GEOTECHNICAL INVESTIGATION:

New House, Flood Retention Tank and Pool at **44 Kooloora Ave, Freshwater**

1. Proposed Development

1.1 Demolish the existing house and granny flat.

1.2 Construct a new part three-storey house by excavating to a maximum depth of ~2.0m for the basement.

1.3 Construct a flood retention tank underneath the NE side of the proposed house by excavating to a maximum depth of ~1.7m

1.4 Install a new pool on the uphill side of the property by excavating to a maximum depth of ~2.8m.

1.5 Details of the proposed development are shown on 7 drawings prepared by Brewster Hjorth Architects, drawings numbered DA03 to DA09, dated 7/1/20.

2. Site Description

2.1 The site was inspected on the 13th March, 2020.

2.2 This residential property is on the higher side of the road and has a SE aspect. The block is located on the gently graded lower reaches of a hillslope. The natural slope falls across the property at an average angle of <5°. The slope above and below the property continues at similar angles.

2.3 Between the road frontage and the house is a near flat lawn and parking area (Photo 1). At the downhill side of the house is a carport with a balcony above (Photo 2). The part two storey brick house is supported by brick walls and brick piers (Photos 2 to 5). One of the supporting walls shows minor cracking through the mortar

(Photo 6). A near flat lawn and a brick granny flat are located at the uphill side of the property (Photos 7 & 8).

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by marine sands (Qhd). These are described as medium to fine grained 'marine' sand with podsols.

4. Subsurface Investigation

One Auger hole was put down to identify the soil materials. Ten Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the sands underlying the site. 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 may have occurred in DCP2, DCP3 and DCP9, but the other tests are expected to be a good representation of the natural profile. The results are as follows:

AUGER HOLE 1 (~RL4.9) **–** AH1 (photo 9)

Depth (m)	Material Encountered
0.0 to 0.2	**SAND**, loose, light brown, medium grained, moist.
0.2 to 1.3	**SAND**, loose, dark brown and grey, medium grained, damp.
1.3 to 2.0	**SAND**, loose, dark brown and grey, medium grained, wet.
2.0 to 3.0	**SAND**, loose, dark brown and grey, medium grained, very wet.

End of Hole @ 3.0m in very wet sand. Watertable encountered at ~2.3m.

DCP RESULTS ON NEXT PAGE

DCP TEST RESULTS – Dynamic Cone Penetrometer					
Equipment: 9kg hammer, 510mm drop, conical tip.			Standard: AS1289.6.3.2 - 1997		
Depth(m) Blows/0.3m	**DCP 1** (~RL4.2)	**DCP 2** (~RL4.7)	**DCP 3** (~RL4.8)	**DCP 4** (~RL4.9)	**DCP 5** (~RL4.9)
0.0 to 0.3	4	5	5	10	2F
0.3 to 0.6	2	6	5	4	1F
0.6 to 0.9	3	3	#	1F	1F
0.9 to 1.2	3F	#		5	10
1.2 to 1.5	2F			6	5
1.5 to 1.8	12			8	8
1.8 to 2.1	7			12	15
2.1 to 2.4	3			14	7
2.4 to 2.7	5			6	10
2.7 to 3.0	9			12	25
3.0 to 3.3	6			14	40
3.3 to 3.6	11			22	#
3.6 to 3.9	18			40	
3.9 to 4.2	26			#	
4.2 to 4.5	14				
4.5 to 4.8	16				
4.8 to 5.1	17				
5.1 to 5.4	24				
5.4 to 5.7	#				
	End of Test @ 5.4m	Refusal @ 0.8m	Refusal @ 0.5m	End of Test @ 3.9m	End of Test @ 3.2m

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

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 6 (~RL5.7)	DCP 7 (~RL5.8)	DCP 8 (~RL5.9)	DCP 9 (~RL5.9)	DCP 10 (~RL6.2)
0.0 to 0.3	20	8	22	5	3
0.3 to 0.6	12	9	4	23	6
0.6 to 0.9	8	2F	6	40	15
0.9 to 1.2	14	8	13	#	21
1.2 to 1.5	15	15	12		23
1.5 to 1.8	15	10	11		10
1.8 to 2.1	22	23	11		13
2.1 to 2.4	40	34	11		23
2.4 to 2.7	#	#	11		40
2.7 to 3.0			14		#
3.0 to 3.3			20		
3.3 to 3.6			25		
3.6 to 3.9			40		
3.9 to 4.2			#		
	End of Test @ 2.3m	End of Test @ 2.4m	End of Test @ 3.9m	End of Test @ 0.9m	End of Test @ 2.7m

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

DCP Notes:

DCP1 – End of test @ 5.4m, DCP still going down, dark brown sand on wet tip.

DCP2 – Refusal @ 0.8m, DCP bouncing, brown sand on moist tip.

DCP3 – Refusal @ 0.5m, DCP bouncing, brown sand on moist tip.

DCP4– End of test @ 3.9m, DCP still very slowly going down, dark grey sand on wet tip.

DCP5 – End of test @ 3.2m, DCP still very slowly going down, dark grey sand on wet tip.

DCP6 – End of test @ 2.3m, DCP still very slowly going down, grey and brown sand on wet tip.

DCP7 – End of test @ 2.4m, DCP still very slowly going down, brown sand on wet tip.

DCP8 – End of test @ 3.9m, DCP still very slowly going down, grey and brown sand on wet tip.

DCP9 – End of test @ 0.9m, DCP still very slowly going down, clean dry tip.

DCP10 – End of test @ 2.7m, DCP still very slowly going down, grey and brown sand on wet tip.

5. Geological Observations/Interpretation

The site is underlain by sand that was encountered to the extent of the testing. To summarise the test results, very loose to loose sands extend to depths of between ~0.9m to ~3.3m below the current surface, these overlie medium dense to dense sands that extend to at least the extent of the testing at 5.4m. See the Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

The watertable was encountered at a depth of ~2.3m (~RL2.6m) below the current surface of auger AH1. The proposed basement level is ~RL2.8. Although ~0.2m above the measured watertable, the sand a metre above the watertable was noted as damp to wet indicating seepage is being moved through the sand towards the base of the proposed excavation. The base of the proposed pool excavation will be on or just above the watertable as the watertable rises roughly parallel to the ground surface (See Type Section Attached). This has implications for the stability of the excavations as the seepage will likely cause undercutting and collapse of the cut batters. It should be noted the watertable fluctuates with the tide and climatic changes. The water table level is to be confirmed at the time of construction by the geotechnical consultant during the piling prior to any excavation commencing.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. It is expected that normal sheet wash will move onto the site from above the property during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below or beside the property. The proposed excavations are a potential hazard until the retaining walls are in place (**Hazard One**). The proposed excavations undercutting the footings of nearby structures is a potential hazard (**Hazard Two**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The proposed excavations collapsing onto the work site before retaining walls are in place.	The proposed excavations undercutting the footings of nearby structures causing failure.
LIKELIHOOD	'Likely' (10^{-2})	'Likely' (10^{-2})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (15%)
RISK TO PROPERTY	'High' (2×10^{-3})	'High' (2×10^{-3})
RISK TO LIFE	5.3×10^{-5}/annum	5.3×10^{-5}/annum
COMMENTS	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.	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 Kooloora Ave. Stormwater from the proposed developments is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to a maximum depth of ~2.0m is required to construct the basement of the proposed house. Another excavation to a maximum depth of ~1.7m is required to construct the proposed flood retention tank. A third excavation to a maximum depth of ~2.8m is required to install the proposed pool. The excavations are expected to be through very loose to dense sand. It is envisaged that excavations through sand can be carried out with an excavator and bucket.

12. Vibrations

Possible vibrations generated during excavations through sand will be below the threshold limit for building damage.

13. Excavation Support Requirements

Bulk Excavation for Basement

An excavation to a maximum depth of ~2.0m is required to construct the basement of the proposed house. Allowing for back-wall drainage, the excavation will be set back ~0.4m from the NW common boundary/brick wall and ~1.2m from the NW neighbouring house. The excavation will be also set back ~0.6m from the SE common boundary/concrete retaining wall along the downhill side, and will be close to flush with the SE common boundary adjacent to the proposed surf board storage area. Thus, the NW common boundary/brick wall, NW neighbouring house and SE common boundary/retaining 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 towards the surrounding structures or boundaries. Heavy ground support is recommended due to the presence of deep sand and the watertable, and the proximity to the surrounding boundaries and structures.

The proposed excavation requires support installed along all sides before excavations commence. In this instance, due to the sand and close proximity to the watertable (basement excavation ~RL2.8m, watertable ~RL2.6m), secant or contiguous piers are suitable support. Secant piers are the preferred option but if contiguous piers are used the gaps between the piers are to be grouted closed as the excavation is lowered so no sand moves through the wall. The piers can be temporarily supported by embedment below the base of the excavation but are to be tied into the floor and ceiling slabs of the house structure during construction.

It is recommended a piling rig capable of drilling through Medium Strength Rock be used for this job as the ground testing did not extend to the likely required depth of the piles. Additionally, the rig will need to be a CFA rig (capable of grout injection during the drilling process due to the presence of the water table in sand - wet sand). Alternatively, exploration drilling is to be carried out prior to the structural design.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all the piers before any steel or concrete is placed. Additionally, during this work the water table depth is to be confirmed.

A sump and pump may be required during construction to keep the base of the excavation dry.

Bulk Excavation for Flood Retention Tank

An excavation to a maximum depth of ~1.7m is required to construct the proposed detention tank. The excavation will be set back ~0.4m from the NW common boundary/brick wall and ~1.2m from the NW neighbouring house at the downhill side of the excavation. The excavation will be also set back ~1.0m from the SE common boundary/concrete retaining wall. The NW common boundary/brick wall, NW neighbouring house along the downhill side and SE common boundary/retaining wall will be within the zone of influence of the proposed excavation.

Due to the presence of deep sand, and the proximity to the surrounding boundaries and structures, the proposed excavation will require support installed along all sides before excavations commence as per the recommendations for the basement excavations.

Bulk Excavation for Pool

An excavation to a maximum depth of ~2.8m is required to construct the proposed pool. The excavation will be set back ~0.7m from the NW common boundary/wall, ~0.7m from the SE common boundary, close to flush with the NE common boundary/wall and ~3.3m from the NE neighbouring granny flat. Thus, the neighbouring boundaries and NE neighbouring granny flat will be within the zone of influence of the proposed excavation.

Due to the presence of deep sand and the close proximity to the watertable (See Type Section Attached), and the proximity to the surrounding boundaries and structures, the proposed excavation will require support installed along all sides before excavations commence as per the recommendations for the basement excavation.

The piers can be temporarily supported by embedment below the base of the excavation and propping if necessary. The pool structure is to support the piled walls permanently once it is in place.

The NW common boundary fence is to be braced before the excavation commences.

A sump and pump may be required during construction to keep the base of the excavation dry.

Advice Applying to All Excavations

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	Passive
Loose Sands	20	0.45	0.55	K_p = 3.0 ultimate
Medium Dense Sands	20	N/A	N/A	K_p = 3.8 ultimate

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the structure, do not account for any surcharge loads and assume 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. Ground materials 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

House and Flood Retention Tank Foundations

The proposed house and flood retention tank can be supported on raft slabs supported at the base of the excavation into the underlying loose to medium dense sands of the natural profile. The footing walls are to be shored with timber to prevent collapse. A maximum allowable bearing pressure of 100kPa can be assumed for footings supported on the loose to medium dense sands of the natural profile.

The base of the footing excavations in sand should be compacted as the excavation will loosen the upper sands. This can be carried out with a hand-held plate compactor. Water may be used to assist in compaction in sand but footing materials should be kept damp but not saturated. As a guide to the level of compaction required a density index of >85% is to be achieved.

Where the loads exceed 100kPa, it is recommended the proposed house and flood retention tank be supported off screw piles due to the presence of sand and the proximity of the watertable (~RL2.6m). It is envisaged these will need to go depths of at least 3.5m from the current surface into the medium dense sands. As screw pile design varies between contractors, the screw piles used would need to be specifically designed to be embedded in sand. Generally, screw piles with a large helix are more suitable for sand. We can advise on screw pile contractors upon request.

Note that we do not certify screw pile foundations. Screw pile design varies between contractors and we are not privy to the details of individual design or how the screw pile contractor converts torque to bearing pressure. As such, the screw pile contractor is totally responsible for ensuring the screw piles can support the loads on the piles and that these are within acceptable settlement limits.

Pool Foundations

It is expected that the base of the pool (~RL3.4m) will be on or just above the watertable (See Type Section Attached). Although the proposed pool is expected to be seated in the medium dense to dense sand that has an adequate bearing pressure to support the pool, we recommend screw piles be installed to prevent possible 'pop-out' that can occur when the pool is empty and it floats on the water table and subsequently pops out of the ground. For bearing pressure, the screw piles are to be torqued to the equivalent of a maximum bearing pressure of 100kPa. The Structural Engineer is to calculate the required equivalent pressure to resist buoyancy.

If another method of "hold down" is used and the pool is supported on the sand at the base of the excavation, it should be compacted as the excavation will loosen the upper sands. This can be carried out with a hand-held plate compactor. As a guide to the level of compaction required, a density index of >65% is to be achieved, correlating to a dense sand. The geotechnical consultant is to inspect and test the compacted base of the pool excavation to ensure the required density has been achieved.

If the cost of these measures to prevent 'pop out' are considered too much and the owners wish to support the pool on the base of the excavation only, we point out the pool will always need to be kept full of water to prevent the possibility of it floating on the water table during wet periods. We recommend the pool be anchored. If it is not and the pool does pop out of the ground, we accept no liability whatsoever.

As the area around the pool will become saturated during pool use, it is recommended any paving around the pool be supported on a raft slab. The rafts are to be taken to a depth of 0.4m below the current surface. This will reduce the risk of settlement around the pool that can result from ongoing saturation of the soil.

Advice Applying to All Foundations

For preliminary design purposes for the piles of the piled walls, assume a maximum allowable end bearing pressure of 200kPa for piles embedded into medium dense sand.

REQUIRED INSPECTIONS ARE ON THE NEXT PAGE

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 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/excavations for ground support are to be inspected and measured before concrete is placed.

- 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: AH1 – Downhole is from top to bottom

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.

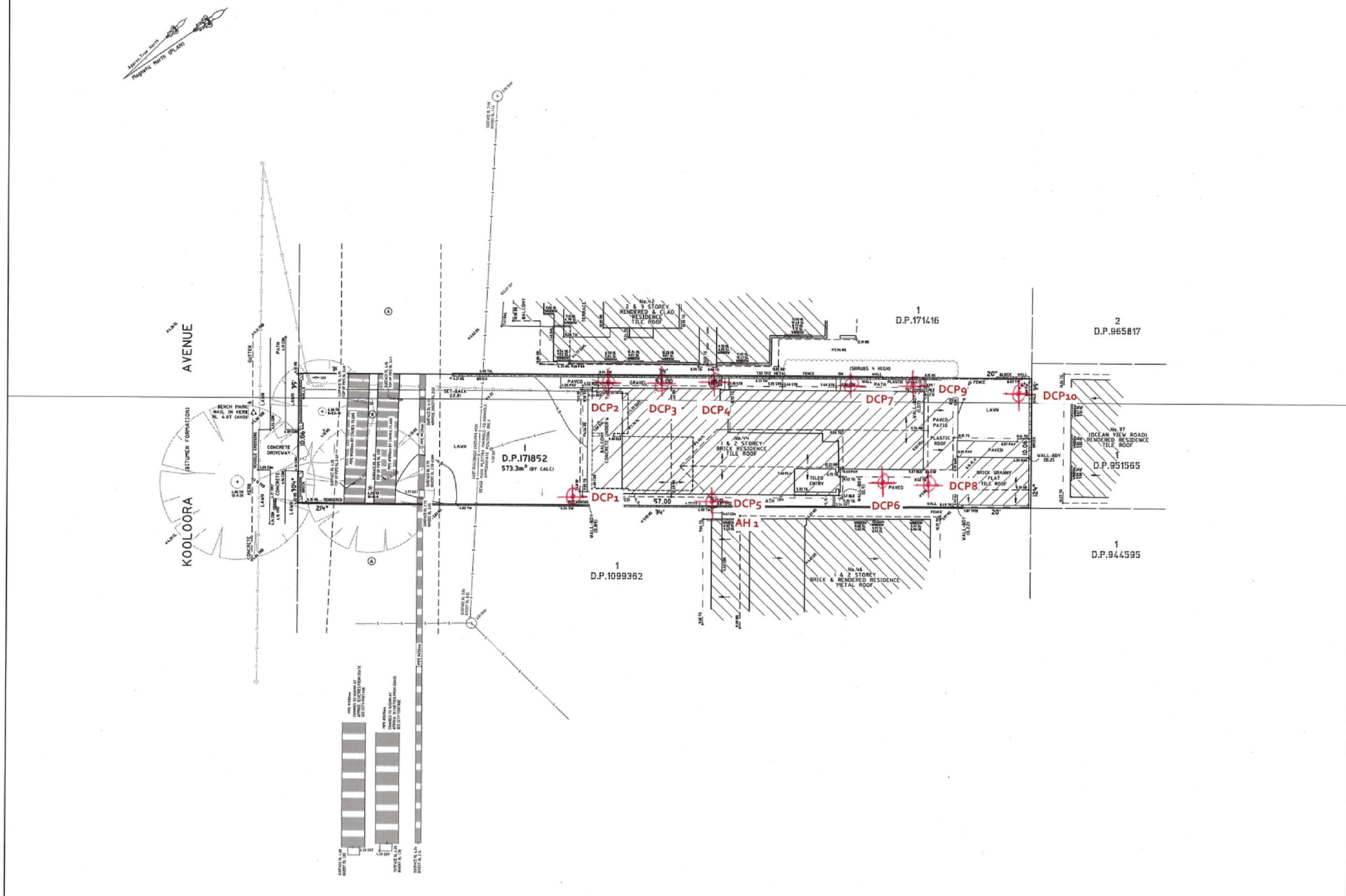
- This report should not be applied to any other project other than that outlined in section 1.0.

- 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.

A0

SITE PLAN – showing test locations



NOTES

- A BOUNDARY SURVEY HAS BEEN UNDERTAKEN.
- WALL TO BOUNDARY DIMENSIONS SHOWN HEREON MUST NOT BE USED FOR CONSTRUCTION.
- IF CONSTRUCTION ON OR NEAR BOUNDARIES IS REQUIRED IT IS RECOMMENDED THAT THE BOUNDARIES OF THE LAND BE MARKED OR THE BUILDING SET OUT.
- TREE SIZES ARE ESTIMATES ONLY.
- THIS PLAN HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF ADRIAN & NICOLE STEWART.
- RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
- EXCEPT WHERE SHOWN BY DIMENSION LOCATION OF DETAIL WITH RESPECT TO BOUNDARIES IS INDICATIVE ONLY.
- ONLY VISIBLE SERVICES HAVE BEEN LOCATED. UNDERGROUND SERVICES HAVE NOT BEEN LOCATED. DIAL BEFORE YOU DIG SERVICES (ph 1100) SHOULD BE USED AND A FULL UTILITY INVESTIGATION, INCLUDING A UTILITY LOCATION SURVEY, SHOULD BE UNDERTAKEN BEFORE CARRYING OUT ANY CONSTRUCTION ACTIVITY IN OR NEAR THE SURVEYED AREA.
- SEWER MAIN PLOTTED FROM SYDNEY WATER SEWER DIAGRAM. LOCATION SHOULD BE MARKED ON SITE IF CRITICAL.
- CRITICAL SPOT LEVELS SHOULD BE CONFIRMED WITH SURVEYOR.
- THIS PLAN IS ONLY TO BE USED FOR THE PURPOSE OF DESIGNING NEW CONSTRUCTIONS.
- CONTOURS SHOWN DEPICT THE TOPOGRAPHY. THEY DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.
- CONTOUR INTERVAL - 0.5 metre. - SPOT LEVELS SHOULD BE ADOPTED.
- POSITION OF RIDGE LINES ARE DIAGRAMMATIC ONLY (NOT TO SCALE).
- THE INFORMATION IS ONLY TO BE USED AT A SCALE ACCURACY OF 1:100.
- DO NOT SCALE OFF THIS PLAN / FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED READINGS.

MURRAY LEARMONT
REGISTERED SURVEYOR (BOSSI NUMBER 1442)

LEGEND:

BAL = BALCONY
BLD = EXTERNAL BUILDING
CL = CENTRELINE
CON = CONCRETE
DS = DOOR SILL LEVEL
FL = FLOOR LEVEL
GAFL = GARAGE FLOOR LEVEL
GAR = GARAGE
GRT = GRATE
HL = HEAD LEVEL
NS = NATURAL SURFACE
PAR = PARAPET
PAV = PAVING
PIT = TOP OF PIT
RF = TOP OF ROOF
RR = ROOF RIDGE
SIP = SEWER INSPECTION PIT
SL = SILL LEVEL
SMH = SEWER MAN HOLE
STR = STAIRS
SWSL = STORMWATER SURFACE LEVEL
SSL = SEWER UNDERGROUND
TFCE = TOP OF FENCE
TG = TOP OF GUTTER
TIL = TILE
TKB = TOP OF KERB
TPIT = TELSTRA PIT
TR = TREE
TW = TOP OF WALL
WM = WATER METER
— E — = ELECTRICITY OVERHEAD
— S — = SEWER UNDERGROUND
TREE SPREAD-DIAMETER-HEIGHT

HORIZONTAL DATUM:
CO-ORDINATE SYSTEM: ASSUMED
MARKS ADOPTED: N/A

VERTICAL DATUM:
DATUM: AUSTRALIAN HEIGHT DATUM (AHD)
B.M. ADOPTED: SSM 772
R.L. 4.254 (ORDER L2)
SOURCE: S.C.I.M.S. (07/02/19)

3	STORMWATER UPDATED	10/01/20
2	STORMWATER & SEWER INVESTIGATION	17/01/20
1	FIRST ISSUE	15/02/19

CLIENT:
ADRIAN & NICOLE STEWART
c/- BREWSTER HJORTH ARCHITECTS
L1 4-14 FOSTER STREET
SURRY HILLS NSW 2000

SURVEY PLAN
SHOWING DETAIL & LEVELS
OVER LOT 1 IN D.P.171852
No. 44 KOOLOORA AVENUE
FRESHWATER NSW 2096

C.M.S. Surveyors Pty Limited
ACN: 096 240 201
PO Box 463 Dee Why NSW 2099
3/9A South Creek Road, Dee Why NSW 2099
Telephone: (02) 9971 4802
Facsimile: (02) 9971 4822
E-mail: info@cmssurveyors.com.au

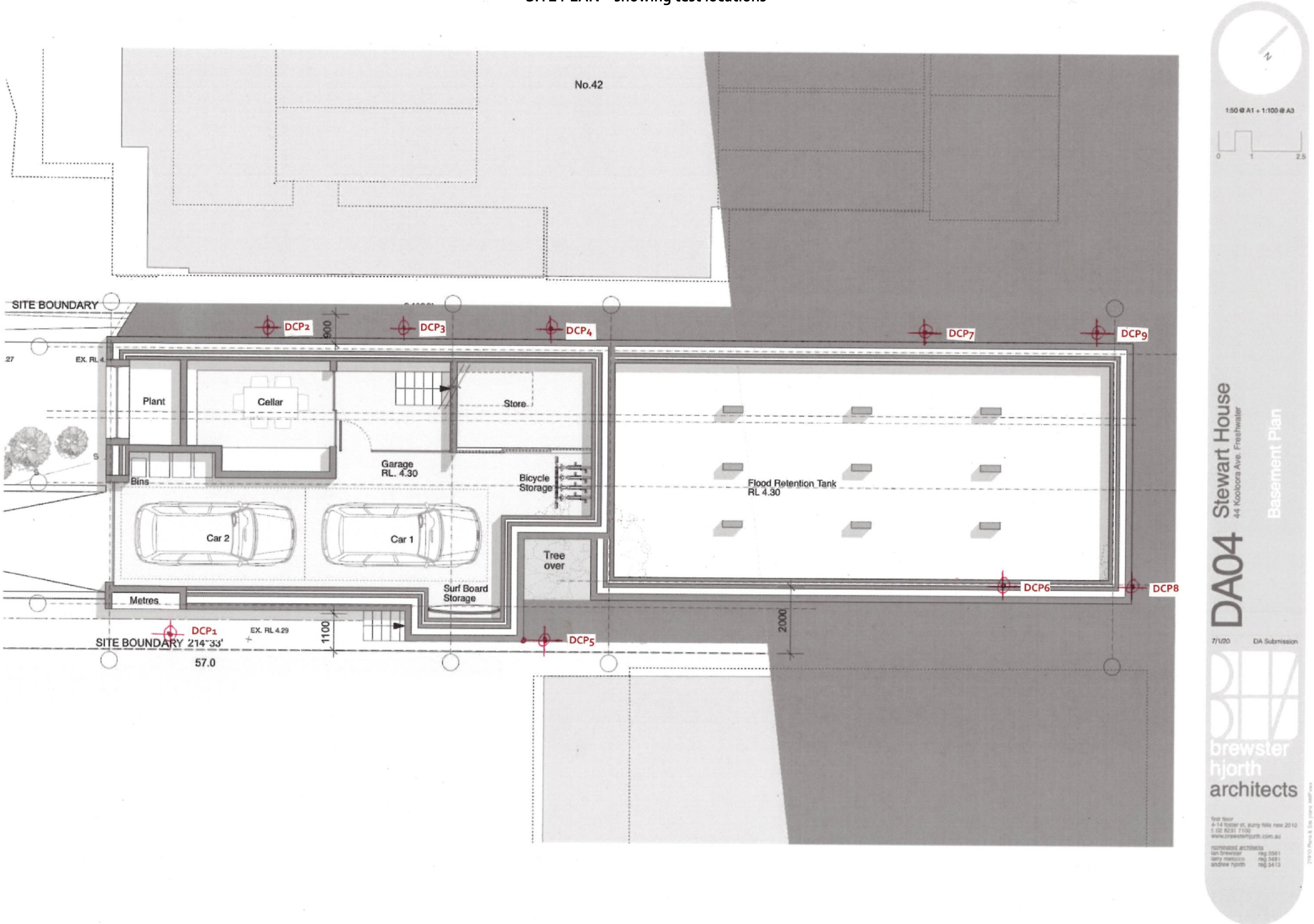
LGA: NORTHERN BEACHES		SHEET 1 OF 2	
SURVEYED	DRAWN	CHECKED	APPROVED
H.H./M.E.	R.N.	H.H./M.E.	A.F.
SURVEY INSTRUCTION 18354A	SCALE 1:100 @ A0	DATE OF SURVEY 08/02/19 & 10/01/20	
DRAWING NAME 18354Adetail		ISSUE 3	
CAD FILE 18354Adetail 3.dwg			

Ⓐ PROPOSED EASEMENT TO DRAIN WATER 6m TO 7.7m WIDE & VARIABLE WIDTH BY DP616528.

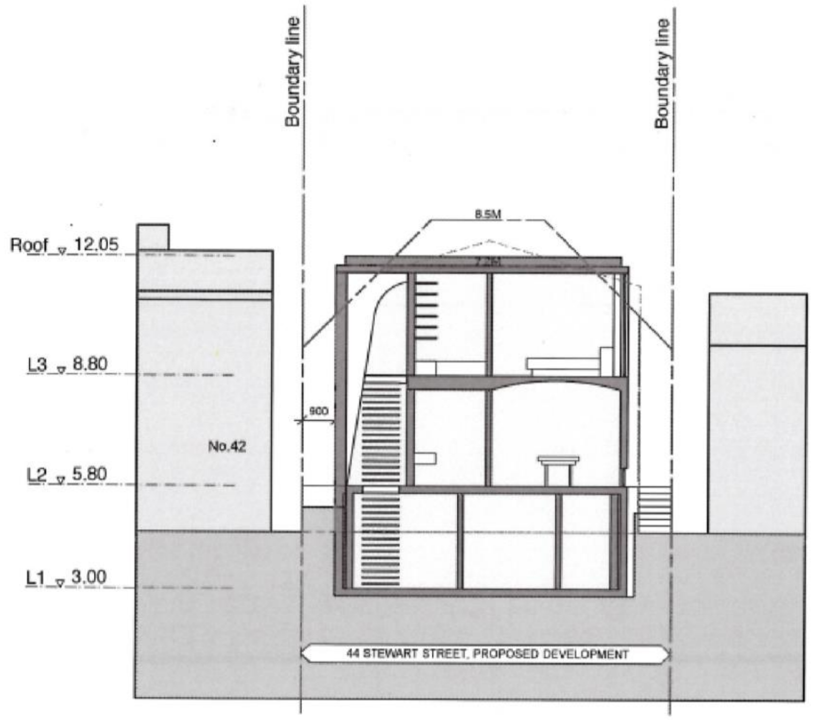
TITLE INDICATES THAT LOT 1 IN D.P.171852 IS SUBJECT TO:
- RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S).

0 1 2 3 4 5 6 7 8 9 10
SCALE 1:100

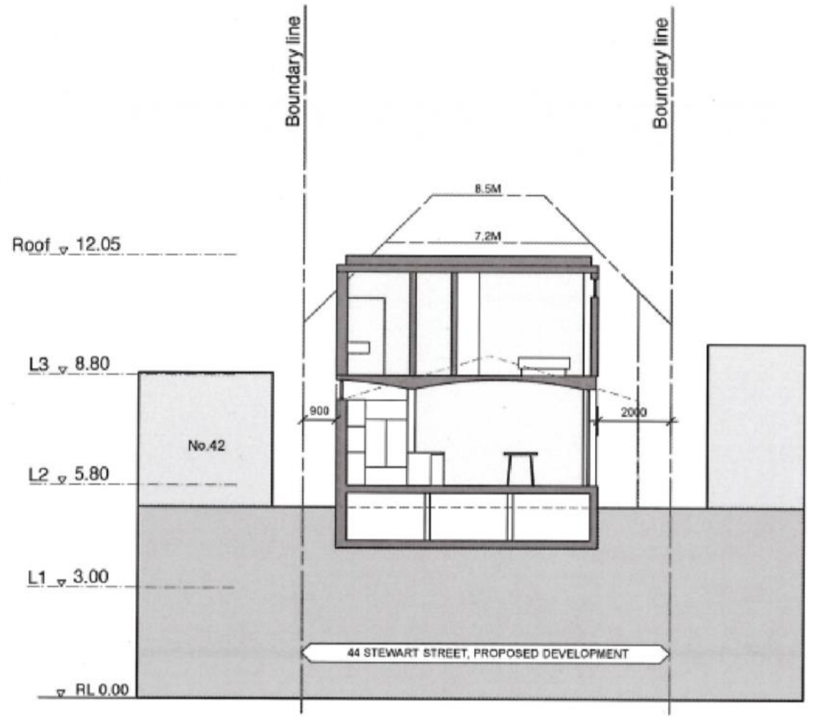
SITE PLAN – showing test locations



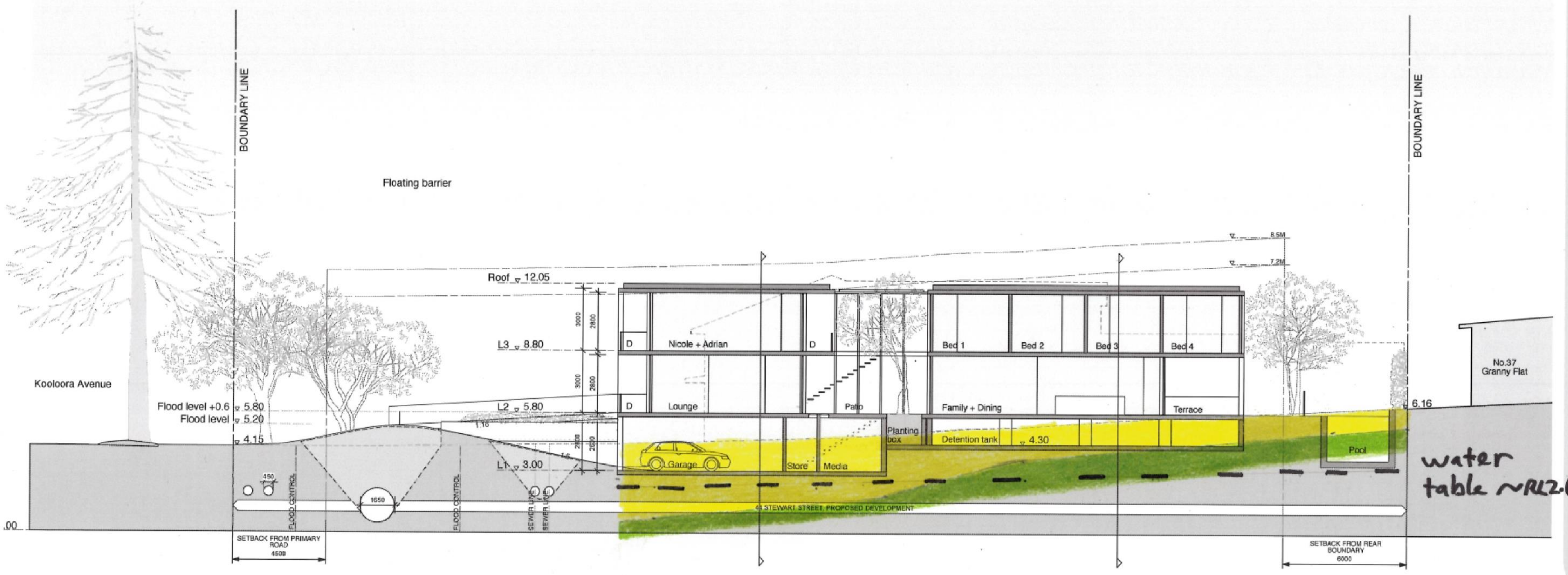
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



SECTION 2



SECTION 3



SECTION 1

Sand – Very Loose to Loose

Sand – Medium Dense to Dense

1:100 @ A1 + 1:200 @ A3

0 1 2 5

DA09 Stewart House

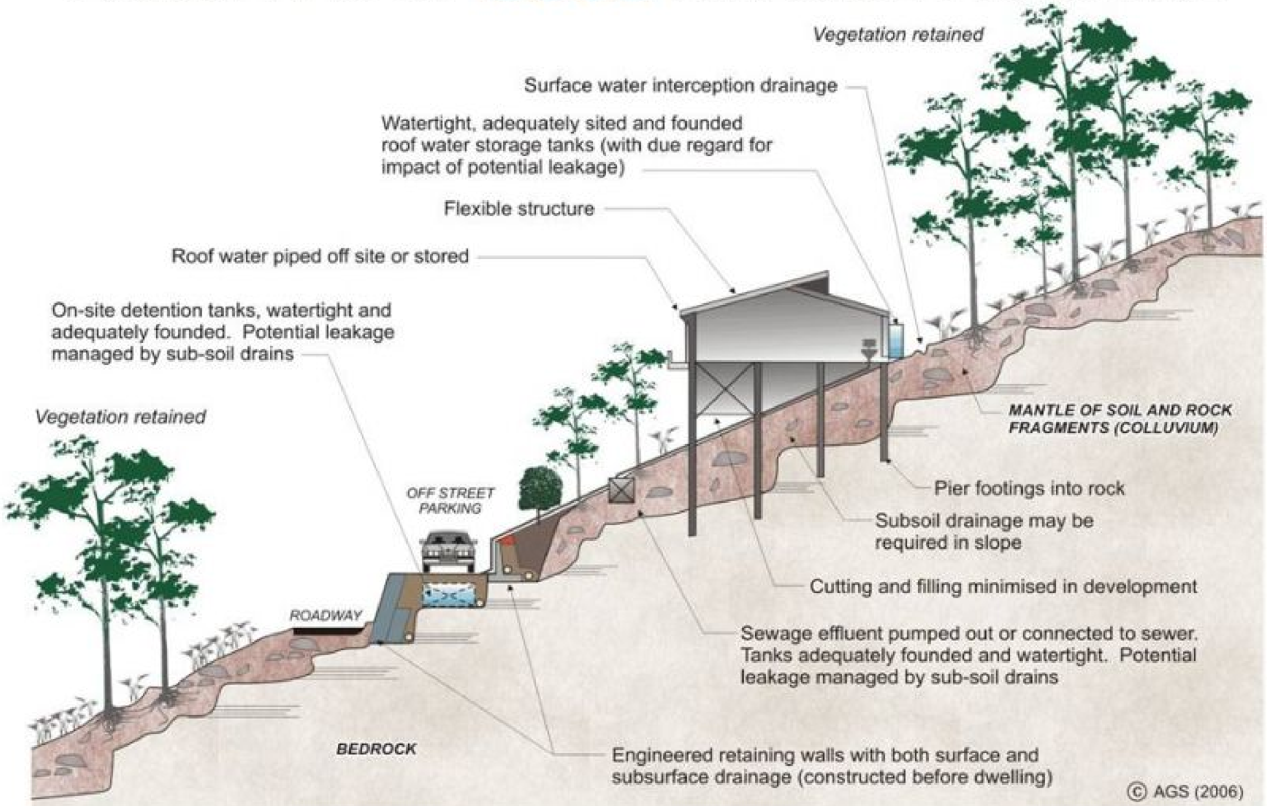
44 Kooloora Ave. Freshwater

Sections

7/1/20 DA Submission

brewster hjorth architects

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE