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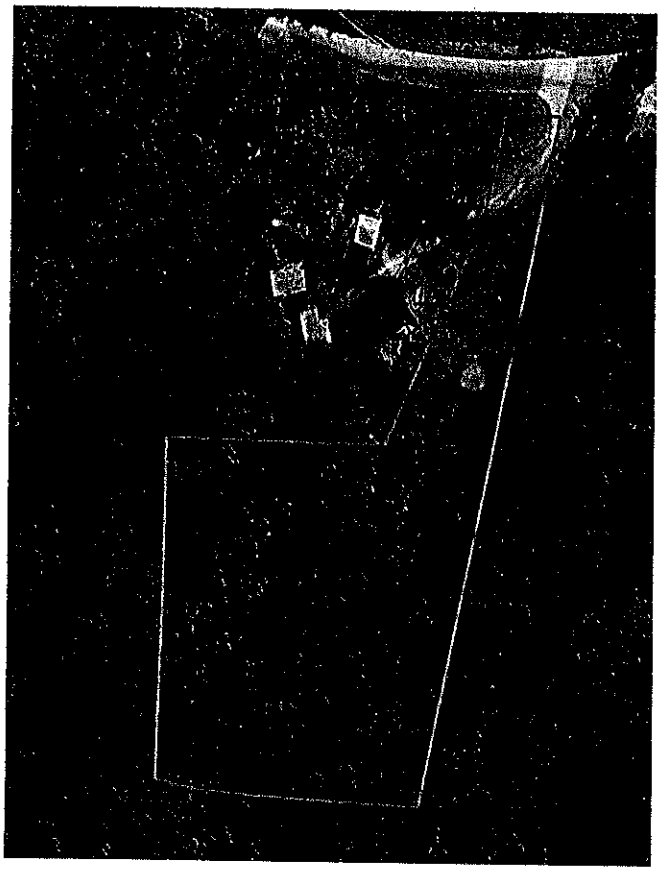
GEOHYDROLOGICAL & GEOLOGICAL SOLUTIONS

FEASIBILITY GEOHYDROLOGICAL INVESTIGATION REPORT: PHASE 1 – MSINSINI SAPS, SUKYVANE VILLAGE, UGU DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE



PROJECT: GC0568
DATE: APRIL 2024
VERSION: VERSION 1
BY: J. DU PREEZ *Pri.Sci.Nat.*

GEOCON CONSULTING

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GEOHYDROLOGICAL & GEOLOGICAL SOLUTIONS

24th April 2024

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FEASIBILITY GEOHYDROLOGICAL INVESTIGATION REPORT: PHASE 1 – MSINSINI SAPS, SUKYVANE VILLAGE, UGU DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE

Dear Sir,

The geohydrological investigation at the abovementioned location refers. Comments and provides recommendations based on a geohydrological investigation at the aforementioned areas and is discussed in this report.

Particular aspects reflected in this report are:

- Desktop - Data Search;
- Hydrocensus;
- Groundwater Potential Study;
- Geophysical Study Results.

We trust that this meets with your requirements in this regard.

Yours Faithfully,

.....

Jacques du Preez
Hydrogeologist (Pr Sci Nat - BSc Hons)

Report Type:	FEASIBILITY GEOHYDROLOGICAL INVESTIGATION REPORT
Project Title:	FEASIBILITY GEOHYDROLOGICAL INVESTIGATION REPORT: PHASE 1 – MSINSINI SAPS, SUKYVANE VILLAGE, UGU DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE
Compiled for:	MAP AFRICA
Compiled by:	Mr. J. Du Preez - Pr.Sci.Nat BSc. (Hons.) Geohydrology
Geocon Reference:	GC0568
Version:	Version 1
Date:	APRIL 2024

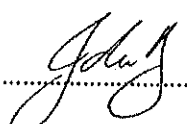
Disclaimer:

The results, conclusions and recommendations of this report are limited to the Scope of Work agreed between Geocon Pty Ltd. and the Client who requested this investigation. All assumptions made and all information contained within this report, its attachments and maps depend on accessibility to and reliability of relevant information. All work conducted by Geocon Pty Ltd. is done in accordance with the Geocon Standard Operating Procedures.

Declaration:

I hereby declare:

1. I have no vested interest (now or in the future) in this project and that I have no personal interest with respect to the parties involved in this project.
2. I have not been offered, nor have I received any significant form of inappropriate reward for compiling this report.
3. I have no bias with regard to this project or towards the various stakeholders involved in this project.



..... (Electronic Signature)

Date: 24th of April 2024

J. Du Preez *Pr.Sci.Nat.*

FEASIBILITY GEOHYDROLOGICAL INVESTIGATION REPORT: PHASE 1 – MSINSINI SAPS, SUKYVANE VILLAGE, UGU DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE

1. Introduction

Following an appointment by Map Africa Consulting, Geocon Consulting (Pty) Ltd was requested to conduct a hydrogeological audit at the abovementioned location. The aim is to develop groundwater sources for water supply to the police station. This report details the following aspects in terms of the geohydrological investigation: -

- Desktop - Data Search;
- Hydrocensus;
- Groundwater Potential Study; and
- Geophysical Study Results.

2. Scope of Works

The main aim of the geophysical survey was to assess the groundwater availability through the identification of potential geological features including fault zones, dolerite dykes and geological lineaments through the remote sensing study by means of geophysical techniques to pinpoint drilling positions at the open space areas on the premises.

The brief of the appointment was to: -

- Conduct a geohydrological feasibility study of the area;
- Conduct a geophysical survey to establish of the most suitable drilling positions;
- Peg borehole drill sites within the study area;
- Provide a factual report on the work carried out and the findings of the investigation.

3. Available Information

Geological, hydrogeological, topographical. Locality and aerial information were obtained from the following sources: -

- Geological Map, Sheets 3030 Port Shepstone (1988) to a scale of 1:250 000;
- Hydrogeological Map Sheets 2928 Durban (1999) to a scale of 1:500 000.
- Google Earth image of the area ©2019.
- Topographical map sheets in digital format.
- National Groundwater Archive (NGA) data set obtained from the Department of Water Affairs (DWA).
- GRIP data set obtained from the Department of Water Affairs (DWA).
- Site Layout Plan received from Mapafrica Consulting Engineers.

4. Data Search

Site Location

The area of investigation is located in Sukyvane Village some 17.5km north-west of Hibberdene approximately 28km north of Port Shepstone and 50km south-east of Ixopo in the Ugu District Municipality, KwaZulu-Natal Province. Refer to Figure 1: Locality map below.

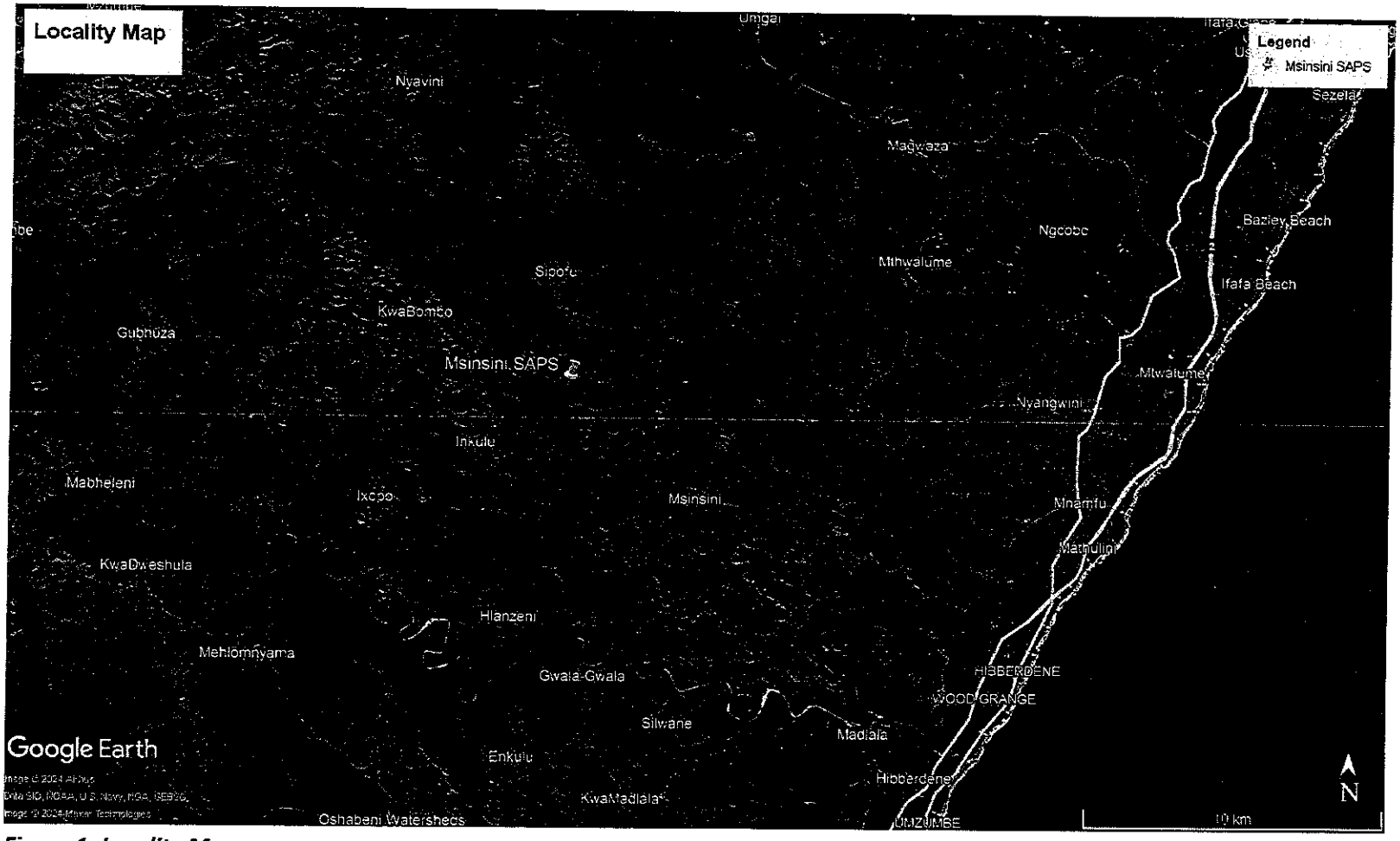


Figure 1: Locality Map

Topography

On a regional scale, the project area consists of moderate to steep sloping terrain with elevations ranging between 800m in the West to 0m above mean sea level in the East. Refer to Figure 2A below.

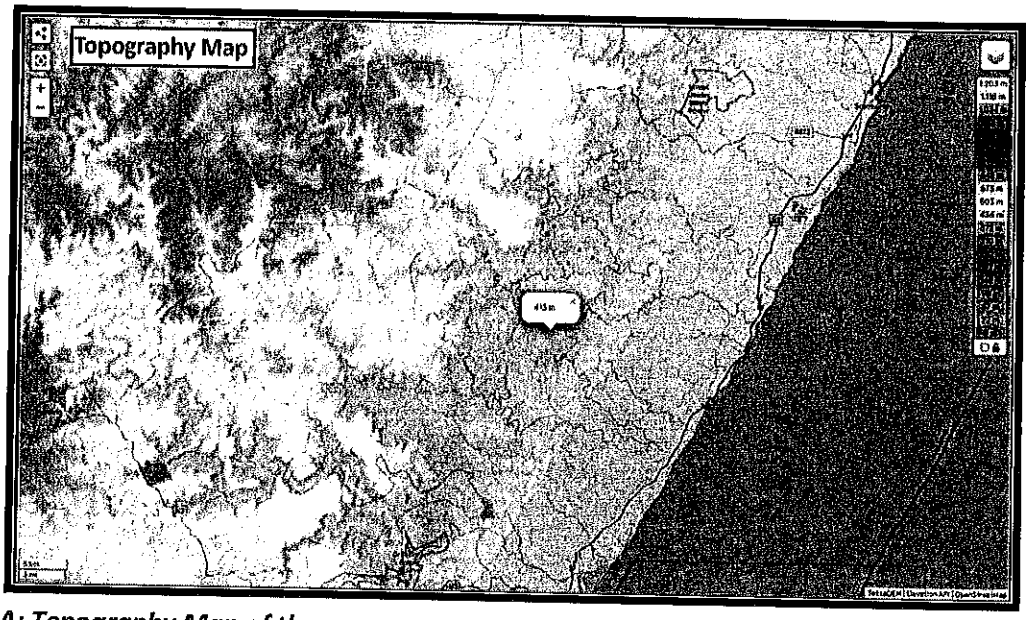


Figure 2A: Topography Map of the area

Drainage

The area is located within quaternary catchments U80C. Quaternary catchment U80C drains south into the Mzimoy River which then flows south-east into the Indian Ocean. Refer to drainage Map - Figure 2B below.

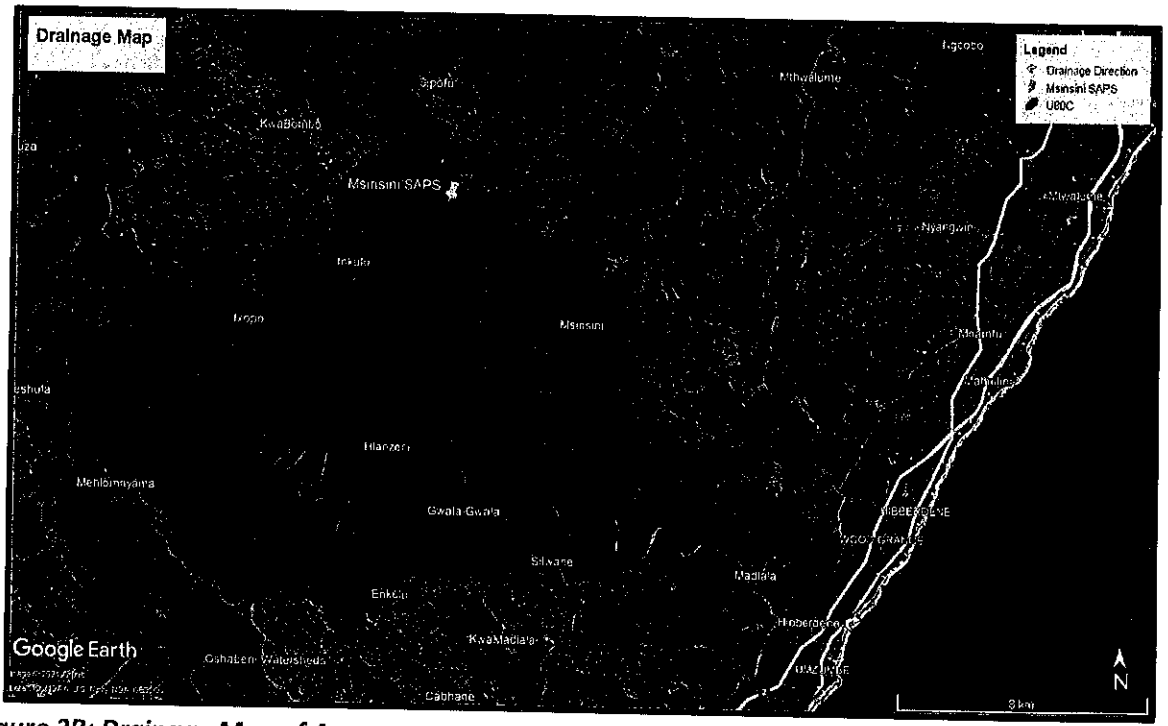


Figure 2B: Drainage Map of Area

Database Search Results: Existing Sources

To formulate a geohydrological model of the area, a desktop study (which entailed the scouring of all available sources of information including the Department of Water Affairs' NGA or National Groundwater Archive and GRIP database to identify existing boreholes, springs, and other water sources was conducted. All existing groundwater resources identified in a 3km radius of the site are listed in Table 1 below for verification through the hydrocensus process. Refer to figure 2C below.

Table 2: Desktop Data Search

Latitude	Longitude	Name	Farm Name / Village Name	Water level (m)	Total Blow Yield Value
30°29'28.32"S	30°25'5.71"E	Existing Borehole	Sukyvane	??	??
30°29'35.20"S	30°25'22.13"E	3030AD00109	THE CABLE PTN. SOSUKWANA	15.5	0.5
30°29'58.60"S	30°25'58.49"E	3030AD00001	ANCHOR - SUKWANE	??	0.41
30°29'59.32"S	30°25'56.69"E	3030AD00070	ANCHOR - SUKWANE	??	??
30°30'43.60"S	30°23'38.08"E	3030CB00092	Location 4	0.9	1.66
30°30'50.80"S	30°23'48.88"E	3030CB00139	Location 4	??	??

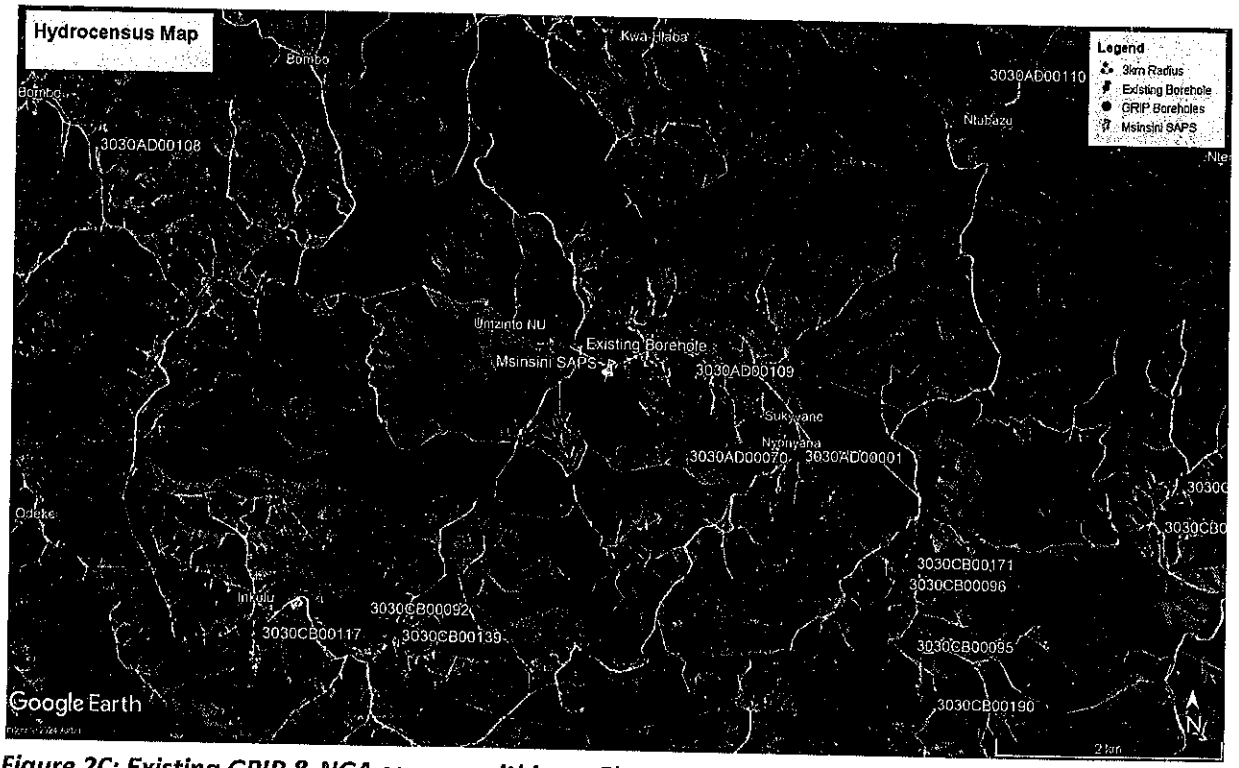


Figure 2C: Existing GRIP & NGA sources within an 5km radius of area

5. Field Verification and Hydrocensus

The verification of existing water sources identified through the data search exercise was done by means of a drive-over survey and brief field investigation in conjunction with the client as well as all role players. During this process, the status, and the location of the project area and existing sources found on site was recorded by means of a handheld Global Positioning System (GPS). ***ONE (1) existing borehole (Refer to Table 2) was identified during the field Hydrocensus.***

6. Geology

Geological Setting			
Underlying Lithology	Information gleaned from the 3030 Port Shepstone Geological series confirmed that the site is underlain by Grey, tonalitic, trondjhemitic, grandioritic andsubordinate quartz-dioritic gneiss of the Mzumbe Gneiss (Nmz)	**Geological Formation / Group**	• Mzumbe Gneiss (Nmz): Namibian Period

These METAMPORPHIC formations are generally massive, but fractured along fault lines, dolerite dyke intrusions and the top weathered section. These fractured zones typically result in increased conductivity and hence better groundwater targets. The fractured zones transport groundwater rapidly in relation to the massive matrix sections, but can also have a limited storage capacity. An excerpt of the inferred geological lineaments is indicated in Figure 3, Geology Map below.

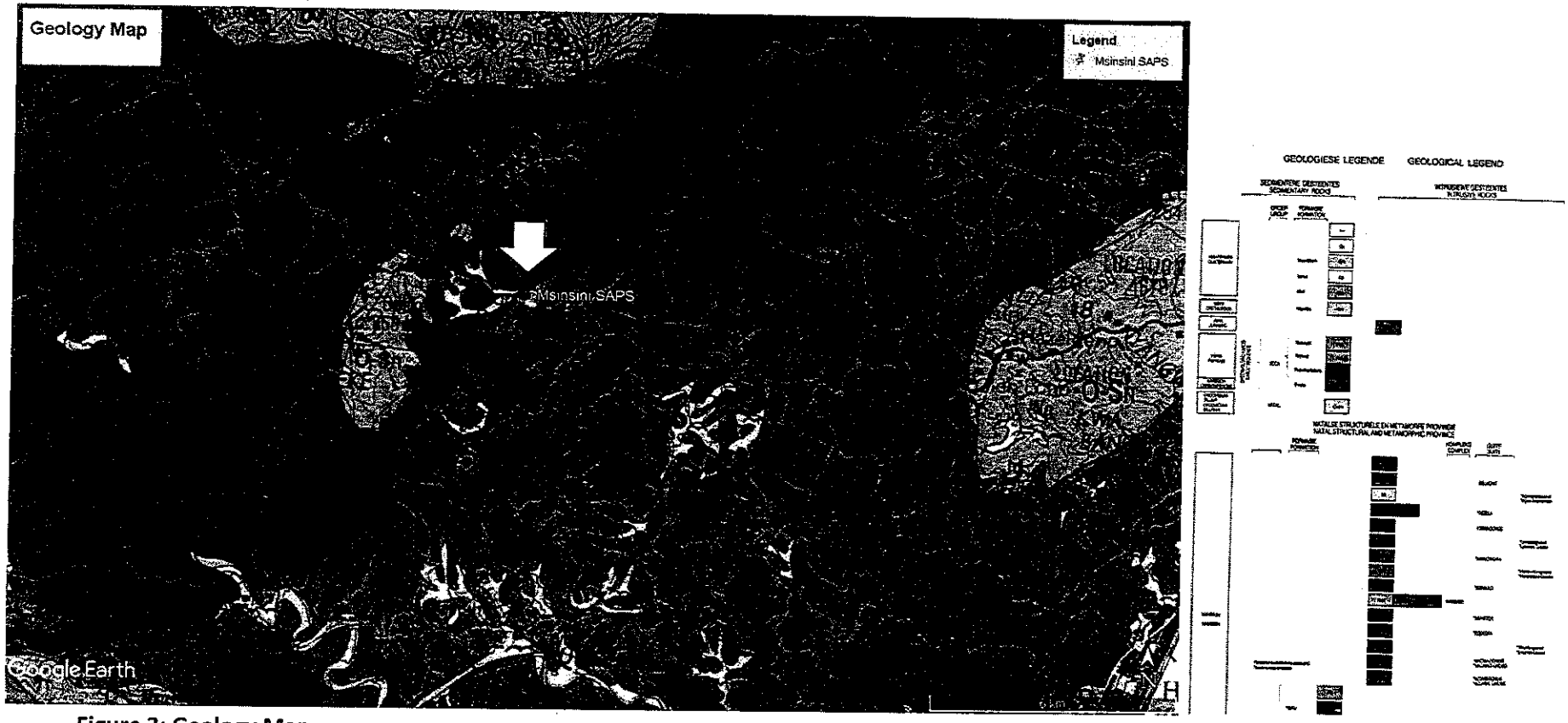


Figure 3: Geology Map

7. Geohydrology

Hydrogeological Aspects - Aquifer Types

Aquifers occurring in these hard rock formations, (typically basalt) are normally ***fractured rock, secondary aquifers***. Both the porosity and the hydraulic permeability of these rocks are known to be low. Movement of groundwater will preferentially be in secondary openings formed by fractures and geological lineaments (faults) or along igneous intrusions zones (dolerite dykes or sills).

The regional hydrogeological information indicates a moderate groundwater potential for the area with **average borehole yields in the order of 0.1 l/s – 0.5l/s (d2)**. However, zones where fracturing occurs, may exhibit good yield potential as evident from the data search results of existing boreholes - see figure 4 below.

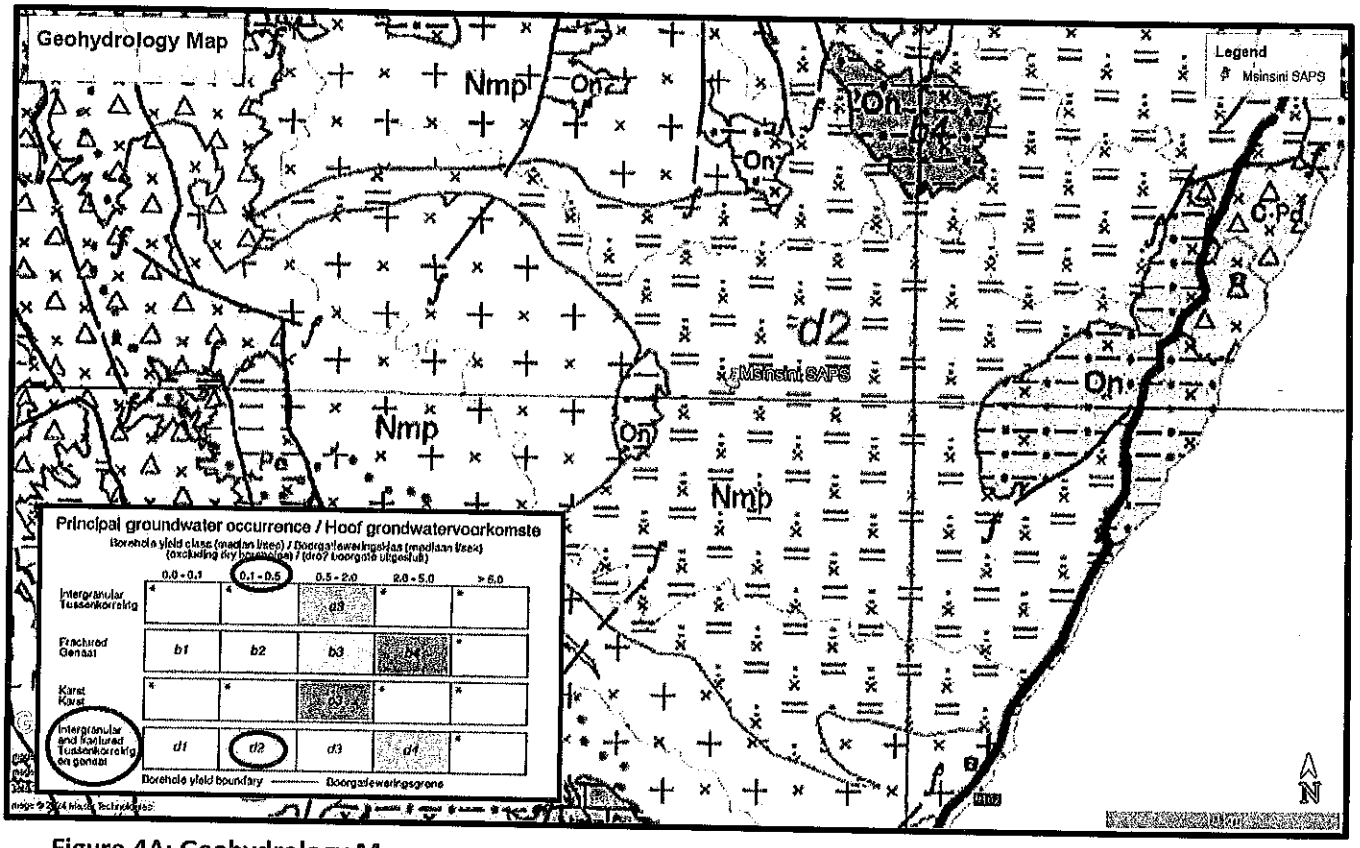


Figure 4A: Geohydrology Map

Reserve Determination - Groundwater Allocation

The national water act allows for the protection of groundwater in a particular quaternary catchment, especially in terms of the baseflow (see description below) and therefore it is a requirement of the act that a reserve determination exercise be conducted to determine the Total Allowable Groundwater Allocation for each individual catchment. This can be calculated by using the following simple formula:

Allowable Groundwater Abstraction = Recharge - (Baseflow + Current Abstraction).
where:
Recharge
Groundwater recharge is an estimate of the percentage of mean annual precipitation (MAP) that enters the sub-soil and ultimately percolates downward to the groundwater table.

Baseflow

Baseflow is defined as the amount of groundwater flowing into a river. It is therefore the sustained low flow in a river during dry or fair-weather conditions, but not necessarily all contributed by groundwater and includes contributions from delayed interflow and groundwater discharge. This contrasts with run-off water that flows into a river after a rainfall event.

This baseflow is important because the water law requires that this baseflow must always be available. Thus, the total amount of water abstracted or stored in a particular catchment is not allowed to influence the baseflow to the detriment of aquatic ecosystems.

Current Abstraction

The current use is quite literally the expected volume of water being abstracted from the catchment.

The project area is located in quaternary catchment U80C. Quaternary catchment U80C comprises an area of 203.758km^2 with an estimated mean annual precipitation of 962.49mm/annum, estimated baseflow (ecological requirements) of 2.7Mm^3/annum and recharge of 32.352Mm^3/annum, seems to indicate relatively unstressed conditions in terms of groundwater abstraction according to South African Reserve Determination classification system. The general authorisation for the catchment is 75m^3/ha/annum. A summary is indicated below.

NAME	Recharge	Ecological requirements	Population	Basic Human Needs	Final allocatable	TDS (mg/l)	Class
U80C	**32.352**	**2.7**	**12700**	**0.1158875**	**29.5361125**	**500**	**1**

The regional hydrochemical information of the area also indicates groundwater of good quality – that is water of ideal quality (Class 0) to water suitable for long-term domestic use (Class 1).

On site the recharge rates appear quite average, but predominantly recognised as a "low to medium fast infiltration" area which includes soft slopes, good vegetation cover, clayey yet permeable residuum and exposed rock along the drainage systems with abundant cultivated well drained loamy soils. Recharge of the area around the Dolerite sills appears to be good when weathered, but sometimes impeded by closed fractures, causing a near surface perched water table with springs and seeps along the strike of these features.

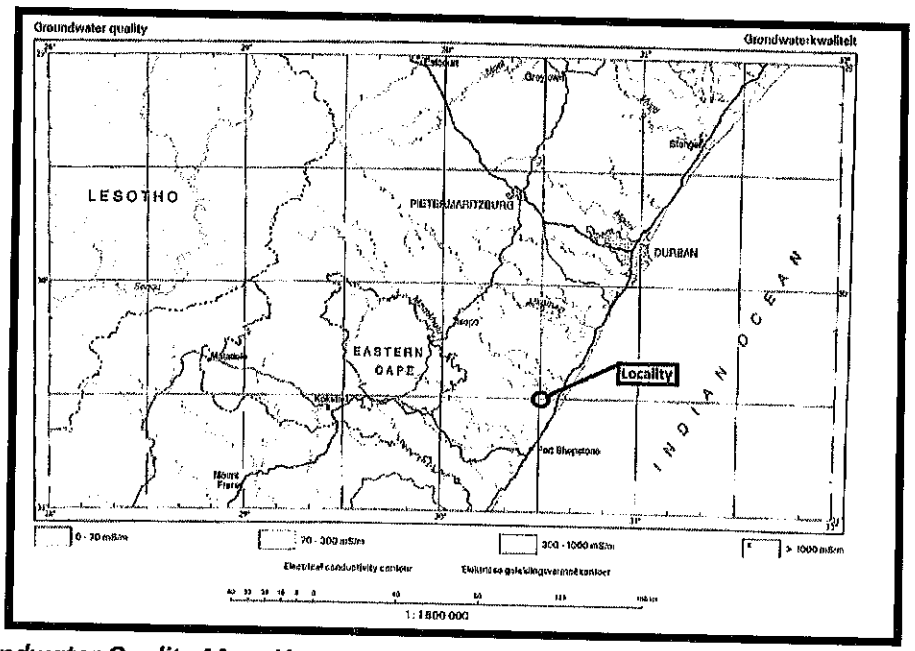


Fig 6: Groundwater Quality Map- Ugu

8. Remote Sensing Potential Zones for Geophysical Investigation

By using a combination of all the previously discussed background results., i.e., allocable groundwater for the catchment, the regional and local geology and geological features, the recharge, topographical setting, etc., one can arrive at a theoretical groundwater model for the area under investigation. This model can be used to determine the geohydrological yield potential and risk associated with groundwater abstraction, water quality and sustainability. This section aims to identify zones for potential exploration based on the findings of the previous sections.

Results

Geologically the occurrence of weathered sections, fracture or fault zones and extensive regional lineaments, result in zones of heightened groundwater potential. These zones act as preferred pathways for groundwater movement. The geophysical investigation usually focuses on these zones.

Obvious fault / fracture zones as well as dolerite dykes and inferred lineaments as well as geological contacts were identified in the vicinity of the site.

Using the results of the desktop study, potential drilling zones were identified for further investigation by means of geophysical techniques. See potential investigation zone in Figure 6A and 6B below.

There were no major geological contact features, while one (1) lineament was inferred as secondary features.

Detailed sensing in closer proximity to each project is shown in the geophysical maps in section 9.

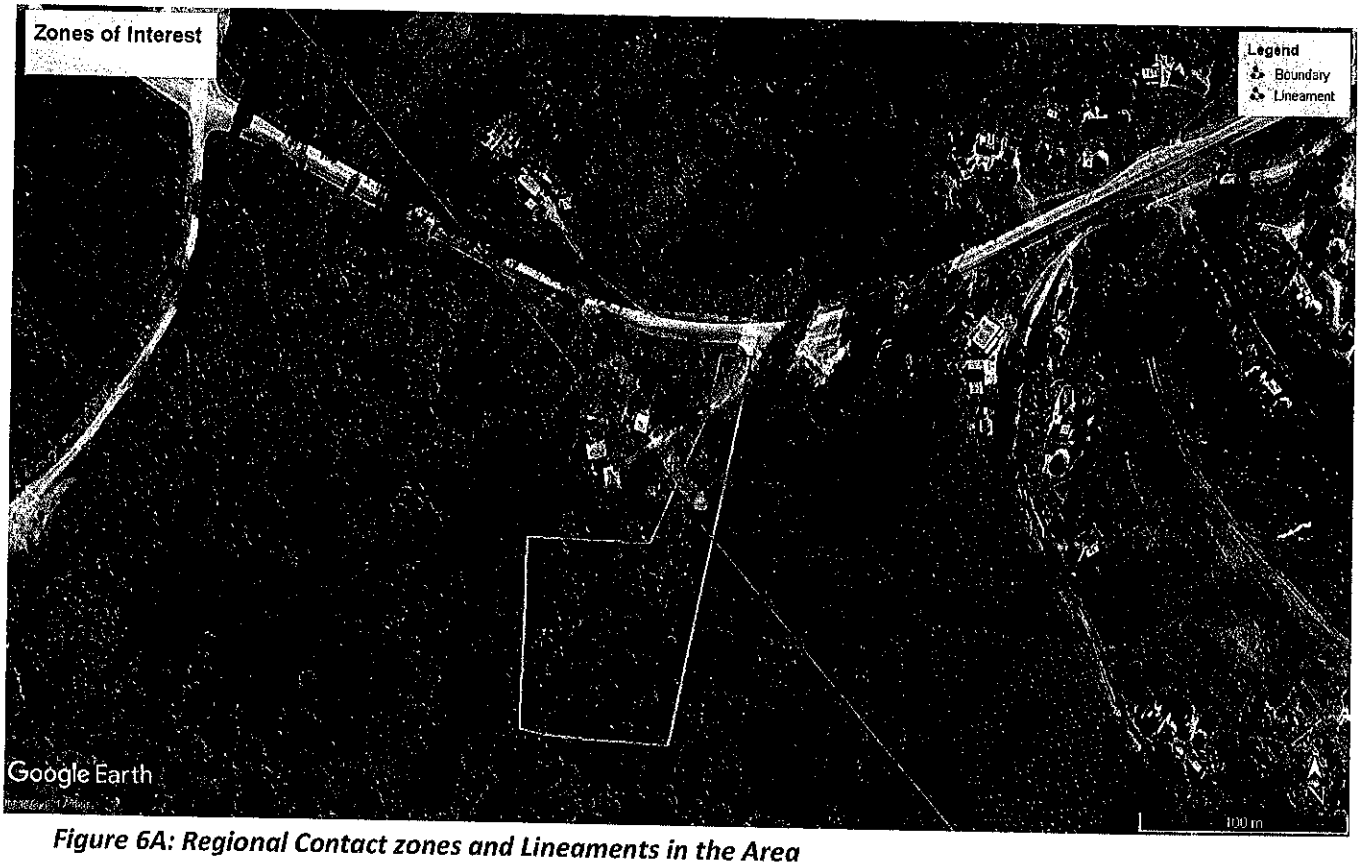


Figure 6A: Regional Contact zones and Lineaments in the Area

9. Geophysical Survey Overview

Considering the geology of the area and the most suitable and cost-effective geophysical techniques for groundwater exploration, the resistivity PQWT (Telluric) method was deployed.

Telluric Method

AMT Receiver: The usefulness of this meter for mineral exploration, particularly in groundwater has already been shown.

Measurement point & spacing: At the start of the survey, the tape is laid out and the operator's electrode (M electrode) is on 0m, and the other electrode (N electrode) is on 10m. The actual measurement point is in the centre – the first measurement is at 5m, and the second measurement is at 10m.

Direction & length of survey line: With confined aquifers (fractures, dykes, faults, karsts, mostly in the older rocks) it is advisable to lay your line perpendicular to the structure. This will make the determination of the contact much easier and whenever possible, do extra lines parallel and spaced 10m to 50m either side for a thorough interpretation. In the case of unconfined aquifers and paleochannels, run your first line along the assumed channel and subsequent lines perpendicular to establish width.

3 Frequency Surveying: When investigating a large area, a 3-frequency survey can be done. Lay out your tape as per normal but the spacing can be up to 10m if speed of coverage is required. Theoretically the three frequencies equate to an approximate depth of 60 to 120m for 170Hz, 120 to 200m for 67Hz, 200 to 400m for 25Hz. This is dependent on geological conditions. For simplicity, 1st curve is a third of the depth (100m for the TC300) 2nd curve is two thirds, and the 3rd curve is approximately the maximum depth. At least three parallel lines should be done to determine the strike of the structure.

The Process function in the Profile screen: After profile data has been collected (10 readings minimum), the curves can be inverted to a contoured profile.

Drill Targets: At the end of the survey, the data were transferred to a computer for further processing and display within Appendix B. The limited available survey area at the site limits the survey effectiveness.

Noise in terms of the aforementioned elements may distort actual readings. These distortions or anomalies may be incorrectly interpreted as geological anomalies or lineaments providing false drilling positions. Due diligence is required when selecting the drilling positions.

9.1. Geophysical Survey Results

Using the available data and aerial photographic interpretations in combination with geophysical techniques, ONE (1) potential drilling site was identified from the ONE (1) traverse. See table 3 below and the geophysical map displayed on Figure 7A & 7B. Hard copy results of the 2-dimensional graphs are included in Appendix A for the geophysical traverses completed and the geophysical map

displayed on Figure 7A. Photos of the peg stations are displayed in Photos 1-2 below.

Table 2: Geophysical Investigation Results – Proposed Drilling Positions

Geophysical Traverse	Latitude	Longitude	Expected Drilling Depth (m)	Priority	Name on Map
Line 1	30°29'38.18"S	30°24'54.19"E	120-150m	1	Peg 1

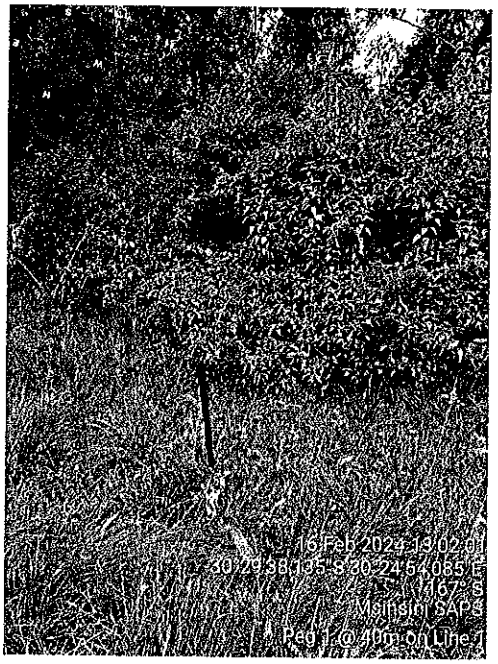


Photo 1: Peg 1 Line 1 @ 80m

Figure 7A: Geophysical Map

Figure 7B: Development Map

10. Conclusion

- The area is located within quaternary catchments U80C. Quaternary catchment U80C drains south into the Mzimoy River which then flows south-east into the Indian Ocean
- SIX (6) existing borehole from the data search (NGA & GRIP databases) was identified within a 3km radius of the site.
- Information gleaned from the 3030 Port Shepstone Geological series confirmed that the site is underlain by Grey, tonalitic, trondjhemitic, grandioritic andsubordinate quartz-dioritic gneiss of the Mzumbe Gneiss (Nmz) of the Namibian Period
- The regional hydrogeological information indicates a ***moderate groundwater potential (d2)*** for the area with ***average borehole yields in the order of 0.1 l/s – 0.5l/s***. However, zones where fracturing occurs, may exhibit good yield potential as evident from the data search results of existing boreholes;
- The project area is located in quaternary catchment U80C. Quaternary catchment U80C comprises an area of 203.758km2 with an estimated mean annual precipitation of 962.49mm/annum, estimated baseflow (ecological requirements) of 2.7Mm^3/annum and recharge of 32.352Mm^3/annum, seems to indicate relatively unstressed conditions in terms of groundwater abstraction according to South African Reserve Determination classification system. The general authorisation for the catchment is 75m3/ha/annum.
- Using the available data, aerial photographic interpretations in combination with geophysical techniques, The geophysical Investigation identified **ONE (1) potential drilling site** from the **ONE (1)** geophysical traverse.

11. Recommendations

- The potential suitable drilling positions (STATION-number) identified through the geophysical investigation should be drilled as a subsequent phase to confirm initial assumptions.
- Considering the nature of the regional geology-that is mainly hard rock, the **rotary air flush percussion drilling method** can be used.
- However, from experience in the area and the occurrence boulders, clay and loose, fractured, problematic formations surrounding the dolerite intrusions, **it may be required that the ODEX or Symmetrix method be used**. In these instances, normally some 18-24m of silty, loose or weathered material is expected. Please allow for this in the quotation process.
- The expected drilling depth is approximately 150-180m and the expected casing required to prevent unstable overburden from collapse is approximately 18m in most instances.
- The drilling priority should be followed but depending on the client's choice of positioning of the storage tanks on site, the priority drilling sequence may be altered.
- The drilling should be carried out according to the Development, Maintenance and Management of Groundwater Sources – SA Code of Practice Ref SABS 0299 1, 2 &3 – Design and Construction of Groundwater Boreholes & Drilling of Groundwater Boreholes.
- Successful boreholes should be test pumped according to the Development, Maintenance and Management of Groundwater Sources – SA Code of Practice Ref SABS 0299 1, 2 &3 – Test Pumping of Groundwater Boreholes and depending on the yield and proposed installation type should

consist of at least a step drawdown and constant discharge tests with associated recovery monitoring.

- Water quality samples should be sampled once the borehole is test pumped and submitted to an accredited laboratory for chemical and bacteriological analysis, especially in terms of the elevated concentrations.
- Additional potential areas that could be investigated if suitable volumes are not found while drilling the targets selected inside the provided village boundary, are indicated in Figure 8 below.

11.1. Drilling methods

Borehole Construction

Considering the nature of the regional geology- rotary air flush percussion drilling method was used. The objective of drilling is to establish a borehole in the identified area that will be sustainable in the long-term.

The drilling was carried out, according to the *Development, Maintenance and Management of Groundwater Sources – SA Code of Practice Ref SABS 0299 1,2 &3 – Design and Construction of Groundwater Boreholes & Drilling of Groundwater Boreholes.*

During the drilling process, a lithological sample for each meter drilled, was taken by the drilling contractor and placed on a cleared patch for the geohydrological consultant to inspect and describe and to discuss and eventually decide the depth of casing installation.

The depth of each water strike is recorded by the drilling contractor, inclusive of seepage. Several water strikes may occur in one borehole and it is therefore important to determine the blow yield of each individual strike. This information is used when the borehole is tested and is vital for equipping of the borehole.

On completion of drilling, the final blow yield of each borehole is measured and recorded.

11.2. Test Pumping Methods

The efficient operation and utilisation of a borehole requires insight into and an awareness of its productivity and that of the groundwater resource (aquifer) from which it draws water. Even though it is almost impossible to predict the aquifer's reaction to pumping, the best means of determining the borehole hydraulic parameters, is achieved by borehole test pumping. This activity provides a means of identifying potential constraints on the performance of a borehole and on the exploitation of the groundwater resource. The recognition and understanding of these constraints promote the proper, judicious and optimum exploitation of the groundwater resource. Ignorance and disregard of these constraints can lead, at best, to the uneconomical operation of the borehole and, at worst, to over-exploitation of the source. Over-exploitation of the groundwater resource can have adverse affects such as depletion of the aquifer.

The test pumping of the new boreholes should be done by accredited and experienced contractors in accordance with the SABS' standards: Development, Maintenance and Management of Groundwater Resources –Part 4: Test-Pumping of water boreholes; SA Code of Practice Ref SABS 0299-4: 2003. Test pumping procedure normally includes:

i. A 4hr step discharge test at various rates;
ii. Followed by a 24 hr constant discharge test,
iii. And a recovery test,
iv. Collection of water sample.

11.3. Abstraction & Equipping Recommendations

The test pumping results should be analysed in terms of the intended application, i.e. to equip the boreholes with submersible pumps, solar driven.

Therefore, the analysis of the drawdown data should be completed to determine the sustainability of the boreholes in terms of short term (emergency) application using submersible pumps as means of abstracting water for domestic water supply.

11.4. Groundwater sampling

Water samples of each successful borehole drilled should be taken at the end of the constant discharge test and conveyed to an approved laboratory for analyses in terms of the following parameters:

- Physical analysis - that is turbidity and colour
- Macro analysis - that is the chemical constituents
- Bacteriological analysis - the detection and quantification of Faecal Coliforms

Water Quality Analysis

The results of the chemical analysis should be classified according to the SANS241:2015 specifications for Domestic Water Supplies. According to these criteria, the water quality of a borehole can be classified in terms of health or general use or aesthetic reasons.

11.5. Implementation – Pump Installation

The successful and suitable boreholes in terms of yield and quality should be equipped with submersible pumps for emergency water supply – human consumption.

Every effort was made during the geophysical survey to ensure that generally accepted practices of our profession were used in the groundwater evaluation of the site.

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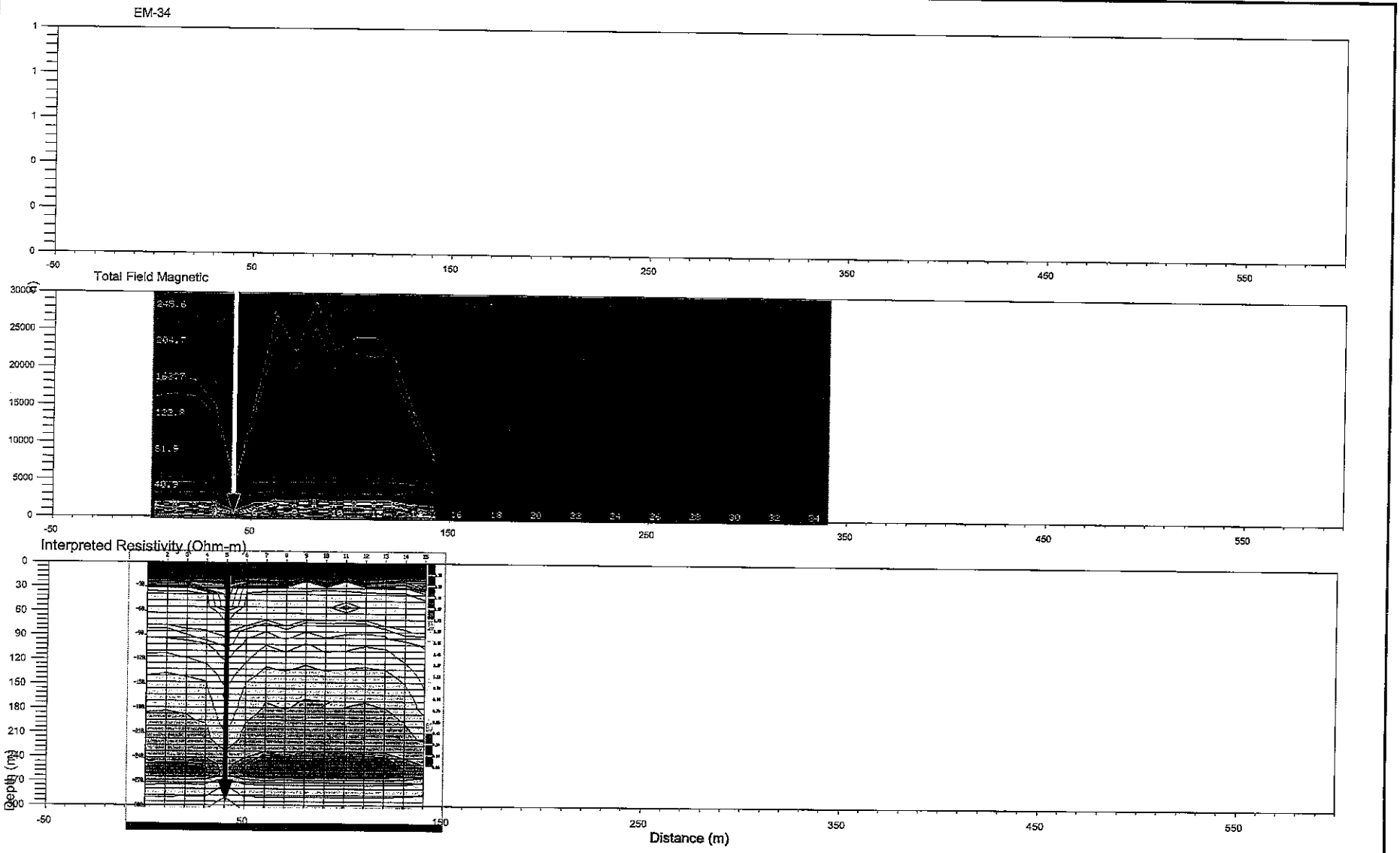
J. Du Preez Hydrogeologist (Pr Sci Nat - BSc Hons)

Appendix A
Geophysical Traverses

GEOCON (Pty) Ltd

Line 1



CLIENT: Map Africa							
BOREHOLE NO:	GC0568	DISTRICT :	Ugu DM	DIR:	N-S	LINE :	Line 1
REGION:	KwaZulu-Natal	VILLAGE:	Sukyvane	LINE START	30°29'37.17"S, 30°24'54.53"E	DRILL STATION:	Station 40m (Peg 1)
PQWT - 967		SITE:	Msinsini SAPS	LINE END	30°29'41.68"S, 30°24'53.34"E	DRILL DEPTH:	150m

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REPORT ON A GEOTECHNICAL INVESTIGATION FOR THE PROPOSED MSINSINI POLICE STATION, SUKYVANE VILLAGE, UMZUMBE, KWAZULU NATAL.

Project: GC0567

Version: 1

Date: 23 April 2024

J. du Preez (Pr.Sci.Nat)

Table of Contents

Report Type:	Phase 1 Geotechnical Investigation
Project Title:	Report on a geotechnical investigation for the proposed Msinsini Police Station, Sukyvane Village, Umzumbe, KwaZulu-Natal.
Compiled for:	Map Africa Consulting Engineers
Compiled by:	J. du Preez *Pr.Sci.Nat.*
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Date:	23rd April 2024
Distribution List:	Mr. G. Tshanga

Disclaimer:
The results, conclusions and recommendations of this report are limited to the Scope of Work agreed between Geocon (Consultant) and the Client who requested this investigation. All assumptions made, and all information contained within this report, and its attachments including maps depend on accessibility to and reliability of information obtained. All work conducted by Geocon is done in accordance with the Geocon Standard Operating Procedures.

Limit of Liability
The Client agrees that any claims against Consultant pertaining to this Project shall be limited to the claims related to, or attributable to, proven negligence by Consultant in the performance of its services, provided that any claims must be brought within 12 months from the earlier of the date of the last service performed by Consultant, or the date of substantial completion of the work.
The amount of claim payable by Consultant shall be limited to the amount that can be claimed under the applicable insurance policy pertaining to the Project, or 50% of the value of engineering fees paid to Consultant on the Project, whichever is less.

In no event shall Consultant (Geocon) be liable, whether in contract or tort, for:

- loss or damage occasioned by any event beyond Consultant's control; or
- consequential damage including without limitation, loss of earnings, loss of production, or loss of use, howsoever caused.

Declaration:

I hereby declare:

1. I have no vested interest (now or in the future) in this project and that I have no personal interest with respect to the parties involved in this project.
2. I have not been offered, nor have I received any significant form of inappropriate reward for compiling this report.
3. I have no bias with regard to this project or towards the various stakeholders involved in this project.

.....(Electronic Signature) Date: 23rd April 2024

J. du Preez *Pr.Sci.Nat.*

REPORT ON A GEOTECHNICAL INVESTIGATION FOR THE PROPOSED MSINSINI POLICE STATION, SUKYVANE VILLAGE, UMZUMBE, KWAZULU-NATAL.

1. INTRODUCTION

A new police station (Msinsini Police Station) is to be developed at Sukyvane Village in the Umzumbe area. The findings of a geotechnical investigation carried at the site, located roughly 17.5km northwest of Hibberdene (Figure 1: *Locality Map*) are given in this report.

The investigation was commissioned by *MAP AFRICA Consulting Engineers* on behalf of their client *South African Police Services*, with the proposed development consisting of multi-storey buildings.
The scope of work for the investigation specified *inter alia* the following investigation procedures:-

i) Determine the site geology and determine the depth to competent bedrock where possible;
ii) Establish the soil, weathered rock and outcrop profiles across the site and evaluate their engineering properties and influence on the proposed structures;
iii) Establish the expected founding conditions for the proposed multi storey structures
iv) Assess the groundwater conditions, including seepage, run-off, ponding and comment on the presence of perched or permanent water table;
v) Estimate the maximum allowable bearing capacity of the in-situ soils;
iv) Comment on general geotechnical conditions and possible geotechnical constraints and potential mitigation measures for the proposed developments.

The report is based on a site visit, followed by subsequent fieldwork including soil profiling, test pitting, soil testing and dynamic cone penetration testing (DCP). The laboratory tests comprised of foundation indicators, road indicators, California Bearing Ratio (CBR) and Modified AASHTO density tests.

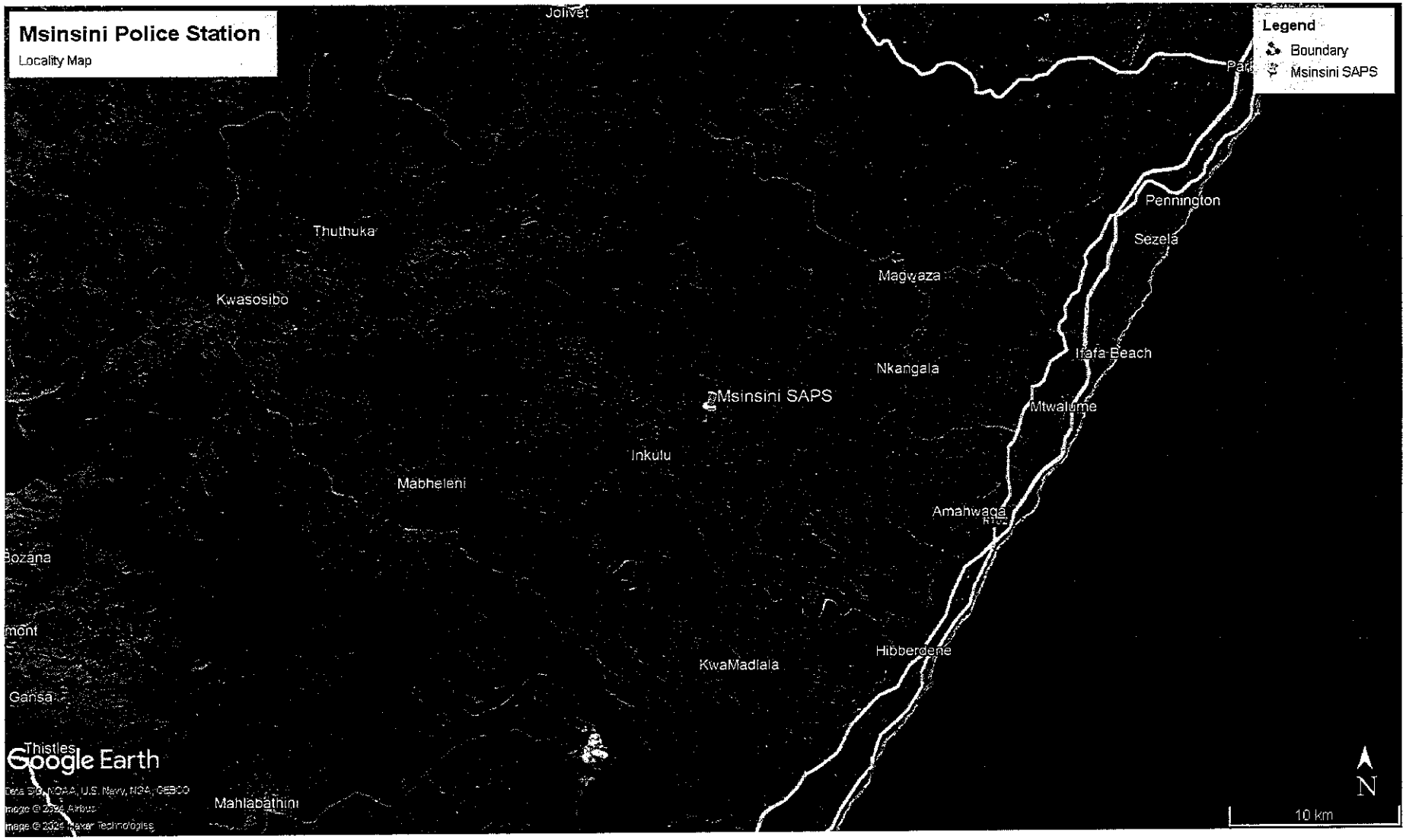


Figure 1: Locality of the proposed Msinsini Police Station

This report is based on information obtained from:

- Geological map (Port Shepstone sheet 3030 (1981) to scale of 1:250 000),
- Topographical Sheets to a scale of 1:50 000,
- Profiles of test pits excavated on site during the investigation,
- Dynamic cone penetration tests (DCP's),
- Layout plan of the proposed development provided by MAP AFRICA.
- WATER RESOURCES OF SOUTH AFRICA 2012 MAPS, SOILS AND SEDIMENTS, AUGUST 2015, WRC & DWS.
- Report to Isibuko Se Africa Development Planners on the Results of a Geotechnical Investigation for the Proposed Kwandelu Police Station, Umzumbe Local Municipality, KwaZulu-Natal, Reference: SGE-044-2016, REP01, Feb 2016, Syncline Geotechnical Engineering (Pty) Ltd.

2. SITE DESCRIPTION

The site is situated in the rural community of Sukyvane Village located in the Umzumbe area some 20km northwest of Hibberdene town, KwaZulu-Natal. The proposed area earmarked for construction is currently undeveloped and covered by dense vegetation with evidence of an old farmhouse and associated farm infrastructure observed on site (See photos in Appendix E),

The site of nearly 10000m2 in size is situated on the Farm Clifton Park 9219 and is accessed off the P73 tarred road. The site has an overall slight to moderate slope gradient which slopes steeply near the western boundary of the investigated area towards a drainage line just west of the site. The slope also has a moderate slope near the eastern boundary of the investigated area towards another drainage line east of the site. The majority of the site is densely vegetated with trees and brush. An existing dilapidated building is located on the southern portion of the site.

The proposed development will consist of multistorey buildings constructed with a combination of masonry walls, reinforced concrete and structural steel columns - Refer to Figure 2 on the following page for Architectural SDP. Our anticipated new service loads are as follows:-

- Column Loads = ± 250 kN
- Brickwork Line Loads = ± 200 kN/m

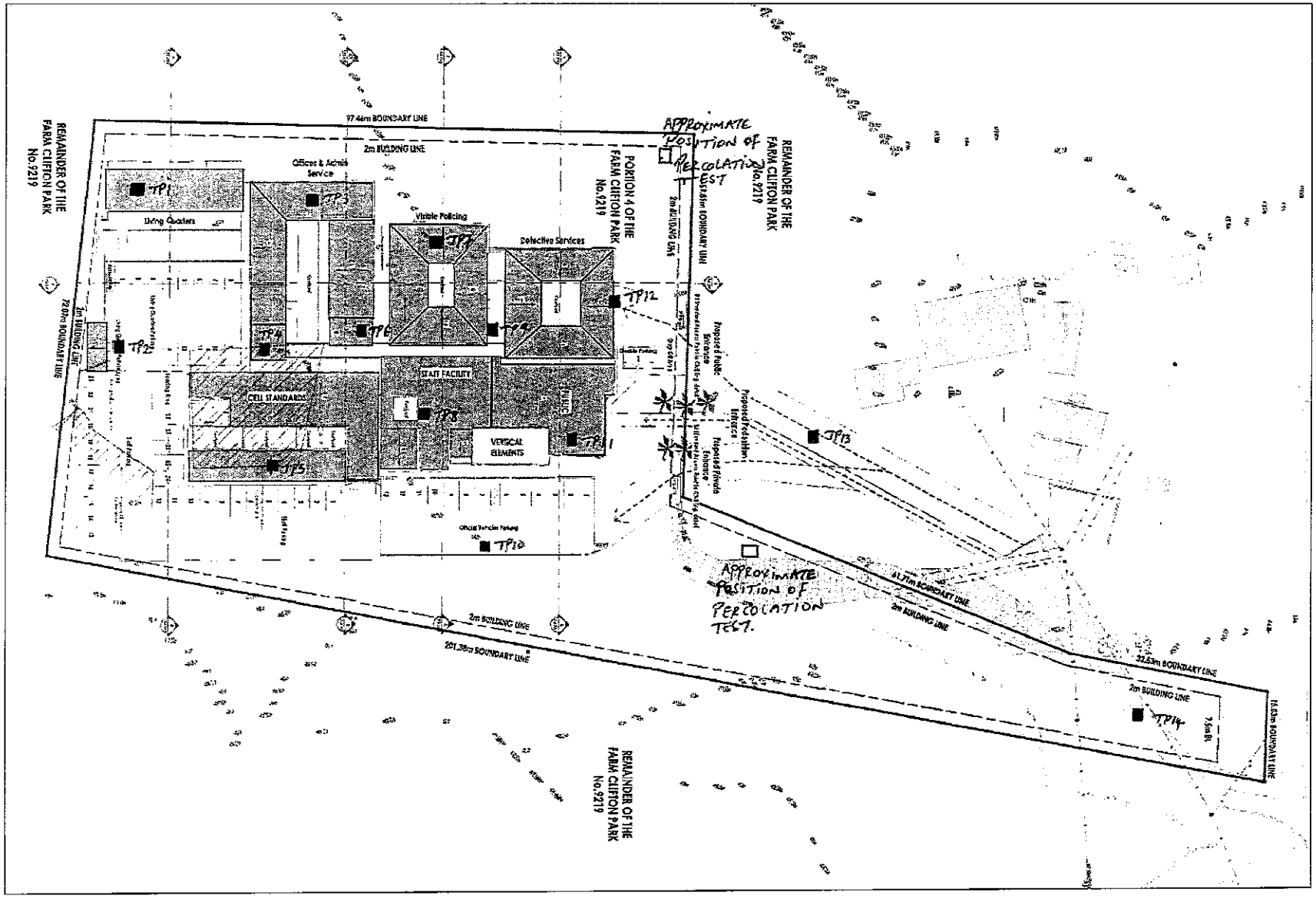


Figure 2: Locality of the proposed Msinsini Police Station

3. GEOLOGY AND SOILS

The geological map (Port Shepstone, 3030) indicates that the site is underlain by rock types of the Mzumbe Gneiss Suite, comprising primarily of grey, tonalitic, trondjihemitic, granodioritic and subordinate quartz-dioritic gneiss.

An extract of the published geological map is given below (*Figure 3, Regional Geology Map*).

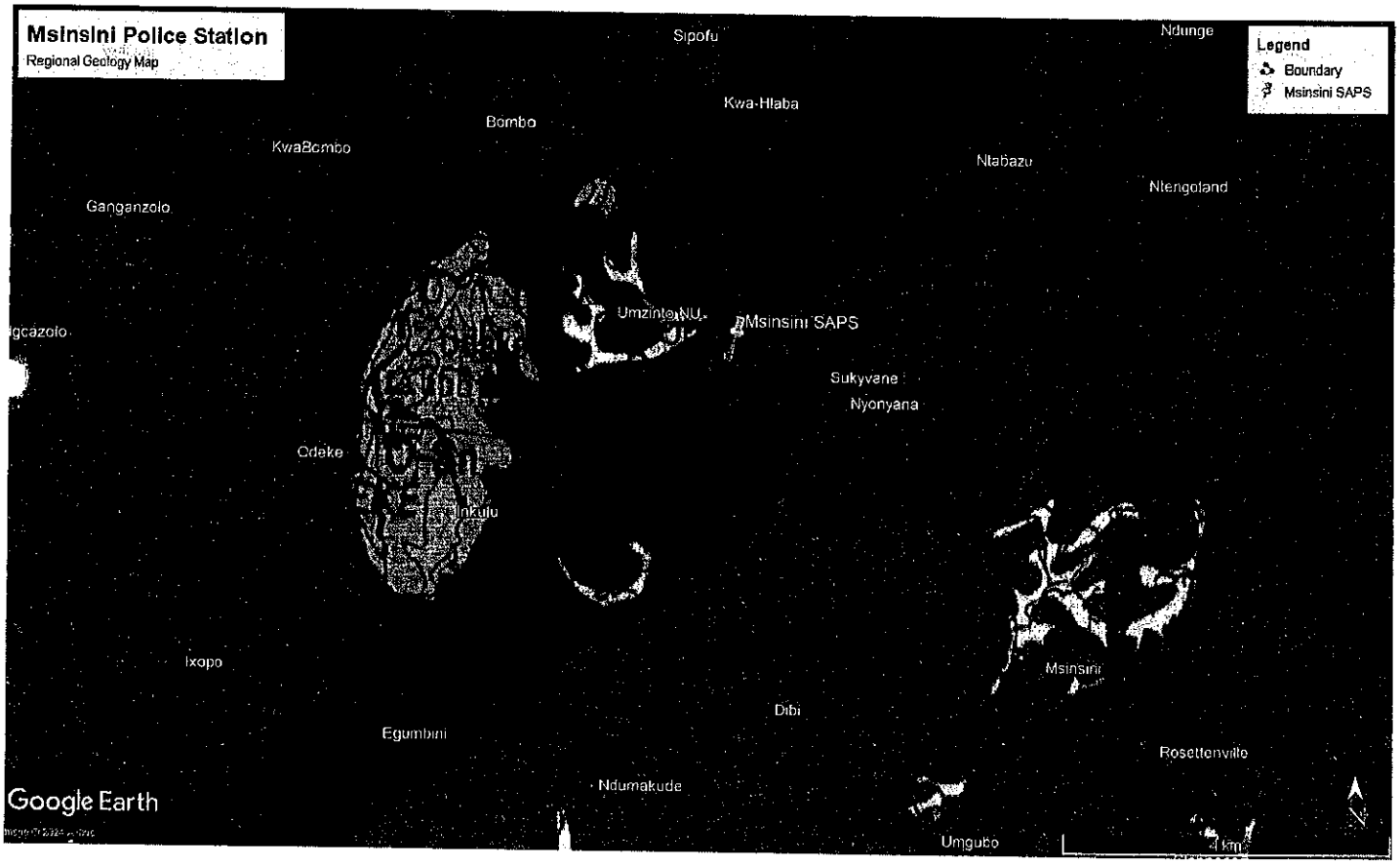
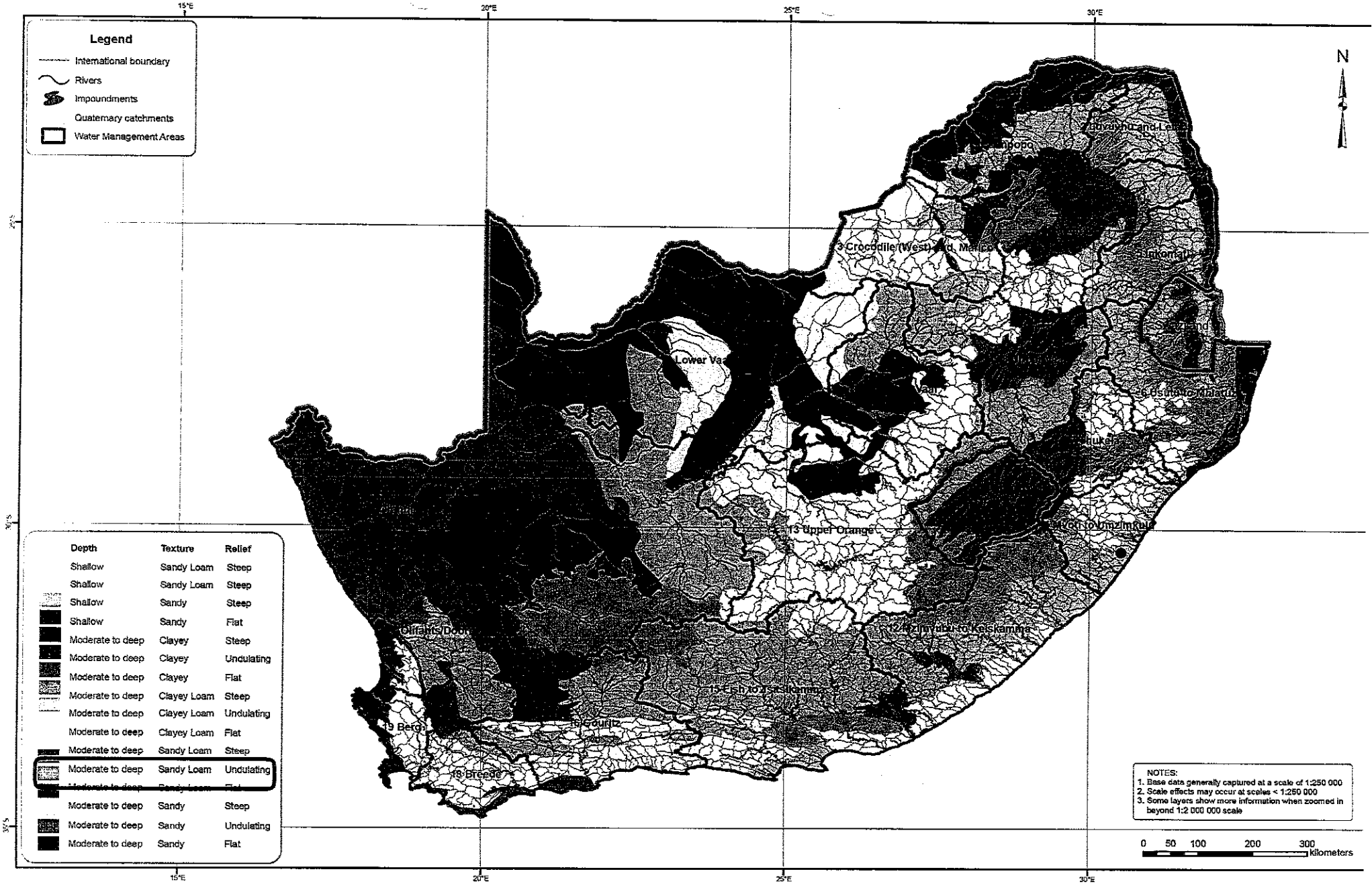


Figure 3: Extract of the published geological Map, indicating the area is underlain by the Mzumbe Gneiss Suite

The WRC 2012 data set indicates the soils in the area typically weathers to **moderate to deep sandy loam soils** as per (Figure 7 Soils – WR90) on the following page. Similarly, the WR90 data set indicates the sediments typically comprise **medium erodible sediments** (10-12) - Figure 8 Erodibility – WR90.



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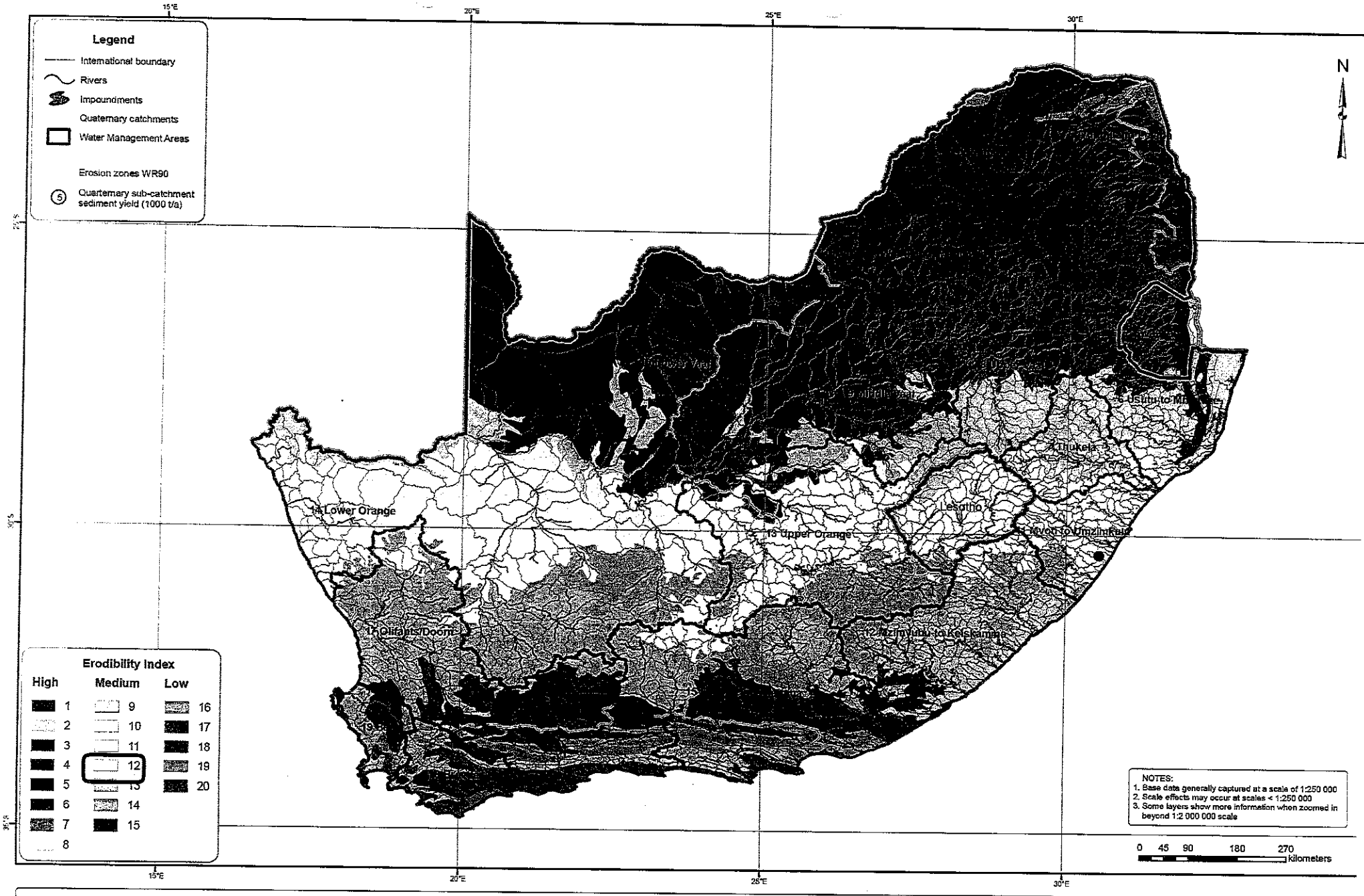
Water Research Commission

Figure 7 : Soils (WR90)

Water Resources of South Africa 2012 Date: August 2015



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Water Research Commission

Figure 8 : Sediment (WR90)

Water Resources of South Africa 2012 Date: August 2015

During the field investigation, evidence of intrusive dolerite was visible around the site and noted particularly in the overlying transported (Colluvium) material encountered in some of the test pits.
No hardpan ferricrete was noted at surface or any of the excavated test pits. A relatively thin layer of colluvium occurs throughout the site down to average depths of 0.00-0.25m below the natural ground level.

Granitic bedrock was typically encountered at an average depth of 0.80-2.0m below the current natural ground level.

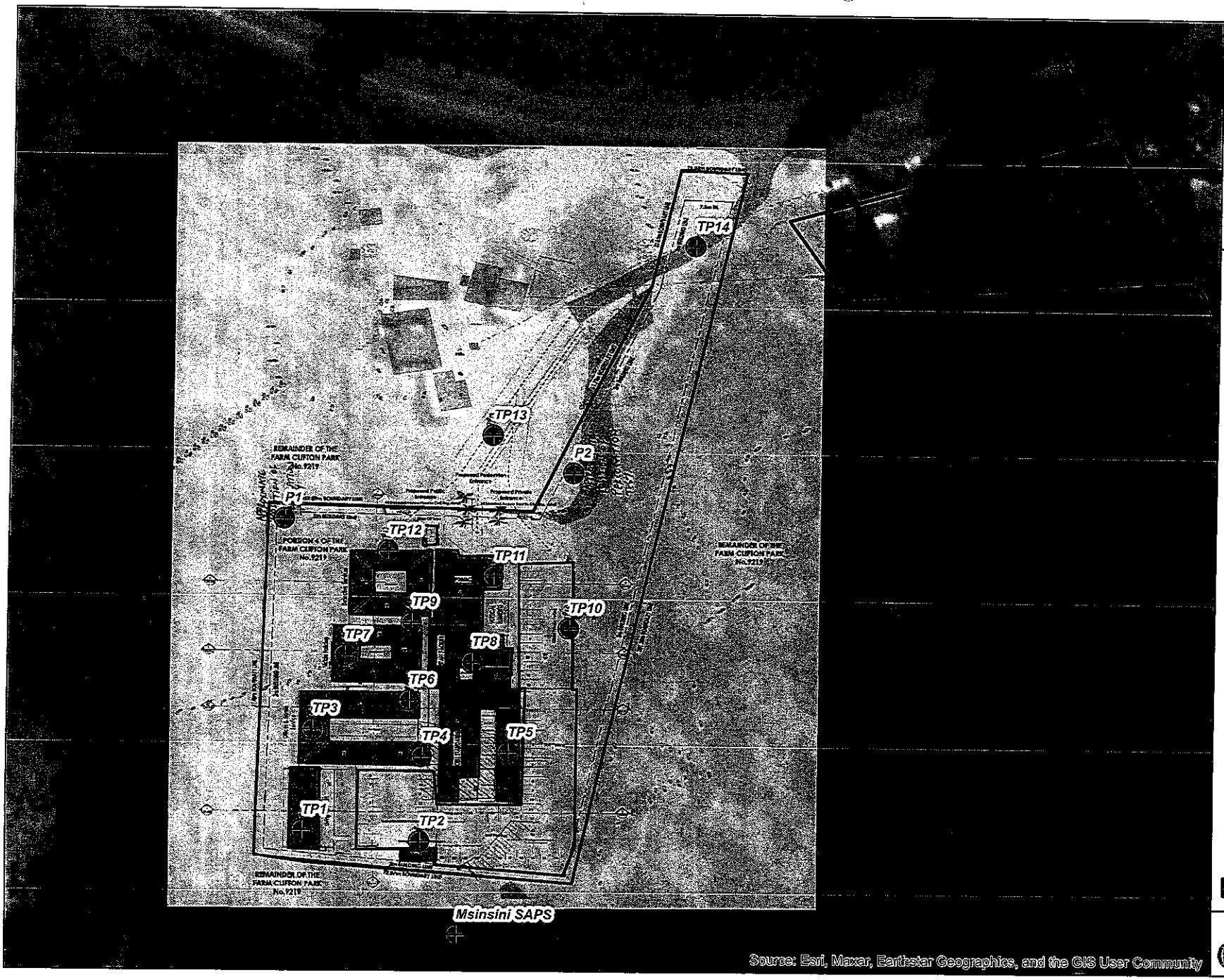
The study area has a climatic N-value of about 2.0 (Weinert, 1980), consequently the main mode of weathering of rock is by chemical decomposition. The residual soils occurring on site typically weather to dark brown, mostly medium dense, gravelly clayey medium to coarse- grained Sand type residual soils.

4. METHOD OF INVESTIGATION

4.1 TEST PITTING AND PROFILING

The geotechnical investigation entailed excavating fourteen (14) test pits with a New Holland B90 tractor-loader-backhoe (TLB) at pre-determined positions. Test Pit 13 (refer to Figure 3) was later excluded from the pre-determined positions as it was discovered to be situated on a private property. The test pits were excavated to average depths of 1.7m below the natural ground level (ngl). The test pit excavations were inspected, and the excavation progress monitored to estimate the consistency of the soil/bedrock profile. The profile assessments were done by a qualified engineering geologist and the materials were described in terms of moisture, colour, consistency, structure and origin in accordance with the methods of Jennings *et al.*

In general, the colluvium and residuum encountered across the site have typically medium dense consistencies throughout the site. No seepage was encountered in any of the test pits. Imported surfacing material was noted in TP14. The soil profiles are included in *Appendix A* and the positions of the test pits are indicated on the Site Plan (*Figures 4 on the following page*).



MSINSINI POLICE STATION

SITE LOCATION

N
W E
S

0 12.5 25 Meters

Legend

- Test Pits
- Farm Portions

ZULMAP GIS & SURVEY CONSULTING

4.2. LABORATORY TEST RESULTS

In order to evaluate properties of the underlying soils, selected samples of the colluvium and residuum/weathered rock were taken from the test pits and submitted to *Soilco Materials Investigations* for testing.

The disturbed samples were submitted for Grading, Atterberg Limits and classification tests. These tests permit a basic classification of the soils and group them according to typical engineering properties. Bulk samples were submitted for MOD/CBR testing to determine the compaction characteristics of the site materials. Copies of the laboratory test results are attached in ***Appendix B*** and are also summarized in the following tables for convenience.

Table 1A: Results of the Foundation Indicator Tests

Test Pit	Depth (m)	Particle Size (%)			Atterberg Limits			Group Index	Heave
		CS to FS	FS	S & C	LL	PI	LS		
TP01	0.50-1.30	65	7	27	27	3	2	A-2-4	
TP01	0.00-0.50	29	41	31	24	5	2.5	A-2-4	Low
TP02	0.26-0.80	48	11	41	24	8	3.5	A-4	
TP05	0.00-1.20	27	54	15	22	5	2.5	A-2-4	Low
TP05	1.2 – 2.0	54	10	36	23	6	3	A-2-4	
TP09	1.2-1.9	63	8	29	36	7	3.5	A-2-4	
TP10	0.0-1.7	51	10	39	32	11	5.5	A-2-6	
TP11	0.30-1.70	52	8	41	35	9	5	A-4	Low
TP12	0.0-0.60	51	12	38	29	9	4.5	/	
TP14	0.0-0.45	64	8	28	26	6	3.5	A-1-b	
TP14	0.45-1.00	49	10	40	34	6	3	A-4	

CS=Coarse Sand FS= FineSand S=Silt C=Clay LL=Liquid Limit PI=Plasticity Index LS=Linear Shrinkage

Table 1B: Results of the MOD/CBR Laboratory Test Results.

Test Pit	Depth (m)	TRH14	OMC (%)	MDD (kg/m³)	CBR @		
					100%	95%	90%
Msinsini Police Station							
TP01	0.50-1.30	G6	10	2026	49	35	24
TP02	0.26-0.80	G8	9.9	2111	22	13	8
TP05	1.2 – 2.0	G7	10.5	2154	60	35	21
TP09	1.2-1.9	G9	10.8	1869	25	10	4
TP10	0.0-1.7	G10	10.3	2048	18	8	4
TP11	0.30-1.70	G8	10	1985	64	34	18
TP14	0.0-0.45	G7	10.1	2092	32	18	10

4.3 DYNAMIC PENETRATION TESTS

4.3.1 Dynamic Cone Penetration (DCP) Tests

A total of THIRTEEN (13) hand-held dynamic penetration tests (DCP's) were completed adjacent to each test pit excavated on site to determine the in-situ subsoil conditions. The DCP or dynamic cone penetrometer is a test in which a 60° cone with diameter of 20mm is driven into the soil by a 7.815kg weight dropped through 575mm. The results are expressed as millimetres penetrated per blow and refusal is achieved when 1mm penetration is recorded after 10 blows. The DCP is most useful for estimating soil conditions during the design of shallow footings or for assessing subgrade soils for road design. A crude approximation of the consistency and strength as well as the in situ inferred CBR values can also be obtained. DCP14 show medium dense to dense consistencies as it situated in a road consisting of imported engineered material.

Results of the DCP tests are provided in **Appendix C.** A summary of the DCP tests are given in the Table below

Table 2: Summary of DCP Test results

	DCP1	DCP2	DCP3	DCP4	DCP5	DCP6	DCP7	DCP8	DCP9	DCP10	DCP11	DCP12	DCP14	
Depth (m)														Colour Key
0,1	15	3	5	3	4	4	8		3	4	4	4	12	Dense
0,2	7	7	4	3	12	10	5	9	4	2	3	2	10	
0,3	4	10	4	9	18	9	2	10	5	2	3	3	11	Loose
0,4	4	13	3	6	10	5	4	6	3	2	3	2	7	Medium Dense
0,5	4	13	2	4	6	5	17	4	2	2	4	3	8	Dense
0,6	6	11	4	4	4	6	14	3	6	2	3	2	8	Very Dense
0,7	13	8	4	4	3	6	10	3	7	2	3	2	8	
0,8	20	6	5	4	3	4	17	4	8	3	4	3	17	
0,9	25	29	7	6	5	6	11	11	10	3	4	3	12	
1	29	30	5	9	5	4	6	4	11	4	6	4	8	
1,1							8	5	13		5	3		
1,2							10	12	17		7	6		
1,3							9	17	10		6	3		
1,4							9	17	10		7	3		
1,5							8	23	13		10	4		
1,6							10	24	10		11	5		
1,7							12	29	14		11	5		
1,8							13	37	14		13	6		
1,9							13	38	15		14	6		
2,0														

4.3.2 PERCOLATION TESTS

TWO (2) percolation tests, Percolation test 1 (P1) and Percolation test 2 (P2) were conducted on site at the following pre-determined positions, 30°29'39.31"S 30°24'51.12"E (P1) and 30°29'38.89"S 30°24'53.61"E (P2). Percolation test 1 was conducted at a depth of 1.00m and percolation test 2 at a depth of 0.8m below the existing ground-level.

The percolation rate was calculated for each test, and a rate of application (ROA) of effluent per square metre of trench sidewall per day was calculated based on the National Home Builders Registration Council (NHBRC) requirements.

Percolation test 1 yielded a ROA of 80 litres and Percolation test 2 yielded a ROA of 55 litres. The results of the tests are discussed in section 6 of the geotechnical appraisal. The results of the percolation tests are also attached in ***Appendix D.***

5. GROUNDWATER, SEEPAGE AND RUN-OFF

Information regarding the groundwater regime with respect to groundwater as a potential source of water supply are detailed in a separate report (Reference: GC0568 Msinsini Police Station Feasibility Geohydrological Report). From a geotechnical perspective, no evidence of a shallow groundwater table persists on site. Through field observations recorded during the profiling, the following was highlighted: -

- No evidence of ponding was observed near or around the site at the time that the investigation was conducted.
- Stormwater systems are lacking on site.
- No seepage was encountered in any of the test pits.

6. GEOTECHNICAL APPRAISAL

The properties of the soils and bedrock observed in the test pits and as encountered by the DCP tests have been evaluated and discussed below:

6.1 ESTIMATED BEARING CAPACITIES

A crude approximation of the bearing capacity can be estimated from the consistency values as determined by the DCP results. The DCP results are attached in *Appendix C*. For convenience Tables 3A and 3B show estimated bearing capacities for inferred soil/rock layers encountered at the proposed Msinsini Police Station, particularly at test pit positions that fall within the footprint of proposed new building structures.

Table 3B: Estimated Allowable Bearing Capacity soil/rock layers encountered on site

Soil/Rock Description	*Consistency*	*Average Layer Depth (m)*	*Estimated Bearing Capacity (kPa)*
Colluvium/Residual Interface	Loose to Dense (Very Loose at TP08 from 0-0.1m)	0.0 – 0.5	30 – 310 (average 35 kPa to 150 kPa)
Residual Soils	Loose to Very Dense	0.5 – 0.8	30 – 550 (average 35 kPa to 170 kPa)
Residual Soils/Rock Interface	Loose to Very Dense	0.8– 1.1	Average 70 kPa to 170 kPa
	Medium Dense to Dense (Loose at TP08 from 1.1-1.5m)	1.1 – 1.6	Average 80 kPa to 310 kPa
	Medium Dense to Very Dense	>1.6	Average 170 kPa to 550kPa

VS = Very Soft S = Soft MD = Medium Dense D = Dense VD = Very Dense

Founding material marginally suitable for the proposed structures (with ***bearing capacities of 200 - 250kPa without modification***) exist within the ***Dense residuum and fair quality rock at an depth of >1.6m***.

6.2 ESTIMATED COMPRESSIBILITY

The results of the visual assessment of the soil profiles and results of the DCP data allows for the compressibility to be estimated. All bulk samples submitted for testing ***have low liquid limits (<<50%). Pin-holing was observed particularly within the residual soils and may indicate potential compressibility.***

6.3 ACTIVE CLAYS

No highly active clays were noted in any of the test pits within the colluvial or residual soils. The laboratory results also show that ***tested colluvium and residuum are generally low in potential activity***.

6.4 FOUNDATION OPTIONS

Founding conditions for structures ***(>150kPa) are present at a depth of (>1.6m) on residual soils/fair rock quality of at least Dense to very Dense consistency***.

6.5 EXCAVATION CHARACTERISTICS

TLB ***mechanical excavation operations will be adequate to excavate through the colluvium and residuum material to depths as shown in the test pit profiles to on average 1.5m***. The DCP results also indicate adequate excavation through the residuum and bedrock as shown by DCP results to depths of at least 2.0m.

6.6 STABILITY OF EXCAVATIONS

Although no imminent collapse was observed for any of the test pits, slumping and raveling of the test pit side walls can occur as a result of high moisture contents and excessive inflows. ***Adequate site drainage should be implemented to prevent ponding and excessive inflows.***

Areas where unstable soils are uncovered are to be either shored or flattened to less than 60° from horizontal. Furthermore, when excavating trenches, spoil material should not be placed closer than the equivalent depth of the trench to avoid unnecessary loading of the sidewalls, especially under moist to saturated conditions.

6.7 EFFLUENT DISPOSAL

As understood, sewage from the toilets and ablutions will be handled in a closed sanitation system that comprises a conservancy tank with active composting bacteria and an overflow for any water which will be allowed to percolate into the ground via a French drain.

The issue that needs to be addressed is the size and location of the evapotranspiration areas. It is imperative that sufficient area is set aside for this purpose – an area that should not be developed, hardened or interfered with in any way except perhaps to plant high water demand vegetation thereon to assist with the transpiration portion of the effluent disposal. The NHBRC publishes estimated effluent volumes for variously sized houses based on the number of bedrooms, including domestic quarters, and these are included in the attached results, along with the required evapotranspiration area. There is the option of connecting several dwellings into a common evapotranspiration area should the layout allow this.

In terms of the size of the soakaways, these have been calculated based on effluent volumes and these results are also included in the attached results. In that the base of the trench is not included in the calculation ***there is no point digging wide trenches as the percolation takes place along the vertical sides of the trench, and mostly along the downslope side***. A narrow trench is also easier to support and does not present a subsidence hazard for vehicles or other equipment which will undoubtedly traverse the evapotranspiration areas. It is important to backfill the

trenches with fist-sized stones, or perhaps clean rubble (half bricks without cement) to provide a filter zone that not only allows the free passage of effluent, but also supports the walls and soil cover. A geofabric separation layer needs to be emplaced between the filter zone and the soil cover. Old car tyres and corrugated iron sheeting as a cover is not a suitable solution over the long term.

It is important that the soakaways are wrapped around the contours as far as possible, and that they are sited away from water courses and boreholes to prevent any contamination of surface water and groundwater.

A peak factor of 2,5 and infiltration of 15% has been applied to the Peak Daily Discharge to cater for the peaks in discharge.

Peak Daily Discharge = Total Average Daily Water Demand x Peak Factor + Infiltration

The average daily sewer discharge generated by the proposed development is calculated at 80% of the water demand, therefore :

Average Daily Discharge *(l/day)*	**24 960**
Daily Peak Discharge (Peak Factor of 2,5) *(l/day)*	**62 400**
Stormwater Infiltration Factor (1,15) *(l/day)*	**71 760**
Total Peak Discharge *(l/sec)*	**0.83**
Total Peak Demand *(m^3/sec)*	**0.00083**

Percolation test 1 has a ROA of 80 litres/day/m^2 and can be ***considered as an eminently suitable area for the disposal of effluent via percolation methods***. It is recommended that an exaggerated French drain be incorporated into the design.

Percolation test 2 has a ROA of 55 litres/day/m^2 and ***can be considered as an eminently suitable area for the disposal of effluent via percolation methods***. It is recommended that an exaggerated French drain be incorporated into the design.

However, considering the sewerage load, the site is classified as unsuitable for the disposal of wastewater via percolation methods as some 447.83 to 651.6m of ***vertical sides of the trench will be required to meet the disposal demand.*** Refer to tables below.

Test No.	PT1	PT2	PT3	PT4	PT5	PT6
Percolation Rate	10					
ROA*	80					
Average ROA*	**80**	*Rate of Application of Effluent (litres/m2 of trench sidewall/day)				

Evapotranspiration Area		
No. of bedrooms	Effluent Volume (litres/day)	Area (m^2)
2	750	300
3	900	360
4	1100	440
5	1400	560

Length of French Drain		
Effluent Volume (litres/day)	ROA* ($l/m^2/day$)	Length of Drain (m)
750	80	4.1
24960		155.3
62400		389.3
71760		447.8

Test No.	PT1	PT2	PT3	PT4	PT5	PT6
Percolation Rate	18					
ROA*	55					
Average ROA*	**55**	*Rate of Application of Effluent (litres/m2 of trench sidewall/day)				

Evapotranspiration Area		
No. of bedrooms	Effluent Volume (litres/day)	Area (m^2)
2	750	300
3	900	360
4	1100	440
5	1400	560

Length of French Drain		
Effluent Volume (litres/day)	ROA* ($l/m^2/day$)	Length of Drain (m)
750	55	6.2
24960		226.2
62400		566.5
71760		651.6

It is recommended that due to the moderate permeability of the soils and the relatively moderate infiltration rates, application rates must be kept on the conservative side in order to prevent over-saturating the soils. Raking of the pit sidewalls will help increase the permeability of the clayey subsoils.

The effect of vegetation on the disposal of effluent should not be underestimated. This is particularly the case in the areas of low percolation soils. The evapotranspiration area should

not be paved or built up and the judicious planting of high water demand plants and trees will assist the evapotranspirative process significantly. Conversely, clearing of vegetation and the building over evapotranspiration areas will greatly limit or debilitate the process.

Notwithstanding the above it should be noted that septic tank and wastewater soakaway disposal is not suited to areas where bedrock occurs within 0,7m of existing ground level and within 30m of any stream course.

Therefore, consideration could be given to the following for the disposal of effluent:

- Use a package plant for the treatment of effluent;
- Import sandy soils to site to form an evapotranspiration bed; or
- Construct an effluent settlement pond or reed bed.

7. SUMMARY AND CONCLUSIONS

The site is well suited for development provided that the recommendations given in this report are implemented. Some important elements relating to the final design are as follows:

- Soft excavation is anticipated, up to the depths achieved in the test pits (1.5m) and up to 2.0m in places as proven by the DCP and TLB excavations
- Structures with higher bearing pressures (200 -250kPa) should be founded on 'dense' to very dense material at depths as shown in the respective DCP tests (~ 1.6m). Depending on the proposed final depth, foundation excavations should be excavated to the proposed depth and backfilled with material of at least G6 quality in runs of no more than 300mm to at least 92% MOD AASHTO.
- Slightly deeper excavation than the average founding depth may be required to the far north of the site (TP12).
- Engineering geologist to confirm the presence of weathered bedrock/sound founding material during construction.
- No significant problem soils (heaving, collapsible, compressible) were noted within any of the test pits.
- As understood, sewage from the toilets and ablutions will be handled in a closed sanitation system that comprises a conservancy tank with active composting bacteria and an overflow for any water which will be allowed to percolate into the ground via a

French drain.

Every effort was made during the soil investigations to ensure that generally accepted practices of our profession were used in the sub-surface evaluation of the site, and that the sampling and testing was representative of the soil/rock conditions observed on-site. However, it is impossible under constraints of a restricted investigation of this nature to guarantee that zones of poorer geological materials were not identified that could have a significant bearing on the outcomes of the investigation. The investigation has therefore attempted, through interpolation and extrapolation at known test locations, to identify problem issues of a geotechnical nature on which this report is based.

Variances in soil and rock quality and quantity from those predicted may be encountered during construction and these should be recorded. There is also no warranty for geological changes that may occur due to natural processes, or human activity.

Jacques du Preez
Pr. Sci. Nat.

Appendix A
Test Pit Profiles

GEOCON CONSULTING

Msinsini Police Station TP01

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP01
LOGGED BY M. Scott
COORDINATES 30°29'41.81"S, 30°24'51.33"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, light greyish brown, loose, intact, silty Sand. Hillwash
0.2		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.3		
0.4		
0.5		Yellow to orange brown speckled black in places, coarse, weathered, soft to medium hard rock, closely jointed. Granite
0.6		
0.7		
0.8		
0.9		
1		
1.1		
1.2		
1.3		
1.4		Notes : i) Stop very Slow Penetration (SVSP) @ 1.40m on medium hard rock Granite.. ii) No Seepage
1.5		
1.6		
1.7		
1.8		
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP02

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP02
LOGGED BY M. Scott
COORDINATES 30°29'42.11"S, 30°24'52.32"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, dark grey brown, loose, intact, Sand with abundant tree roots. Colluvium
0.2		
0.3		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.4		
0.5		
0.6		
0.7		
0.8		Yellow stained orange brown and speckled black in places, very coarse, weathered, soft to medium hard rock, closely jointed. Granite
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		Notes : i) SVSP @ 1.70m on medium hard rock Granite. ii) No Seepage
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP03

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP03
LOGGED BY M. Scott
COORDINATES 30°29'41.14"S, 30°24'51.39"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, dark grey brown, loose, intact, silty Sand with abundant tree roots. Colluvium
0.2		
0.3		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.4		
0.5		
0.6		
0.7		
0.8		Yellow stained orange brown and speckled black in places, very coarse, weathered, soft to medium hard rock, closely jointed. Granite
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		Notes :
1.8		
1.9		i) SVSP @ 1.70m on medium hard rock Granite.
2		ii) No Seepage
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP04
LOGGED BY M. Scott
COORDINATES 30°29'41.41"S, 30°24'52.14"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.2		
0.3		
0.4		
0.5		
0.6		Yellow stained orange brown and speckled black in places, very coarse, weathered, soft to medium hard rock, widely jointed. Granite
0.7		
0.8		
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
2		Notes : i) SVSP @ 1.90m on medium hard rock Granite. ii) No Seepage
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

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PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP05
LOGGED BY M. Scott
COORDINATES 30°29'41.14"S, 30°24'53.01"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1 – 1.1		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
1.2 – 1.9		Yellow stained orange brown and speckled black in places, coarse, weathered, very soft to soft rock, closely jointed. Granite
2 – 2.9		Notes : i) SVSP @ 2.00m on medium hard rock Granite. ii) No Seepage

GEOCON CONSULTING

Msinsini Police Station TP06

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP06
LOGGED BY M. Scott
COORDINATES 30°29'41.14"S, 30°24'51.39"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, grey and orange brown interlayered, medium dense, gravelly Sand. Engineered fill material
0.2		
0.3		
0.4		
0.5		Orange brown stained black, very coarse, highly weathered, very soft rock. Granite
0.6		
0.7		Yellow stained orange brown and speckled black in places, coarse, weathered, soft to medium hard rock, closely jointed. Granite
0.8		
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		Notes : i) SVSP @ 1.50m on medium hard rock Granite. ii) No Seepage
1.7		
1.8		
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP07

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP07
LOGGED BY M. Scott
COORDINATES 30°29'40.49"S, 30°24'51.66"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, light greyish brown, loose, intact, silty Sand. Hillwash
0.2		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.3		
0.4		
0.5		Yellow to orange brown speckled black in places, coarse, weathered, micaceous, closely jointed, soft rock. Granite
0.6		
0.7		
0.8		
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		Notes :
1.7		i) Stop very Slow Penetration (SVSP) @ 1.60m on medium hard rock Granite..
1.8		ii) No Seepage
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP08

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP08
LOGGED BY M. Scott
COORDINATES 30°29'40.56"S, 30°24'52.69"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, dark grey brown, loose, intact, Sand with abundant tree roots. Colluvium
0.2		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		Yellow stained orange brown and speckled black in places, very coarse, weathered, soft to medium hard rock, closely jointed. Granite
1		
1.1		Notes : I) SVSP @ 1.00m on medium hard to hard rock Granite. II) No Seepage
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP09

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP09
LOGGED BY M. Scott
COORDINATES 30°29'40.13"S, 30°24'52.08"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, grey and orange brown interlayered, medium dense, gravelly Sand. Engineered fill material
0.2		
0.3		
0.4		
0.5		Orange brown stained black, very coarse, highly weathered, very soft rock. Granite
0.6		
0.7		
0.8		
0.9		
1		
1.1		
1.2		Yellow stained orange brown and speckled black in places, coarse, weathered, soft to medium hard rock, closely jointed. Granite
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
2		Notes : i) SVSP @ 1.90m on medium hard rock Granite. ii) No Seepage
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

GEOCON CONSULTING

Msinsini Police Station TP10

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP10
LOGGED BY M. Scott
COORDINATES 30°29'39.85"S, 30°24'53.55"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1 – 0.7		Slightly moist, dark grey brown, medium dense, gravelly Sand with few concrete slabs. Fill material
0.7 – 1.7		Orange brown speckled black in places, coarse, weathered, soft to medium hard rock, closely jointed. Granite
1.8 – 2.9		Notes : i) SVSP @ 1.70m on medium hard rock Granite. ii) No Seepage

GEOCON CONSULTING

Msinsini Police Station TP11

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP11
LOGGED BY M. Scott
COORDINATES 30°29'39.73"S, 30°24'52.92"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, dark brown, medium dense to dense, pinholed, gravelly Sand. Residual Granite
0.2		
0.3		
0.4		Yellow stained orange brown and speckled black in places, coarse, weathered, micaceous, very soft to soft rock, closely jointed. Granite
0.5		
0.6		
0.7		
0.8		
0.9		
1		
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		Notes :
1.8		
1.9		i) SVSP @ 1.70m on medium hard rock Granite.
2		ii) No Seepage
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP12
LOGGED BY M. Scott
COORDINATES 30°29'39.59"S, 30°24'52.04"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1 – 0.6		Slightly moist, greyish black, loose to medium dense to dense, silty clayey Sand. Colluvium
0.6 – 1.8		Yellow stained orange brown and speckled black in places, coarse, weathered, micaceous, soft rock, closely jointed. Granite
1.9 – 2.9		Notes : i) SVSP @ 1.80m on medium hard rock Granite. ii) No Seepage

GEOCON CONSULTING

Msinsini Police Station TP14

PROJECT NAME GC0567 Msinsini Police Station
CLIENT MapAfrica
MACHINE New Holland B90B

HOLE NO. TP14
LOGGED BY M. Scott
COORDINATES 30°29'36.90"S, 30°24'54.64"E

COMMENTS

Depth (m)	Graphic Log	Material Description
0.1		Slightly moist, maroon and orange brown, medium dense to dense, silty sandy gravel. Road layer
0.2		
0.3		Slightly moist, yellow brown stained orange in places, medium dense, sandy gravel. Road layer
0.4		
0.5		Slightly moist, dark grey brown, loose to medium dense, gravelly silty Sand. Residual Granite
0.6		
0.7		
0.8		
0.9		
1		
1.1		Notes : I) No refusal ii) No Seepage
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
2		
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		

Appendix B
Laboratory Test 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

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

T 0823

Date : 2024-03-28

For the Attention of : Jacques Du Preez

Customer Name : Geocon Consulting

Address : 18 Montrosse Boulevard
Pietermaritzburg
3201

Project Information : GC0567 - Msinsini Police Station

Job Card Number : 250605

Sample Number / s : P6981 - P6994

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
Materials Report (Soilco SF 33)	Sieve Analysis	SANS 3001 GR 1	9
	Atterberg Limits	SANS 3001 GR 10 - GR 12	
	The Determination of Maximum Dry Density & Optimum Moisture Content	SANS 3001 GR 30	
	California Bearing Ratio	SANS 3001 GR 40	
Moisture / Density Relationship (Soilco SF 38)	The Determination of Maximum Dry Density & Optimum Moisture Content	SANS 3001 GR 30	8

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

Yours faithfully,

For Soilco S. Jayraj (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 of samples as received and tested at the Laboratory . 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

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

T 0823

Customer	:	Geocon Consulting	**Job Card No.**	:	250605
Project	:	GCO567 Msinsini SAPS	**Date Received**	:	2024-02-19
			Date Tested	:	2024-02-19 to 2024-03-19
Condition of Sample	:	Moist	**Date Reported**	:	2024-03-28
Environmental Conditions	:		**Date Sampled**	:	2024-02-19
Sampling Process	:	Samples Delivered by Customer			

MATERIALS TEST REPORT

Laboratory Number		P6982				
Field Number		TP01				
Position in field / Location		-				
Depth (mm)		600-1300				
Sample Description		Y. to Or. Br. Speckled Black Weath. Granite				
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		100				
14.0 mm		99				
5.0 mm		83				
2.0 mm		66				
0.425 mm		35				
0.075 mm		18				
Grading Modulus	SANS 3001 PR 6	1.81				
Mechanical Analysis - SANS 3001 - GR 1						
Coarse Sand	(%)	47				
Coarse - Fine Sand	(%)	10				
Medium - Fine Sand	(%)	8				
Fine - Fine Sand	(%)	7				
Silt and Clay	(%)	27				
Atterberg Limits - SANS 3001 - GR 10 and GR 12						
Liquid Limit	(%)	27				
Plasticity Index	(%)	3				
Linear Shrinkage	(%)	2.0				
Materials Classification						
Classification Group Index	#	A - 2 - 4				
COLTO Classification	#	G6				
TRH 14 Classification (1985)	#	G6				
Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30						
Maximum Dry Density	(kg/m^3)	2026				
Optimum Moisture Content	(%)	10.0				
California Bearing Ratio - SANS 3001 - GR 40						
CBR @ 100 % Compaction		49				
CBR @ 98 % Compaction		43				
CBR @ 95 % Compaction		35				
CBR @ 93 % Compaction		30				
CBR @ 90 % Compaction		24				
Swell @ 100 % Compaction		0.53				

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

For Soilco - S. Jayraj (Technical Signatory)
2018-05-22

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009686 / 07

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

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

T 0823

Customer	:	Geocon Consulting	**Job Card No.**	:	250605
Project	:	GCO567 Malnsl SAPS	**Date Received**	:	2024-02-19
			Date Tested	:	2024-02-19 to 2024-03-19
Condition of Sample	:	Moist	**Date Reported**	:	2024-03-28
Environmental Conditions	:		**Date Sampled**	:	2024-02-19
Sampling Process	:	Samples Delivered by Customer			

MATERIALS TEST REPORT

Laboratory Number		P6983				
Field Number		TP 02				
Position in field / Location		-				
Depth	(mm)	280-800				
Sample Description		Dk. Br. Gravelly Sand Residual Granite				
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		100				
5.0	mm		98				
2.0	mm		96				
0.425	mm		75				
0.075	mm		39				
Grading Modulus		SANS 3001 PR 5	0.91				

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	22				
Coarse - Fine Sand	(%)	14				
Medium - Fine Sand	(%)	12				
Fine - Fine Sand	(%)	11				
Silt and Clay	(%)	41				

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit	(%)	24				
Plasticity Index	(%)	8				
Linear Shrinkage	(%)	3.5				

Materials Classification

Classification Group Index	#	A - 4				
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)	2111				
Optimum Moisture Content	(%)	9.9				

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	22			
CBR	@	98 %	Compaction	18			
CBR	@	95 %	Compaction	13			
CBR	@	93 %	Compaction	11			
CBR	@	90 %	Compaction	8			
Swell	@	100 %	Compaction	0.13			

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

For Soilco - S. Javia (Technical Signatory) 2024/03/28

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

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

T 0823

Customer	:	Geocon Consulting	**Job Card No.**	:	250605
Project	:	GCO567 Msinsini SAPS	**Date Received**	:	2024-02-19
			Date Tested	:	2024-02-19 to 2024-03-19
Condition of Sample	:	Moist	**Date Reported**	:	2024-03-28
Environmental Conditions	:		**Date Sampled**	:	2024-02-19
Sampling Process	:	Samples Delivered by Customer			

MATERIALS TEST REPORT

Laboratory Number		P6985				
Field Number		TP05				
Position in field / Location		-				
Depth (mm)		1200-2000				
Sample Description		Y. Stained Or. Br. Weath. Granite				
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		100				
5.0 mm		97				
2.0 mm		92				
0.426 mm		68				
0.075 mm		33				
Grading Modulus	SANS 3001 PR 5	1.07				
Mechanical Analysis - SANS 3001 - GR 1						
Coarse Sand	(%)	26				
Coarse - Fine Sand	(%)	16				
Medium - Fine Sand	(%)	12				
Fine - Fine Sand	(%)	10				
Silt and Clay	(%)	36				
Atterberg Limits - SANS 3001 - GR 10 and GR 12						
Liquid Limit	(%)	23				
Plasticity Index	(%)	6				
Linear Shrinkage	(%)	3.0				
Materials Classification						
Classification Group Index	#	A - 2 - 4				
COLTO Classification	#	G7				
TRH 14 Classification (1985)	#	G7				
Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30						
Maximum Dry Density	(kg/m^3)	2154				
Optimum Moisture Content	(%)	10.5				
California Bearing Ratio - SANS 3001 - GR 40						
CBR @ 100 % Compaction		60				
CBR @ 98 % Compaction		48				
CBR @ 95 % Compaction		35				
CBR @ 93 % Compaction		29				
CBR @ 90 % Compaction		21				
Swell @ 100 % Compaction		0.30				

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

For Soilco / S. Jayraj (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

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

T 0623

Customer	:	Geocon Consulting	**Job Card No.**	:	250605
Project	:	GCO567 Msinsini SAPS	**Date Received**	:	2024-02-19
			Date Tested	:	2024-02-19 to 2024-03-19
Condition of Sample	:	Moist	**Date Reported**	:	2024-03-28
Environmental Conditions	:		**Date Sampled**	:	2024-02-19
Sampling Process	:	Samples Delivered by Customer			

MATERIALS TEST REPORT

Laboratory Number		P6987				
Field Number		TP09				
Position in field / Location		-				
Depth (mm)		1200 - 1900				
Sample Description		Y. Stained Or. Br. Speckled Black Weathered Granite				
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		100				
5.0 mm		98				
2.0 mm		93				
0.425 mm		68				
0.075 mm		27.6				
Grading Modulus	SANS 3001 PR 6	1.11				

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	27				
Coarse - Fine Sand	(%)	21				
Medium - Fine Sand	(%)	15				
Fine - Fine Sand	(%)	8				
Silt and Clay	(%)	29				

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit	(%)	36				
Plasticity Index	(%)	7				
Linear Shrinkage	(%)	3.5				

Materials Classification

Classification Group Index	#	A - 2 - 4				
COLTO Classification	#	G9				
TRH 14 Classification (1985)	#	G9				

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

Maximum Dry Density	(kg/m^3)	1869				
Optimum Moisture Content	(%)	10.8				

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	26			
CBR	@	98 %	Compaction	17			
CBR	@	95 %	Compaction	10			
CBR	@	93 %	Compaction	7			
CBR	@	90 %	Compaction	4			
Swell	@	100 %	Compaction	0.30			

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

For Soilco - S. Jonsal (Technical Signatory)
2024-03-28

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

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

T 0823

Customer : Geocon Consulting
Project : GCO567 Msinsini SAPS

Condition of Sample : Moist
Environmental Conditions :
Sampling Process : Samples Delivered by Customer

Job Card No. : 250605
Date Received : 2024-02-19
Date Tested : 2024-02-19 to 2024-03-19
Date Reported : 2024-03-28
Date Sampled : 2024-02-19

MATERIALS TEST REPORT

Laboratory Number		P6988				
Field Number		TP10				
Position in field / Location		-				
Depth (mm)		0-1700				
Sample Description		Dk. Gr. Br. Gravelly Sand + Weath. Granite				
Stabilising Agent		Natural				
Sieve Analysis (Wet Preparation) SANS 3001 - GR 1						
100.0 mm	Percentage Passing					
75.0 mm						
63.0 mm						
60.0 mm						
37.5 mm						
28.0 mm						
20.0 mm						
14.0 mm		100				
5.0 mm		97				
2.0 mm		92				
0.425 mm		71				
0.075 mm		35.4				
Grading Modulus	SANS 3001 PR 5	1.02				
Mechanical Analysis - SANS 3001 - GR 1						
Coarse Sand	(%)	23				
Coarse - Fine Sand	(%)	14				
Medium - Fine Sand	(%)	14				
Fine - Fine Sand	(%)	10				
Silt and Clay	(%)	39				
Atterberg Limits - SANS 3001 - GR 10 and GR 12						
Liquid Limit	(%)	32				
Plasticity Index	(%)	11				
Linear Shrinkage	(%)	6.5				
Materials Classification						
Classification Group Index	#	A - 2 - 6				
COLTO Classification	#	>G9				
TRH 14 Classification (1985)	#	G10				
Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30						
Maximum Dry Density	(kg/m^3)	2046				
Optimum Moisture Content	(%)	10.3				
California Bearing Ratio - SANS 3001 - GR 40						
CBR @ 100 % Compaction		18				
CBR @ 98 % Compaction		13				
CBR @ 95 % Compaction		8				
CBR @ 93 % Compaction		6				
CBR @ 90 % Compaction		4				
Swell @ 100 % Compaction		0.38				

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

For Soilco - S. Javlal (Technical Signatory)
2015-05-12

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1995 / 009585 / 07

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

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

T 0823

Customer	:	Geocon Consulting	**Job Card No.**	:	250605
Project	:	GCO567 Melsini SAPS	**Date Received**	:	2024-02-19
			Date Tested	:	2024-02-19 to 2024-03-19
Condition of Sample	:	Moist	**Date Reported**	:	2024-03-28
Environmental Conditions	:		**Date Sampled**	:	2024-02-19
Sampling Process	:	Samples Delivered by Customer			

MATERIALS TEST REPORT

Laboratory Number		P6990				
Field Number		TP11				
Position in field / Location		-				
Depth	(m)	300-1700				
Sample Description		Y. Stained Or. Br. Speckled Black Weathered Granite				
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		100				
2.0	mm		99				
0.425	mm		88				
0.075	mm		40.4				
Grading Modulus		SANS 3001 PR 5	0.72				

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	12				
Coarse - Fine Sand	(%)	20				
Medium - Fine Sand	(%)	20				
Fine - Fine Sand	(%)	8				
Silt and Clay	(%)	41				

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit	(%)	35				
Plasticity Index	(%)	9				
Linear Shrinkage	(%)	5.0				

Materials Classification

Classification Group Index	#	A - 4				
COLTO Classification	#	>G9				
TRH 14 Classification (1985)	#	G8				

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

Maximum Dry Density	(kg/m^3)	1985				
Optimum Moisture Content	(%)	10.0				

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	64			
CBR	@	98 %	Compaction	50			
CBR	@	96 %	Compaction	34			
CBR	@	93 %	Compaction	27			
CBR	@	90 %	Compaction	18			
Swell	@	100 %	Compaction	0.08			

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

For Soilco - S. Jantjies (Technical Signatory)
2018-05-17

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

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

T 0823

Customer : Geocon Consulting
Project : GCO567 Msinsini SAPS

Condition of Sample : Moist
Environmental Conditions :
Sampling Process : Samples Delivered by Customer

Job Card No. : 250605
Date Received : 2024-02-19
Date Tested : 2024-02-19 to 2024-03-19
Date Reported : 2024-03-28
Date Sampled : 2024-02-19

MATERIALS TEST REPORT

Laboratory Number		P6992				
Field Number		TP12				
Position in field / Location		-				
Depth (mm)		0-600				
Sample Description		Greyish Black Silty Clayey Sand				
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		100				
5.0	mm		99				
2.0	mm		95				
0.425	mm		77				
0.075	mm		36.4				
Grading Modulus		SANS 3001 PR 5	0.92				

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	20				
Coarse - Fine Sand	(%)	16				
Medium - Fine Sand	(%)	16				
Fine - Fine Sand	(%)	12				
Silt and Clay	(%)	36				

Atterberg Limits - SANS 3001 - GR 10 and GR 12

Liquid Limit	(%)	29				
Plasticity Index	(%)	9				
Linear Shrinkage	(%)	4.5				

Materials Classification

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

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

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

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction				
CBR	@	98 %	Compaction				
CBR	@	95 %	Compaction				
CBR	@	93 %	Compaction				
CBR	@	90 %	Compaction				
Swell	@	100 %	Compaction				

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

For Soilco - S. Jayraj (Technical Signatory)
2015-05-12

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

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

T 0823

Customer : Geocon Consulting
Project : GCO567 Msinsini SAPS

Condition of Sample : Moist
Environmental Conditions :
Sampling Process : Samples Delivered by Customer

Job Card No. : 250605
Date Received : 2024-02-19
Date Tested : 2024-02-19 to 2024-03-19
Date Reported : 2024-03-28
Date Sampled : 2024-02-19

MATERIALS TEST REPORT

Laboratory Number		P6993	P6994			
Field Number		TP14				
Position in field / Location		-	-			
Depth (m)		0-450	450-1000			
Sample Description		Or. Br. Silty Sandy Gravel	Dk. Grey Br. Gravelly Silty Sand, Residual Granite			
Stabilising Agent		Natural	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		100	100			
14.0 mm		90	98			
5.0 mm		68	96			
2.0 mm		54	91			
0.425 mm		32	71			
0.075 mm		15.1	37			
Grading Modulus	SANS 3001 PR 5	1.99	1.01			
Mechanical Analysis - SANS 3001 - GR 1						
Coarse Sand	(%)	42	21			
Coarse - Fine Sand	(%)	12	16			
Medium - Fine Sand	(%)	10	12			
Fine - Fine Sand	(%)	8	10			
Silt and Clay	(%)	28	40			
Atterberg Limits - SANS 3001 - GR 10 and GR 12						
Liquid Limit	(%)	26	34			
Plasticity Index	(%)	6	6			
Linear Shrinkage	(%)	3,6	3,0			
Materials Classification						
Classification Group Index	#	A - 1 - b	A - 4			
COLTO Classification	#	G7				
TRH 14 Classification (1985)	#	G7				
Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30						
Maximum Dry Density	(kg/m^3)	2092				
Optimum Moisture Content	(%)	10.1				
California Bearing Ratio - SANS 3001 - GR 40						
CBR @ 100 % Compaction		32				
CBR @ 98 % Compaction		26				
CBR @ 95 % Compaction		18				
CBR @ 93 % Compaction		15				
CBR @ 90 % Compaction		10				
Swell @ 100 % Compaction		0,27				

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

For Soilco - S. Jawitz (Technical Signatory)
2015-06-11

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

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

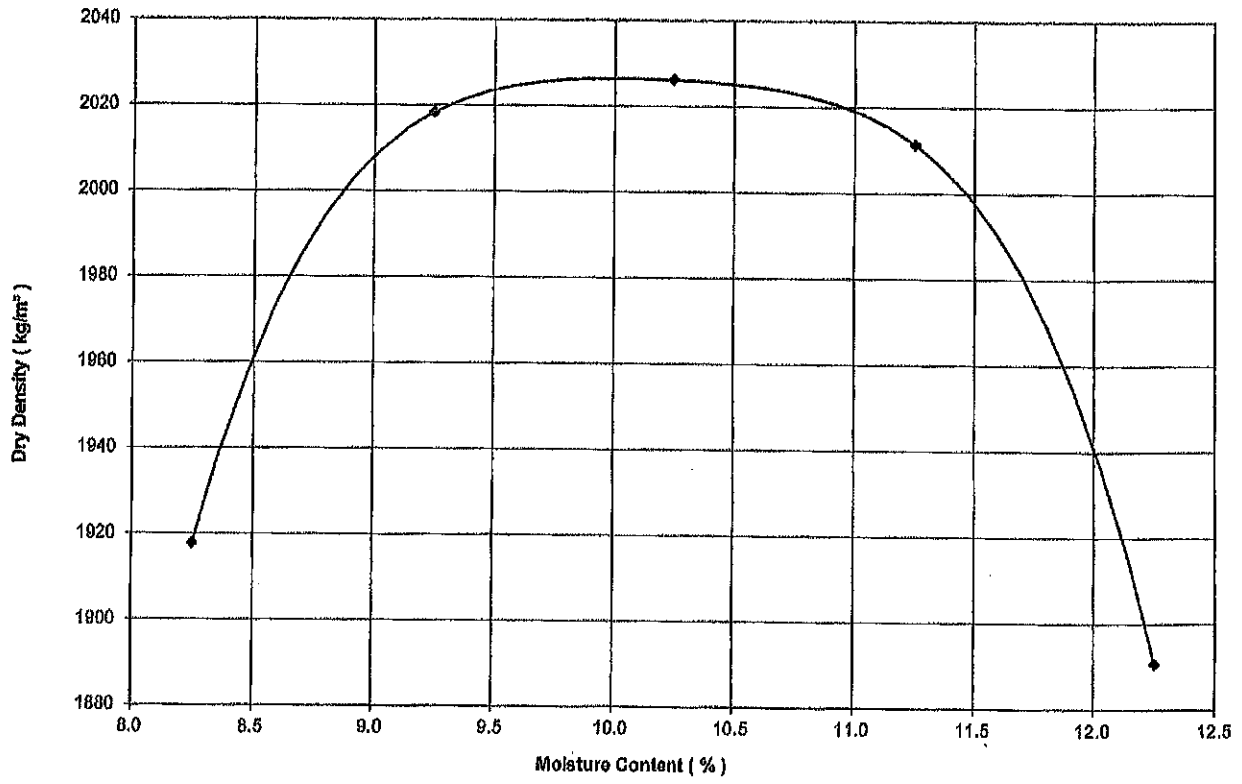
T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

Laboratory Number :	P6982	**Field Reference No. :**	TP01
Position in field / Location :	-	**Depth (mm) :**	500-1300
Material Description :	Y. to Or. Br. Speckled Black Weathered Granite	**Condition of Sample :**	Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	8.3	9.3	10.3	11.3	12.3	Maximum Dry Density	2026 kg/m^3
Dry Density (kg/m^3)	1918	2018	2026	2011	1891	Optimum Moisture Content	10.0 %



Remarks :

Method of Preparation : Scalping Process

For Soilco : _____

S. Jayraj (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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

T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

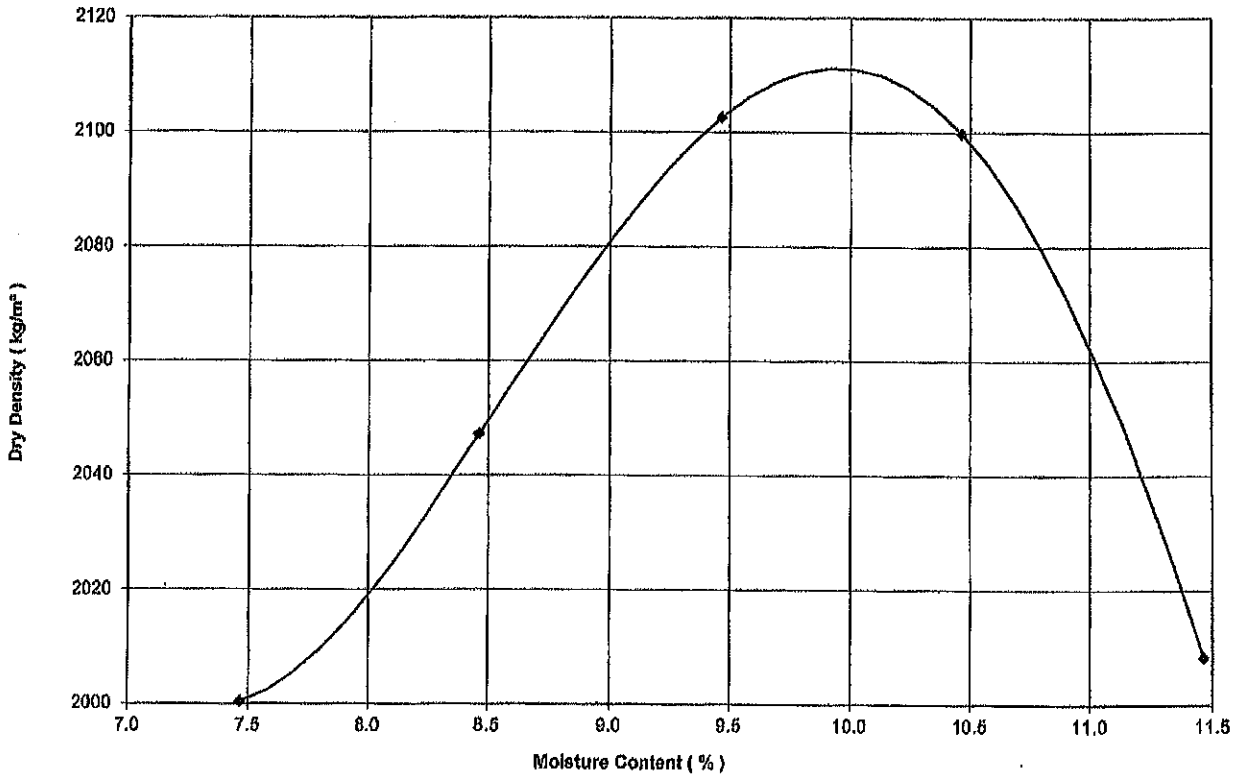
Laboratory Number : P6983 **Field Reference No. :** TP 02

Position in field / Location : - **Depth (mm) :** 260-800

Material Description : Dk. Br. Gravelly Sand. Residual Granite **Condition of Sample :** Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	7.5	8.5	9.5	10.5	11.5	Maximum Dry Density	2111 kg/m³
Dry Density (kg/m³)	2000	2047	2103	2100	2008	Optimum Moisture Content	9.9 %



Remarks :

Method of Preparation : Scalping Process

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

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

T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

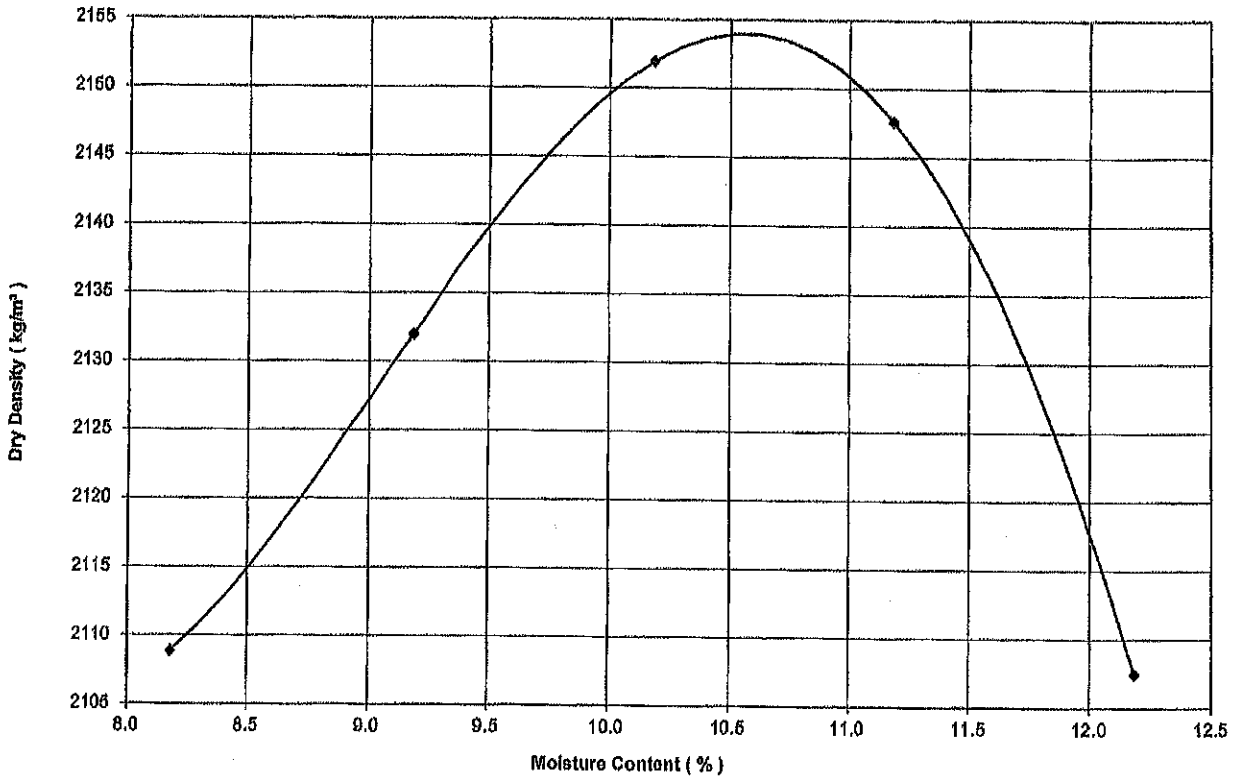
Laboratory Number : P6985 **Field Reference No. :** TP 05

Position in field / Location : - **Depth (mm) :** 1200-2000

Material Description : Y. Stained Or. Br. Weathered Granite **Condition of Sample :** Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	8.2	9.2	10.2	11.2	12.2	Maximum Dry Density	2154 kg/m^3
Dry Density (kg/m^3)	2109	2132	2152	2148	2107	Optimum Moisture Content	10.5 %



Remarks :

Method of Preparation : Scalping Process

For Soilco : S. Ikaran (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1985 / 009585 / 07

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

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

T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

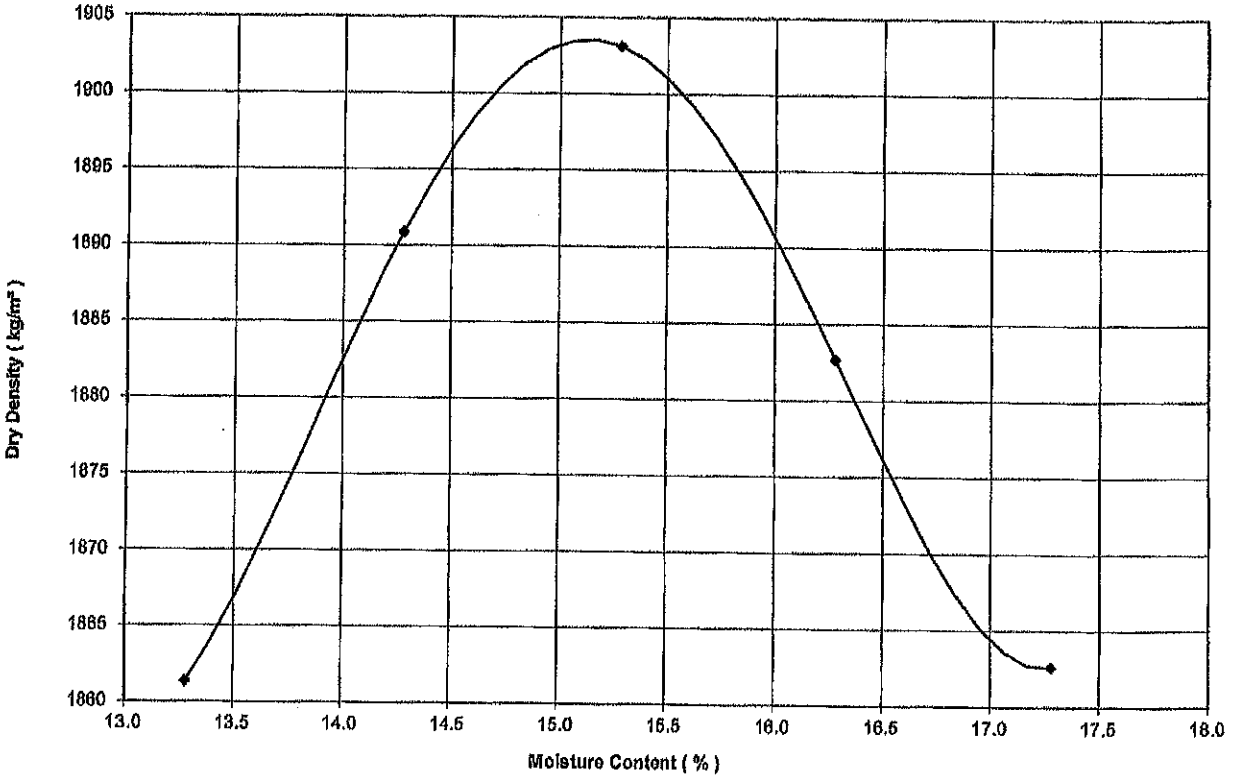
Laboratory Number : P6986 **Field Reference No. :** TP 06

Position in field / Location : - **Depth (mm) :** 0-1500

Material Description : Greyish Or. Br. Gravely Sand + Granite **Condition of Sample :** Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	13.3	14.3	15.3	16.3	17.3	Maximum Dry Density	1903 kg/m^3
Dry Density (kg/m^3)	1861	1891	1903	1883	1863	Optimum Moisture Content	15.2 %



Remarks :

Method of Preparation : Scalping Process

For Soilco : S. Jayraj (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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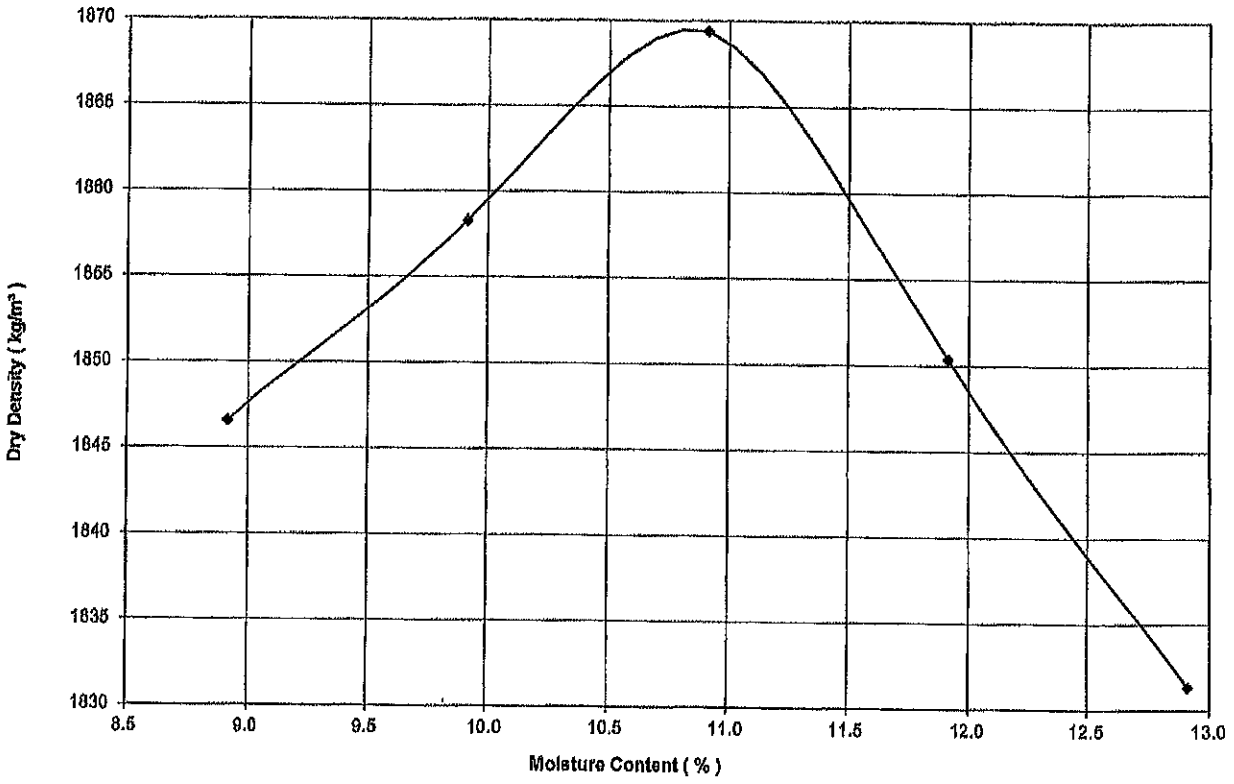
T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

Laboratory Number :	P6987	**Field Reference No. :**	TP 09
Position in field / Location :	-	**Depth (mm) :**	1200-1900
Material Description :	Y. Or. Br. Speckled Black Weathered Granite	**Condition of Sample :**	Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	8.9	9.9	10.9	11.9	12.9	Maximum Dry Density	**1869 kg/m³**
Dry Density (kg/m³)	1847	1858	1869	1850	1831	Optimum Moisture Content	**10.8 %**



Remarks :

Method of Preparation : Scalping Process

For Soilco : _____

S. Iqbal (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1985 / 009585 / 07

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

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

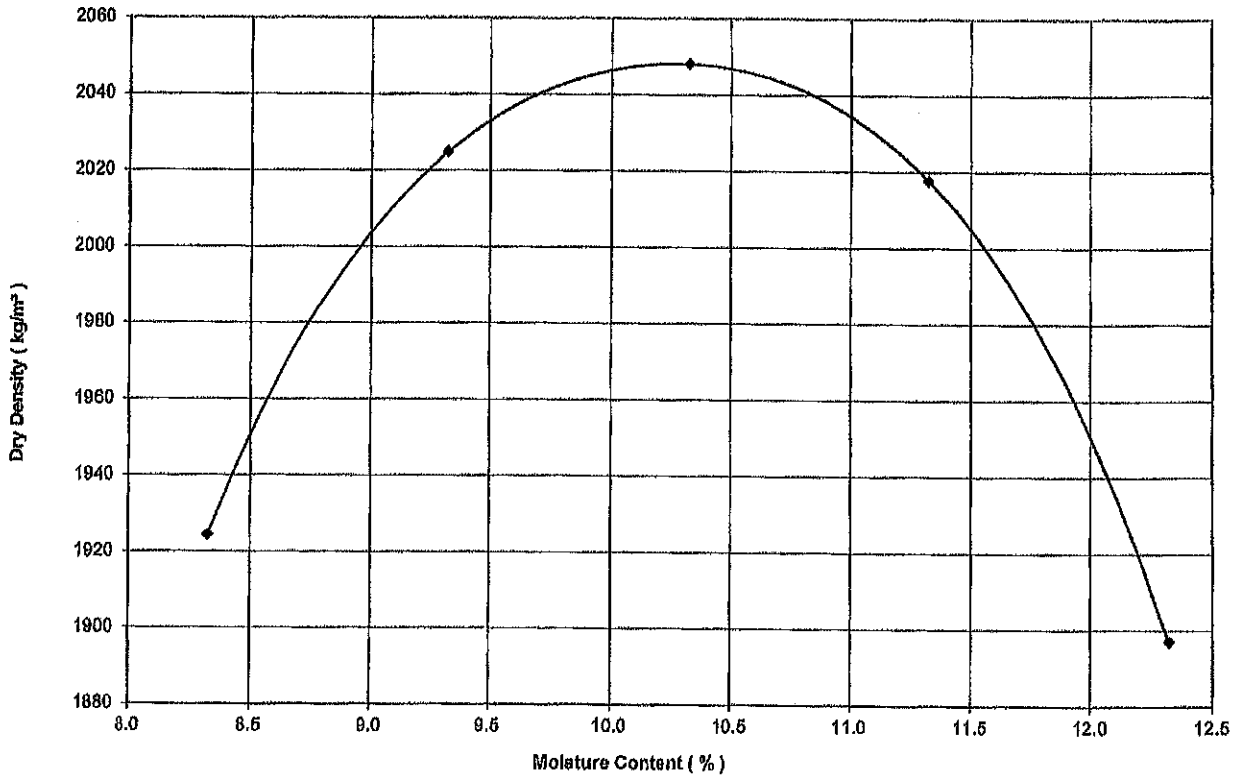
T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

Laboratory Number :	P6988	**Field Reference No. :**	TP 10
Position in field / Location :	-	**Depth (mm) :**	0-1700
Material Description :	Dk. Gr. Br. Gravelly Sand + Weathered Granite	**Condition of Sample :**	Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	8.3	9.3	10.3	11.3	12.3	Maximum Dry Density	**2048 kg/m³**
Dry Density (kg/m³)	1924	2025	2048	2018	1897	Optimum Moisture Content	**10.3 %**



Remarks :

Method of Preparation : Scalping Process

For Soilco : S. Taylor (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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T 0823

Client :	Geocon Consulting	**Job Card No. :**	
Project :	GC0567 Msinsini SAPS	**Date Received :**	
		Date Tested :	
Environmental Conditions :		**Date Reported :**	
Sampling Process :		**Date Sampled :**	

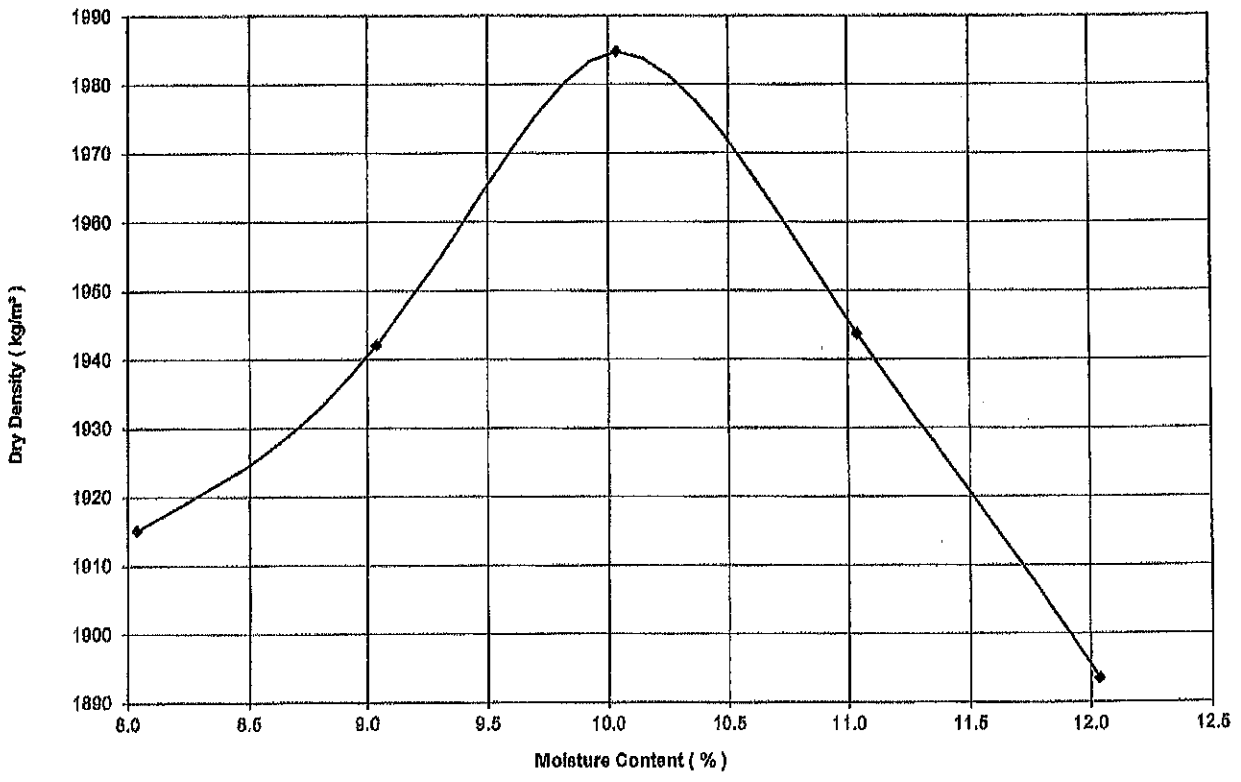
Laboratory Number : P6990 **Field Reference No. :** TP 11

Position in field / Location : - **Depth (mm) :** 300-1700

Material Description : Y. Stained Or. Br. Speckled Black Weathered Granite **Condition of Sample :** Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	8.0	9.0	10.0	11.0	12.0	Maximum Dry Density	1985 kg/m^3
Dry Density (kg/m^3)	1915	1942	1985	1944	1893	Optimum Moisture Content	10.0 %



Remarks :

Method of Preparation : Scalping Process

For Soilco : S. Jeyaraj (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

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

T 0823

Client :	Geocon Consulting	**Job Card No. :**	250605
Project :	GC0567 Msinsini SAPS	**Date Received :**	2024-02-19
		Date Tested :	2024-02-19 to 2024-03-19
Environmental Conditions :		**Date Reported :**	2024-03-28
Sampling Process :	Samples Delivered by Customer	**Date Sampled :**	2024-02-19

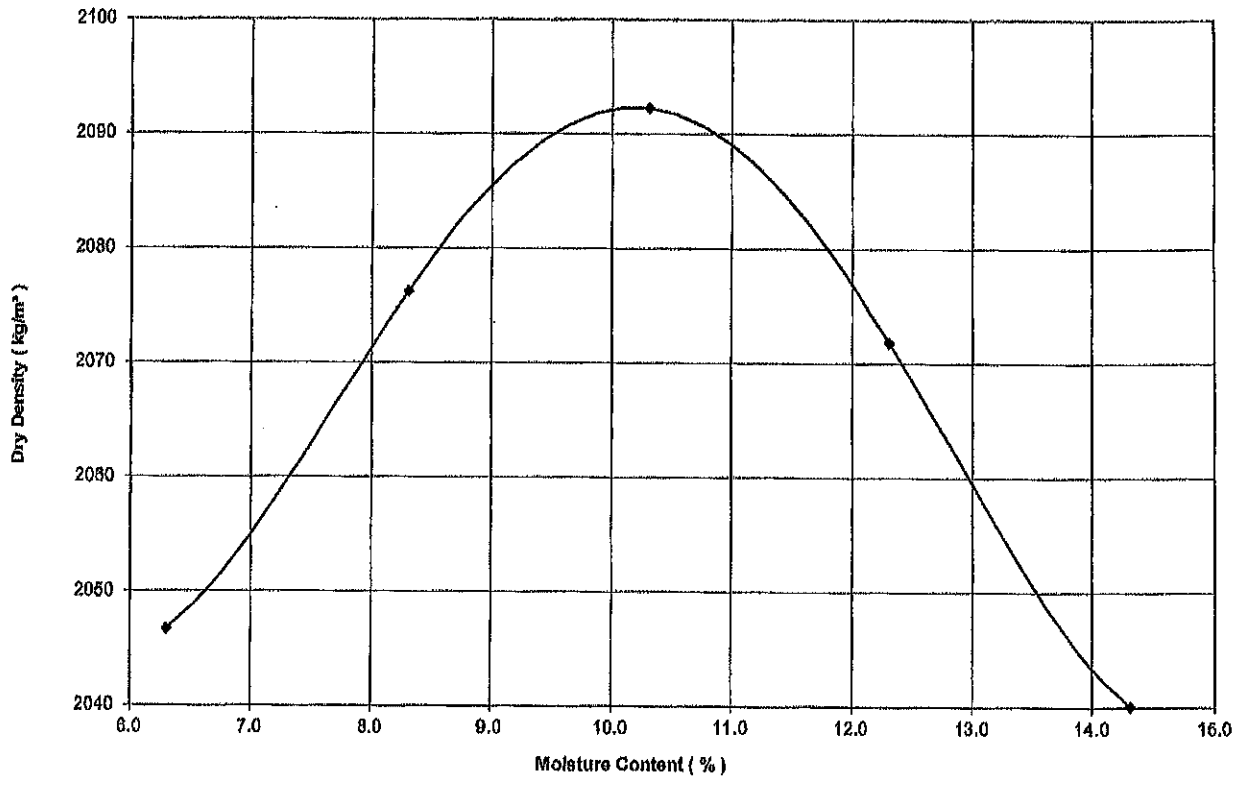
Laboratory Number : P6993 **Field Reference No. :** TP 14

Position in field / Location : - **Depth (mm) :** 0-450

Material Description : Or. Br. Silty Sandy Gravel **Condition of Sample :** Moist

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR 30

Moisture Content; (%)	6.3	8.3	10.3	12.3	14.3	Maximum Dry Density	**2092 kg/m³**
Dry Density (kg/m³)	2047	2076	2092	2072	2040	Optimum Moisture Content	**10.1 %**



Remarks :

Method of Preparation : Scalping Process

For Soilco : S. Sivraj (Technical Signatory)

Appendix C
DCP Test Results

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP01***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	16	Dense	130 kPa	29
0.2	7	Medium Dense	60 kPa	12
0.3	4	Loose	35 kPa	7
0.4	4	Loose	35 kPa	7
0.5	4	Loose	35 kPa	7
0.6	6	Medium Dense	50 kPa	10
0.7	13	Dense	110 kPa	23
0.8	20	Very Dense	>150 kPa	37
0.9	25	Very Dense	>150 kPa	49
1.0	29	Very Dense	>150 kPa	>55
1.1				
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1.5				
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1.8				
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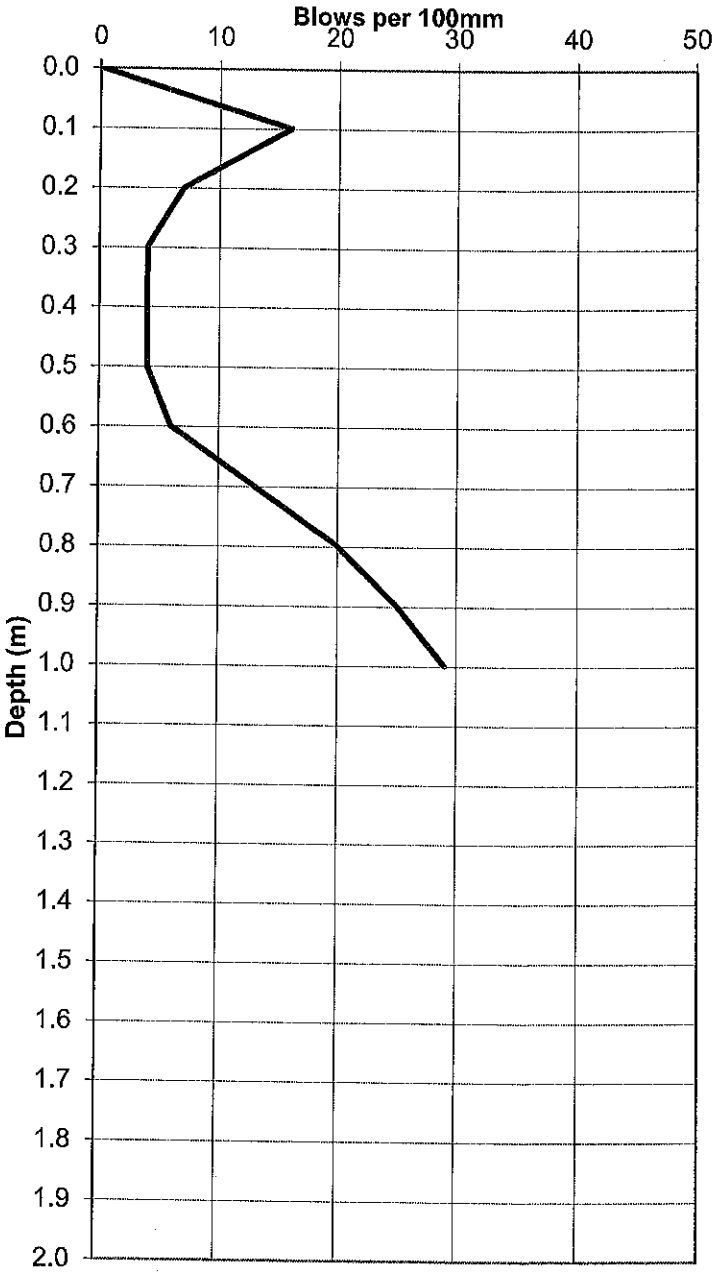

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP02***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	3	Loose	25kPa	5
0.2	7	Medium Dense	60 kPa	12
0.3	10	Dense	85 kPa	17
0.4	13	Dense	110 kPa	23
0.5	13	Dense	110 kPa	23
0.6	11	Dense	90 kPa	19
0.7	8	Medium Dense	65 kPa	14
0.8	6	Medium Dense	50 kPa	10
0.9	29	Very Dense	>150 kPa	>55
1.0	50	Very Dense	>150 kPa	>55
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1.8				
1.9				
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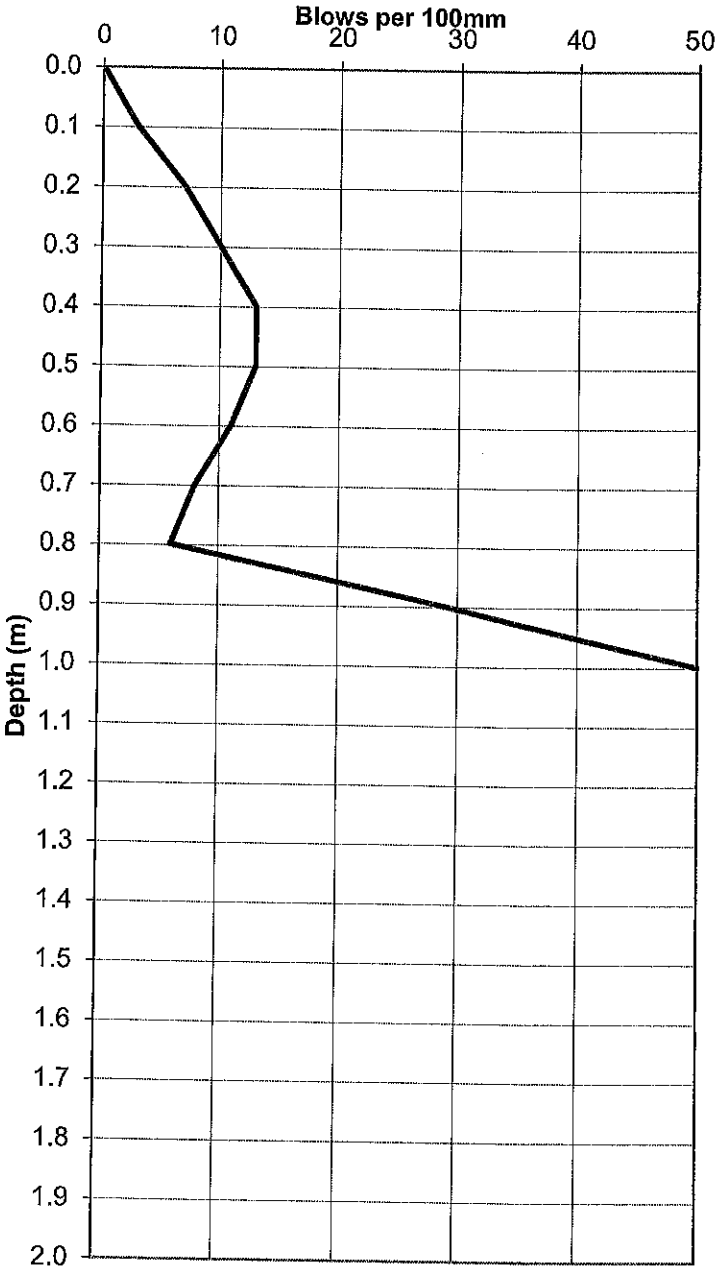

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP03***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	5	Medium Dense	40 kPa	8
0.2	4	Loose	35 kPa	7
0.3	4	Loose	35 kPa	7
0.4	3	Loose	25kPa	5
0.5	2	Loose	20 kPa	3
0.6	4	Loose	35 kPa	7
0.7	4	Loose	35 kPa	7
0.8	5	Medium Dense	40 kPa	8
0.9	7	Medium Dense	60 kPa	12
1.0	5	Medium Dense	40 kPa	8
1.1				
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1.3				
1.4				
1.5				
1.6				
1.7				
1.8				
1.9				
2.0				
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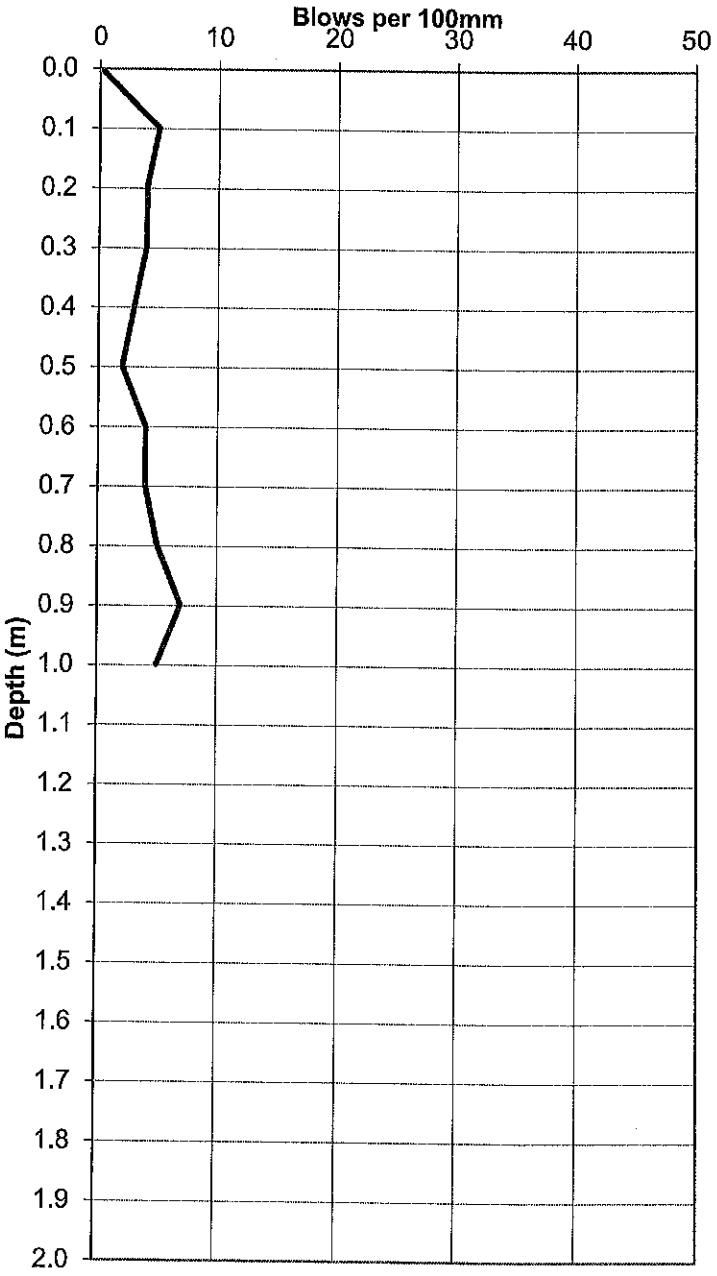

Client:	Map Africa	Ref. No.:	GC0567-568
Project:	Msinsini SAPS	Date:	16/02/2024
Section:	Msinsini	Operator:	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) **TEST No. DCP04**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	3	Loose	25kPa	5
0.2	3	Loose	25kPa	5
0.3	9	Dense	75 kPa	15
0.4	6	Medium Dense	50 kPa	10
0.5	4	Loose	35 kPa	7
0.6	4	Loose	35 kPa	7
0.7	4	Loose	35 kPa	7
0.8	4	Loose	35 kPa	7
0.9	6	Medium Dense	50 kPa	10
1.0	9	Dense	75 kPa	15
1.1				
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1.8				
1.9				
2.0				
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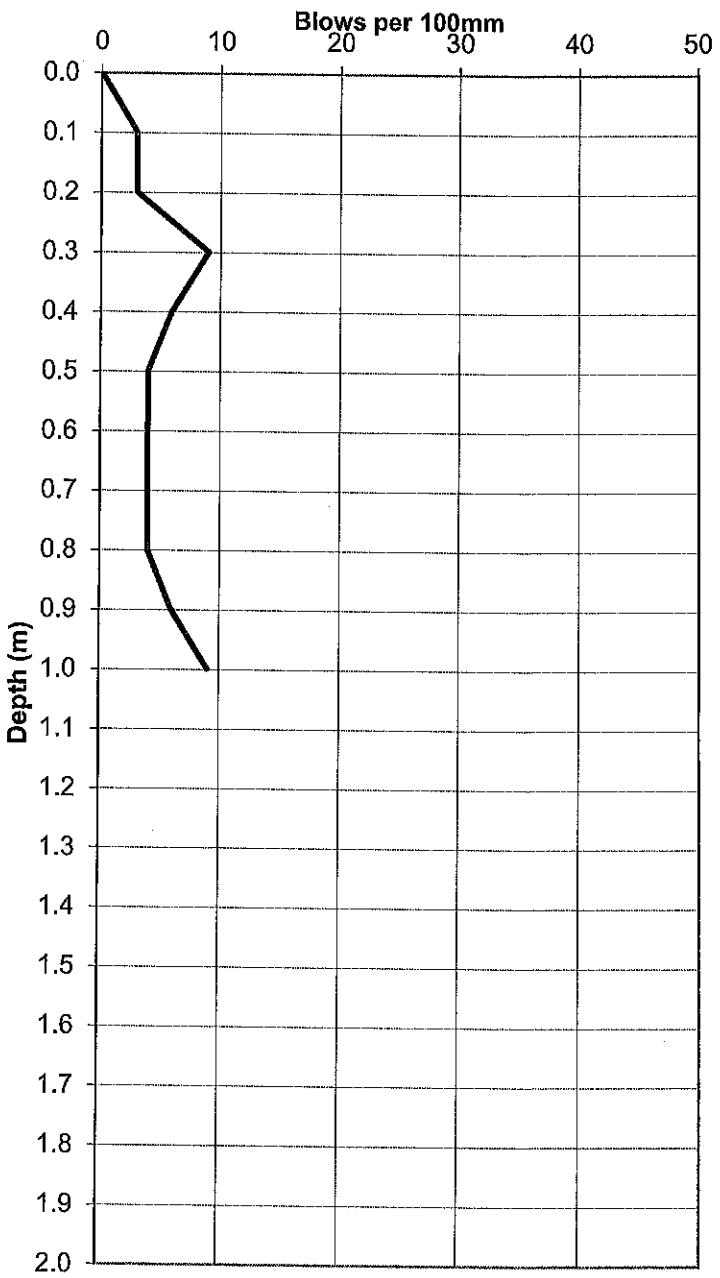

Client:	Map Africa	Ref. No.:	GC0567-568
Project:	Msinsini SAPS	Date:	16/02/2024
Section:	Msinsini	Operator:	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP05***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	4	Loose	35 kPa	7
0.2	12	Dense	100 kPa	21
0.3	18	Dense	150 kPa	33
0.4	10	Dense	85 kPa	17
0.5	6	Medium Dense	50 kPa	10
0.6	4	Loose	35 kPa	7
0.7	3	Loose	25kPa	5
0.8	3	Loose	25kPa	5
0.9	5	Medium Dense	40 kPa	8
1.0	4	Loose	35 kPa	7
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1.8				
1.9				
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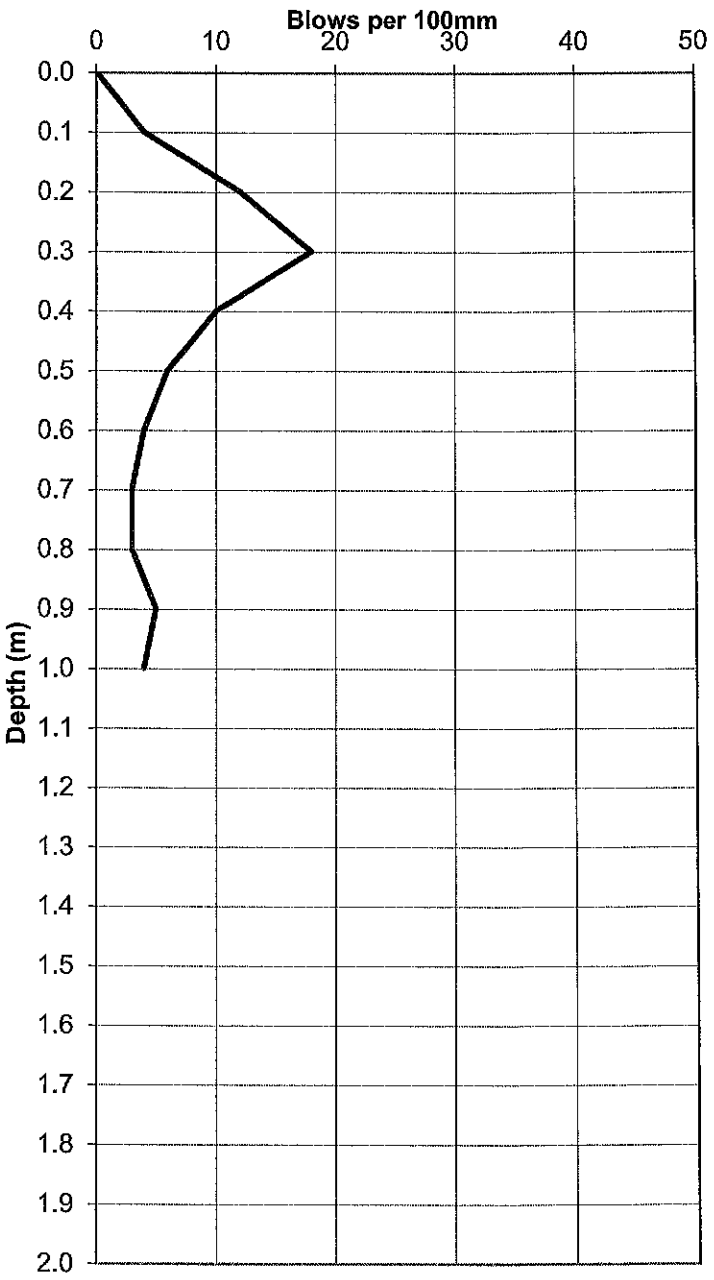

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP06***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	4	Loose	35 kPa	7
0.2	10	Dense	85 kPa	17
0.3	9	Dense	75 kPa	15
0.4	5	Medium Dense	40 kPa	8
0.5	5	Medium Dense	40 kPa	8
0.6	6	Medium Dense	50 kPa	10
0.7	6	Medium Dense	50 kPa	10
0.8	4	Loose	35 kPa	7
0.9	6	Medium Dense	50 kPa	10
1.0	4	Loose	35 kPa	7
1.1				
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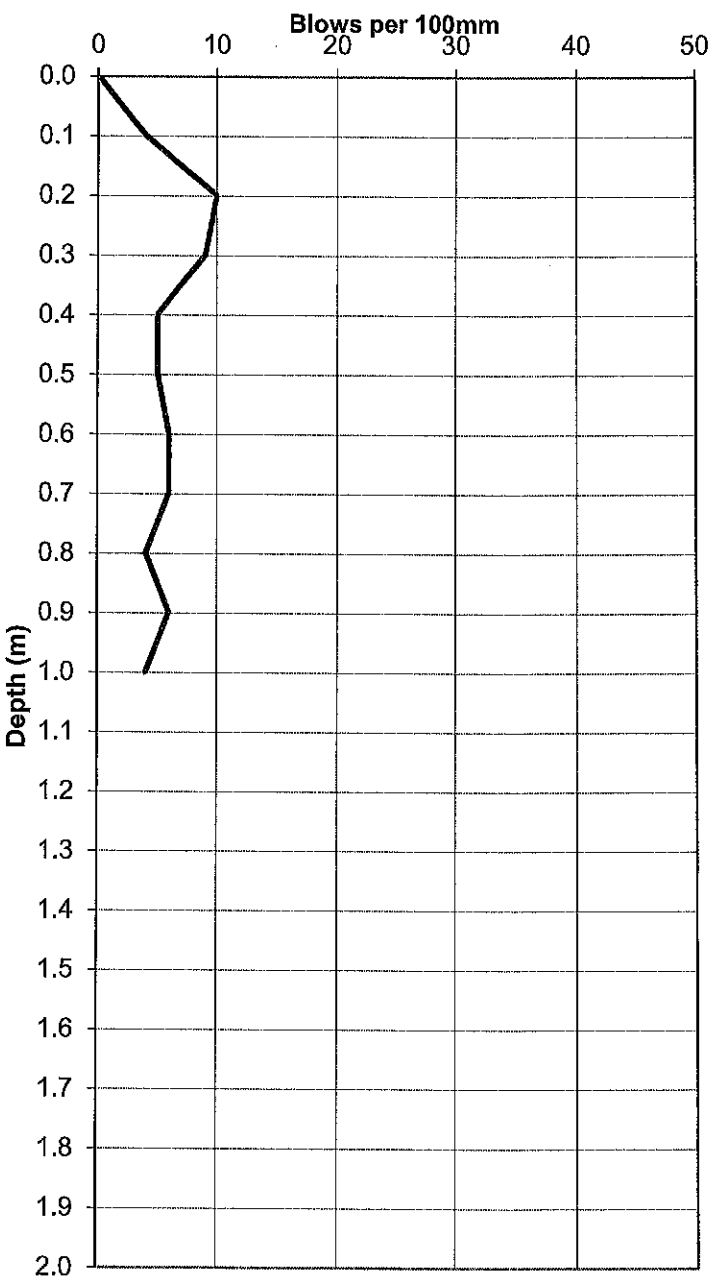

Client:	Map Africa	Ref. No.:	GC0567-568
Project:	Msinsini SAPS	Date:	16/02/2024
Section:	Msinsini	Operator:	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) TEST No. DCP07

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	8	Medium Dense	65 kPa	14
0.2	5	Medium Dense	40 kPa	8
0.3	2	Loose	20 kPa	3
0.4	4	Loose	35 kPa	7
0.5	17	Dense	140 kPa	31
0.6	14	Dense	115 kPa	25
0.7	10	Dense	85 kPa	17
0.8	17	Dense	140 kPa	31
0.9	11	Dense	90 kPa	19
1.0	6	Medium Dense	50 kPa	10
1.1	8	Medium Dense	65 kPa	14
1.2	10	Dense	85 kPa	17
1.3	9	Dense	75 kPa	15
1.4	9	Dense	75 kPa	15
1.5	8	Medium Dense	65 kPa	14
1.6	10	Dense	85 kPa	17
1.7	12	Dense	100 kPa	21
1.8	13	Dense	110 kPa	23
1.9	13	Dense	110 kPa	23
2.0				
2.1				
2.2				
2.3				
2.4				
2.5				
2.6				
2.7				
2.8				
2.9				
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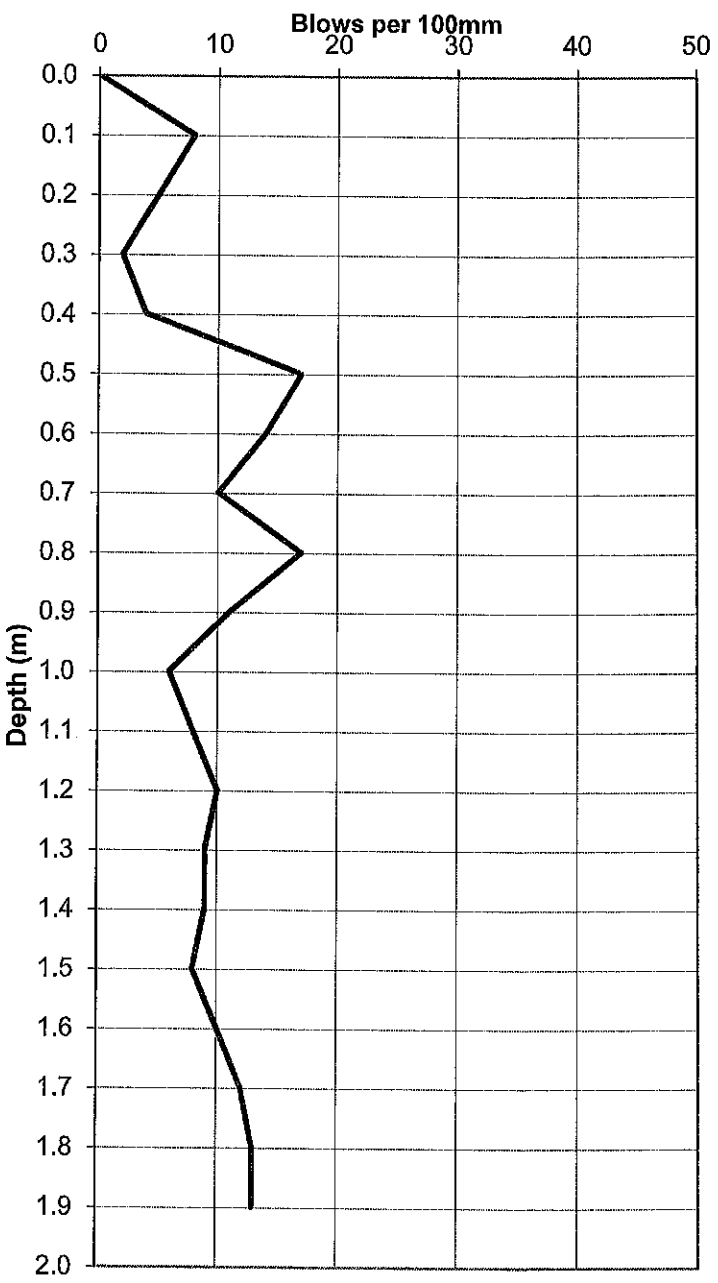

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP08***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	1	Very Loose	<20 kPa	2
0.2	9	Dense	75 kPa	15
0.3	10	Dense	85 kPa	17
0.4	6	Medium Dense	50 kPa	10
0.5	4	Loose	35 kPa	7
0.6	3	Loose	25kPa	5
0.7	3	Loose	25kPa	5
0.8	4	Loose	35 kPa	7
0.9	11	Dense	90 kPa	19
1.0	4	Loose	35 kPa	7
1.1	5	Medium Dense	40 kPa	8
1.2	12	Dense	100 kPa	21
1.3	17	Dense	140 kPa	31
1.4	17	Dense	140 kPa	31
1.5	23	Very Dense	>150 kPa	44
1.6	24	Very Dense	>150 kPa	47
1.7	24	Very Dense	>150 kPa	47
1.8	37	Very Dense	>150 kPa	>55
1.9	38	Very Dense	>150 kPa	>55
2.0				
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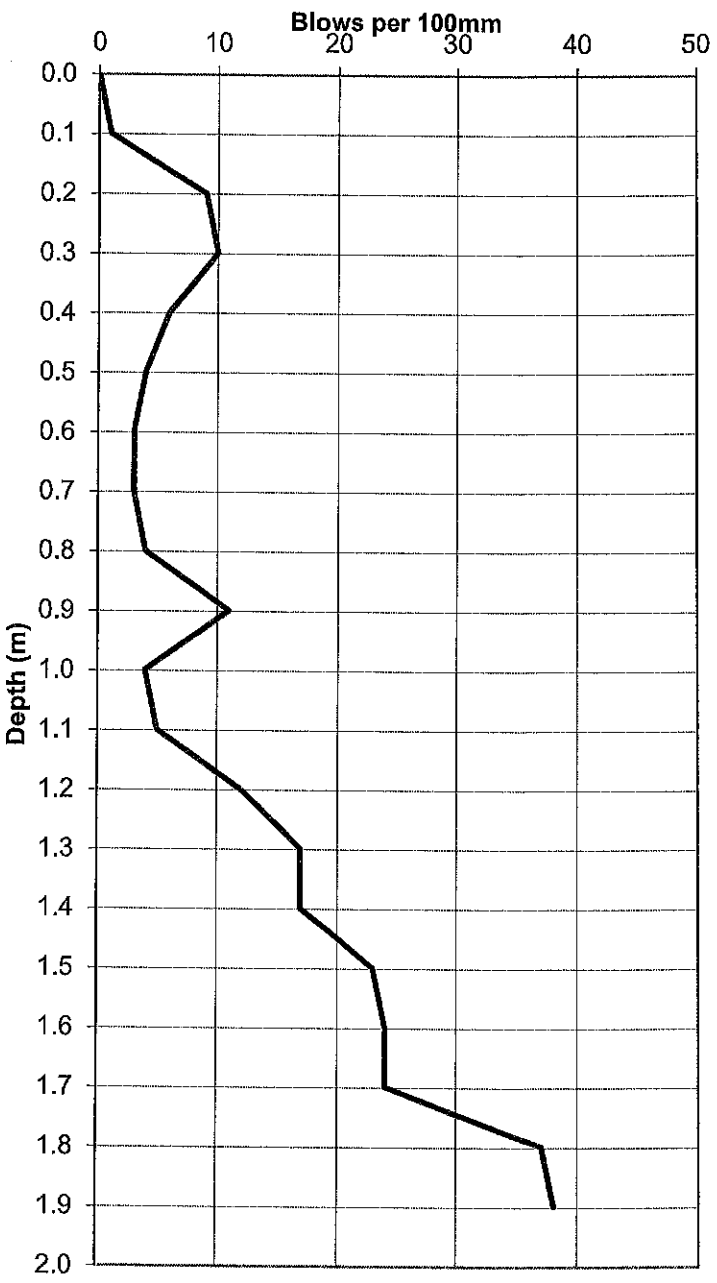

GC0567-568 Msinsini SAPS DCP Results

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP09***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	3	Loose	25kPa	5
0.2	4	Loose	35 kPa	7
0.3	5	Medium Dense	40 kPa	8
0.4	3	Loose	25kPa	5
0.5	2	Loose	20 kPa	3
0.6	6	Medium Dense	50 kPa	10
0.7	7	Medium Dense	60 kPa	12
0.8	8	Medium Dense	65 kPa	14
0.9	10	Dense	85 kPa	17
1.0	11	Dense	90 kPa	19
1.1	13	Dense	110 kPa	23
1.2	17	Dense	140 kPa	31
1.3	10	Dense	85 kPa	17
1.4	10	Dense	85 kPa	17
1.5	13	Dense	110 kPa	23
1.6	10	Dense	85 kPa	17
1.7	14	Dense	115 kPa	25
1.8	14	Dense	115 kPa	25
1.9	15	Dense	125 kPa	27
2.0				
2.1				
2.2				
2.3				
2.4				
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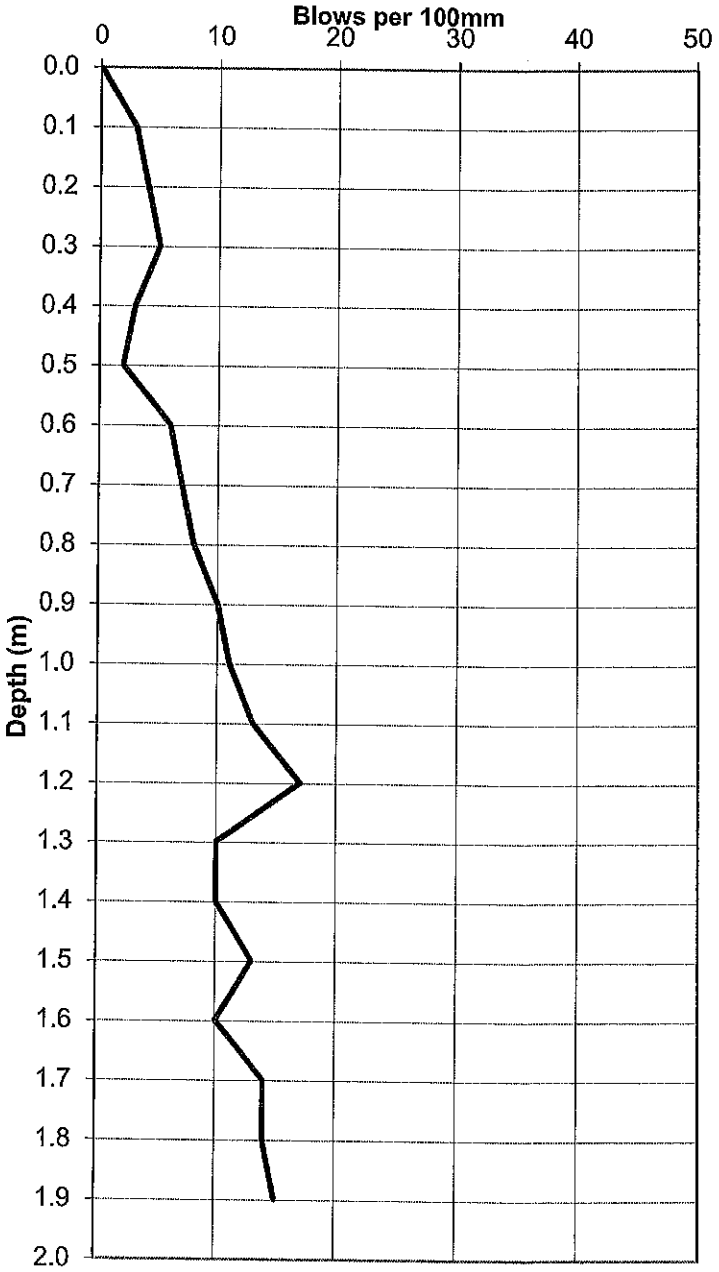

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP10***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	4	Loose	35 kPa	7
0.2	2	Loose	20 kPa	3
0.3	2	Loose	20 kPa	3
0.4	2	Loose	20 kPa	3
0.5	2	Loose	20 kPa	3
0.6	2	Loose	20 kPa	3
0.7	2	Loose	20 kPa	3
0.8	3	Loose	25kPa	5
0.9	3	Loose	25kPa	5
1.0	4	Loose	35 kPa	7
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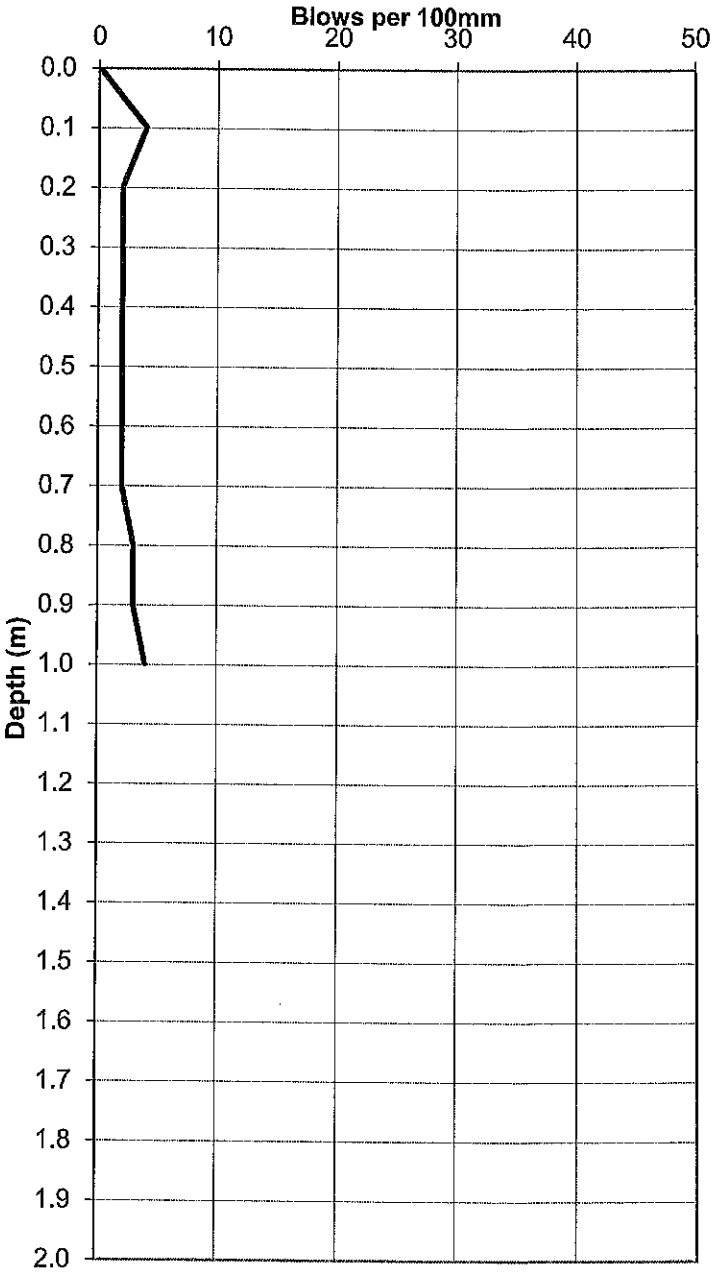

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP11***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	4	Loose	35 kPa	7
0.2	3	Loose	25kPa	5
0.3	3	Loose	25kPa	5
0.4	3	Loose	25kPa	5
0.5	4	Loose	35 kPa	7
0.6	3	Loose	25kPa	5
0.7	3	Loose	25kPa	5
0.8	4	Loose	35 kPa	7
0.9	4	Loose	35 kPa	7
1.0	6	Medium Dense	50 kPa	10
1.1	5	Medium Dense	40 kPa	8
1.2	7	Medium Dense	60 kPa	12
1.3	6	Medium Dense	50 kPa	10
1.4	7	Medium Dense	60 kPa	12
1.5	10	Dense	85 kPa	17
1.6	11	Dense	90 kPa	19
1.7	11	Dense	90 kPa	19
1.8	13	Dense	110 kPa	23
1.9	14	Dense	115 kPa	25
2.0				
2.1				
2.2				
2.3				
2.4				
2.5				
2.6				
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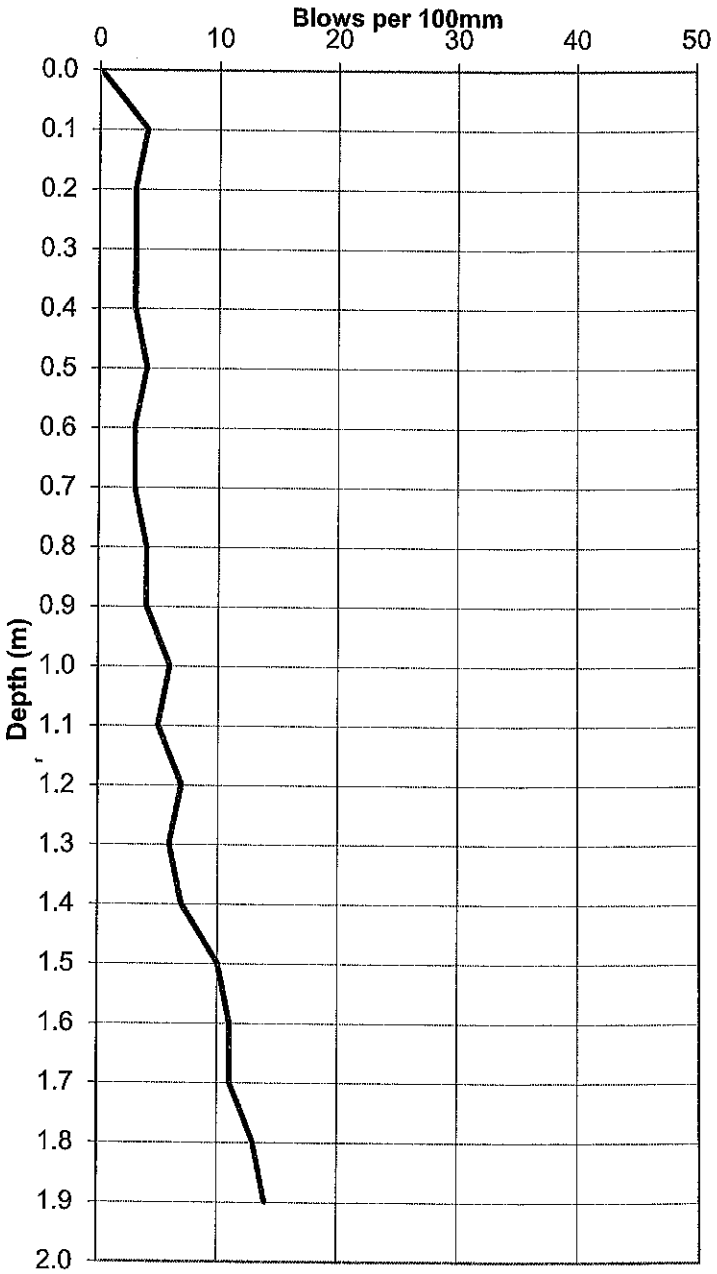

Client:	Map Africa	Ref. No.:	GC0567-568
Project:	Msinsini SAPS	Date:	16/02/2024
Section:	Msinsini	Operator:	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) TEST No. DCP12

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	4	Loose	35 kPa	7
0.2	2	Loose	20 kPa	3
0.3	3	Loose	25kPa	5
0.4	2	Loose	20 kPa	3
0.5	3	Loose	25kPa	5
0.6	2	Loose	20 kPa	3
0.7	2	Loose	20 kPa	3
0.8	3	Loose	25kPa	5
0.9	3	Loose	25kPa	5
1.0	4	Loose	35 kPa	7
1.1	3	Loose	25kPa	5
1.2	6	Medium Dense	50 kPa	10
1.3	3	Loose	25kPa	5
1.4	3	Loose	25kPa	5
1.5	4	Loose	35 kPa	7
1.6	5	Medium Dense	40 kPa	8
1.7	5	Medium Dense	40 kPa	8
1.8	6	Medium Dense	50 kPa	10
1.9	6	Medium Dense	50 kPa	10
2.0				
2.1				
2.2				
2.3				
2.4				
2.5				
2.6				
2.7				
2.8				
2.9				
3.0				
3.1				
3.2				
3.3				
3.4				
3.5				
3.6				
3.7				
3.8				
3.9				
4.0				
4.1				
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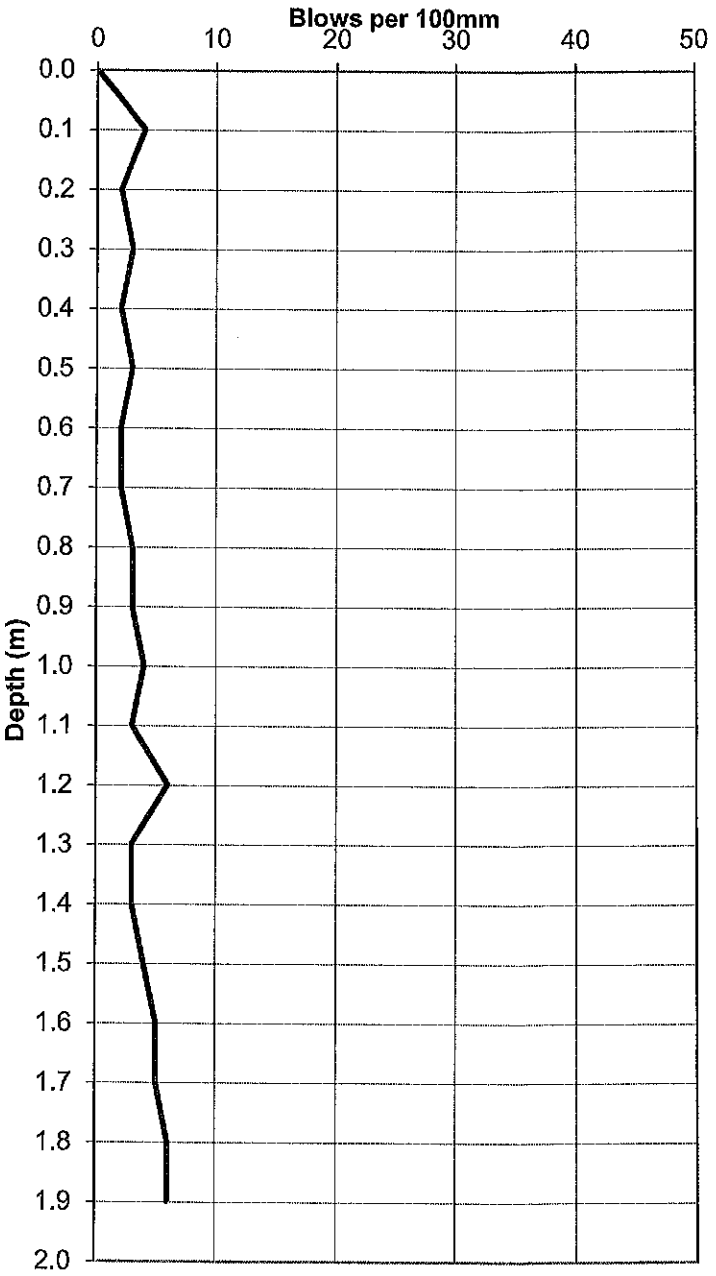
4.3				
4.4				
4.5				
4.6				
4.7				
4.8				
4.9				
5.0				



GC0567-568 Msinsini SAPS DCP Results

Client:	Map Africa	**Ref. No.:**	GC0567-568
Project:	Msinsini SAPS	**Date:**	16/02/2024
Section:	Msinsini	**Operator:**	Michael Scott

CBR DYNAMIC CONE PENETROMETER PROBE (LIGHT) ***TEST No. DCP14***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE AND SHOULD BE VERIFIED BY TEST OR OBSERVATION.

Depth (m)	Blows/ 100mm	Inferred Consistency	Shear Strength	CBR %
0.0	0			
0.1	12	Dense	100 kPa	21
0.2	20	Very Dense	>150 kPa	37
0.3	11	Dense	90 kPa	19
0.4	7	Medium Dense	60 kPa	12
0.5	8	Medium Dense	65 kPa	14
0.6	8	Medium Dense	65 kPa	14
0.7	8	Medium Dense	65 kPa	14
0.8	17	Dense	140 kPa	31
0.9	12	Dense	100 kPa	21
1.0	8	Medium Dense	65 kPa	14
1.1				
1.2				
1.3				
1.4				
1.5				
1.6				
1.7				
1.8				
1.9				
2.0				
2.1				
2.2				
2.3				
2.4				
2.5				
2.6				
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4.0				
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4.7				
4.8				
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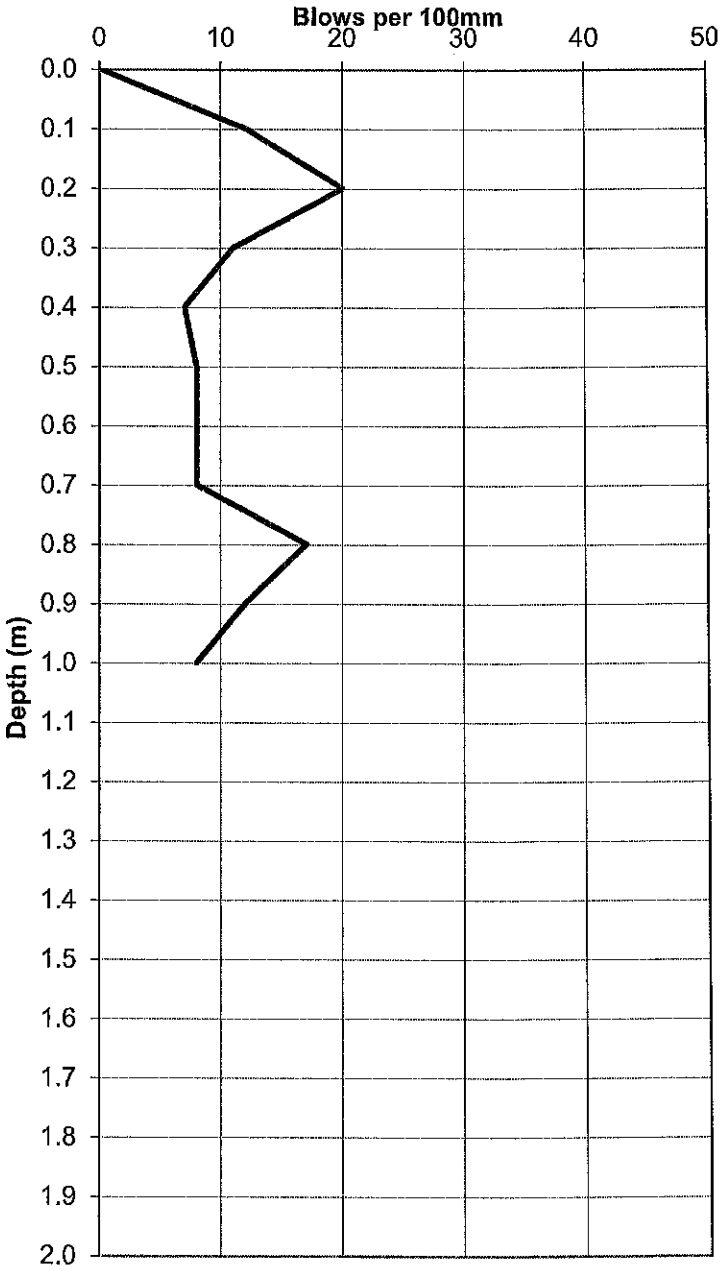
5.0				



Appendix D
Percolation Test Results

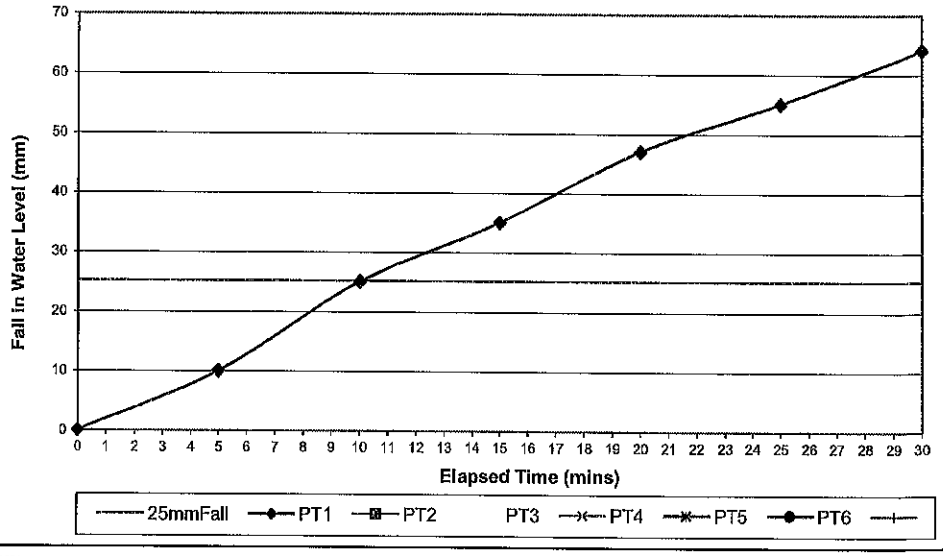
GEOCON CONSULTING

GEO-HYDROLOGICAL & GEOLOGICAL SOLUTIONS

Job Description:	Ref. No. GC0567-568
Msinsini SAPS - Position 1	Date: 16/02/2024

Field Results						
Elapsed Time (minutes)	Fall in Water Level (mm)					
	PT1	PT2	PT3	PT4	PT5	PT6
0	0					
5	10					
10	25					
15	35					
20	47					
25	55					
30	64					

Plot of Fall in Water Level vs Elapsed Time



Test No.	PT1	PT2	PT3	PT4	PT5	PT6
Percolation Rate	10					
ROA*	80					
Average ROA*	80	*Rate of Application of Effluent (litres/m2 of trench sidewall/day)				

Evapotranspiration Area		
No. of bedrooms	Effluent Volume (litres/day)	Area (m^2)
2	750	300
3	900	360
4	1100	440
5	1400	560

Length of French Drain		
Effluent Volume (litres/day)	ROA* ($l/m^2/day$)	Length of Drain (m)
750	80	4.1
24960		155.3
62400		389.3
71760		447.8

Notes:

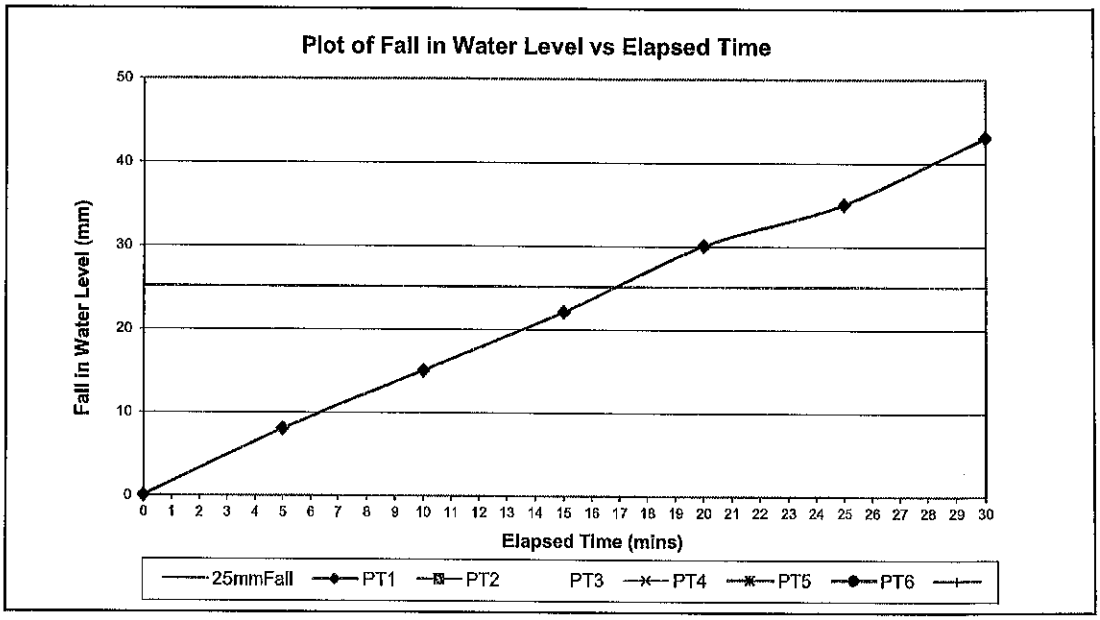
- An allowance of 15 percent for stormwater and other contingencies should be added when deciding on the size of the septic
- The size of French drain is based on a 1.0 m deep, 0.75 m wide trench.
- French Drains should be filled with clean brick rubble or rocks and not old tyres
- French Drains should be sited and constructed so as not to pollute any public stream, spring, well or water source that is used, or that is likely to be used, for drinking, domestic or kitchen purposes
- French drains should preferably be constructed along the contours and shall be located at least 5 m away from any buildings. They should be so positioned that the foundations of the structure are not adversely affected by their discharge.

GEOCON CONSULTING

GEOHYDROLOGICAL & GEOLOGICAL SOLUTIONS

Job Description:	Ref. No. GC0567-568
Msinsini SAPS - Position 2	Date: 16/02/2024

Field Results						
Elapsed Time (minutes)	Fall in Water Level (mm)					
	PT1	PT2	PT3	PT4	PT5	PT6
0	0					
5	8					
10	15					
15	22					
20	30					
25	35					
30	43					



Test No.	PT1	PT2	PT3	PT4	PT5	PT6
Percolation Rate	18					
ROA*	55					
Average ROA*	55	*Rate of Application of Effluent (litres/m2 of trench sidewall/day)				

Evapotranspiration Area		
No. of bedrooms	Effluent Volume (litres/day)	Area (m^2)
2	750	300
3	900	360
4	1100	440
5	1400	560

Length of French Drain		
Effluent Volume (litres/day)	ROA* ($l/m^2/day$)	Length of Drain (m)
750	55	6.2
24960		226.2
62400		566.5
71760		651.6

Notes:

- An allowance of 15 percent for stormwater and other contingencies should be added when deciding on the size of the septic
- The size of French drain is based on a 1.0 m deep, 0.75 m wide trench.
- French Drains should be filled with clean brick rubble or rocks and not old tyres
- French Drains should be sited and constructed so as not to pollute any public stream, spring, well or water source that is used, or that is likely to be used, for drinking, domestic or kitchen purposes
- French drains should preferably be constructed along the contours and shall be located at least 5 m away from any buildings. They should be so positioned that the foundations of the structure are not adversely affected by their discharge.

Appendix E
Photo Report

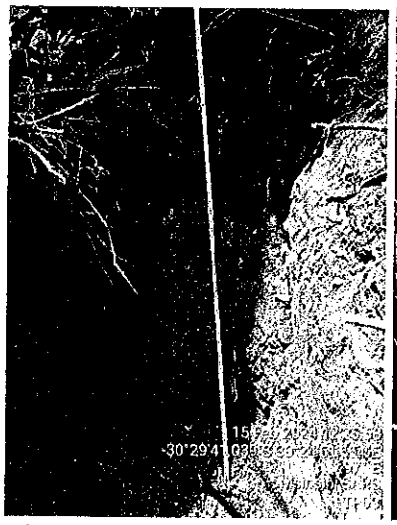


Photo 1 : TP01

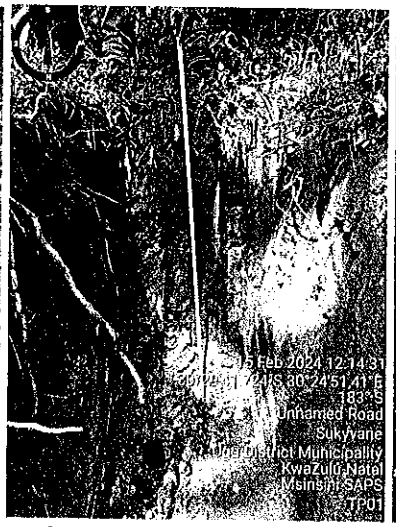


Photo 2 : TP02

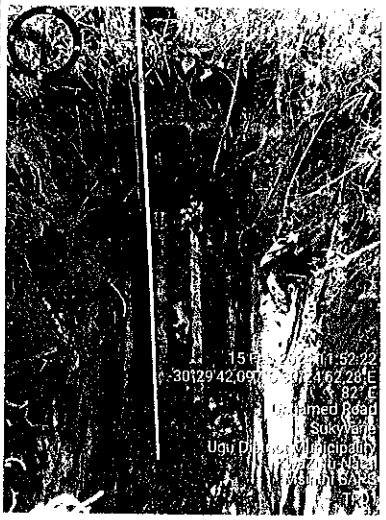


Photo 3 : TP03

Photo 4 : TP04

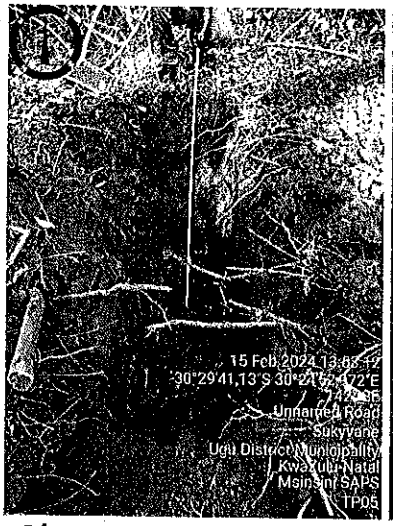


Photo 5 : TP05

Photo 6 : TP06

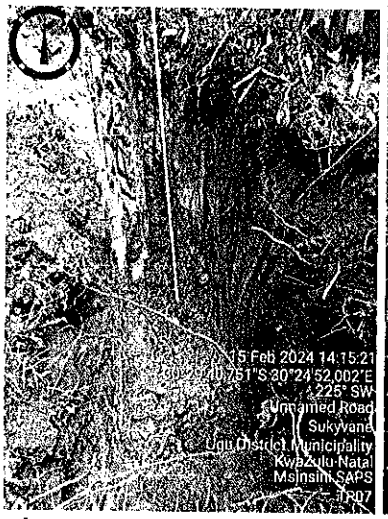


Photo 7 : TP07

Photo 8 : TP08

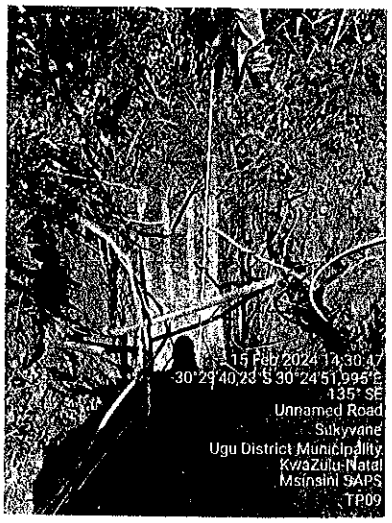


Photo 9 : TP09

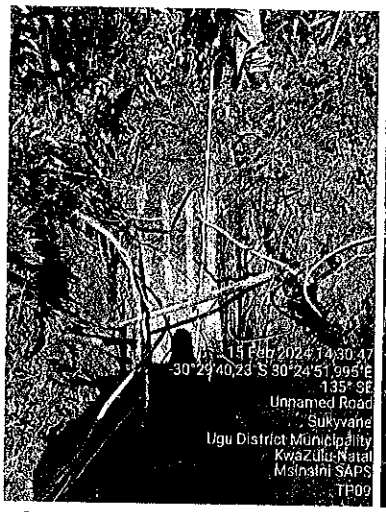


Photo 10 : TP10

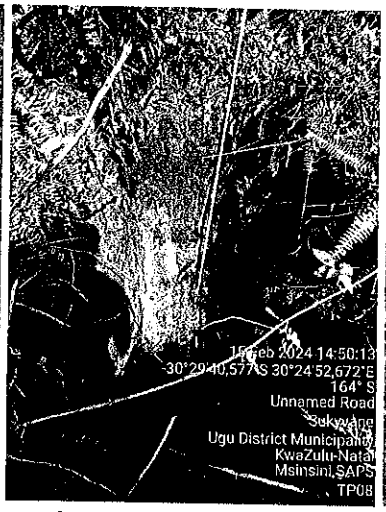


Photo 11 : TP11

Photo 12 : TP12

Photo 12 : TP14

Photo 13 : Old Farm House

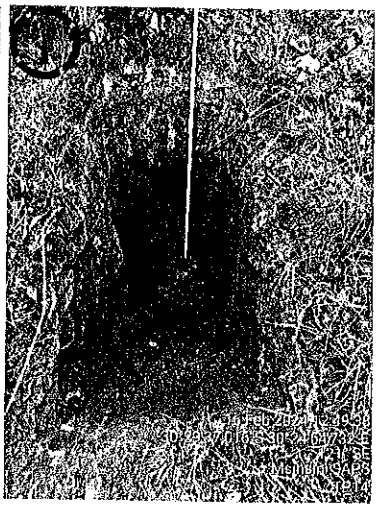


Photo 14 : Old Farm House