OUTENIQUA
GEOTECHNICAL SERVICES

Consulting Geotechnical Engineers and Engineering Geologists
Reg. No. 1999/062743/23

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GEOTECHNICAL SOIL TEST REPORT

Client: Tuiniqua Consulting Engineers
Project: Ptn 76 of Farm Uitzicht 216, Knysna
Date of test: 19.05.2019

Geotechnical Constraint	Risk			NHBRC Classification
	Low	Medium	High	
Active clay	X			
Compressible soil		X		S1
Collapsible soil	X			
Uncontrolled/controlled fill	X			
Chemically aggressive soils	X			
Saturated soils/ groundwater seepage	X			
Shallow hard rock/ difficult excavations	X			
Slope stability problems		X		
Flood potential	X			
Seismicity	X			
Dolomitic land	X			

Disclaimer:The above classification is provided as a guideline and is true for the specific locations that were tested and may not be true for the entire site.

Site description:

The site is characterised by hilly topography, with distinct dune ridgelines and thickly vegetated valleys, with moderate to steep slopes (see Fig 1-2). The vegetation consists of a mixture of thick indigenous fynbos and some alien species. Access to the site is via a narrow dirt road along the northern boundary. At the time of the investigation, access across the site along the proposed new road was only possible on foot.

Figure 1: Looking south from the access road

Figure 2: Overlooking the site for the proposed new dwelling

Methods of investigation:

Three shallow test pits were excavated by hand to max depth of 1.5m, one test was on the proposed house footprint and two test pits along the proposed road (refer to test positions indicated on the attached plan). Ten DCP tests was conducted from natural ground level to a depth of ~2m to assess soil consistency. Samples of soil were collected for Mod.AASHTO/CBR and Foundation Indicator tests.

Geology and Soil profile:

The 1:250 000 geological map indicate that site is underlain by unconsolidated aeolian sand with shell inclusions of Quaternary age. The coastal dunes are known to have significant internal lithification in places, with the formation of sporadic soft aeolianite rock (dune rock). The dunes are generally stable in their natural state. The soil profile recorded in test pits generally consists of a dark brown silty fine sand topsoil horizon with abundant rootlets (max 800mm thick), which is underlain by light brown cohesionless fine sand. DCP test results indicate that the consistency of the upper ~1m of the profile is very loose to loose (40-75mm/blow, roughly equivalent to φ=27-30°), but the consistency improves below this depth to a medium dense state (20-40mm/blow, roughly equivalent to φ=30-33°). The sidewalls of some of the test pits collapsed due to the cohesionless nature of the sandy soil. No bedrock was encountered in the test pits and is not expected for several meters below ground level.

Lab results indicate that all soils are non-plastic and dominated by fine sand-sized particles with 99% passing the 0.425mm sieve. All soils are classified as SP or SM (poorly graded sands with little or no fines or silty sands with non-plastic fines). No heave is expected from the site due to the lack of plastic fines.

None of the test pits encountered any groundwater and there were no signs of any poorly drained areas or marshy surface conditions. The sands are highly permeable and will generally drain well. Seasonal seepage or wet surface conditions may be expected along natural drainage lines that cross the site.

Recommendations:

Earthworks: All excavations to a depth of 3m are classified as “Soft” as per SABS1200D. Sidewalls of excavations will be highly unstable at angles greater than 30° and excavations should be battered to a safe angle or retained with properly designed retaining walls.

The soil below the topsoil layer is generally suitable for backfilling in cut-to fill platforms, behind retaining walls, under floors, pipe cradles, etc., but should be approved by the engineer before placement.

The site for the proposed dwelling is moderately sloping (~1:5) and will require significant earthworks to create a level platform(s). The proposed access road follows an undulating path over some steep terrain and will also involve significant earthworks and retaining walls for the box cut.

Foundations and floors: The recommended foundation method for single and/or double storey masonry and/or timber structures is lightly reinforced concrete strips or pads/bases at a nominal founding depth of 0.6m below ground level on well compacted insitu sands or controlled-fill material with a max bearing pressure of 100kPa. As a guideline to achieve adequate compaction of loose soil, foundation trenches should be excavated to a depth of 1.2m, well wetted and compacted with several passes of a mechanical trench rammer (Wacker), until the base of the trench is firm, and then backfilled with 0.6m of ex-insitu sand (up to founding level) in 0.15m-thick compacted layers. Sand must be moist to achieve compaction. To ensure adequate compaction and bearing capacity is achieved below foundations, foundation trenches should be tested with a DCP and the recommended acceptance criteria is a max penetration rate of 20mm/blow to a depth of at least 1m

below the foundation invert level. Foundations on sloping ground (1:8<slope<1:4) should be placed at slightly greater depth on similarly well compacted soil.

Sloping sites can be cut and filled to create level platforms, but the fill should be adequately benched into the insitu after the removal of organic-rich topsoil and compacted with a steel drum roller. Cut and fill edges of platforms should be adequately supported with retaining walls designed by the engineer. Raft foundations may also be suitable on level platforms. Steep slopes (>1:4) are not recommended for development due to excessive cost of earthworks and foundations and risk of settlement or sliding. Deep foundations (piles) can be considered on steep slopes. The engineer should also inspect foundations before casting to ensure suitable founding conditions. Filling under reinforced concrete floors must be compacted at the optimum moisture content to 100% of Mod AASHTO density.

Roads: The road layout should take cognisance of the natural contours and drainage lines on the site in order to minimise earthworks. Deep box cuts should be properly retained. Box cuts are unlikely to encounter rock and fills can be constructed using the soil ex insitu (less the organic-rich topsoil).

The insitu subgrade material is variable (G7-G9) and it is generally recommended that an allowance is made for importation of at least one selected subgrade layer of G7 quality, in addition to normal layerworks (i.e. subbase, base/pavers/cement slabs), for lightly trafficked internal roads and parking areas.

Drainage: The soil is highly permeable and site drainage is not envisaged to be a problem. No subsoil drains are deemed necessary along roads, but are recommended behind retaining walls as standard.

Conclusions:

The site is considered suitable for the proposed development with some precautions for expected geotechnical constraints. Conventional construction methods are envisaged and some practical recommendations have been provided for the engineer's consideration to improve founding conditions on compressible soils.

Iain Paton Pr.Sci.Nat. BSc Hons MEng

Client: Tuiniqua Consulting Engineers
Project: New Dwelling and New Road
Site: Ptn 76 of farm Uitzicht 216
Area: Knysna

Drawing Name: Geological map
Drawing No:
Date: 30 May 2019
Revision: 0
Drawn By: S Ngema
Checked By: I Paton

Scale 1:150000

0 1.2 2.4 km

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N

Legend

- Test Positions
- Proposed road

Client: Tuiniqua Consulting Engineers
Project: New Dwelling and New Road
Site: Ptn 76 of farm Uitzicht 216
Area: Knysna

Drawing Name: Geotechnical Test Positions
Drawing No:
Date: May 2019
Revision: 0
Drawn By: S Ngema
Checked By: I Paton

Scale 1:5000

0 20 60 100 m

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Geotechnical Soil Profile

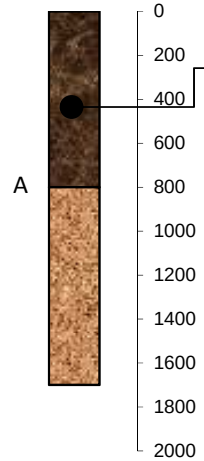
OUTENIQUA GEOTECHNICAL SERVICES

Client:	Tuiniqua Consulting Engineers
Project:	Portion 76 of Uitzicht 216
Area:	Knysna
Date:	14.05.19
Excavator:	By Hand

TP 4

Datum: NGL | Co-ords: 23 Y-000352 X3771175

Key to symbols: ● Sample taken | Groundwater



(0 to 800) Moist, dark red brown, very loose to loose, intact, **SILTY FINE SAND & roots**, transported.

MOD / CBR / Indicator

(800 to 1700) Moist, light brown, medium dense, intact, **SILTY FINE SAND**, transported (Aeolian).

TP Stopped
No Water

Dynamic Cone Penetrometer (DCP)

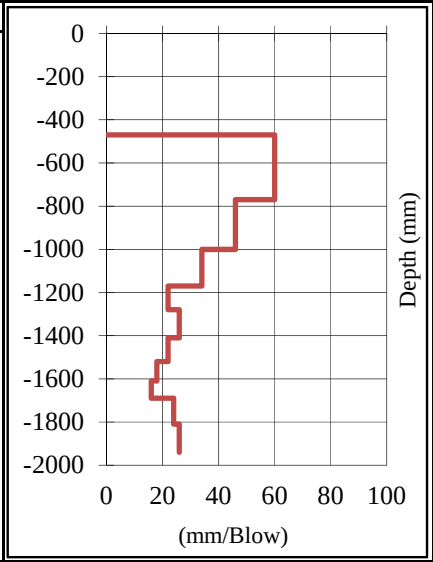
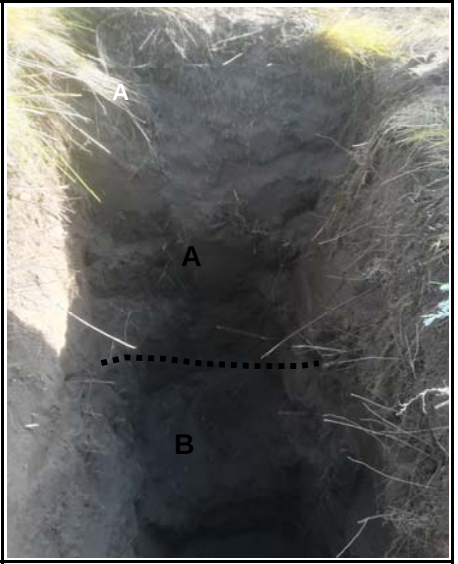


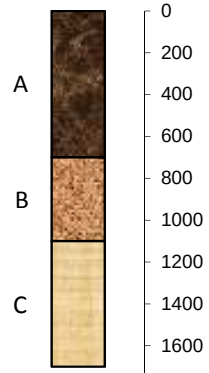
Photo of Test Pit



TP 7

Datum: NGL | Co-ords: 23 Y-000282 X3771380

Key to symbols: ● Sample taken | Groundwater



(0 to 700) Moist, dark red brown, very loose, intact, **SILTY FINE SAND & roots**, transported.

(700 to 1100) Moist, light brown, loose, intact, **FINE SAND & SHELL FRAGMENTS**, transported (aeolian).

(1100 to 1700) Moist, light yellow, medium dense, intact, **FINE SAND**, transported (aeolian).

TP Stopped
No Water

Dynamic Cone Penetrometer (DCP)

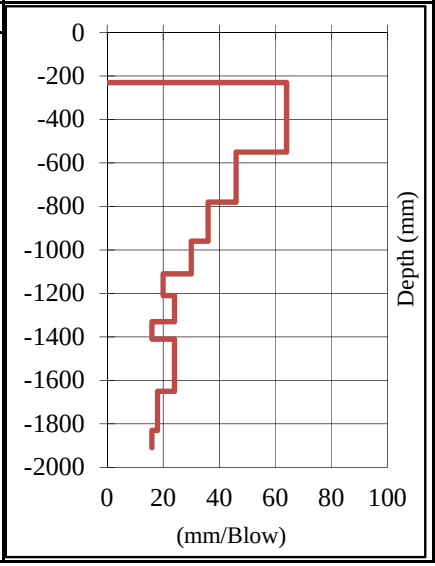
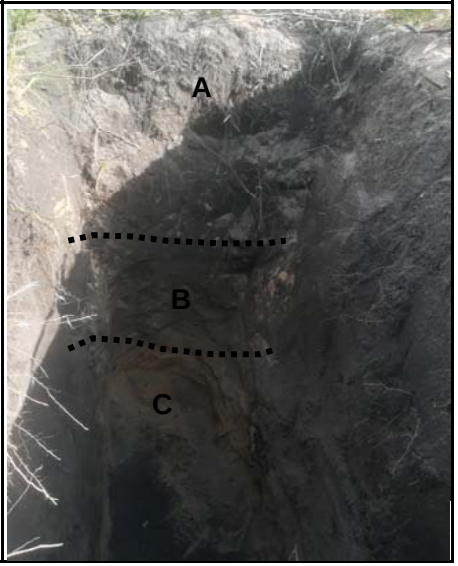


Photo of Test Pit



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Geotechnical Soil Profile

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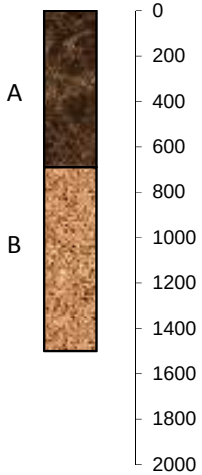
Project:	Portion 76 of Uitzicht 216
Area:	Knysna
Date:	14.05.19
Excavator:	By Hand

TP 8

Datum: NGL | Co-ords: 23 Y-000162 X3771432

Key to symbols: ● Sample taken | Groundwater



(0 to 690)	Moist, dark red brown, loose, intact, **SILTY FINE SAND & rootlets**, transported (aeolian).
(690 to 1500)	Slightly moist, light yellow, medium dense, intact, **SAND**, aeolian.
	TP Stopped
	No Water

Dynamic Cone Penetrometer (DCP)

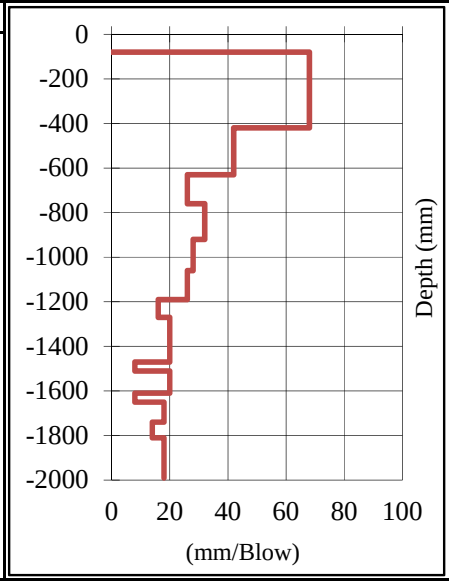
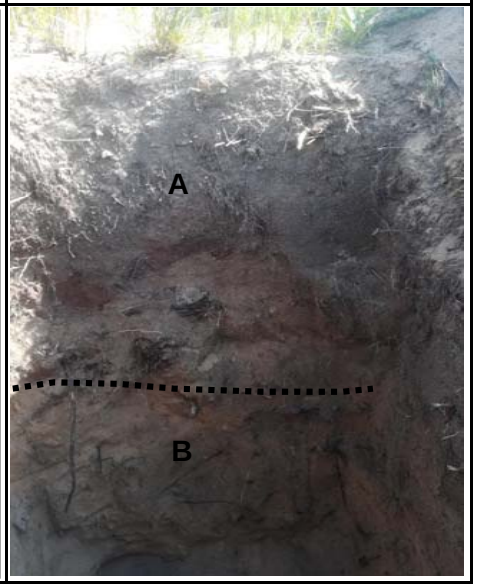


Photo of Test Pit



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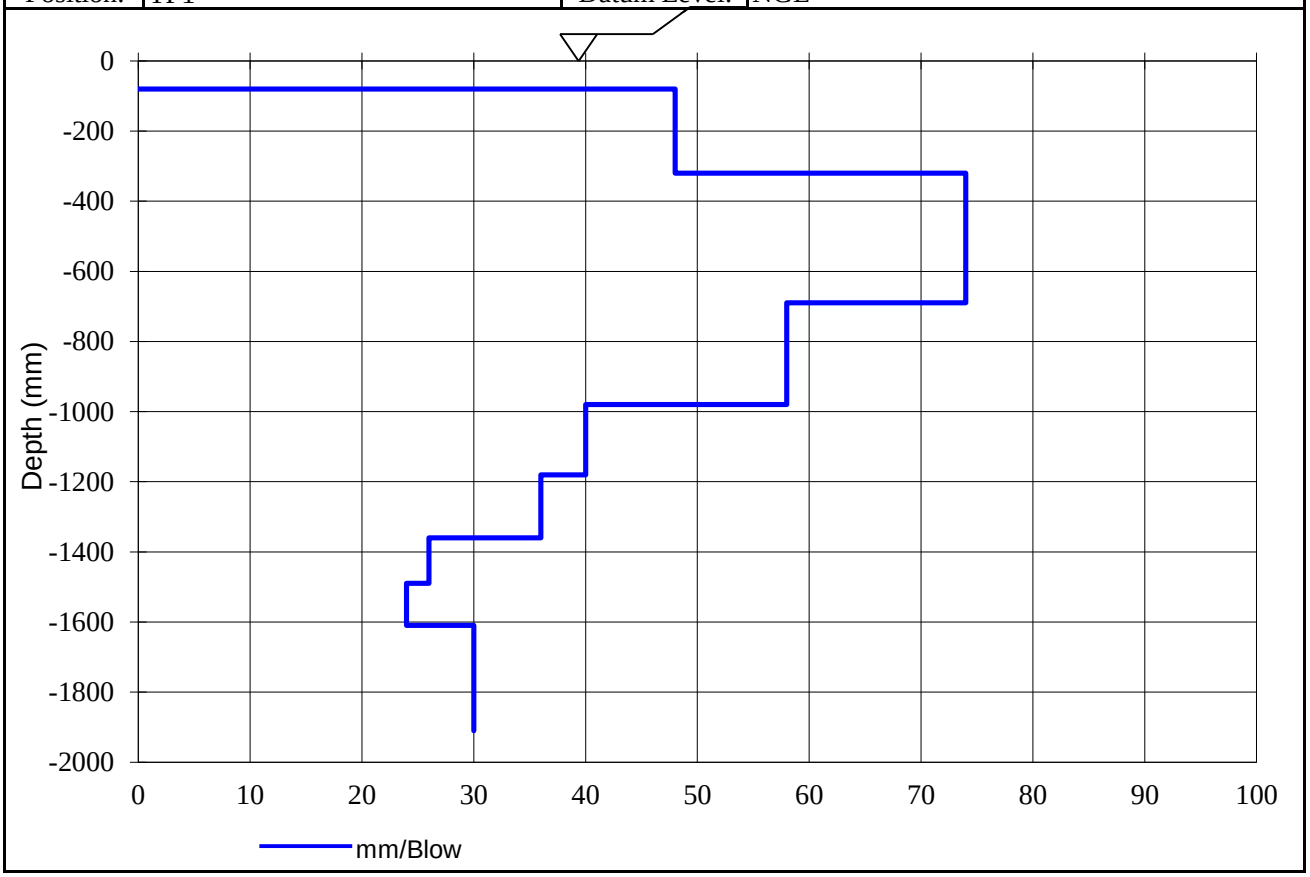
Customer :	Tuiniqua Consulting Engineers P.O. Box 2862 Knysna 6570	Project :	Portion 76 of Uitzicht 216, Knysna
		Date Received :	06.05.19
		Date Reported :	14.05.19
		Req. Number :	
Attention :	Serett Maree	No. of Pages :	1 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP1	Datum Level:	NGL



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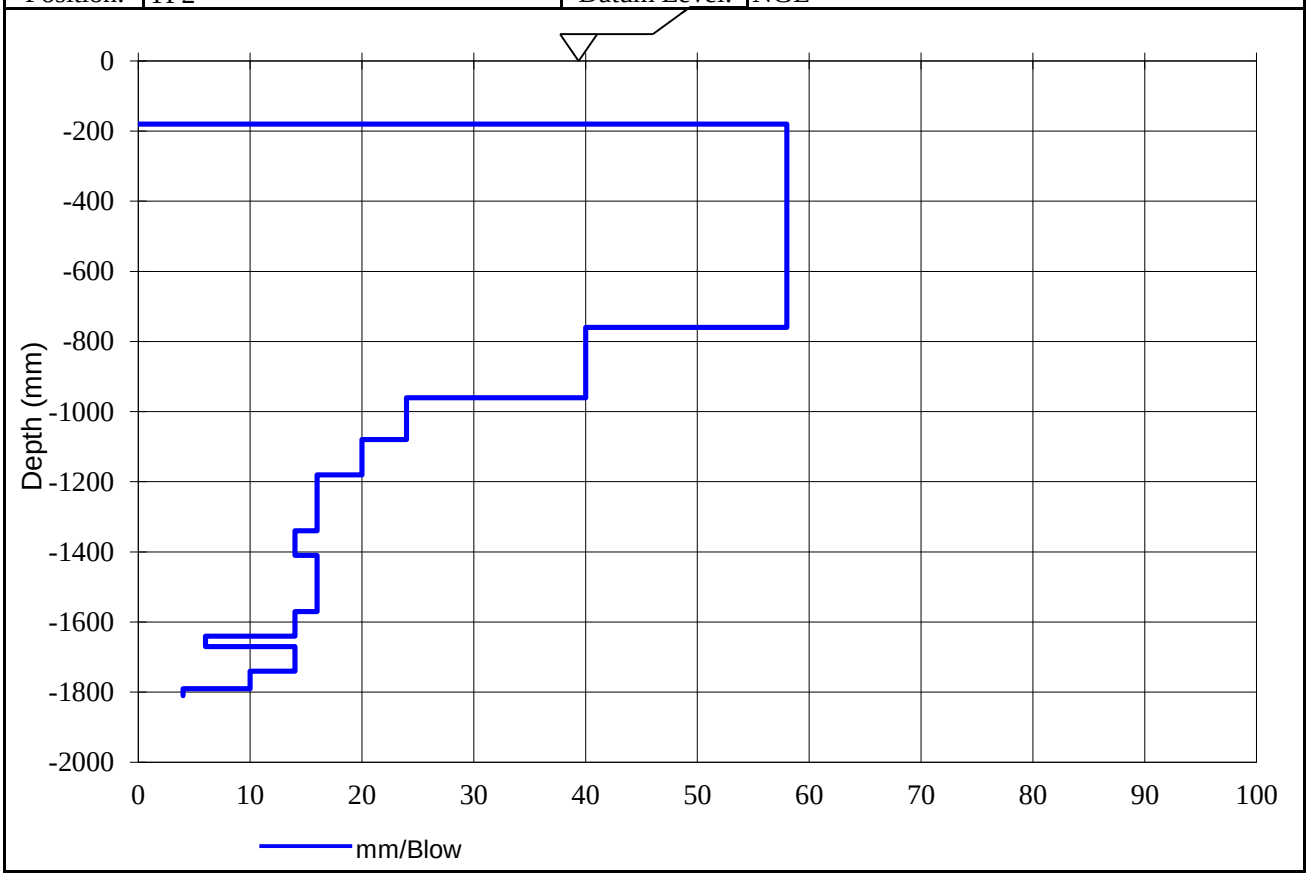
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP2	Datum Level:	NGL



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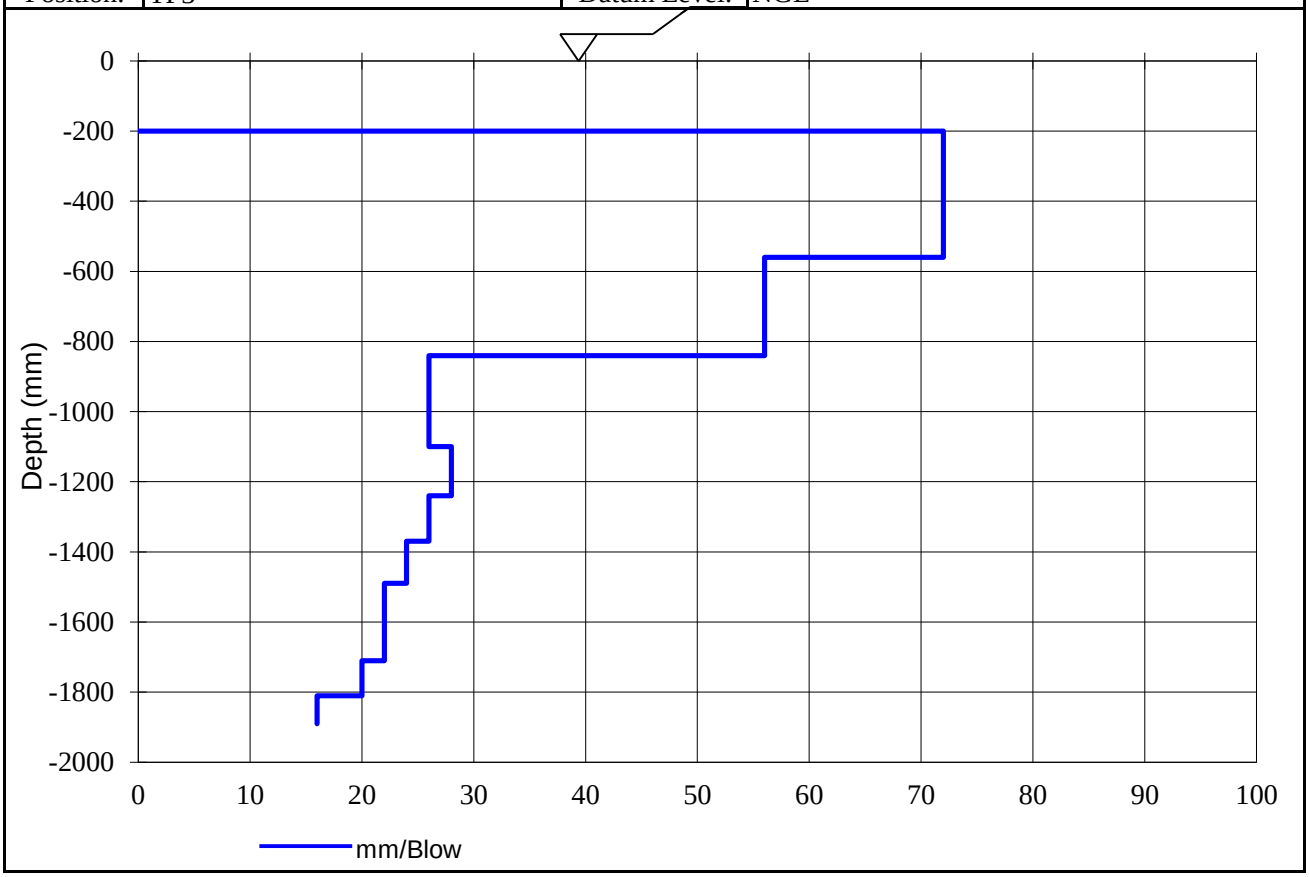
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP3	Datum Level:	NGL



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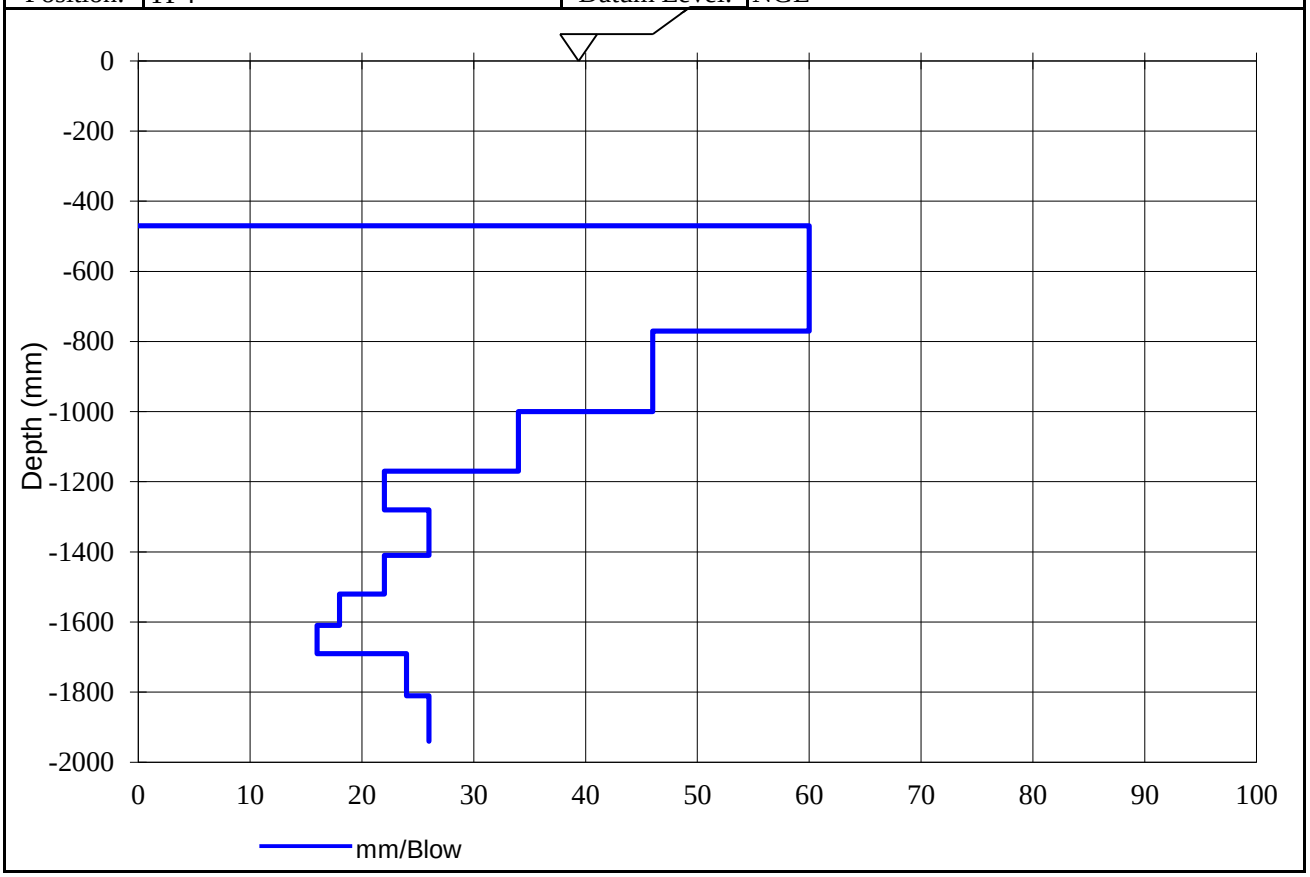
TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP4	Datum Level:	NGL



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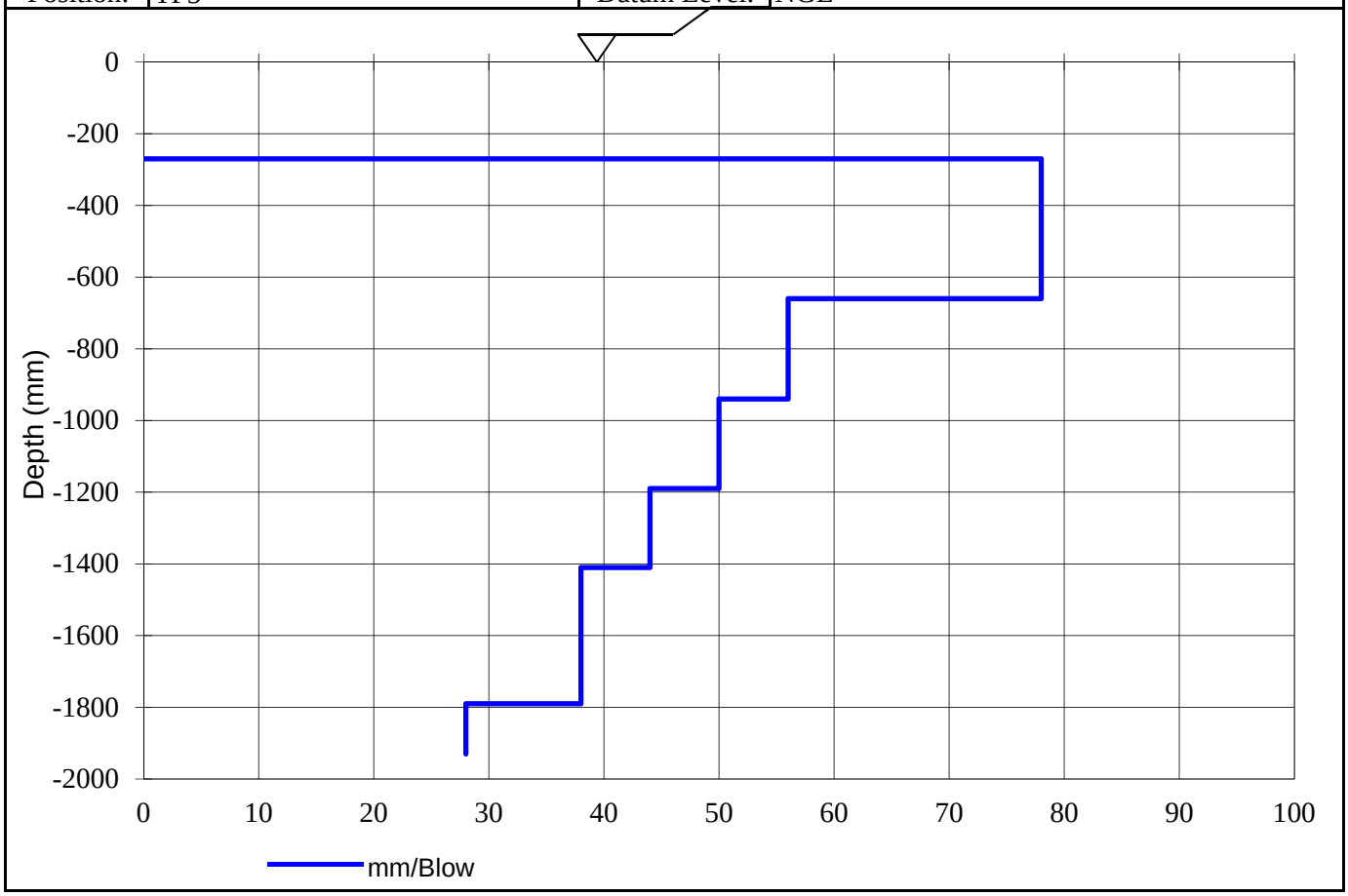
Attention :	Serett Maree	No. of Pages :	5 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP5	Datum Level:	NGL



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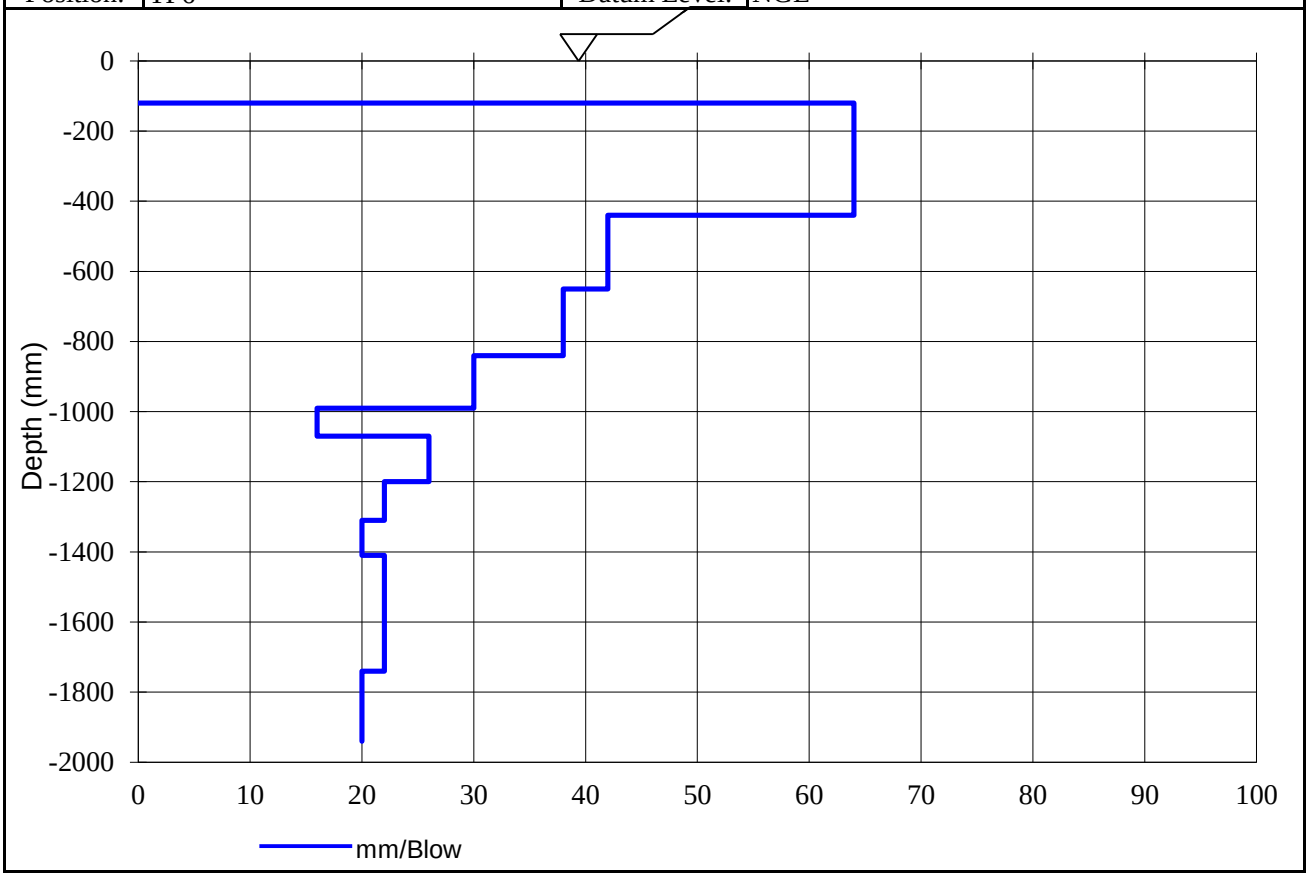
Attention :	Serett Maree	No. of Pages :	6 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP6	Datum Level:	NGL



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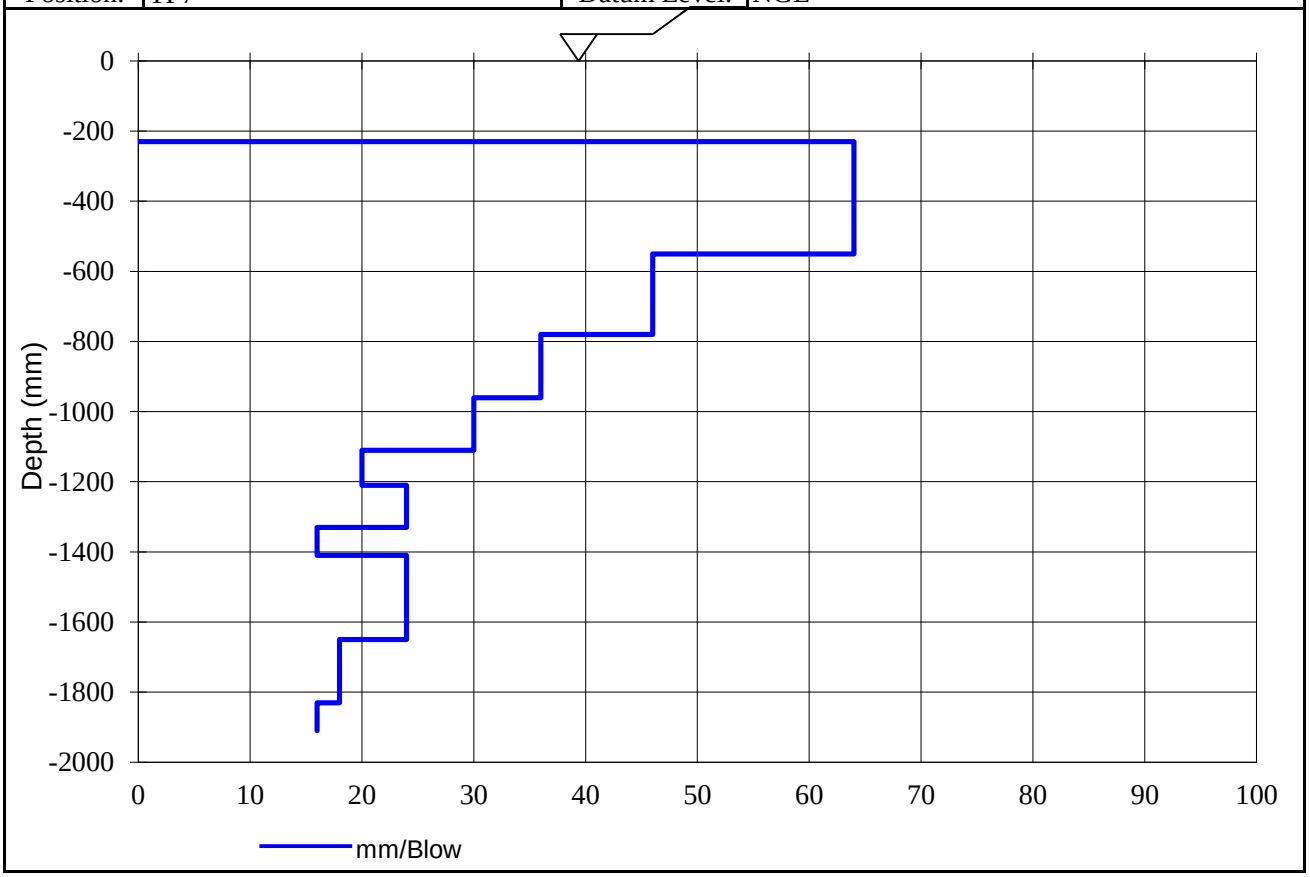
Attention :	Serett Maree	No. of Pages :	7 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP7	Datum Level:	NGL



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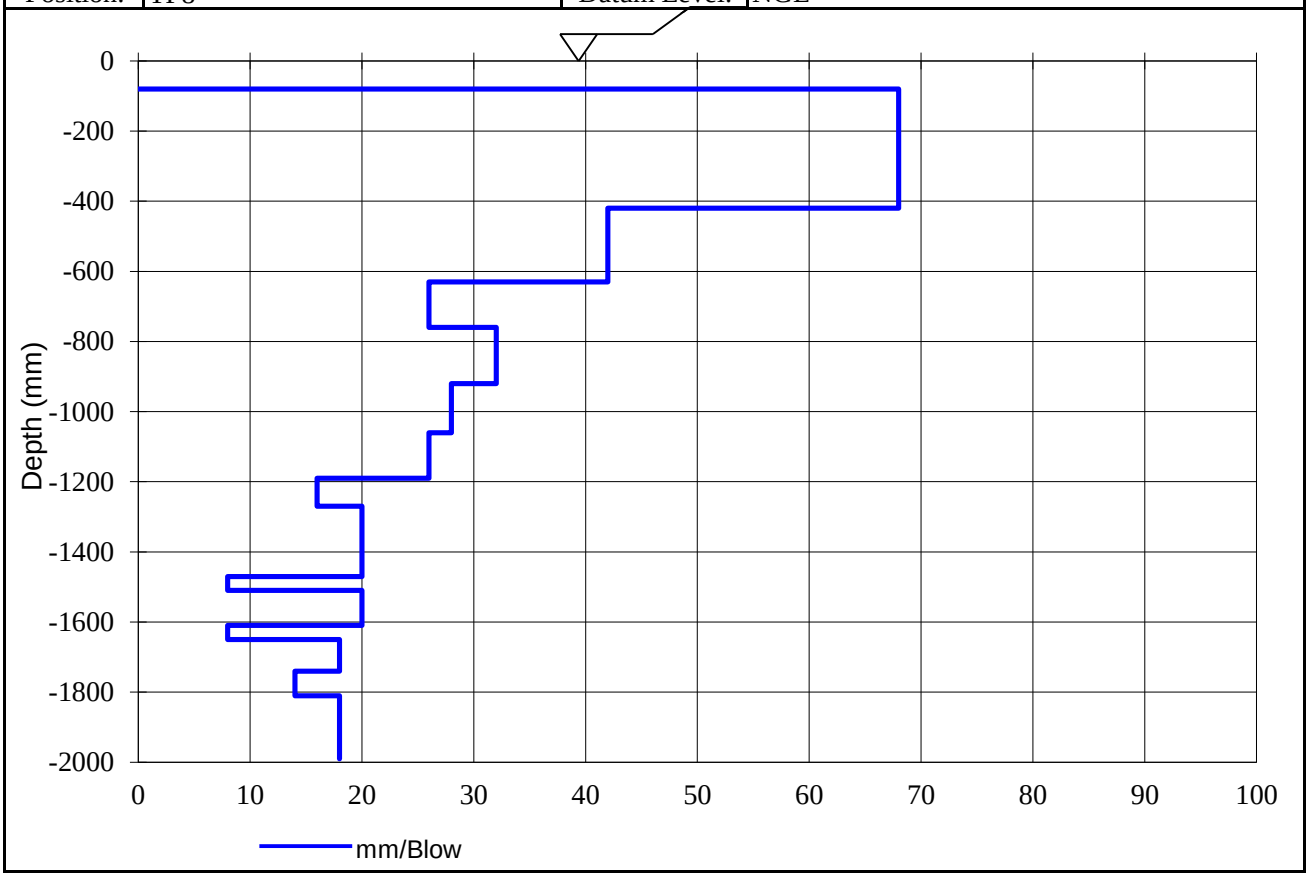
Attention :	Serett Maree	No. of Pages :	8 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP8	Datum Level:	NGL



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Geotechnical Engineering Consultants

Registration No. 1999/062743/23

18 Clyde Street, Knysna : PO Box 964, Knysna, 6570

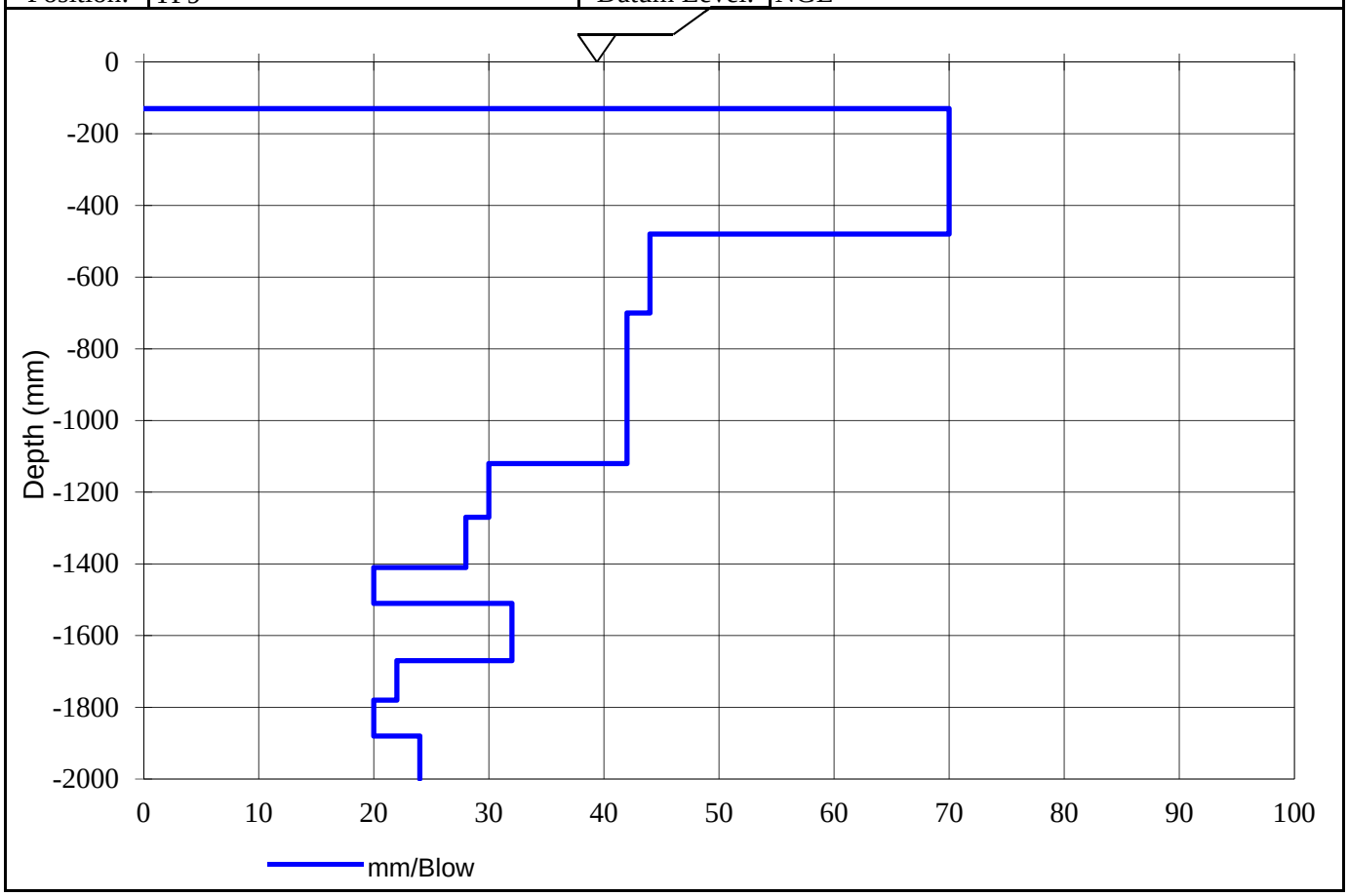
Tel: 044 3820502 : Fax: 044 3820503 : e-mail: iain@outeniqualab.co.za

Customer :	Tuiniqua Consulting Engineers P.O. Box 2862 Knysna 6570	Project :	Portion 76 of Uitzicht 216, Knysna
		Date Received :	06.05.19
		Date Reported :	14.05.19
		Req. Number :	
Attention :	Serett Maree	No. of Pages :	9 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP9	Datum Level:	NGL



I Paton (Member)
For Outeniqua Geotech. Services cc.
Technical Signatory

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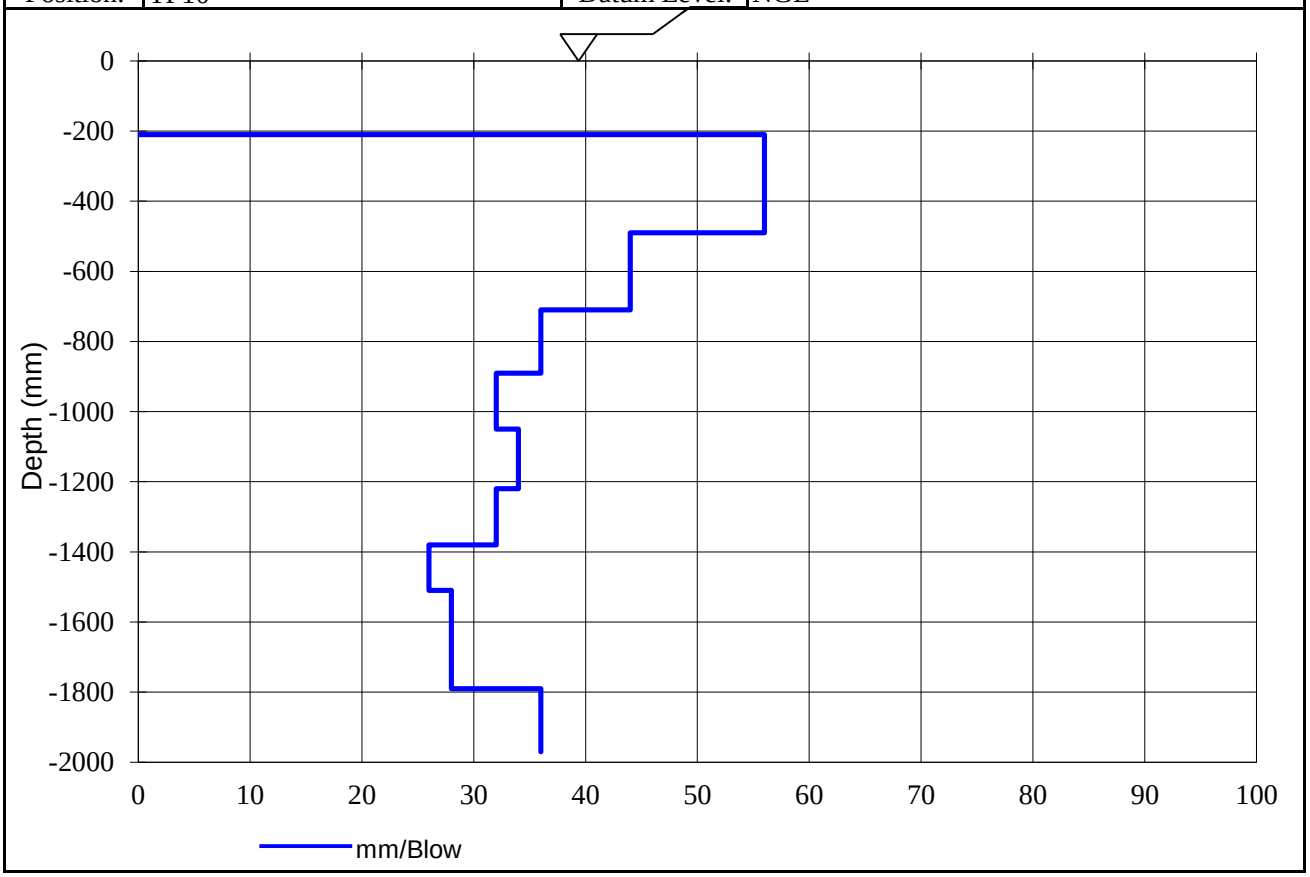
		Date Reported :	14.05.19
		Req. Number :	
Attention :	Serett Maree	No. of Pages :	10 of 10

TEST REPORT

Dynamic Cone Penetrometer (DCP) - (TMH 6 Method ST6)

Position:	TP10	Datum Level:	NGL



I Paton (Member)
For Outeniqua Geotech. Services cc.
Technical Signatory

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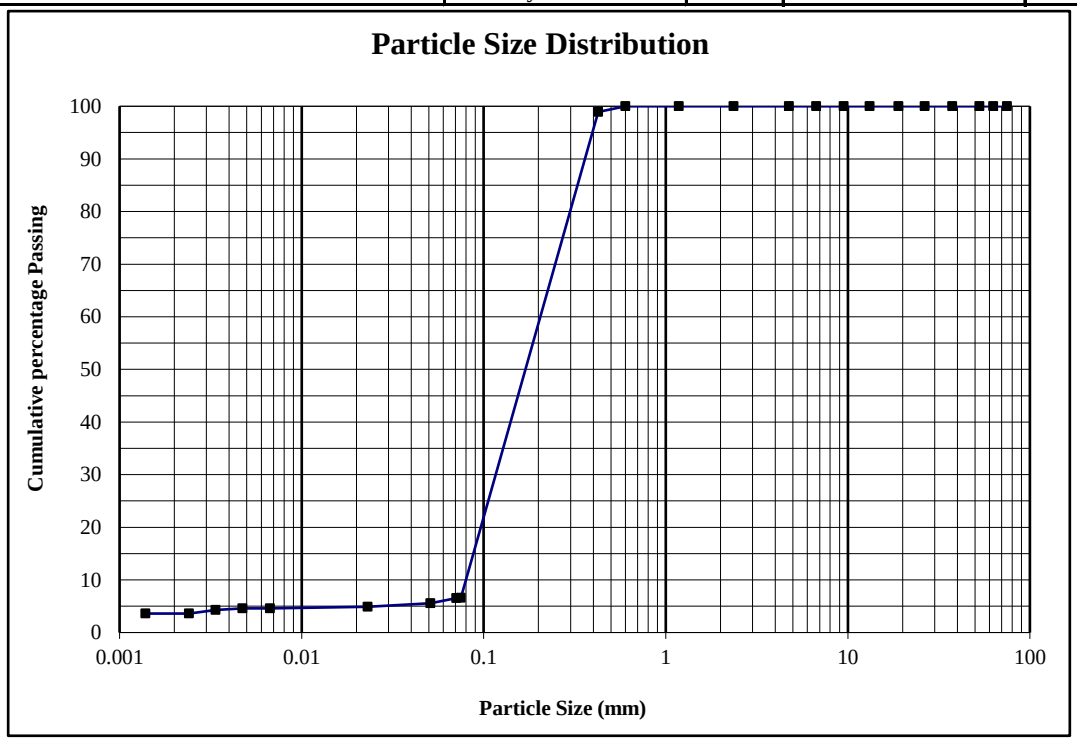
OUTENIQUA LAB (Pty) Ltd
Materials Testing Laboratory
Registration No. 95/07742/07
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

Customer :	Outeniqua Geotechnical Services	Project :	Portion 76 of Uitzicht 216 - Brenton on Sea - Knysna
	P O Box 964	Date Received :	22/05/19
	Knysna	Date Reported :	05/06/19
	6570	Req. Number :	1798/19
Attention :	Iain Paton	No. of Pages :	1

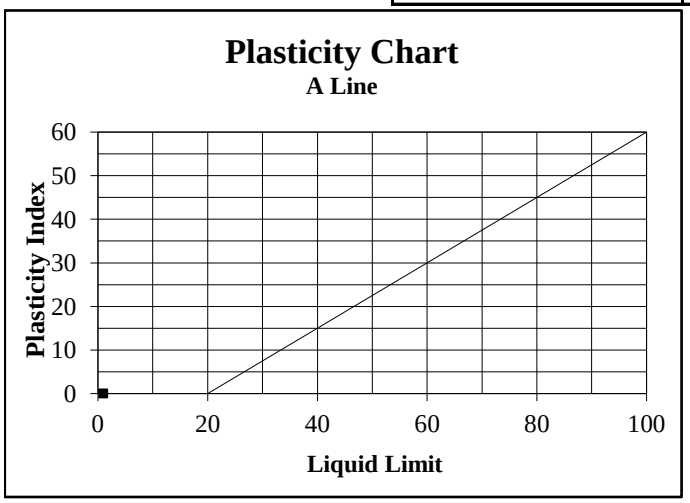
TEST REPORT
FOUNDATION INDICATOR - (TMH 1 Method A1(a),A2,A3,A4,A5) & (ASTM Method D422)

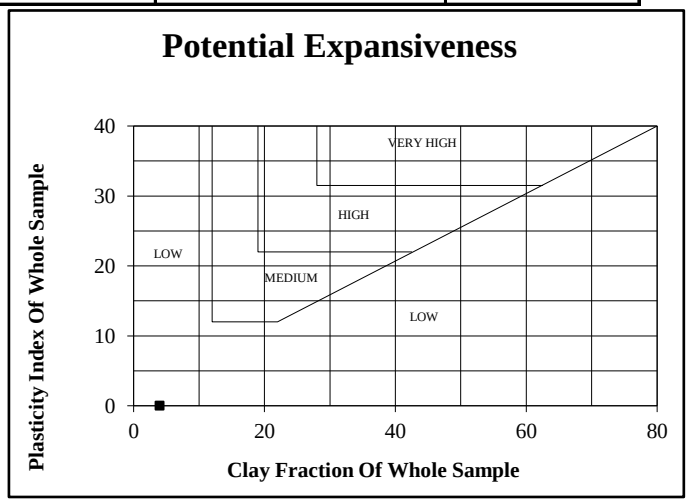
Material Description:	Dark Redish Brown Sand	Sample Number:	75712		
Position:	TP 4 - Layer 1	Liquid Limit	NP	Linear Shrinkage	0
Depth:	0-1700	Plasticity Index	NP	Insitu M/C%	9

Sieve Size(mm)	% Passing
75.0	100
63.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	100
2.36	100
1.18	100
0.600	100
0.425	99
0.075	7
0.0707	7
0.0509	6
0.0230	5
0.0067	5
0.0047	5
0.0034	4
0.0024	4
0.0014	4



% Clay	4	% Silt	2	% Sand	94	% Gravel	0
Unified Soil Classification		SP-SM		PRA Soil Classification		A-3 / A-2-4	





Notes:

- **Specimens delivered to Outeniqua Lab in good order.**

1. **Sampling falls outside the scope of Outeniqua Lab's SANAS accreditation.**
2. The test results are reported with an approximate 95% level of confidence.
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For Outeniqua Lab (Pty) Ltd.

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

Materials Testing Laboratory

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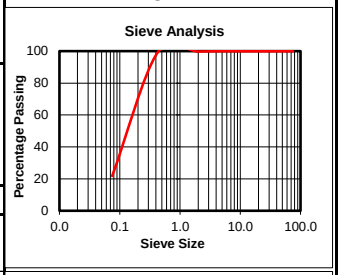
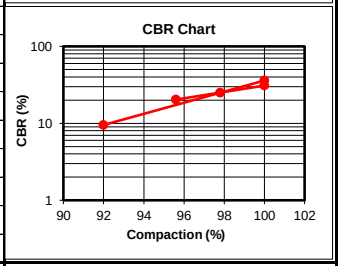
Customer :	Outeniqua Geotechnical Services cc PO Box 964 Knysna 6570	Project :	Ptn 76 of Uitzicht 216 - Brenton on Sea - Knysna
		Date Received :	22/05/19
		Date Reported :	18/06/19
		Req. Number :	1798/19
Attention :	Iain Paton	No. of Pages :	2/2

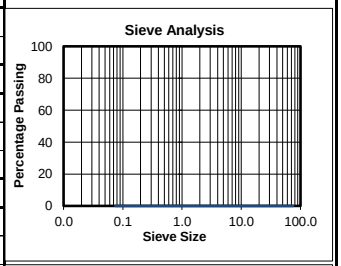
TEST REPORT
CALIFORNIA BEARING RATIO

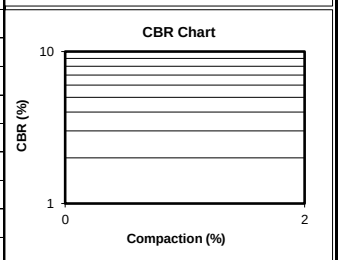
Sample Position (SV)		TP1 - Layer 1	COLTO:				
Depth (mm)		0-400	G8 SSG				
Sample No		75711					
Materials Description	Source	In-Situ					
	Colour	Dark Reddish Brown					
	Soil Type	Silty Sand					
	Classification	Selected Subgrade					
Material Indicators - (SANS 3001 Method AG1,GR20)							
Percentage Passing	75 mm	100		Opinion			
	63 mm	100					
	50 mm	100					
	37.5 mm	100					
	28 mm	100					
	20 mm	100					
	14 mm	100					
	5 mm	100					
	2 mm	100					
	0.425 mm	99					
	0.075 mm	21.8					
Material Indicators - (SANS 3001 Method PR5)							
Grading Modulus		0.79	0.75 - 2.70	✓			
Coarse Sand Soil-Mortar (%)		1					
Atterberg Limits - (SANS 3001 Method GR10)							
Liquid Limit (%)		Undetermined					
Plasticity Index (%)		NP	≤ 12	✓			
Linear Shrinkage (%)		NP					
Material Strength - (SANS 3001 Method GR30,GR40)							
MOD	Max Dry Density (kg/m^3)	1830					
	Optimum Moisture Content (%)	9.1					
	Mould Moisture Content (%)	9.1					
	@100% Mod AASHTO	100.0					
	Swell (%)	0.0	≤ 1.5	✓			
NRB	100% NRB	95.6					
	Swell (%)	0.0					
Proc	100% Proctor	92.0					
	Swell (%)	0.0					
CBR	@ 100% Mod AASHTO	36					
	@ 98% Mod AASHTO	26					
	@ 95% Mod AASHTO	16					
	@ 93% Mod AASHTO	11	≥ 10	✳			
	@ 90% Mod AASHTO	7					
Material Condition - (SANS 3001 Method GR20)							
Insitu Moisture Content (%)							
Soil Classification Achieved By The Material							
COLTO:		G8 SSG					
AASHTO System		A-2-4					
Unified System		SM					

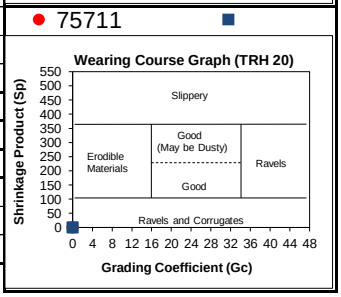
75711











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Ruaan Lesch
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (P), non compliant (Í) and uncertain (Ú) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
2. The uncertain (Ú) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (P) or non compliant (Í) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
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