudstone cliffs (as applies at the subject property over the lower portion, with interbedded siltstone/sandstone) subject to chemical and mechanical weathering of 6mm per year was determined by Crozier and Braybrooke (1992), with a maximum of 18mm/year. An approximate 50m of cliff recession (observed in aerial photography) seaward of the subject property over the last 6,400 years (since sea levels stabilised around their present levels) represents an average rate of 8mm/year, consistent with the average value.

An allowance for recession/weathering of the cliff face of 18mm per year is considered to be reasonable to apply for conservative planning purposes over a design life of 100 years, including allowance for projected sea level rise. This rate of 18mm/year should be considered and assessed by the geotechnical engineer.

The geotechnical engineer should consider this rate in conjunction with an understanding of the particular nature of the cliff materials east of the subject property, their resistance to erosion, and potential failure planes related to geotechnical issues such as the joint spacing<sup>3</sup>.

This should be confirmed by the geotechnical engineer, but it is expected that the erosion/weathering described above would lead to undercutting and collapse of blocks on the cliff face over the long term, with failure planes at the joints.

## **6. COASTAL INUNDATION**

With the cliff seaward of the subject property above 65m AHD, coastal inundation is not a significant risk to the proposed development over a planning period of well over 100 years.

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<sup>3</sup> Coffey & Partners (1987) noted that the controlling feature of interbedded sandstone/siltstone cliffs (as per the subject property) was the bedding spacing and relative proportion of sandstone/siltstone.



## **7. MERIT ASSESSMENT**

### **7.1 Preamble**

This merit assessment has been undertaken assuming that the geotechnical engineer for this DA will determine that there will be acceptably low risk to life and low risk to property for the proposed development, if their recommendations are adhered to.

### **7.2 *State Environmental Planning Policy (Coastal Management) 2018***

#### **7.2.1 *Preamble***

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

#### **7.2.2 *Clause 14***

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”.

With regard to Clause (a)(i), the proposed development is entirely on private property and will not affect public foreshore, beach, headland or rock platform access.

Clauses (a)(ii) and a(iii) are not coastal engineering matters so are not considered herein.

With regard to (a)(iv), a search of the Office of Environment and Heritage “Aboriginal Heritage Information Management System” (AHIMS) was undertaken on 6 January 2020, which found that there were no particular Aboriginal sites recorded nor Aboriginal places declared within at least 200m of the subject property.

With regard to (a)(v), the nearest environmental heritage item to the subject property listed in Schedule 5 of *Pittwater Local Environmental Plan 2014* is the trigonometrical station at

Bangalley Head. The proposed development is 270m from this station and would not be expected to impact on it.

With regard to (b), the proposed development has been designed and sited to avoid any potential adverse impacts referred to in Clause 14(1) for the matters considered herein.

Clause (c) is not a coastal engineering matter so is not considered herein.

#### 7.2.3 Clause 15

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”.

Assuming that the proposed development is at an acceptably low risk of damage from projected coastal erosion/recession for a planning period of 100 years based on the DA geotechnical report, and given that it is well above projected wave runoff to 2100, the proposed development would not even be expected to interact with coastal processes over its design life, let alone affect any other land. That is, the proposed development is unlikely to cause increased risk of coastal hazards on that land or other land over its design life.

#### 7.2.4 Clause 16

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 certified coastal management program applies at the subject property.

#### 7.2.5 Synthesis

The proposed development satisfies the requirements of *State Environmental Planning Policy (Coastal Management) 2018* for the matters considered herein.

### 7.3 ***Pittwater Local Environmental Plan 2014***

Clause 7.5 of *Pittwater Local Environmental Plan 2014* (LEP 2014) applies at the subject property, as the property is identified as “Bluff/Cliff Instability” on the Coastal Risk Planning Map Sheet CHZ\_016. Based on Clause 7.5(3) of LEP 2014, “development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

- (a) is not likely to cause detrimental increases in coastal risks to other development or properties, and
- (b) is not likely to alter coastal processes and the impacts of coastal hazards to the detriment of the environment, and
- (c) incorporates appropriate measures to manage risk to life from coastal risks, and
- (d) is likely to avoid or minimise adverse effects from the impact of coastal processes and the exposure to coastal hazards, particularly if the development is located seaward of the immediate hazard line, and



- (e) provides for the relocation, modification or removal of the development to adapt to the impact of coastal processes and coastal hazards, and
- (f) has regard to the impacts of sea level rise, and
- (g) will have an acceptable level of risk to both property and life, in relation to all identifiable coastline hazards”.

With regard to (a) and (b), the proposed development would not increase coastal risks nor alter coastal processes and the impacts of coastal hazards, as it would not affect the wave impact process on the base of the cliff.

Items (c), (d) and (g) are for the geotechnical engineer to assess, with consideration of the findings herein. Assuming that they find that the proposed development is at an acceptably low risk of damage over a 100 year planning period with appropriate measures incorporated in the design and construction, this would meet (c), (d) and (g). On this basis, (e) should not be necessary, noting that this would be more applicable in a sandy beach environment.

With regard to (f), sea level rise has been considered herein.

## **8. FORM**

Completed *Geotechnical Risk Management Policy for Pittwater* Form No. 1 is attached at the end of the document herein. Note that the declaration on Form No. 1 is not appropriate for a coastal report, with the revised declaration below:

“I am aware that the above Coastal Report, prepared for the abovementioned site is to be submitted to assist with a geotechnical investigation for a Development Application for this site, with that geotechnical investigation relied on by Northern Beaches Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed. No declaration can be made on the geotechnical investigation as this has not been prepared nor reviewed by me, and nor do I have geotechnical engineering expertise”.

## **9. CONCLUSIONS**

An allowance for erosion/weathering of 18mm/year of the cliff seaward of 36 Watkins Road Avalon Beach should be considered and assessed by the geotechnical engineer.

The geotechnical engineer should consider this estimated rate in conjunction with an understanding of the particular nature of the cliff materials seaward of the subject property, their resistance to erosion, and potential failure planes related to geotechnical issues such as the joint spacing.

Coastal inundation is not a significant risk for the proposed development over a planning period of well over 100 years. Given this, and assuming that the geotechnical engineer finds that the development is at an acceptably low risk of damage from coastal/geotechnical hazards over a 100 year design life, the proposed development satisfies the requirements of *State Environmental Planning Policy (Coastal Management) 2018* (Clauses 14, 15 and 16) and Clause 7.5 of *Pittwater Local Environmental Plan 2014* for the matters considered herein.

## 10. REFERENCES

Coffey & Partners (1987), "Coastal Management Study, Assessment of Bluff Areas", *Report No. S8002/1-AA*, March, for Warringah Shire Council

Crozier, PJ and JC Braybrooke (1992), "The morphology of Northern Sydney's rocky headlands, their rates and styles of regression and implications for coastal development", *26th Newcastle Symposium on Advances in the Study of the Sydney Basin*, University of Newcastle

Public Works Department (1985), "Coastal Management Strategy, Warringah Shire, Report to Working Party", *PWD Report 85016*, June, prepared by AD Gordon, JG Hoffman and MT Kelly, for Warringah Shire Council

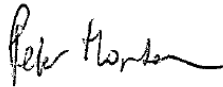
Sunamura, Tsuguo (1983), "Processes of Sea Cliff and Platform Erosion", Chapter 12 in *CRC Handbook of Coastal Processes and Erosion*, editor Paul D Komar, CRC Press Inc, Boca Raton, Florida, ISBN 0-8493-0208-0

## 11. 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 +61 407 012 538.

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 Brett & Lisa Lewthwaite (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.

*Geotechnical Risk Management Policy for Pittwater Form No. 1 is attached overleaf*

**GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER**  
**FORM NO. 1 – To be submitted with Development Application**

Development Application for <b>Brett &amp; Lisa Lewthwaite</b>
Name of Applicant
Address of site <b>36 Watkins Road Avalon Beach</b>

*Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report*

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

on this the **10 January 2020** certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 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 \$2million.

I:

**Please mark appropriate box**

- ☐ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ☐ am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ☐ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.
- ☐ have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- ☐ have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- ☒ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

**Coastal  
Geotechnical Report Details:**

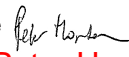
Report Title: <b>Coastal Engineering Advice on 36 Watkins Road Avalon Beach</b>
Report Date: <b>10 January 2020</b>
Author: <b>Peter Horton</b>
Author's Company/Organisation: <b>Horton Coastal Engineering Pty Ltd</b>

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

<b>See Section 2 and Section 10 of coastal report</b>

~~I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical 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 reasonable and practical measures have been identified to remove foreseeable risk.~~

**See revised declaration in Section 8 of report**

Signature  .....

Name **Peter Horton** .....

Chartered Professional Status **MIEAust CPEng NER** .....

Membership No. **452980** .....

Company **Horton Coastal Engineering Pty Ltd** .....