GEOTECHNICAL INVESTIGATION:

New House, Granny Flat & Studio at **4 Southern Cross Way, Allambie Heights**

1. Proposed Development

1.1 Demolish the existing house.

1.2 Construct a new three storey house by excavating to a maximum depth of ~2.1m.

1.3 Construct a suspended driveway connecting the road frontage to the middle level of the proposed new house.

1.4 Construct a new granny flat and studio on the downhill side of the property.

1.5 Details of the proposed development are shown on 7 drawings prepared by Sabton & Son. Drawings numbered PR020.03 page 1 to 5 are dated 10/4/2020 dated and drawings numbered PR020.03 page 01a and page 01b are undated. Additional details of the proposed development are shown on 1 landscape drawing prepared by Dayspring Landscaping, drawing number L/D2020-11, sheet 1, Issue A, dated 14/4/20.

2. Site Description

2.1 The site was inspected on the 20th of July, 2020.

2.2 This residential property is on the low side of the road and has an E aspect. It is located on the moderately graded upper middle reaches of a hillslope. The natural slope falls at an average angle of ~8° from the uphill boundary of the property to the downhill side of the existing house. The rocky slope below the existing house falls at an angle of ~15°. The slope above the property increases in grade and the slope below the property decreases in grade.

2.3 At the road frontage a concrete and concrete stripped driveway runs down the slope to a carport beside the existing house (Photos 1 & 2). Sandstone is exposed at the surface under the carport (Photo 3). The part two storey brick and weatherboard clad house is supported by brick walls and brick piers (Photos 4 & 5). The supporting walls and piers stand vertical and show no significant signs of movement (Photo 6). Competent Medium Strength Sandstone bedrock is outcropping on the slope on the downhill side of the property (Photo 7). Stable low sandstone block retaining walls support fill on the downhill side of the house and carport (Photo 8). No signs of slope instability were observed on the property. The adjoining neighbouring properties were observed to be in good order as seen from the street and subject property

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

Nine Dynamic Cone Penetrometer (DCP) 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. But due to the possibility that the actual ground conditions vary from our interpretation there should be allowances in the excavation and foundation budget to account for this. We refer to the appended “Important Information about Your Report” to further clarify. The results are as follows:

DCP TEST RESULTS – Dynamic Cone Penetrometer

Equipment: 9kg hammer, 510mm drop, conical tip. Standard: AS1289.6.3.2 - 1997

Depth(m) Blows/0.3 m	DCP 1 (~RL82.9)	DCP 2 (~RL82.4)	DCP 3 (~RL81.7)	DCP 4 (~RL80.8)	DCP 5 (~RL80.2)	DCP 6 (~RL79.7)	DCP 7 (~RL78.4)	DCP 8 (~RL8.6)	DCP 9 (~RL77.1)
0.0 to 0.3	6	17	18	4	4	4	#	4	#
0.3 to 0.6	18	9	5	3	3	7		8	
0.6 to 0.9	32	#	#	#		45		#	
0.9 to 1.2	38					16			
1.2 to 1.5	#					21			
1.5 to 1.8						#			
	Refusal @ 1.1m	Refusal @ 0.4m	Refusal @ 0.4m	Refusal @ 0.4m	Refusal @ 0.4m	Refusal @ 1.4m	Rock at surface	Refusal @ 0.5m	Rock at surface

#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, white sandstone fragments on dry tip.
DCP2 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, white sandstone fragments on dry tip.
DCP3 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, dark brown soil on moist tip.
DCP4 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, dark brown soil on moist tip.
DCP5 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, dark brown soil on moist tip.
DCP6 – Refusal on rock @ 1.4m, DCP bouncing off rock surface, dark brown soil on damp tip.
DCP7 – Rock exposed at surface.
DCP8 – Refusal on rock @ 0.5m, DCP bouncing off rock surface, dark brown soil on damp tip.
DCP9 – Rock exposed at surface.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the 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. The rock is overlain by fill, sandy soil and clay that fills the bench step

formation. Fill provides level platforms on the downhill side of the house and carport. In the test locations, the depth to rock ranged from the surface to depths of between ~0.4 to ~1.4m below the current surface. The sandstone underlying the property is estimated to be Medium Strength or better. 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 in the rock.

Due to the slope and elevation of the block, the water table in the location is expected to be many metres below the proposed works.

7. Surface Water

No evidence of 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 Southern Cross Way above.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside or below the property. The moderately graded slope that falls across the property and continues above is a potential hazard (**Hazard One**). The proposed excavation is a potential hazard until retaining structures are in place (**Hazard Two**). The vibrations from the proposed excavation are a potential hazard (**Hazard Three**).

RISK ANALYSIS SUMMARY ON NEXT PAGE

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The moderately graded slope that falls across the property and continues above failing and impacting on the property.	The proposed excavation collapsing onto the worksite before retaining walls are in place.	The vibrations produced during the proposed excavation impacting on the surrounding structures.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (15%)	'Medium' (15%)
RISK TO PROPERTY	'Low' (2 x 10^{-5})	'Moderate' (2 x 10^{-4})	'Moderate' (2 x 10^{-4})
RISK TO LIFE	8.3 x 10^{-7}/annum	8.3 x 10^{-6}/annum	8.3 x 10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 11 & 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

Ideally, it is recommended a drainage easement be obtained from the downhill neighbouring property and all stormwater or drainage runoff from the proposed development be piped to the street below. If this option is not feasible, a spreader/dispersion trench is suitable as a

last resort, provided flows are kept close to natural runoff for the site. All stormwater is to be piped through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to maximum depth of ~2.1m will be required to construct the proposed new house. The excavation is expected to be through topsoil, with Medium Strength Sandstone expected from the surface to a depth of ~0.4m below the surface. It is envisaged that excavations through soil can be carried out with a machine and bucket and excavations through Medium Strength Sandstone or better will require grinding or rock sawing and breaking.

12. Vibrations

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

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the neighbouring properties to the N and S. 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 property boundaries. 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 property 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 properties.

13. Excavations Support Requirements

An excavation to maximum depth of ~2.1m will be required to construct the proposed new house. Due to the presence of shallow rock the house excavation is set back sufficiently from the property boundaries and adjoining structures to negate excavation induced instability.

The shallow soil portion of the excavation is to be battered temporarily at 1.0 Vertical to 2.0 Horizontal (26°) until the retaining walls are in place. 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 face in 1.5m intervals as it is lowered to ensure ground materials are as expected and that additional support is not required.

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

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

14. Retaining Structures

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

TABLE 1 ON NEXT PAGE

Table 1 – Likely Earth Pressures for Retaining Structures

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Soil	20	0.40	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 full hydrostatic pressures are to be accounted for in the retaining structure design.

15. Foundations

Piers supported off Medium Strength Sandstone are suitable footings for the proposed suspended driveway. The proposed house is expected to be seated in Medium Strength Sandstone. This is a suitable bearing material. Where the rock drops away with the slope on the downhill side of the house, shallow spread footings/piers will be required to maintain a uniform bearing material across the structure. Spread footings or piers supported off Medium Strength Sandstone are suitable foundations for the proposed granny flat and home office. 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 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.

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 Occupation Certificate 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 face in 1.5m intervals as it is lowered to ensure ground materials are as expected and that additional support is not 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.,
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No. 222757
Engineering Geologist

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.

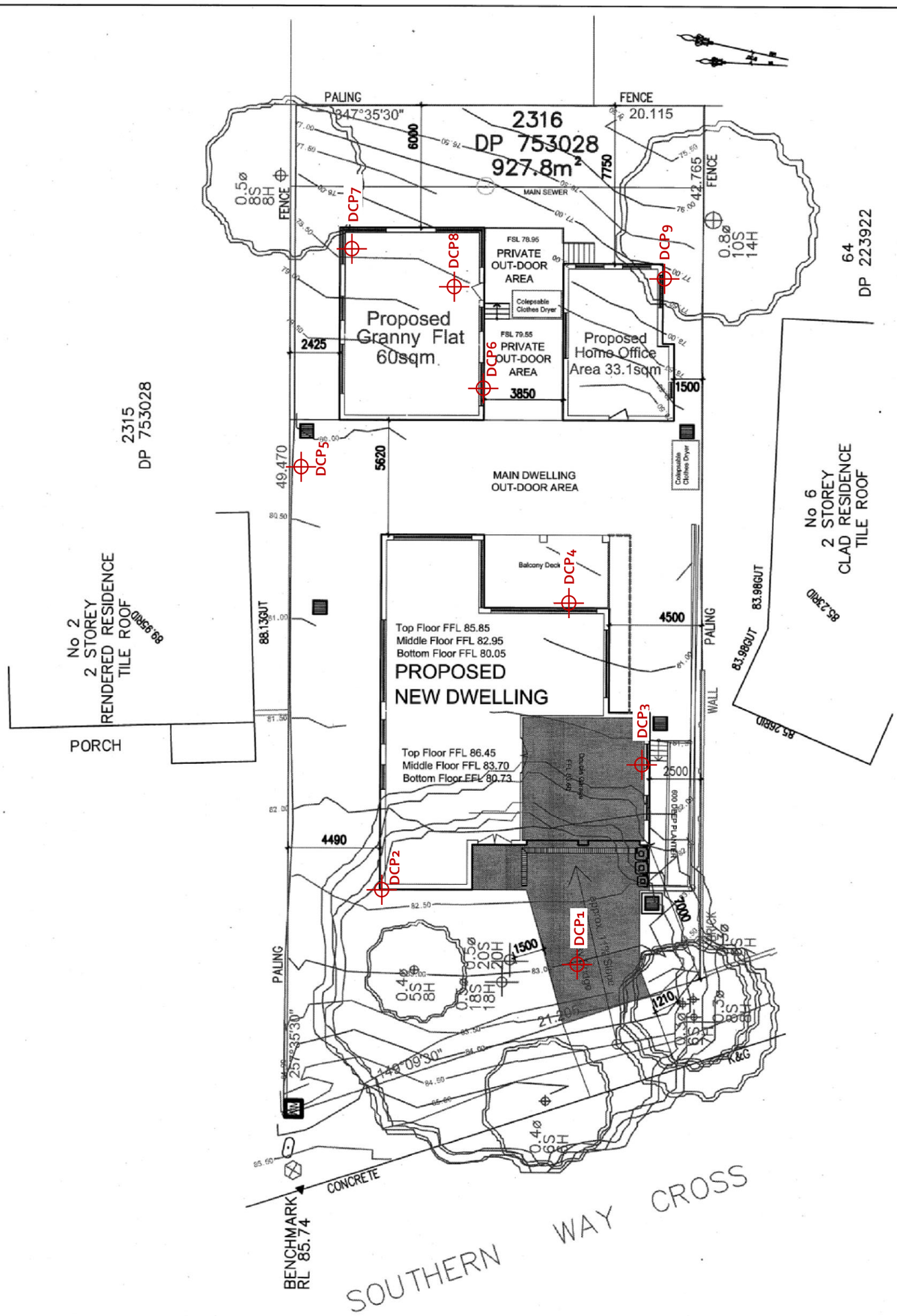
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



SITE PLAN

SOFT LANDSCAPE REQIRED MIN. 40%

SOFT LANDSCAPE PROVIDED 387.52sqm = 41.7%

BUILDING DESIGNERS
ASSOCIATION OF AUSTRALIA

DO NOT SCALE DRAWINGS. FIGURED DIMENSIONS ONLY TO BE USED. ALL DIMENSIONS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF THE WORKS.

ALL WORK TO BE DONE IN TRADESPERSON MANNER AND SHALL COMPLY IN ALL RESPECTSS WITH LOCAL GOVERNMENT REQUIREMENTS, RELEVANT AUSTRAL. STANDARDS , BUILDING CODE OF AUSTRALIA AND INDUSTRY TRADE PRACTICE.

PROJECT
Proposed Demolition of Existing Structures and Erecting a New Dwelling, Granny Flat and a Home Office Studio.

1	ISSUED FOR DA APPLICATION	APRIL 2020

ADDRESS
4 Southern Cress Way
Allambie Heights NSW

CLIENT
Mr. Chris Jaczac

DRAWN	SCALE	DATE
AJ	1:200	2020 0410

DRAWING No: PR020.03, Page 1

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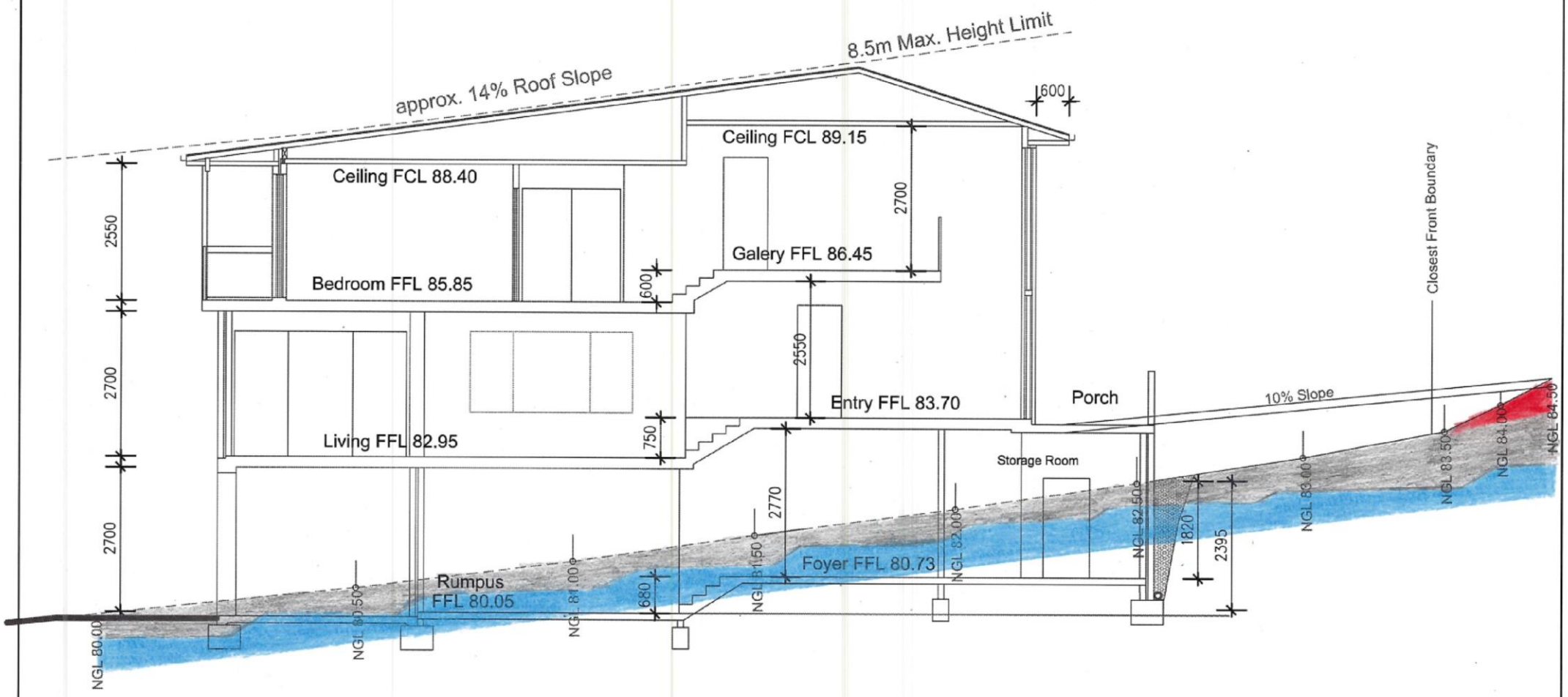
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



SECTION THROUGH A - A

BUILDING DESIGNERS
ASSOCIATION OF AUSTRALIA

DO NOT SCALE DRAWINGS. FIGURED DIMENSIONS ONLY TO BE USED. ALL DIMENSIONS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF THE WORKS.

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PROJECT
Proposed Demolition of Existing Structures and Erecting a New Dwelling, Granny Flat and a Home Office Studio.

1	ISSUED FOR DA LODGMENT	APRIL 2020

ADDRESS
4 Southern Cress Way
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CLIENT
Mr. Chris....

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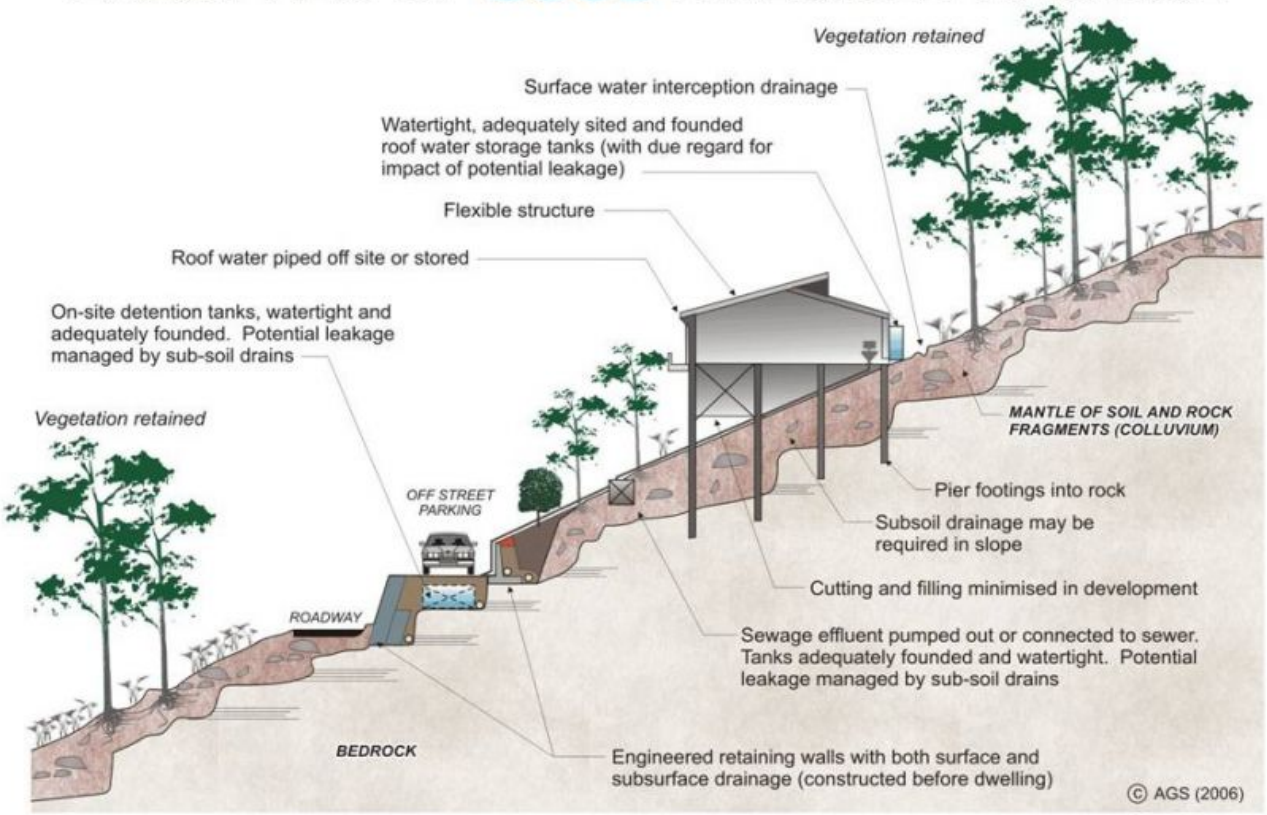
EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE