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

**Development Application for** _____
Name of Applicant

**Address of site** 33 Hillcrest Avenue, Mona Vale

*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 19/11/18 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 **33 Hillcrest Avenue, Mona Vale**

Report Date: 19/11/18

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** 33 Hillcrest Avenue, Mona Vale

*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 **33 Hillcrest Avenue, Mona Vale**

Report Date: 19/11/18

Author: BEN WHITE

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

**Please mark appropriate box**

☒ Comprehensive site mapping conducted **8/11/18**
(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 **9/11/18**

☒ 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, Pool and cabana at **33 Hillcrest Avenue, Mona Vale**

## 1. Proposed Development

**1.1** Demolish the existing house and construct a new three storey house in the same location by excavating to a maximum depth of ~2.5m into the slope.

**1.2** Construct and pool and cabana on the downhill side of the property by excavating to a maximum depth of ~3.7m into the slope.

**1.3** Details of the proposed development are shown on 9 drawings prepared by Gartner Trovato Architects, Issue A, project numbered 1809, drawings numbered A.01 to A.09, dated September 2018.

## 2. Site Description

**2.1** The site was inspected on the 8th November, 2018.

**2.2** This residential property is on the low side of the road and has a SW aspect. It is located on the moderately graded upper reaches of a hillslope. From the road frontage to the downhill side of the house, the slope falls at average angles of ~11° and continues at ~14° to the lower boundary. The slope above the property eases as the crest of the slope is approached. The land surface below falls at similar angles.

**2.3** At the road frontage a concrete and sandstone paved driveway runs to a garage on the uphill side of the house (Photo 1). A ~0.6m high brick retaining wall to the S of the driveway supports a cut that levels a paved patio on the uphill side of the house (Photo 2). The root system of a large palm has damaged the wall but it will be demolished as part of the proposed works. The two-storey brick and timber clad house will be demolished as part of the proposed works (Photo 3). The slope between the downhill side of the house and the lower boundary is densely-vegetated with exotic weeds and shrubs (Photo 4). No significant signs of movement were observed on the

property. No geotechnical hazards that could impact on the subject property were observed on the neighbouring properties as seen from the subject property and the road.

## 3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group. It is described as interbedded laminate, shale and quartz to lithic quartz sandstone.

## 4. Subsurface Investigation

One Hand Auger Hole (AH) was put down to identify the ground materials. Eight 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. 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 and the results are as follows:

**AUGER HOLE 1** (~RL46.6) **–** AH1 (Photo 5)

| Depth (m) | Material Encountered |
|---|---|
| 0.0 to 0.4 | **TOPSOIL,** sandy soil, brown, organic matter throughout, fine to medium grained, rock fragments, loose, dry. |
| 0.4 to 0.6 | **CLAY**, firm, brown and orange, malleable, dry. |

End of test @ 0.6m in clay. 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** | **DCP1** (~RL48.4) | **DCP2** (~RL47.1) | **DCP3** (~RL45.1) | **DCP4** (~RL45.2) |
| 0.0 to 0.3 | 4 | 5 | 6 | 8 |
| 0.3 to 0.6 | 39 | 8 | 10 | 6 |
| 0.6 to 0.9 | 11 | 10 | 16 | 9 |
| 0.9 to 1.2 | 40 | 35 | 17 | 9 |
| 1.2 to 1.5 | # | # | 30 | 15 |
| 1.5 to 1.8 | | | # | 26 |
| 1.8 to 2.1 | | | | # |
| | Refusal @ 1.2m | End of Test @ 1.2m | Refusal @ 1.4m | Refusal @ 1.7m |

| DCP TEST RESULTS – Dynamic Cone Penetrometer | | | | |
|---|---|---|---|---|
| Equipment: 9kg hammer, 510mm drop, conical tip. | | | Standard: AS1289.6.3.2- 1997 | |
| **Depth(m) Blows/0.3m** | **DCP5** (~RL46.6) | **DCP6** (~RL39.0) | **DCP7** (~RL37.2) | **DCP8** (~RL37.6) |
| 0.0 to 0.3 | 2 | 7 | 9 | 11 |
| 0.3 to 0.6 | 6 | 9 | 40 | 18 |
| 0.6 to 0.9 | 10 | 37 | # | # |
| 0.9 to 1.2 | 13 | # | | |
| 1.2 to 1.5 | 24 | | | |
| 1.5 to 1.8 | 33 | | | |
| 1.8 to 2.1 | # | | | |
| | End of Test @ 1.8m | End of Test @ 0.9m | Refusal @ 0.5m | Refusal @ 0.4m |

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

***DCP Notes:***

DCP1 – Refusal @ 1.2m, DCP bouncing off hard surface, yellow clay on dry tip.

DCP2 – End of test @ 1.2m, DCP still very slowly going down, orange clay on dry tip.

DCP3 – Refusal @ 1.4m, DCP bouncing off hard surface, yellow clay on wet tip.

DCP4 – Refusal @ 1.7m, DCP bouncing off hard surface, yellow clay on dry tip.

DCP5 – End of test @ 1.8m, DCP still very slowly going down, yellow clay on dry tip.
DCP6 – End of test @ 0.9m, DCP still very slowly going down, yellow clay on dry tip.
DCP7 – Refusal @ 0.5m, DCP bouncing off hard surface, yellow/white shale on dry tip.
DCP8 – Refusal @ 0.4m, DCP bouncing off hard surface, clean dry tip.

## 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 shallow sandy topsoil over firm to stiff clays. The clays merge into the underlying weathered rock at depths of between ~1.2 to ~1.8m below the current ground surface becoming shallower downslope. The weathered zone is interpreted to be Extremely Low Strength Shale that becomes progressively stronger with depth. See Site Plan attached for a diagrammatical representation of the expected ground materials.

## 6. Groundwater

Normal ground water seepage is expected to move over the buried surface of the rock and through the cracks.

Due to the slope and elevation of the block, the water table is expected to be many metres below the base of the proposed excavation.

## 7. Surface Water

No evidence of surface flows were observed on the property during the inspection. Normal sheet wash from the slope above will be intercepted by the street drainage system on Hillcrest Avenue.

## 8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below or beside the property. The moderately graded slope that falls across the property is a potential hazard (**Hazard One**). The proposed excavations are a potential hazard until retaining walls and structures are in place (**Hazard Two**).

## Risk Analysis Summary

| HAZARDS | Hazard One | Hazard Two |
|---|---|---|
| **TYPE** | The moderately graded slope that falls across the property collapsing onto the proposed works is a potential hazard. | The proposed excavations collapsing onto the worksite before retaining structures are in place. |
| **LIKELIHOOD** | 'Possible' ($10^{-3}$) | 'Unlikely' ($10^{-4}$) |
| **CONSEQUENCES TO PROPERTY** | 'Medium' (25%) | 'Medium' (30%) |
| **RISK TO PROPERTY** | 'Moderate' ($2 \times 10^{-4}$) | 'Low' ($2 \times 10^{-5}$) |
| **RISK TO LIFE** | $8.3 \times 10^{-4}$/annum | $8.3 \times 10^{-7}$/annum |
| **COMMENTS** | This level of risk is 'ACCEPTABLE' | This level of risk to life and property is '**UNACCEPTABLE'**. To move the risk levels 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

Stormwater from the existing house is either discharged beside the house or is piped underground and the discharge location could not be visually identified. It is recommended a drainage easement be obtained from the downhill neighbouring property and all stormwater or drainage runoff from the proposed development be piped to the street below. If this option is not feasible an infiltration/dispersion trench is suitable as a last resort, provided flows are

kept close to natural runoff for the site with the use of onsite detention. All stormwater is to be piped through any other tanks that may be required by the regulating authorities.

## 11. Excavations

Two excavations are required to install the proposed new house. The cut for the storage room is to be a maximum depth of ~1.8m and the cut for the lower ground floor is to be a maximum depth of ~2.5m with a horizontal distance of ~6.0m between the two cuts. Both excavations are expected to be through a shallow sandy soil over firm to stiff clays that merge into Extremely Low Strength Shale at an average depth of ~1.5m below the surface.

Another excavation is required to install the proposed pool and lawn area. The excavation will be a maximum depth of ~3.7m below the current ground surface. The excavation is expected to be through a shallow sandy soil over firm to stiff clays that merge into Extremely Low Strength Shale at an average depth of ~1.5m below the surface.

It is envisaged the excavations can be carried out with a bucket only and that rock hammers will not be required.

## 12. Vibrations

No excessive vibrations will be generated by excavation through soil, clay or Extremely Low Strength Shale.

## 13. Excavation Support Requirements

**Storage room, pool & pool areas**

The excavation for the storage room will be a maximum depth of ~1.8m and be located ~0.5m from the N common boundary allowing for back wall drainage. Thus the N common boundary will be within the zone of influence of the storage room excavation. The proposed excavation for the lawn area will reach a maximum depth of ~2.0m and increase in depth to the N for the pool to ~3.7m. The lawn excavation will come flush with the N and S common boundaries.

Due to the depths of these excavations and their proximities to the boundaries we recommend ground support be installed prior to the commencement of the excavation. Support is to be in the form of spaced concrete piers or similar. Pier spacing is typically ~ 2.0m but can vary between 1.6 to 2.4m depending on the design. The piers can be supported by embedment or another suitable method. A standard domestic excavator is not considered suitable to drill the required pier holes. To drill the pier holes for the wall a powerful excavator or small pilling rig that can excavate through medium strength rock will be required. If a machine of this type is not available we recommend carrying out core drilling before the construction commences to confirm the strength of the rock and to ensure the excavation equipment is capable of reaching the required depths. 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 installed behind the panels. The respective walls are to be tied into the house and pool structures upon construction after which any temporary support can be released. See Site Plan attached for location of recommended piling in blue.

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

**Excavation for the lower level of the house and other unsupported cut batters**

The upper 1.0m of the excavation for the house is to be battered temporarily at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining walls are in place. The remaining lower portions of the excavations will stand at near vertical angles for short periods of time until retaining walls are in place provided the cut batters are kept from becoming saturated.

Exposed cut batters 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. Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. The materials and labour to construct the retaining structures 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.

The geotechnical professional is to inspect both upper and lower excavation faces in 1.5m intervals as they are being lowered, while the machine is on site to ensure ground materials are as expected and that no additional support is required.

## 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 – Likely Earth Pressures for Retaining structures**

| Unit | Earth Pressure Coefficients | | | |
|---|---|---|---|---|
| | Unit weight ($kN/m^3$) | 'Active' $K_a$ | 'At Rest' $K_0$ | Passive |
| Sandy Soil and Residual Clays | 20 | 0.4 | 0.55 | N/A |
| Extremely Low Strength Rock | 22 | 0.25 | 0.35 | 400kPa '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 do not account for any surcharge loads, assume the surface above the structures is near level and retaining structures are fully drained. It should be noted that passive pressure is an ultimate value 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. 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

A stiffened concrete slab supported directly off Extremely Low Strength Shale is a suitable footing for the proposed dwelling. This ground material is expected to be exposed across the base of the excavation. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low Strength Shale.

The proposed pool is expected to be seated in the Extremely Low Strength Shale. This is a suitable foundation material.

A concrete slab and shallow piers supported on the underlying Extremely Low Strength Shale are suitable footings for the proposed cabana. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low Strength Shale.

As the bearing capacity of clay and shale 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 wet clay or shale 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.

***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. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide certification for the regulating

authorities or the owner 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 pier for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations.

- All finished pier holes for the piled wall are to be inspected and measured before concrete is placed.

- The geotechnical consultant is to inspect all cut faces in 1.5m intervals as they are being lowered, while the machine is on site to ensure ground materials are as expected and that no additional support is required.

- All footings are to be inspected and approved by the geotechnical consultant while the excavation equipment is still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

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


*Photo 1*


*Photo 2*


*Photo 3*


*Photo 4*


*Photo 5: Auger Hole 1: Top of hole at top of image*

## 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 tests 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 professional. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

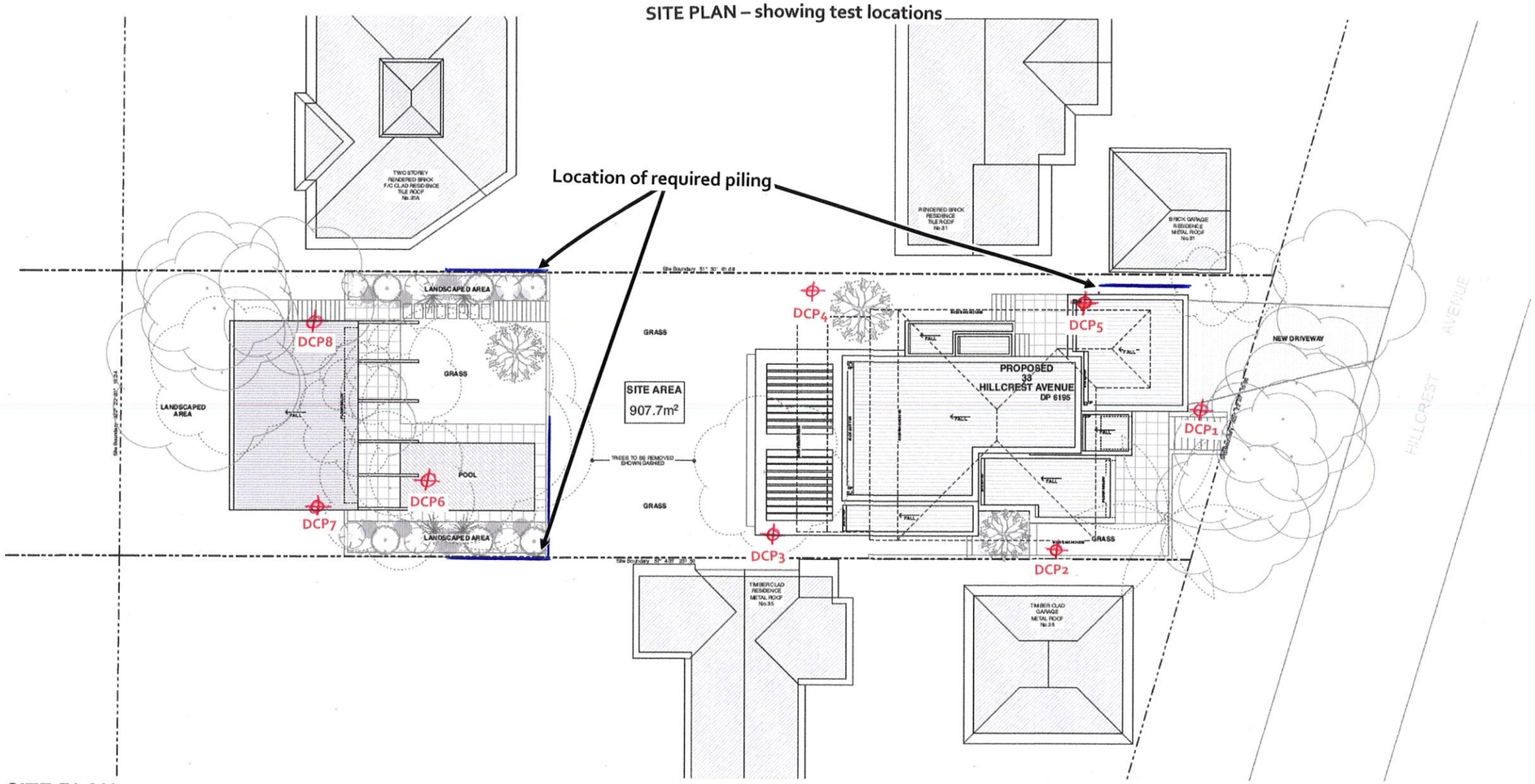
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

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

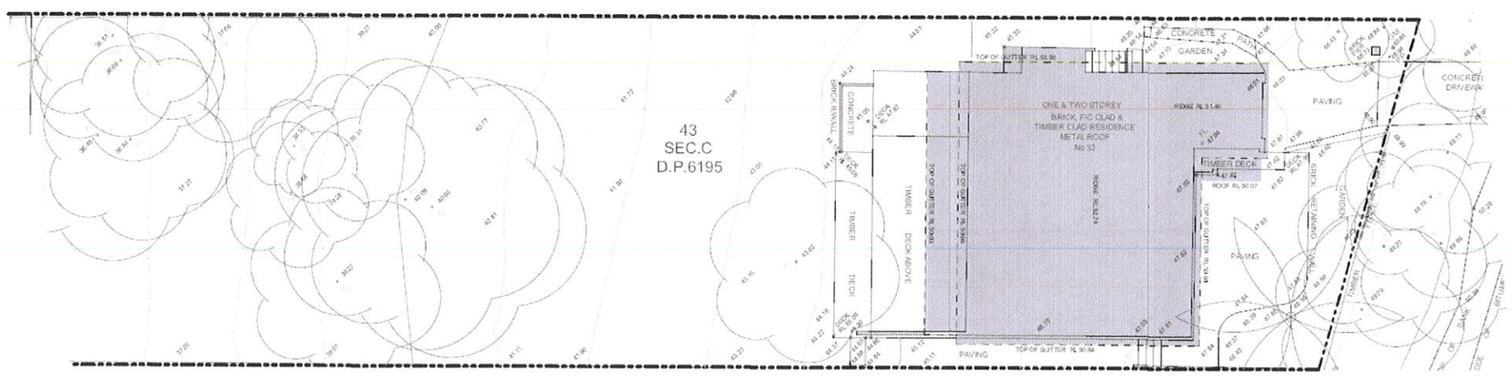
- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

## SITE PLAN – showing test locations




**SITE PLAN** **1:200**




**SITE CALCULATIONS (EXISTING)** **1:200**

N

| Date : | Issue : | Description : | Date : | Issue : | Description : |
|---|---|---|---|---|---|
| Sep 2018 | A | DA Submission | | | |

The builder shall check and verify all dimensions and verify all errors and omissions to the Architect. Do not scale the drawings. Drawings shall not be used for construction purposes until issued by the Architect for construction.

GARTNERTROVATO ARCHITECTS

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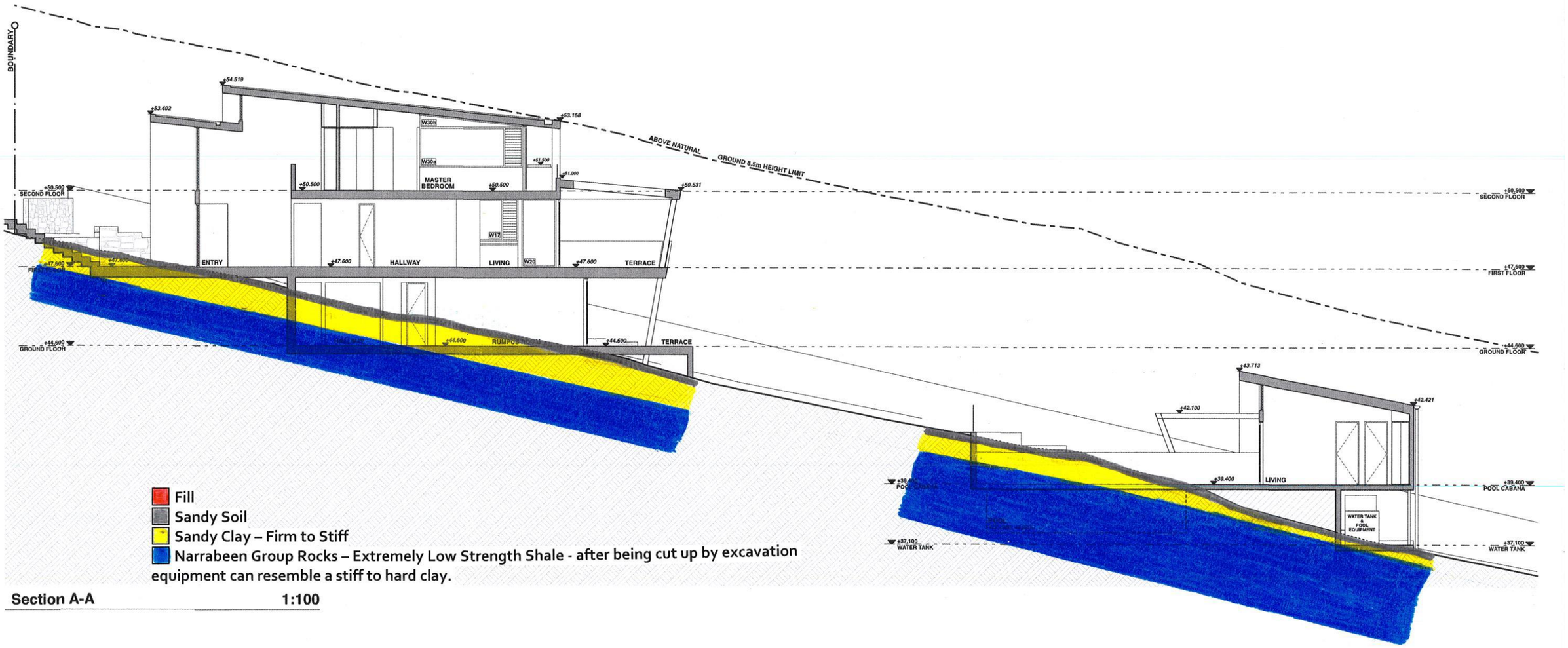
E MAIL@GT.COM.AU

| | | | | | |
|---|---|---|---|---|---|
| Project : | House 33 - LOT 43 - D.P. 6195 HILLCREST AVENUE, MONA VALE | Drawn/Designed : | LT | Date : | SEP 2018 |
| | **NEW HOUSE + POOL** | Project Number : | 1809 | Scale : | 1:100 @ (A2) |
| Client : | STEVENS | Drawing No. : | **A.01** | Issue : | **A** |
| Drawing : | **Sketch Design SITE PLAN** | | | | |

Plot Date: 3/11/18

# TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials




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

**Section A-A** **1:100**

| Date : | Issue : | Description : | Date : | Issue : | Description : |
|---|---|---|---|---|---|
| Sep 2018 | A | DA Submission | | | |

The builder shall check and verify all dimensions and verify all errors and omissions to the Architect. Do not scale the drawings. Drawings shall not be used for construction purposes until issued by the Architect for construction.

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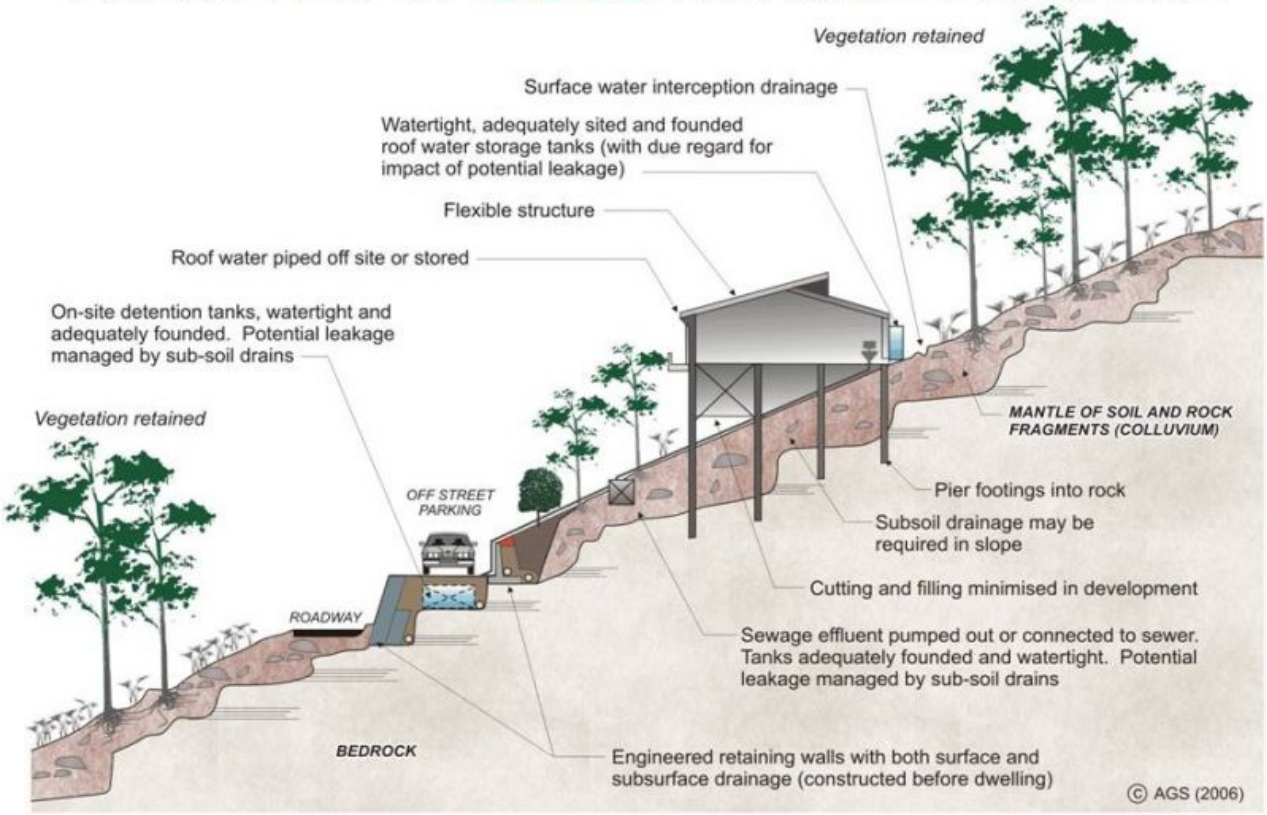
Plot Date: 5/11/18

| | | | | | |
|---|---|---|---|---|---|
| Project : | House 33 - LOT 43 - D.P. 6195 HILLCREST AVENUE, MONA VALE | Drawn/Designed : | LT | Date : | SEP 2018 |
| | **NEW HOUSE + POOL** | Project Number : | 1809 | Scale : | 1:100 @ (A2) |
| Client : | STEVENS | Drawing No. : | **A.09** | Issue : | **A** |
| Drawing : | **Sketch Design SECTION A-A** | | | | |

# EXAMPLES OF **GOOD** HILLSIDE PRACTICE




# EXAMPLES OF **POOR** HILLSIDE PRACTICE