GEOTECHNICAL INVESTIGATION:

New Pool at **10 Beverly Place, Curl Curl**

1. Proposed Development

1.1 Install a pool on the uphill side of the property by excavating to a maximum depth of ~2.0m into the outcropping rock face.

1.2 Details of the proposed development are shown on 10 drawings prepared by Laura Cook, drawings numbered DA.00 to Da.10, dated 5.4.23.

2. Site Description

2.1 The site was inspected on the 1st July, 2022.

2.2 This residential property is accessed off the high side of a turning circle at the end of Beverly Place. The property has an E aspect. It is located on the moderate to steeply graded middle reaches of a hillslope. The natural slope rises across the property at an average angle of 12° before stepping up some ~4.0m at a rock face and continuing at moderate angles to the upper common boundary. The slope above and below the property continues at similar angles.

2.3 At the road frontage, a concrete driveway runs to a garage and carport underneath the downhill side of the house (Photos 1 & 2). A fill for a lawn area in between the lower common boundary and the house is lined by a ~2.0m high sandstone flagging wall. The two-storey rendered brick house is supported on external brick walls. The external brick walls show no significant signs of movement. The cut to create the level platform for the house has been taken through Competent Medium Strength Sandstone (Photo 3). A ~4.0m high rock face steps up the N side of the property (Photo 4 & 5). The outcrop was observed to be slightly undercut on the E face but is considered stable. There is a cavity on the S side of the rock face that is

undercut to ~1.5m and overhangs ~0.5m from the bulk rock face below (Photos 6 & 7). The cavity is bridged on both sides and considered currently stable however the overhang will likely need to be removed as part of the proposed excavation works. Competent Medium Strength Sandstone outcrops above the house and extends to a ~1.3m high stable stack rock retaining wall that lines the upper common boundary (Photo 8). A ~stable 0.6m high sandstone block retaining wall supports a fill for a level lawn area in the upper NE corner of the property (Photo 9).

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** (~RL45.9)	**DCP 2** (~RL45.8)	**DCP 3** (~RL45.9)	**DCP 4** (~RL45.7)
0.0 to 0.3	Rock exposed at the surface	Rock exposed at the surface	Rock exposed at the surface	Rock exposed at the surface
0.3 to 0.6				
0.6 to 0.9				

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

DCP Notes:

DCP1 – Rock exposed @ surface.
DCP2 – Rock exposed @ surface.
DCP3 – Rock exposed @ surface.
DCP4 – Rock exposed @ surface.

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 fill and sandy soils that fill the bench step formation. Filling has been placed near the upper common boundary for a level lawn area and garden beds. In the test locations, competent Medium Strength Sandstone bedrock was entirely exposed. 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

Seepage was observed moving over the exposed sandstone outcrops during the inspection. This is considered to be normal ground water seepage that 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. It is expected that normal sheet wash will move onto the site from above the property during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside the property. The moderate to steeply graded slope that rises across the property and continues above and below is a potential hazard (**Hazard One**). The large sandstone face that steps ~4.0m up the slope is a potential hazard (**Hazard Two**). The vibrations from the proposed excavation are a potential hazard (**Hazard Three**). The proposed excavation is a potential hazard until the pool structure is in place (**Hazard Four**).

RISK ANALYSIS ON THE NEXT PAGE

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate to steep slope that rises across the property and continues above and below failing and impacting on the proposed works.	The sandstone face that steps ~4.0m up the slope failing and impacting on the proposed works (Photo 4 & 5).
LIKELIHOOD	'Unlikely' (10^{-4})	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (25%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Low' (2×10^{-5})
RISK TO LIFE	8.3×10^{-7}/annum	2.9×10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk is 'ACCEPTABLE'.

HAZARDS	Hazard Three	Hazard Four
TYPE	The vibrations produced during the proposed excavation impacting on the surrounding structures.	The excavation for the pool (up to a maximum depth of 2.0m) collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (15%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Low' (2×10^{-5})
RISK TO LIFE	5.3×10^{-7}/annum	8.3×10^{-7}/annum
COMMENTS	'UNACCEPTABLE' level of risk to property. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 12** are to be followed.	'ACCEPTABLE' level of risk to life and property, provided 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 ~2.0m is required to install the proposed pool. The excavation is expected to be entirely through outcropping Medium Strength Sandstone.

It is envisaged that excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

It is expected that the entirety of the excavation 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 subject house and neighbouring structure to the N. The setbacks are as follows:

- ~1.4m from the N common boundary.
- ~2.6m from N neighbouring house.
- ~3.4m from the subject house.

Dilapidation reporting carried out on the N neighbouring property is recommended prior to the excavation works commencing to minimise the possibility of spurious 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 8mm/sec at 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.
- 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

The excavation for the proposed pool will reach a maximum depth of ~2.0m. The setbacks are as follows:

- ~Flush with the cavity and overhang on the S side of the rock face.
- ~1.4 from the N common boundary.
- ~2.6m from N neighbouring house.
- ~3.4m from the subject house.

As the cut will be entirely through exposed Medium Strength Sandstone bedrock, no structures or boundaries are expected to be within the zone of influence of the excavation.

All excavation margins are to be cut with a rock saw to create a clean, uniform cut.

The cavity and overhang (Photos 6 & 7) on the S side of the excavation are likely to be destabilised during the excavation. As such, the overhanging portion of the rock is to be cut with rock saws and demolished prior to the commencement of the pool excavation. See site plan for location of overhanging rock to be removed.

The geotechnical consultant is to inspect the early stages of the excavation 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. The materials and labour to construct the pool structure/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.

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
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 is expected to be seated directly in Medium Strength Sandstone. This is a suitable foundation material.

A maximum allowable bearing pressure of 1000kPa can be assumed for footings on Medium Strength Sandstone.

NOTE: If the contractor is unsure of the footing material required, it is more cost effective to get the geotechnical consultant on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over-excavation in clay like shaly rock but can be valuable in all types of geology.

16. Inspections

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

- The geotechnical consultant is to inspect the early stages of the excavation 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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Engineering Geologist.

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

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

Location of construction waste, recycling and materials storage.

Proposed 26kL plunge pool to Structural Engineer's detail.

Existing stair from lower level to be removed. Make good terrace over.

Existing residence.

DCP1 DCP4 DCP2 DCP3

Extent of rock overhang to be removed shown in blue

1543 side setback (pool)

9405 rear setback (pool)

40.430m boundary

30.520m boundary

5.260m boundary

6.815m boundary

5.725m boundary

12.405m boundary

38.915m boundary

Site Plan Scale 1:200

Area Calculations

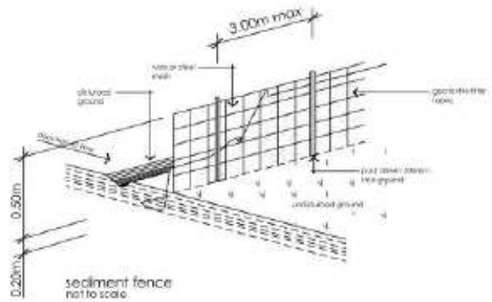
Site area	1316.6sqm
Existing Gross Floor Area (GFA)	260.0sqm
Proposed Gross Floor Area (GFA)	260.0sqm

Legend

- Vehicle entry
- Existing structure to be demolished
- Extent of new works

Erosion and Sediment Control

Install controls in accordance with the requirements of Northern Beaches Council.
Provide filter bags at boundary and nearest stormwater inlet pit where site sediments controls do not prevent sediment entering stormwater system or pits.
Construct washdown area in accordance with Council's requirements if required.
Construct stabilised site entry.
Provide sedimentation fence if site conditions do not prevent sediment accessing stormwater system.
All sediment control measures are to be in place prior to commencing works and shall be maintained and stay in place until site is stabilised or revegetated.
Builder shall submit plan to Council prior to commencing works.



A	ISSUED FOR DEVELOPMENT APPLICATION	05.04.23
P1	CONSULTANT ISSUE	07.11.22

AMENDMENTS

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KRETCHMER/GLEW RESIDENCE
10 BEVERLEY PLACE, CURL CURL

DEVELOPMENT APPLICATION

SITE PLAN
SCALE 1:200 @ A3

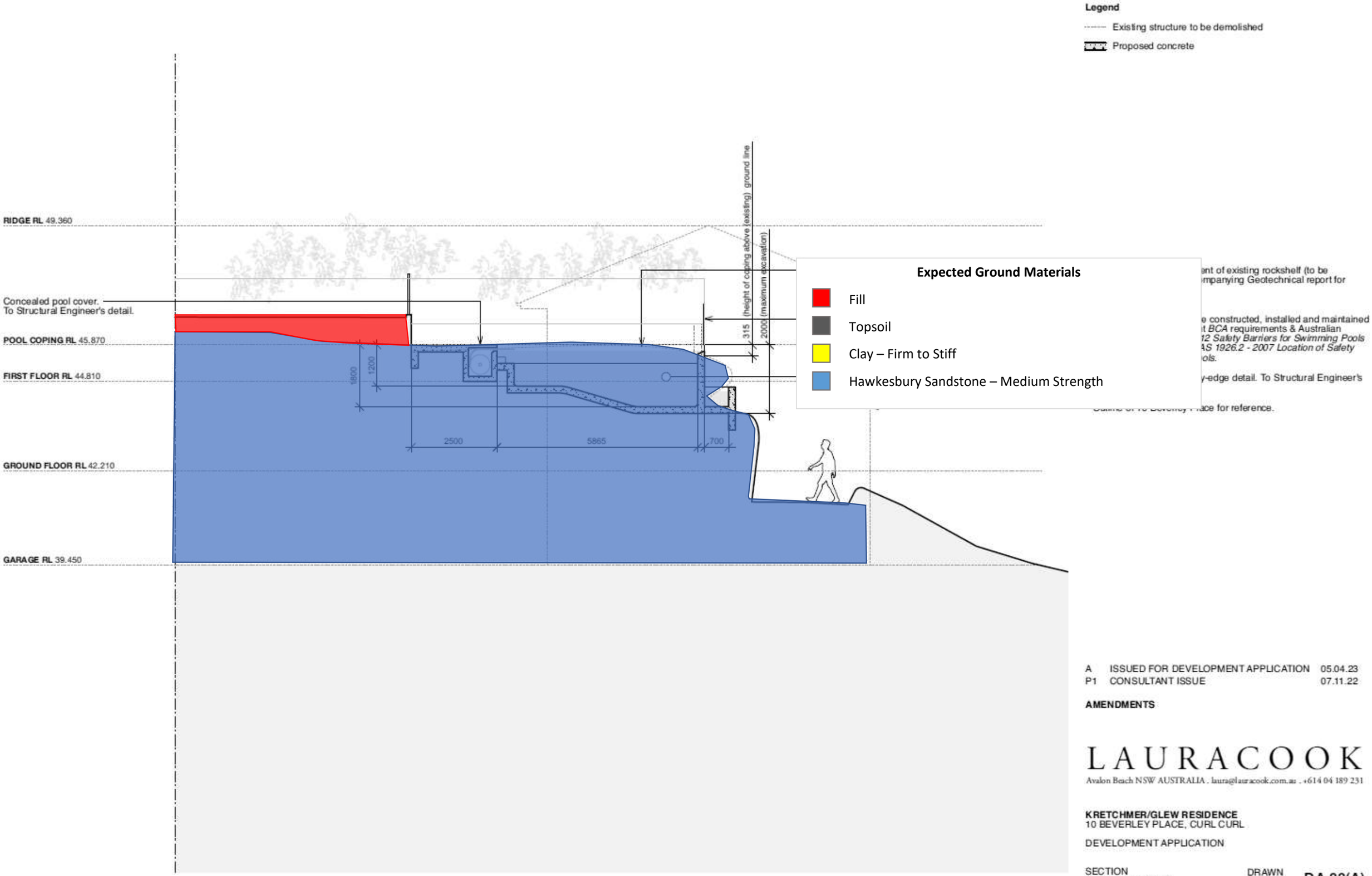
DRAWN
LC

DA.01(A)

All works to be in accordance with Australian Standards, The Building Code of Australia, other relevant codes, and with Manufacturers' recommendations and instructions.

Do not scale from drawings. Verify all dimensions on site prior to construction.

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



Section A Scale 1:100

A	ISSUED FOR DEVELOPMENT APPLICATION	05.04.23
P1	CONSULTANT ISSUE	07.11.22

AMENDMENTS

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KRETCHMER/GLEW RESIDENCE
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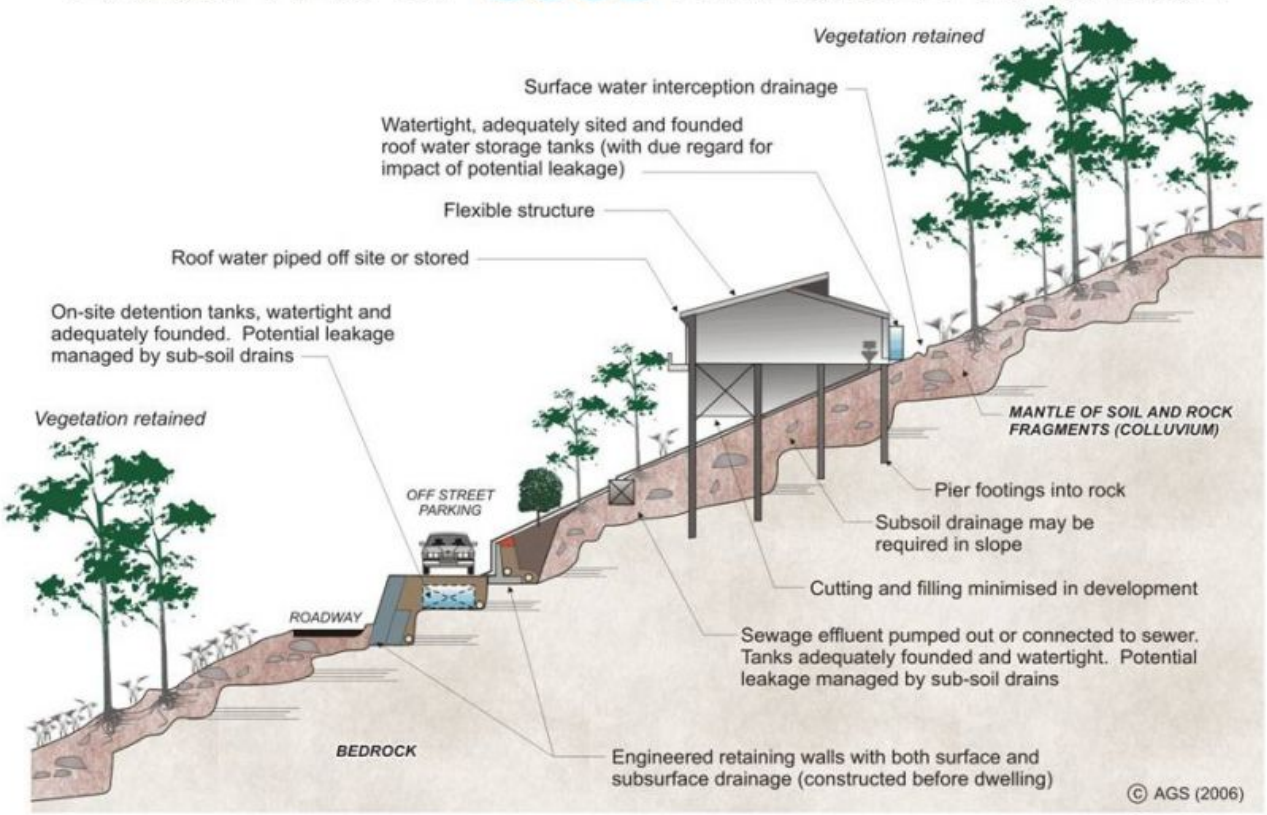
DEVELOPMENT APPLICATION

SECTION
SCALE 1:100 @ A3

DRAWN
LC

DA.08(A)

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE