1 Tabalum Road, Balgowlah Heights

Geotechnical Comments for Section 4.55.

We have reviewed the existing geotechnical report, the original plans, and the 22 amended plans by Legend Design Studio, Project number MOO 0219, drawings numbered A00 to A02, A05, A07, A09 to A11, A13 to A17, A19, A21, A23 to A27, A36, and A37, Revision A, dated 21/6/21.

The changes are as follows:

- Extend the bin area on the garage floor level of the house.
- Partially extend and alter the layout of level 2.
- Clerestory roof extended to the W.

The proposed changes are considered minor from a geotechnical perspective and do not alter the recommendations or the risk assessment in the original report carried out by this firm numbered J2324 and dated the 22nd October, 2019.

White Geotechnical Group Pty Ltd.

Ben White M.Sc. Geol.,
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No. 222757
Engineering Geologist.

1 Tabalum Road, Balgowlah Heights

Geotechnical Comments for New DA.

We have reviewed the geotechnical report done by this firm for a previous DA and the 38 plans for a new DA by Sanctum Design, Project number MOO 0219, drawings numbered A00 to A37, Issue DA01, dated 20/1/20.

The new DA includes:

- Altering the layout of Level 1 of the proposed new dwelling.

The new proposed works for this DA have not increased the geotechnical risk, are considered minor from a geotechnical perspective, and do not alter the recommendations in the original report carried out by this firm numbered J2324 and dated the 22nd October, 2019.

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GEOTECHNICAL INVESTIGATION:

New House and Pool at **1 Tabalum Road, Balgowlah Heights**

1. Proposed Development

1.1 Demolish the existing house and construct a new four-storey house by excavating to a maximum depth of ~6.0m.

1.2 Demolish part of the existing pool and install a new pool on the downhill side of the property by excavating to a maximum depth of ~1.8m.

1.3 Details of the proposed development are shown on 37 drawings prepared by Sanctum Design, Project number MOO 0219, drawings numbered A00 to 36, Issue DA01, dated 21/10/19.

2. Site Description

2.1 The site was inspected on the 6th August, 2019.

2.2 This residential property is a corner block and has a SW aspect. It is on the downhill side of Tabalum Road and the uphill side of Cutler Road. It is located on the moderately graded upper middle reaches of a hillslope. The slope falls across the site at an average angle of ~13°. The slope above the property continues at more gentle angles. The slope below the property continues at similar angles.

2.3 At the road frontage to Tabalum Road, a concrete driveway runs to a carport attached to the uphill side of the house (Photo 1). Competent Medium Strength Sandstone bedrock was observed to be outcropping on both sides of this driveway (Photo 2). Between the road frontage and the house is a gently sloping garden area (Photo 3). At the road frontage to Cutler Road, a concrete driveway runs to a garage on the lower ground floor of the house (Photo 4). The cut for the driveway has been partially taken through outcropping sandstone (Photo 5). The remainder of the cut is supported by a timber retaining wall. The part three-storey rendered brick house was observed to be supported directly onto outcropping sandstone bedrock and will be demolished as part of the proposed works (Photo 6). A pool has been constructed on the downhill side of the property and will be partially demolished as part of the proposed works (Photo 7). A gently sloping lawn-covered fill has been placed around the pool and is supported by a stable sandstone block retaining wall ~4.0m high (Photo 8).

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 laminite lenses.

4. Subsurface Investigation

Six 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 and the results are as follows:

DCP RESULTS ON NEXT 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** (~RL76.4)	**DCP 2** (~RL75.6)	**DCP 3** (~RL73.4)	**DCP 4** (~RL71.9)	**DCP 5** (~RL72.0)	**DCP 6** (~RL68.8)
0.0 to 0.3	Rock Exposed at Surface	3	Rock Exposed at Surface	6	12	5
0.3 to 0.6		20		#	8	13
0.6 to 0.9		#			8	13
0.9 to 1.2					9	#
1.2 to 1.5					8	
1.5 to 1.8					7	
1.8 to 2.1					13	
2.1 to 2.4					18	
2.4 to 2.7					26	
2.7 to 3.0					17	
3.0 to 3.3					#	
		Refusal on Rock @ 0.6m		Refusal on Rock @ 0.2m	Refusal on Rock @ 2.8m	Refusal on Rock @ 0.9m

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

DCP Notes:

DCP1 – Rock exposed at surface.

DCP2 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, white sandstone fragments on dry tip.

DCP3 – Rock exposed at surface.

DCP4 – Refusal on rock @ 0.2m, DCP bouncing off rock surface, white impact dust on damp tip.

DCP5 – Refusal on rock @ 2.8m, DCP bouncing off rock surface, white sandstone fragments on wet tip.

DCP6 – Refusal on rock @ 0.9m, DCP bouncing off rock surface, white sandstone fragments on 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 natural sandy soils and firm to stiff sandy clays that fill the bench step formation. In the test locations, where rock was not exposed, it was encountered at depths of between 0.2 to 0.9m below the current surface, being deeper due to the stepped nature of the underlying bedrock. Relatively deep fill has been placed across the downhill side of the property for a level lawn and pool area. DCP5 was taken through this fill and encountered rock at a depth of 2.8m. The exposed sandstone across the site is estimated to be Medium Strength and a similar strength rock is expected to underly the entire site. 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 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 excavations.

7. Surface Water

No evidence of significant 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 Tabalum Road above.

8. Geotechnical Hazards and Risk Analysis

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

(**Hazard One**). The vibrations from the proposed excavations and pool demolition are a potential hazard (**Hazard Two**). A loose boulder, wedge, or similar geological defect toppling onto the work site during the excavation process is a potential hazard (**Hazard Three**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The moderate slope that falls across the property and continues below failing and impacting on the property.	The vibrations produced during the proposed excavations and pool demolition impacting on the surrounding structures (Photo 8).	A loose boulder, wedge, or similar geological defect toppling onto the work site during the excavation process.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (15%)	'Medium' (30%)
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	1.2×10^{-3}/annum
COMMENTS	'ACCEPTABLE' level of risk to life & property.	This level of risk to 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.

(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 Cutler Road. Roof water 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 ~6.0m is required to construct the garage level of the proposed house. The excavation is expected to be through a maximum of ~0.6m of topsoil over Medium Strength Sandstone.

Another excavation to a maximum depth of ~1.8m is required to install the proposed pool on the downhill side of the property. This excavation is expected to be taken entirely through fill.

It is envisaged that excavations through fill and sandy soil can be carried out with a bucket and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through fill and sandy soil will be below the threshold limit for building damage. The majority of the proposed excavation for the garage level is expected to be through Medium Strength Sandstone.

Excavations through Medium Strength Sandstone or better should be carried out to minimise the potential to cause vibration damage to the N neighbouring house. The supporting walls of the neighbouring house to the N will be as close as ~5.0m from the N edge of the proposed excavation. Close controls by the contractor over rock excavation are recommended so excessive vibrations are not generated.

Additional vibrations may be caused by the partial demolition of the existing pool to install the new pool. The demolition of the existing pool will be immediately beside the sandstone block retaining wall at the lower boundary of the property (Photo 8).

Excavation and demolition methods are to be used that limit peak particle velocity to 10mm/sec at the common boundaries and sandstone block retaining wall. 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 10mm/sec at the common boundaries using the method provided the saw cuts are kept well below the rock to broken. The portion of the existing pool that needs to be demolished is to be cut up with rock saws and removed without the use of rock hammers if the work will be carried out without vibration monitoring.

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

13. Excavation Support Requirements

Bulk Excavation for Garage Level of Proposed House

Due to the shallow depth of the sandstone and setbacks from the common boundaries and road reserves, no structures or boundaries will be within the zone of influence of the excavation. In this instance, the zone of influence is the area above a theoretical 30° line through fill and soil, and a 45° line through clay from the top of Medium Strength Sandstone towards the surrounding structures and boundaries.

The excavation through soil is to be scraped back from the excavation line at least 0.5m and battered at 1.0 Vertical to 1.7 Horizontal (30°) prior to the excavation through rock commencing. Excavations through Medium Strength Sandstone or better will stand at vertical angles unsupported subject to approval by the geotechnical consultant.

During the excavation process, the geotechnical consultant is to inspect the cut faces in 1.5m intervals as they are lowered or after encountering softer sections of rock, while the machine is on site to ensure the ground materials are as expected and no wedges or other geological defects are present that could require additional support. Should any weak sections of rock be encountered, works are to stop until temporary or permanent support such as rock anchors, bolts, sprayed concrete, or similar support designed by the structural engineer is installed in consultation with the geotechnical consultant.

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

Bulk Excavation for the Proposed Pool

The proposed pool excavation will be taken mostly through fill and partially through the existing pool. The proposed pool excavation will be immediately beside the sandstone block retaining wall at the lower boundary of the property (Photo 8). The work will need to be carried out with care so as not to damage the existing wall. Depending on the construction technique, the wall may need to be propped or lowered as necessary to avoid damage from the proposed works.

The remaining cut faces of the proposed pool excavation will stand at near-vertical angles for short periods of time until the pool structure is installed, provided the cut batters are kept from becoming saturated.

Advice Applying to Both Excavations

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. Unsupported cut batters through fill and soil 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. The materials and labour to construct the retaining walls/pool structure 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.

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 pressure 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
Fill and Sandy Soil	20	0.4	0.55
Medium Strength Sandstone	24	0.00	0.01

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, do not account for any surcharge loads, and assume retaining structures are fully drained. Rock strength 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

A concrete slab supported directly off Medium Strength Sandstone is a suitable footing for the proposed house. This material is expected to be exposed across most of the base of the excavation. Where it is not exposed, and where the footprint of the proposed house does not fall over the excavation, piers will be required to maintain a uniform bearing material.

Piers supported off Medium Strength Sandstone are suitable footings for the proposed pool. This material is expected at a maximum depth of ~4.0m below the current ground surface due to the fill in this location.

A maximum allowable bearing pressure of 1000kPa 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.

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.

- During the excavation process, the geotechnical consultant is to inspect the cut faces in 1.5m intervals as they are lowered to ensure ground materials are as expected and that there are no wedges or other defects present in the rock that may require additional support.

- 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.,
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Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

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

NOTES:

1) CAUTION: SHOULD ANY DEVELOPMENT OR CONSTRUCTION BE PLANNED ON OR NEAR THE BOUNDARIES, THE BOUNDARIES SHOULD BE CLEARLY MARKED ON SITE.

2) AREA AND DIMENSIONS HAVE BEEN SURVEYED FROM PLANS MADE AVAILABLE AT LAND REGISTRY SERVICES.

3) ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM P.M. 33346 RL 75.529 A.H.D.

4) TREE SPREADS ARE DIAGRAMMATIC ONLY AND ARE NOT SYMMETRICAL.

5) UNDERGROUND (NON VISIBLE) SERVICE LINES HAVE BEEN SHOWN FROM "DIAL BEFORE YOU DIG" SERVICE AUTHORITY RECORDS & ARE DIAGRAMMATIC ONLY IN REGARD TO THEIR POSITION & WIDTH UNLESS STATED OTHERWISE.

6) SPOT LEVELS ARE ACCURATE.

7) BEARINGS SHOWN ARE ON TRUE NORTH.

TRUE NORTH

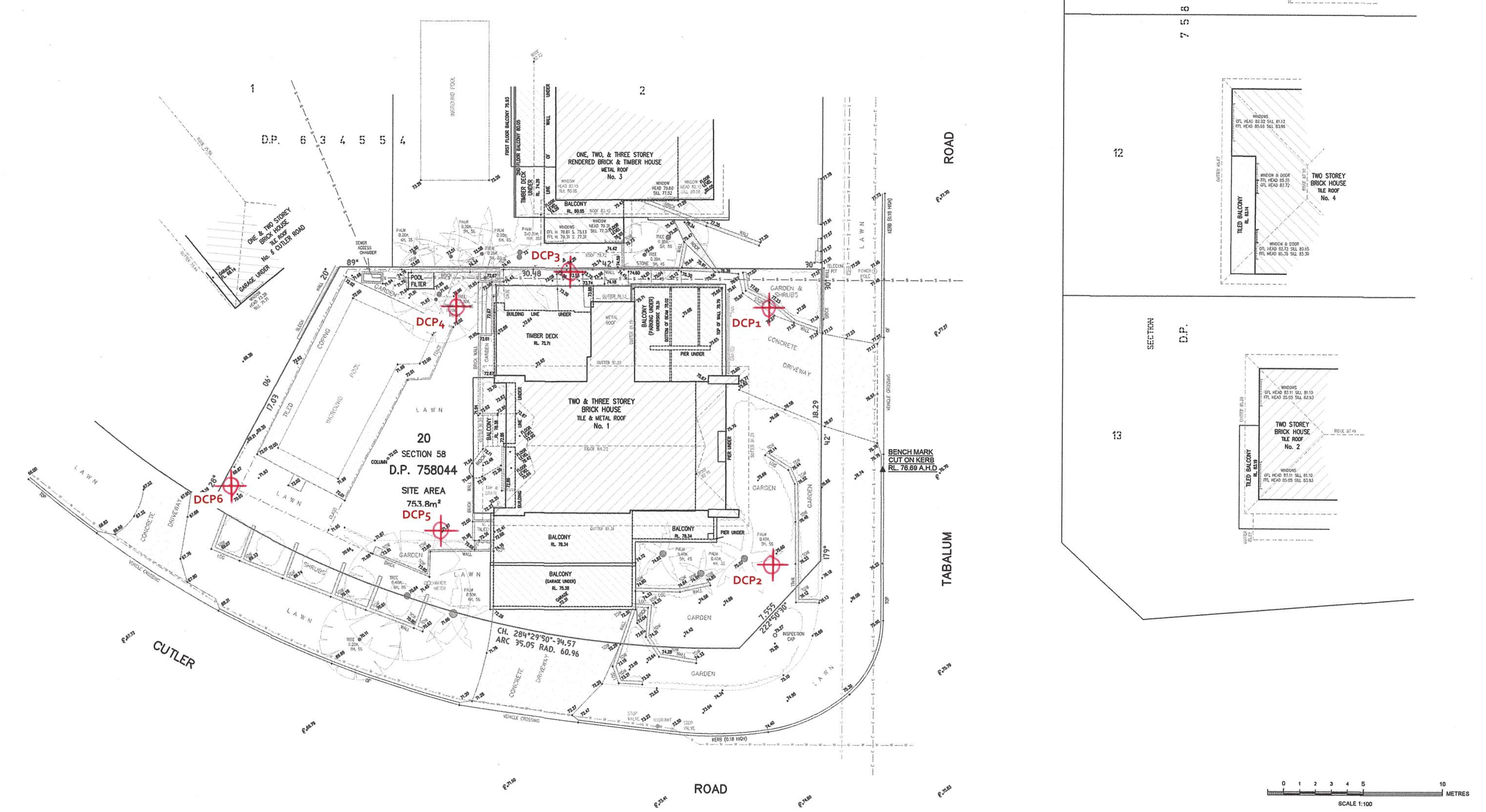
www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

INVESTIGATION OF "DIAL BEFORE YOU DIG" UNDERGROUND SERVICES HAS BEEN MADE, DETECTION OF UNDERGROUND SERVICES IS NOT AN INTEGRAL PART OF THIS SURVEY. ALL RELEVANT AUTHORITIES SHOULD BE NOTIFIED PRIOR TO ANY EXCAVATION ON OR NEAR THE SITE

DEVELOPERS & EXCAVATORS MAY BE HELD FINANCIALLY RESPONSIBLE BY THE ASSET OWNER SHOULD THEY DAMAGE UNDERGROUND NETWORKS.

CARELESS DIGGING CAN:
- CAUSE DEATH OR SERIOUS INJURY TO WORKERS AND THE GENERAL PUBLIC
- INCONVENIENCE USERS OF ELECTRICITY, GAS, WATER AND COMMUNICATIONS
- LEAD TO CRIMINAL PROSECUTION AND DAMAGES CLAIMS
- CAUSE EXPENSIVE FINANCIAL LOSSES TO BUSINESS
- CUT OFF EMERGENCY SERVICES
- DELAY PROJECT COMPLETION TIMES WHILE THE DAMAGE IS REPAIRED

MINIMISE YOUR RISK AND DIAL BEFORE YOU DIG.
TEL. 1100



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LEGEND

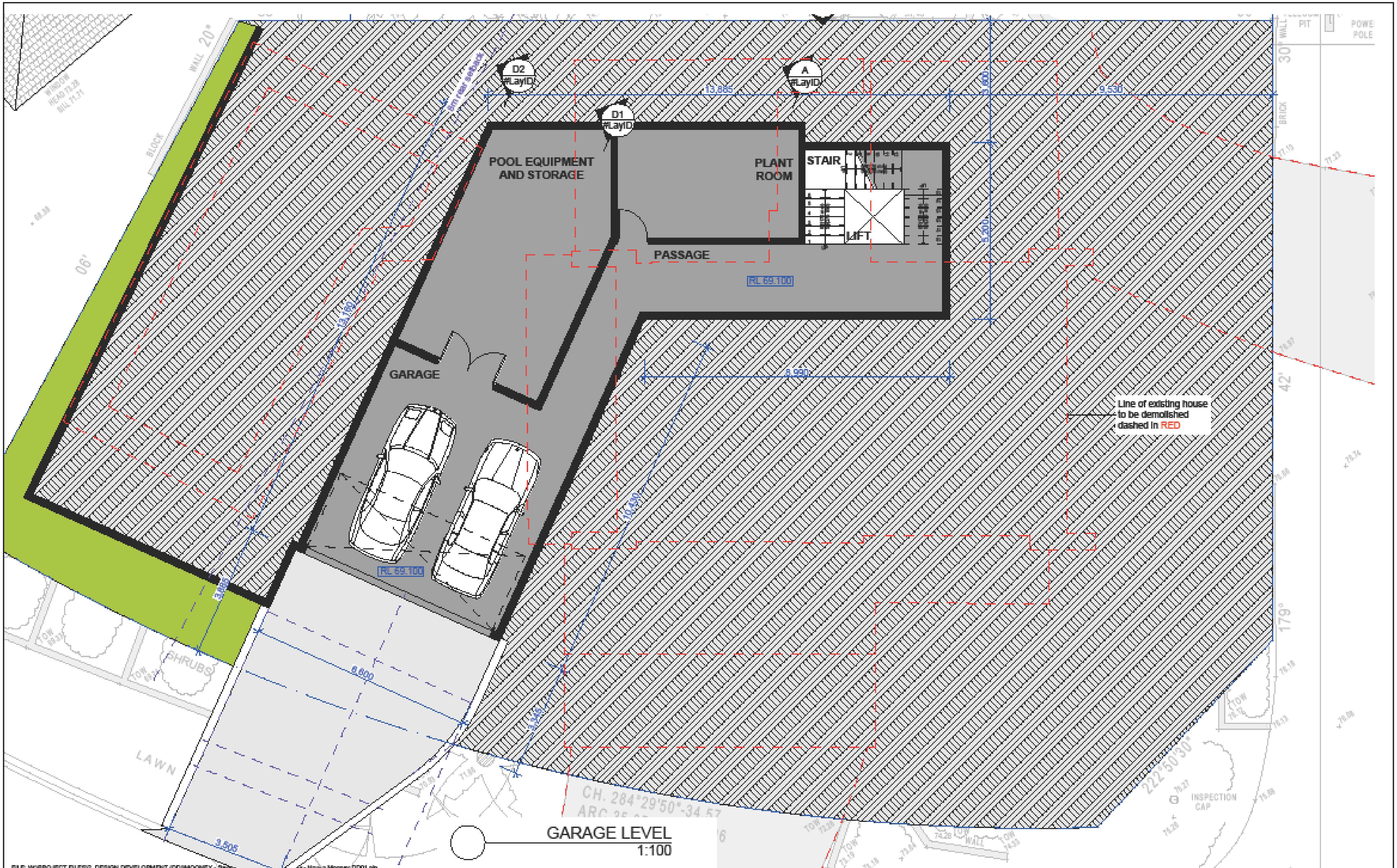
TREE 0.40∅, 5H, 4S	DENOTES APPROX. 0.40m DIAMETER OF TREE; DENOTES APPROX. 5m HEIGHT OF TREE; DENOTES APPROX. 4m SPREAD OF TREE
℄	DENOTES CENTRE LINE OF ROAD
GUTTER	DENOTES TOP OF GUTTER
TOW	DENOTES TOP OF WALL

OVERHEAD ELECTRIC LINES
BOARDS SEWER
TELECOMMUNICATION LINES
WATER LINES
GAS LINES

PLAN SHOWING BOUNDARIES, RELATIVE HEIGHTS & PHYSICAL FEATURES OVER LOT 20 SECTION 58 IN D.P. 758044 KNOWN AS No. 1 TABALUM ROAD, BALGOWLAH HEIGHTS.

L.G.A.: NORTHERN BEACHES

CLIENT	Mr K. MOONEY			REF No.	17288
PROPERTY	No. 1 TABALUM ROAD, BALGOWLAH HEIGHTS				
DATUM	A.H.D.	SCALE	1:100 @ B1	DATE 20/05/2019	SHEET No. 1 of 1
SURVEYED	A.M./B.W.	DRAWN	J.M.	DWG No. 17288A	REV No. 00



GARAGE LEVEL
1:100

FILE: W:\PROJECT FILES\2. DESIGN DEVELOPMENT (DD)\MOONEY - ... House Mooney DD01.pln

N	Revision	Date	Revision Note

General Notes:

Project: New Dwelling	Drawing: GARAGE		
Client: Kevin Mooney	Project #: MOO 0219	Issue Type:	DD01
	Original Sheet Size: A3	Issue Date:	4/09/2019
Address: 1 Tabalum Rd, Balgowlah Heights Lot 20, Section 58, DP 758044	Scale @ A3: 1:100	Sheet #: A 05	Revision:
	Chkd:	Drawn:	

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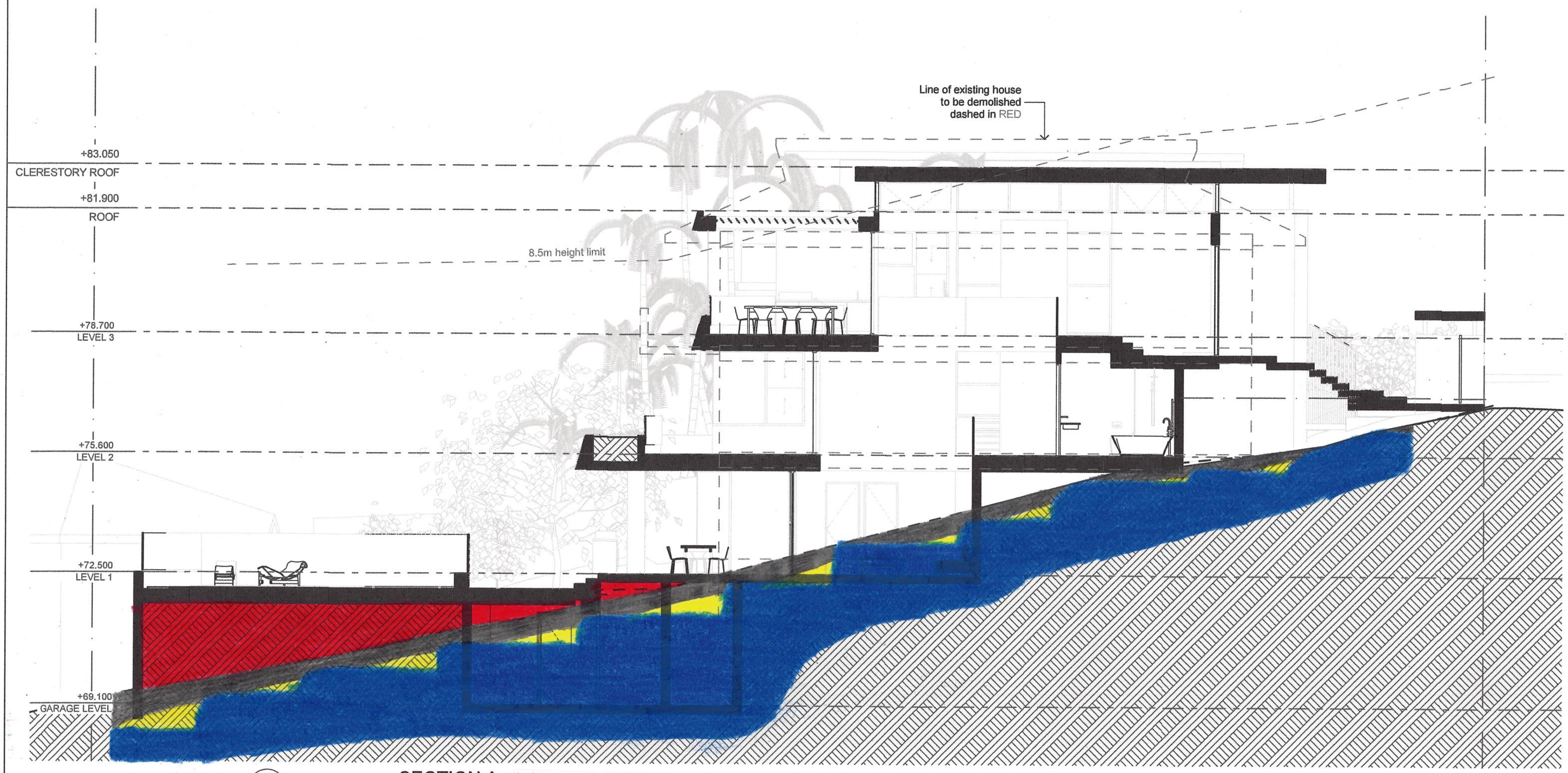
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



SECTION A
1:100

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

FILE: W:\PROJECT FILES\2. DESIGN DEVELOPMENT (DD)\MOONEY - Balgowlah Heights\MOO 0219 - House Mooney DD01.pln

N

Revision	Date	Revision Note

General Notes:

Project: **New Dwelling**

Client: **Kevin Mooney**

Address: **1 Tabalum Rd, Balgowlah Heights**
Lot 20, Section 58, DP 758044

Drawing: **SECTION A**

Project #:	MOO 0219	Issue Type:	DD01
Original Sheet Size:	A3	Issue Date:	4/09/2019
Scale @ A3:	1:100	Sheet #:	A 10
		Revision:	
Chkd:		Drawn:	

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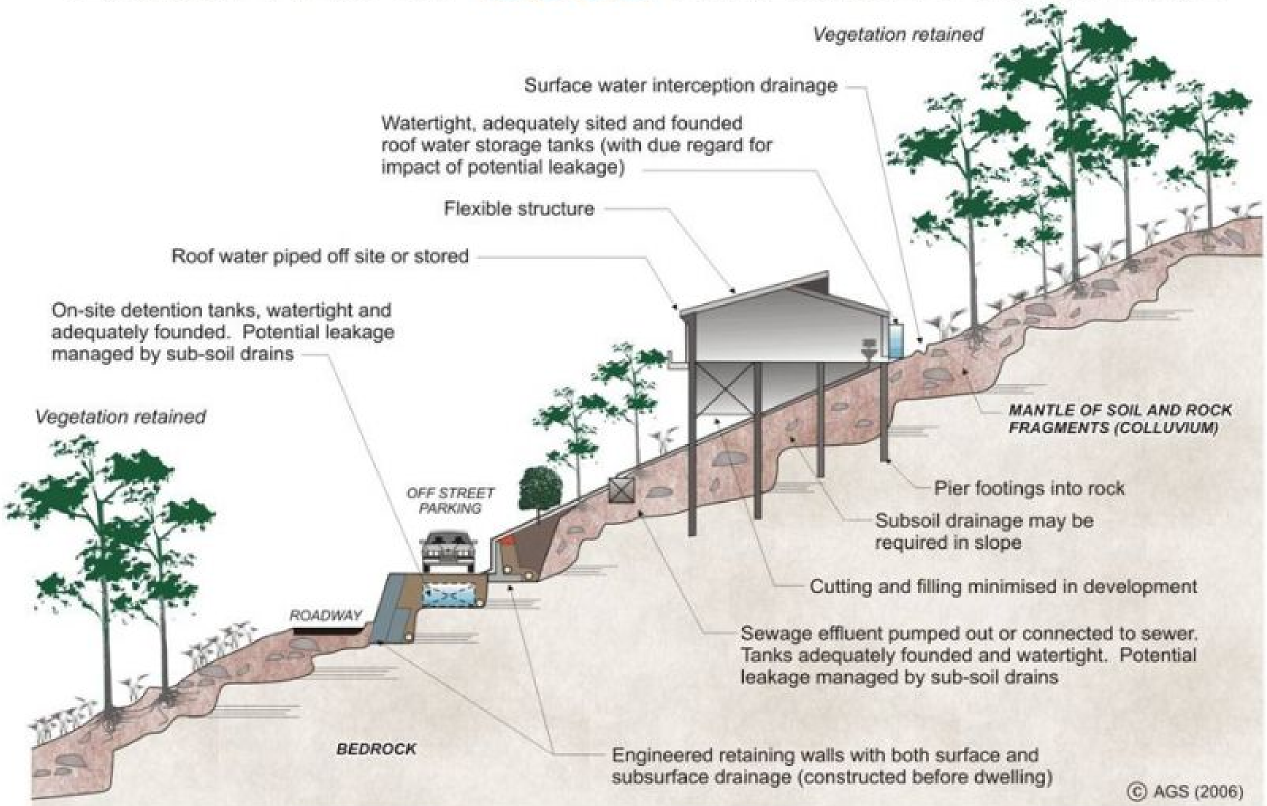
Principal: James Cooper. Member BDANSW
Nominated Architect, Ian Bassett NSW Reg. No. 6987

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE