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ENGINEERING GEOLOGICAL INVESTIGATION REPORT OF PORTION 243 ROODEKRANS 183 IQ, MOGALE CITY.

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Report No 0624
July 2024

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ENGINEERING GEOLOGICAL INVESTIGATION REPORT OF PORTION 243 ROODEKRANS 183 IQ, MOGALE CITY.

1. INTRODUCTION

1.1 Preamble

During May 2024, Ms. N. Conradie of Hunter Theron Town Planners invited Mr. Jan Arkert Consulting Engineering Geologist to submit a proposal for the completion of a geotechnical investigation of a site situated on Portion 243 of the farm Roodekrans 183-IQ, to be referred to as Homes Haven Ext. 65 in Mogale City.

Subsequently, on 25th June 2024 an email was received from Hunter Theron, confirming the appointment of Mr. Arkert to proceed with the required investigation.

1.2 Database

The following information was supplied to Jan Arkert:

- The site covers a surface area of some 1.57ha.
- It is intended to develop a restaurant, guesthouse and “Residential 3" units.

1.3 Objectives

The objectives of the investigation were:

- to identify the soil and rock conditions below the site to a depth of 3.0m or refusal.
- to recommend suitable foundation systems, and founding depths for the proposed structures.
- to comment on any perceived geotechnical problems which may affect either the design or construction of the project.
- to determine the geomorphological characteristics of the site.
- to classify the site in terms of the National Home Builders Registration Council (NHBRC) of 2016.

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2. FACTUAL REPORT

2.1 Programme of Work

2.1.1 *Literary Review*

The geological evaluation of the site is based on a literature search and appropriate information was obtained from the following maps:-

i. The 1: 250 000 geological map, No 2626 West Rand, published by The Government Printers, Pretoria 1986.
ii. The 1 : 50 000 Topo-cadastral maps 2627 BB Roodepoort, published by The Department of Survey and Mapping, Mowbray 1995.
iii. Aerial photographs obtained from Google.earth, which covers the study area.
iv. "Engineering Geology of Southern Africa" volume 1, by A.B.A. Brink (1979), published by Building Publications.
v. "The Natural Road Construction Materials of Southern Africa" by H.H. Weinert (1980) published by Council for Scientific and Industrial Research, Pretoria.
vi. The *"Guidelines for Urban Engineering Geological Investigations"* as published by the South African Institute of Engineering Geologists*."*
vii. "The engineering geology of the PWV area" by A.B.A. Brink 1991
viii. Course notes "Introduction to Ground Water" prepared by the Geological Society of South Africa Ground Water Division, 1992.

2.1.2 *Field Work*

On 22nd July 2024, five test pits were excavated by hand at positions that were selected on the site. The layout of the test pits are shown on the Site Plan in Appendix 1. Each hole was profiled by an engineering geologist according to the Jennings, Brink and Williams system, sampled as necessary and backfilled. The detailed profile logs are shown in Appendix 2.

2.1.3 *Office and Laboratory Work*

From the soil samples recovered, four were selected for Foundation Indicator Tests and all the individual test results are included in Appendix 3 of this report.

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2.2 Site Description

The site covers a surface area of some 1.57ha, and is located on the western side of Viljoen Str. in Poortview in Mogale City. The site is approximately rectangular in shape and is bound to the east by Viljoen Str. and to the west by the perennial Crocodile River. The remaining boundaries are defined by existing agricultural holdings and residential developments.

An occupied house and associated outbuildings are situated on the eastern side of the stand. The property, which slopes at a gradient of some 10 to 12% down to the west is covered by a scattered well developed trees interspersed with lawns around the existing house, while the remainder of the property consist of natural veld grasses.

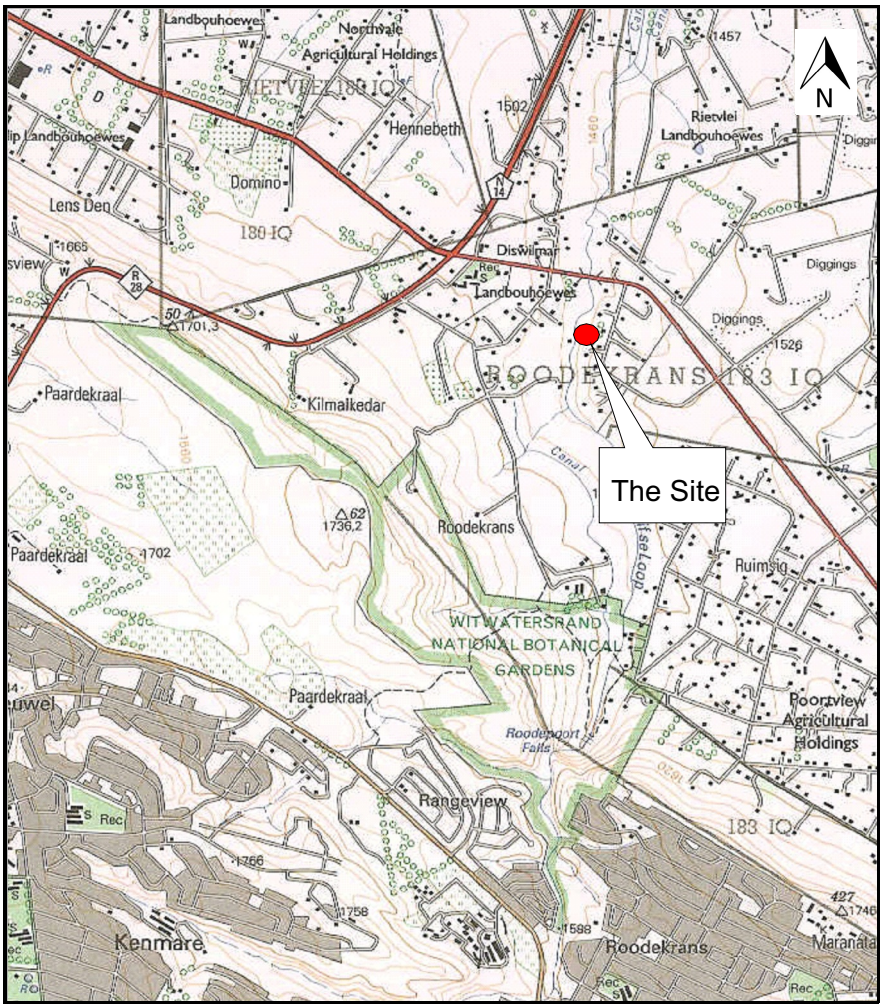


Figure 1. Map showing location, topography and adjacent land use

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2.3 Site Geology

According to the 1 : 250 00 West Rand geological sheet (2626), the site is underlain by mafic and ultra mafic rocks, mainly altered to serpentinite, talc chlorite schist's and amphibolites, more commonly known as greenstones. These rocks belong to the Swaziland Supergroup which form part of a primitive crustal remnant which has been intruded by Basement Granites.

To the south of the site the very prominent Witwatersrand Ridge can be seen. This ridge is the base of the Witwatersrand Supergroup which lies unconformably over the much older greenstones. No evidence of faulting or dykes are present across the site.

The site is situated on the northern pediment slope of the Witwatersrand ridge. As a result of the resistant Orange Grove Quartzite ridge locally protecting the residual greenstone soils from erosion, a thick mantle of residual soils have been formed below north facing talus and upper pediment slopes.

No structural features of significance are known to occur in the area.

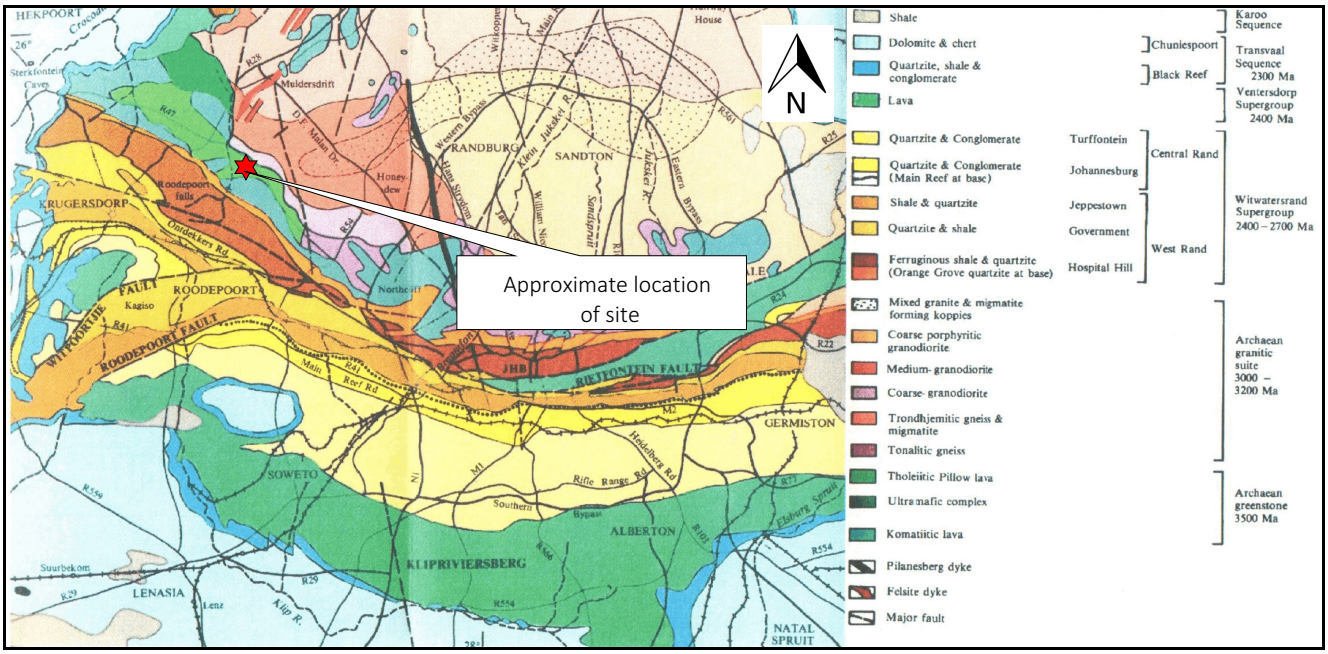


Figure 2. Regional geology map of western Gauteng

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2.4 Hydrology

The average annual rainfall in this area is approximately 750mm, most of which occurs as heavy, isolated thunder showers between October and March. Storm water runoff is primarily in the form of sheetwash towards the western side of the site and all surface drainage from the property is towards the perennial Crocodile River. The property will be affected by the positions of the 1:50 and 1:100 year flood lines, that must be determined.

No groundwater seepage was recorded in any test pit, however seasonal fluctuations of the level of the perched water table must be anticipated.

2.5 Observations

The test pits were excavated to an average depth of 1.5m and near refusal was encountered in all the test pits. A description of the soils that blanket the site is summarised below.

2.5.1 *Transported Soils*

The entire site is covered by a thin horizon, on average 0.5m thick, which consists of dense quartz and quartzite gravels and boulders contained in a silty sand matrix. The material is of colluvial origin, derived from the prominent quartzite ridges located to the south of the site.

The base of the transported soils is defined by the pebble marker which consists of sub-rounded and angular quartz gravels with ferricrete nodules, in a matrix of light orangey brown sand. The degree of cementation of the pedogenic material varies from scattered ferricrete nodules to honeycomb ferricrete, and the consistency of the horizon is dependant on the degree pedogenisis, varying from dense to very dense, and it is on average 0.3m thick.

2.5.2 *Residual Talc Schist*

The residual soil which originates from the in-situ weathering of the talc schist parent rock underlies the entire site. The soil was described as dense angular gravels in a matrix of silty and clayey sand that is strongly ferruginised in places. With increasing depth the consistency of the soil improves and becomes very dense.

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2.5.3 *Talc Schist (Greenstone) Bedrock*

The residual soil which originates from the in-situ weathering of the talc schist parent rock underlies the entire site. The soil is of dense consistency, showing the typical fine laminations often seen in residual schist soils, and consists of slightly sandy and clayey silt. With increasing depth the consistency of the soil improves and becomes very dense and tending to very soft rock schist.

2.6 Laboratory and Field Test Results

2.6.1 *Indicator testing*

For more accurate identification and classification purposes, Particle Size Distribution and Atterberg Limits Tests were carried out on representative samples of the various soil horizons present within the site. The results are shown in Appendix 3 of this report and are summarised in Table 1 below.

TABLE 1. Summary of Indicator test results

TP No.	Depth (m)	Material	PI	PI (ws)	LS (%)	Activity
1	0.4-0.6	Gravel and silty sand. Colluvium	8	2	4	low
1	1.2-1.4	Gravel and silt. Residual Talc Schist	14	6	6	low
2	0.7-0.8	Gravel with sandy clayey silt Residual Talc Schist	14	10	6	low
4	0.8-1.0	Silty sand and gravels. Colluvium	15	10	7	low

3. INTERPRETIVE REPORT

3.1 Discussion of Results

The Collapse Potential test and the Consolidation test results completed on the residual talc schist indicated that these soils are marginally compressible. The magnitudes of the anticipated settlements are shown in table 3 below. These values have been calculated by assuming that 700mm wide strip footings will be placed at an average depth of 0.8m below natural ground surface and the foundations would apply a bearing pressure of 100kPa.

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TABLE 3. Calculated Total Settlements (These estimates are only applicable for the footing geometry assumed above)			
Position	Collapse Settlement (mm)	Consolidation Settlement (mm)	Total Settlement (mm)
TP 1	0	0 to 5	0 to 5
TP 2	0	0 to 5	0 to 5

3.2 Classification of Site.

In order to classify the geotechnical characteristics of the underlying soils, the classification method proposed in the National Home Builders Registration Council (NHBRC) of 2016 has been applied to this site. Table 4 shown below indicates the various geotechnical characteristics and the criteria used to evaluate the soils.

TABLE 4. Residential Site Class Designations (National Home Builders Registration Council of 2016).				
Typical Founding Material	Character of Founding Material	Expected Range of Total Soil Movements (mm)	Assumed Differential Movement (%of Total)	Site Class
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	Compressible Soil	<10 10-20 >20	50% 50% 50%	S S1 S2

In terms of the National Home Builders Registration Council (NHBRC) of 2016 site classification system, the site has been classified as shown below.

S/R Less than 10mm consolidation settlement anticipated and shallow bedrock.

3.3 Design Solutions

No development will be permitted within the 1:100 year flood line. The site is subject to flooding and the position of the 1:50 and 1:100 year flood lines on the Crocodile River must be determined by a hydrologist.

3.3.1 *Structures*

The site has been classified an S/R site and is characterised by a thin surface horizon of transported soils which is underlain talc schist bedrock within 1.0m of

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the surface. Negligible consolidation settlement is anticipated under assumed applied pressures of less than 100kPa and total settlements of less than 10mm have been determined, using the assumptions presented in section 3.1.

It is recommended that structures built within this zone should be founded using normal strip footings placed on dense to very dense residual talc schist or very soft rock talc schist at an average depth of 0.6m. The maximum allowable bearing capacity of the residual talc schist is 100kPa, and on the talc schist bedrock bearing pressures must not exceed 300kPa.

It must be stressed that the foundations must be placed on uniform materials and should be founded completely on bedrock or completely on residual soils. Should the footings straddle rock and soil, it is strongly recommended that the entire structure is placed on soil mattress in order to prevent differential settlement occurring. The rock should be removed to a minimum depth of 1.0m below the proposed founding level. A suitable G7 to G8 quality fill material should be placed in layers of 150mm, compacted to 93% Mod AASHTO at -1% to +2% OMC. The final two layers below the foundations should be compacted to 95% Mod AASHTO. The structures may be placed on conventional strip footings, applying a maximum load of 100kPa.

3.3.2 *Roads and Terraces*

The results of the indicator tests have been used to classify the in-situ soils to determine the suitability of this material for the construction of terraces and pavement layers. The soil classification varies fro G6 to G7 material and may therefore be used in the construction of the terraces and as in-situ sub-grade. Suitable materials for use in the sub-base and base course layers must be imported from a commercial source.

3.3.3 *Excavation Classification*

It is expected that the excavation class will be “soft” according to SABS 1200 D: Earthworks, up to a depth of 1.0m. It is anticipated that the excavation will be “intermediate” and “hard” beyond a depth of 1.0m and it must also be expected that some “boulder” excavation will be encountered throughout the site. .

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3.3.4 *Stormwater Management*

It is good practice to implement sound stormwater management around each building and it is therefore suggested that the precautions presented below are considered to limit the amount of moisture reaching the foundation and thereby reducing the risk of settlement occurring.

i. All water bearing services must be provided with flexible couplings where pipes enter the buildings.
ii. A 1200mm wide apron paving must be provided around the perimeter of the structures. Joints between the paved areas and the walls of the buildings should be sealed with a flexible sealant to prevent moisture reaching the foundations.
iii. Storm water management around the structures must facilitate the efficient disposal of excess water from the site.
iv. No flower beds, garden taps, trees or down pipe discharge must be allowed adjacent to the structures, and must be placed as far away as possible.

3.4 General

3.4.1 *Buried services*

Due to the potentially mildly acidic groundwater environment, non-ferrous or plastic pipes are recommended.

3.5 Construction Problems

It must be anticipated that corestones and boulders may be encountered in the excavations. Areas of shallow bedrock immediately beneath the surface may be exposed, and limited blasting may be required for service trenches.

3.6 Additional Investigations

This investigation was completed for the purposes of township proclamation, and whilst the site has been zoned and generalised foundation recommendations have been presented for typical residential structures, the results contained in this report should not be used for site specific foundation design purposes. Additional detailed geotechnical investigations would be required for structures other than single and double storey residential units.

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APPENDIX 1

LOCALITY AND SITE MAPS



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HUNTER THERON TOWN PLANNERS

PORTION 243 ROODEKRANS 183-IQ
MOGALE CITY

LOCALITY MAP

Job No. 0624

Date: July 2024

Figure No. 3



N

0 50m

Geotechnical Classification

Site Class S/R Less than 10mm consolidation settlement anticipated and shallow bedrock.

LEGEND

TP 3 Test pit position

Boundary of site investigated

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HUNTER THERON TOWN PLANNERS

PORTION 243 ROODEKRANS 183-IQ
MOGALE CITY

GEOTECHNICAL SITE MAP

Job No. 0624

Date: July 2024

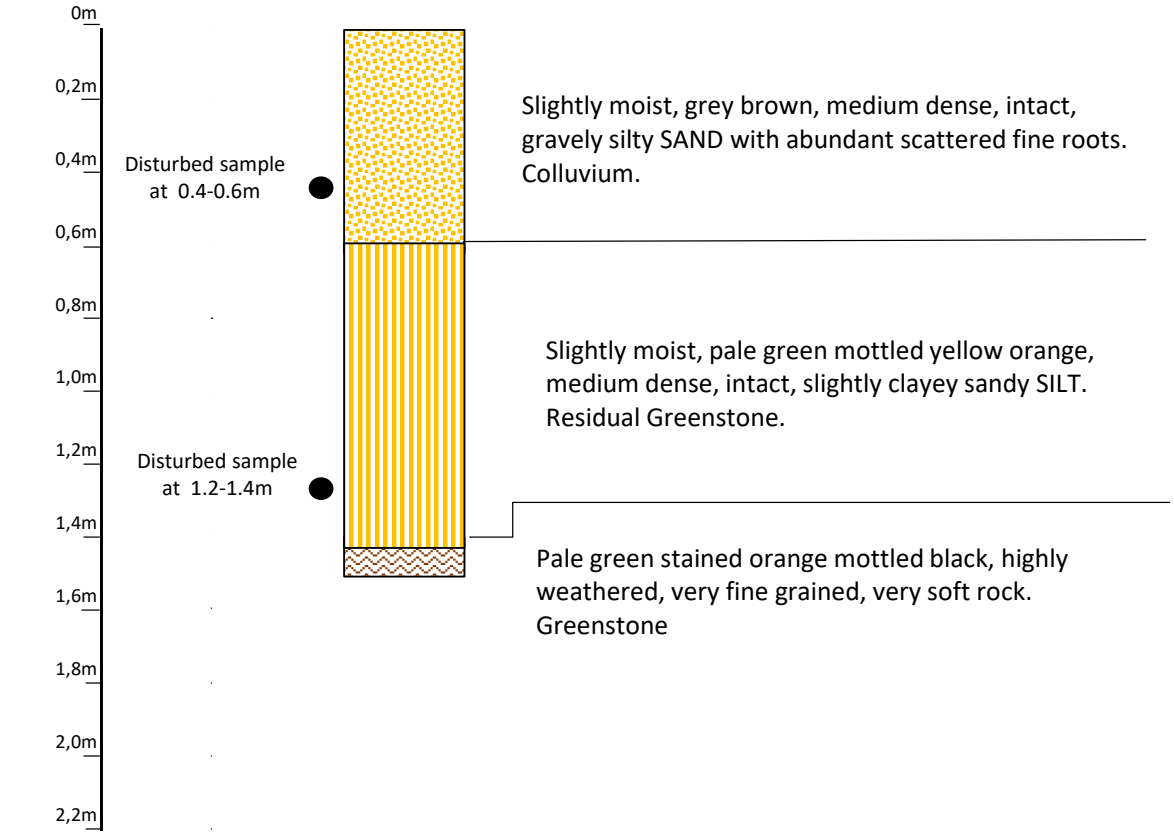
Figure No. 4

APPENDIX 2

SOIL PROFILES

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Client:	Hunter Theron Town Planners
Site:	Ptn 243 Roodekrans 183 IQ Mogale City
Project:	Mixed Use Development



Notes

1. Hard dig at 1,5m
2. No groundwater seepage observed.
3. Disturbed sample taken at 0.4-0.6m.
4. Disturbed sample taken at 1.2-1.4m

Date:	July 2024	**Machine:**	Hand
Job No:	0624	**Contractor:**	Africa Exposed
Profiler:	PR	**Test Pit No.**	**1**

J. ARKERT
ENGINEERING GEOLOGIST

Client:	Hunter Theron Town Planners
Site:	Ptn 243 Roodekrans 183 IQ Mogale City
Project:	Mixed Use Development

Depth	*Comments*	*Lithology*	*Description*
0m			
0,2m			Slightly moist, medium brown, dense, intact, gravely silty SAND with abundant roots. Colluvium
0,4m			Brown mottled yellow and pale green, highly weathered, fine grained, very soft rock. Greenstone.
0,6m			Slightly moist, pale green mottled yellow orange, medium dense, intact, slightly clayey sandy SILT. Residual Greenstone
0,8m	Disturbed sample at 0.7-0.8m		
1,0m			Pale green stained orange mottled black, highly weathered, very fine grained, very soft rock. Greenstone
1,2m			
1,4m			
1,6m			
1,8m			
2,0m			
2,2m			

Notes

1. Hard dig at 1,0m
2. No groundwater seepage observed.
3. Disturbed sample taken at 0.7-0.8m.

Date:	July 2024	**Machine:**	Hand
Job No:	0624	**Contractor:**	Africa Exposed
Profiler:	PR	**Test Pit No.**	**2**

J. ARKERT
ENGINEERING GEOLOGIST

Client:	Hunter Theron Town Planners
Site:	Ptn 243 Roodekrans 183 IQ Mogale City
Project:	Mixed Use Development

Depth	*Comments*	*Lithology*	*Description*
0m			
0,2m			Slightly moist, medium brown, dense, intact, silty gravely SAND with abundant medium size roots. Containing old metal, plastic bricks. Fill.
0,4m			
0,6m			
0,8m			
1,0m			
1,2m			
1,4m			Pale green stained orange mottled black, highly weathered, very fine grained, very soft rock. Greenstone
1,6m			
1,8m			
2,0m			
2,2m			

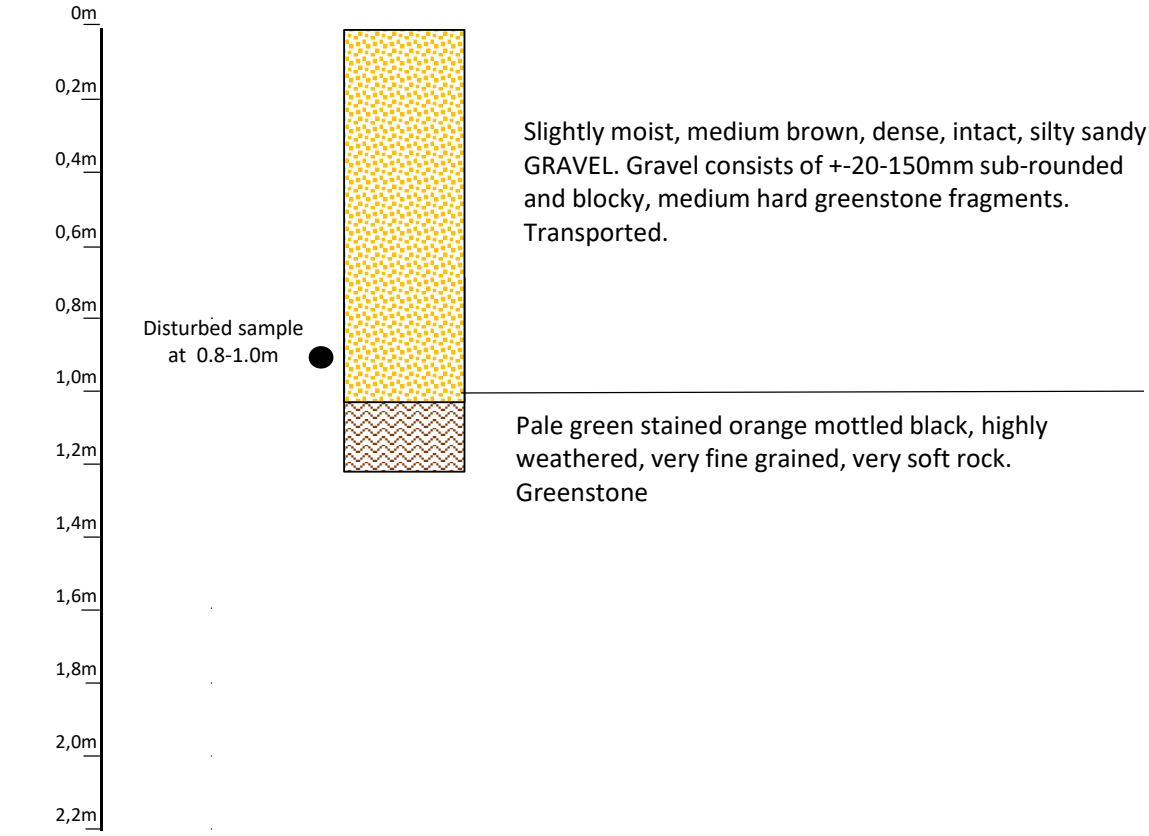
Notes

1. Hard dig at 1.6m
2. No groundwater seepage observed.
3. No samples taken

Date:	July 2024	**Machine:**	Hand
Job No:	0624	**Contractor:**	Africa Exposed
Profiler:	PR	**Test Pit No.**	**3**

J. ARKERT
ENGINEERING GEOLOGIST

Client:	Hunter Theron Town Planners
Site:	Ptn 243 Roodekrans 183 IQ Mogale City
Project:	Mixed Use Development



Notes

1. Hard dig at 1,2m
2. No groundwater seepage observed.
3. Disturbed sample taken at 0.8-1.0m.

Date:	July 2024	**Machine:**	Hand
Job No:	0624	**Contractor:**	Africa Exposed
Profiler:	PR	**Test Pit No.**	**4**

J. ARKERT
ENGINEERING GEOLOGIST

Client:	Hunter Theron Town Planners
Site:	Ptn 243 Roodekrans 183 IQ Mogale City
Project:	Mixed Use Development

Depth	*Comments*	*Lithology*	*Description*
0m			
0,2m			Slightly moist, medium brown, dense, intact, silty sandy GRAVEL. Gravel consists of +-20-150mm sub-rounded and blocky, medium hard greenstone fragments. Transported.
0,4m			
0,6m			Slightly moist, pale green mottled yellow orange, medium dense, intact, slightly clayey sandy SILT. Residual Greenstone
0,8m			
1,0m			
1,2m			Pale green stained orange mottled black, highly weathered, very fine grained, very soft rock. Greenstone
1,4m			
1,6m			
1,8m			
2,0m			
2,2m			

Notes

1. Hard dig at 1,4m
2. No groundwater seepage observed.
3. No samples taken.

Date:	July 2024	**Machine:**	Hand
Job No:	0624	**Contractor:**	Africa Exposed
Profiler:	PR	**Test Pit No.**	**5**

APPENDIX 3

LABORATORY TEST RESULTS

AFRICA EXPOSED

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FOUNDATION INDICATOR

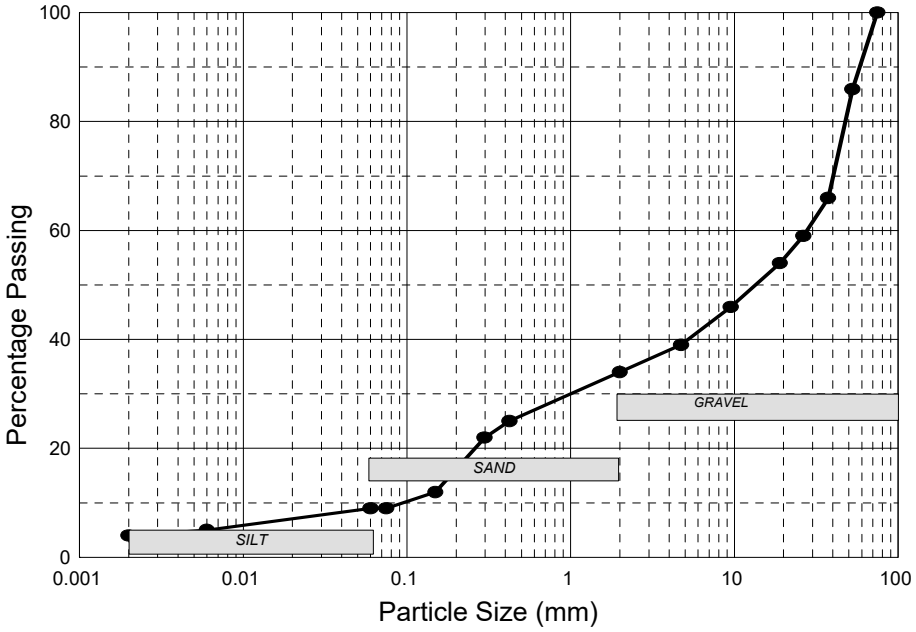
Client	HUNTER THERON TOWN PLANNERS		
Location	PTN 243 ROODEKRANS 183 IQ JOHANNESBURG.		
Date	2024/07/30	Test No	TP 1 @ 0.4 - 0.6m
Job No	0624	Checked By	JA

SIEVE ANALYSIS

Values are expressed as a percentage of total sa .

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	86.00
37.50	66.00
26.50	59.00
19.00	54.00
9.50	46.00
4.75	39.00
2.00	34.00
0.425	25.00

GRADING ANALYSIS

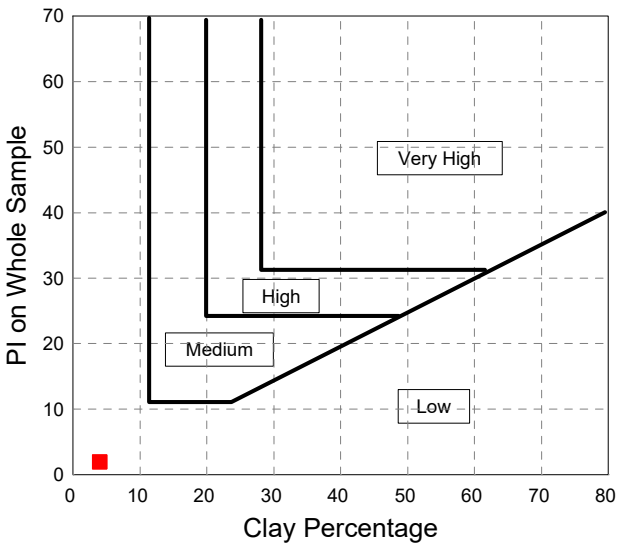


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.3000	22.00
0.1500	12.00
0.0750	9.00
0.0600	9.00
0.0060	5.00
0.0020	4.00

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	23
Plastic Limit	15
Plastic Index	8
Linear Shrinkage	4
Grading Modulus	2.19
PI on Whole Sample	2

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FOUNDATION INDICATOR

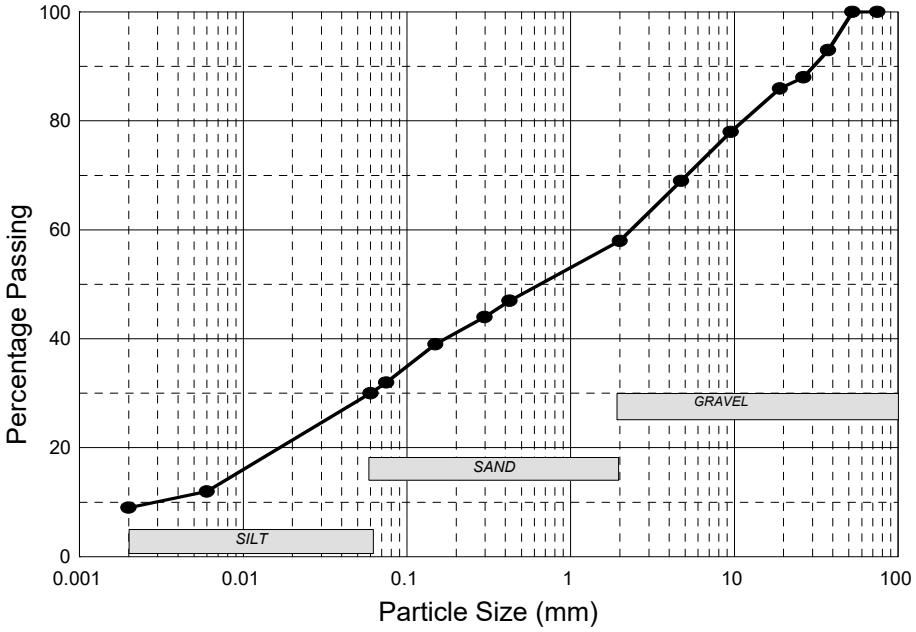
Client	HUNTER THERON TOWN PLANNERS		
Location	PTN 243 ROODEKRANS 183 IQ JOHANNESBURG.		
Date	2024/07/30	Test No	TP 1 @ 1.2 - 1.4m
Job No	0624	Checked By	JA

SIEVE ANALYSIS

Values are expressed as a percentage of total sa .

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	93.00
26.50	88.00
19.00	86.00
9.50	78.00
4.75	69.00
2.00	58.00
0.425	47.00

GRADING ANALYSIS

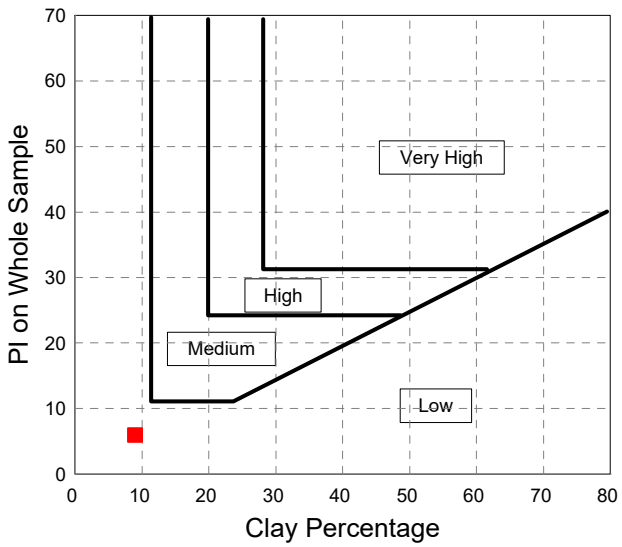


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.3000	44.00
0.1500	39.00
0.0750	32.00
0.0600	30.00
0.0060	12.00
0.0020	9.00

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	40
Plastic Limit	54
Plastic Index	14
Linear Shrinkage	6
Grading Modulus	1.51
PI on Whole Sample	6

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FOUNDATION INDICATOR

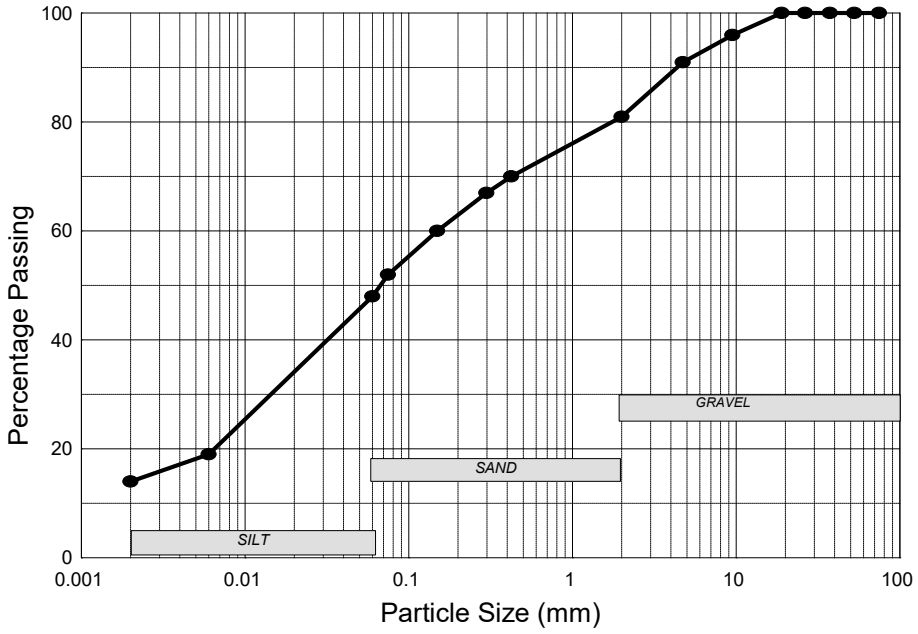
Client	HUNTER THERON TOWN PLANNERS		
Location	PTN 243 ROODEKRANS 183 IQ JOHANNESBURG.		
Date	2024/07/30	Test No	TP 2 @ 0.7-0.8m
Job No	0624	Checked By	JA

SIEVE ANALYSIS

Values are expressed as a percentage of total sa .

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
9.50	96.00
4.75	91.00
2.00	81.00
0.425	70.00

GRADING ANALYSIS

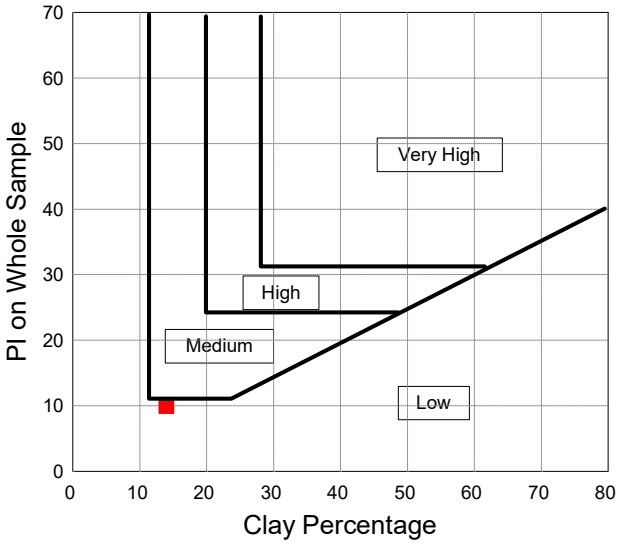


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.3000	67.00
0.1500	60.00
0.0750	52.00
0.0600	48.00
0.0060	19.00
0.0020	14.00

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	37
Plastic Limit	41
Plastic Index	14
Linear Shrinkage	6
Grading Modulus	0.82
PI on Whole Sample	10

AFRICA EXPOSED

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FOUNDATION INDICATOR

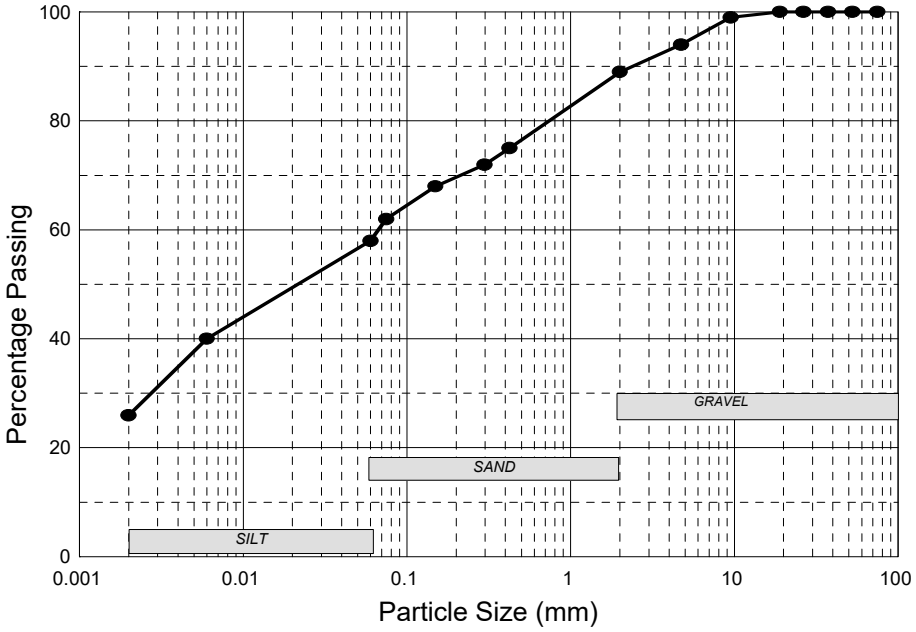
Client	HUNTER THERON TOWN PLANNERS		
Location	PTN 243 ROODEKRANS 183 IQ JOHANNESBURG.		
Date	2024/07/30	Test No	TP 4 @ 0.8 - 1.0m
Job No	0624	Checked By	JA

SIEVE ANALYSIS

Values are expressed as a percentage of total sa .

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
9.50	99.00
4.75	94.00
2.00	89.00
0.425	75.00

GRADING ANALYSIS

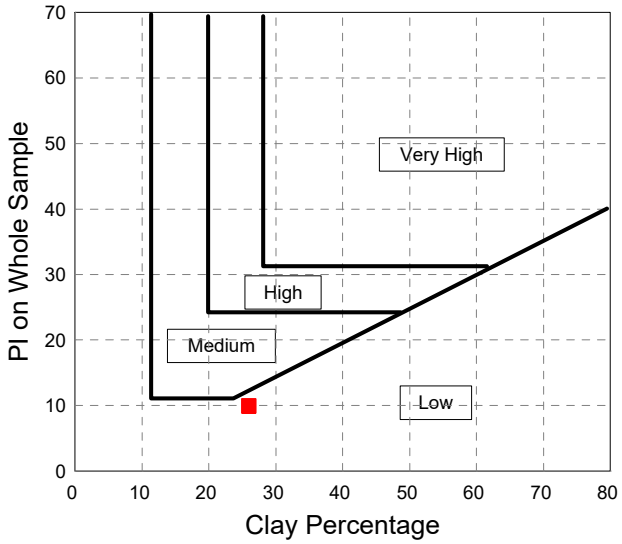


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.3000	72.00
0.1500	68.00
0.0750	62.00
0.0600	58.00
0.0060	40.00
0.0020	26.00

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	38
Plastic Limit	53
Plastic Index	15
Linear Shrinkage	7
Grading Modulus	0.64
PI on Whole Sample	10