18 Alexander Street, Collaroy

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 19 drawings prepared by Walsh[2] Architects, drawings numbered DA000, 010, 101 to 103, 111 to 113, 123, 200, 300, 401, 500, 502, 503, 511 to 513, and 800, Revision A, dated 10/2/20.

The changes relate mainly to the site usage and the proposed structures are very similar. As such, the changes to the plans are minor from a geotechnical perspective and do not alter the recommendations or the risk assessment in the report carried out by this firm numbered J2125 and dated the 4th April, 2019.

White Geotechnical Group Pty Ltd.

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

GEOTECHNICAL INVESTIGATION:

New House and Pool at **18 Alexander Street, Collaroy**

1. Proposed Development

1.1 Subdivide the property into two separate lots.

1.2 Demolish the majority of the existing house and construct a new house over and a secondary dwelling on the W lot.

1.3 Construct a new part three storey house and secondary dwelling on the E lot by excavating to a maximum depth of ~2.2m into the slope.

1.4 Details of the proposed development are shown on 15 drawings prepared by Walsh[2] Architects, drawings numbered DA005, DA010, 100, 101, 102, 111, 112, 121, 122, 200, 201, 300 to 302, 401, dated 24/1/2019.

2. Site Description

2.1 The site was inspected on the 5th March, 2019.

2.2 This residential property is on the high side of the road and has a north easterly aspect. The block is positioned on the gently graded lower reaches of a hill slope that rises to Collaroy Plateau. The natural southerly slope rises evenly across the property at gentle angles that do not exceed ~7°. The slope below the property eases towards the foot of the slope. The slope above the property continues at similar angles.

2.3 At the road frontage, a concrete driveway runs to a garage beneath the house (Photo 1). A free standing studio is located beside the driveway (Photo 2). A gravel driveway runs up the slope to a car parking space on the E side of the studio (Photo 3). The area between the road frontage and the house is otherwise densely vegetated (Photo 4). The majority of the part three storey brick house will be demolished as part of the proposed works (Photo 5). A stable timber retaining wall reaching a maximum height of ~1.0m terraces the slope on the E side of the house. The wall retains a fill that levels a lawn area above (Photo 6). A near level lawn area rises from the uphill side of the house to a stable ~0.5m high sandstone block retaining wall along the uphill boundary (Photo 7). A recently constructed pool in the SW corner of the property is in good condition with no signs of cracking or movement in the pool shell (Photo 8). No signs of movement were observed on the grounds. The adjoining neighbouring properties were observed to be in good order as seen from the road and the subject property. No geotechnical hazards were observed on these properties that could impact on the 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

One Hand Auger Hole (AH) was put down to identify the ground materials. Six DCP (Dynamic Cone Penetrometer) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The locations of the tests are shown on the site plan. 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:

SEE OVER THE PAGE FOR AUGER HOLE ONE

AUGER HOLE 1 (~RL12.4) **–** AH1 (Photo 11)

Depth (m)	Material Encountered
0.0 to 0.1	**FILL**, disturbed sandy soil, light brown, loose, fine to medium grained, organic matter, dry.
0.1 to 0.6	**SANDY SOIL**, dark brown, rock fragments, fine to medium grained, loose, dry.
0.6 to 0.8	**SAND**, light grey, loose, fine to medium grained, dry.
0.8 to 0.9	**SAND**, light tan, loose, fine to medium grained, dry.
0.9 to 1.3	**SANDY CLAY**, orange with yellow and grey mottling, firm to stiff, fine to medium grained, dry.
1.3 to 1.4	**SANDY CLAY**, orange with yellow and grey mottling, stiff, fine to medium grained, dry.

End of test @ 1.4m in sandy clay. No watertable encountered.

SEE OVER THE PAGE FOR DCP TEST RESULTS

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** (~RL10.2)	**DCP 2** (~RL9.8)	**DCP 3** (~RL10.2)	**DCP 4** (~RL11.4)	**DCP 5** (~RL12.4)	**DCP 6** (~RL11.6)
0.0 to 0.3	13	7	4	5	2	4
0.3 to 0.6	30	10	10	5	6	6
0.6 to 0.9	27	10	15	18	15	5
0.9 to 1.2	17	9	15	13	7	11
1.2 to 1.5	28	15	20	20	12	13
1.5 to 1.8	48	18	16	40	15	18
1.8 to 2.1	#	17	23	#	22	22
2.1 to 2.4		16	19		28	35
2.4 to 2.7		24	28		51	#
2.7 to 3.0		28	35		#	
3.0 to 3.3		48	#			
3.3 to 3.6		#				
	End of Test @ 1.8m	End of Test @ 3.3m	End of Test @ 3.0m	End of Test @ 1.8m	End of Test @ 2.7m	End of Test @ 2.4m

#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 @ 1.8m, DCP bouncing off rock surface, brown and white sandstone fragments on dry tip.

DCP2 – End of test @ 3.3m, DCP bouncing off rock surface, white impact dust on dry tip, brown clay in collar above tip.

DCP3 – End of test @ 3.0m, DCP bouncing off rock surface, white sandstone fragments on dry tip.

DCP4 – End of test @ 1.8m, DCP bouncing off rock surface, yellow sand on wet tip.

DCP5 – End of test @ 2.7m, DCP bouncing off rock surface, clean dry tip, brown clay in collar above tip.

DCP6 – End of test @ 2.4m, DCP bouncing off rock surface, white impact dust on dry tip.

5. Geological Observations/Interpretation

The slope materials are colluvial at the near surface and residual at depth. In the test locations, the ground materials consist of a fill and sandy topsoil over sand to a depth of ~0.9m over firm to stiff sandy clays. The sandy clays merge into the underlying weathered rock at an average depth of ~1.7m below the current ground surface. The weathered zone is interpreted to be Extremely Low Strength Shale that becomes progressively stronger with depth. This ground material is clay like when cut up by excavation equipment. Fill was encountered to a maximum depth of ~0.6m on the E side of the house. 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 excavation.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. Normal sheet wash will move onto the site from the slope above during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below, or beside the property. The proposed excavation undercutting the E neighbouring house walls is a potential hazard (**Hazard One**). The proposed excavation collapsing onto the worksite before retaining walls are in place is a potential hazard (**Hazard Two**).

SEE OVER THE PAGE FOR HAZARD RISK ANALYSIS SUMMARY

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The proposed excavation undercutting the neighbouring house to the E, causing failure in the supporting walls of the neighbouring house (Photos 9 & 10).	The proposed excavation collapsing onto the worksite and impacting on the E neighbouring property before retaining walls are in place.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Minor' (15%)	'Medium' (20%)
RISK TO PROPERTY	'Moderate' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	6.6×10^{-7}/annum	6.8×10^{-4}/annum
COMMENTS	This level of risk to property is '**UNACCEPTABLE**'. To move the risk levels to acceptable levels the recommendations in **Section 13** are to be followed.	This level of risk to life and property is '**UNACCEPTABLE**'. To move the risk levels 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 Alexander Street. 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 ~2.2m is required to install the proposed house on the E lot. The excavation is expected to be through a shallow fill and soil, over sand and clay. It is envisaged that excavations through fill, sandy soil, sand, and clays can be carried out with an excavator and bucket.

12. Vibrations

No excessive vibrations will be generated by excavation through soil, sand, clay or Extremely Low Strength Shale.

13. Excavation Support Requirements

Apart from footings, no excavations are required for the new house on the lot to the W. The excavation for the proposed new house on the E lot will be a maximum depth of ~2.0m high on the uphill side and will decrease to a minimum height to ~1.0m across the footprint of the proposed new house. Accounting for back wall drainage, the entire excavation will be as close as ~0.4m from the E common boundary, between ~1.2m to 1.8m from the E neighbouring house and 0.8m from the garage attached to the neighbouring house. It will be ~1.3m from the remaining supporting walls of the existing house. Thus, the E common boundary, neighbouring house, and remaining walls of the existing house 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, soil, and sand, and a 45° line through clay from the base of the excavation, towards the surrounding structures and boundaries.

Due to the depth of the excavation and its close proximity to the boundary, the portion of the excavation that runs parallel with the E neighbouring house is to be supported before any excavations commence with secant or contiguous piers or similar. Secant piers are the preferred option but, if contiguous piers are used, the gaps between the piers are to be grouted closed as the excavation is lowered, so no fill, sandy soil, or sand moves through the wall. The piers can be temporarily supported by embedment below the base of the excavation. For ease of design and construction, piers may be installed around the entire perimeter of the excavation. The required piling is shown in blue on the Site Plan attached. If the required excavation for the proposed driveway exceeds 0.5m deep the piling will need to extend to the N end of the neighbouring garage. To drill the pier holes for the wall, a powerful excavator or small pilling rig that can excavate through medium strength rock will be required. If a machine of this type is not available, we recommend carrying out core drilling before the construction commences to confirm the strength of the rock, and to ensure the excavation equipment is capable of reaching the required depths. The retaining wall is to be tied into the concrete floor and ceiling slabs of the garage to permanently brace the retaining wall.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all the piers before any concrete is placed.

The remaining cut batter of the excavation along the E common boundary will require temporary support If it is not piled along the entire extent. Braced form ply or sprayed concrete or similar suitable support. The support is to be designed/approved by the structural engineer. The temporary support is to remain in place until retaining walls are built.

The W side of the excavation will be as close as ~1.3m from the remaining supporting walls of the existing house. Only where the excavation extends beyond a depth of 1.3m does the excavation have the potential to undercut the remaining walls of the house. This accounts for ~0.4m of the wall parallel with the excavation, and the SE corner of the house.

We think it likely the footings of the subject house are supported on sand. This is to be confirmed with small pits dug by the builder beside the structures to expose the footing material. Upon completion, the pits are to be inspected by the geotechnical consultant to confirm the footing material. If these structures are founded on rock or are taken below the base of the proposed excavation, no additional support is required. If the foundations do not reach these depths, and are within the zone of influence of the excavation, they are to be underpinned to below the base of the excavation, or rock whichever is encountered first, prior to the bulk excavation commencing.

If underpinning is required, it is to follow an underpinning sequence as specified by the structural engineer. In no circumstances is the bulk excavation to be taken to the edge of the house wall or footing and then underpinned. The underpins are to be carried out in drives pushed forward from beyond the zone of influence following the underpinning sequence. Under pins should not exceed 0.6m in width. Allowances are to be made for drainage through the underpinning to prevent a build-up of hydrostatic pressure. Underpins that are not designed as retaining walls are to be supported by retaining walls. The void between the retaining walls and the underpinning is to be filled with free draining material, such as gravel.

Due to the depth of the excavation, this option may prove to be difficult. Alternatively, for ease of design and construction, piers may be extended around this portion of the cut.

The remaining unsupported sides of the excavation through fill, soil and sand are to be battered temporarily at 1.0 Vertical:2.0 Horizontal (30°). Excavations through natural firm to stiff clay and Extremely Low Strength Shale will stand unsupported for a short period of time until the retaining walls are in place provided they are kept from becoming saturated.

During the excavation process, the geotechnical consultant is to inspect the cut in 1.5m intervals as it is lowered, while the machine/excavation equipment is on site, to ensure the ground materials are as expected and no additional temporary support is required.

Unsupported cut batters through fill, 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.

Excavation spoil is to be removed from site.

14. Retaining Walls

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	Passive
Sandy Soil, Fill and Sand	20	0.40	0.55	N/A
Residual Clays	20	0.35	0.45	Kp2
Extremely Low Strength Shale	22	0.30	0.40	400 kPa Ultimate

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

It is to be noted that the earth pressures in Table 1 do not account for any surcharge loads, assume the surface above the wall is near level, and retaining walls are fully drained. It should be noted that passive pressure is an ultimate value and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. 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.

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.

15. Foundations

A concrete slab and shallow piers supported directly off Extremely Low Strength Shale are suitable footings for the proposed houses and secondary dwellings. This ground material is expected at a maximum depth of ~2.7m below the current ground surface. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low Strength Shale.

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

- The geotechnical consultant is to inspect the drilling process of the entire first pile of the retaining walls, and the ground materials at the base of all the piers before any concrete is placed.

- The geotechnical consultant is to inspect the cut as it is lowered to a depth of 1.5m, while the machine/excavation equipment is on site, to ensure the ground materials are as expected and no temporary support is required.

- 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.

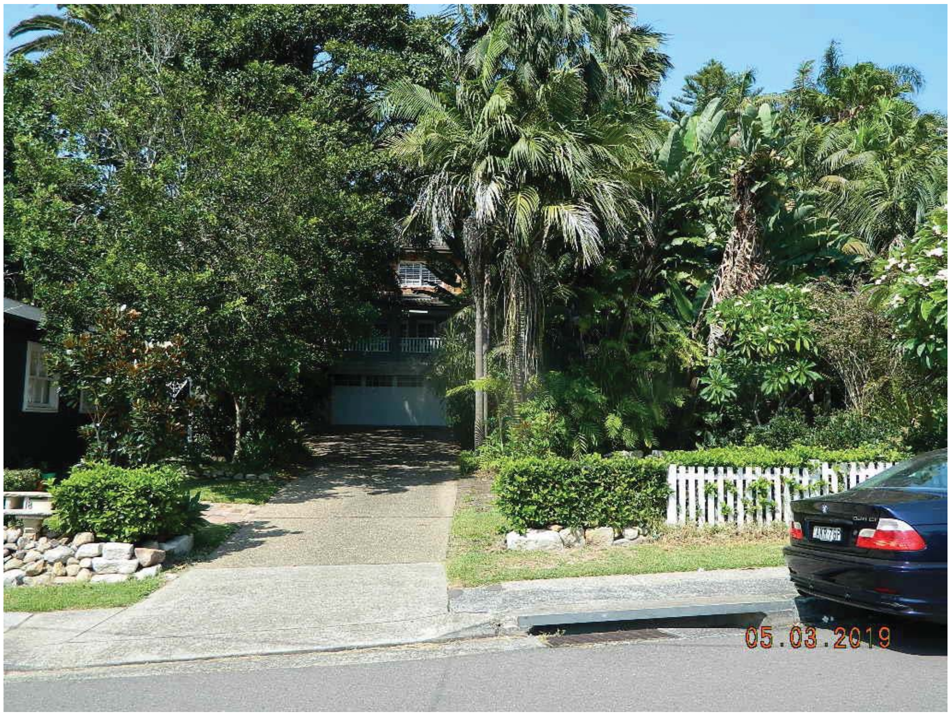


Photo 1

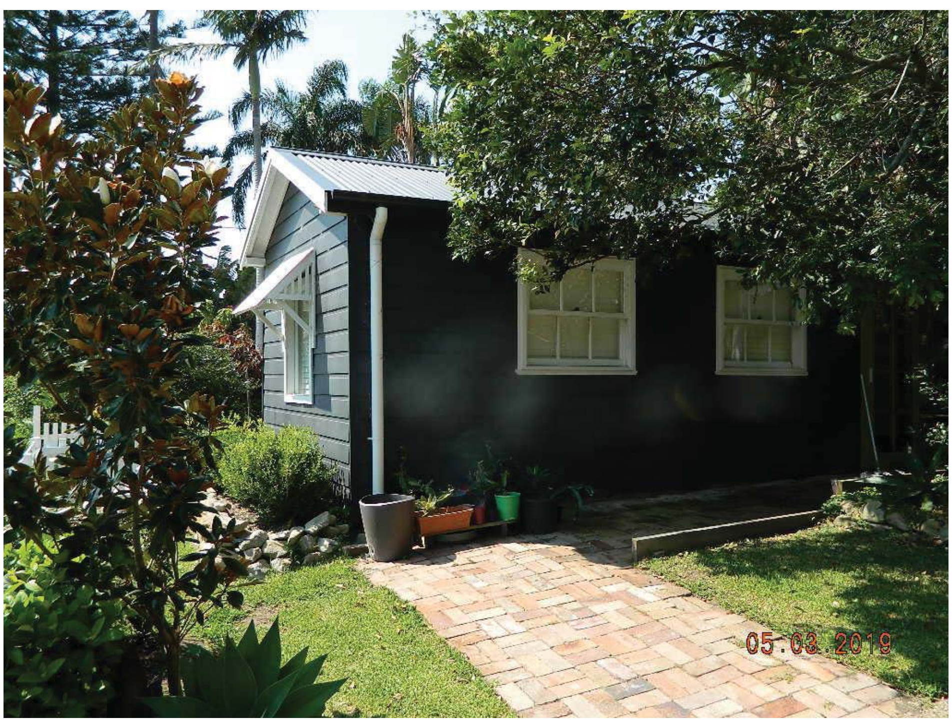


Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

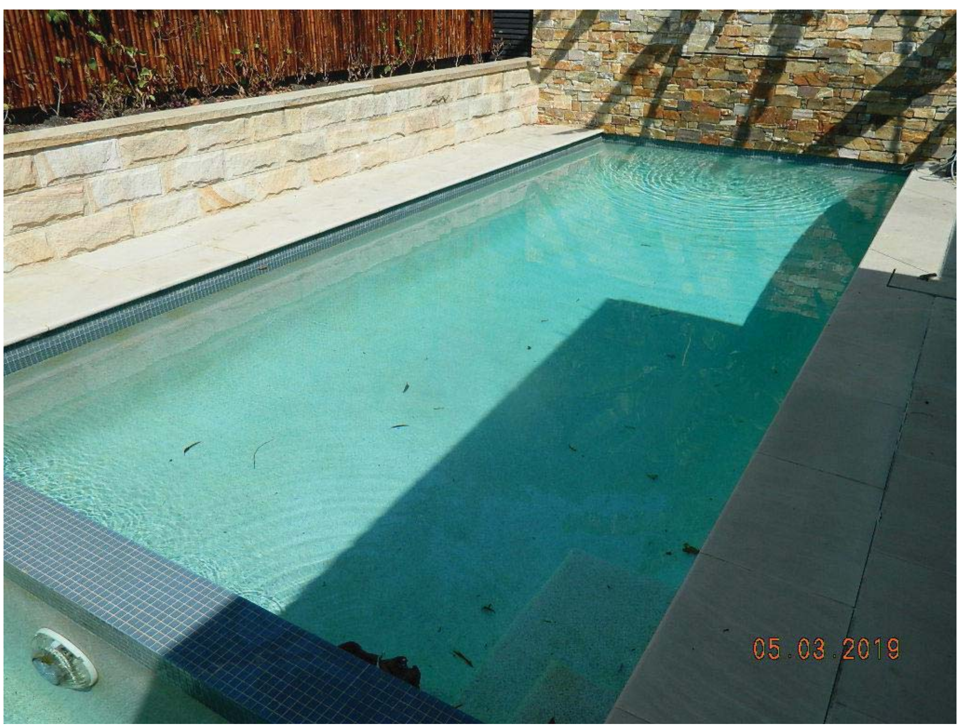


Photo 8

Photo 9

Photo 10

Photo 11: Auger Hoe 1: The base of auger hole is at the base of the image.

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.

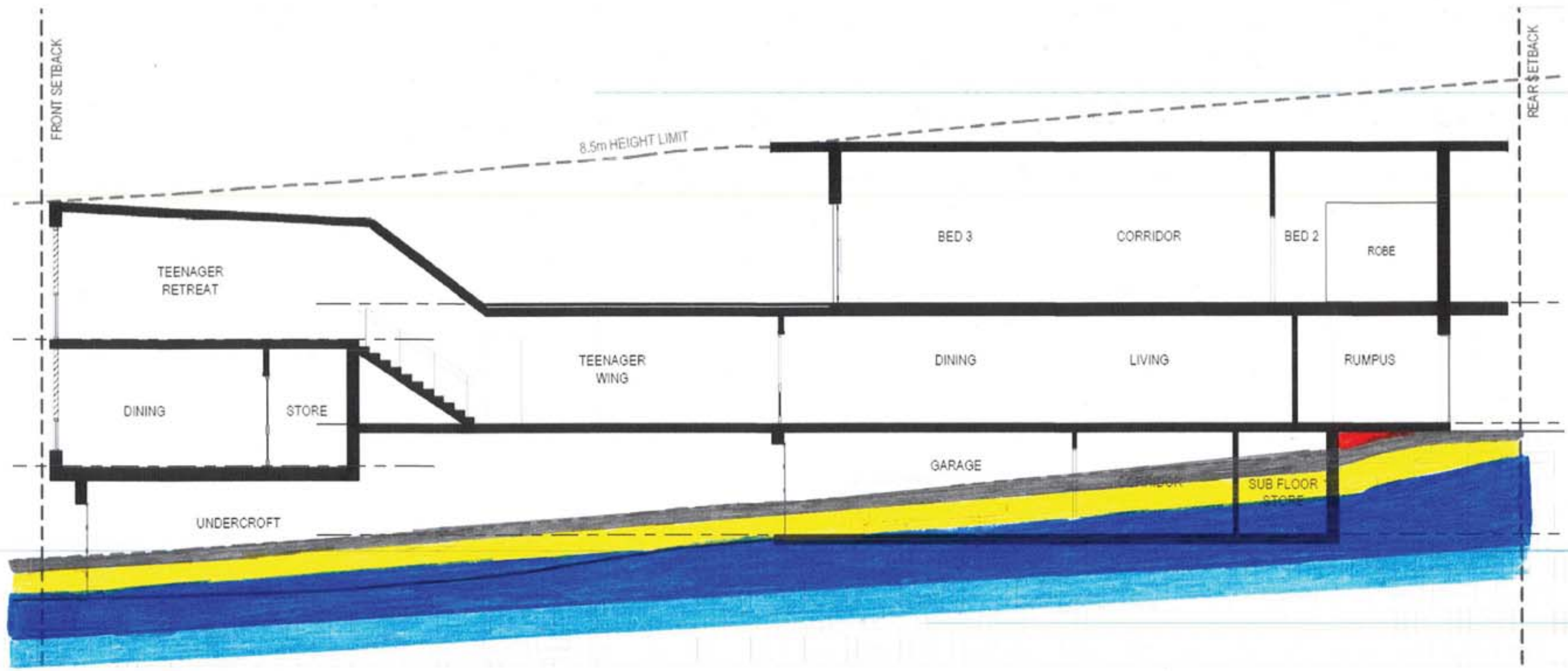
- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report, contact White Geotechnical Group. We are familiar 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

Project: ALTS + ADDS 18 ALEXANDER STREET COLLAROY Client: BRENDAN & SIMONE WAIGHTS	Walsh² Architects	Nominated Architect: Scott ACT 2624 NSW 10366 scott@walsharchitects.com.au 0466 049 880	Scale 1 : 100 @ A1	Sheet Name GARAGE & GROUND FLOOR PLANS	Number DA121	Rev. 3

No.	Description	Date
1	PRELIMINARY	18.12.18
2	PRELIMINARY	09.01.19
3	95% SET - FOR DA CLIENT REVIEW	24.01.19

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



1 SECTION 6
DA201 1 : 100 @ A1

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

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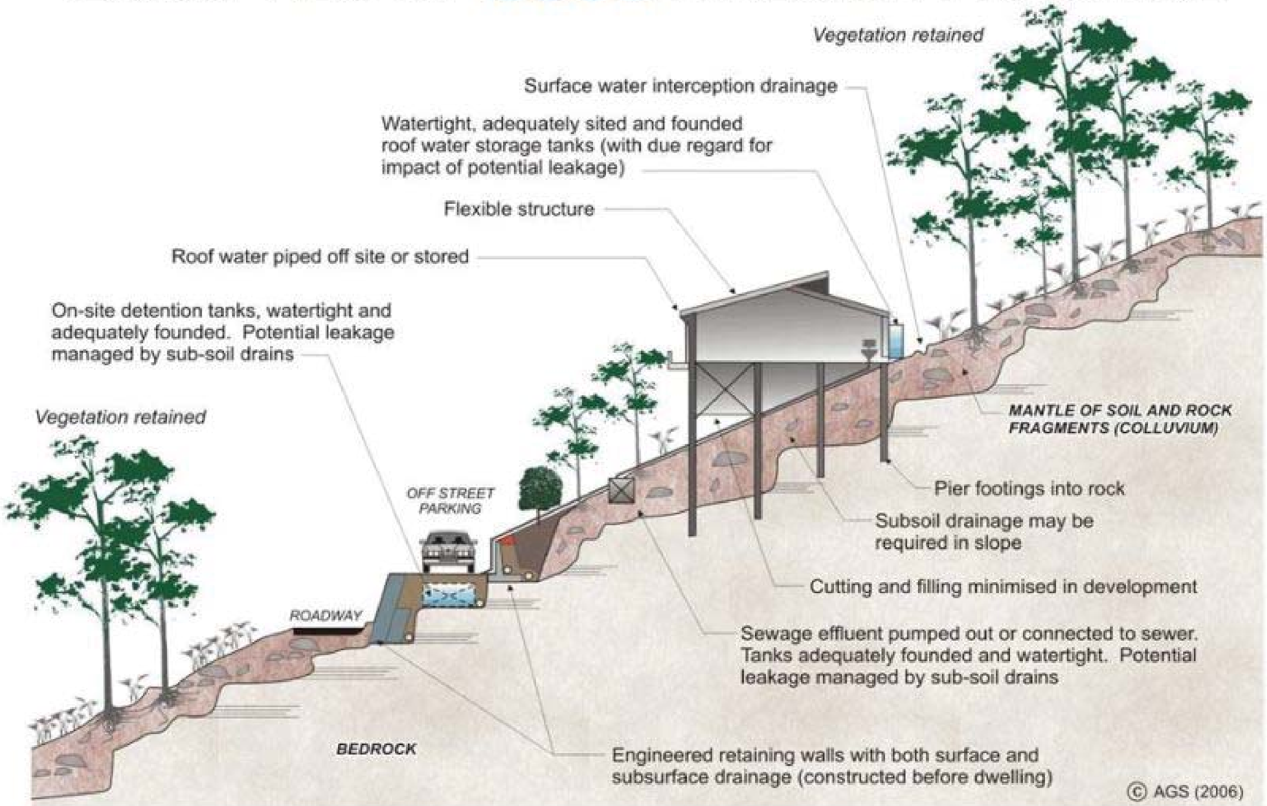
No.	Description	Date	Rev.
1	95% SET - FOR DA CLIENT REVIEW	24.01.19	1

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE