

DRENNAN MAUD (PTY) LTD

GEOTECHNICAL ENGINEERS AND ENGINEERING GEOLOGISTS
Incorporating Drennan Maud & Partners (Est.1975)



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Our Ref : 33330

Your Ref :

22nd September 2021

Ms M. Chettle
P.O. BOX 174
Nottingham Road
3280

Attention: Ms M. Chettle

email: mchettle@mweb.co.za

Dear Madam,

GEOTECHNICAL INVESTIGATION FOR A PROPOSED NEW DWELLING ON REM OF ERF 680 LEISURE BAY

1. INTRODUCTION

Drennan Maud (Pty) Ltd (DML) undertook a geotechnical investigation on the above mentioned property for a proposed new dwelling. The purpose of the investigation was to determine the general subsoil conditions across the site and to make recommendations regarding;

- appropriate founding type for the proposed new structure,
- existing slope stability,
- on-site storm water disposal, and
- potential geotechnical problems involving the proposed development i.e excavatability, groundwater etc.

The site was visited on the 20th August 2021 at which time the geotechnical investigation was carried out.

Set out below are the findings of the investigation, an assessment of the results and recommendations for the proposed development.

2. DEVELOPMENT PROPOSAL

It is understood that a new split level double storey dwelling with lower and upper floor level, is to be constructed on the property.

3. SITE DESCRIPTION

The site is located in Leisure Bay within Ray Nkonyeni Municipality. It is bounded to the north by Lot 679, to the south by Portion 1 of Lot 680, to the east by Brighton Avenue and to the west by Dove Crescent. It has a general planar conformation falling gently to moderately steep in an easterly direction. The approximate location of the site is shown on the on Google earth image (Plates 1).

At the time of the investigation, the site was covered with lawn and few matured trees.



Plate 1 - Locality of the site bordered in yellow

4. FIELD WORK

The fieldwork was carried out on the 20th August 2021 and consisted of the following;

- General site assessment
- Hand auger boring
- Dynamic Cone Penetrometer testing
- Percolation testing

The approximate field test positions are indicated on Drawing № 33330-01 accompanying this report.

4.1 Auger Holes (AH1 - 4)

Four hand bored augers, designated AH's 1 - 4, were put down at the approximate positions indicated on Drawing № 33330-01 to ascertain the prevailing geology and to assess the groundwater conditions across the site. The subsoils recovered by the auger were examined and logged by an Engineering Geologist familiar with the procedures of soil logging in terms of the Guidelines for Soil and Rock Logging in South Africa, edited by A.B.A. Brink & R.M.H. Bruin, 2nd Impression 2002, recording the following parameters;

- For soil : Moisture condition, consistency, structure (where applicable), soil texture and origin.
- For rock : Colour, weathering, discontinuities, hardness and rock name.

The profiles for each of the auger holes, AH's 1 - 4 are presented as logs in Appendix A of this report.

4.2 Dynamic Cone Penetrometers Tests (DCP 1 - 6)

Six dynamic cone penetrometers, designated DCP 1 - 6, were carried out across the site. The aim of DCP testing was to establish the consistency of the subsoil underlying the site at shallow to moderate depths as well as to establish the depth to the bedrock if occurring at shallow to moderate depths.

The results of the DCP tests are graphically presented in Appendix B of this report.

Table 1, presented below, is provided to aid in the interpretation of the DCP test results in terms of the inferred subsoil consistency. It must be noted that the table is based on the DML apparatus and should be used as a guide only.

Table 1 : Subsoil Consistency Inferred from DCP Results Reference Table

Non Cohesive Soils	
№ of blows/300 mm Penetration	Subsoil Consistency
<8	Very loose
8-18	Loose
19-54	Medium dense
55-90	Dense
>90	Very Dense

4.3 Percolation Test (PT 1)

A percolation test, PT1, was carried out in terms of National Building Regulations whereby the soils were soaked for the prescribed 4 hours before testing commenced. The result of the percolation test is discussed in more details in Section 7 of this report. The percolation test was carried out to obtain an indication of the subsoil percolation rate for use in the design of the waste water disposal system for the development.

5. GEOLOGY AND SOILS

5.1 General

The site is underlain at depth by Margate granite bedrock and the residual soils derived therefrom. Overlying the bedrock is windblown sands and colluvium sediments.

Typically light grey brown to light brown, very loose to loose silty fine dune sand to a depth of between 1.0 and 1.6 metre overlies the site. The thickness of this latter horizon increases from west to east.

A moist becoming saturated, dark brown to yellowy orange, stiff, clayey sand or sandy clay with occasional highly to completely weathered Margate granite bedrock occurs beneath the dune sand.

5.2 Groundwater Conditions

Strong subsurface seepage flows characterize the site. Groundwater was encountered at depths between 0.6 and 0.7m in all auger holes and is expected to rise rapidly during periods of heavy rains. It is perched within the upper, permeable, leached sands and colluvium and unable to drain downward through the less permeable residual clayey horizon or weathered bedrock.

Therefore, DML would strongly recommend that plastic sheeting be installed under the floors and foundations to prevent rising damp.

6. GEOTECHNICAL ASSESSMENT

6.1 Slope Stability

There was no obvious evidence of slope instability on this site. However, caution must be exercised during construction to ensure instability is not introduced by aggressive building practices on this site.

6.2 Material Consistency

DCP's conducted across the site, indicate that the subsoils are generally very loose to loose to depths between 1.2 and 2.4m from the surface. Below this depth, the subsoils become very dense or firm to stiff depending of the clay content, before it reaches refusal.

6.3 Earthworks

Although no earthworks drawing was provided at the time of the investigation, from the architectural plans provided, it is evident that some earthworks will need to be carried out to accommodate the development, including the access road(s) and excavation for the lower ground floor, swimming pool, foundations and services. The lower ground level is planned to be cut 1.0 to 1.454m into the natural slope requiring some earthworks to be carried out.

As the upper 1.6m in-situ soils are susceptible to collapse settlement, they should be proof rolled with a vibratory roller before being filled or developed upon.

Prior to construction all vegetation must be cleared including the tree stumps and their root bulbs.

6.4 Excavatability

Based on the DCP results and hand bored auger hole soil profiles, 'soft' excavation as defined by SABS 1200D is expected to extend to a depth of in the order of 3.3m to 4.2m below present ground levels, but shallow groundwater conditions will make excavation difficult and tedious with the continuous collapse of trench and foundation sidewalls.

Excavation for the proposed lower ground floor is expected through loose dune sands and within residual granite to completely weathered granite.

6.5 NHBRC Classification

Based on the prevailing soils and ground water conditions, the site is classified as being C2 but becomes H2/H3 in the residual and completely weathered Margate Granite in terms of NHBRC.

7. DEVELOPMENT RECOMMENDATIONS

7.1 Cut and Fill Embankments

7.1.1 *Cuts*

Any permanent cut embankments proposed within the loose dune sands must be restricted to a slope batter of about 1 : 2 (V:H) (26°). Whereas the more clayey sands of residual granite may be laid back to a slope batter of about 1 : 1.75 (V:H) (30°)

Similarly, all service and foundation trenches excavations greater than 1.2m depth must be battered back to the above mentioned temporary batter or suitably shored to prevent the collapse of excavation sidewalls thereby ensuring safe working conditions therein.

7.1.2 *Fills*

Prior to the placement of any fills, the natural ground should be stripped of all vegetation.

The construction of any fills on site should proceed in the following manner;

- Placement of fill material meeting the minimum requires of a G10 type material in layers of maximum 300mm loose thickness.
- Compaction of fill material to 93% and 95% Mod AASHTO density for the more clayey and sandy varieties of the granite derived material and dune sand material respectively.
- The maximum particle size of material in the fill should be restricted to two thirds the layer thickness (i.e 200mm) to ensure adequate and uniform compaction therein.
- The outer batter of any engineered fill embankment should be restricted to 1:1.75 (30°). Should this batter not be achievable within the confines of the site the fill embankment should be suitably retained on a permanent basis.
- All unsupported cut and fill embankments should be grassed/vegetated as soon as possible after construction to ensure potential erosion is kept to a minimum.

7.2 Founding Recommendations

7.2.1 *General*

The investigation revealed that the study area is overlain by unconsolidated very loose dune sands. Below these sediments, highly weathered Margate granite is to be expected.

7.2.2 Double Storey Structure (Lower ground floor and upper ground floor level)

In terms of the sectional drawings provident, the final floor level of the lower ground floor is at an elevation of 21 525m.a.s.l, which means the structural footprint along its western margin will be in approximately 1,5m relative cut.

The founding material will range from the clayey residual granitic soils in the west, to very loose dune sand in the east. The foundations will therefore straddle a range of soil materials of varying composition, including both active (expansive) and highly compressible (collapsible) soils. Moreover, the foundations on the western margin of the lower ground floor, will be below groundwater table. Excavation below such conditions will be tedious and will require de-watering and lateral support.

Based on the above, and with cognizance to the NHBRC classification of the final platform, it is recommended that the proposed new dwelling be founded on reinforced ground beams supported on isolated bases be taken down through all the dune sands, residual soils into hard hand pickable granite at a depth not less than 1.0m below final platform of the lower ground floor. If this is not achieved then foundation movement could be experienced over time. An allowable bearing capacity on the weathered granite bedrock would be 150 kPa. Notwithstanding this, the bases should not be less than 1.0m x 1.0m.

7.2.3 Double Garage (ground level, south western portion of the property)

As per the architectural layout, the proposed garages are to be constructed on ground level and on the south western side of the property.

Therefore, it should be supported on reinforced ground beams supported on isolated, deep, column bases taken into the completely to moderately weathered granite bedrock, which appears to occur at a depth of approximately 3.0m below present ground level. An allowable bearing capacity for pads of 100 kPa can be used for design purposes.

It is further recommended that the garages be articulated from the main dwelling to allow any minor differential settlement as may occur. An inert, uniform thickness base layer under the floor slab should be provide.

7.2.4 Staff Quarter (north western portion of the property)

The staff quarter is isolated from the main dwelling and is not expected to exact much load. Therefore, it can be supported on raft foundation.

All foundation trenches and excavations (pad) should be inspected and certified by the responsible Engineering Geologist or Engineer prior to casting of concrete to ensure that the founding conditions described above are achieved.

7.3 Retaining Structures

If any retaining structures are required, it is recommended that shear strength parameters of internal friction (Φ) = 28° and cohesion (c) = 0 kPa be used. Furthermore if rising damp is to be prevented, it should be damp proofed to intercept the anticipated perched watertable and an agricultural drain provided. Subsoil drains must be provided behind all retaining walls to facilitate drainage. The retaining wall foundation bearing capacity would be as for the main structure detailed under Section 7.2.2

7.4 Swimming Pools

The following issues should be taken into consideration when designing the swimming pool.

- The DCP results indicate that the materials on the proposed position of a swimming pool are very soft down to 2.1m depth and becoming stiff with depth.
- Ground water was encountered at approximately 0.6m below existing ground level.

Excavation below water table could prove problematic requiring de-watering to achieve the required depths.

It is also recommended that the swimming pool should take the form of a fibre-glass shell in place of a gunite/marblite pool.

7.5 Effluent Disposal

Due to the clayey nature of the subsoils and shallow watertable, the percolation test results at PT1 returned percolation rates of greater than 30 minutes per 25mm drop in water level, which is effectively a failure. On-site effluent disposal by subsoil percolation is therefore not considered feasible on this site with a high probability of failure in the short term.

It is therefore recommended that the development be placed on a conservancy tank system which will require regularly effluent removal by vacuum tanker (honey sucker) to a municipal sewage treatment facility. The tank should be placed where it would be easily accessible by a vacuum tanker from the road. The conservancy tank should also have a minimum capacity of one week effluent, hence, based on a daily flow of about 1700 litres it would have to have a capacity of not less than 11900 litres. Notwithstanding this recommendation, the final decision to accept a conservancy tank lies with the Local Authority.

Furthermore, if the conservancy tanks are to be subject to vehicular and/or soil loading it will have to be designed by an Engineer. The effects of buoyancy on empty conservancy tanks must also be taken into account.

7.6 Subsoil Drainage and Damp Proofing

Given the documented perched groundwater table, subsoil drainage is essential behind any new retaining structures. In addition, perimeter subsoil drains should be included around the final development platform to intercept any groundwater that might flow in laterally along the dune sand / residual granite contact.

7.7 Stormwater Disposal

All stormwater should be collected from roofs and paved areas and stored in tanks for back-up water supply and/or irrigation.

Excess stormwater should be piped to discharge into the system provided in the area.

As alluded to above, the weathered Margate granite and residual soils derived therefrom are not very permeable. Hence soak pits should not be considered on this site as the soils are not conducive to subsoils percolation.

After construction the site must be properly graded to facilitate the runoff of storm water and prevent ponding.

8. CONCLUSION

The proposed development of Rem of Lot 680 Leisure Bay, is considered feasible provided that the geotechnical recommendations set out above are strictly adhered to, these amounting to no more than good engineering practice.

9. DISCLAIMER

The ground conditions described in this report refer specifically to those positions where testing was carried out. It is therefore quite possible that ground conditions may vary from those in the above mentioned testing positions. The information in this report is given in good faith, as an indication of the materials and conditions likely to be encountered during construction. However, there is no warranty that the information is totally representative of the entire area and no responsibility will be accepted for any consequences arising from actual conditions being different from those indicated in this report.

We trust this meets with your immediate requirements in this matter however please feel at liberty to contact the author should you have any questions.

Yours faithfully

DRENNAN MAUD (PTY) LTD



M J HADLOW Pr.Sci.Nat.



G. NTAKA Cert.Sci.Nat.

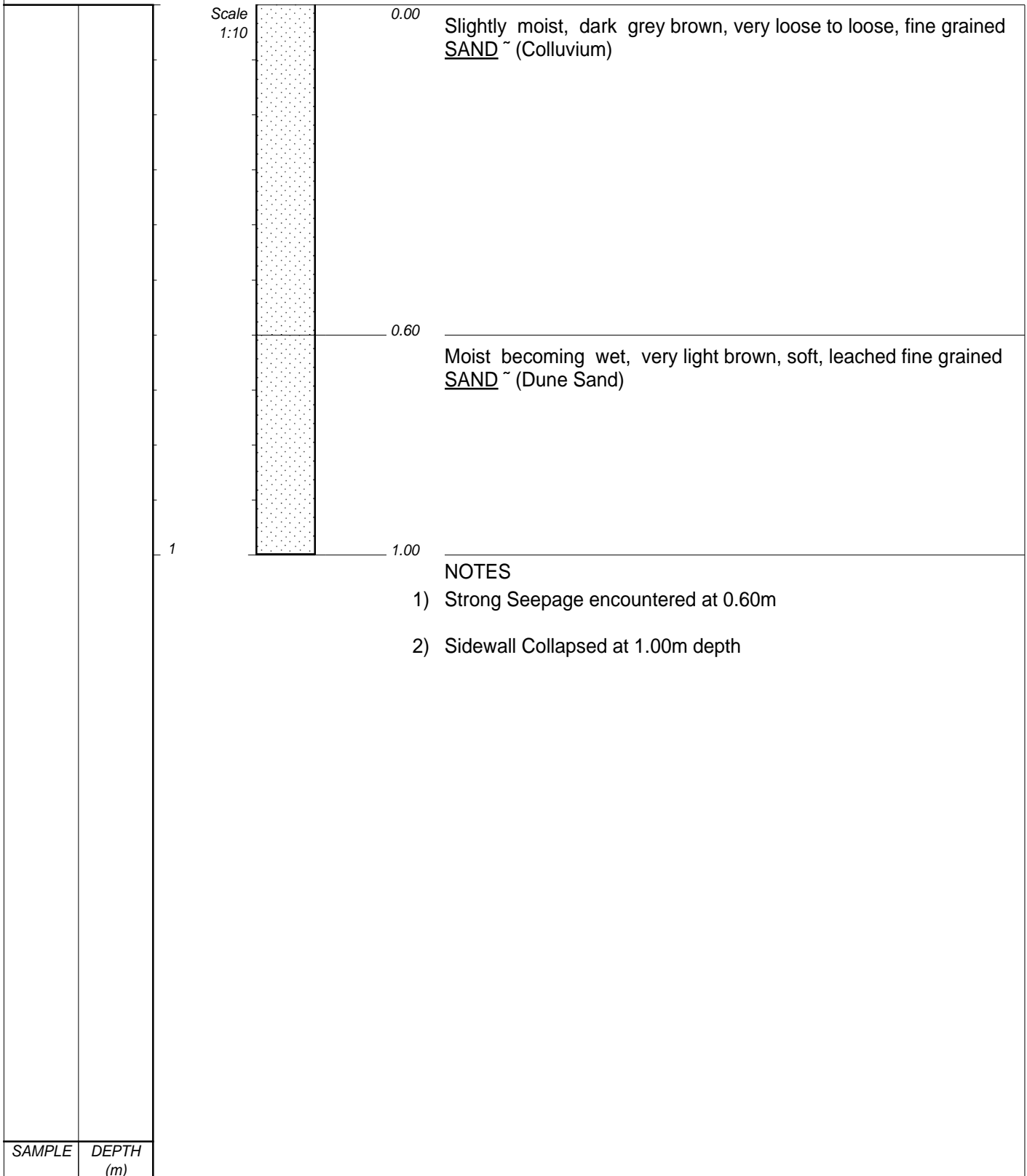
Encls: Appendix A - AH's 1 - 4
Appendix B - DCP's 1 - 3
Drawing № 33330/01 - Site Plan

/gn/kc

APPENDIX A

AUGER HOLE PROFILES

(AH 1 - AH 4)

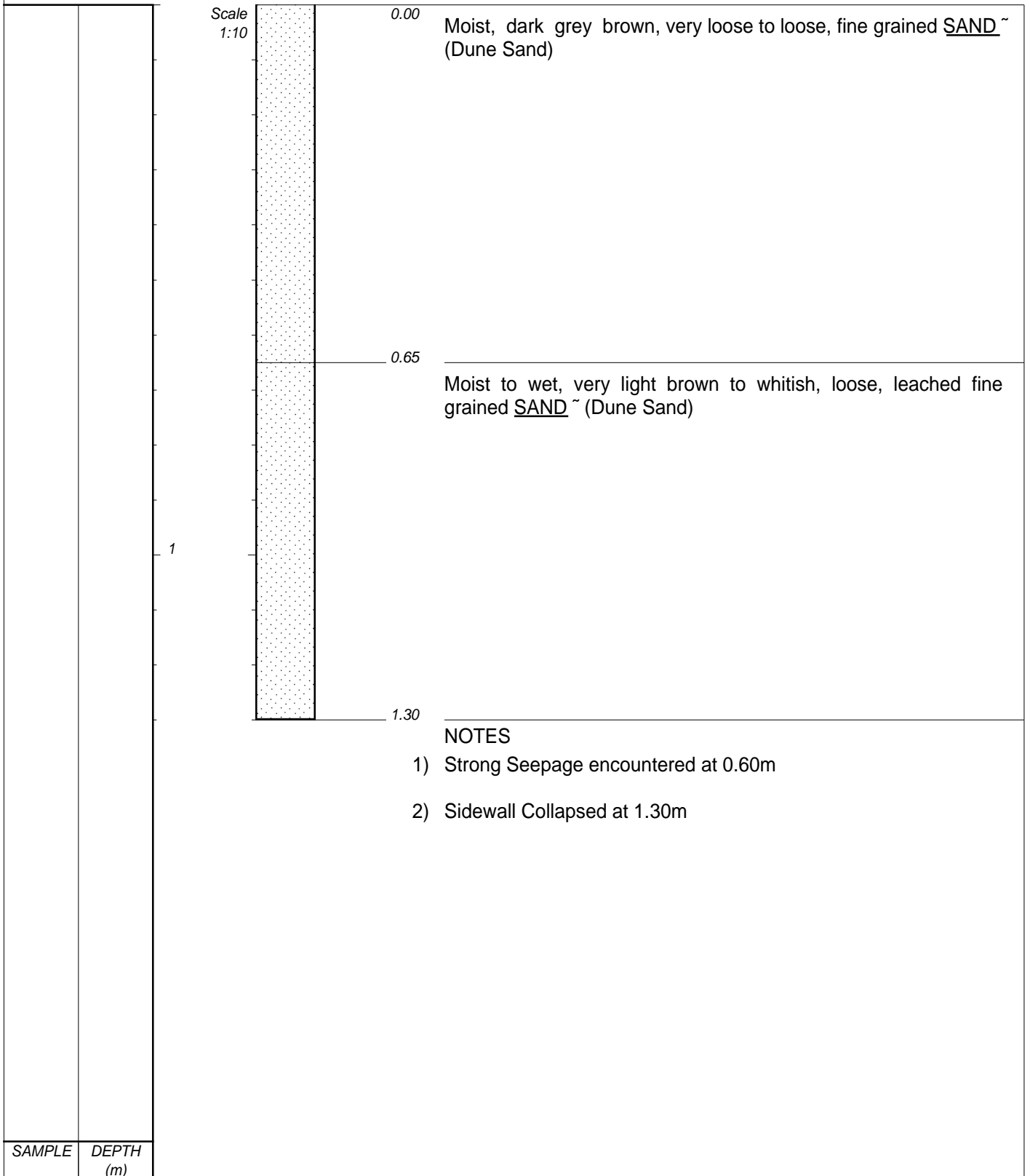


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PROFILED BY : GN.

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DIAM : NA
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Y-COORD :

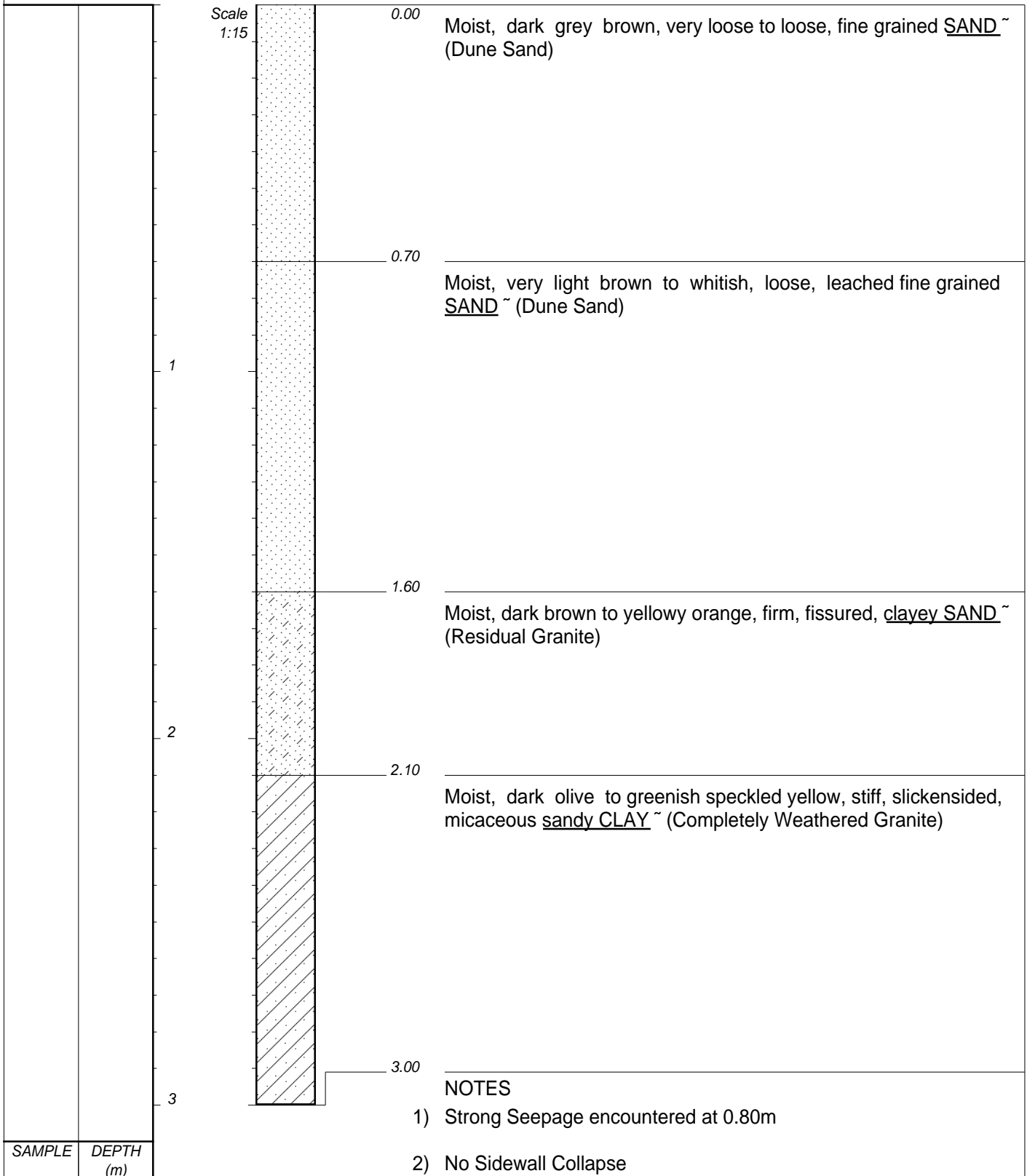
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CONTRACTOR :
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DIAM : NA
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DATE : August 2021
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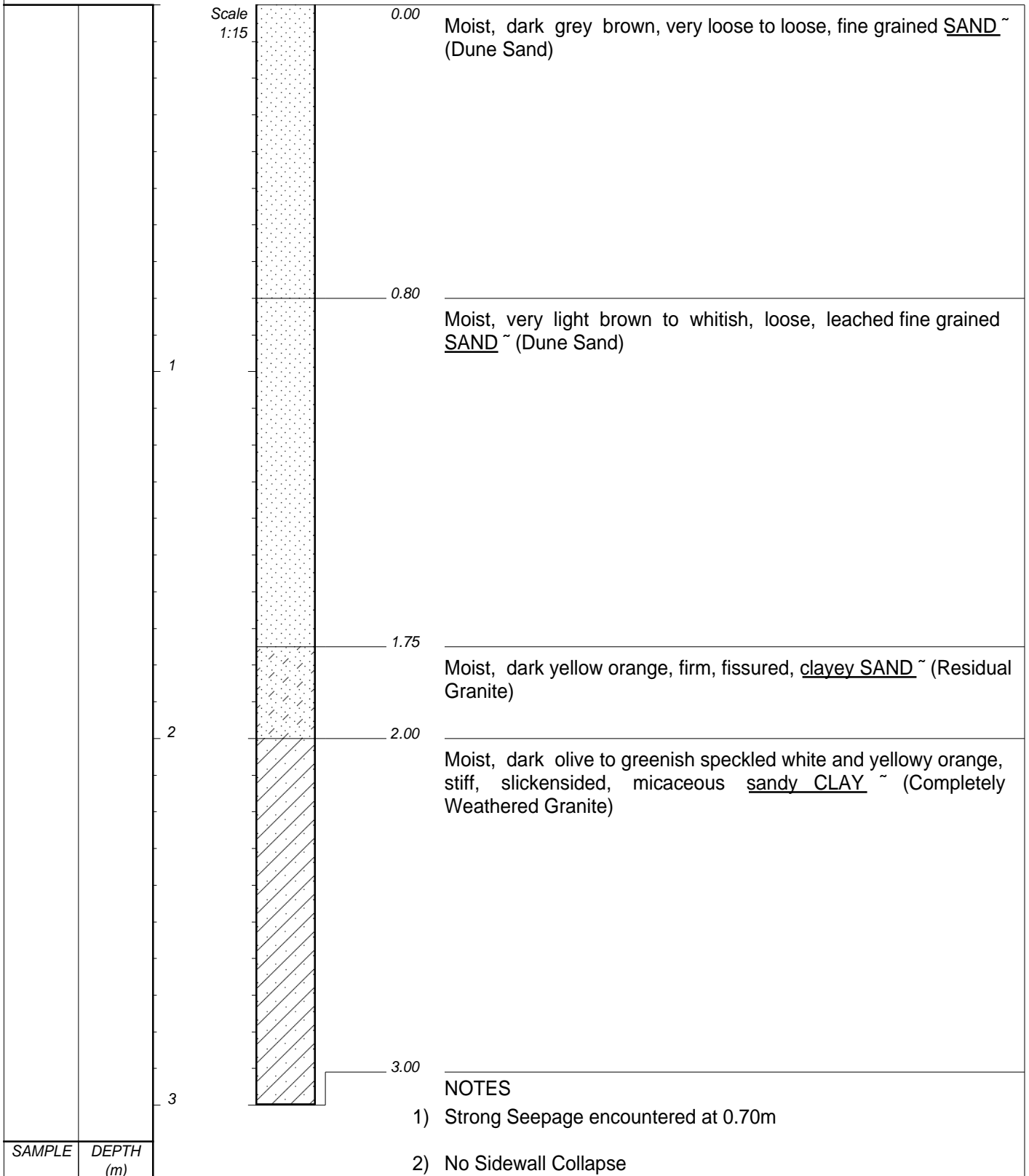
ELEVATION :
X-COORD :
Y-COORD :



CONTRACTOR :
MACHINE : Hand Bored Auger
DRILLED BY : NA
PROFILED BY : GN.

INCLINATION :
DIAM : NA
DATE : NA
DATE : August 2021
DATE : 22/09/2021 09:49
TEXT : C:\DOTIN\SPMASTER.DOC

ELEVATION :
X-COORD :
Y-COORD :



SAMPLE	DEPTH (m)

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MACHINE : Hand Bored Auger
DRILLED BY : NA
PROFILED BY : GN.
TYPE SET BY :
SETUP FILE : SOIL PROFILE.SET

INCLINATION :
DIAM : NA
DATE : NA
DATE : August 2021
DATE : 22/09/2021 09:49
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ELEVATION :
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Y-COORD :

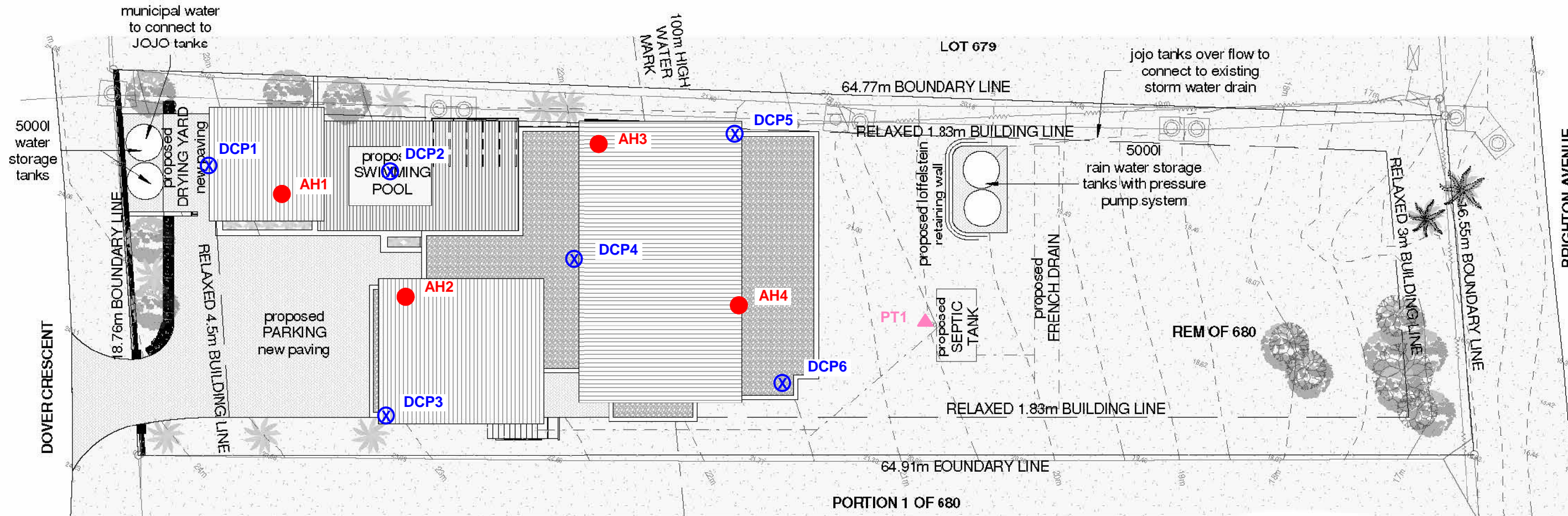
HOLE No: AH 4

APPENDIX B

**DYNAMIC CONE PENETROMETER TEST
RESULTS (DCP 1 - DCP 6)**

DRAWING № 33330/01

SITE PLAN



KEY

- DCP1⊗ APPROX. POSITION OF DYNAMIC CONE PENETROMETER TESTS
- AH1● APPROX. POSITION OF AUGER HOLES
- PT1▲ APPROX. POSITION OF PERCOLATION TEST

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DRAWN : S.P.
DATE : 25-08-2021
SCALE : AS SHOWN
CHECKED :

GEOTECHNICAL INVESTIGATION
REM. OF ERF 680 LEISURE BAY
SITE PLAN

DRAWING NO.

33330-01