15 Tutus Street, Balgowlah Heights

Comments on updates to Plans

We have reviewed the existing geotechnical report, the plans used to carry out the report, and the updated plans for DA shown on 13 drawings prepared by Cadence and Co Design, Project number PAN0518, sheets numbered A00, 03 to 12, 16, and 20, Revision A, dated 14/6/19.

The changes include:

- Lowering the house and pool by 0.15m, slightly increasing excavation depths accordingly.
- Increasing the front setback to the house by 0.6m.
- Decreasing the rear setback to the pool by 0.6m.
- Various other minor changes.

Provided the excavation support advice in the original report is followed, the proposed changes do not significantly alter the recommendations or the risk assessment in the report carried out by this firm numbered J2038 and dated the 30th January, 2019.

White Geotechnical Group Pty Ltd.

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

GEOTECHNICAL INVESTIGATION:

New House at **15 Tutus Street, Balgowlah Heights**

1. Proposed Development

1.1 Demolish the existing house and construct a new three-storey house by excavating to a maximum depth of ~3.0m into the slope.

1.2 Install a pool on the uphill side of the property by excavating to a maximum depth of ~2.1m into the slope.

1.3 Details of the proposed development are shown on 13 drawings prepared by Cadence and Co Design, project number PAN 0518, drawings numbered A0-0 to A012, dated 25/10/18.

2. Site Description

2.1 The site was inspected on the 3rd December, 2018.

2.2 This residential property is on the high side of the road and has an E aspect. It is located on the gently graded upper reaches of a N-S trending ridge that falls to Reef Bay. From the road frontage, the natural slope rises at an average angle of ~7° to the downhill side of the house and continues at average angles of <5° to the upper boundary. The slope below the property continues at increasing angles. The grade above the block gradually eases as the crest of the slope is approached.

2.3 At the road frontage a concrete driveway runs to a garage on the downhill side of the property (Photo 1 & 2). The garage has been cut into the slope. The cut for the garage has been taken through competent Medium Strength Sandstone (Photo 3). The garage will be demolished as part of the proposed works. Medium Strength Sandstone was observed outcropping on the S side of the driveway (Photo 4). A gently sloping

lawn rises from the garage to the downhill side of the house (Photo 5). Gardens encompass the N and S common boundaries. The single-storey brick house will be demolished as part of the proposed works (Photo 6). Medium Strength Sandstone was observed outcropping on the N side of the house (Photo 7). A near level lawn area extends from the uphill side of the house to the uphill boundary (Photo 8). A timber deck on the N side of the lawn will be demolished as part of the proposed works (Photo 9).

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

One Hand Auger Hole (AH) was put down to identify the soil materials. Nine Dynamic Cone Penetrometer (DCP) 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 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 OVER THE PAGE FOR DCP TEST RESULTS

AUGER HOLE 1 (~RL46.4) **–** AH1 (Photo 13)

Depth (m)	Material Encountered
0.0 to 0.3	**SANDY SOIL**, loose, dark brown, fine to medium grained, rock fragments, dry.
0.3 to 0.5	**SILTY SAND**, orange to light brown, loose, medium grained, dry.
0.5 to 0.7	**SANDY CLAY**, orange/brown, firm, fine to medium grained, dry.
0.7 to 1.0	**SANDY CLAY**, weathered sandstone, light brown/orange, white mottling, fine to medium grained, dry.

End of hole @ 1.0m in 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 (~RL46.5)	DCP 2 (~RL49.3)	DCP 3 (~RL46.4)	DCP 4 (~RL48.0)
0.0 to 0.3	7	1	8	4
0.3 to 0.6	#	11	10	9
0.6 to 0.9		#	12	#
0.9 to 1.2			#	
	Refusal on Rock @0.2m	Refusal on Rock @ 0.5m	Refusal on Rock @ 0.9m	End of Test @ 0.6m

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

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 5 (~RL49.1)	DCP 6 (~RL49.7)	DCP 7 (~RL48.3)	DCP 8 (~RL49.5)	DCP 9 (~RL49.4)
0.0 to 0.3	7	12	5	5	7
0.3 to 0.6	#	#	#	14	21
0.6 to 0.9				#	#
0.9 to 1.2					
	Refusal on Rock @ 0.4m	Refusal on Rock @ 0.3m	Refusal on Rock @ 0.2m	Refusal on Rock @ 0.5m	Refusal on Rock @ 0.5m

#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 @ 0.2m, DCP bouncing off rock surface, red rock fragments on dry tip.
DCP2 – Refusal on rock @ 0.5m, DCP bouncing off rock surface, red rock fragments and clay on dry tip.
DCP3 – Refusal on rock @ 0.9m, DCP bouncing off rock surface, red impact dust on dry tip.
DCP4 – End of test @ 0.6, DCP still very slowly going down, sandy wet tip.
DCP5 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, rock fragments and impact dust on dry tip.
DCP6 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, rock fragments and impact dust on dry tip.
DCP7 – Refusal on rock @ 0.2m, DCP bouncing off rock surface, dirt on dry tip.
DCP8 – Refusal on rock @ 0.5m, DCP bouncing off rock surface, red clay on dry tip.
DCP9 – Refusal on rock @ 0.5m, DCP bouncing off rock surface, red clay and impact dust on dry tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the outcropping and underlying sandstone bedrock that steps up 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 natural sandy soils over sand and sandy clays that cover the bench step formation. In the test locations, the depth to rock ranged between ~0.2 to ~0.9m 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. 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 significant surface flows were observed on the property during the inspection.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above or below the property. The vibrations from the proposed excavations are a potential hazard (**Hazard One**). A loose boulder wedge or similar collapsing onto the worksite is a potential hazard (**Hazard Two**). The remaining pillar of rock on the N side of the excavation is a potential hazard (**Hazard Three**).

SEE OVER THE PAGE FOR RISK ANALYSIS SUMMARY

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The vibrations produced during the proposed excavations impacting on the N, S and W neighbouring properties.	A loose boulder wedge or similar collapsing onto the worksite before retaining structures are in place.	The pillar of rock that will be left after the proposed excavation is complete (Photos 11 & 12) collapsing onto the worksite and N neighbouring property.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (15%)	'Medium' (20%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.3×10^{-6}/annum	2.7×10^{-3}/annum	4.6×10^{-4}/annum
COMMENTS	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.	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 life and property is 'UNACCEPTABLE'. To move 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

There is fall to Tutus street below. All stormwater or drainage runoff from the proposed development is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to a maximum depth of ~3.0m is required to construct the house. Another excavation to a maximum depth of ~2.1m is required to install the proposed pool. Both excavations are expected to be through a sandy soil over sand and firm to stiff sandy clays with Medium Strength Sandstone expected at an average depth of ~0.4m below the current surface. It is envisaged that excavations through sandy soil and sandy clays can be carried out by a bucket only and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

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

As the excavation will be ~2.0m from a ~1.0m high cut face on the N neighbouring property, a rock saw is to be used along the perimeter of the excavation in this location prior to commencement of the excavation regardless of the equipment used. This is to prevent any vibrations damaging the 2.0m wide pillar of rock that will be left on completion of the excavation between the subject and N neighbouring property.

It is expected that the majority of the excavations will be through Medium Strength Sandstone. Excavations through rock should be carried out to minimise the potential to cause vibration damage to the N neighbouring house and cut face and neighbouring houses to the S and W. The neighbouring house and cut face to the N will be ~2.0m, the S neighbouring house ~6.0 and the W neighbouring house will be ~6.5m from 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 5mm/sec at the excavation perimeters. 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 supporting brick walls of the house and garage and common boundaries 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 neighbouring house.

13. Excavation Support Requirements

No structures or boundaries will be within the zone of influence of the excavations.

Accounting for back wall drainage, a portion of the N side of the proposed excavation for the house will be ~2.0m from a ~1.0m high cut batter of shallow soil and clay over sandstone on the neighbouring property to the N (Photos 10, 11 & 12). The proposed excavation will extend parallel with the cut on the N neighbouring property for some 5.0 metres before the neighbouring cut tappers to level to the E. On completion of the proposed excavation a ~2.0m wide pillar of shallow sandy soil and clay over rock will be left between the subject property and the N neighbouring property. To prevent damage to the cut on the neighbouring property it is critical that the advice in **Section 12** vibrations be followed and a rock saw be used on the excavation perimeter adjacent to the low cut on the neighbouring property to the N before the bulk excavation takes place.

The soil portion of the cut for the house is to be battered at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining walls are in place. The clay portions of the cut will stand at near-vertical angles for short periods of time until the garage structure is constructed, provided the cut batters are kept from becoming saturated. Excavations through Medium Strength Sandstone or better will stand at vertical angles unsupported subject to approval by the geotechnical consultant.

The cut through soil and clay for the proposed pool will stand at near vertical angles for short periods of time until the pool structure is installed provided the cut batters are kept dry. If the soil and clay portions of the pool are left for more than a few days without pool construction commencing, it is recommended that standard pool shoring such as sacrificial sheet iron be used to support the cut batters.

Cut batters through soil and clay are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. 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.

As the excavation is lowered in 1.5m intervals, it is to be inspected by the geotechnical consultant to ensure the ground materials are as expected and no wedges or other defects are present in the rock.

Upon completion of this excavation, 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 is to be removed from site.

14. Retaining Structures

For cantilever or singly propped retaining walls 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 Walls

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Sandy Soil and Sand	20	0.4	0.55
Residual Clays	20	0.35	0.45
Medium Strength Rock	24	0.00	0.10

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 retaining wall design.

15. Foundations

A concrete slab supported directly off Medium Strength Sandstone is a suitable footing for the proposed house. This bearing material is expected to be exposed across the base of the excavation.

It is expected the pool will be seated in Medium Strength Sandstone which is a suitable bearing material.

A maximum allowable bearing pressure of 800kPa can be assumed for footings on Medium Strength Sandstone.

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 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.

SEE OVER THE PAGE FOR REQUIRED INSPECTIONS

16. 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.

- As the excavation is lowered in 1.5m intervals it is to be inspected by the geotechnical consultant to ensure the ground materials are as expected and no wedges or defects are present in the rock.

- 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

Photo 12

Photo 13: Ager Hole 1: Top of Auger at top of hole

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 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.

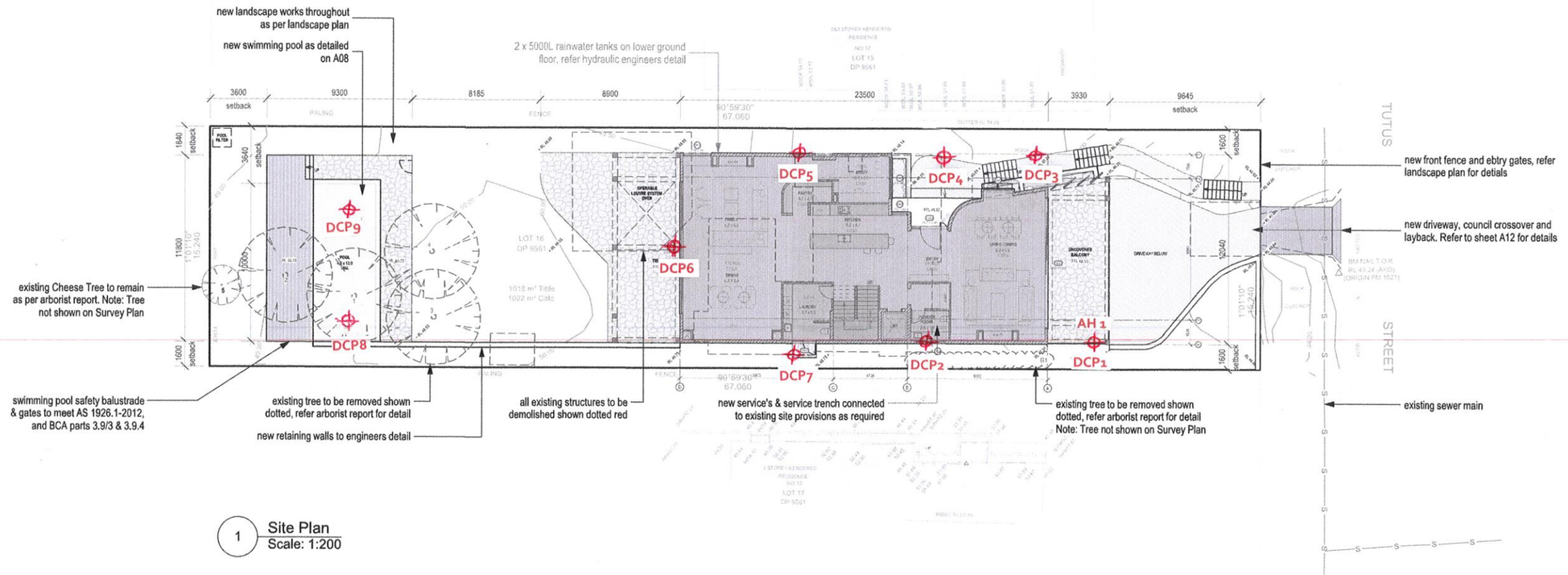
- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- 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.

DA AREA CALCULATIONS COMPLIANCE TABLE (m2)

	SITE AREA	Lower Ground Floor	Ground Floor	First Floor	FSR - Area B	Total Open Space	Landscaped Area	Open Space Above Ground
CONTROL					0.4:1 408.8 sq m	min 60% of total site area 613.2 sq m	at least 40% of total open space 245.28 sq m	max. 25% of total open space 153.3 sq m
PROPOSED	1022 sq m	30.2 sq m	220.6 sq m	183.4 sq m	434.2 sq m	30% 310.1 sq m	56% 343.5 sq m	20% 62.5 sq m
COMPLIANCE	N/A				NO	NO	YES	YES

SITE PLAN – showing test locations



CADENCE & CO DESIGN PTY LTD
Suite 7, 287 Mona Vale Rd,
Terrey Hills, NSW, 2084,
P 9450 1950
E info@cadenceandco.com.au
ABN: 12 168 714 752

DRAFT 1 - 25/10/18

REVISION	DATE	REVISION NOTE

CLIENT: Colin & Emily Panagakis

DRAWING: Site Plan & Area Calculations

PROJECT: 15 Tutus St, Balgowlah Heights
Being LOT 16 in D.P. 9561

PROJECT NO: PAN 0518

ISSUE TYPE: DA1

DRAWN: PV

CHKD:

ISSUE DATE: 11/10/18

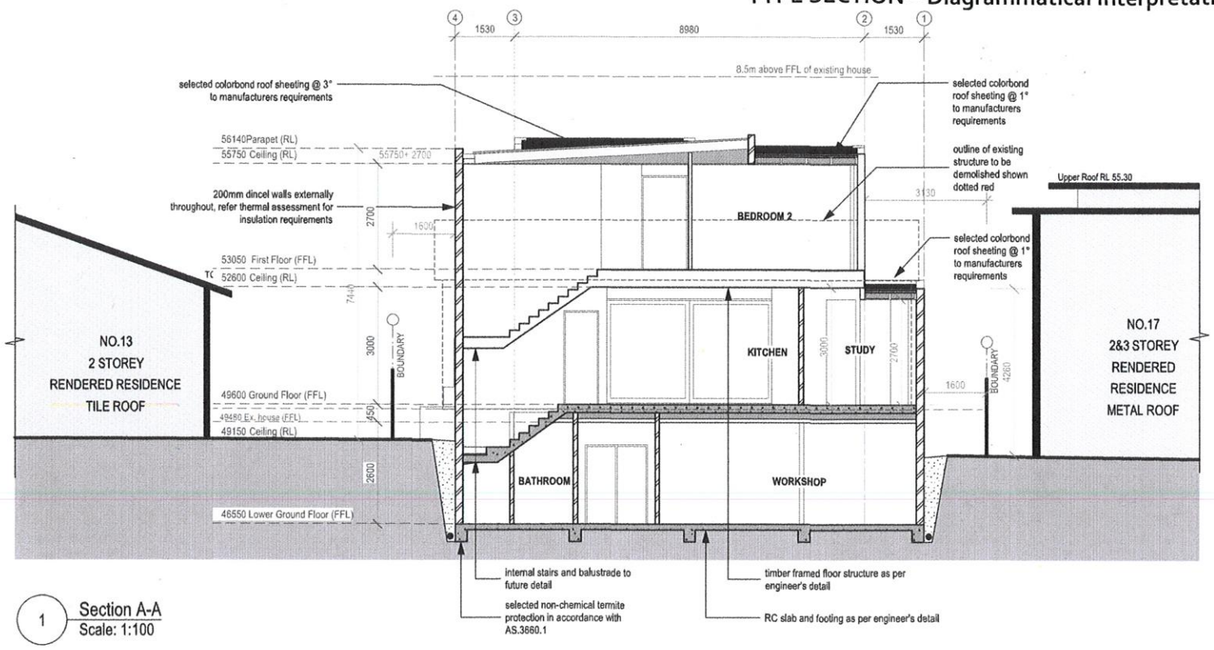
SHEET NO: A03

SCALE @ A2: 1:200

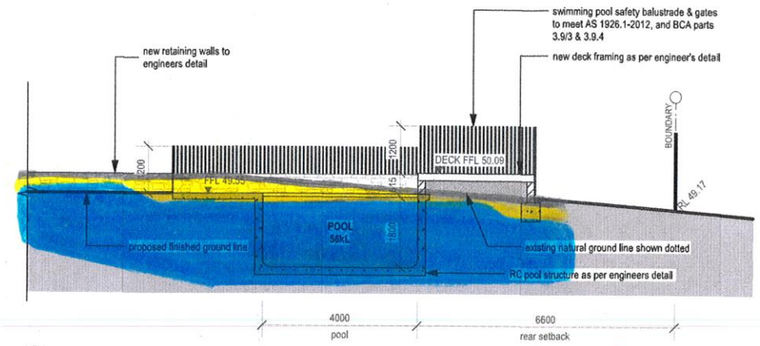
REVISION:

GENERAL NOTES: ALL RL'S SHOWN ARE FINISHED LEVELS. BUILDER TO PROVIDE SET DOWNS & ALLOWANCES AS REQUIRED. ALL OPENING DIMENSIONS ARE NOMINAL. BUILDER TO CHECK SIZES ON-SITE BEFORE ORDERING WINDOW AND DOOR UNITS.

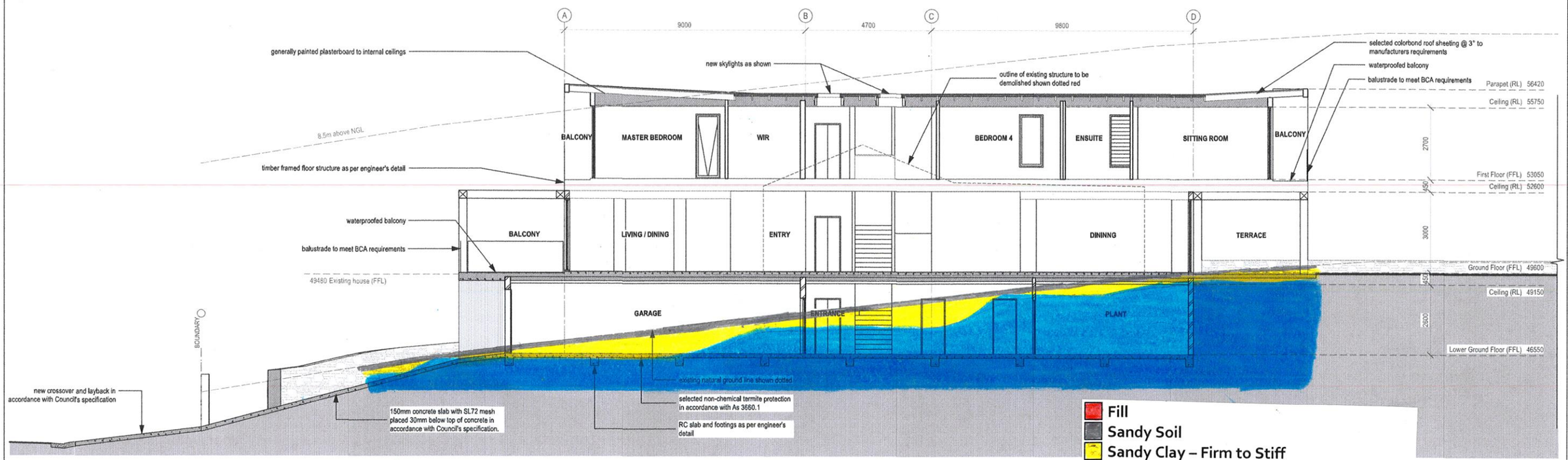
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



1 Section A-A
Scale: 1:100



3 Section D-D - Swimming Pool
Scale: 1:100



2 Driveway Section / Section B-B
Scale: 1:100

CADENCE & CO DESIGN
PTY LTD
Suite 7, 267 Mona Vale Rd,
Terrey Hills, NSW, 2084,
P 9450 1950
E info@cadenceandco.com.au
ABN: 12 168 714 752

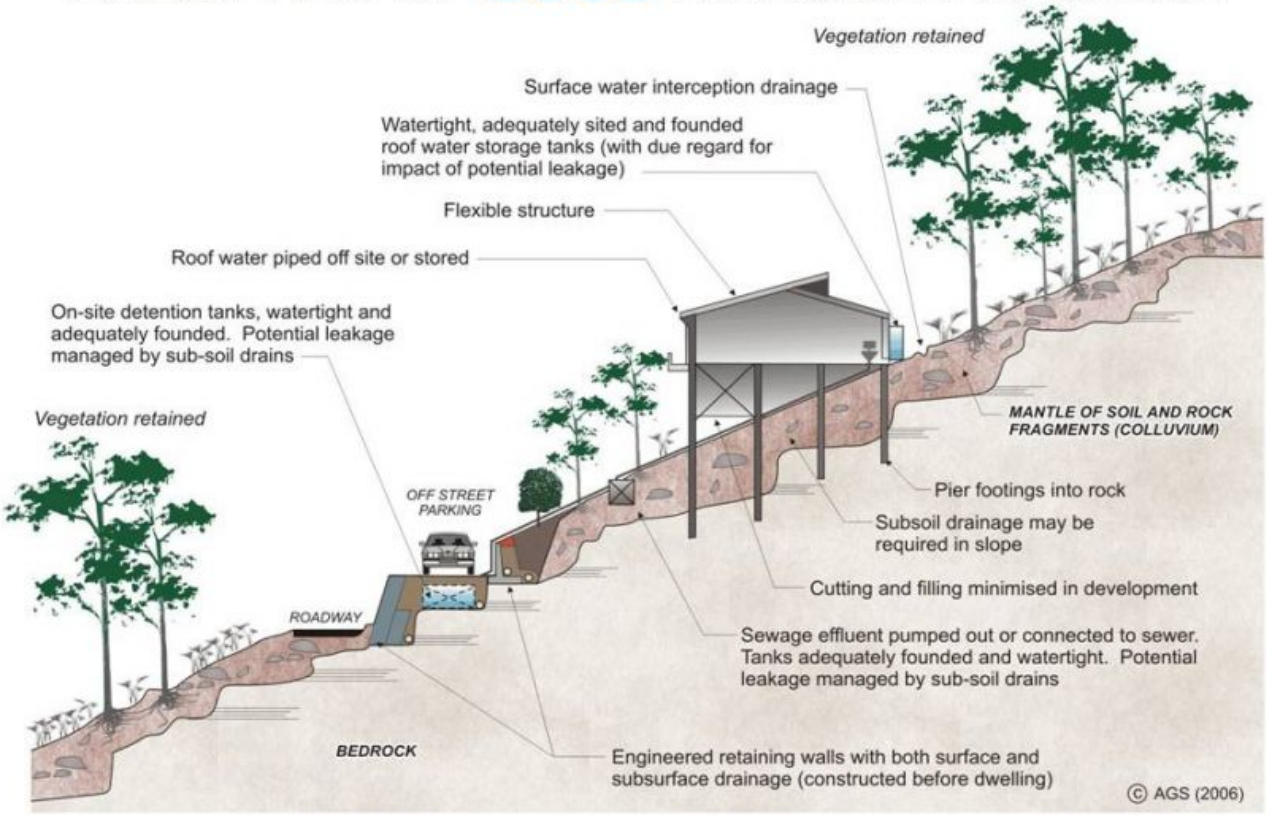
DRAFT 1 - 25/10/18

REVISION	DATE	REVISION NOTE

CLIENT: Colin & Emily Panagakis
DRAWING: Section
PROJECT: 15 Tutus St, Balgowlah Heights
Being LOT 16 in D.P. 9561
PROJECT NO: PAN 0518
ISSUE TYPE: DA1
DRAWN: PV
CHKD:
ISSUE DATE: 11/10/18
SHEET NO: A11
SCALE @ A2: 1:100
REVISION:

GENERAL NOTES: ALL RL'S SHOWN ARE FINISHED LEVELS, BUILDER TO PROVIDE SET DOWNS & ALLOWANCES AS REQUIRED. ALL OPENING DIMENSIONS ARE NOMINAL, BUILDER TO CHECK SIZES ON-SITE BEFORE ORDERING WINDOW AND DOOR UNITS.

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE