GEOTECHNICAL INVESTIGATION:

New House and Pool at **327 McCarrs Creek Road, Terrey Hills**

1. Proposed Development

1.1 Demolish the existing house and construct a new house and pool by excavating to a maximum depth of ~2.6m.

1.2 Other minor external additions and alterations.

1.3 Details of the proposed development are shown on 9 drawings prepared by Playoust Churcher Architects, project number 23-844, drawings numbered A100 to A104, A200 to 202, and A210. All revision A. All dated 23/05/2025.

2. Site Description

2.1 The site was inspected on the 5th December, 2024, and previously in November 2019 and March 2020.

2.2 This large rural/residential property is on the low side of the road and has an E aspect. It is located on the gentle to moderately graded upper reaches of a hillslope. The natural slope falls across the property at an average angle of ~8°. The slope above and below the property continue at similar gentle angles.

2.3 At the road frontage, a concrete driveway runs to a gravel parking area on the uphill side of the property (Photo 1). The driveway diverts to a large shed in the NW corner of the property (Photo 2). The cut for the shed is supported by a stable sandstone log retaining wall reaching ~1.9m high (Photo 3). In the SW corner of the property, the two-storey brick house is supported on brick walls. No significant signs of movement were observed in the visible supporting walls. The house will be demolished as part of the proposed works. The steeply battered but well vegetated cut for the house on the uphill sides rises ~1.5m to the S common boundary, and

returns along the W side of the house. This cut is currently considered stable (Photo 4).

A gently-sloping lawn extends off the downhill side of the house to a pool which has been cut into the slope (Photo 5). The pool shows no signs of movement and will also be demolished. Competent Medium Strength Sandstone was observed to be outcropping S of the pool (Photo 6). The outcropping rock in this location was observed to be slightly undercut but is considered stable. A cut and fill has been made in the slope below the pool for a large level paddock. The cut is supported by a stable timber retaining wall ~1.4m high (Photo 7). The fill is supported by a stepped timber retaining wall reaching ~2.5m high (Photo 8). The E corner of the lower step of the wall was measured to be tilting downslope ~6° from vertical, however this wall will be demolished as part of the proposed works. The slope surrounding this paddock is lawn-covered and falls gently to the lower common boundary.

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

One hand Auger Hole (AH) was put down to identify the soil materials. Seven 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 attached. 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 have been an issue for 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:

AUGER HOLE 1 (~RL207.5) **–** AH1 (Photo 9)

Depth (m)	**Material Encountered**
0.0 to 0.2	**TOPSOIL**, clayey soil, brown, Stiff, dry, Fine to Medium grained.
0.2 to 0.5	**RESIDUAL CLAY**, sandy clay, derived from weathered sandstone, mottled orange, maroon and grey, Very Stiff, dry, Fine to Medium grained.

Refusal @ 0.5m on rock. Auger grinding. No water table 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** (~RL207.5)	**DCP 2** (~RL206.8)	**DCP 3** (~RL203.0)	**DCP 4** (~RL201.9)	**DCP 5** (~RL203.1)	**DCP 6** (~RL203.4)	**DCP 7** (~RL205.4)
0.0 to 0.3	10	7	Rock Exposed at Surface	21	20	6	17
0.3 to 0.6	17	#		20	23	27	#
0.6 to 0.9	#			#	#	13	
0.9 to 1.2						#	
	Refusal on Rock @ 0.6m	Refusal on Rock @ 0.1m		Refusal on Rock @ 0.5m	Refusal on Rock @ 0.4m	Refusal on Rock @ 0.7m	Refusal on Rock @ 0.2m

#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 @ 0.6m, DCP bouncing off rock surface, white impact dust and mottled orange and maroon sandy clay on dry tip and in collar above tip.

DCP2 – Refusal on Rock @ 0.1m, DCP bouncing off rock surface, white impact dust and mottled orange and maroon sandy clay on dry tip and in collar above tip.

DCP3 – Medium Strength Sandstone exposed at surface.

DCP4 – Refusal on Rock @ 0.5m, DCP bouncing off rock surface, brown sandy clay on dry tip and in collar above tip.

DCP5 – Refusal on Rock @ 0.4m, DCP bouncing off rock surface, white impact dust on dry tip, orange sandy clay in collar above tip.

DCP6 – Refusal on Rock @ 0.7m, DCP bouncing off rock surface, white impact dust on dry tip.
DCP7 – Refusal on Rock @ 0.2m, DCP bouncing off rock surface, white 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 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 shallow soils over clays that fill the bench step formation. Filling has been placed across the property for landscaping. In the location of the proposed house, where the rock is not exposed, it was encountered at depths of between 0.1 to 0.7m below the current surface, being slightly deeper due to the presence of fill and the stepped nature of the underlying bedrock. 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 as all the DCP tests bounced at refusal. 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

McCarrs Creek Road above the property is not guttered and will provide only limited drainage diversion from surface flows, so we expect surface flows to move onto the property from above the property during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below, or beside the property. The gentle to moderately graded slope that falls across the property and continues above and below at gentle angles is a potential hazard (**Hazard One**). The vibrations from the proposed excavations 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 gentle to moderate slope that falls across the property and continues above and below at gentle angles failing and impacting on the proposed works.	The vibrations produced during the proposed excavations impacting on the surrounding structures.	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' (12%)	'Medium' (15%)	'Medium' (20%)
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	6.6×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	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 and 14** 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

The fall is away from the street. The stormwater engineer is to refer to council stormwater policy for suitable options for stormwater disposal.

11. Excavations

An excavation up to a maximum depth of ~2.5m is required to construct the proposed garage. An excavation to a maximum depth of ~2.6m is required at the location of the Lower Ground Floor.

The excavations are expected to be through shallow soil and clay with Medium Strength Sandstone expected at depths of between 0.1m and 0.7m below the surface in the area of the proposed excavations.

It is envisaged that excavations through soil and clay can be carried out with an excavator and bucket, and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through soil, and clay will be below the threshold limit for building damage utilising a domestic-sized excavator up to 16 tonnes. It is expected that the majority of the excavations will be through Medium Strength Sandstone or better.

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the S neighbouring house. Allowing ~0.5m for backwall drainage, the setbacks from the proposed excavation to the existing structures are as follows:

- ~7.5m from the S neighbouring residence.

Dilapidation reporting carried out on the S neighbouring property is recommended prior to the excavation works commencing to minimise the potential for spurious building damage claims.

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 S neighbouring house walls. Vibration monitoring will be required to verify this is achieved. Vibration monitoring must include a light/alarm so the operator knows if vibration limits have been exceeded. The equipment is to log and record vibrations throughout the excavation works.

In Medium Strength rock or better techniques to minimise vibration transmission will be required. These include:

- Rock sawing the excavation perimeter to at least 1.0m deep prior to any rock breaking with hammers, keeping the saw cuts below the rock to be broken throughout the excavation process.
- Limiting rock hammer size.
- Rock hammering in short bursts so vibrations do not amplify.
- Rock breaking with the hammer angled away from the nearby sensitive structures.
- Creating additional saw breaks in the rock where vibration limits are exceeded, as well as reducing hammer size as necessary.
- Use of rock grinders (milling head).

Should excavation induced vibrations exceed vibration limits after the recommendations above have been implemented, excavation works are to cease immediately and our office is to be contacted.

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

13. Excavation Support Requirements

The retaining walls which support fill for the corral and reach up to ~2.5m (Photos 7 & 8) high are to be demolished as part of the proposed works. These walls are to be demolished from the top down in an orderly manner with the fill behind the walls being systematically lowered at the same time. The soil batter slope is not to exceed 1.0 Vertical to 1.7 Horizontal (30°) as the walls are demolished.

The excavations for the proposed house will reach a maximum depth of ~2.6m. Medium Strength Sandstone or better was encountered at shallow depths of 0.7m or less across the location of the proposed excavation. As such, the excavations will be sufficiently set back from any nearby structures and boundaries.

Due to the depth of the excavation through rock, the shallow overlying soil and clay portions of the excavation face are to be scraped back at least 0.4m from the edge of the excavation through rock and battered temporarily at 1.0 Vertical to 1.0 Horizontal (45°) until the retaining walls are in place. Medium Strength Sandstone or better is expected to stand at vertical angles unsupported subject to approval by the geotechnical consultant.

During the excavation process, the geotechnical consultant is to inspect the cut in 1.5m intervals as it is lowered to ensure the ground materials are as expected and no wedges or other geological defects are present that could require additional support. Should additional ground-support be required, this will likely involve the use of mesh, sprayed concrete, and rock bolts.

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. All unsupported 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 cannot blow off in a storm. 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.

Upon completion of the 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 spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

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
Fill and Topsoil	20	0.40	0.55
Residual Clays	20	0.35	0.45
Medium Strength Rock	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 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 full hydrostatic pressures are to be accounted for in the retaining wall design.

15. Site Classification

The site classification is Class A in accordance with AS2870-2011. Assume no ground movement from moisture changes for footings supported on Medium Strength Sandstone.

16. Foundations

The proposed house is expected to be partially seated in Medium Strength Sandstone or better. This is a suitable foundation material. It is expected to be exposed across the uphill side of the excavation. Where it is not exposed, and where the footprint of the proposed house does not fall over the footprint of the excavation, shallow piers taken to rock will be required to maintain a uniform foundation material across the structure. The piers for the downhill side of the house are expected to encounter Medium Strength Sandstone or better at depths of between ~0.1m to ~0.7m below the current surface.

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 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.

17. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide geotechnical certification for the owner or the regulating authorities if the following inspections have not been carried out during the construction process.

- During the excavation process, the geotechnical consultant is to inspect the cut faces as they are lowered in 1.5m intervals 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 and contractors are still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

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Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9 – downhole is top to bottom

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.

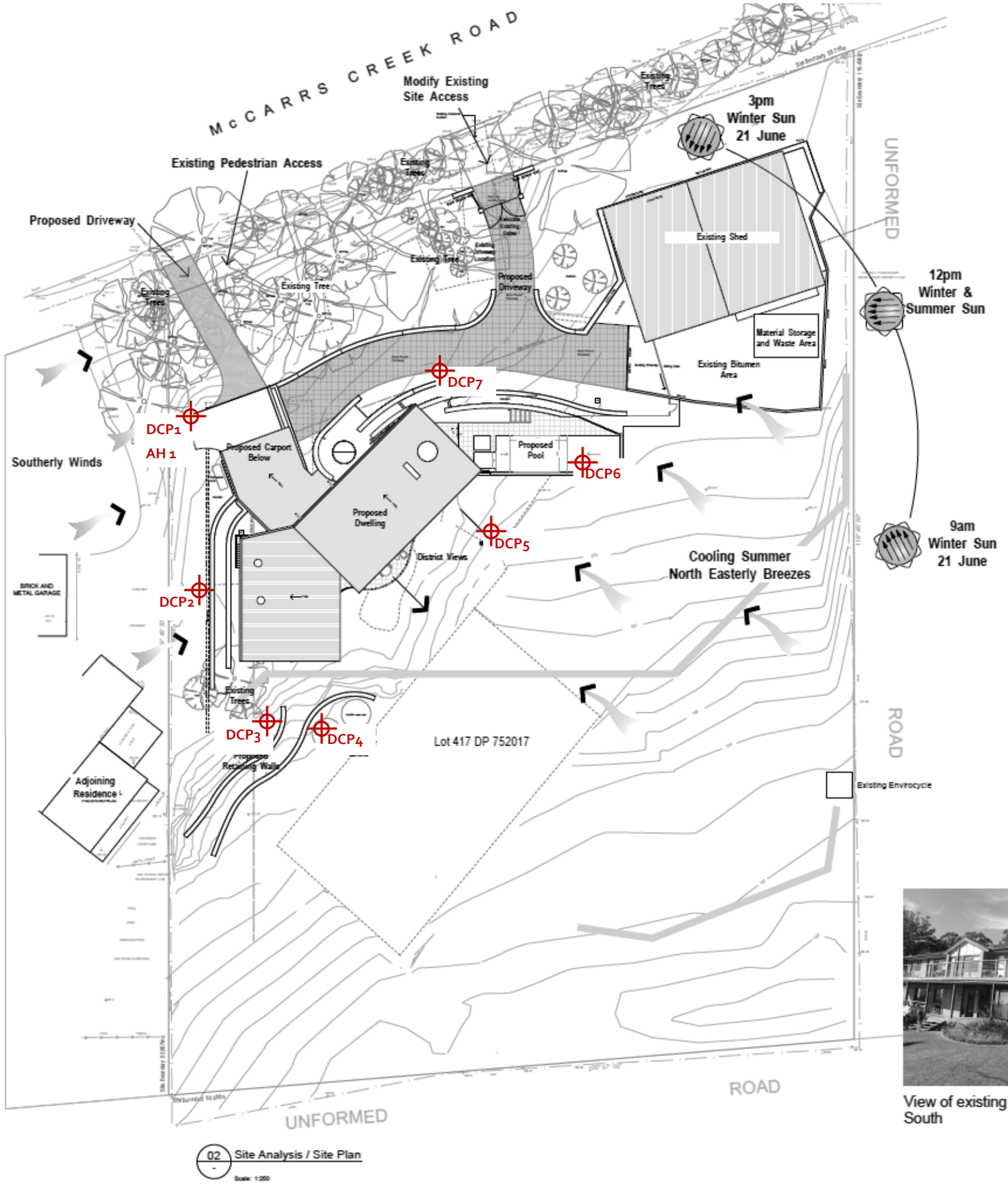
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



02 Site Analysis / Site Plan

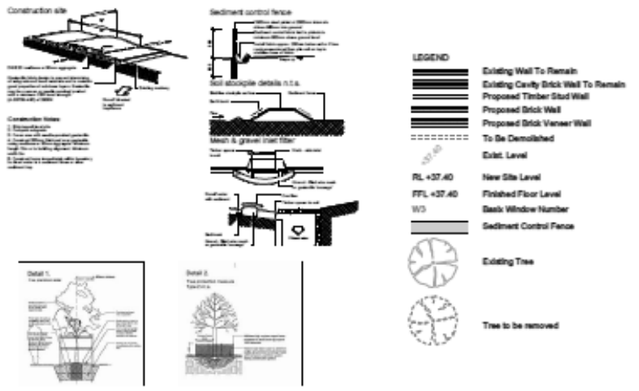
Scale: 1:250

01 Location Plan

NTS

DA Drawing List

DA A100-A	Site Analysis/ Site Plan
DA A101-A	Existing / Demolition Plan
DA A102-A	Ground Floor Plan
DA A103-A	First Floor Plan
DA A104-A	Roof Plan
DA A200-A	Street Elevation (Site Images)
DA A201-A	Elevations Sheet 1
DA A202-A	Elevations Sheet 2
DA A210-A	Sections
DA A1000-A	Finishes Selections



04 Sediment Control Diagrams

NTS

Landscape Area Calculations

Site Area	8486m2
Required Area (30%)	2545.8m2
Proposed Landscape Area	6664m2 (78.5%)

View of existing dwelling, looking South

View of existing shed, looking West

north

A 23/05/2025 FOR DA SUBMISSION TL

rev date revision notes by

Figured dimensions to be taken in preference to scaling. Contractor to verify all dimensions on job before commencing any work or making shop drawings.

project project # 23-844

Proposed Residence

327 McCarrs Creek Road. Terry Hills

client

dwg

Site Analysis

printed	drawn	chkd	scale@A1
29/05/2025	TL	KvB	NTS

stage drawing # revision

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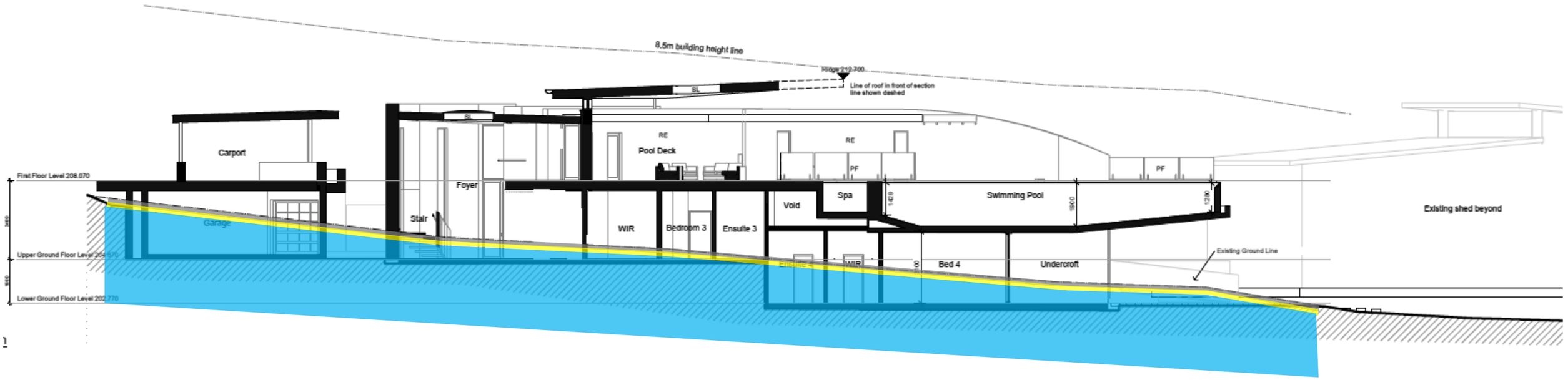
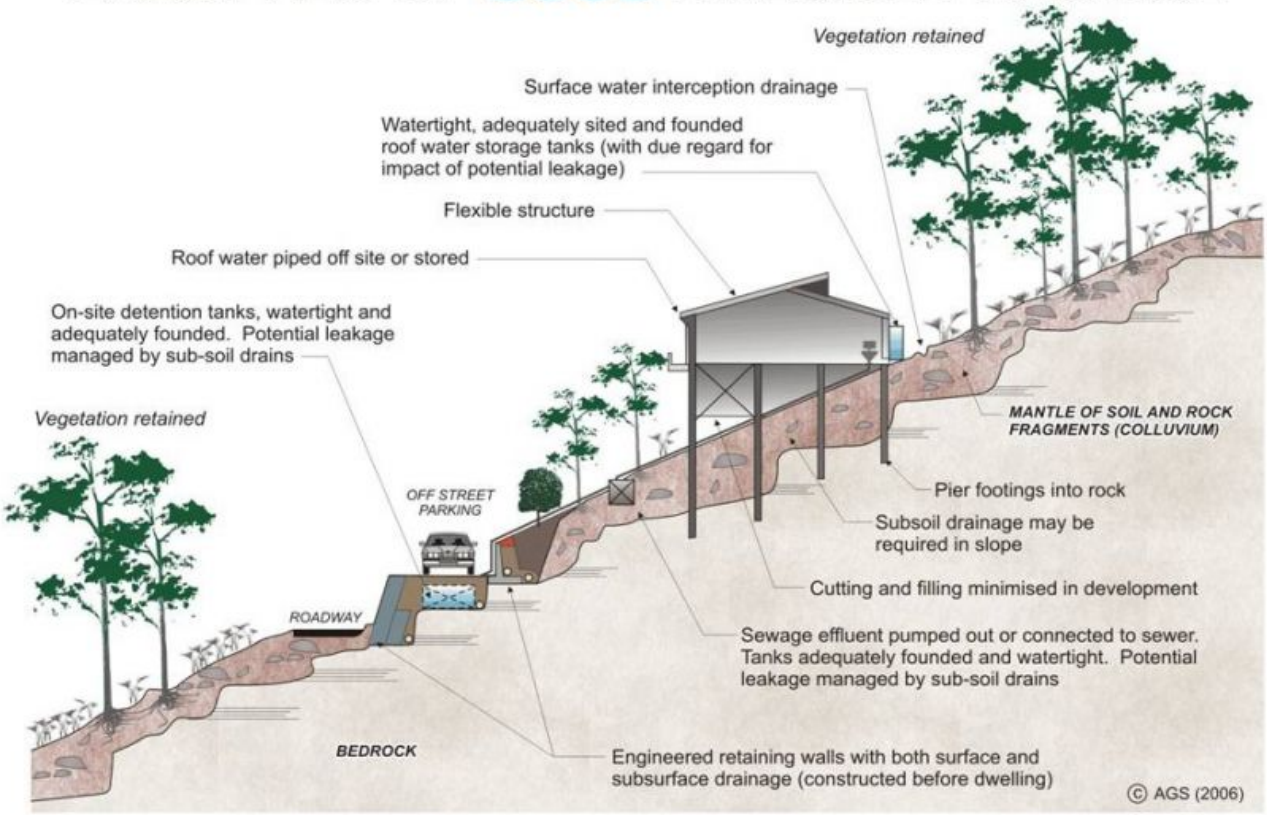
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

- Topsoil
- Clay
- Hawkesbury Sandstone – Medium Strength



EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE