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Draft Geotechnical Investigation Report for Mpharane Senior Secondary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province

For

THE MVULA TRUST
A leading developmental NGO

By

ILZ Consulting

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Draft Geotechnical Investigation Report for Mpharane Senior Secondary School as Part of the Implementation of Sanitation Programme at Various Schools in the Eastern Cape Province

Report
Version – Draft

July 2026

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Author	Sphesihle Mdlalose *Pr.Sci.Nat*	

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1 INTRODUCTION

iLZ Consulting (Pty) Ltd was appointed by The Mvula Trust to undertake geotechnical investigations at various schools for the Implementation of Sanitation Programme at Various schools in Eastern Cape Province (Sanitation 17).

The aim of the investigation was to:

a. To assess the subsoil conditions pertaining to the site and their suitability for the proposed development,

b. To provide foundation recommendation for the proposed development and to comment on the excavatibility of the site,

c. To comment on any other geotechnical aspect of the site.

This report contains results of the geotechnical investigation carried out at **Mpharane Senior Secondary School**, highlighting the following

- General soil/rock profile on-site,
- Groundwater occurrence,
- Excavatibility classification,
- Recommendations for foundations.

Although considered unlikely, should significant variations from the inferred conditions become apparent during construction, the advice of a geotechnical professional must be sought.

2 INFORMATION AVAILABLE

Information made available to or sourced by iLZ at the time of investigation comprised of the following:

- Terms of reference
- Site Development Plan
- GPS Coordinates of the schools
- 1:250 000 Geological Map Sheets

3 SITE LOCATION AND ACCESSIBILITY

Mpharane Senior Secondary School is located in Mpharane, a village approximately 37km west of Matatiele, under the Alfred Nzo District Municipality in the Eastern Cape Province, South Africa. Access is via gravel roads which detours from R56. (see **Figure 3-1).** The school has 3 classroom blocks, an admin block, a kitchen, and 2 existing toilets for leaners and teachers.

The approximate central coordinates are -30.263395°Lat and 28.476520°Long. The coordinates are WGS84.

Topographically, the site is located on a relatively flat terrain.

Figure 3-1: Locality Map relative to Matatiele.

4 FIELD WORK

Geotechnical site investigation was undertaken on the 10th of July 2026 and comprised of the following:

- Siting of 2 trial pits using SDP's of where the proposed structures positions:
  - New ablutions (boys, girls, and staff)
- Test pits were excavated using hand tools and profiled by an Engineering Geologist using SANS 633 guidelines.
- Penetrometer tests (DCP) tests were conducted adjacent to each trial pit

These positions are all marked in **Figure 4-1** below as per the provided SDP.

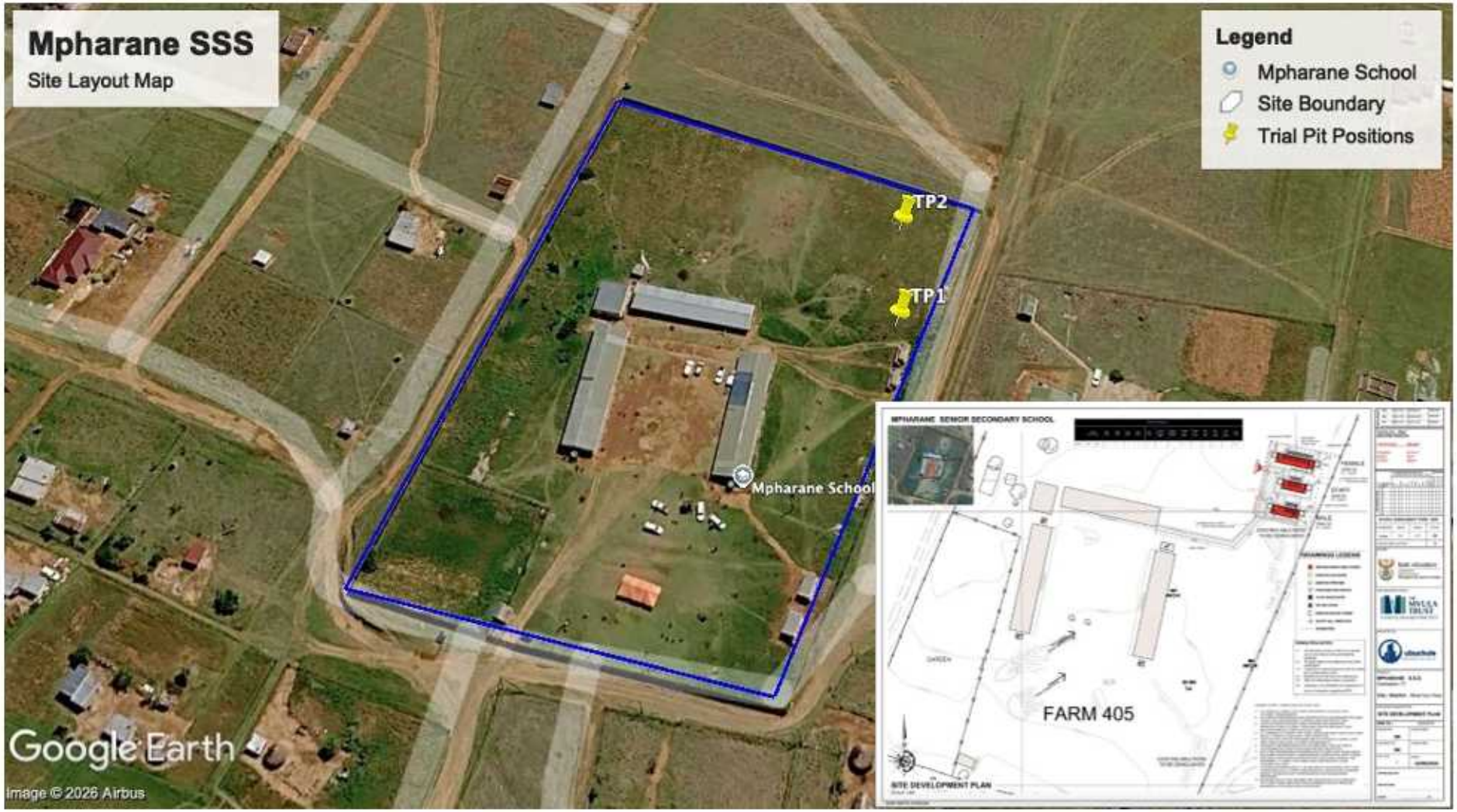

Figure 4-1: Trial pit positions.

4.1 Soil/rock Profiling

Two trial pits, labelled TP1 and TP2, were excavated manually with pick and shovel at locations designated for the proposed new ablutions, i.e. proposed positions as per SDP. The excavation focused on areas planned for boys, girls and staff. The trial pits were all excavated to a maximum refusal depth of 1.10 meters below the existing ground level (mbgl).

The subsoils were profiled by an Engineering Geologist following the SANS 633 guidelines.

4.2 Dynamic Cone Penetrometer (DCP) Test

Two Dynamic Cone Penetrometer tests (DCP), designated DCP1 and DCP2, were conducted adjacent to the test pits. The tests were all advanced to a maximum refusal depth between 0.90m and 1.10m below existing ground level. The tests were done to primarily ascertain excavation classification and to estimate the bearing capacity of the local soils.

5 REGIONAL GEOLOGY

According to **3028 Kokstad** 1:250 000 Geological Map Series, the site is underlain by the Eliiot Formation (Tre) mudstones and sandstones as shown in **Figure 5-1** below.

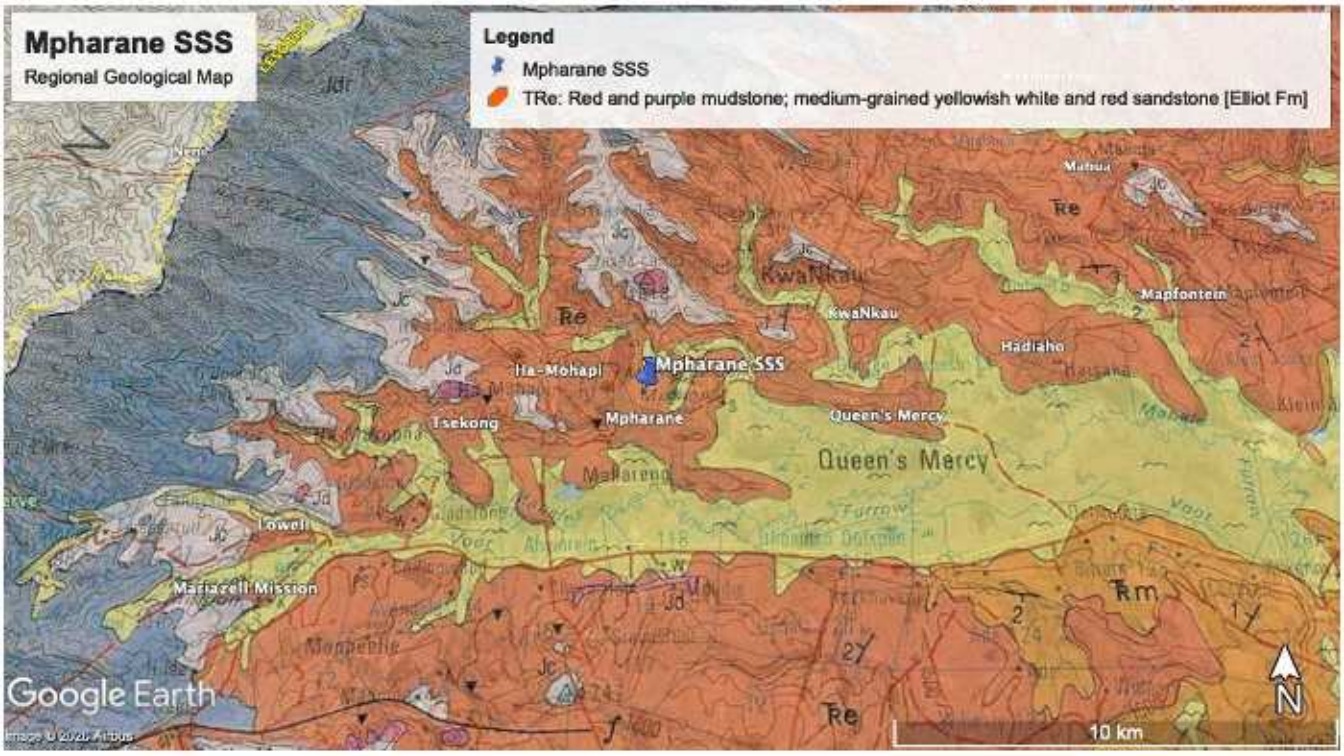

Figure 5-1: Regional geology of the site.

5.1 Local Geology

Field investigations show that the site is underlain by colluvial soils, residual soils and weathered mudstone bedrock in TP1 and TP2.

The detailed logs are attached in **Appendix A** of this report, while a description of each layer is given below.

5.1.1 Colluvium

This horizon was encountered in both pits occurring from surface to 0.20m below existing ground level. It was described as slightly moist, grey, soft, intact, fine to grained, sandy silt with roots.

5.1.2 Residual Mudstone

This horizon forms as a result of complete weathering of the underlying bedrock. It was encountered in both pits overlying the weathered mudstone at depths 0.10 m to 0.80m below existing ground level. It was described as moist, brownish red, speckled light brown, soft to firm, intact, fine to medium grained, clayey sandy silt with mudstone fragments.

5.1.3 Weathered Mudstone (TRe)

This weathered bedrock was encountered throughout the site at depths ranging from 0.75m to 1.10m. It was described as brown, stained brownish red, highly weathered, highly fractured, fine grained, very soft to soft mudstone.

The rock strength is expected to increase with depth.

5.2 Groundwater Occurrence

No groundwater seepage was encountered during the investigation.

However, perched groundwater levels may be encountered at the soil/rock interface during rainy season. If encountered during construction, it will need to be removed from foundations through dewatering.

6 LABORATORY TEST RESULTS

In order to assess more accurately the engineering properties of the various materials encountered on site and their suitability for use for construction of road layers, the following materials classification tests were carried out on selected samples during the investigation:

- Atterberg Limit and Linear Shrinkage Determinations
- Mod AASHTO and California Bearing Ratio
- Hydrometer

The laboratory test results were not yet available at the time of preparation of this draft report. They will be incorporated into the report once they are received from the laboratory.

7 GEOTECHNICAL APPRAISAL

7.1 Bearing Capacity

Dynamic Cone Penetration can assist in determining the estimated allowable safe bearing pressures (EASBP) of the soils. **Appendix B** shows that EASBP below 1.0m (on weathered mudstone) is greater than 243kPa.

7.2 Site Classification

The evaluation of the foundation soils and subsequent classification of the site into foundation classes has been carried along the guidelines as proposed by Watermayer and Tromp (1992) and the Structural Division of the SAICE as prescribed by the NHBRC. Based on the geology and the soil profiles encountered during investigation; the site class for is **R.**

Table 7-1: NHBRC Residential Site Classification

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	< 7,5 7,5 – 15 15 – 30 > 30	50% 50% 50% 50%	H H1 H2 H3
Silty sands, sands, sandy and gravely soils	COMPRESSIBLE AND POTENTIALLY COLLAPSABLE SOILS	<5 5-10 >10	75% 75% 75%	C C1 C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravely soils	COMPRESSIBLE SOILS	<10 10-20 >20	50% 50% 50%	S S1 S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip, Landfill, Marshy areas Mine waste fill, mining subsidence Reclaimed areas, Uncontrolled fill, Very soft silts/silty clays	VARIABLE	VARIABLE		P

7.3 Foundation Recommendations

- Position TP1 and TP2
    - The proposed location is underlain by residual mudstone and weathered mudstone. These residual soils have soft to firm consistencies and the weathered bedrock has very dense consistencies and may be classified as **R** according to NHBRC. Based on the penetrometer tests, the structures should therefore be placed on weathered mudstone using conventional strip footings.

Reinforcement of the foundations will be determined by the Structural Engineer based on the prevailing site conditions.

7.4 Excavatibility

SANS 1200 has been used to assess the excavatibility of the material underlying the site. The SANS 1200 excavation classification are shown in **Table 7-2** below.

Table 7-2: SANS 1200D excavation class descriptions- restricted excavation

Excavation Class	Description
Soft	Excavation in material that can be efficiently removed by a back-acting excavator of flywheel power approximately 0.10 kW per millimetre of tined-bucket width, without the use of pneumatic tools such as paving breakers
Intermediate	Excavation in material that requires a back-acting excavator of flywheel power exceeding 0.10 kW per millimetre of tined-bucket width or the use of pneumatic tools before removal by equipment equivalent to that specified for soft excavation.
Hard	Hard rock excavation shall be excavation in material (excluding boulder excavation) that cannot be efficiently removed without blasting or wedging and splitting.
Boulder (excavation class A)	Excavation in material containing more than 40% by volume of boulders of size in the range of 0.03-20m^3, in a matrix of soft or smaller boulders.

Based on the site investigation i.e. trial pit profile and penetrometer tests, the ease of excavation according to SANS 1200D can be expected as shown in **Table 7-3** below. Furthermore, the excavation classification for 1.5 to 2.5m has been inferred based on the penetrometer tests.

Table 7-3: Excavation classification

Location	Excavation classification	
	0-1.5m	1.5-2.5m
Position TP1	Soft to hard	Hard
Position TP2	Soft to hard	Hard

8 CONCLUSION

This draft report contains the results of a geotechnical investigation carried out for the proposed new ablutions facilities at Mpharane Senior Secondary School.

The site is considered suitable for the proposed development from a geotechnical perspective provided the recommendations given in this report are adhered to.

Finally, the ground conditions described in this report refer specifically to those encountered in the inspection pits and DCP test conducted on site.

It is therefore quite possible that conditions at variance with those discussed above can be encountered elsewhere. It is advised that a competent person be called to advise on the way forward should conditions at variance be encountered.

9 REFERENCES

- SANS 633: Soil profiling and rotary percussion borehole logging on dolomite land in Southern Africa for engineering purposes, 2012.
- 1: 250 000 Scale Geological Map. Sheet **3028 Kokstad**. Published by South African Council for Geoscience.
- Code of Practice _ the Safety of Persons Working in Small Diameter Shafts and Test Pits for Civil Engineering Purposes – Geotechnical Division of SAICE –2003.
- Draft TMH 6. Special Methods. Method ST6. Measurement of the In Situ Strength of Soils by the Dynamic Cone Penetrometer (DCP), (1984).
- SANS 10400-P (2010): The application of the National Building Regulations Part P: Drainage

APPENDIX A: GEOLOGICAL PROFILES

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Mpharane SSS

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: 26_056_Mpharane SSS

Scale 1:10

0.10-0.80m

0.00	Slightly moist, grey, soft, intact, fine to grained, sandy silt with roots. Colluvium.
0.10	Moist, brownish red, speckled light brown, soft to firm, intact, fine to medium grained, clayey sandy silt with mudstone fragments. Residual mudstone.
0.80	Brown, stained brownish red, highly weathered, highly fractured, fine grained, very soft to soft mudstone. Elliot Formation.
1.10	

NOTES

1) Refusal at 1.10m weathered mudstone.
2) No groundwater seepage.
3) No sidewall collapse.
4) MOD-CBR-ind sample at 0.10-0.80m.

CONTRACTOR :
MACHINE : Pick and Shovel
DRILLED BY :
PROFILED BY : A Mdlalose

INCLINATION :
DIAM :
DATE :
DATE : 10/07/2026

ELEVATION :
X-COORD : 28.477238´
Y-COORD : -30.263206´

HOLE No: TP1

TYPE SET BY : A Mdlalose
SETUP FILE : STANDARD.SET

DATE : 13/07/2026 07:32
TEXT : ..SSS\Logs\MpharaneSSS.txt

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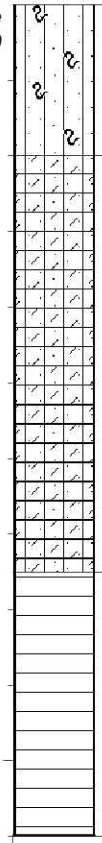
Mvula Trust
Mpharane SSS

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: 26_056_Mpharane SSS

Scale 1:10



0.00 Slightly moist, grey, soft, intact, fine to grained, sandy silt with roots. Colluvium.

0.20 Moist, brownish red, speckled light brown, soft to firm, intact, fine to medium grained, clayey sandy silt with mudstone fragments. Residual mudstone.

0.75 Brown, stained brownish red, highly weathered, highly fractured, fine grained, very soft to soft mudstone. Elliot Formation.

1.10

NOTES

1) Refusal at 1.10m weathered mudstone.
2) No groundwater seepage.
3) No sidewall collapse.

CONTRACTOR :
MACHINE : Pick and Shovel
DRILLED BY :
PROFILED BY : A Mdlalose

INCLINATION :
DIAM :
DATE :
DATE : 10/07/2026

ELEVATION :
X-COORD : 28.477271´
Y-COORD : -30.262903´

HOLE No: TP2

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SETUP FILE : STANDARD.SET

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Mpharane SSS

LEGEND
Sheet 1 of 1

JOB NUMBER: 26_056_Mpharane SSS

	SANDY	{SA05}
	SILT	{SA06}
	CLAYEY	{SA09}
	MUDSTONE	{SA12}
Name ●	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : A Mdlalose
SETUP FILE : STANDARD.SET

DATE : 13/07/2026 07:32
TEXT : ..SSS\Logs\MpharaneSSS.txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX B: PENETROMETER TEST RESULTS

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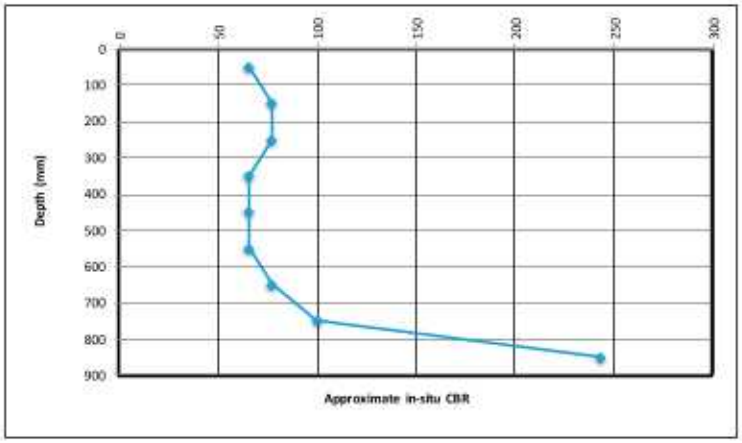
APPROXIMATE INSITU CBR FROM DCP

Project Name **Mpharane SSS**
Date 2026/07/10 **DCP No.** 1
Hammer size 8kg with 20mm point
Applied Factor : 1 times Terzaghi's value

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75 -100	132-210	Very Dense
30 - 75	78-132	Dense
10 - 30	25-78	Med Dense
5 - 10	10 25	Loose
< 5	<10	Very Loose

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

Depth of hole in which DCP was taken : 0 mm below NGL
note: EASBP from Terzaghi & Peck p491 for 25mm settlement

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	4	50	25	5	7	66
2	100	200	150	5	150	20	6	9	77
3	200	300	250	5	250	20	6	9	77
4	300	400	350	4	350	25	5	7	66
5	400	500	450	4	450	25	5	7	66
6	500	600	550	4	550	25	5	7	66
7	600	700	650	5	650	20	6	9	77
8	700	800	750	7	750	14	8	14	100
9	800	900	850	15	850	7	18	39	243

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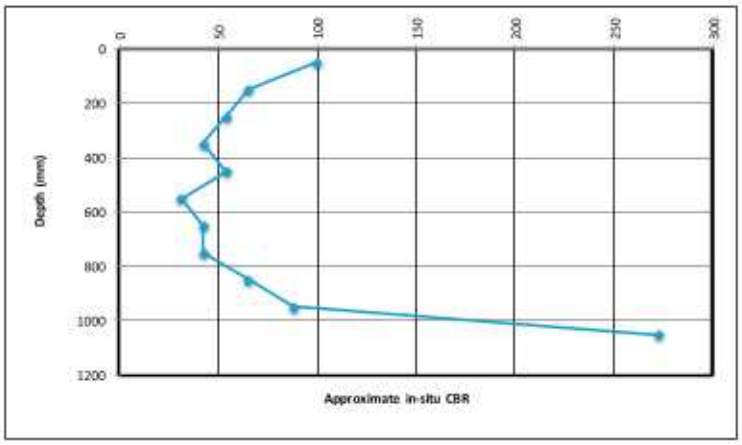
APPROXIMATE INSITU CBR FROM DCP

Project Name **Mpharane SSS**
Date 2026/07/10 **DCP No.** 2
Hammer size 8kg with 20mm point
Applied Factor : 1 times Terzaghi's value

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN



Penetration Guide		
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30 - 75	78-132	Dense
10 - 30	25-78	Med Dense
5 - 10	10 25	Loose
< 5	<10	Very Loose

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

Depth of hole in which DCP was taken : 0 mm below NGL
note: EASBP from Terzaghi & Peck p491 for 25mm settlement

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	7	50	14	8	14	100
2	100	200	150	4	150	25	5	7	66
3	200	300	250	3	250	33	4	5	54
4	300	400	350	2	350	50	2	3	43
5	400	500	450	3	450	33	4	5	54
6	500	600	550	1	550	100	1	0	31
7	600	700	650	2	650	50	2	3	43
8	700	800	750	2	750	50	2	3	43
9	800	900	850	4	850	25	5	7	66
10	900	1000	950	6	950	17	7	12	88
11	1000	1100	1050	17	1050	6	20	46	273