



BASHAN CONSULTING SERVICES

(Geosciences & Geotechnical Business Consulting)

ALIWAL NORTH LANDFILL SITE

Geotechnical Investigations Report Conducted for the Proposed Aliwal North Landfill Site, Aliwal North, Eastern Cape.

Report Number: BCS-23-0005

(Effective Date: 17 February 2023)

Prepared by Bashan Consulting Services for:

Geo-Soils Laboratory (Pty) Ltd.

Acting for and on-behalf of:

Afroteam Consultants.



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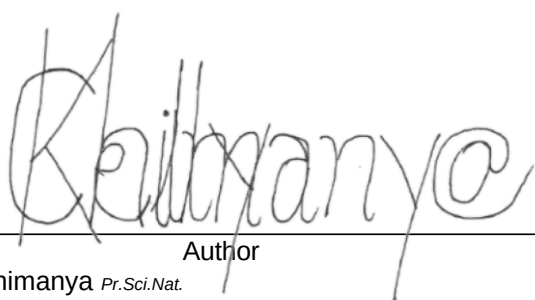
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Author(s):	Kelvin Chimanya <i>Pr.Sci.Nat.</i>	Corporate Consultant (Engineering Geosciences)	BSc (Hons) Geology, SACNASP, MSAIEG, MGSSA, MSAICE, MNHBRC
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	Bashan Consulting Services	(01)	



Author

Kelvin Chimanya *Pr.Sci.Nat.*
Corporate Geotechnical Consultant

17 February 2023

The Project Manager
Afroteam Consultants
No. 2 Merriman Street
Mbuque
Eastern Cape
South Africa
5100

Dear Sir / Madam,

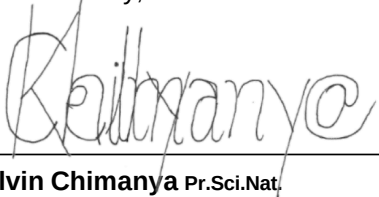
RE: GEOTECHNICAL INVESTIGATIONS OF THE ALIWAL NORTH LANDFILL SITE

We are glad to submit our final, geotechnical investigations report conducted at the proposed construction site for the municipal landfill near Aliwal North in the Eastern Cape Province. The purpose of the investigation was to establish the geotechnical conditions on site for the proposed infrastructure.

The final geotechnical assessments contained in this Report are based on the results of a desktop study, reconnaissance survey, DCP testing survey, trial / test pitting, soil sampling activities, engineering materials testing and data analysis.

We trust the above is in order and should you wish to seek further information and/or clarifications, kindly do not hesitate to contact the undersigned at your earliest convenience.

Yours faithfully,



Kelvin Chimanya Pr.Sci.Nat.

Managing Geoscientist

EXECUTIVE SUMMARY

Afroteam Consultants has appointed Geo-Soils Laboratory (Pty) Ltd (or “Geo-Soils”) to conduct a near-surface, geotechnical investigation programme at the proposed site of the Aliwal North Landfill. The area of interest consists of a virgin land located 5 km west of the town of Aliwal North. Although the development details remain scarce, it is envisaged that proposed development is likely to consist of a double volume steel frame structure which will be utilised as a recycling shelter.

A total of four (04) test pits were excavated on site in addition to the four (04) dynamic cone penetrometer (DCP) tests that were performed at the project site. Other activities included soil profiling and sample collection and the conducting of laboratory testing of the soil materials testing at the Roadlab engineering materials testing laboratory.

Based on the 1:250 000 Geological map of the Aliwal North region (sheet 3026), the oldest rocks at the site are assigned to the Tarkastad Subgroup (**Trt**), a stratigraphic unit within the Beaufort Group of the Karoo Supergroup. The Trt lithologies are comprised of a brownish red to greenish-grey mudstone with intercalated fine to medium-grained, Sandstone. Dolerite intrusions (**Jd**) in the form of sills, sheets and dykes cover the upper parts of the project site. Within the test pits, dolerite was observed in five different categories, namely, solid, or fresh; fractured; boulders; gravelly; granular (or sugary) and as residual dolerite soil.

Younger, unconsolidated sediment deposits of Quaternary age (**Q**) consisting of a discontinuous cover of alluvium cover the residual soils and the solid bedrock, often occurring in pockets and along streams. The geotechnical team has delineated a maximum of upto four (04) soil material sublayers divided into hillwash (0 – 450 mm); Reworked residual (400 – 700 mm), Residual soils (300 – 1 700 mm) and a hard bedrock of dolerite with an uneven surface exceeding 1 425 mm. The profiles generally indicate a similar material layering across the site. In terms of SABS 1200D: 1988 Earthworks, excavations to depths of between 400 mm and 1 500 mm are likely to classify as “soft” and below this depth as “intermediate”. All excavations greater than 1 500 mm would need to be suitably battered back to a suitable angle of 1:1,5 (or shored where necessary), to ensure the safety of construction personnel and equipment working in these excavations.

Based on the available geotechnical data, the recommended geotechnical site class at the proposed construction site is **H / C - C1 / S - S1**. Bashan Geotechnics highly recommends the removal of the upper cohesionless, un-engineered, hillwash prior to the commencement of the construction stage. The foundation types recommended for a double volume steel frame structure which will be utilised as a recycling shelter at the proposed site are the spread footings (or pad footings) and the strip footings with light reinforcement. The concrete floor slab (surface bed) with a light reinforcement (193 Ref Mesh) should be founded on a completed terrace compacted using G6 or G7 quality material of a minimum of 200 mm thickness with a subgrade reaction of 67MPa / m.

The residual soils classify as G7 to G10 material according to TRH 14 classification system. Road pavement layers requiring material classifications better than G8 will need to be imported from a commercial source or nearby borrow pit. It is recommended that should terracing be required, a minimum quality G7 material be considered for the backfilling.

Isolated areas where the materials do not meet the required specifications will have to be determined at construction stage. This will have to be undercut to the depth of the layer and replaced with a suitable material or modified by means of stabilization.

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1 INTRODUCTION AND TERMS OF REFERENCE

1.1 General Introduction

Afroteam Consultants appointed Geo-Soils Laboratory (Pty) Ltd (or “Geo-Soils”) to conduct a near-surface, geotechnical investigation programme at the proposed site of the Aliwal North Landfill.

Geo-Soils, acting together in a coordinated effort with the Competent Person of the Geotechnics Unit of Bashan Consulting Services (“Bashan Consulting”) has performed an independent, site assessment of the materials on site at the project site. Bashan Consulting understands that one of the greatest risks is in the ground. The soil, rock and water form the core foundations upon which our social and physical infrastructure is built. Hence, our specialist knowledge of these components during the early planning phases (and through to design and construction) of a project can ensure success.

1.2 Project Background

According to information obtained in the public domain, the WSLM was fined R1 million (suspended for five years), by the Aliwal North Magistrates’ Court in 2021 for non-compliance at the municipality’s old, Maletswai Landfill west of Aliwal North that is located adjacent to an informal settlement.

A landfill site (also known as a tip, dump, rubbish dump, garbage dump, or dumping ground) is a site for the disposal of waste materials. Operators of well-run landfills for non-hazardous waste meet predefined specifications by applying techniques to confine waste to as small an area as possible and compact waste to reduce volume. They can also cover waste (usually daily) with layers of soil or other types of material such as woodchips and fine particles. Landfills have the potential to cause a number of social and environmental issues. Infrastructure disruption (such as damage to access roads by heavy vehicles) may occur. Pollution of local roads and watercourses from wheels on vehicles when they leave the landfill can be significant and can be mitigated by wheel washing systems. Pollution of the local environment (such as contamination of groundwater or aquifers or soil contamination) may occur, as well.

1.3 Terms of Reference

The primary objective of the investigation was to assess the soil and rock profile across the sites and obtain engineering parameters for the design of foundations for the proposed development. The general scope of the appointment for this project is to conduct a systematic approach towards establishing the site stability and a materials investigation aimed at investigating the suitability of the site for the intended engineering use at the project site. The current site investigation is thus being used to access soil materials, define soil properties and, soil behaviour (on site) and to establish the site-specific geotechnical conditions at the proposed project. The scope, inter alia, has included the following:

- Evaluation of the site-specific geology and hydrogeology of the site and to establish the subsoil conditions prevailing at the proposed project site.
- Conducting a near surface soil investigations horizon that seeks to establish an in-situ evaluation of the ground profile to a minimum target depth of 2.0 m (or to refusal depth), identification of the soil profile below the site using trial holes and collecting representative samples from the main soil horizons.
- Identifying conditions and constraints (such as mining-related problems, areas of outcrop, slope instability, contaminated land, unconsolidated fill, etc.), and provide information on the drainage of the site.
- Submitting appropriate recommendations regarding the existing conditions and risk mitigating measures for the sole aim of aiding the effective design of the proposed structures on site.
- Conducting a review of the general geotechnical stability conditions on site and proposing new recommendations.

1.4 Available Information

1.4.1 Topographic Data

- 1: 50 000 scale topographic map series of the Aliwal North area (Sheet 3026 DA) issued by the Chief Directorate-Surveys and Mapping, Department of Land Affairs, 2001

1.4.2 Geological Information

- 1:250 000 scale geological map series of the Aliwal North region (Sheet 3026) issued by the Geological Survey of South Africa (Council for Geoscience), 1983.

1.5 Project Scope

The area of interest consists of a virgin land located 5 km west of the town of Aliwal North. Although the development details remain scarce, it is envisaged that proposed development is likely to consist of a double volume steel frame structure which will be utilised as a recycling shelter. The scope of work includes establishing the following:

- The type of material at the proposed site
- The thickness of all existing materials on site
- Engineering properties of the existing soil materials on site.
- Identification of any geotechnical problems.

1.6 Limitations

The information provided in this Geotechnical Report is based on information provided by the Client and or the client's representatives, published geoscientific / geotechnical literature, maps, and information published in the public domain and that collected by Bashan Consulting during the current geotechnical survey.

1.7 Author's Credentials and Declaration of Independence

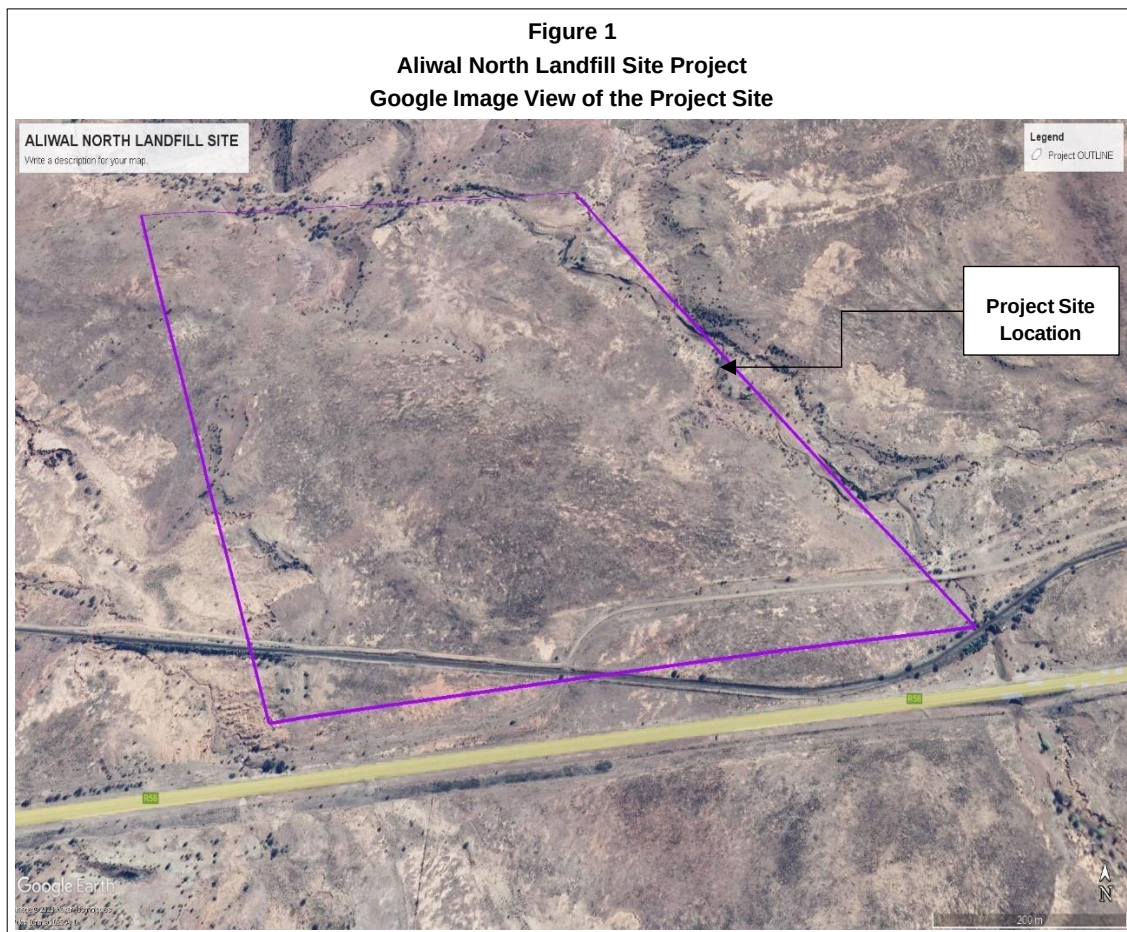
The Author of this Report, Kelvin Chimanya is a professional Engineering Geologist, registered with the South African Council of Natural and Scientific Professions (Pr. Sci.Nat #: 400297/12). Kelvin has 21 years' experience obtained in the mining and civil engineering sectors. He has conducted several geotechnical investigations for infrastructural development and has performed several undermining investigations in the Republic of South Africa.

In addition, Kelvin is a member of the Geological Society of South Africa (GSSA #: 966428), an Associate member of the South African Institute for Engineering and Environmental Geologists (SAIEG #: 17/489) and he is member of the South African Institution of Civil Engineering (SAICE #: Member 201701195). The compilation of the Report and any other work done by Bashan Corporation (Bashan Geotechnics) for the Client is strictly in return for professional fees. Payment for the work is not in any way dependent neither on the outcome of the work, nor on the success or otherwise of the Company's own business dealings. As such there is no conflict of interest in Bashan Geotechnics' undertaking the survey as contained in this document

2 SITE DESCRIPTION

2.1 Site Location

The proposed project site is centred at Latitude 30°42'24.24"S and Longitude 26°39'25.39"E and is approximately 5 km west of the existing municipal landfill located at the Maletswai Landfill. The proposed landfill site measures approximately 40 hectares (in surface area) and is located approximately 5 km west of Aliwal North (officially Maletswai). Aliwal North located on the banks of the Orange River is a medium-sized commercial centre in the northernmost part of the Eastern Cape. Aliwal North is part of the Walter Sisulu Local Municipality of the wider Joe Gqabi District Municipality. The Google Earth image of the project outline is shown in Figure 1 whilst the regional site map is shown in Figure 2.



2.2 Drainage and Topography

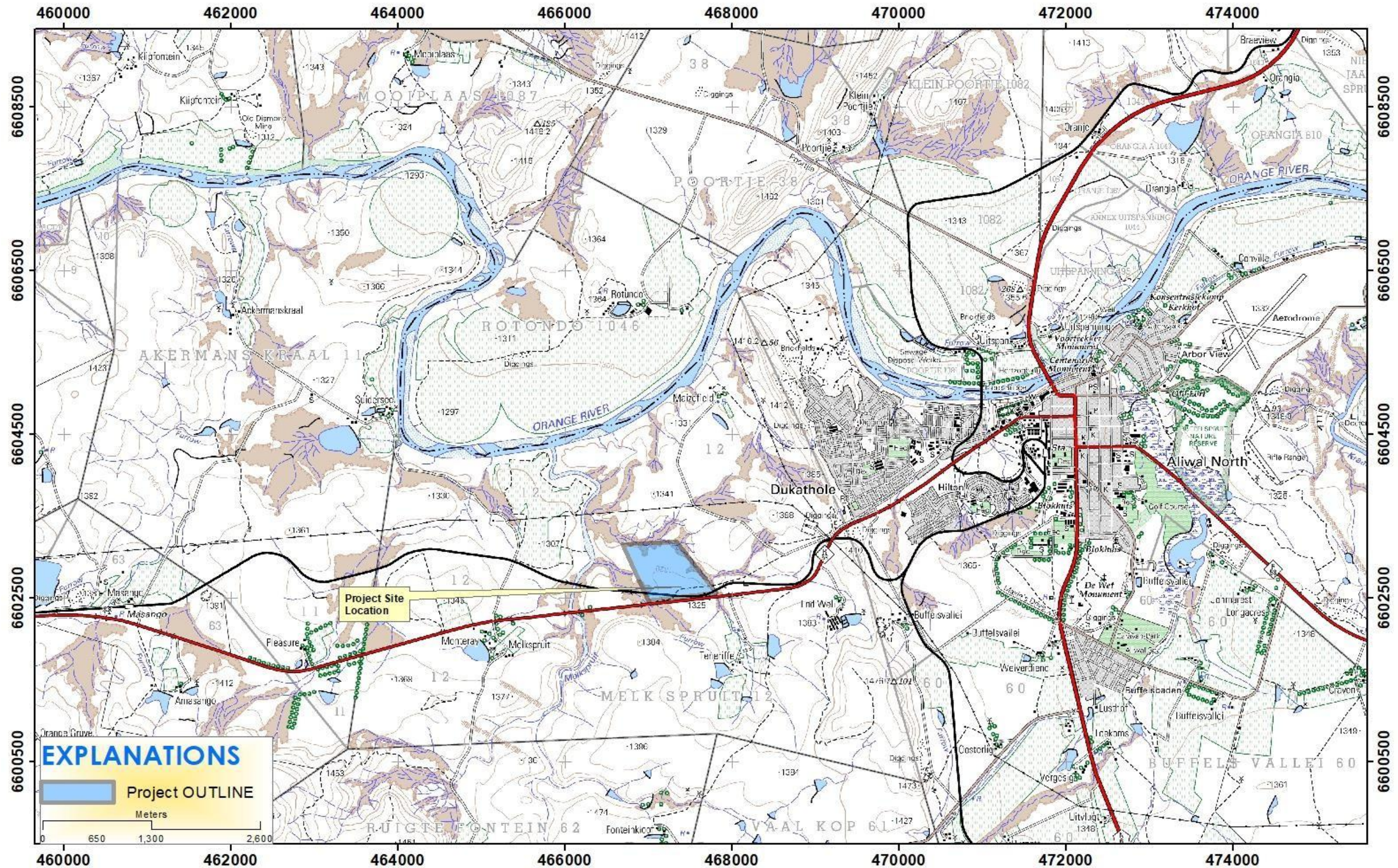
Topographically, the area has a variable gradient comprising of gentle slopes. The area is considered naturally stable as far as slope instability is concerned with elevation varying between 1322 m (in the east) and then drops to 1311 m and finally 1304 m above mean sea level towards the west with a slope gradient of approximately 3 %.

No preferential drainage channels were noted on site, and it is expected that drainage, particularly during periods of heavy or prolonged rainfall would be in the form of sheetwash down towards the south.

2.3 Climate

Climatic indicators available for the proposed project site is characterised as tropical and subtropical steppe climate. The warmest month is January with an average temperature of 21°C whilst the coolest month is June with an average temperature of 7°C (Source: www.weatherbase.com). The average annual precipitation is 533 mm with February being the month with the most precipitation (84 mm) and July at 10 mm being the month with the least precipitation.

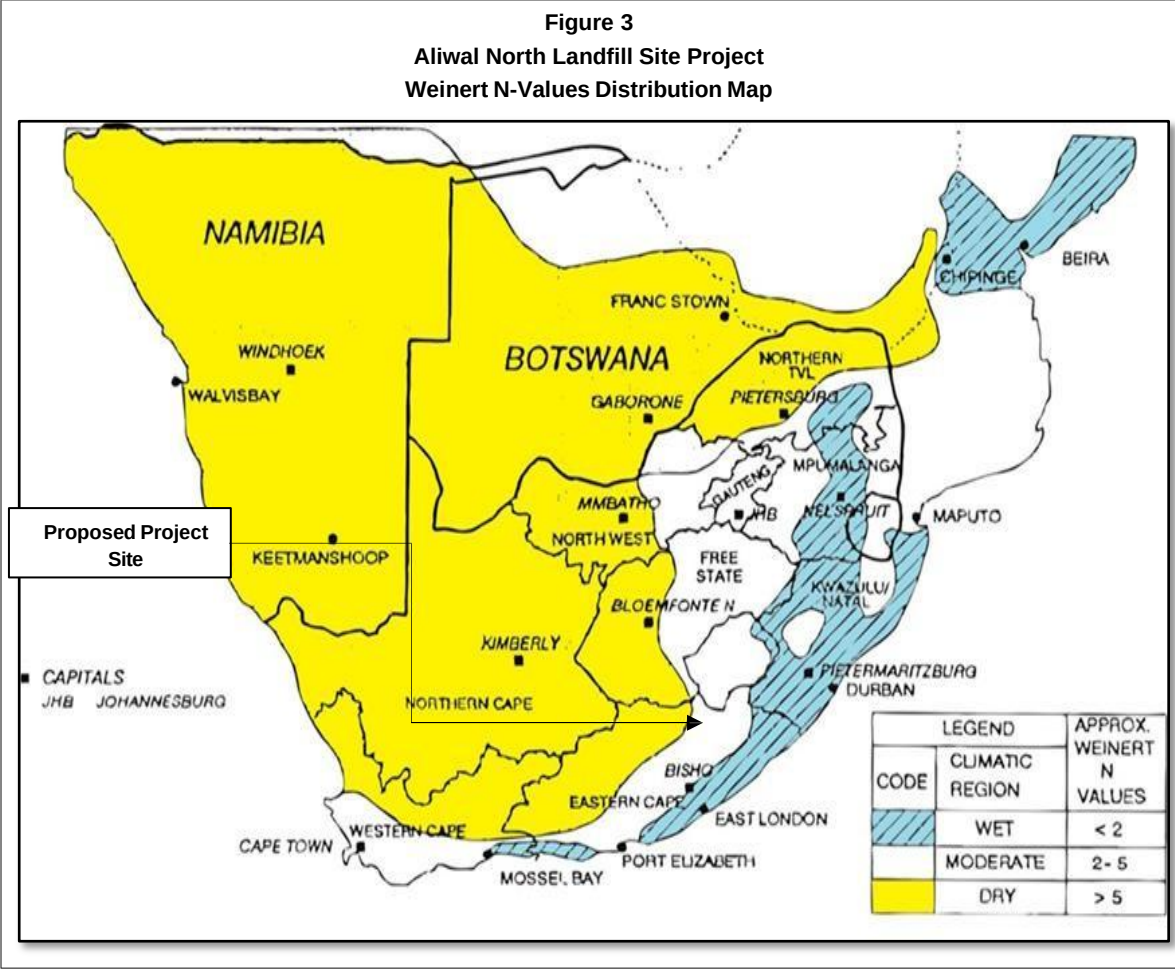
Figure 2
Aliwal North Landfill Site Project
General Site Locality Map



  	Geotechnical Investigations of the Aliwal North Landfill Site (Regional Site Locality Map)	1:40,000		Map Datum	Date	Drawn By
		A3 Paper Size		WGS 84 (Zone 35 S)	2023-02-15	KC

2.4 Macro-climatic indicators

The macro-climatic regime of an area plays a fundamental role in the development of a soil profile and the weathering of rocks. From an engineering point of view, a soil can be regarded as any uncemented or a weakly cemented accumulation of mineral particles formed mainly by the weathering of rocks, with void spaces filled with air and / or water between the particles. Weinert (1980) developed the N-value to differentiate between regions of similar weathering characteristics.



A brief review of the above map confirms that the Weinert's N-Value for the project site is moderate (2-5). This indicates that the weathering of primary minerals is predominantly via chemical decomposition with deep weathering profiles producing significant secondary minerals. The residual soils produced are a mixture of resistant primary minerals (such as quartz), insoluble weathering products (such as alumina or silica) and other new or secondary minerals such as clays. They may also contain soluble products such as chlorides, sulphates and bicarbonates of sodium, potassium, magnesium, or calcium, which may subsequently be leached out. In this climatic zone, montmorillonite changes to kaolinite (in the topsoil layers) thereby producing deep weathering profiles.

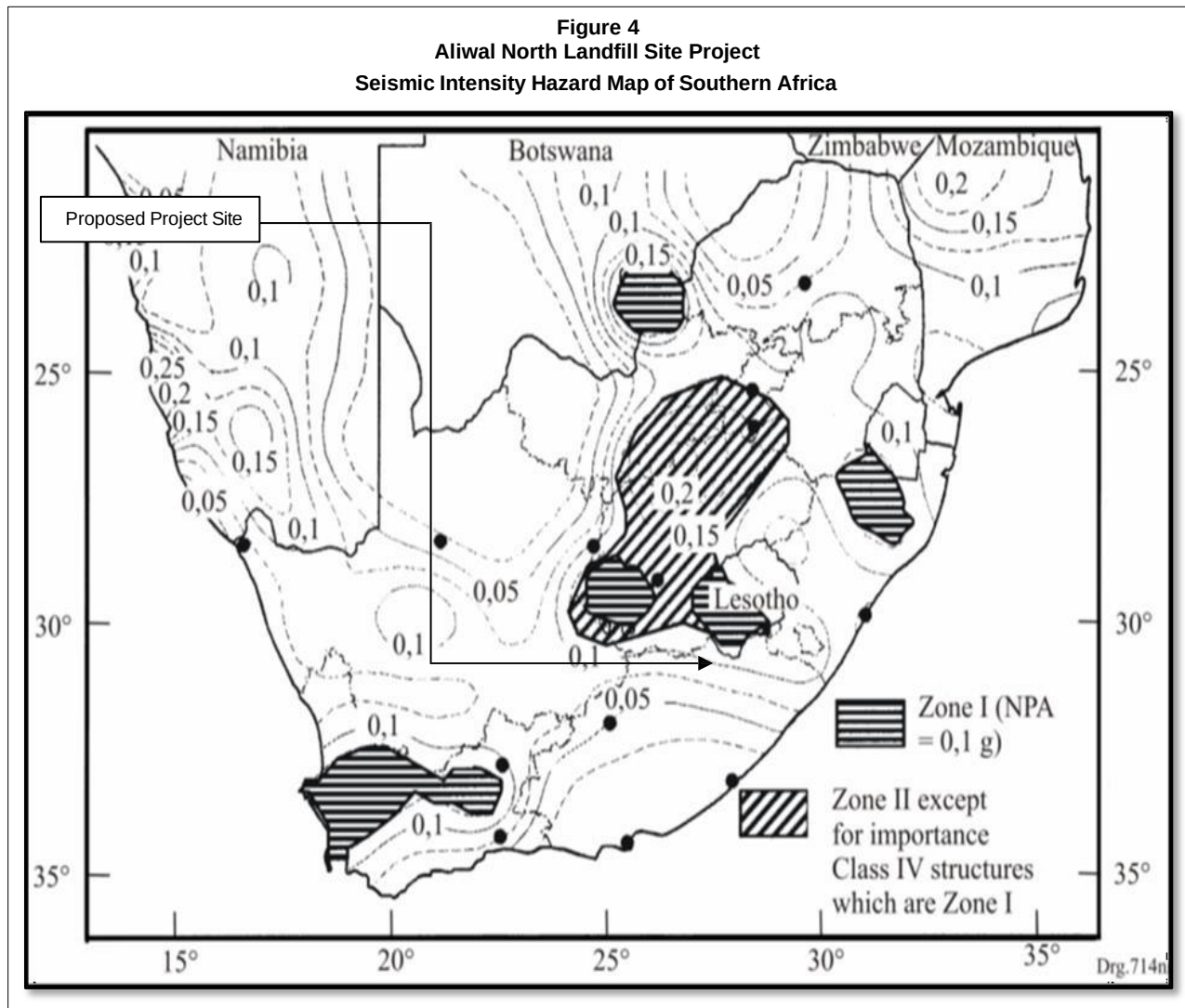
3 GEOHAZARDS

3.1 Seismic Hazards

Generally, there are two types of seismic activities that occur in South Africa, namely.

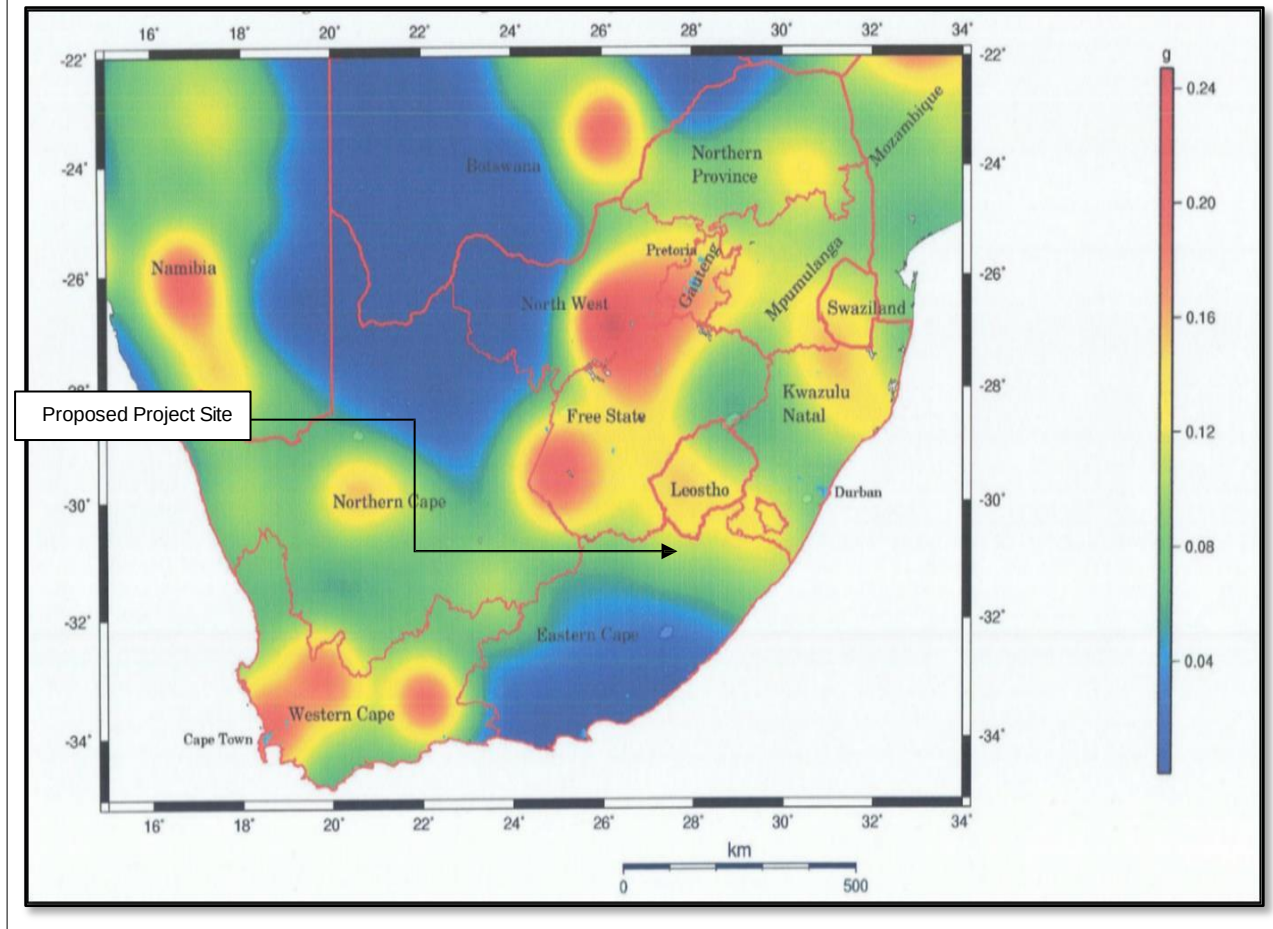
- Regions of natural seismic activity (Zone I)
- Regions of mining-induced and natural seismic activity (Zone II).

In accordance with the seismic hazard zones contained in SANS 10160-4 (2011), the site falls within Zone I, as shown in Figure 4.



The seismic zones are determined from the seismic hazard map (Figure 4) which represents peak ground acceleration with a 10% probability of being exceeded in a 50-year period. It includes both natural and mining-induced seismicity. Both the seismic hazard zones map (Figure 3) and the seismic hazard map (Figure 4) produced by Kijko (2003) shows that the site is situated in an area where the peak ground acceleration with a 10% probability of exceedance in a 50-year period is approximately between 0.08 to 0.12 g.

Figure 5
Aliwal North Landfill Site Project
Seismic Intensity Hazard Map of Southern Africa



3.2 Ground Subsidence

Subsidence occurs in areas with large underground cavities typically resulting from large scale shallow to very shallow mining and from dolomite/limestone dissolution. It may also appear where thick deposits of unconsolidated material exist. No signs of previous subsidence were evident during the site investigation and no mining activity has occurred in this area.

3.3 Sinkhole Formation

Like subsidence, sinkhole formation occurs in areas with very large to extremely large underground cavities resulting from poorly designed shallow underground activities. Dissolution of dolomites or limestones over millions of years, may lead to cavity formations which later manifest as sinkholes. The available geological map and field observations indicate that the site is not underlain by dolomite.

3.4 Landslides and Mudslides

The probability of landslides and mudslides occurring within this area are remote. This is primarily due to the low relief and the relatively shallow gradient along the road alignment.

3.5 Rockfalls and Rockslides

The probability of the occurrence of rockfalls and rockslides is low due to the low relief and shallow gradient.

4 EVALUATION PROCEDURES USED IN THE INVESTIGATIONS

4.1 General Field Survey

The investigation comprised a desktop study, visual assessment of the site, excavation of test pits, dynamic probing and laboratory testing. A literature review of the available data and assimilation of other information (as part of the preliminary investigation).

4.2 Test Pit Excavations

The field work was conducted on the 30th of January 2023. A total of four (04) test pits were excavated across the site. The test pits were backfilled and compacted in layers. The test pit collars (coordinates and excavated depth) are provided in Table 4.2_1 whilst Figure 6 shows the test pit location.

Table 4.2_1 Aliwal North Landfill Site Project Test Pit Collar Information						
Test Station	Latitude	Longitude	Total Depth (m)	Shallow Seepage (m)	Refusal (Y / N)	Reason For Termination / Excavation Stoppage
TP01	30°42'30.54"S	26°39'32.06"E	1.45	-	Y	Slow excavation progress on a weathered Dolerite bedrock
TP02	30°42'19.45"S	26°39'16.61"E	1.55	-	Y	Slow excavation progress on a weathered Dolerite bedrock
TP03	30°42'20.94"S	26°39'35.10"E	1.77	-	Y	Slow excavation progress on a weathered Dolerite bedrock
TP04	30°42'24.41"S	26°39'24.48"E	1.00	-	Y	Slow excavation progress on a weathered Dolerite bedrock

The mode of excavation was via mechanical methods via a TLB and excavating to a target depth of 2.00 m (or at the interception of the country bedrock layer and/or to refusal or flooding). In conducting this excavation, emphasis was placed on accessing the soil materials found inside the test pit, conducting in-situ profiling, soil sampling, slope stability, visual assessment of groundwater seepage, conducting a detailed study of the test pit sidewalls and the appraisal of the excavatability. The excavated test pits were profiled (in-situ) with the aim of developing the site stratigraphy, identifying seepage behaviour, appraise the slope stability (for excavations purposes) and to sample the different soil profiles and / or horizons (for engineering materials testing purposes at the laboratory).

In conducting this excavation, emphasis was placed on accessing the soil materials found inside the test pit, conducting in-situ profiling, soil sampling, slope stability, visual assessment of groundwater seepage, conducting a detailed study of the test pit sidewalls and the appraisal of the excavatability.

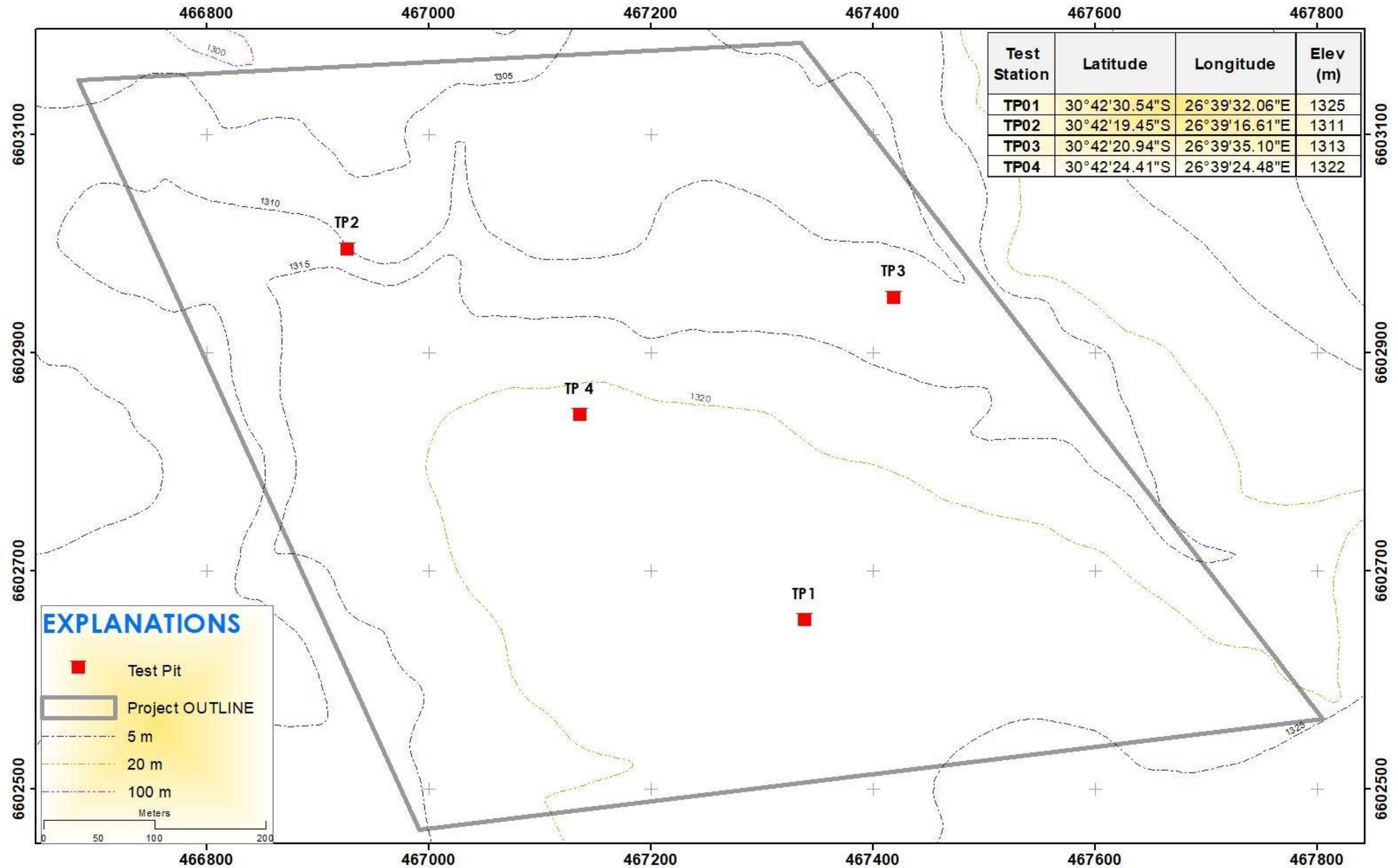
The test pit sidewalls were critically studied along the vertical face of the excavation and an in-situ soil profiling exercise conducted in line with the guidelines promulgated by Jennings et al (1973) and Brink, A.B.A. and Bruin, R.M.H. (editors); 2001; Guidelines for Soil and Rock Logging in South Africa.

4.3 Dynamic Cone Penetrometer

Dynamic Cone Penetrometer tests were conducted adjacent to each test pit along the pipe centreline to obtain an indication of the in-situ material consistencies and CBR values for the subsoil. The DCP test is conducted by driving a 60° steel cone, 20mm in diameter, into the ground by an 8kg hammer falling through 575mm. The penetration resistance is expressed as penetration rate (mm) for every 5 consecutive blows. The test is used as a guide in compaction control.

Measurements were taken at depths varying from the surface up to 1.0 m or refusal below ground level. Summarised results are shown in Table 4.3_1 while detailed DCP results are included in Appendix B.

Figure 6
Aliwal North Landfill Site Project
Test Pit Locality Plan



EXPLANATIONS

- Test Pit
- Project OUTLINE
- 5 m
- 20 m
- 100 m

Meters

	Geotechnical Investigations of the Aliwal North Landfill Site (Test Pit Locality Plan)	1:3,000 A3 Paper Size		Map Datum	Date	Drawn By
				WGS 84 (Zone 35 S)	2023-02-15	KC

Table 4.3_1 Aliwal North Landfill Site Project Summarised DCP Survey Results					
Layer	Test Pit Station	TP01	TP02	TP03	TP04
LAYER 1	Start Depth (mm)	0	0	0	0
	Boundary Depth (mm)	120	125	40	90
	Layer Depth (mm)	120	125	40	90
	Material Consistency	Very stiff	Very stiff	Very stiff	Very stiff
	Average Insitu CBR	100	53	29	68
	Average Bearing Strength (kPa)	168	173	123	184
LAYER 2	Start Depth (mm)	120	125	40	90
	Boundary Depth (mm)	234	410	364	335
	Layer Depth (mm)	114	285	324	245
	Material Consistency	Very stiff	Very stiff	Very stiff	Very stiff
	Average Insitu CBR	477	161	220	124
	Average Bearing Strength (kPa)	174	191	191	182

5 SITE GEOLOGY AND GROUNDWATER

5.1 Regional Geology

Based on the 1:250 000 Geological map of the Aliwal North region (sheet 3026), the oldest rocks at the site are assigned to the Tarkastad Subgroup (**Trt**), a stratigraphic unit within the Beaufort Group of the Karoo Supergroup. The Trt lithologies are comprised of a brownish-red to greenish-grey mudstone with intercalated fine to medium-grained, Sandstone. In certain localities, it is common to intersect the upper Molteno Formation (**Trm**) characterised by grey mudstones and shales occurring in 1 to 10 m layers and also often intercalated by a subordinate, grey, Sandstone that occurs in 1 to 2 m thick layering. An extract of the Geological map is shown in Figure 7.

Dolerite intrusions (**Jd**) in the form of sills, sheets and dykes cover the upper parts of the project site. On a regional scale, dolerite occurs as a network of dykes, sills or sheets intruded into the sedimentary strata along the bedding planes and fractures. Locally, dolerite occurs mainly in the form of sills and inclined sheets intruded concordantly into the host sediments that may vary in thickness from a few meters to over 200 m or more. On surface exposure, dykes are commonly mapped as being generally only a few meters wide (3 – 10 m wide) but extending for several kilometres (5 – 30 km) long. When intercepted in test pits, dolerite is usually observed in five different categories, namely, solid, or fresh; fractured; boulders; gravelly; granular (or sugary) and as residual dolerite soil.

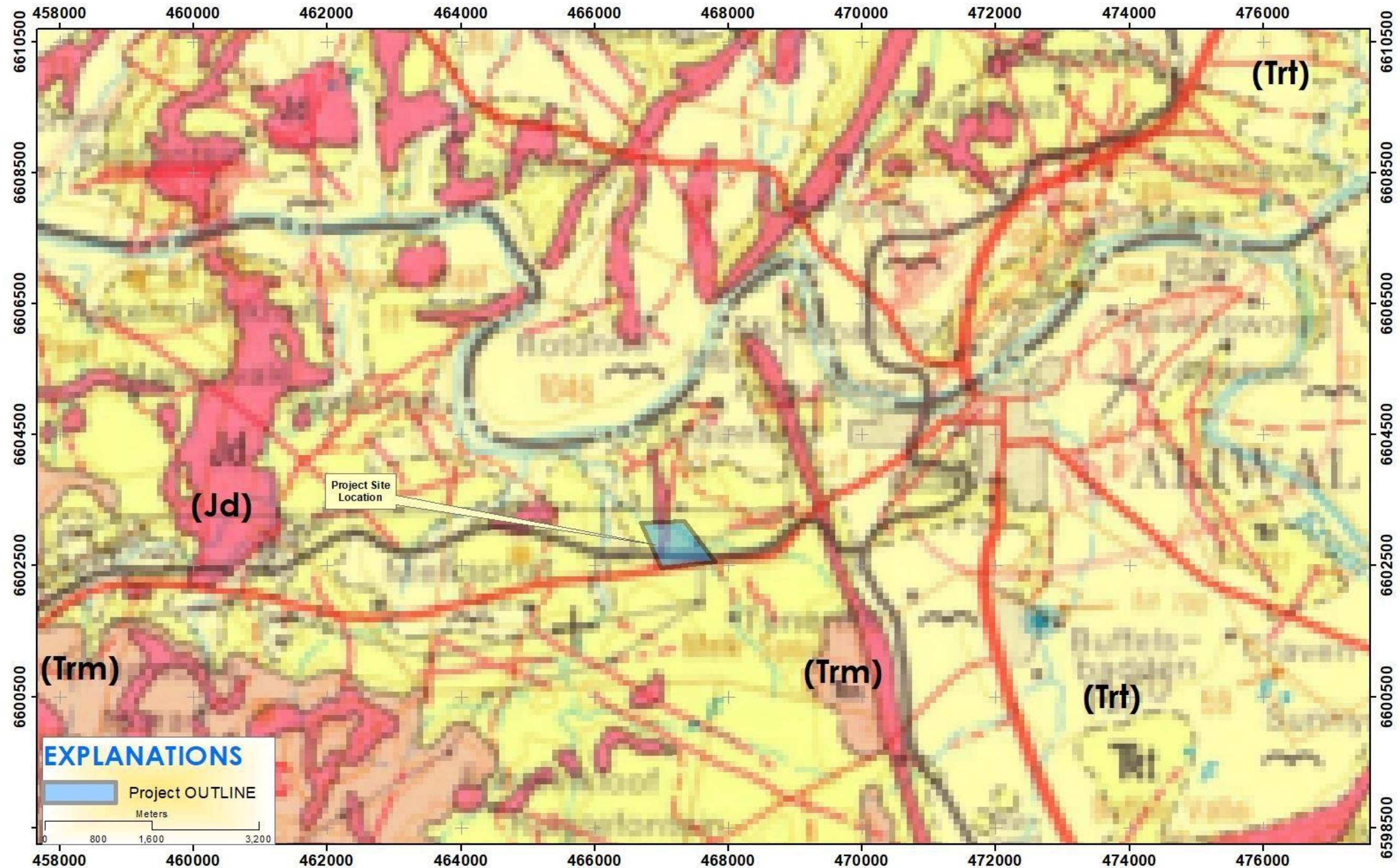
Younger, unconsolidated sediment deposits of Quaternary age (**Q**) consisting of a discontinuous cover of alluvium cover the residual soils and the solid bedrock, often occurring in pockets and along streams. Sporadic deposits of river terrace gravels that locally could signify the presence of the reworked, Basement Complex and comprising of a variable mixture of unconsolidated deep coloured, silty to gravelly-sand intermixed with sub-rounded to sub-angular fragments of quartzite can be observed locally. Occasional slickenside surfaces are present and joint surfaces (when present) are often stained brown and may have preserved within them, fine rootlets.

5.2 Site Soils Overlying Bedrock Geology

The geotechnical team has delineated a maximum of upto four (04) soil material sublayers divided into hillwash (0 – 450 mm); Reworked residual (400 – 700 mm), Residual soils (300 – 1 700 mm) and a hard bedrock of dolerite with an uneven surface exceeding 1 425 mm. The profiles generally indicate a similar material layering across the site. Table 5.2_1 shows a summarised table of the intercepted soil layer materials. Detailed soil profiling information is depicted in Appendix A attached to this Report.

Table 5.2_1 Aliwal North Landfill Site Project Summarised Soil Profiling Results									
Test Pit	TRANSPORTED SOIL MATERIALS			RESIDUAL SOIL MATERIALS					
	LAYER 1			LAYER 2			LAYER 3		
	HILLWASH			REWORKED RESIDUAL			RESIDUAL SOIL		
	From (mm)	To (mm)	Run (mm)	From (mm)	To (mm)	Run (mm)	From (mm)	To (mm)	Run (mm)
TP01	0	300	300	-	-	-	300	1450	1150
TP02	0	450	450	-	-	-	450	1550	1100
TP03	0	400	400	400	700	300	700	1700	1000
TP04	0	400	400	-	-	-	400	1000	600

Figure 7
Aliwal North Landfill Site Project
Regional Geological Map of the Project Site



			Geotechnical Investigations of the Aliwal North Landfill Site (Regional Site Geological Map)	1:50,000		Map Datum	Date	Drawn By
				A3 Paper Size		WGS 84 (Zone 35 S)	2023-02-15	KC

5.2.1 Hillwash

The upper soil layer found across the site is comprised of an undifferentiated topsoil of hillwash materials defined as a slightly moist to moist, dark reddish brown, loose to medium dense, fine to coarse-grained, intact, Silty Clayey SAND (and sometimes with gravelly intercalations). This material layer is intercepted from the existing ground surface to a maximum depth of 450 mm (below the existing ground level).

5.2.2 Reworked Residual Layer

The second layer found on site is comprised of reworked residual soils and is defined as a slightly moist, purplish to reddish brown, medium dense, intact, Silty Sandy GRAVEL (after a decomposed dolerite). This material was intercepted at a single site (TP03) between the depth of 400 to 700 mm (below the existing ground level).

5.2.3 Residual Soil Layer

The residual soil layer found on site is defined as a dry to slightly moist, dark brownish grey, very dense to hard, intact Sandy GRAVEL (after a decomposed dolerite). Immediately below the residual soil layer is a moist, pale, greenish to reddish brown, hard bedrock of a decomposed dolerite.

5.3 Groundwater

The water-holding capacity of construction materials (such as soil) is dependent on a range of engineering properties including particle size distribution, clay type present, amount of organic matter, bulk density, and structure of the soil.

Groundwater found in sediments associated with the Karoo Supergroup is often associated with basins of weathering troughs (in dolerite sills) and in highly jointed sedimentary rocks. Groundwater aquifers can also be found associated with sedimentary rocks that are enclosed by dolerite and other, weathered, fractured sedimentary rocks (not associated with the dykes). Fractured zones are often associated with dolerite intrusions, shear zones and lithological boundaries. Shallow seepage is the body of groundwater that is frequently (but not always) located above the groundwater level (usually within the top 1.50 m below the existing ground surface). It is rarely independent or isolated and is normally hydraulically connected to surface water systems.

Groundwater seepage was not encountered in any of the test pits on site. However, Bashan Consulting is of the view that since soil moist conditions were observed during the site investigation indicates that groundwater seepage should be anticipated at shallow depth across the site.

6 GEOTECHNICAL EVALUATION

6.1 Foundation Indicators

To confirm the visual assessments of the engineering properties of the soil, a few representative samples were taken and submitted for laboratory testing. Disturbed soil samples, considered to be representative of the materials on site were subjected to foundation indicator testing (as per SANS 3001 test methods).

Foundation Indicator tests to determine the to determine the soil grading, Atterberg limits and potential expansiveness of the founding soils. The grain size analysis is widely used in classification of materials and determination of the engineering behaviour of materials. The distribution of different grain sizes affects the engineering properties of materials. Grain size analysis provides the grain size distribution, and it is required in classifying the material. Particle size grading of the soils or sieve analysis is the easiest way to describe the relative amounts of gravel, sand, silt, and clay within the soil. A summary of the foundation indicator test results is shown in Table 6.1_1 whilst detailed test results are depicted in Appendix C attached to this Report.

The potential expansiveness of the soil materials encountered on site was interpreted using the method suggested by Van der Merwe (1964), as revised by Savage (2007). Under the above criteria, a clayey soil material with $PI < 12\%$ is normally regarded as having low expansiveness; $12\% > PI < 23\%$ as medium expansiveness, and a $PI > 23\%$ as high expansiveness.

6.2 Moisture / Density Relationships and Compaction

These tests are used to test for the parameters that often yield the results of the bulk density and the compaction effort required on site to achieve the desired soil density on disturbed soils that are compacted in-situ. Laboratory tests to determine the moisture / density relationship as well as the compaction characteristics at modified AASHTO compaction was completed. The test results are summarized in Table 6.1_2 whilst detailed test results are depicted in Appendix D attached to this Report.

These tests often yield values of the optimum moisture, the moisture-density relationships, and the California Bearing Ratio (CBR) or capacity values. This test method provides for the determination of the CBR values of a material at an optimum water content and/or a range of water content from a specified compaction test and a specified dry unit weight. The suitability of the near surface soil materials on site for infrastructure construction purposes can be inferred from the Committee of Land Transport Officials (COLTO) and the Technical Recommendations for Highways (TRH14) soil classifications.

Table 5.2_1
Aliwal North Landfill Site Project
Foundation Indicators – Summarised Laboratory Results

Trial Pit	From (mm)	To (mm)	Soil Description	2 mm Pass	0.425 mm Pass	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Wtd PI (%)	LL (%)	PI (%)	LS (%)	Potential Expansion	Surface Heave (mm)	Vertical Heave (mm)	USSC Class
(HILLWASH)																	
TP01	0	300	Silty Clayey SAND	98	97	22.7	16.2	59.1	1.9	12.7	42.0	13.0	6.0	Medium	3.9	5.9	SM
TP02	0	450	Silty Clayey SAND	99	97	22.0	11.6	65.3	1.1	11.7	40.0	12.0	6.0	Low	-	-	SM
TP04	0	400	Silty Clayey SAND	95	93	30.9	12.5	51.9	4.8	13.1	41.0	14.0	7.0	Low	-	-	SM
(RESIDUAL SOIL)																	
TP02	450	1,550	GRAVEL	9	4	0.7	0.7	7.5	91.1	-	-	SP	1.2	Low	-	-	GM
TP04	400	1,000	GRAVEL	7	5	1.0	1.6	4.5	92.9	-	-	NP	-	Low	-	-	GM

PI (Wtd) = Plasticity Index of whole sample
LL = Liquid Limit
PI = Plasticity Index
LS = Linear Shrinkage
PL = Plasticity Limit
OMC = Optimum Moisture Content
MDD = Modified Dry Density
GM = Grading Modulus
NP = non-plastic
SP = Slightly plastic
Clay = 0.001 – 0.002 mm
Silt = 0.002 – 0.06 mm
Sand = 0.06 – 2.00 mm
Gravel = 2.00 – 60.0 mm

Granules = 2 – 4 mm
Pebbles = 4 – 64 mm
Cobbles = 64 – 256 mm
Boulders = > 256 mm
PE = Potential Expansion
HRB = Highway Research Board
USSC = Unified Soil Classification System
ND = Not Determined

GW = Well graded gravels, gravel sand mixtures (little or no fines)
GP = Poorly graded gravels, gravel-sand
GM = Silty Gravels
GC = Clayey Gravels, gravel-sand-clay mixtures
SW = Well graded sands, gravelly sands (little or no fines)
SP = Poorly graded sands, gravelly sands (little or no fines)
SM = Silty sands, sand-sit mixtures
SC = Clayey sands, sand-clay mixtures
MH = Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils, elastic silts
ML = Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL = Inorganic silts, micaceous or diatomaceous, fine, sandy or silty soils, elastic silts
CH = Inorganic clays of medium to high plasticity, fat clays
OL = Organic silts and organic silt-clays of low plasticity
OH = Organic clays of medium to high plasticity, organic silts.
PT = Peat and other highly organic soils.

Table 5.3_1
Aliwal North Landfill Site Project
Compaction Testing – Summarised Laboratory Results

Trial Pit	From (mm)	To (mm)	Soil Description	0.075 mm Pass	LL (%)	PI (%)	LS (%)	GM	OMC (%)	MDD (kg/m³)	Compaction	Swell (%)	CBR @ 100%	CBR @ 98%	CBR @ 97%	CBR @ 95%	CBR @ 93%	CBR @ 90%	HRB Class	COLTO Class	TRH14 Class
(HILLWASH)																					
TP01	0	300	Silty Clayey SAND	39	42	13.0	6.0	0.7	12.4	1909	12.0	1.40	5	4	4	3	3	2	-	<G10	<G10
TP02	0	450	Silty Clayey SAND	36	40	12.0	6.0	0.7	12.1	1853	12.4	2.10	3	3	2	2	2	1	-	G10	G10
TP04	0	400	Silty Clayey SAND	5	-	NP	-	2.8	6.5	2348	6.5	0.10	75	55	47	34	25	15	-	G6	G6
(RESIDUAL SOIL)																					
TP02	450	1,550	GRAVEL	40	41	14.0	7.0	0.7	14.6	1789	14.3	3.80	2	2	2	1	1	1	A-6	G10	G10
TP04	400	1,000	GRAVEL	2	0	SP	1.2	2.9	6.0	2067	6.0	0.10	68	48	41	29	21	12	-	G6	G7

7 DISCUSSION OF LABORATORY RESULTS

7.1 Hillwash

This material is defined as a slightly moist to moist, dark reddish brown, loose to medium dense, fine to coarse-grained, intact, Silty Clayey SAND (and sometimes with gravelly intercalations). It has a coarse soil fraction ranging between 97 to 100 % (averaging 98%) and exhibits a between a low to marginally medium, potential expansion with average PI values ranging between 12 to 14 % (with an average of 13%). It generally classifies as silty sands (SM) on the USSC and as A-7-6 group on the AASHTO classification. This material rates as a “poor to fair” subgrade material for use as an engineered fill.

A soil sample collected from TP01 (between 0 to 300 mm) returned a medium potential expansiveness and was subjected to heave calculations using the method suggested by Van der Merwe (1964), as revised by Savage (2007). The surface heave was 3.9 mm whilst the vertical heave was 5.9 mm.

The moisture / density test yields a maximum dry density ranging between 1909 to 2348 kg/m³ (averaging 1997 kg/m³) at an optimum moisture content ranging between 6.5 to 12.4% (averaging 10.3%). The average CBR value is 10 at a compaction density of 93% Modified AASHTO, and 13 at a compaction density of 95% Modified AASHTO with an average grading modulus of 1.4. Based on the TRH14 classification and the COLTO specification, the hillwash material is classified as ranging between G6 to <G10.

7.2 Reworked Residual Soil

This material is defined as a slightly moist, purplish to reddish brown, medium dense, intact, Silty Sandy GRAVEL (after a decomposed dolerite). This material is restricted to a single test pit (TP03) locality and was not sampled for engineering materials testing.

The general visual inspection of these soil materials indicates a potentially low compressibility of the soils (if subjected to various saturated conditions) and a low to medium, collapsible grain structure within the soil matrix is likely to occur.

7.3 Residual Soil

This material is defined as a dry to slightly moist, dark brownish grey, very dense to hard, intact Sandy GRAVEL (after a decomposed dolerite). This material has a coarse soil fraction ranging between 91 to 92% and exhibits a low potential expansion with a PI value ranging from being slightly plastic (SP) to non-plastic (NP). The material generally classifies as being silty Gravels (GM) on the USSC and as A-1-a group on the AASHTO classification. This material rates as an “excellent to good” subgrade material for use as an engineered fill.

The moisture / density tests yield a maximum dry density ranging between 1789 to 2067 kg/m³ (averaging 1928 kg/m³) at an optimum moisture content ranging between 6 to 14.3% (averaging 10.3%). The average CBR value is 11 at a compaction density of 93% Modified AASHTO, and 15 at a compaction density of 95% Modified AASHTO with an average grading modulus of 1.8. Based on the TRH14 classification the residual soil material is classified as ranging between G6 and G10.

8 RECOMMENDATIONS AND SOLUTIONS

8.1 Design Parameters

Based on the results of the geotechnical investigations conducted, the summarised materials are shown in Table 8.1_1.

Table 8.2_1 Aliwal North Landfill SiteW Project Pavement Material Classes						
Layer Number	Material Source	Soil Horizon	From Depth (mm)	To Depth (mm)	TRH14 Classification	Bearing Capacity (kPa)
Layer 1	TRANSPORTED SOIL	Hillwash	0	400	G6 to <G10	80
Layer 2	RESIDUAL SOIL	Reworked Residual	400	550	Not Tested	100
Layer 3	RESIDUAL SOIL	Residual Soil	550	1 700	G7 to G10	150

8.2 Geotechnical Issues

Residual soils derived from fine-grained rocks of the Karoo typically form silty sands that may exhibit a collapsible grain structure. These soils may competently bear imposed loads when dry but when inundation occurs and the soil is under load the colloidal 'bridges' in these voided soils fail and the soil typically collapses into a denser state, leading to differential settlement. The differential settlement may result in structural damage. Cracking of buildings in corners is often observed in buildings built in areas with collapsible soils.

The variable engineering impacts associated with the types of soil materials prevalent on site include the presence of a low to moderate compressibility potential, a collapsible grain structure, potential of expansive clays, an uneven bedrock surface and a potentially, low bearing capacity in certain pockets.

8.3 Development Recommendations

Based on the available geotechnical data, the recommended geotechnical site class at the proposed construction site is **H / C - C1 / S – S1**. Bashan Geotechnics highly recommends the removal of the upper cohesionless, un-engineered, hillwash prior to the commencement of the construction stage. However, a final decision regarding the technical specifications (in line with adopted founding solutions) shall be done so at the discretion of the Design Engineer.

All topsoil material (hillwash) needs to be stripped to spoil to a depth of 300 mm below existing ground Level. Precautions limited to the compaction of founding soils to at least 93% of Modified AASTHO density to a depth of 1.5 times the foundation width, light reinforcement in foundations and additional stormwater drainage, service and plumbing precautions will assist in the safe delivery of the project. Remove any incompressible or wet soils (in the upper soil layers) and replace with imported G7 material or suitably drier organic-free, insitu soil (or as directed by the resident engineer). Backfill above the foundations should be compacted to the same density as the remainder of the terrace to avoid zones of high porosity and permeability around the foundations.

8.4 Foundation Assessment

Foundation earthworks should be conducted in accordance with SABS 1200D, COLTO 3300 or other applicable standards. A founding depth of 600 mm is recommended. The choice of foundation type and the design of the foundations will need to be done by a competent engineer once the final structural layouts have been determined. The foundation types recommended for the proposed site are as follows:-

- Spread footings (or Pad footings)
- Strip footings with light reinforcement

8.4.1 Spread Footings

The proposed columns for the building structure should be founded on concrete bases / spread footings adequately reinforced and individually compacted. The excavations of foundation bases should be carried through to a residual layer at a depth of 1 000 mm below the current ground level and a width of $1.5 \times B$ (where B is the width of a footing).

Upon reaching the founding depth of 1 000 mm, the excavation base should be compacted in-situ to 93% MOD AASHTO at optimum moisture content. The foundation for the proposed structures could then be founded onto the residual compacted layer, adequately reinforced with steel and adopting a safe allowable bearing pressure of 150 kPa.

8.4.2 Strip Footings

The brick wall for the proposed structure should be founded on strip footings of typically 600 mm width and 250 mm thickness with light reinforcement at a depth of 600 mm below the surface. Insitu material should be removed and replaced with a suitable material compacted to 93% Mod AASHTO density at -1% to $+2\%$ OMC. Strip footings can then be placed on compacted in-situ soils utilizing an allowable bearing capacity of 100 kPa.

8.5 Floor Slab (Surface Bed)

The concrete floor slab (surface bed) with a light reinforcement (193 Ref Mesh) should be founded on a completed terrace compacted using G6 or G7 quality material of a minimum of 200 mm thickness with a subgrade reaction of 67MPa / m.

8.6 Roads and Terraces

The results of the compaction and indicator tests have been used to classify the in-situ soils to determine their suitability for use in the construction of terraces and pavement layers. The residual soils classify as G7 to G10 material according to TRH 14 classification system. Road pavement layers requiring material classifications better than G8 will need to be imported from a commercial source or nearby barrow pit. It is recommended that should terracing be required, a minimum quality G7 material be considered for the backfilling.

8.7 Excavation Classification

In terms of SABS 1200D: 1988 Earthworks, excavations to depths of between 400 mm and 1 500 mm are likely to classify as “soft” and below this depth as “intermediate”. All excavations greater than 1 500 mm would need to be suitably battered back to a suitable angle of 1:1.5 (or shored where necessary), to ensure the safety of construction personnel and equipment working in these excavations.

8.8 Stormwater Management

The most important factor in the stable development and operation of the road pavement is the control and removal of both surface and groundwater from the construction site. Appropriate cut-off drains should be allowed during the construction phase of the project.

Storm water should be collected and piped preferably off site. If this is not feasible, all stormwater should be led well down slope of all structures and building terraces to discharge in a carefully controlled fashion by means of surface spreaders / headwalls (to the Engineer's detail). A concrete splash apron should be constructed around the perimeter of the proposed structure. This will prevent ingress of surface water close to the foundations, thereby affecting the moisture content of the founding soils.

8.9 Anticipated Construction Problems

The following general problems are envisaged during construction:

- Safety of workers in deep excavations must be adequately addressed prior to the commencement of the project.
- Unknown underground services.

8.10 Additional Investigations

No additional, geotechnical site investigations are considered necessary for the assessment of the subsoils.

8.11 Construction Monitoring

It is recommended that all foundations should be inspected by a Competent Person prior to placing any concrete and regular checks on the quality and compaction of the backfill to the terraces should be made.

9 CONCLUSIONS

9.1 Conclusions

This geotechnical report presents the findings of a materials investigation conducted for the sole purpose drawing material characteristics to pave way for the establishment of a municipal landfill site near Aliwal North in the Eastern Cape. A landfill site (also known as a tip, dump, rubbish dump, garbage dump, or dumping ground) is a site for the disposal of waste materials.

The area of interest consists of a virgin land located 5 km west of the town of Aliwal North. Although the development details remain scarce, it is envisaged that proposed development is likely to consist of a double volume steal frame structure which will be utilised as a recycling shelter.

The variable engineering impacts associated with the types of soil materials prevalent on site include the presence of a low to moderate compressibility potential, a collapsible grain structure, potential of expansive clays, an uneven bedrock surface and a potentially, low bearing capacity in certain pockets. Isolated areas where the materials do not meet the required specifications will have to be determined at construction stage. This will have to be undercut to the depth of the layer and replaced with a suitable material or modified by means of stabilization.

Based on the available geotechnical data, the recommended geotechnical site class at the proposed construction site is **H / C - C1 / S – S1**. Bashan Geotechnics highly recommends the removal of the upper cohesionless, un-engineered, hillwash prior to the commencement of the construction stage. The foundation types recommended for a of a double volume steal frame structure which will be utilised as a recycling shelter at the proposed site are the spread footings (or pad footings) and the strip footings with light reinforcement. The concrete floor slab (surface bed) with a light reinforcement (193 Ref Mesh) should be founded on a completed terrace compacted using G6 or G7 quality material of a minimum of 200 mm thickness with a subgrade reaction of 67MPa / m.

The residual soils classify as G7 to G10 material according to TRH 14 classification system. Road pavement layers requiring material classifications better than G8 will need to be imported from a commercial source or nearby barrow pit. It is recommended that should terracing be required, a minimum quality G7 material be considered for the backfilling.

9.2 Discussions

The ground conditions described in this Report refer specifically to those conditions encountered inside of the test pits excavated at the site. It is highly likely that certain conditions that may be at variance with those discussed above could be encountered at the site in the future.

Bashan Consulting wishes to elaborate that this investigation was thorough (at the required level) and was in line with the Client's objectives). Whilst every effort has been made during the fieldwork phase of this investigation with the aim of identifying the various soil horizons (including the associated potential problems and their likely distribution), it is highly impossible to guarantee that isolated zones of poor material could have been missed.

Whilst every effort has been made during the fieldwork phase of this investigation with the aim of identifying the various soil horizons (including the associated potential problems and their likely distribution), it is highly impossible to guarantee that isolated zones of poor material could have been missed.

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Appendix A

Soil Profiles





GEO-SOILS LABORATORY

CIVIL ENGINEERING AND GEOTECHNICAL

GEO-SOILS LABORATORY (PTY) LTD

HEAD OFFICE
22 Umnqama Road
Sunset Bay
East London, 5201
TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

Test Pit : TP1 Coordinates: 30°42'30.54"S 26°39'32.06"E
REQUEST NO: GEO-

Date Profiled: 30/01/2023

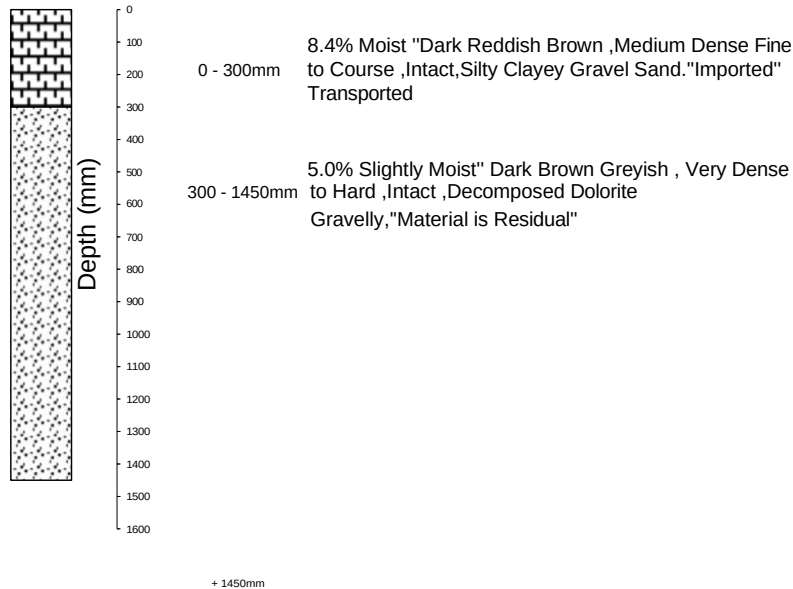
CLIENT: **Afroteam Consultants**
No. 2 Merriman Street
Mthatha

Starting Depth: 0mm
Excavation Method Mechanical
Water Table NO
Refusal YES
Side Walls Stable
Sampling Method TMH5 MC1

ATTENTION: Igeny Shone

PROJECT: **ALIWAL NORTH LANDFILL SITE**

End Depth: 1450mm





GEO-SOILS LABORATORY

CIVIL ENGINEERING AND GEOTECHNICAL

GEO-SOILS LABORATORY (PTY) LTD

HEAD OFFICE

22 Umnqama Road

Sunset Bay

East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

Test Pit : TP2

Coordinates: 30°42'19.45"S 26°39'16.61"E

Date Profiled: 30/01/2023

REQUEST NO: GEO-

CLIENT: **Afroteam Consultants**

No. 2 Merriman Street
Mthatha

Starting Depth: 0mm

Excavation Method Mechanical

Water Table NO

Refusal YES

Side Walls Stable

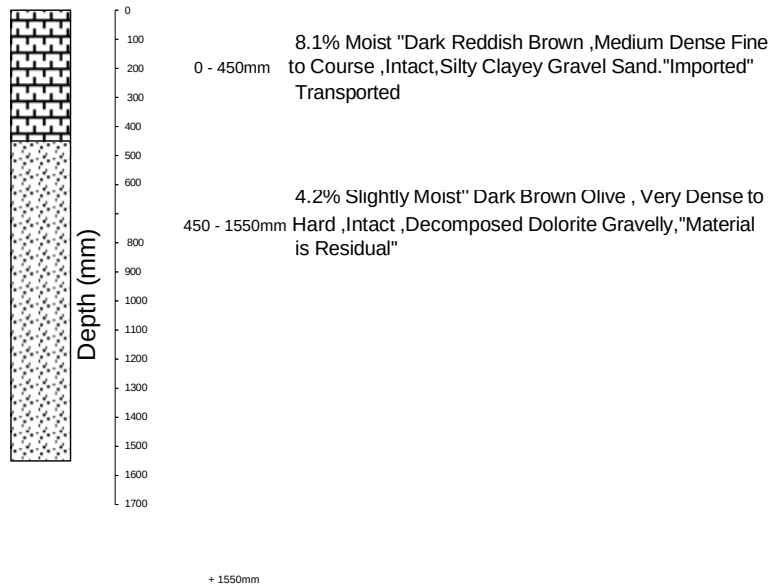
Sampling Method TMH5 MC1

ATTENTION Igeny Shone

ALIWAL NORTH LANDFILL SITE

PROJECT:

End Depth: 1550mm





GEO-SOILS LABORATORY

CIVIL ENGINEERING AND GEOTECHNICAL

GEO-SOILS LABORATORY (PTY) LTD

HEAD OFFICE

22 Umnqama Road

Sunset Bay

East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

Test Pit : TP3

Coordinates: 30°42'20.94"S 26°39'35.10"E

Date Profiled: 30/01/2023

REQUEST NO: GEO-

CLIENT: Afroteam Consultants

No. 2 Merriman Street

Mthatha

Starting Depth: 0mm

Excavation Method Mechanical

Water Table NO

Refusal YES

Side Walls Stable

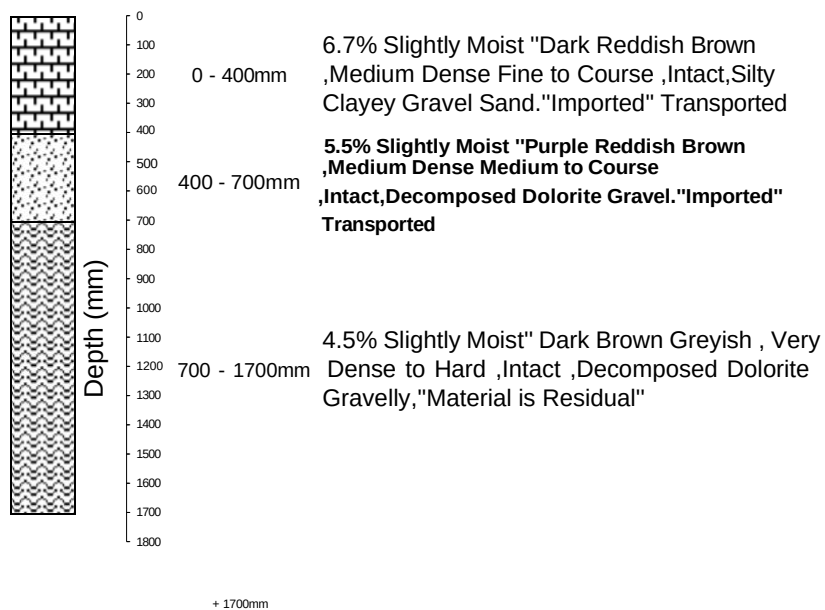
Sampling Method TMH5 MC1

ATTENTION Igany Shone

ALIWAL NORTH LANDFILL SITE

PROJECT:

End Depth: 1700mm



Disturbed Samples:





GEO-SOILS LABORATORY

CIVIL ENGINEERING AND GEOTECHNICAL

GEO-SOILS LABORATORY (PTY) LTD

HEAD OFFICE

22 Umnqama Road

Sunset Bay

East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

Test Pit : TP4

Coordinates: 30°42'24.41"S 26°39'24.48"E

Date Profiled: 30/01/2023

REQUEST NO: GEO-

CLIENT: **Afroteam Consultants**

No. 2 Merriman Street
Mthatha

Starting Depth: 0mm

Excavation Method Mechanical

Water Table NO

Refusal YES

Side Walls Stable

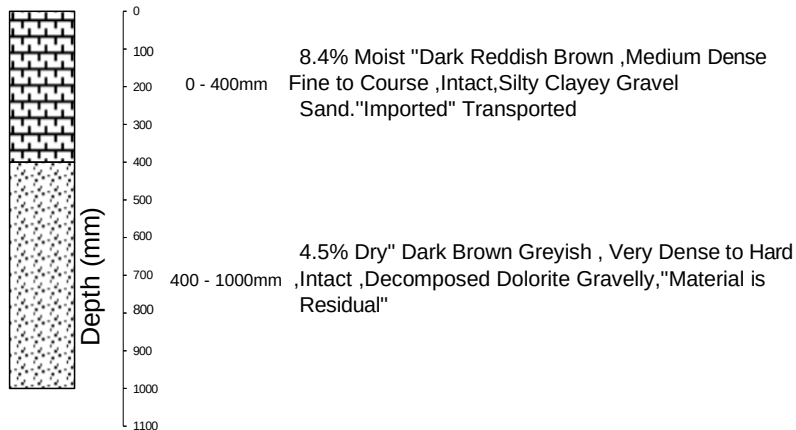
Sampling Method TMH5 MC1

ATTENTION Igenny Shone

ALIWAL NORTH LANDFILL SITE

PROJECT:

End Depth: 1000mm



Appendix B

DCP Survey Results





GEO-SOILS LABORATORY

CIVIL ENGINEERING AND GEOTECHNICAL

GEO-SOILS LABORATORY (PTY) LTD

HEAD OFFICE
22 Umnqama Road
Sunset Bay
East London, 5201

TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

JOB No: 2323 Ref. No: 0 Date: 30/01/2023

Client: **Afroteam Consultants**
No. 2 Merriman St
Mthatha
5100
Attention: **Igeny Shone**

Tel: 0
Fax: 0

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: ALIWAL NORTH LANDFILL SITE
TEST POSITION: Test Pit 1
TEST DEPTH: DCP 1 m (This is a standard accredited Method)
MATERIAL TYPE: Clayey Materials
CONSTRUCTION TYPE: Structural
Environmental Conditions: Hot
REFUSAL: YES- HARD ROCK

MATERIALS TECHNICIAN: Anda
ASSISTANT: Mike
STARTING DEPTH: 60mm
INSTRUMENT (DCP) SET No: DCP01
Max. penetration depth: #REF! mm
LEVEL: @ NGL
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR 410x (dn) ^{-1.27}	In Situ CBR (TMH 6)	In Situ UCS 290x (dn) ^{-1.09}
0	70	0	0	0					
5	120	50	50	10.0	Very Stiff	105	22	23	236
10	155	85	35	7.0	Very Stiff	136	35	37	348
15	170	100	15	3.0	Very Stiff	>200	102	110	876
20	180	110	10	2.0	Very Stiff	>200	170	>110	1362
25	190	120	10	2.0	Very Stiff	>200	170	>110	1362
30	230	160	40	8.0	Very Stiff	123	29	31	301
35	256	186	26	5.2	Very Stiff	169	51	54	481
40	286	216	30	6.0	Very Stiff	152	42	45	411
45	300	230	14	2.8	Very Stiff	>200	111	>110	944
50	302	232	2	0.4	Very Stiff	>200	1313	>110	7873
55	304	234	2	0.4	Very Stiff	>200	1313	>110	7873



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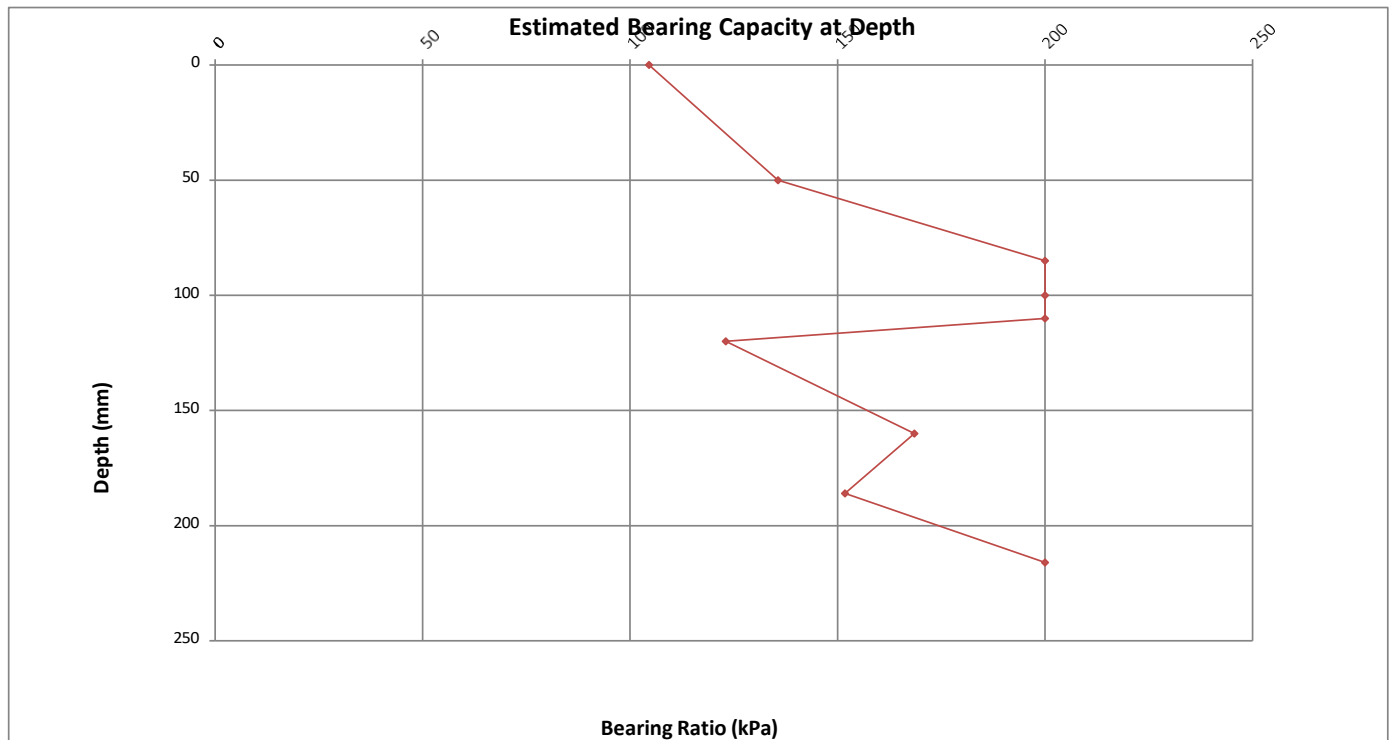
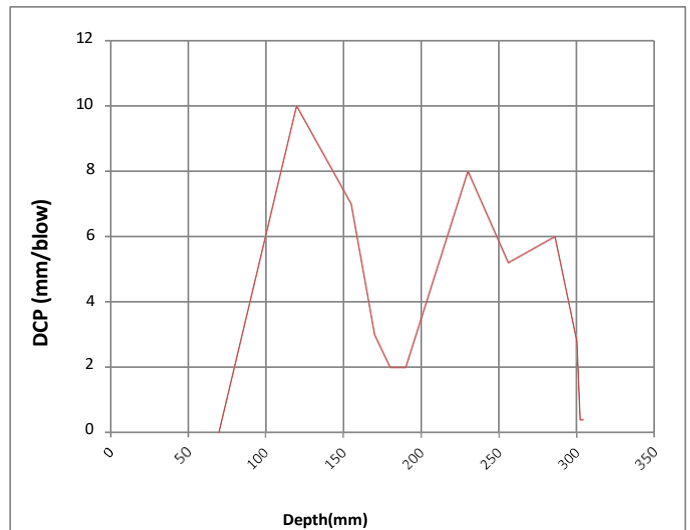
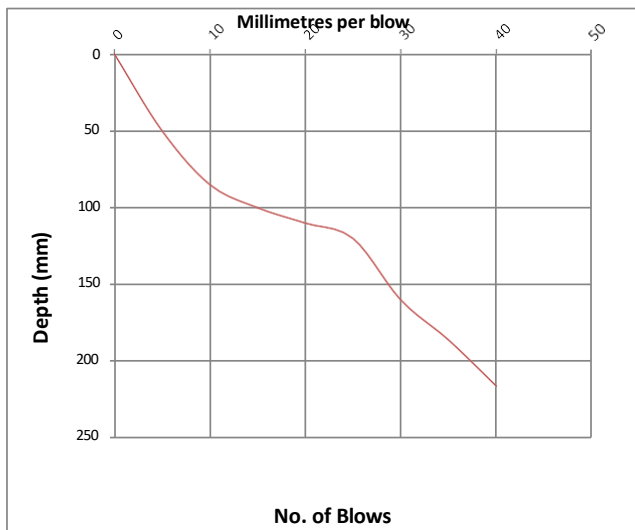
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22 Umnqama Road
Sunset Bay
East London, 5201

TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

JOB No:	Ref. No:	0	Date:	2/2/2022
Client	Afroteam Consultants	Tel:	0	
	No. 2 Merriman St	Fax:	0	
	Mthatha			
	5100			
Attention:	Igeny			Test Pit 1



Remarks:

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Sunset Bay
East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

JOB No: 2323 Ref. No: 0 Date: 30/01/2023

Client: Afroteam Consultants
No. 2 Merriman Street
Mthatha
5100
Attention: Igeny Shone

Tel: 0
Fax: 0

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: ALIWAL NORTH LANDFILL SITE
TEST POSITION: Test Pit 2
TEST DEPTH: DCP 1 m (This is a standard accredited Method)
MATERIAL TYPE: Clayey Materials
CONSTRUCTION TYPE: Structural
Environmental Conditions: Hot
REFUSAL: YES- HARD ROCK

MATERIALS TECHNICIAN: Anda
ASSISTANT: Mike
STARTING DEPTH: 60mm
INSTRUMENT (DCP) SET No: DCP01
Max. penetration depth: #REF! mm
LEVEL: @ NGL
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR 410x (dn) ^{-1.27}	In Situ CBR (TMH 6)	In Situ UCS 290x (dn) ^{-1.09}
0	50	0	0	0					
5	75	25	25	5.0	Very Stiff	173	53	57	502
10	100	50	25	5.0	Very Stiff	173	53	57	502
15	125	75	25	5.0	Very Stiff	173	53	57	502
20	150	100	25	5.0	Very Stiff	173	53	57	502
25	175	125	25	5.0	Very Stiff	173	53	57	502
30	190	140	15	3.0	Very Stiff	>200	102	110	876
35	210	160	20	4.0	Very Stiff	200	70	77	640
40	230	180	20	4.0	Very Stiff	200	70	77	640
45	250	200	20	4.0	Very Stiff	200	70	77	640
50	266	216	16	3.2	Very Stiff	>200	94	104	816
55	278	228	12	2.4	Very Stiff	>200	135	>110	1117
60	293	243	15	3.0	Very Stiff	>200	102	110	876
65	310	260	17	3.4	Very Stiff	>200	87	96	764
70	320	270	10	2.0	Very Stiff	>200	170	>110	1362
75	340	290	20	4.0	Very Stiff	200	70	77	640
80	360	310	20	4.0	Very Stiff	200	70	77	640
85	400	350	40	8.0	Very Stiff	123	29	31	301
90	440	390	40	8.0	Very Stiff	123	29	31	301
95	445	395	5	1.0	Very Stiff	>200	410	>110	2900
100	450	400	5	1.0	Very Stiff	>200	410	>110	2900
105	455	405	5	1.0	Very Stiff	>200	410	>110	2900
110	460	410	5	1.0	Very Stiff	>200	410	>110	2900



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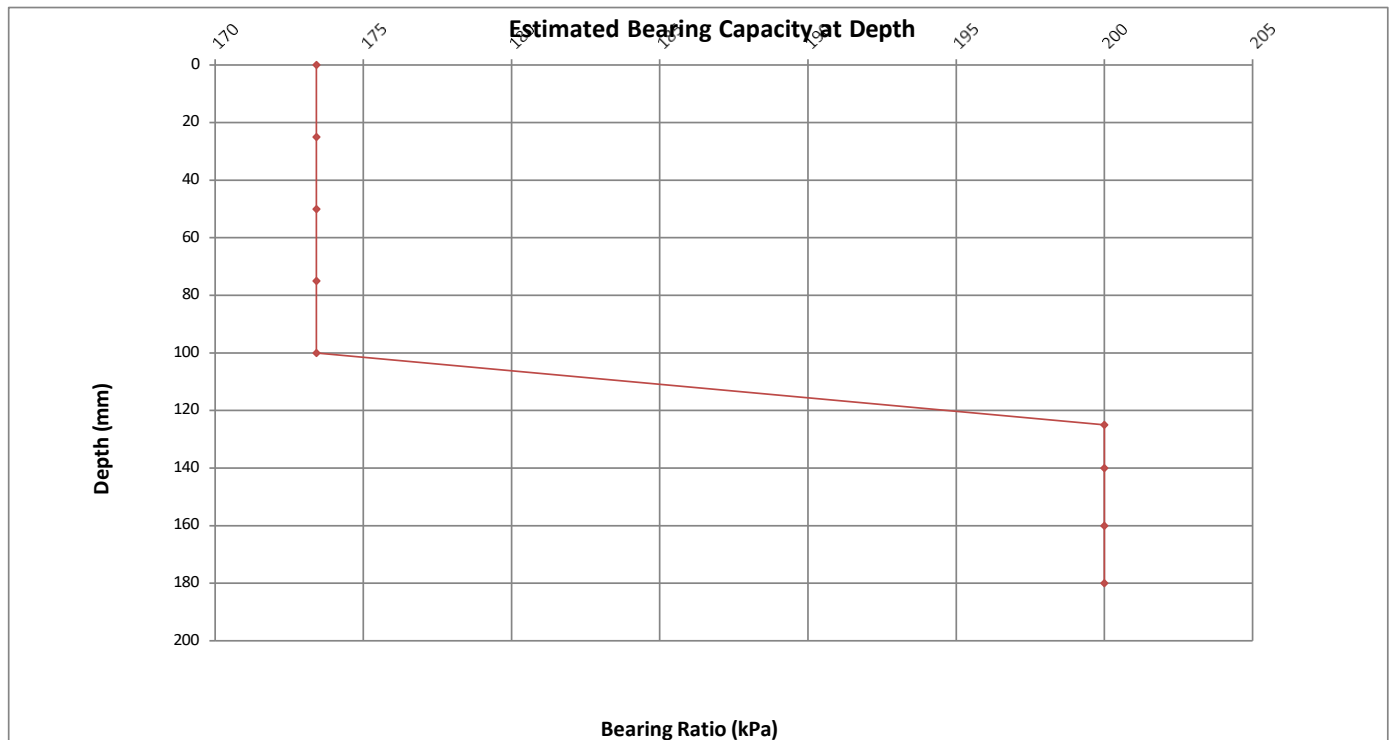
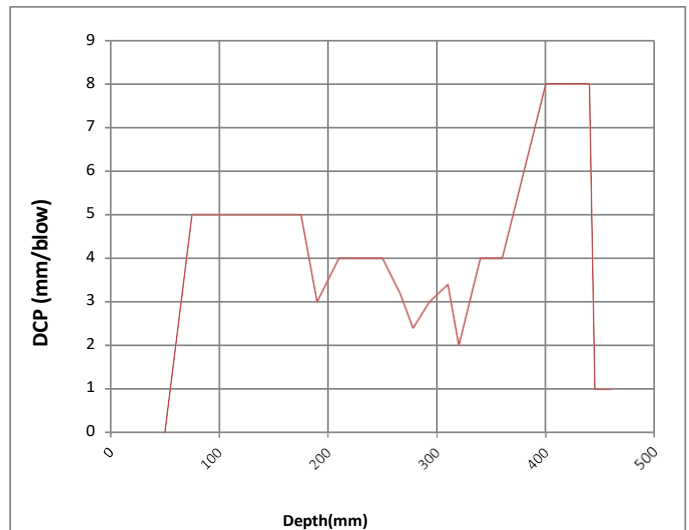
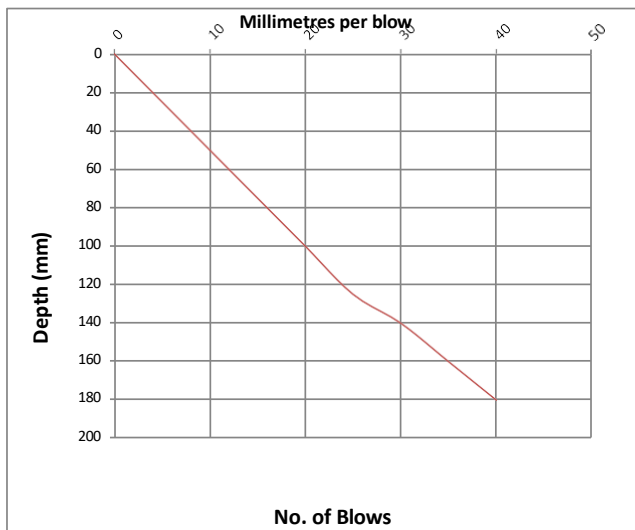
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22 Umnqama Road
Sunset Bay
East London, 5201

TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

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	5100			
Attention:	Igeny			Test Pit 2



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HEAD OFFICE
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Sunset Bay
East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

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	No. 2 Merriman Street				
	Mthatha				
	5100				
Attention:	Igeny Shone				

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	ALIWAL NORTH LANDFILL SITE	MATERIALS TECHNICIAN:	Anda
TEST POSITION:	Test Pit 3	ASSISTANT	Mike
TEST DEPTH:	DCP 1 m (This is a standard accredited Method)	STARTING DEPTH:	60mm
MATERIAL TYPE:	Clayey Materials	INSTRUMENT (DCP) SET No:	DCP01
CONSTRUCTION TYPE:	Structural	Max. penetration depth:	#REF! mm
Environmental Conditions	Hot	LEVEL:	@ NGL
REFUSAL:	YES- HARD ROCK	FOUNDATION:	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR 410x (dn) ^{-1.27}	In Situ CBR (TMH 6)	In Situ UCS 290x (dn) ^{-1.09}
0	60	0	0	0					
5	100	40	40	8.0	Very Stiff	123	29	31	301
10	112	52	12	2.4	Very Stiff	>200	135	>110	1117
15	122	62	10	2.0	Very Stiff	>200	170	>110	1362
20	134	74	12	2.4	Very Stiff	>200	135	>110	1117
25	150	90	16	3.2	Very Stiff	>200	94	104	816
30	168	108	18	3.6	Very Stiff	>200	81	89	718
35	182	122	14	2.8	Very Stiff	>200	111	>110	944
40	200	140	18	3.6	Very Stiff	>200	81	89	718
45	225	165	25	5.0	Very Stiff	173	53	57	502
50	250	190	25	5.0	Very Stiff	173	53	57	502
55	272	212	22	4.4	Very Stiff	190	62	68	577
60	298	238	26	5.2	Very Stiff	169	51	54	481
65	318	258	20	4.0	Very Stiff	200	70	77	640
70	342	282	24	4.8	Very Stiff	179	56	61	525
75	360	300	18	3.6	Very Stiff	>200	81	89	718
80	385	325	25	5.0	Very Stiff	173	53	57	502
85	412	352	27	5.4	Very Stiff	164	48	52	461
90	420	360	8	1.6	Very Stiff	>200	226	>110	1737
95	422	362	2	0.4	Very Stiff	>200	1313	>110	7873
100	424	364	2	0.4	Very Stiff	>200	1313	>110	7873



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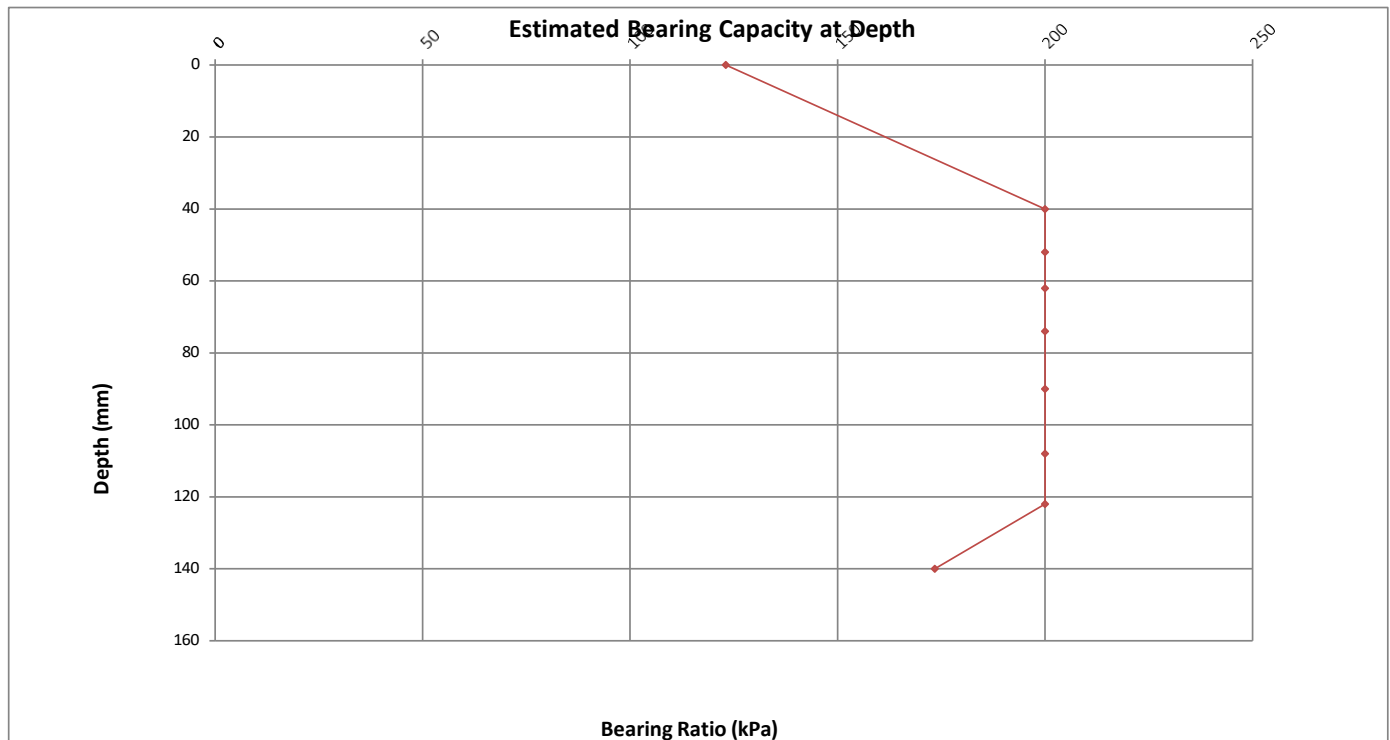
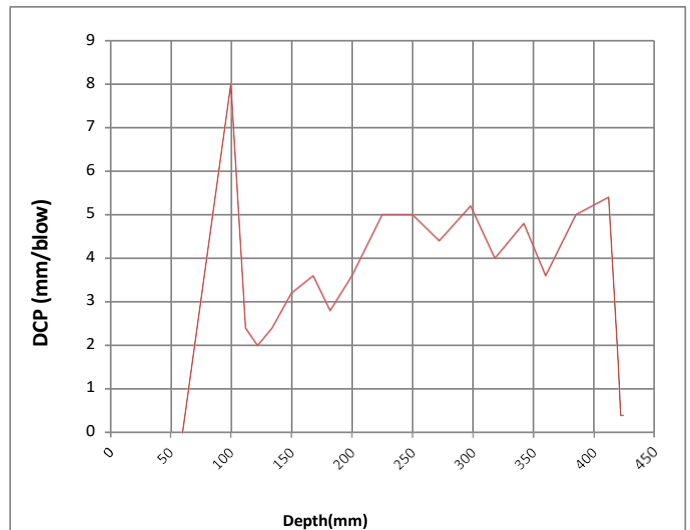
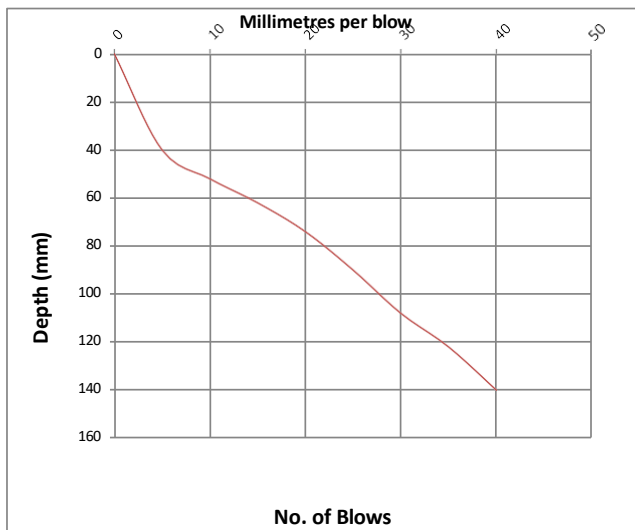
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22 Umnqama Road
Sunset Bay
East London, 5201

TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

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	No. 2 Merriman Street	Fax:	0	
	Mthatha			
	5100			
Attention:	Igeny			Test Pit 3



Remarks:

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East London, 5201

TEL : 043 004 0004

CELL : 068 001 9670

EMAIL : info@geosoils.co.za

WEB : www.geosoils.co.za

JOB No: 2323 Ref. No: 0 Date: 30/01/2023

Client: Afroteam Consultants
No. 2 Merriman Street
Mthatha
5100
Attention: Igeny Shone

Tel: 0
Fax: 0

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: ALIWAL NORTH LANDFILL SITE
TEST POSITION: Test Pit 4
TEST DEPTH: DCP 1 m (This is a standard accredited Method)
MATERIAL TYPE: Clayey Materials
CONSTRUCTION TYPE: Structural
Environmental Conditions: Hot
REFUSAL: YES- HARD ROCK

MATERIALS TECHNICIAN: Anda
ASSISTANT: Mike
STARTING DEPTH: 60mm
INSTRUMENT (DCP) SET No: DCP01
Max. penetration depth: #REF! mm
LEVEL: @ NGL
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR 410x (dn) ^{-1.27}	In Situ CBR (TMH 6)	In Situ UCS 290x (dn) ^{-1.09}
0	70	0	0	0					
5	105	35	35	7.0	Very Stiff	136	35	37	348
10	122	52	17	3.4	Very Stiff	>200	87	96	764
15	140	70	18	3.6	Very Stiff	>200	81	89	718
20	160	90	20	4.0	Very Stiff	200	70	77	640
25	170	100	10	2.0	Very Stiff	>200	170	>110	1362
30	180	110	10	2.0	Very Stiff	>200	170	>110	1362
35	190	120	10	2.0	Very Stiff	>200	170	>110	1362
40	200	130	10	2.0	Very Stiff	>200	170	>110	1362
45	230	160	30	6.0	Very Stiff	152	42	45	411
50	255	185	25	5.0	Very Stiff	173	53	57	502
55	275	205	20	4.0	Very Stiff	200	70	77	640
60	300	230	25	5.0	Very Stiff	173	53	57	502
65	325	255	25	5.0	Very Stiff	173	53	57	502
70	350	280	25	5.0	Very Stiff	173	53	57	502
75	390	320	40	8.0	Very Stiff	123	29	31	301
80	400	330	10	2.0	Very Stiff	>200	170	>110	1362
85	405	335	5	1.0	Very Stiff	>200	410	>110	2900



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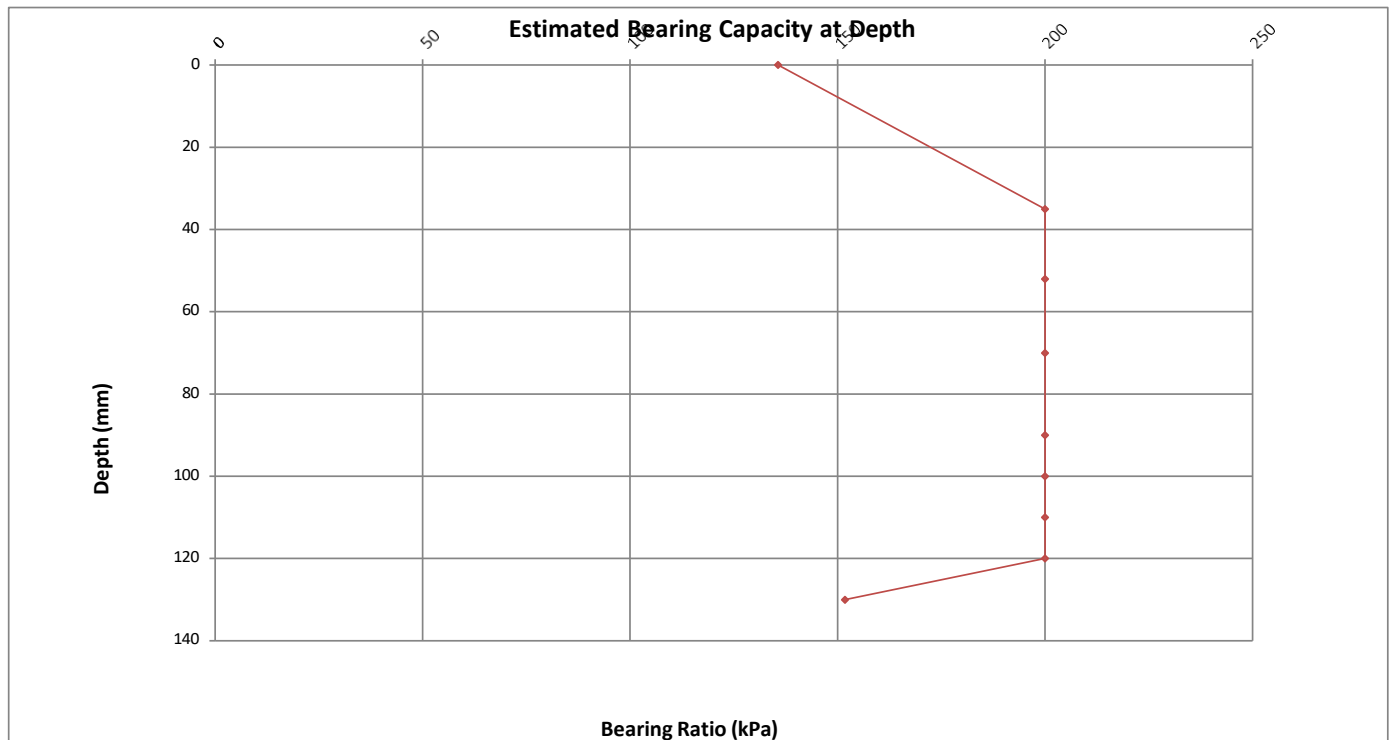
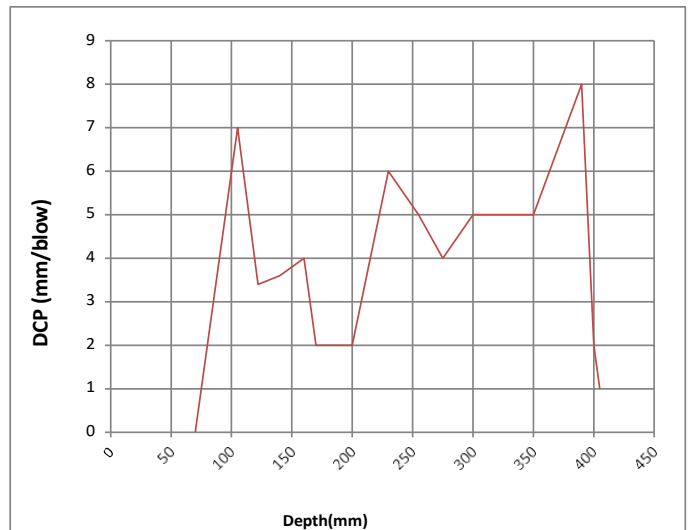
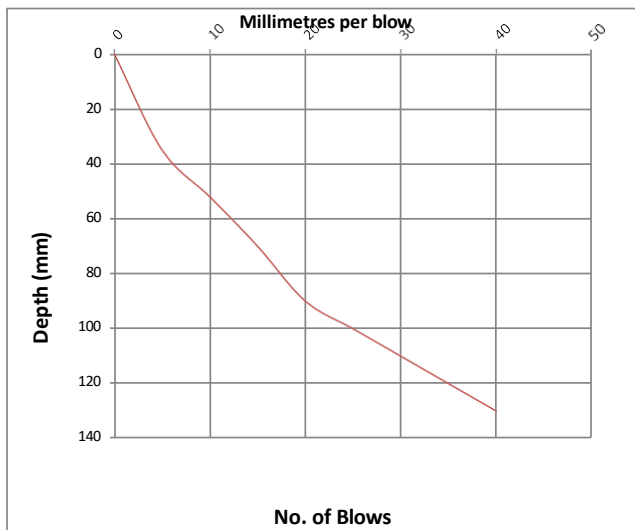
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Sunset Bay
East London, 5201

TEL : 043 004 0004
CELL : 068 001 9670
EMAIL : info@geosoils.co.za
WEB : www.geosoils.co.za

JOB No:	Ref. No:	0	Date:	2/2/2022
Client:	Afroteam Consultants No. 2 Merriman Street Mthatha 5100	Tel:	0	
Attention:	Igeny	Fax:	0	
				Test Pit 4



Remarks:

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Appendix C

Foundation Indicators Test Results





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BBBEE Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4670261090

+27 43 722 1940
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henryl@roadlab.co.za
52 Beaconsfield Road,
Braelyn, East London

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OUR REF : -

CLIENT : AFROTEAM CONSULTANTS

PROJECT : ALIWAL NORTH LANDFILL SITE

DATE RECEIVED : 31/01/2023

POSITION : TP 4

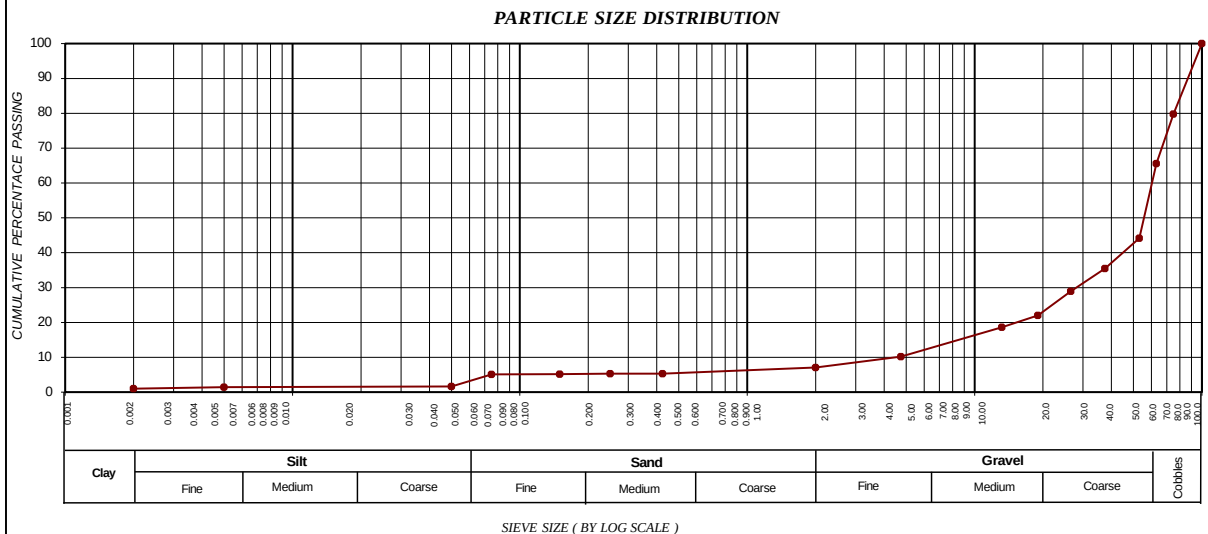
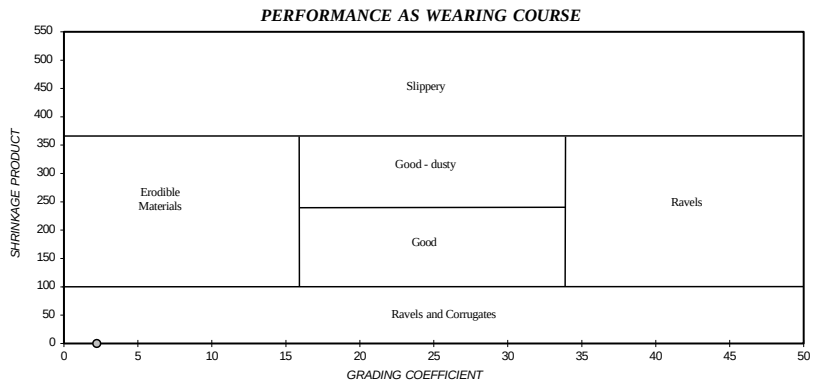
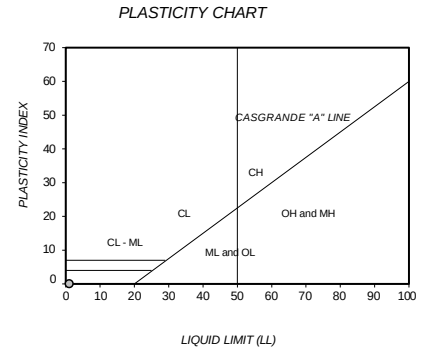
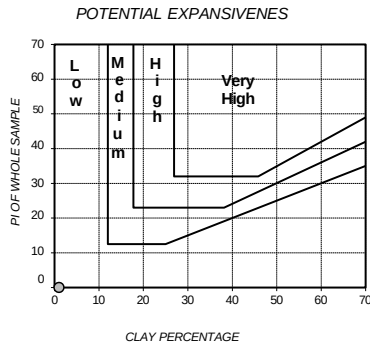
LAYER : 0.400 - 1.000

SAMPLE No. : E075

SAMPLE DESCRIPTION : Dark Brown Greyish
Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		-
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	80
	63.0	66
	50.0	44
	37.5	35
	28.0	29
	20.0	22
	14.0	19
	5.00	10
	2.000	7
	0.425	5
	0.250	5
	0.150	5
	0.075	5
Soil Mortar Analysis % < 2.00mm	50 µm	2
	5 µm	1
	2 µm	1.0
	2.000 - 0.425	25
	0.425 - 0.250	0
Effective size	0.250 - 0.150	1
	0.150 - 0.075	1
	< 0.075	72
		4.813
		12.4
Uniformity Coefficient		3.0
Curvature Coefficient		64.5
Oversize Index		0
Shrinkage Product		2.2
Grading Coefficient		2.83
Atterberg Limits	Liquid Limit	-
	Plasticity Index	NP
	Linear Shrinkage	-
	PI < 0.075	-
Unified Soil Classification		GM
U.S. Highway Classification		A-1-a (0)



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
1.0	1.6	4.5	92.9



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+27 43 722 1940
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PROJECT : ALIWAL NORTH LANDFILL SITE

DATE RECEIVED : 31/02/2023

POSITION : TP 2

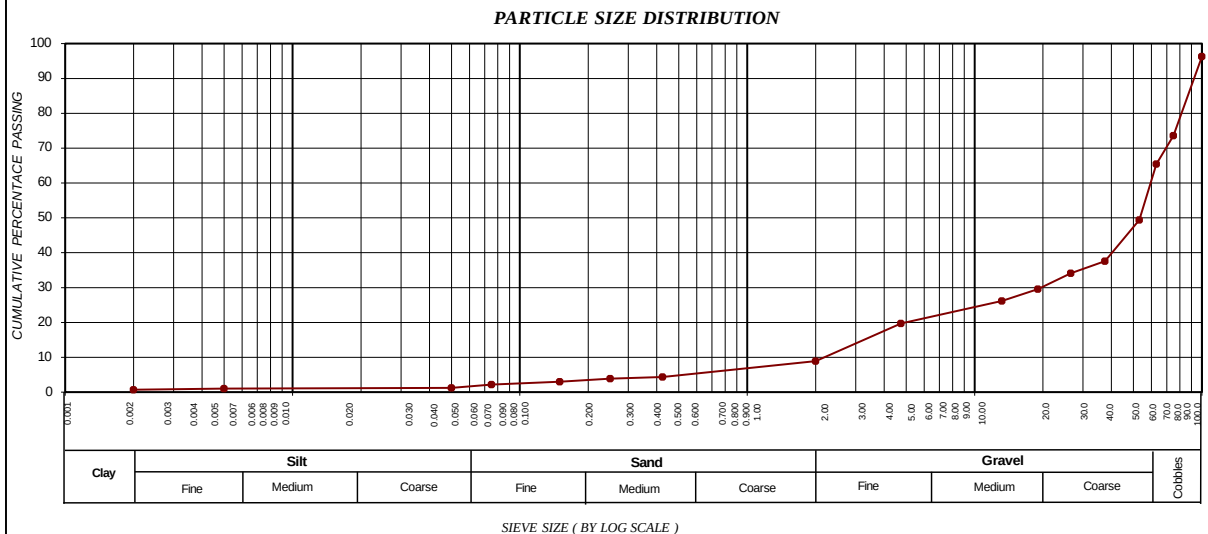
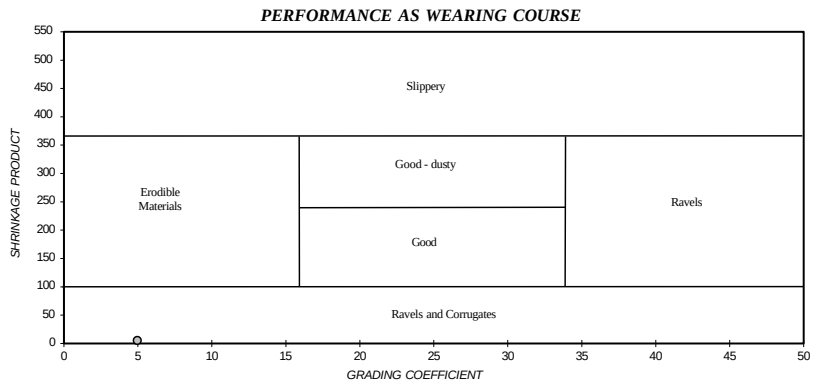
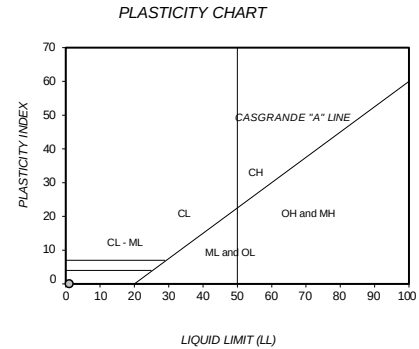
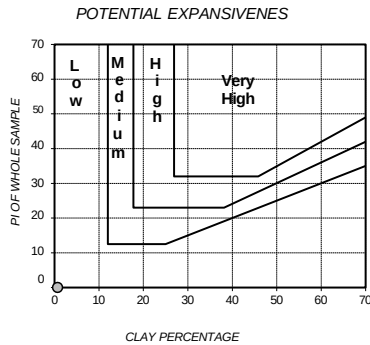
LAYER : 0.450 - 1.550

SAMPLE No. : E077

SAMPLE DESCRIPTION : Dark Brown Olive
Gravel

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		-
Sieve analysis Cumulative percentage passing (mm)	100.0	96
	75.0	74
	63.0	65
	50.0	49
	37.5	38
	28.0	34
	20.0	30
	14.0	26
	5.00	20
	2.000	9
	0.425	4
	0.250	4
	0.150	3
	0.075	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	51
	0.425 - 0.250	5
	0.250 - 0.150	9
	0.150 - 0.075	10
	< 0.075	24
Effective size		2.301
Uniformity Coefficient		25.5
Curvature Coefficient		3.2
Oversize Index		62.4
Shrinkage Product		5.2
Grading Coefficient		5.0
Grading modulus		2.85
Atterberg Limits	Liquid Limit	-
	Plasticity Index	SP
	Linear Shrinkage	1.2
	PI < 0.075	-
Unified Soil Classification		GM
U.S. Highway Classification		A-1-a (0)



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
0.7	0.7	7.5	91.1



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Registration No: 2011/005423/07
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+27 43 722 1940
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henryl@roadlab.co.za
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POSITION : TP 1

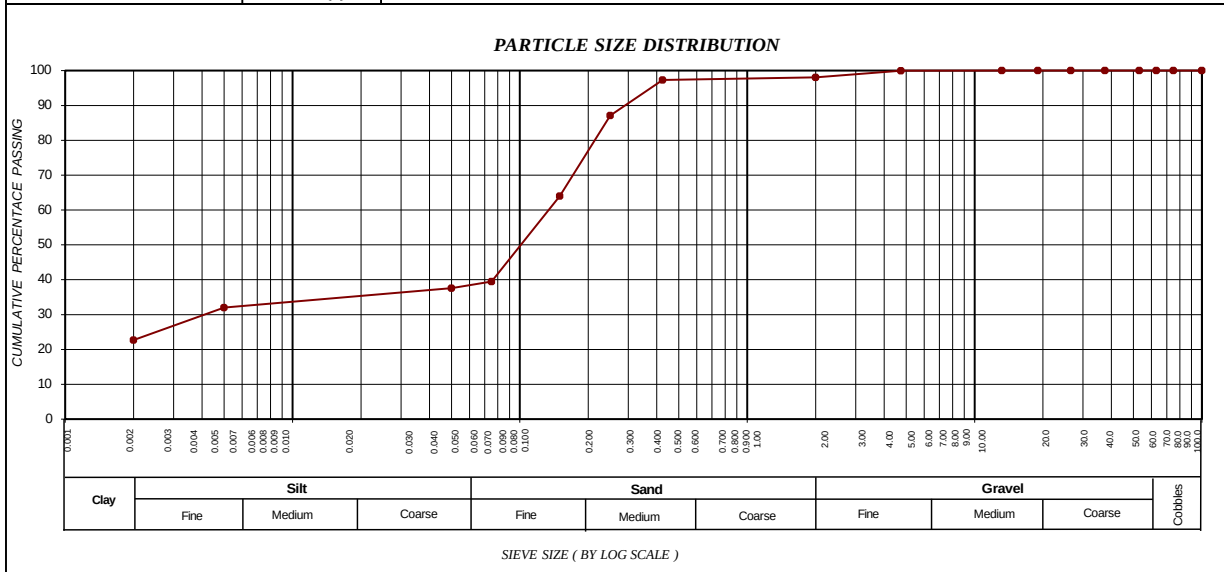
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SAMPLE No. : E061

SAMPLE DESCRIPTION : Dark Reddish Brown
Silty Clayey Sand

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		12.7		
Sieve analysis Cumulative percentage passing (mm)	100.0	100	POTENTIAL EXPANSIVENES CLAY PERCENTAGE PLASTICITY CHART LIQUID LIMIT (LL)	
	75.0	100		
	63.0	100		
	50.0	100		
	37.5	100		
	28.0	100		
	20.0	100		
	14.0	100		
	5.00	100		
	2.000	98		
	0.425	97		
	0.250	87		
	0.150	64		
	0.075	40		
	50 µm	38		
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1	PERFORMANCE AS WEARING COURSE SHRINKAGE PRODUCT GRADING COEFFICIENT	
	0.425 - 0.250	10		
	0.250 - 0.150	24		
	0.150 - 0.075	25		
	< 0.075	40		
Effective size		0.002		
Uniformity Coefficient		68.8		
Curvature Coefficient		0.1		
Oversize Index		0.0		
Shrinkage Product		583.9		
Grading Coefficient		1.9		
Grading modulus		0.65		
Atterberg Limits	Liquid Limit	42		
	Plasticity Index	13		
	Linear Shrinkage	6.0		
	PI < 0.075	-		
Unified Soil Classification		SM		
U.S. Highway Classification		A-7-6 (2)		



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
22.7	16.2	59.1	1.9



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BBBEE Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4670261090

+27 43 722 1940
+27 64 611 1239
henryl@roadlab.co.za
52 Beaconsfield Road,
Braelynn, East London

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CLIENT : AFROTEAM CONSULTANTS

PROJECT : ALIWAL NORTH LANDFILL SITE

DATE RECEIVED : 31/01/2023

POSITION : TP 2

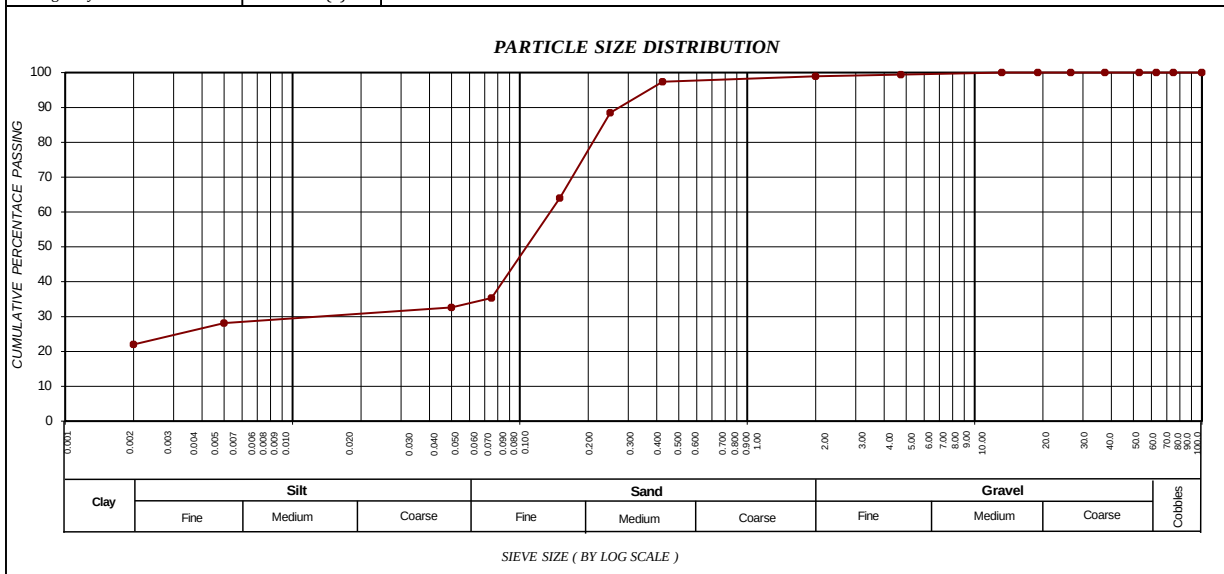
LAYER : 0.0 - 0.450

SAMPLE No. : E070

SAMPLE DESCRIPTION : Dark Reddish Brown
Silty Clayey Sand

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		11.7		
Sieve analysis Cumulative percentage passing (mm)	100.0	100	POTENTIAL EXPANSIVENES PLASTICITY CHART	
	75.0	100		
	63.0	100		
	50.0	100		
	37.5	100		
	28.0	100		
	20.0	100		
	14.0	100		
	5.00	99		
	2.000	99		
	0.425	97		
	0.250	88		
	0.150	64		
	0.075	35		
	50 µm	33		
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2	PERFORMANCE AS WEARING COURSE	
	0.425 - 0.250	9		
	0.250 - 0.150	25		
	0.150 - 0.075	29		
	< 0.075	36		
Effective size		0.002		
Uniformity Coefficient		69.8		
Curvature Coefficient		2.1		
Oversize Index		0.0		
Shrinkage Product		584.4		
Grading Coefficient		1.1		
Grading modulus		0.69		
Atterberg Limits	Liquid Limit	40		
	Plasticity Index	12		
	Linear Shrinkage	6.0		
	PI < 0.075	-		
Unified Soil Classification		SM		
U.S. Highway Classification		A-2-6 (0)		



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
22.0	11.6	65.3	1.1



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VAT No: 4670261090

+27 43 722 1940
+27 64 611 1239
henryl@roadlab.co.za
52 Beaconsfield Road,
Braelynn, East London

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CLIENT : AFROTEAM CONSULTANTS

PROJECT : ALIWAL NORTH LANDFILL SITE

DATE RECEIVED : 31/01/2023

POSITION : TP 4

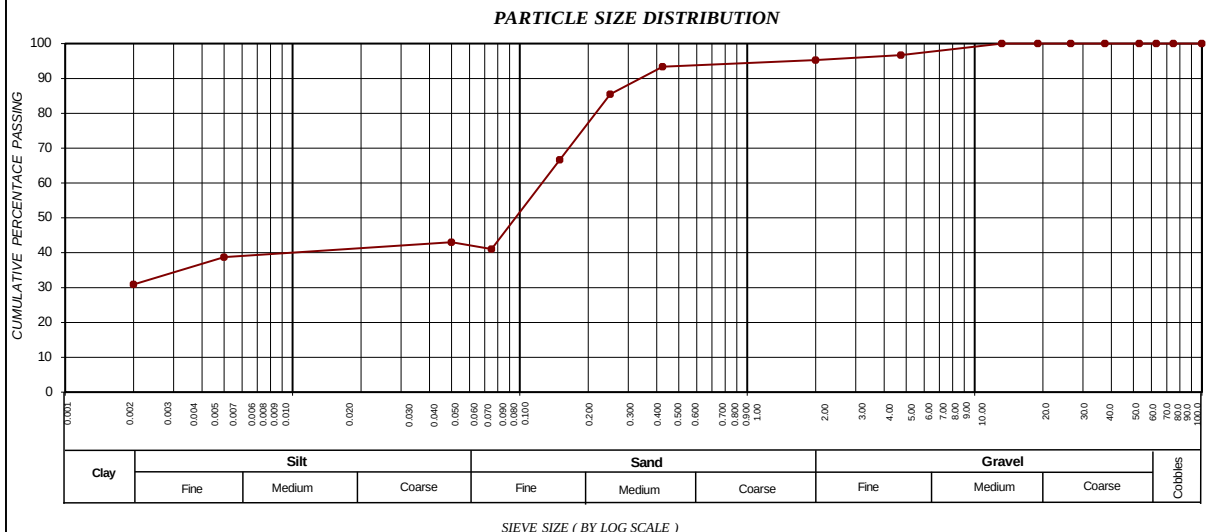
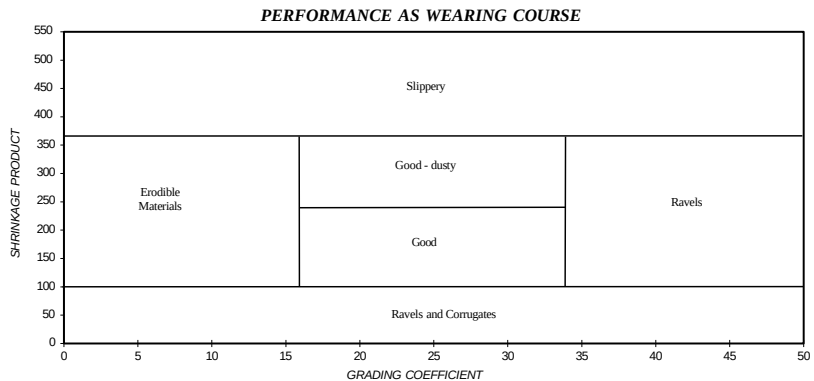
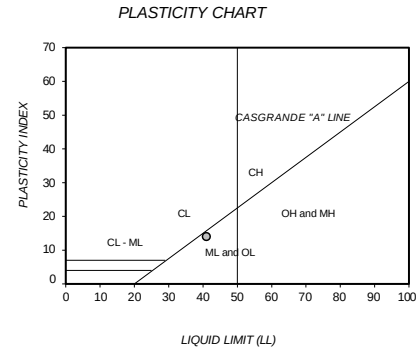
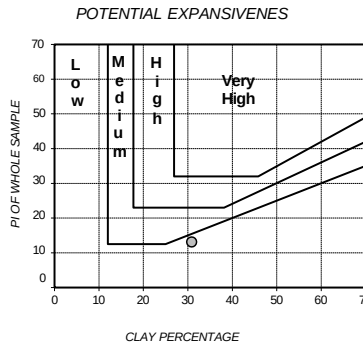
LAYER : 0.0 - 0.400

SAMPLE No. : E072

SAMPLE DESCRIPTION : Dark Reddish Brown
Silty Clayey Sand

FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		13.1
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	100
	14.0	100
	5.00	97
	2.000	95
	0.425	93
	0.250	86
	0.150	67
	0.075	41
	50 µm	43
	5 µm	39
	2 µm	30.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	8
	0.250 - 0.150	20
	0.150 - 0.075	27
	< 0.075	43
Effective size		0.002
Uniformity Coefficient		65.2
Curvature Coefficient		0.0
Oversize Index		0.0
Shrinkage Product		653.5
Grading Coefficient		4.6
Grading modulus		0.70
Atterberg Limits	Liquid Limit	41
	Plasticity Index	14
	Linear Shrinkage	7.0
	PI < 0.075	-
Unified Soil Classification		SM
U.S. Highway Classification		A-7-6 (2)



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
30.9	12.5	51.9	4.8

Appendix D

Compaction Test Results





Roadlab Laboratories (Pty) Ltd

Civil Materials Testing
BBBEE Level 1 Contributor
 Registration No: 2011/005423/07
 VAT No: 4670261090

+27 43 722 1940
 +27 82 609 6118
 brian@roadlab.co.za
 10 St Pauls Road
 Northend, East London,
 5200

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Our Ref - 01-0001-23

Req No - RE4571

Date - 16/02/2023

Afroteam Consultants

No. 2 Merriman Street
 Mthatha
 5100

Attention: Igeny Shone

Dear Sir

TEST REPORT

Project ALIWAL NORTH LANDFILL SITE

Please find the attached test results for the sample/s as submitted to and tested by Roadlab Laboratories (PTY) Ltd. In East London.
 The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES

SAMPLE No.				
CONTAINER USED FOR SAMPLING	E061			
SIZE / WEIGHT OF SAMPLE	80kg			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL	Moist			
HOLE No. / Km. / CHAINAGE	TP 1			
ROAD No. OR NAME	N/A			
LAYER TESTED / SAMPLED FROM	0.00 - 0.300mm			
DATE SAMPLED	31/01/2023			
DATE TESTED	31/01/2023			
CLIENT'S MARKING	Not Specified			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)	Dark Reddish Brown Silty Clay Sand			

SIEVE ANALYSIS - % PASSING SIEVES (SANS 300 - GR1 : 2013)

SIEVE ANALYSIS SANS GR1 : 2013 % PASSING	75.0	100			
	63.0	100			
	50.0	100			
	37.5	100			
	28.0	100			
	20.0	100			
	14	100			
	5	100			
	2.00	98			
	0.425	97			
0.075	39				

SOIL MORTAR ANALYSIS *(SANS - PR5 : 2011)

Soil Mortar	98		
Coarse Sand	1		
Fine Sand	59		
Coarse Fine Sand	10		
Medium Fine Sand	23		
Fine Fine Sand	26		
Silt & Clay	40		
Coarse Sand Ratio	0		

ATTERBERG LIMITS ANALYSIS (SANS 3001 - GR10 : 2013)

ATTERBERG LIMITS (%) SANS 3001 GR10 : 2013	LL%	42.0		
	P.I.	13.0		
	LS%	6.0		
	GM	0.70		
CLASSIFICATION	H.R.B.*	*		
	COLTO*	<G10		
	T.R.H. 14*	<G10		

CALIFORNIA BEARING RATIO (SANS 3001 - GR30 : 2015, SANS 3001 - GR40 : 2014)

SANS 3001 GR30 : 2015	OMC%	12.4		
	MDD(KG/M³)	1909		
	COMP MC %	12.0		
	% SWELL	1.40		
C.B.R SANS 3001 GR40 : 2014	100%	5		
	98%	4		
	97%	4		
	95%	3		
	93%	3		
	90%	2		
MOD ITS : DRY (kPa) (GR54)		N/A		
ITS @ 95% : DRY (kPa)		N/A		
STABILISED WITH	IN LAB	N/A		
	ON SITE	N/A		
TEST TYPE		Indicator, MDD, CBR		
SAMPLED BY		T.Buyisile		
DELIVERED BY		T.Buyisile		
SAMPLING METHOD		TMH5 - MC 1		
ENVIRONMENTAL CONDITION WHEN SAMPLED		Clear		

REMARKS & NOTES

Kind Regards

Brian Taleli
 Technical Signatory



Remarks :

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The samples were subjected to analysis according to SANS 3001

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Civil Materials Testing
BBBEE Level 1 Contributor
 Registration No: 2011/005423/07
 VAT No: 4670261090

+27 43 722 1940
 +27 82 609 6118
 brian@roadlab.co.za
 10 St Pauls Road
 Northend, East London,
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 Mthatha
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TEST REPORT
Project ALIWAL NORTH LANDFILL SITE

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 The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES

SAMPLE No.				
CONTAINER USED FOR SAMPLING	E070			
SIZE / WEIGHT OF SAMPLE	80kg			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL	Moist			
HOLE No. / Km. / CHAINAGE	TP 2			
ROAD No. OR NAME	N/A			
LAYER TESTED / SAMPLED FROM	0.00 - 0.450mm			
DATE SAMPLED	31/01/2023			
DATE TESTED	31/01/2023			
CLIENT'S MARKING	Not Specified			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)	Dark Reddish Brown Silty Clay Sand			

SIEVE ANALYSIS - % PASSING SIEVES (SANS 300 - GR1 : 2013)

SIEVE ANALYSIS SANS GR1 : 2013 % PASSING	75.0	100			
	63.0	100			
	50.0	100			
	37.5	100			
	28.0	100			
	20.0	100			
	14.0	100			
	5.0	99			
	2.00	99			
	0.425	98			
0.075	36				

SOIL MORTAR ANALYSIS *(SANS - PR5 : 2011)

Soil Mortar	99			
Coarse Sand	1			
Fine Sand	63			
Coarse Fine Sand	9			
Medium Fine Sand	25			
Fine Fine Sand	28			
Silt & Clay	36			
Coarse Sand Ratio	0			

ATTERBERG LIMITS ANALYSIS (SANS 3001 - GR10 : 2013)

ATTERBERG LIMITS (%) SANS 3001 GR10 : 2013	LL%	40.0		
	P.I.	12.0		
	LS%	6.0		
	GM	0.70		
CLASSIFICATION	H.R.B.*	-		
	COLTO*	G10		
	T.R.H. 14*	G10		

CALIFORNIA BEARING RATIO (SANS 3001 - GR30 : 2015, SANS 3001 - GR40 : 2014)

SANS 3001 GR30 : 2015	OMC%	12.1		
	MDD(KG/M³)	1853		
	COMP MC %	12.4		
	% SWELL	2.10		
C.B.R SANS 3001 GR40 : 2014	100%	3		
	98%	3		
	97%	2		
	95%	2		
	93%	2		
	90%	1		
MOD ITS : DRY (kPa) (GR54)		N/A		
ITS @ 95% : DRY (kPa)		N/A		
STABILISED WITH	IN LAB	N/A		
	ON SITE	N/A		
TEST TYPE		Indicator, MDD, CBR		
SAMPLED BY		T.Buyisile		
DELIVERED BY		T.Buyisile		
SAMPLING METHOD		TMH5 - MC 1		
ENVIRONMENTAL CONDITION WHEN SAMPLED		Clear		

REMARKS & NOTES

Kind Regards

Brian Taleli
 Technical Signatory



Remarks :

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 Registration No: 2011/005423/07
 VAT No: 4670261090

+27 43 722 1940
 +27 82 609 6118
 brian@roadlab.co.za
 10 St Pauls Road
 Northend, East London,
 5200

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 Mthatha
 5100

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 The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES

SAMPLE No.				
CONTAINER USED FOR SAMPLING	E072			
SIZE / WEIGHT OF SAMPLE	80kg			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL	Moist			
HOLE No. / Km. / CHAINAGE	TP 4			
ROAD No. OR NAME	N/A			
LAYER TESTED / SAMPLED FROM	0.00 - 0.400mm			
DATE SAMPLED	31/01/2023			
DATE TESTED	31/01/2023			
CLIENT'S MARKING	Not Specified			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)	Light Yellowish Brown Silty Clay Sand			

SIEVE ANALYSIS - % PASSING SIEVES (SANS 300 - GR1 : 2013)

SIEVE ANALYSIS SANS GR1 : 2013 % PASSING	75.0	100			
	63.0	100			
	50.0	100			
	37.5	100			
	28.0	100			
	20.0	100			
	14.0	100			
	5.0	100			
	2.00	97			
	0.425	93			
	0.075	40			

SOIL MORTAR ANALYSIS *(SANS - PR5 : 2011)

Soil Mortar	95		
Coarse Sand	2		
Fine Sand	56		
Coarse Fine Sand	8		
Medium Fine Sand	20		
Fine Fine Sand	27		
Silt & Clay	42		
Coarse Sand Ratio	0		

ATTERBERG LIMITS ANALYSIS (SANS 3001 - GR10 : 2013)

ATTERBERG LIMITS (%) SANS 3001 GR10 : 2013	LL%	41.0		
	P.I.	14.0		
	LS%	7.0		
GM		0.70		
CLASSIFICATION	H.R.B.*	A-6		
	COLTO*	G10		
	T.R.H. 14*	G10		

CALIFORNIA BEARING RATIO (SANS 3001 - GR30 : 2015, SANS 3001 - GR40 : 2014)

SANS 3001 GR30 : 2015	OMC%	14.6			
	MDD(KG/M³)	1789			
	COMP MC %	14.3			
C.B.R SANS 3001 GR40 : 2014	% SWELL	3.80			
	100%	2			
	98%	2			
	97%	2			
	95%	1			
	93%	1			
	90%	1			
MOD ITS : DRY (kPa) (GR54)		N/A			
ITS @ 95% : DRY (kPa)		N/A			
STABILISED WITH	IN LAB	N/A			
	ON SITE	N/A			
TEST TYPE		Indicator, MDD, CBR			
SAMPLED BY		T.Buyisile			
DELIVERED BY		T.Buyisile			
SAMPLING METHOD		TMH5 - MC 1			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Clear			

REMARKS & NOTES

Kind Regards

Brian Taleli
 Technical Signatory



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Civil Materials Testing
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Registration No: 2011/005423/07
VAT No: 4670261090

+27 43 722 1940
+27 64 611 1239
henryl@roadlab.co.za
52 Beaconsfield Road,
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Mthatha
5100

Attention: Igeny Shone

Dear Sir

Project **TEST REPORT**
ALIWAL NORTH LANDFILL SITE

Please find the attached test results for the sample/s as submitted to and tested by Roadlab Laboratories (PTY) Ltd. In East London.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES

SAMPLE No.				
CONTAINER USED FOR SAMPLING	E075			
SIZE / WEIGHT OF SAMPLE	80kg			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL	Moist			
HOLE No. / Km. / CHAINAGE	TP 4			
ROAD No. OR NAME	N/A			
LAYER TESTED / SAMPLED FROM	0.400 - 1.000mm			
DATE SAMPLED	31/01/2023			
DATE TESTED	31/01/2023			
CLIENT'S MARKING	Not Specified			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)	Dark Brown Greyish Dolorite Gravel			

SIEVE ANALYSIS - % PASSING SIEVES (SANS 300 - GR1 : 2013)

SIEVE ANALYSIS SANS GR1 : 2013 % PASSING	75.0	80		
	63.0	66		
	50.0	44		
	37.5	35		
	28.00	29		
	20.0	22		
	14	19		
	5	10		
	2.00	7		
	0.425	5		
0.075	5			

SOIL MORTAR ANALYSIS *(SANS - PR5 : 2011)

Soil Mortar	7		
Coarse Sand	75		
Fine Sand	0		
Coarse Fine Sand	0		
Medium Fine Sand	0		
Fine Fine Sand	0		
Silt & Clay	7		
Coarse Sand Ratio	0.3		

ATTERBERG LIMITS ANALYSIS (SANS 3001 - GR10 : 2013)

ATTERBERG LIMITS (%) SANS 3001 GR10 : 2013	LL%	-		
	P.I.	NP		
	LS%	-		
GM		2.83		
CLASSIFICATION	H.R.B.*	-		
	COLTO*	G6		
	T.R.H. 14*	G6		

CALIFORNIA BEARING RATIO (SANS 3001 - GR30 : 2015, SANS 3001 - GR40 : 2014)

SANS 3001 GR30 : 2015	OMC%	6.5		
	MDD(KG/M³)	2348		
	COMP MC %	6.5		
	% SWELL	0.10		
C.B.R SANS 3001 GR40 : 2014	100%	75		
	98%	55		
	97%	47		
	95%	34		
	93%	25		
	90%	15		
MOD ITS : DRY (kPa) (GR54)		N/A		
ITS @ 95% : DRY (kPa)		N/A		
STABILISED WITH	IN LAB	N/A		
	ON SITE	N/A		
TEST TYPE	Indicator, Mod, CBR			
SAMPLED BY	By Client			
DELIVERED BY	By Client			
SAMPLING METHOD	By Client			
ENVIRONMENTAL CONDITION WHEN SAMPLED	Clear			
REMARKS & NOTES				

Kind Regards

Brian Taleli
Technical Signatory



T0860

Remarks :

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Civil Materials Testing
BBBEE Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4670261090

+27 43 722 1940
+27 64 611 1239
henryl@roadlab.co.za
52 Beaconsfield Road,
Braelyn, East London

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No. 2 Merriman Street
Mthatha
5100

Attention: Igeny shone

Dear Sir

Project **TEST REPORT**
ALI WAL NORTH LANDFILL SITE

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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES

SAMPLE No.	E077			
CONTAINER USED FOR SAMPLING	Bag			
SIZE / WEIGHT OF SAMPLE	80kg			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL	Moist			
HOLE No. / Km. / CHAINAGE	TP 2			
ROAD No. OR NAME	N/A			
LAYER TESTED / SAMPLED FROM	0.450 - 1.550mm			
DATE SAMPLED	31/01/2023			
DATE TESTED	31/01/2023			
CLIENT'S MARKING	Not Specified			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)	Dark Reddish Brown Silty Clay Sand			

SIEVE ANALYSIS - % PASSING SIEVES (SANS 300 - GR1 : 2013)

SIEVE ANALYSIS SANS GR1 : 2013 % PASSING	75.0	74			
	63.0	65			
	50.0	49			
	37.5	38			
	28.0	34			
	20.0	30			
	14	26			
	5	20			
	2.00	9			
	0.425	4			
0.075	2				

SOIL MORTAR ANALYSIS *(SANS - PR5 : 2011)

Soil Mortar	9		
Coarse Sand	44		
Fine Sand	33		
Coarse Fine Sand	11		
Medium Fine Sand	11		
Fine Fine Sand	11		
Silt & Clay	22		
Coarse Sand Ratio	0.4		

ATTERBERG LIMITS ANALYSIS (SANS 3001 - GR10 : 2013)

ATTERBERG LIMITS (%) SANS 3001 GR10 : 2013	LL%	0.0		
	P.I.	SP		
	LS%	1.2		
GM		2.85		
CLASSIFICATION	H.R.B.*	-		
	COLTO*	G6		
	T.R.H. 14*	G7		

CALIFORNIA BEARING RATIO (SANS 3001 - GR30 : 2015, SANS 3001 - GR40 : 2014)

SANS 3001 GR30 : 2015	OMC%	6.0		
	MDD(KG/M³)	2067		
	COMP MC %	6.0		
	% SWELL	0.10		
C.B.R SANS 3001 GR40 : 2014	100%	68		
	98%	48		
	97%	41		
	95%	29		
	93%	21		
	90%	12		
MOD ITS : DRY (kPa) (GR54)		N/A		
ITS @ 95% : DRY (kPa)		N/A		
STABILISED WITH	IN LAB	N/A		
	ON SITE	N/A		
TEST TYPE	Indicator, Mod, CBR			
SAMPLED BY	By Client			
DELIVERED BY	By Client			
SAMPLING METHOD	By Client			
ENVIRONMENTAL CONDITION WHEN SAMPLED	Clear			
REMARKS & NOTES				

Kind Regards

Brian Taleli
Technical Signatory



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Remarks :

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