GEOTECHNICAL INVESTIGATION:

New Pool at **13 Redman Street, Seaforth**

1. Proposed Development

1.1 Install a new pool on the uphill side of the property by excavating to a maximum depth of ~3.4m.

1.2 Create a levelled area above the proposed pool by excavating to a maximum depth of ~1.4m.

1.3 Details of the proposed development are shown on 4 drawings, project number 201745, drawings numbered DA01-DA03, and DA05 dated 7th April 2021.

2. Site Description

2.1 The site was inspected on the 12th May, 2021.

2.2 This residential property is on the corner of Peacock Street and Redman Street. It is level with Peacock Street and on the uphill side of Redman Street. The property has a SE aspect. It runs longways to the E so there is a slight crossfall. The site is located on the moderately graded upper reaches of a hillslope. The slope falls across the property at angles averaging ~9°.

2.3 Between the road frontage to Redman Street and the house is a gently sloping lawn-covered fill. The fill is supported by a brick retaining wall that is tilting downslope to a maximum of 8° from vertical, and displays stepped cracking through the mortar (Photo 1). The wall will be demolished as part of the proposed works for the separate approved DA. The single-storey brick house is also to be demolished as part of the separate approved DA (Photo 2). A concrete driveway extends from Peacock Street to a parking area on the uphill side of the house (Photo 3). A moderately sloping lawn

area rises to the upper common boundary. Sandstone bedrock can be observed to be outcropping across the uphill side of the property (Photo 4). A portion of the sandstone bedrock above the property is undercut ~0.7m and will be retained as part of the proposed works (**See Section 12 for advice regarding the undercut rock**) (Photos 5 & 6).

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

Four 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 be an issue for the testing on this site. However, excavation and foundation budgets should always allow for the possibility that the interpreted ground conditions in this report vary from those encountered during excavations. See the appended "Important information about your report" for a more comprehensive explanation. The results are as follows:

GROUND TEST RESULTS ON THE 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 (~RL97.6)	DCP 2 (~RL97.6)	DCP 3 (~RL96.1)	DCP 4 (~RL96.1)
0.0 to 0.3	7	7	9	8
0.3 to 0.6	#	12	#	#
0.6 to 0.9		9		
0.9 to 1.2		#		
	Refusal on Rock @ 0.25m	Refusal on Rock @ 0.75m	Refusal on Rock @ 0.25m	Refusal on Rock @ 0.25m

#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 @ 0.25m, DCP bouncing off rock surface, yellow impact dust on dry tip.
DCP2 – Refusal on rock @ 0.75m, DCP bouncing off rock surface, white impact dust on dry tip.
DCP3 – Refusal on rock @ 0.25m, DCP bouncing off rock surface, clean dry tip.
DCP4 – Refusal on rock @ 0.25m, DCP bouncing off rock surface, yellow sand on damp tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the outcropping and underlying sandstone bedrock that steps up the property forming sub-horizontal benches between the steps. Where the grade is steeper, the steps are larger and the benches narrower. Where the slope eases, the opposite is true. Where the rock is not exposed, it is overlain by sandy soils and sandy clays that fill the bench step formation. Filling has been placed below the house for landscaping. In the test locations, the depth to rock ranged between 0.25 to 0.75m below the current surface, being slightly deeper due to 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. 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 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 Redman Street below.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside the property. The moderately graded slope that rises across the property and continues above and below is a potential hazard (**Hazard One**). The undercut rock face (Photos 5 & 6) failing and toppling onto the work site during the excavation process is a potential hazard (**Hazard Two**). The vibrations from the proposed excavations are a potential hazard (**Hazard Three**). The proposed excavation is a potential hazard until retaining walls are in place (**Hazard Four**).

RISK ANALYSIS ON THE NEXT PAGE

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate slope that rises across the property and continues above and below failing and impacting on the proposed works.	The undercut sandstone outcrop that rises ~1.5m up the slope failing during the excavation and impacting on proposed works (Photos 5 & 6)
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (20%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	2.32×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Section 12** are to be followed.

HAZARDS	Hazard Three	Hazard Four
TYPE	The vibrations produced during the proposed excavation impacting on the surrounding structures.	The excavation (up to a maximum depth of 3.4m) collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (25%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.3×10^{-7}/annum	5.9×10^{-5}/annum
COMMENTS	'UNACCEPTABLE' level of risk to life and property. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 12** are to be followed.	'UNACCEPTABLE' level of risk to life and property. 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

No significant additional stormwater runoff will be created by the proposed development.

11. Excavations

An excavation to a maximum depth of ~3.4m is required to install the proposed pool. An excavation to a maximum depth of ~1.4m is required to level the slope above the proposed pool area. The excavations are expected to be through sandy soils and firm to stiff sandy clays with Medium Strength Sandstone either exposed or expected at depths between 0.25 and 0.75m below the surface.

It is envisaged that excavations through sandy soil and sandy clays 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 sandy soil and clays will be below the threshold limit for building damage. It is expected that the majority of the excavations will be through Medium Strength Sandstone or better.

Excavations through rock should be carried out to minimise the potential to cause vibration damage to the neighbouring houses to the S and W, and the undercut rock outcrop on the uphill side of the property (Photo 5 & 6). The S and W Neighbouring common boundaries will be as close as ~3.2m and the neighbouring houses will come as close as 10.0m to the proposed excavation. The undercut sandstone outcrop will be close to flush with the excavation (Photos 5& 6). To preserve the integrity of the exposed sandstone outcrop, no pneumatic hammering

is to be used until saw cuts have been installed around the perimeter of the outcropping rock to reduce vibration (Photos 5 & 6).

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 outcropping rock that is to remain and the property boundaries. Vibration monitoring will be required to verify this is achieved. The Vibration monitoring equipment must include a light/alarm so the operator knows if vibration limits have been exceeded. It also must 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 (In this case < 300kg).
- 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.

13. Excavation Support Requirements

No structures or boundaries will be within the zone of influence of either excavation. In this instance, the zone of influence is the area above a theoretical 30° line from the top of Medium Strength Rock towards the surrounding structures and boundaries.

The soil and clay portions of the proposed pool excavation are expected to 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. If the cut batters through soil and clay remain

unsupported for more than a few days before pool construction commences, they are to be supported with typical pool shoring until the pool structure is in place.

Any soil portions of the excavation for the levelled area above the pool are to be battered temporarily at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining walls are in place. Excavations through natural clay will stand unsupported for a short period of time at near vertical angles until the retaining walls are in place, provided they are kept from becoming saturated. 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 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.

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. Excavation spoil may be used for landscaping on site.

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 pool structure/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.

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 & Sandy Soil	20	0.40	0.55
Residual Clays	20	0.30	0.40
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

The proposed pool on the uphill side of the house is expected to be seated directly on the Medium Strength Sandstone. This is a suitable bearing material. 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.

16. Inspections

The client and builder are to familiarise themselves with the following required inspection 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.

- 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 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

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.

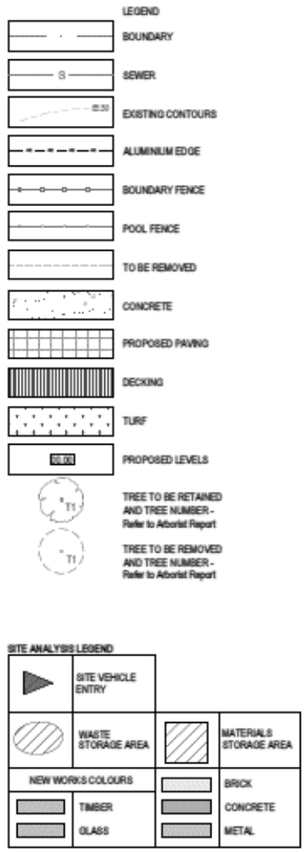
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

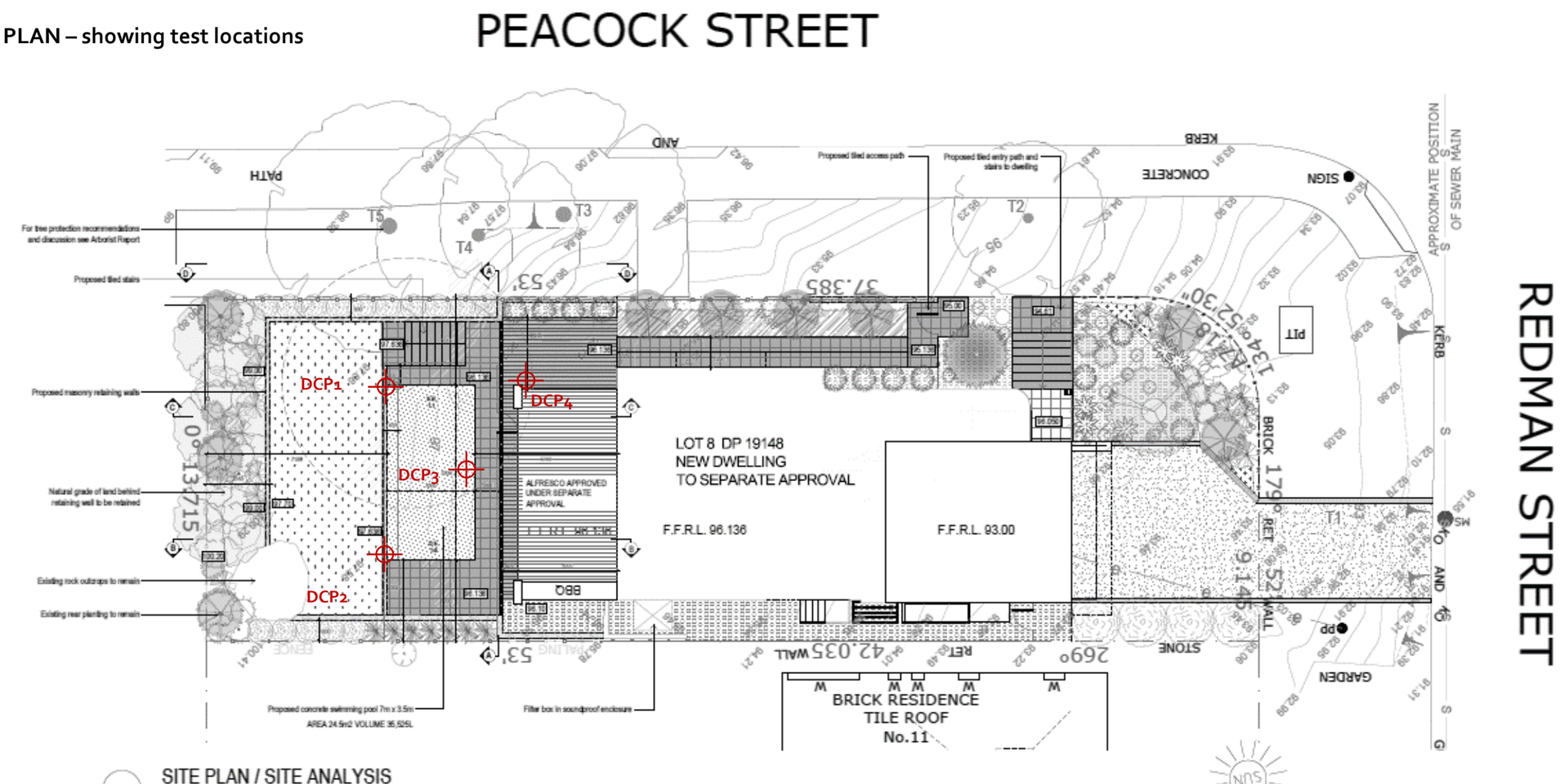
- This report should not be applied to any other project other than that outlined in section 1.0.

- 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.

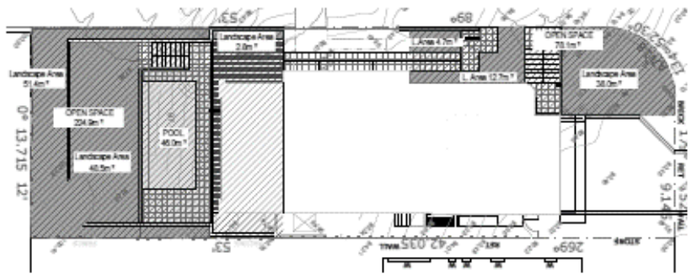
SITE PLAN – showing test locations





SITE PLAN / SITE ANALYSIS

SCALE 1:100



LANDSCAPE OPEN SPACE CALCULATIONS

SCALE 1:200

LANDSCAPE OPEN SPACE

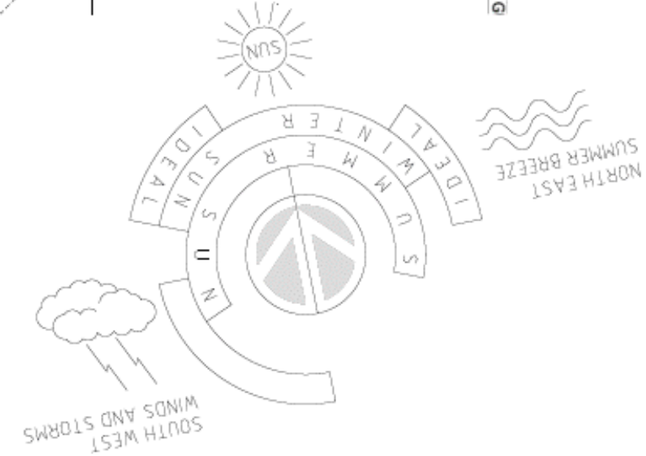
Denotes Open Space >3m

Denotes Landscape Area >0.5m

Denotes Pool Component of OS

Residential Development Control Area OS3 requires 55% of site area to be Open Space with 35% of that open space to be Landscaped Area.

Site Area:	571.5m²	
Open Space required:	314.3m²	55%
Open Space proposed:	303.0m²	53.0%
Maximum pool component of OS	94.3m²	30%
Pool proposed of Open Space:	46.0m²	14.6%
Landscape Area required:	110.0m²	35% of 314.3m²
Landscape Area proposed:	158.1m²	50.3%



POOL NOTES:

1) Refer to Pool Fencing Code per AS 1926.1 - 2012 for compliance of the safety barriers for swimming pools.

2) Overflow of pool is to be connected to sewer according to Sydney Water specifications.

3) Pool pavement pattern and setout shown is indicative only. No allowance has been made for coping overhang, mortar gaps and joints.

4) Pool fence shown is the approximate position of proposed 1200mm(h) minimum childproof safety barrier with solid gate in accordance with AS1926.1-2012. The proposed pool enclosure has been designed to comply with the Australian Standard, the Swimming Pools Act and Swimming Pool Regulations.

5) The boundary fence inside the pool zone must be a minimum height of 1800mm with a non climbable zone of 900mm on the inside of the fencing. Any shrubs or plants located adjacent to the inside of the boundary fence must be maintained for the lifetime of the development at a height that does not interfere with the 900mm non climbable zone.

EXISTING TREE SCHEDULE

TREE No.	SPECIES	HEIGHT (m)	SPREAD (Radius)	
1	*Liquidamber styraciflua*	5m	2m	Removed under house CDC
2	*Callistemon viminalis*	5m	3m	Retain
3	*Lophostemon confertus*	10m	5m	Retain
4	*Lophostemon confertus*	14m	4m	Retain
5	*Lophostemon confertus*	9m	5m	Retain
6	*Lophostemon confertus*	14m	5m	Remove

This schedule is to be used in accordance with the accompanying arborist report

Rev.	Date	Issue	Checked
A	19/11/20	DA Issue	AR
B	07/04/21	DA Issue	AR

SPACE LANDSCAPE DESIGNS

Space Landscape Designs Pty Ltd
ABN 60 758 643 674 ACN 136 316 291
info@spacedesigns.com.au
spacedesigns.com.au
P 02 8005 7570 F 02 8005 7567
Suite 136, 117 Old Pittwater Rd, Brookvale NSW 2100

CLIENT: Katherine Schimdhofer
ADDRESS: 13 Redman Street, SEAFORTH NSW 2092

DRN: T.Browne (M.L.AAM)
DATE: 07/04/2021
SCALE: 1:100@A1
PROJECT NO: 201745

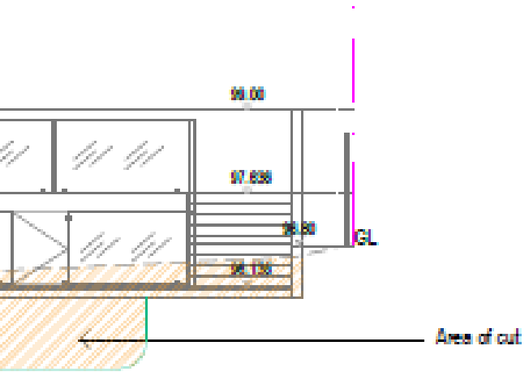
NORTH

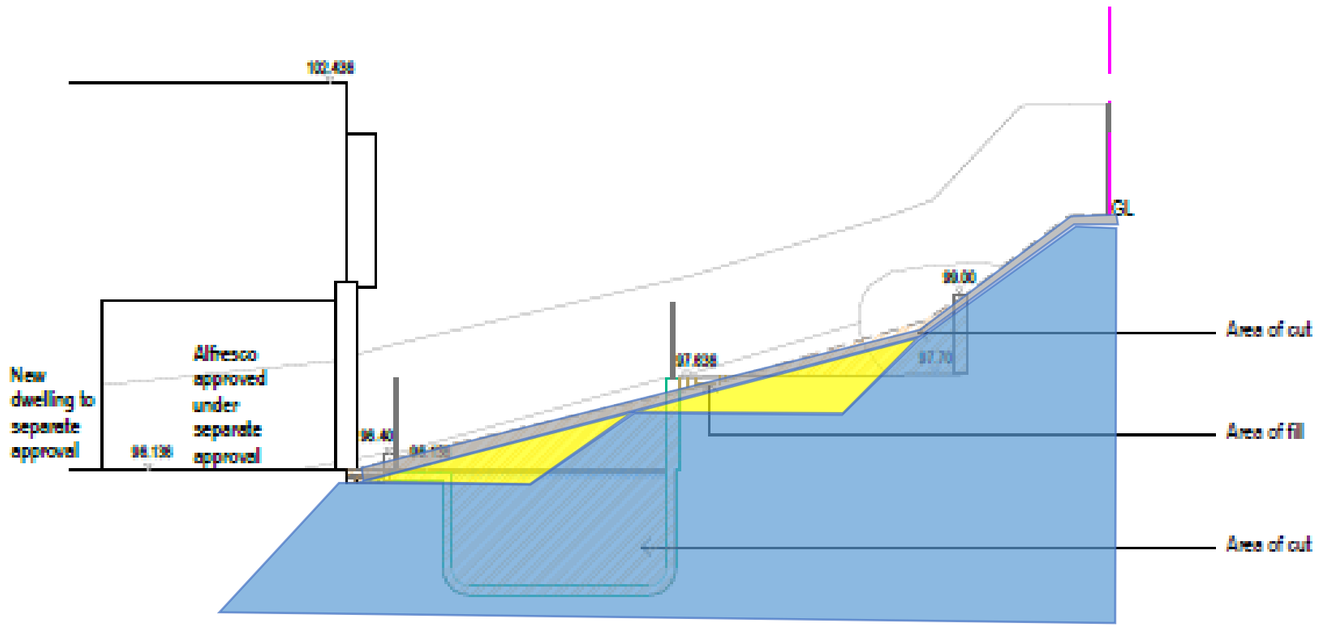
SITE PLAN & SITE ANALYSIS
LANDSCAPE OPEN SPACE CALCULATIONS
DA-01 Rev B

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

- Fill
- Topsoil
- Sandy Clay – Soft to Firm
- Hawkesbury Sandstone – Medium Strength

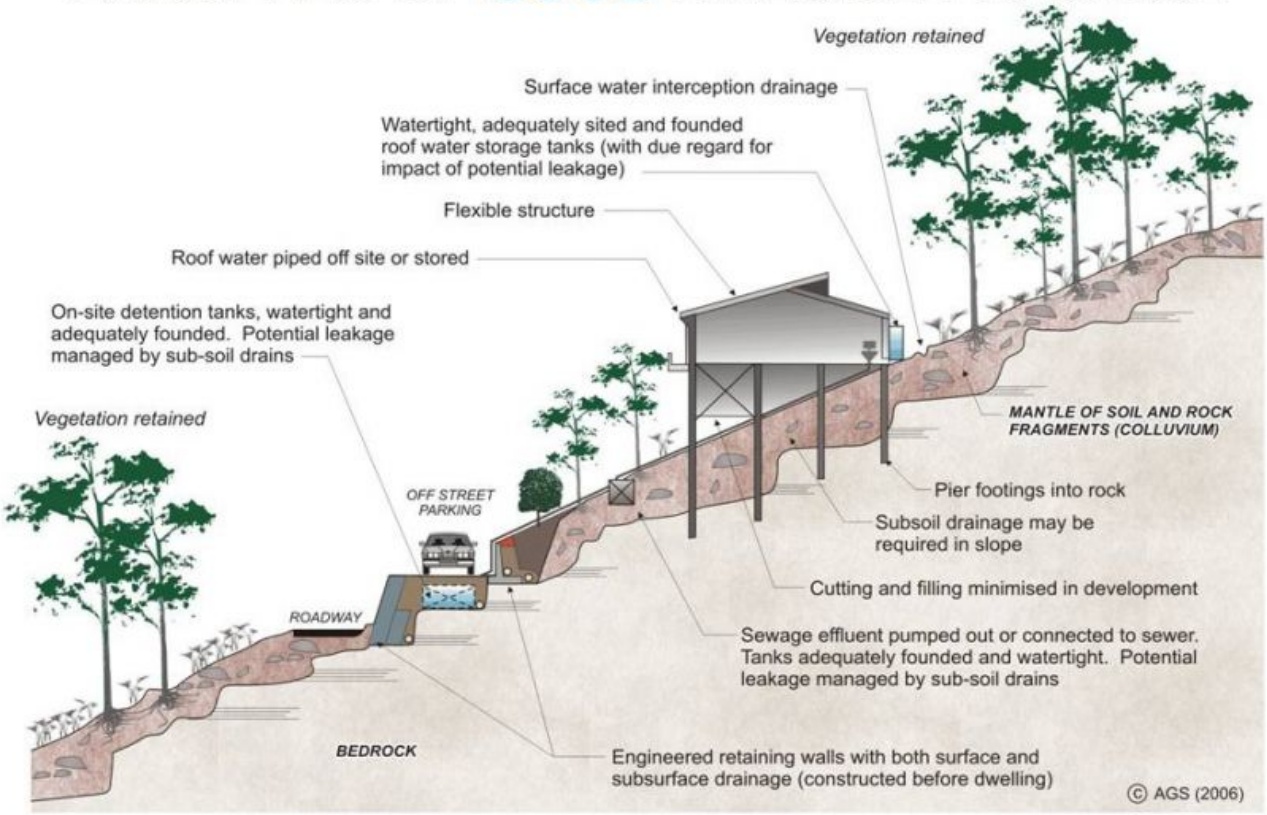




NORTHERN SECTION ELEVATION - BB

SCALE 1:100

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE