7 Laura Street, Seaforth

Geotechnical Comments for Section 96.

We have reviewed the existing geotechnical report, the original plans, and the 10 amended plans done by DRD numbered S96 1503 .000, .200 to .205, .330, 400 & 401 all Issue D accept .201 that is Issue E and all dated June 31.10.17. The main changes from a geotechnical perspective is:

- The addition of a basement plant room & store that requires an excavation up to ~ 3.0m that is close to the NE common boundary.

The other proposed changes are either covered by the existing advice in the report or are considered minor from a geotechnical perspective.

The following Risk Assessment and advice is in relation plant room & store basement. It should be considered in conjunction with the report attached.

1. Geotechnical Hazards and Risk Analysis

The proposed excavation to a maximum depth of 3.0m for the basement plant room & store is a potential hazard until retaining walls are in place (**Hazard One**).

Risk Analysis Summary

HAZARDS	Hazard One
TYPE	The cut through the soil portion of the excavation for the basement, adjacent with the NE common boundary, failing before retaining walls are in place and impacting on the worksite and the neighbouring property.
LIKELIHOOD	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (30%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})
RISK TO LIFE	2.1×10^{-5}/annum
COMMENTS	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels the recommendations in **Section 2** are to be followed.

2. Excavation Support Requirements

The excavation for the proposed basement is up to ~ 3.0m deep and is expected to be through up to ~ 1.2m of variable depth soil over medium strength sandstone. Allowing for drainage the bulk excavation will come as close as 0.7m from the NE common boundary. As such excavations through soil along the common boundary will need to be supported prior to any excavation through rock commencing. Excavations through medium strength sandstone will stand unsupported at near vertical angles.

Where soil is more than 0.7m deep along the NE common boundary it is to be supported with temporary support such as sandbags or a similar form of temporary support. Alternatively a staged retaining wall can be installed as the excavation through soil proceeds using a 'hit 1 miss 3' technique. The wall can be supported on bar grouted into the top of the underlying sandstone. It is to be installed to be set back from the proposed excavation face through rock and angled away from the cut face.

3. 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 owner or the regulating authorities if the following inspections have not been carried out during the construction process.

- During the excavation process for the basement plant room & store the geotechnical professional is to inspect the cut face in 1.5m intervals as it is being lowered to ensure ground materials are as expected and that there are no wedges or other defects present that could affect the stability of the cut face.

White Geotechnical Group Pty Ltd.

[redacted]

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

GEOTECHNICAL INVESTIGATION:

Alterations & Additions at **7 Laura Street, Seaforth**

1. Proposed Development

1.1 Replace the garage on the uphill side of the house.

1.2 Extend the lower ground floor of the house by excavating to a maximum depth of ~2.8m into the slope.

1.3 Terrace the area on the downhill side of the house by placing fill to a maximum height of ~1.5m.

1.4 Various internal and external modifications.

1.5 Details of the proposed development are shown on 14 drawings prepared by Dino Raccanello Design, drawings numbered DA1503.000, DA1503.100 to 104, DA1503.200 to 204, DA1503.300, DA1503.400 & DA1503.401 labelled Issue A dated 28/03/17.

2. Site Description

2.1 The site was inspected on the 4th April, 2017.

2.2 This residential property is on the low side of the road and has a S aspect. It is located on the moderate to steeply graded lower reaches and toe of a hillslope that falls to the waterfront at Middle Harbour. At the road frontage the natural slope falls at an average angle of ~10° that quickly increases to ~25° below the house. The slope above the property rises at steep angles. The grade below the property quickly eases as the waterfront is approached.

2.3 At the road frontage a concrete driveway runs to a garage and parking area on the uphill side of the house (Photo 1). A cut has been made into the slope to create a level platform for the garage. It is supported by a rendered brick retaining wall that appears stable (Photo 2). The downhill supporting brick wall of the garage is tilting and bulging due to the presence of a tree growing immediately beside it. The garage is being demolished and the tree removed as part of the proposed works (Photos 3 & 4). The part three storey brick and dimensioned sandstone block house steps down the slope. The external supporting walls of the house display no significant signs of movement that could be related to slope stability. Competent, medium strength sandstone is

exposed at the surface on the E and W sides of the house (Photos 5 & 6). The lower level of the house has been cut into the slope. The E side of the excavation was observed through an internal access door of the house. The cut face reaches a maximum depth of ~2.4m. The majority of the cut face was accessible and from what could be seen it is through competent, medium strength sandstone (Photo 7). A sandstone block retaining wall supports filling on the W and downhill sides of the house (Photos 8 & 9). The wall is obscured by thick creeper and vegetation and its condition could not be commented on. It is estimated that the wall is at least 25 years old and no visible signs of movement were observed immediately above the wall. The lower boundary of the property falls steeply to the waterfront (Photo 10). There is a combination of large sandstone joint blocks and rough stack rock retaining walls in this area. This area is also thickly vegetated however from what could be seen, no signs of movement were observed. A timber jetty extends below the property into Middle Harbour.

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by Hawkesbury Sandstone. It is described as a medium to coarse grained quartz sandstone with very minor shale and laminate lenses.

4. Subsurface Investigation

Five Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to bedrock. The location of the tests are shown on the site plan. It should be noted that a level of caution should be applied to 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 and the results are as follows:

SEE THE DCP RESULTS OVER THE PAGE

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** (~RL 9.0)	**DCP 2** (~RL 12.6)	**DCP 3** (~RL 12.7)	**DCP 4** (~RL 8.30)	**DCP 5** (~RL 7.80)
0.0 to 0.3	1F	1F	1F	1F	1F
0.3 to 0.6	6	6	7	9	7F
0.6 to 0.9	14	15	16	#	9
0.9 to 1.2	11	9	#		8
1.2 to 1.5	#	#			16
1.5 to 1.8					#
	Refusal on Rock @ 1.1m	Refusal on Rock @ 1.0m	Refusal on Rock @ 0.9m	Refusal on Rock @ 0.6m	Refusal on Rock @ 1.4m

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

DCP Notes:
DCP1 – Refusal on rock @ 1.1m, DCP bouncing off rock surface, clean dry tip.
DCP2 – Refusal on rock @ 1.0m, DCP bouncing off rock surface, clean dry tip.
DCP3 – Refusal on rock @ 0.9m, DCP bouncing off rock surface, clean dry tip.
DCP4 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, clean dry tip.
DCP5 – Refusal on rock @ 1.4m, DCP bouncing off rock surface, clean dry tip.

5. Geological Observations /Interpretation

The surface features of the block are controlled by the outcropping and underlying sandstone bedrock that steps down the property forming sub horizontal benches between the steps. Where the grade is steeper the steps are larger and the benches narrower. Where the slope eases the opposite is true. Where the rock is not exposed it is overlain by sandy soils over sandy clays that cover the bench step formation. In the test locations the depth to rock ranged between 0.6 to 1.4m below the current surface. The outcropping sandstone on the property is estimated to be medium strength or better and similar strength rock is expected to underlie the entire site. This is supported by the response of the DCP testing bouncing off the rock surface in all tests. See the Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Normal ground water seepage is expected to move over the exposed rock and the buried surface of the rock and through the cracks.

Due to the slope and elevation of the block, the water table is expected to be many metres below the base of the proposed excavation.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. It is expected that most sheet wash from the slope above will be intercepted by the street drainage system.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed below or beside the property. The slope that falls across the property and continues above is a potential hazard (**Hazard One**). The excavations to extend the lower ground floor of the house are a potential hazard (**Hazard Two**). The vibrations produced during the proposed excavations are a potential hazard (**Hazard Three**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The moderate to steeply graded slope that falls across the property and continues above at steep angles failing and impacting on the existing house or proposed works.	The excavation to extend the lower ground floor of the house undercutting the supporting footings of the house and causing failure	The vibrations produced during the proposed excavation damaging the supporting walls of the house.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (20%)	'Medium' (11%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	4.3×10^{-5}/annum	6.5×10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	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.	This level of risk to 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)

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.

There is fall to the waterfront at Middle Harbour below. All stormwater or drainage runoff from the proposed development is to be piped to the waterfront.

11. Excavations.

An excavation to a maximum depth of ~2.8m will be required to extend the lower ground floor level of the house. The E side of the excavation will be through exposed medium strength sandstone. It is interpreted from a DCP taken on the external, uphill side of the house that the uphill side of the excavation will be through ~0.6m of sandy soil over a firm to stiff clay with medium strength sandstone expected at a depth of ~1.1m below the current surface. Shallow levelling to a depth of ~0.6m will be required to lower the floor level of the existing lower ground floor and to install the proposed garage and entry courtyard. It is envisaged that excavations through sandy soil and sandy clays can be carried out by hand or an excavator and bucket. Excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations.

Possible vibrations generated during excavations through sandy soil and sandy clays will be below the threshold limit for building damage.

The majority of the excavations are expected to be through medium strength sandstone or better. Excavations through rock should be carried out to minimise the potential to cause vibration damage to the supporting walls of the subject house. The supporting walls of the subject house will be immediately beside the proposed excavations. 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 10mm/sec at the perimeter of the excavation. Vibration monitoring will be required to verify this is achieved.

The excavations through rock will be inside the house and it is envisaged that hand tools such as jack hammers will be used. Provided the excavation is carried out with hand tools no vibration monitoring will be required and peak particle velocity will be less than 10mm/sec at the perimeter of the excavations.

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

13. Excavation Support Requirements

The proposed excavations for the lower ground floor will extend into the foundation space of the house. It is expected that the footings for the house are supported on sandstone bedrock however this is to be confirmed with exploration pits dug by the builder beside the house footings before any excavations commence. Upon completion the pits are to be inspected by the geotechnical professional to confirm the footing material. If the footings are not founded on rock they are to be underpinned to medium strength sandstone before any excavations commence. No additional support is required if the footings are supported on medium strength sandstone bedrock.

The house footings that are currently located above the line of the excavations will have to be propped/supported and then removed. The support is to be designed by a structural engineer and any additional footings that are required are to be supported on rock.

Once the required propping and underpinning (if necessary) has been completed the bulk excavation for the proposed lower ground floor extension can commence. On the uphill side of the excavation the soil and clay portions of the cut are to be temporarily battered at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining wall is in place. Excavations through medium strength sandstone will stand at vertical angles unsupported subject to approval by the geotechnical professional.

During the excavation process for the lower ground floor the geotechnical professional is to inspect the cut face in 1.4m intervals as it is being lowered to ensure ground materials are as expected and that there are no wedges or other defects present that could affect the stability of the cut face.

The unsupported cut batters through soil and clay that are exposed to the weather are to be covered to prevent access of water in wet weather and loss of moisture in dry weather until the retaining wall is in place. The covers are to be tied down with metal pegs or other suitable fixtures so they can't blow off in a storm. Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. 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.

Upon completion of all excavations it is recommended all cut faces be supported with retaining walls to prevent any potential future movement of joint blocks in the cut face that can occur over time, when unfavourable jointing is obscured behind the excavation face. Additionally retaining walls will help control seepage and to prevent minor erosion and sediment movement.

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

14. Retaining Walls

Retaining walls supporting fill, sandy soil and sandy clays can be designed for a lateral earth pressure coefficient K_a of 0.35 and assume a bulk density of 20kN/m^3. Where the fill is composed of excavated sandstone assume a bulk density of 22kN/m^3. It should be noted that this lateral earth pressure coefficient assumes the surface above the wall is near level. Cuts through medium strength sandstone will exert no earth pressure subject to the inspection of the cut face by the geotechnical professional to ensure no wedges or other defects are present.

It is likely the starter bars for the retaining walls can be drilled and grouted directly into the sandstone at the base of the cut subject to an inspection and approval of the exposed rock by the geotechnical professional.

Any surcharge loads that may act on the proposed retaining walls are to be accounted for in the design.

All retaining walls are to have sufficient back wall drainage and be backfilled immediately behind the wall with free draining material (such as gravel) or drainage cell. 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 likely hydrostatic pressures are to be accounted for in the retaining wall design.

15. Filling

Filling to a maximum height of ~1.5m will be placed on the downhill side of the existing house to create a level area. The surface is to be prepared before any fills are laid by removing any organic matter and topsoil. Fills are to be laid in a loose thickness not exceeding 0.3 before being moderately compacted. Tracking the machine over the loose fill in 1 to 2 passes should be sufficient for landscaping works. Immediately behind

the retaining wall (say to 1.5m) the fill is to be compacted with light weight equipment such as a hand held plate compactor so as not to damage the retaining wall. 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 fill.

16. Foundations

The proposed garage can be supported on shallow piers supported on medium strength sandstone. This ground material is expected at an average depth of ~0.9m below the current surface. A maximum allowable bearing pressure of 1.2MPa can be assumed for footings on medium strength sandstone.

A concrete slab supported on medium strength sandstone is a suitable footing for the proposed lower ground floor extension. This ground material is expected to be exposed at the base of the proposed excavations.

A concrete slab supported on the underlying medium strength sandstone is a suitable footing for the entry courtyard and terrace to the E of the house. Where this ground material is not exposed or the surface slopes away extended rafts or shallow piers will be required to ensure a uniform bearing material.

Naturally occurring vertical cracks known as joints commonly occur in sandstone. These are generally filled with soil and are the natural seepage paths through the rock. They can extend to depths of several metres and are usually relatively narrow but can range between 0.1 to 0.8m wide. If a pad footing falls over a joint in the rock the construction process is simplified if with the approval of the structural engineer the joint can be spanned or alternatively the footing can be repositioned so it does not fall over the joint.

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.

SEE THE REQUIRED INSPECTIONS OVER THE PAGE

17. 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 owner or the regulating authorities if the following inspections have not been carried out during the construction process.

- The geotechnical professional is to inspect the required exploration pits to determine footing material of the house.

- During the excavation process for the lower ground floor the geotechnical professional is to inspect the cut face in 1.4m intervals as it is being lowered to ensure ground materials are as expected and that there are no wedges or other defects present that could affect the stability of the cut face.

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

White Geotechnical Group Pty Ltd.

[redacted]

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

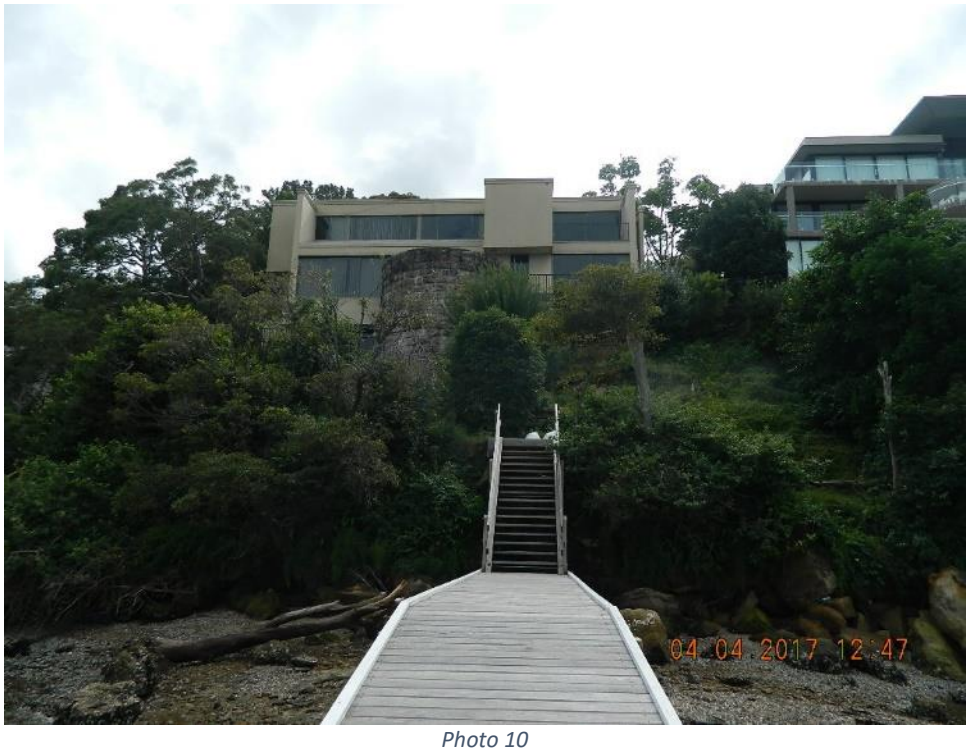


Photo 10

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 tests 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 professional. 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.

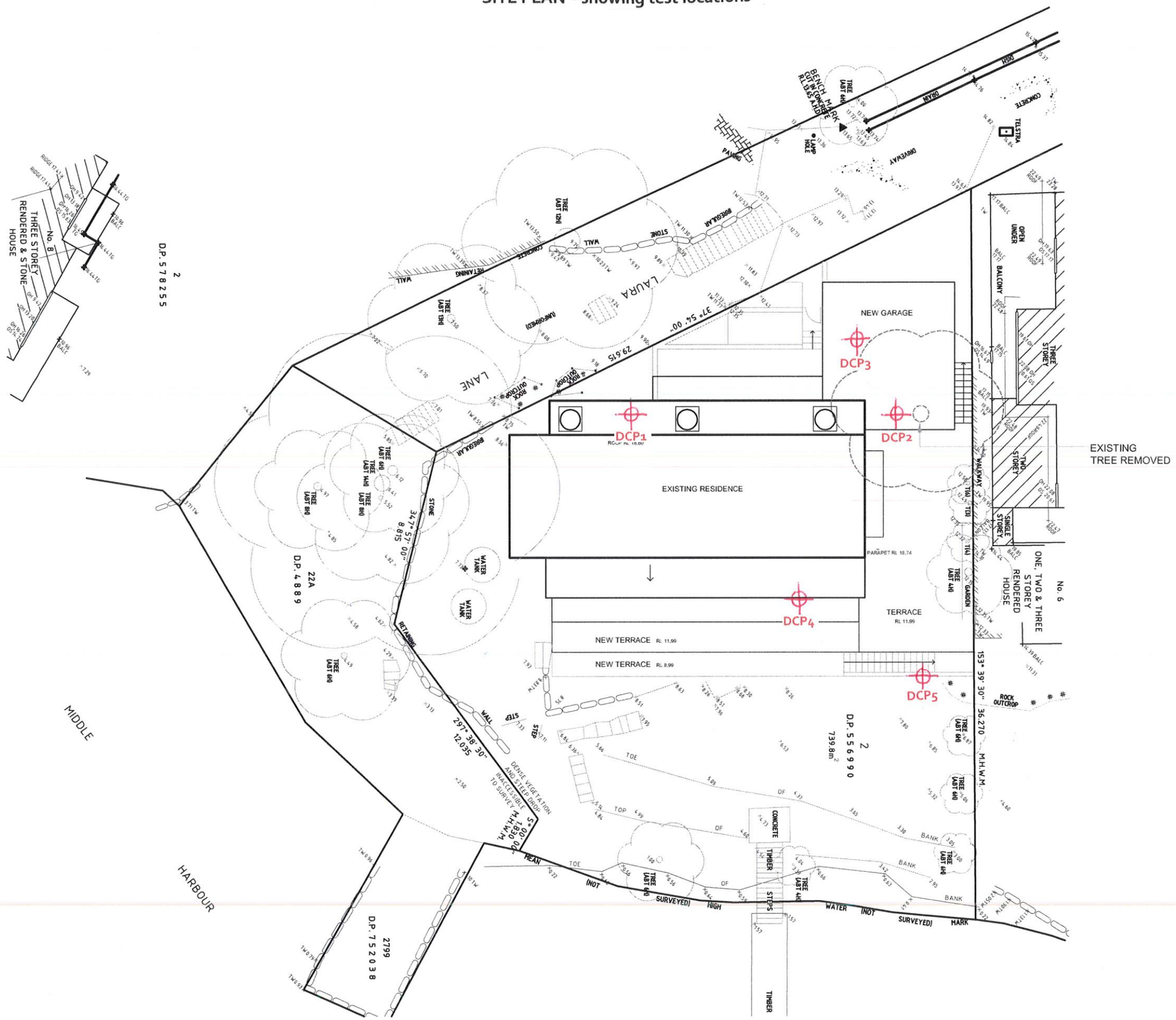
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



DRD

Dino Raccanello Design Pty. Ltd. **ACN** 163 527 277 **C** PO Box 425 Potts Point 1335 **E** dino@dinoraccanellodesign.com

Only use figured dimensions do not scale off drawing. Check dimensions on site before proceeding with the work. All discrepancies to be referred for instruction prior to works proceeding

Issue	Date	Description
A	28.03.17	Preliminary Issue

Issue	Date	Description

Client N · MANETTAS

Drawn LL
Scale 1:200 @ A3
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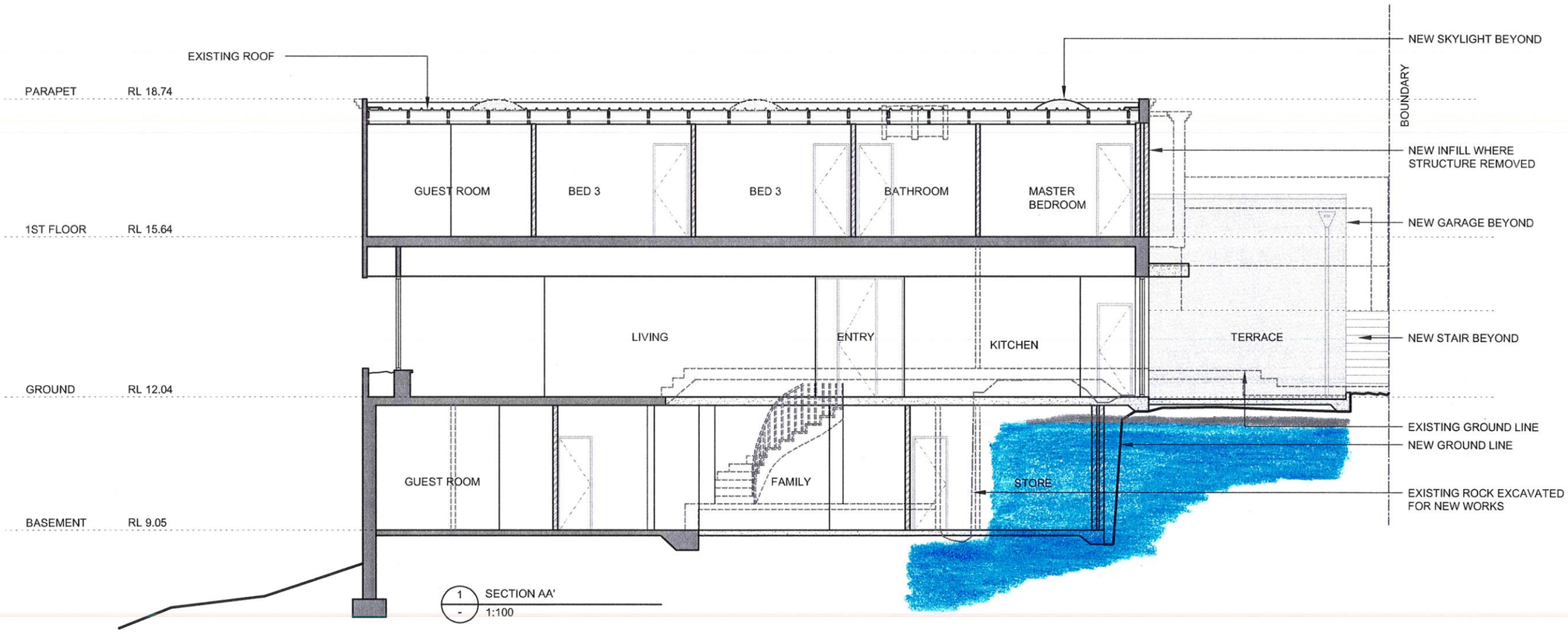
Project Refurbishment of Existing Residence
7 Laura st, Seaforth NSW 2092

SITE PLAN

DA1503.200 A

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



Fill
Sandy Soil
Sandy Clay – Firm to Stiff
Hawkesbury Sandstone – Medium Strength

DRD

Dino Raccanello Design Pty. Ltd. **ACN** 163 527 277 **C** PO Box 425 Potts Point 1335 **E** dino@dinoraccanellodesign.com

Issue	Date	Description	Issue	Date	Description
A	28.03.17	Preliminary Issue			

Client N · MANETTAS

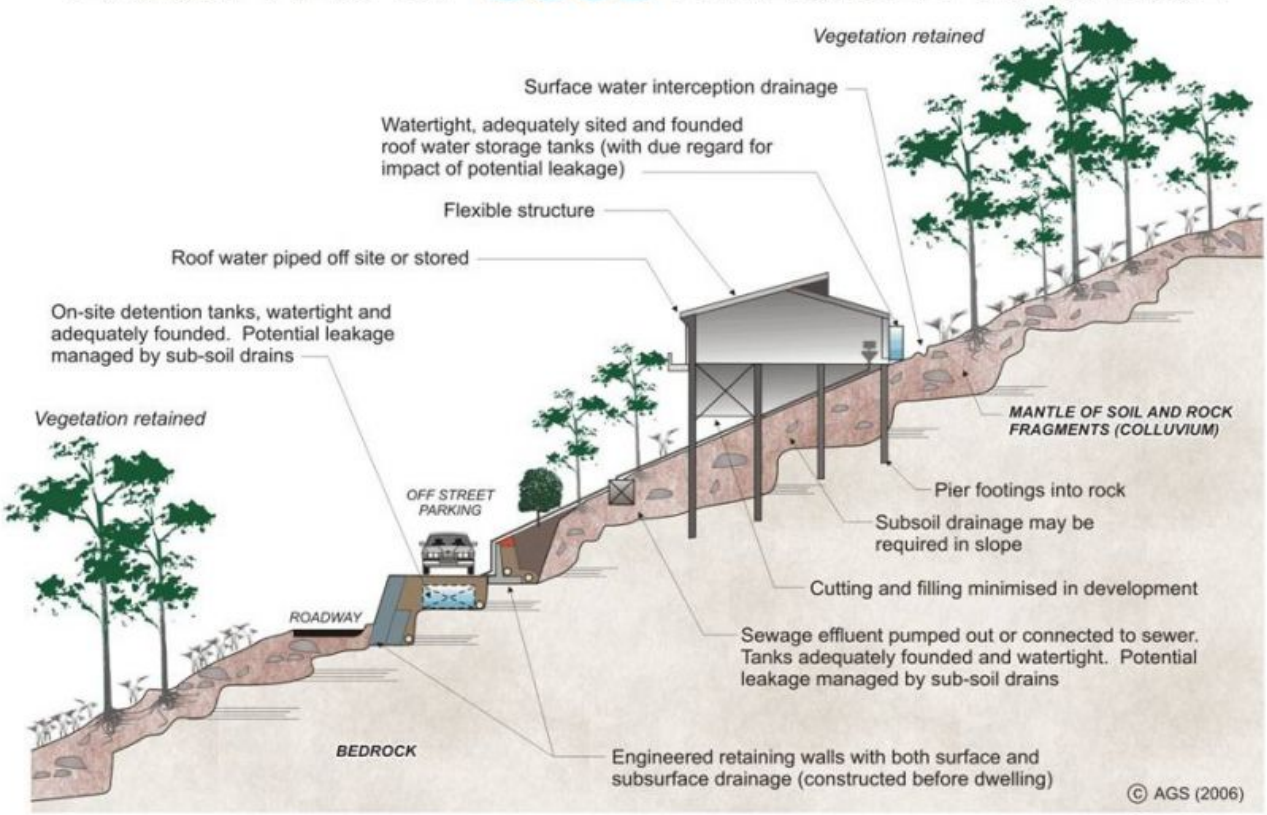
Drawn LL
Scale 1:100 @ A3
Checked

Project Refurbishment of Existing Residence
7 Laura st, Seaforth NSW 2092

SECTION AA'

DA1503.300 A

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE