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

Development Application for _____
Name of Applicant

Address of site 155 Pacific Road, Palm 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 26/11/21 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 **155 Pacific Road, Palm Beach**
Report Date: 26/11/21

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 155 Pacific Road, Palm 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 **155 Pacific Road, Palm Beach**

Report Date: 26/11/21

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **16/11/21**
(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 **16/11/21**

☒ 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:

Alterations and Additions and New Pool and Studio at **155 Pacific Road, Palm Beach**

1. Proposed Development

1.1 Construct a staircase on the uphill side of the house by excavating to a maximum depth of ~2.9m.

1.2 Install a lift on the uphill side of the house by excavating to a maximum depth of ~3.0m.

1.3 Construct an extension to the N and W sides of the house by excavating up to a maximum depth of ~0.9m.

1.4 Construct a studio on the downhill side of the property by excavating to a maximum depth of ~3.3m.

1.5 install a pool off the downhill side of the house.

1.6 Various other internal and external additions and alterations.

1.7 Details of the proposed development are shown on 27 drawings prepared by CM Studio, project number 2021_135, drawings numbered DA030, DA040, DA050, DA051, DA101 to DA105, DA201 to DA206, DA301 to DA303, DA402 to DA404, DA501 to DA503, DA601, and DA602 dated 2021-11-21, DA401, dated 2021-10-19, and DA402 to DA404, and DA501 to DA503, undated.

2. Site Description

2.1 The site was inspected on the 16th November, 2021.

2.2 This residential property has dual access. It is on the low side of Pacific Road, and accessed by a footpath on the high side of Livistona Lane. This property has a NE aspect. It is located on the steeply graded upper reaches of a hillslope. The slope falls

across the upper two thirds of the property at angles averaging ~28°, before easing to an average of ~20° to the lower common boundary. The slope above eases to the crest of the hill and the slope below the property continues at similar angles.

2.3 At the road frontage to Pacific Road, a concrete driveway runs down the slope to a carport and continues to two garages in the SW corner of the property (Photo 1). Between the road frontage and the house is a stable, ~1.0m high sandstone block retaining wall that supports a cut to create a level lawn area (Photo 2). The cut has been partially made through outcropping competent Medium Strength Sandstone. A stable, ~0.5m high sandstone block retaining wall supports the fill for the level lawn area above (Photo 3). The part three-storey timber clad house is supported on brick walls and brick piers. The external brick walls show no significant signs of movement. One of internal brick piers on the downhill side of the house appear to be askew to the bearer (Photo 4). Some of the walls and piers of the house were observed to be supported directly off outcropping Competent Medium Strength Sandstone (Photo 5). An inclined lift runs down the NW side of the property. A series of sandstone block retaining walls of varying heights between ~0.3m and ~1.8m terrace the slope immediately below the house to the NE common boundary. One of the sandstone block retaining walls has started to separate at the mortar due to root action of the palm tree above (Photo 6 & 7). See **Section 16** for advice regarding this wall. Competent Medium Strength Sandstone can be seen outcropping in various places and some of the walls are supported directly on this ground material. On the E corner of the property is a timber shed. The cut for the shed is supported by a concrete block and sandstone block retaining wall reaching up to ~1.7m high. The shed and retaining wall are to be demolished as part of the proposed works. A ~3.0m high sandstone rockface that falls to the neighbouring property on the NE common boundary is undercut to ~1.0m (Photo 8 & 9). Given the thickness of the supporting cantilever arms with no visible defects, the undercut rock is considered to be stable. A moderately to

steeply sloping pathway and garden area extend ~50m to the lower common boundary and Road frontage to Livistona Lane.

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. Eight 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:

AUGER HOLE 1 (~RL68.1) **–** AH1 (Photo 10)

Depth (m)	**Material Encountered**
0.0 to 0.6	**FILL**, sandy, dark brown, loose, dry, medium grained, fine trace of organic matter.
0.6 to 0.7	**SOIL,** dark brown, loose, medium to coarse grained, dry.
0.7 to 0.9	**SAND**, grey with orange and white intermixed, medium dense, coarse grained, damp.

