GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for _____
Name of Applicant

Address of site 187 Riverview Road, Avalon Beach

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk ***Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report***

I, Ben White *on behalf of* White Geotechnical Group Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 7/9/23 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $10million.

I:
Please mark appropriate box

☒ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☒ am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☐ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.

☐ have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Report **187 Riverview Road, Avalon Beach**

Report Date: 7/9/23

Author: BEN WHITE

Author's Company/Organisation: **WHITE GEOTECHNICAL GROUP PTY LTD**

Documentation which relate to or are relied upon in report preparation:

Australian Geomechanics Society Landslide Risk Management March 2007.

White Geotechnical Group company archives.

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature _____

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for _____
Name of Applicant

Address of site 187 Riverview Road, Avalon Beach

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Report **187 Riverview Road, Avalon Beach**

Report Date: 7/9/23

Author: BEN WHITE

Author's Company/Organisation: WHITE GEOTECHNICAL GROUP PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted **4/8/23**
(date)

☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)

☒ Subsurface investigation required
- ☐ No Justification _____
- ☒ Yes Date conducted **4/8/23**

☒ Geotechnical model developed and reported as an inferred subsurface type-section

☒ Geotechnical hazards identified
- ☒ Above the site
- ☒ On the site
- ☐ Below the site
- ☐ Beside the site

☒ Geotechnical hazards described and reported

☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Consequence analysis
- ☒ Frequency analysis

☒ Risk calculation

☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.

☒ Design Life Adopted:
- ☒ 100 years
- ☐ Other _____
specify

☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified

☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.

☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature _____

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL INVESTIGATION:

New House and Pool at **187 Riverview Road, Avalon**

1. Proposed Development

1.1 Demolish the existing house.

1.2 Construct a new part three storey house with pool, terrace, courtyard, landscaping works, garage and suspended driveway by excavating to a maximum depth of ~5.4m. The pool and lower ground floor portions of the excavation reach maximum depths of ~4.0m and ~5.4m respectively. A stepped excavation with six steps is required for the ground floor, courtyard and landscaping works. The depths of each step range from ~0.7m to ~2.3m deep. The benches between the steps range from ~1.3m to ~4.3m wide. The maximum combined stepped excavation depth is ~4.5m.

1.3 Construct a new inclined lift that runs from the proposed terrace on the downhill side of the house to a deck at the waterfront.

1.4 Details of the proposed development are shown on 22 drawings prepared by Andrew Burges Architects, drawings numbered DA-A00 to DA-A08, DA-D01 to DA-D05, DA-E01 to DA-E03, DA-F01 to DA-F03, DA-M01 and DA-W02, Revision A, dated 4/9/23.

2. Site Description

2.1 The site was inspected on the 4th August, 2023 and previously on the 13th August, 2021.

2.2 This waterfront residential property is on the low side of the road and has a W aspect. It is located on the steeply graded upper to lower reaches of a hillslope that falls to Pittwater. The natural slope falls from the uphill property boundary to the

downhill side of the house at an average angle of ~20° before reaching the top of a sandstone rock face that is estimated to be ~6.0m high. The slope below the rock face falls at an angle of ~30° before reaching Pittwater. The slope above the property decreases in grade.

2.3 At the road frontage, a concrete driveway runs down the slope to a rendered masonry garage that shows no significant signs of movement (Photo 1). Rendered masonry and concrete block retaining walls up to ~1.8m high beside and below the driveway support cuts and fills for lawn and garden areas (Photos 1 & 2). The upper retaining wall displays a vertical crack, but will be demolished as part of the proposed works. The two storey rendered brick house is supported on brick walls (Photos 3 & 4). The external supporting walls show no significant signs of movement.

A timber deck and balcony extend off the downhill side of the house. An inclined lift runs from the upper floor of the house to the waterfront. Masonry retaining walls up to ~2.0m high support filled garden areas on the downhill side of the house (Photos 5 & 6). The retaining walls were partially obscured by vegetation, but from what could be seen of the walls they appear to be stable. The lower wall is supported directly on a Medium Strength Sandstone rock face that is estimated to be up to ~6.0m high (Photo 7). The rock face displays some jointing (Photo 8), but appears to be currently stable. Another sandstone rock face that is estimated to be up to ~4.5m high is located downhill of the upper rock face (Photo 9). The rock is undercut slightly at the base (Photo 10), but given the relatively thick cantilever arm in relation to its overhang length the rock is considered to be stable. Large detached sandstone joint blocks are located in stable positions on the slope below the rock faces near the waterfront (Photo 11). Construction works are ongoing at the waterfront. The works have slightly undercut a brick and mortared stone retaining wall ~2.0m high (Photo 12). The owner of the property has informed us that this wall will be remediated as part of the ongoing boatshed construction works.

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

Two hand Auger Holes (AH) were put down to identify the soil materials. Five 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 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 (~RL31.0) **–** AH1 (Photo 13)

Depth (m)	Material Encountered
0.0 to 0.4	**FILL**, sandy soil and clay, dark brown, orange, grey, damp, fine to coarse grained.
0.4 to 0.5	**SANDY CLAY**, orange brown, firm to stiff, moist.

End of test @ 0.5m in firm to stiff sandy clay. No watertable encountered.

AUGER HOLE 2 (~RL22.6) **–** AH2 (Photo 14)

Depth (m)	**Material Encountered**
0.0 to 0.35	**FILL**, sandy soil and clayey soil, with some rock fragments, brown, orange, grey white, dry, fine to coarse grained.

Refusal @ 0.35m in fill. No watertable 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** (~RL31.0)	**DCP 2** (~RL26.4)	**DCP 3** (~RL26.4)	**DCP 4** (~RL22.6)	**DCP 5** (~RL20.5)
0.0 to 0.3	6	3	3	16	Medium Strength Sandstone exposed at base of ~2.0m high retaining wall.
0.3 to 0.6	11	#	#	19	
0.6 to 0.9	8			34	
0.9 to 1.2	18			38	
1.2 to 1.5	22			#	
1.5 to 1.8	5				
1.8 to 2.1	#				
2.1 to 2.4					
2.4 to 2.7					
	Refusal on Rock @ 1.6m	Refusal on Rock @ 0.2m	Refusal on Rock @ 0.2m	Refusal on Rock @ 1.2m	

#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 @ 1.6m, DCP thudding on rock surface, brown orange clay and brown soil on damp tip.
DCP2 – Refusal on Rock @ 0.2m, DCP bouncing off rock surface, dark brown soil on damp tip.
DCP3 – Refusal on Rock @ 0.2m, DCP bouncing off rock surface, dark brown soil on damp tip.
DCP4 – Refusal on Rock @ 1.2m, DCP bouncing off rock surface, orange brown rock fragments on dry tip.

DCP5 – Medium Strength Sandstone bedrock exposed at the base of a ~2.0m high concrete block retaining wall.

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 fill and a thin topsoil over firm to stiff clays. Fill to a maximum depth of ~2.0m provides level platforms for lawn, garden and paved areas across the property. In the test locations, the clays merge into the weathered zone of the underlying rock at depths of between ~0.2m to ~2.0m below the current surface, being deeper where the fill is deepest (DCP5) and shallower on the downhill side of a retaining wall that supports a cut (DCP2 & 3). The weathered zone of the underlying rock is interpreted as Extremely Low to Medium Strength Rock. It is to be noted that Extremely Low Strength Rock is a soft rock and can appear as a mottled stiff clay when it is cut up by excavation equipment. Medium Strength Sandstone bedrock is outcropping downhill of the house (Photos 7 to 10). This is interpreted to be an unusually thick band of sandstone in an otherwise shale dominated profile. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Ground water seepage is expected to move over the denser and less permeable clay and weathered rock layers in the sub-surface profile and through the cracks in the rock. Due to the slope and elevation of the block, the water table is expected to be many metres below the base of the proposed works.

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 or below the property. The steeply graded slope that falls across the property and continues above is a potential hazard (**Hazard One**). The vibrations produced during the proposed excavation are a potential hazard (**Hazard Two**). The proposed excavation is a potential hazard (**Hazard Three**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The steep slope that falls across the property and continues above failing and impacting on the property.	The vibrations produced during the proposed excavation for the house, pool and landscaping impacting on the neighbouring properties and jointed sandstone rock face (Photos 7 & 8).	The proposed excavation for the house, pool and landscaping collapsing onto the worksite and impacting the neighbouring properties during the excavation process.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'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	3.7×10^{-4}/annum
COMMENTS	This level of risk is 'ACCEPTABLE', provided the recommendations in **Section 16** are carried out.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 11 & 12** are to be followed.	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.

(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 to Pittwater. All stormwater from the proposed development is to be piped to Pittwater through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to a maximum depth of ~5.4m is required to construct the proposed house, with pool, terrace, courtyard and landscaping works. The pool and lower ground floor portions of the excavation reach maximum depths of ~3.4m and ~5.4m respectively. A stepped excavation with six steps is required for the ground floor, courtyard and landscaping works. The depths of each step range from ~0.7m to ~2.3m deep. The benches between the steps range from ~1.0m to ~3.8m wide. The maximum combined stepped excavation depth is ~4.5m.

The excavation is expected to be through fill, topsoil and clay, with Extremely Low to Medium Strength Rock expected at depths of between ~0.2m to ~2.5m below the current surface, being deeper in the filled areas.

Excavations through fill, soil, clay and Extremely Low to Low Strength Rock are expected to be carried out with an excavator and toothed bucket. If Medium Strength Rock is encountered it will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through fill, soil, clay and rock up to Low Strength will be below the threshold limit for building damage utilising a domestic sized excavator up to 16 tonne.

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the S and N neighbouring properties and jointed sandstone rock face (Photos 7 & 8). Allowing for backwall drainage, the excavation is set back ~3.0m from the S neighbouring house, ~1.0m from the S neighbouring garage, ~1.7m from the N neighbouring house (currently under construction), ~1.2m from the N neighbouring garage (currently under construction) and is estimated to be set back ~3.0m from a joint in the sandstone rock face (Photo 8).

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

Excavation methods are to be used that limit peak particle velocity to 5mm/sec at the neighbouring houses and at the jointed sandstone rock face (Photos 7 & 8). 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 neighbouring houses.

13. Excavation Support Requirements

As this job is considered technically complex and due to the depth of the excavation, we recommend it be carried out by builders and contractors who are well experienced in similar work and can provide a proven history of completed work. We recommend a pre-construction meeting between the structural engineer, the builder, and the geotechnical consultant to discuss and confirm the excavation plan and to ensure suitable excavation equipment will be on site.

Allowing for backwall drainage, the setbacks are as follows:

- The lower ground floor portion of the excavation is set back ~2.0m from the S neighbouring concrete pathway that runs beside the common boundary, ~3.0m from the S neighbouring house and ~0.5m from the N common boundary.
- The pool portion of the excavation is set back ~3.0m from the S common boundary.
- The landscaping excavation comes flush with the S common boundary, ~1.0m from the S neighbouring garage, flush with the N common boundary and flush with the road reserve.

The above structures and boundaries 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 (from horizontal) through fill/soil and a 45° line through clay / weathered rock (Extremely Low to Low Strength Rock) from the base of the excavation or the top of Medium Strength, whichever comes first, towards the surrounding structures and boundaries.

Due to the depth of the excavation and its proximity to nearby structures and common boundaries, the perimeters of the excavation will require ground support installed prior to the commencement of the excavation. See the Lower Ground Floor and Ground Floor plans attached for the minimum extent of the required shoring shown in blue.

A spaced pile retaining wall is one of the suitable methods of support. Pier spacing is typically ~2.0m but can vary between 1.6 to 2.4m depending on the design. As the excavation is lowered in 1.5m lifts, infill sprayed concrete panels or similar are added between the piers to form the wall. Drainage is to be installed behind the panels. To drill the pier holes for the walls, a pilling rig that can excavate through Medium to High Strength Rock will be required. The piers can be temporarily supported by embedment below the base of the excavation or with a combination of embedment and propping. For permanent bracing, the walls can be tied into the proposed structures (house slabs, courtyard slab and pool shell), braced with buttresses, or anchored. Where anchors need to be drilled into and below the adjoining property, the permission of the owners is required (in this case permission will need to be granted by the N and S neighbouring properties and the appropriate authority responsible for the road reserve).

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all pile holes/excavations installed for ground support purposes.

Where shoring is not required for the middle cuts/steps that form part of the stepped excavation for the ground floor and landscaping, the excavations through clay and rock up to Low Strength are expected to stand at near vertical angles for short periods of time until the retaining walls are in place, provided the cut batters are kept from becoming saturated. Medium Strength Rock 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 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 through fill, soil, clay and rock up to Low Strength 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 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 cut batters through fill, soil, clay and rock up to Low Strength remain unsupported for more than a few days before the construction of the retaining walls they are to be temporarily supported until the retaining walls are in place.

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 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	Passive	Bond Stress
Fill and Topsoil	20	0.40	0.55	N/A	N/A
Residual Clays	20	0.35	0.45	Kp = 2.0 'ultimate'	N/A
Extremely Low to Very Low Strength Rock	22	0.25	0.38	Kp = 2.5 'ultimate'	70kPa 'ultimate'
Low Strength Rock	24	0.20	0.35	1000kPa 'ultimate'	300kPa 'ultimate'
Medium Strength Rock	24	0.00	0.01	2000kPa 'ultimate'	1000kPa '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 assume a level surface above the structure and do not account for any surcharge loads, noting that surcharge loads from the structures and slope above will be acting on the wall that will need to be accounted for in the design. It also assumes retaining structures are fully drained. It should be noted that the passive pressures and bond stresses are ultimate values 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. Ground materials and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

A multi-propped or anchored shoring system can be designed using a rectangular lateral earth pressure distribution using a pressure of 4H kPa for soil/clay and 3H kPa for rock up to Low Strength, where H is the depth of the excavation in metres (or to the top of competent

Medium Strength Rock). Where small movements are not tolerable, the wall can be designed using a pressure of 6H kPa for soil/clay and 4H kPa for rock up to Low Strength. Using these values will give relatively conservative support. More refined design can be obtained using an appropriate retaining wall design program.

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 house, pool and terrace are expected to be seated in Extremely Low Strength Rock or better on the uphill side. This is a suitable foundation material. The proposed suspended driveway, inclined lift and the downhill side of the house, pool and terrace (where these structures are not seated in weathered rock at the base of the excavation) are to be supported on piers embedded into Extremely Low Strength Rock or better. This ground material is expected at depths of between ~0.2m to ~2.5m below the current surface, being deeper in the filled areas. A maximum allowable bearing pressure of 600kPa can be assumed for footings embedded in Extremely Low Strength Rock or better.

The downhill side of the proposed pool and terrace are in close proximity to a ~6.0m high sandstone rock face. The piers are to be set back at least 1.0m from the top edge of the rock face. This may require the downhill edge of the pool or terrace be designed by the structural engineer with a small cantilever so no loads are placed within 1.0m of the rock face.

As the bearing capacity of weathered rock reduces when it is wet we recommend the footings be dug, inspected and poured in quick succession (ideally the same day if possible). If the

footings get wet, they will have to be drained and the soft layer of weathered rock on the footing surface will have to be removed before concrete is poured.

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 and inspected.

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. Ongoing Maintenance

Where slopes are steep and approach or exceed 30°, such as on this property, it is prudent for the owners to occasionally inspect the slope (say annually or after heavy and prolonged rainfall events, whichever occurs first). Should any of the following be observed: movement or cracking in retaining walls, cracking in any structures, cracking or movement in the slope surface, tilting or movement in established trees, leaking pipes, or newly observed flowing water, or changes in the erosional process or drainage regime, then a geotechnical consultant should be engaged to assess the slope. We can carry out these inspections upon request. The risk assessment in **Section 8** is subject to this ongoing maintenance being carried out.

17. Geotechnical Review

The structural plans are to be checked and certified by the geotechnical engineer as being in accordance with the geotechnical recommendations. On completion, a Form 2b will be issued. This form is required for the Construction Certificate to proceed.

REQUIRED INSPECTIONS ON NEXT PAGE

18. 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.

- The geotechnical consultant is to inspect the ground materials while the first pile for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations. All finished pile holes for piled wall/excavations for ground support are to be inspected and measured before concrete is placed.

- 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 and contractors are still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

Reviewed By:

Dion Sheldon
BEng(Civil)(Hons),
Geotechnical Engineer.

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

Photo 1

Photo 2

Photo 3

Photo 4

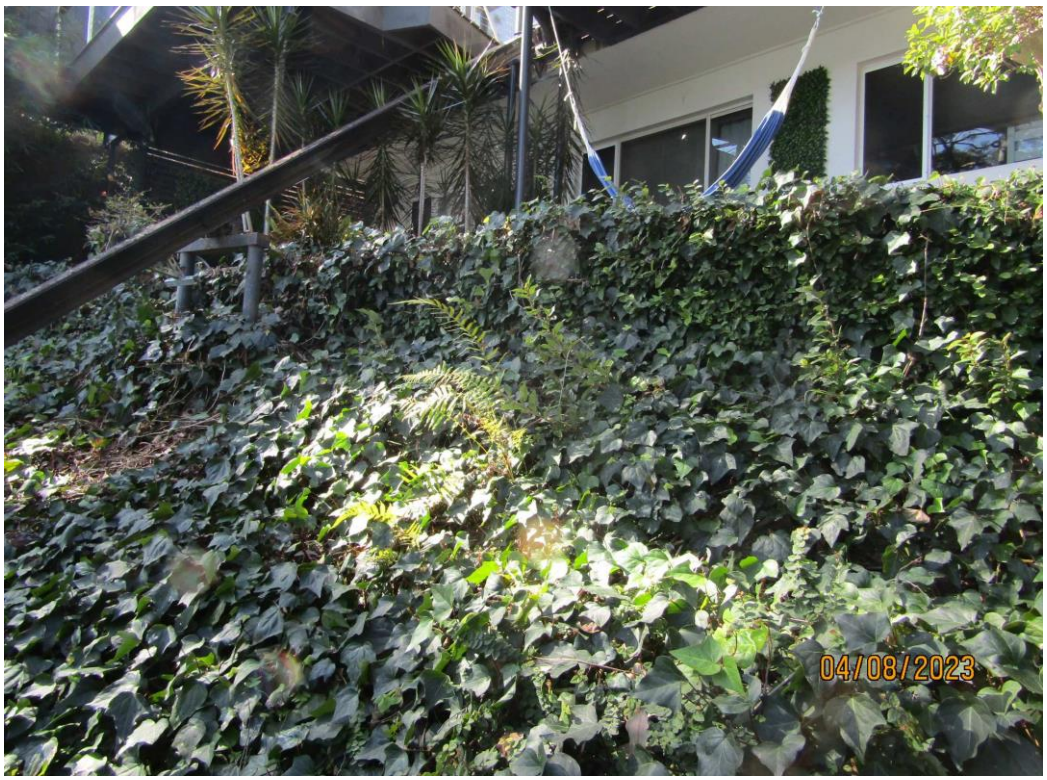


Photo 5

Photo 6

Photo 7

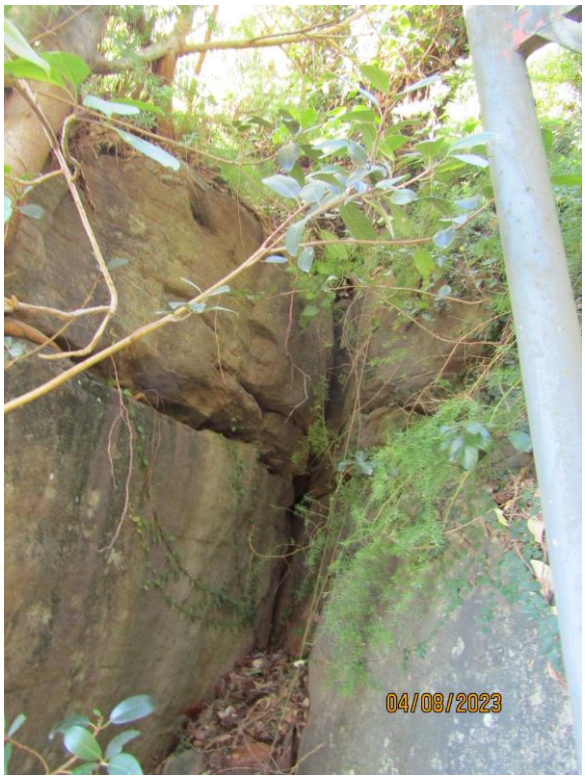


Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13: AH1 – Downhole is from left to right.

Photo 14: AH2 – Downhole is from left to right.

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.

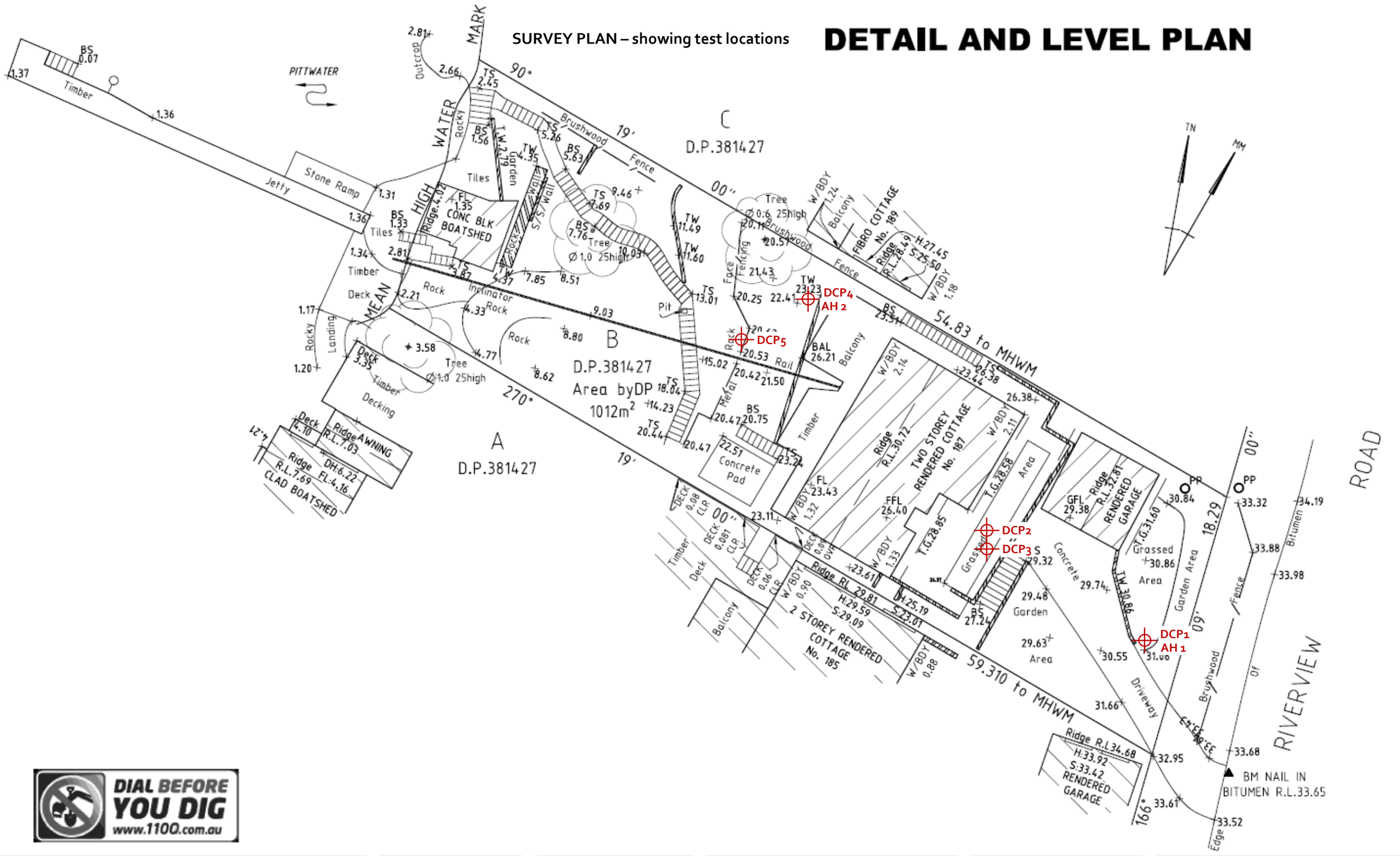
- This report should not be applied to any other project other than that outlined in section 1.0.

- 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.

SURVEY PLAN – showing test locations

DETAIL AND LEVEL PLAN



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SCALE 1:250
DATUM : AHD71
ORIGIN :PM 11663
SURVEYED : RL
DRAWN : RL
DATE:22/01/2021

REVISION No.	DATE
1	09/02/21

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TITLE DESCRIPTION
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L.G.A. NORTHERN BEACHES

187 RIVERVIEW ROAD

AVALON BEACH

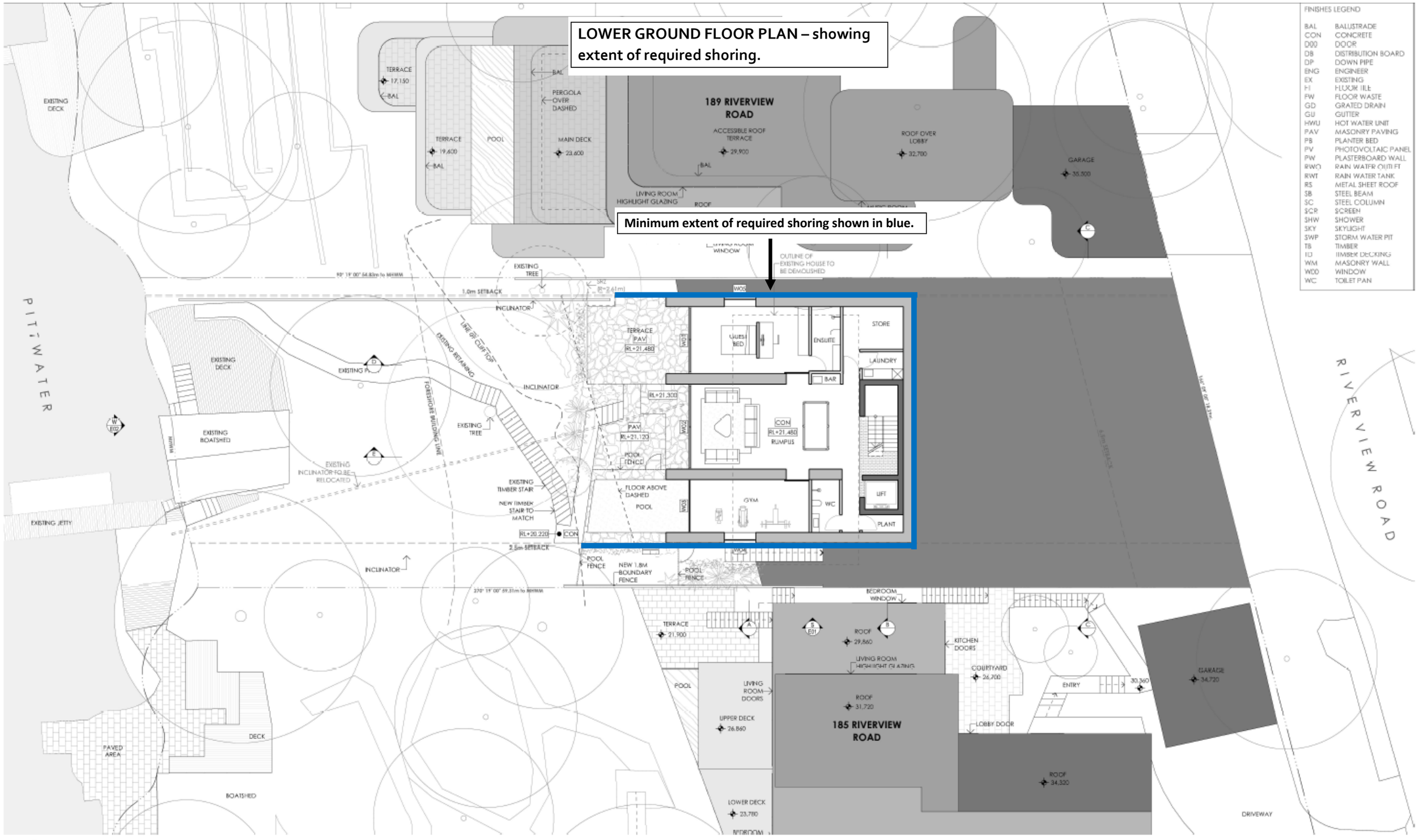
REFERENCE No. 160

SHEET 1 of 1

A3

LOWER GROUND FLOOR PLAN – showing extent of required shoring.

Minimum extent of required shoring shown in blue.



FINISHES LEGEND

BAL	BALUSTRADE
CON	CONCRETE
DOO	DOOR
DB	DISTRIBUTION BOARD
DP	DOWN PIPE
ENG	ENGINEER
EX	EXISTING
FT	FEATURE TILE
FW	FLOOR WASTE
GD	GRATED DRAIN
GU	GUTTER
HWU	HOT WATER UNIT
PAV	MASONRY PAVING
PB	PLANTER BED
PV	PHOTOVOLTAIC PANEL
PW	PLASTERBOARD WALL
RWO	RAIN WATER OUTLET
RWT	RAIN WATER TANK
RS	METAL SHEET ROOF
SB	STEEL BEAM
SC	STEEL COLUMN
SCR	SCREEN
SHW	SHOWER
SKY	SKYLIGHT
SWP	STORM WATER PIT
TB	TIMBER
TD	TIMBER DECKING
WM	MASONRY WALL
WDO	WINDOW
WC	TOILET PAN

01 - LOWER GROUND FLOOR PLAN 1:200

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KEY

- EXISTING STRUCTURES/HARD SURFACES TO BE MAINTAINED
- EXISTING NEIGHBOURS
- PROPOSED MASONRY STRUCTURE
- PROPOSED TIMBER FRAMED STRUCTURE
- PROPOSED CONCRETE STRUCTURE
- PROPOSED METAL STRUCTURE
- PROPOSED GLAZING

REV	DATE	DESCRIPTION
A	04.09.2023	FOR COORDINATION

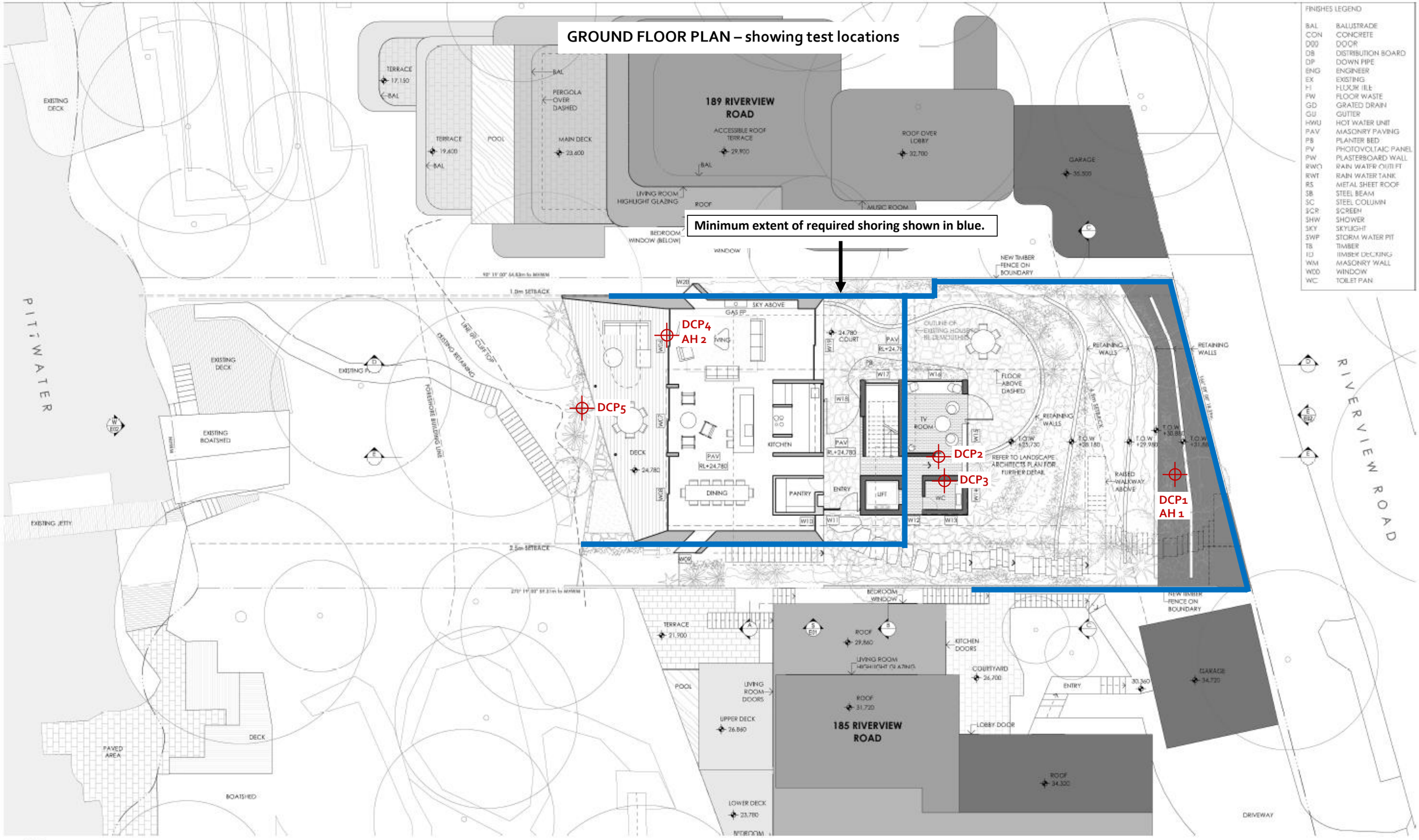
SCALE 1:200 @ A3

CLIENT ADAM & VANESSA RICHARDS
FIRST ISSUE 04.09.2023
DATE 187 RIVERVIEW ROAD AVALON BEACH

DRAWING LOWER GROUND FLOOR PLAN
REV. A

DA-D01

GROUND FLOOR PLAN – showing test locations



FINISHES LEGEND

BAL	BALUSTRADE
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SKY	SKYLIGHT
SWP	STORM WATER PIT
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TD	TIMBER DECKING
WM	MASONRY WALL
WDO	WINDOW
WC	TOILET PAN

01 – GROUND FLOOR PLAN
1:200

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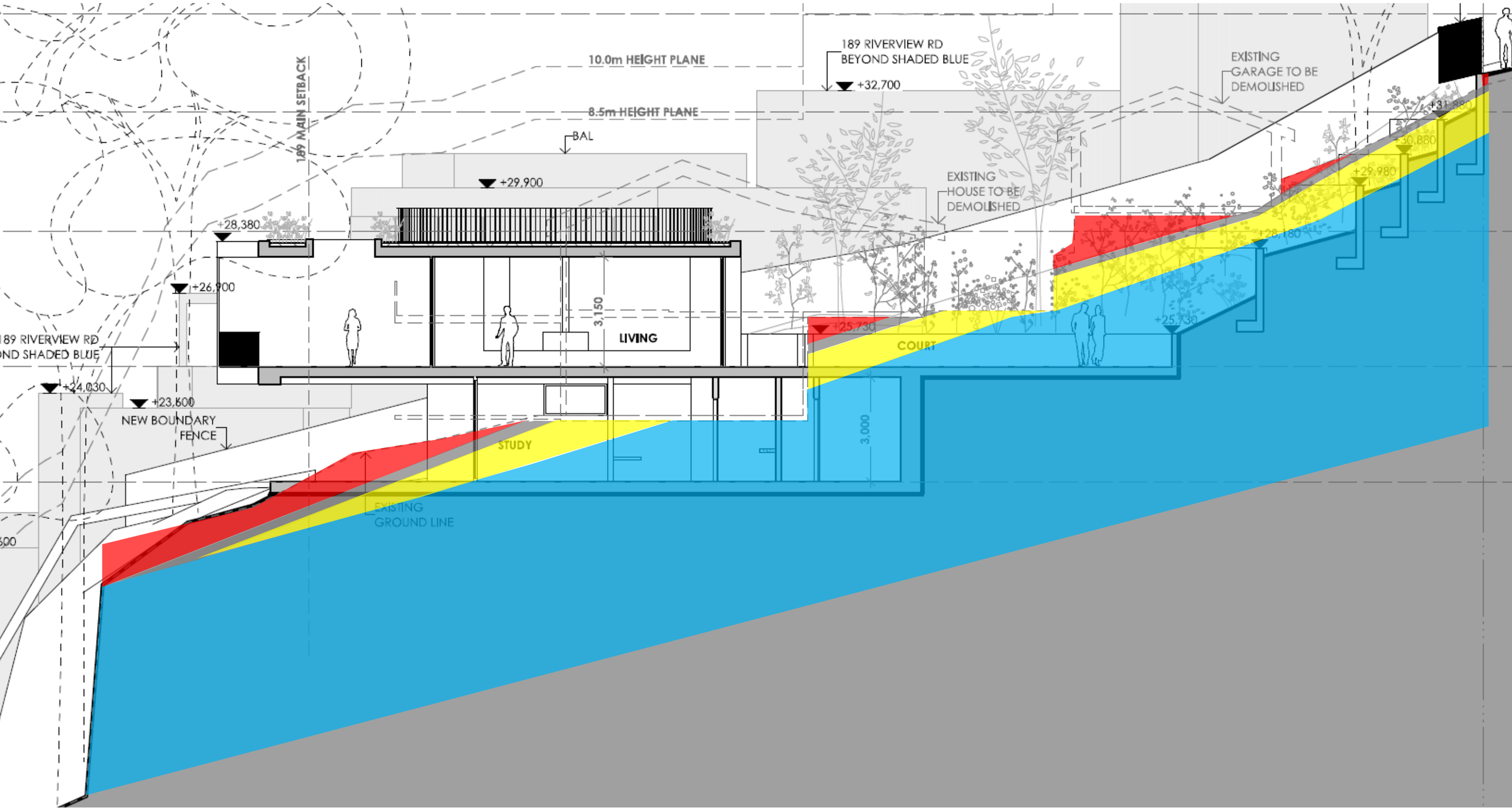
DRAWING
GROUND FLOOR PLAN

REV.
B

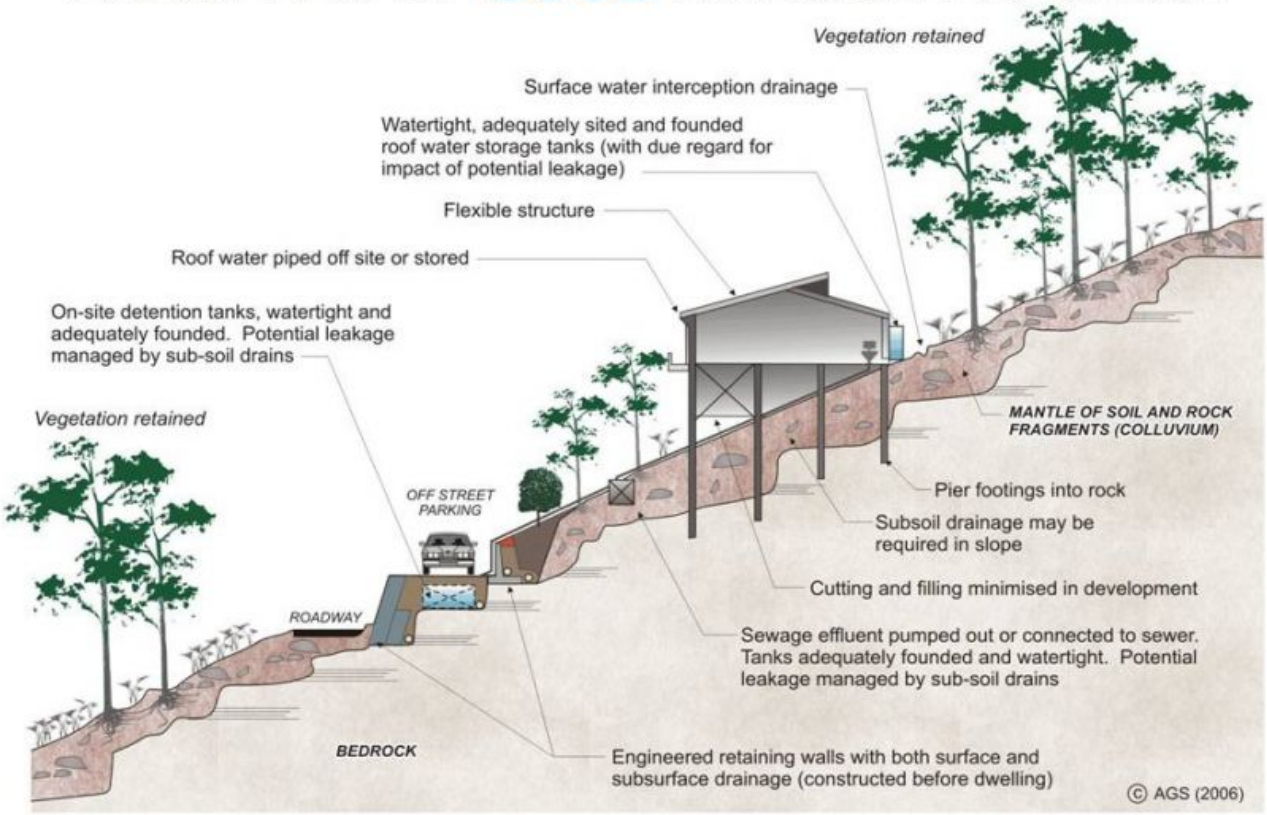
DA-D02

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



- Fill
- Topsoil
- Clay – Firm to Stiff
- Narrabeen Group Rocks – Extremely Low to Medium Strength Rock - after being cut up by excavation equipment can resemble a stiff to hard clay.

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE