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

Development Application for _____
Name of Applicant

Address of site 114 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 20/11/20 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 **114 Whale Beach Road, Whale Beach**
Report Date: 20/11/20

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 114 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 **114 Whale Beach Road, Whale Beach**

Report Date: 20/11/20

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **4/9/20**
(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 **4/9/20**

☒ 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:

Alterations and Additions at **114 Whale Beach Road, Whale Beach**

1. Proposed Development

1.1 Demolish the existing retaining wall above the driveway. Extend the driveway and construct a new retaining wall by excavating to a maximum depth of ~1.5m and filling to a maximum depth of ~1.8m.

1.2 Construct a retaining wall uphill of the driveway by filling to a maximum depth of ~0.7m.

1.3 Details of the proposed development are shown on 2 drawings by Space Landscape Designs, project number 201758, drawings numbered DA-100, Revision A and DA-300, Revision B, dated 17/8/2020.

2. Site Description

2.1 The site was inspected on the 4th September, 2020.

2.2 This residential property is on the high side of the road and encompasses the crest and moderate to steeply graded flanks a hillslope. The natural slope rises from Whale Beach Rd at an angle of ~20° before easing to the crest of the hillslope across the house. The slope falls at the SW side of the crest at an average angle of ~25° towards the SW property boundary. The slope below the NE property boundary increases in grade and the slope below the SW property boundary gradually decreases in grade.

2.3 The property is accessed by a concrete right of carriageway (ROW) (Photos 1 & 2). The upper portion of the cut for the driveway is unsupported and the lower portion of the cut is supported by a low sandstone flagging retaining wall in poor condition. A portion of the wall has partially collapsed but the wall will be replaced as

part of the proposed works. A large tree is located directly above the cut. Parts of the tree's roots are exposed near the base of the tree. Clay and weathered sandstone is visible below and beside the exposed roots (Photo 3). This material shows signs of minor erosion and has reeled back slightly over time. The proposed retaining wall will support this portion of the cut.

The driveway runs to a paved parking area and garage (Photo 4). The cut for the parking area is supported by a rendered retaining wall up to ~3m high in good condition (Photo 5). Next to the parking area is an above ground pool and terrace/lawn area in good condition (Photo 6). The garage is located below the terrace. The part three storey house is supported by rendered walls and stone dressed concrete walls (Photos 4 & 7). The external supporting walls show no significant signs of movement. Fill provides level lawn and garden areas on the SW side of the property (Photos 8 to 10). The fill is supported by low timber retaining walls and a stable ~1.6m high concrete block retaining wall. Overall the slope across the property is considered stable. The adjoining neighbouring properties pose no risk of instability to the subject property as seen from the street and subject property.

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 Auger holes were put down to identify the soil materials. Three DCP (Dynamic Cone Penetrometer) tests were put down to determine the relative density of the overlying soil and the depth to bedrock. The locations of the tests are shown on the site plan. 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 be an issue for the testing on this site. However, excavation and foundation budgets should always allow for the possibility that the interpreted ground conditions in this report vary from those encountered during excavations. See the appended "Important information about your report" for a more comprehensive explanation. The results are as follows:

AUGER HOLE 1 (~RL55.1) **–** AH1 (photo 11)

Depth (m)	**Material Encountered**
0.0 to 0.1	**TOPSOIL**, sandy soil, brown, dry, fine to medium grained.
0.1 to 0.2	**SANDY CLAY**, orange brown, stiff to very stiff, dry.

Refusal @ 0.2m in stiff to very stiff clay. No watertable encountered.

AUGER HOLE 1 (~RL55.4) **–** AH1 (photo 12)

Depth (m)	**Material Encountered**
0.0 to 0.1	**TOPSOIL**, sandy soil, brown, dry, fine to medium grained.
0.1 to 0.2	**SANDY CLAY**, orange brown, stiff to very stiff, dry.

Refusal @ 0.2m in stiff to very stiff 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** (~RL55.1)	**DCP 2** (~RL55.4)	**DCP 3** (~RL54.7)
0.0 to 0.3	15	18	5
0.3 to 0.6	30	26	16
0.6 to 0.9	40	20	23
0.9 to 1.2	#	40	20
1.2 to 1.5		#	#
	End of Test @ 0.8m	End of Test @ 1.0m	Refusal @ 1.0m

#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 @ 0.8m, DCP still very slowly going down, white and orange impact dust on dry tip.
DCP2 – End of Test @ 1.0m, DCP still very slowly going down, white impact dust on dry tip.
DCP3 – Refusal on rock @ 1.0m, DCP bouncing off rock surface, orange impact dust and rock fragments on dry tip.

5. Geological Observations/Interpretation

Weathered sandstone is exposed across the existing cut for the driveway. The sandstone is interpreted to be a band of sandstone through the otherwise shale-dominated profile. Manmade fill has been placed across SW side of the property for landscaping. Below the fill, the rock is overlain by a thin sandy topsoil and sandy clays. In the test locations, the depth to rock ranged from depths of between ~0.6m to ~1.0m below the current surface. We conservatively estimate the strength of the rocks underlying the property to be of Extremely Low to Very Low Strength. It is to be noted that this material 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

Normal ground water seepage is expected to move over the buried surface of the clay and rock and through the cracks in the rock. Due to the slope and elevation of the block, the water table in the location 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. As the property encompasses the crest of the slope any surface flows are limited to those generated on site and will flow away from the property.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above or beside the property. The moderate to steeply graded slope that falls across the property and continues below is a potential hazard

(**Hazard One**). The proposed fill is a potential hazard until retaining walls are in place (**Hazard Two**). The proposed excavation is a potential hazard until retaining walls are in place (**Hazard Three**). The proposed excavation undercutting the tree above the existing driveway (Photos 1 & 3) is a potential hazard (**Hazard Four**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate to steep slope that falls across the property and continues below failing and impacting on the property.	The proposed fill failing and impacting on the proposed works below before the retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (25%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	5.3×10^{-5}/annum
COMMENTS	'ACCEPTABLE' level of risk.	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Section 12** are to be followed.

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

RISK ANALYSIS SUMMARY CONTINUES ON NEXT PAGE

HAZARDS	Hazard Three	Hazard Four
TYPE	The proposed excavation collapsing onto the worksite during the excavation process.	The proposed excavation undercutting the tree above the existing driveway causing failure (Photos 1 & 3).
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Minor' (8%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (5×10^{-5})
RISK TO LIFE	8.3×10^{-6}/annum	5.3×10^{-3}/annum
COMMENTS	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.	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.

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

No significant stormwater runoff will be created by the proposed development.

11. Excavations

An excavation to a maximum depth of ~1.5m will be required to extend the driveway. The excavation is expected to be through topsoil and sandy clay, with Extremely Low to Very Low Strength Rock expected at depths from between ~0.6m to ~1.0m below the current surface. Excavations through soil, clay and rock up to Low Strength can be carried out with an excavator and bucket. If Medium Strength Rock is encountered it will require grinding or rock sawing and breaking.

12. Vibrations

It is expected the proposed excavations will be carried out with an excavator and bucket and the vibrations produced will be below the threshold limit for building or infrastructure damage.

If Medium Strength Rock or better is encountered, excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the subject pool. Close controls by the contractor over rock excavation are recommended so excessive vibrations are not generated.

Excavation methods are to be used that limit peak particle velocity to 5mm/sec at the subject pool. Vibration monitoring will be required to verify this is achieved.

If a milling head is used to grind the rock, vibration monitoring will not be required. Alternatively, if rock sawing is carried out around the perimeter of the excavation boundaries in not less than 1.0m lifts, a rock hammer up to 300kg could be used to break the rock without vibration monitoring. Peak particle velocity will be less than 5mm/sec at the subject pool using this method provided the saw cuts are kept well below the rock to broken.

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 properties.

13. Excavation Support Requirements

An excavation to a maximum depth of ~1.5m will be required to extend the driveway. The excavation will come close to a tree above the existing driveway (Photos 1 & 3). For safety reasons and to ensure the ongoing durability of the proposed retaining wall for the driveway, the tree is to be removed prior to the excavation commencing.

The shallow soil portion of the excavation is to be battered temporarily at 1.0 Vertical to 2.0 Horizontal (26°) until the retaining walls are in place. Excavations through clay and Extremely

Low to Low Strength Rock will stand unsupported for a short period of time until the retaining walls are in place, provided the cut batters are kept from becoming saturated.

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. All unsupported cut batters are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. The materials and labour to construct the retaining walls are to be organised so on completion of the excavations they can be constructed as soon as possible. The excavations are to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast. If the retaining walls are not constructed within a few days of the excavation being completed temporary shoring will be required.

All excavation spoil is to be removed from site or is to be supported by engineered retaining walls.

14. Fill

Fill will be placed for landscaping purposes above the proposed new retaining walls. No fills are to be laid until the retaining walls are in place.

The fill will reach a maximum depth of ~1.8m. The surface is to be prepared before any fills are laid by removing any organic matter and topsoil. Fills for landscaping purposes are to be laid in a loose thickness not exceeding 0.3m before being moderately compacted. Tracking the machine over the loose fill in 1 to 2 passes should be sufficient. Immediately behind the retaining walls (say to 1.5m), the fills are to be compacted with light weight equipment such as a hand-held plate compactor so as not to damage the retaining walls. Where light weight equipment is used, fills are to be laid in a loose thickness not exceeding 0.2m before being compacted. No structures are to be supported on landscaped fill.

15. Retaining Walls

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

Table 1 – Likely Earth Pressures for Retaining Walls

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Soil	20	0.40	0.55
Residual Clays	20	0.35	0.45
Rock up to Low Strength	24	0.25	0.35

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 wall, do not account for any surcharge loads and assume retaining walls are fully drained. Rock strength and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining walls are to have sufficient back-wall drainage and be backfilled immediately behind the wall 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 walls, the likely hydrostatic pressures are to be accounted for in the structural design.

16. Foundations

The proposed retaining wall for the driveway can be supported by the exposed Extremely Low to Very Low Strength rock. This is a suitable bearing material. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low to Very Low Strength rock

The upper retaining wall can be supported in the underlying sandy clays of the natural profile. A maximum allowable bearing pressure of 200kPa can be assumed for footings in clay.

As the bearing capacity of clay 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 clay 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 consultant 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.

17. Inspections

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

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

White Geotechnical Group Pty Ltd.

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: AH1 – Downhole is from left to right.

Photo 12: AH2 – 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.

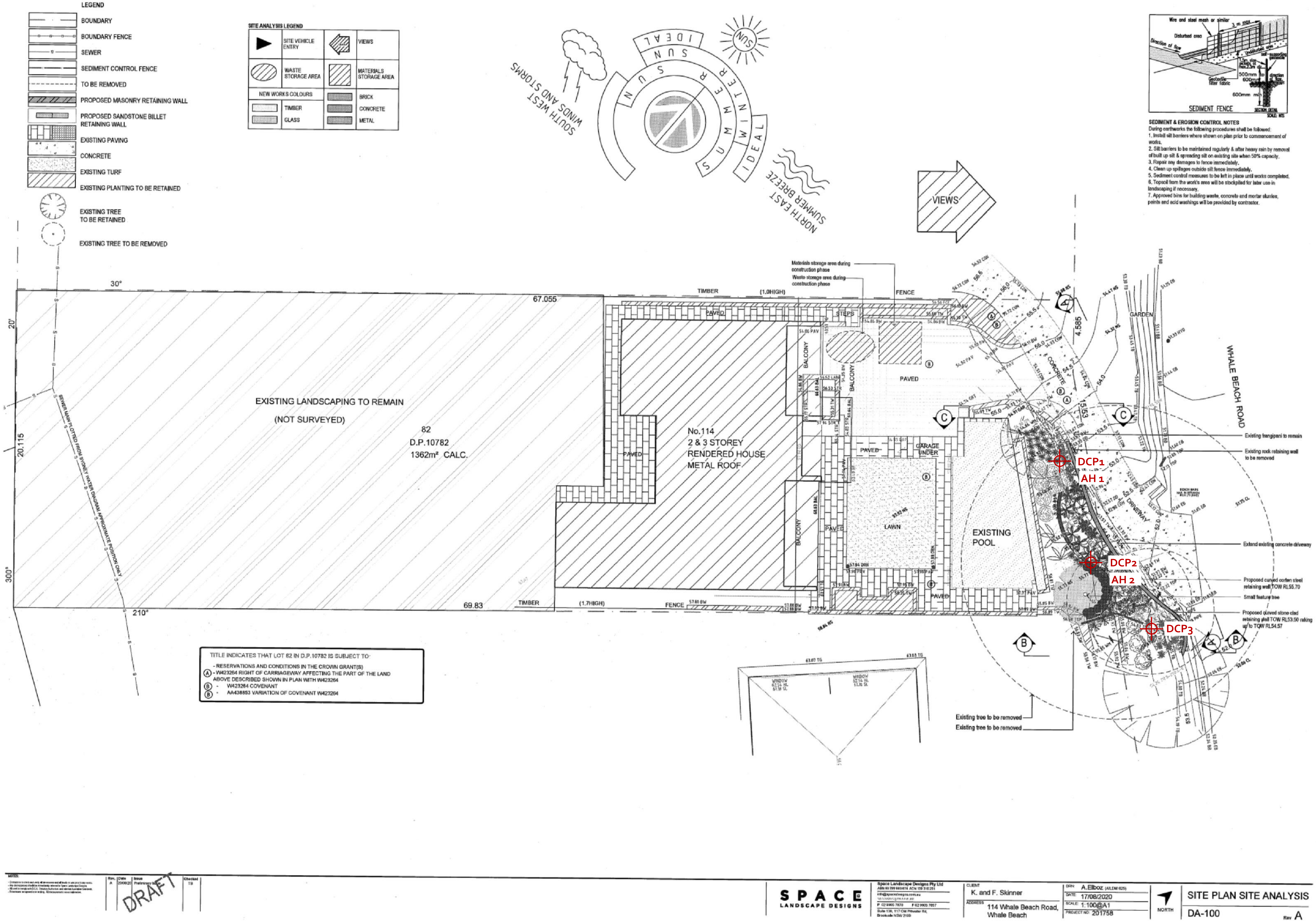
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

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

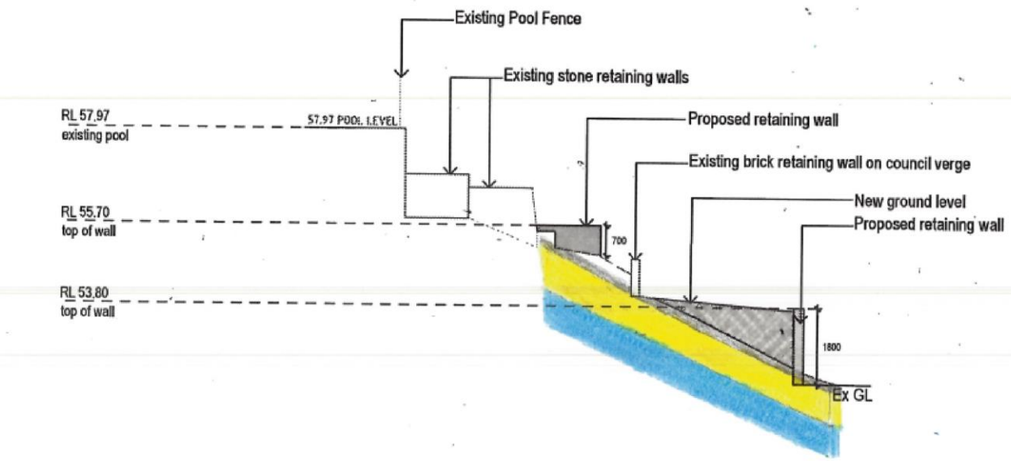
- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- 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.

SITE PLAN – showing test locations



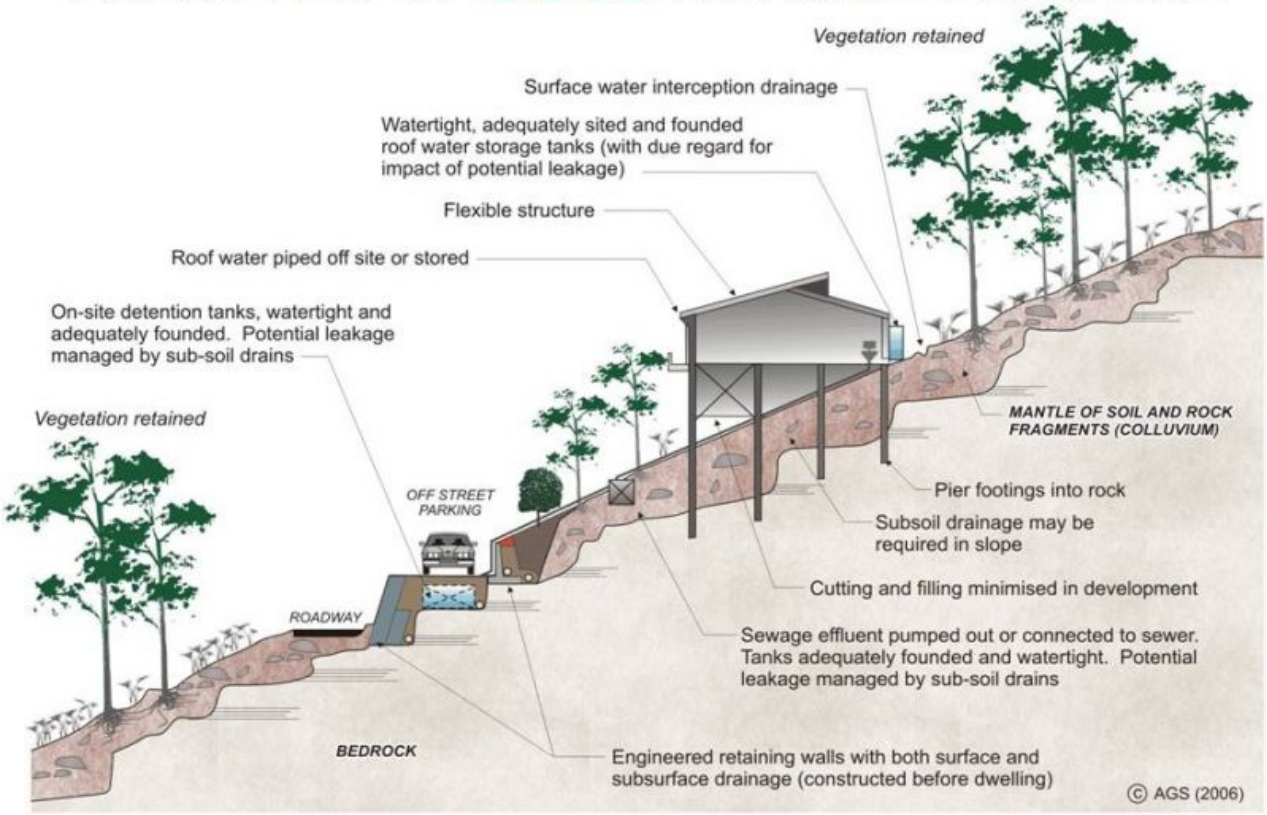
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



SOUTH EAST ELEVATION BB - PROPOSED WALLS
SCALE 1:100

- Topsoil
- Sandy Clay
- Narrabeen Group Rocks – Extremely Low to Very Low Strength Rock

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE