Mandeni Hlomendlini Sports Field Project – Geotechnical Investigation Report

Report Prepared for

Mandeni Local Municipality

MANDENI LOCAL MUNICIPALITY

Report Number 559426

Report Prepared by

srk consulting

March 2021

Mandeni Hlomendlini Sports Field Project – Geotechnical Investigation Report

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March 2021

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Executive Summary

SRK Consulting (South Africa) (Pty) Ltd (SRK) was appointed by Mandeni Local Municipality (the Client) to conduct a geotechnical investigation for the proposed Mandeni Hlomendlini Sports Field Project (the Site) located in Mandeni, KwaZulu-Natal. The Site covers an area of approximately 3.4 hectares and it is envisaged that the project will include the construction of a proposed soccer field, grandstands, ablutions and changerooms, septic tank, soakaway, irrigation system, and a combi court, and then at a later stage, a future proposed track field, practise field, futsal court, and parking area. The intrusive geotechnical investigation comprised the excavation of four test pits, twenty DCP tests, two percolation tests and laboratory testing of samples retrieved from test pits. This investigation was carried out by SRK during January 2021.

The site is underlain by tillite of the Dwyka Group, which forms part of the Karoo Supergroup. In test pits, colluvium, and residual tillite were typically intersected at a depth range from surface to an average depth of 0.3 m and from an average depth of 0.3 m to 1.6 m below existing ground level. Un-engineered fill was observed in one test pit from 0.1 m to 0.4 m. The colluvium classifies as silty sand (SM), the residual soils classify as clayey sand (SC), clayey sand with gravel (SC-SM) and silty clayey gravel (GC-GM). The residual tillite soils classify as G8 in terms of the TRH14 guidelines. Based on the results from the test pits and DCPs, the soils underlying the study area generally has a medium dense consistency, having an E Modulus value ranging from 10 to 30 MPa.

The colluvial and residual soils may be used as bulk fill. Soft excavation in terms of SANS 1200D is likely to be encountered from surface to approximately 1.6 m below existing ground level. Intermediate becoming hard rock excavation is likely to be encountered at depths greater than 1.6 m. The results of two percolation tests undertaken on site, indicate an average application of effluent to subsoil infiltration areas of 35 litres per m^2 can be expected from the underlying subsoil material encountered on site.

The grandstand and ablution facilities should be founded on competent tillite bedrock at depths ranging from 1.0 m to 1.6 m below existing ground level. Where the remaining proposed structures are to be founded on colluvial soils and residual tillite, they are considered Site Class S1/S2 and the foundation design as described above should be adhered to.

Geotechnical constraints affecting, but not limiting development within the study area to any significant degree include areas requiring removal of boulders, moderate compressible nature of the soils overlying the tillite bedrock, low lying areas affected by flooding, low lying areas with a perched water table, areas of intermediate soil erodibility and areas of difficult excavation conditions (bedrock <1.5 m bgl).

This geotechnical report is based on preliminary investigations within the area with minimal representative test locations and the recommendations given are based on information gathered from this. It should be borne in mind that other conditions which were not encountered during this specific investigation may exist. Detailed investigations by an Engineering Geologist or Geotechnical Engineer are recommended during the construction phase of this project, to determine the site specific geotechnical characteristics for foundations and on-site sewerage disposal. Three founding methods are recommended with respect to the most favourable, intermediate and least favourable founding conditions and the most appropriate founding method should be selected, based on the detailed geotechnical investigation.

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Mandeni Local Municipality (the Client). The opinions in this Report are provided in response to a specific request from the Client to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

ha	hectares
DCP	Drop Cone Penetrometer
CBR	California Bearing Ratio
GM	Grading Modulus
LL	Liquid Limit
LS	Linear Shrinkage
MDD	Maximum Dry Density
EC	Electrical Conductivity
NHBRC	National Home Builders Regulation Council
OMC	Optimum Moisture Content
PE	Potential Expansiveness
PI	Plasticity Index
USCS	Unified Soil Classification System
GPS	Global Positioning System
km	kilometres
PGA	Peak Ground Acceleration
m	metres
mm	millimeters
mamsl	metres above mean sea level
SRK	SRK Consulting (South Africa) (Pty) Ltd
SPT	Standard Penetration Test
SANS	South African National Standards

1 Introduction and Scope of Report

SRK Consulting (South Africa) (Pty) Ltd (SRK) was appointed by Mandeni Local Municipality (the Client) in terms of the appointment letter "An Appointment Letter For Design and Project Management of the Hlomendlini Sportsfield in Ward 4" dated 26 February 2020. The appointment is in reference to our prior selection on the Mandeni Municipality Panel of Engineering Consultants Bid No: 11/17/18. As part of the scope of work, SRK has been appointed to undertake specialist studies, which include conducting a geotechnical investigation for the proposed Mandeni Hlomendlini Sports Field Project (the Site) located in Mandeni, KwaZulu-Natal. The site covers an area of approximately 3.4 hectares and it is envisaged that the project will include the construction of a proposed soccer field, grandstands, ablutions and changerooms, septic tank, soakaway, irrigation system, and a combi court. At a later stage a track field, practise field, futsal court, and parking area will be constructed.

SRK undertook a site visit from 19 January 2021 to 20 January 2021, during which intrusive field investigations were conducted and samples retrieved for testing. This interpretive geotechnical report presents factual results of the intrusive investigation with recommendations and conclusions for the proposed site.

2 Scope of Work

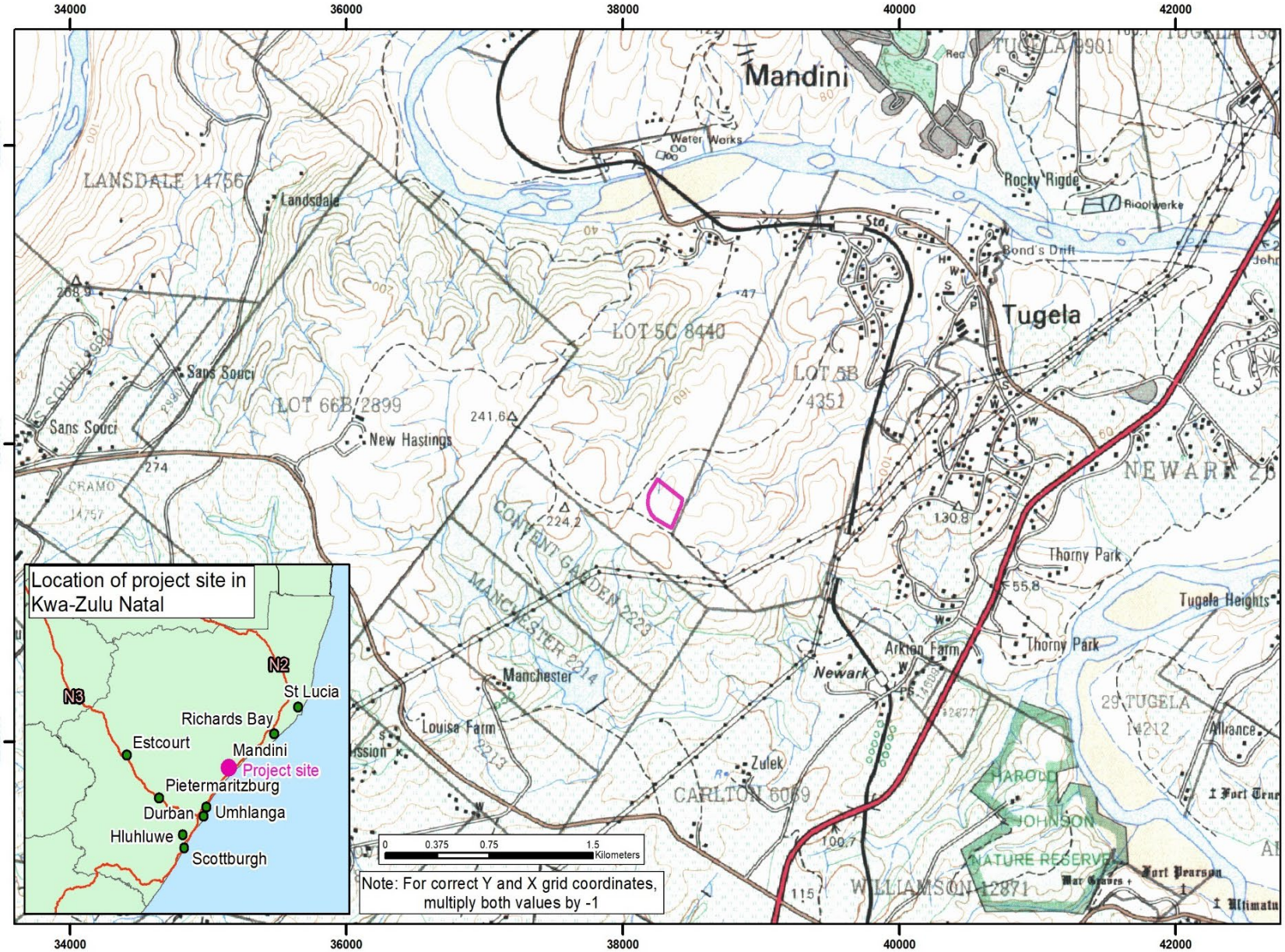
SRK undertook a site visit from 19 January 2021 to 20 January 2021 during which the following work was conducted:

- Four test pits were manually excavated beneath the footprint of the proposed structures to a maximum depth of 1.6 m below existing ground level, or to earlier refusal;
- The ground profiles were recorded in accordance with the Jennings, *et al.* procedure and the SAICE "Guidelines for Soil and Rock Logging in SA (2nd Impression 2002)";
- Test pits were backfilled immediately after ground profiling and sampling;
- Twenty DCP tests were conducted adjacent to the test pits as well as selected positions across the site to a maximum depth of 2.9 m below existing ground level or refusal (assumed to be on boulders and bedrock) in the underlying soil profile;
- Two percolation tests were conducted in selected horizons, in accordance with the NHBRC and SABS 10400P; 2010 guidelines;
- The test pit, DCP and percolation test positions were located using a hand-held GPS;
- Representative disturbed samples were retrieved from the test pits and submitted to the SANAS accredited Soilco Materials Investigations (Pty) Ltd in Pietermaritzburg.

3 Site Description

3.1 Site Description and Topography

The site covers an area of approximately 3.4 ha and it is envisaged that the site will include the construction of a proposed soccer field, grandstands, ablutions and changerooms, septic tank, soakaway, irrigation system, and a combi court, and then at a later stage, a track field, practice field, futsal court, and parking area. The site is located in Mandeni, within the Mandeni Local Municipality, within the KwaZulu-Natal Province. The general locality map showing the outline of the proposed development area on the 1:50 000 scale topographic map and aerial photograph is provided in Figure 3.1 and Figure 3.2 respectively.



Legend

Mandeni sports field project site

Data Source: Topographic map 2931AB	
Scale 1:40 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo 31	
Date: 28/01/2021	Compiled by: BRCH
Project No. 559426	Fig No. 3.1

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MANDENI HLOMENDLINI SPORTS FIELD GEOTECHNICAL INVESTIGATION

LOCALITY PLAN

Path: G:\559426_MANDENI_HLOM_SF_W4_SIMM\8GIS\GISPROJ\MXD\559426_F3-1_MANDENI_HLOM_SF_W4_Locality_A4CL_20210128.mxd

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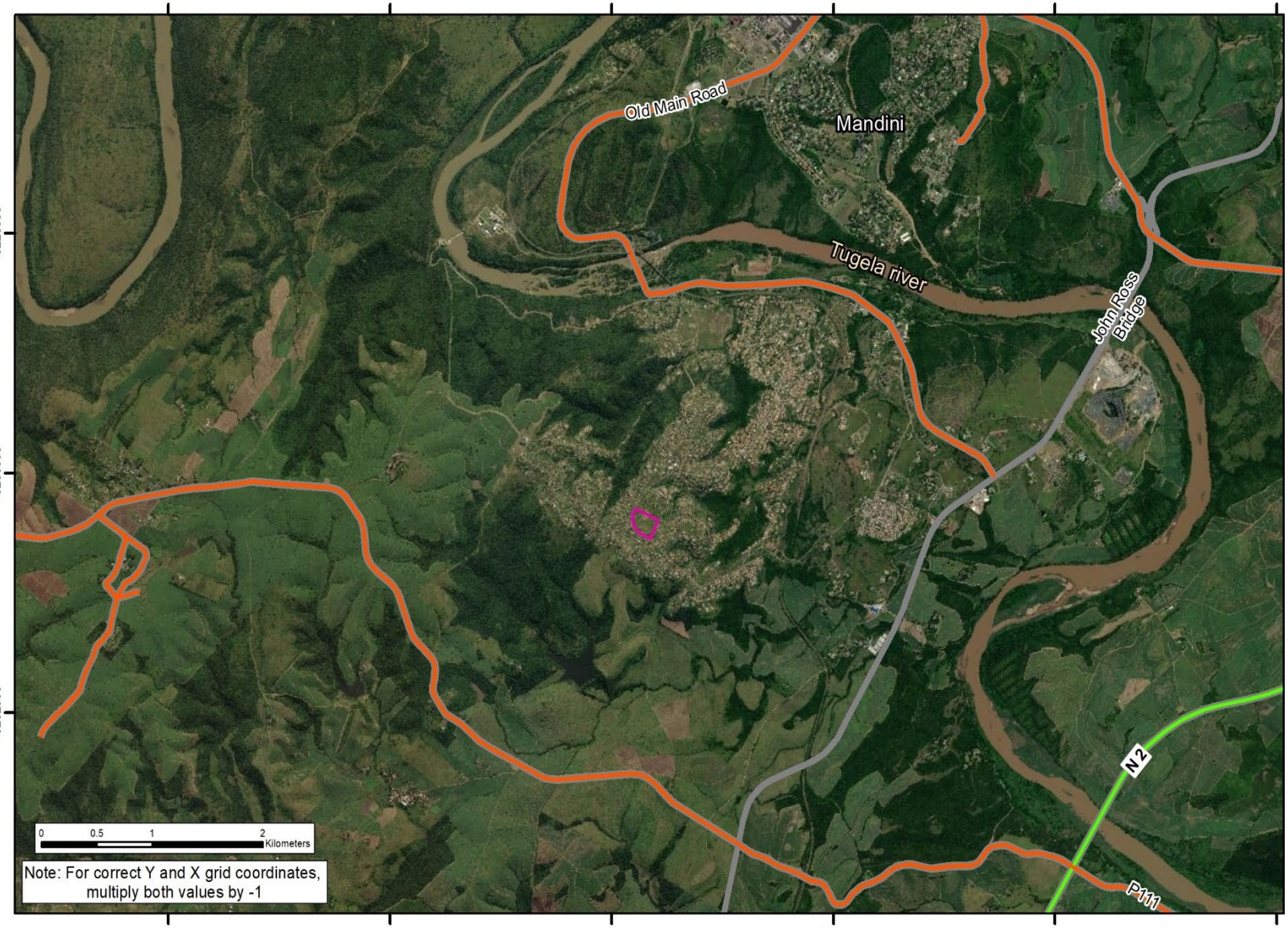

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Legend

Roads

- National freeway
- Arterial route
- Secondary road
- Madeni sports field project site

Data Source: ESRI Basemap Imagery	
Scale 1:50 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo 31	
Date: 28/01/2021	Compiled by: BRCH
Project No. 559426	Fig No. 3.2

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MANDENI HLOMENDLINI SPORTS FIELD GEOTECHNICAL INVESTIGATION

AERIAL PLAN

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Revision: A Date: 03 02 2021

The site is bounded by a secondary road to the north, west and south, whilst an informal settlement is seen to the east of the site. There are a number of informal businesses and settlements surrounding the site, whilst the Hlomendlini Clinic is approximately 440 m to the north of the proposed development.

Moderate topographic variations occur from the south to the north of the site (194 mamsl to 179 mamsl). Gentle topographic variations occur from the east to the west of the site (182 mamsl to 187 mamsl).

Site drainage is in a northerly direction. A perennial stream flows across the site, in a northerly direction, which in turn drains into the Tugela River, which is approximately 2.4 km to the north of the site.

3.2 Climate

The climate of Mandeni can be classified as warm and temperate. The Mandeni area receives an average annual rainfall of 690 mm, the bulk of which occurs during the summer months. The average midday temperatures range from 11˚C in June to 29˚C in January.

Figure 3.3 shows the mean monthly minimum and maximum temperatures as well as the mean monthly average precipitation. It should be noted however, that the values shown are based on 30 years of hourly weather model simulations and the simulated weather data have a spatial resolution of approximately 30km.

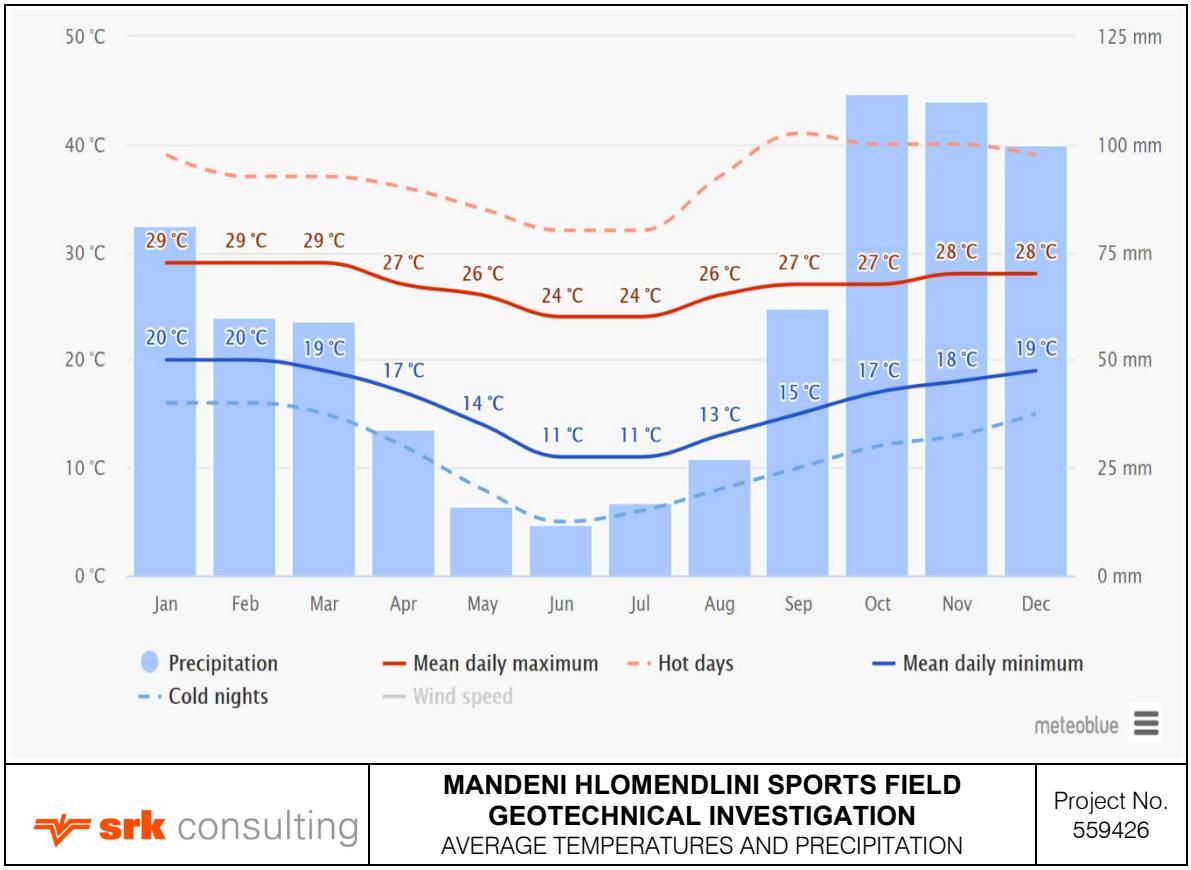


Figure 3.3 Average Temperatures and Precipitation for Mandeni, KwaZulu Natal (www.meteoblue.com)

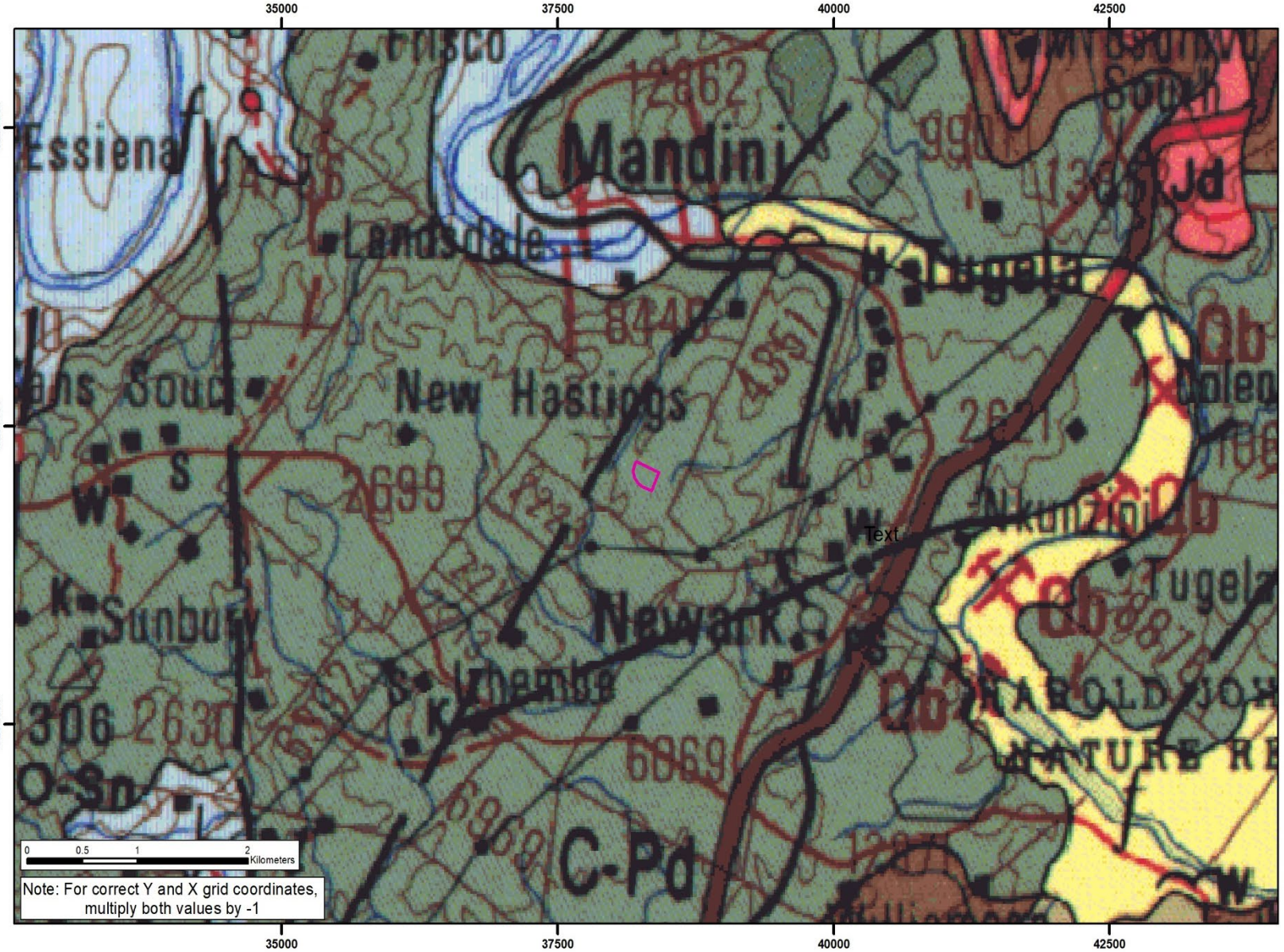
3.3 Geology

Based on the 1: 250 000 scale 2930 Durban Geological Map, the general area has a cover of tillite from the Dwyka Group, which forms part of the Karoo Supergroup. Quaternary-aged alluvium is seen to the north of the site as shown in Figure 3.4.

A variety of lithological facies types have been recognised in the Dwyka Group, which is considered to have been deposited in a marine basin. The Dwyka Group shows distinct lithological differences over the basin, which led to the recognition of a northern and southern facies. The northern valley/inlet facies belong to the Mbizane Formation, and is characterised by rapid thickness changes, a highly variable lithology, and a low massive diamictite and high mudrock content. The southern platform facies constitute the Elandsvlei Formation and is characterised by a progressive increase in thickness towards the south, a fairly uniform lithology, and a high massive diamictite and low mudrock content (Johnson *et al* 2006).

The intrusive Karoo dolerite suite occurs as an interconnected network of dykes, sills and saucer-shaped sheets (Duncan & Marsh, 2006). No intrusions are shown to be present within the proposed development area. Colluvium, un-engineered fill, and residual tillite soils were intersected in test pits. No signs of intrusions were observed in the test pits.

From the excavated test pits at the proposed site, the site is generally underlain by colluvium from the surface to an average depth of 0.3 m below existing ground level. This in turn, is underlain by residual tillite to an average depth of 0.7 m. In test pit, TP3, un-engineered fill material is noted from surface to a depth of 0.4 m. In percolation test pit TP1, un-engineered fill material was noted to depths ranging between 0.3 m to 0.5 m. The detailed test pit ground profiles are included in Appendix A.



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Geology

Qs	Quaternary sand (Alluvium)
Jd	Jurassic aged Dolerite
Pp	Pietermaritzburg formation Shale
C-Pd	Dwyka group Tillite
O-Sn	Natal group Sandstone

Legend

Site Boundary

Data Source: 1:50 000 Geology map	
Scale 1:50 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo 31	
Date: 29/01/2021	Compiled by: BRCH
Project No. 559426	Fig No. 3.4

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MANDENI HLOMENDLINI SPORTS FIELD GEOTECHNICAL INVESTIGATION

GEOLOGICAL PLAN

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Revision: A Date: 02 02 2021

4 Seismicity

The South African seismic hazard map was compiled during a study conducted by the Council for Geoscience to produce probabilistic peak ground acceleration and spectral seismic hazard maps for South Africa. The parametric-historic procedure was used in the estimation of the seismic hazard and the map shows the contoured median values of acceleration with a 10% probability of exceedance in 50 years. The proposed site is located in a low seismic hazard area with a PGA of approximately 0.02 g as shown on Figure 4.1.

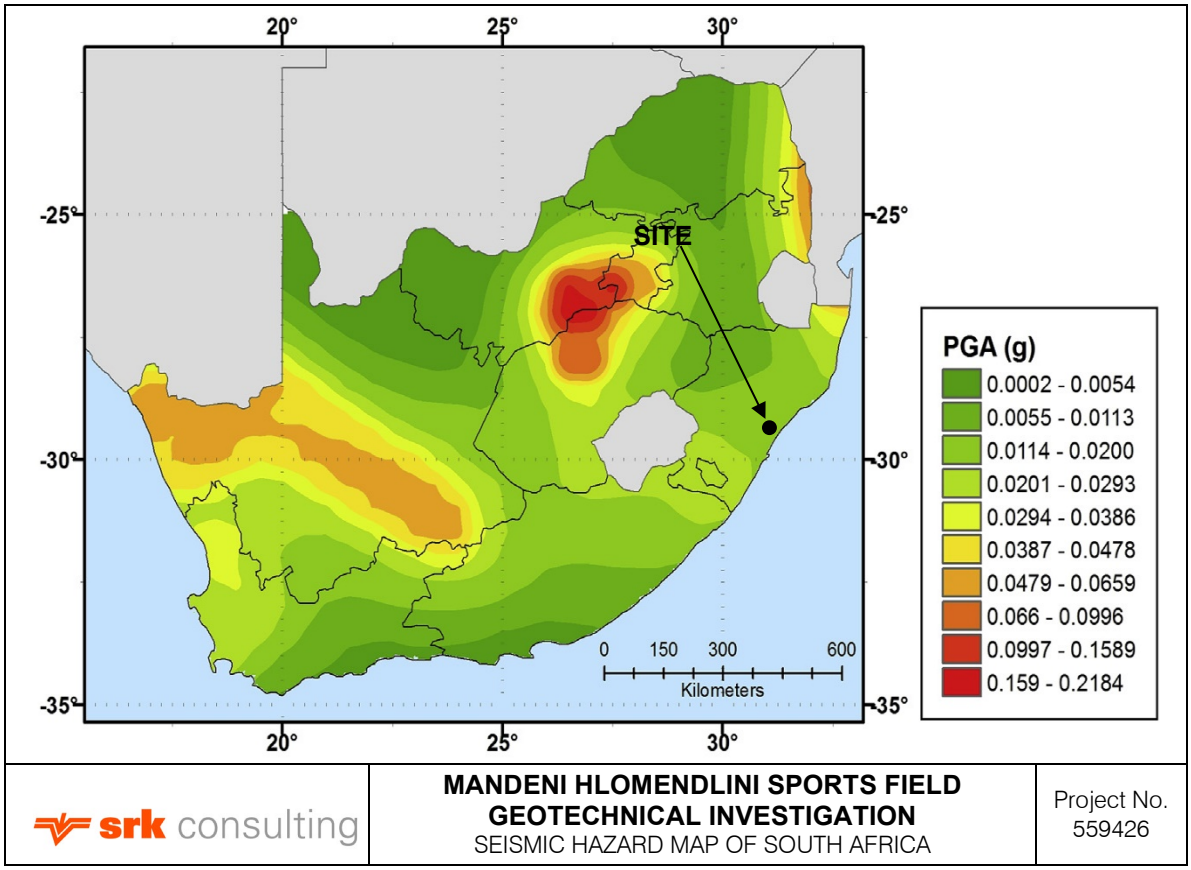


Figure 4.1 Seismic Hazard Map for South Africa (V. Midzi *et al.*, 2020)

5 Fieldwork Results

The results of the field investigation are discussed in the sections below.

5.1 Test Pits

5.1.1 Test Pit Coordinates

The test pit locations are shown in Figure 5-1 and Figure 5-2 and their coordinates are provided in Table 5-1.

Table 5-1: Test Pit Coordinates

Test Pit Reference	UTM Grid	
	X-Coordinate	Y-Coordinate
TP1	343 817.50	6 769 845.00
TP2	343 804.67	6 769 797.09
TP3	343 841.88	6 769 935.91
TP4	343 778.05	6 769 969.75
Exposure	343 797.00	6 769 804.00

5.1.2 Ground Profile Summary

The ground profiles recorded in the test pits excavated across the site are summarised in Table 5-2 and attached as Appendix A. Photographs of the ground profile can be seen in the photographic report attached as Appendix B.

The site is generally underlain by colluvium from the surface to an average depth of 0.3 m below existing ground level. This in turn, is underlain by residual tillite to an average depth of 0.7 m below existing ground level. In test pit, TP3, un-engineered fill material is noted from surface to a depth of 0.4 m below existing ground level. In percolation test pit TP1, un-engineered fill material was noted to depths ranging between 0.3 m to 0.5 m below existing ground level. The subsequent subsections describe the soil horizons profiled across the site.

5.1.2.1 Un-Engineered Fill

Silty Sand

The silty fine sand was described in two of the test pits. In test pit, TP3, un-engineered fill material is noted from surface to a depth of 0.4 m below existing ground level. The horizon was profiled as slightly moist, dark brown, loose, intact, silty fine sand. In percolation test pit TP1, un-engineered fill material was noted to depths ranging between 0.3 m to 0.5 m below existing ground level. The horizon was profiled as slightly moist, dark brown, loose, intact, silty fine sand with pieces of cobble sized asphalt.

5.1.2.2 Colluvium

Silty Sand

The silty fine sand was described in five of the test pits. This horizon is typically from the surface to an average depth of 0.2 m below existing ground level. The horizon was profiled as dry to slightly moist, light orange/grey brown and dark brown, loose, intact, silty fine to medium sand with minor fine to coarse sub-angular gravel and rootlets.

5.1.2.3 Residual Tillite

Clayey Sand and Silty Clayey Sand

The clayey sand was described in test pits TP1, TP2 and TP4. This horizon was encountered at depths ranging from 0.3 m to 0.8 m below existing ground level and was profiled as slightly moist to moist, brown to yellow brown mottled orange brown, medium dense, intact, moderately clayey fine sand with minor fine to coarse sub-angular gravel and trace sub-angular cobbles.

The silty clayey fine sand was described in percolation test pit TP01 and percolation test TP02. This horizon was seen on average from 0.5 m to 1.0 m below existing ground level and was profiled as slightly moist to moist, dark brown to yellow brown mottled orange brown, loose to medium dense, intact, silty clayey fine sand with minor fine to coarse sub-angular gravel and trace sub-angular cobbles.

Silty Clayey Gravel

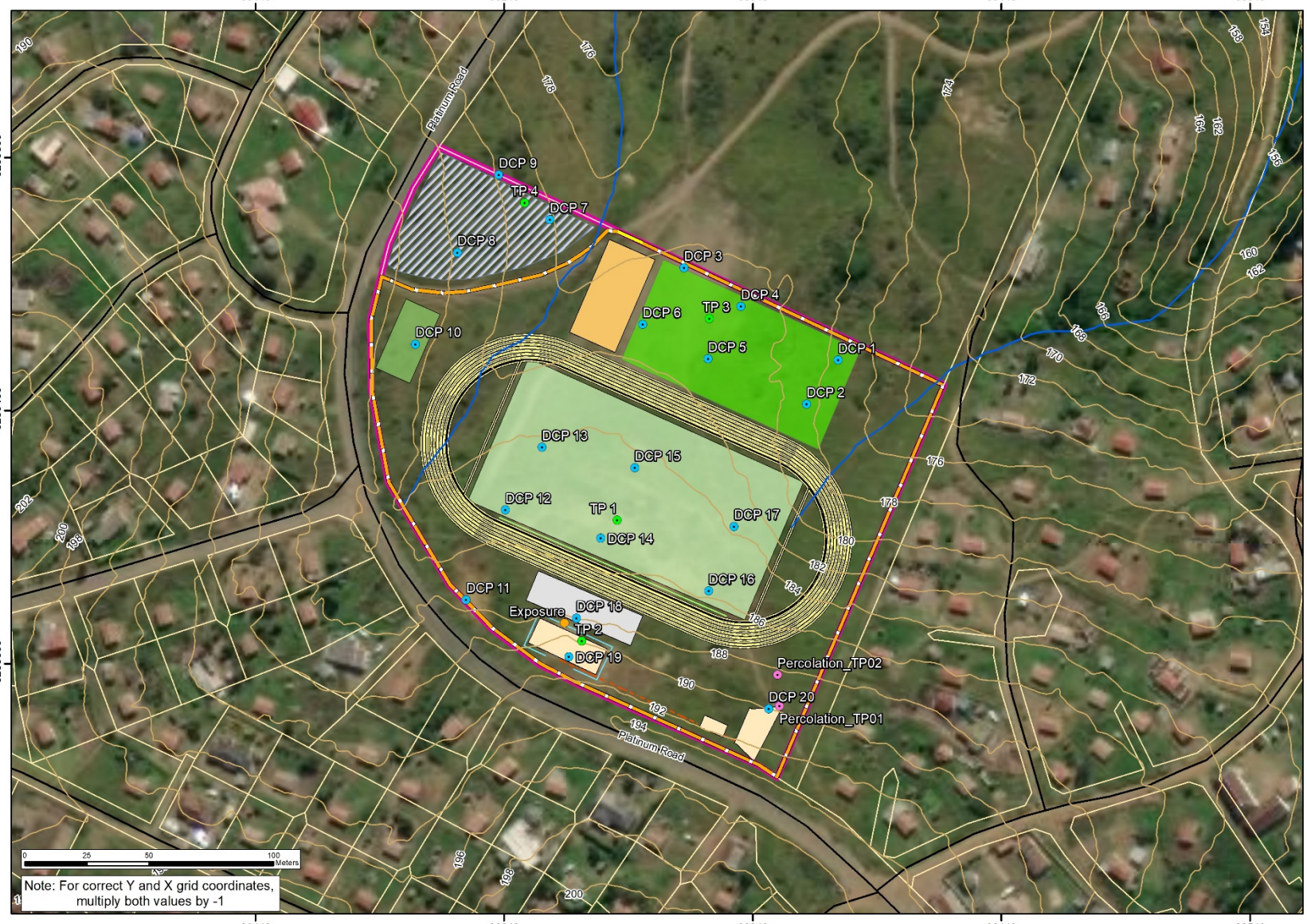
The silty clayey gravel was described in TP3. This horizon was seen from 0.4 m to 1.3 m below existing ground level and was profiled as slightly moist to moist, orange brown mottled dark yellow brown, medium dense to dense, intact, silty clayey fine gravel with trace sub-angular cobbles.

Silty Clay

The silty clay was described in TP3. This horizon was seen from 1.3 m to 1.6 m below existing ground level and was profiled as slightly moist to moist, orange brown mottled dark brown to black, stiff, intact, silty clay.

5.1.2.4 Tillite

Refusal was encountered in all test pits on orange brown to yellow brown, fine grained to medium grained, medium weathered to highly weathered, very soft to medium hard tillite at depths ranging from 0.5 m to 1.6 m below existing ground level (Most suitable founding material).



N

Legend

Test Points

- DCP
- PTP
- TP
- Exposure
- Contours (2m)
- Road Network
- Rivers
- Sewer Line
- Potable Water
- Proposed Irrigation System
- Entrance
- Fence
- Future Proposed Track Field
- Cadastral
- Future Proposed Parking Area
- Proposed Soccer Field
- Future Proposed Practice Field
- Future Proposed Futsal Court
- Proposed Stands
- Proposed Changerooms and Ablutions
- Proposed Septic Tank
- Proposed Soakaway
- Future Combi Court
- Study Area

Data Source: ESRI Basemap Imagery	
Scale: 1:1 500	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo 31	
Date: 02/02/2021	Compiled by: BRCH
Project No: 559426	Fig No: 5.1

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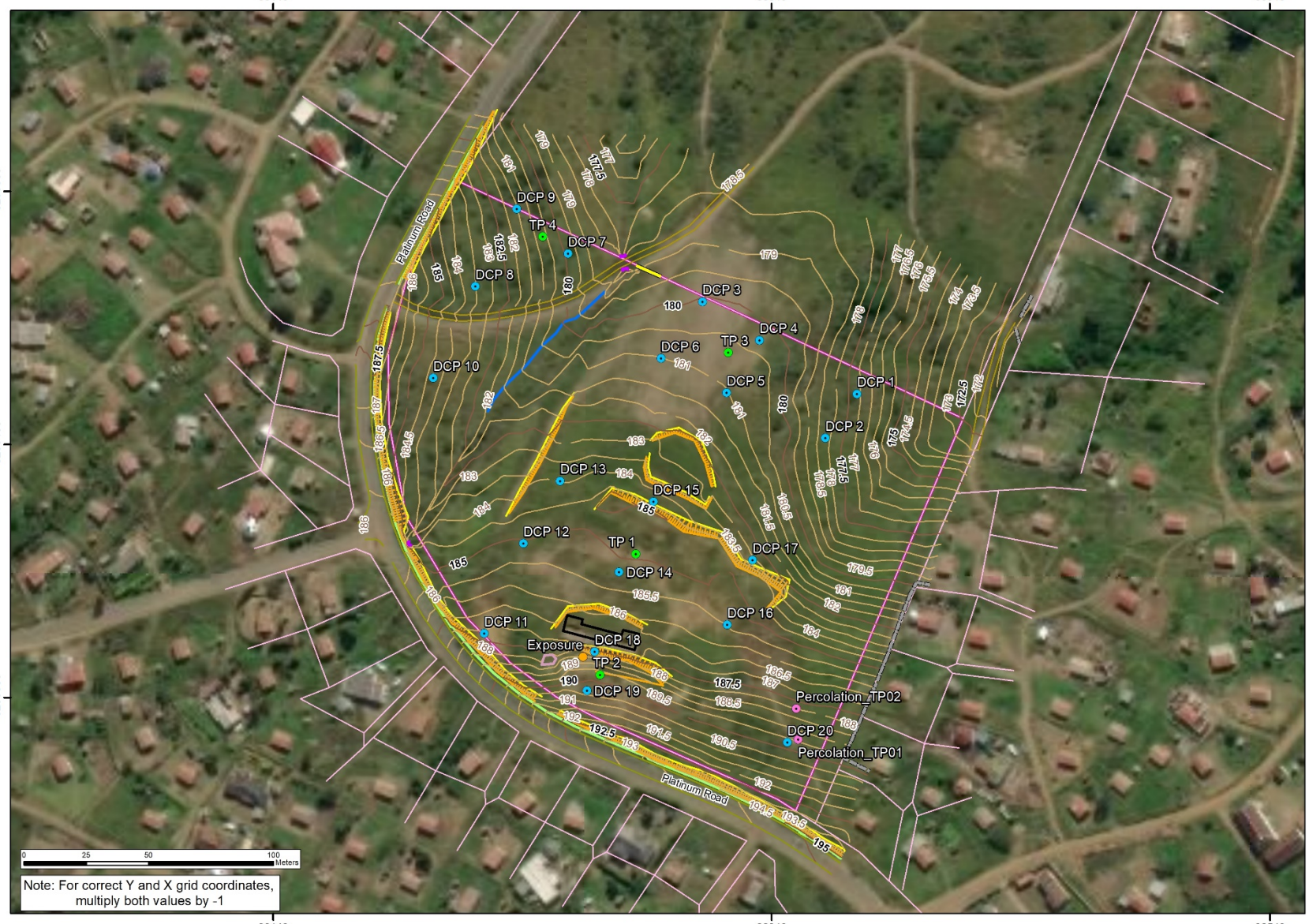
MANDENI HLOMENDLINI SPORTS FIELD GEOTECHNICAL INVESTIGATION

SITE PLAN SHOWING TEST PIT/AUGER HOLE POSITIONS, DCP POSITIONS, EXPOSURES AND PERCOLATION TEST POSITIONS

Path: G:\559426_MANDENI_HLOM_SF_W4_SIMM\8GIS\GISPROJ\MXD\559426_F5-1_MANDENI_HLOM_SF_W4_SitePlan_A3CL_20210202.mxd

Revision: A Date: 02 02 2021



Legend

Test Points

- DCP
- PTP
- TP
- Exposure
- Entrance
- B Kerb
- Concrete
- Fence
- Building
- Wall
- G Contour
- Major Contour
- Bot Bank
- Top Bank
- Track
- Walkway
- Cadastral
- Study Area

Data Source: ESRI Basemap Imagery

Scale: 1:1 500

Projection: TM | Datum: HH94

Central Meridian/Zone: Lo 31

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MANDENI HLOMENDLINI SPORTS FIELD GEOTECHNICAL INVESTIGATION

GEOTECHNICAL SITE PLAN SHOWING TEST PIT/AUGER HOLE POSITIONS, DCP POSITIONS, EXPOSURES AND PERCOLATION TEST POSITIONS

Date:	Compiled by:
03/02/2021	BRCH
Project No: 559426	Fig No: 5.2

Path: G:\559426_MANDENI_HLOM_SF_W4_SIMM\8GIS\GISPROJ\MXD\559426_F5-2_MANDENI_HLOM_SF_W4_GeotechSitePlan_A3CL_20210129.mxd

Revision: A Date: 03 02 2021

Test pit ref.	Depth to top of strata in metres (thickness in brackets)											Final Depth (m)
	Colluvium		Un-engineered Fill		Residual Tillite						Tillite	
	Silty SAND		Silty SAND with Asphalt		Clayey/Silty SAND		Silty/Clayey GRAVEL		Silty CLAY			
TP1	0.0	(0.1)	-	-	0.1	(0.6)	-	-	-	-	+0.7	0.7
TP2	0.0	(0.1)	-	-	0.1	(0.4)	-	-	-	-	+0.5	0.5
TP3	-	-	0.0	(0.4)	-	-	0.4	(0.9)	1.3	(0.3)	+1.6	1.6
TP4	0.0	(0.5)	-	-	0.5	(0.3)	-	-	-	-	+0.8	0.8
Percolation TP1	0.0	(0.3)	0.3	(0.2)	0.5	(0.5)	-	-	-	-	+1.0	1.0
Percolation TP2	0.0	(0.2)	-	-	0.2	(0.8)	-	-			+1.0	1.0
Exposure	-	-	-	-	-	-	-	-	-	-	+0.6	0.6
Min.	0.0	(0.1)	0.0	(0.4)	0.1	(0.3)	0.4	(0.9)	1.3	(0.3)	- -	0.5
Max.	0.0	(0.5)	0.3	(0.2)	0.5	(0.8)	0.4	(0.9)	1.3	(0.3)	- -	1.6
Ave.	0.0	(0.2)	0.2	(0.3)	0.3	(0.5)	0.4	(0.9)	1.3	(0.3)	- -	0.9

5.2 Groundwater

A perennial stream flows across the site, in a northerly direction, which in turn drains into the Tugela River, located approximately 2.4 km to the north of the site. It is plausible that a perched/shallow aquifer underlies the site, particularly during the summer/rainy season. It should, however, be noted that no groundwater seepage was encountered in any of the test pits during the investigation.

5.3 Percolation Test Results

Two percolation tests were performed in the vicinity of the proposed septic tank and proposed soakaway area and down-gradient thereof, towards the west of the site, in accordance with the NHBRC and SABS 10400P 2010 Standards. The percolation tests were carried out to confirm the suitability of the subsoils to accommodate on-site sewerage effluent disposal. The rate at which water moves into the surrounding soil both vertically and horizontally was measured.

Percolation test pit TP01 and percolation test pit TP02 were tested in silty clayey sand. After 30 minutes, the water level lowered by 15 mm and 90 mm respectively. By projecting these readings, it would take approximately 50 minutes and 8 minutes to achieve a 25 mm drop in water in the specified horizons of percolation test pit TP01 and percolation test pit TP02 respectively. If an average was taken for these two test pits, it would take approximately 29 minutes to achieve a 25 mm drop in water.

As per the NHCRC building regulations (Part 2, Section 9, Table 1), the percolation rate for percolation test pit TP01 do not allow a rate of application of effluent to subsoil infiltration areas given that the percolation rate is over 30 minutes. The percolation rate for percolation test pit TP02 allows a rate of application of effluent to subsoil infiltration areas of approximately 90 litres per m^2. If an average is used for both percolation tests, the percolation rate allows a rate of application of effluent to subsoil infiltration areas of approximately 35 litres per m^2.

5.4 Dynamic Cone Penetrometer Test Results

Twenty DCP tests were conducted adjacent to test pit positions as well as selected positions across the site to a maximum depth of 2.9 m below existing ground level or refusal. Refusal was accepted where blow counts per 100 mm exceeded 30 blows. This would be equivalent to a Standard Penetration Test (SPT) N_{field} value of ±30, which can be classed as a stiff/dense soil. The results of the DCP testing conducted indicates that the consistency of the northern portion of the study area (the future proposed practise field, the future proposed futsal court and the future proposed parking area) and in the areas in the vicinity of TP3 and TP4, is firm/medium dense for the profile tested. To the east of the study area (the proposed future combi court), the consistency is generally firm/medium dense for the profile tested. To the south of the study area (the proposed soccer field, the proposed grandstands, and the proposed changerooms and ablutions) and in the areas in the vicinity of TP1 and TP2, is generally firm/medium dense becoming stiff/dense with depth. Very stiff/very dense soils are encountered in the vicinity of DCP12 at a depth of 1.8 m below existing ground level. A summary of the DCP results with equivalent SPT N_{field} values and related consistencies are presented in Table 5-3 and Appendix C.

Table 5-3 SPT-N_{field} Value and consistency correlations based on DCP test results.

Depth Below Surface (mm)	DCP1		DCP2		DCP3		DCP4		DCP5	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	14	firm/medium dense	8	loose/soft	16	firm/medium dense	21	firm/medium dense	34	stiff/dense
600	28	firm/medium dense	7	loose/soft	39	stiff/dense	41	stiff/dense	42	stiff/dense
900	-	-	5	loose/soft	-	-	-	-	-	-
1200	-	-	5	loose/soft	-	-	-	-	-	-
1500	-	-	-	-	-	-	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-
2100	-	-	-	-	-	-	-	-	-	-
2400	-	-	-	-	-	-	-	-	-	-
2700	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-
Depth Below Surface (mm)	**DCP6**		**DCP7**		**DCP8**		**DCP9**		**DCP10**	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	14	firm/medium dense	15	firm/medium dense	13	firm/medium dense	10	loose/soft	8	loose/soft
600	8	loose/soft	36	stiff/dense	30	firm/medium dense	21	firm/medium dense	13	firm/medium dense
900	34	stiff/dense	-	-	-	-	11	firm/medium dense	19	firm/medium dense
1200	-	-	-	-	-	-	29	firm/medium dense	20	firm/medium dense
1500	-	-	-	-	-	-	-	-	14	firm/medium dense
1800	-	-	-	-	-	-	-	-	11	loose/soft
2100	-	-	-	-	-	-	-	-	42	stiff/dense
2400	-	-	-	-	-	-	-	-	-	-
2700	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-

Depth Below Surface (mm)	DCP11		DCP12		DCP13		DCP14		DCP15	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	38	stiff/dense	19	firm/medium dense	17	firm/medium dense	8	loose/soft	14	firm/medium dense
600	-	-	20	firm/medium dense	18	firm/medium dense	-	-	14	firm/medium dense
900	-	-	28	firm/medium dense	38	stiff/dense	-	-	18	firm/medium dense
1200	-	-	36	stiff/dense	-	-	-	-	12	firm/medium dense
1500	-	-	47	stiff/dense	-	-	-	-	-	-
1800	-	-	54	very stiff/very dense	-	-	-	-	-	-
2100	-	-	-	-	-	-	-	-	-	-
2400	-	-	-	-	-	-	-	-	-	-
2700	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-

Depth Below Surface (mm)	DCP16		DCP17		DCP18		DCP19		DCP20	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	8	loose/soft	14	firm/medium dense	12	firm/medium dense	17	firm/medium dense	9	loose/soft
600	7	loose/soft	25	firm/medium dense	9	loose/soft	45	stiff/dense	33	stiff/dense
900	2	loose/soft	16	firm/medium dense	11	loose/soft	45	stiff/dense	16	firm/medium dense
1200	25	firm/medium dense	34	stiff/dense	-	-	-	-	-	-
1500	-	-	-	-	-	-	-	-	-	-
1800	-	-	-	-	-	-	-	-	-	-
2100	-	-	-	-	-	-	-	-	-	-
2400	-	-	-	-	-	-	-	-	-	-
2700	-	-	-	-	-	-	-	-	-	-
3000	-	-	-	-	-	-	-	-	-	-

6 Laboratory Test Results

Samples retrieved from the study area were submitted to Soilco Materials Investigations (Pty) Ltd in Pietermaritzburg for testing. The following laboratory tests were conducted on representative samples retrieved from test pits:

- Sieve analysis.
- Atterberg limits.
- Natural moisture content.
- Specific gravity.
- Modified AASHTO compaction tests (moisture condition/density relationship) with measurement of California Bearing Ratio (CBR).
- pH and conductivity of soil.

6.1 Ground Classification Testing

The ground classification testing results from the colluvium and residual soils obtained within the study area are presented in Table 6-1. The detailed laboratory results sheets are included in Appendix D. Note that the results of the gradings of the various samples tested are provided in Table 6-1 in terms of the TMH1 A1, A5 and MT1 classification systems. As a result, there are some differences between the field descriptions in Section 5 and the USCS classification descriptions in this section (classified in accordance to ASTM D2487), due to the particle sizes for sands defined differently by the two classifications methods. The sample results have also been classified and provided in terms of the USCS. The results of both classification systems are discussed in this section and carried through into the geotechnical evaluation and recommendation in Sections 7 and 8.

6.1.1 Colluvium

According to the USCS, the colluvium sample classified as silty SAND (SM). The grading results for the colluvium sample consist of 14% gravel, 67% sand, 15% silt and 4% clay. The grading modulus (GM) is 1.87, whilst the moisture content (MC) is 7.3%. The Liquid Limit (LL) is measured as 0%, the Plasticity Index (PI) is measured as slightly plastic (SP), the linear shrinkage (LS) is measured as 1%, and the equivalent PI is measured as 0%. Potential Expansiveness (PE) is low for these soils.

6.1.2 Residual Tillite

The residual soils have a gravel content ranging from 13% to 42% (average 27%), sand content ranging from 40% to 56% (average 48%), silt content from 10% to 26% (average 15%) and clay content ranging from 5% to 15% (average of 10%). The GM and MC range from 1.12 to 2.10 (average 1.74) and 8.1% to 12.2% (average 10.1%) respectively. The PI, LL and LS range from 4% to 12% (average 8%), 20% to 30% (average 25%) and 1.5% to 5.5% (average 3.6%) respectively. The PE is low for these residual soils.

6.2 Compaction Testing

Modified AASHTO compaction testing with CBR determinations was conducted on the silty clayey gravel (residual tillite) for test pit TP3. The results are provided in Table 6-2 and the detailed results are included in Appendix D. The soils tested with a low CBR value. The residual tillite soils classify as G8 in terms of the TRH14 guidelines.

6.3 Soil Chemical Testing

Chemical testing was conducted on the clayey sand material from TP1. Soilco Materials Investigations (Pty) Ltd undertook this testing. The results of this test indicated that the pH of the soil is 7.42 and the electrical conductivity is 0.18 m/S. The detailed results are included in Appendix D.

Table 6-1 Soil Classification Test Results

						1TMH1 A1, A5 and MT1										
						>2.0 mm	0.06 - 2.0 mm	0.002 - 0.06 mm	< 0.002 mm							
TP Ref.	**Depth (m)**	**Short field description**	**NMC**	**GM**	**SG**	**Gravel %**	**Sand %**	**Silt %**	**Clay %**	**LL**	**PI**	**LS**	**Overall PI**	**PE**	**USCS**	**USCS Description**
TP1	0.1 - 0.7	Clayey Sand; Residual Tillite	10.3	1.12	-	13	46	26	15	27	10	4.5	7	Low	SC	Clayey Sand
TP2	0.1 - 0.5	Clayey Sand; Residual Tillite	12.2	1.74	-	26	49	14	11	30	12	5.5	5.5	Low	SC	Clayey Sand
TP3	0.4 - 1.3	Silty Clayey Gravel; Residual Tillite	8.1	1.99	2.687	42	40	10	8	22	4	1.5	1.50	Low	GC-GM	Silty, clayey Gravel
TP4	0.0 - 0.5	Silty Sand; Colluvium	7.3	1.87	-	14	67	15	4	0	SP	1.0	0	Low	SM	Silty Sand
PT2	0.6 - 1.0	Silty Clayey Sand; Residual Tillite	9.9	2.10	-	28	56	11	5	20	6	3.0	1.8	Low	SC - SM	Silty, clayey sand with gravel

NMC – Natural Moisture Content GM - Grading Modulus SG – Specific Gravity LL – Liquid Limit LS – Linear Shrinkage PI – Plasticity Index
PE - Potential Expansiveness USCS – Unified Soils Classification System

Table 6-2 Summary of Compaction Test Results

TP Ref.	Depth (m)	USCS	OMC (%)	MOD AASHTO (TMH1 A7) MDD (kg/m³)	% Swell	CBR % (Modified AASHTO) TMH1 A8					TRH 14 Classification
						100%	98%	95%	93%	90%	
TP3	0.4 -1.3	GC-GM	9.8	2092	0.02	45	30	16	10	6	G8

USCS – Unified Soils Classification System OMC – Optimal Moisture Content MDD – Maximum Dry Density CBR – California Bearing Ratio

7 Geotechnical Evaluation

7.1 General Ground Profile

From the excavated test pits, the area is generally underlain by colluvium material from surface to an average depth of 0.3 m below existing ground level. This in turn, is underlain by residual tillite to an average depth of 0.7 m below existing ground level. In test pit, TP3, un-engineered fill material is noted from surface to a depth of 0.4 m below existing ground level. In percolation test pit TP1, un-engineered fill material was noted between 0.3 m to 0.5 m below existing ground level

The colluvium is classified as a silty sand (SM) in accordance with the USCS classification as seen for TP4. The residual tillite is classified as a clayey sand (SC) in accordance with the USCS classification for test pits TP1 and TP2, the residual tillite is classified as a silty, clayey sand with gravel (SC-SM) in accordance with the USCS classification in the vicinity of the percolation test PT2. The residual tillite near TP3 is classified as a silty clayey gravel (GC-GM) in accordance with the USCS classification.

The colluvium material had a loose consistency. The residual tillite had a medium dense to dense consistency. The underlying tillite is generally described as very soft to medium hard rock.

7.2 Soils Consistency

The Technical Recommendations for Highways, TRH10 (1994) document was used to relate the equivalent SPT N_{field} to E modulus values as shown in Table 7-1.

Table 7-1: Consistency descriptions for granular soils as a function of SPT N and E Modulus values (TRH10)

Description	SPT N	Modulus E (MPa)
Very loose	4	4
Loose	4-10	4-10
Medium dense	10-30	10-30
Dense	30-50	30-40
Very dense	>50	>40

Based on the results from the test pits and DCPs, the soils underlying the practice field has a medium dense becoming dense consistency with having an E Modulus value ranging from 10 to 40 MPa with depth. The soils underlying the parking area has a medium dense consistency with having an E Modulus value ranging from 10 to 30 MPa. The soils underlying the combi court has a medium dense consistency with having an E Modulus value ranging from 10 to 30 MPa. The soils underlying the soccer field has a medium dense consistency with having an E Modulus value ranging from 10 to 30 MPa. The soils underlying the grandstands and changerooms has a medium dense consistency with having an E Modulus value ranging from 10 to 30 MPa. The soils underlying the septic tank and soakaway area has a loose becoming medium dense consistency with having an E Modulus value ranging from 4 to 30 MPa.

7.3 Founding Conditions

The founding conditions for the proposed Mandeni Hlomendlini Sports Field typically comprises moderately to highly compressible soils which extend to depths ranging approximately from 0.3 m to 1.6 m below existing ground level.

7.3.1 NHBRC Foundation Recommendations

The portions of the study area identified as potential areas for development, have been evaluated in terms of the foundation class system guidelines recommended by the National Home Builders Registration Council (NHBRC). These guidelines are summarised in Appendix E at the back of this report.

The proposed grandstand and ablution facilities should be founded on competent tillite bedrock at depths ranging from 0.5 m to 1.6 m below existing ground level.

Where the remaining proposed structures are founded within the colluvial and residual tillite subsoils, **Site Class S1/S2** with expected differential settlements of 10 mm to 20 mm is anticipated and the following founding design are recommended:

Site Class S1

- Modified normal
- Compaction of in-situ soils below individual footings
- Deep strip foundations
- Soil raft
- Good site drainage

Site Class S2

- Stiffened strip footings, stiffened or cellular raft
- Deep strip foundations
- Compaction of in-situ soils below individual footings
- Piled or pier foundations
- Soil raft
- Good site drainage

7.3.2 Foundation Design

Based on the results of these investigations and NHBRC site class recommendations, a foundation method most suited to the on-site soil conditions will be recommended by the site engineer. Where consideration is given to the cost and ease of construction, the following foundation types may be considered in terms of most favourable and intermediate founding conditions. Details of these foundations are provided in Appendix E.

- **Foundation Type 1 (Site Class S1)**
  - Favourable founding Conditions
  - Settlement< 25mm
- **Foundation Type 2 (Site Class S2)**
  - Moderate founding conditions
  - Settlement 25 mm to 50 mm

During the construction phase particular attention must be given by the project team and in particular the building contractors, to the compaction of fill and the zone directly below the foundations. This must include the assessment of the suitability of material for fill and the control of the compaction process.

7.3.3 General Foundations Discussion

Where cut to fill platforms are constructed, it is recommended that all structures are kept in the cut portion of the platforms to ensure long term stability. In valley bottoms above potential 1: 100 year flood lines and where soils are expected to be clayey, beam stiffened rafts may be best suited to counteract the potentially compressible subsoil material.

7.4 On-site Effluent Disposal

7.4.1 Percolation Rates and Effluent Application Rate

Two percolation tests were performed in the vicinity of the proposed septic tank and proposed soakaway area and down-gradient thereof, towards the west of the site, in accordance with the NHBRC and SABS 10400P 2010 Standards. The percolation tests were carried out to confirm the suitability of the subsoils to on-site sewerage effluent disposal. The rate at which water moves into the surrounding soil both vertically and horizontally was measured.

Percolation test pit TP01 and percolation test pit TP02 were tested in silty clayey sand. After 30 minutes, the water level lowered by 15 mm and 90 mm respectively. By projecting these readings, it would take approximately 50 minutes and 8 minutes to achieve a 25 mm drop in water in the specified horizons of percolation test pit TP01 and percolation test pit TP02 respectively. If an average was taken for these two test pits, it would take approximately 29 minutes to achieve a 25 mm drop in water.

As per the NHCRC building regulations (Part 2, Section 9, Table 1), the percolation rate for percolation test pit TP01 do not allow a rate of application of effluent to subsoil infiltration areas given that the percolation rate is over 30 minutes. The percolation rate for percolation test pit TP02 allows a rate of application of effluent to subsoil infiltration areas of approximately 90 litres per m^2. If an average is used for both percolation tests, the percolation rate allows a rate of application of effluent to subsoil infiltration areas of approximately 35 litres per m^2.

7.4.2 Design of Proposed Soakaway Structure

In determining the sizes of the soakaway system required for the proposed sports field, the following considerations were taken into account:

The assumed effluent loading for the proposed sports field based on the current standards (5 litres per day) for two hundred people (150 spectators and 50 players and support staff) is estimated to be 1 000 litres per day.

Accordingly, the dimensions of soakaway are based on the following:

Daily Effluent Load – 1 000 ℓ/day;

Application Rate – 35 ℓ/m^2/day;

Area required – 29 m^2;

Length Soakaway required – 14.2 m long x 1.0 m deep x 0.6 m wide.

7.5 Excavation Conditions

Colluvium material extends from surface to an average depth of 0.3 m below existing ground level. This material requires Soft excavation class in terms of SANS 1200D. Residual soils in this area occur from 0.3 m to 1.6 m below existing ground level and have an average thickness of 1.3 m. This material type is classed as soft excavation. Intermediate becoming hard rock excavation is likely to be encountered at depths greater than 1.6 m below existing ground level.

7.6 Construction Materials

The potential use of the in-situ materials for construction purposes across the study area was evaluated during this investigation. Given the proposed level of infrastructure development, it is anticipated that all roads will be gravel surfaced.

According to the laboratory results, the residual soils classify as a G8 quality material according to the TRH14 materials classification guidelines and are unsuitable for use in selected layers or as subgrade material in the pavement. Stabilisation of these materials using cement or lime may render them more suitable as road construction material, however this will require further sampling and laboratory investigations to confirm this. Suitable construction materials will need to be imported from commercial sources for road and building platform construction purposes.

Colluvium

Colluvium soils were most commonly found overlying the residual soils. These soils are expected to occur to a depths of approximately 0.3 m below existing ground level and are expected to impact most significantly on the construction of roads, earthworks and foundations. The soils classify as silty sand (SM) according to the USCS and may be used as bulk fill.

Residual Tillite

Residual tillite were found between 0.3 m and 1.6 m below existing ground level. These soils classify as a clayey sand (SC) for test pits TP1 and TP2 and silty, clayey sand with gravel (SC-SM) in the vicinity of the percolation test PT2. The residual tillite near TP3 is classified as a silty clayey gravel (GC-GM) and may be used as bulk fill.

7.7 Geotechnical Conditions and Constraints

The geotechnical constraints that are likely to have an effect on the proposed development are listed below.

- Areas requiring removal of boulders.
- Moderate compressible nature of the colluvial and residual soils overlying the tillite bedrock.
- Low lying areas affected by flooding.
- Areas of intermediate soil erodibility.
- Areas of difficult excavation conditions (bedrock <1.5m).

7.8 Slope Stability

Slope instability should not prove problematic across the site, however in the steeper areas, slope instability must be considered, specifically where cuts are made into the slope. Removal of existing vegetation should only take place when absolutely necessary, as the vegetation significantly increases slope stability.

7.9 Soil Erosion

The colluvial and residual soils found within the area are not expected to be highly susceptible to erosion as a result of their clayey and silty nature, however, steeper areas with sandy and gravelly soils may be susceptible to soil erosion. Removal of existing vegetation should only take place when absolutely necessary, as the vegetation significantly reduces erosion.

8 Conclusions and Recommendations

This report presents the test pit and DCP results of the intrusive geotechnical investigation conducted for the proposed Mandeni Hlomendlini Sports Field. It also outlines the geotechnical flaws associated with the study area and provides conclusions on geotechnical parameters and foundation design considerations for the site. The main conclusions derived from these results are summarised below:

- The results of the geotechnical investigation indicate that the study area is underlain by colluvial and residual soils which overlie tillite.
- The colluvium classifies as a silty sand (SM), the residual soils classify as a clayey sand (SC), clayey sand with gravel (SC-SM) and silty clayey gravel (GC-GM).
- The residual tillite soils classify as G8 in terms of the TRH14 guidelines and is unsuitable for use in selected layers or as subgrade material in the pavement for road construction.
- The colluvial and residual soils may be used as bulk fill.
- Soft excavation in terms of SANS 1200D is likely to be encountered from surface to approximately 1.6 m below existing ground level. Intermediate becoming hard rock excavation is likely to be encountered at depths greater than 1.6 m below existing ground level.
- The results of two percolation tests undertaken on site, indicate an average application of effluent to subsoil infiltration areas of 35 litres per m^2 can be expected from the underlying subsoil material encountered on site.
- Based on the results from the test pits and DCPs, the soils underlying the study area generally has a medium dense consistency, having an E Modulus value ranging from 10 to 30 MPa.
- The grandstand and ablution facilities should be founded on competent tillite bedrock at depths ranging from 1.0 m to 1.6 m below existing ground level. Where the remaining proposed structures are to be founded on colluvial soils and residual tillite, they are considered Site Class S1/S2 and the foundation design as described above should be adhered to.
- Geotechnical constraints affecting, but not limiting development within the study area to any significant degree include areas requiring removal of boulders, moderate compressible nature of the soils overlying the tillite bedrock, low lying areas affected by flooding, low lying areas with a perched water table, areas of intermediate soil erodibility and areas of difficult excavation conditions (bedrock <1.5 m bgl).
- This geotechnical report is based on preliminary investigations within the area with minimal representative test locations and the recommendations given are based on information gathered from this. It should be borne in mind that other conditions which were not encountered during this specific investigation may exist.
- Detailed investigations by an Engineering Geologist or Geotechnical Engineer are recommended during the construction phase of this project, to determine the site specific geotechnical characteristics for foundations and on-site sewerage disposal. Three founding methods are recommended with respect to the most favourable, intermediate and least favourable founding conditions and the most appropriate founding method should be selected, based on the detailed geotechnical investigation.

Prepared by

SRK Consulting - Certified Electronic Signature

srk consulting

559426/44261/Final Report

3304-4240-9994-KRES-08/03/2021

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Engineering Geologist

Project Partner and Reviewed by

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4909-7508-6324-WESC-19/10/2021

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C Wessels, *Pr.Sci.Nat*

Principal Engineering Geologist / Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

9 References

Brink, A. B. A (1983) Engineering Geology of South Africa, Volume 3: The Karoo Sequence. Building Publications. Silverton.

National Department of Housing of the Republic of South Africa, Generic Specification GFSH-2, Geotechnical Site Investigations for Housing Developments: Project Linked Greenfield Subsidy Project Developments. (2002)

NHBRC House Building Manual Parts 1&2; Revision No. 1, February 1999

SANS 1200. 2007. Standardized Specification for Civil Engineering Construction (All Parts). South African Bureau of Standards.

South African Institute of Engineering Geologists, South African Institute of Civil Engineers, Geotechnical Division, 2nd Impression. Guidelines for Soil and Rock Logging in SA. (2002).

Technical Recommendations for Highways (TRH14): Guidelines for Road Construction Materials. Prepared for the Department of Transport. Committee for State Road Authorities. (1989).

Appendices

Appendix A: Test Pit Profiles

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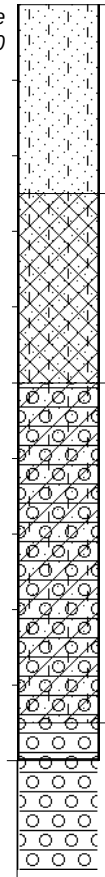
Mandeni Hlomendlini
Sports Field
Geotechnical Investigation

HOLE No: Percolation_TP01
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



0.00	Dry to slightly moist, light grey brown, loose, intact, silty fine SAND, rootlets; **Colluvium**.
0.25	Slightly moist, dark brown, loose, intact, silty fine SAND with pieces of asphalt ; **Un-Engineered Fill**.
0.50	Slightly moist, dark brown to yellow brown mottled orange brown, soft to firm, intact, silty sandy CLAY with minor fine to coarse sub-angular gravel and trace sub-angular cobbles; **Residual Tillite**.
0.95	Orange brown, fine grained, highly weathered, soft to medium hard ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.
2) Stable sidewalls.
3) Refusal at 1.0 m.
4) No samples taken.

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

ELEVATION :
X-COORD : 343889.56
Y-COORD : 6769777.59

HOLE No: Percolation_TP01

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

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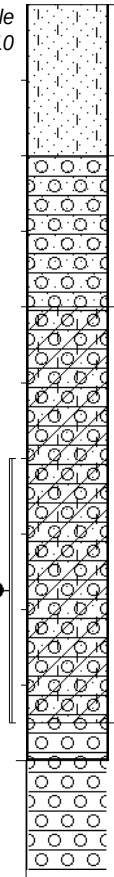
Mandeni Hlomendlini
Sports Field
Geotechnical Investigation

HOLE No: Percolation_TP02
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



0.00 Dry to slightly moist, light grey brown, loose, intact, silty fine SAND, rootlets; **Colluvium**.

0.20 Slightly moist, dark brown, loose, intact, fine SAND with abundant fine to coarse angular to sub-rounded gravel; **Residual Tillite**.

0.40 Slightly moist, light brown to yellow brown mottled orange brown, soft to firm, intact, silty sandy CLAY with minor fine to coarse angular to sub-angular gravel and trace sub-angular cobbles; **Residual Tillite**.

0.95 Orange brown, fine grained, highly weathered, soft to medium hard ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.
2) Stable sidewalls.
3) Small bag sample taken from 0.6--0.95 m.
4) Refusal at 1.0 m.

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

ELEVATION :
X-COORD : 343883.03
Y-COORD : 6769785.51

HOLE No: Percolation_TP02

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

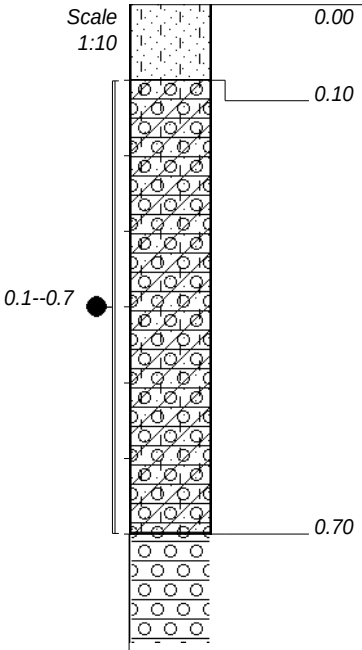
srk consulting

Mandeni Hlomendlini
Sports Field
Geotechnical Investigation

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



0.00

Dry, light orange brown, loose, intact, silty fine SAND with minor fine to coarse sub-angular gravel, rootlets; **Colluvium**.

0.10

Slightly moist to moist, orange brown, firm, intact, silty sandy CLAY with minor fine to coarse sub-angular gravel and trace sub-angular cobbles; **Residual Tillite**.

0.70

Grey brown blotched orange brown, fine grained to medium grained, medium to highly weathered, soft to medium hard ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.

2) Stable sidewalls.

3) Refusal at 0.7 m.

4) Large bag sample taken from 0.1--0.7 m

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

ELEVATION :
X-COORD : 343870.83
Y-COORD : 6769955.45

HOLE No: TP1

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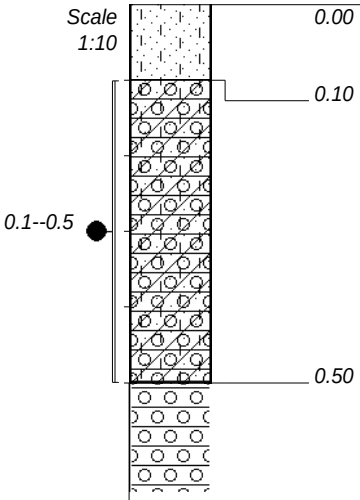
Mandeni Hlomendlini
Sports Field
Geotechnical Investigation

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



0.00	Slightly moist, light orange brown, loose, intact, silty fine to coarse SAND, rootlets; **Colluvium**.
0.10	Slightly moist, yellow brown mottled dark orange brown, soft, intact, silty sandy CLAY with trace fine to coarse sub-angular gravel; **Residual Tillite**
0.50	Yellow brown to grey brown, fine grained, highly weathered, soft ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.
2) Stable sidewalls.
3) Refusal at 0.5 m on suspected boulder.
4) Small bag sample taken from 0.1--0.5 m

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

ELEVATION :
X-COORD : 343804.67
Y-COORD : 6769797.09

HOLE No: TP2

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

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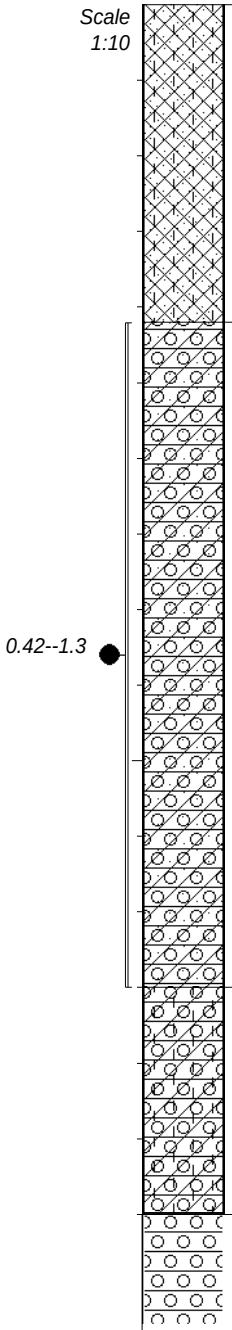
Sports Field
Geotechnical Investigation

HOLE No: TP3
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



0.00

Slightly moist, dark brown, loose, intact, silty fine SAND; **Un-Engineered Fill**.

0.42

Slighly moist, orange brown mottled dark yellow brown, firm to stiff, intact, SANDY CLAY with minor fine to coarse sub-angular to sub-rounded gravel and trace sub-angular cobbles; **Residual Tillite**.

1.30

Slightly moist to moist, orange brown mottled dark brown to black, stiff, intact, silty CLAY; **Residual Tillite**.

1.60

Orange brown to yellow brown, fine grained, highly weathered, soft to medium hard ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.
2) Stable sidewalls.
3) Refual at 1.6 m.
4) Large bag samples taken from 0.42--1.3 m.

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

ELEVATION :
X-COORD : 343841.88
Y-COORD : 6769935.91

HOLE No: TP3

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

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Sports Field
Geotechnical Investigation

HOLE No: TP4
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10

0.0--0.5

0.00	Slightly moist, dark brown, loose, intact, silty fine to medium SAND; **Colluvium**.
0.50	Slightly moist, brown to orange brown, firm, intact, silty sandy CLAY with minor fine to coarse angular to sub-angular gravel; **Residual Tillite**.
0.80	Orange brown to yellow brown, fine grained, highly weathered, soft to medium hard ROCK; **TILLITE**.

NOTES

1) No groundwater seepage.
2) Stable sidewalls.
3) Refusal at 0.8 m.
4) Large bag sample taken from 0.0--0.5 m.

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

ELEVATION :
X-COORD : 343778.05
Y-COORD : 6769969.75

HOLE No: TP4

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

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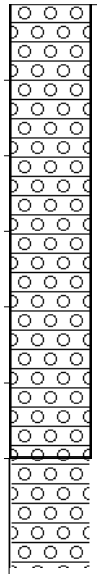
Sports Field
Geotechnical Investigation

HOLE No: Exposure
Sheet 1 of 1

JOB NUMBER: 559426

Scale 1:10



Orange brown to dark blue stained red brown, fine grained, highly weathered, highly fractured very soft to medium hard ROCK; **TILLITE**.

CONTRACTOR :
MACHINE : Not Applicable - Hand Excavation
DRILLED BY :
PROFILED BY : KRES

TYPE SET BY : KRES
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 19/01/2021 - 20/01/2021

DATE : 27/01/2021 14:34
TEXT : ..erFieldProjectTPLogs.txt

ELEVATION :
X-COORD : 343797.22
Y-COORD : 6769804.29

HOLE No: Exposure

Appendix B: Photographs

Boulder exposures on the proposed soccer field.

View of boulders on the proposed soccer field.

View of proposed combi court area to the east of the site.

Culvert which drains across the site in a northerly direction towards the Tugela River.

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DCPs being undertaken.

East of the site.

Face/exposure that was in close vicinity to the proposed ablutions and changerooms.

Face/exposure that was in close vicinity to the proposed ablutions and changerooms.

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View of proposed parking area.

Percolation test pit TP01

Alternative view of percolation test pit TP01

Percolation test TP02

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View to the north of the site.

View to the west of the site.

View of water filled for percolation test pit TP01

View of water filled for percolation test pit TP02

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TP1 Pit

Hand auguring for TP2

TP3 Pit

TP4 Pit

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View of proposed practise soccer field.

View of proposed soccer field, ablutions and change rooms to the south of the site.

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Appendix C: DCP Results Sheets

Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP1

Date : 19/01/2021

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Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	10	13	200	10.0	25.4
4	300	7	20	300	14.3	16.9
5	400	8	28	400	12.5	19.7
6	500	18	46	500	5.6	49.8
7	600	13	59	600	7.7	34.3
8	700	30	89	700	3.3	80.0
9	800					
10	900					
11	1000					
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
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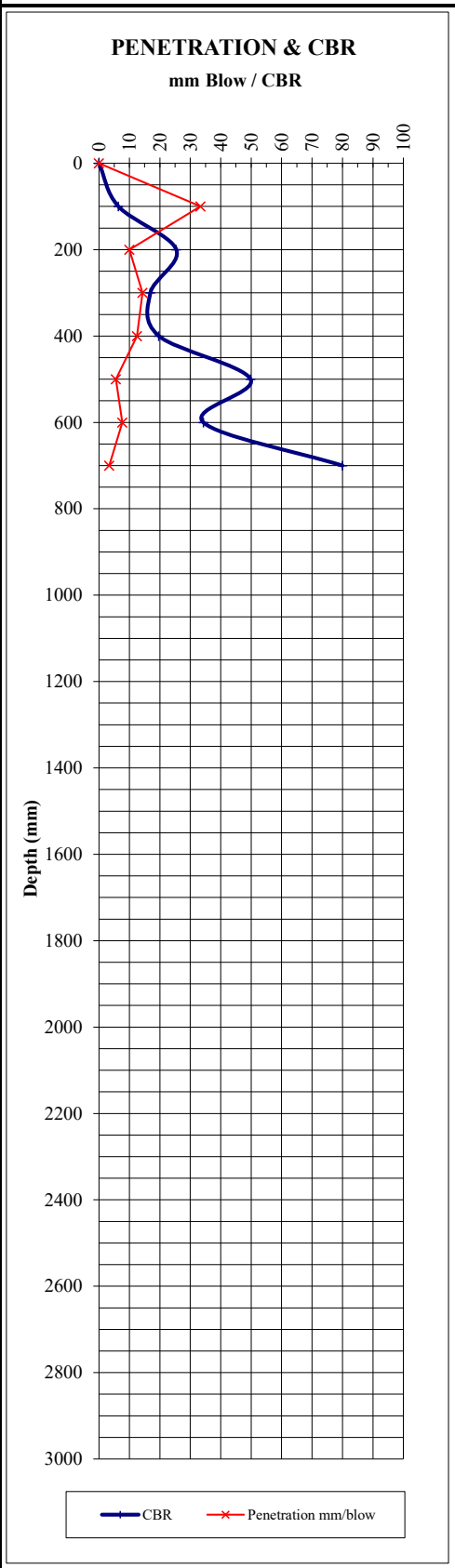

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP2
Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	3	11	300	33.3	6.4
5	400	3	14	400	33.3	6.4
6	500	3	17	500	33.3	6.4
7	600	4	21	600	25.0	8.9
8	700	3	24	700	33.3	6.4
9	800	2	26	800	50.0	4.0
10	900	2	28	900	50.0	4.0
11	1000	3	31	1000	33.3	6.4
12	1100	2	33	1100	50.0	4.0
13	1200	2	35	1200	50.0	4.0
14	1300	3	38	1300	33.3	6.4
15	1400	30	68	1400	3.3	80.0
16	1500					
17	1600					
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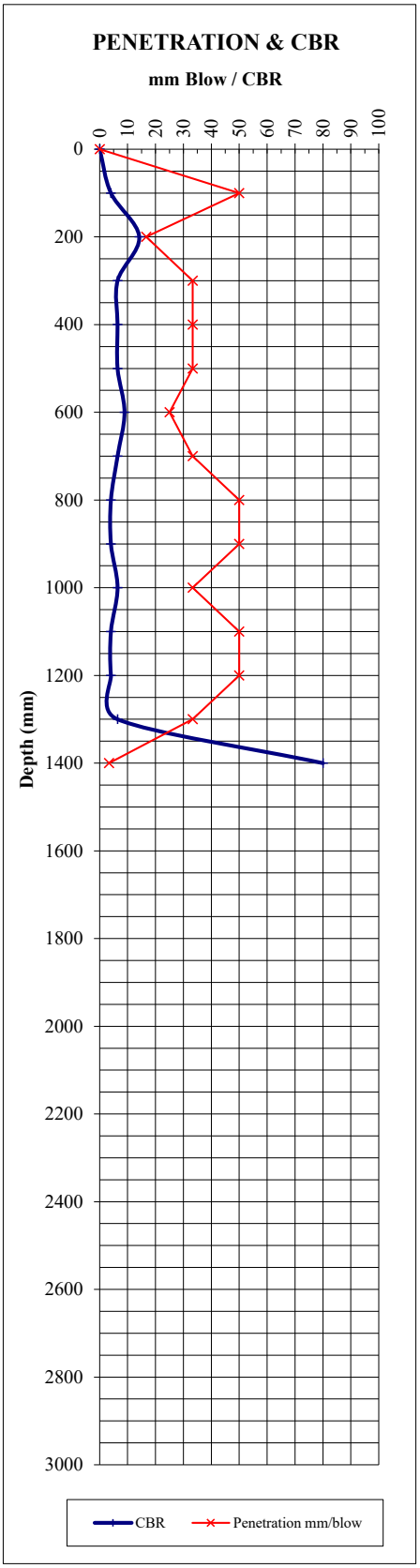
61	6000					



Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP3
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	10	12	200	10.0	25.4
4	300	10	22	300	10.0	25.4
5	400	12	34	400	8.3	31.3
6	500	12	46	500	8.3	31.3
7	600	30	76	600	3.3	80.0
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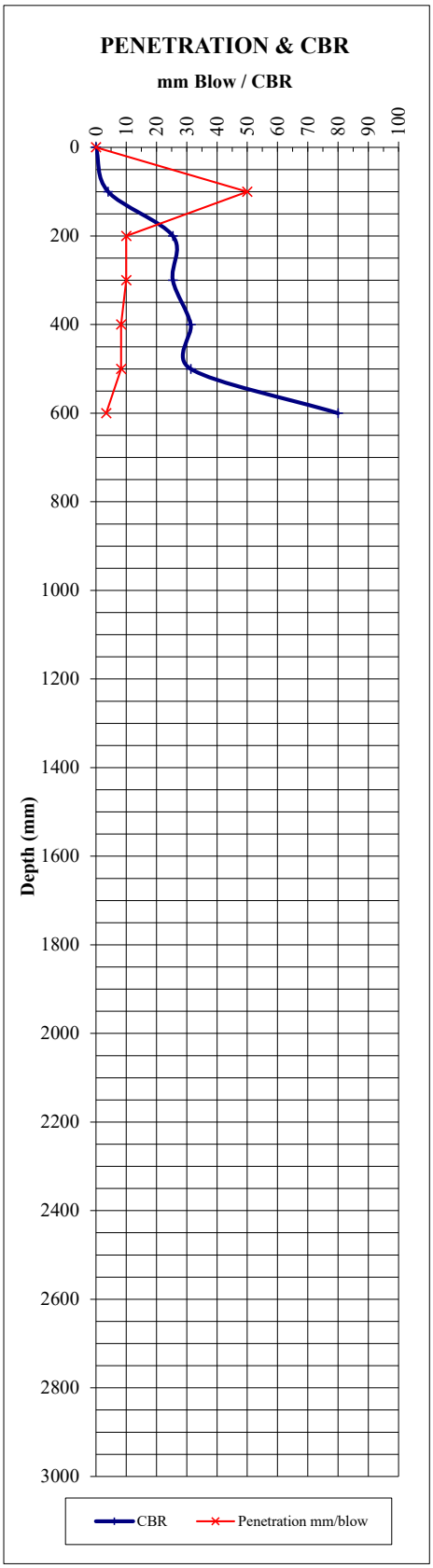

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP4
Date : 19/01/2021

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Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	5	5	100	20.0	11.5
3	200	12	17	200	8.3	31.3
4	300	12	29	300	8.3	31.3
5	400	15	44	400	6.7	40.4
6	500	19	63	500	5.3	53.0
7	600	22	85	600	4.5	62.7
8	700	30	115	700	3.3	80.0
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11	1000					
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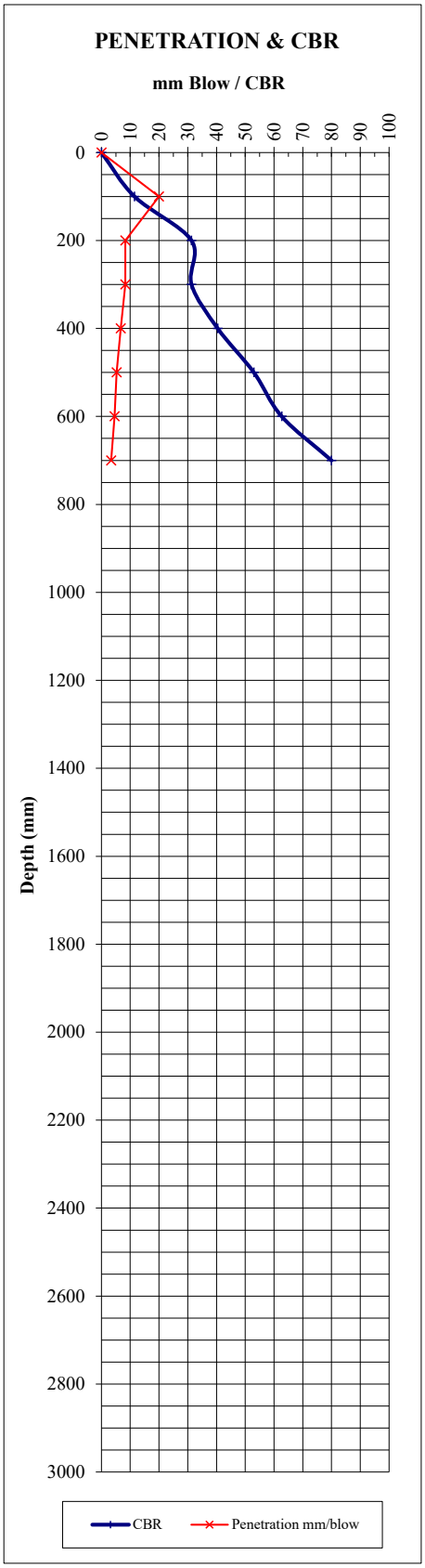

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP5
Date : 19/01/2021

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Reading No	c	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	16	18	200	6.3	43.5
4	300	29	47	300	3.4	80.0
5	400	19	66	400	5.3	53.0
6	500	8	74	500	12.5	19.7
7	600	30	104	600	3.3	80.0
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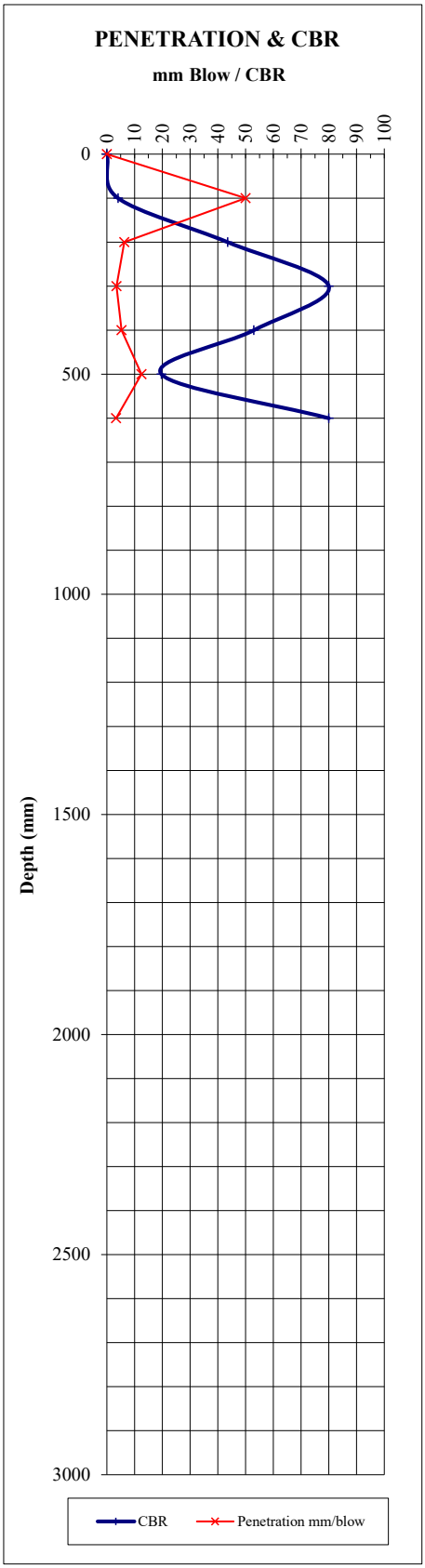

Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP6

Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	6	9	200	16.7	14.2
4	300	10	19	300	10.0	25.4
5	400	4	23	400	25.0	8.9
6	500	3	26	500	33.3	6.4
7	600	5	31	600	20.0	11.5
8	700	10	41	700	10.0	25.4
9	800	18	59	800	5.6	49.8
10	900	19	78	900	5.3	53.0
11	1000	30	108	1000	3.3	80.0
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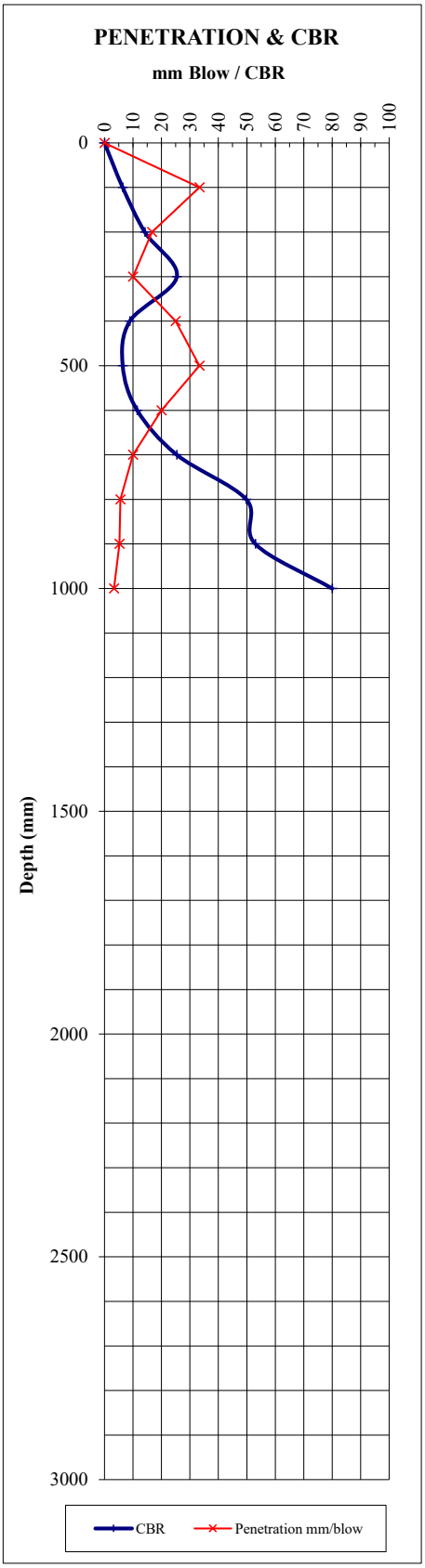

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP7
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	7	9	200	14.3	16.9
4	300	12	21	300	8.3	31.3
5	400	12	33	400	8.3	31.3
6	500	8	41	500	12.5	19.7
7	600	30	71	600	3.3	80.0
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9	800					
10	900					
11	1000					
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39	3800					
40	3900					
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50	4900					
51	5000					
52	5100					
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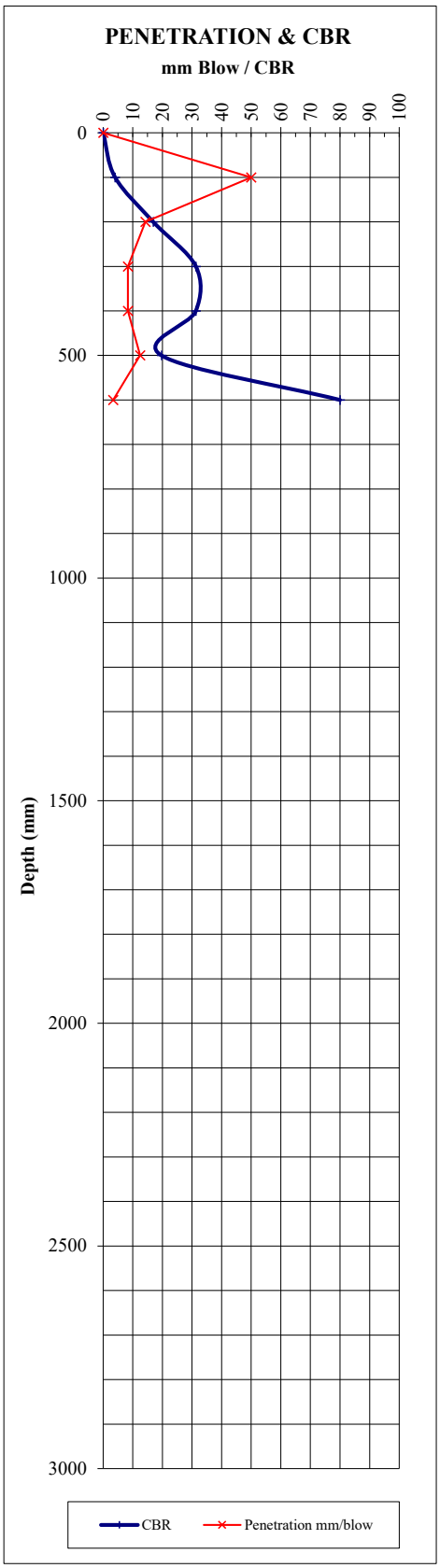

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP8
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	8	10	200	12.5	19.7
4	300	8	18	300	12.5	19.7
5	400	8	26	400	12.5	19.7
6	500	19	45	500	5.3	53.0
7	600	14	59	600	7.1	37.4
8	700	15	74	700	6.7	40.4
9	800	30	104	800	3.3	80.0
10	900					
11	1000					
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
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31	3000					
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33	3200					
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41	4000					
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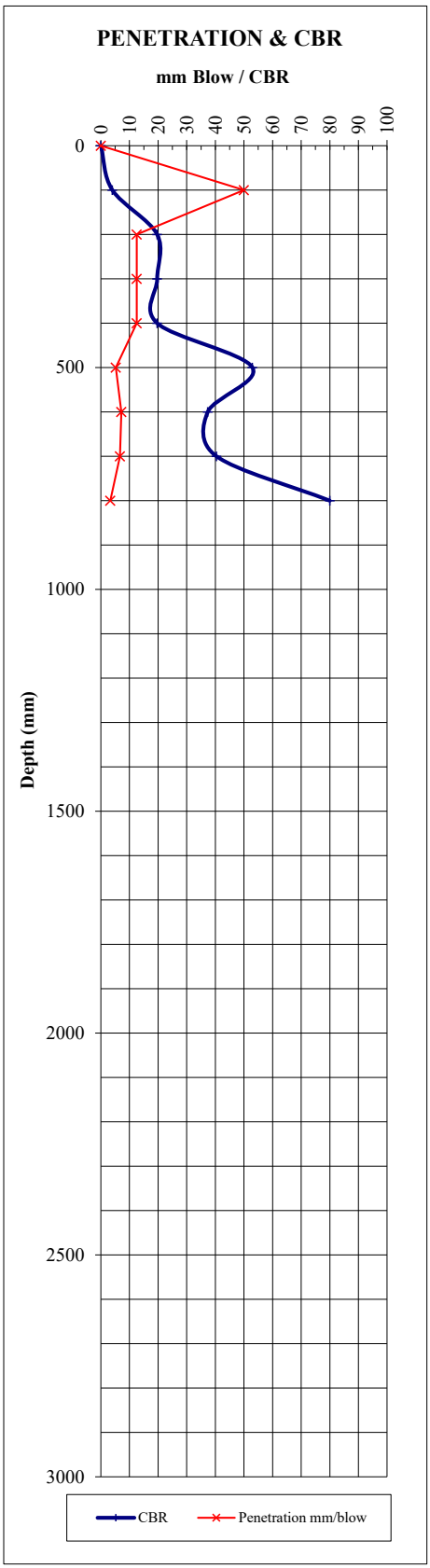

Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP9

Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	6	14	300	16.7	14.2
5	400	4	18	400	25.0	8.9
6	500	13	31	500	7.7	34.3
7	600	12	43	600	8.3	31.3
8	700	8	51	700	12.5	19.7
9	800	5	56	800	20.0	11.5
10	900	3	59	900	33.3	6.4
11	1000	3	62	1000	33.3	6.4
12	1100	7	69	1100	14.3	16.9
13	1200	30	99	1200	3.3	80.0
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
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29	2800					
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31	3000					
32	3100					
33	3200					
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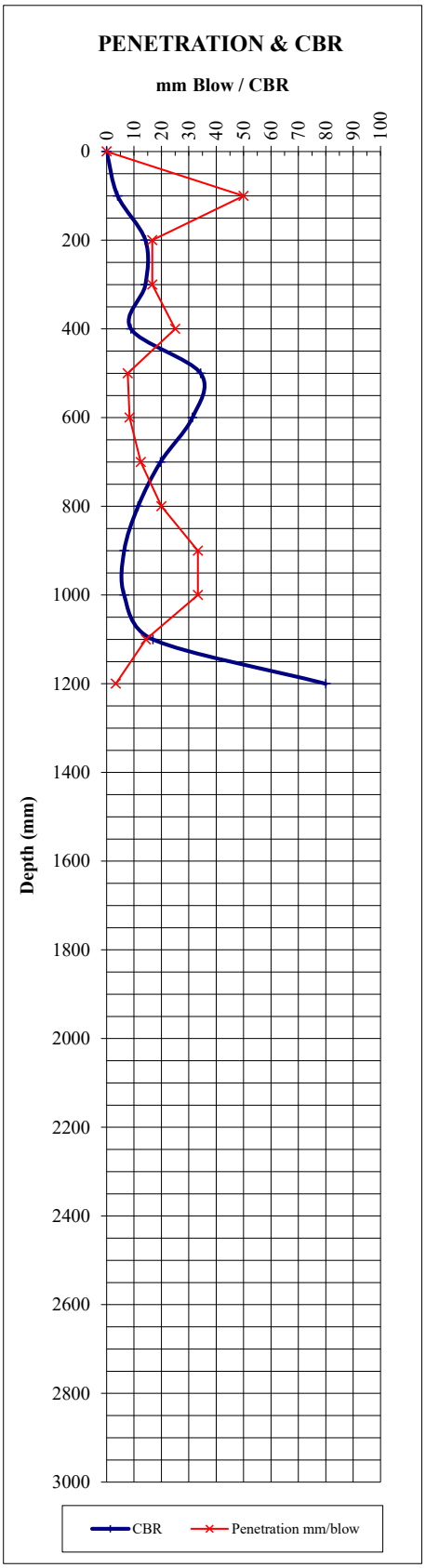

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP10
Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	7	7	200	20.0	11.5
4	300	4	11	300	25.0	8.9
5	400	3	14	400	33.3	6.4
6	500	5	19	500	20.0	11.5
7	600	10	29	600	10.0	25.4
8	700	9	38	700	11.1	22.5
9	800	10	48	800	10.0	25.4
10	900	8	56	900	12.5	19.7
11	1000	6	62	1000	16.7	14.2
12	1100	12	74	1100	8.3	31.3
13	1200	10	84	1200	10.0	25.4
14	1300	7	91	1300	14.3	16.9
15	1400	8	99	1400	12.5	19.7
16	1500	5	104	1500	20.0	11.5
17	1600	3	107	1600	33.3	6.4
18	1700	6	113	1700	16.7	14.2
19	1800	6	119	1800	16.7	14.2
20	1900	6	125	1900	16.7	14.2
21	2000	22	147	2000	4.5	62.7
22	2100	30	177	2100	3.3	80.0
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
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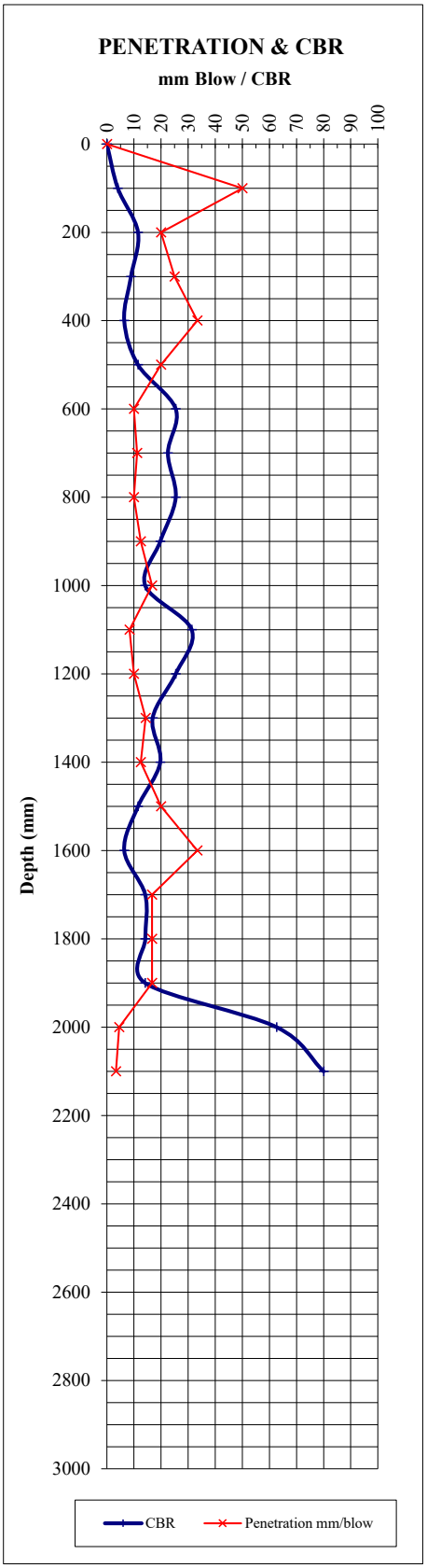

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP11
Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	5	5	100	20.0	11.5
3	200	19	24	200	5.3	53.0
4	300	28	52	300	3.6	80.0
5	400	30	82	400	3.3	80.0
6	500					
7	600					
8	700					
9	800					
10	900					
11	1000					
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
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23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
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35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
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43	4200					
44	4300					
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48	4700					
49	4800					
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51	5000					
52	5100					
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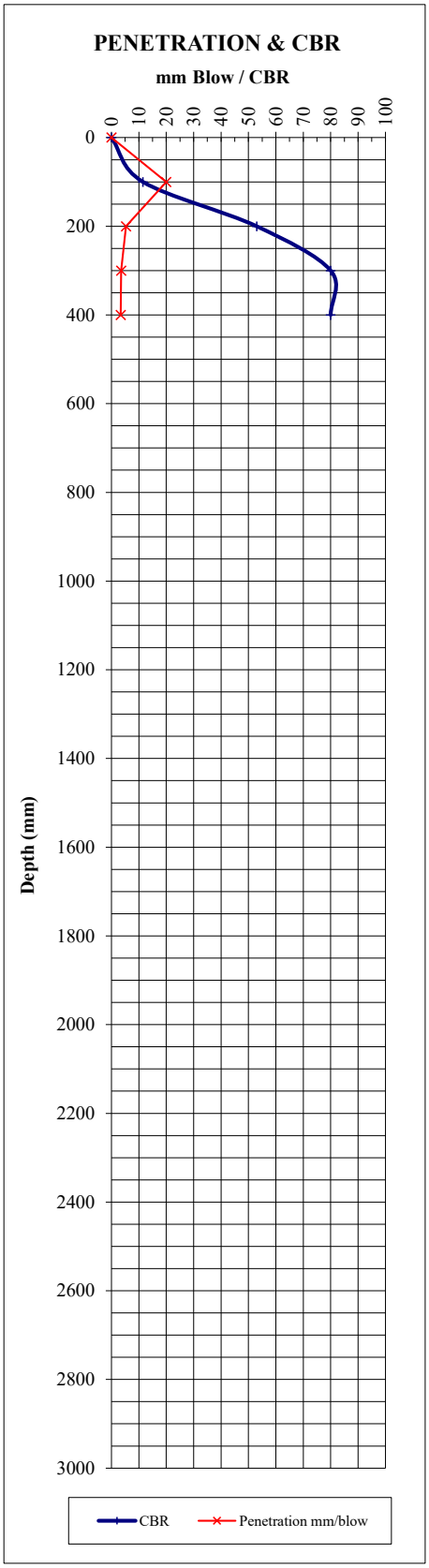
61	6000					



Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP12

Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	8	11	200	12.5	19.7
4	300	15	26	300	6.7	40.4
5	400	12	38	400	8.3	31.3
6	500	12	50	500	8.3	31.3
7	600	4	54	600	25.0	8.9
8	700	9	63	700	11.1	22.5
9	800	15	78	800	6.7	40.4
10	900	15	93	900	6.7	40.4
11	1000	15	108	1000	6.7	40.4
12	1100	18	126	1100	5.6	49.8
13	1200	16	142	1200	6.3	43.5
14	1300	12	154	1300	8.3	31.3
15	1400	23	177	1400	4.3	65.9
16	1500	30	207	1500	3.3	80.0
17	1600	24	231	1600	4.2	69.2
18	1700	27	258	1700	3.7	79.2
19	1800	23	281	1800	4.3	65.9
20	1900	30	311	1900	3.3	80.0
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
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38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
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50	4900					
51	5000					
52	5100					
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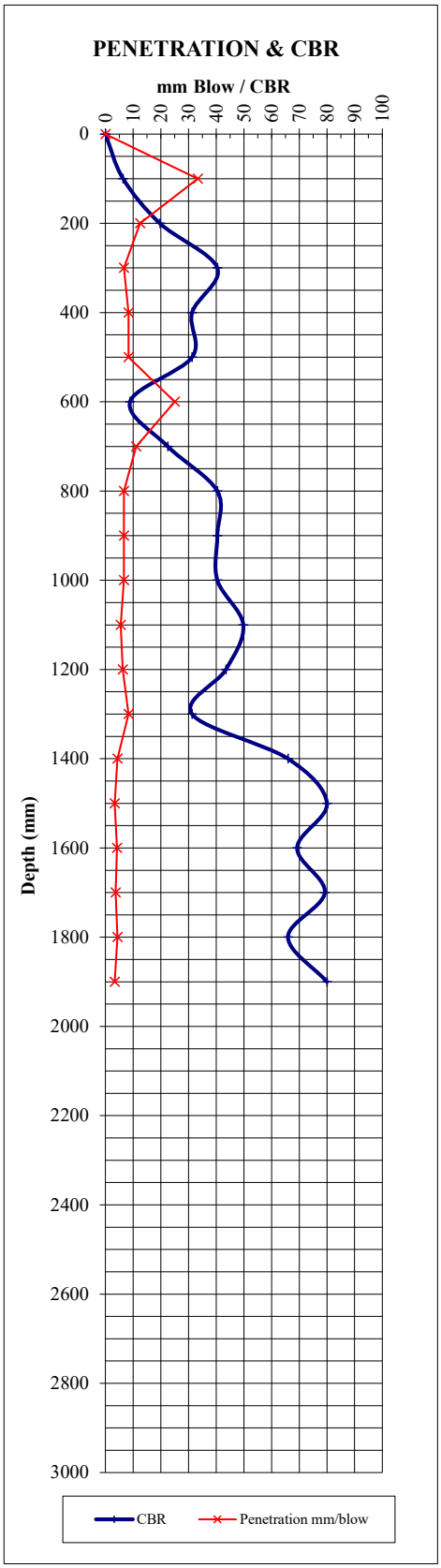

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP13
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	14	17	200	7.1	37.4
4	300	7	24	300	14.3	16.9
5	400	5	29	400	20.0	11.5
6	500	7	36	500	14.3	16.9
7	600	13	49	600	7.7	34.3
8	700	15	64	700	6.7	40.4
9	800	20	84	800	5.0	56.2
10	900	17	101	900	5.9	46.7
11	1000	30	131	1000	3.3	80.0
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
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25	2400					
26	2500					
27	2600					
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29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
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36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
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51	5000					
52	5100					
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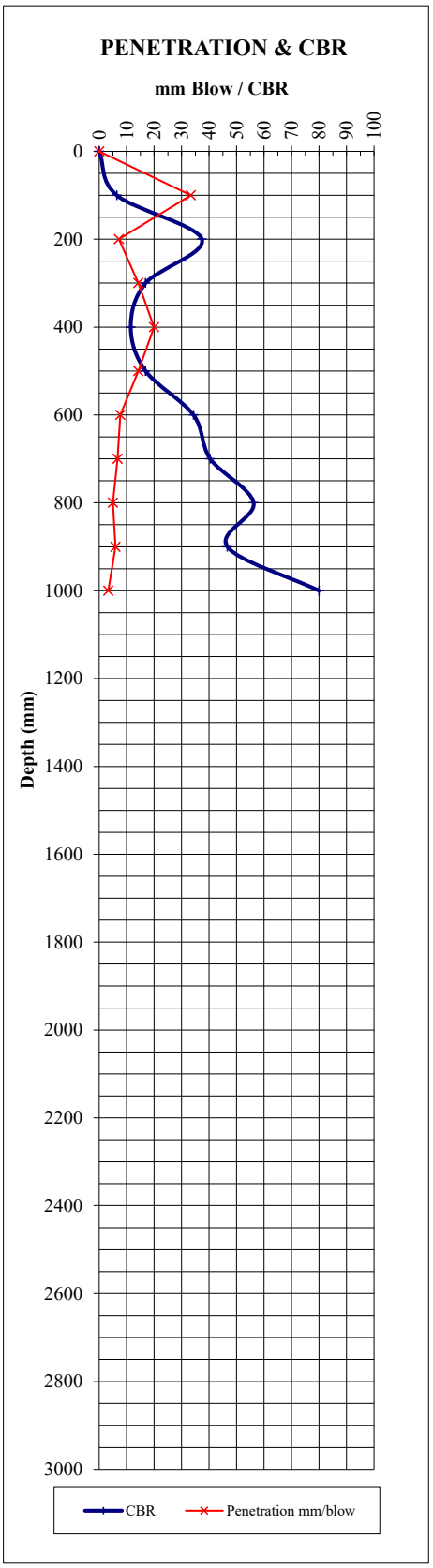
61	6000					



Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP14

Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	4	7	200	25.0	8.9
4	300	5	12	300	20.0	11.5
5	400	19	31	400	5.3	53.0
6	500	30	61	500	3.3	80.0
7	600					
8	700					
9	800					
10	900					
11	1000					
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
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29	2800					
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31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
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45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
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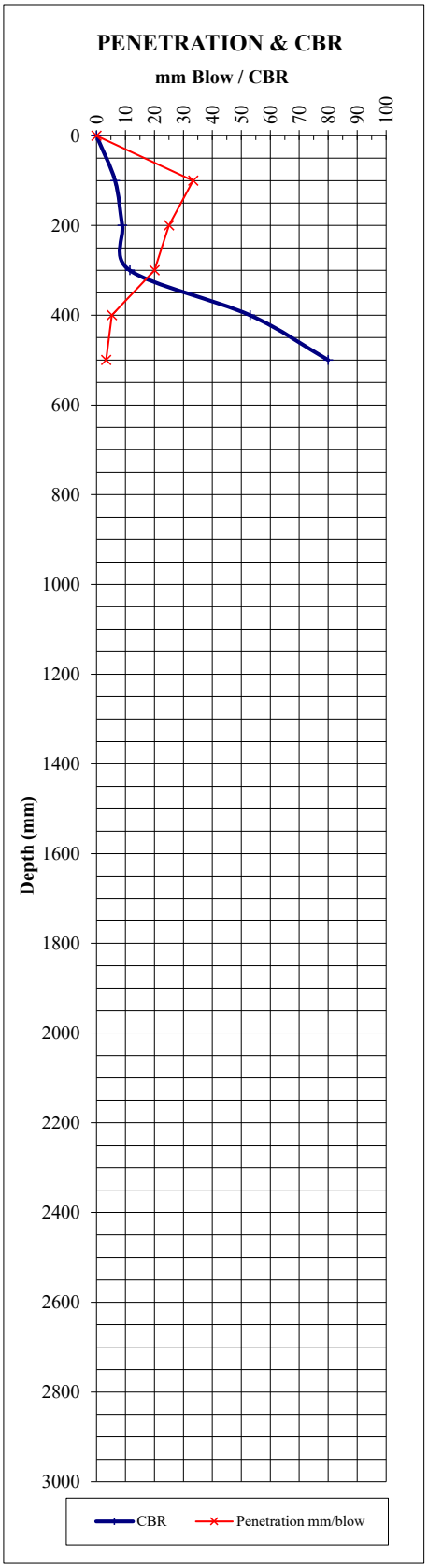
59	5800					
60	5900					
61	6000					



Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP15
Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	10	13	200	10.0	25.4
4	300	7	20	300	14.3	16.9
5	400	5	25	400	20.0	11.5
6	500	4	29	500	25.0	8.9
7	600	10	39	600	10.0	25.4
8	700	13	52	700	7.7	34.3
9	800	6	58	800	16.7	14.2
10	900	6	64	900	16.7	14.2
11	1000	7	71	1000	14.3	16.9
12	1100	4	75	1100	25.0	8.9
13	1200	6	81	1200	16.7	14.2
14	1300	6	87	1300	16.7	14.2
15	1400	4	91	1400	25.0	8.9
16	1500	5	96	1500	20.0	11.5
17	1600	6	102	1600	16.7	14.2
18	1700	6	108	1700	16.7	14.2
19	1800	5	113	1800	20.0	11.5
20	1900	5	118	1900	20.0	11.5
21	2000	5	123	2000	20.0	11.5
22	2100	6	129	2100	16.7	14.2
23	2200	7	136	2200	14.3	16.9
24	2300	7	143	2300	14.3	16.9
25	2400	7	150	2400	14.3	16.9
26	2500	8	158	2500	12.5	19.7
27	2600	8	166	2600	12.5	19.7
28	2700	8	174	2700	12.5	19.7
29	2800	8	182	2800	12.5	19.7
30	2900	30	212	2900	3.3	80.0
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
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41	4000					
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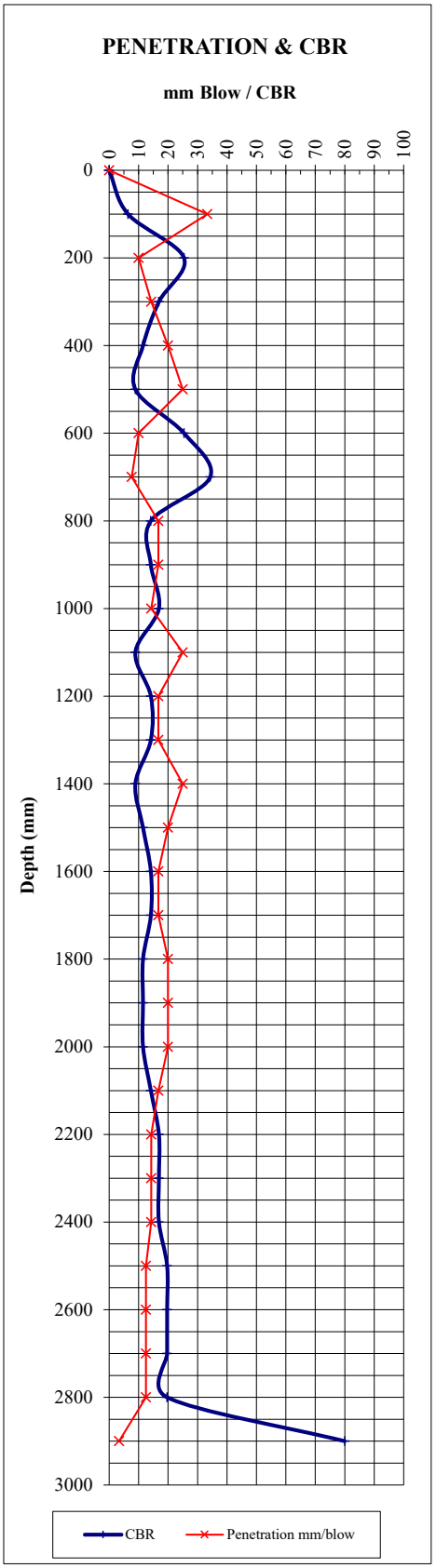
61	6000					



Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP16

Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	5	8	200	20.0	11.5
4	300	4	12	300	25.0	8.9
5	400	4	16	400	25.0	8.9
6	500	3	19	500	33.3	6.4
7	600	3	22	600	33.3	6.4
8	700	2	24	700	50.0	4.0
9	800	1	25	800	100.0	1.8
10	900	1	26	900	100.0	1.8
11	1000	1	27	1000	100.0	1.8
12	1100	3	30	1100	33.3	6.4
13	1200	30	60	1200	3.3	80.0
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
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31	3000					
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35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
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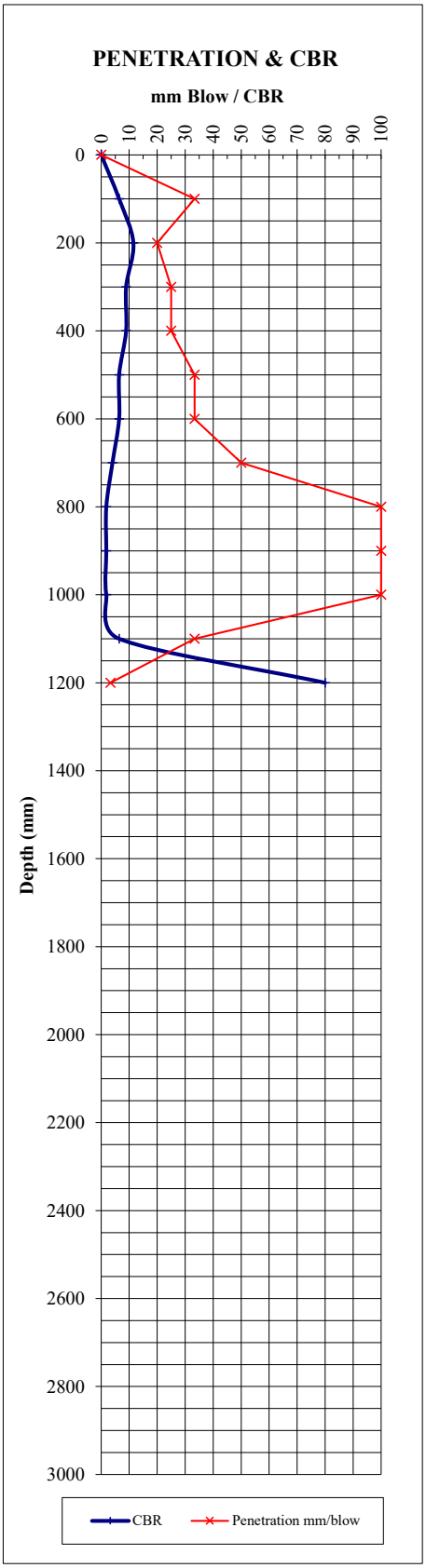

Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

srk consulting

Test No: DCP17
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	7	10	200	14.3	16.9
4	300	10	20	300	10.0	25.4
5	400	12	32	400	8.3	31.3
6	500	11	43	500	9.1	28.3
7	600	12	55	600	8.3	31.3
8	700	4	59	700	25.0	8.9
9	800	6	65	800	16.7	14.2
10	900	12	77	900	8.3	31.3
11	1000	9	86	1000	11.1	22.5
12	1100	8	94	1100	12.5	19.7
13	1200	30	124	1200	3.3	80.0
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
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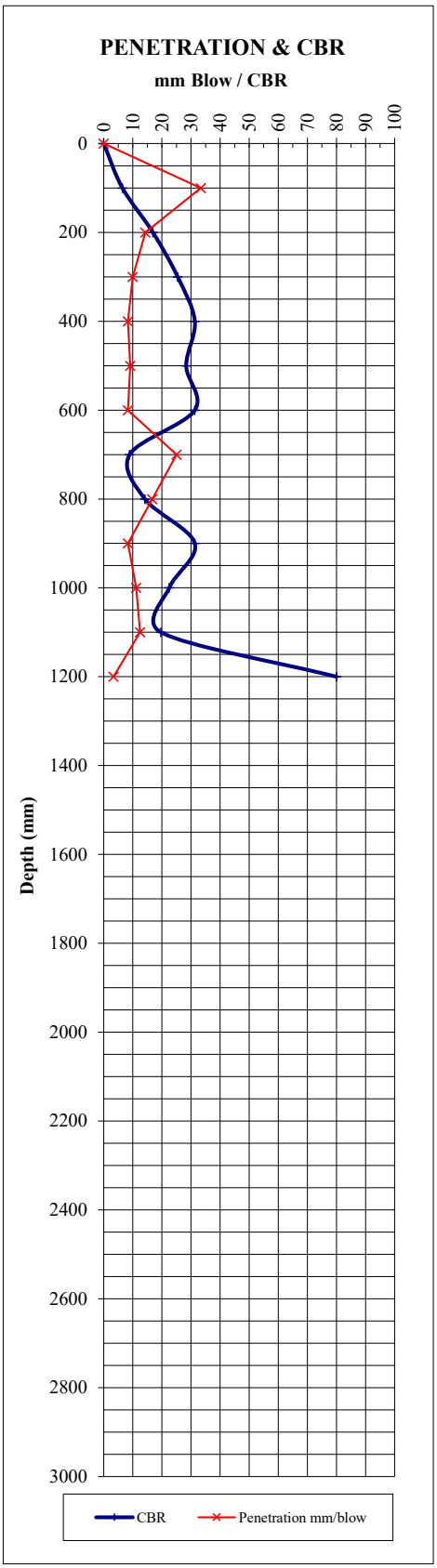
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					

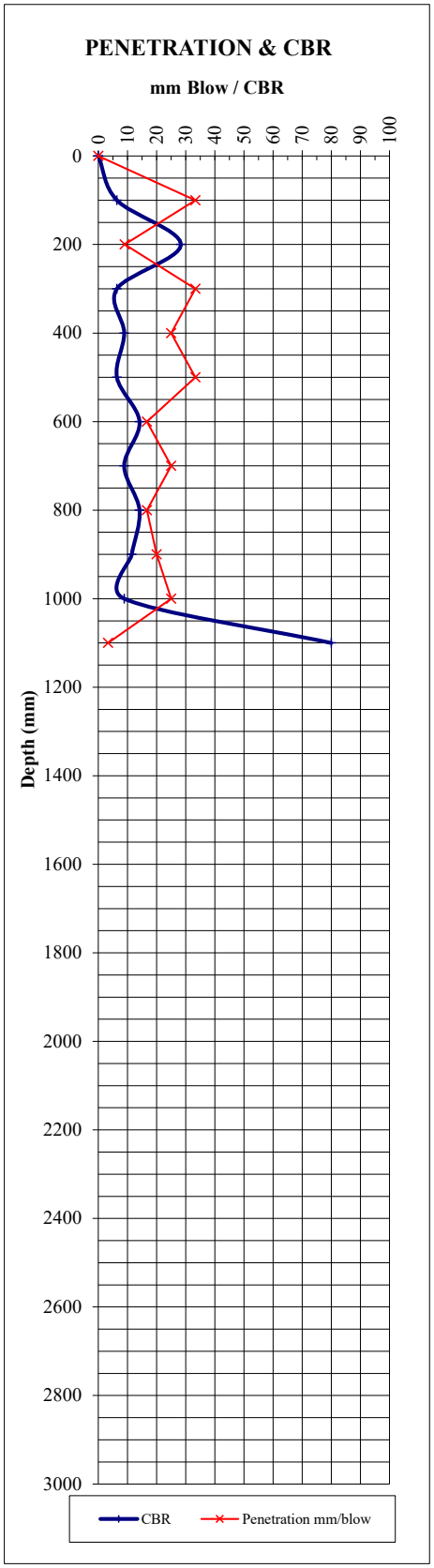


Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP18
Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	11	14	200	9.1	28.3
4	300	3	17	300	33.3	6.4
5	400	4	21	400	25.0	8.9
6	500	3	24	500	33.3	6.4
7	600	6	30	600	16.7	14.2
8	700	4	34	700	25.0	8.9
9	800	6	40	800	16.7	14.2
10	900	5	45	900	20.0	11.5
11	1000	4	49	1000	25.0	8.9
12	1100	30	79	1100	3.3	80.0
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. 559426
Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP19
Date : 19/01/2021

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	12	14	200	8.3	31.3
4	300	10	24	300	10.0	25.4
5	400	9	33	400	11.1	22.5
6	500	25	58	500	4.0	72.6
7	600	28	86	600	3.6	80.0
8	700	20	106	700	5.0	56.2
9	800	12	118	800	8.3	31.3
10	900	30	148	900	3.3	80.0
11	1000					
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
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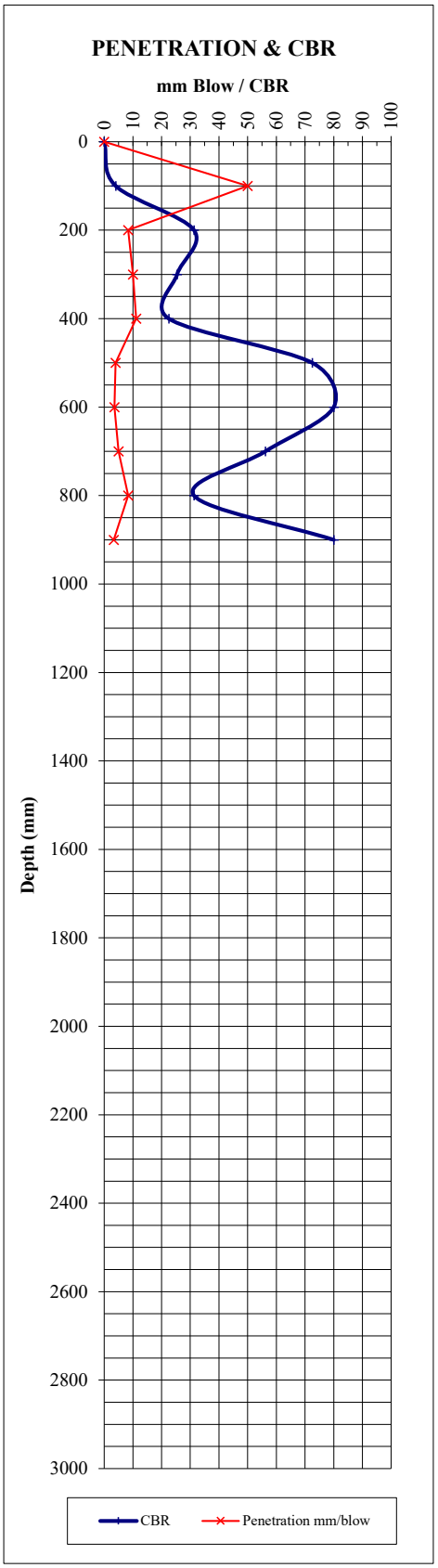
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. 559426

Job Name : Mandeni Soccer Field Project Geotechnical Investigation

Test No: DCP20

Date : 19/01/2021

srk consulting

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	**0**	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	6	13	300	16.7	14.2
5	400	13	26	400	7.7	34.3
6	500	19	45	500	5.3	53.0
7	600	13	58	600	7.7	34.3
8	700	10	68	700	10.0	25.4
9	800	6	74	800	16.7	14.2
10	900	7	81	900	14.3	16.9
11	1000	30	111	1000	3.3	80.0
12	1100					
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
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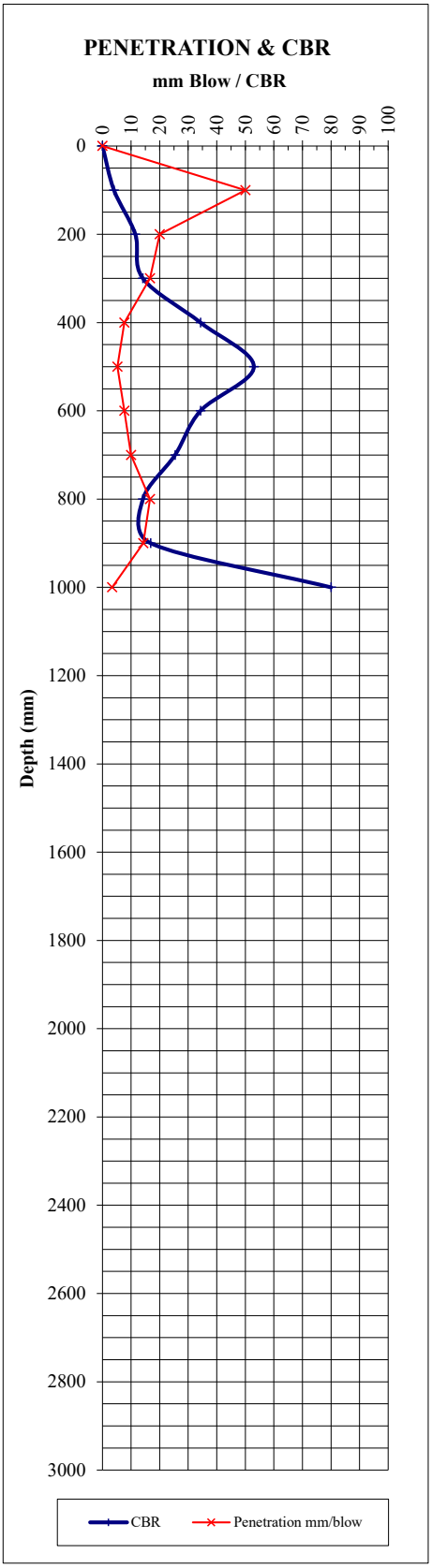


Appendix D: Laboratory Results

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 HALSTED ROAD - 24 DAVLEN PARK - MKONDENI - P.O.BOX 846 PIETERMARITZBURG - 3200

TELEPHONE : 033 - 386 9095 TELEFAX : 033 - 386 1878 email : balin@soilco.co.za

T 0823

Date : 2021-01-29

For the Attention of : Shannon Krebs

Customer Name : SRK Construction

Address : P.O.Box 1223
Hilton
3245

Project Information : Mandeni Soccer Field - 559426

Job Card Number : 228091

Sample Number / s : P13668 - P13670

Dear Sir / Madam,

Herewith, please find the original report / s, pertaining to the above - mentioned project. All tests conducted are in accordance with prescribed test method / s. Information herein consists of the following : -

Materials Report and Reference No.	Test Conducted	Prescribed Method	No. of Pages
Hydrometer Analysis Test Report	Hydrometer Analysis to 1.5 microns	ASTM D422	6

We thank you for your valued support and look forward to assisting you in the near future.

Yours faithfully,

For Soilco (Technical Signatory)

The following results pertain only to the area or samples tested. Whilst every precaution is taken to ensure accurate testing and reporting, Soilco Materials Investigations (Pty) Ltd will not be held responsible for any erroneous testing or reporting thereof.
Information in relation to the client and associated test results are considered proprietary, regard as confidential, and will not be reproduced or disclosed to any person or organization without prior written consent from the client, i.e. unless prohibited by law or covered by legally enforceable, signed confidentiality undertakings (i.e. SANAS Assessors or Internal Auditors).
If the arrangement is not suitable to you, our client, please contact the management of Soilco Materials Investigations (Pty) Ltd.

Tests marked * in this report are " Not SANAS Accredited " and are not included in the SANAS Schedule of Accreditation for this Laboratory. # Opinions and Interpretations expressed herein are Outside the Scope of SANAS Accreditation.

Deviation from Test Method : - Moisture Contents Dried Overnight at 105°C to 110°C.

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

SOILCO

Reg. No. : 1965 / 009585 / 07

11 Halsted Road 24 Davlen Park Mkondeni p.o.Box 846 Pietermaritzburg 3200

TELEPHONE : 033 386 9095 / 386 3410 Telefax 033 386 1878 Email: balin@soilco.co.za / hazel@soilco.co.za

Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sampling Process : - Client

HYDROMETER ANALYSIS TEST REPORT

Laboratory No.	P13668	P13669	P13671	P13672	P13670
Field No.					
Position in Field	TP1	TP2 / AH2	TP3	TP4	PT2
Depth (mm)	100-700	100-500	420-1300	0-500	600-950
Material Description	Yellow Grey Brown Clayey Sand Gravel Res.Tillite	Light Yellow Dark Brown Clayey Sand Gravel Res.Tillite	Light Brown Silty Sand Gravel Res.Tillite	Dark Brown Silty Sand Colluvium	Light Yellow brown Silty Sand Gravel Res.Tillite
Moisture Content	10,3	12,2	8,1	7,3	9,9

Sieve Analysis (Wet Preparation) SANS 3001 : GR 1

Sieve Aperture						
75,0	mm					
63,0	mm					
50,0	mm					
37,5	mm					
28,0	mm					
20,0	mm			100		
14,0	mm	100	100	81	100	100
5,0	mm	87	74	58	86	72
2,0	mm	77	55	45	51	44
0,425	mm	70	46	38	43	30
0,075	mm	41	25	18	19	16

Hydrometer Analysis (ASTM - D422)

Sieve Aperture						
0,060	mm	38	22	17	17	14
0,050	mm	34	20	15	16	13
0,026	mm	31	18	13	12	11
0,015	mm	27	17	11	10	10
0,010	mm	24	15	10	8	8
0,0074	mm	21	14	9	7	7
0,005	mm	20	13	8	6	7
0,0036	mm	18	12	8	5	6
0,0020	mm	15	11	8	4	5
0,0015	mm	13	10	7	3	4

Soil Mortar Analysis SANS 3001 : GR 1

Coarse Sand	%	9	16	16	16	32
Fine Sand	%	42	43	47	51	35
Silt	%	29	20	20	25	21
Clay	%	20	20	17	8	12

Atterberg Limits SANS 3001 : GR 10 - GR 12

Liquid Limit	%	27	30	22	0	20
Plasticity Index	%	10	12	4	SP	6
Linear Shrinkage	%	4,5	5,5	1,5	1	3
Equivalent PI	%	7,0	5,5	1,5	0	1,8
Classification (Group Index)		A4(0)	A26(0)	A1-b(0)	A1-b(0)	A-1-b(0)

For Soilco : _____ Technical Signatory

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 Halsted Road 24 Davlen Park Mkondeni p.o.Box 846 Pietermaritzburg 3200

TELEPHONE : 033 386 9095 / 386 3410 Telefax 033 386 1878 Email: balin@soilco.co.za / hazel@soilco.co.za

Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No. : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sample Delivered by : Client

Sample Number : P13668

Position in field : TP1

Field or Pit Number : -

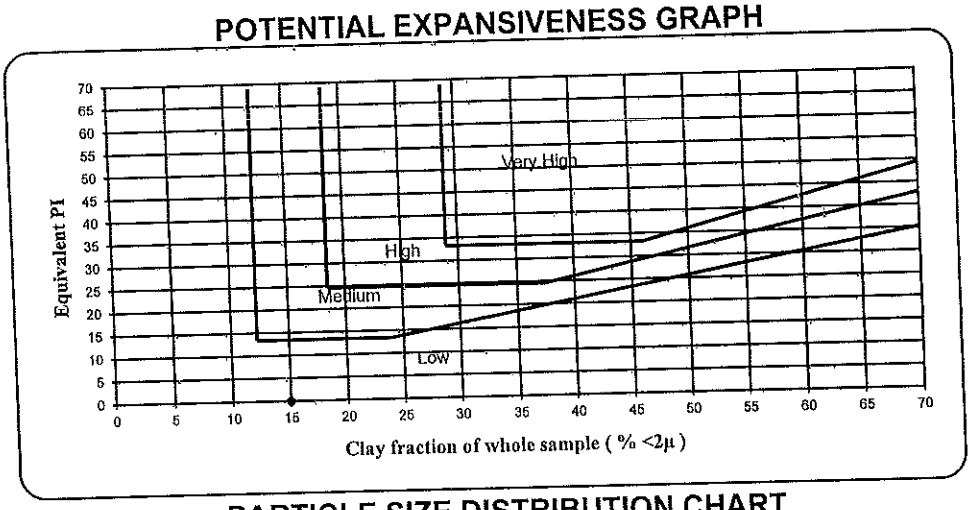
Depth (mm) : 100-700

Sample Description : Yellow Grey Brown Clayey Sand Gravel Res.Tillite

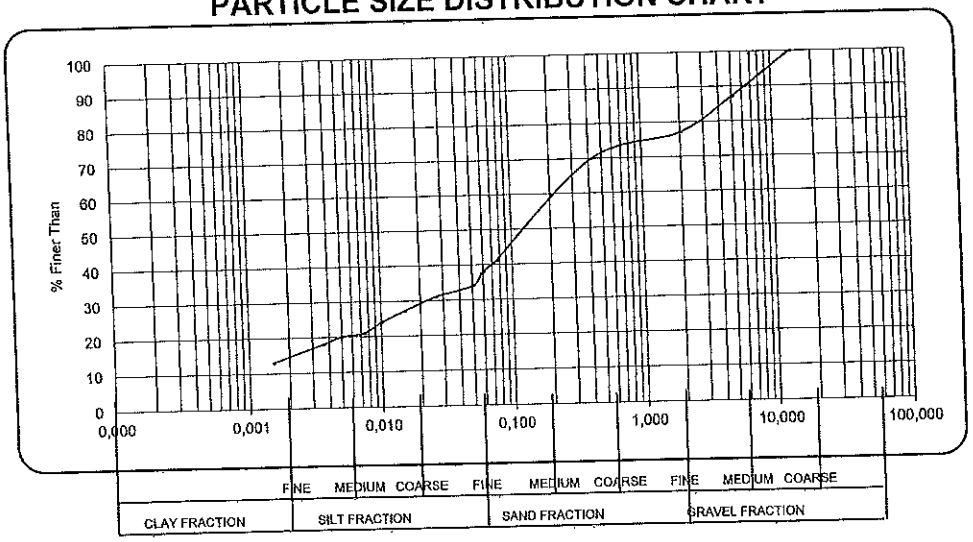
Equivalent PI : 7,0

Clay fraction of whole sample (% <2μ) : 15

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



For Soilco : _____ Technical Signatory

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 Halsted Road 24 Davlen Park Mkondeni p.o.Box 846 Pietermaritzburg 3200

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Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No. : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sample Delivered by : Client

Sample Number : P13669

Position in field : TP2 / AH2

Sample Description : Light Yellow Dark Brown Clayey Sand Gravel Res.Tillite

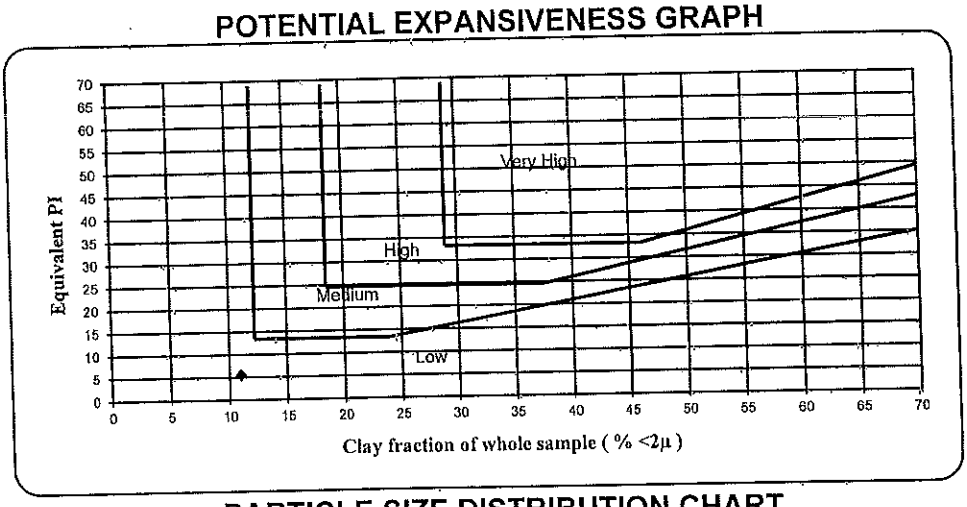
Field or Pit Number : -

Depth (mm) : 100-500

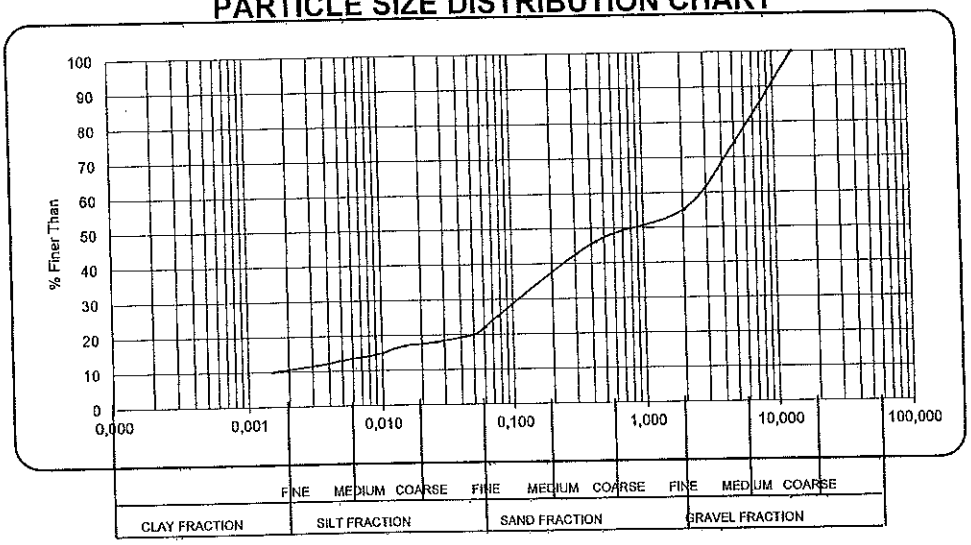
Equivalent PI : 5,5

Clay fraction of whole sample (% <2μ) : 11

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



For Soilco : _____ Technical Signatory

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 Halsted Road 24 Davlen Park Mkondeni p.o.Box 846 Pietermaritzburg 3200

TELEPHONE : 033 386 9095 / 386 3410 Telefax 033 386 1878 Email: balin@soilco.co.za / hazel@soilco.co.za

Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No. : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sample Delivered by : Client

Sample Number : P13671

Position in field : TP3

Sample Description : Light Brown Silty Sand Gravel Res.Tillite

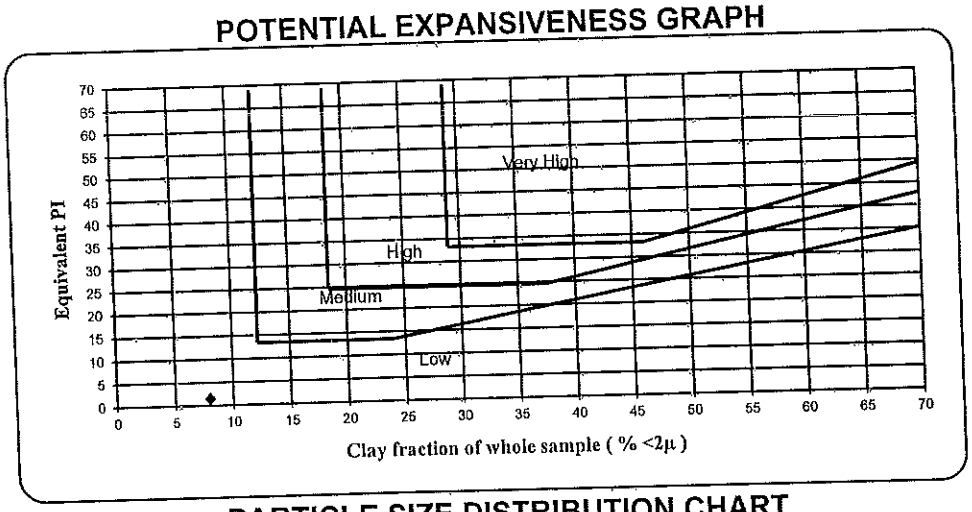
Field or Pit Number : -

Depth (mm) : 420-1300

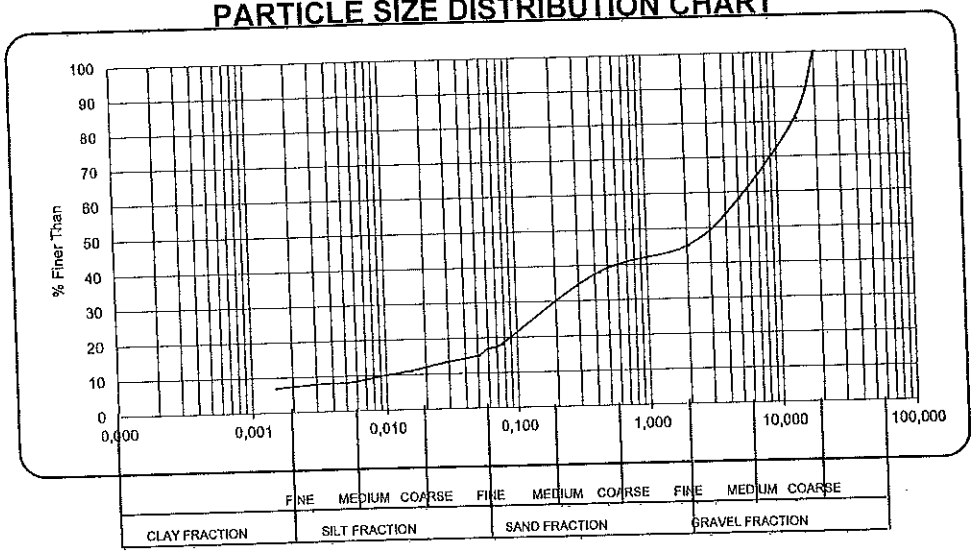
Equivalent PI : 1,5

Clay fraction of whole sample (% <2μ) : 8

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



For Soilco : _____ Technical Signatory

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

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Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No. : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sample Delivered by : Client

Sample Number : P13672

Position in field : TP4

Sample Description : Dark Brown Silty Sand Colluvium

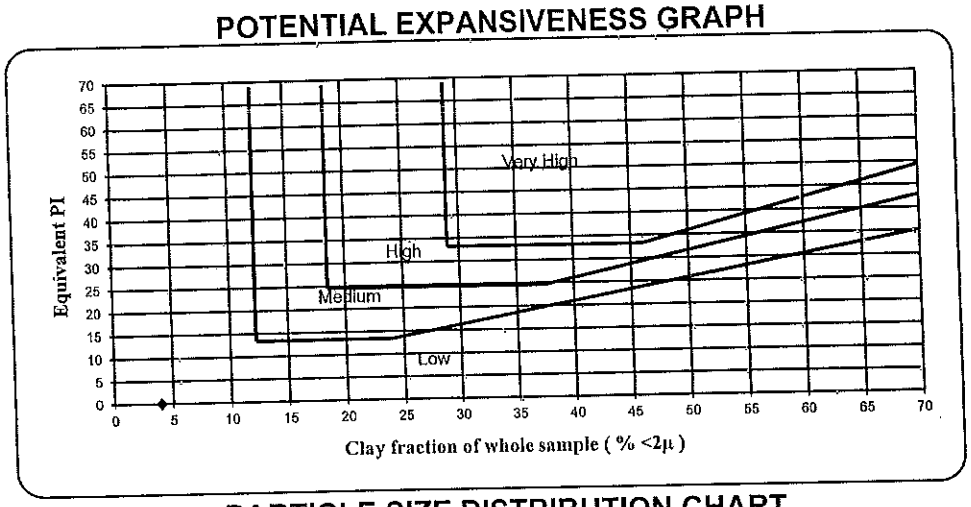
Field or Pit Number : -

Depth (mm) : 0-500

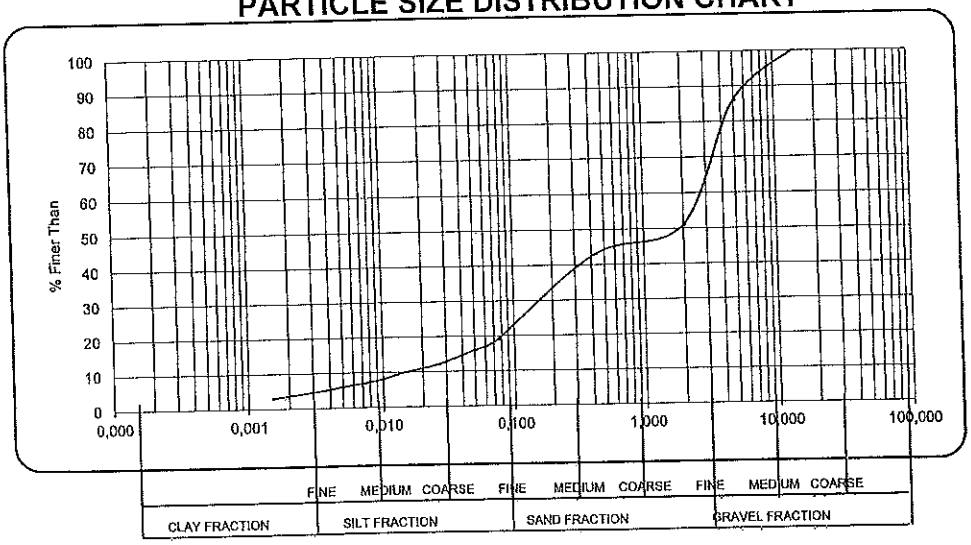
Equivalent PI : 0

Clay fraction of whole sample (% <2μ) : 4

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



For Soilco : _____ Technical Signatory

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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Client : SRK Consulting

Project : Mandeni Soccer Field - 559426

Job Card No. : 228091

Date Received : 2021-01-22

Date Tested : 2021-01-25

Date Reported : 2021-01-29

Sample Delivered by : Client

Sample Number : P13670

Field or Pit Number : -

Position in field : PT2

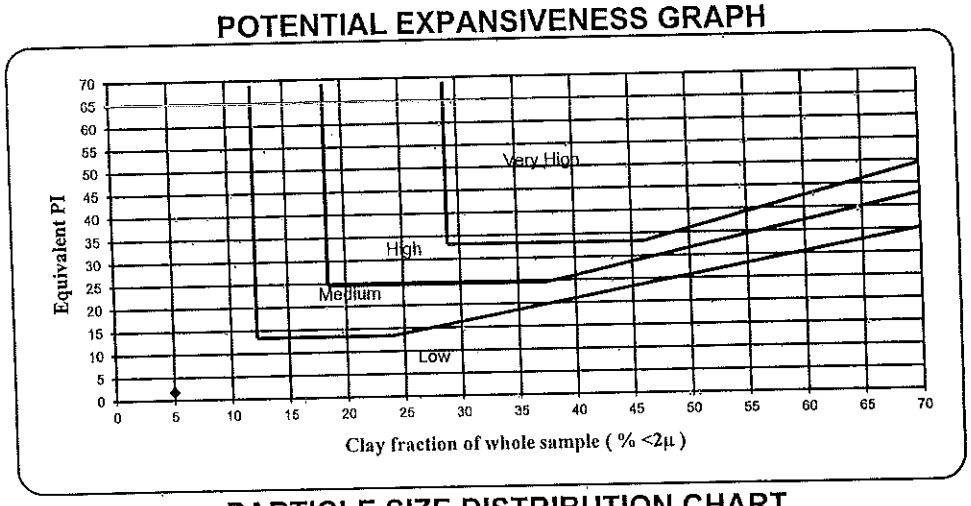
Depth (mm) : 600-950

Sample Description : Light Yellow brown Silty Sand Gravel Res.Tillite

Equivalent PI : 1,8

Clay fraction of whole sample (% <2μ) : 5

POTENTIAL EXPANSIVENESS GRAPH



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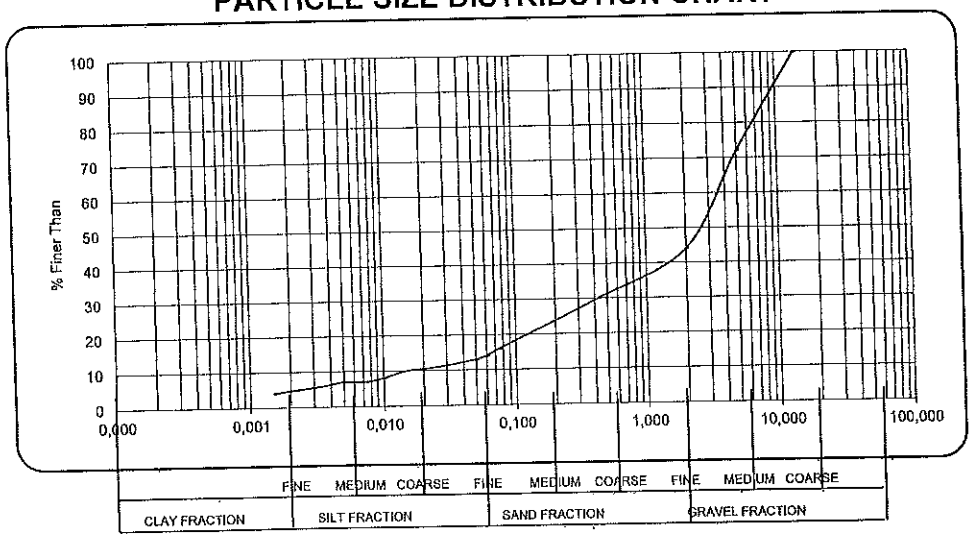


For Soilco : _____ **Technical Signatory**

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 HALSTED ROAD - 24 DAVLEN PARK - MKONDENI - P.O.BOX 846 PIETERMARITZBURG - 3200

TELEPHONE : 033 - 386 9095 TELEFAX : 033 - 386 1878 email : balin@soilco.co.za

T 0823

Date : 2021-02-10

For the Attention of : Shannon Krebs

Customer Name : SRK Consulting

Address : P O Box 1969
Westville
3630

Project Information : Mandeni Soccer Field, 559426

Job Card Number : 228091

Sample Number / s : P13671

Dear Sir / Madam,

Herewith, please find the original report / s, pertaining to the above - mentioned project. All tests conducted are in accordance with prescribed test method / s. Information herein consists of the following : -

Materials Report and Reference No.	Test Conducted	Prescribed Method	No. of Pages
Materials Report (Soilco SF 33)	The Determination of Maximum Dry Density & Optimum Moisture Content	SANS 3001 GR 30	1
	California Bearing Ratio	SANS 3001 GR 40	1

We thank you for your valued support and look forward to assisting you in the near future.

Yours faithfully,

For Soilco (Technical Signatory)

Any test results contained in this report and marked with * in the table above are " Not SANAS Accredited ", and are Not included in the Schedule of Accreditation for this Laboratory.

Any information contained in this test report pertain only to the areas and / or samples tested. Documents may only be reproduced or published in their full context. Any information in relation to the client and associated test results, gained by the laboratory prior, during or after the test process will be treated as confidential and will not be reproduced or disclosed to any person or organization, without the prior written consent from the client, unless required by law or covered by legally enforceable, signed confidentiality undertakings (i.e. SANAS Assessors or Internal Auditors). If the arrangement is not suitable to you, our client, please contact the management of Soilco Materials Investigations (Pty) Ltd.

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

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

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

Deviation from Test Method : - Moisture Contents Dried Overnight at 105°C to 110°C.

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 HALSTED ROAD - 24 DAVLEN PARK - MKONDENI - P.O.BOX 846 PIETERMARITZBURG - 3200

TELEPHONE : 033 386 9095 TELEFAX : 033 386 1878 email : balin@soilco.co.za

T 0823

Customer	: SRK Consulting	Job Card No.	: 228091
Project	: Mandeni Soccer Field, 559426	Date Received	: 2021-01-21
		Date Tested	: 2021-02-04 to 2021-02-08
Sampling Process	: Samples Delivered by Customer	Date Reported	: 2021-02-10

MATERIALS TEST REPORT

Laboratory Number	P13671				
Field Number					
Position in field	TP 3				
Depth (mm)	420 - 1300				
Sample Description	Light Brown Silty Sand, Gravel, Res Tillite				
Stabilising Agent	Natural				

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0 mm	Percentage Passing					
75.0 mm						
63.0 mm						
50.0 mm						
37.5 mm						
28.0 mm						
20.0 mm						
14.0 mm						
5.0 mm						
2.0 mm						
0.425 mm						
0.075 mm						
Specific Gravity	2.687					

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)					
Coarse - Fine Sand	(%)					
Medium - Fine Sand	(%)					
Fine - Fine Sand	(%)					
Silt and Clay	(%)					

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit	(%)					
Plasticity Index	(%)					
Linear Shrinkage	(%)					

Classification

Classification Group Index						
COLTO Classification	#	G8				
TRH 14 Classification (1985)	#	G8				

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Maximum Dry Density	(kg/m^3)	2092				
Optimum Moisture Content	(%)	9.8				

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	45			
CBR	@	98 %	Compaction	30			
CBR	@	95 %	Compaction	16			
CBR	@	93 %	Compaction	10			
CBR	@	90 %	Compaction	6			
Swell	@	100 %	Compaction	0.02			

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

For Soilco - P. Govender (Technical Signatory)
2015-05-12

Revision 1

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

11 HALSTED ROAD - 24 DAVLEN PARK - MKONDENI - P.O.BOX 846 - PIETERMARITZBURG 3200

TELEPHONE : 033 - 3869095 : TELEFAX 033 - 3861878 - email : balin@soilco.co.za

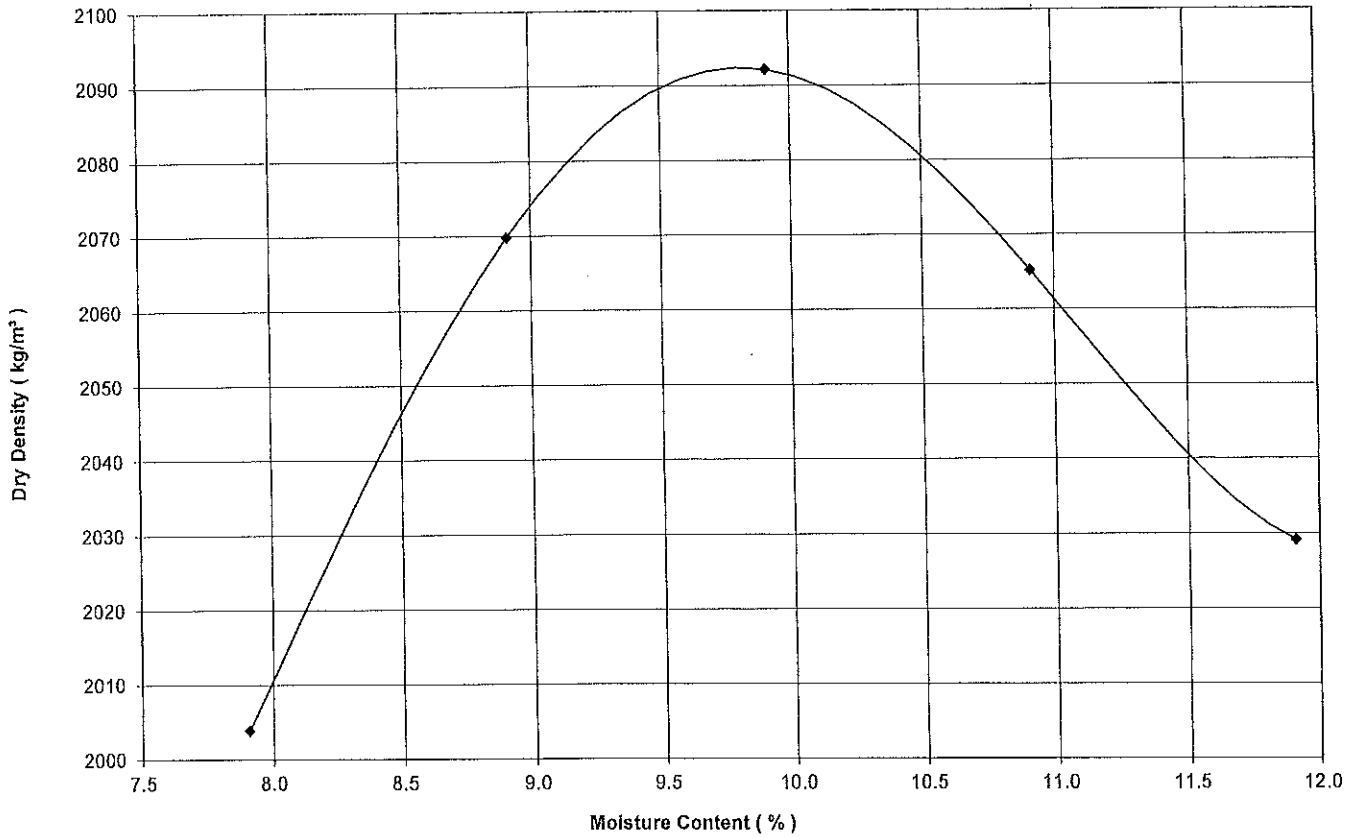
T 0823

Client :	SRK Consulting	Job Card No. :	228091
Project :	Mandeni Soccer Field, 559426	Date Received :	2021-01-21
		Date Tested :	2021-02-04
Sampling Process :	Samples Delivered by Customer	Date Reported :	2021-02-10

Laboratory Number :	P13671	Field Reference No. :	
Position in field :	TP 3	Depth (mm) :	420 - 1300
Material Description :	Light Brown Silty Sand, Gravel, Res Tillite		

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	8.9	9.9	10.9	11.9	7.9	Maximum Dry Density	2092 kg/m³
Dry Density (kg/m³)	2070	2092	2065	2029	2004	Optimum Moisture Content	9.8 %



Remarks :

Method of Preparation : Scalping Process

For Soilco :

P. Govender (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

`CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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TELEPHONE : 031 - 7004325 TELEFAX : 031 - 7001909 email : soilslab@mweb.co.za

sanas T 0213

Date : 2021-02-01

For the Attention of : Contracts Manager

Customer Name : SRK Consulting

Address : P.O Box 460
Pietermaritzburg
3200

Project Information : Mandeni Soccer Field - 559426

Job Card Number : 2021-D-0176

Sample Number / s : D0176-1

Dear Sir / Madam,

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

Materials Report and Reference No.	Test Conducted	Prescribed Method	No. of Pages
Aggregate Test Report (Soilco SF 56)	Electrical Conductivity	TMH 1 - A21T	1
Aggregate Test Report (Soilco SF 56)	pH Value	TMH 1 A20	

We thank you for your valued support and look forward to assisting you in the near future.

Yours faithfully,

For Soilco (Technical Signatory)

Any test results contained in this report and marked with * in the table above are " Not SANAS Accredited ", and are Not included in the Schedule of Accreditation for this Laboratory.

Any information contained in this test report pertain only to the areas and / or samples tested. Documents may only be reproduced or published in their full context. Any information in relation to the client and associated test results, gained by the laboratory prior, during or after the test process will be treated as confidential and will not be reproduced or disclosed to any person or organization, without the prior written consent from the client, unless required by law or covered by legally enforceable, signed confidentiality undertakings (i.e. SANAS Assessors or Internal Auditors). If the arrangement is not suitable to you, our client, please contact the Management of Soilco Materials Investigations (Pty) Ltd.

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

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

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

Deviation from Test Method : - Moisture Contents Dried Overnight at 105°C to 110°C.

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

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TELEPHONE : 031 7004325 TELEFAX : 031 7001909 email : soilslab@mweb.co.za

a SANAS Accredited Testing Laboratory, No. T0213

T0213

Customer : SRK Consulting via Soilco Vryheid

Project : Mandeni Soccer Field - 559426

Job Card No. : 2021-D-0176

Date Received : 2021-01-26

Date Tested : 2021-01-28

Date Reported : 2021-02-01

Sampling Process : Samples Delivered by Customer

AGGREGATE TEST REPORT

Laboratory No.	D0176-1					
Field No.	P13668 / TP 1					
Position in Field						
Depth (mm)						
Material Description	Lt.Y.Greyish Br. Silty Sandy Clay Residual Tillite					

Sieve Analysis (% Passing) SANS AG 1

Sieve Aperture							
	100.0	mm					
	75.0	mm					
	63.0	mm					
	50.0	mm					
	37.5	mm					
	28.0	mm					
	20.0	mm					
	14.0	mm					
	10.0	mm					
	7.1	mm					
	5.0	mm					
	2.0	mm					
	1.0	mm					
	0.600	mm					
	0.425	mm					
	0.300	mm					
	0.150	mm					
	0.075	mm					

Material Characteristics

Fineness Modulus			**SANS PR 5**					
Flakiness Index		**(%)**	**SANS AG 4**					
Average Least Dimension		**(mm)**	**SANS AG 2**					
Aggregate Crushing Value		**(%)**	**SANS AG 10**					
10% Fact	**(Dry)**	**(Kn)**						
	(Wet)	**(Kn)**						
	Wet / Dry Ratio	**(%)**						
Organic Impurity			**TMH 1 B6**					
pH Value *			**TMH 1 A20**	7.42				
Electrical Conductivity *		**$S.m^{-1}$**	**TMH 1 - A21T**	0.17880				
Water Absorption		**(%)**	**SANS AG 20 or 21**					
Bulk Density		**(kg / m^3)**						
Apparent Density		**(kg / m^3)**						

Remarks :

For Soilco : (Technical Signatory)

2015-04-06 Revision 2

Appendix E: Summary of NHBRC Foundation Recommendations

Home Building Manual: Part 1 Section 2 Tables 1 - 7

- Table 1
- Table 2
- Table 3
- Table 4
- Table 5
- Table 6
- Table 7
- Table 8

Home Building Manual: Part 1 Section 2, Table 1

Residential site class designations

TYPICAL FOUNDATION 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 waist fill, mining subsidence, Reclaimed areas, Uncontrolled fill, Very soft silts/silty clays	VARIABLE	VARIABLE		P

Home Building Manual: Part 1, Section 2, Table 2

Classification of damage with reference to masonry walls in single storey units

DESCRIPTION OF DAMAGE IN TERMS OF EASE OF REPAIR AND TYPICAL EFFECTS	APPROXIMATE MAXIMUM CRACK WIDTH IN WALLS (mm)	CATEGORY AND DEGREE OF EXPECTED DAMAGE
MINOR DAMAGE - CATEGORIES 0 TO 2		
Hairline cracks less than about 0,25 mm width are classed as negligible.	<0,25	0 Negligible
Fine internal cracks, which can easily be treated during normal decoration. Cracks rarely visible in external	< 1 (Isolated; localized)	1

DESCRIPTION OF DAMAGE IN TERMS OF EASE OF REPAIR AND TYPICAL EFFECTS	APPROXIMATE MAXIMUM CRACK WIDTH IN WALLS (mm)	CATEGORY AND DEGREE OF EXPECTED DAMAGE
MINOR DAMAGE - CATEGORIES 0 TO 2		
masonry.		Very slight
Internal cracks easily filled. Redecoration probably required. Recurrent cracks can be masked by suitable linings. Cracks not necessarily visible externally. Doors and windows may stick slightly.	<5	2 Slight
SIGNIFICANT DAMAGE - CATEGORIES 3 TO 5		
Cracks can *be* repaired and possibly a small amount of masonry may have to be replaced. Articulation joints may have to be cut into some of the walls. Doors and windows sticking. Rigid service pipes may fracture. Weather tightness often impaired. Up to 10 mm gap between ceiling cornices and walls.	5 to 1 5 (or a number of cracks (3 to 5) in one group)	3 Moderate
Extensive repair work which includes breaking out and replacing sections of walls, especially over doors and windows, cutting of articulation joints in walls and the construction of moisture trenches and apron slabs around the building, or the jacking of foundations depending on the type of soil movement. Window and door frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes probably disrupted. Up to 20 mm gap between ceiling cornices and walls.	15 to 25 (depending also on number of cracks in a group)	4 Severe
Major repair work required, involving partial rebuilding and the above mentioned repair techniques. Beams loose bearing, walls tilt badly and require shoring. Windows broken and distorted. Danger of instability.	Usually greater than 25 (depending also on number of cracks in a group)	5 Very severe

NOTE:
1. Crack width is only one factor in assessing damage and should not be used on its own as a direct measure of damage. In assessing the degree of severity of damage, account must be taken of the location in the building where it occurs, and also of the function of the building.
2. This classification is based on the ease of repair which may be considered under three headings representing a progression in difficulty of repair, viz. redecoration due to wear and tear, remedial work to reinstate functional efficiency and structural repair. former two categories relate to minor damage (categories 0 to 2).
3. In most instances, minor damage (categories 0 to 2) represent aesthetic damage as opposed to serviceability damage (Categories 3 and 4) and stability damage (category 5).
4. Where cracks less than 1 mm are widespread throughout the building, the damage may be regarded as being Category 2.
5. The descriptions contained in the first column relate to single storey construction. In multi-storey construction, these descriptions will require modification for a particular category of expected damage.

Home Building Manual: Part 1, Section 2, Table 3

Classification of damage with reference to concrete floors

DESCRIPTION OF TYPICAL DAMAGE	APPROXIMATE MAXIMUM CRACK WIDTH IN FLOOR (mm)	MAXIMUM DEVIATION OF ANY JOINT FROM A 3 m STRAIGHT EDGE (mm)	CATEGORY AND DEGREE OF EXPECTED DAMAGE

MINOR DAMAGE - CATEGORIES 0 TO 2			
Hairline cracks, insignificant tilt of floor or change in level.	<0,3	<5	0 Negligible
Fine but noticeable cracks. Floor reasonably level.	<1,0	<1,0	1 Very slight
Distinct cracks. Floor noticeably curved or changed in level.	<2,0	<10	2 Slight
SIGNIFICANT DAMAGE - CATEGORIES 3 TO 5			
Wide cracks. Obvious curvature or change in level - local deviation of slope from the horizontal may exceed 1 :100	2 to 4	10 to 20	3 Moderate
Gaps in floor. Disturbing curvature or change in level.		>20	4 to 5 Severe to very severe

NOTE: Local deviation of slope, from the horizontal or vertical, of more than 1/100 will normally be clearly visible. Overall deviations in excess of 1/250 are undesirable.

Home Building Manual: Part 1, Section 2, Table 4

Classification of damage caused by ground floor slab settlement

DESCRIPTION OF TYPICAL DAMAGE	APPROXIMATE CRACK WIDTH IN FLOOR (mm)	APPROXIMATE GAP (mm)	CATEGORY OF DEGREE OF EXPECTED DAMAGE
MINOR DAMAGE - CATEGORIES 0 TO 2			
Hairline cracks between floor and skirtings.		Up to 1	0 Negligible
Settlement of the floor slab, either at a comer or along a short wall, or possibly uniformly, such that a gap opens up below skirting boards but which can be masked by resetting skirting boards. No cracks in floor slabs, although there may be negligible cracks in floor screed and finish. Slab reasonably level.		Up to 5	1 Very slight
Larger gaps below skirting boards; some obvious but limited local settlement leading to slight slope of floor slab; gaps can be masked by resetting skirting boards and some local re-screeding may be necessary. Fine cracks appear in internal walls which may require some redecoration; slight distortion in door frames which may result in sticking of doors. No cracks in floor slab although there may be very slight cracks in floor screed and finish. Slab reasonably level.	Up to 1	Up to 15	2 Slight

DESCRIPTION OF TYPICAL DAMAGE	APPROXIMATE CRACK WIDTH IN FLOOR (mm)	APPROXIMATE GAP (mm)	CATEGORY OF DEGREE OF EXPECTED DAMAGE
MINOR DAMAGE - CATEGORIES 0 TO 2			
SIGNIFICANT DAMAGE - CATEGORIES 3 TO 5			
Significant gaps below skirting boards with some areas of floor, especially at corners or ends, where local settlements may have caused slight cracking of floor slab. Sloping of floor In these areas is clearly visible. (Slope approximately 1 in 150). Some disruption to drain, plumbing or heating pipes may occur. Damage to internal walls is more widespread with some crack filling or re-plastering of partitions being necessary. Doors may have to be refitted. Inspection reveals some voids below slab with poor or voids below slab with voids below slab with poor or loosely compacted fill.	Up to 5	Up to 20	3 Moderate
Large, localized gaps below skirting boards; possibly some cracks in floor slab with sharp fall to edge of slab; (slope approximately 1 in 100 or more). Inspection reveals voids exceeding 50 mm below slab and/or poor or loose fill likely to settle further. Local breaking-out, part refilling and relaying of floor slab or grouting of fill may be necessary; damage to internal partitions may require replacement of some portions of masonry walling.	5 to 15	Up to 25	4 Severe
Either very large, overall floor settlement with large movement of walls and damage at junctions extending up into 1st floor area, with possible damage to exterior walls, or large differential settlements across floor slab. Voids exceeding 75 mm below slab; and/or very poor or very loose fill likely to settle Risk of instability. Most or all of floor slab requires breaking out and relaying or grouting of fill; internal partitions need replacement.	Usually greater than 15 but depends on the number of cracks	Greater than 25	5 Very severe

NOTE: "Gap" refers to the space, usually between the skirting and finished floor, caused by settlement after making appropriate allowance for discrepancy in building, shrinkage, normal bedding down and the like.

Home Building Manual: Part 1, Section 2, Table 5

Foundation design, building procedures and precautionary measures for single storey residential structures founded on expansive soil horizons.

SITE CLASS	ESTIMATED TOTAL HEAVE (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
H	<7,5	Normal	* Normal construction (strip footing or slab-on-the-ground) foundation. * Site drainage and service/plumbing precautions recommended
H1	7,5-15	Modified normal	* Lightly reinforced strip footings. * Articulation joints at all internal/external doors and openings. * Light reinforcement in masonry. * Site drainage and plumbing/service precautions.
H1	7,5-15	Soil raft	* Remove all or necessary parts of expansive horizon to 1,0 m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1 % to + 2% of optimum moisture content. * Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7,5 mm, or construction type appropriate to residual movements. * Site drainage and plumbing/service precautions.
H2	15-30	Stiffened or cellular raft	* Stiffened or cellular raft of articulated lightly reinforced masonry. * Site drainage and plumbing/service precautions.
H2	15-30	Piled construction	* Piled foundations with suspended floor slabs with or without ground beams. * Site drainage and plumbing/service precautions.
H2	15-30	Split construction	* Combination of reinforced masonry and full movement joints. * Suspended floors or fabric reinforced ground slabs acting independently from the building. * Site drainage and plumbing/service precautions
H2	15-30	Soil raft	* As for H1.
H3	>30	Stiffened or cellular raft	* As for H2.
H3	>30	Piled Construction	* As for H2.
H3	>30	Soil raft	* As FOR H1.

NOTE:
1) Differential heave equals 50% of total heave.
2) The relaxation of some of these requirements, e.g. the reduction or omission of reinforcement or articulation joints, may result in a Category 2 level of expected damage.

Home Building Manual: Part 1, Section 2, Table 6

Foundation design, building procedures and precautionary measures for single storey residential structures founded on soil horizons subject to both consolidation and collapse settlement

SITE CLASS	ESTIMATED TOTAL SETTLEMENT (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)

SITE CLASS	ESTIMATED TOTAL SETTLEMENT (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
C	<5	Normal	* Normal construction (strip footing or slab-on-the-ground) foundations * Good site drainage
C1	5-10	Modified normal	* Reinforced strip footings. * Articulation joints at some internal and all external doors * Light reinforcement in masonry. * Site drainage and service/plumbing precautions * Foundation pressure not to exceed 50 kPa
C1	5-10	Compaction of insitu soils below individual footings	* Remove insitu material below foundations to a depth and width of 1 ,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1 % to + 2% of optimum moisture content. * Normal construction with lightly reinforced strip fooncatror and light reinforcement in masonry.
C1	5-10	Deep strip foundations	* Nomal construction with drainage precautions. * Founding on a competent horizon below the problem horizon.
C1	5-10	Soil raft	* Remove insitu material to 1 ,0 m beyond perimeter of the building to a depth of 1 ,5 times the widest foundation or to a competent horizon and replace with material compacted to to 93% MOD AASHTO density at 1% to - 2% of optimum moisture content. * Normal construction with lightly reinforced strip footings and lightly reinforcement in masonry.
C2	>10	Stiffened strip footings, stiffened or cellular raft	* Stiffened strip footings or stiffened or cellular raft with lightly reinforced or articulated masonary. * Beering pressure not to exceed 50 kPa. * Fabric reinforcement in floor slabs. * Site drainage and service/plumbing precautions.
C2	>10	Deep strip foundations	* As for C1 but with fabric reinforcement in floor slabs.
C2	>10	Compaction of insitu soils below individual footings	* As for C1
C2	>10	Piled or pier foundations	* Reinforced concrete ground beams or solid slabs on piled or pier foundations. * Ground slabs with fabric reinforcement * Good site drainage.
C2	>10	Soil raft	* As for C1.

NOTE:
1) Differential settlement equals 75% of total settlement.
2) The relaxation of some of these requirements, e.g. the reduction or omission of reinforcement or articulation joints, may result in a Category 2 level of expected damage.

Home Building Manual: Part 1, Section 2, Table 7

Foundation design, building procedures and precautionary measures for single storey residential structures founded on soil horizons subject to consolidation settlement.

SITE CLASS	ESTIMATED TOTAL SETTLEMENT (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
S	<10	Normal	* Normal construction (strip footing or slab-on-the ground) foundation. * Foundation bearing pressure not to exceed 50 kPa * Good site drainage.
S1	10-20	Modified normal	* Remove insitu material below foundations to a depth and width of 1,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1 % to + 2% of optimum moisture content. * Normal construction with lightly reinforced strip foundations and light reinforcement in masonry.
S1	10-20	Compaction of insitu soils below individual footings	* Remove insitu material below foundations to a depth and width of 1 ,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1 % to + 2% of optimum moisture content. * Normal construction with lightly reinforced strip foundation and light reinforcement in masonry.
S1	10-20	Deep strip foundations	* Normal construction with drainage precautions. * Founding on a competent horizon below the problem horizon.
S1	10-20	Soil raft	* Remove insitu material to 1,0 m beyond perimeter of building to a depth of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1 % to + 2% of optimum moisture content. * Normal construction with lightly reinforced strip footings and light reinforcement in masonry.
S2	>20	Stiffened strip footings, stiffened or cellular raft	* Stiffened strip footings or stiffened or cellular raft with lightly reinforced or articulated masonry. * Bearing pressure not to exceed to 50 kPa. * Mesh reinforcement in floor slabs. * Site drainage and service/plumbing precautions.
S2	>20	Deep strip foundations	* As for S1 but with mesh reinforcement in floor slabs.
S2	>20	Compaction of insitu soils below individual footings	* As for S1.
S2	>20	Piled or pier foundations	* Reinforced concrete ground beams or solid slabs on piled or pier foundations. * Ground slabs with fabric reinforcement. * Good site drainage.
S2	>10	Soil raft	* As for S1.

NOTE:
1) Differential settlement equals 50% of total settlement.
2) The relaxation of some of these requirements, e.g. the reduction or omission of reinforcement or articulation joints, may result in a Category 2 level of expected damage.
3) Account must be taken of sloping sites where differential fill heights may lead to greater differential settlements.

4) Settlements induced by loads imposed by deep filling beneath surface beds may necessitate the adoption of a construction type appropriate to a more severe site class.

Home Building Manual: Part 1, Section 2, Table 8

DOLOMITIC AREA CLASS	DESCRIPTION	TYPICAL FOUNDATION SOLUTIONS
D1	No precautionary measures are required to permit the construction of housing units due to an adequate overburden thickness. Sites can be classified in accordance with Part 1, Section 2, Table 1 on the basis of the characteristics of the near surface soil horizons.	Foundations in accordance with Part 1, Section 2, Tables 5 to 7.
D2	The risk of sinkhole and doline formation is adjudged to be such that only general precautionary measures, which are intended to prevent the concentrated ingress of water into the ground, are required to permit the construction of housing units. Sites can be classified in accordance with Part 1, Section 2, Table 1 on the basis of the characteristics of the near surface soil horizons.	Foundations in accordance with Part 1, Section 2, Tables 5 to 7.
D3	The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground, are required to permit the construction of housing units.	Possible solutions include the use of either shallow reinforced strip footings or reinforced concrete slab-on-the-ground foundation which in turn are founded on engineered fill mattresses comprising chert gravel or other granular fill; concrete raft foundations spanning between near surface pinnacles or other appropriate solutions
D4	The risk of sinkhole and doline formation is such that precautionary measures cannot adequately reduce such risks to acceptable limits so as to permit the construction of housing units or the precautionary measures which are required are impracticable to implement.	

NOTE:
The method of scenario supposition (Buttrich and Van Schalkwyk 1995) should be used to arrive at dolomitic zone designations (See Addendum to Code of Practice for foundations and superstructures for single storey residential buildings of masonry construction, May 1998).

SRK Report Distribution Record

Report No. 559426

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