End of test @ 0.9m. 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** (~RL54.0)	**DCP 2** (~RL55.3)	**DCP 3** (~RL60.1)	**DCP 4** (~RL61.3)
0.0 to 0.3	Rock exposed at the surface	4	4	Rock exposed at the surface
0.3 to 0.6		9	11	
0.6 to 0.9		3	11	
0.9 to 1.2		#	#	
		Refusal on Rock @ 0.7m	Refusal on Rock @ 0.65m	

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 5** (~RL65.1)	**DCP 6** (~RL68.2)	**DCP 7** (~RL69.6)	**DCP 8** (~RL67.9)
0.0 to 0.3	3	4	6	6
0.3 to 0.6	#	5	13	12
0.6 to 0.9		10	#	14
0.9 to 1.2		13		7
1.2 to 1.5		17		#
1.5 to 1.8		#		
	Refusal on Rock @ 0.25m	Refusal on Rock @ 1.35m	Refusal on Rock @ 0.45m	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 – Rock exposed at the surface.

DCP2 – Refusal on rock @ 0.7m, DCP bouncing off rock surface, white and orange impact dust on dry tip.

DCP3 – Refusal on rock @ 0.65m, DCP bouncing off rock surface, white and orange impact dust on dry tip.

DCP4 – Rock exposed at the surface.

DCP5 – Refusal on rock @ 0.25m, DCP bouncing off rock surface, white impact dust on dry tip.
DCP6 – Refusal on rock @ 1.35m, DCP bouncing off rock surface, white impact dust on dry tip, orange sand in collar.
DCP7 – Refusal on rock @ 0.45m, DCP bouncing off rock surface, white impact dust on dry tip.
DCP8 – Refusal on rock @ 1.2m, 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 sandy soils and sands that fill the bench step formation. Filling has been placed above and below the house for landscaping. In the test locations, where the rock was not exposed, it was encountered at depths of between 0.25m and 1.2m 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 excavations.

7. Surface Water

No evidence of surface flows was observed on the property during the inspection. It is expected that there will be minimal to no sheet wash entering the property from above during prolonged rainfall as the site is near the crest of the hill. Most sheetwash that moves down the steep site will be generated on the property.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above or beside the property. The moderate to steeply graded slope that falls across the property and continues below is a potential hazard (**Hazard One**). The cracked retaining wall below the house is a potential hazard (**Hazard Two)**. The vibrations from the proposed excavations are a potential hazard (**Hazard Three**). The proposed excavations are a potential hazard until retaining walls are in place (**Hazard Four**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate to steep slope that falls across the property and continues below failing and impacting on the proposed works.	Further movement of the ~1.8m high sandstone block retaining wall below the house that causes damage or failure (Photos 6 & 7).
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (15%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	9.1×10^{-7}/annum	1.3×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE', provided the recommendations in **Section 17** are followed.	This level of risk to life and property is 'TOLERABLE'. To move the risk to 'ACCEPTABLE' levels, the recommendations in **Section 16** are to be followed.

RISK ANALYSIS CONTINUES ON THE NEXT PAGE

HAZARDS	Hazard Three	Hazard Four
TYPE	The vibrations produced during the proposed excavations impacting on the surrounding structures.	The excavations (up to a maximum depth of ~3.3m) 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	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.	This level of risk to life and property is 'UNACCEPTABLE'. 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

The fall is to Livistona Lane. Roof water from the development is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations

Four excavations are required for the proposed development:

- A new staircase to a maximum depth of ~2.9m.
- A new lift to a maximum depth of ~3.0m.
- An extension to the NW side of the house to a maximum depth of ~0.9m.

- A cut to create a level platform for a studio on the downhill side of the property to a maximum depth of ~3.3m.

Where Medium Strength Sandstone is not exposed at the surface the excavations are expected to be through fill, sandy soils, and sands to depths of between ~0.2m and ~1.2m before encountering the rock.

It is envisaged that excavations through fill, soil, and sands can be carried out with a bucket and excavations through Medium Strength Rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through fill, soil, and sand 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 remaining supporting walls of the subject house. Allowing for ~0.5m of backwall drainage, the setbacks are as follows:

- Flush with the supporting walls of the subject house.
- ~0.5m from the SE common boundary.
- ~1.5m from the sandstone block retaining wall uphill of the studio.
- ~2.7m from the subject garage.
- ~9.0m from the NW neighbouring house.

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 supporting walls of the subject house and SE 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

Bulk Excavation for the Staircase and Lift and Extension to the NW side of the house

The excavation for the proposed Staircase will reach a maximum depth of ~2.9m. The excavation for the lift shaft will reach a maximum depth of ~3.0m. The excavation for the extension to the NW side of the house will reach a maximum depth of ~0.9m. Allowing for ~0.5m of backwall drainage, the setbacks are as follows:

- Near flush with the remaining supporting walls of the house.
- ~2.7m from the uphill subject garage.

Medium Strength Sandstone is expected at depths of between ~0.5m and ~1.2m below the current surface in the area of the proposed Lift and Staircase, and at a maximum depth of ~0.3m below the surface in the area of the proposed extensions to the NW. The subject walls that are to remain are directly supported on the underlying sandstone bedrock.

As such, no structures or boundaries are expected to be within the zone of influence of these excavations.

Where room permits, the fill, soil, and sand portions of the excavation face are to be battered temporarily at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining walls are in place. Medium Strength Sandstone or better will stand at vertical angles unsupported subject to approval by the geotechnical consultant.

During the excavation process, the geotechnical consultant is to inspect the excavations as they approach no less than 1.0m horizontally from the remaining foundations of the house to confirm the stability of the cut to go flush with the footings.

Bulk Excavation for the Studio on the Downhill Side of the Property

The excavation for the studio on the will reach a maximum depth of 3.3m. Allowing for ~0.5m of backwall drainage, the setbacks are as follows:

- ~0.5m from the SE common boundary.
- ~1.5m from the uphill sandstone block retaining wall.

Medium Strength Sandstone is expected at a maximum depth of ~0.7m below the current surface in the area of the proposed works and can be seen outcropping in several places. As such, only the SE common boundary will be within the zone of influence of the proposed excavation. In this instance, the zone of influence is the area above a theoretical 30° line from the base of the excavation or top of Medium Strength Rock, whichever is encountered first, towards the surrounding structures and boundaries.

Where the SE common boundary falls within the zone of influence of the excavation, provided the fill, soil, and sand portions of the excavation faces are to be battered temporarily at 1.0 Vertical to 1.7 Horizontal (30°) and the cut batters are covered in plastic, the cut is expected to stand unsupported for the short period until the retaining walls are in place. Where the rock is too deep to allow for batters, temporary or permanent support is to be installed through the fill and soil portion of the cut before excavation through rock commences.

The remaining low-cut batters are expected to stand unsupported at near-vertical angles for short periods of time until retaining walls are installed, provided they are kept from becoming saturated.

Advice Applying to all Excavations

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. Unsupported cut batters through fill, soil, and sand 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 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.

During the excavation process, the geotechnical consultant is to inspect the cuts in 1.5m intervals as they are 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.

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, Soil, and Sand	20	0.40	0.55
Medium Strength Rock	24	0.00	0.10

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 lift, and staircase are expected to be entirely seated in Medium Strength Sandstone. The proposed extension to the NW and the studio on the downhill side of the property are expected to be partially seated in Medium Strength Sandstone. This is a suitable

foundation material. Where it is not exposed, or where the footprint of the proposed works does not fall over the excavations, shallow piers taken to rock will be required to maintain a uniform bearing material across the structure. The piers for the downhill side of the studio are expected to encounter Medium Strength Sandstone at a maximum depth of ~0.7m below the current surface and the piers for the downhill side of the extension to the NW side of the house are expected to encounter Medium Strength Sandstone at shallow depths.

Due to the steep grade of the slope below the location of the proposed pool, piers potted at least ~0.3m into Medium Strength Sandstone are suitable footings. This material is expected to be exposed at the surface or at shallow depths. Where footings are over an exposed sloping rock surface, they may be supported off level pads cut into the rock and fixed with suitable bar grouted / epoxied 04m into the rock.

Any additional footings required for the proposed additions and alterations to the house are also to be taken to the underlying or exposed Medium Strength Sandstone.

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. Remedial Works

The ~1.8m high sandstone block retaining wall has started to crack through the mortar due to root action of the tree above (Photos 6 & 7). We recommend consideration be made to repairing/replacing the retaining walls during the proposed works. Alternatively, the retaining walls can to be inspected by the owners on an annual basis or after heavy prolonged rainfall, whichever occurs first, keeping a photographic record of the inspections. We can carry out these inspections upon request. Should any new movement be observed, the retaining walls are to be remediated or rebuilt to current engineering standards.

17. Site Maintenance

Where slopes approach or exceed 30°, such as on this site, it is prudent for the owners to occasionally inspect the slope (say annually or after heavy 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 site maintenance being carried out.

18. 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.

19. 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 owners and Occupation Certificate if the following inspections have not been carried out during the construction process.

- During the excavation process, the geotechnical consultant is to inspect the excavations as they approach no less than 1.0m horizontally from the foundations of the house to confirm the stability of the cut to go flush with the footings.

- 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.

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 (Right to Left)

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.

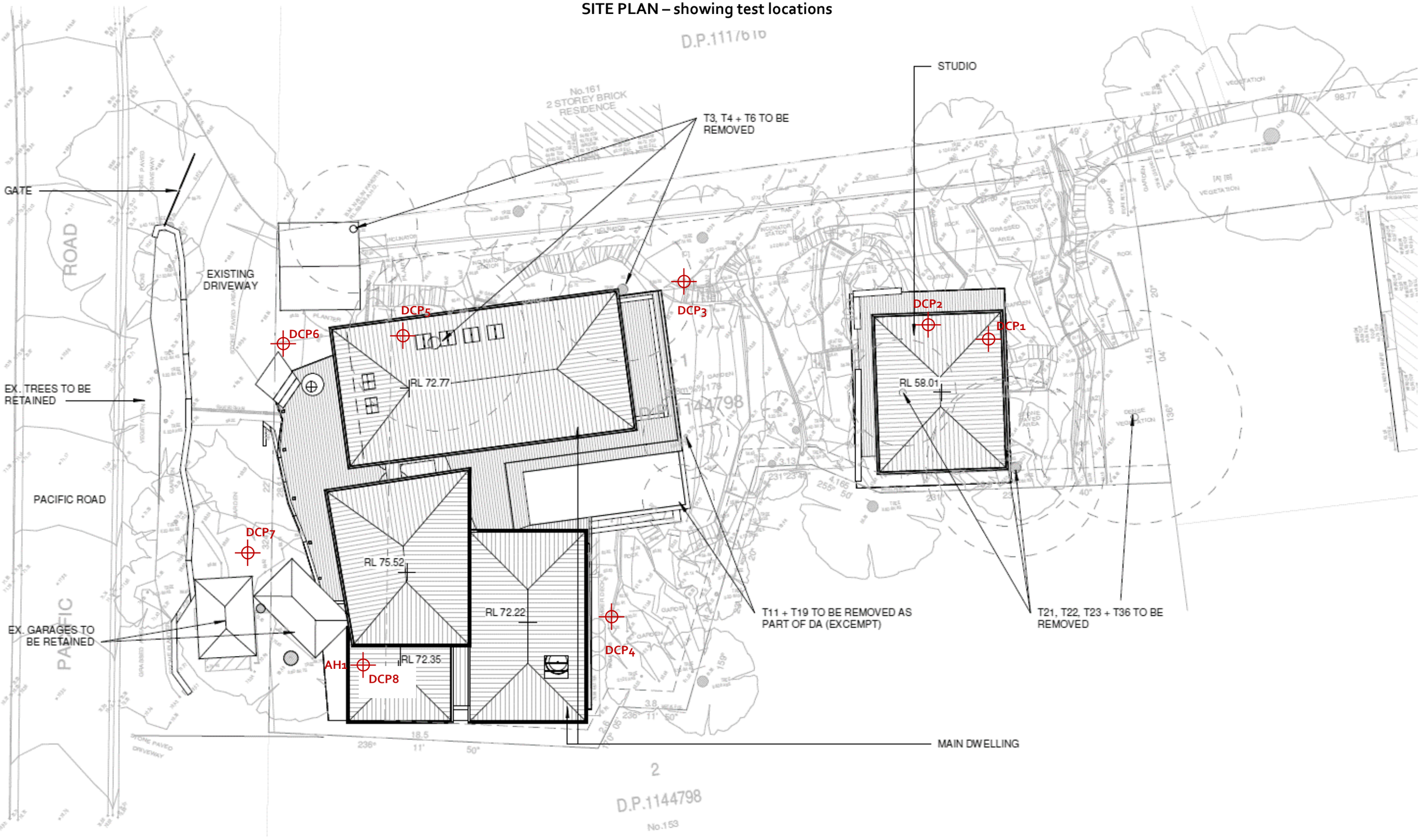
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



Project:
Greader Lambert-Smith House

155 Pacific Road, Palm Beach

Project number 2021_135

Revisions

No.	Description	Date
1	DA	2021-11-22

Client:
Philip & Jo

Drawing Number: DA030 Issue 1

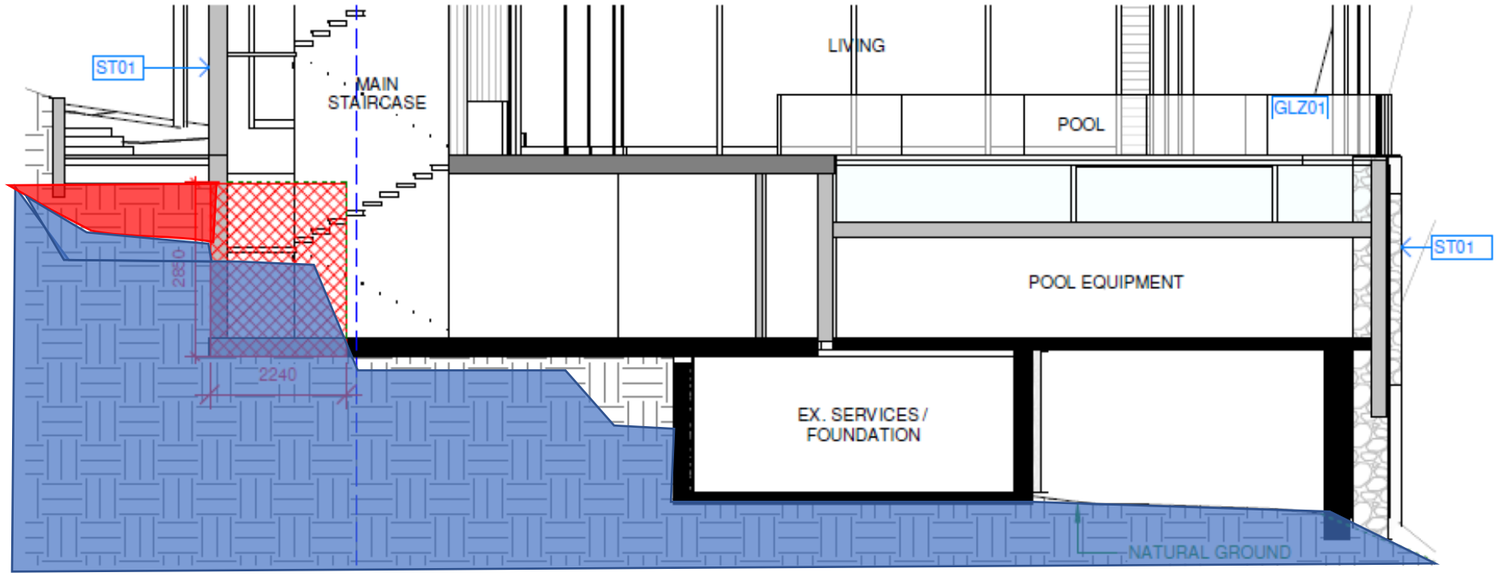
Date 2021-11-22

Drawing:
Site Plan

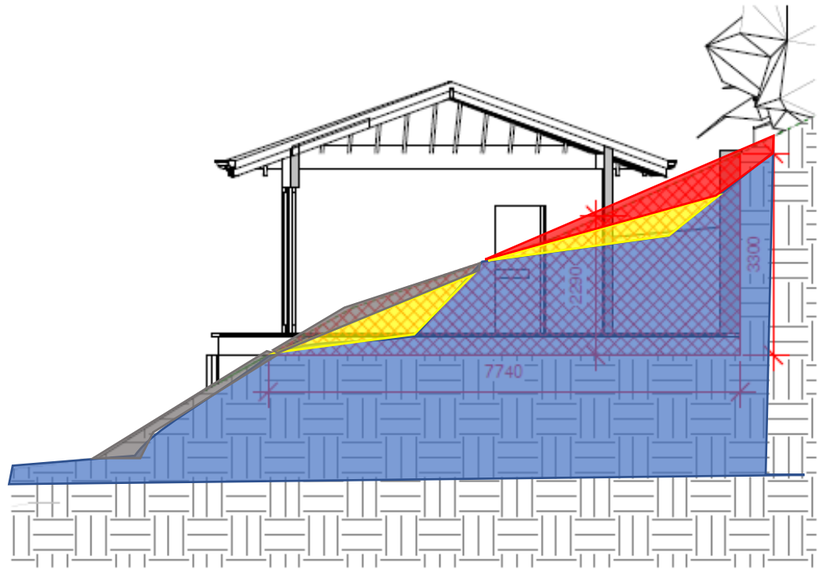
Scale 1 : 200 @ A3

Drawn by: EW Checked by: MB

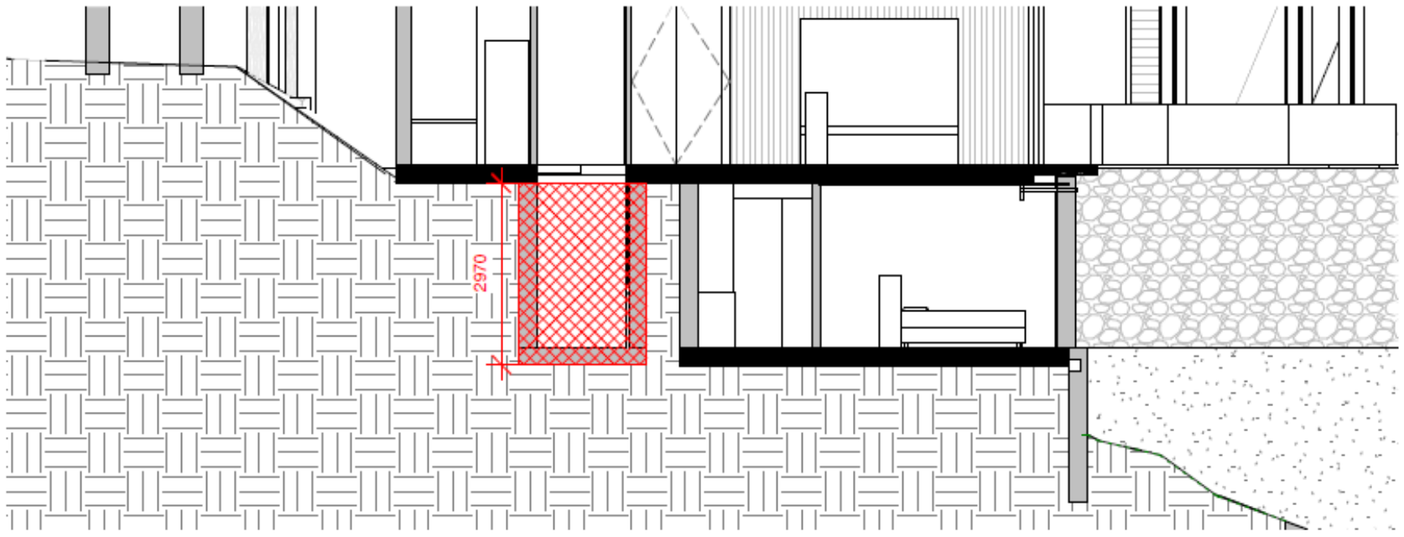
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



1 Excavation Section 1
1 : 100



2 Excavation Section 2
1 : 100



3 Excavation Section 3
1 : 100

Expected Ground Materials

- Fill
- Topsoil
- Sand
- Hawkesbury Sandstone – Medium Strength

Project:
Greader Lambert-Smith House

155 Pacific Road, Palm Beach

Project number 2021_135

Revisions		
No.	Description	Date
1	DA	2021-11-22

Client:
Philip & Jo

Drawing Number: DA602 Issue 1

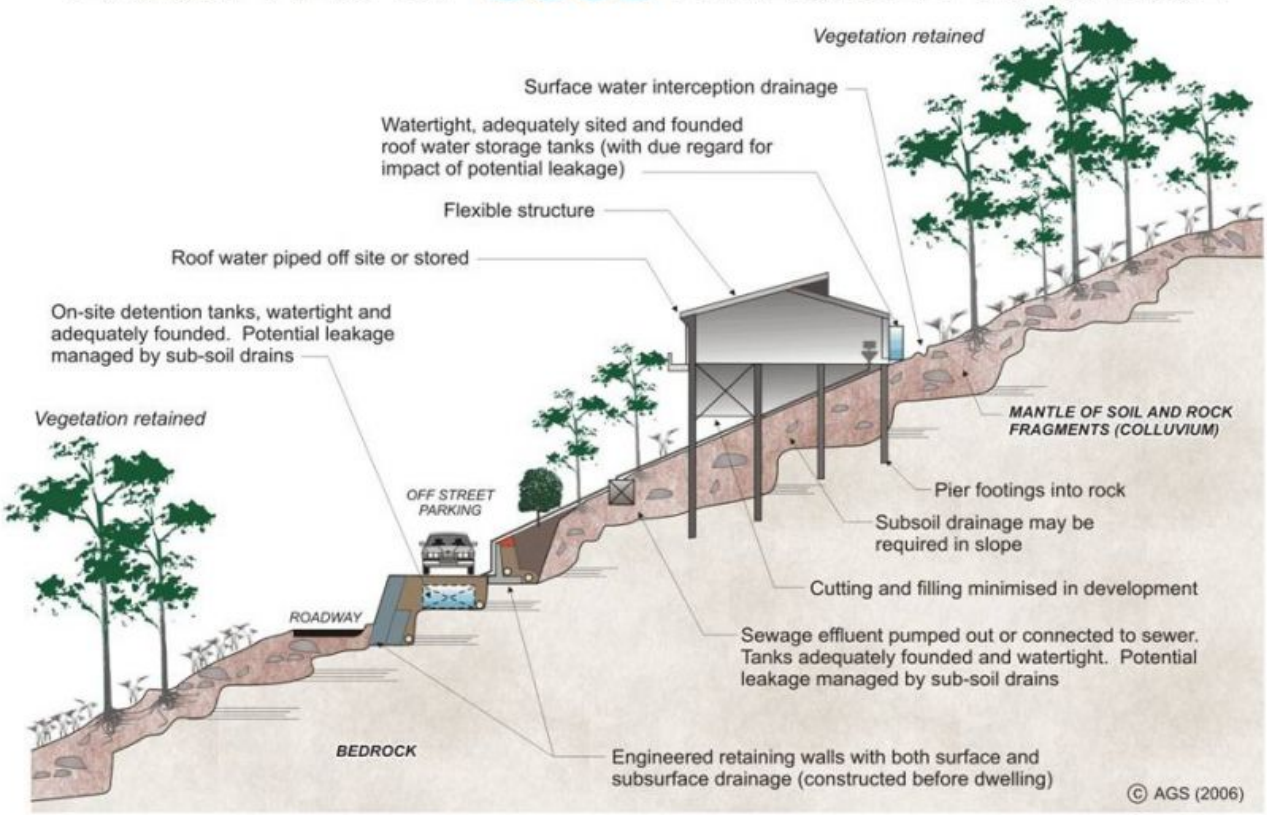
Date 2021-11-22

Drawing:
Excavation Section

Scale 1 : 100 @ A3

Drawn by: EW Checked by: MB

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE