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

Development Application for _____
Name of Applicant

Address of site 47 The Serpentine, Bilgola

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 1/4/19 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 **47 The Serpentine, Bilgola**

Report Date: 1/4/19

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 47 The Serpentine, Bilgola

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 **47 The Serpentine, Bilgola**

Report Date: 1/4/19

Author: BEN WHITE

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

Please mark appropriate box

- ☒ Comprehensive site mapping conducted **20/3/19** (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 **21/3/19**
- ☒ 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 Pool at **47 The Serpentine, Bilgola**

1. Proposed Development

1.1 Install a pool on the downhill side of the property.

1.2 Minor levelling may be required to install the proposed pool.

1.3 Details of the proposed development are shown on 4 drawings prepared by Serenescapes Landscape Designs, project numbered 19508, Revision B, drawings numbered L-01 to L-04, dated 1st March 2019.

2. Site Description

2.1 The site was inspected on the 20th March, 2019.

2.2 This residential property has two road frontages with The Serpentine, at the NE and SW boundaries. It encompasses the crest of a NW –SE trending ridgeline. From the upper NE boundary to the uphill side of the house, the slope rises at average angles of ~5° and falls at average angles of ~17° to the SW boundary. The slopes below the property continue at increasing angles.

2.3 At the NE road frontage a concrete driveway runs to a garage on the NE side of the property (Photos 1 & 2). An excavation has been made for the garage and driveway. Stable concrete retaining walls reaching a maximum height of ~2.5m support the cut for the driveway (Photo 3). Medium Strength Sandstone was observed outcropping at the road frontage and in the garden on the SE side of the garage and driveway (Photo 4). The part three-storey, concrete block, brick, sandstone flagging and timber clad and framed house is supported on concrete block and brick walls, and brick and timber piers (Photo 5). No significant signs of movement or cracking were observed in the external supporting walls of the house and the brick piers stand

vertical (Photo 6). An excavation has been made on the NW side of the house along the boundary for the lower ground floor of the subject house. The cut is supported by a stable concrete wall reaching a maximum height of ~1.0m (Photo 7). The slope below the house is landscaped with a series of stable terraced gardens and intermittent open grassy areas that extend to the road frontage along the SW boundary (Photos 8 & 9). The terraces are constructed of large, stacked sandstone boulders. 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. This is described as interbedded laminite, shale and quartz to lithic quartz sandstone. The outcropping sandstone along the NE common boundary is interpreted to be a band of sandstone in the otherwise shale dominated profile.

4. Subsurface Investigation

One Hand Auger Hole (AH) was put down to identify the ground materials. Three 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 (~RL55.0) **–** AH1 (Photo 11)

Depth (m)	Material Encountered
0.0 to 0.2	**FILL**, greyish dark brown/black, loose, damp, fine to medium grained, rock fragments, organic matter.
0.2 to 0.4	**FILL**, disturbed sandy clay, yellow, stiff, fine to medium grained, red rock fragments, dry.
0.4 to 0.7	**LOAMY SOIL**, marks the original ground surface, brown, roots, fine to medium grained, rock fragments, firm.
0.7 to 1.0	**CLAY**, yellow, very stiff, orange mottling, fine grained, dry.

Refusal @ 1.0m in very stiff 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**	**DCP 1** (~RL55.0)	**DCP 2** (~RL54.3)	**DCP 3** (~RL54.3)
0.0 to 0.3	1F	1F	1F
0.3 to 0.6	24	16	8F
0.6 to 0.9	31	10	5
0.9 to 1.2	#	19	18
1.2 to 1.5		45	25
1.5 to 1.8		#	50
1.8 to 2.1			#
	Refusal on Rock @ 1.0m	Refusal on Rock @ 1.6m	Refusal on Rock @ 1.8m

#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 @ 1.0m, DCP bouncing off rock surface, muddy clay tip, wet.

DCP2 – Refusal on rock @ 1.6m, DCP bouncing off rock surface, yellow rock fragments on wet tip.

DCP3 – Refusal on rock @ 1.8m, DCP bouncing off rock surface, white impact dust on dry tip.

5. Geological Interpretation

The slope materials are colluvial at the near surface and residual at depth. They consist of fill and loamy soil over clay with rock fragments throughout the profile. In the test locations the clays merge into the weathered zone of the underlying rock at an average depth of ~1.5m below the current ground surface. The tests indicate sandstone beds may be present in the otherwise shale dominated profile. To be prudent we interpret the underlying rock as Very Low Strength Rock. Filling to a maximum depth of ~0.4m was encountered on the SW side of the property during the testing on the site. No other significant fills were observed during the testing on the site. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

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

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

7. Surface Water

No evidence of significant surface flows were observed on the property during the inspection. As the property is located at the crest of a ridge, the property will only be affected by surface water that accumulates on the site.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above or beside the property. The moderately graded slope that falls below the house and continues below is a potential hazard (**Hazard One**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One
TYPE	The moderately graded slope that falls below the house and continues below failing and impacting on the proposed works (Photo 10).
LIKELIHOOD	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Minor' (9%)
RISK TO PROPERTY	'Low' (5×10^{-6})
RISK TO LIFE	8.3×10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater

No significant stormwater will be created by the proposed works.

11. Excavations

Levelling to a maximum depth of ~0.9m is required to install the proposed pool. The excavation is expected to be through fill and shallow loamy soil over a firm to very stiff clay. It is envisaged the excavations through fill, soil, and clay can be carried out with an excavator and bucket.

12. Vibrations

It is expected the proposed excavation will be carried out with an excavator and bucket and the vibrations produced through fill, soil, and clay will be below the threshold limit for building damage.

13. Excavation Support Requirements

No structures or boundaries will be within the zone of influence of the excavation.

The cuts through fill, soil, and clay for the pool will stand at near vertical angles for a short period of time until the pool structure is installed provided the cut is prevented from becoming saturated.

The 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 excavation they can be constructed as soon as possible. The excavations are to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

All excavation spoil is to be removed from site.

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
Fill and Sandy Soil	20	0.40	0.55
Residual Clays	20	0.35	0.45
Low Strength Rock	22	0.25	0.35

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 retaining structure design.

15. Foundations

Piers supported on the underlying Very Low Strength Rock is a suitable bearing material for the proposed pool. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Very Low Strength Rock. Required peer depths are expected to be in the order of 1.5 to 1.8m below the current ground surface.

As the area around the pool will become saturated during pool use, it is recommended any paving around the pool be supported on a slab supported off Very Low Strength Rock. This will reduce the risk of settlement around the pool that can result from ongoing saturation of the soil.

As the bearing capacity of 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 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 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.

SEE OVER THE PAGE FOR REQUIRED INSPECTIONS

16. Inspections

The client and builder are to familiarise themselves with the following required inspection as well as council geotechnical policy. We cannot provide geotechnical certification for the owners or the Occupation Certificate if the following inspection has not been carried out during the construction process.

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

White Geotechnical Group Pty Ltd.

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

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

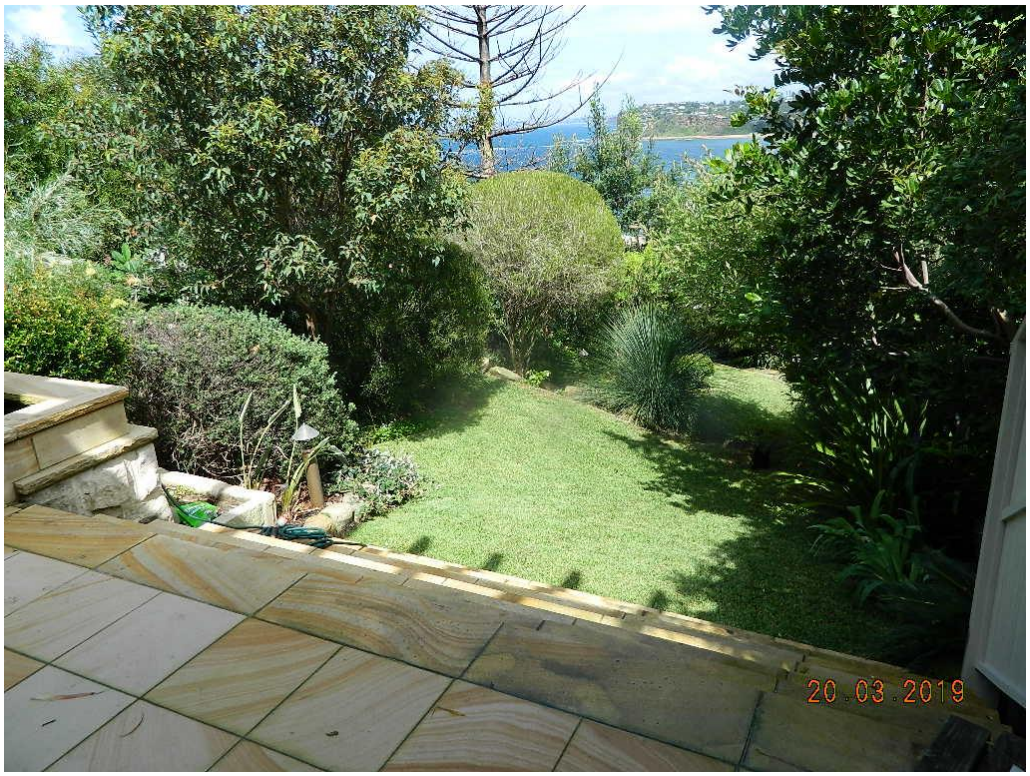


Photo 8

Photo 9

Photo 10: Downhill boundary at The Serpentine

Photo 11: Auger Hole 1; base of hole at base 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.

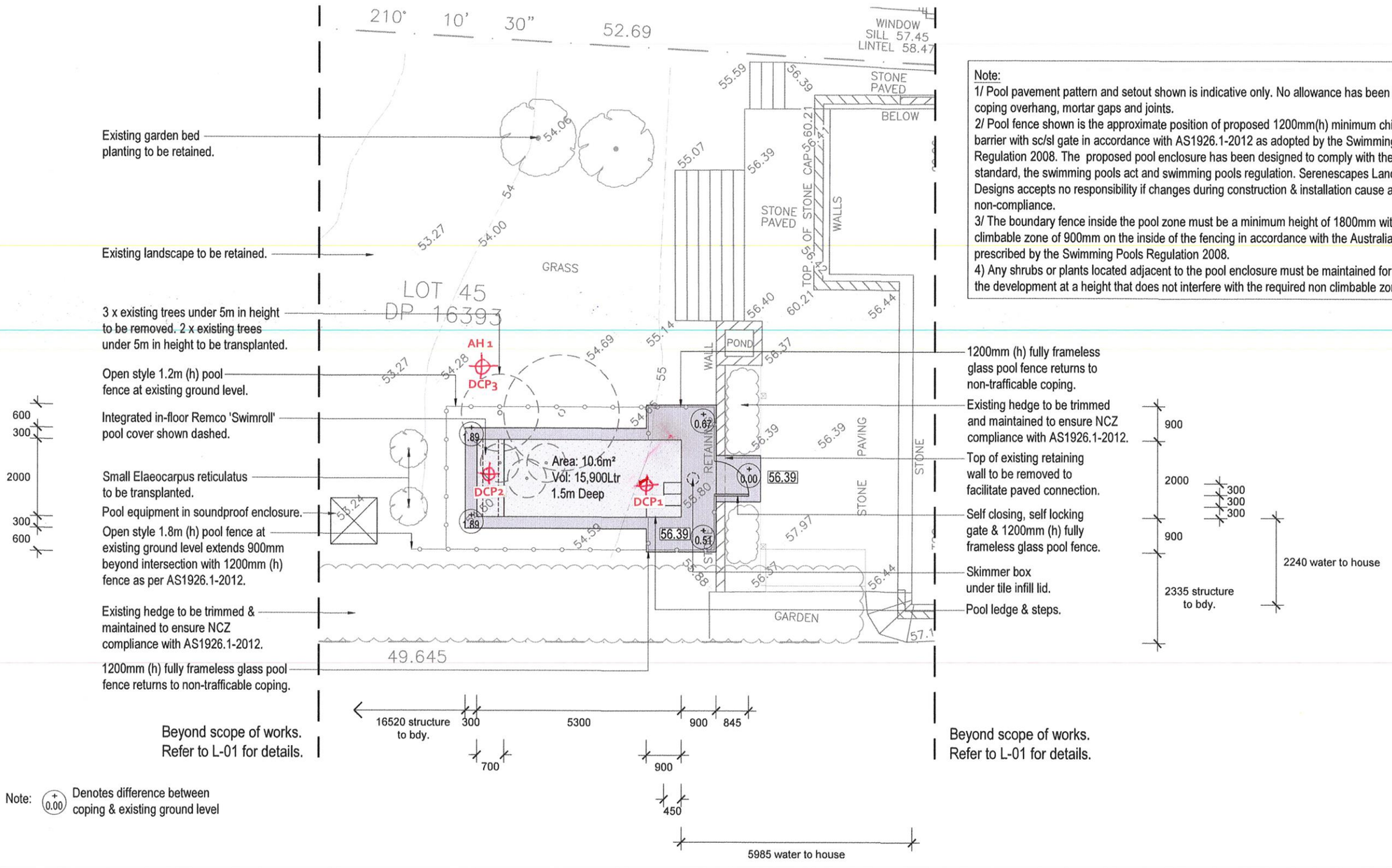
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



Note:
1/ Pool pavement pattern and setout shown is indicative only. No allowance has been made for coping overhang, mortar gaps and joints.
2/ Pool fence shown is the approximate position of proposed 1200mm(h) minimum childproof safety barrier with sc/sl gate in accordance with AS1926.1-2012 as adopted by the Swimming Pools Regulation 2008. The proposed pool enclosure has been designed to comply with the Australian standard, the swimming pools act and swimming pools regulation. Serenescapes Landscape Designs accepts no responsibility if changes during construction & installation cause any non-compliance.
3/ The boundary fence inside the pool zone must be a minimum height of 1800mm with a non climbable zone of 900mm on the inside of the fencing in accordance with the Australian Standard prescribed by the Swimming Pools Regulation 2008.
4) Any shrubs or plants located adjacent to the pool enclosure must be maintained for the lifetime of the development at a height that does not interfere with the required non climbable zones.

Note: (+0.00) Denotes difference between coping & existing ground level

Note:
- Contractors to check and verify all dimensions and all levels on site prior to any works.
- Any discrepancies should be immediately referred to Serenescapes Landscape Designs.
- All work to comply with B.C.A. Statutory Authorities and relevant Australian Standards.
- Dimensions recognised over scaling. All measurements are in millimetres.
- Copyright Serenescapes Landscape Designs 2019.

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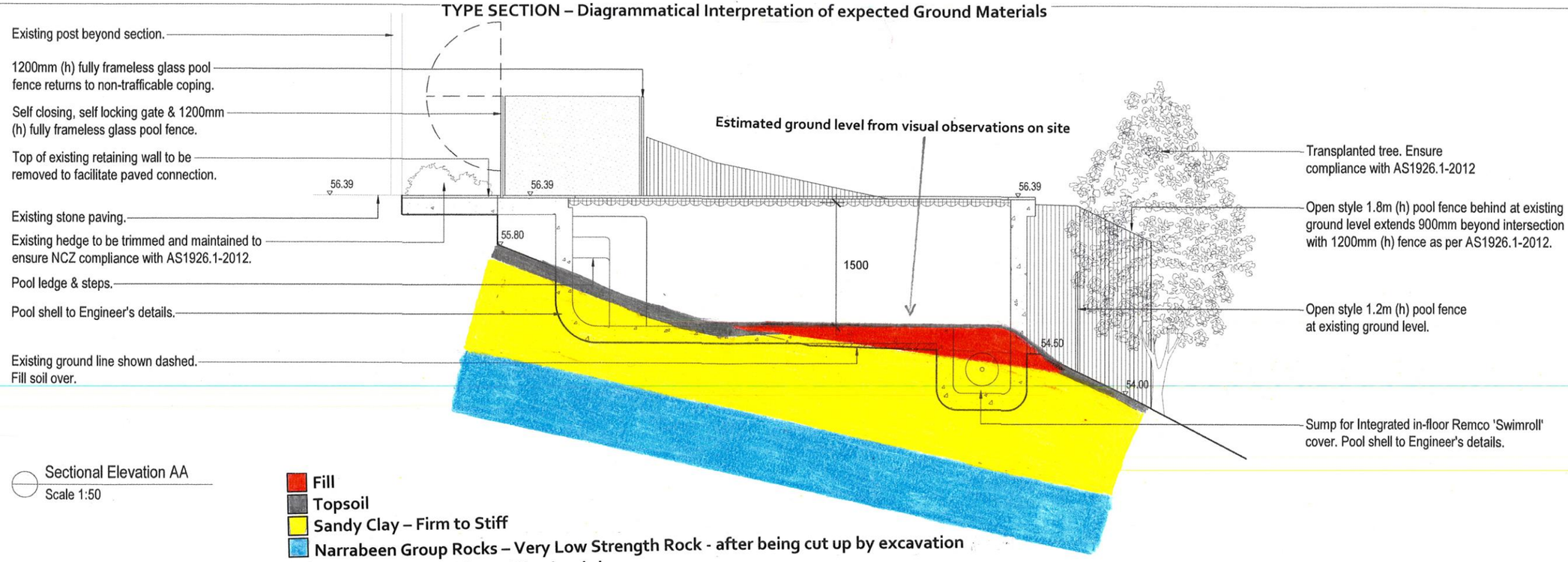
Client:	Keith & Heather Wilkinson
Site Address:	47 The Serpentine Bilgola Beach
Drawing Title:	Detail Plan
Drawn by:	Ben Farrar AILDM # 1179
Project Number:	19508
Scale:	1:100 @ A3
Sheet Number:	L-02 of 4

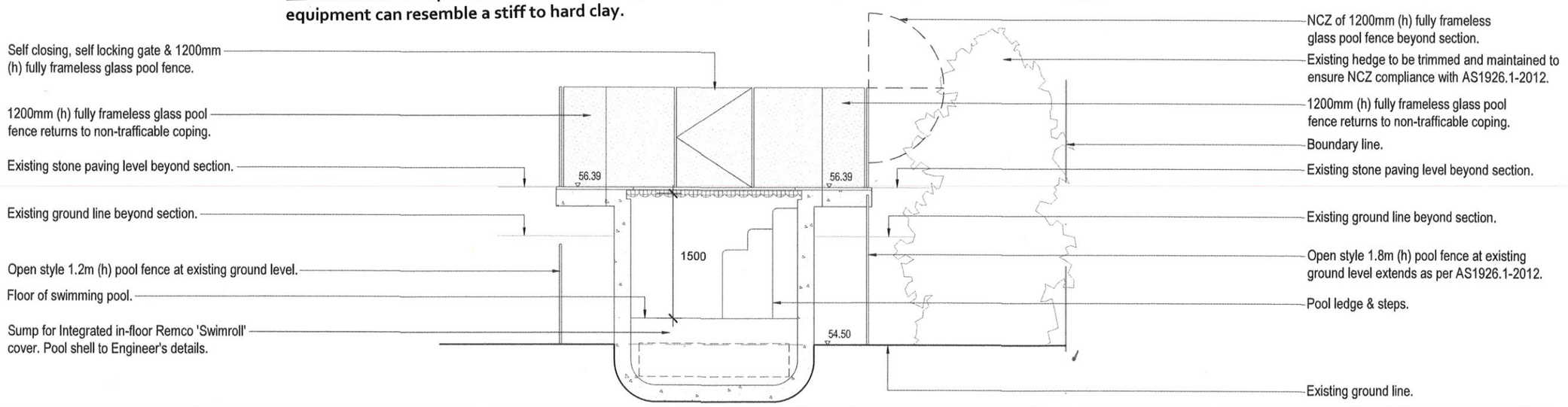
Rev:	Date:	Issue:	Checked:
A	20/02/19	Preliminary Issue	TB
B	01/03/19	DA Issue	TB

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



Sectional Elevation AA
Scale 1:50

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



Sectional Elevation BB
Scale 1:50

Note:
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- Dimensions recognised over scaling. All measurements are in millimetres.
-

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Client:	Keith & Heather Wilkinson
Site Address:	47 The Serpentine Bilgola Beach
Drawing Title:	Sectional Elevation
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Sheet Number:	L-03 of 4

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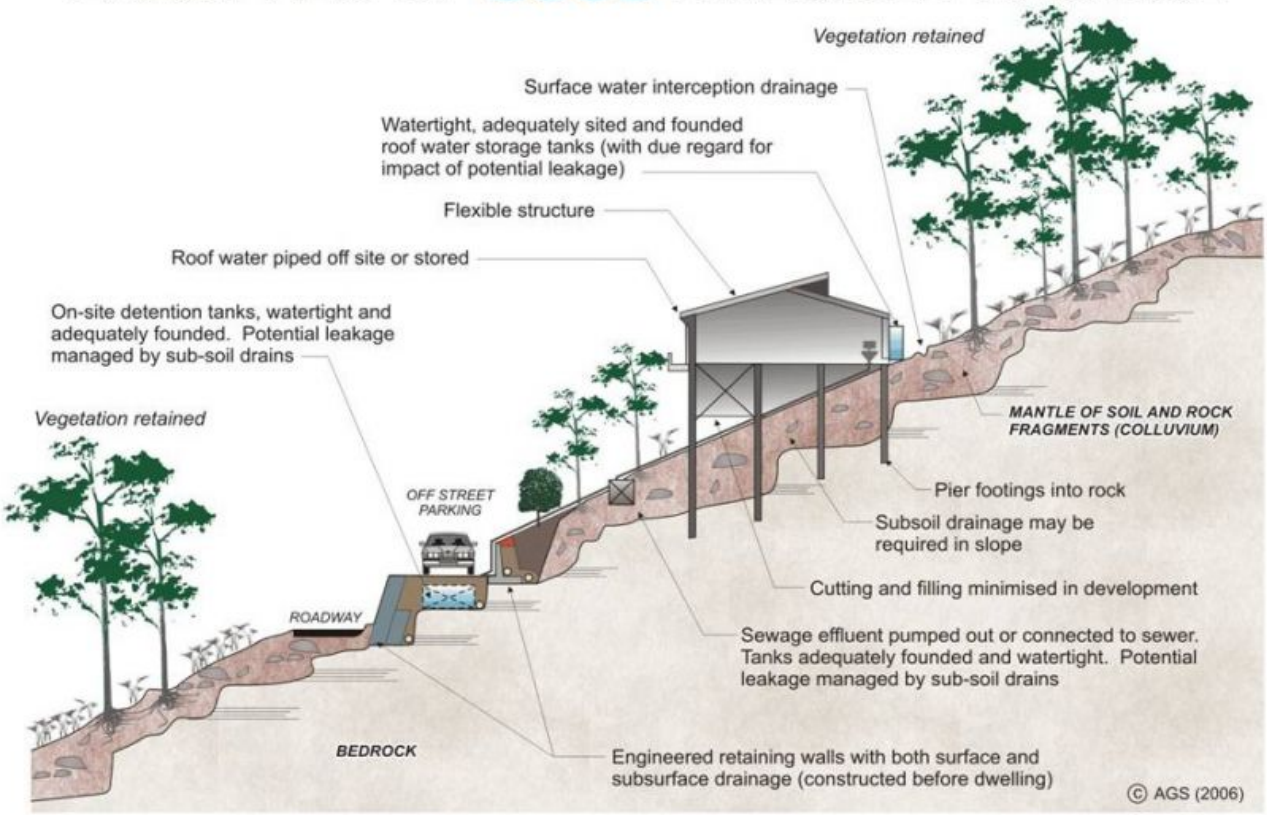
EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE