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

Development Application for _____
Name of Applicant

Address of site 173-175 Whale Beach Road, Whale Beach

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk ***Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report***

I, Ben White *on behalf of* White Geotechnical Group Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 17/4/23 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 $10million.

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

Geotechnical Report Details:

Report Title: Geotechnical Report **173-175 Whale Beach Road, Whale Beach**

Report Date: 17/4/23

Author: BEN WHITE

Author's Company/Organisation: **WHITE GEOTECHNICAL GROUP PTY LTD**

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

Australian Geomechanics Society Landslide Risk Management March 2007.

White Geotechnical Group company archives.

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.

Signature _____

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for _____
Name of Applicant

Address of site 173-175 Whale Beach Road, Whale Beach

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Report **173-175 Whale Beach Road, Whale Beach**

Report Date: 17/4/23

Author: BEN WHITE

Author's Company/Organisation: WHITE GEOTECHNICAL GROUP PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted **11/11/22**
(date)

☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)

☒ Subsurface investigation required
- ☐ No Justification _____
- ☒ Yes Date conducted **11/11/22**

☒ Geotechnical model developed and reported as an inferred subsurface type-section

☒ Geotechnical hazards identified
- ☒ Above the site
- ☒ On the site
- ☒ Below the site
- ☐ Beside the site

☒ Geotechnical hazards described and reported

☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Consequence analysis
- ☒ Frequency analysis

☒ Risk calculation

☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.

☒ Design Life Adopted:
- ☒ 100 years
- ☐ Other _____
specify

☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified

☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.

☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal 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.

Signature 

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL INVESTIGATION:

Subdivision and New Houses at **173-175 Whale Beach Road, Whale Beach**

1. Proposed Development

1.1 Subdivide the existing property into three separate lots.

1.2 Demolish the existing house, driveways and pool.

1.3 Construct suspended driveways and part three storey houses with lifts and with garages above on each lot. The new houses require excavations. The ground floor and the first excavations for the Dwelling A house reach maximum depths of ~3.8m and ~3.2m respectively. The ground floor and the first excavations for the Dwelling B house reach maximum depths of ~4.2m and ~2.4m respectively. The ground floor and the first excavations for the Dwelling C house reach maximum depths of ~0.7m and ~2.1m respectively.

1.4 Install partially suspended pools on the downhill sides of the houses on each lot. The dwelling A pool requires an excavation to a maximum depth of ~1.5m. The dwelling B and C pools require minor levelling and the demolition of the existing pool and deck.

1.5 Details of the proposed development are shown on 22 drawings prepared by Bureau SRH Architecture, project number 22077, drawings numbered DA000 to DA003, DA100 to DA104, DA200 to DA203, DA300 to DA302 and DA500 to DA503, Revision A, dated 12/4/23.

2. Site Description

2.1 The site was inspected on the 11th November, 2022.

2.2 This residential property is on the low side of the road and has a NE aspect. It is located on the steeply graded upper to lower reaches of a hillslope. The natural slope falls across the property at an average angle of ~25°. The slope above the property continues at steep angles for some 30m before reaching the crest of the hill. The slope below the property increases in grade across the coastal bluff before reaching the Pacific Ocean.

2.3 At the road frontage, a partially suspended concrete driveway runs to a brick garage on the uphill side of the house (Photos 1 & 2). Another partially suspended concrete driveway runs from the road frontage to a concrete parking area above the garage (Photo 3). The fill batter for the road and road reserve falls at steep angles and merges into the natural steep slope (Photos 4 & 5). The two storey brick and rendered brick house (on 173 Whale Beach Rd) is supported by brick walls and columns (Photos 6 & 7). Some of the columns and walls on the downhill side of the house display minor cracks in the external render (Photo 7), but show no significant signs of deflection and appear to be stable. A pool and timber deck extend off the downhill side of the house (Photo 8). The pool shows no significant signs of movement. One of the timber posts supporting the deck displays significant deflection (Photo 9). The two posts that are beside the deflected post are tilting upslope slightly. The deck will be demolished as part of the proposed works.

The steep slope on the downhill side of the house and across the adjoining vacant lot (175 Whale Beach Road) is well vegetated (Photos 10 to 12). Detached sandstone joint blocks are scattered across the slope. The slope increases in grade across the coastal bluff (Careel Headland Reserve) downhill of the property (Photos 13 & 14). Competent Medium Strength Sandstone Bedrock outcrops at the base of the coastal bluff. The rock face across the lower portion of the coastal bluff is estimated to be set back ~18m from the downhill property boundary and at least 44m from the proposed works. Horton Coastal Engineering has provided a 5mm/year to 12mm/year allowance for

erosion of the cliff. See the Coastal Engineering Report attached to this report. Erosion of the cliff is not expected to impact on the subject property or the proposed works in the next century given the horizontal setback from the seacliff.

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group. This is described as interbedded laminite, shale, and quartz to lithic quartz sandstone.

4. Subsurface Investigation

Two hand Auger Holes (AH) were put down to identify the soil materials. Six Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The locations of the tests are shown on the site plan attached. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. This is not expected to have been an issue for this site. But due to the possibility that the actual ground conditions vary from our interpretation there should be allowances in the excavation and foundation budget to account for this. We refer to the appended "Important Information about Your Report" to further clarify. The results are as follows:

AUGER HOLE 1 (~RL43.3) **–** AH1 (Photo 17)

Depth (m)	**Material Encountered**
0.0 to 0.8	**FILL**, sandy soil and sandy clay, with rock fragments, dark brown, brown, orange, grey, moist to damp, fine to course grained.

Refusal @ 0.8m in fill. No watertable encountered.

AUGER HOLE 2 (~RL41.5) **–** AH2 (Photo 18)

Depth (m)	Material Encountered
0.0 to 0.5	**FILL**, sandy soil, with rock fragments, dark brown, brown, white, moist, fine to course grained.
0.5 to 0.9	**CLAYEY SOIL**, brown, moist, fine grained.
0.9 to 1.1	**SANDY CLAY**, light brown, moist, firm to stiff.

End of hole @ 1.1m in firm to stiff sandy clay. No watertable encountered.

DCP TEST RESULTS – Dynamic Cone Penetrometer

Equipment: 9kg hammer, 510mm drop, conical tip. Standard: AS1289.6.3.2 -1997

Depth(m) Blows/0.3m	DCP 1 (~RL41.5)	DCP 2 (~RL33.4)	DCP 3 (~RL33.0)	DCP 4 (~RL37.9)	DCP 5 (~RL40.5)	DCP 6 (~RL43.3)
0.0 to 0.3	15	17	12	6	7	5
0.3 to 0.6	10	9	5	13	9	7
0.6 to 0.9	7	9	6	38	10	9
0.9 to 1.2	12	11	14	21	18	35
1.2 to 1.5	22	7	9	#	16	25
1.5 to 1.8	22	10	7		15	16
1.8 to 2.1	26	22	12		18	15
2.1 to 2.4	49	26	18		#	#
2.4 to 2.7	#	31	33			
2.7 to 3.0		#	#			
	End of Test @ 2.4m	End of Test @ 2.7m	End of Test @ 2.7m	Refusal @ 1.0m	Refusal @ 2.1m	Refusal @ 1.9m

#refusal/end of test. F=DCP fell after being struck showing little resistance through all or part of the interval.

DCP Notes:

DCP1 – End of Test @ 2.4m, DCP still very slowly going down, white and brown impact dust and orange brown clay on dry tip.

DCP2 – End of Test @ 2.7m, DCP still very slowly going down, orange red shale fragments on moist tip.

DCP3 – End of Test @ 2.7m, DCP still very slowly going down, orange impact dust on dry tip.

DCP4 – Refusal on Rock @ 1.0m, DCP thudding on rock surface, orange red shale fragments and orange clay on moist tip.

DCP5 – Refusal on Rock @ 2.1m, DCP bouncing off rock surface, orange clay and dark brown soil on moist tip.

DCP6 – Refusal on Rock @ 1.9m, bouncing off on rock surface, orange shale fragments and orange clay on moist tip.

5. Geological Observations/Interpretation

The slope materials are colluvial at the near surface and residual at depth. In the test locations, the ground materials consist of fill and clayey soil over firm to stiff sandy clays. Fill to a maximum depth of ~1.2m has been placed at various locations on the slope that falls across the property. In the test locations, the clays merge into the weathered zone of the under lying rocks at depths of between ~1.0m to ~2.7m below the current surface, being deeper in the filled areas and on the downhill side of the existing house. The weathered zone of the underlying rock is interpreted as Extremely Low to Low Strength Rock. It is to be noted that this material is a soft rock and can appear as a mottled stiff clay when it is cut up by excavation equipment. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Ground water seepage is expected to move over the denser and less permeable clay and weathered rock layers in the profile. Due to the slope and elevation of the block, the water table is expected to be many metres below the base of the proposed works.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. Normal sheet wash from the slope above will be intercepted by the street drainage system for Whale Beach Road above. Runoff generated on the long slope on site will move down the slope at a relatively high velocity due to the steep grade.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside the property. The steeply graded slope that falls across the property and continues above and below is a potential hazard (**Hazard One**). The vibrations produced during the proposed excavations are a potential hazard (**Hazard Two**). The proposed excavations are a potential hazard (**Hazard Three**).

RISK ANALYSIS SUMMARY ON NEXT PAGE

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The steep slope that falls across the property and continues above failing and impacting on the property.	The vibrations produced during the proposed excavations for the houses impacting on the neighbouring properties.	The proposed excavations for the houses collapsing onto the worksite and impacting the neighbouring properties during the excavation process.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (15%)	'Medium' (20%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	5.3×10^{-7}/annum	3.7×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE', provided the recommendations in **Section 16** are carried out.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 11 & 12** are to be followed.	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater

The fall is to a council reserve and coastal bluff on the downhill side of the property. Stormwater from the proposed development is to be piped to the downhill side of the property through a diffuser and any tanks that may be required by the regulating authorities.

11. Excavations

Excavations are required to construct the proposed new houses. The ground floor and the first excavations for the Dwelling A house reach maximum depths of ~3.8m and ~3.2m respectively. The ground floor and the first excavations for the Dwelling B house reach maximum depths of ~4.2m and ~2.4m respectively. The ground floor and the first excavations for the Dwelling C house reach maximum depths of ~0.7m and ~2.1m respectively.

The dwelling A pool requires an excavation to a maximum depth of ~1.5m. The dwelling B and C pool require minor levelling and the demolition of the existing pool and deck.

The excavations are expected to be through fill, clayey soil and sandy clay, with Extremely Low to Low Strength Rock expected at depths of between ~1.0m to ~2.7m below the current surface, being deeper in the filled areas and on the downhill side of the existing house. Excavations through fill, soil, clay and rock up to Low Strength can be carried out with an excavator and toothed bucket.

12. Vibrations

Given the expected ground materials (Extremely Low to Low Strength Rock) the Dwelling B and C excavations are set back sufficiently from any surrounding structures so that vibrations from the excavations will not exceed tolerable limits for building or infrastructure damage.

It is expected the proposed excavation for Dwelling A will be carried out with an excavator and toothed bucket through weathered shale and the vibrations produced will be below the threshold limit for building or infrastructure damage using a domestic sized excavator up to 20 tonne.

If Medium Strength Rock or better is encountered, excavations through this ground material are to be carried out to minimise the potential to cause vibration damage to the neighbouring properties.

Allowing for backwall drainage, the excavation for Dwelling A is set back ~4.1m from the NW neighbouring house.

Dilapidation reporting carried out on the NW neighbouring property is recommended prior to the excavation works commencing to minimise the potential for spurious building damage claims.

Excavation methods are to be used that limit peak particle velocity to 5mm/sec at the NW neighbouring house. Vibration monitoring will be required to verify this is achieved. Vibration monitoring must include a light/alarm so the operator knows if vibration limits have been exceeded. The equipment is to log and record vibrations throughout the excavation works.

In Medium Strength rock or better techniques to minimise vibration transmission will be required. These include:

- Rock sawing the excavation perimeter to at least 1.0m deep prior to any rock breaking with hammers, keeping the saw cuts below the rock to be broken throughout the excavation process.
- Limiting rock hammer size.
- Rock hammering in short bursts so vibrations do not amplify.
- Rock breaking with the hammer angled away from the nearby sensitive structures.
- Creating additional saw breaks in the rock where vibration limits are exceeded, as well as reducing hammer size as necessary.
- Use of rock grinders (milling head).

Should excavation induced vibrations exceed vibration limits after the recommendations above have been implemented, excavation works are to cease immediately and our office is to be contacted.

It is worth noting that vibrations that are below thresholds for building damage may be felt by the occupants of the subject house and neighbouring houses.

13. Excavation Support Requirements

On steep sites such as this one, to help maintain excavation stability before retaining walls are in place, it is critical upslope runoff be diverted from the proposed excavation with temporary or permanent drainage measures. Temporary measures may be trenches and sandbag mounds and permanent measures could be a wide diameter dish drain or similar. These are to be installed before any excavation work commences.

Excavations to a maximum depth of ~4.2m will be required to construct the proposed new houses and pools. Allowing for backwall drainage, the setbacks are as follows:

- The Dwelling A and B excavations are set back sufficiently from the surround structures and boundaries.

- The ground and first floor Dwelling C excavations are set back ~0.5m from the SE common boundary. The Dwelling C ground floor excavation comes flush or close to flush with the existing retaining wall that supports the cut for the ground floor of the existing house.

- The pool excavations are set back sufficiently from the surround structures and boundaries.

The SE common boundary and existing retaining wall will be within the zone of influence of the Dwelling C excavations. In this instance, the zone of influence is the area above a theoretical 45° line (from horizontal) through clay/weathered rock from the base of the excavation towards the surrounding structures and boundaries.

Any trees near the proposed cuts are to be assessed by an arborist and removed if their stability will be detrimentally impacted by the excavations.

Any loose boulders or detached joint blocks immediately above the proposed excavation faces are to be removed before any excavation commences.

It is recommended that the existing retaining wall that supports the cut for the existing house ground floor remain in place. It is to be underpinned to below the base of the Dwelling C ground floor excavation, prior to the excavation commencing. See the ground floor plan attached for the minimum extent of the required underpinning shown in red.

Due to the depths of the Dwelling A, B and C excavations, these excavations will require ground support installed prior to the commencement of the excavations.

A spaced pile retaining wall is one of the suitable methods of support. See the Ground Floor and First Floor plans attached for the minimum extent of the required piling shown in blue. Pier spacing is typically ~2.0m but can vary between 1.6 to 2.4m depending on the design. As the excavation is lowered in 1.5m lifts infill sprayed concrete panels or similar are added between the piers to form the wall. Drainage is to be installed behind the panels. To drill the pier holes for the walls, a pilling rig that can excavate through Medium to High Strength Rock will be required. If a machine of this type is not available, we recommend carrying out core drilling before the construction commences to confirm the strength of the rock and to ensure the excavation equipment is capable of reaching the required depths. The piers can be temporarily supported by embedment below the base of the excavation or with a combination of embedment and propping. The walls are to be tied into the ground, first and second floor slabs to provide permanent bracing after which any temporary bracing can be released.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all pile holes/excavations installed for ground support purposes.

Due to the proximity to the SE common boundary the SE sides of the Dwelling C excavations will need to be temporarily or permanently supported prior to the commencement of the

excavation, or during the excavation process in a staged manner, so cut batters are not left unsupported. The support will need to be designed by the structural engineer. Due to the steep grade of the slope the Dwelling A pool excavation is to be temporarily supported with typical pool shoring such as braced form ply until the pool structure is in place. See the Site Plan attached for the minimum extent of the required shoring shown in green.

As discussed above upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. The excavations are to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

All excavation spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

14. Retaining Structures

For cantilever or singly propped retaining structures it is suggested the design be based on a triangular distribution of lateral pressures using the parameters shown in Table 1.

Table 1 – Likely Earth Pressures for Retaining Structures

Unit	Earth Pressure Coefficients			
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0	Passive
Fill and Topsoil	20	0.40	0.55	N/A
Residual Clays	20	0.35	0.45	Kp = 2.0 'ultimate'
Extremely Low to Very Low Strength Rock	22	0.25	0.38	Kp = 2.5 'ultimate'
Low Strength Rock	24	0.20	0.35	1000kPa 'ultimate'

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the structure and do not account for any surcharge loads, noting that surcharge loads from the slope above will be acting on the wall, so will need to be accounted for in the design. It also assumes retaining structures are fully drained. It should be noted that passive pressure is an ultimate value and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. Ground materials and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining structures are to have sufficient back-wall drainage and be backfilled immediately behind the structure with free-draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back-wall drainage is installed in retaining structures, the likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

The ground and first floors of the proposed new houses are expected to be seated in Extremely Low Strength Rock or better on the uphill side. This is a suitable foundation material. The proposed suspended driveways, pools and houses (where they are not cut into this ground material) are to be supported on piers embedded at least 1.0m into Extremely Low Strength Rock or better from the downhill edge of the footing. This ground material is expected at an average depth of ~2.0m below the current surface and is expected to range from depths of between ~1.0m to ~4.0m below the current surface, being deepest across the fill for the road/road reserve. Therefore the required pier depths on the uphill side of the suspended driveways are expected to be ~5.0m deep. A maximum allowable bearing pressure of 600kPa can be assumed for footings embedded in Extremely Low Strength Rock or better. It should be noted that this material is a soft rock and a rock auger will cut through it so the builders should not be looking for refusal to end the footings.

As the bearing capacity of weathered rock reduces when it is wet we recommend the footings be dug, inspected and poured in quick succession (ideally the same day if possible). If the footings get wet, they will have to be drained and the soft layer of weathered rock on the footing surface will have to be removed before concrete is poured.

If a rapid turnaround from footing excavation to the concrete pour is not possible a sealing layer of concrete may be added to the footing surface after it has been cleaned.

NOTE: If the contractor is unsure of the footing material required it is more cost effective to get the geotechnical professional on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over excavation in clay like shaly rock but can be valuable in all types of geology.

16. Ongoing Maintenance

Where slopes are steep and approach or exceed 30°, such as on this site, it is prudent for the owners to occasionally inspect the slope (say annually or after heavy and prolonged rainfall events, whichever occurs first). Should any of the following be observed: movement or cracking in retaining walls, cracking in any structures, cracking or movement in the slope surface, tilting or movement in established trees, leaking pipes, or newly observed flowing water, or changes in the erosional process or drainage regime, then a geotechnical consultant should be engaged to assess the slope. We can carry out these inspections upon request. The risk assessment in **Section 8** is subject to this ongoing maintenance being carried out.

17. Geotechnical Review

The structural plans are to be checked and certified by the geotechnical engineer as being in accordance with the geotechnical recommendations. On completion a Form 2b will be issued. This form is required for the Construction Certificate to proceed.

18. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide geotechnical certification for the Occupation Certificate if the following inspections have not been carried out during the construction process.

- The geotechnical consultant is to inspect the ground materials while the first pile for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations. All finished pile holes for piled wall/excavations for ground support are to be inspected and measured before concrete is placed.

- All footings are to be inspected and approved by the geotechnical consultant while the excavation equipment and contractors are still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

Dion Sheldon
BEng(Civil)(Hons),
Geotechnical Engineer.

Reviewed By:

Ben White M.Sc. Geol.,
AusIMM., CP GEOL.
No. 222757
Engineering Geologist.

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

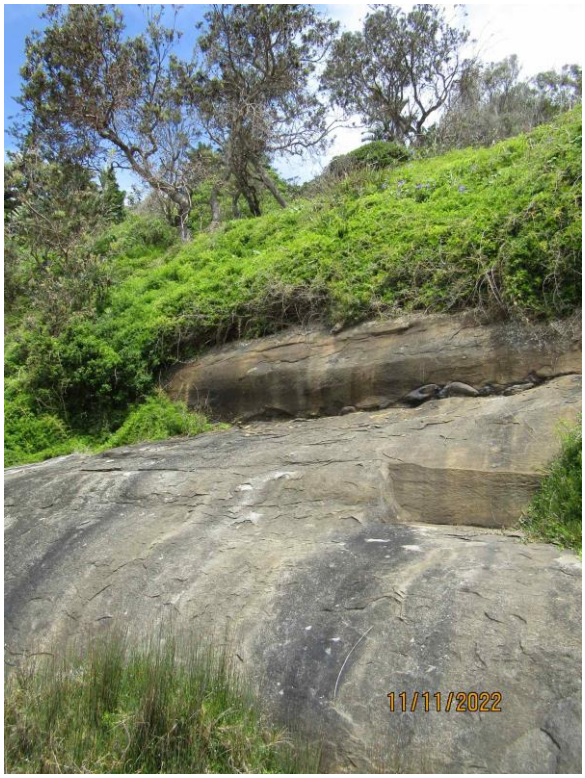


Photo 13

Photo 14

Photo 15

Photo 16

Photo 17: AH1 – Downhole is from left to right.

Photo 18: AH1 – Downhole is from left to right.

Important Information about Your Report

It should be noted that Geotechnical Reports are documents that build a picture of the subsurface conditions from the observation of surface features and testing carried out at specific points on the site. The spacing and location of the test points can be limited by the location of existing structures on the site or by budget and time constraints of the client. Additionally, the test themselves, although chosen for their suitability for the particular project, have their own limiting factors. The testing gives accurate information at the location of the test, within the confines of the test's capability. A geological interpretation or model is developed by joining these test points using all available data and drawing on previous experience of the geotechnical consultant. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such, a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report, it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process, any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

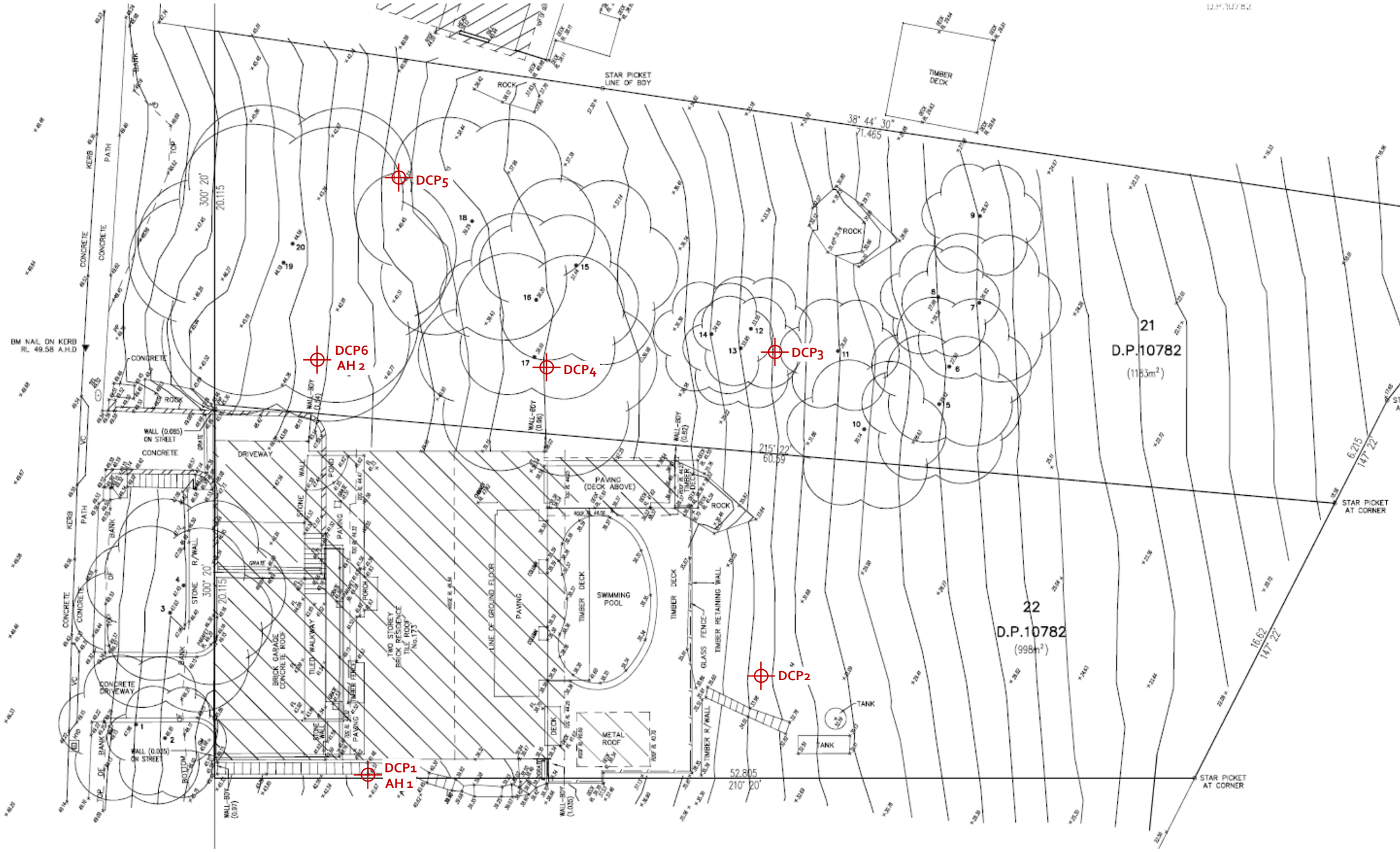
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- This report should not be applied to any other project other than that outlined in section 1.0.

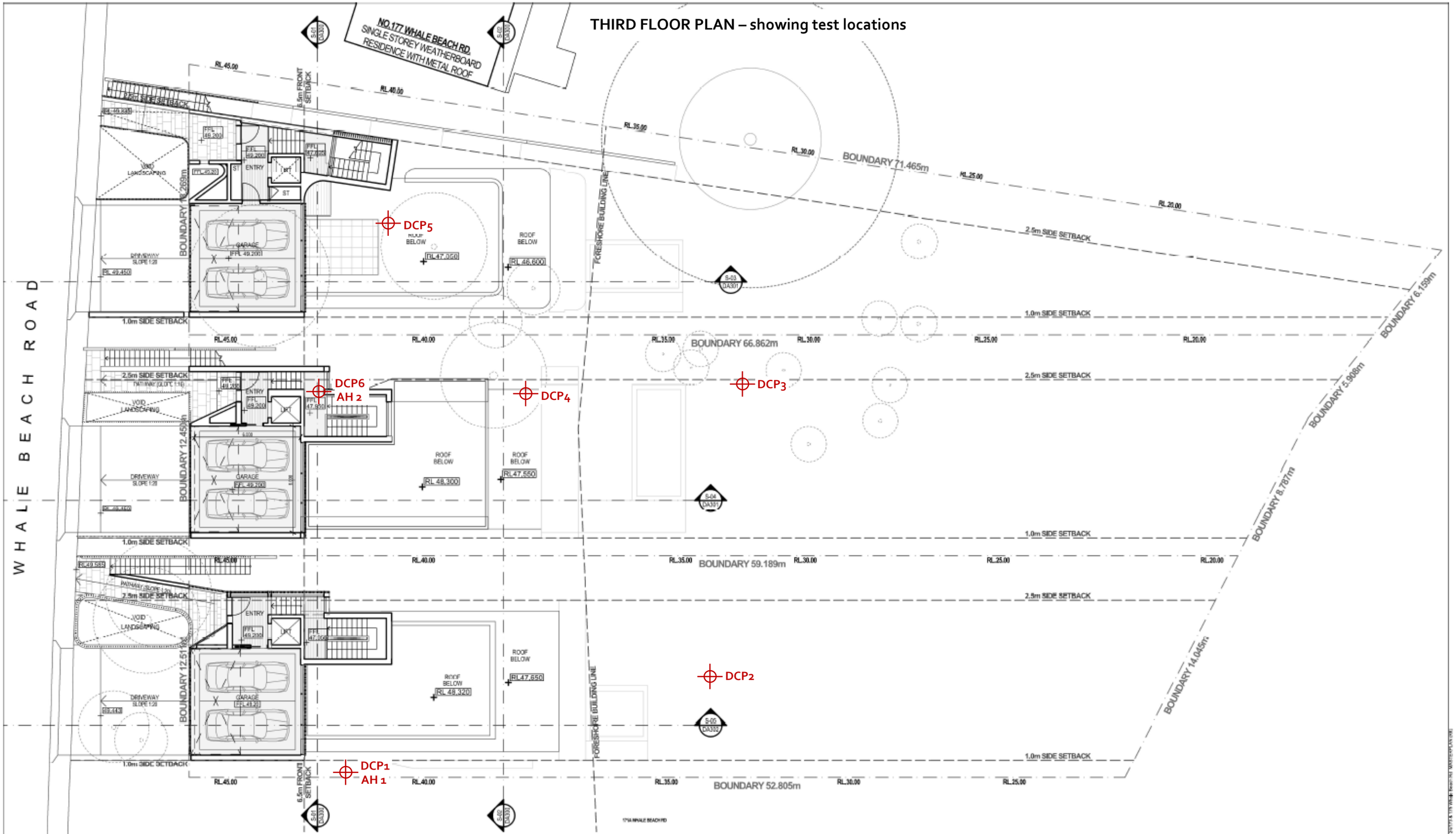
- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report, contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

SURVEY PLAN – showing test locations



THIRD FLOOR PLAN – showing test locations



1 THIRD FLOOR (STREET LEVEL) PLAN
1:200

NOT FOR CONSTRUCTION

BUREAU SRH | architecture
STUDIO 3 | 2 VERONA STREET | PADDINGTON | NSW | 2021 | AUSTRALIA |
ABN: 94 115 880 834 | TEL: +61 2 9380 4066 | admin@bureausrh.com
NOMINATED ARCHITECT: SIMON HANSON # 6739

LEGEND:

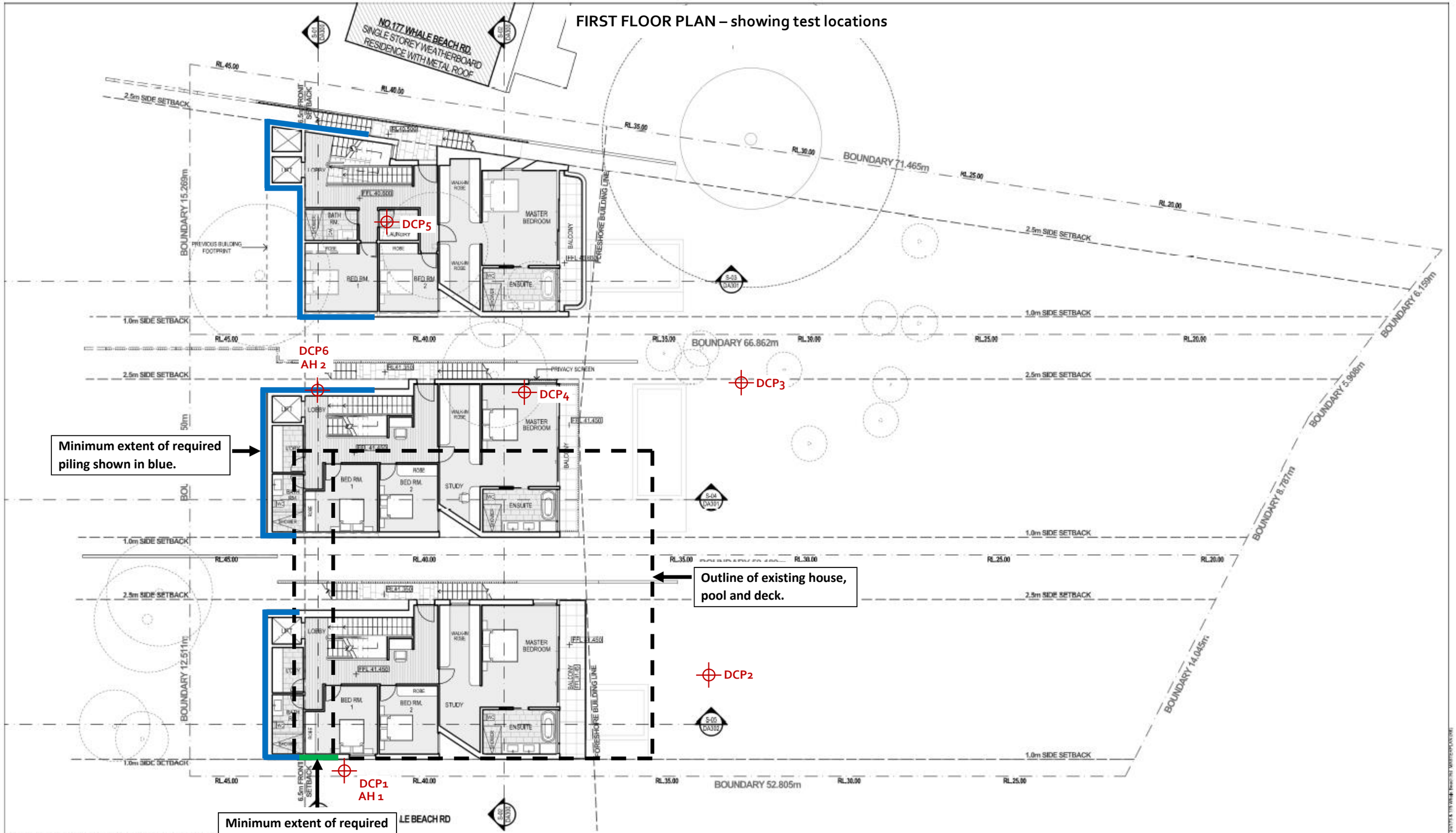
RESIDENTIAL DWELLINGS

REV	DATE	NAME
A	12/04/2023	CONSULTANT ISSUE

173-175 WHALE BEACH RD, WHALE BEACH

STAGE: DA
DRAWING TITLE: THIRD FLOOR (STREET LEVEL) PLAN
PROJECT No: 22077
DRAWING No: DA100
REVISION: A
SCALE @ A3: 1:200
NORTH
CLIENT: P. HEYWORTH
DRAWN: KD
CHECKED: HHH
APPROVED: SRH

FIRST FLOOR PLAN – showing test locations



FIRST FLOOR PLAN
1:200

NOT FOR CONSTRUCTION

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LEGEND:

RESIDENTIAL DWELLINGS		
REV	DATE	NAME
A	12/04/2023	CONSULTANT ISSUE

173-175 WHALE BEACH RD, WHALE BEACH

PROJECT No: 22077

STAGE: DA

DRAWING TITLE: FIRST FLOOR PLAN

DRAWING No: DA102

SCALE @ A3: 1:200

NORTH

CLIENT: P. HEYWORTH

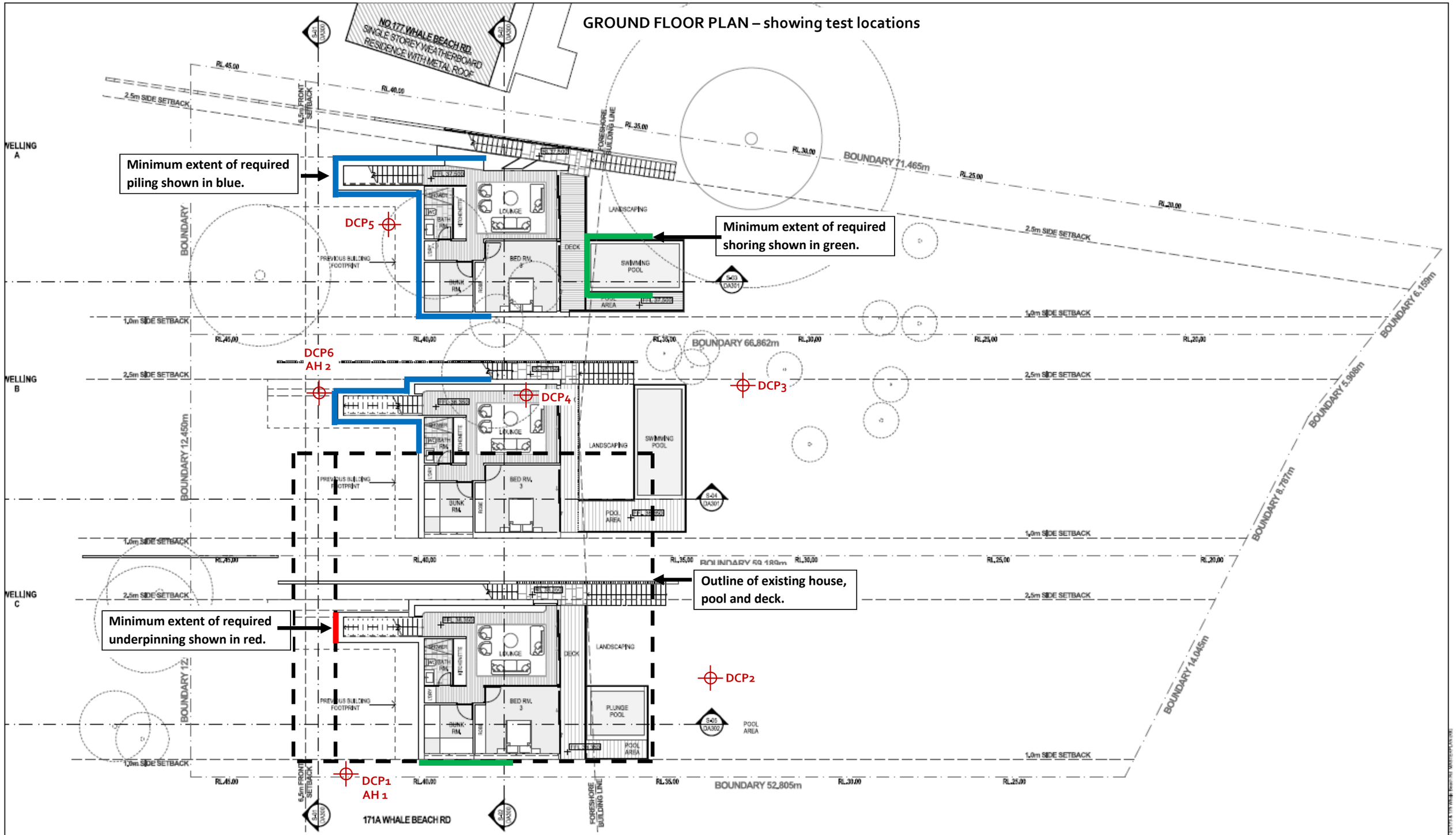
CHECKED: HHH

DRAWN: KD

APPROVED: SRH

REVISION: A

GROUND FLOOR PLAN – showing test locations



1 GROUND FLOOR PLAN
1:200

NB: THE BUILDING HAS NOT BEEN DOCUMENTED AS A BIM MODEL. THE DOCUMENTS ARE STRICTLY REPRESENTATIONAL AND THEY HAVE BEEN PRODUCED SOLELY TO BE PRINTED OUT (OR CONVEYED AS PDF FORMAT) WITH THE INFORMATION CONTAINED THEREON TO BE READ OFF THE PRINTED 2D DRAWINGS (OR PDFs). THEY ARE NOT TO BE USED AS THE BASIS OF EXACTITUDE COORDINATION FOR CONSTRUCTION IN SITU DATA. BUREAU SRH ARE NOT LIABLE FOR THE DOCUMENTS BEING USED IN ANY MANNER EXCEPT THE MANNER DESCRIBED ABOVE, AND BUREAU SRH WILL NOT BE RESPONSIBLE FOR ANY INACCURACIES OR DISCREPANCIES WHICH RESULT FROM USING THE DOCUMENTS IN ANY OTHER WAY.
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LEGEND:

RESIDENTIAL DWELLINGS

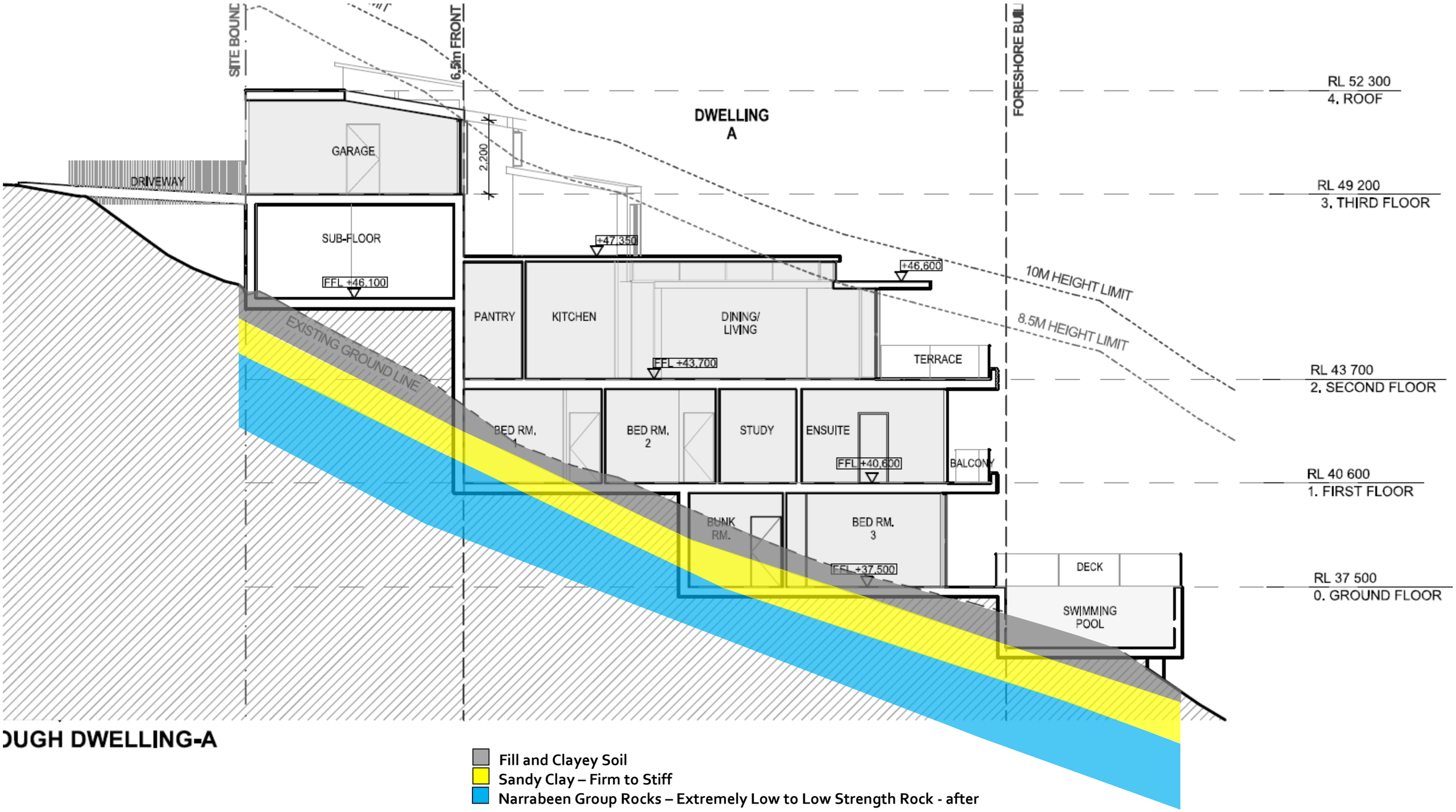
REV	DATE	NAME
A	12/04/2023	CONSULTANT ISSUE

173-175 WHALE BEACH RD, WHALE BEACH

PROJECT No: 22077

STAGE: DA
DRAWING TITLE: GROUND FLOOR PLAN
DRAWING No: DA103
SCALE @ A3: 1:200
NORTH
CLIENT: P. HEYWORTH
DRAWN: KD
CHECKED: HHH
APPROVED: SRH
REVISION: A

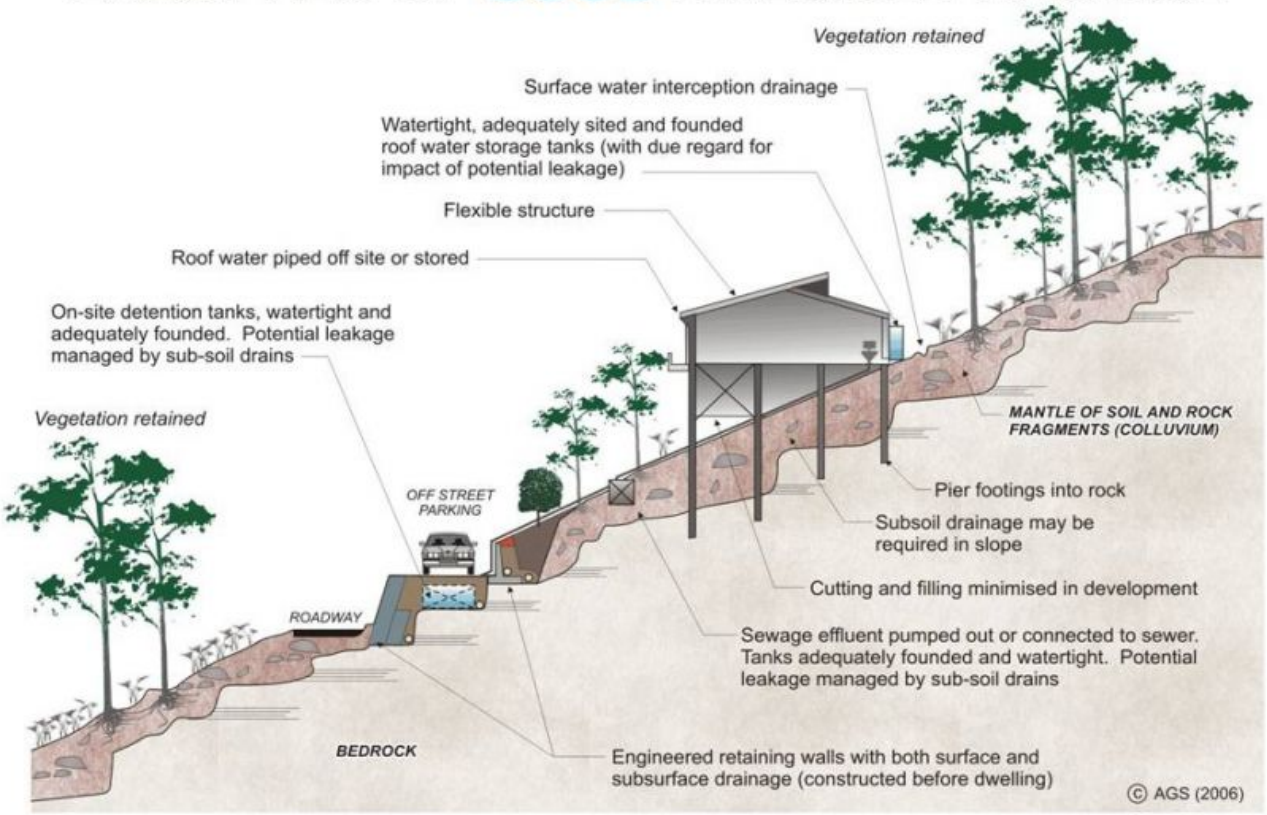
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



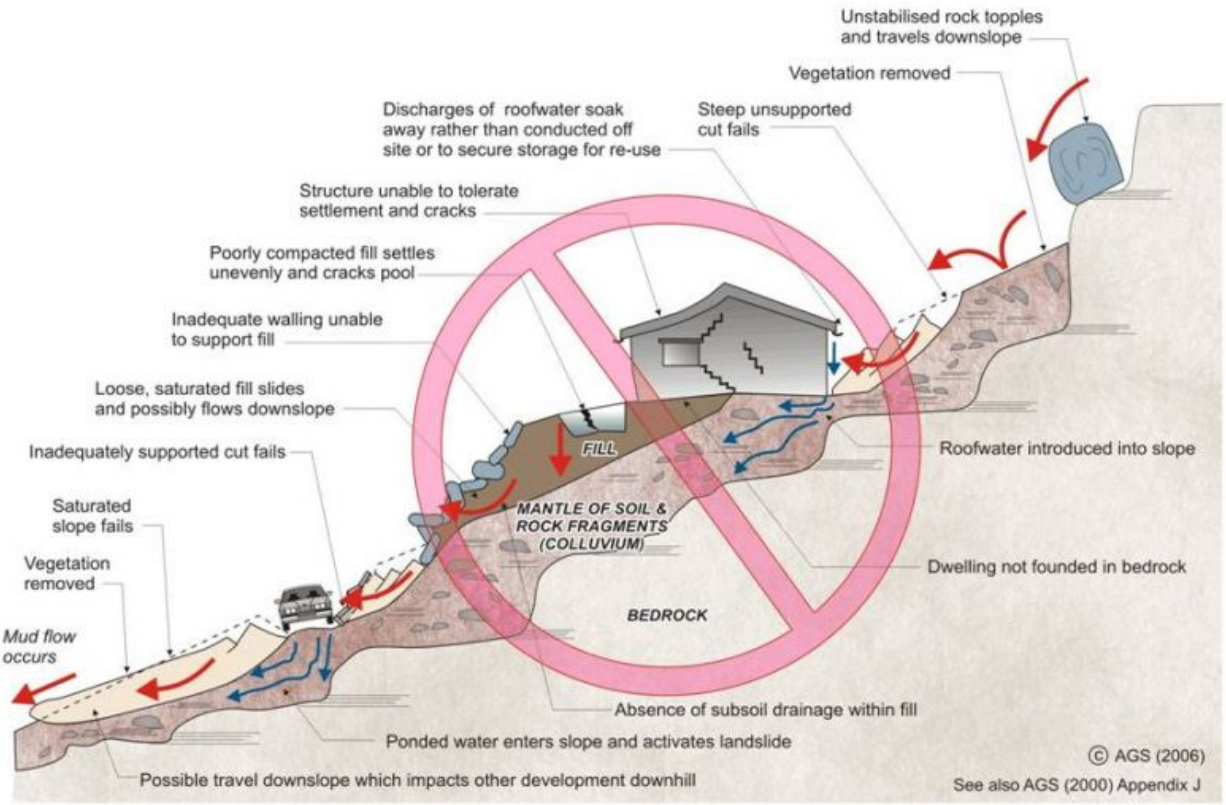
OUGH DWELLING-A

- Fill and Clayey Soil
- Sandy Clay – Firm to Stiff
- Narrabeen Group Rocks – Extremely Low to Low Strength Rock - after being cut up by excavation equipment can resemble a stiff to hard clay.

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



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Studio 3, 2 Verona Street
Paddington NSW 2021
(sent by email only to il@bureausrh.com)

13 April 2023

Coastal Engineering Advice on 173-175 Whale Beach Road Whale Beach

1. INTRODUCTION AND BACKGROUND

It is proposed to demolish a dwelling, and to subdivide and construct three new dwellings at 173-175 Whale Beach Road Whale Beach, hereafter denoted as the 'site'. A Development Application is to be submitted to Northern Beaches Council for these works.

The site is located within a "Bluff/Cliff Instability" area designated on the *Coastal Risk Planning Map* (Sheet CHZ_015) that is referenced in *Pittwater Local Environmental Plan 2014*. Therefore, the site is subject to Chapter B3.4 of the DCP[1], 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 Director of Horton Coastal Engineering and a professional Coastal Engineer with 31 years of coastal engineering experience. He has postgraduate qualifications in coastal engineering, and is a Member of Engineers Australia and Chartered Professional Engineer (CPEng) registered on the National Engineering Register. 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 prepared coastal engineering reports for numerous cliff/bluff properties in the former Pittwater Local Government Area in recent years, including along Whale Beach Road. He undertook a specific inspection of the site (including its cliff face and adjacent rock platform) on 30 November 2022.

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

[1] The Pittwater 21 DCP up to Amendment No. 27, which came into effect on 18 January 2021, was considered herein.

2. INFORMATION PROVIDED

Horton Coastal Engineering was provided with 20 architectural drawings prepared by Bureau SRH (Drawing Nos DA100 to 104, 200 to 203, 300 to 302, and 500 to 507), all dated 23 March 2023 and Revision A. A site survey by Stutchbury Jaques Pty Ltd was also provided, reference 11499/22 and dated 24 April 2022.

3. EXISTING SITE DESCRIPTION

The site is located along the northern face of Careel Head at its NW corner, along a rocky cliff section of coastline that extends a distance of 3.3km between the sandy Whale Beach in the north and Avalon Beach in the south. Vertical and oblique aerial views of the site are provided in Figure 1 and Figure 2 respectively, with a section location denoted as Section A depicted in Figure 1[2]. A photograph of the cliff seaward of the site is provided in Figure 3. Based on NSW Government Airborne Laser Scanning (ALS) data that was collected in 2020, elevations along Section A (from Figure 1) perpendicular to the cliff face are depicted in Figure 4.

Figure 1: Aerial view of site (red outlines), with location of Section A shown in blue and outline of proposed development in yellow (aerial photograph taken 6 March 2023)

[2] Note that the property boundaries depicted in Figure 1 are only approximate.

Figure 2: Oblique aerial view of site (centre at arrow) on 5 April 2022, facing SW

Figure 3: View of cliff face NE of site (centre at arrow) on 30 November 2022, facing SSW

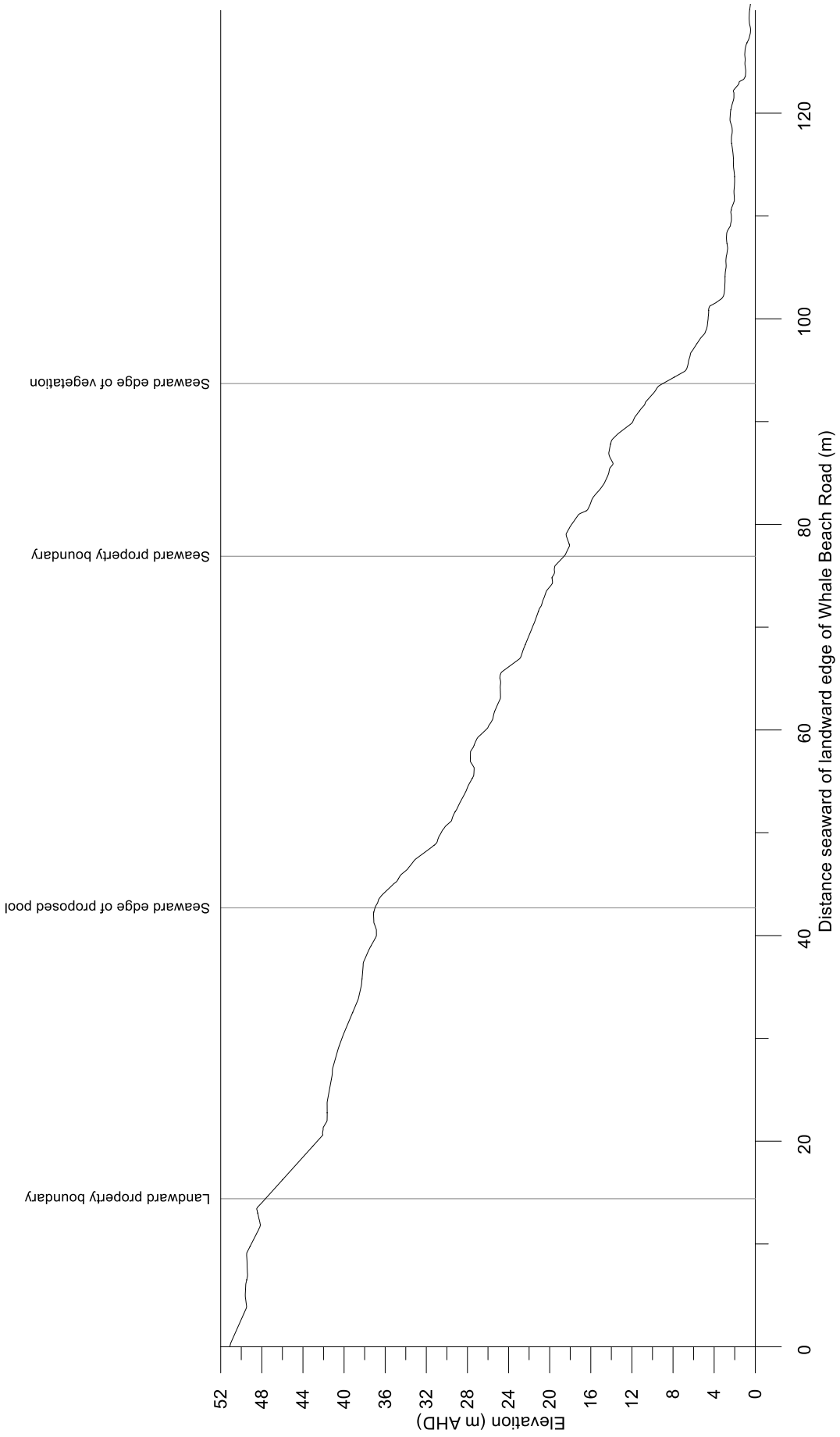


Figure 4: Section A through site and cliff to NE

Ground elevations along Section A approximately vary from 48m AHD at the landward property boundary, 19m AHD at the seaward property boundary, and 9m AHD at the seaward edge of vegetation. The average slope from the landward property boundary to the seaward edge of vegetation is 1:2.1 (vertical:horizontal, V:H) or 26°. The exposed cliff section below and seaward of the vegetation, down to about 3m AHD, has a similar average slope. Rock boulders are strewn over the rock platform seaward of this for a distance of about 13m AHD, with the seaward edge of the visible rock platform at about 0.5m AHD.

Coffey & Partners (1987) noted that the cliff/bluff at Careel Head was formed of sandstone (steep lower 10m of the cliff profile, with slope angles between 70° to vertical), and interlaminated siltstone/sandstone (upper 20m of cliff profile, with slope angles between 35° and 40°). The lower sandstone profile was described as having undercutting on bedding planes or thin siltstone layers inducing toppling of overlying sandstone blocks. The upper interlaminated siltstone/sandstone profile was described as being covered by thick vegetation, reducing erosion rates (presumably surface erosion related to weathering and rainfall runoff). However, these slopes are steeper than at and seaward of the site, with the site and seaward of the site noticeably flatter than areas further east along Careel Head.

4. PROPOSED DEVELOPMENT

It is proposed to demolish a dwelling, and to subdivide and construct three new dwellings at 173-175 Whale Beach Road Whale Beach, over four levels. An outline of the proposed dwellings has been provided on Figure 1.

The lowest habitable finished floor level, on the ground floor, is 37.5m AHD for the most northern dwelling (Dwelling A) and 38.4m AHD for the other two dwellings (Dwelling B and Dwelling C).

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 varies vertically along the cliff profile. 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.

Mechanical weathering can also be caused by wind.

Historical rates of recession for softer beds of Sydney coastline sandstone cliffs, which include chemical and mechanical weathering, have been determined to be 2mm to 5mm per year by Dragovich (2000). This is consistent with average recession rates for Sydney Northern Beaches coastline sandstone cliffs of 4mm/year determined by Crozier and Braybrooke (1992).

An apparent approximate 20m to 30m of cliff recession (observed in aerial photography as the distance of the top of the exposed cliff face from the seaward edge of the rock platform at present) seaward of the site over the last 6,400 years (since sea levels stabilised around their present levels, and assuming that the cliff face was at the seaward edge of the rock platform at that time) represents an average recession rate of 3mm/year to 5mm/year, consistent with these values. Note that maximum rates of recession for Sydney Northern Beaches coastline sandstone cliffs of 12mm/year were determined by Crozier and Braybrooke (1992).

The exposed cliff, seaward of vegetation down to about 3m AHD, is above the intertidal zone (above 1m AHD), but would occasionally be impacted by wave runup during severe coastal storms with large waves and elevated water levels. This wave runup could extend up to levels of about 8m AHD at present in a 100 year Average Recurrence Interval (ARI) storm, increasing to around 9m AHD in 100 years if projected sea level rise is realised.

Given this, it should be assumed that both chemical and wave-induced mechanical weathering would apply at the cliff face below 9m AHD. A recession/weathering rate of 5mm per year of the cliff face is considered to be appropriate, with sensitivity testing for a rate of 12mm/year. Therefore, an allowance for recession/weathering of the cliff face of about 5mm to 12mm per year should be considered and assessed by the geotechnical engineer. These rates are considered to be reasonable to apply over a design life of 100 years, including allowance for projected sea level rise.

The geotechnical engineer should consider these rates in conjunction with an understanding of the particular nature of the cliff materials at the site, their resistance to erosion/recession, and potential failure planes related to geotechnical issues such as the joint spacing[3].

This should be confirmed by the geotechnical engineer, but it is expected that the recession/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. That stated, any future failure of the upper slope of the cliff in the vicinity of the proposed development may be unrelated to coastal processes at the base of the cliff, so other failure mechanisms should be considered by the geotechnical engineer.

6. COASTAL INUNDATION

With the habitable development above 37m AHD, coastal inundation is not a significant risk to the proposed development over a planning period of well over 100 years, including consideration of projected sea level rise.

[3] Coffey & Partners (1987) noted that the controlling feature of interbedded sandstone/siltstone cliffs was the bedding spacing and relative proportion of sandstone/siltstone.

7. MERIT ASSESSMENT

7.1 Preamble

The merit assessment herein has been undertaken assuming that the geotechnical engineer will find that the proposed development is at an acceptably low risk of damage from coastal erosion/recession of the cliff seaward of the site, and other processes, for a design life of at least 100 years.

7.2 *State Environmental Planning Policy (Resilience and Hazards) 2021*

7.2.1 Preamble

Based on *State Environmental Planning Policy (Resilience and Hazards) 2021* (SEPP Resilience)[4] and its associated mapping, the site is partly within a "Coastal Environment" area (see Section 7.2.2) and within a "Coastal Use" area (see Section 7.2.3).

7.2.2 Clause 2.10

Based on Clause 2.10(1) of SEPP Resilience, "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".

This is not a coastal engineering matter, but it can be noted with regard to (a), the proposed development would not be expected to adversely affect the biophysical, hydrological (surface and groundwater) and ecological[5] environments, being in an existing developed area and with conventional stormwater management features such as rainwater tanks, on-site detention and discharge in the seaward direction to arrestor pits and energy dissipators (rip-rap).

With regard to (b), the proposed development would not be expected to adversely affect coastal environmental values or natural coastal processes over an acceptably long design life, as it would be founded on a cliff well above wave action for an acceptably rare storm.

With regard to (c), the proposed development would not be expected to adversely impact on water quality, with the residential land use, as long as appropriate construction environmental

[4] Formerly *State Environmental Planning Policy (Coastal Management) 2018*.
[5] Assuming that there are no species of native vegetation and fauna and their habitats of significance that would be impacted at the site.

controls are applied. No sensitive coastal lakes are located in the vicinity of the proposed development.

With regard to (d), the proposed development would not impact marine vegetation, undeveloped headlands and rock platforms, with none of these items in proximity to the development (being on an already developed headland, and being well above and landward of the rock platform at and seaward of the site for an acceptably rare storm and acceptably long life). No significant impacts on marine fauna and flora would be expected as a result of the proposed development, as the development would not interact with subaqueous areas for an acceptably rare storm and acceptably long life. Assuming that there are no species of native vegetation and fauna and their habitats of significance that would be impacted at the site, (d) is satisfied.

With regard to (e), it can be noted that the proposed development is entirely on private property and will not alter existing public access arrangements outside of the site.

With regard to (f), a search of the Heritage NSW "Aboriginal Heritage Information Management System" (AHIMS) was undertaken on 13 April 2023. This resulted in no Aboriginal sites nor Aboriginal places being recorded or declared within at least 200m of the site.

With regard to (g), the proposed development would not interact with the surf zone for an acceptably rare storm occurring over an acceptably long life, so would not impact on use of the surf zone.

Based on Clause 2.10(2) of SEPP Resilience, "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".

The proposed development has been designed and sited to avoid any potential adverse impacts referred to in Clause 2.10(1).

7.2.3 Clause 2.11

Based on Clause 2.11(1) of SEPP Resilience, "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), no Aboriginal sites nor Aboriginal places have been recorded or declared within at least 200m of the site, as noted in Section 7.2.2.

With regard to (a)(v), the nearest environmental heritage item to the site listed in Schedule 5 of *Pittwater Local Environmental Plan 2014* is the ocean rock pool at the southern end of Whale Beach. This heritage item is located about 250m from the site. The proposed development would not be expected to impact on this heritage item.

With regard to (b), the proposed development has been designed and sited to avoid any potential adverse impacts referred to in Clause 2.11(1) for the matters considered herein. Clause (c) is not a coastal engineering matter so is not considered herein.

7.2.4 Clause 2.12

Based on Clause 2.12 of SEPP Resilience, "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 geotechnical engineer will find that the proposed development is at an acceptably low risk of damage from erosion/recession over a 100 year design life, and given that the proposed development is well above and landward of projected wave runup over 100 years, 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.

7.2.5 Clause 2.13

Based on Clause 2.13 of SEPP Resilience, "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 site.

7.2.6 Synthesis

The proposed development satisfies the requirements of *State Environmental Planning Policy (Resilience and Hazards) 2021* for the matters considered herein.

7.3 Clause 7.5 of *Pittwater Local Environmental Plan 2014*

Clause 7.5 of *Pittwater Local Environmental Plan 2014* (LEP 2014) applies at the site, as the site is identified as "Bluff/Cliff Instability" on the Coastal Risk Planning Map Sheet CHZ_015. 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 at 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 design and construction, (c), (d) and (g) would be met. 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

A 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 5mm/year of the cliff face seaward of 173-175 Whale Beach Road Whale Beach, with sensitivity testing up to 12mm/year, should be considered and assessed by the geotechnical engineer. The geotechnical engineer should consider these estimated rates in conjunction with an understanding of the particular nature of the cliff

materials at the site, their resistance to erosion, and potential failure planes related to geotechnical issues such as the joint spacing. That stated, any future failure of the upper slope of the cliff in the site may be unrelated to coastal processes at the base of the cliff, so other failure mechanisms should be considered by the geotechnical engineer.

Coastal inundation is not a significant risk to the proposed development over a planning period of well over 100 years. Given this, and assuming that the geotechnical engineer will find that the development is at an acceptably low risk of damage from erosion/recession over a 100 year design life, the proposed development satisfies the requirements of *State Environmental Planning Policy (Resilience and Hazards) 2021* (Clauses 2.10 to 2.13), 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

Dragovich, Deirdre (2000), "Weathering Mechanisms and Rates of Decay of Sydney Dimension Sandstone", pp. 74-82 in *Sandstone City, Sydney's Dimension Stone and Other Sandstone Geomaterials*, edited by GH McNally and BJ Franklin, Environmental, Engineering and Hydrogeology Specialist Group (EEHSG), Geological Society of Australia, Monograph No. 5

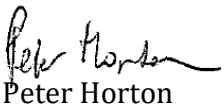
Public Works Department (1985), "Coastal Management Strategy, Warringah Shire, Report to Working Party", *PWD Report 85016*, June, prepared by AD Gordon, JG Hoffman and MT Kelly, for Warringah Shire Council

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 or via mobile on 0407 012 538.

Yours faithfully
HORTON COASTAL ENGINEERING PTY LTD



Peter Horton
Director and Principal Coastal Engineer

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 Peter & Karley Heyworth
Name of Applicant

Address of site 173-175 Whale Beach Road Whale Beach

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 13 April 2023 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: Coastal Engineering Advice on 173-175 Whale Beach Road Whale Beach
Report Date: 13 April 2023
:
Author: Peter Horton
Author's Company/Organisation: Horton Coastal Engineering Pty Ltd

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

See Section 2 and Section 10 of coastal report

~~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.~~

Signature Peter Horton ..... See revised declaration in Section 8 of report

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

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

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

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