GONDWANA GEO SOLUTIONS

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Report to iX Engineers on a Geotechnical Investigation
Proposed New Science Exploratorium, Carnarvon, Northern Cape

Project No.: 23-072R01

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	PREPARED:
DATE:	**August 2023**
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Report to iX Engineers on a Geotechnical Investigation
Proposed New Science Exploratorium, Carnarvon, Northern Cape

1. INTRODUCTION

At the request of Mr Deon Rossouw of iX Engineers, Gondwana Geo Solutions (Pty) Ltd, or GGS, submitted a proposal on the 10th February 2023 to carry out a foundation investigation for the proposed new Science Exploratorium in Carnarvon, Northern Cape Province. Mr Fritz van Loggerenberg of iX Engineers subsequently appointed GGS on the 27th June 2023 to proceed with the investigation.

This report contains the results of the geotechnical investigation and provides recommendations for foundations, excavations, materials assessment and subgrade treatment for roads, parking and paved areas.

2. INFORMATION SUPPLIED

The following information was made available electronically by iX Engineers:

- Bid document referenced "BID NO: NRF/SARAO SHAO/40/2022-23"
- Document titled *"20230627_NEW CARNARVON SCIENCE EXPLORATORIUM – SITE PLAN"*

3. SITE DESCRIPTION

The site is situated in Carnarvon, in the Pixley ka Seme District Municipality of the Northern Cape Province of South Africa. It is located to the west of the Carnarvon CBD and can be accessed via End Street. The site is bounded by Mark Street on the north, End Street on the east, open ground on the west, and Van Riebeeck Street on the south.

The site has scattered small to medium indigenous trees and sparse veld grass. An empty space to the northeast of the site is used as an informal sports field. At the northwest corner of the site, the concrete foundations of demolished structures are visible on the surface.

The site slopes from the west to east moderately steeply but flattening towards the central area. The central and eastern parts of the site are generally flat to very gently sloping, with gradients in the range 1V to between 8 and 12H.

The following plates provide a more detailed perspective of the site.

Plates 1 & 2: General views of the site; note steeper ground on the west which flattens out towards the central and eastern parts of the site

The general layout of the site is shown in Figure 1 below.

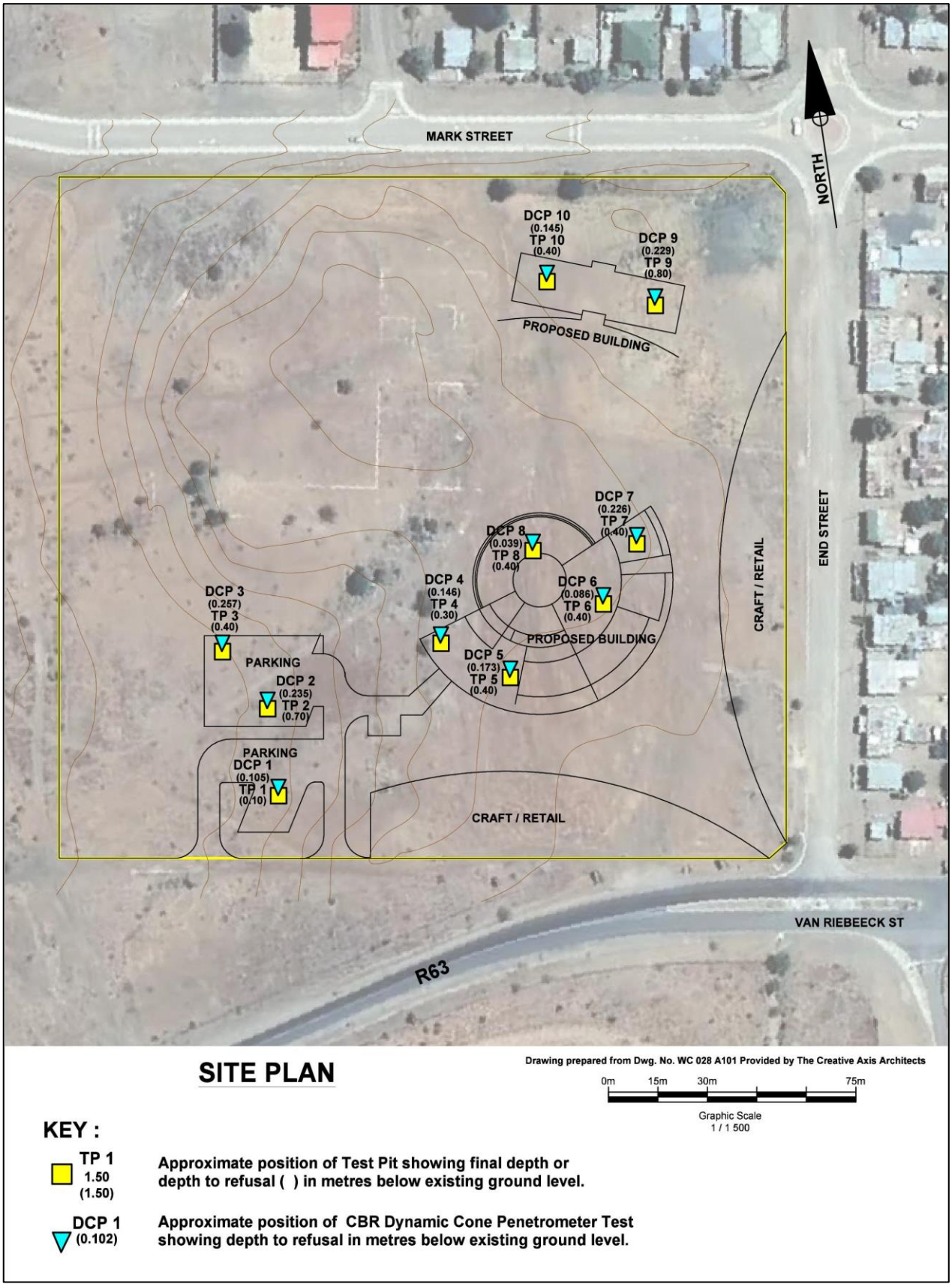

Figure 1: Site Plan showing positions of new buildings and geotechnical tests carried out

4. FIELDWORK

The fieldwork for the investigation was carried out during July 2023 and comprised the following:

- Test Pits, and
- CBR-Dynamic Cone Penetrometer (DCP) Tests

4.1 Test Pits

Ten test pits, designated TP1 to TP10, were excavated by a TLB excavator at the approximate positions shown in Figure 1 to allow soil identification and sampling of the insitu materials.

The test pits were dug to final or refusal depths of between 0.10 and 0.80 metres below existing ground level (mbegl).

The test pits were profiled[1] and representative soil samples were recovered for later laboratory testing.

The detailed logs are given in Appendix A and summarised in Table 1 below.

Table 1
Summary of Test Pit Details

Test Pit No.	Depth (mbegl)	Geology
TP1	0.10	0.00-0.10m: Dry light brown dense slightly weathered sub-rounded highly weathered dolerite GRAVEL with silt, sand and calcrete sedimentation. Residual/Pedogenic. 0.10m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.10m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP2	0.70	0.00-0.40m: Dry orange brown loose silty SAND. Transported. 0.40-0.70m: Dry orange grey white dense highly weathered angular dolerite GRAVEL with sand and calcrete sedimentation. Residual/Pedogenic. 0.70m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.70m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP3	0.40	0.00-0.30m: Dry orange brown loose silty SAND. Transported. 0.30-0.40m: Dry orange grey white dense highly weathered angular dolerite GRAVEL with sand and calcrete sedimentation. Residual/Pedogenic. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP4	0.30	0.00-0.30m: Dry orange white dense silty SAND with highly weathered angular dolerite gravel and calcrete. Residual/Pedogenic. 0.30m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.30. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP5	0.40	0.00-0.30m: Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported. 0.30-0.40m: Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**

[1] Guidelines for Soil and Rock Logging in South Africa, *Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG*, 1990

Test Pit No.	Depth (mbegl)	Geology
TP6	0.40	0.00-0.20m: Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported. 0.20-0.40m: Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP7	0.40	0.00-0.30m: Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported. 0.30-0.40m: Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP8	0.40	0.00-0.30m: Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported. 0.30-0.40m: Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP9	0.80	0.00-0.20m: Dry light brown dense silty SAND with angular calcrete gravel. Paedogenic. 0.20-0.50m: Dry white dense angular calcrete GRAVEL. Pedogenic 0.50-0.80m: Dry grey white dense highly weathered angular dolerite GRAVEL with calcrete sediment. Residual/Pedogenic. 0.80m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.80m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**
TP10	0.40	0.00-0.30m: Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported. 0.30-0.40m: Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic. 0.40m+: Hard slightly weathered dolerite ROCK. **Final depth at 0.40m. Refusal on dolerite.** **No groundwater seepage.** **No sidewall collapse.**

Note: mbegl = metres below existing ground level

4.2 CBR - Dynamic Cone Penetrometer or DCP Tests

Ten CBR-Dynamic Cone Penetrometer or (DCP) tests, designated DCP1 through DCP10, were carried out at the approximate positions shown in Figure 1 to determine the consistency of the soils underlying the site.

The DCP tests were advanced to a refusal or final depth of between 0.039 and 0.257 metres below existing ground level (mbegl).

The results of the DPL tests, consisting of blow count and inferred consistency against depth are attached in Appendix B and summarised in Table 2 below.

Table 2
Summary of DCP Test Results

DPL No.	Depth (mbegl)	Comments
DCP1	0.105	Dense to 0.039m Very dense to 0.105m
DCP2	0.235	Medium dense to 0.111m Dense to 0.204m Very dense to 0.235m
DCP3	0.257	Loose to 0.159m Dense to 0.246 Very dense to 0.257m
DCP4	0.146	Dense to 0.030m Very dense to 0.146m
DCP5	0.173	Very dense to 0.173m
DCP6	0.086	Very dense to 0.086m
DCP7	0.226	Dense to 0.063m Very dense to 0.226m
DCP8	0.039	Very dense to 0.039m
DCP9	0.229	Dense to 0.034m Very dense to 0.229m
DCP10	0.145	Very dense to 0.145m

5. SITE GEOLOGY

The geology of the site is dolerite of Jurassic age which has intruded the older sedimentary rocks (mudrock and sandstone) of the Teekloof Formation of the Adelaide Subgroup, Beaufort Group.

The site is underlain by a relatively thin mantle of transported colluvial soils comprising dark grey to brown silty gravelly sands, with prolific small to large dolerite boulders. Dolerite bedrock underlies this mantle of soil cover, comprising medium to slightly weathered, medium jointed rock of hard strength, below an average depth of 0.45m in the range 0.1 to 0.8m below existing ground level (mbegl).

6. GROUNDWATER

No groundwater seepage was encountered in any of the test pits put down.

However, shallow perched groundwater seepage at the interface of the colluvial soils and the underlying shallow bedrock should be anticipated during or after rainy periods.

7. LABORATORY TESTING AND MATERIALS ASSESSMENT

In order to classify materials and to assess their suitability for the construction of earthworks, pipe and cable bedding materials and roads, the following laboratory testing was conducted on soils taken from the inspection pits.

- Foundation Indicator testing to determine Atterberg Limits, Particle Size Distribution and clay activity.
- Modified AASHTO Density and California Bearing Ratio (CBR) Tests to determine the suitability of the materials for roads and platform construction.
- Chemical analyses on soils samples to determine Electrical Conductivity and pH.

The results of the laboratory tests are provided in Appendix C and summarised in Table 3 and Table 4 below.

Table 3
Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations and CBR tests

TP No.	Depth (m)	Description	Particle Size %				Atterberg Limits			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)					Swell (%)	Classification & Activity
			Clay	Silt	Sand	Gravel	LL	PI	LS%		MDD (kg/m³)	OMC %	90	93	95	98	100		
TP2	0.40-0.70	Orange grey white poorly graded SAND with silt and highly weathered angular dolerite gravel and calcrete sedimentation. Residual / Pedogenic.	1	4	33	62	27	4	2.0	2.39	2244	7.4	24	35	44	64	812	0.0	A-1-a(0); SP-SM; Low; G6
TP5	0.00-0.30	Orange brown loose silty clayey SAND with sub-rounded highly weathered dolerite gravel. Transported.	3	17	38	42	21	4	2.5	1.79	2372	7.4	18	30	42	70	98	0.1	A-1-b(0); SC-SM; Low; G6
TP9	0.20-0.50	White dense poorly graded angular calcrete GRAVEL with clay and sand. Pedogenic	1	7	28	64	-	NP	0.0	2.35	1690	16.3	13	23	35	63	94	0.0	A-1-a(1); GP-GC; Low; G6
	0.50-0.80	Grey white dense well graded highly weathered angular dolerite GRAVEL with sand and calcrete sediment. Residual / Pedogenic.	1	5	27	67	-	NP	0.0	2.42									A-1-a(1); GW-GC; Low. Anticipate G6

LL - Liquid Limit
PI - Plasticity Index
LS - Linear Shrinkage
GM - Grading Modulus
MDD - Maximum Dry Density
OMC - Optimum Moisture Content

Classification in Terms of:
USPRA[2]
Unified Soil Classification System[3]
D.H. Van Der Merwe (1964)[4]
COLTO[5]

[2] US Public Roads Administration Classification (Modified from Allen 1945)
[3] ASTM D 2487-06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). June 2006
[4] 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
[5] COLTO. Committee for Land Transport Officials: Specifications for Roads and Bridgeworks

Table 4
Summary of results of Electrical Conductivity and pH tests

TP No.	Depth (m)	Description	Electrical Conductivity Ec (Sm^{-1})	pH Value	Classification[6]
TP7	0.00-0.30	Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.	0.1024	7.40	Moderately corrosive and moderately alkaline
TP9	0.50-0.80	Dry grey white dense well graded highly weathered angular dolerite GRAVEL with sand and calcrete sediment. Residual/Pedogenic.	0.0605	7.88	Corrosive and moderately alkaline

[6] Stapelberg (2005) The Engineering Geology of Cape Town & Environs, South Africa

8. DEVELOPMENT RECOMMENDATIONS

8.1 Proposed Development

The new buildings associated with the proposed Science Exploratorium at Carnarvon will comprise the following:

- Circular, main Science Exploratorium Building on the southeastern quadrant of the site, comprising the main planetarium or auditorium are with related research rooms, ablutions and interest areas on the southern half, with the outdoor amphitheatre on the north,
- Accommodation hostels on the northeastern side of the site,
- Parking areas to the west and southwest of the planetarium building, and
- Stalls for crafts and retail on the southern and eastern sides of the planetarium building

8.2 Excavatibility & Trenching

Due to the relatively thin soil mantle covering this site, Soft Excavation[7] is limited to on average about 0.5m, in the range 0.1 to 0.8m, below existing ground level. Below the rockhead depth, trenches and excavations for foundations, pipes and cables, will require Hard Rock Excavation. This will consist of jack-hammer excavation, wedging, splitting and localised blasting of dolerite boulders and corestones, where necessary.

8.3 Road Materials Assessment

The potential usage of materials encountered on site is given below.

Clay	=	1 to 3%
Silt	=	4 to 17%
Sand	=	27 to 38%
Gravel	=	42 to 67%
Classification	=	A-1-a(0) ; A-1-b(0); and A-1-a(1) in terms of USPRA; SP-SM and GW-GC in terms of USCS

- The material falls into the Low potential heave category.
- This material classifies as G6 in terms of COLTO, and therefore suitable as a selected subgrade material for road and pavement construction.
- It occurs in relatively limited quantities on the site due to the natural layer thickness.

8.4 Soil Corrosivity and pH

From the results of the chemical analyses (pH and Ec) in Table 4, the following comments are made regarding the chemical nature of the insitu soils beneath the site:

- Moderately corrosive to corrosive, and
- Moderately alkaline

This aspect must be considered in the design of concrete foundations and other buried infrastructure.

8.5 Foundations

All foundations for buildings must be taken through the colluvial soil cover and into the dolerite bedrock underneath.

In founding these structures, the following is applicable:

- A maximum allowable bearing pressure of 250kPa may be adopted for the design of foundations placed on the weathered dolerite bedrock.
- Provided this is adhered to, differential settlements will be less than 10mm.

[7] SANS634:2012: Geotechnical Investigations for Townships: pp16, Table 5 - Classification of material for machine excavation

8.6 Retaining Walls and Drainage

The following shear strength parameters are considered applicable when using the colluvial/fill soils for the design of retaining walls (compacted to 95% MDD):

Soil friction angle: 32 degrees
Cohesion 0 kPa

Retaining walls must be designed with an efficient back-drainage system.

Attention should be given to final floor levels to ensure they are either raised well above the anticipated level of seepage (i.e. the top of the bedrock) or have under-drainage to cater for this eventuality.

8.7 Subgrade Treatment beneath Roads, Parking and Paved Areas

The existing colluvial and residual material is relatively limited in volume, being on average 0.45m in thickness. These soils are of average G6 in quality and will be suitable for use in the structural layers (including subbase) of roads, parking and paved areas. For the construction of roads, a nominal rip, wet and recompact procedure may be adopted. Provided a compaction of 95% MDD is obtained, a CBR of 20 may be used for design.

It is important that all boulders larger than 2/3 of the designated layer thickness are removed before compaction is carried out.

Provided ***concrete surface beds*** are cast on similarly compacted soils a modulus of subgrade reaction, ***k***, of 50kPa/mm pressure[8] may be used for their design.

9. CONCLUSIONS

This report contains the results of a geotechnical investigation carried out for the proposed new Science Exploratorium in Carnarvon, Northern Cape.

The results of the geotechnical investigation are presented and recommendations for excavations, foundations, materials usage and subgrade treatment beneath roads, paved areas and surface beds are provided.

Finally, the ground conditions described in this report refer specifically to those encountered in the test pits done on site. It is therefore quite possible that conditions at variance with those discussed above can be encountered elsewhere. It is therefore important that the Engineer carry out periodic inspections of the earthworks and open foundation excavations. Any change from the anticipated ground conditions can then be taken into account to avoid unnecessary expense.

[8] Portland Cement Institute – Concrete in Pavement Engineering. (Workshop 1991).” Thickness Design for Concrete Pavements” by JR Hodgkinson

APPENDIX A

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP1**
Sheet 1 of 1

JOB NUMBER: 23-072

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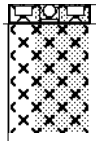

0.00 Dry light brown dense slightly weathered sub-rounded highly weathered dolerite GRAVEL with silt, sand and calcrete sedimentation. Residual/Pedogenic.

0.10 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.10m. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

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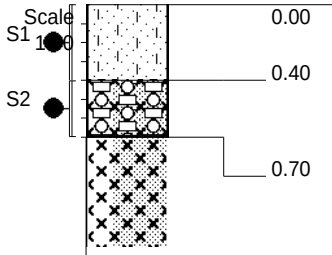
Carnarvon Science Exploratorium

HOLE No: **TP2**
Sheet 1 of 1

JOB NUMBER: 23-072



Dry orange brown loose silty SAND. Transported.

Dry orange grey white dense highly weathered angular dolerite GRAVEL with sand and calcrete sedimentation. Residual/Pedogenic.

Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.70m. Refusal on dolerite.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.00--0.40m (1 x Small)
S2 0.40--0.70m (3 x Bulk)

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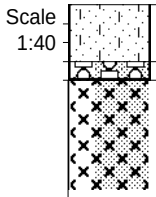
HOLE No: **TP2**

GONDWANA GEO SOLUTIONS

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP3**
Sheet 1 of 1

JOB NUMBER: 23-072



0.00 Dry orange brown loose silty SAND. Transported.

0.30 Dry orange grey white dense highly weathered angular dolerite GRAVEL with sand and calcrete sedimentation. Residual/Pedogenic.

0.40 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

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GONDWANA GEO SOLUTIONS

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Carnarvon Science Exploratorium

HOLE No: **TP4**
Sheet 1 of 1

JOB NUMBER: 23-072

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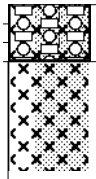

0.00 Dry orange white dense silty SAND with highly weathered angular dolerite gravel and calcrete. Residual/Pedogenic.

0.30 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.30. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

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HOLE No: **TP4**

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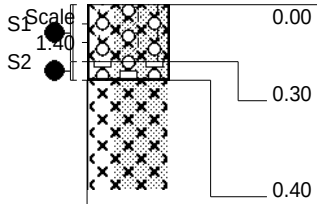
Carnarvon Science Exploratorium

HOLE No: **TP5**
Sheet 1 of 1

JOB NUMBER: 23-072



Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.

Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual.

Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.00--0.30m (3 x Bulk)
S2 0.30--0.40m (1 x Small)

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PROFILED BY : PVH

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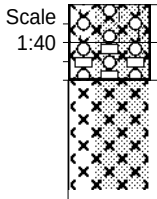
GONDWANA GEO SOLUTIONS

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP6**
Sheet 1 of 1

JOB NUMBER: 23-072



0.00 Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.

0.20 Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic.

0.40 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

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GONDWANA GEO SOLUTIONS

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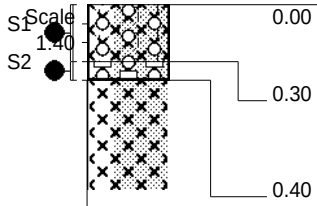
Carnarvon Science Exploratorium

HOLE No: **TP7**
Sheet 1 of 1

JOB NUMBER: 23-072



Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.

Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic.

Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.00--0.30m (1 x Small)
S2 0.30--0.40m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : PVH

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 25/07/2023
DATE : 25/07/2023

DATE : 17/08/2023 13:22
TEXT : ..atorium\Logs\TP1TP10.doc

ELEVATION :
X-COORD :
Y-COORD :

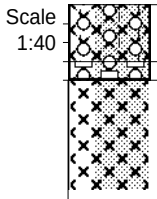
HOLE No: **TP7**

GONDWANA GEO SOLUTIONS

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP8**
Sheet 1 of 1

JOB NUMBER: 23-072



0.00 Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.

0.30 Dry orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic.

0.40 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : PVH

INCLINATION :
DIAM :
DATE : 25/07/2023
DATE : 25/07/2023

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP8**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

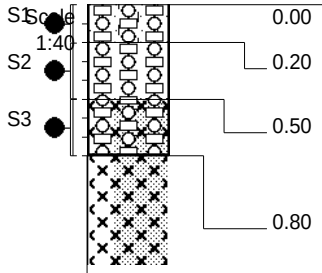
DATE : 17/08/2023 13:22
TEXT : ..atorium\Logs\TP1TP10.doc

GONDWANA GEO SOLUTIONS

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP9**
Sheet 1 of 1

JOB NUMBER: 23-072



Dry light brown dense silty SAND with angular calcrete gravel. Pedogenic.

Dry white dense angular calcrete GRAVEL. Pedogenic

Dry grey white dense highly weathered angular dolerite GRAVEL with calcrete sediment. Residual/Pedogenic.

Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.80m. Refusal on dolerite.

2) No groundwater seepage.

3) No sidewall collapse.

4) Samples taken :
S1 0.00--0.20m (1 x Small)
S2 0.20--0.50m (3 x Bulk)
S3 0.50--0.80m (1 x Small)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : PVH

INCLINATION :
DIAM :
DATE : 25/07/2023
DATE : 25/07/2023

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP9**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

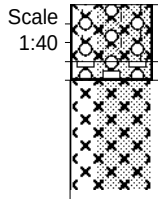
DATE : 17/08/2023 13:22
TEXT : ..atorium\Logs\TP1TP10.doc

GONDWANA GEO SOLUTIONS

iX ENGINEERS
Carnarvon Science Exploratorium

HOLE No: **TP10**
Sheet 1 of 1

JOB NUMBER: 23-072



0.00 Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel. Transported.

0.30 orange grey white dense angular highly weathered dolerite GRAVEL with calcrete sediment. Residual/Pedogenic.

0.40 Hard slightly weathered dolerite ROCK.

NOTES

1) Final depth at 0.40m. Refusal on dolerite.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : PVH
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 25/07/2023
DATE : 25/07/2023
DATE : 17/08/2023 13:22
TEXT : ..atorium\Logs\TP1TP10.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP10**

APPENDIX B

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 82 821 9435, +27 (0) 51 448 8329, simbfn@simlab.co.za

DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 1 - Car 1	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	57	0	-	-	-	-	-
5	96	39	39	7.8	Dense	126	32
10	114	57	18	3.6	Very Dense	> 200	88
15	133	76	19	3.8	Very Dense	> 200	82
20	142	85	9	1.8	Very Dense	> 200	> 110
25	149	92	7	1.4	Very Dense	> 200	> 110
30	151	94	2	0.4	Very Dense	> 200	> 110
35	158	101	7	1.4	Very Dense	> 200	> 110
40	162	105	4	0.8	Very Dense	> 200	> 110
45	162	105	0	0.0	Very Dense	> 200	> 110
50	162	105	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
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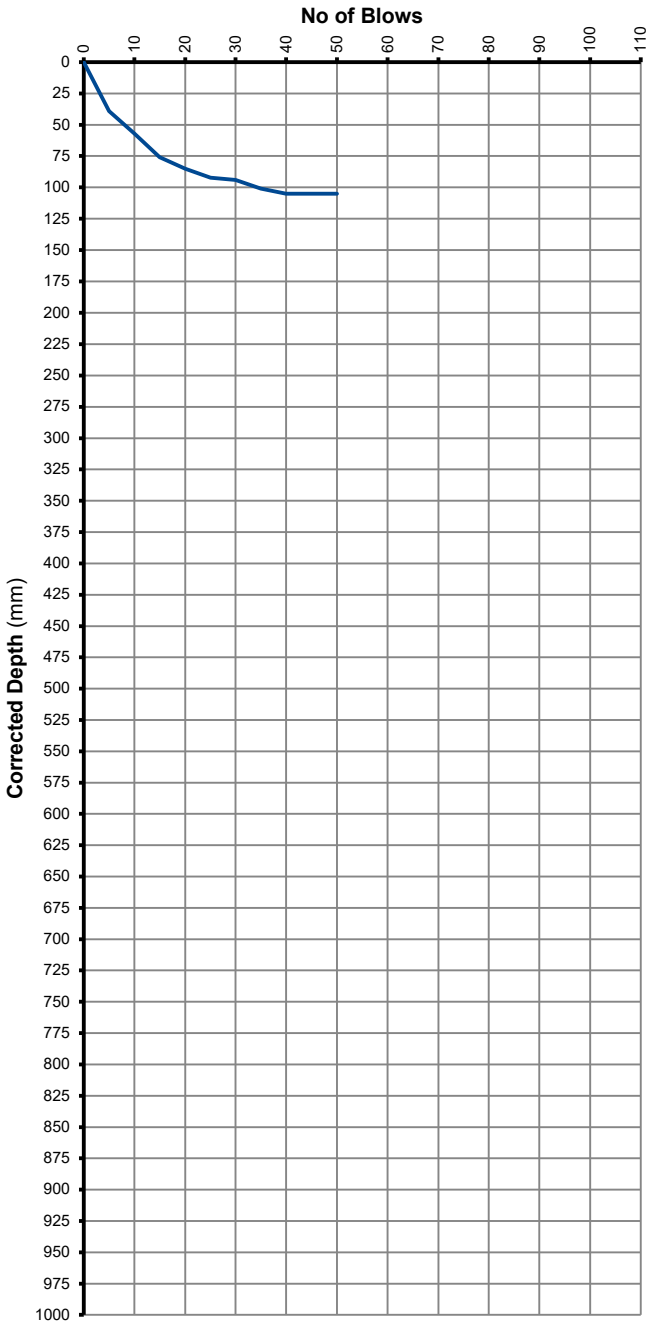
DYNAMIC CONE PENETROMETER (DCP) TEST

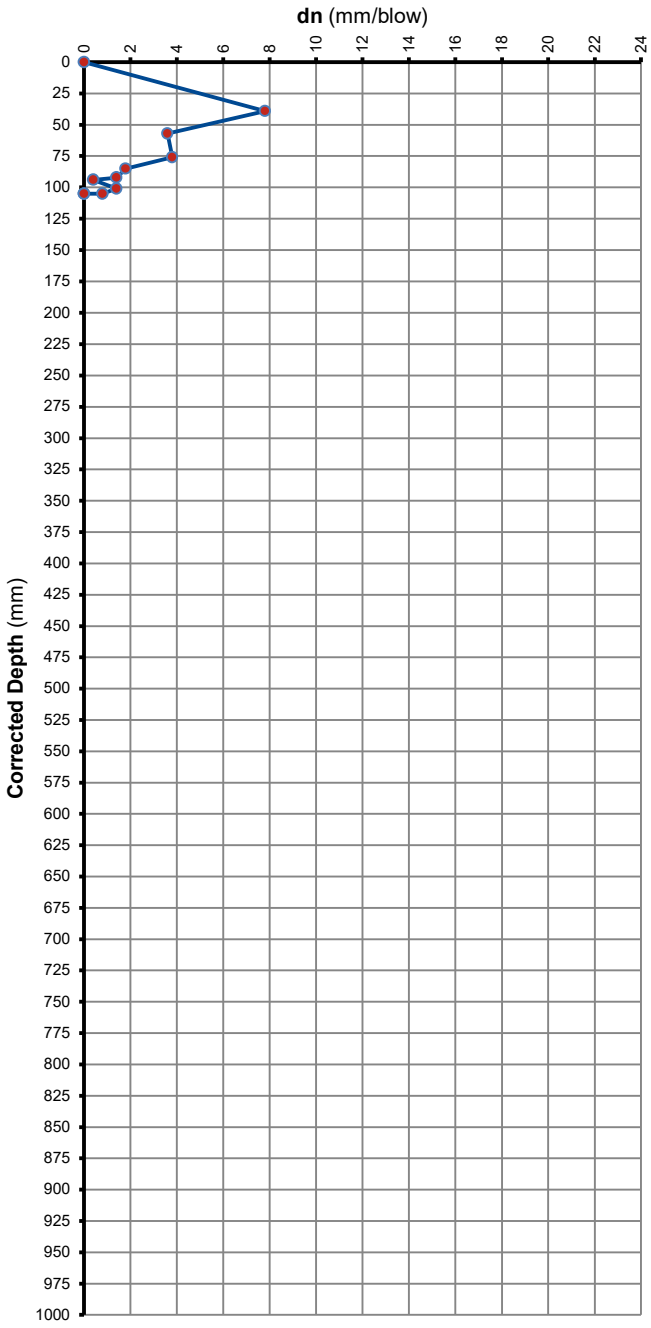
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 1 - Car 1	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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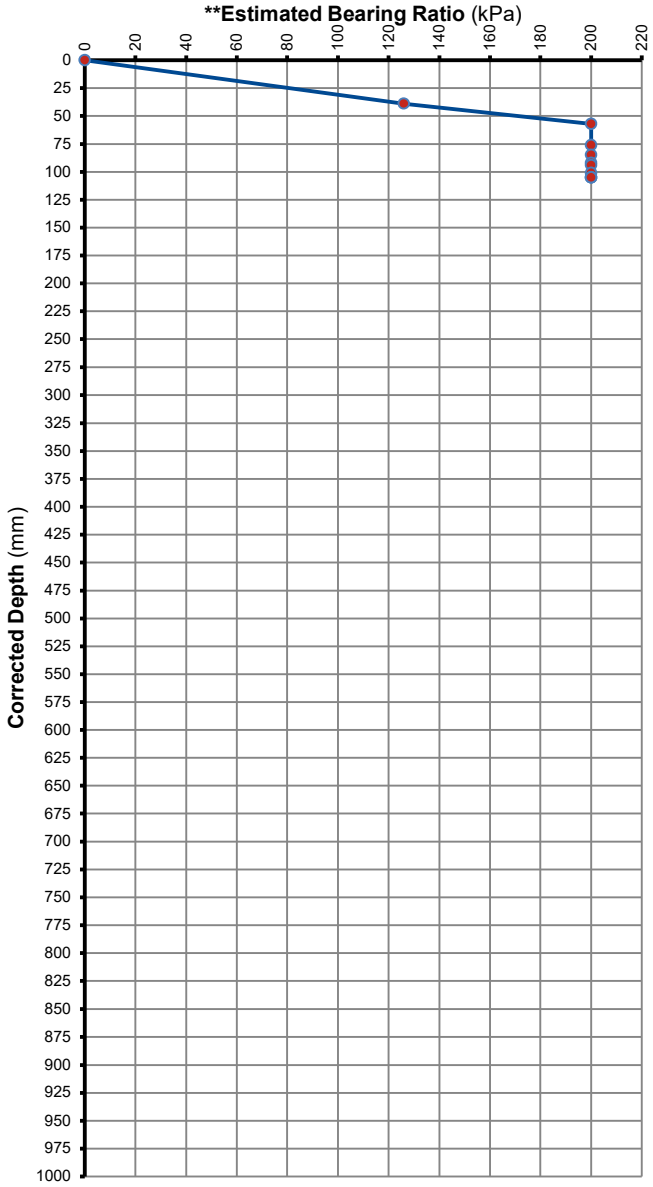
DYNAMIC CONE PENETROMETER (DCP) TEST

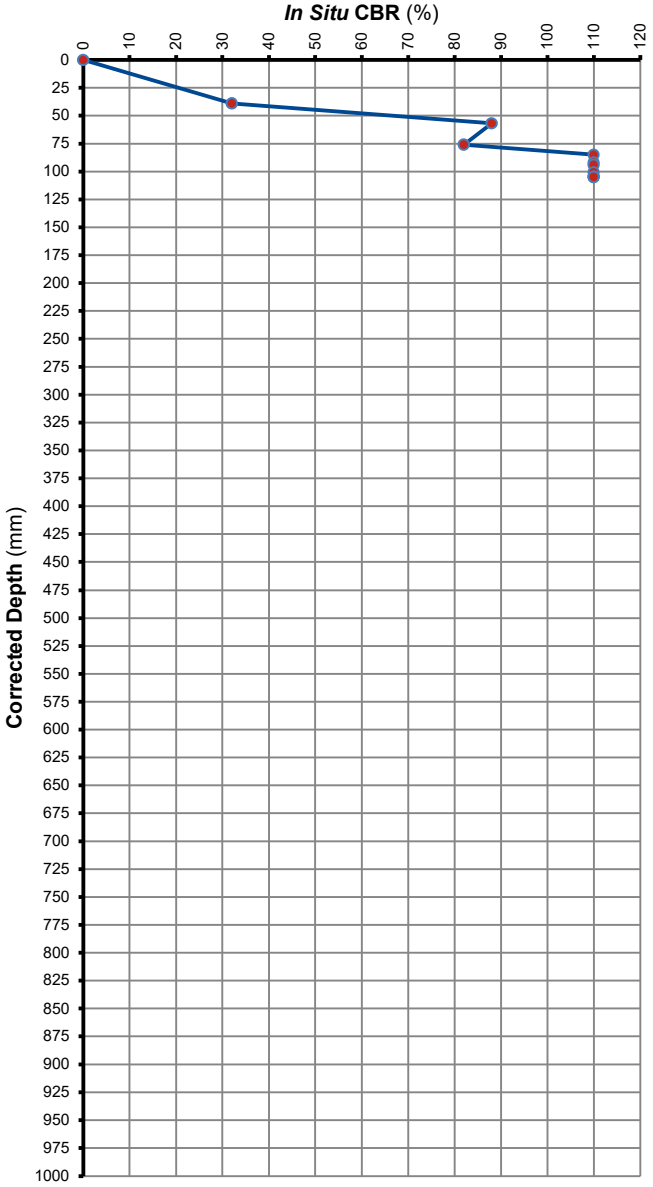
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 1 - Car 1	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



** According to Dr B van Wyk's Method

PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 82 821 9435, +27 (0) 51 448 8329, simbfn@simlab.co.za

DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 2 - Car 2	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	162	0	-	-	-	-	-
5	273	111	111	22.2	Medium Dense	59	8
10	309	147	36	7.2	Dense	134	35
15	338	176	29	5.8	Dense	157	47
20	366	204	28	5.6	Dense	161	49
25	381	219	15	3.0	Very Dense	> 200	> 110
30	393	231	12	2.4	Very Dense	> 200	> 110
35	397	235	4	0.8	Very Dense	> 200	> 110
40	397	235	0	0.0	Very Dense	> 200	> 110
45	397	235	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
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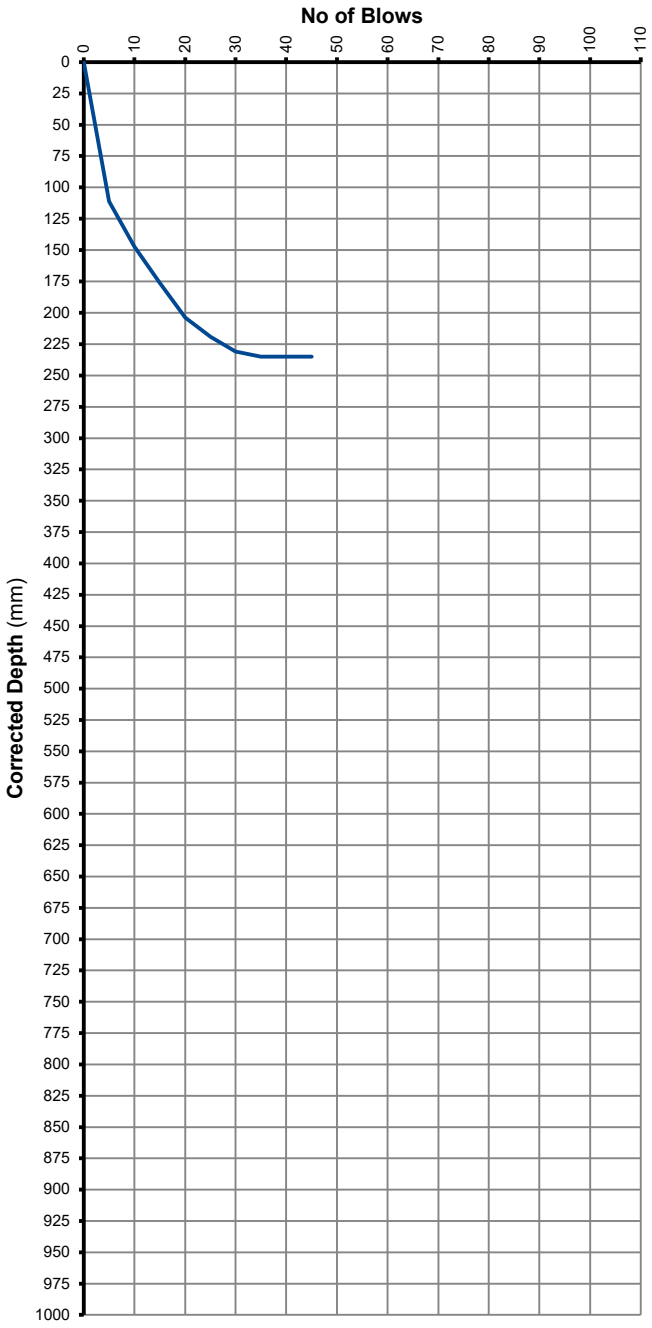
DYNAMIC CONE PENETROMETER (DCP) TEST

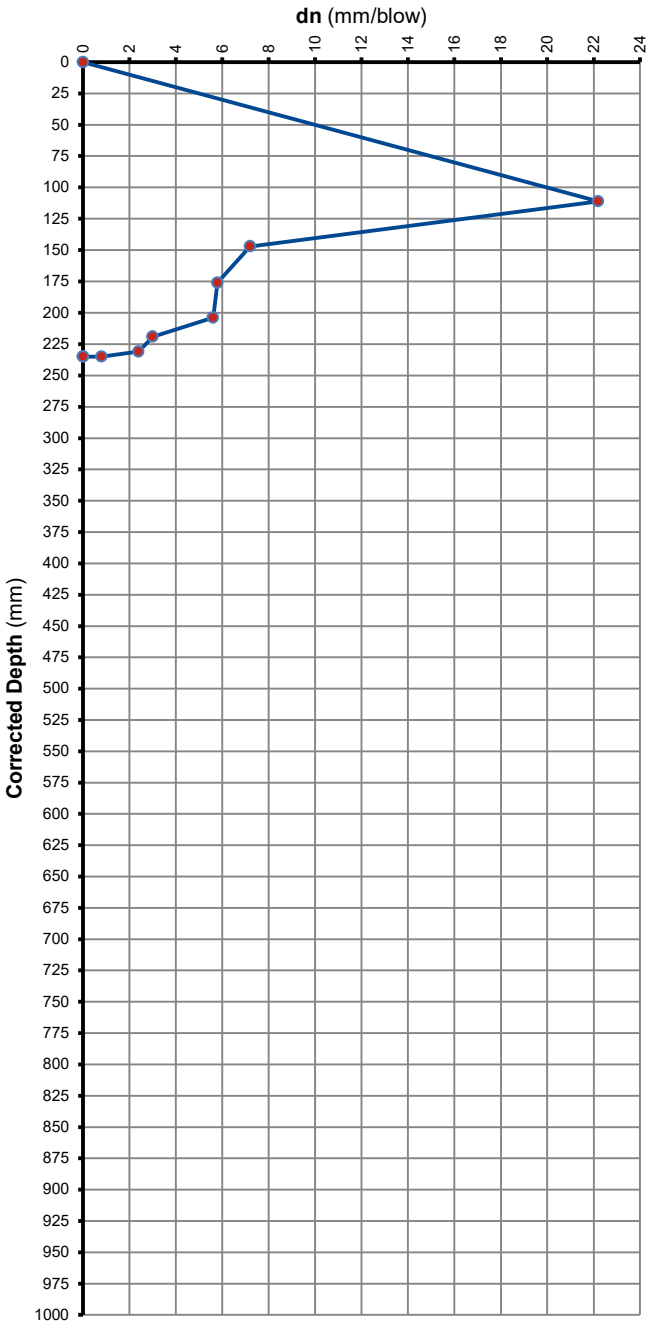
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 2 - Car 2	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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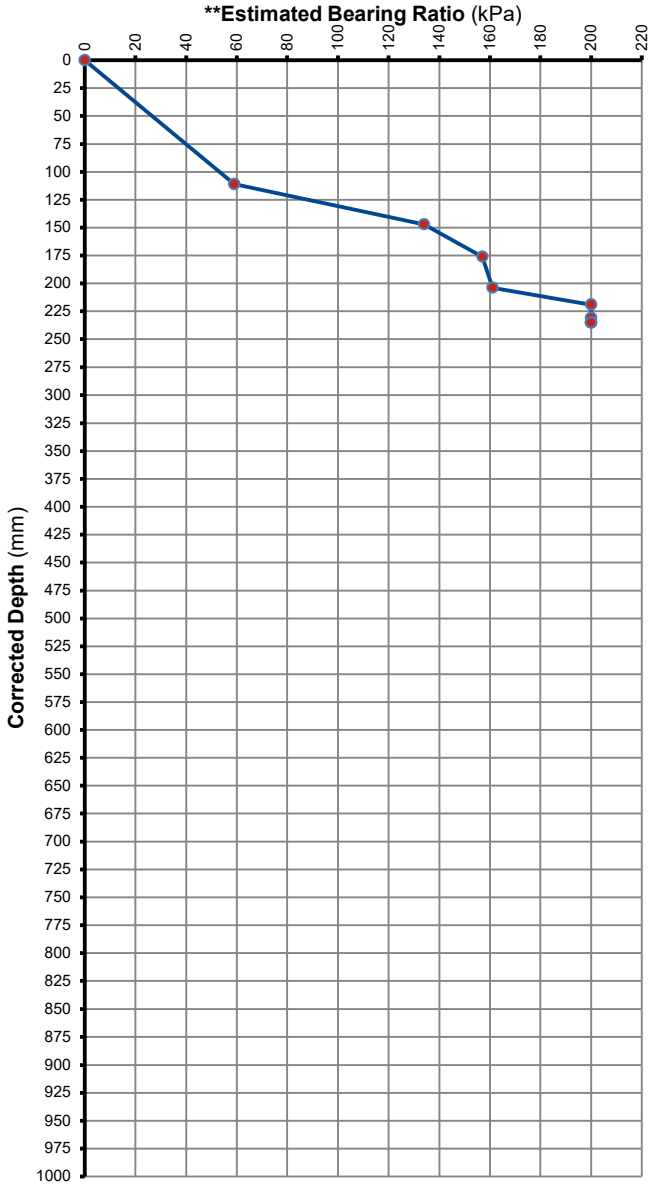
DYNAMIC CONE PENETROMETER (DCP) TEST

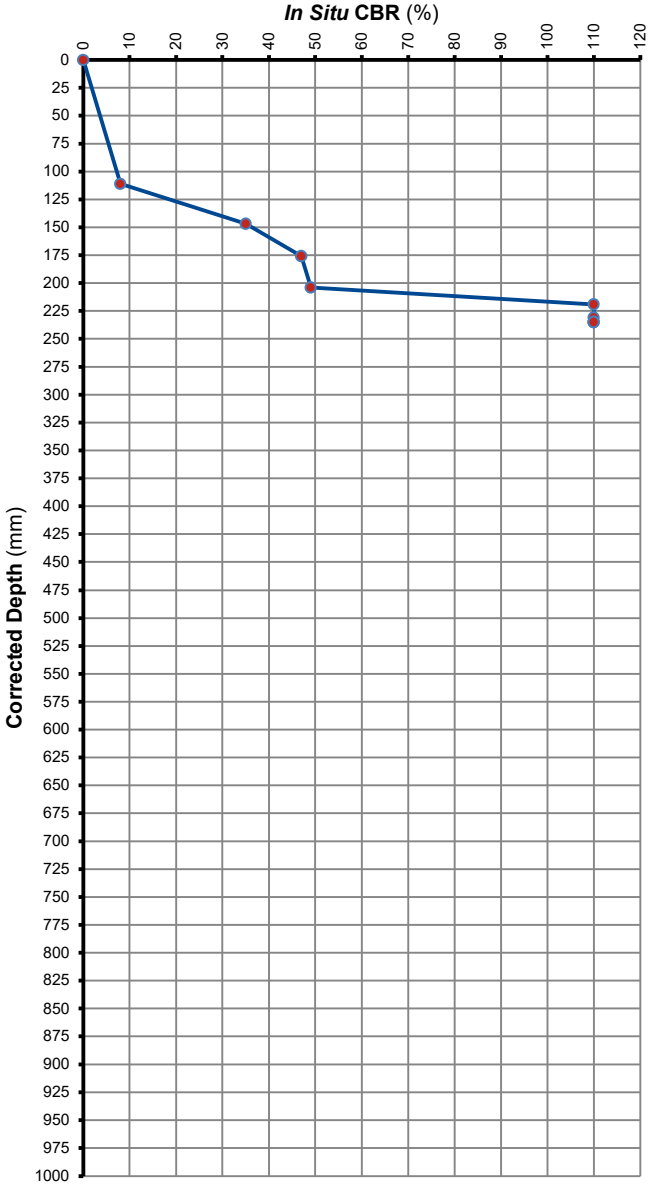
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 2 - Car 2	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



** According to Dr B van Wyk's Method

PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
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REG. No. 1987/004282/07 NLA No. 2012/187
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☎ +27 (0) 51 447 0224/5, +27 (0) 82 821 9435, +27 (0) 51 448 8329, simbfn@simlab.co.za

DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 3 - Car 3	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	178	0	-	-	-	-	-
5	337	159	159	31.8	Loose	44	5
10	396	218	59	11.8	Dense	92	18
15	424	246	28	5.6	Dense	161	49
20	435	257	11	2.2	Very Dense	> 200	> 110
25	435	257	0	0.0	Very Dense	> 200	> 110
30	435	257	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

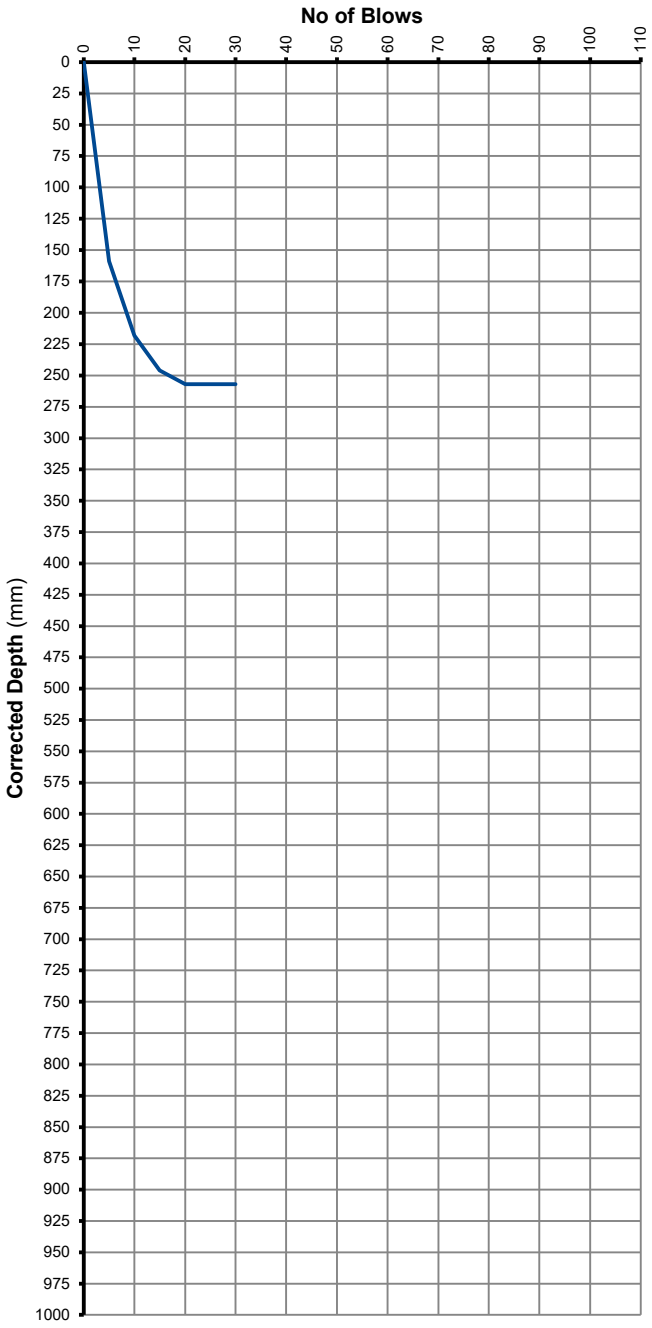
Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
6249, BLOEMFONTEIN, 9300, SOUTH AFRICA. Cnr. Lunn Road & Grey Street, Hilton, BLOEMFONTEIN, 9301
☎ +27 (0) 51 447 0224/5, +27 (0) 82 821 9435, +27 (0) 51 448 8329, simbfn@simlab.co.za

DYNAMIC CONE PENETROMETER (DCP) TEST

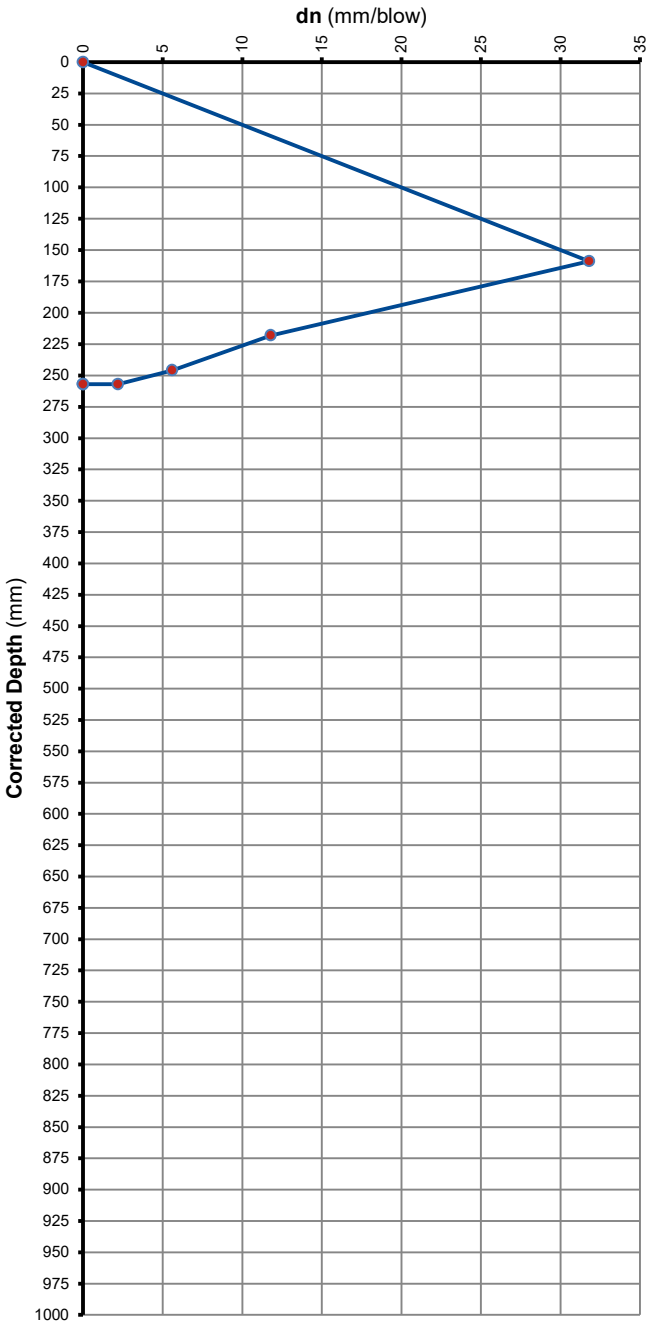
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 3 - Car 3	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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REG. No. 1987/004282/07 NLA No. 2012/187
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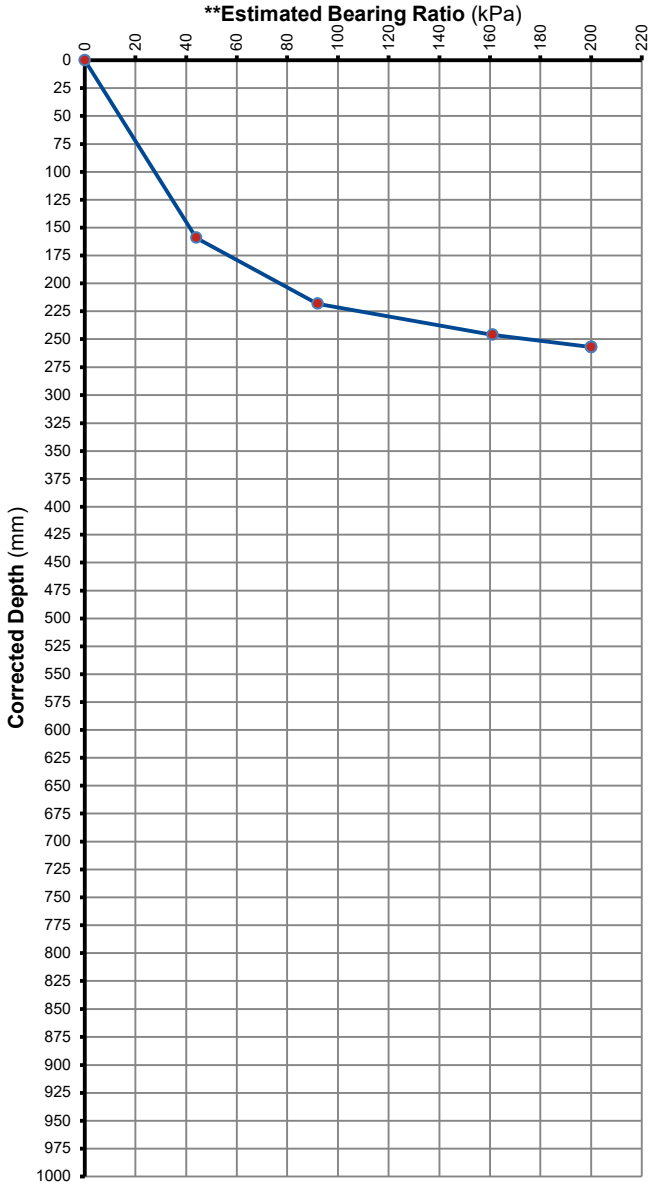
DYNAMIC CONE PENETROMETER (DCP) TEST

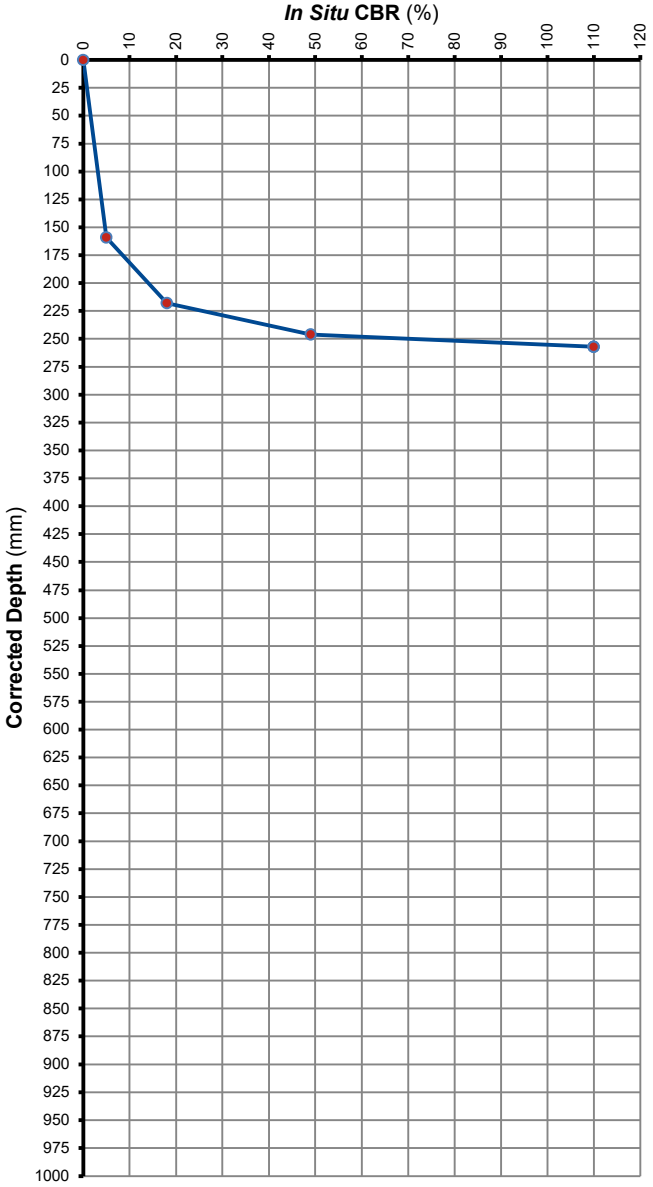
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 3 - Car 3	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



** According to Dr B van Wyk's Method

PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 4 - Car 4	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	162	0	-	-	-	-	-
5	192	30	30	6.0	Dense	154	45
10	214	52	22	4.4	Very Dense	188	68
15	228	66	14	2.8	Very Dense	> 200	> 110
20	242	80	14	2.8	Very Dense	> 200	> 110
25	257	95	15	3.0	Very Dense	> 200	> 110
30	278	116	21	4.2	Very Dense	193	72
35	296	134	18	3.6	Very Dense	> 200	88
40	304	142	8	1.6	Very Dense	> 200	> 110
45	308	146	4	0.8	Very Dense	> 200	> 110
50	308	146	0	0.0	Very Dense	> 200	> 110
55	308	146	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
(PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
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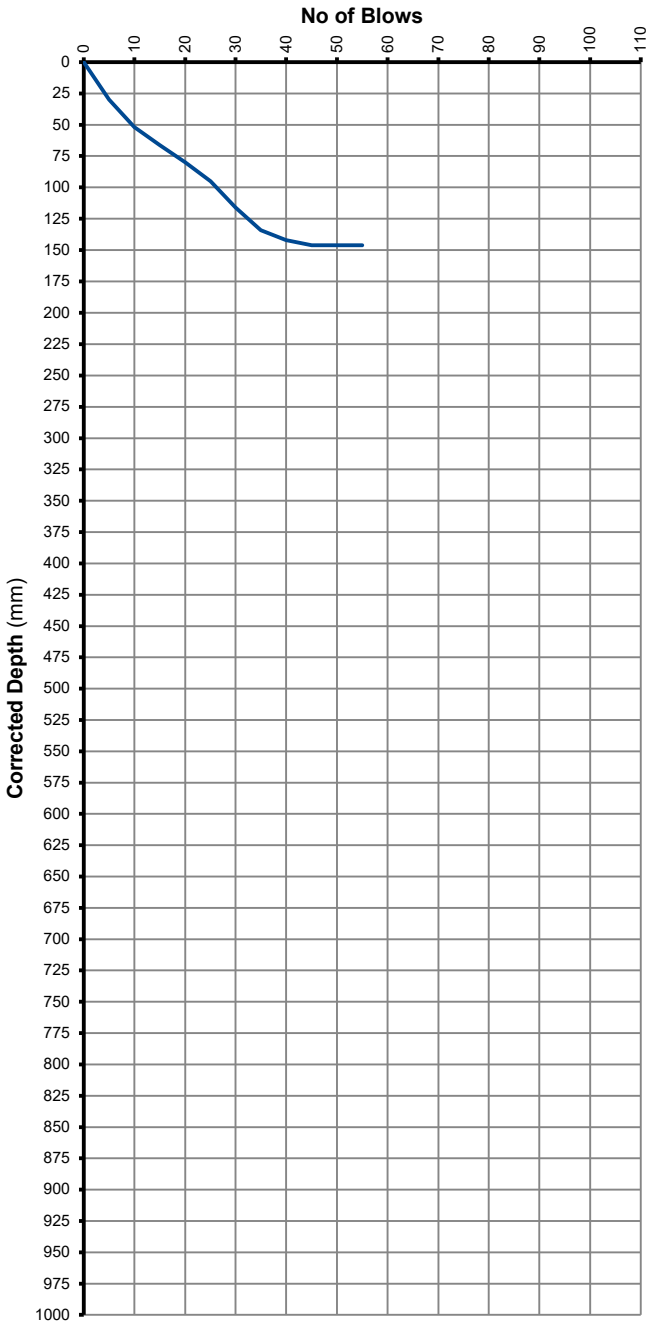
DYNAMIC CONE PENETROMETER (DCP) TEST

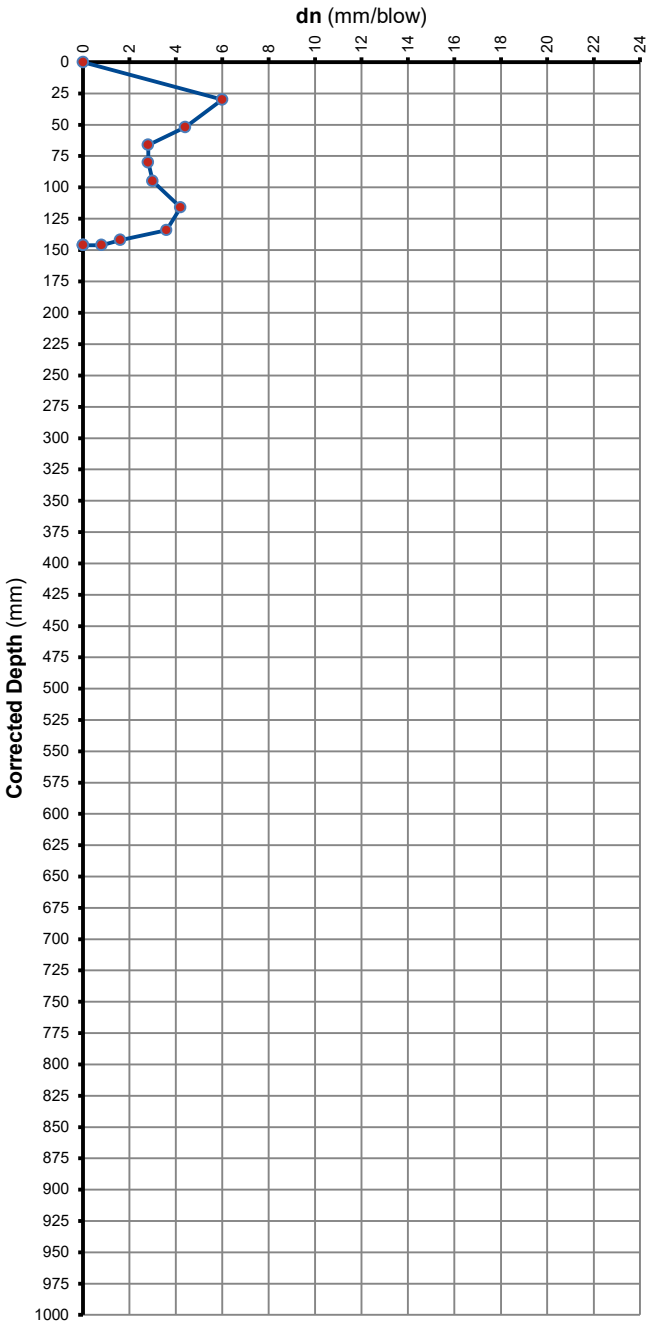
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 4 - Car 4	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



** According to Dr B van Wyk's Method

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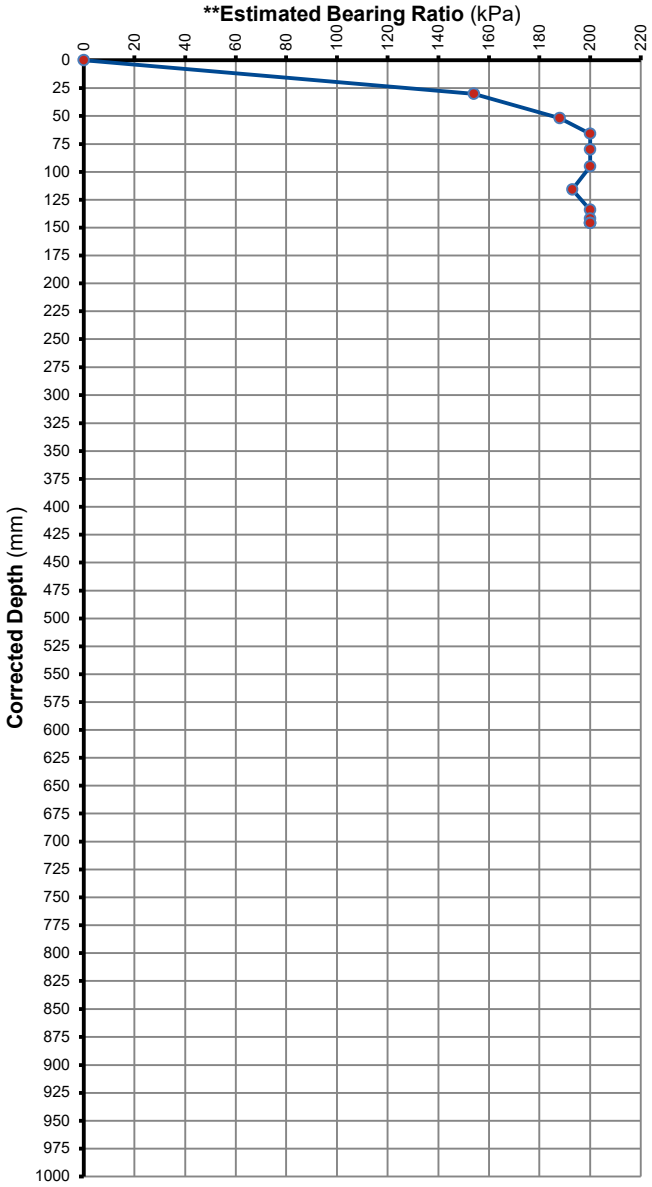
DYNAMIC CONE PENETROMETER (DCP) TEST

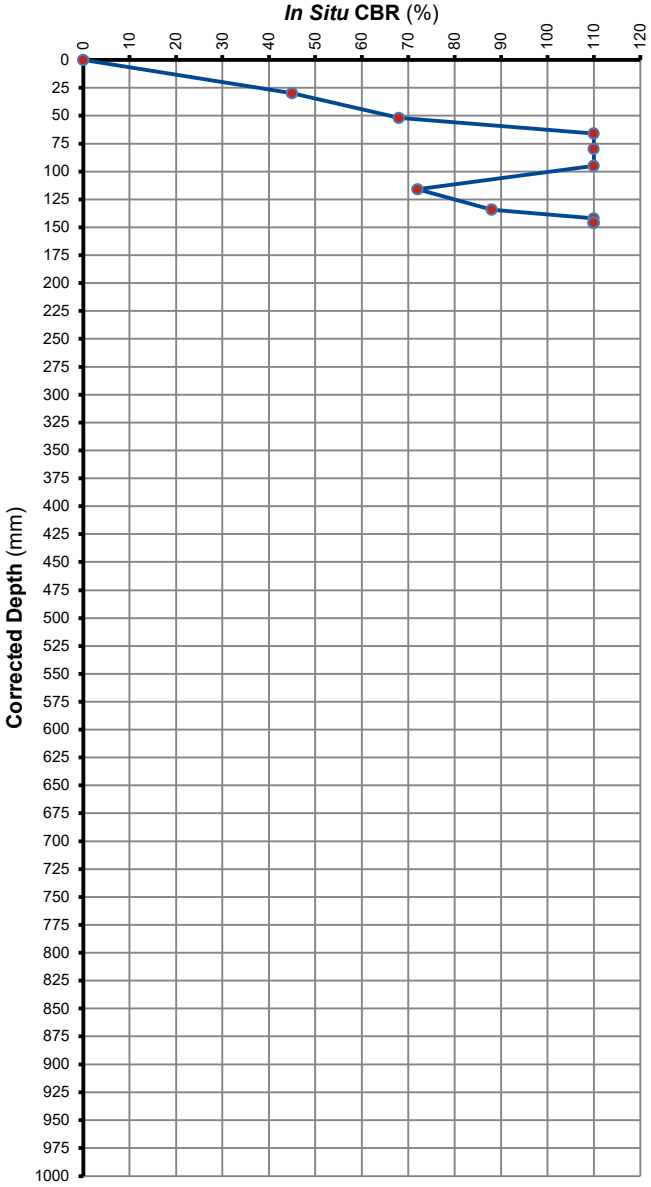
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 4 - Car 4	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



** According to Dr B van Wyk's Method

PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 5 - Car 5	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	164	0	-	-	-	-	-
5	186	22	22	4.4	Very Dense	188	68
10	197	33	11	2.2	Very Dense	> 200	> 110
15	212	48	15	3.0	Very Dense	> 200	> 110
20	231	67	19	3.8	Very Dense	> 200	82
25	249	85	18	3.6	Very Dense	> 200	88
30	270	106	21	4.2	Very Dense	193	72
35	287	123	17	3.4	Very Dense	> 200	95
40	301	137	14	2.8	Very Dense	> 200	> 110
45	311	147	10	2.0	Very Dense	> 200	> 110
50	322	158	11	2.2	Very Dense	> 200	> 110
55	328	164	6	1.2	Very Dense	> 200	> 110
60	337	173	9	1.8	Very Dense	> 200	> 110
65	337	173	0	0.0	Very Dense	> 200	> 110
70	337	173	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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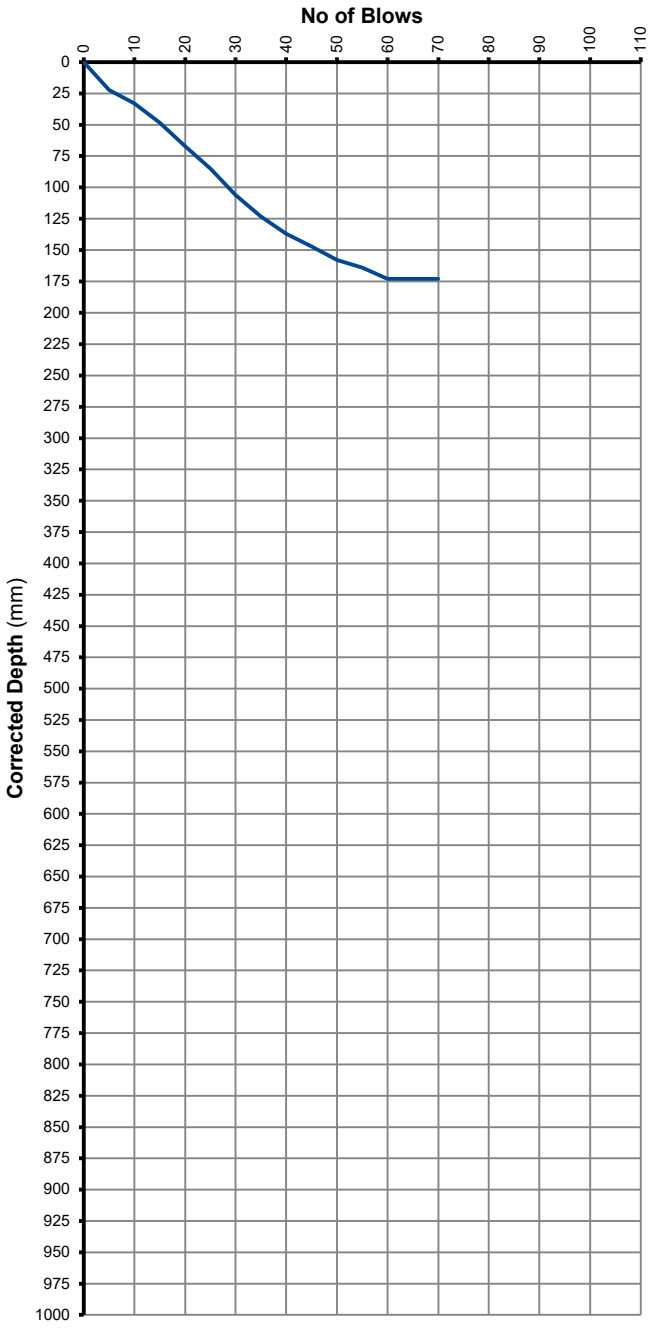
DYNAMIC CONE PENETROMETER (DCP) TEST

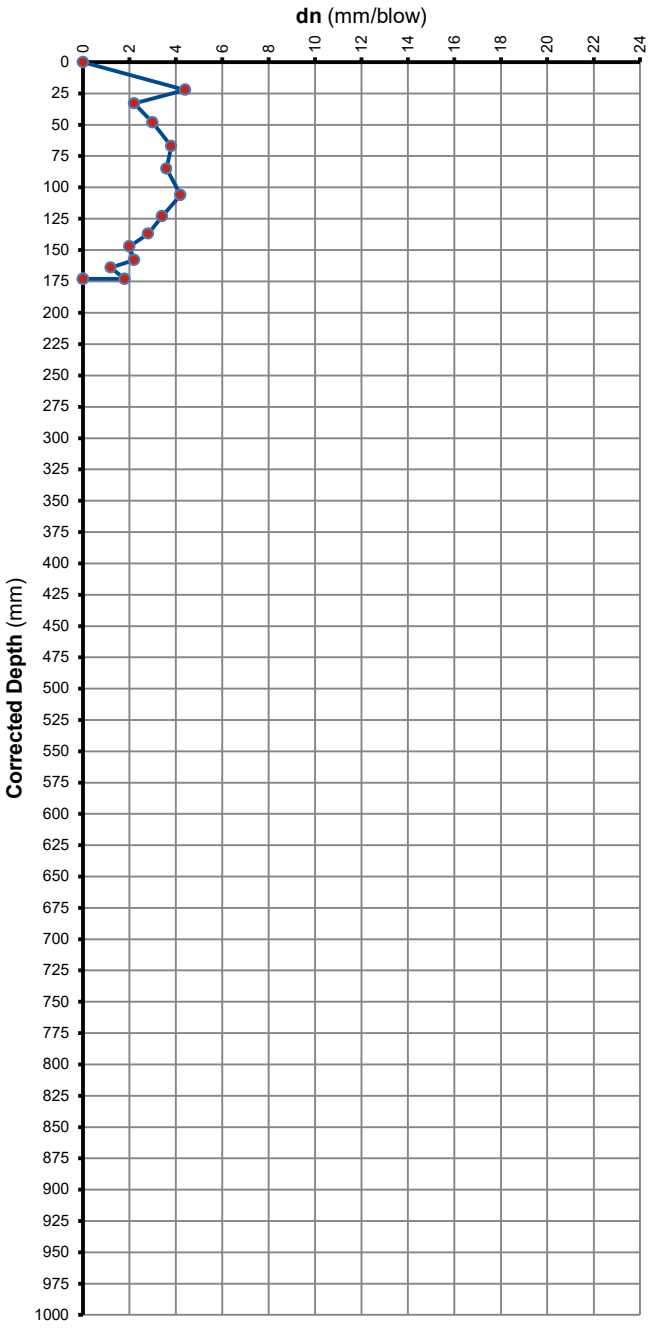
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 5 - Car 5	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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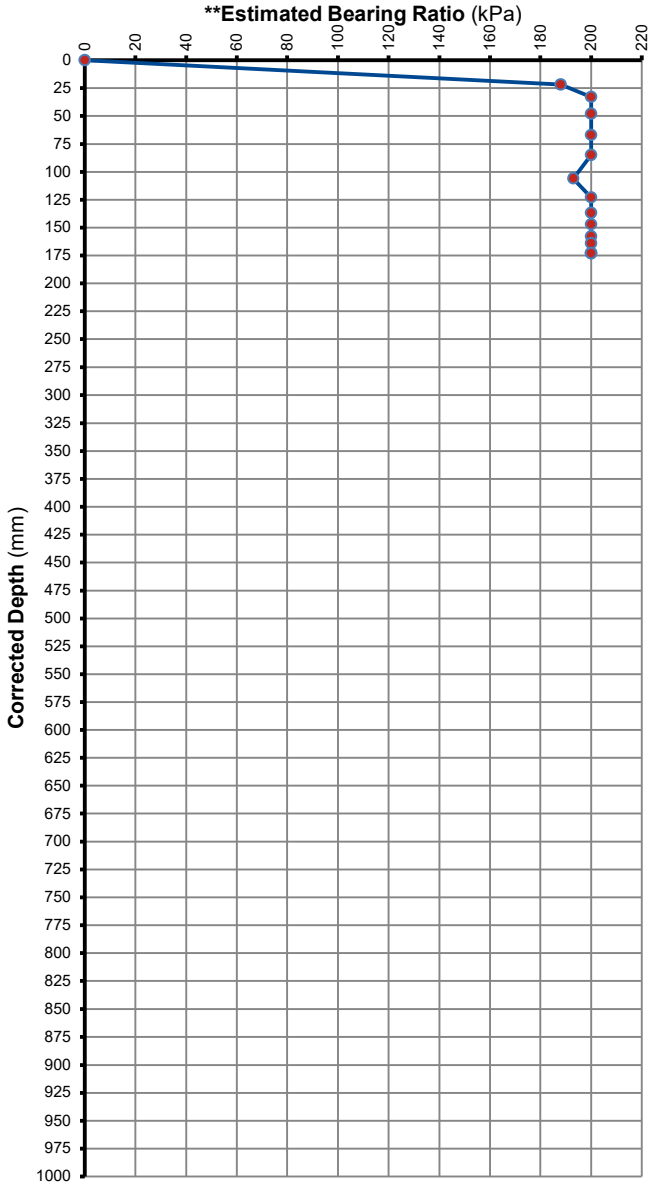
DYNAMIC CONE PENETROMETER (DCP) TEST

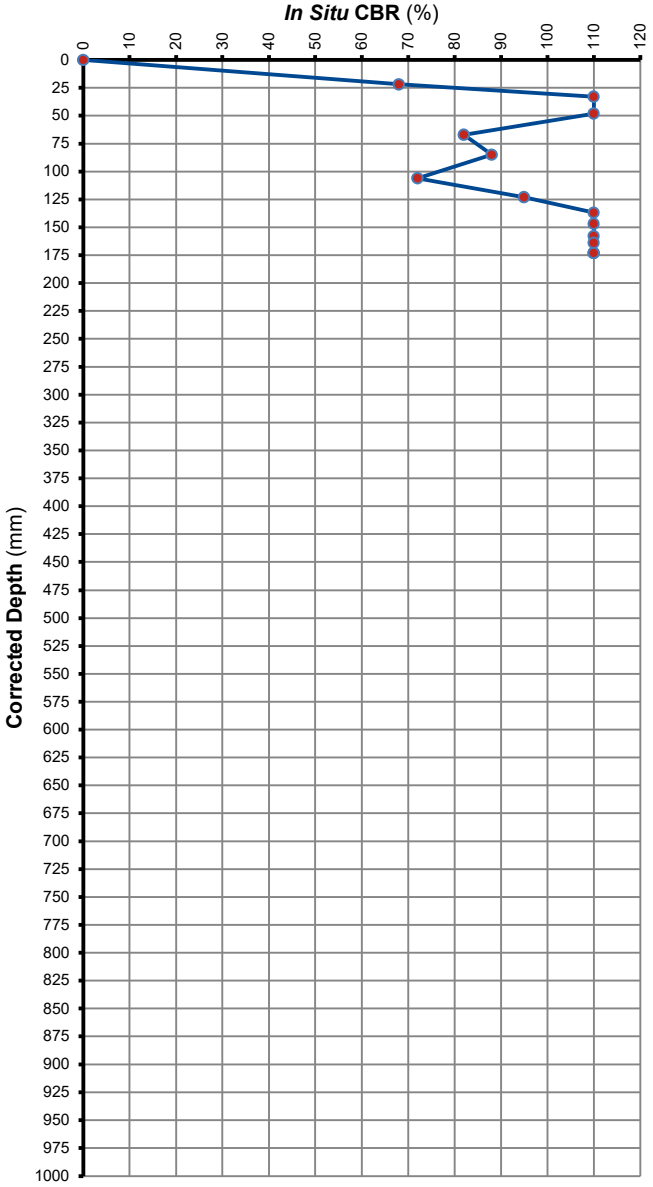
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 5 - Car 5	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



** According to Dr B van Wyk's Method

PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

Results reported relate only to the position tested

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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 6 - Car 6	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	166	0	-	-	-	-	-
5	189	23	23	4.6	Very Dense	183	64
10	207	41	18	3.6	Very Dense	> 200	88
15	221	55	14	2.8	Very Dense	> 200	> 110
20	233	67	12	2.4	Very Dense	> 200	> 110
25	245	79	12	2.4	Very Dense	> 200	> 110
30	249	83	4	0.8	Very Dense	> 200	> 110
35	252	86	3	0.6	Very Dense	> 200	> 110
40	252	86	0	0.0	Very Dense	> 200	> 110
45	252	86	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

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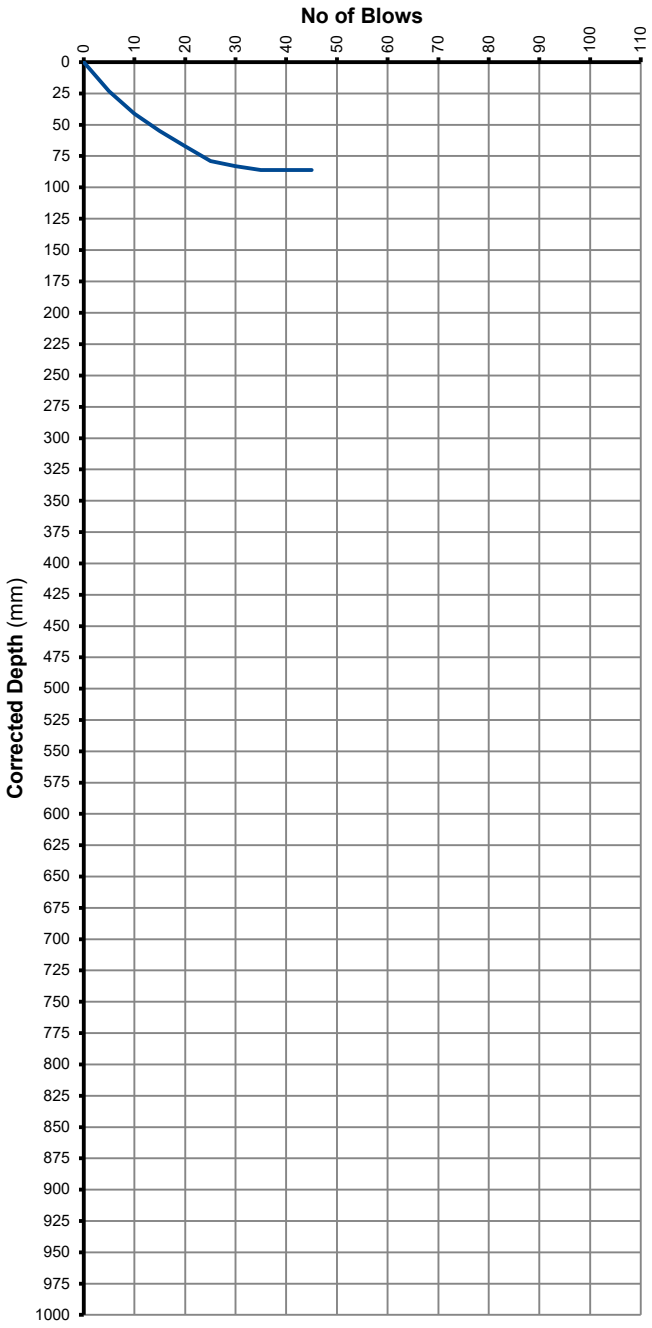
DYNAMIC CONE PENETROMETER (DCP) TEST

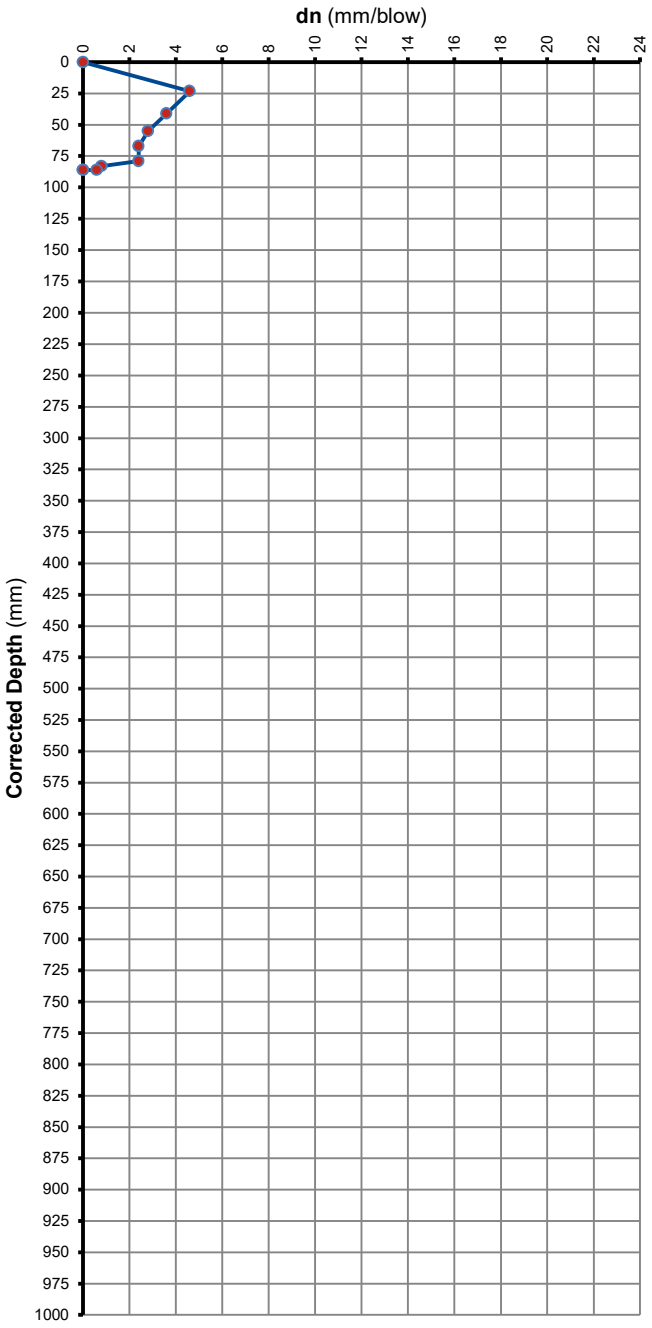
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 6 - Car 6	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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DYNAMIC CONE PENETROMETER (DCP) TEST

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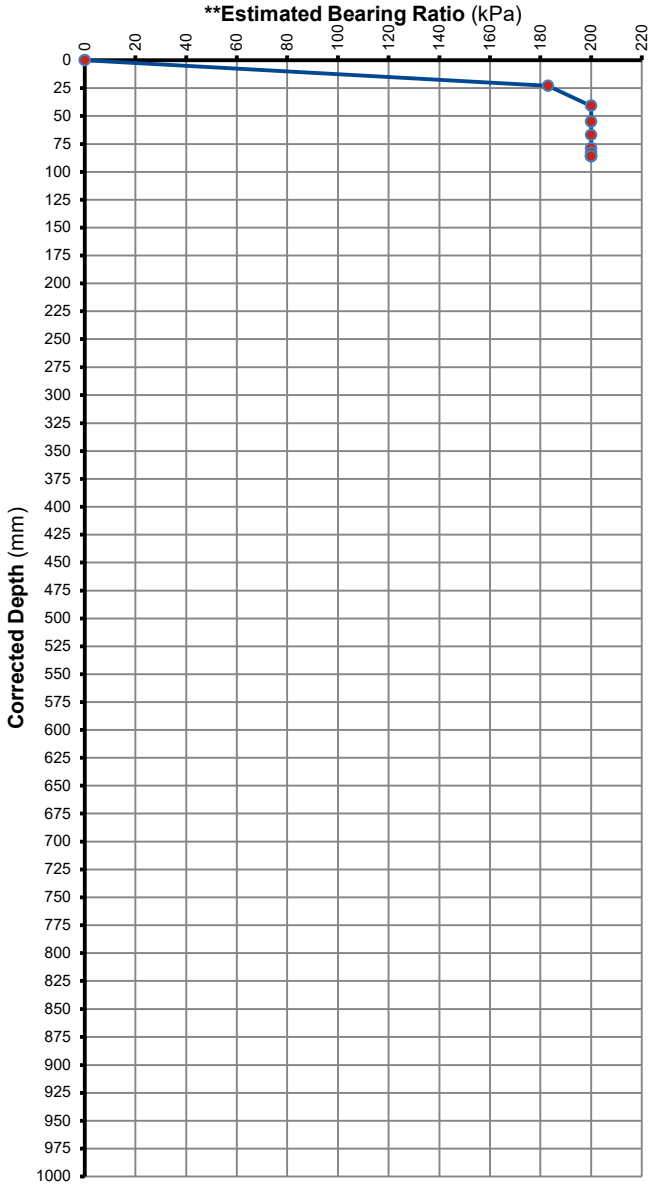
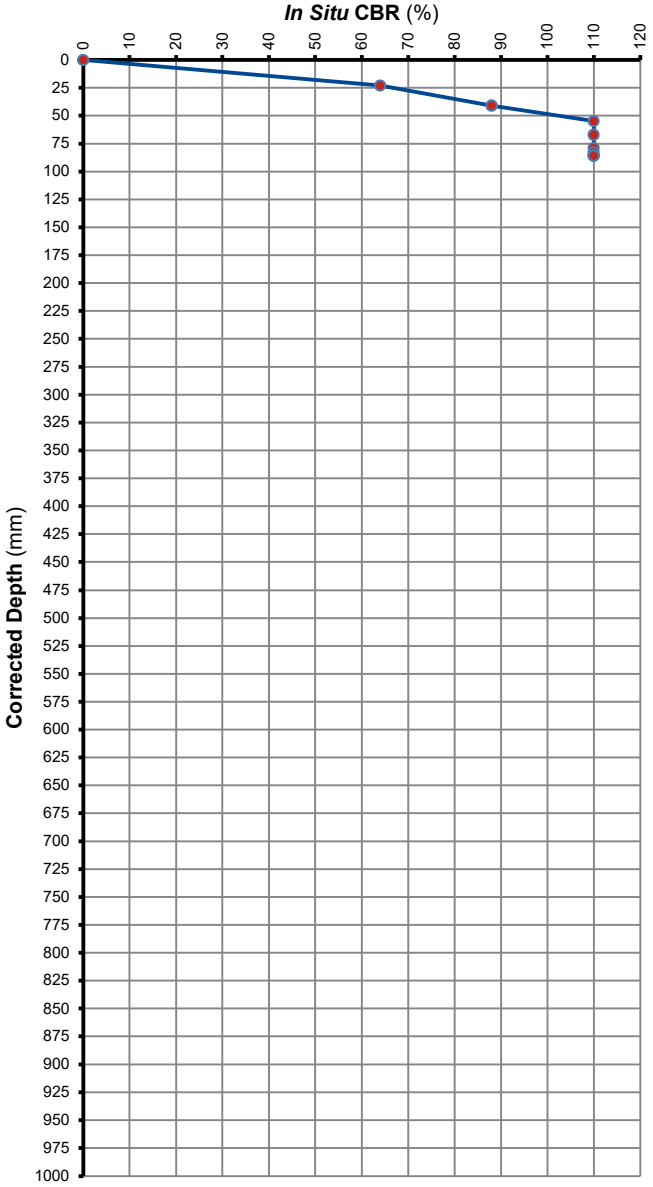
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 6 - Car 6	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 7 - Car 7	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	158	0	-	-	-	-	-
5	189	31	31	6.2	Dense	150	43
10	221	63	32	6.4	Dense	147	41
15	239	81	18	3.6	Very Dense	> 200	88
20	256	98	17	3.4	Very Dense	> 200	95
25	272	114	16	3.2	Very Dense	> 200	103
30	288	130	16	3.2	Very Dense	> 200	103
35	306	148	18	3.6	Very Dense	> 200	88
40	322	164	16	3.2	Very Dense	> 200	103
45	340	182	18	3.6	Very Dense	> 200	88
50	356	198	16	3.2	Very Dense	> 200	103
55	368	210	12	2.4	Very Dense	> 200	> 110
60	377	219	9	1.8	Very Dense	> 200	> 110
65	384	226	7	1.4	Very Dense	> 200	> 110
70	384	226	0	0.0	Very Dense	> 200	> 110
75	384	226	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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DYNAMIC CONE PENETROMETER (DCP) TEST

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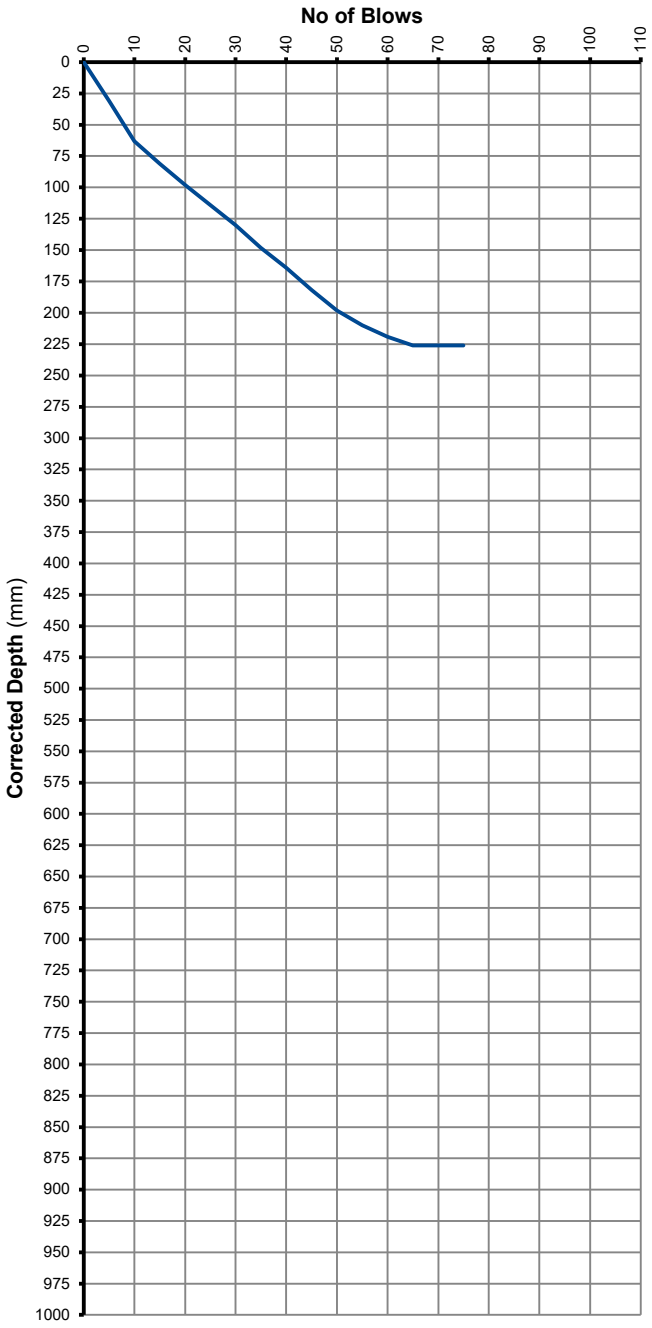
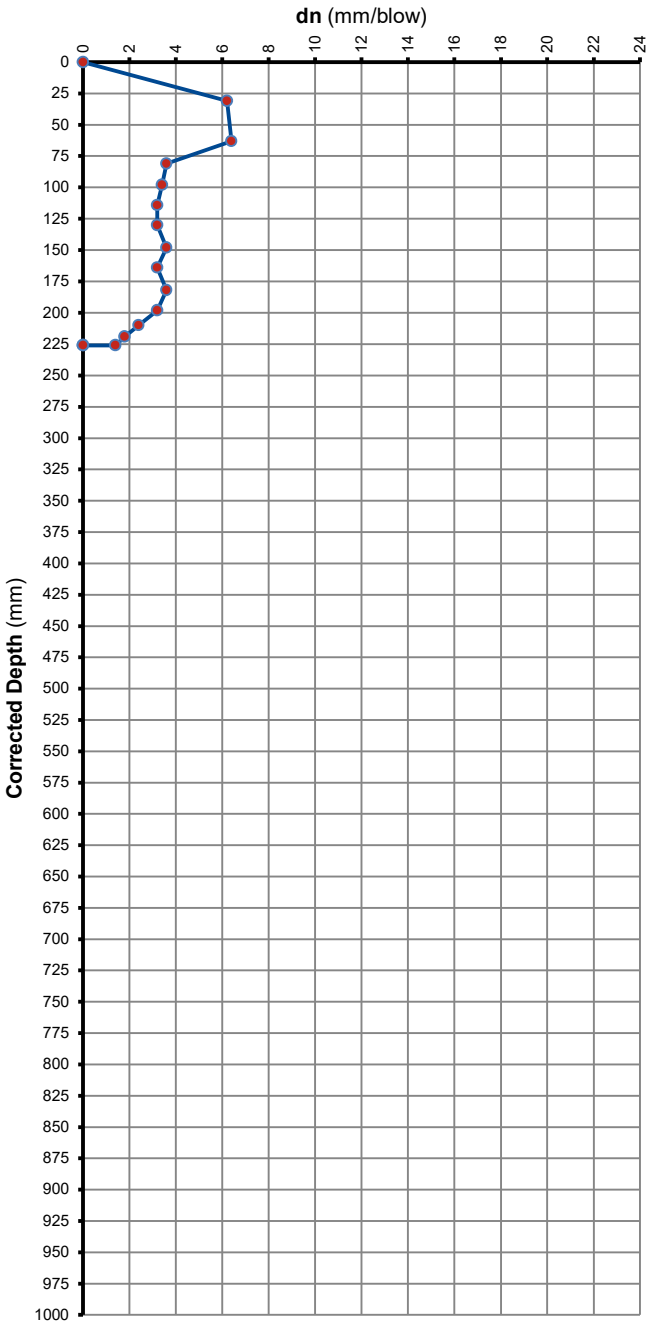
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 7 - Car 7	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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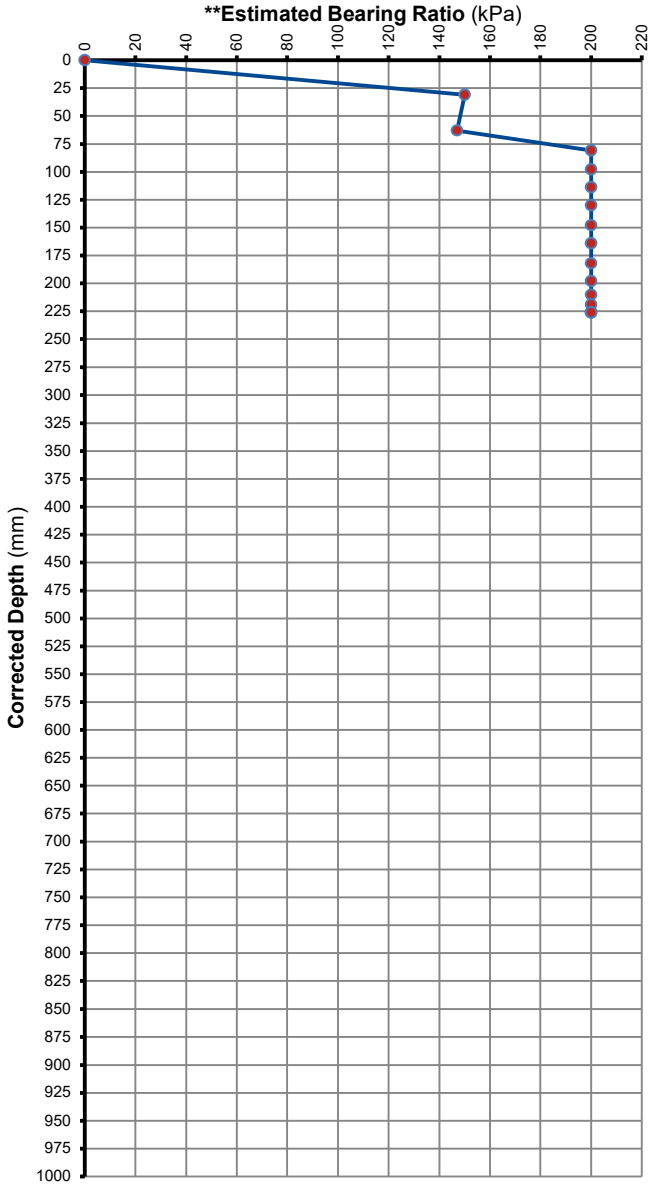
DYNAMIC CONE PENETROMETER (DCP) TEST

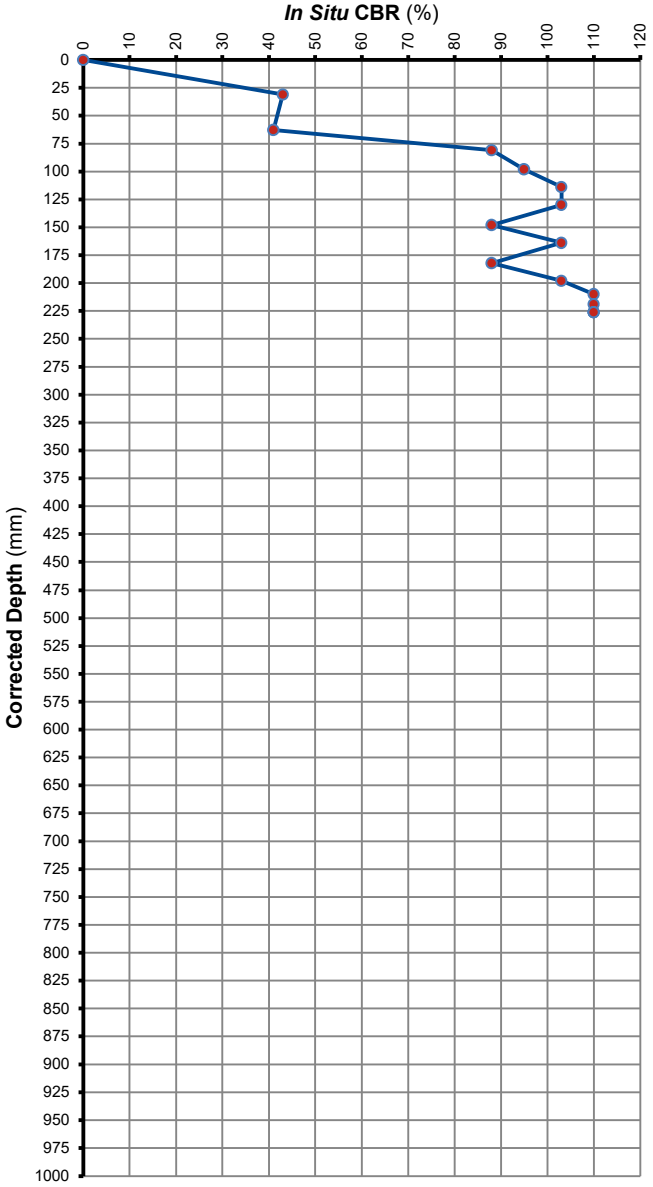
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 7 - Car 7	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



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PW VAN HEERDEN (Technologist)
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BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

Results reported relate only to the position tested

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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 8 - Car 8	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	152	0	-	-	-	-	-
5	173	21	21	4.2	Very Dense	193	72
10	179	27	6	1.2	Very Dense	> 200	> 110
15	184	32	5	1.0	Very Dense	> 200	> 110
20	191	39	7	1.4	Very Dense	> 200	> 110
25	191	39	0	0.0	Very Dense	> 200	> 110
30	191	39	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

Results reported relate only to the position tested

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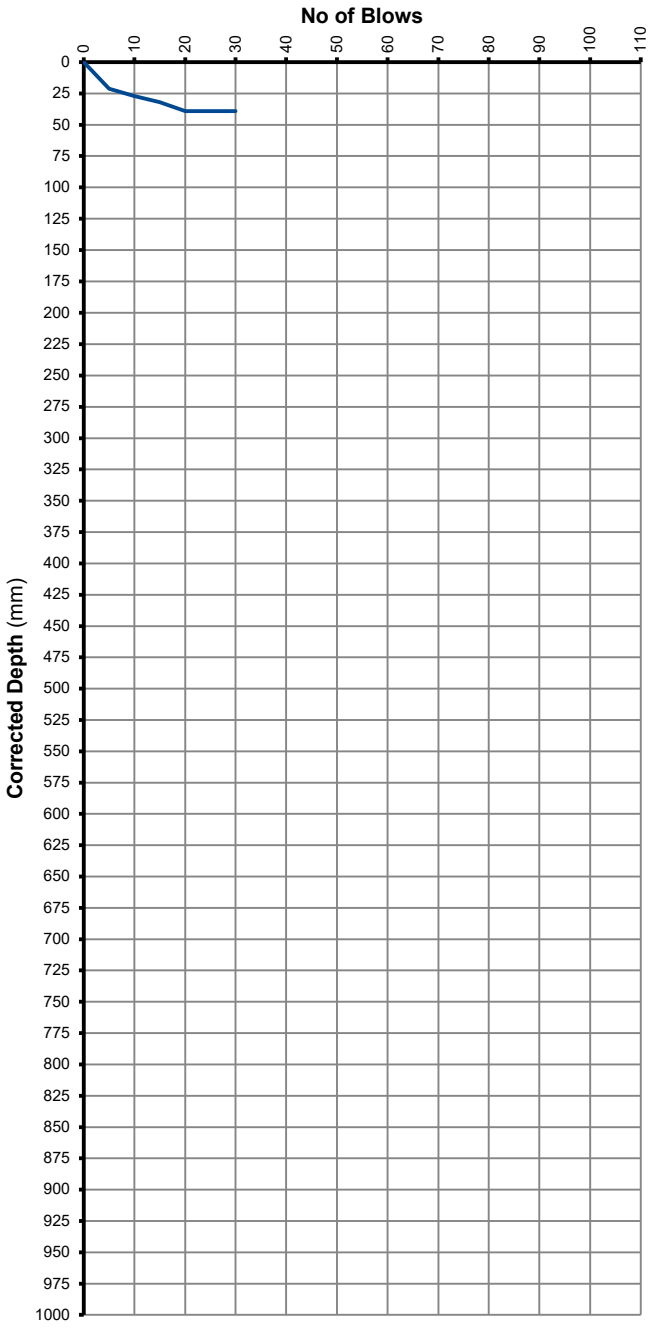
DYNAMIC CONE PENETROMETER (DCP) TEST

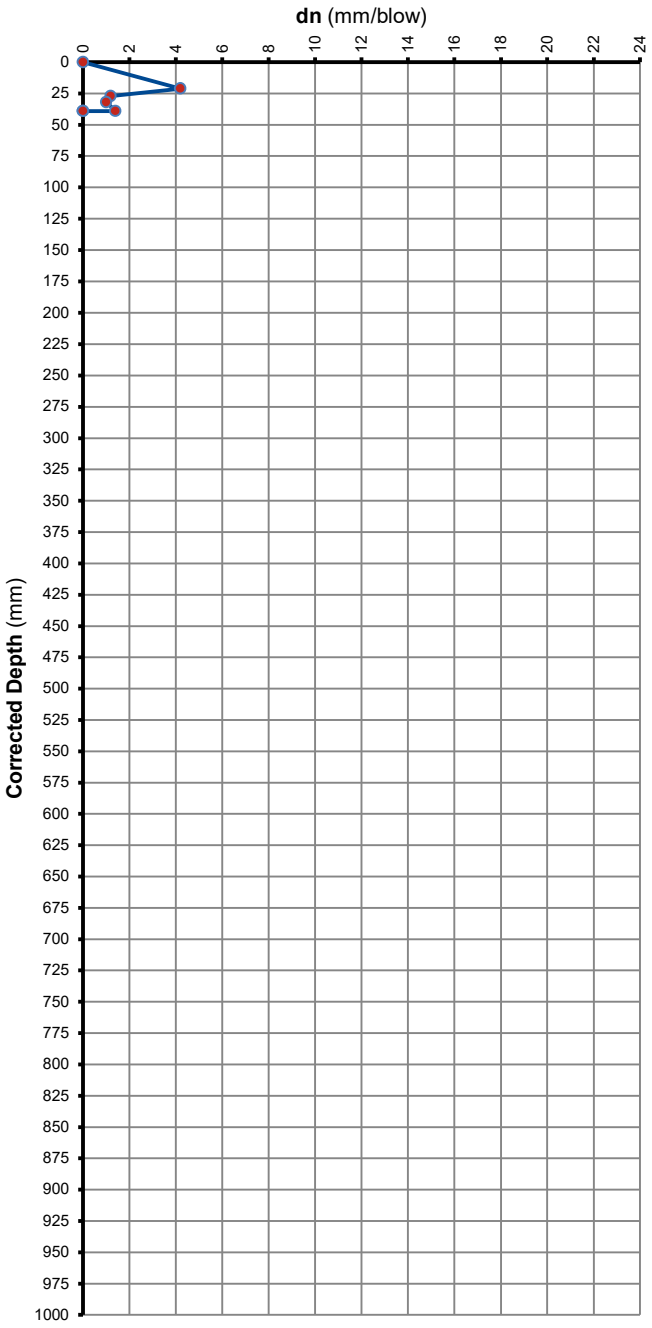
CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 8 - Car 8	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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DYNAMIC CONE PENETROMETER (DCP) TEST

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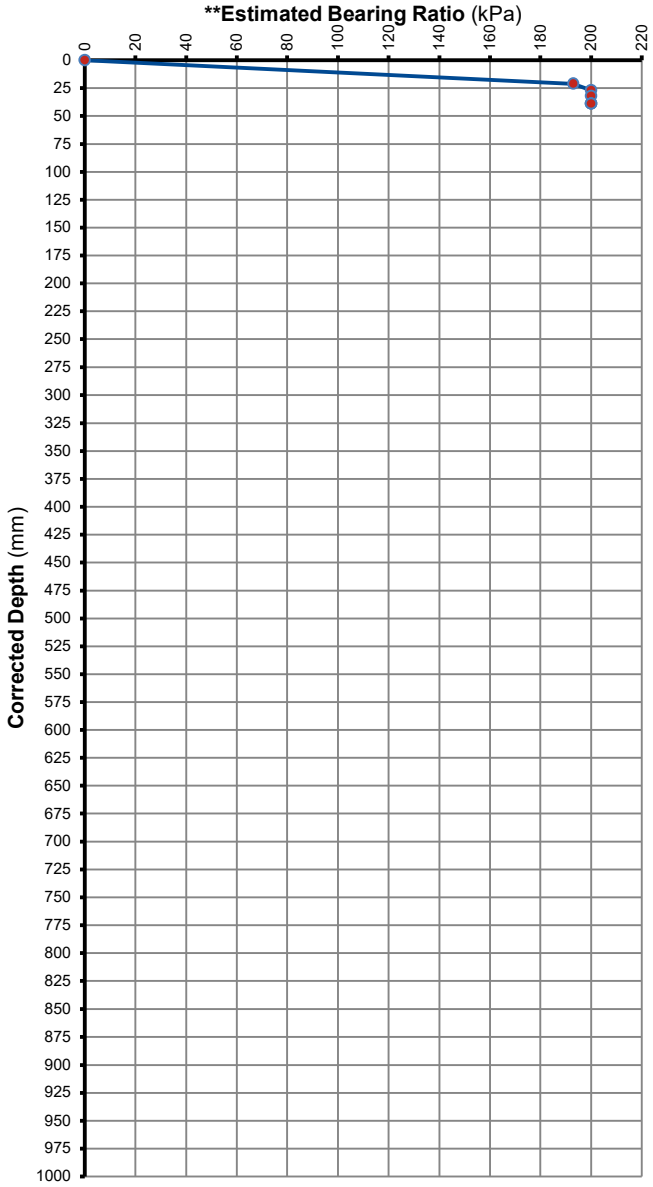
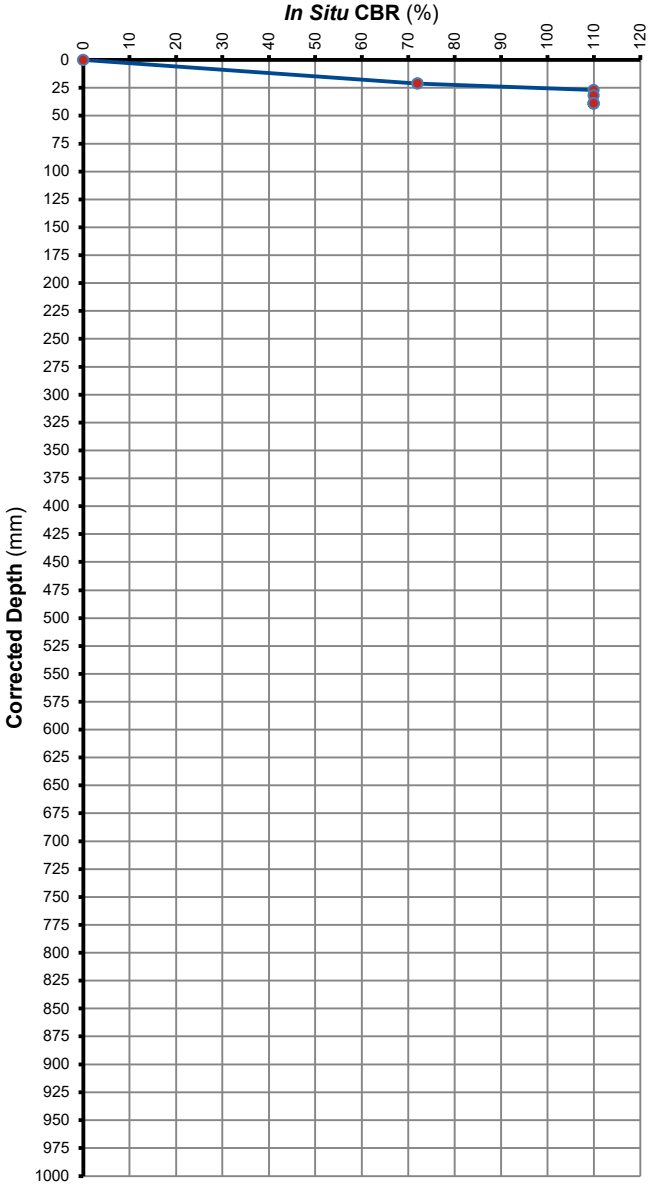
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 8 - Car 8	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



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PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
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DYNAMIC CONE PENETROMETER (DCP) TEST

CLIENT :	**GONDWANA GEO SOLUTIONS (PTY) LTD**	**DATE :**	14/08/2023
	13 Rocklands Road, Simonstown	**REFERENCE :**	SL / 1640
	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 9 - Car 9	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	153	0	-	-	-	-	-
5	187	34	34	6.8	Dense	140	38
10	206	53	19	3.8	Very Dense	> 200	82
15	227	74	21	4.2	Very Dense	193	72
20	244	91	17	3.4	Very Dense	> 200	95
25	261	108	17	3.4	Very Dense	> 200	95
30	276	123	15	3.0	Very Dense	> 200	> 110
35	292	139	16	3.2	Very Dense	> 200	103
40	307	154	15	3.0	Very Dense	> 200	> 110
45	326	173	19	3.8	Very Dense	> 200	82
50	341	188	15	3.0	Very Dense	> 200	> 110
55	359	206	18	3.6	Very Dense	> 200	88
60	374	221	15	3.0	Very Dense	> 200	> 110
65	382	229	8	1.6	Very Dense	> 200	> 110
70	382	229	0	0.0	Very Dense	> 200	> 110
75	382	229	0	0.0	Very Dense	> 200	> 110

** According to Dr B van Wyk's Method

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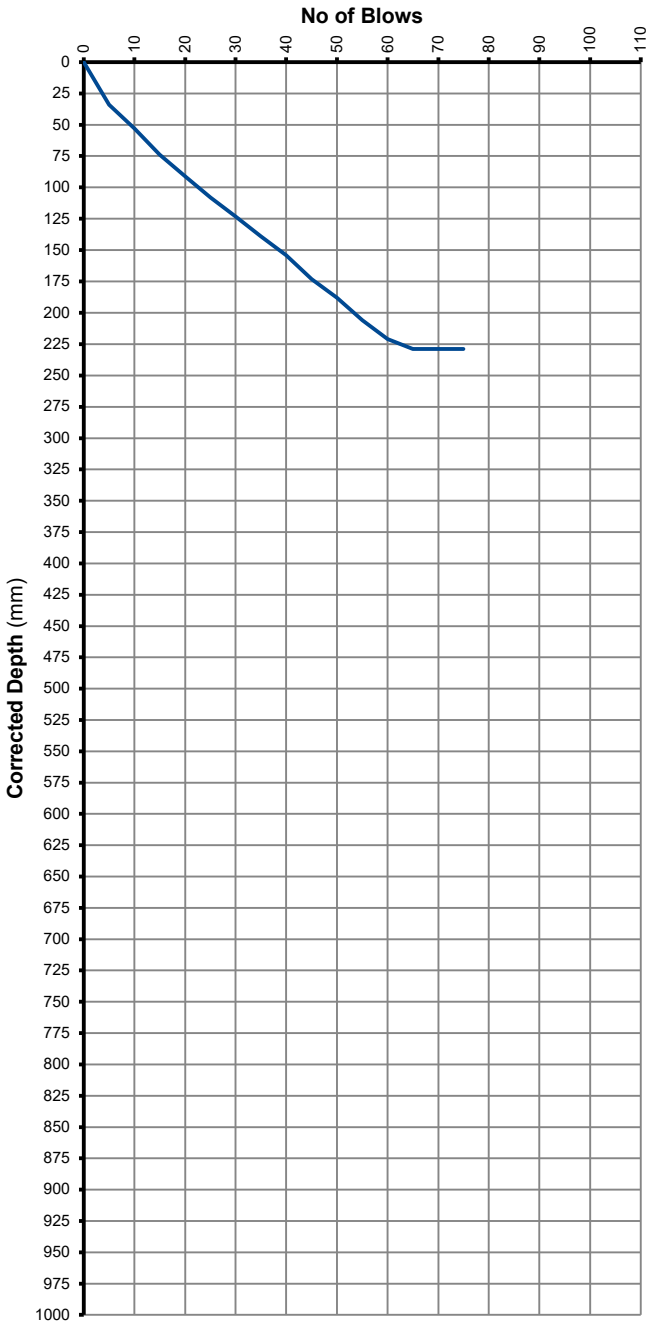
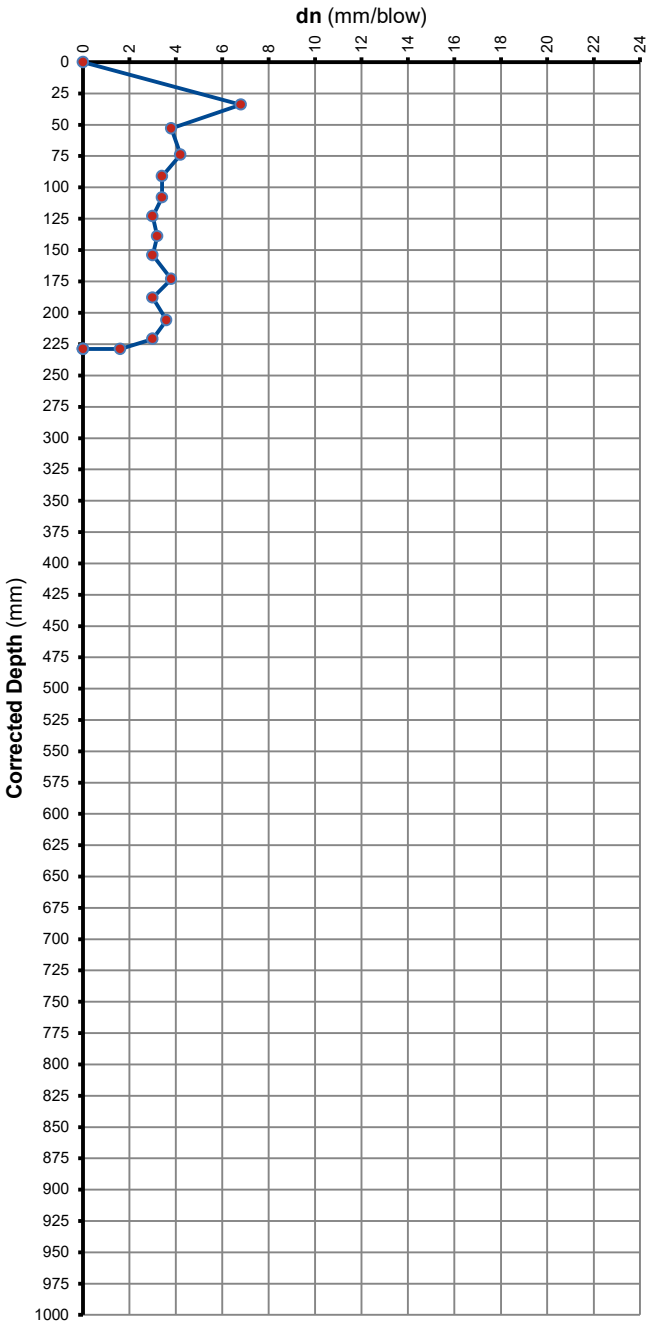
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 9 - Car 9	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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DYNAMIC CONE PENETROMETER (DCP) TEST

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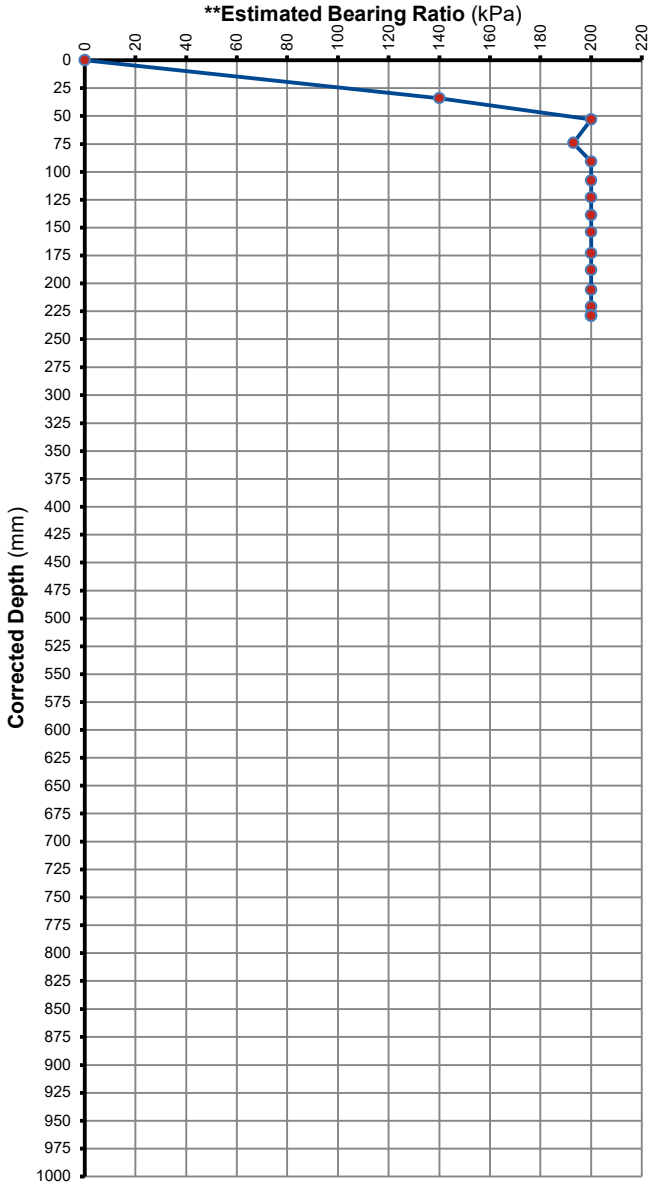
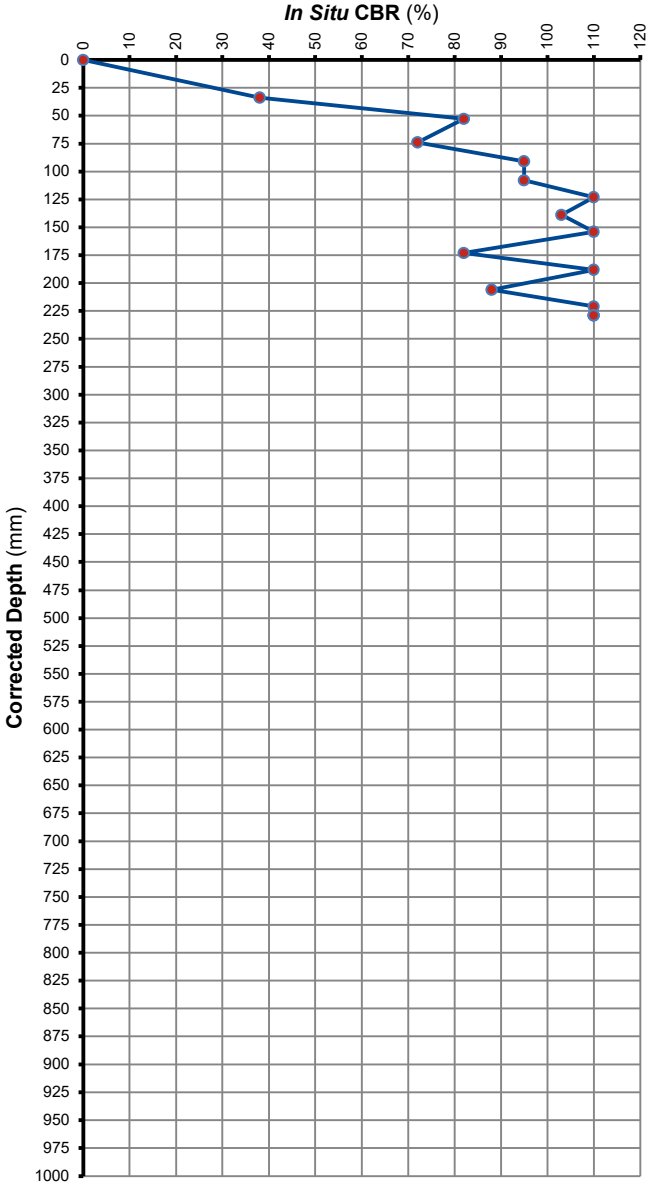
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 9 - Car 9	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



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PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

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	CAPE TOWN, 'WESTERN CAPE, 7675	**DOCUMENT No. :**	023/1057(a)
ATTENTION :	Mr. Mark Richter	**ORDER No. :**	-
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM	**NUMBER OF PAGES :**	1 of 3
POSITION :	DCP 10 - Car 10	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows	Depth (mm)	Corrected Depth (mm)	Penetration Tempo	dn (mm/blow)	Consistency	**Estimated Bearing Ratio (kPa)	*In Situ* CBR
0	159	0	-	-	-	-	-
5	184	25	25	5.0	Very Dense	174	57
10	202	43	18	3.6	Very Dense	> 200	88
15	218	59	16	3.2	Very Dense	> 200	103
20	239	80	21	4.2	Very Dense	193	72
25	244	85	5	1.0	Very Dense	> 200	> 110
30	263	104	19	3.8	Very Dense	> 200	82
35	277	118	14	2.8	Very Dense	> 200	> 110
40	284	125	7	1.4	Very Dense	> 200	> 110
45	294	135	10	2.0	Very Dense	> 200	> 110
50	299	140	5	1.0	Very Dense	> 200	> 110
55	303	144	4	0.8	Very Dense	> 200	> 110
60	304	145	1	0.2	Very Dense	> 200	> 110
65	304	145	0	0.0	Very Dense	> 200	> 110
70	304	145	0	0.0	Very Dense	> 200	> 110
75	304	145	0	0.0	Very Dense	> 200	> 110

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DYNAMIC CONE PENETROMETER (DCP) TEST

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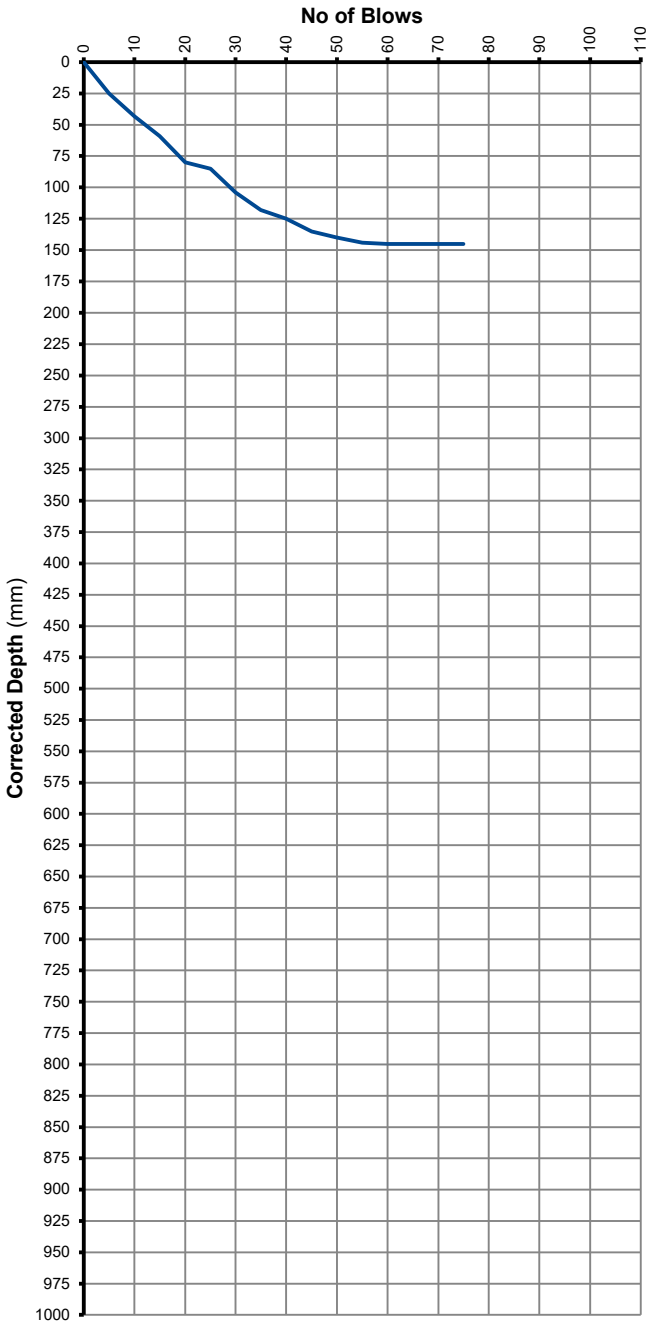
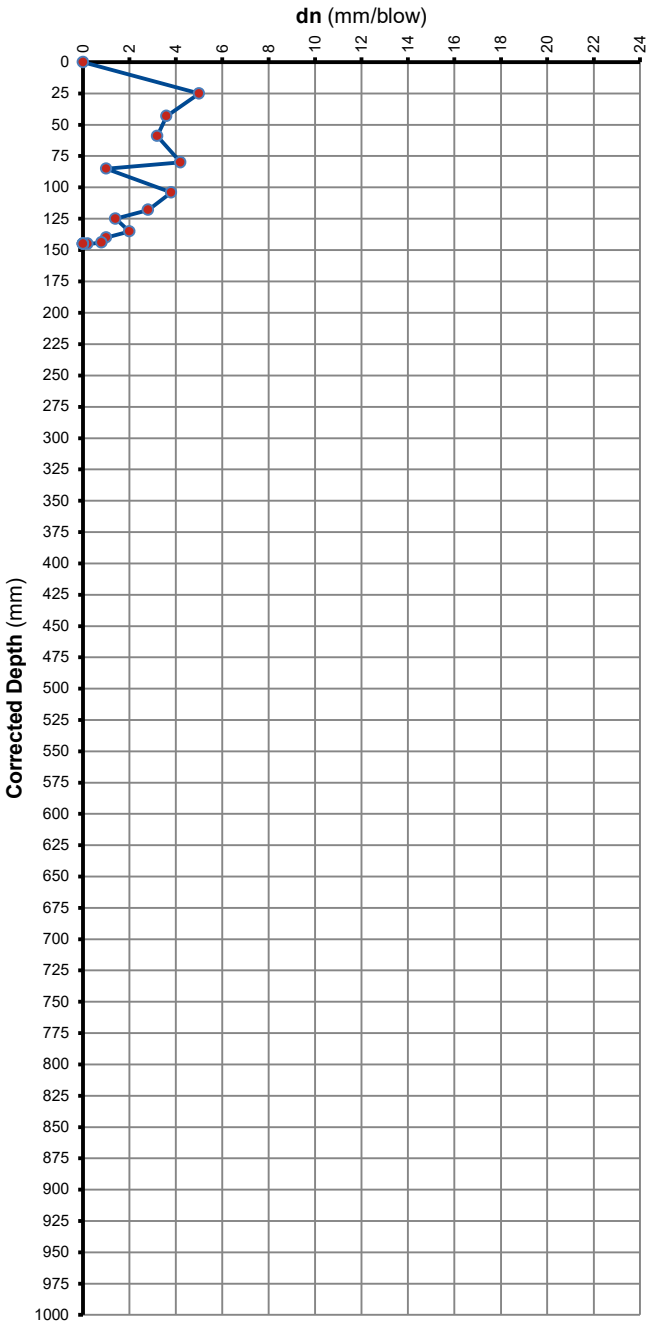
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	2 of 3
POSITION:	DCP 10 - Car 10	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

No of Blows VS Corrected Depth



dn VS Corrected Depth



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DYNAMIC CONE PENETROMETER (DCP) TEST

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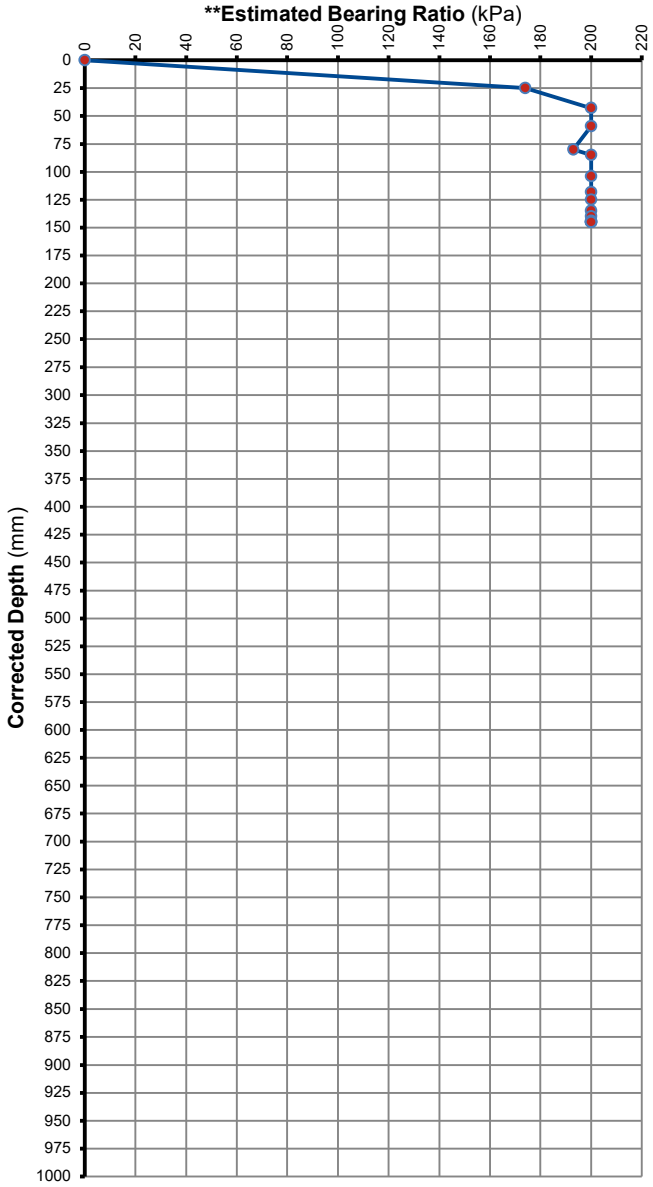
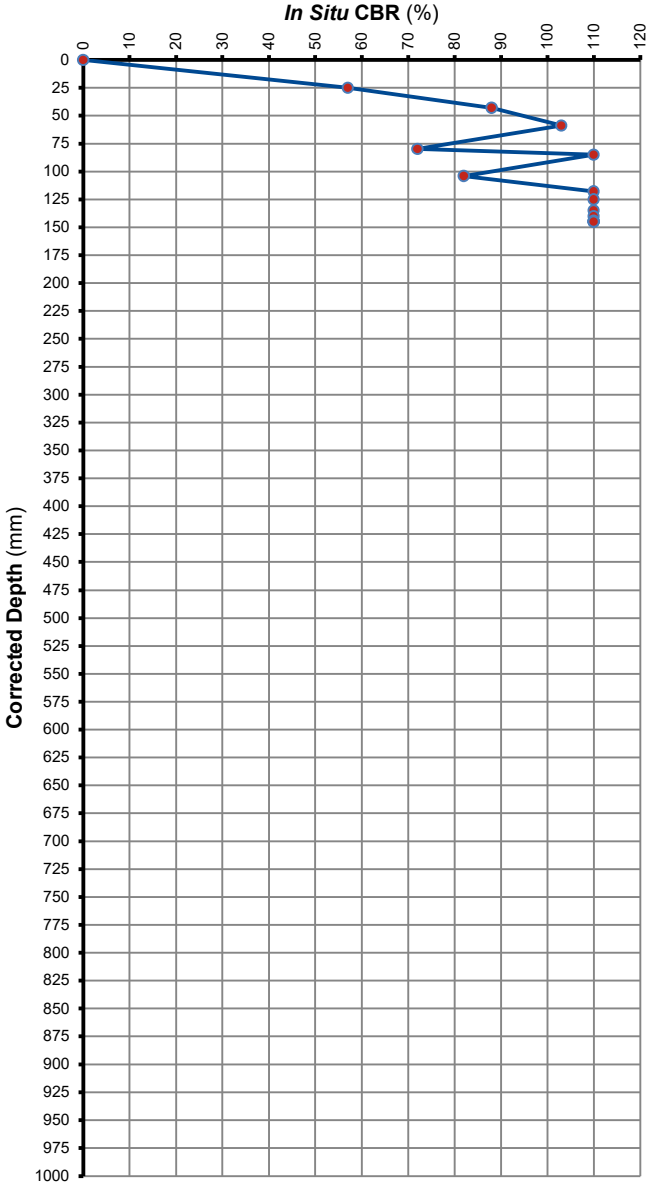
ATTENTION :	Mr. Mark Richter	**DOCUMENT No. :**	023/1057(a)
PROJECT :	23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORII	**NUMBER OF PAGES :**	3 of 3
POSITION:	DCP 10 - Car 10	**DEPTH BELOW NGL :**	0.000 m

DYNAMIC CONE PENETROMETER TEST RESULT SUMMARY (TMH 6: 1984, METHOD ST6)

****Estimated Bearing Ratio VS Corrected Depth**



***In Situ* CBR VS Corrected Depth**



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PW VAN HEERDEN (Technologist)
for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

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APPENDIX C

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE
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sanas Testing Laboratory T0455

REG. No. 1987/004282/07 NLA No. 2012/187
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CLIENT : **GONDWANA GEO SOLUTIONS (PTY) LTD**
13 Rocklands Road
Simonstown
CAPE TOWN
WESTERN CAPE
7675

ATTENTION : Mr. Mark Richter

PROJECT : 23-072 GEOTECHNICAL INVESTIGATION - CARNAVON SCIENCE EXPLORATORIUM

DATE : 16/08/2023
REFERENCE : SL / 3146
DOCUMENT No.: 023/1057(a)
ORDER No.: None
NUMBER OF PAGES : 1 of 6

TEST REPORT

SAMPLE / LABORATORY No. :	Samples 1 - 5: 023/1057 - 023/1061
DATE SAMPLE RECEIVED :	26/07/2023
DATE SAMPLE TESTED :	31/07/2023 - 10/08/2023
TESTING LABORATORY :	Simlab (Pty) Limited (Bloemfontein)
SAMPLE REPORTED BY :	Zanelle Wentzel (Technical Assistant)
DATE SAMPLED :	Not supplied
LOCATION SAMPLED :	25/07/2023
SAMPLE METHOD :	Material sampled by Simlab (Pty) Limited (Bloemfontein)
ENVIRONMENTAL CONDITIONS DURING SAMPLING :	Cold and slight overcast
SAMPLE CONDITION :	Sample in good condition.
CLIENT REFERENCE / MARKINGS :	Car 2, Car 5, Car 7 & Car 9

TEST METHODS :

1.) SANS 3001-GR1 : 2013 - The wet preparation and particle size analysis
2.) *SANS 3001-PR5 : 2011 - The computation of soil-mortar percentages, coarse sand ratio, grading modules and fineness modules
3.) SANS 3001-GR10 : 2013 - The determination of one point liquid, plastic limit, plasticity index and linear shrinkage
4.) SANS 3001-GR20 : 2010 - The determination of the moisture content by oven-drying
5.) SANS 3001-GR30 : 2015 - The determination of the maximum dry density and optimum moisture content
6.) SANS 3001-GR40 : 2013 - The determination of the California bearing ratio
7.) *TMH1 : 1986, Method A6 - The determination of the grain size distribution in soils by means of a hydrometer
8.) *The electrometric determination of the pH value of a soil suspension, TMH1, 1986, Method A20
9.) *The tentative method for the determination of the electrical conductivity of a saturated soil paste and water, TMH1, 1986, Method A21T
10.) *The determination of the potential expansiveness of soil according to Van Der Merwe's method.

REMARKS : * Tests marked "Not SANAS Accredited" in this report are not in the SANAS Schedule of Accreditation for this laboratory.
The Colto Classification is not included in the SANAS Accreditation for this laboratory.

NOTE : Report continues on next page, see attached page 2 of 2

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for : SIMLAB (PTY) LIMITED - GEOTECHNICAL SERVICES

BJ VAN VUUREN (Technologist / CEO)
(Technical Signatory)

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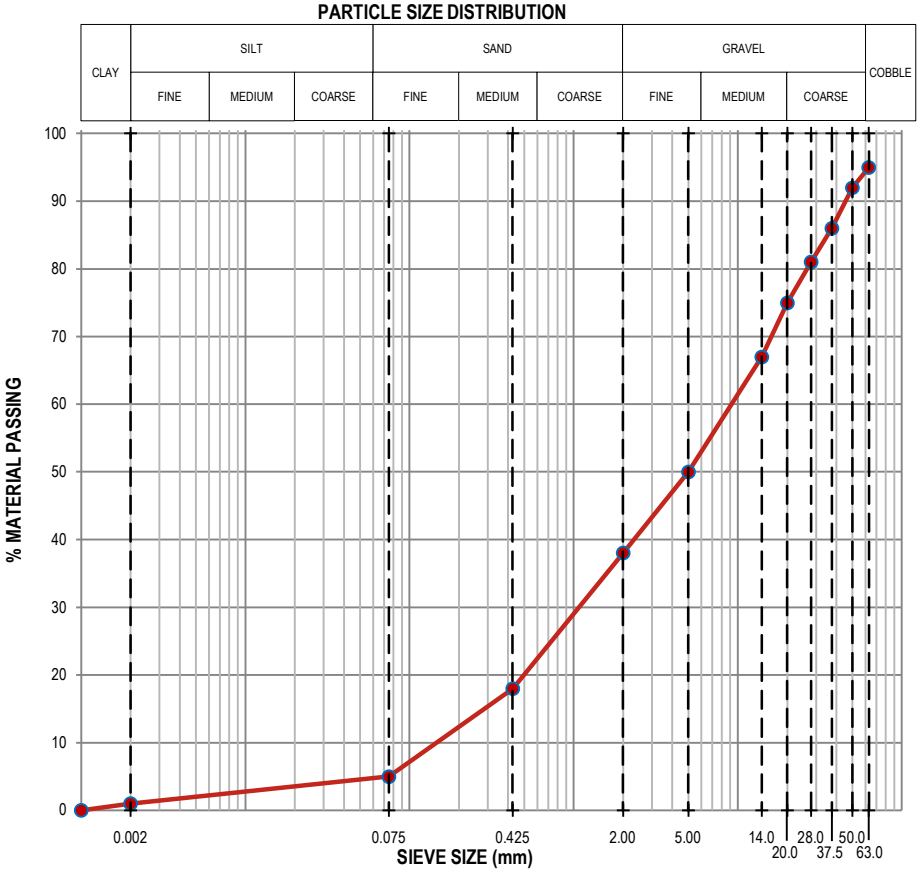
sanas Testing Laboratory T0455

MATERIAL CLASSIFICATION TEST RESULTS

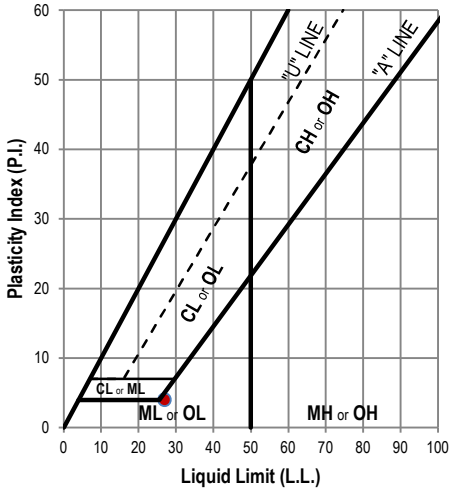
TEST PIT / HOLE No.:	Car 2	MATERIAL DEPTH (mm) :	400 - 700	SAMPLE No / LABORATORY No.:	CA2
MATERIAL DESCRIPTION :	Dry orange grey white dense poorly graded SAND with silt and highly weathered angular dolerite gravel and calcrete sedimentation; Residual/Pedogenic.				

IN SITU MOISTURE CONTENT (GR20) (%)			2.5
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE		% PASSING
		63.0 mm	95
		50.0 mm	92
		37.5 mm	86
		28.0 mm	81
		20.0 mm	75
		14.0 mm	67
		5.00 mm	50
		2.00 mm	38
		0.425 mm	18
		0.075 mm	5
*TMH1: METHOD A6		0.002 mm	1
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)		2.39
	SOIL MORTAR	COARSE SAND	53
		FINE SAND (Course)	9
		FINE SAND (Medium)	10
		FINE SAND (Fine)	15
		SILT AND CLAY (<0.075mm)	14
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011		L.L. (%)	27
		P.I. (%)	4
		L.S. (%)	2.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)		0.3
	C_C (ASTM D2487)		158.6
	% Clay (>0.002mm)		1
	% Silt (0.075 - 0.002mm)		4
	% Sand (0.075 - 2.0mm)		33
	% Gravel (>2.0mm)		62
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)		2244
	OPTIMUM MOISTURE (%)		7.4
	SWELL (%)		0.0
	CBR @ 100%		81
	CBR @ 98%		64
	CBR @ 95%		44
	CBR @ 93%		35
	CBR @ 90%		24
PROCTOR MAX. DRY DENSITY (kg/m³)			2019
*COMPACTIBILITY (Ratio) (SABS 1200 LB)			
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)			
*pH VALUE (TMH1: Method A21)			
*POTENTIAL EXPANSIVENESS			Low - 0.0mm
*AASHTO SOIL CLASSIFICATION			A-1-a (0)
*UNIFIED SOIL CLASSIFICATION			SP-SM
*COLTO CLASSIFICATION			G6

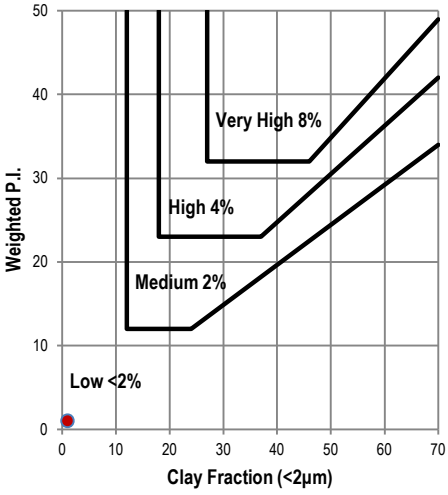
PARTICLE SIZE DISTRIBUTION



PLASTICITY CHART



POTENTIAL EXPANSIVENESS



REMARKS.:

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* The AASHTO Classification, UNIFIED SOIL Classification and COLTO Classification is not included in the SANAS Accreditation for this laboratory.

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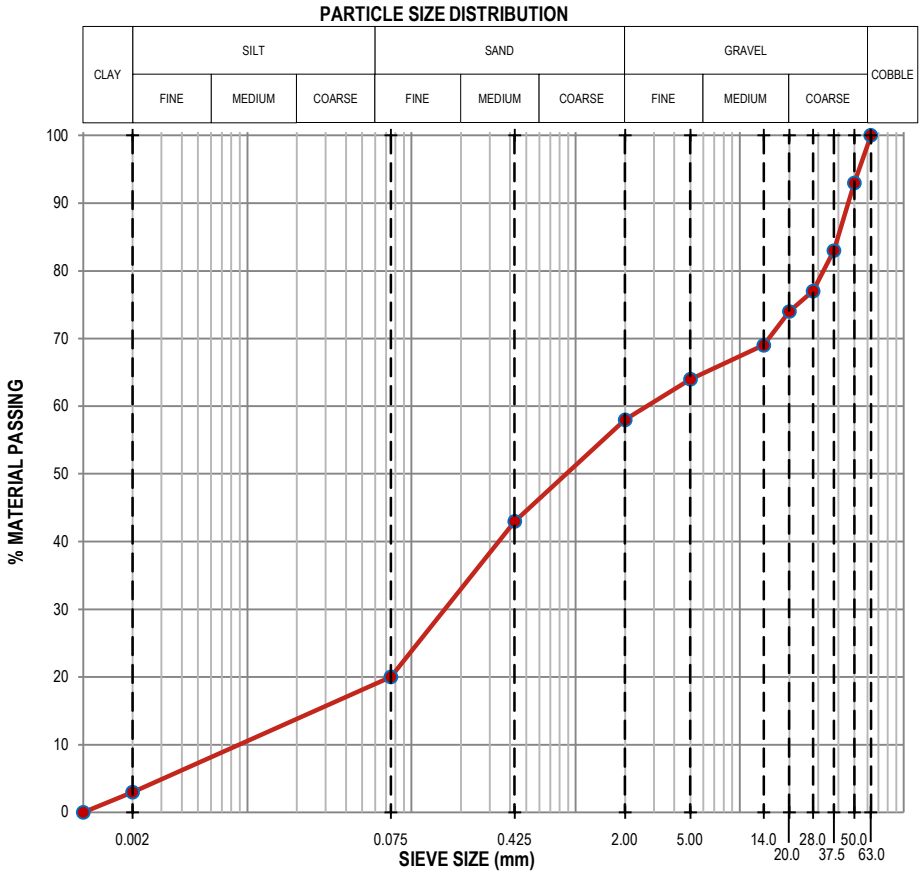
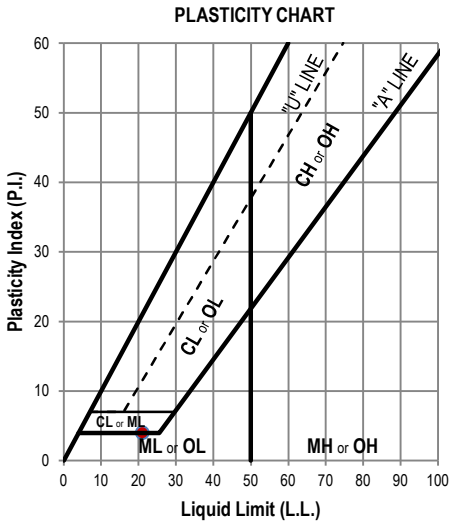
sanas Testing Laboratory T0455

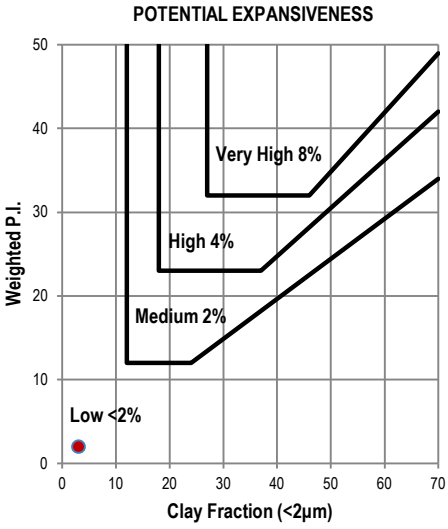
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Car 5	MATERIAL DEPTH (mm) :	0 - 300	SAMPLE No / LABORATORY No.:	CA3
MATERIAL DESCRIPTION :	Dry orange brown loose silty clayey SAND with sub-rounded highly weathered dolerite gravel; Transported.				

IN SITU MOISTURE CONTENT (GR20) (%)		3.3
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	100
	50.0 mm	93
	37.5 mm	83
	28.0 mm	77
	20.0 mm	74
	14.0 mm	69
	5.00 mm	64
	2.00 mm	58
	0.425 mm	43
	0.075 mm	20
*TMH1: METHOD A6	0.002 mm	3
*SANS 3001 PR5: 2011 SOIL MORTAR	GRADING MODULUS (GM)	1.79
	COARSE SAND	25
	FINE SAND (Course)	6
	FINE SAND (Medium)	10
	FINE SAND (Fine)	25
	SILT AND CLAY (<0.075mm)	34
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	21
	P.I. (%)	4
	L.S. (%)	2.5
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	425.1
	C_C (ASTM D2487)	0.7
	% Clay (>0.002mm)	3
	% Silt (0.075 - 0.002mm)	17
	% Sand (0.075 - 2.0mm)	38
	% Gravel (>2.0mm)	42
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	2372
	OPTIMUM MOISTURE (%)	7.4
	SWELL (%)	0.1
	CBR @ 100%	98
	CBR @ 98%	70
	CBR @ 95%	42
	CBR @ 93%	30
	CBR @ 90%	18
PROCTOR MAX. DRY DENSITY (kg/m³)		2134
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
*pH VALUE (TMH1: Method A21)		
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-1-b (0)
*UNIFIED SOIL CLASSIFICATION		SC-SM
*COLTO CLASSIFICATION		G6







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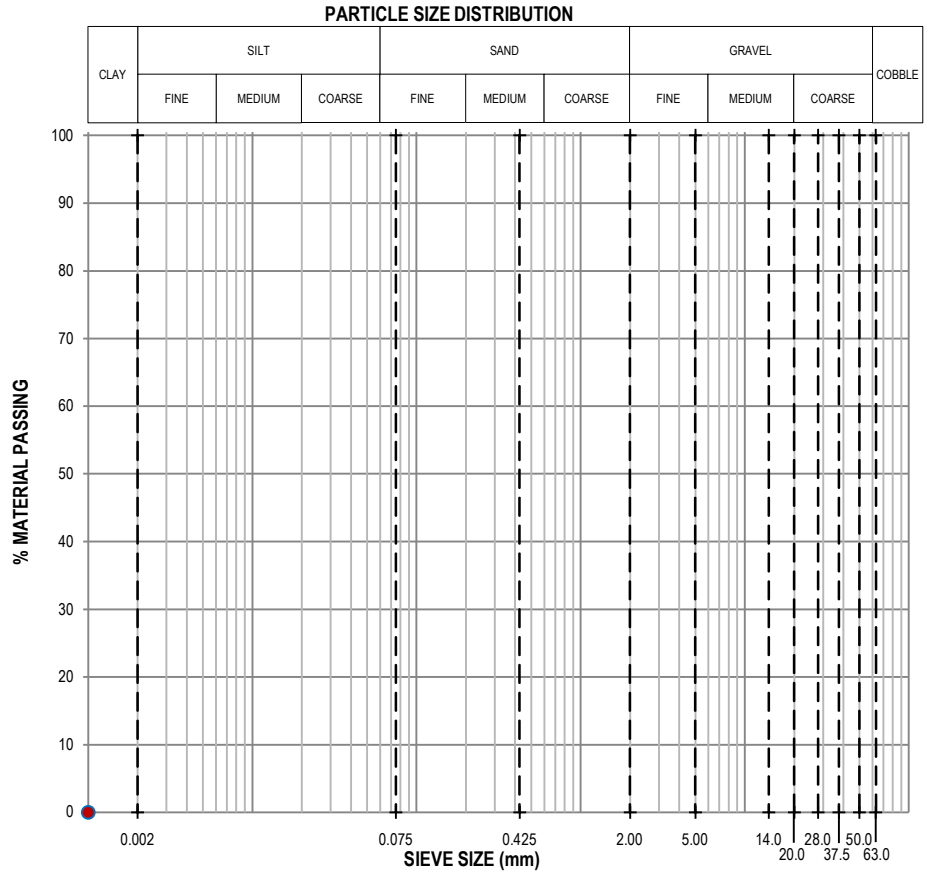
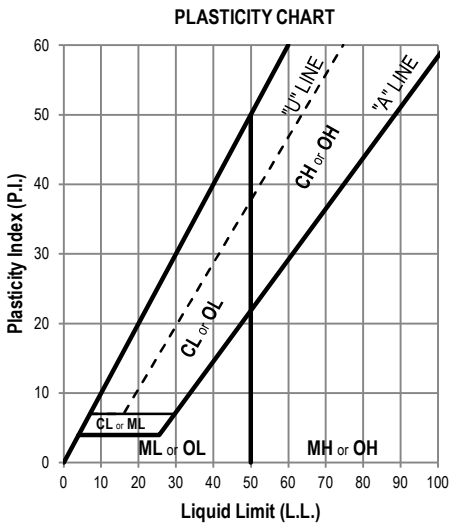
sanas Testing Laboratory T0455

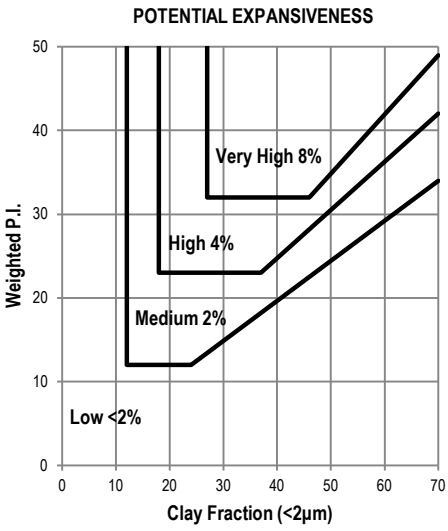
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Car 7	MATERIAL DEPTH (mm) :	0 - 300	SAMPLE No / LABORATORY No.:	CA5
MATERIAL DESCRIPTION :	Dry orange brown loose silty SAND with sub-rounded highly weathered dolerite gravel; Transported.				

IN SITU MOISTURE CONTENT (GR20) (%)		0.0
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	
	50.0 mm	
	37.5 mm	
	28.0 mm	
	20.0 mm	
	14.0 mm	
	5.00 mm	
	2.00 mm	
	0.425 mm	
	0.075 mm	
*TMH1: METHOD A6	0.002 mm	
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	3.00
SOIL MORTAR	COARSE SAND	
	FINE SAND (Course)	
	FINE SAND (Medium)	
	FINE SAND (Fine)	
	SILT AND CLAY (<0.075mm)	
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	
	P.I. (%)	
	L.S. (%)	
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	
	C_C (ASTM D2487)	
	% Clay (>0.002mm)	100
	% Silt (0.075 - 0.002mm)	0
	% Sand (0.075 - 2.0mm)	0
	% Gravel (>2.0mm)	0
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	
	OPTIMUM MOISTURE (%)	
	SWELL (%)	
	CBR @ 100%	
	CBR @ 98%	
	CBR @ 95%	
	CBR @ 93%	
	CBR @ 90%	
PROCTOR MAX. DRY DENSITY (kg/m³)		
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.1024
*pH VALUE (TMH1: Method A21)		7.40
*POTENTIAL EXPANSIVENESS		
*AASHTO SOIL CLASSIFICATION		
*UNIFIED SOIL CLASSIFICATION		
*COLTO CLASSIFICATION		







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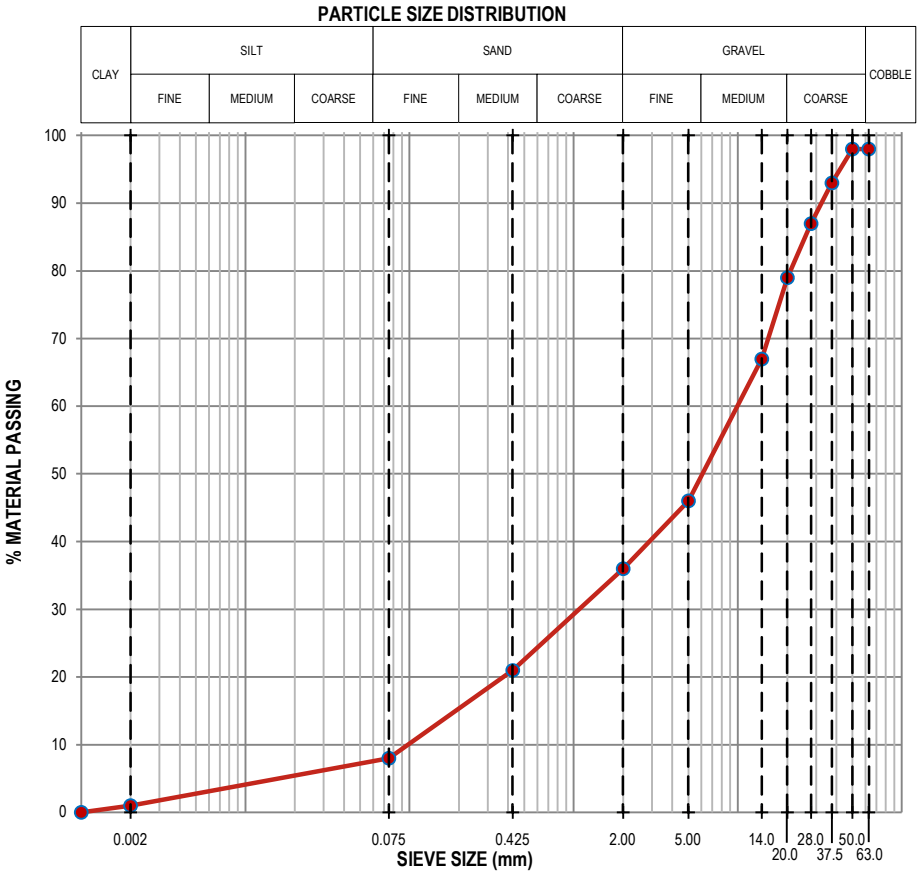
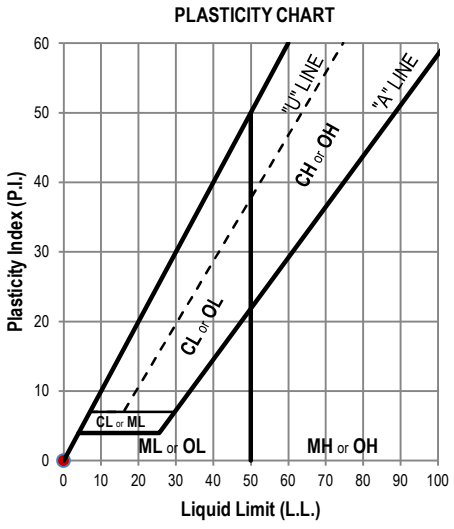
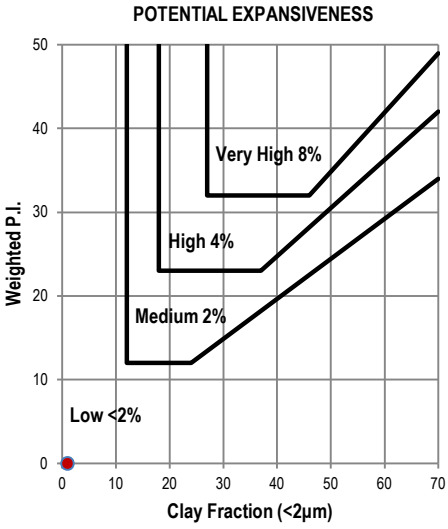
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Car 9	MATERIAL DEPTH (mm) :	200 - 500	SAMPLE No / LABORATORY No.:	CA8
MATERIAL DESCRIPTION :	Dry white dense poorly graded angular calcrete GRAVEL with clay and sand; Pedogenic				

IN SITU MOISTURE CONTENT (GR20) (%)		7.8
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	98
	50.0 mm	98
	37.5 mm	93
	28.0 mm	87
	20.0 mm	79
	14.0 mm	67
	5.00 mm	46
	2.00 mm	36
	0.425 mm	21
	0.075 mm	8
*TMH1: METHOD A6	0.002 mm	1
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.35
SOIL MORTAR	COARSE SAND	41
	FINE SAND (Course)	10
	FINE SAND (Medium)	11
	FINE SAND (Fine)	16
	SILT AND CLAY (<0.075mm)	22
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	-
	P.I. (%)	Non Plastic
	L.S. (%)	0.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	0.3
	C_C (ASTM D2487)	437.6
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	7
	% Sand (0.075 - 2.0mm)	28
	% Gravel (>2.0mm)	64
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	1690
	OPTIMUM MOISTURE (%)	16.3
	SWELL (%)	0.0
	CBR @ 100%	94
	CBR @ 98%	63
	CBR @ 95%	35
	CBR @ 93%	23
	CBR @ 90%	13
PROCTOR MAX. DRY DENSITY (kg/m³)		1521
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		
*pH VALUE (TMH1: Method A21)		
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-1-a (1)
*UNIFIED SOIL CLASSIFICATION		GP-GC
*COLTO CLASSIFICATION		G6







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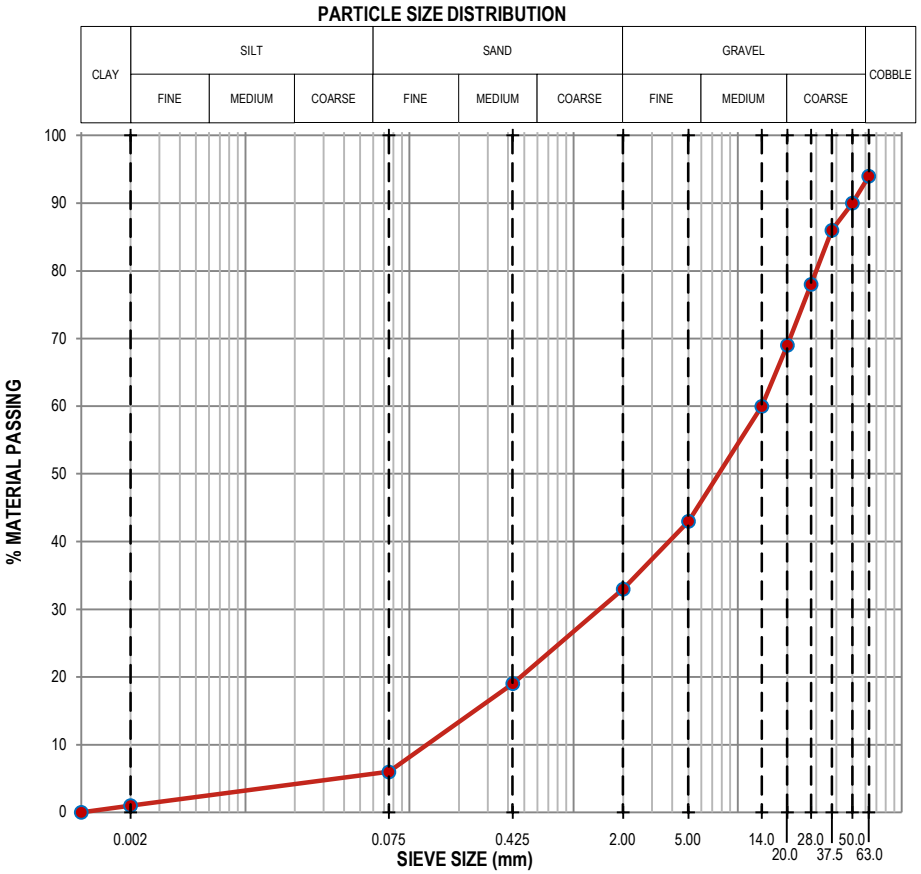
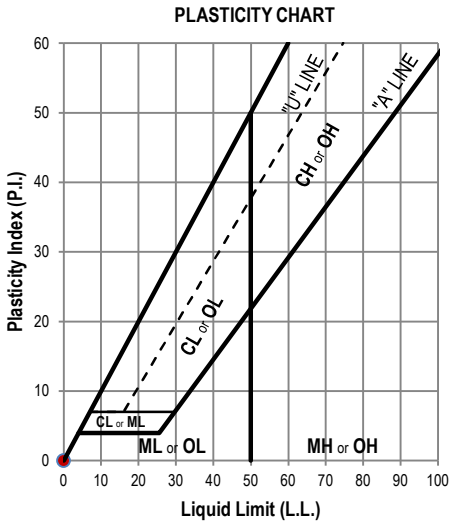
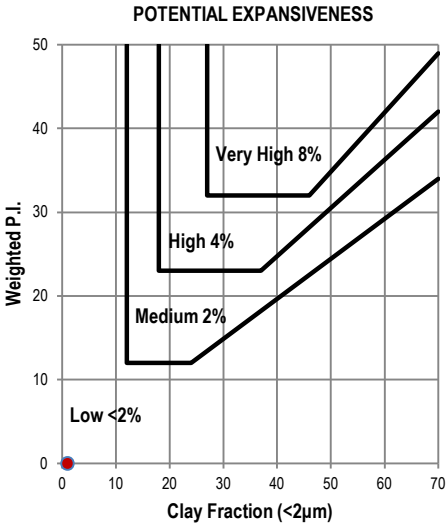
MATERIAL CLASSIFICATION TEST RESULTS

TEST PIT / HOLE No.:	Car 9	MATERIAL DEPTH (mm) :	500 - 800	SAMPLE No / LABORATORY No.:	CA9
MATERIAL DESCRIPTION :	Dry grey white dense well graded higly weathred angular dolerite GRAVEL with sand and calcrete sediment; Residual/Pedogenic.				

IN SITU MOISTURE CONTENT (GR20) (%)		8.2
SIEVE ANALYSIS SANS 3001 - GR1 : 2013	SIEVE SIZE	% PASSING
	63.0 mm	94
	50.0 mm	90
	37.5 mm	86
	28.0 mm	78
	20.0 mm	69
	14.0 mm	60
	5.00 mm	43
	2.00 mm	33
	0.425 mm	19
	0.075 mm	6
*TMH1: METHOD A6	0.002 mm	1
*SANS 3001 PR5: 2011	GRADING MODULUS (GM)	2.42
SOIL MORTAR	COARSE SAND	41
	FINE SAND (Course)	10
	FINE SAND (Medium)	13
	FINE SAND (Fine)	17
	SILT AND CLAY (<0.075mm)	19
ATTERBERG LIMITS MATERIAL PASSING 0.425mm SANS 3001 - GR10: 2011	L.L. (%)	-
	P.I. (%)	Non Plastic
	L.S. (%)	0.0
* MEASURES OF GRADATIONS	C_U (ASTM D2487)	109.4
	C_C (ASTM D2487)	1.1
	% Clay (>0.002mm)	1
	% Silt (0.075 - 0.002mm)	5
	% Sand (0.075 - 2.0mm)	27
	% Gravel (>2.0mm)	67
CBR DETERMINATION SANS 3001 - GR 40: 2013	MAX. DRY DENSITY (kg/m³)	
	OPTIMUM MOISTURE (%)	
	SWELL (%)	
	CBR @ 100%	
	CBR @ 98%	
	CBR @ 95%	
	CBR @ 93%	
	CBR @ 90%	
PROCTOR MAX. DRY DENSITY (kg/m³)		
*COMPACTIBILITY (Ratio) (SABS 1200 LB)		
*CONDUCTIVITY (Sm⁻¹) (TMH1: Method A20)		0.0605
*pH VALUE (TMH1: Method A21)		7.88
*POTENTIAL EXPANSIVENESS		Low - 0.0mm
*AASHTO SOIL CLASSIFICATION		A-1-a (1)
*UNIFIED SOIL CLASSIFICATION		GW-GC
*COLTO CLASSIFICATION		







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