Geotechnical Investigation – Alheit Van Der Merwe School – Aliwal North - Eastern Cape

Reference: 23-713

Dated: March 2023

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1. INTRODUCTION AND TERMS OF REFERENCE

As per the email request and RFQ document received on the 2nd November 2022, Delta Geotech (Pty) Ltd provided a proposal, on the 7th November 2022 to undertake a geotechnical investigation for the proposed Alheit Van Der Merwe School Upgrade in Aliwal North. The proposal indicated the methodology and cost to undertake a geotechnical investigation. Delta Geotech's quote was successful, and a letter of appointment was awarded on the 25th January 2023 to proceed with the investigation.

2. SCOPE OF REPORT

The geotechnical report sets out the findings of the geotechnical investigation. The objectives of the investigation were as follows:

a) Undertake a desktop study using topographical and geological maps, as well as, a review of available geotechnical literature.

b) An assessment of groundwater and bedrock conditions (if present)

c) A summary of the engineering properties of the soil derived from laboratory tests.

d) An assessment of the excavatability of the soil/rock and sidewall stability for service trenches and tank excavations.

e) Identifications of problematic soil conditions on the site.

f) Percolation tests to determine percolation rates for proposed soakaway systems.

g) The quality of the in-situ soil subgrade and its suitability for use during construction.

h) Provide a range of geotechnical parameters to assist in design of pavements and structures.

i) Recommendations on suitable founding level and safe allowable bearing pressures.

3. INFORMATION SUPPLIED

The following information was utilized during the investigation:

- Site development plan and KMZ of the site location.
- RFQ – Geotech Eng RFQ.PDF indicating the scope of works.
- Remote Colour Imagery – Google (2022)
- The 1:250 000 geological map – Aliwal North (Council for Geoscience)
- Brink A.B.A (1985). Engineering Geology of South Africa – Post Gondwana Deposits. Volume 4. Building Publications. South Africa. 332pp

4. SITE DESCRIPTION

The proposed site is located in the existing grounds of Alheit Van Der Merwe Primary School in Maletswai (formerly Aliwal North) in the Walter Sisulu Local Municipality. Access was gained through the main school gates in the north-east and north off the Marcow Street circle in Hilton (See Figure 1 – Locality Plan and Figure 2 – Site Plan).

The site is enclosed by tall fence while bordered by Marcow Street in the north, EUR Sports Field to the east and an ephemeral tributary of the Orange River to the west. The topography of the general area is slightly to moderately undulating in the form of hills and river valleys. On the site, a gentle fall generally toward the south and west occurs across the site with a slight rise at the southern boundary. There is also a slight depression and higher saturation on the school's sport field around test pit TP3 under the proposed new assembly slab.

Services for the school occur near to an in between existing buildings (classrooms and ablution) while bulk water and main electrical supply services occur along the northern boundary.

Figure 1: Locality plan indicating site location in Aliwal North.

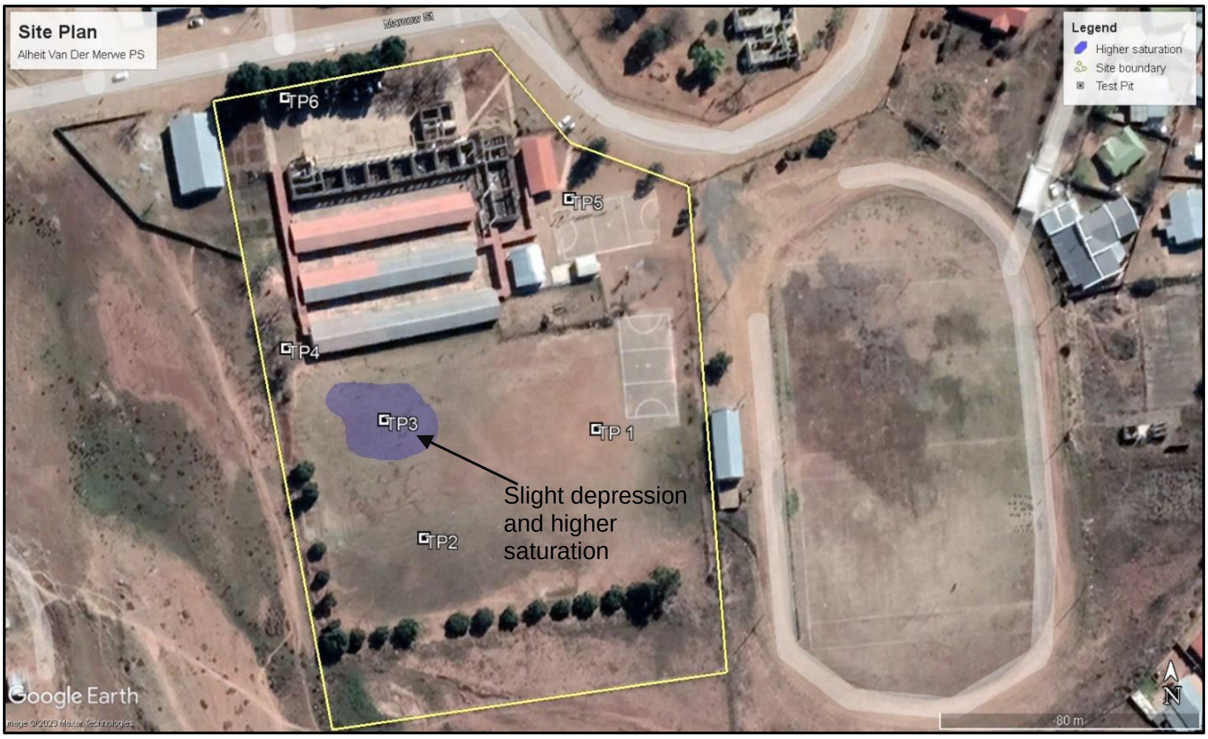

Figure 2: Site plan indicating features of the study area and TP1 – TP6 locations and adjacent DCP tests.

Plate 1-2 below provides an indication of conditions encountered on site.

Plate 1: Looking east, existing classrooms adjacent to the school sports field with approximate area of higher saturation.

Plate 2 & 3: Blotched mudstone (left) intersected in test pit TP1-TP5 and sandstone (right) intersected in TP6.

5. NATURE OF INVESTIGATION

The fieldwork for the investigation was carried out on the 2ndFebruary 2023 and comprised the following:

- Test Pit Excavations, profiling and sampling
- Dynamic Cone Penetration (DCP) tests
- Percolation test in proposed soakaway area

5.1 Test Pitting

A total of six (6) test pits, designated TP1 to TP6 were excavated using a TLB digger loader. Test pits were positioned at the location provided by the client as per the site development plan.

Test pits were advanced from surface to depths of between 1.40m to 2.70m begl and were profiled[1]. The detailed logs of all the profiles are provided in Appendix A with test pit co-ordinates included on test pit profiles.

Representative disturbed samples of material were taken from selected horizons and is discussed below in Section 7.

5.2 DCP Tests

A total of eight (8) DCP tests were conducted from existing ground level alongside test pits and at various levels within the test pits to determine the bearing capacity of the soils overlying the site. These have been numbered in conjunction with test pit positions.

The DCP tests extended to depths of between 0.56m and 1.90m begl.

The results of the DCP tests are provided in Appendix B.

6. GEOLOGY AND GROUNDWATER CONDITIONS

6.1 General Geology of the Area

The general geology of the area comprises sedimentary mudstone and sandstone rock. These rock units form part of the Tarkastad Subgroup; Beaufort Group; Karoo Supergroup. The sedimentary rocks are extensively intruded by igneous dolerite sills and dykes of Jurassic Age, though these were not encountered during the investigation (Figure 3).

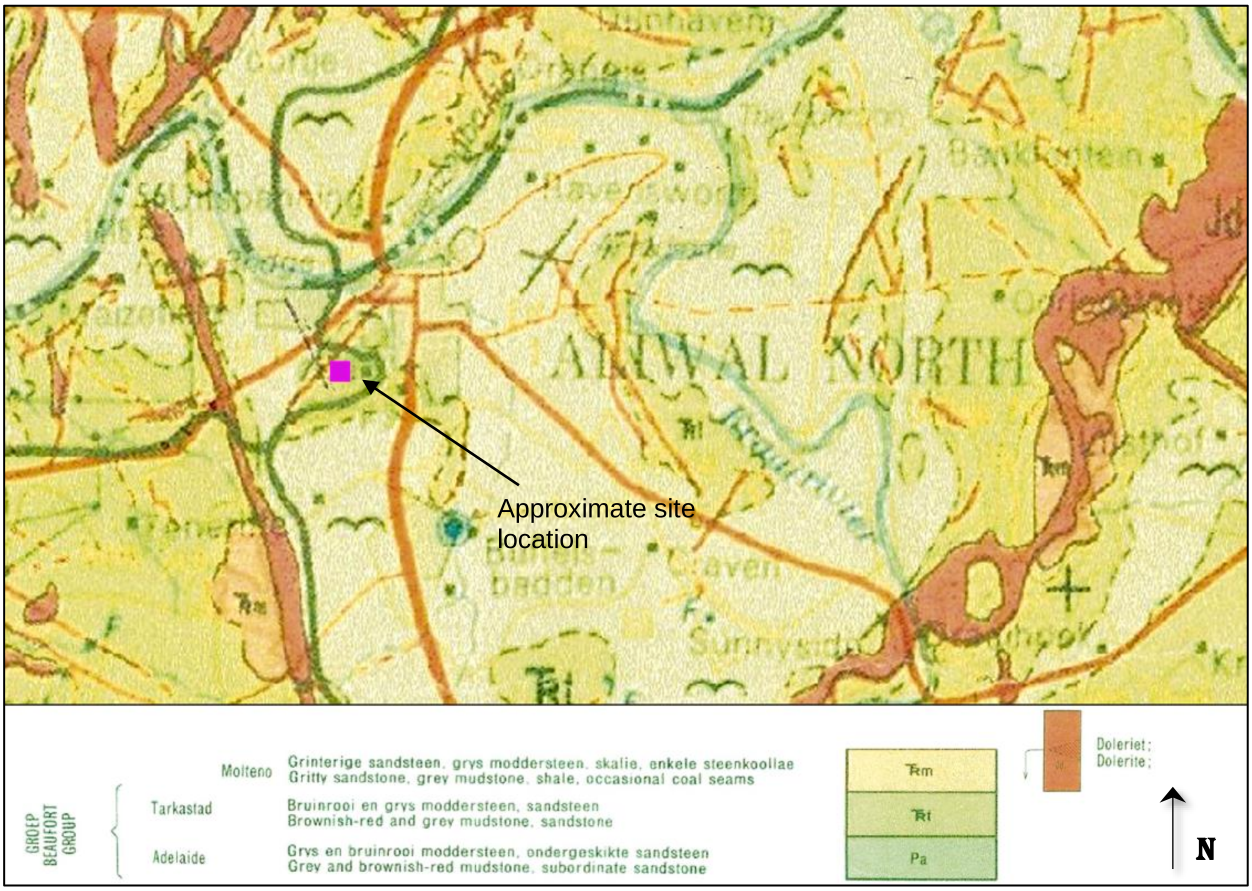

Figure 3: Geological Plan - Regional Geology of the area. Note pink rectangle indicating approximate location of the site.

6.2 Site Geology and Soils

The site, as intersected by the test pits, is overlain by fill and residual soils that transition into weathered mudstone or sandstone as follows:

6.2.1 Fill

Fill soils occur in all test pits from surface to depths of between 0.10m to 0.75m begl. This horizon in test pits TP1-TP4 resembles the underlying residual soil and likely originates from the historical earth works for the current school infrastructure. Its composition comprises cohesive gravelly sandy clayey silt to gravelly clayey sandy silt. In test pits TP5 and TP6 the fill comprises granular silty sandy gravel and silty sand respectively. The fill material occasionally includes sporadic refuse and builders' rubble.

6.2.2 Residual

Residuum occurs in all test pits underlying the fill and was intersected from depths of between 0.10m and 0.75m begl which extends to depths of between 0.45m and 1.40m begl. This horizon generally comprises cohesive gravelly clayey sandy silt (TP1, TP4) to gravelly sandy clayey silt (TP2, TP3) and clayey sandy silt (TP5, TP6). Frequent calcrete nodules occur within the residuum, as well as, sporadic zones of completely weathered rock which holds a similar colour to the underlying mudstone. A gradual transition to the underlying rock occurs creating a zone for the soil-rock boundary rather than a distinct interface

6.2.3 Mudstone and Sandstone

Maroon completely and highly to moderately weathered mudstone was intersected in all test pits TP1-TP6 with the colour occurring as blotched and layered red and light blue grey. The completely weathered mudstone was intersected from depths of between 0.45m and 1.40m begl which extends to depths of between 0.80m and 2.40m begl. The highly to moderately weathered mudstone in TP1-TP5 was intersected below the completely weathered mudstone and extends to depths in excess of between 1.90m and 2.70m begl. Olive grey to light grey highly to moderately weathered sandstone was intersected in test pit TP6. The sandstone was overlain by a thin completely weathered mudstone lens and was intersected from 1.00m begl.

6.3 Groundwater

Groundwater seepage was encountered in test pits TP3 at depth of 2.60m begl. Seasonally perched ground water could exist at the interface between impermeable and permeable soil horizons as well as at soil rock interface.

7. LABORATORY TESTING

Two Foundation Indicator samples, collected and sent for laboratory testing, were required to determine the particle size distribution of materials. Whilst one moisture-density (MOD) and Californian Bearing Ratio (CBR) test and a road indicator was required to determine the compactive strength of materials intersected in the test pits.

The points below provide a summary of the laboratory tests undertaken:

- Foundation Indicator testing comprising Atterberg Limits, Particle Size Distribution and Hydrometer analysis

- Moisture density using CBR moulds to determine the maximum dry density (MDD) and compaction curve.

- California Bearing Ratio strength test providing a CBR strength value.

The laboratory results are provided in Table 1 and interpreted in Table 2. The full laboratory results are included in Appendix C.

Table 1:

Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations and MOD/CBR Tests.

TP No.	Depth (m)	Description	Particle Size Distribution %				Atterberg Limits %			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)					Swell (%)	
			Clay	Silt	Sand	Gravel	LL	PI	LS		MDD (kg/m^3)	OMC %	90	93	95	98	100		Classification
1	0.50-1.00	Residual	12	52	31	5	29	18	9.5	0.40	-	-	-	-	-	-	-	-	A-6(11); CL; Medium heave potential
4	0.80-1.20	Residual	26	41	30	4	32	17	8.5	0.34	-	-	-	-	-	-	-	-	A-6(11); CL; Medium heave potential
5	0.10-1.00	Residual	66		33	1	27	14	6.0	0.58	2021	8.8	2	2	1	1	1	3.8	A-6(6); Less than G9 according to COLTO

LL	-	Liquid Limit	GM	-	Grading Modulus	Classification in Terms of:	COLTO
PI	-	Plasticity Index	OMC	-	Optimum Moisture Content		Unified Soil Classification System[1]
LS	-	Linear Shrinkage					Van der Merwe[2]
							TRH14(1985)[3]

[1] ASTM D 2487-06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). June 2006

[2] D.H. Van Der Merwe (1964) The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp 103-107

[3] TRH 14 (1985) - Guidelines for Road Construction Materials; Technical Recommendations for Highways, South African National Institute for Transport and Road Research

8. ENGINEERING PARAMETERS

8.1 Parameter Value Derivation

This section summarises the available in-situ and laboratory data for each stratum recorded across the site based on the site-specific investigation obtained from the ground investigation.

The derivation of geotechnical parameter values will generally follow the guidance set out in Eurocode 7 (EC7). EC7 defines the Characteristic Value as a cautious estimate of the value affecting the occurrence of the limit state and also describes it as a cautious estimate of the mean. This can be defined as being analogous with the 'moderately conservative' values in accordance with CIRIA 104 and CIRIA 185. Where feasible, the characterisation process will follow this statistical approach, whereby Characteristic Values are derived by an assessment of the standard deviation of the dataset. In general, this applies to index properties where there are large data sets. Where data sets are small, or the data shows a trend with depth the selection of the characteristic values has relied on engineering judgement using a plot of the data.

In the absence of sufficient data, published data and empirical correlations have been considered. In these cases, care must be taken during design, as factors such as consolidation history, soil composition variability, and moisture content will drastically affect these parameters. The method of derivation, and any empirical relationships utilised, for each parameter are presented in the following sections for each strata unit and the range of engineering parameters recorded is presented in the tables below.

To aid in the clarity of interpreting the laboratory results the interpretation of the materials has been summarized overpage in Table 2.

Table 2: Materials Classification and Usage for Construction

Material	Lab Results Summary	Evaluation	Inferred Geotechnical Parameters
Residual	Clay = 12-26% Silt = 41-52% Sand = 31-30.% Gravel = 1-5% PI = 14 to 18 LL = 27 to 32 GM = 0.34 to 0.58 LS = 6.0 to 9.5 CBR = 2 @ 90% MDD CBR = 2 @ 93% MDD CBR = 1 @ 95% MDD CBR = 1 @ 98% MDD CBR = 1 @ 100% MDD A-6(11), A-6(6); CL; medium heave potential; less than G9 quality according to COLTO.	Generally higher portions of fines to granular material therefor more of a cohesive material across the site, therefore expect poor workability. With elevated Atterberg limits the residual soils also have medium heave potential material. Low CBR strength values that classifies as less than G9 according to COLTO specifications. The residual soils should not be considered as a construction material and would require precautions if considered as an *in-situ* subgrade or founding horizon.	Assume cohesive and firm material: Moist unit weight – γmoist – 18.0kN/m^3 to 19.0kN/m^3 (BS 8002, 2015), (CIRIA 516, 2000). Equivalent "N" Value based on DCP results – 2 to 38 and 33 to 50 with depth. Undrained shear strength – Cu – 25 to 50kN/m^2 (EPRI 6800, 1990). Youngs Modulus / Elastic Modulus, Eu – 4 to 7MPa (Obrzud and Truty, 2012). Poisson's Ratio V' = 0.30 to 0.35 (EPRI, 1990) Co-efficient of subgrade reaction – k = 12 MN/m^3 to 24MN/m^3 (Bowles, 1996).

9. GEOTECHNICAL EVALUATION

9.1 Engineering and Materials Characteristics

On the basis of the desk study and the available geotechnical investigation information, the following points relating to the site geotechnical conditions and constraints, may be made:

a) DCP results for the predominately cohesive (TP1-TP4) fill horizon that occurs over much of the site, generally indicate variable consistency for the fill through their vertical profile from very soft and stiff becoming very stiff with depth. The fill is therefore, overall, highly to only slightly compressible. The more granular variety (TP5-TP6) is medium dense and dense and therefore moderately to slightly compressible. The fill is also highly variable in composition. Field observations indicate high fines which exhibit plasticity. Due to the highly variable and potentially active nature of the fill this material should not be considered as a subgrade for surface beds nor pavements and definitely not as a founding horizon for proposed structures.

b) DCP data indicate the cohesive residual soils intersected in all the test pits TP1-TP6 are highly variable in consistency from very soft to very stiff throughout their profiles from depths of between 0.10m and 0.75m begl which extend to depths of between 0.45m and 1.40m begl. The residuum is therefore highly to slightly compressible overall. Laboratory results indicate high fines content and very low CBR strength with a COLTO classification of less than G9. The residuum will not compact well but where at least firm in consistency should form a suitable *in-situ* subgrade. In terms of a foundation substrate, due to the presence of rock relatively close to surface, founding in this horizon will not be required and is not recommended.

a) Completely weathered very soft rock mudstone was encountered in all test pits. Highly weathered or less weathered mudstone was encountered in TP1-TP5 and would generally classify as G6/G7 while sandstone in TP6 would generally classify G7/G8. The completely weathered and highly weathered rock could be considered as founding horizons but bearing capacity of each horizon must be adjusted according to the degree of weathering and rock hardness.

b) Groundwater was intersected in TP3 during site investigations at a depth 2.60m begl. It is possible during time of peak rainfall that perched groundwater conditions could develop at the contact between upper lower consistency and less permeable deeper soils or rock. Precautions should therefore be considered.

c) Sidewall collapse was not observed during the investigation.

10. RECOMMENDATIONS

10.1 Foundations

The following foundation options are recommended in accordance with the site geotechnical conditions:

1) Found structures on at least firm/medium dense residual soils using cellular raft foundations with an approximate bearing pressure of 80kPa
2) Found structures using strip or pad footings on completely weathered soft hard rock with modified construction techniques and founding depths of 0.45m to 1.40m. An approximate bearing pressure or 100kPa would be achievable.
3) If higher bearing pressures are required, found structures using deep strip or pad footings on at least highly weathered medium hard rock at depths of 1.40 to 2.40m begl. An approximate bearing pressure of 350kPa should be achievable. To create shallower founding a cement stabilized G5 gravel compacted to at least 98% MDD could be used to reach the required founding levels.

It is recommended that all foundation excavations are inspected by a professionally registered geotechnical consultant to confirm depth of founding and bearing pressure before concrete is cast.

10.2 Pavements and surface beds

Surface beds to be suspended/incorporated into raft foundation or floating or suspended where they occur over fill or residual soils.

For pavements, due to the expansive nature of the residual soils, these should be stabilized or replaced with a geotechnically inert material below any proposed pavements. Options to be considered are indicated in Table 4.

Table 4: Subgrade Improvement Options

Subgrade Improvement Methods	Details	Comments
Option 1 Non-volumetrically active capping layer	Introduce a geotechnically inert pioneer rock layer. For areas in fill this should be 0.50m to 1.0m thick. And areas of cut 0.25 to 0.50m thick.	Generally, an economically viable solution depending on availability of a pioneer rock source.
Option 2 Lime + cement stabilization of residual soils	Rework in-situ subgrade with 4 to 8% lime.	Lime demand tests required to determine the permanent nature of the lime stabilization. Select a contractor with sufficient and proven experience in undertaking lime stabilization ground improvement.
Option 3 Geosynthetic separation layers	Emplace geo grids to provide strength and to minimize heave and shrinkage movements.	High cost. Difficult to manage and ensure appropriate installation.
This option should be considered throughout Subgrade moisture content management	Based on a median average rainfall of 512mm per annum (Aliwal North 2022). Construction should be undertaken when the in-situ residual subgrade has an OMC of 100%. I.e. 8.8% MC.	Construction at this time will encourage equilibrium conditions below the pavement and minimize ground heave and shrinkage.

The options detailed in Table 4 should be considered based on-site suitability, the proposed roadway/pavement design and associated costs. The proposed roadway layers can then be emplaced above.

10.3 Excavatability

Excavation requirements in materials on site in terms of the SANS 1200DM Earthworks Specifications classifies as:

- Soft excavations in all the soils and completely weathered rock. These materials can be removed using hand excavations or a backhoe / digger loader.
- Intermediate excavations in highly weathered rock requires a back-acting excavator having a fly wheel power >0.10kW, or the use of pneumatic tools before removal.
- Hard rock excavations in moderately weathered rock requires blasting or wedging and spitting for removal.

10.4 Drainage

Attention to drainage and the effective collection and disposal of storm water run-off is required throughout the site as part of general surface water management. Measures to prevent water ingress into soils below and against foundations are also required. These would include, where applicable, grading of slopes to promote run-off and prevent ponding close to the building, effective collection, and removal off site of storm water and water from downpipes and regular checking of wet services for leaks.

Stream formalization will be required to direct water influx during peak rainfall moths. In addition, measures to prevent groundwater inflow during construction, such as pumping from sumps or well points, should also be considered.

11. CONCLUSIONS

The site has challenges in terms of management of fill soils, expansive residual soils and perched ground water in places. But through careful design, the development will be achievable.

Structures should be founded using cellular raft foundations on residual soils or making use of the relatively shallow rock with strip or pad footing. The ground where pavements occur will require ground improvement and or replacement to accommodate the fill soils and underlying expansive residual soils.

Lastly, the ground conditions described in this report refer specifically to point sources encountered in test pits and at DCP test positions. It is therefore possible, or probable, that conditions at variance with those discussed may be encountered. Important then is that Delta Geotech (Pty) Ltd carry out periodic inspections during construction, before *in situ* subgrade treatment is carried out. Any change from the anticipated ground conditions could then be taken into account to avoid unnecessary expense. In this regard, it is important that the construction phase of the project be treated as an augmentation of the geotechnical investigation. This additional work can be conducted on a time and cost basis.

We trust that the information provided meets with your requirements. Should you have any queries do not hesitate to contact us.

Yours faithfully,

DELTA GEOTECH (PTY) LTD

	Compiled by	Reviewed by	Approved by
Date	March 2023	March 2023	March 2023
Name	Bernard Grunewald	Matthew Jones	Matthew Jones
Qualifications / Registrations	BSc Geol	Pr.Sci.Nat SAIEG	Pr.Sci.Nat SAIEG
Signature			

12. REFERENCES

Johnson and Kavanaugh, 1968. (1968). *The design of foundations for buildings.* NY: McGraw Hills.

Jennings et al. (1973). Revised guide to soil profiling for civil engineering purposes in South Africa. *South African Institute for Civil Engineering*, 3-13, 15.

Reese. (1975). Field testing and analysis of laterally loaded piles in stiff clay. *Proceedings - Offshore Technology* (p. Vol 2). Houston TX: Conference.

BS 8002. (2015). *Code of practice for earth retaining structures.* British Standard.

CIRIA 516. (2000). *Modular Gravity retaining walls design guidance.* Construction Industry Reserarch and Information Association.

Look. (2007). *Handbook of geotechnical investigation and design tables.* London: Taylor and Francis Group.

EPRI 6800. (1990). *Manual of estimating soil properties for foundation design.*

BS 8004. (2015). *Code of practice for foundation design.* British Standard.

Obrzud and Truty. (2012). *The hardening soil model - A practical guidebook.* PC 100701 Report.

BS 5930. (1999). *Code of practice for site investigations.* British Standard.

Bowles. (1996). *Foundation analysis amd design.* 5th Ed: McGraw-Hill.

NAVFAC DM7. (1971). *Soil Mechanics - Foundation and Earth Structures - Design Manual DM7.* Alexandria USA: Naval Facilities Engineering Command.

APPENDIX - A

DELTA GEOTECH

Alheit Van Der Merwe School

HOLE No: **TP01**	*Sheet 1 of 1*
JOB NUMBER: 23-713	

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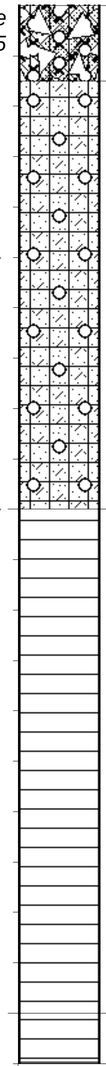

0.50

1.00m

0.00	Moist light brown medium dense slightly shattered GRAVELLY SANDY CLAYEY SILT: Fill with occasional builders rubble and angular gravels of dolerite.
0.15	Slightly moist greyish maroon purple dense to very dense shattered GRAVELLY CLAYEY SANDY SILT: Residual with coarse sand grains and sporadic completely weathered mudstone zones.
1.00	Maroon purple blotched and layered red and light blue grey completely weathered highly fractured closely jointed very soft rock MUDSTONE.
2.00	Maroon purple blotched and layered red and light blue grey highly to moderately weathered highly fractured closely jointed soft to medium hard rock MUDSTONE.
2.10	

NOTES

1) End of hole @ 2.10m.
2) TLB refusal on bedrock.
3) No water table.
4) Sample small 0.50 to 1.00m.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : BG

INCLINATION :
DIAM :
DATE :
DATE : 2 February 2023

ELEVATION :
X-COORD : 304200.40
Y-COORD : 264148.30

HOLE No: **TP01**

TYPE SET BY : BG
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DELTA GEOTECH

Alheit Van Der Merwe School

HOLE No: **TP02**
Sheet 1 of 1

JOB NUMBER: 23-713

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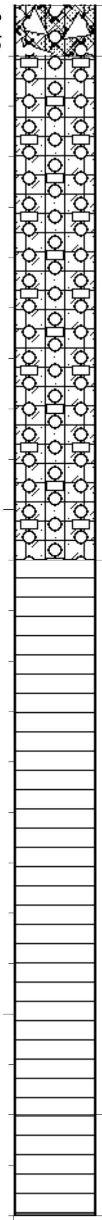

0.00	Moist light brown medium dense slightly shattered GRAVELLY SANDY CLAYEY SILT: Fill with occasional builders rubble and angular gravels of dolerite.
0.10	Moist greyish maroon purple dense to very dense shattered GRAVELLY SANDY CLAYEY SILT: Residual with frequent gravel sized calcrete nodules and sporadic completely weathered mudstone zones.
1.10	Maroon purple blotched and layered red and light blue grey completely to highly weathered highly fractured closely jointed very soft to soft rock MUDSTONE.
2.20	Maroon purple blotched and layered red and light blue grey highly to moderately weathered highly fractured closely jointed soft rock MUDSTONE.
2.40	

NOTES

1) End of hole @ 2.40m

2) TLB refusal on bedrock.

3) No water table.

4) No sample.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : BG

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DIAM :
DATE :
DATE : 2 February 2023

ELEVATION :
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Y-COORD : 264146.33

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DELTA GEOTECH

Alheit Van Der Merwe School

HOLE No: **TP03**
Sheet 1 of 1

JOB NUMBER: 23-713

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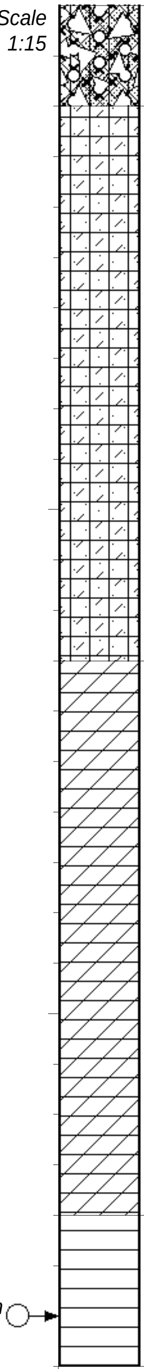

Depth (m)	Description
0.00 – 0.20	Wet light brown medium dense slightly shattered GRAVELLY SANDY CLAYEY SILT: Fill with occasional builders rubble and angular gravels of dolerite.
0.20 – 1.30	Wet to moist maroon purple brown dense to very dense shattered GRAVELY SANDY CLAYEY SILT: Residual with sporadic completely weathered mudstone zones.
1.30 – 2.40	Maroon purple blotched and layered red and light blue grey completely to highly weathered highly fractured closely jointed with clay infill very soft to soft rock MUDSTONE.
2.40 – 2.70	Maroon purple blotched and layered red and light blue grey highly to moderately weathered highly fractured closely jointed soft rock MUDSTONE.

NOTES

1) End of hole @ 2.70m.

2) TLB refusal on bedrock.

3) Groundwater seepage at 2.60m.

4) No Sample.

CONTRACTOR :
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PROFILED BY : BG

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DATE : 2 February 2023

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HOLE No: **TP03**

DELTA GEOTECH

Alheit Van Der Merwe School

HOLE No: **TP04**
Sheet 1 of 1

JOB NUMBER: 23-713

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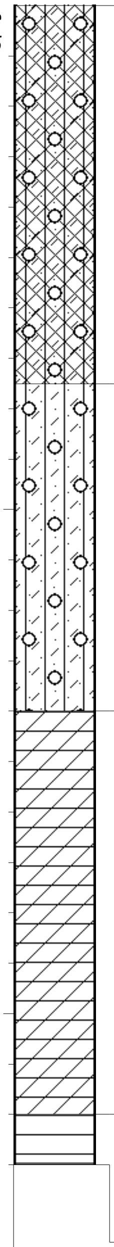

0.80
1.20m

Depth (m)	Description
0.00	Moist maroon purple brown dense shattered GRAVELLY CLAYEY SANDY SILT: Fill consisting of residual with occasional refuse.
0.75	Slightly moist greyish maroon purple dense to very dense shattered GRAVELLY CLAYEY SANDY SILT: Residual.
1.40	Maroon purple blotched and layered red and light blue grey completely to highly weathered highly fractured closely jointed with clay infill very soft to soft rock MUDSTONE.
2.20	Maroon purple blotched and layered red and light blue grey highly to moderately weathered highly fractured closely jointed soft rock MUDSTONE.
2.30	

NOTES

1) End of hole @ 2.30m.
2) TLB refusal on bedrock.
3) No water table.
4) Sample small 0.80 to 1.20m.

CONTRACTOR :
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HOLE No: **TP04**

DELTA GEOTECH

Alheit Van Der Merwe School

HOLE No: **TP05**	*Sheet 1 of 1*
JOB NUMBER: 23-713	

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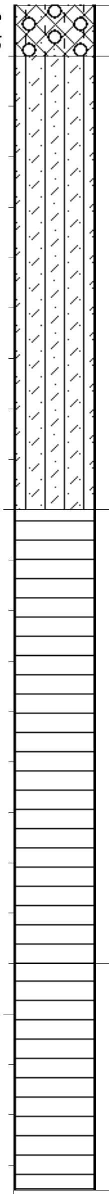
0.10

1.00m



Depth (m)	Description
0.00	Moist light orange grey brown speckled dark grey dense intact SILTY SANDY GRAVEL: Fill sabunga.
0.10	Moist maroon brown medium dense intact CLAYEY SANDY SILT: Residual.
1.00	Maroon purple blotched and layered red and light blue grey completely to highly weathered highly fractured closely jointed soft to very soft rock MUDSTONE.
1.90	Maroon purple blotched and layered red and light blue grey highly to moderately weathered highly fractured closely jointed soft to medium hard rock MUDSTONE.
2.35	

NOTES

1) End of hole @ 2.35m.

2) TLB refused on bedrock.

3) No water table.

4) Bulk sample 0.10 to 1.00m.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : BG

INCLINATION :
DIAM :
DATE :
DATE : 2 February 2023

ELEVATION :
X-COORD : 304158.10
Y-COORD : 264148.00

HOLE No: **TP05**

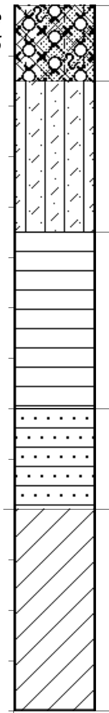
TYPE SET BY : BG
SETUP FILE : STANDARD.SET
DATE : 24/03/2023 07:28
TEXT : ..choolTestPitProfiles.txt

DELTA GEOTECH

Alheit Van Der Merwe School

JOB NUMBER: 23-713

Scale 1:15



Depth (m)	Description
0.00	Moist reddish brown medium dense intact GRAVELLY SILTY SAND: Fill with sporadic 20-30mm thick roots and angular coarse gravels of dolerite.
0.15	Slightly moist brown stiff intact CLAYEY SANDY SILT: Residual.
0.45	Brown maroon completely weathered very soft rock MUDSTONE.
0.80	Olive brown maroon completely weathered soft rock SANDSTONE.
1.00	Olive grey to light grey highly becoming moderately weathered medium jointed soft becoming medium hard rock with depth SANDTONE with clay infill between 1-5mm.
1.40	

NOTES

1) End of hole @ 1.40m.
2) TLB near refusal on bedrock.
3) No water table.
4) No sample.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : BG

INCLINATION :
DIAM :
DATE :
DATE : 2 February 2023

ELEVATION :
X-COORD : 304157.10
Y-COORD : 264144.73

HOLE No: **TP06**

TYPE SET BY : BG
SETUP FILE : STANDARD.SET
DATE : 24/03/2023 07:28
TEXT : ..choolTestPitProfiles.txt

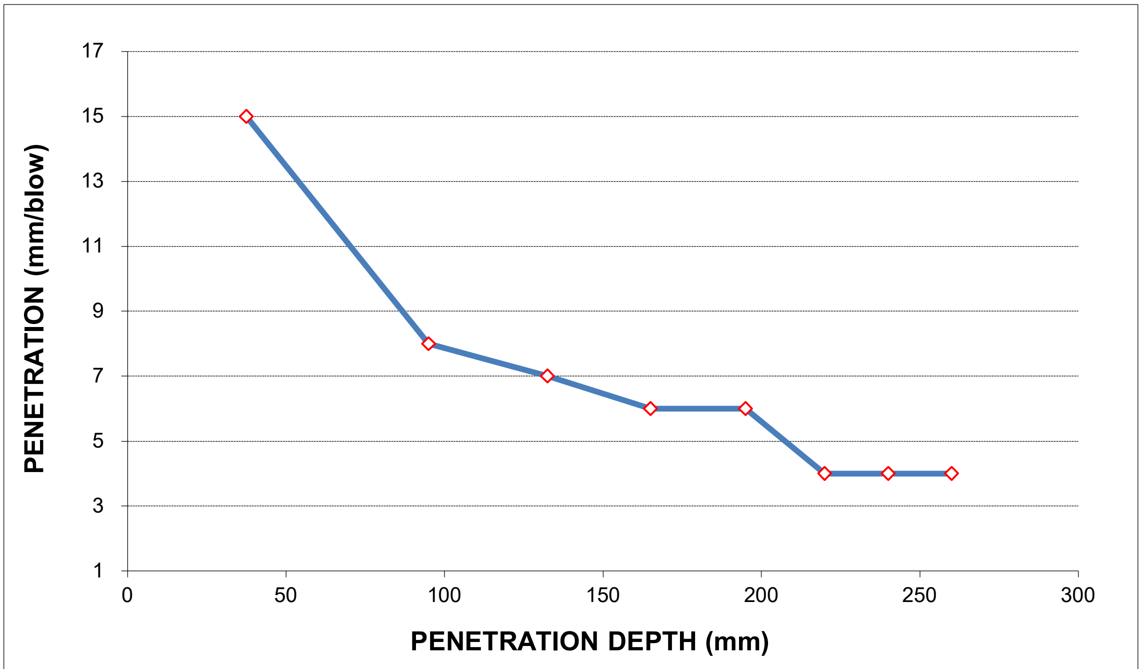
APPENDIX - B

DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DCP No: 1 Location: **TP1 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 17

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	75	37.5	5	37.5	15	20	13	336
2	75	115	95	5	95	8	38	31	654
3	115	150	132.5	5	132.5	7	43	36	751
4	150	180	165	5	165	6	50	44	900
5	180	210	195	5	195	6	50	44	900
6	210	230	220	5	220	4	50	76	900
7	230	250	240	5	240	4	50	76	900
8	250	270	260	5	260	4	50	76	900
9	270	285	277.5	5	277.5	3	50	110	900
10	285	300	292.5	5	292.5	3	50	110	900
11	300	320	310	5	310	4	50	76	900
12	320	340	330	5	330	4	50	76	900
13	340	360	350	5	350	4	50	76	900
14	360	380	370	5	370	4	50	76	900
15	380	400	390	5	390	4	50	76	900
16	400	420	410	5	410	4	50	76	900
17	420	440	430	5	430	4	50	76	900

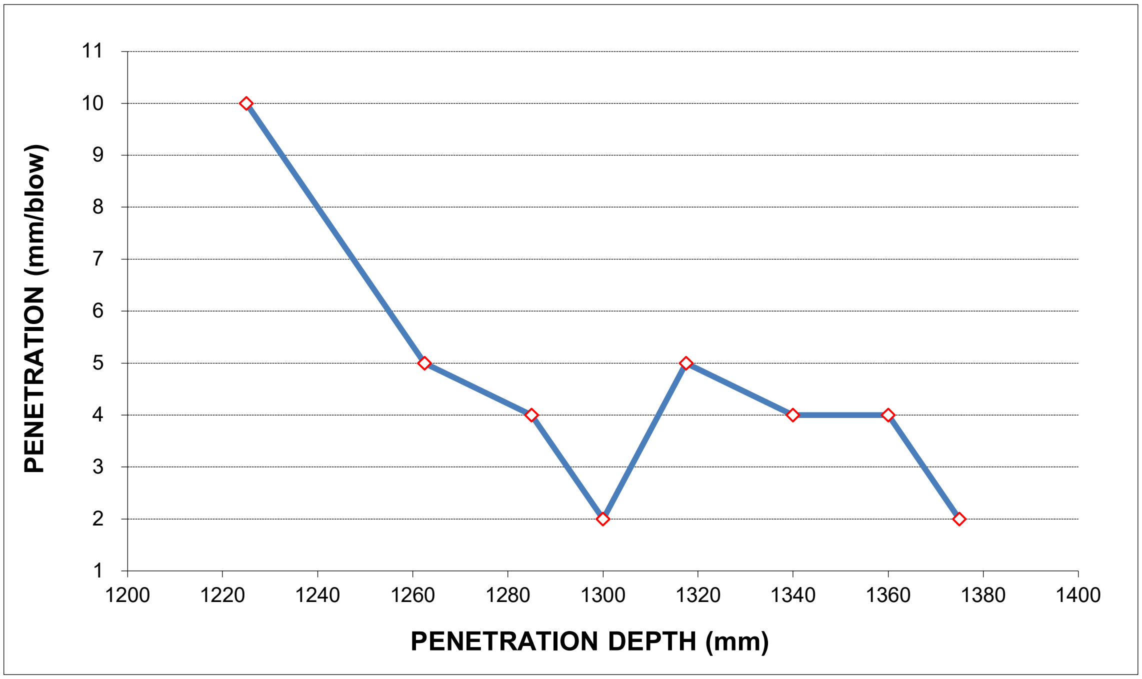
DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DELTA GEOTECH

DCP No: 2 Location: **TP1 @ 1.20m begl**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 1200 mm below NGL Readings : 8

Applied Factor : 1.5 times Terzaghi's value

Remarks :

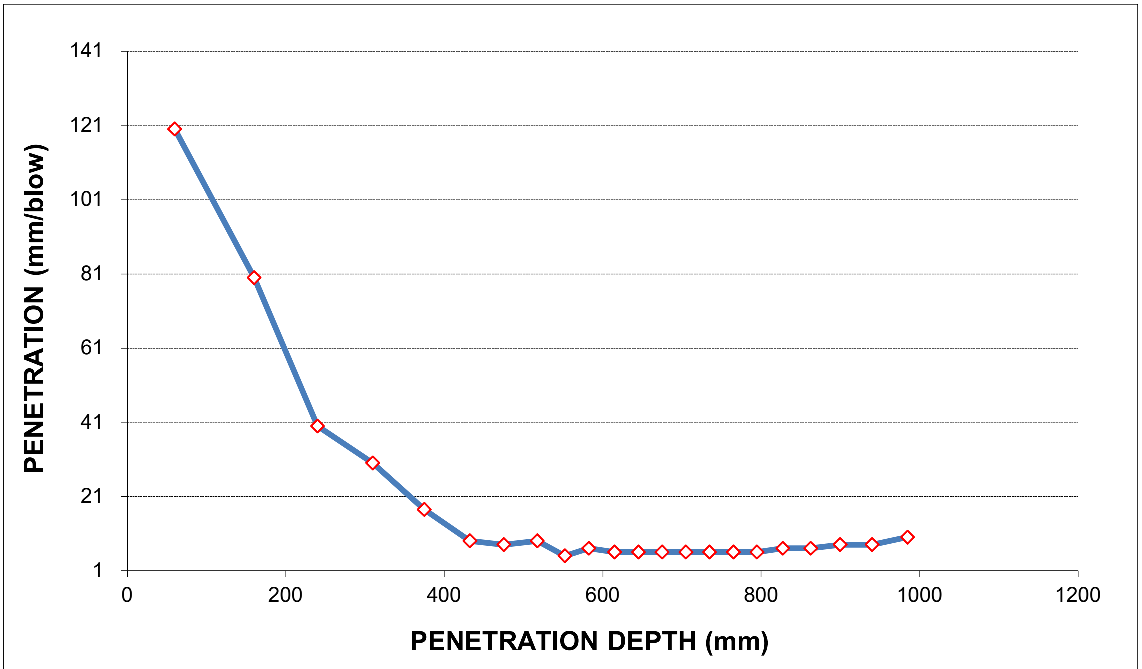
Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	50	25	5	1225	10	30	23	518
2	50	75	62.5	5	1262.5	5	50	56	900
3	75	95	85	5	1285	4	50	76	900
4	95	105	100	5	1300	2	50	110	900
5	105	130	117.5	5	1317.5	5	50	56	900
6	130	150	140	5	1340	4	50	76	900
7	150	170	160	5	1360	4	50	76	900
8	170	180	175	5	1375	2	50	110	900

DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DCP No: 3 Location: **TP2 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 22

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	120	60	1	60	120	3	0	19
2	120	200	160	1	160	80	4	1	42
3	200	280	240	2	240	40	8	4	110
4	280	340	310	2	310	30	10	5	155
5	340	410	375	4	375	18	17	11	285
6	410	455	432.5	5	432.5	9	33	26	578
7	455	495	475	5	475	8	38	31	654
8	495	540	517.5	5	517.5	9	33	26	578
9	540	565	552.5	5	552.5	5	50	56	900
10	565	600	582.5	5	582.5	7	43	36	751
11	600	630	615	5	615	6	50	44	900
12	630	660	645	5	645	6	50	44	900
13	660	690	675	5	675	6	50	44	900
14	690	720	705	5	705	6	50	44	900
15	720	750	735	5	735	6	50	44	900
16	750	780	765	5	765	6	50	44	900
17	780	810	795	5	795	6	50	44	900

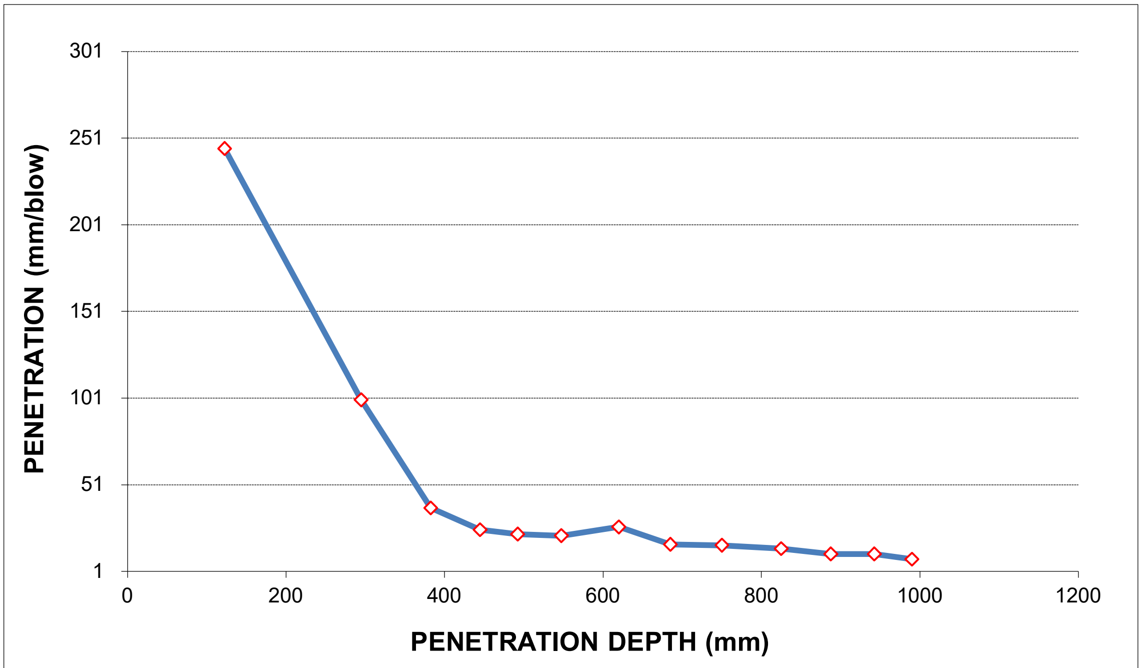
18	810	845	827.5	5	827.5	7	43	36	751
19	845	880	862.5	5	862.5	7	43	36	751
20	880	920	900	5	900	8	38	31	654
21	920	960	940	5	940	8	38	31	654
22	960	1010	985	5	985	10	30	23	518

DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DCP No: 4 Location: **TP3 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 13

Applied Factor : 1.5 times Terzaghi's value

Remarks :

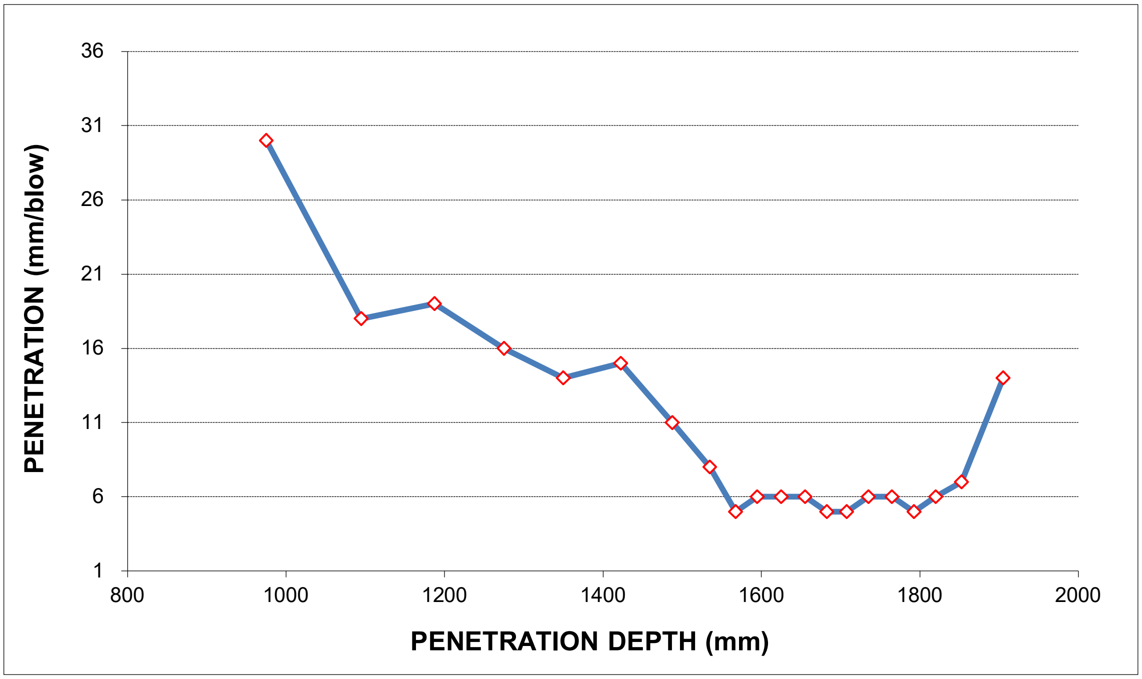
Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	245	122.5	1	122.5	245	1	0	-4
2	245	345	295	1	295	100	3	0	28
3	345	420	382.5	2	382.5	38	8	4	119
4	420	470	445	2	445	25	12	7	192
5	470	515	492.5	2	492.5	23	13	8	216
6	515	580	547.5	3	547.5	22	14	8	225
7	580	660	620	3	620	27	11	6	178
8	660	710	685	3	685	17	18	12	300
9	710	790	750	5	750	16	19	12	314
10	790	860	825	5	825	14	21	15	362
11	860	915	887.5	5	887.5	11	27	20	468
12	915	970	942.5	5	942.5	11	27	20	468
13	970	1010	990	5	990	8	38	31	654

DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DCP No: 5 Location: **TP3 @ 0.90m begl**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 900 mm below NGL Readings : 16

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	150	75	5	975	30	10	5	155
2	150	240	195	5	1095	18	17	11	276
3	240	335	287.5	5	1187.5	19	16	10	260
4	335	415	375	5	1275	16	19	12	314
5	415	485	450	5	1350	14	21	15	362
6	485	560	522.5	5	1422.5	15	20	13	336
7	560	615	587.5	5	1487.5	11	27	20	468
8	615	655	635	5	1535	8	38	31	654
9	655	680	667.5	5	1567.5	5	50	56	900
10	680	710	695	5	1595	6	50	44	900
11	710	740	725	5	1625	6	50	44	900
12	740	770	755	5	1655	6	50	44	900
13	770	795	782.5	5	1682.5	5	50	56	900
14	795	820	807.5	5	1707.5	5	50	56	900
15	820	850	835	5	1735	6	50	44	900
16	850	880	865	5	1765	6	50	44	900
17	880	905	892.5	5	1792.5	5	50	56	900

18	905	935	920	5	1820	6	50	44	900
19	935	970	952.5	5	1852.5	7	43	36	751
20	970	1040	1005	5	1905	14	21	15	362

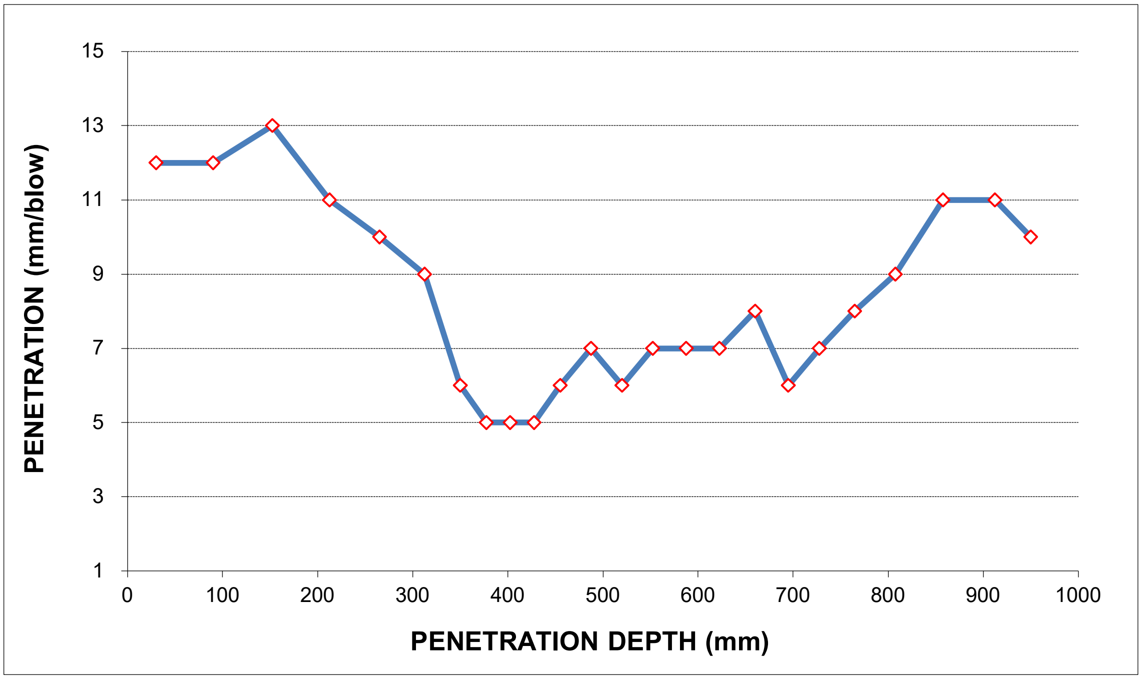
DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DELTA GEOTECH

DCP No: 6 Location: **TP4 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 24

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	60	30	5	30	12	25	18	427
2	60	120	90	5	90	12	25	18	427
3	120	185	152.5	5	152.5	13	23	16	392
4	185	240	212.5	5	212.5	11	27	20	468
5	240	290	265	5	265	10	30	23	518
6	290	335	312.5	5	312.5	9	33	26	578
7	335	365	350	5	350	6	50	44	900
8	365	390	377.5	5	377.5	5	50	56	900
9	390	415	402.5	5	402.5	5	50	56	900
10	415	440	427.5	5	427.5	5	50	56	900
11	440	470	455	5	455	6	50	44	900
12	470	505	487.5	5	487.5	7	43	36	751
13	505	535	520	5	520	6	50	44	900
14	535	570	552.5	5	552.5	7	43	36	751
15	570	605	587.5	5	587.5	7	43	36	751
16	605	640	622.5	5	622.5	7	43	36	751
17	640	680	660	5	660	8	38	31	654

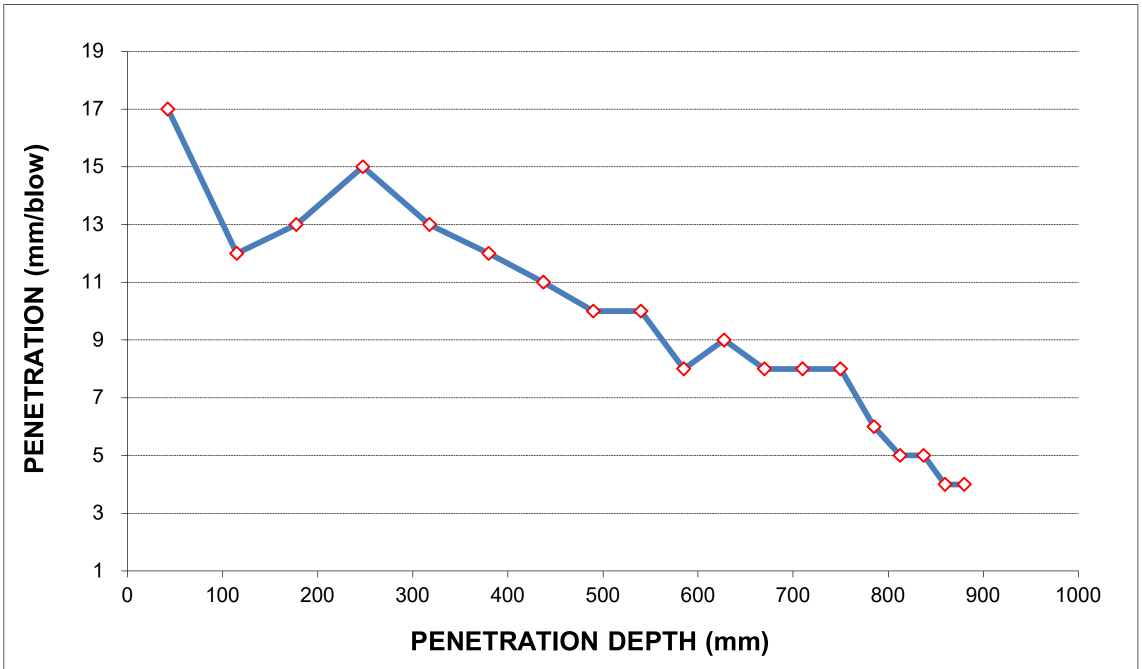
18	680	710	695	5	695	6	50	44	900
19	710	745	727.5	5	727.5	7	43	36	751
20	745	785	765	5	765	8	38	31	654
21	785	830	807.5	5	807.5	9	33	26	578
22	830	885	857.5	5	857.5	11	27	20	468
23	885	940	912.5	5	912.5	11	27	20	468
24	940	960	950	2	950	10	30	23	518

DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DCP No: 7 Location: **TP5 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 19

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	85	42.5	5	42.5	17	18	11	294
2	85	145	115	5	115	12	25	18	427
3	145	210	177.5	5	177.5	13	23	16	392
4	210	285	247.5	5	247.5	15	20	13	336
5	285	350	317.5	5	317.5	13	23	16	392
6	350	410	380	5	380	12	25	18	427
7	410	465	437.5	5	437.5	11	27	20	468
8	465	515	490	5	490	10	30	23	518
9	515	565	540	5	540	10	30	23	518
10	565	605	585	5	585	8	38	31	654
11	605	650	627.5	5	627.5	9	33	26	578
12	650	690	670	5	670	8	38	31	654
13	690	730	710	5	710	8	38	31	654
14	730	770	750	5	750	8	38	31	654
15	770	800	785	5	785	6	50	44	900
16	800	825	812.5	5	812.5	5	50	56	900
17	825	850	837.5	5	837.5	5	50	56	900

18	850	870	860	5	860	4	50	76	900
19	870	890	880	5	880	4	50	76	900

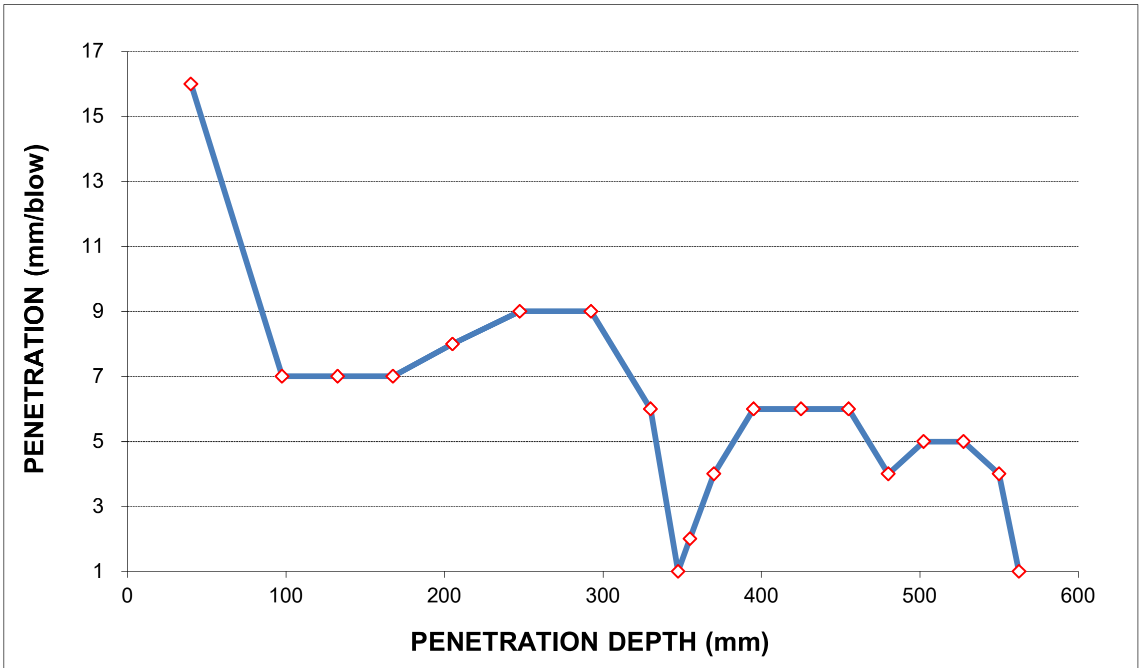
DYNAMIC CONE PENETROMETER TEST

Job Name Alheit Van Der Merwe PS

File No: Job No: 23-713 Date of Test: Feb 2023

DELTA GEOTECH

DCP No: 8 Location: **TP6 @ surface**



Penetration Guide	
mm/blow	Consistency
< 5	Very Dense
5 - 10	Dense
10 - 30	Med Dense
30 - 75	Loose
75 -100	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Depth of hole in which DCP was taken : 0 mm below NGL Readings : 19

Applied Factor : 1.5 times Terzaghi's value

Remarks :

Reading No.	Layer From	Layer To	Average Layer Depth	Field Reading Blows/layer	Level Below NGL mm	DCP No DN mm/blow	Equiv. N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	80	40	5	40	16	19	12	314
2	80	115	97.5	5	97.5	7	43	36	751
3	115	150	132.5	5	132.5	7	43	36	751
4	150	185	167.5	5	167.5	7	43	36	751
5	185	225	205	5	205	8	38	31	654
6	225	270	247.5	5	247.5	9	33	26	578
7	270	315	292.5	5	292.5	9	33	26	578
8	315	345	330	5	330	6	50	44	900
9	345	350	347.5	5	347.5	1	50	110	900
10	350	360	355	5	355	2	50	110	900
11	360	380	370	5	370	4	50	76	900
12	380	410	395	5	395	6	50	44	900
13	410	440	425	5	425	6	50	44	900
14	440	470	455	5	455	6	50	44	900
15	470	490	480	5	480	4	50	76	900
16	490	515	502.5	5	502.5	5	50	56	900
17	515	540	527.5	5	527.5	5	50	56	900

18	540	560	550	5	550	4	50	76	900
19	560	565	562.5	5	562.5	1	50	110	900

APPENDIX - C

Labco Southern Africa (Pty) Ltd
Email: infoel@labco.co.za ■ www.labco.co.za
Email: justin@labco.co.za ■ Phone: +27 (0)43 050 0903
East London Branch – Unit 5 Evergreen Park, C/o B Road & Main Road, Beacon Bay ■ PO Box 10114 Linton Grange 6015

sanas Testing Laboratory
T0787

MATERIALS TEST REPORT

Client : Delta Geotech (Pty) Ltd
Address : 17 Clearview Place
: Beacon Bay
: East London , 5205
Attention : Mr. D. Miller
Facsimile : -
E-mail : dan@deltageotech.co.za
Project : Alheit Van Der Merwe School
Job Card : E1414

Client Reference : Alheit
Order No. : -
Report Status : Complete
Date Received : 03.02.2023
Date Tested : 16.02.2023 - 16.02.2023
Date Reported : 23.02.2023
Page : 1 of 1

Sampling Procedure(s): SABITA MANUAL 37 GENERAL METHODS
SAMPLES DELIVERED TO THE LABORATORY

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Test Method(s)
Sieve Analysis	SANS 3001 - GR1
Hydrometer Analysis	SANS 3001 - GR3
Atterberg Limits	SANS 3001 - GR10
California Bearing Ratio	SANS 3001-GR40
Maximum Dry Density & Ptimum Moisture Content	SANS 3001- GR30

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context. Any information gained by the laboratory prior, during or after the test process will be treated as confidential and will not be reproduced or disclosed to any person or organisation, unless required to do so by law.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Labco Southern Africa (Pty) Ltd nor its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.

The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

Deviations in Test Methods:

**All results are authorized by technical signatories.

Justin Tarr
Technical Signatory.

Labco Southern Africa (Pty) Ltd
sanas Testing Laboratory T0787
Email: justin@labco.co.za ■ www.labco.co.za
Email: ELBookings@labco.co.za ■ Phone: +27 (0)43 050 0903
East London ■ Unit 5 Evergreen Park, Holmhill, c/o Main Road & B Road, Beacon Bay ■ PO Box 10114 Linton Grange 6015

Job Card No: E1414

FOUNDATION INDICATOR

Laboratory Number		E1414/1◆	E1414/2■
Field Number		-	-
Client Reference			
Depth (m)		0.50 - 1.00	0.80 - 1.20
Position		TP 1	TP 4
Coordinates	X		
	Y		
Visual Description		Residual	Residual
Classification Description		Clay of low plasticity \ Silt-Clay Materials	Clay of low plasticity \ Silt-Clay Materials
Stabilizing Agent			

Moisture Content & Relative Density

Moisture Content (%)	12.2	14.9
Relative Density (S.G.)		

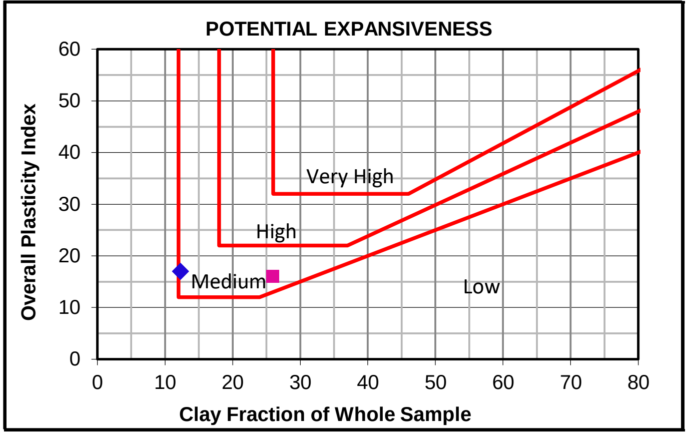
Sieve Analysis (Wet Prep)

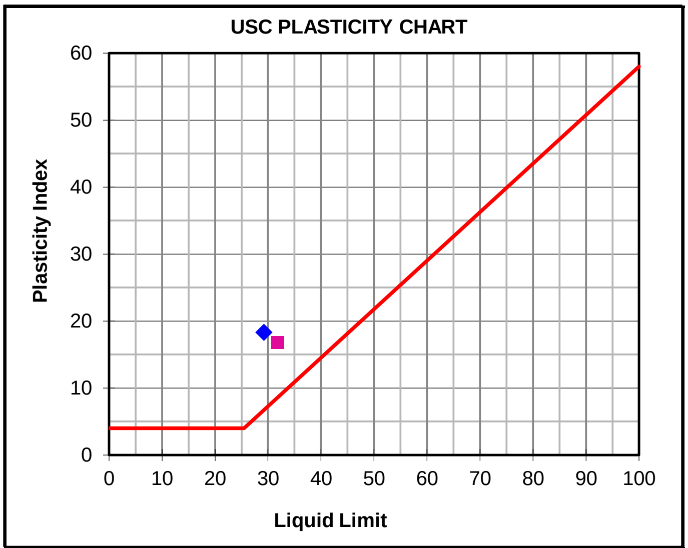
Percentage Passing		
100 mm		
75 mm		
63 mm		
50 mm		
37.5 mm		
28 mm		
20 mm		
14 mm	100	100
5 mm	98	99
2 mm	95	96
1 mm	95	96
0.425 mm	92	94
0.250 mm	87	91
0.150 mm	81	84
0.075 mm	74	76
Grading Modulus	0.40	0.34

Hydrometer Analysis

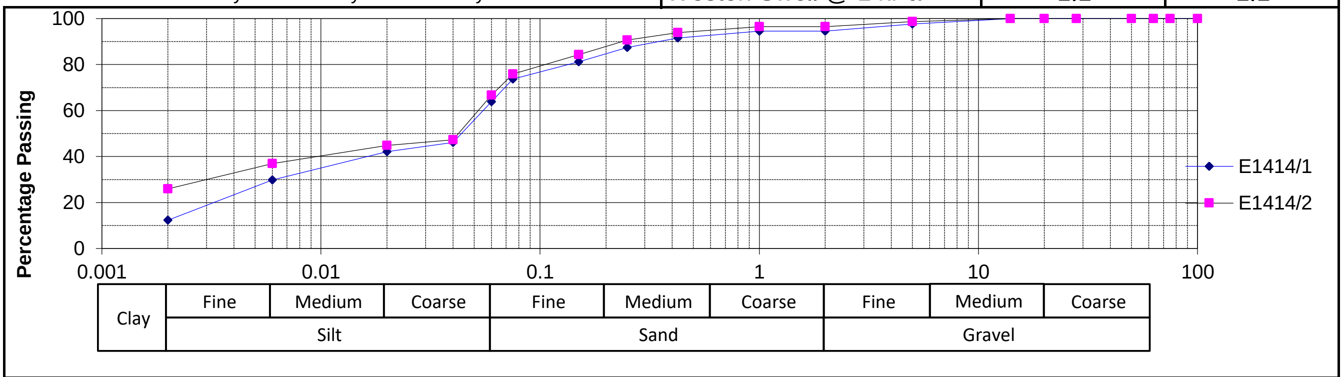
Percentage Passing	-0.425 mm	-0.425 mm
0.060 mm	64	67
0.040 mm	46	47
0.020 mm	42	45
0.006 mm	30	37
0.002 mm	12	26
Gravel %	5	4
Sand %	31	30
Silt %	52	41
Clay %	12	26

Note: An assumed S.G. may be used in Hydrometer Analysis calculations





Laboratory Number		E1414/1 ◆	E1414/2 ■
Atterberg Limits			
Liquid Limit	%	29	32
Plasticity Index	%	18	17
Linear Shrinkage	%	9.5	8.5
Overall PI	%	17	16
Classifications			
HRB (AASHTO)		A-6(11)	A-6(11)
Unified (ASTM D2487)		CL	CL
Weston Swell @ 1 kPa		1.1	1.1



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Job Card No: E1402

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		E1414/3 ◆	■
Field Number		-	
Client Reference		-	
Depth (m)		0.10 - 1.00	
Position		TP 5	
Coordinates	X		
	Y		
Description		Light Brown Silty Sand Clay	
Additional information		-	
Calcrete/Crushed		N/A	
Stabilizing Agent		N/A	

Sieve Analysis (Wet preparation)

Percentage Passing			
	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	100	
	20 mm	100	
	14 mm	100	
	5 mm	99	
	2 mm	94	
	1 mm	94	
	0.425 mm	86	
	0.075 mm	62	
Grading Modulus		0.58	

Soil Mortar Analysis

Coarse Sand	9	
Coarse Fine Sand	5	
Medium Fine Sand	8	
Fine Fine Sand	11	
Silt and Clay	66	

Atterberg Limits	<0.425mm	<0.425mm
Liquid Limit (%)	27	
Plasticity Index (%)	14	
Linear Shrinkage (%)	6.0	

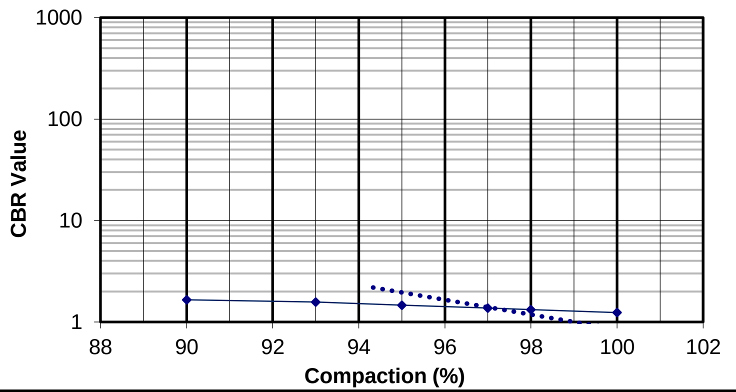
Laboratory No.		E1414/3 ◆	■

Maximum Dry Density & Optimum Moisture Content

MDD	kg/m^3	2021	
OMC	%	8.8	

California Bearing Ratio

Compaction Data							
Moisture	%	8.8					
Dry Density	kg/m^3	2040	1924	1847	2037	1950	1857
Compaction	%	100.0	94.3	90.5	100.0	95.7	91.1
Penetration Data							
CBR at	2.50 mm	1	2	2			
	5.00 mm	3	2	2			
	7.50 mm	3	2	1			
Swell @ 96hrs (%)		1.6	2.5	3.8			
Final Moisture (%)		14.0	17.3	19.0			

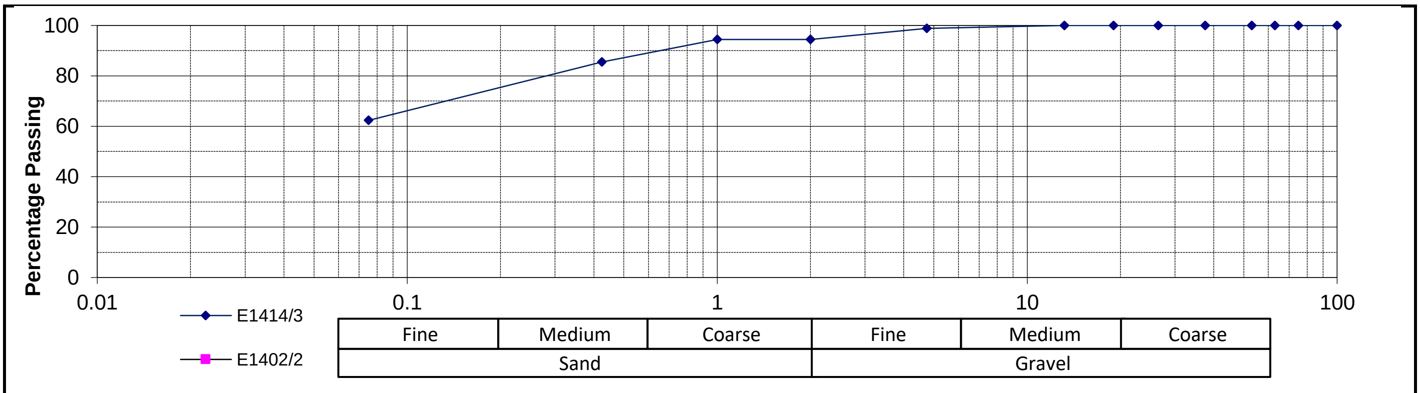


Interpolated CBR Data

CBR	@	100%	Mod. AASHTO	1	
	@	98%		1	
	@	97%		1	
	@	95%		1	
	@	93%		2	
	@	90%		2	
	@	SANS3001 Midpoint		1	

Classifications

HRB (AASHTO)	A-6(6)	
COLTO*		
TRH14*		



*The Colto / TRH 14 Classifications are only based on the above results. Further testing may be required