Engineering Geological Report

In support of the proposed

Township Establishment on
Erf 266 and the Remainder of Erf 21
Riversdale

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The information presented in this document is based on the information supplied by the Client prior to the commencement of the investigation. All care and diligence have been taken in rendering services and preparing these documents.

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1. Introduction

This report describes the results of a geotechnical site investigation in support of the proposed township establishment on Erf266 and the Remainder of Erf21, located on the western outskirts of the town of Riversdale in the Western Cape. The development entails the construction of various residential units and associated internal roads network.

1.1. Terms of Reference

Terra Geotechnical was appointed in November 2021 by Mr G Pepler (representing Belladonna (Pty) Ltd), to conduct this geotechnical investigation. The area of the investigation was defined and approved before the commencement of the investigation. The distribution of testing locations and the associated sampling were done where physically possible and to best model the geotechnical character of the site for this specific development. Testing frequency was discussed and approved by the engineer during the quotation phase and were guided by the standards provided by the *SANS 634: "Geotechnical Investigations for Township Development"*.

The quantity and nature of samples were governed by the nature of the proposed development and the in-situ characteristics of the material excavated across the site.

1.2. Sources of Information

The following sources of information were utilized:

- Remote Sensing Information:
- Google Earth Pro TM
- Elevation Heat Map; Online Resource
- Planet GIS

1.3. Objectives

The investigation had the following aims:

- identify potential hazards
- to determine and evaluate the mechanical properties of the soil material occurring within the boundaries of the study area regarding the construction of low load bearing buildings
- define the ground conditions and classify the conditions through detailed soil profile descriptions and groundwater occurrences within the zone of influence of foundations
- to determine the reusability of the natural soil materials during the construction phase
- to evaluate site excavatability
- to recommend measures to be implemented during design and development of the area

The development potential of the study area is assessed based on the following premises:

- Construction of low load bearing structures incorporating shallow foundations.

It must be noted that this investigation was conducted to assist with the design and construction phases.

2. General Location and Description of Site

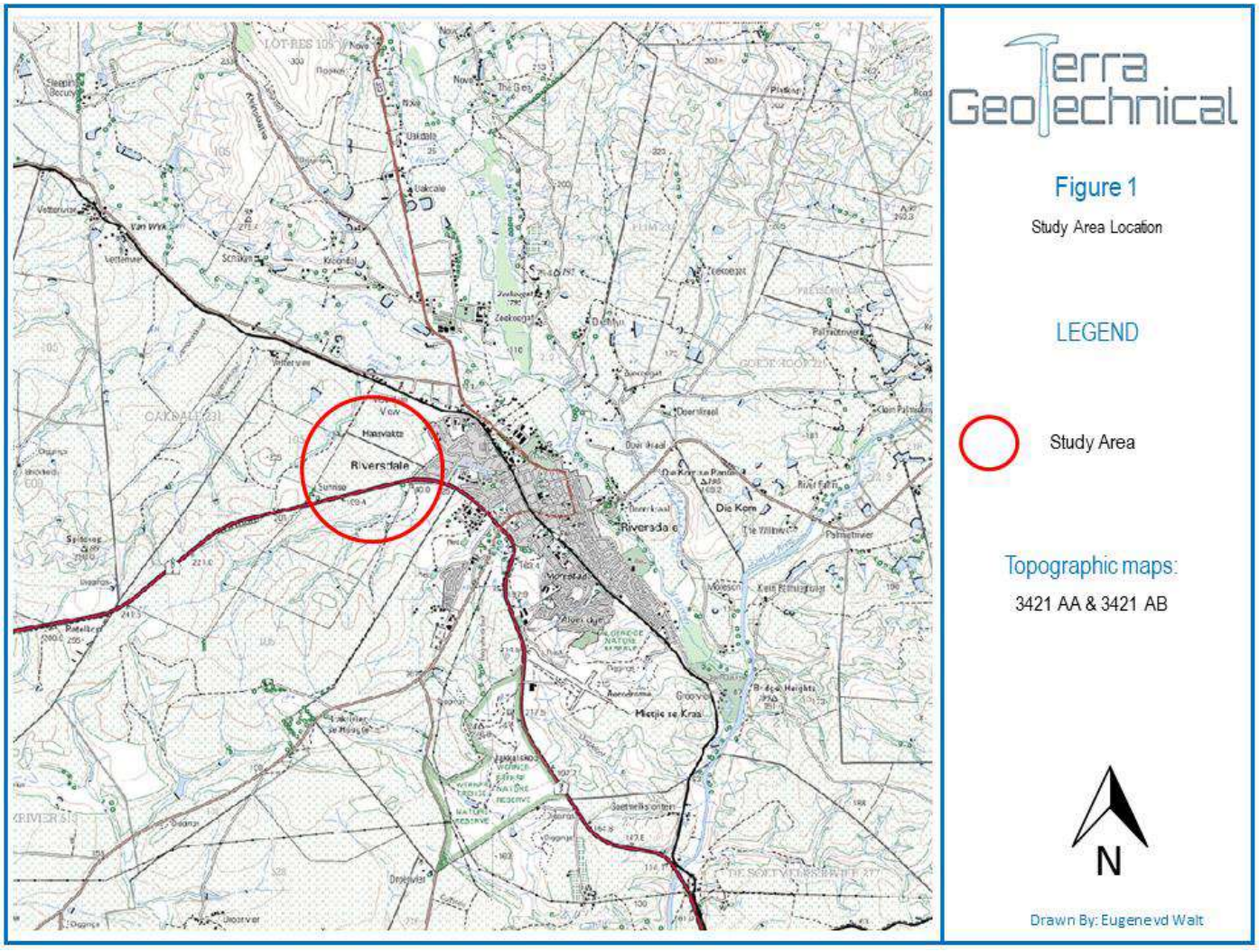
2.1. Location

The study area for this investigation is located on the western outskirts of the town of Riversdale, forming part of the Hessequa Municipality. The site is defined as a portion of the Remainder of Lot 21 and Lot 266.

Figure 1 graphically depicts the location of the study area.

The site is located roughly at the following coordinates:

Latitude: 34.086780° S Longitude: 21.231822° E



The site is further located on an open (undeveloped) parcel of land directly west of the residential development of Riversdale. This open parcel of land is currently being utilized as part of the Oakdale farming activities. Furthermore, the site is bordered to the south by the National Highway 2 (N2). The site has a total surface area of approximately 56 ha.

2.1. Topography

A single ridge type structure located to the west of the site gives rise to a variable topography with gentle to moderate sloping landscapes. The weaker strata are typically weathered and eroded to form incised valley features.

The site is located on the eastern foot slope of the ridge feature and displays a gentle sloping morphology, decreasing in elevation towards the east.

The colour coded image below depicts the topographic nature of the study area, with the higher lying structures depicted by the red/orange and the lower lying valley structures depicted by the blue/green colours

Image 2A: Regional topography and elevation

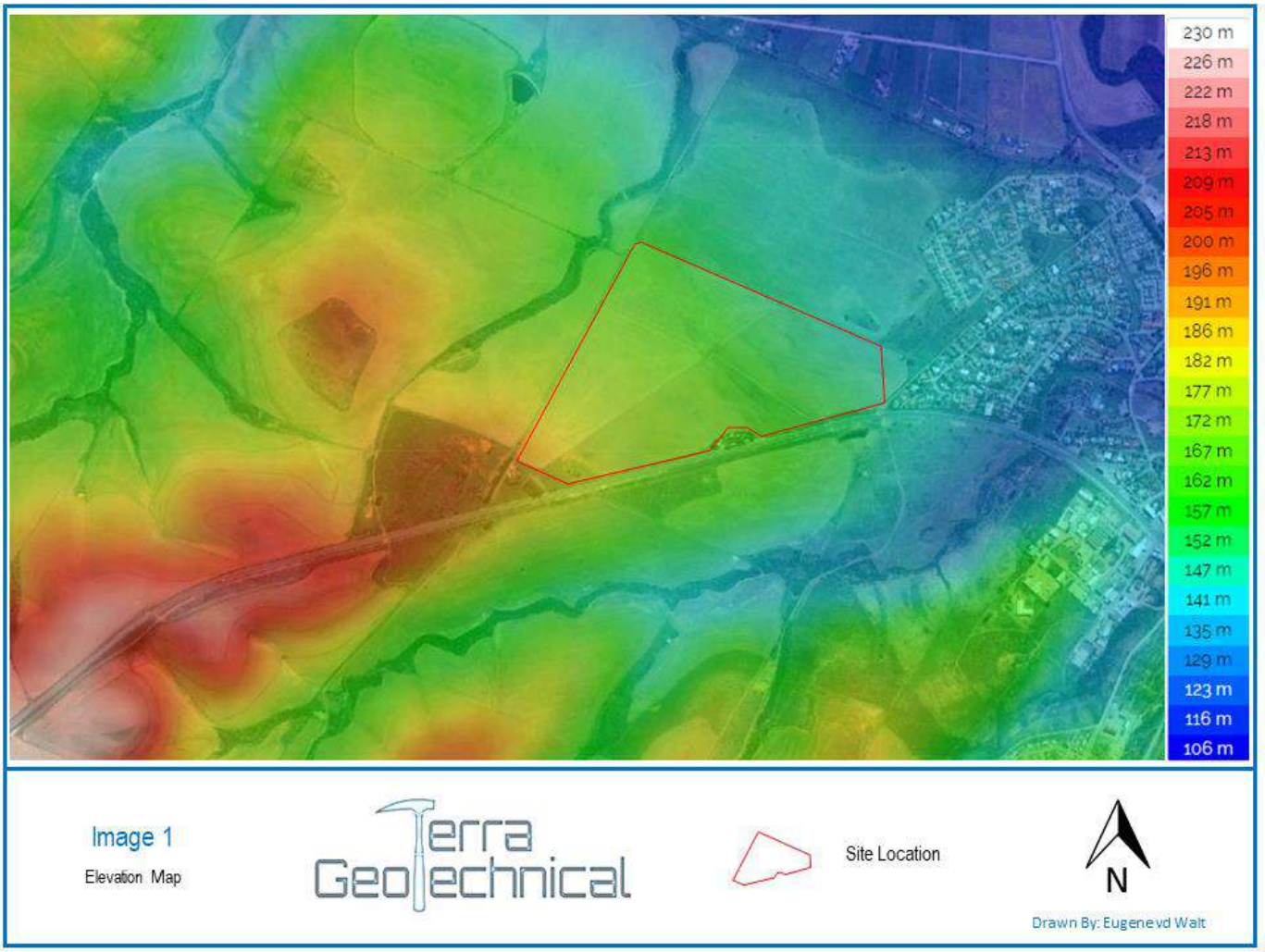


Figure 2 below visually depicts the current site conditions. The site is currently undeveloped and seen to be utilized for farming activities. The image shows the 5m contour lines indicating a drop in elevation from west to east. Various non-perennial drainage channels occur around the site, but none are identified to traverse the site. On the upper western portion, the site is approximately 190 m above mean sea level, and at its lowest point on the east, the site is approximately 140 m above mean sea level.

The site is seen to host gentle slopes of between 1 and 3 degrees

2.2. Drainage

The study area is located in the Breede-Gouritz Water Management Area, with the area falling within Quaternary Catchment Area H90C.

The study area is drained mainly by means of surface run-off (i.e.: sheetwash), with storm water eventually flowing into the Vet River to the east of the site. The natural drainage east the site has been altered due to the built-up nature of the area (construction of roads, buildings and installation of storm water services).

2.3. Climate

The study area experiences rainfall throughout the year. The mean annual precipitation is approximately 407 mm. Mean monthly minimum and maximum temperatures are 12˚C in July and 21˚C in February.

The climatic N-value (Weinert, 1980) of the area is deemed to be less than 5; therefore, chemical decomposition rather than mechanical disintegration, of the parent rocks is deemed the principal mode of weathering.

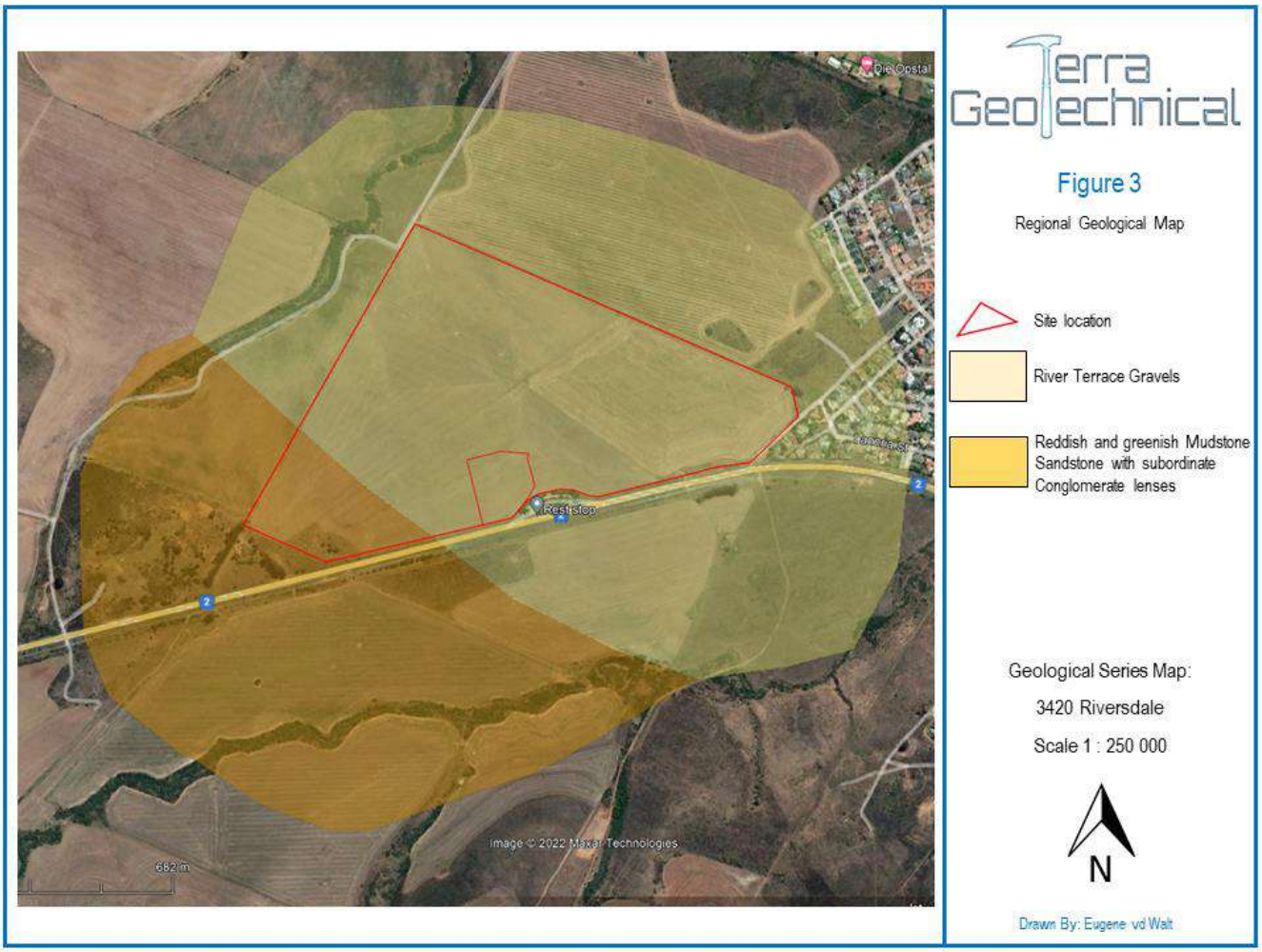
3. Geological Setting

3.1. Regional Geological Setting

According to the 1:250 000 scale geology map 3420 Riversdale, the study area hosts at least two geological formations with the contact on the western edge of the site. According to the geology map, the site is predominantly underlain by Tertiary aged River Terrace Gravels, with the western edge underlain by sediments of the Kirkwood Formation consisting of Reddish and Greenish Mudstone and Sandstone with subordinate Conglomerate lenses forming part of the Uitenhage Group.

During the investigation, the presence of both these geological units were observed.

The regional geological setting of the study area (minus the surficial soil cover) is illustrated by Figure 3.



The study area does not reflect any risk for the formation of sinkholes or subsidence caused by the presence of water-soluble rocks (dolomite or limestone), and as such is not deemed “dolomitic land

3.2. General Material Properties of Geological Strata

According to A.B.A. Brink, (*Engineering Geology of South Africa Volume 4, Post Gondwana Deposits*, *1985),* the predominantly argillaceous sediments of the Kirkwood Formation is generally very soft rock and soft rock consistency in fresh or partially weathered states, but usually display properties similar to those of highly overconsolidated clay. Their engineering behaviours is thus controlled by properties of the material rather than by the structural properties of the rock mass. The rock mass is generally very impervious. The intact mudstones become unstable on the absorption of water, but display quite variable slaking rates involving equally variable but significant swell pressures after drying.

Residual and transported soils derived from the Kirkwood sediments are almost always clayey, with the activity varying in relation to composition. The major engineering problems associated with these soils are the volumetric changes associated with wetting and drying.

The Kirkwood Sediments do not provide any notable sources of construction materials, mainly due to the poorly consolidated nature and activity of the clays.

4. Geotechnical Field Investigation and Laboratory Testing

4.1. Reconnaissance Study

The investigation commenced with the conducting of the following actions:

- The collation and evaluation of available geological and geotechnical information, with specific reference to previous geotechnical investigations undertaken within the vicinity.
- The compilation of a base map showing the regional geological setting

4.2. Site Investigation

The field work phase was conducted over various days by Terra Geotechnical during December 2021 and January 2022. Test pits were placed throughout the study area in such a way as to accurately describe the general soil conditions occurring within the boundaries of the study area. The succession of soil and rock layers exposed within the test pits were logged according to the industry-standard method proposed by Jennings et al (1973), and a series of detailed photographs were taken of the different soil layers, and samples were taken of the soil- and rock material deemed to be important to the proposed development.

DCP tests were conducted at various locations scattered across the site, however, due to the frequent gravel, cobbles and boulders encountered across the site which hampered the testing, the results are not deemed relevant.

4.3. Laboratory Testing

The following tests were conducted on soil samples taken during the field work phase:

- Standard foundation indicator tests were conducted on disturbed soil samples in order to determine its composition (i.e.: the relative percentages of gravel, sand, silt and clay present within each sample), to evaluate the heave and compressibility potential of these soils, and to calculate the maximum heave and/or differential settlement that can be expected. The following tests were conducted:
    - ❖ Atterberg Limits (Liquid Limit and Plasticity Index) and Linear Shrinkage
    - ❖ Particle-size distribution
- Standard road indicator tests were conducted on bulk soil samples in order to determine its composition, and to evaluate the suitability of the materials for use in the construction of access roads and parking areas. These tests were conducted:
    - ❖ Maximum Dry Density versus Optimum Moisture Content
    - ❖ Californian Bearing Ratio versus Compaction Effort (MOD AASHTO method)
- Specialised Geotechnical testing on the Undisturbed samples were conducted by Steyn-Wilson laboratory (Cape Town) in order to determine the in-situ properties of the material present across the site. The following tests were conducted:
    - ❖ Consolidation test (Single Oedometer).
    - ❖ Swell Potential

5. Geotechnical Setting

5.1. Trenching

5.1.1. Excavation of test pits

A total of 31 test pits, numbered TP1 to TP31, were excavated across the site, by means of a TLB-type light mechanical excavator during the site investigation, at which time the exposed soil layers were profiled. Figure 4 on the following page depicts the test pit layout superimposed on the proposed developmental layout.

5.1.2. Generalised engineering geological parameters

The following general engineering geological characteristics were noted:

- **Site Excavatability**

Across the site, the TLB-type light mechanical excavator experienced only localized difficulty to a depth of 2.5 m. This difficulty in excavation was encountered due to the presence of a boulder alluvial horizons. Difficulty was encountered within TP13 and TP26 at depths of 2.1m and 1.5m respectively.

No problems are foreseen during the excavation of **shallow foundations,** with **localized difficulty** expected during the excavation of **deep service trenches** to a depth of at least 2.5 m below the existing ground level, through the use of a TLB-type light mechanical excavator.

The excavation type to a depth of at least 2.50 m below the existing ground level is deemed to be **Soft Excavation**, with **localized Intermediate Excavation** (SANS 1200D).

- **Rock- and/or pedocrete outcrops**

Bedrock or pedocrete outcrops were not encountered within the investigated area.

- **Sidewall stability**

The sidewalls of all test pits generally remained stable for at least 1 hour.

- **Groundwater seepage**

Groundwater seepage was encountered throughout the study area in many of the test pits excavated. Pedogenic material (ferricrete nodules) was also identified across the site at shallow depth, indicating the occurrence of a fluctuating water table or soil moisture evaporation. Groundwater seepage was generally encountered at the contact of the boulder alluvium and the underlying less permeable clayey horizon.

5.1.3. DCP results

DCP tests were conducted at locations across the site. Due to the presence of frequent gravels, cobbles and boulders within the profile, the results were highly variable and not deemed useful for the report.

Figure 4

Test Pit Positions

5.1.4. Generalised soil profile

Note: this description is based on field observations, and does not reflect the results of any laboratory tests

The results of the trenching phase indicate that the whole site is covered by a variable succession of soil layers. Typically, the site was covered by an alluvial boulder horizon with abundant root structures in the upper parts. This layer is typically underlain by another alluvial horizon hosting varying amounts of cobbles and boulders. Below the gravel and/or boulder horizon, a cohesive silty/clayey horizon was encountered in most test pits. Underlying these alluvial horizons, the residuum in the form of residual siltstone was exposed within approximately half of the test pits.

The table on the next page summarizes the various horizon depths encountered during the field work phase.

Boulder Alluvium:

The whole site was covered with a variable thickness of boulder alluvium. It was present as frequent rounded and sub-rounded gravels and cobbles in a matrix of slightly moist grey brown medium dense silty/clay sand. The horizon varies across the site in the size and concentration of boulders encountered, with some areas hosting boulders in excess of 1.0 m in diameter. The layer is generally clast supported. The upper portion of this layer typically hosted an abundance of roots structures. This layer was generally encountered from surface to a depth of approximately 800 mm, however, in some test pits multiple layers of this horizon was encountered and found to extend for the complete depth of the test pit (2200 mm).

In some test pits, the frequent boulder horizon was underlain by a scattered boulder horizon in a cohesive matrix deemed to also be of alluvial origin.

Alluvial horizon

Another Alluvial horizon was encountered throughout most of the site. This horizon was seen to be cohesive in nature. This layer was generally present as Generally, it was present as moist, red and orange or yellow, stiff to very stiff, clayey silt with scattered or frequent gravels. This layer was either intact or strongly structured (slickensided). Water movement in these layers were evident with the ferruginization of particles prevalent.

Scattered cobbles and boulders were also encountered within this horizon.

Residual Siltstone

In half of the test pits excavated, a residual horizon was encountered below the various alluvial horizons. This layer was generally present as moist, reddish brown, clayey/silty sand. This residual horizon is deemed to exhibit a very dense or very stiff consistency.

Detailed test pit profiles are included in Appendix A.

Soil Profile Summary					
Test Pit	Horizon Depth (mm)				Seepage Encountered (mm)
	Boulder/Cobble Alluvium	Alluvium (with scatt Cobbles)		Residual Siltstone	
	Frequent Boulders	Clayey	Gravelly		
1	0-2200				
2	0-800		800-2700		
3	0-400		400-2800		
4	0-1100		1100-3000		3000
5	0-900	900-1500		1500-3000	1000
6	0-600	600-1100		1100-2600	
7	0-1000			1000-3000	1200
8	0-800	800-2600		2600-2900	800 and 2500
9	0-800 and 1800-3100	800-1800			
10	0-600 and 1600-2400	600-1600			800
11	0-1100	1100-1800		1800-2800	
12	0-2600				
13	0-2100				
14	0-1000	1000-1500		1500-2900	
15	0-600	600-1800		1800-2800	
16	0-500	500-1600		1600-2800	from surface
17	0-500	500-1500		1500-2500	500
18	0-600	600-2200		2200-2700	600
19	0-1500		1500-2700		
20	0-2200	2200-2900			
21	0-800		800-2800		
22	0-700	700-2100		2100-2800	
23	0-500	500-2100		2100-3000	
24	0-500	500-2800			
25	0-400 and 1300-2800	400-2300			
26	0-1500				1000
27	0-1800	1800-2300			1000
28	0-900		900-2100	2100-2800	
29	0-600	600-1900		1900-2500	600
30	0-600	600-1300		1300-2600	
31	0-600		600-2700		2500

6. Geotechnical Evaluation

6.1. Engineering- and material characteristics

6.1.1. Sampling

The following samples were taken:

Disturbed samples	:	2 x Gravel Alluvium
		10 x Clayey Alluvium
	:	3 x Residual Siltstone
Bulk samples	:	1 x Gravel Alluvium
		3 x Clayey Alluvium
	:	1 x Residual Siltstone

Detailed soil test results are included in Appendix B.

It should be noted that when saturated and loaded, the soils will undergo loss of strength with the soil grains being forced into a denser state of packing and a reduction in void ratio (decrease in volume). Due to the fine grained nature of the material, the material is also deemed to be sensitive to moisture changes and will undergo heave and shrinkage with changes in moisture. The result of which is varying degrees of consolidation and heave. For this reason, the assessment and quantification of both the degree and nature of consolidation and heave, under planned foundation loads, will form the basis of the mechanical assessment of the sites' subsoils to follow.

6.1.2. Soil Test Results: Gravel Alluvium

In the light of the soil test results and visual observations, the **Gravel Alluvium** sampled across the site can be summarised as follows:

- The material has a fines fraction (passing the 0.075 mm sieve) of between 16 and 27%.
- This **plasticity** of the fines fraction of the material is measured to be between 6 and 20.
- According to the Unified Soil Classification the material classifies as a silty/clayey sand **(SM & SC)** and clayey gravel **(GC)** with a **Grading Modulus** of between **1.88 and 2.25.**
- According the to the ***van der Merwe*** method of determining **Potential expansiveness**, this material classifies as a **low risk** for potential expansiveness.

- This material is deemed to be **Potentially Compressible**

The results of road indicator tests conducted on the bulk samples of this material can be summarized as follows:

This material reacts very poorly to compaction with as CBR value of 5 at a compaction effort of 93% MOD AASHTO. This material classifies as a **worse than G9-type** material (COLTO classification system)**.**

6.1.3. Soil Test Results: Clayey Alluvium

In the light of the soil test results and visual observations, the **Clayey Alluvium** sampled across the site can be summarised as follows:

- The material has a fines fraction (passing the 0.075 mm sieve) of between 40 and 87%, with the clay fraction constituting 6-19% of the samples.
- This **plasticity** of the fines fraction of the material is deemed to vary **between 18 and 30.**
- According to the Unified Soil Classification the material classifies as a low/high plasticity clay **(CL and CH)** with a **Grading Modulus** of **between 0.14 and 1.08.**
- The **in-situ moisture content** of this material was tested to be **13.2** and **18.8%**.
- According the to the ***van der Merwe*** method of determining **Potential expansiveness**, this material classifies as a **low to high risk** for potential expansiveness.
- This material is deemed to be **Highly expansive** and **Compressible.**

The results of road indicator tests conducted on the bulk samples of this material can be summarized as follows:

This material reacts very poorly to compaction with as CBR values of between 1 and 2 at a compaction effort of 93% MOD AASHTO. This material classifies as a **worse than G9-type** material (COLTO classification system).

6.1.4. Soil Test Results: Residual Siltstone

In the light of the soil test results and visual observations, the **Residual Siltstone** sampled across the site can be summarised as follows:

- The material has a fines fraction (passing the 0.075 mm sieve) of between 62 and 82%, with the clay fraction constituting between 8.4 and 14.3% of the samples.

- This **plasticity** of the fines fraction of the material is deemed to be **18.**
- According to the Unified Soil Classification the material classifies as a low plasticity clay **(CL)** with a **Grading Modulus** of between **0.31 and 0.74.**
- According the to the ***van der Merwe*** method of determining **Potential expansiveness**, this material classifies as a **low to medium risk** for potential expansiveness.
- This material is deemed to be **moderately expansive** and **Potentially Compressible.**

The results of road indicator tests conducted on the bulk samples of this material can be summarized as follows:

This material reacts very poorly to compaction with as CBR value of 2 at a compaction effort of 93% MOD AASHTO. This material classifies as a **worse than G9-type** material (COLTO classification system).

Detailed soil test results are included as in Appendix B.

The table on the next page provides a summary of the lab results of the on-site material

Soil Profile Make-up and Associated Sampling		Material Characteristics- Laboratory Assessment																		
Test Pit nr & Material Description	Sample Depth (mm below ground level)	Soil Composition							Fines Analysis (measured from material passing the 0.075 mm sieve)				Activity			Material Compaction Characteristics			
		Sieve Analysis (cumulative percentage passing)					Grading Modulus (GM)	USCS Classification	Plasticity Index (PI)		Linear Shrinkage (LS)		Potential Expansiveness (according to van der Merwe)	In-situ moisture Content	Swell Percentage	COLTO Classification	Measured CBR Values (percentage compaction of MOD AASTHO; CBR of 13.344 kN)		
		5,0 mm	2,0 mm	0,425 mm	0,075 mm	0,002 mm			Minimum	Maximum	Minimum	Maximum					90%	93%	95%
TP2 Alluvium	800-2700	88	72	50	36	5,8	1,42	SC	17		6,2		Low		0,00%	>G9	2	3	4
TP4 Alluvium	1500-1800	92	87	76	61	9,6	0,76	CL	20		8,5		Low		0,00%	Inferred >G9, due to high PI values			
TP6 Residual Siltstone	1100-2600	93	87	77	64	8,4	0,72	CL	17		6,2		Low		0,00%	>G9	2	2	2
TP8 Clay Alluvium	1200-1800	98	95	90	73	10,7	0,42	CL	23		7,9		Low		0,00%	Inferred >G9, due to low GM and high PI values			
TP17 Clay Alluvium	500-1500	96	93	82	67	13,9	0,57	CL	19		7,7		Medium		2,00%	>G9	1	2	2
TP21 Gravel Alluvium	0-800	63	46	38	27	6	1,88	SM & SC	6		2,2		Low		0,00%				
TP21 Clay Alluvium	800-2800	91	83	69	40	6,2	1,08	SC	18		6,2		Low		0,00%	>G9	1	1	1
TP24 Clay Alluvium	500-1000	100	99	97	89	19,5	0,14	CH	25		10,7		High	18,8	4,00%	Inferred >G9, due to low GM and high PI values			
TP24 Clay Alluvium	1000-2800	99	98	93	78	17,6	0,31	CL	26		9,5		Med/High	15	4,00%	Inferred >G9, due to low GM and high PI values			
TP25 Clay Alluvium	400-1300	99	99	95	80	19,9	0,26	CL	25		10,3		High	17,6	4,00%	Inferred >G9, due to low GM and high PI values			
TP27 Clay Alluvium	1000-1800	97	90	83	68	13,8	0,59	CL	28		9,4		Medium	16,9	2,00%	Inferred >G9, due to high PI values			
TP29 Residual	1900-2500	97	95	92	82	10,9	0,31	CL	21		8,5		Low/Medium	10,5	2,00%	Inferred >G9, due to low GM and high PI values			
TP30 Clay Alluvium	600-1300	100	99	97	87	16,4	0,17	CH	30		12,1		Med/High	14,8	3,00%	Inferred >G9, due to low GM and high PI values			
TP30 Residual	1300-2600	87	84	80	62	14,3	0,74	CL	22		8,3		Medium	13,2	2,00%	Inferred >G9, due to high PI values			
TP31 Gravel Alluvium	600-2100	38	33	26	16	3	2,25	GC	20		8,7		Low		0,00%	>G9	3	5	6

6.1.5. Heave Characteristics of In-Situ Soils:

Soil heave is the process of the change in volume correlating to a change in moisture content. This phenomenon is prominent in soils containing a high content of active clays.

According to van der Merwe, the **clayey alluvial material** across the site classifies as a **medium to high potential for heave**.

For swell potential, free swell (Holtz and Gibbs, 1956) and oedometer tests were performed.

The results below are a summary of the free swell tests that were performed on various samples of the subsoils encountered across the site. Please note the results include a factor of safety of 1.5.

Free Swell Test Results											
Riversdale Township Establishment - RE/21 & Erf266											
Material Horizon	Sample Number	Sample Depth (m)	Maximum Horizon Thickness (m)	Bulk Density (kg/m^3)	Sample Height (mm)		% Swell of Sample	Measured Swell Pressure (kPa)	Foundation Load (kPa)	% Swell of Horizon	Calculated Swell (mm)
					Before Saturation	After Saturation					
Alluvium	**UN2**	**1,2-1,8**	**1,9**	1670	20,3	20,348	**0,236**	**1,00**	25	-	-
									50	-	-
									100	-	-
Alluvium	**UN4**	**1,5-1,8**	**1,9**	1820	20,3	20,452	**0,749**	**5,90**	25	-	-
									50	-	-
									100	-	-
Clayey Alluvium	**UN8**	**1,2-1,8**	**1,8**	2150	20,3	22,612	**11,389**	**165,90**	25	4,217	113,86
									50	2,672	72,16
									100	1,128	30,45
Clayey Alluvium	**UN27**	**1,0-1,8**	**0,8**	2100	20,3	22,221	**9,463**	**116,00**	25	3,055	36,66
									50	1,675	20,10
									100	0,295	3,55

When the oedometer test was conducted on the **clayey alluvium**, it yielded a swell pressure of between 116 and 165 kPa. This means that the expansive clay can exert an upward swelling pressure in excess of 100 kPa whereas most of the planned lightweight slabs in the area typically exert unit-bearing pressures of less 100 kPa on the sub-soils.

The results reveal that in the case of the sample extracted from TP8, even at 100 kPa load, 30 mm of heave is still expected when material becomes saturated.

Detailed results are included in Appendix B.

6.1.6. Standard Consolidation of In-Situ Soils:

There are three components to settlement namely immediate settlement (also referred to as elastic settlement), primary consolidation settlement and secondary consolidation (also referred to as creep).

Immediate settlement takes place as a load is exerted on the soil mainly due to distortion of the soil. As pore water begins to flow out of the soil a time dependant decrease in volume occurs which is termed consolidation settlement. This settlement will continue until a condition of constant effective stress is reached. This primary consolidation settlement takes place generally in fine grained materials (high percentage of clay or silt).

Secondary consolidation settlement is not considered a concern as this type of settlement usually occurs in soft organic clays where plastic flow within the soil mass results in displacement of the soil particles.

Based on the consolidation tests performed on samples extracted from the subsoils, it is noted that various amounts of settlements are expected when exposed to various different loads. The results assume a foundation with of 0.6 m.

Consolidation Test - Settlement Analysis Riversdale Township Establishment - RE/21 & Erf266					
Material Origin	**Sample No.**	**Test Pit**	**Average Depth (m)**	**Calculated Settlement Factor of Saftey = 1.5 (between mm)**	
				50 kPa	100 kPa
Alluvium	**UN2**	**TP2**	1,2-1,8	36 to 51	50 to 71
Alluvium	**UN4**	**TP4**	1,5-1,8	12 to 17	22 to 31
Clayey Alluvium	**UN8**	**TP8**	1,2-1,8	15 to 21	22 to 31
Clayey Alluvium	**UN27**	**TP27**	1,0-1,8	18 to 25	27 to 37

Based on visual observations and tests performed on the samples across the site, the alluvial material encountered across the site are deemed to undergo a large amount of settlement upon loading and wetting.

Detailed results are included in Appendix B.

6.1.7. Collapse Settlement Characteristics of the In-Situ Soils

Collapse settlement is defined as the sudden loss of volume of a material once saturated, as compared to the more gradual settlement related to standard consolidation. As such, these soils typical undergo low settlement in the dry state (apparent strength), with a sharp increase in settlement upon saturation.

The material is **not deemed to undergo collapse settlement**

6.2. Material usage

The material encountered across the site displayed a strongly cohesive nature and tested poorly with regards to its re-use during construction. It is recommended that this material not be utilized for layer works during construction and that it rather be stockpiled and removed off-site or be utilized in landscaping purposes. In the light of the soil tests which were completed on the material sampled across the site, the material has a tested and inferred COLTO classification of **worse than G9**.

It is recommended that material be imported for any layer works in foundations or roads.

6.3. Bearing Capacity

Observations during the field work phase indicates that the soils encountered across the site exhibits at least a firm to stiff consistency, typically increasing with depth.

According to Look (2014), the cohesive **reworked residual soils** (encountered from below the transported alluvium) exhibiting a stiff consistency, exhibits a bearing capacity of between **50 and 100 kPa**. This **does not** take into account the **reduction of bearing capacity** due to the inundation with water.

The effect that an increase in moisture content has on the strength of the material can clearly be seen by comparing looking at the laboratory tested CBR results. The reason for these poor CBR results are that the **lab specimen** is tested under **saturated** conditions. This provides that should the soil on site become saturated, it will undergo a reduction in strength.

Due to the potential for activity of the soils and the possibility that the subsoils could soften up if they become saturated, they are not considered as a suitable founding medium for any of the structures.

7. Geotechnical Site Classification

7.1. General

The results of this study reveal that the site exhibits geotechnical characteristics that may require the implementation of specific design and precautionary measures to reduce the risk of structural damage due to adverse geotechnical conditions.

The following constraints needs to be considered;

- The results of this investigation reveal that the soils covering the site may undergo a degree of **heave and/or consolidation** (i.e. loss and gain of volume) under loading or when saturated; requiring that structures be adequately strengthened to prevent structural damage due to **differential settlement** beneath foundations
- Tested **potential swell** in **excess of 30 mm** under loads of 50 kPa.
- Tested **settlement** values **in excess of 20 mm** under loads of 50 kPa.
- Differential movements will be exacerbated due to heave and shrinkage when moisture conditions under structures change
- Presence of **perched groundwater** table at shallow depth.
- Clayey Alluvium deemed to be **moderately to highly expansive** and **moderately to highly compressible**.
- **Clayey Alluvium** exhibit **high tested swell pressures** (>100 kPa)
- **Large boulders** encountered within the upper 1.5 m, may cause differential settlement beneath the structures.

However, these characteristics do not disqualify the site from being used for the proposed development, but rather require the implementation of site-specific precautionary measures.

7.2. Groundwater Occurrence

Groundwater seepage was encountered throughout the study area in many of the test pits excavated. Pedogenic material (ferricrete nodules) was also identified across the site at shallow depth, indicating the occurrence of a fluctuating water table or soil moisture evaporation. Groundwater seepage was generally encountered at the contact of the boulder alluvium and the underlying less permeable clayey horizon.

7.3. Soil Excavatability

Across the site, the TLB-type light mechanical excavator experienced only localized difficulty to a depth of 2.5 m. This difficulty in excavation was encountered due to the presence of a boulder alluvial horizons. Difficulty was encountered within TP13 and TP26 at depths of 2.1m and 1.5m respectively.

No problems are foreseen during the excavation of **shallow foundations,** with **localized difficulty** expected during the excavation of **deep service trenches** to a depth of at least 2.5 m below the existing ground level, through the use of a TLB-type light mechanical excavator.

The excavation type to a depth of at least 2.50 m below the existing ground level is deemed to be **Soft Excavation**, with **localized Intermediate Excavation** (SANS 1200D).

The following additional comments on excavation of service trenches apply:

- sidewalls of deep excavations should be shored to prevent injury or death due to side wall failure (according to standard construction practices)
- Trenches will have to be dewatered after heavy precipitation events, due to perceived low permeability that would hamper infiltration

7.4. Slope Stability

During the time of the investigation, no evidence was noted of any specific site stability problems. However, any disturbance to the natural topography could induce localized slope stability issues, especially during rainy periods.

7.5. Site Classification

In the light of the results of this study, the site can be subdivided into a THREE geotechnical entities/development potential zones. The site carries a dual class, due to both heave and consolidation expected under loads. Figure 5 on the following page depicts the zone boundaries.

Development Potential Zone	NHBRC Site Classification	Geotechnical constraints according to Partridge, Wood and Brink (1993)
Zone A	S2/H	**2B**- Fluctuating moisture conditions less than 1.5 m below ground **1C**- Low Soil Heave **3D**- High soil compressibility
Zone B	S1/S2	**2B**- Fluctuating moisture conditions less than 1.5 m below ground **2D/3D**- Moderate/High soil compressibility
Zone C	H3/S2	**2B-** Fluctuating moisture conditions less than 1.5 m below ground **3C-** High soil heave potential **3D-** High soil compressibility

Zone A

The lab results and field observations from Zone A proved material is moderately to highly compressible and not generally expansive. Consolidation tests yielded settlement results of between 12 and 51 mm under loads of 50 kPa. The swell potential tests conducted on these samples proved the material is generally not expansive. However, it must be noted that during the site investigation, signs of movement due to heave and shrinkage was observed.

For this reason, this zone has been allocated the dual class rating of **S2/H1.**

Zone B

The lab results and field observations from Zone B, indicate material is moderately to highly compressible and not generally expansive.

For this reason, this zone has been allocated the dual class rating of S1/S2.

Zone C

The lab results and field observations from Zone C proved material is moderately to highly expansive and moderately to highly compressible. Consolidation tests yielded settlement results of between 15 and 25 mm under loads of 50 kPa. The swell potential tests conducted on these samples proved the material is generally very highly expansive with free swell tests yielding movement of up to 70 mm at loads of 50 kPa, with swell pressure exceeding 100 kPa.

For this reason, this zone has been allocated the dual class rating of **H3/S2**.

Development Potential Zone	NHBRC Site Classification	Geotechnical constraints according to Partridge, Wood and Brink (1993)
Zone A	S2/H	2B- Fluctuating moisture conditions less than 1.5 m below ground 1C- Low Soil Heave 3D- High soil compressibility
Zone B	S1/S2	2B- Fluctuating moisture conditions less than 1.5 m below ground 2D/3D- Moderate/High soil compressibility
Zone C	H3/S2	2B- Fluctuating moisture conditions less than 1.5 m below ground 3C- High soil heave potential 3D- High soil compressibility

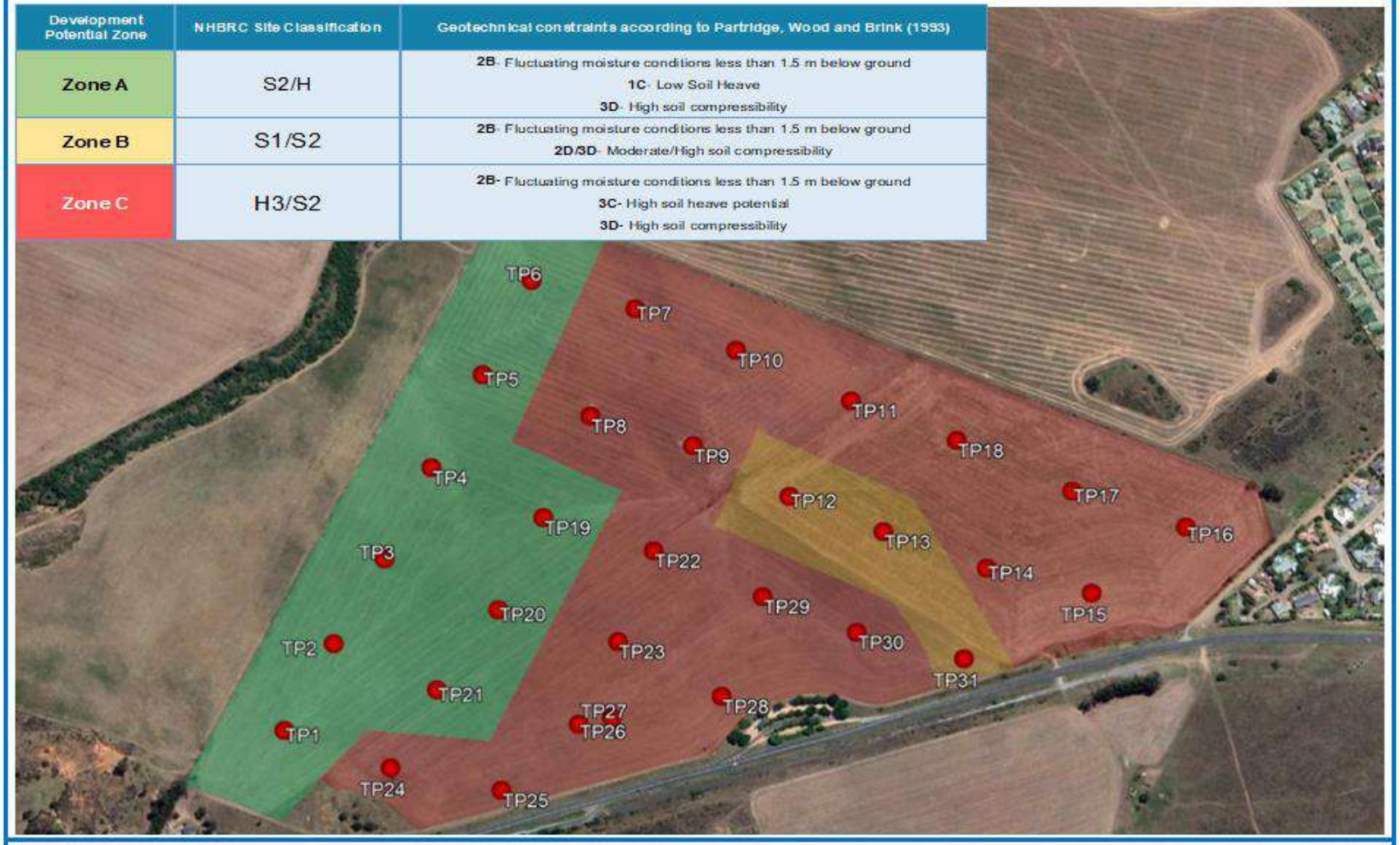


Figure 5

Development Potential Zonation

Terra Geotechnical

Test Pit Location

Investigative Boundary

N

Drawn By: Eugene vd Walt

8. Foundation Recommendations and Solutions

It is recommended that EITHER of the following foundation designs be used in the specific developmental zone (According to the NHBRC guidelines):

Zone A - Site Class S2/H1 & Zone B – Site Class S1/S2

1. **Stiffened or cellular raft:**
    - Stiffened or cellular raft with articulation joints or lightly reinforced masonry.
    - Site drainage and plumbing/service precautions.
2. **Split Construction:**
    - Combination of reinforced brickwork and full movement joints
    - Suspended floors and fabric-reinforced ground slabs acting independently from the structure.
    - Site drainage and plumbing/service precautions.
3. **Soil Raft:**
    - Remove all or part of expansive horizon to 1.0 m beyond the perimeter of the structure and replace with inert backfill, compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
    - Normal construction with lightly reinforced strip footings and light reinforcement in masonry.
    - Site drainage and plumbing/service precautions

Zone C - Site Class H2/S2

1. **Stiffened or cellular raft:**
    - Stiffened or cellular raft with articulation joints or lightly reinforced masonry.
    - Site drainage and plumbing/service precautions.
2. **Soil Raft:**
    - Remove all or part of expansive horizon to 1.0 m beyond the perimeter of the structure and replace with inert backfill, compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
    - Normal construction with lightly reinforced strip footings and light reinforcement in masonry.
    - Site drainage and plumbing/service precautions

It must be noted that differential heave is assumed to equal 50 % of the total heave. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.

Where the expansive clay soils will remain as portions of the subgrade, care must be taken to ensure they remain in a moist and fully swelled condition. This is critical to all areas of the site. Covering over dried out expansive clay soils will likely result in swell/heave issues when these re-swell during the wet winter months

9. Subgrade and Pavement

Naturally occurring **expansive roadbed** with a proven **low CBR** and tested **poor re-use** (according to COLTO) are encountered across the site. In the lab, these on-site materials displayed very poor soaked CBR results, tested to between 1 and 5%.

This will require specific engineering design to mitigate the effect of these characteristics. The following recommendations can be considered to assist with the mitigating, although the final design is the responsibility of the design engineer.

Expansive clay soils are present on this site and will be encountered at or near pavement subgrade elevations, depending upon final site grading. Pavements supported directly on or near expansive soils will likely heave and crack to some degree and create a maintenance problem and provide poor performance and serviceability and require periodic maintenance and repair.

These weak materials will require a capping layer/working platform. Typically, a geotextile reinforcement and/or separation layer and/or working platform is required.

To reduce movement and enhance performance, we recommend supporting pavements on a zone of low-volume change (LVC) fill consisting of properly moisture conditioned and compacted on-site soils or approved import materials. Depending upon final site grading, this will require over-excavation, moisture conditioning and re-compaction (ground modification) below site pavements. The fill should be placed and compacted as per industry standard guidelines. It should be recognized that even if heave mitigation is performed some pavement distress and cracking should be anticipated. In order to effectively reduce swell potential, the expansive clay materials will need to be properly processed and re-compacted at or above optimum moisture content. These types of materials, when compacted at higher moisture contents tend to “pump” and deflect when proof rolled and can create a problem with subgrade stability. Consequently, a contingency can be provided in the construction budget to chemically treat and stabilize the upper part of the subgrade in order to provide a stable surface for pavement construction.

Furthermore, the use of lime treatment can enhance pavement performance, extend pavement life and reduce maintenance requirements.

Please note that problems with heave and shrinkage is only expected if large scale moisture changes occur in the roadbed.

Future performance of pavements constructed on the site will be dependent upon several factors, including:

- maintaining stable moisture content of the subgrade soils; and
- providing for a planned program of preventative maintenance.

The performance of all pavements can be enhanced by minimizing excess moisture which can reach the subgrade soils.

10. Limitations

The extent of the investigations undertaken is deemed adequate, within the time and budget constraints, to present an overview of the geotechnical conditions across the investigation site.

It must be borne in mind that the overall interpretation of geotechnical conditions is based upon point information derived from the respective test positions and that conditions intermediate to these have been inferred by interpolation, extrapolation and professional judgement.

It is recommended the author be appointed to inspect the earthworks and foundation excavations during the development of the site to confirm founding depths and validate the recommendations provided in this report.

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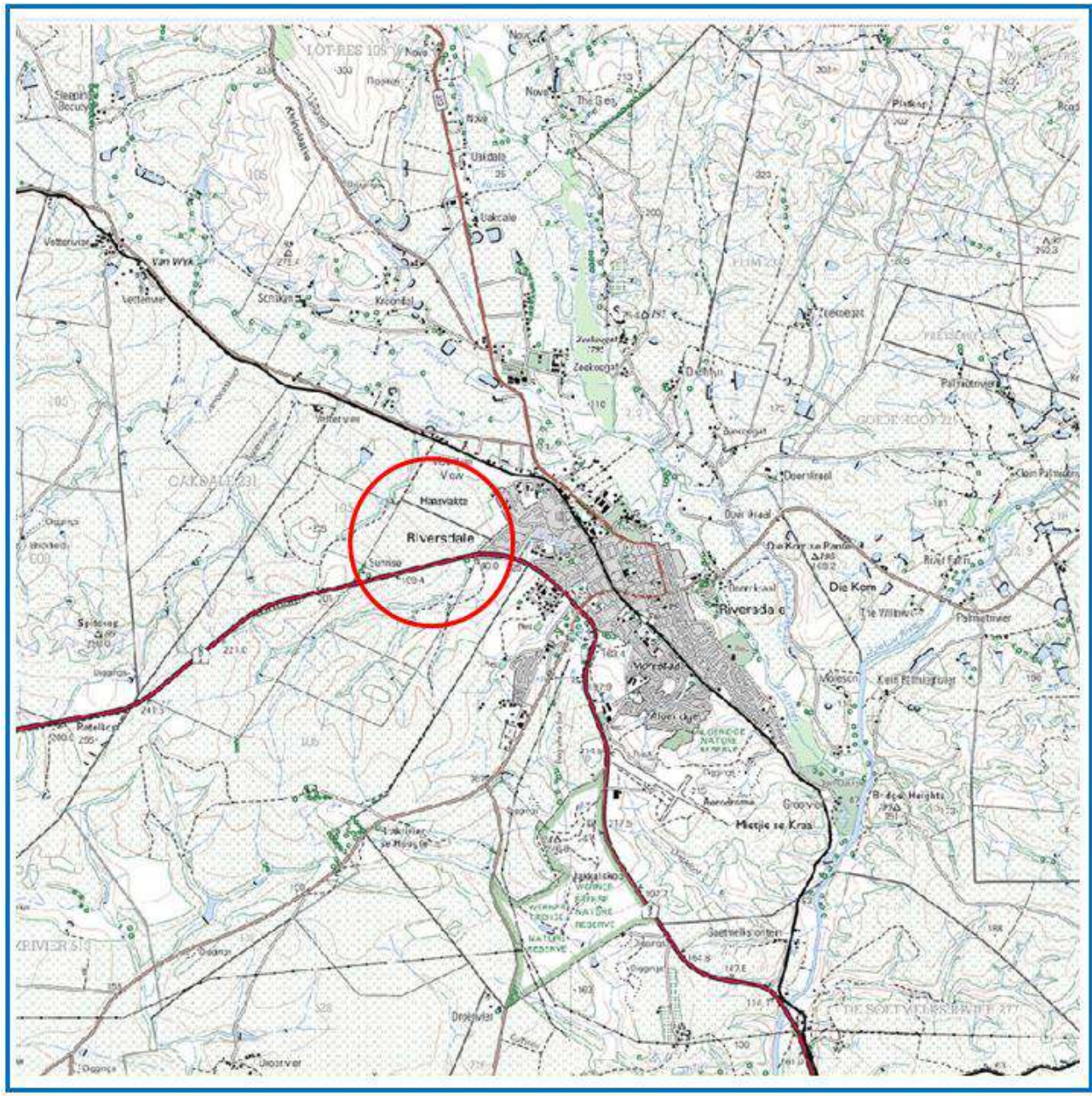
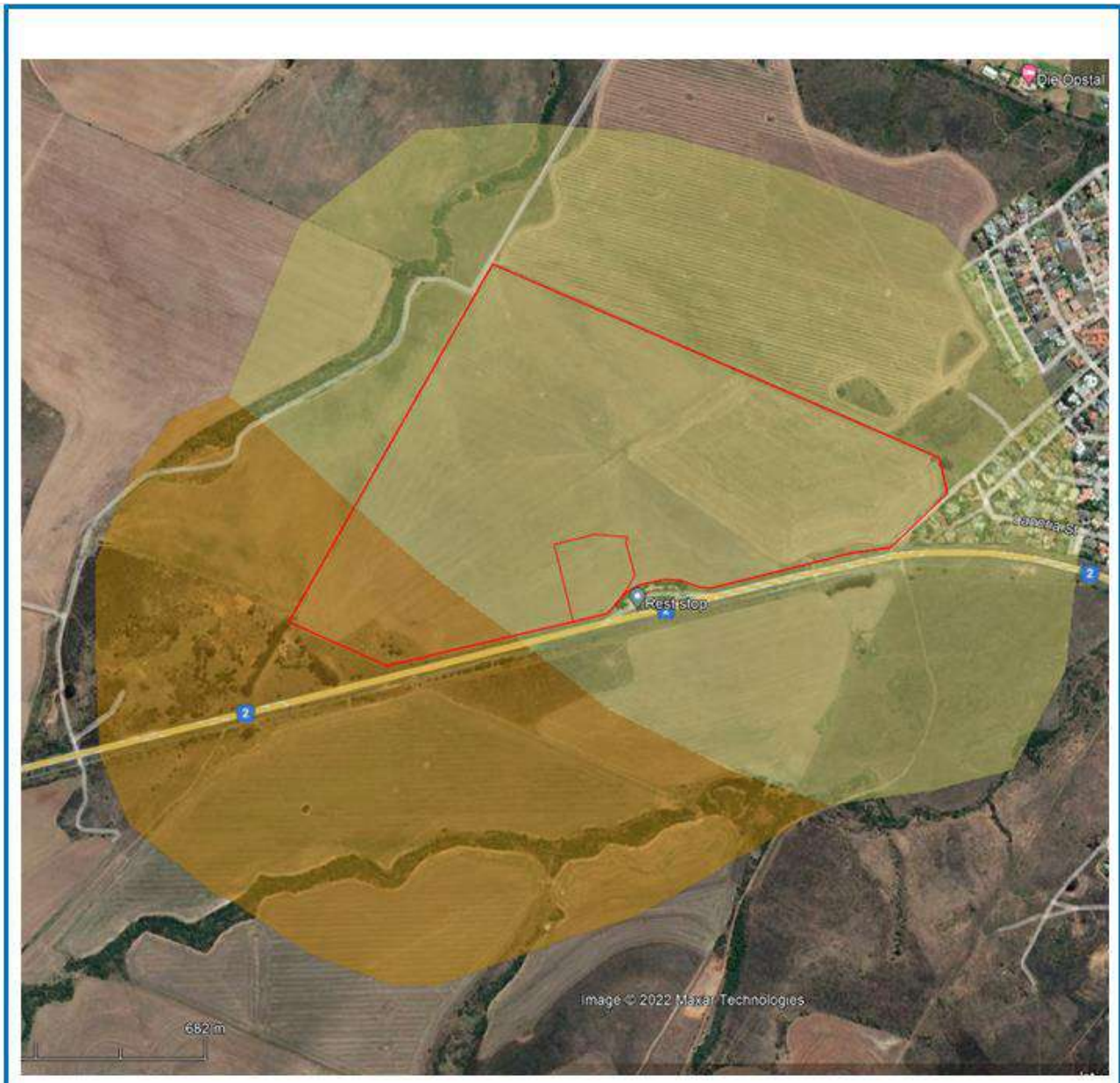
MAPS


Riversdale
Harvakte
Uitzicht
Sunrise
Die Kom
Riversdale
Mietjie se Kraa
Terra Geotechnical
Figure 1
Study Area Location
LEGEND
Study Area
Topographic maps:
3421 AA & 3421 AB
N
Drawn By: Eugene vd Walt


Terra GeoTechnical
Figure 2
Study Area Location
Aerial View
Proposed Development Area
Erf 266 & Remainder of Erf 21
Drainage Channels
5m Contours
N
Drawn By: Eugene vd Walt



Terra Geotechnical

Figure 3

Regional Geological Map

Site location

River Terrace Gravels

Reddish and greenish Mudstone Sandstone with subordinate Conglomerate lenses

Geological Series Map:

3420 Riversdale

Scale 1 : 250 000

N

Drawn By: Eugene vd Walt

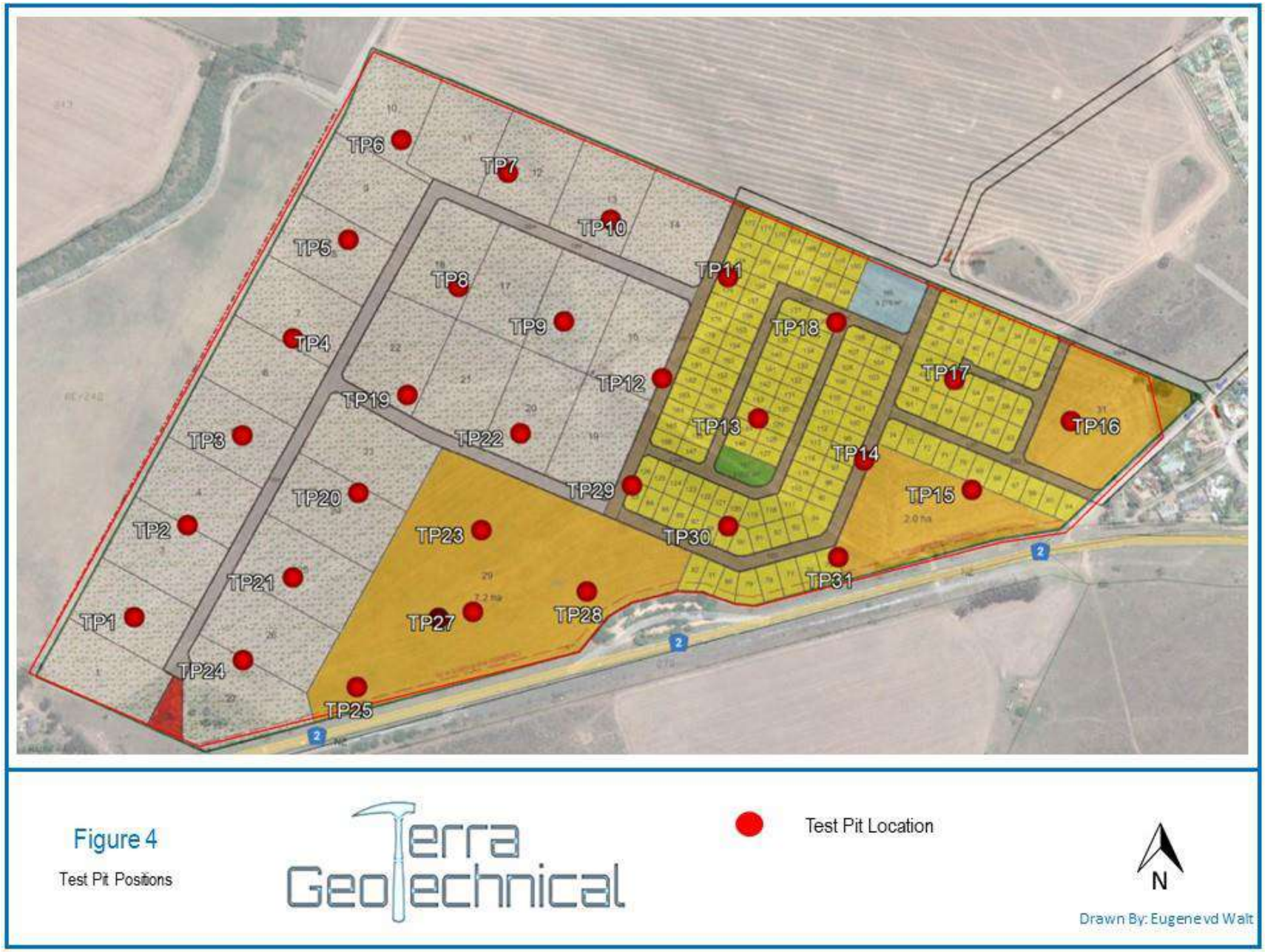


Figure 4

Test Pit Positions

Development Potential Zone	NHBRC Site Classification	Geotechnical constraints according to Partridge, Wood and Brink (1993)
Zone A	S2/H	2B- Fluctuating moisture conditions less than 1.5 m below ground 1C- Low Soil Heave 3D- High soil compressibility
Zone B	S1/S2	2B- Fluctuating moisture conditions less than 1.5 m below ground 2D/3D- Moderate/High soil compressibility
Zone C	H3/S2	2B- Fluctuating moisture conditions less than 1.5 m below ground 3C- High soil heave potential 3D- High soil compressibility

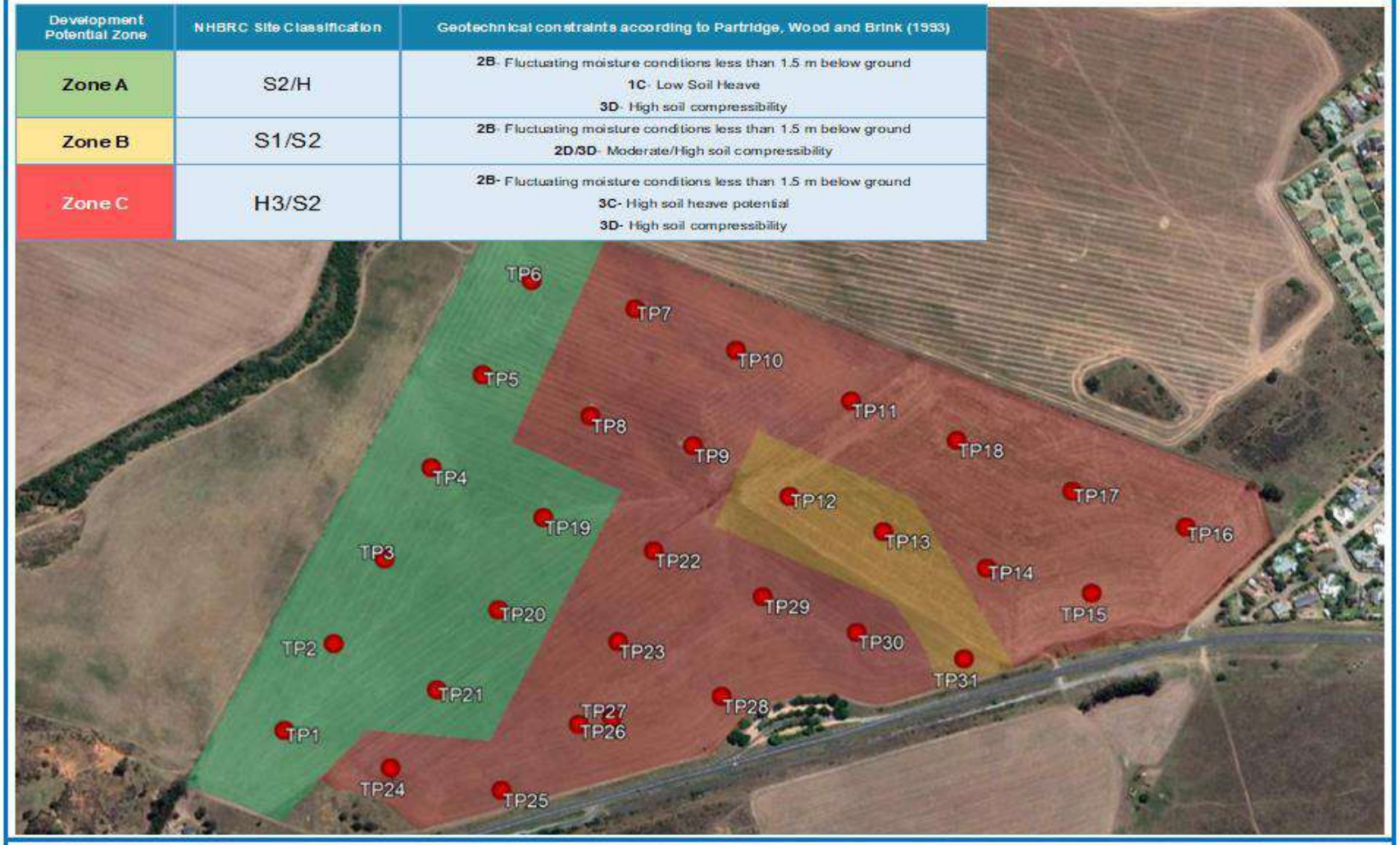


Figure 5

Development Potential Zonation

Terra Geotechnical

Test Pit Location

Investigative Boundary

N

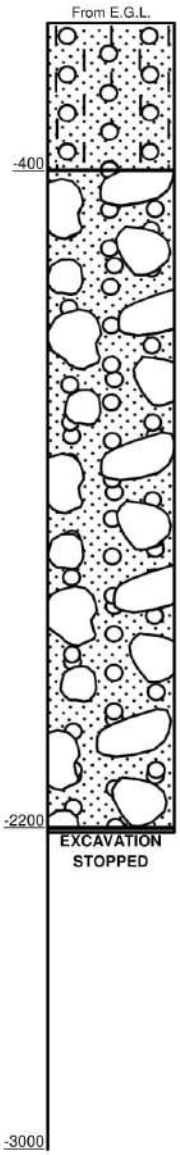
Drawn By: Eugene vd Walt

APPENDIX A

A.1
Test Pit Profiles

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP1



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

frequent rounded and subrounded highly - moderately weathered gravels, cobbles and bolders in a matrix of slightly moist; red brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

Test Pit Notes

Coordinates:	34,088649°S 22,226879°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP1

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP1

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP1

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP2

frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red and mottled black; dense; stiff; clayey silty sand with scattered gravels; alluvium; Bulk Sample No. 2; Disturbed Sample No. TP2; Undisturbed Sample No. UN2.

Test Pit Notes

Coordinates:	34,087672°S 22,227576°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Bulk Sample, 1 Disturbed Sample, 1 Undisturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP2

Terra Geotechnical Portion of the remainder of lot 21

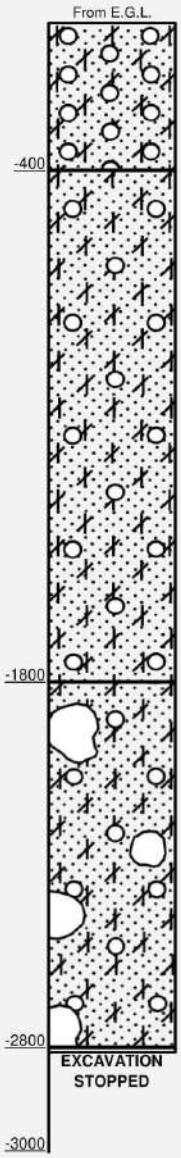
Material Present in Test Pit TP2

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP2

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP3



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red and mottled black; stiff; intact; clayey silty sand with scattered gravels; alluvium; Not Sampled.

slightly moist; yellow brown patched red; firm - stiff; intact; clayey silt sand with frequent gravels, cobbles and scattered boulders; Not Sampled.

Test Pit Notes

Coordinates:	34,086727°S 22,228252°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

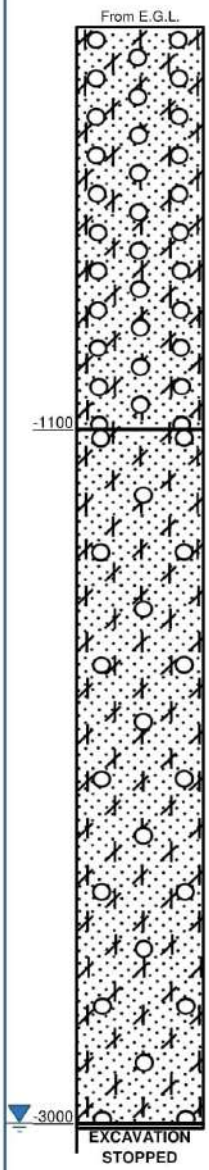
Soil Profile Photo of Test Pit TP3

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP3

Site:	Portion of the remainder of lot 21
Location:	Riversdale
Client:	Gideon Pepler

Soil Profile for Test Pit TP4



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; intact; clayey silty sand with scattered gravels and cobbles; alluvium; Disturbed Sample No. TP4; Undisturbed Sample No. UN4.

Test Pit Notes

Coordinates:	34,085717°S 22,228954°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Slow general seepage at base
Samples Extracted:	1 Disturbed Sample, 1 Undisturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

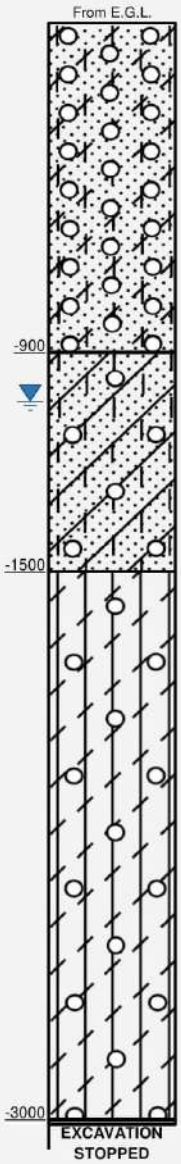
Soil Profile Photo of Test Pit TP4

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP4

Site:	Portion of the remainder of lot 21
Location:	Riversdale
Client:	Gideon Pepler

Soil Profile for Test Pit TP5



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; slickensided; clayey silty sand with scattered gravels and cobbles; alluvium; Not Sampled.

slightly moist; yellowish brown mottled orange; firm; slickensided; clayey silt scattered rounded gravels; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,084727°S 22,229645°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Slow general seepage at 1 m
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

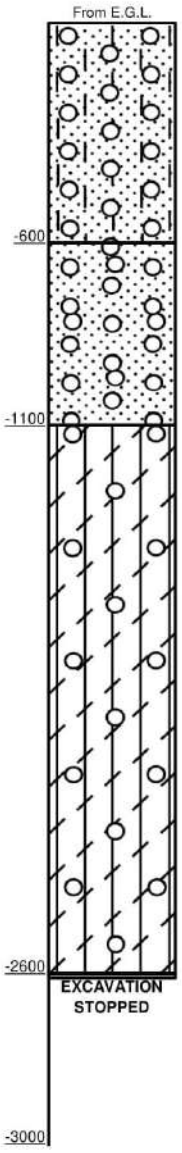
Soil Profile Photo of Test Pit TP5

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP5

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP6



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

frequent rounded and subrounded highly - moderately weathered gravels and cobbles in a matrix of slightly moist; red brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

slightly moist; olive green mottled orange specled black; very dense; intact; clayey silt scattered rounded gravels; residual siltstone; Bulk Sample No. 6; Disturbed Sample No. TP6.

Test Pit Notes

Coordinates:	34,083682°S 22,230352°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Bulk Sample, 1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP6

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP6

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP7

frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

slightly moist; red brown; dense; intact; clayey silty sand scattered rounded gravels and cobbles; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,084021°S 22,231692°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Localized moderate seepage at 1.2 m
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP7

Terra Geotechnical Portion of the remainder of lot 21

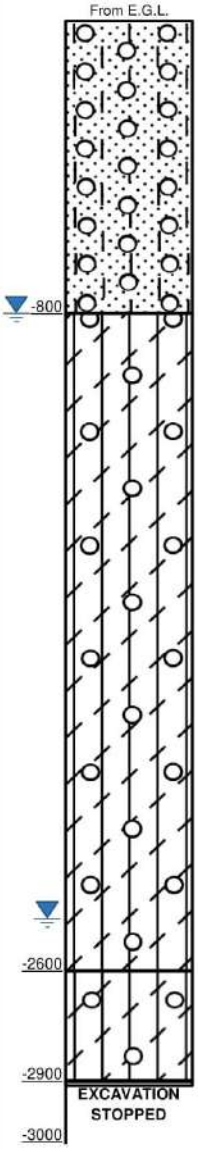
Material Present in Test Pit TP7

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP7

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP8



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels; alluvium; Disturbed Sample No. TP8; Undisturbed Sample No. UN8.

slightly moist; olive green mottled orange specled black; very dense; intact; clayey silt scattered rounded gravels; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,085205°S 22,231042°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Localized seepage at 0,8 m and 2,5 m
Samples Extracted:	1 Disturbed Sample, 1 Undisturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP8

Terra Geotechnical Portion of the remainder of lot 21

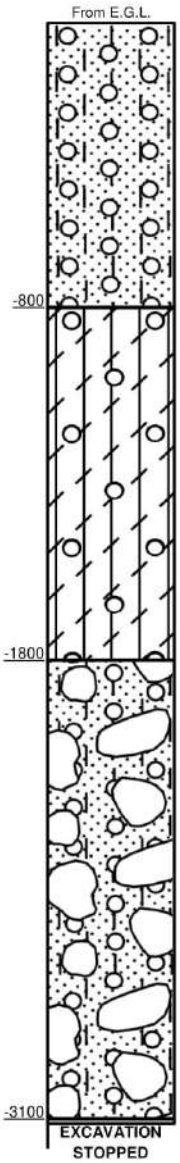
Material Present in Test Pit TP8

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP8

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP9



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels; alluvium; Not Sampled.

frequent rounded and sub-rounded highly - moderately weathered gravels, cobbles and boulders in a matrix of slightly moist; red brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

Test Pit Notes

Coordinates:	34,085596°S 22,232365°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

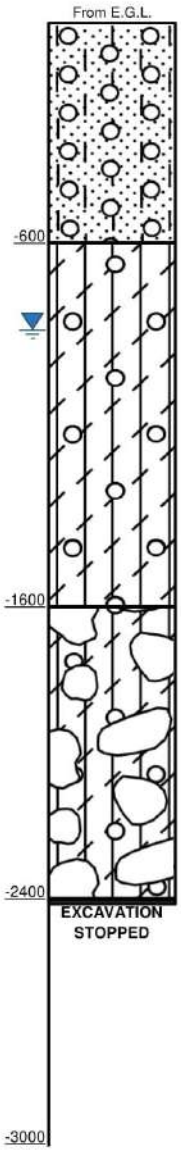
Soil Profile Photo of Test Pit TP9

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP9

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP10



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels; alluvium; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels, cobbles and boulders; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,084511°S 22,232946°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Localized seepage at 0,8 m
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

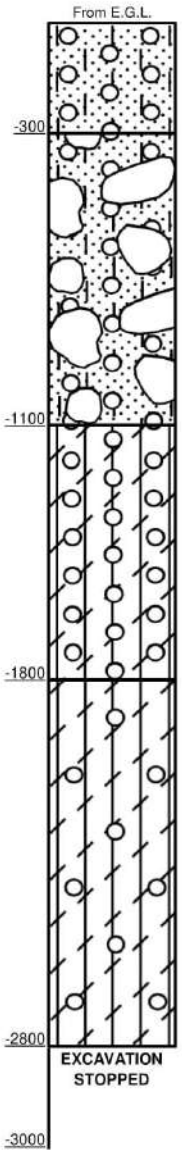
Soil Profile Photo of Test Pit TP10

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP10

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP11



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

frequent rounded and sub-rounded highly - moderately weathered gravels, cobbles and boulders in a matrix of slightly moist; red brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels; alluvium; Not Sampled.

slightly moist; olive green mottled orange specled black; very dense; intact; clayey silt scattered rounded gravels; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,085152°S 22,234443°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

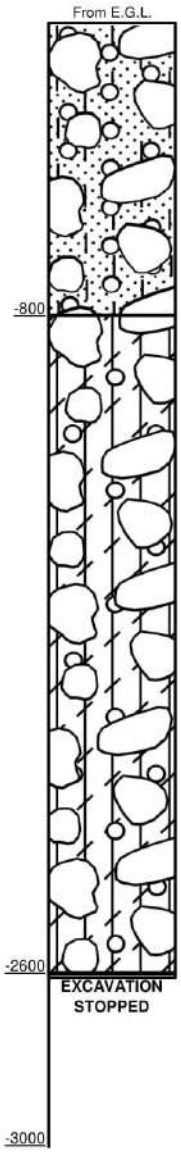
Soil Profile Photo of Test Pit TP11

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP11

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP12



frequent rounded and subrounded gravels, cobbles and boulders in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels, cobbles and boulders; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,086211°S 22,233618°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encoutered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

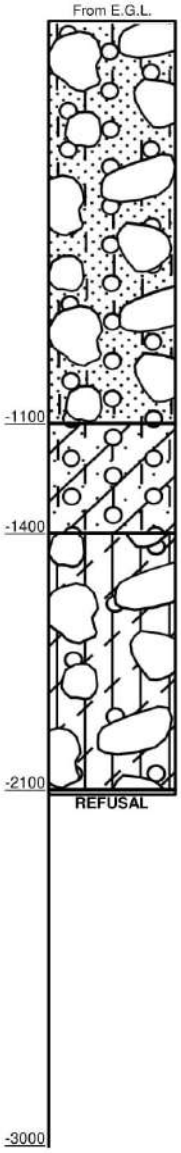
Soil Profile Photo of Test Pit TP12

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP12

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP13



frequent rounded and subrounded gravels, cobbles and boulders in a matrix of slightly moist; reddish brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

frequent sub-round and sub-angular cobbles and gravels loosely packed in a matri of moist; grey; dense; intact; silty sandy clay with frequent ferricrete nodules and concrete; alluvium; Not Sampled.

moist; red and orange brown; very stiff; intact; clayey silt frequent gravels, cobbles and large boulders; alluvium; clast supported; Not Sampled.

Test Pit Notes

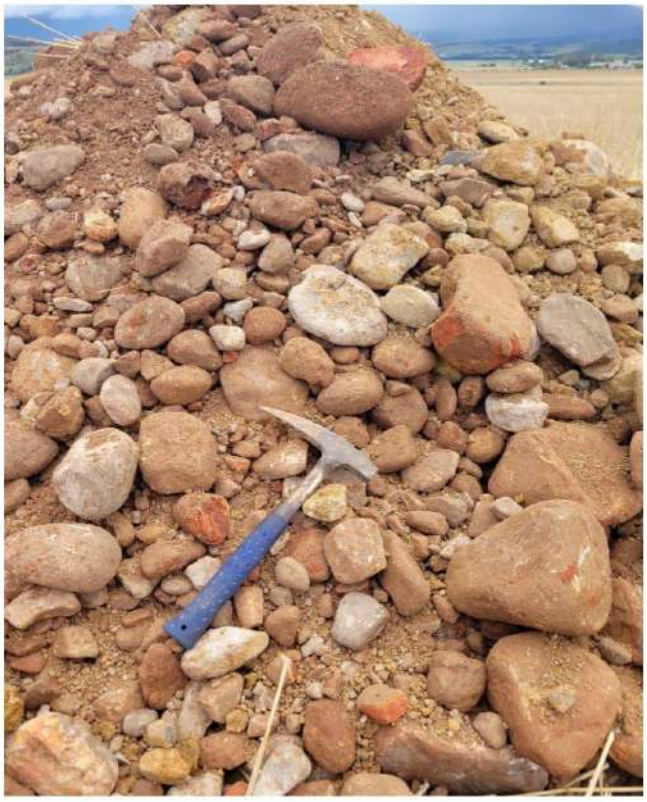
Coordinates:	34,086605°S 22,234799°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Difficult Excavation on large boulders at 2,1 m below existing ground level
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encoutered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP13

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP13

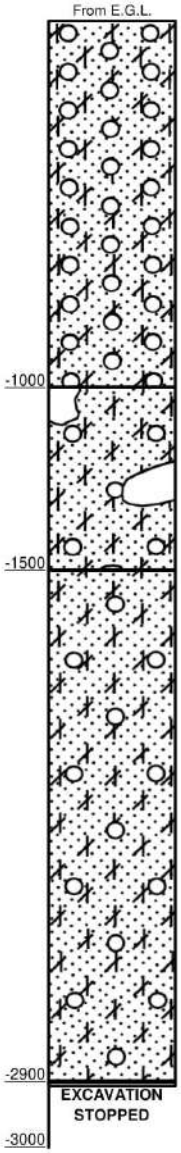


Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP13

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP14



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red; firm - stiff; intact; clayey silt sand with frequent gravels, cobbles and scattered boulders; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; intact; clayey silty sand with scattered gravels and cobbles; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,087112°S 22,236118°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

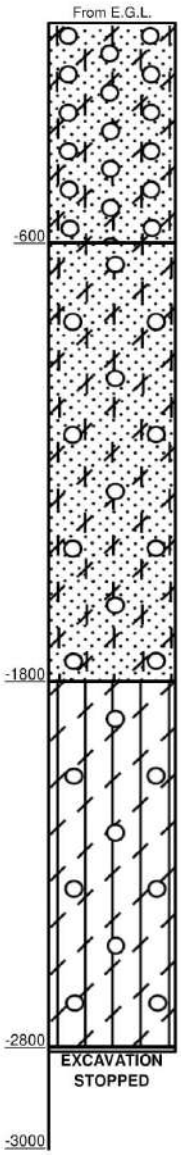
Soil Profile Photo of Test Pit TP14

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP14

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP15



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; intact; clayey silty sand with scattered gravels and cobbles; alluvium; Not Sampled.

slightly moist; olive green mottled orange specled black; very dense; intact; clayey silt scattered rounded gravels; residual siltstone; highly weathered bedrock; Not Sampled.

Test Pit Notes

Coordinates:	34,087372°S 22,237484°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

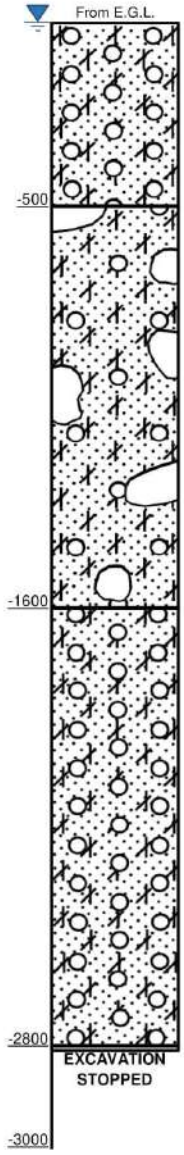
Soil Profile Photo of Test Pit TP15

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP15

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP16



frequent rounded and subrounded gravels and cobbles in a matrix of wet; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

wet; yellow brown patched red; firm - stiff; intact; clayey silt sand with frequent gravels, cobbles and scattered boulders; Not Sampled.

wet; red brown; dense; intact; clayey silty sand scattered rounded gravels and cobbles; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,086674°S 22,238757°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	General water seepage from the surface to the depth of the test pit
Samples Extracted:	N/A
Notes:	Stagnant water ponding
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP16

Terra Geotechnical Portion of the remainder of lot 21

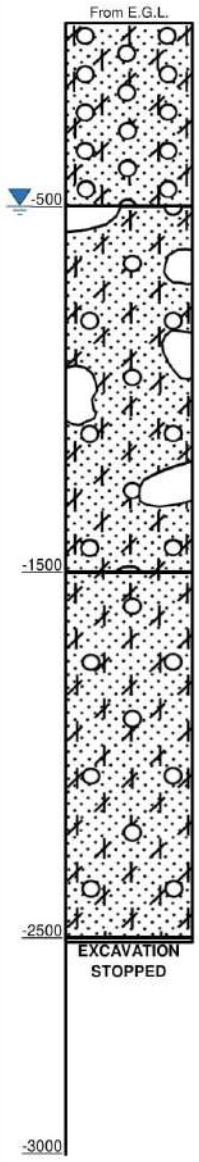
Material Present in Test Pit TP16

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP16

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP17



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red; firm - stiff; intact; clayey silt sand with frequent gravels, cobbles and scattered boulders; Bulk Sample No. 17; Disturbed Sample No. TP17.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; intact; clayey silty sand with scattered gravels and cobbles; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,086265°S 22,237296°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Slight local seepage from 0,5 m
Samples Extracted:	1 Bulk Sample, 1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP17

Terra Geotechnical Portion of the remainder of lot 21

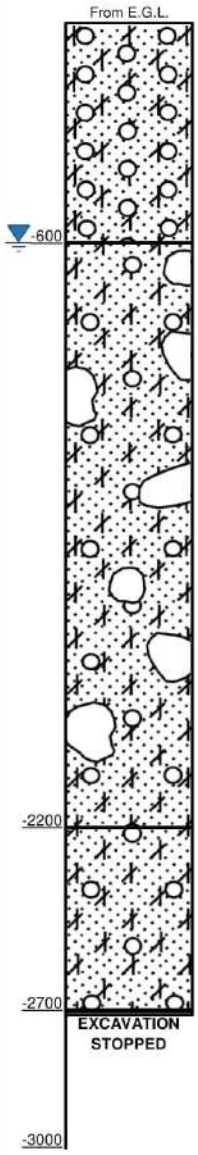
Material Present in Test Pit TP17

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP17

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP18



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; firm; slickensided; clayey silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red; firm - stiff; intact; clayey silt sand with frequent gravels, cobbles and scattered boulders; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; intact; clayey silty sand with scattered gravels and cobbles; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,085633°S 22,235809°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Slight local seepage from 0,6 m
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

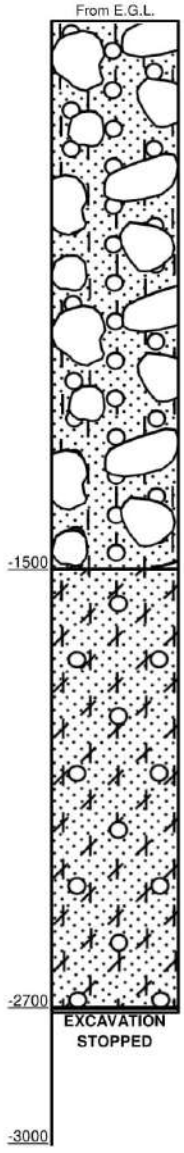
Soil Profile Photo of Test Pit TP18

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP18

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP19



frequent rounded and subrounded gravels, cobbles and boulders in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red and mottled black; dense; stiff; clayey silty sand with scattered gravels; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,08633°S 22,230392°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

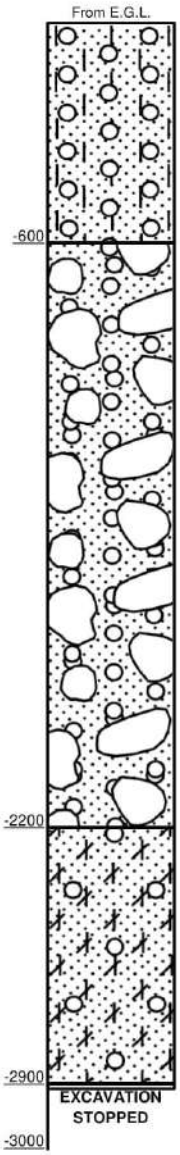
Soil Profile Photo of Test Pit TP19

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP19

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP20



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

frequent rounded and subrounded highly - moderately weathered gravels, cobbles and bolders in a matrix of slightly moist; red brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

slightly moist; yellow brown patched red and mottled black; dense; stiff; clayey silty sand with scattered gravels; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,08734°S 22,22973°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

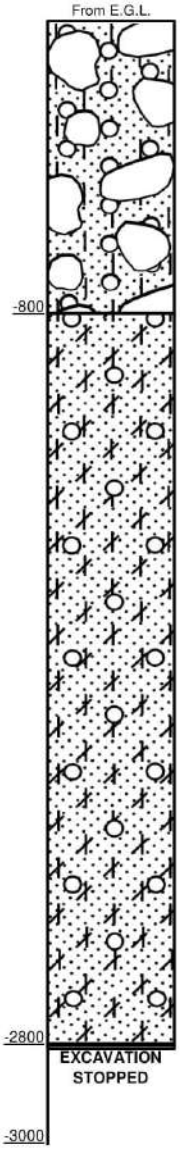
Soil Profile Photo of Test Pit TP20

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP20

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP21



frequent rounded and subrounded gravels, cobbles and boulders in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Disturbed Sample No. TP21,1.

slightly moist; yellow brown patched red and mottled black; dense; stiff; clayey silty sand with scattered gravels; alluvium; Bulk Sample No. 21; Disturbed Sample No. TP21,2.

Test Pit Notes

Coordinates:	34,088223°S 22,22891°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Bulk Sample, 2 Disturbed Samples
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

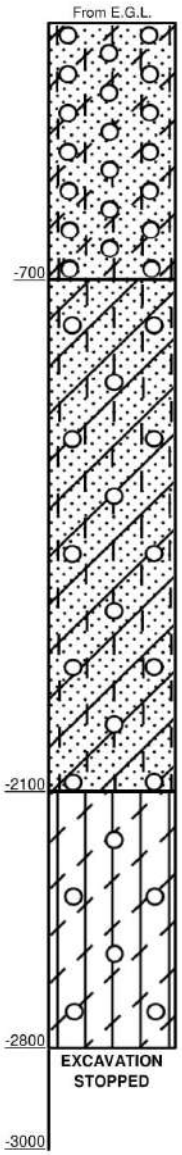
Soil Profile Photo of Test Pit TP21

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP21

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP22



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; slickensided; clayey silty sand with scattered gravels and cobbles; alluvium; Not Sampled.

slightly moist; yellowish brown mottled orange; firm; slickensided; clayey silt scattered rounded gravels; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,086747°S 22,231817°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	N/A
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

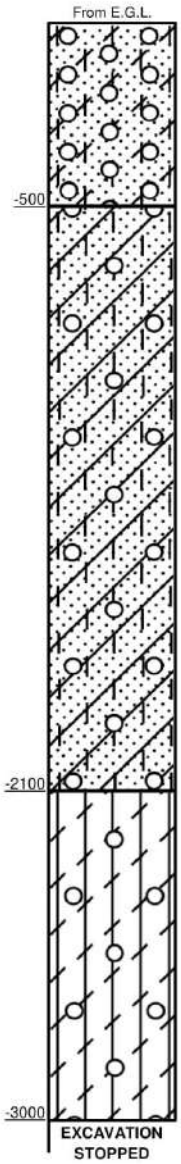
Soil Profile Photo of Test Pit TP22

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP22

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP23



frequent rounded and subrounded gravels and cobbles in a matrix of slightly moist; grey brown; medium dense; intact; silty sand; alluvium; clast supported; Not Sampled.

moist; dark orange brown patched yellow mottled red and black; firm - stiff; slickensided; clayey silty sand with scattered gravels and cobbles; alluvium; Not Sampled.

slightly moist; yellowish brown mottled orange; firm; slickensided; clayey silt scattered rounded gravels; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,087757°S 22,231299°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	02/12/2021
Date Profiled:	02/12/2021
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

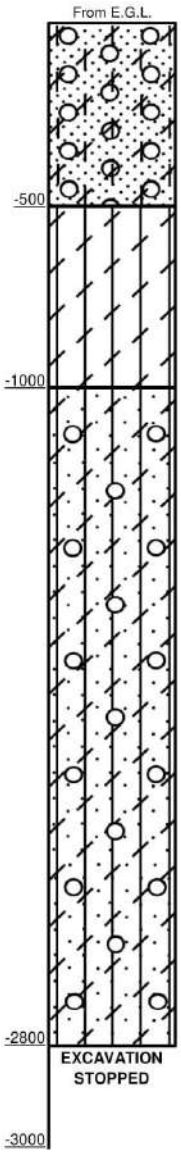
Soil Profile Photo of Test Pit TP23

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP23

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP24



frequent sub-angular gravels and cobbels in a matrix of slightly moist; light brown; firm; intact; clayey silty sand; alluvium; Not Sampled.

moist; dusky orange specled black; firm; slickenside; clayey silt; alluvium; Disturbed Sample No. TP24,1.

moist; orange brown specled black and red; very stiff; minor slickenside; sandy clayey silt with scattered sub angular gravels and cobbels; alluvium; Disturbed Sample No. TP24,2.

Test Pit Notes

Coordinates:	34,089117°S 21,228285°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	2 Disturbed Samples
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP24

Terra Geotechnical Portion of the remainder of lot 21

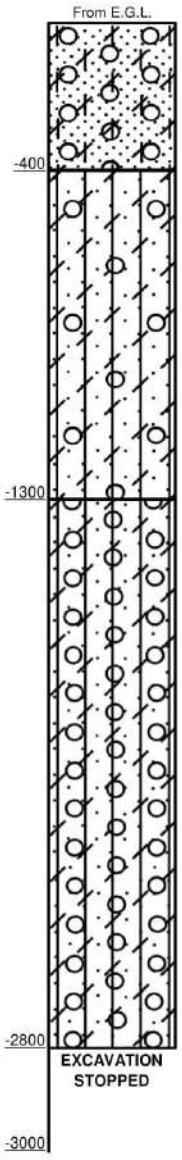
Material Present in Test Pit TP24

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP24

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP25



frequent sub-angular gravels and cobbels in a matrix of slightly moist; light brown; firm; intact; clayey silty sand; alluvium; Not Sampled.

moist; orange brown specled black and red; very stiff; minor slickenside; sandy clayey silt with scattered sub angular gravels and cobbels; alluvium; Disturbed Sample No. TP25.

slightly moist; redish brown specled orange and black; stiff; slickenside; sandy clayey silt with frequent sub angular gravel and cobbels; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,089006°S 21,228254°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP25

Terra Geotechnical Portion of the remainder of lot 21

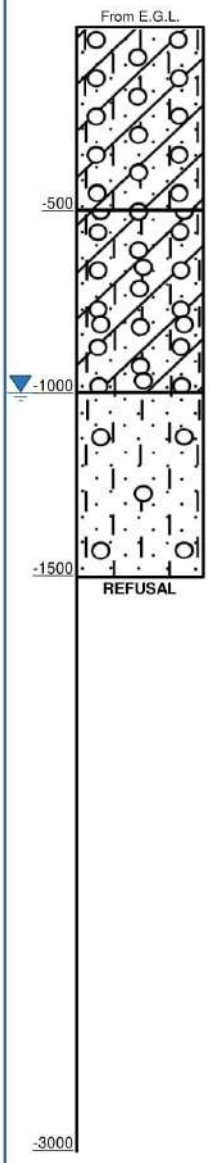
Material Present in Test Pit TP25

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP25

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP26



frequent sub-round and sub-angular cobbles and gravels moderately packed in a matrix of slightly moist; reddish brown; firm; intact; silty sandy clay with ferricrete nodules and concretions; alluvium; clast supported; Not Sampled.

frequent sub-round and sub-angular cobbles and gravels loosely packed in a matrix of slightly moist; grey; firm; intact; silty sandy clay with ferricrete nodules and concretions; alluvium; clast supported; Not Sampled.

moist; dark redish brown patched orange and grey; very dense; intact; silty sandy gravel with scattered cobbels strongly cemented; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,088691°S 21,230752°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Difficult Excavation strongly cemented alluvial material at 1,5 m below existing ground level
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Localised slight seepage at 1m
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP26

Terra Geotechnical Portion of the remainder of lot 21

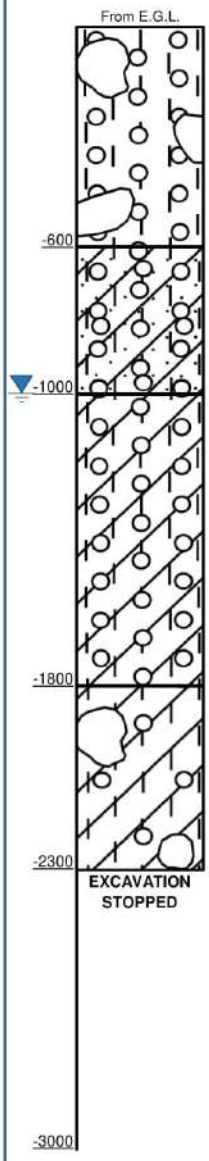
Material Present in Test Pit TP26

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP26

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP27



frequent cobbels and gravels, and scattered boulders in a matrix of slightly moist; light brown; medium dense; intact; silty sand; alluvium; Not Sampled.

frequent sub-round and sub-angular cobbles and gravels loosely packed in a matrix of slightly moist; grey; firm; intact; silty sandy clay with ferricrete nodules and concretions; alluvium; clast supported; Not Sampled.

frequent gravels and scattered cobbles in a matrix of wet; olive brown; firm; slickenside; silty clay; alluvium; Not Sampled.

scattered cobbles and boulders in a matrix of moist; red brown; stiff to very stiff; slickenside; silty clay; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,088618°S 21,231167°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	General slow seepage at 1m
Samples Extracted:	1 Distrubed Sample, 1 Undisturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP27

Terra Geotechnical Portion of the remainder of lot 21

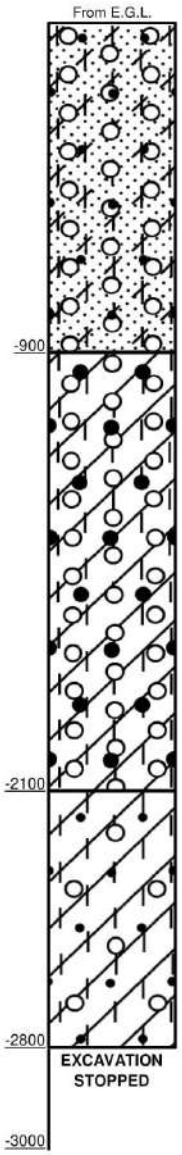
Material Present in Test Pit TP27

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP27

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP28



frequent sub-angular gravels and cobbels in a matrix slightly moist; light brown; firm; intact; silty clayey sand with ferricrete at base; alluvium; Not Sampled.

frequent gravels and scattered cobbles in a matrix of slight moist; olive brown with white and yellow sandy patches; firm; slickenside; silty clay with ferricrete nodules; alluvium; Not Sampled.

moist; red brown with white sandy patches; stiff to very stiff; slickenside; silty clay with scattered cobbles and boulders; residual siltstone; Not Sampled.

Test Pit Notes

Coordinates:	34,088434°S 21,232561°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Not Encountered
Samples Extracted:	N/A
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP28

Terra Geotechnical Portion of the remainder of lot 21

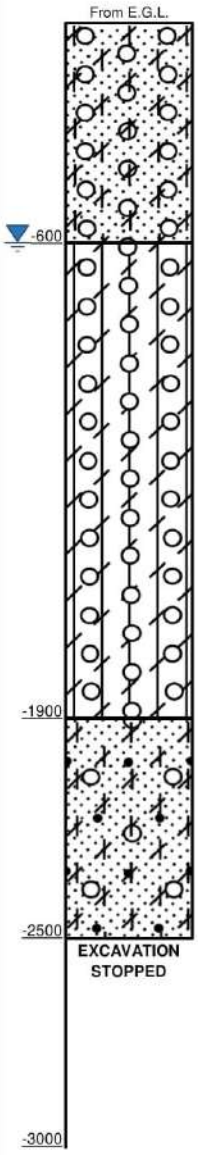
Material Present in Test Pit TP28

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP28

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP29



frequent sub-angular gravels and cobbels in a matrix of slightly moist; light brown; firm; intact; clayey silty sand; alluvium; Not Sampled.

frequent gravels and scattered cobbles in a matrix of moist; yellow brown patched black and grey; stiff; intact; clayey silt; ferruginized alluvium; Not Sampled.

scattered gravel in a matrix of moist; red brown; very stiff; slickenside; clayey silty sand; residual siltstone; Disturbed Sample No. TP29.

Test Pit Notes

Coordinates:	34,087326°S 21,233215°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Slight localized sleepage at 0,6m
Samples Extracted:	1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP29

Terra Geotechnical Portion of the remainder of lot 21

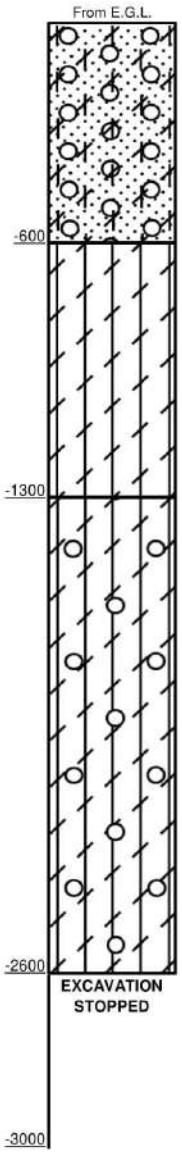
Material Present in Test Pit TP29

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP29

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP30



frequent sub-angular gravels and cobbels in a matrix of slightly moist; dark grey; firm; intact; clayey silty sand; alluvium; Not Sampled.

moist; dusky orange specled black; firm; slickenside; clayey silt; alluvium; Disturbed Sample No. TP30,1.

scattered sub-angular gravels and cobbels in a matrix of moist; orange brown specled black and red; very stiff; minor slickenside; clayey silt; residual siltstone; Disturbed Sample No. TP30,2.

Test Pit Notes

Coordinates:	34,087745°S 21,234408°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Not encountered
Samples Extracted:	2 Disturbed Samples
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP30

Terra Geotechnical Portion of the remainder of lot 21

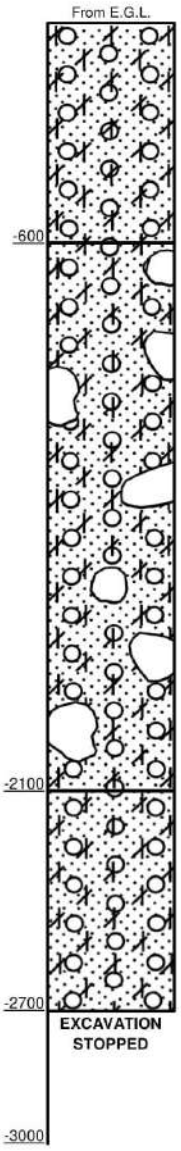
Material Present in Test Pit TP30

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP30

Terra Geotechnical	**Site:**	Portion of the remainder of lot 21
	Location:	Riversdale
	Client:	Gideon Pepler

Soil Profile for Test Pit TP31



frequent gravels and scattered cobbles in a matrix of moist; dark grey; stiff; intact; clayey silty sand; alluvium; Not Sampled.

frequent gravels and cobbels scattered boulders (20cm) in a matrix of slightly moist; dusky orange patched black; stiff; intact; clayey silty sand; ferruginized alluvium; Bulk Sample No. 31; Disturbed Sample No. TP31.

frequent gravels in a matrix of slightly moist; dusky orange patched black; stiff; intact; clayey silty sand; alluvium; Not Sampled.

Test Pit Notes

Coordinates:	34,088041°S 21,235843°E
Method of Excavation:	TLB Type Light Mechanical Excavator- CAT 428 F
Excavation Character:	Excavation Stopped due to maximum reach
Date Excavated:	25/01/2022
Date Profiled:	25/01/2022
Groundwater Seepage:	Moderate general seepage at 2,5m
Samples Extracted:	1 Bulk Sample, 1 Disturbed Sample
Notes:	N/A
Profiled by:	Eugene van der Walt (Pri.Sci.Nat)

Terra Geotechnical Portion of the remainder of lot 21

Soil Profile Photo of Test Pit TP31

Terra Geotechnical Portion of the remainder of lot 21

Material Present in Test Pit TP31

Terra Geotechnical Portion of the remainder of lot 21

Surroundings of Test Pit TP31

APPENDIX B

B.1 Laboratory Test Results

ROADLAB

Roadlab Laboratories (Pty) Ltd
7 Bally Crescent, Voorbaai
P.O. Box 35, Hartenbos
Tel: 067 418 4529 Fax:
Email: elizabeth@roadlab.co.za
Web: www.roadlab.co.za

Job Request No.: RM14693
Terra Geotechnical
Andre Nel Building
C/O Fynbos & Perdekuil Avenue, Stilbaai
6674
Attention : Eugene van der Walt

Date Reported : 2022/01/12

Project : Riversdal - RE21

Full Classification SANS 3001 - GR40/GR41

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.		8721	8725	8723	8726
HOLE NO./ Km / CHAINAGE					
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2		RE 21	RE 21	RE 21	RE 21
LAYER TESTED/SAMPLED		TP 2	TP17	TP 6	TP 21
SAMPLE DEPTH		800-2700mm	500-1500mm	1100-2600mm	800-2800mm
DATE SAMPLED		2021/12/09	2021/12/09	2021/12/09	2021/12/09
COLOUR OF SAMPLE		Light Brown	Drk Br Reddish	Dark Olive	Reddish Brown
TYPE OF SAMPLE		Clayey Gravel	Clayey	Clayey Mudstone Grav	Clayey
SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)					
SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm				
	75.0 mm				
	63.0 mm				
	50.0 mm	100			
	37.5 mm	99	100	100	
	28.0 mm	99	99	99	
	20.0 mm	98	98	98	100
	14.0 mm	96	98	98	99
	5.0 mm	88	96	93	91
	2.0 mm	72	93	87	83
	0.425 mm	50	82	77	69
	0.075 mm	36	67	64	40
GM %		1.4	0.60	0.70	1.1
SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)					
COARSE SAND	2.000 - 0.425	31	12	11	16
COARSE FINE SAND	0.425 - 0.250	5	3	2	10
MEDIUM FINE SAND	0.250 - 0.150	6	5	4	13
FINE FINE SAND	0.150 - 0.075	8	9	10	12
SILT CLAY	0.075	50	72	74	48
ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)					
ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	38	34	30	32
	PLASTICITY INDEX	17	19	17	18
	LINEAR SHRINKAGE	6.0	7.5	6.0	6.0
CLASSIFICATION	H.R.B.	A-6(2)	A-6(10)	A-6(9)	A-6(3)
	COLTO	-	-	-	-
	TRH 14	-	-	-	-
CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)					
SANS GR30 MAX. DRY DENSITY	OMC %	10.0	11.5	6.1	8.9
	MDD (kg/m³)	1868	1824	2070	1901
	COMP MC %	10.1	11.4	6.0	8.2
SWELL % @	MOD | NRB | PRO	1.02 | 1.67 | 2.41	1.09 | 1.78 | 3.30	0.77 | 1.13 | 1.70	1.49 | 2.06 | 3.16
C.B.R. SANS GR40	100 %	5	4	4	2
	98 %	5	3	3	1
	97 %	4	3	3	1
	95 %	4	2	2	1
	93 %	3	2	2	1
	90 %	2	1	2	1
STABILISER IN LAB					
TEST TYPE		CBR	CBR	CBR	CBR
SAMPLING METHOD		TMH 5	TMH 5	TMH 5	TMH 5
WEATHER WHEN SAMPLED		Sunny	Sunny	Sunny	Sunny

Deviation from Test Method : Sampled & Delivered by client.
Remarks and Notes : Sampled & Delivered by client.

Opinions and interpretations are not included in our schedule of accreditation. (T0947)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
Further use of the above information the responsibility or liability of Roadlab.
Document may only be reproduced of published in their full context.
Report compiled by : Jessica Myburgh

sanas Testing Laboratory
Accreditation No. T0947
Prog.ver 10.7 (2019/11/07)

Elizabeth Roux
Technical Signatory

2

Roadlab Laboratories (Pty) Ltd

Civil Materials Testing
SANAS Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4570261050

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7 Bally Crescent, Voorbaai, Mossel Bay, Western Cape

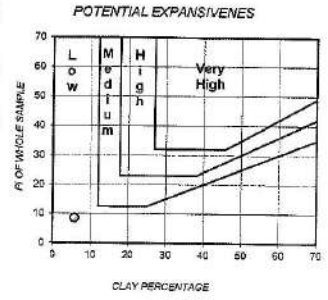
> material Passion.
> trusted Accuracy.
> timeous Excellence.

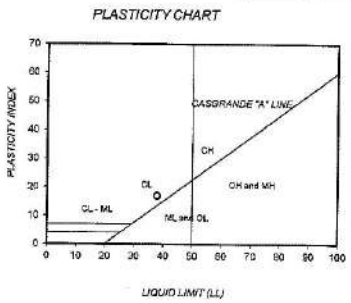
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

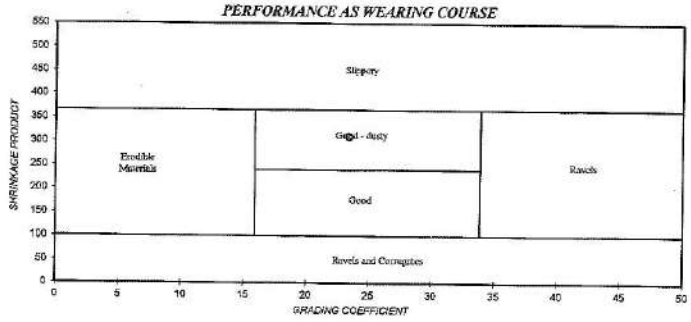
DATE RECEIVED : 2021.12.09
POSITION : TP2
LAYER : (800-2700mm)
SAMPLE No. : 8721
SAMPLE DESCRIPTION : Light Brown Clayey Gravel Silty Gravelly Sand

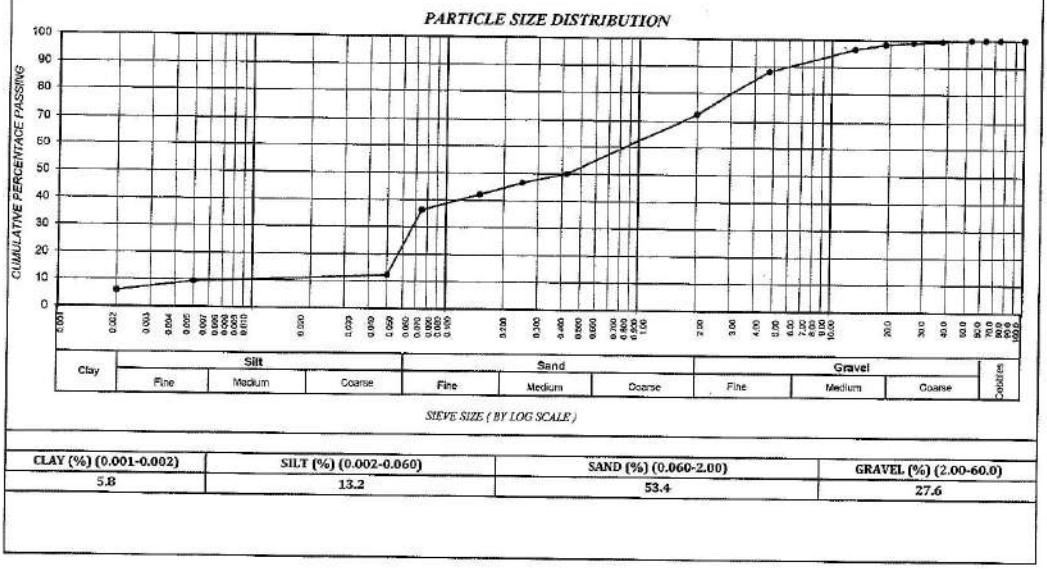
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		8.5
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	99
	28.0	99
	20.0	98
	14.0	96
	5.00	88
	2.000	72
	0.425	50
	0.250	46
	0.150	42
	0.075	36
	50 µm	12
	5 µm	9
	2 µm	5.8
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	31
	0.425 - 0.250	5
	0.250 - 0.150	6
	0.150 - 0.075	8
	< 0.075	50
Effective size		0.015
Uniformity Coefficient		77.1
Curvature Coefficient		0.3
Oversize Index		0.6
Shrinkage Product		309.9
Grading Coefficient		23.4
Grading modulus		1.42
Atterberg Limits	Liquid Limit	38
	Plasticity Index	17
	Linear Shrinkage	6.2
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-6 (2)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.8	13.2	53.4	27.6

ROADLAB

Roadlab Laboratories (Pty) Ltd

Civil Materials Testing
SSBBEE Level 1 Contributor
Registration No: 2011/005423/07
VAT No: 4870261080

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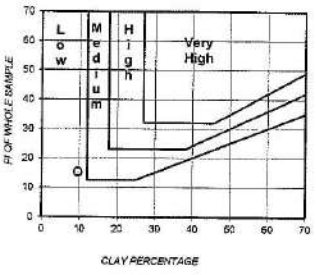
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

DATE RECEIVED : 2021.12.09
POSITION : TP4
LAYER : (1500-1800mm)
SAMPLE No. : 8722
SAMPLE DESCRIPTION : Dark Brown Reddish Clayey + Calcrete Gravelly Silty Sand

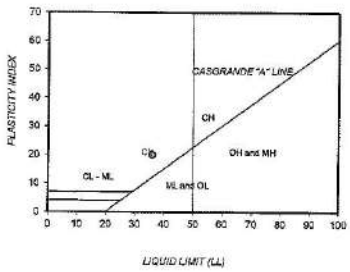
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**15.3**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	99
	20.0	98
	14.0	97
	5.00	92
	2.000	87
	0.425	76
	0.250	74
	0.150	70
	0.075	61
	50 µm	20
	5 µm	15
	2 µm	9.6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	12
	0.425 - 0.250	3
	0.250 - 0.150	4
	0.150 - 0.075	10
	< 0.075	70
Effective size		0.002
Uniformity Coefficient		33.4
Curvature Coefficient		19.2
Oversize Index		0.4
Shrinkage Product		650.0
Grading Coefficient		11.0
Grading modulus		0.76
Atter-berg Limits	Liquid Limit	36
	Plasticity Index	20
	Linear Shrinkage	8.5
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (9)

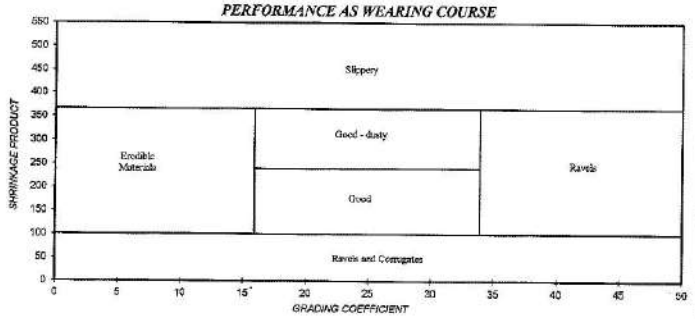
POTENTIAL EXPANSIVENES



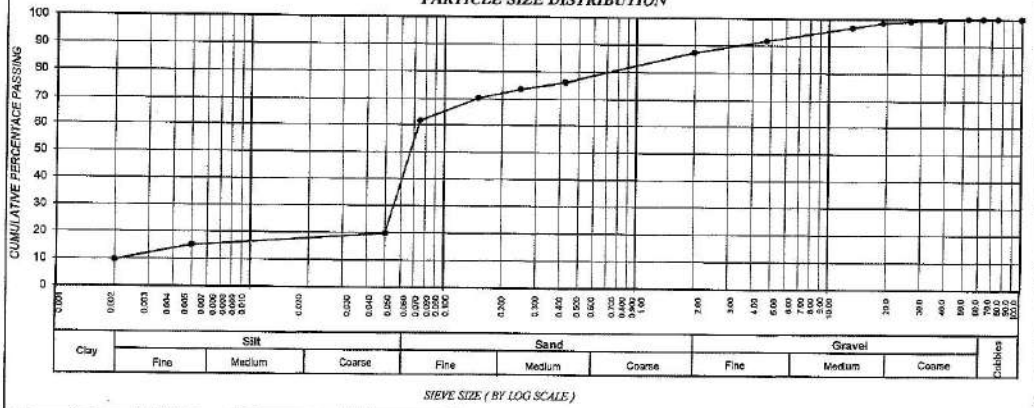
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
9.6	22.0	55.5	12.8

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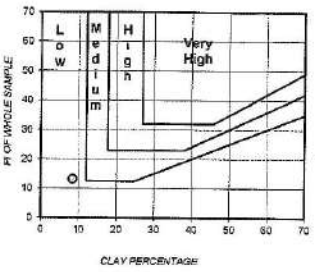
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

DATE RECEIVED : 2021.12.09
POSITION : TP6
LAYER : (1100-2600mm)
SAMPLE No. : 8723
SAMPLE DESCRIPTION : Dark Olive Clayey Mudstone Gravel Gravelly Silty Sand

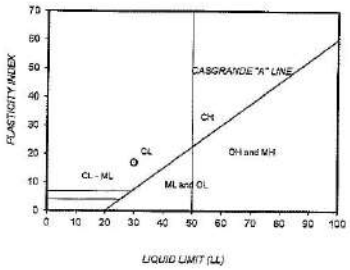
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

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	99
	20.0	98
	14.0	98
	5.00	93
	2.000	87
	0.425	77
	0.250	76
	0.150	73
	0.075	64
	50 µm	19
	5 µm	13
	2 µm	8.4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	11
	0.425 - 0.250	2
	0.250 - 0.150	3
	0.150 - 0.075	10
	< 0.075	74
Effective size		0.003
Uniformity Coefficient		24.4
Curvature Coefficient		14.5
Oversize Index		0.0
Shrinkage Product		479.1
Grading Coefficient		11.7
Grading modulus		0.72
Atterberg Limits	Liquid Limit	30
	Plasticity Index	17
	Linear Shrinkage	6.2
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (8)

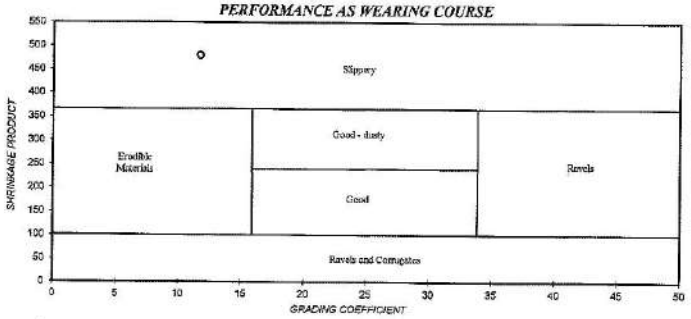
POTENTIAL EXPANSIVENES



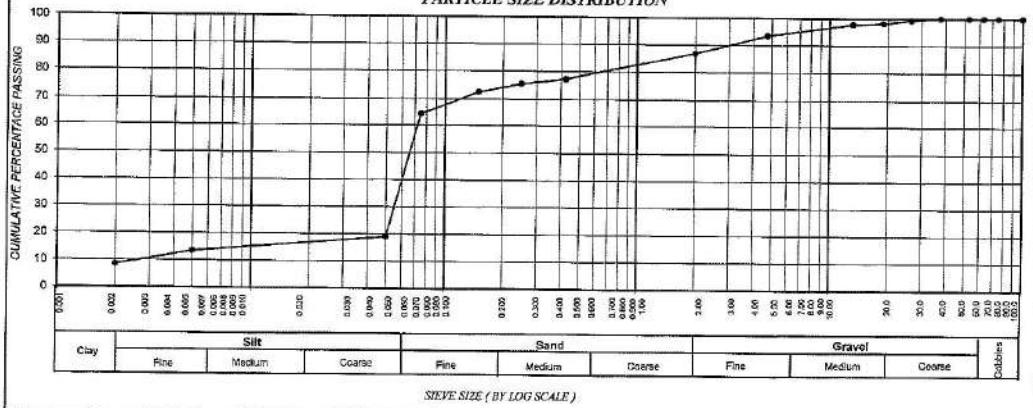
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
8.4	23.6	54.7	13.3

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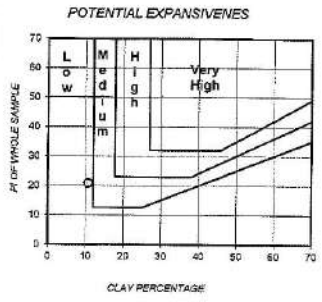
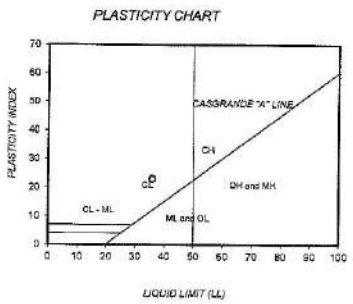
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

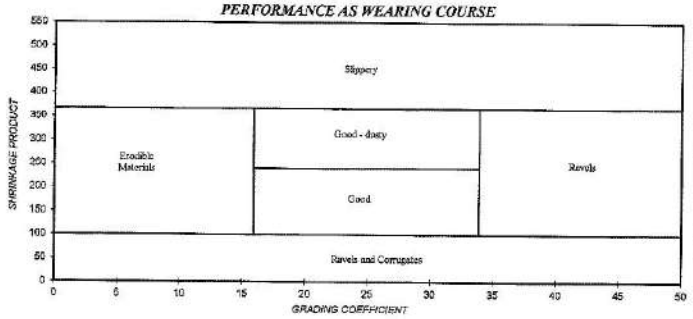
DATE RECEIVED : 2021.12.09
POSITION : TP8
LAYER : (1200-1800mm)
SAMPLE No. : 8724
SAMPLE DESCRIPTION : Orange Reddish Clayey + Small Ferricrete Pebbles Clayey Silty Sand

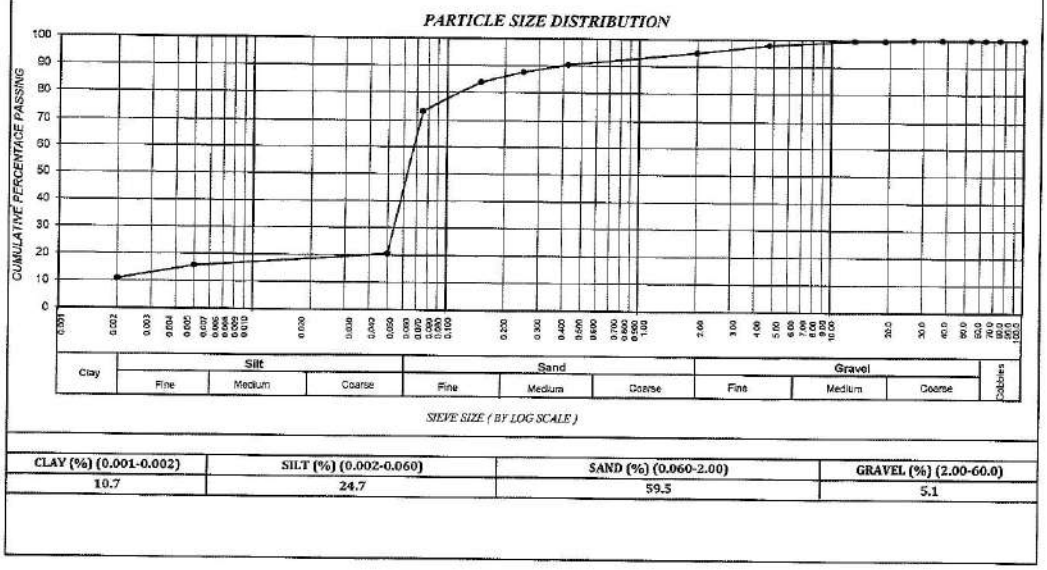
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**20.8**
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	98
	2.000	95
	0.425	90
	0.250	88
	0.150	84
	0.075	73
	50 µm	21
	5 µm	16
	2 µm	10.7
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	5
	0.425 - 0.250	3
	0.250 - 0.150	4
	0.150 - 0.075	11
	< 0.075	77
Effective size		0.002
Uniformity Coefficient		34.4
Curvature Coefficient		21.6
Oversize Index		0.0
Shrinkage Product		709.8
Grading Coefficient		5.0
Grading modulus		0.42
Atterberg Limits	Liquid Limit	36
	Plasticity Index	23
	Linear Shrinkage	7.9
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (14)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
10.7	24.7	59.5	5.1

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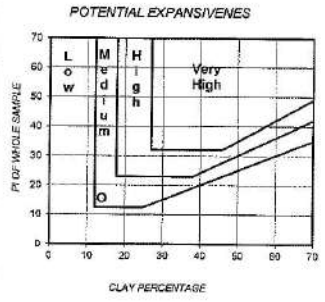
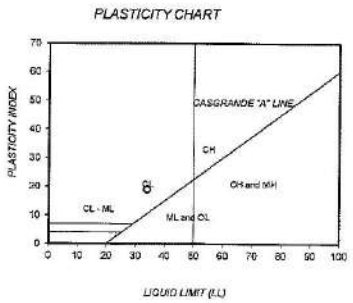
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

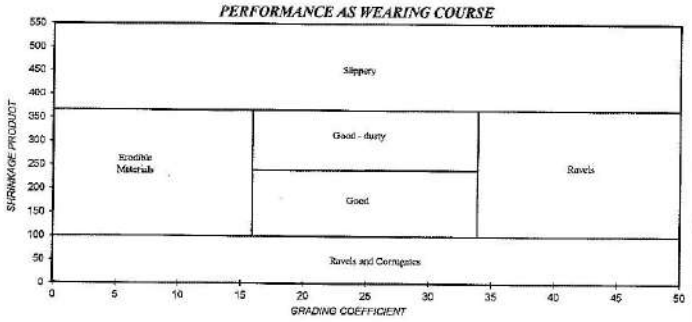
DATE RECEIVED : 2021.12.09
POSITION : TP17
LAYER : (500-1500mm)
SAMPLE No. : 8725
SAMPLE DESCRIPTION : Light Brown Reddish Clayey Clayey Silty Sand

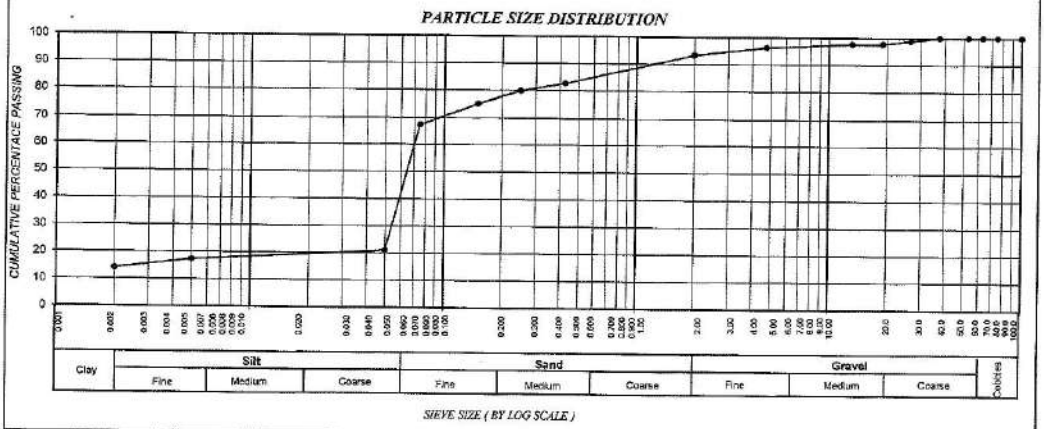
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		15.7
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	99
	20.0	98
	14.0	98
	5.00	96
	2.000	93
	0.425	82
	0.250	80
	0.150	75
	0.075	67
	50 µm	21
	5 µm	17
	2 µm	13.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	12
	0.425 - 0.250	3
	0.250 - 0.150	5
	0.150 - 0.075	8
	< 0.075	72
Effective size		0.002
Uniformity Coefficient		35.5
Curvature Coefficient		21.2
Oversize Index		0.0
Shrinkage Product		635.2
Grading Coefficient		5.4
Grading modulus		0.57
Atterberg Limits	Liquid Limit	34
	Plasticity Index	19
	Linear Shrinkage	7.7
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (10)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.9	20.3	59.1	6.7

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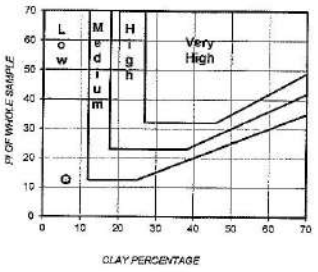
PROJECT : Riversdal - RE21

DATE RECEIVED : 2021.12.09
POSITION : TP21
LAYER : (800-2800mm)
SAMPLE No. : 8726
SAMPLE DESCRIPTION : Reddish Brown Clayey Silty Gravelly Sand

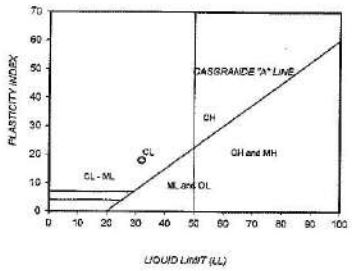
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		12.5
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	99
	5.00	91
	2.000	83
	0.425	69
	0.250	61
	0.150	50
	0.075	40
	50 µm	12
	5 µm	10
	2 µm	6.2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	16
	0.425 - 0.250	10
	0.250 - 0.150	13
	0.150 - 0.075	12
	< 0.075	49
Effective size		0.005
Uniformity Coefficient		47.7
Curvature Coefficient		3.6
Oversize Index		0.0
Shrinkage Product		431.9
Grading Coefficient		15.5
Grading modulus		1.08
Atter-berg Limits	Liquid Limit	32
	Plasticity Index	18
	Linear Shrinkage	6.2
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-6 (3)

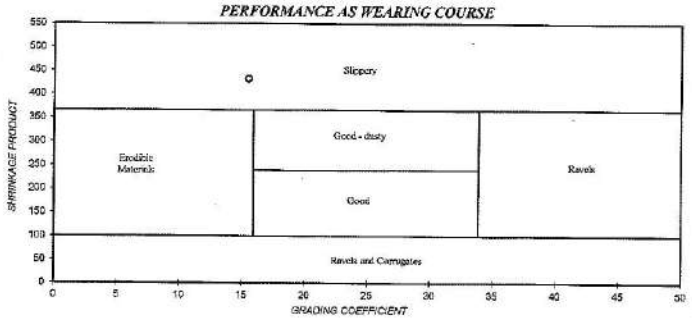
POTENTIAL EXPANSIVENES



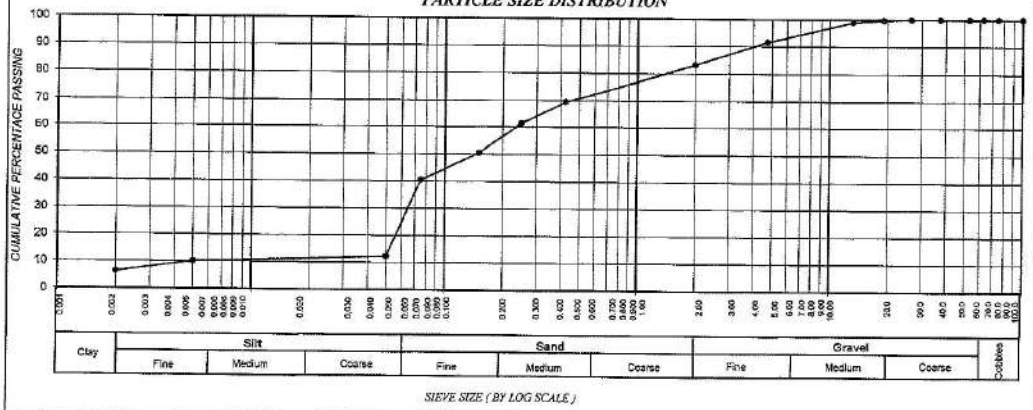
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
6.2	13.4	63.5	17.0

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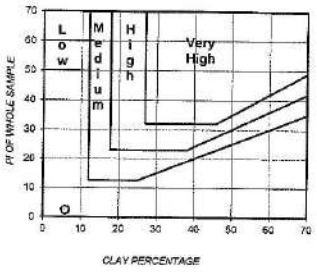
OUR REF : RM14693
CLIENT : Terra Geotechnical
PROJECT : Riversdal - RE21

DATE RECEIVED : 2021.12.09
POSITION : TP21
LAYER : (0-800mm)
SAMPLE No. : 8727
SAMPLE DESCRIPTION : Dark Brown Silty Sand + Q/S/S Boulders Sandy Gravel

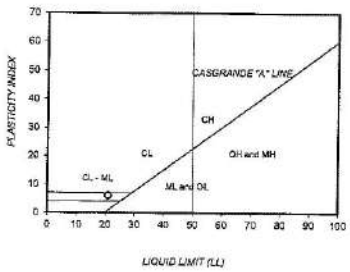
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		2.3
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	96
	37.5	94
	28.0	92
	20.0	87
	14.0	81
	5.00	63
	2.000	46
	0.425	38
	0.250	36
	0.150	33
	0.075	27
	50 µm	11
	5 µm	9
	2 µm	6.0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	17
	0.425 - 0.250	5
	0.250 - 0.150	7
	0.150 - 0.075	14
	< 0.075	57
Effective size		0.030
Uniformity Coefficient		146.8
Curvature Coefficient		0.1
Oversize Index		5.8
Shrinkage Product		83.7
Grading Coefficient		28.5
Grading modulus		1.88
Atterberg Limits	Liquid Limit	21
	Plasticity Index	6
	Linear Shrinkage	2.2
	PI < 0.075	-
Unified Soil Classification		SM & SC
U.S. Highway Classification		A-2-4 (0)

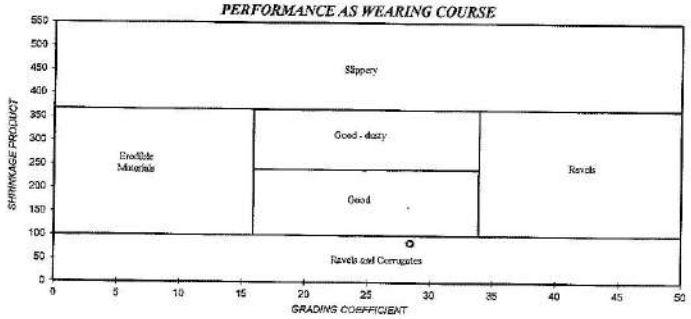
POTENTIAL EXPANSIVENES



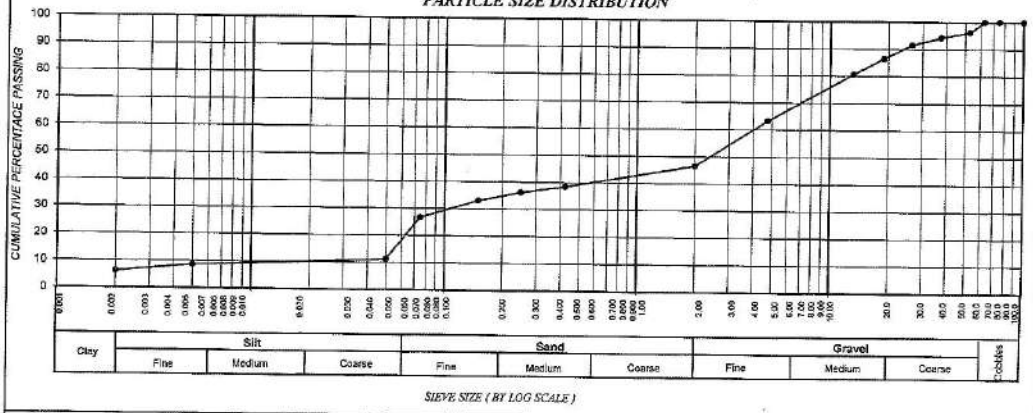
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
6.0	9.8	30.6	53.5

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Job Request No.: RM14730
Terra Geotechnical
Andre Nel Building
C/O Fynbos & Perdekuil Avenue, Stilbaai
6674
Attention : Eugene van der Walt

Date Reported : 2022/02/11

Project : Riversdale RE/21

Full Classification SANS 3001 - GR40/GR41

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO.		8747			
HOLE NO./ Km / CHAINAGE					
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2		N/A			
LAYER TESTED/SAMPLED		TP 31			
SAMPLE DEPTH		600-2100mm			
DATE SAMPLED		2022/01/31			
COLOUR OF SAMPLE		Light Brown			
TYPE OF SAMPLE		Clayey Gravel+ G/S/S			
SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)					
SIEVE ANALYSIS (GR 1) % PASSING	100.0 mm	100			
	75.0 mm	94			
	63.0 mm	85			
	50.0 mm	75			
	37.5 mm	64			
	28.0 mm	61			
	20.0 mm	53			
	14.0 mm	47			
	5.0 mm	38			
	2.0 mm	33			
	0.425 mm	26			
	0.075 mm	16			
GM %		2.2			
SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)					
COARSE SAND	2.000 - 0.425	23			
COARSE FINE SAND	0.425 - 0.250	13			
MEDIUM FINE SAND	0.250 - 0.150	8			
FINE FINE SAND	0.150 - 0.075	8			
SILT CLAY	0.075	48			
ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)					
ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	43			
	PLASTICITY INDEX	20			
	LINEAR SHRINKAGE	8.5			
CLASSIFICATION	H.R.B.	A-2-7(0)			
	COLTO	-			
	TRH 14	G10			
CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)					
SANS GR30 MAX. DRY DENSITY	OMC %	10.3			
	MDD (kg/m³)	2011			
	COMP MC %	10.8			
SWELL % @	MOD | NRB | PRO	0.95 | 1.33 | 1.65			
C.B.R. SANS GR40	100 %	11			
	98 %	8			
	97 %	8			
	95 %	6			
	93 %	5			
	90 %	3			
STABILISER IN LAB					
TEST TYPE		CBR			
SAMPLING METHOD		TMH 5			
WEATHER WHEN SAMPLED		Sunny			

Deviation from Test Method : Sampled & Delivered by client.
Remarks and Notes : Sampled & Delivered by client.

Opinions and interpretations are not included in our schedule of accreditation. (T0947)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
Further use of the above information the responsibility or liability of Roadlab.
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Report compiled by : Jessica Myburgh

sanas Testing Laboratory
Accreditation No. T0947
Prog.ver 10.7 (2019/11/07)

Elizabeth Roux
Technical Signatory

2

Terra Geotechnical

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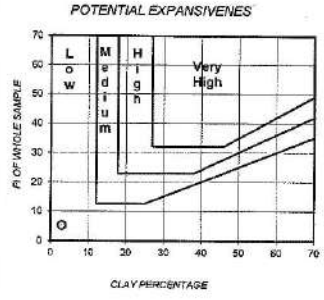
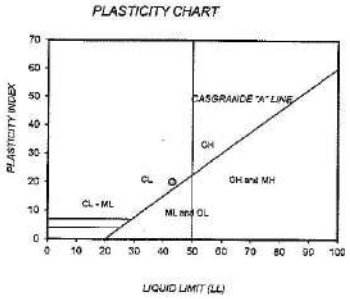
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

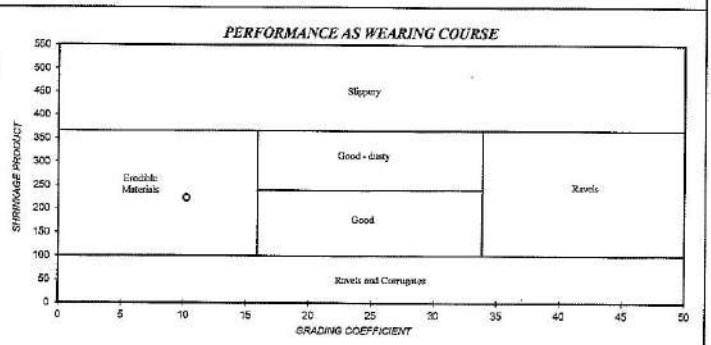
DATE RECEIVED : 2022.01.31
POSITION : TP 31
LAYER : 600-2100mm
SAMPLE No. : 8747
SAMPLE DESCRIPTION : Light Brown Clayey Gravel + Q/S/S Boulders Sandy Gravel

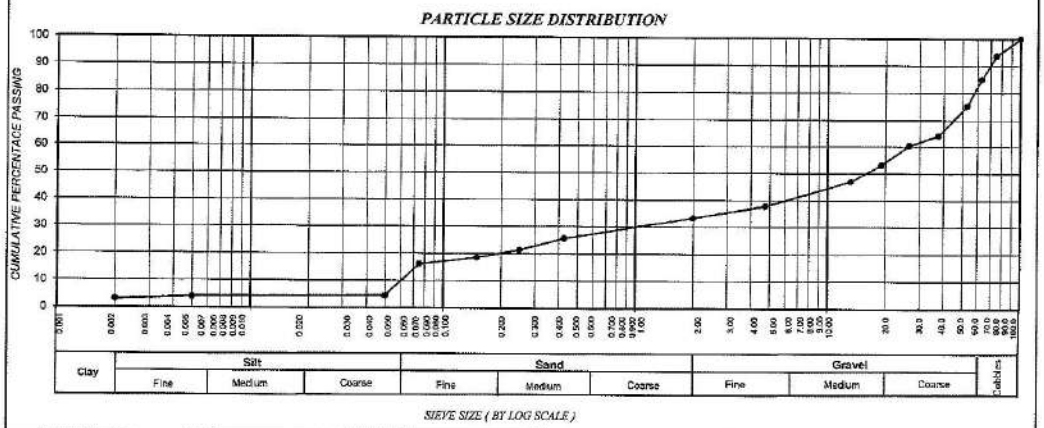
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**5.1**
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	94
	63.0	85
	50.0	75
	37.5	64
	28.0	60
	20.0	53
	14.0	47
	5.00	38
	2.000	33
	0.425	26
	0.250	21
	0.150	18
	0.075	16
	50 µm	4
	5 µm	4
	2 µm	3.0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	23
	0.425 - 0.250	13
	0.250 - 0.150	8
	0.150 - 0.075	7
	< 0.075	48
Effective size		0.062
Uniformity Coefficient		444.1
Curvature Coefficient		1.0
Oversize Index		36.0
Shrinkage Product		222.9
Grading Coefficient		10.2
Grading modulus		2.25
Atter-berg Limits	Liquid Limit	43
	Plasticity Index	20
	Linear Shrinkage	8.7
	PI < 0.075	-
Unified Soil Classification		GC
U.S. Highway Classification		A-2-7 (0)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	4.5	25.7	66.8

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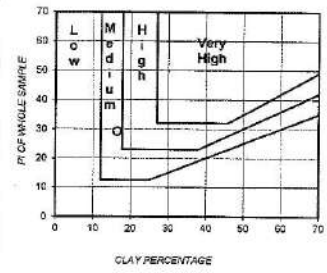
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

DATE RECEIVED : 2022.01.31
POSITION : TP 30
LAYER : 600-1300mm
SAMPLE No. : 8748
SAMPLE DESCRIPTION : Light Brown Clayey Clayey Silty Sand

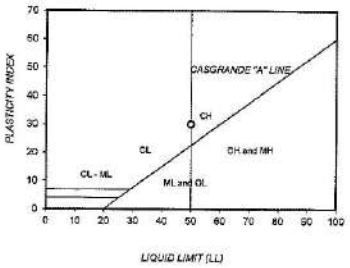
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		29.1
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	100
	2.000	99
	0.425	97
	0.250	95
	0.150	92
	0.075	87
	50 µm	21
	5 µm	19
	2 µm	16.4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	2
	0.250 - 0.150	3
	0.150 - 0.075	6
	< 0.075	87
Effective size		0.002
Uniformity Coefficient		32.5
Curvature Coefficient		22.1
Oversize Index		0.0
Shrinkage Product		1175.8
Grading Coefficient		0.5
Grading modulus		0.17
Atterberg Limits	Liquid Limit	50
	Plasticity Index	30
	Linear Shrinkage	12.1
	PI < 0.075	-
Unified Soil Classification		CH
U.S. Highway Classification		A-7-6 (27)

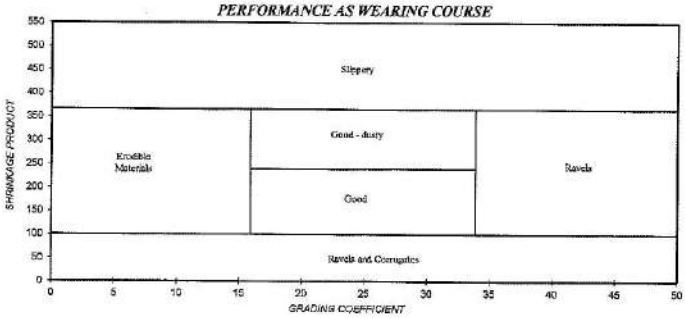
POTENTIAL EXPANSIVENES



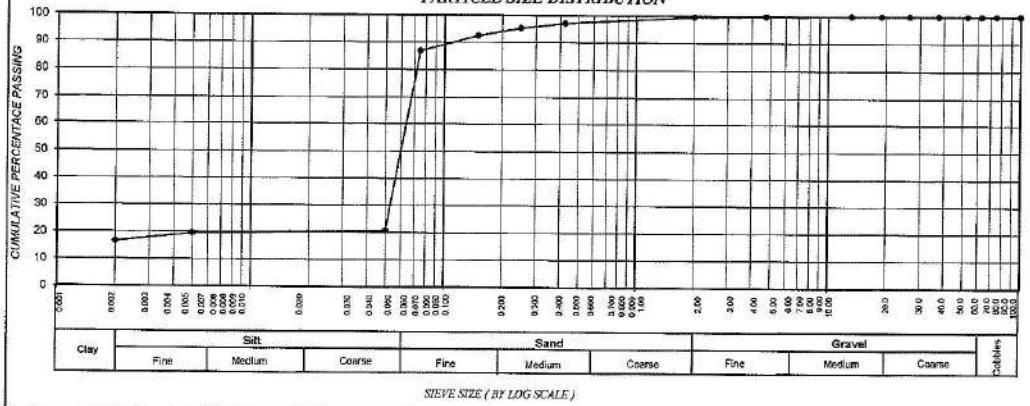
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
16.4	22.7	60.4	0.5

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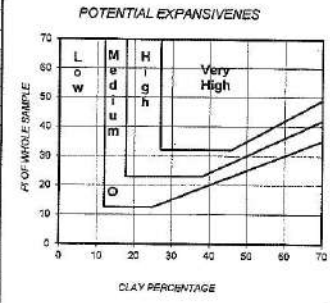
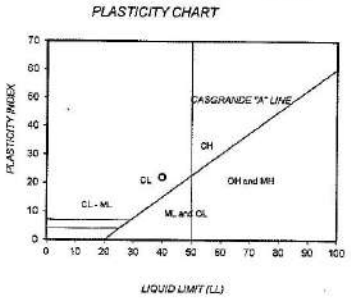
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

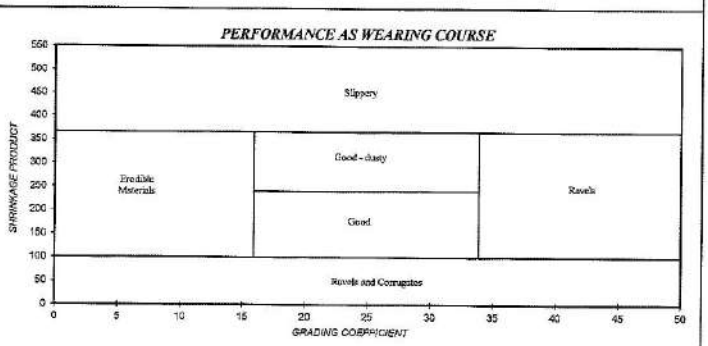
DATE RECEIVED : 2022.01.31
POSITION : TP 30
LAYER : 1300-2600mm
SAMPLE No. : 8749
SAMPLE DESCRIPTION : Light Brown Weathered Ferricrete Cravel with Clayey Clayey Gravelly Silty Sand

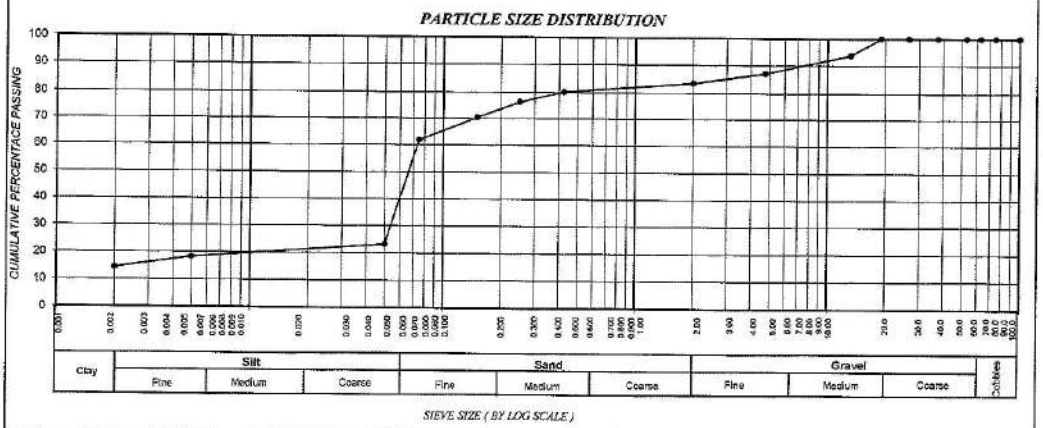
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		17.6
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	94
	5.00	87
	2.000	84
	0.425	80
	0.250	76
	0.150	70
	0.075	62
	50 µm	23
	5 µm	18
	2 µm	14.3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4
	0.425 - 0.250	5
	0.250 - 0.150	7
	0.150 - 0.075	10
	< 0.075	74
Effective size		0.002
Uniformity Coefficient		36.9
Curvature Coefficient		20.0
Oversize Index		0.0
Shrinkage Product		662.1
Grading Coefficient		14.3
Grading modulus		0.74
Atterberg Limits	Liquid Limit	40
	Plasticity Index	22
	Linear Shrinkage	8.3
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (11)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
14.3	20.6	48.7	16.5

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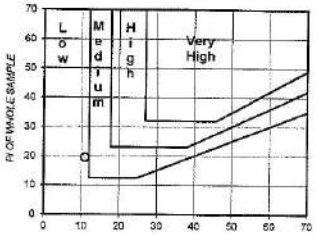
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

DATE RECEIVED : 2022.01.31
POSITION : TP 29
LAYER : 1900-2500mm
SAMPLE No. : 8750
SAMPLE DESCRIPTION : Reddish Brown Clayey Gravel + Pebbles
Clayey Silty Sand

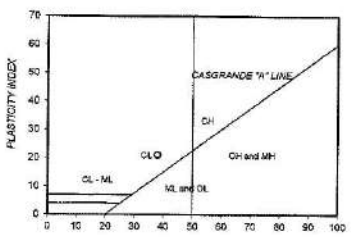
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		**19.4**
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	92
	0.250	91
	0.150	89
	0.075	82
	50 µm	19
	5 µm	15
	2 µm	10.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	1
	0.250 - 0.150	3
	0.150 - 0.075	7
	< 0.075	86
Effective size		0.002
Uniformity Coefficient		33.2
Curvature Coefficient		22.3
Oversize Index		0.0
Shrinkage Product		787.4
Grading Coefficient		5.3
Grading modulus		0.31
Atterberg Limits	Liquid Limit	38
	Plasticity Index	21
	Linear Shrinkage	8.5
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-6 (16)

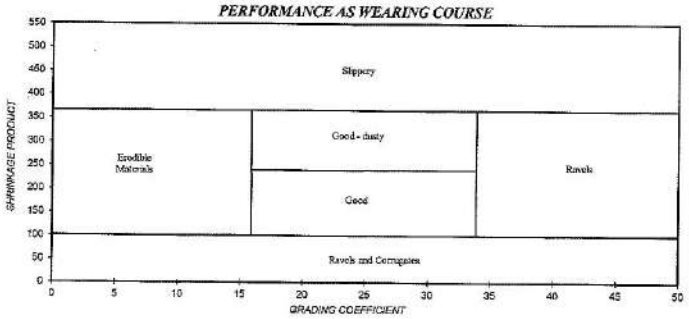
POTENTIAL EXPANSIVENES



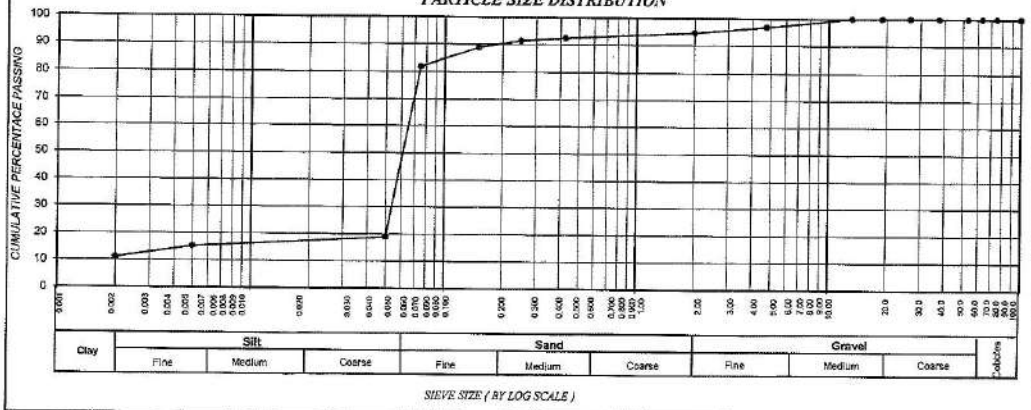
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
10.9	25.6	58.0	5.5

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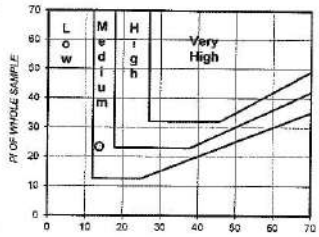
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

DATE RECEIVED : 2022.01.31
POSITION : TP 27
LAYER : 1000-1800mm
SAMPLE No. : 8751
SAMPLE DESCRIPTION : Olive Brown Clayey Clayey Silty Sand

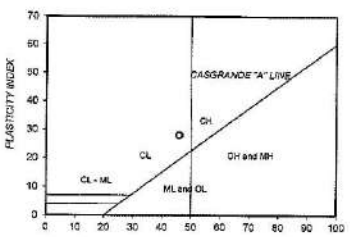
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		23.3
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	90
	0.425	83
	0.250	79
	0.150	75
	0.075	68
	50 µm	21
	5 µm	19
	2 µm	13.8
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	8
	0.425 - 0.250	4
	0.250 - 0.150	4
	0.150 - 0.075	8
	< 0.075	76
Effective size		0.002
Uniformity Coefficient		35.3
Curvature Coefficient		21.2
Oversize Index		0.0
Shrinkage Product		782.0
Grading Coefficient		9.5
Grading modulus		0.59
Atterberg Limits	Liquid Limit	46
	Plasticity Index	28
	Linear Shrinkage	9.4
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-7-6 (17)

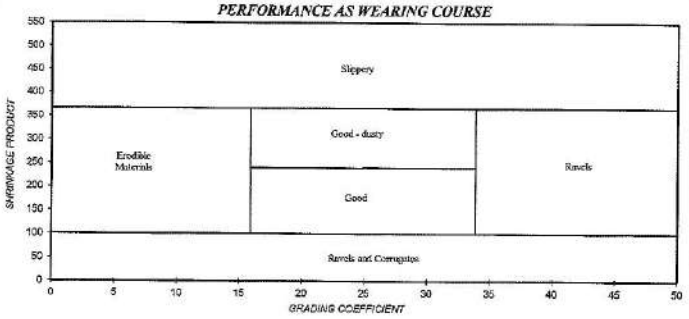
POTENTIAL EXPANSIVENES



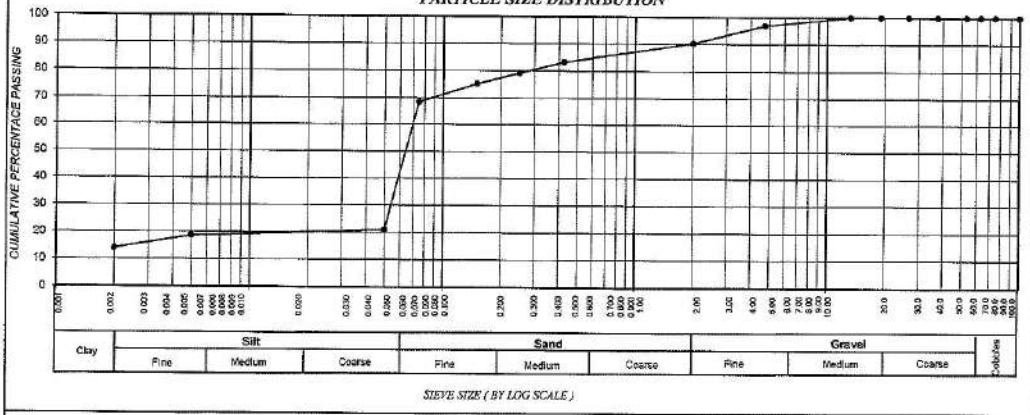
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
13.8	20.7	55.8	9.8

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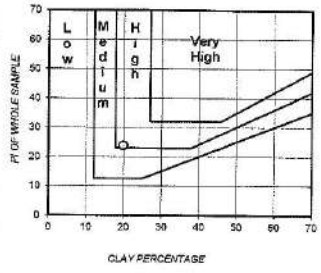
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

DATE RECEIVED : 2022.01.31
POSITION : TP 25
LAYER : 400-1300mm
SAMPLE No. : 8752
SAMPLE DESCRIPTION : Light Brown Silty Clayey + Ferricrete Gravel Clayey Silty Sand

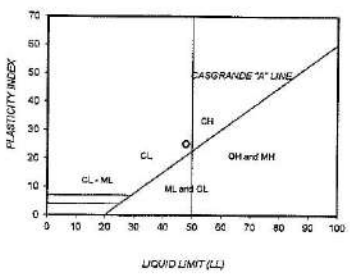
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		23.8
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	99
	2.000	99
	0.425	95
	0.250	91
	0.150	87
	0.075	80
	50 µm	27
	5 µm	23
	2 µm	19.9
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4
	0.425 - 0.250	4
	0.250 - 0.150	5
	0.150 - 0.075	6
	< 0.075	81
Effective size		0.002
Uniformity Coefficient		32.7
Curvature Coefficient		20.1
Oversize Index		0.0
Shrinkage Product		976.9
Grading Coefficient		1.2
Grading modulus		0.26
Atter-berg Limits	Liquid Limit	48
	Plasticity Index	25
	Linear Shrinkage	10.3
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-7-6 (21)

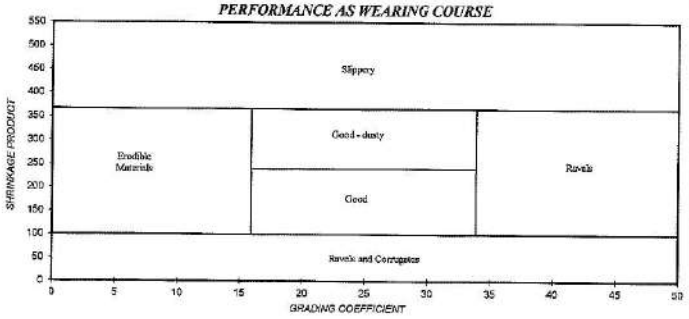
POTENTIAL EXPANSIVENES



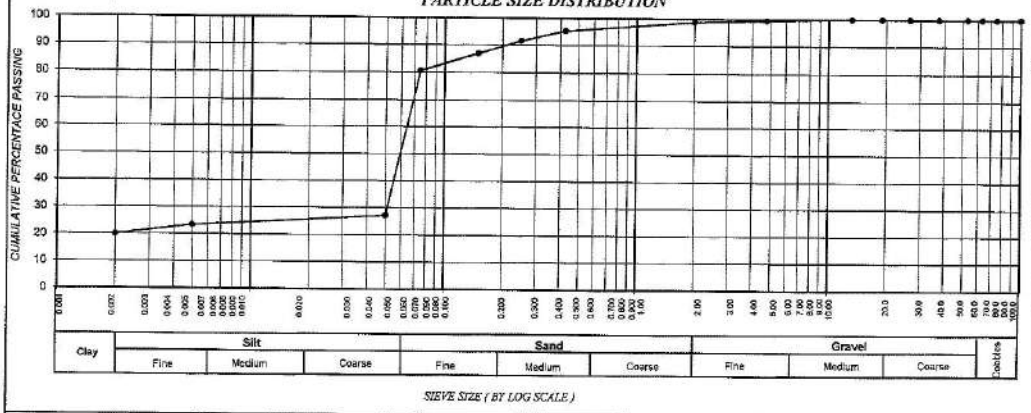
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
19.9	22.9	56.0	1.2

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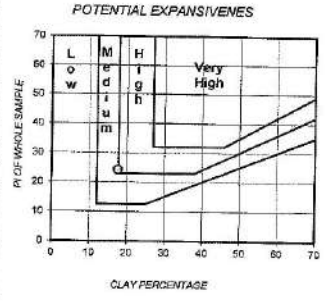
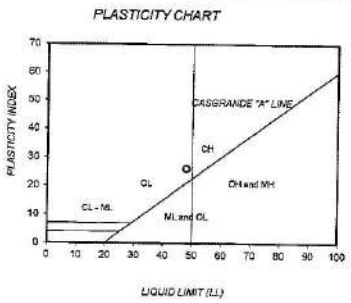
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

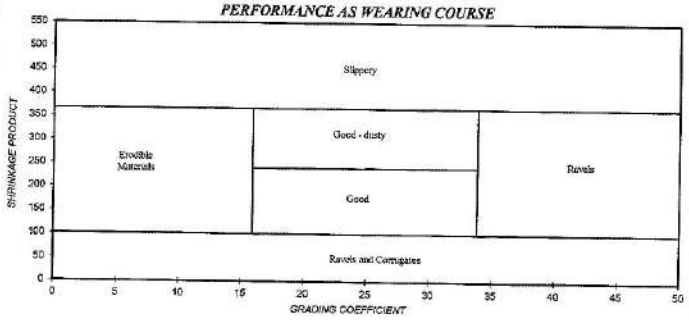
DATE RECEIVED : 2022.01.31
POSITION : TP 24
LAYER : 1000-2800mm
SAMPLE No. : 8753
SAMPLE DESCRIPTION : Light Brown Sandy Clayey Clayey Silty Sand

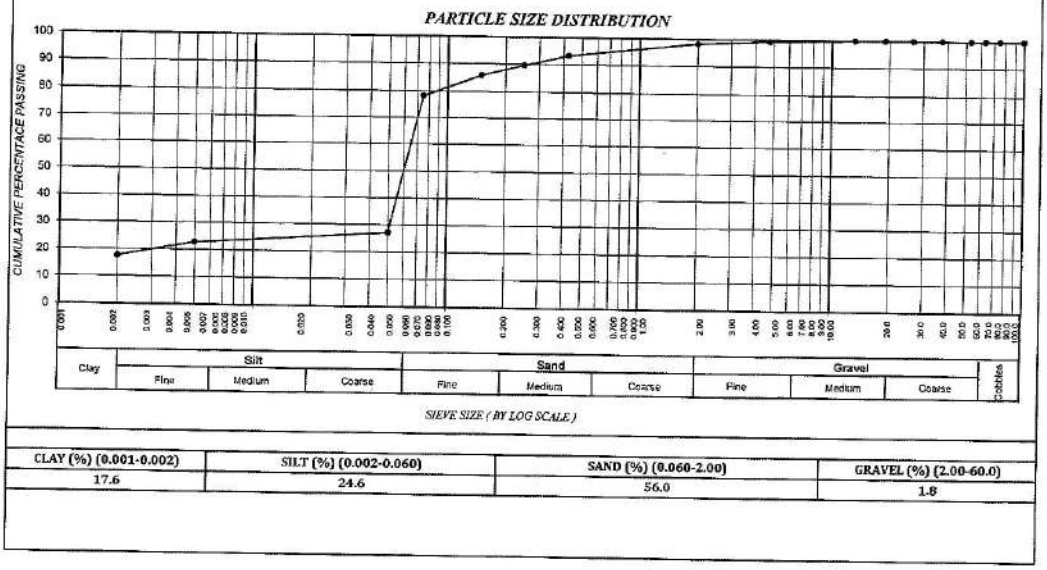
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		24.2
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	99
	2.000	98
	0.425	93
	0.250	89
	0.150	86
	0.075	78
	50 µm	27
	5 µm	23
	2 µm	17.6
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	5
	0.425 - 0.250	4
	0.250 - 0.150	4
	0.150 - 0.075	8
	< 0.075	80
Effective size		0.002
Uniformity Coefficient		33.0
Curvature Coefficient		20.0
Oversize Index		0.0
Shrinkage Product		879.7
Grading Coefficient		1.8
Grading modulus		0.31
Atterberg Limits	Liquid Limit	48
	Plasticity Index	26
	Linear Shrinkage	9.5
	PI < 0.075	-
Unified Soil Classification		CL
U.S. Highway Classification		A-7-6 (20)









CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
17.6	24.6	56.0	1.8

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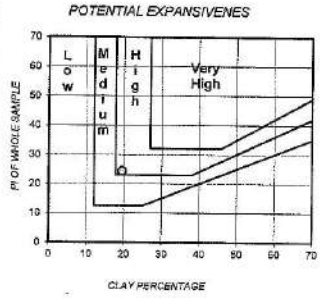
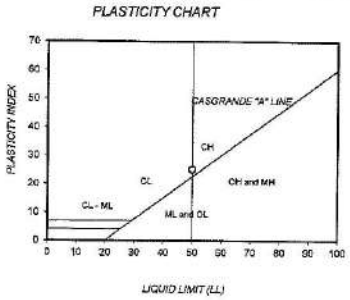
OUR REF : RM14730
CLIENT : Terra Geotechnical
PROJECT : Riversdale RE/21

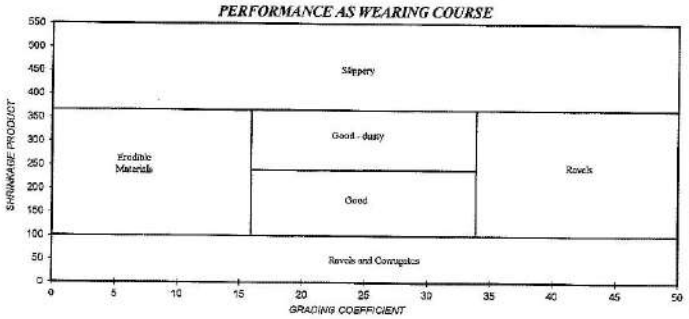
DATE RECEIVED : 2022.01.31
POSITION : TP 24
LAYER : 500-1000mm
SAMPLE No. : 8754
SAMPLE DESCRIPTION : Dark Brown Olive Clayey + Ferricrete Gravel Clayey Silty Sand

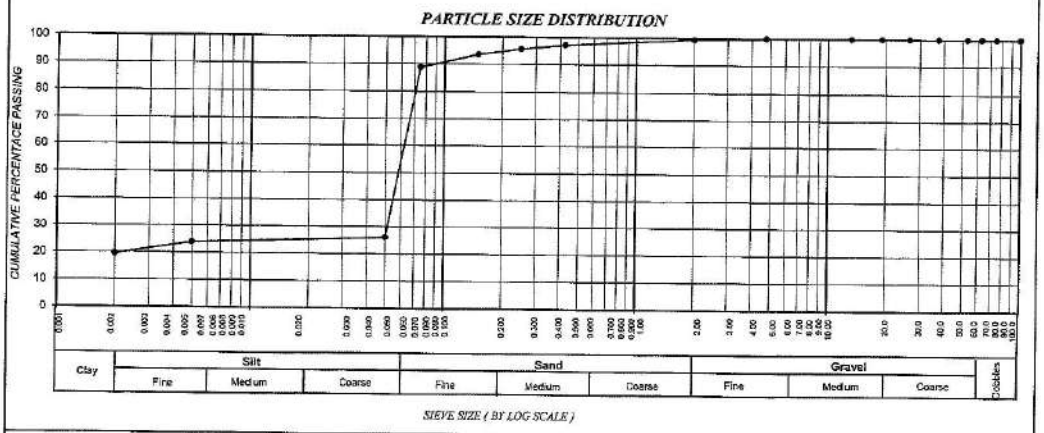
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		24.3
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	100
	2.000	99
	0.425	97
	0.250	96
	0.150	93
	0.075	89
	50 µm	26
	5 µm	24
	2 µm	19.5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	2
	0.425 - 0.250	2
	0.250 - 0.150	2
	0.150 - 0.075	5
	< 0.075	89
Effective size		0.002
Uniformity Coefficient		31.8
Curvature Coefficient		20.9
Oversize Index		0.0
Shrinkage Product		1034.3
Grading Coefficient		0.6
Grading modulus		0.14
Atter-berg Limits	Liquid Limit	50
	Plasticity Index	25
	Linear Shrinkage	10.7
	PI < 0.075	-
Unified Soil Classification		CH
U.S. Highway Classification		A-7-6 (25)

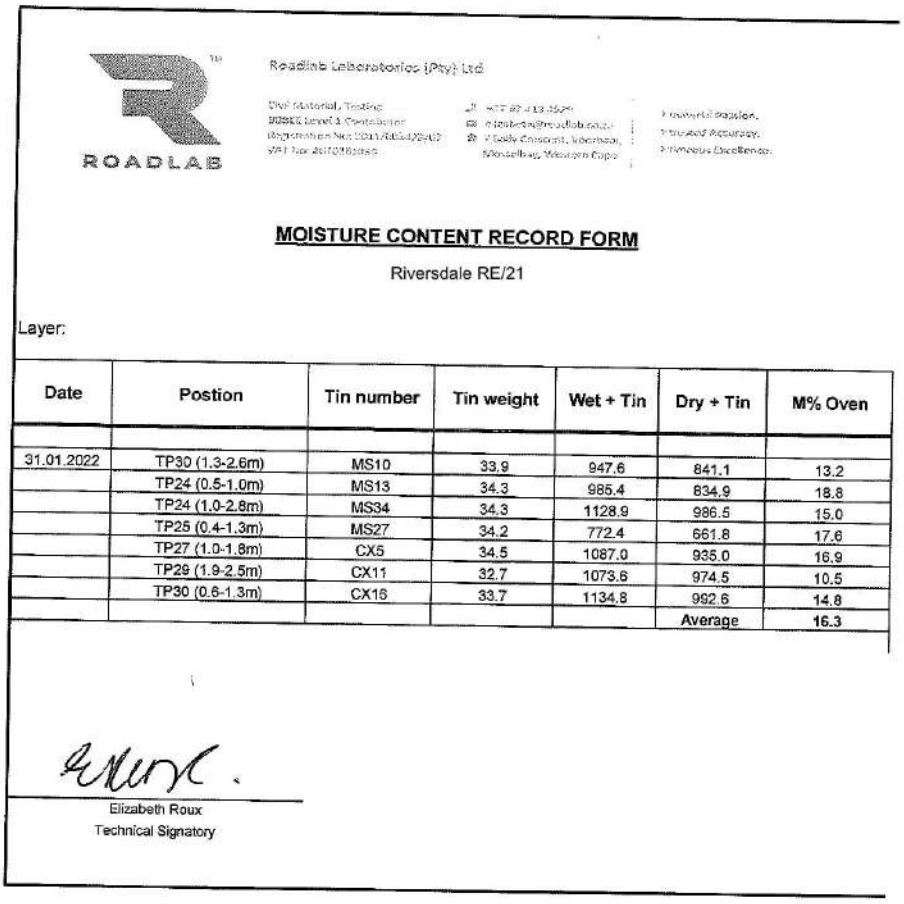








CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
19.5	24.7	55.2	0.6



ROADLAB

Roadlab Laboratories (Pty) Ltd

MOISTURE CONTENT RECORD FORM

Riversdale RE/21

Layer:

Date	Postion	Tin number	Tin weight	Wet + Tin	Dry + Tin	M% Oven
31.01.2022	TP30 (1.3-2.6m)	MS10	33.9	947.6	841.1	13.2
	TP24 (0.5-1.0m)	MS13	34.3	985.4	834.9	18.8
	TP24 (1.0-2.8m)	MS34	34.3	1128.9	986.5	15.0
	TP25 (0.4-1.3m)	MS27	34.2	772.4	661.8	17.6
	TP27 (1.0-1.8m)	CX5	34.5	1087.0	935.0	16.9
	TP29 (1.9-2.5m)	CX11	32.7	1073.6	974.5	10.5
	TP30 (0.6-1.3m)	CX16	33.7	1134.8	992.6	14.8
					Average	16.3

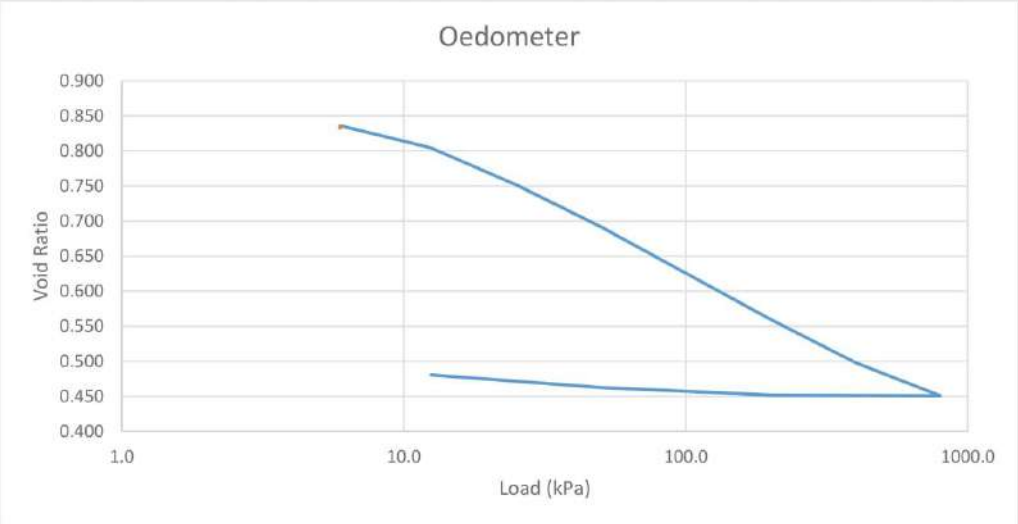
Elizabeth Roux
Technical Signatory

Oedometer Swell Test

Sample Detail		Initial	Final
Height	(mm)	20.3	16.4
Diameter	(mm)	63.5	63.5
Weight	(g)	107.3	116.4
Moisture	(%)	13.7	26.7
Dry Density	(Mg/m^3)	1.47	1.77
Bulk Density	(Mg/m^3)	1.67	2.24
Void Ratio		0.832	0.481
Particle Density	(Mg/m^3)	2.69	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m^3)	-	

Load (kPa)	Height (mm)	Void Ratio
5.9	20.300	0.832
5.9	20.348	0.836
12.5	19.993	0.804
25	19.412	0.752
50	18.749	0.692
100	18.015	0.626
200	17.287	0.560
400	16.603	0.498
800	16.077	0.451
200	16.088	0.452
50	16.208	0.463
12.5	16.410	0.481

Swell Results		
Swell Percentage	0.2	%
Swell Pressure	0.8	kPa



STEYN-WILSON GEOTECHNICAL

sanas

Project	Riversdale		
Sample	TP2_1200 - 1800		
Client	Terra Geotechnical	Test Method	BS1377 - 5: 1990
Jobfile	SWG00273	Test Date	03/02/2022

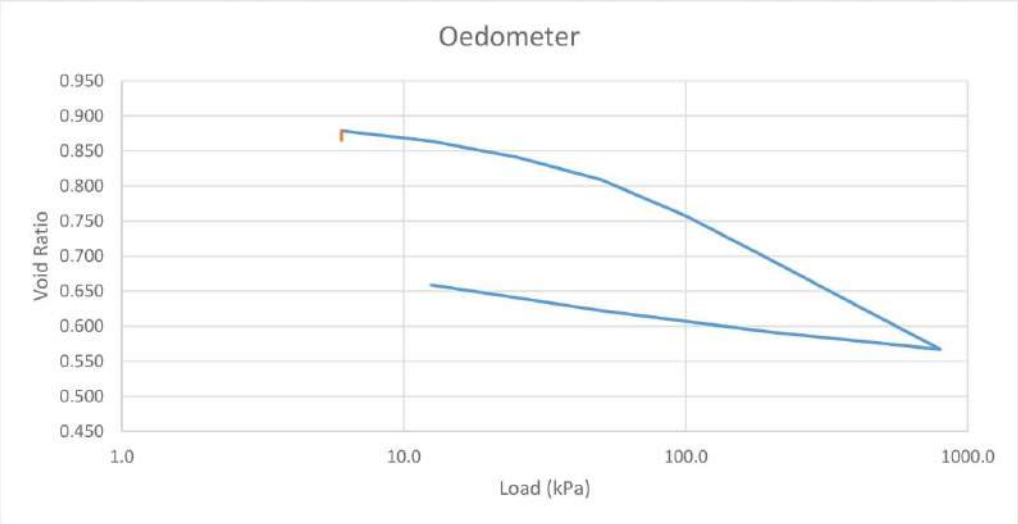
01/02/2021 Rev2 TR/GEO-SW0009 Compiled: M. Steyn Approved: R. Wilson

Oedometer Swell Test

Sample Detail		Initial	Final
Height	(mm)	20.3	18.1
Diameter	(mm)	63.5	63.5
Weight	(g)	116.7	120.9
Moisture	(%)	22.6	31.8
Dry Density	(Mg/m^3)	1.48	1.60
Bulk Density	(Mg/m^3)	1.82	2.11
Void Ratio		0.865	0.659
Particle Density	(Mg/m^3)	2.76	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m^3)	-	

Load (kPa)	Height (mm)	Void Ratio
6.0	20.300	0.865
6.0	20.452	0.879
12.5	20.289	0.864
25	20.047	0.841
50	19.694	0.809
100	19.130	0.757
200	18.449	0.695
400	17.750	0.630
800	17.059	0.567
200	17.329	0.592
50	17.660	0.622
12.5	18.059	0.659

Swell Results		
Swell Percentage	0.7	%
Swell Pressure	5.9	kPa



STEYN-WILSON GEOTECHNICAL

sanas

Project	Riversdale		
Sample	TP4_1500 - 1800		
Client	Terra Geotechnical	Test Method	BS1377 - 5: 1990
Jobfile	SWG00273	Test Date	08/02/2022

01/02/2021 Rev2 TR/GEO-SW0009 Compiled: M. Steyn Approved: R. Wilson

Oedometer Swell Test

Sample Detail		Initial	Final
Height	(mm)	20.3	20.3
Diameter	(mm)	63.5	63.5
Weight	(g)	138.0	144.8
Moisture	(%)	16.3	22.0
Dry Density	(Mg/m^3)	1.85	1.85
Bulk Density	(Mg/m^3)	2.15	2.26
Void Ratio		0.463	0.461
Particle Density	(Mg/m^3)	2.70	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m^3)	-	

Load (kPa)	Height (mm)	Void Ratio
6.0	20.300	0.463
6.0	22.612	0.630
12.5	22.266	0.605
25	21.908	0.579
50	21.415	0.543
100	20.861	0.503
200	20.100	0.448
400	19.418	0.399
800	18.782	0.354
200	19.106	0.377
50	19.642	0.415
12.5	20.269	0.461

Swell Results		
Swell Percentage	11.4	%
Swell Pressure	165.9	kPa

STEYN-WILSON GEOTECHNICAL

sanas

Project	Riversdale		
Sample	TP8_1200 - 1800mm		
Client	Terra Geotechnical	Test Method	BS1377 - 5: 1990
Jobfile	SWG00273	Test Date	01/02/2022

01/02/2021 Rev2 TR/GEO-SW0009 Compiled: M. Steyn Approved: R. Wilson

Oedometer Swell Test

Sample Detail		Initial	Final
Height	(mm)	20.3	19.7
Diameter	(mm)	63.5	63.5
Weight	(g)	135.0	136.7
Moisture	(%)	21.2	24.6
Dry Density	(Mg/m^3)	1.73	1.76
Bulk Density	(Mg/m^3)	2.10	2.20
Void Ratio		0.564	0.514
Particle Density	(Mg/m^3)	2.71	
Disturbed/Undisturbed		Undisturbed	
Remoulded Density	(Mg/m^3)	-	

Load (kPa)	Height (mm)	Void Ratio
8.0	20.300	0.564
8.0	22.221	0.712
12.5	22.021	0.697
25	21.693	0.671
50	21.134	0.628
100	20.456	0.576
200	19.831	0.528
400	18.920	0.458
800	18.248	0.406
200	18.471	0.423
50	19.142	0.475
12.5	19.652	0.514

Swell Results		
Swell Percentage	9.5	%
Swell Pressure	116	kPa

STEYN-WILSON GEOTECHNICAL

sanas

Project	Riversdale		
Sample	TP27_1.0 - 1.8m		
Client	Terra Geotechnical	Test Method	BS1377 - 5: 1990
Jobfile	SWG00273	Test Date	17/02/2022

01/02/2021 Rev2 TR/GEO-SW0009 Compiled: M. Steyn Approved: R. Wilson

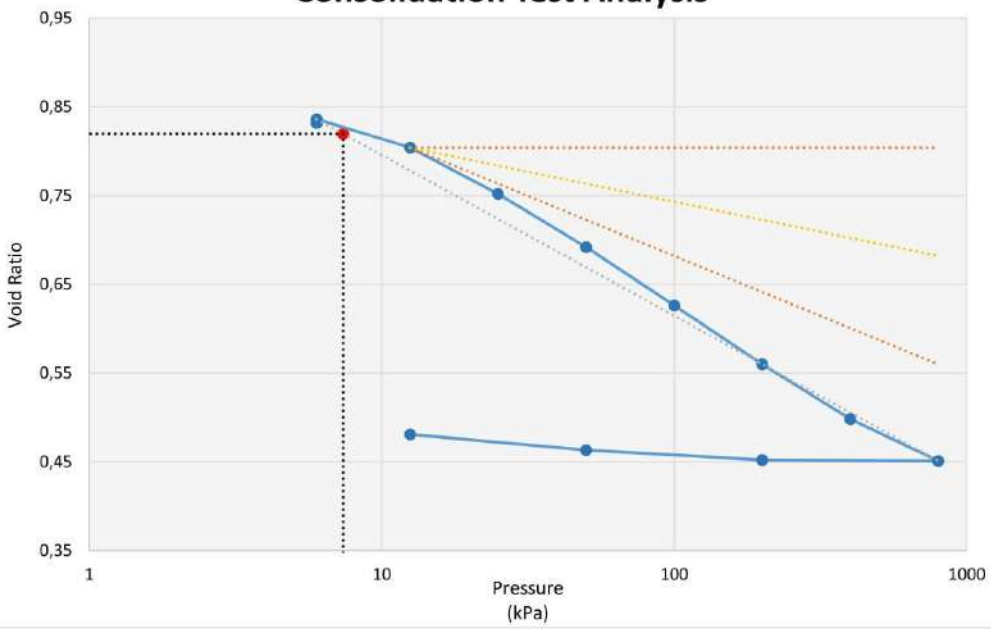
Single Oedometer "Consolidation" Test

Undisturbed Sample UNTP2

Load Increment (kPa)		6	12,5	25	50	100	200	400	800
Void Ratio	Loading	0,836	0,804	0,752	0,692	0,626	0,560	0,498	0,451
	Unloading	-	0,481	-	0,463	-	0,452	-	-

Horizons	H1	H2	H3	H4	H5	H6	Inferred In-situ Overburden (kPa)
Final Depth (m)	1,5						
Moisture Content (%)	13,7						
Dry Density (kg/m^3)	1470						
Bulk Density (kg/m^3)	1670						
Overburden (kPa)	24,549						24,5

Consolidation Test Analysis



Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,753		
	Loaded	0,752	0,692	0,626
a		0,0030	0,0024	0,0017
Mv		1,7271	1,3751	0,9628
Oedometer Settlement		21,37	34,03	47,66
*Settlement Range (mm)	Lower	22	36	50
	Upper	32	51	71

Preconsolidation State	
Pressure (kPa)	Void Ratio
7,4	0,819
Normally Consolidated	

Factor of Safety	1,5

Foundation Width (m)	0,6

** the settlement range presented above assumes a **depth of influence** factor of 1.5 times the presented foundation width (below the foundation level)*

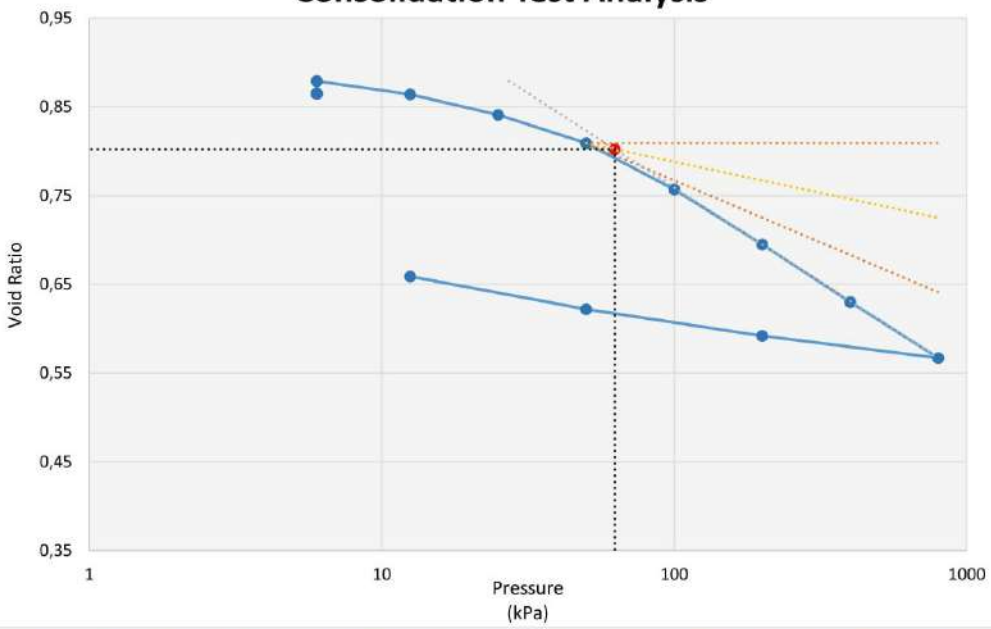
Single Oedometer "Consolidation" Test

Undisturbed Sample UNTP4

Load Increment (kPa)		6	12,5	25	50	100	200	400	800
Void Ratio	Loading	0,879	0,864	0,841	0,809	0,757	0,695	0,630	0,567
	Unloading	-	0,659	-	0,622	-	0,592	-	-

Horizons	H1	H2	H3	H4	H5	H6	Inferred In-situ Overburden (kPa)
Final Depth (m)	1,65						
Moisture Content (%)	22,6						
Dry Density (kg/m^3)	1480						
Bulk Density (kg/m^3)	1820						
Overburden (kPa)	29,429						**29,4**

Consolidation Test Analysis



Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,833		
	Loaded	0,841	0,809	0,757
a		0,0017	0,0012	0,0011
Mv		0,9273	0,6488	0,5910
Oedometer Settlement		11,48	16,06	29,25
*Settlement Range (mm)	Lower	9	12	22
	Upper	12	17	31

Preconsolidation State	
Pressure (kPa)	Void Ratio
62,7	0,802
Overconsolidated	

Factor of Safety	1,5

Foundation Width (m)	0,6

** the settlement range presented above assumes a **depth of influence** factor of 1.5 times the presented foundation width (below the foundation level)*

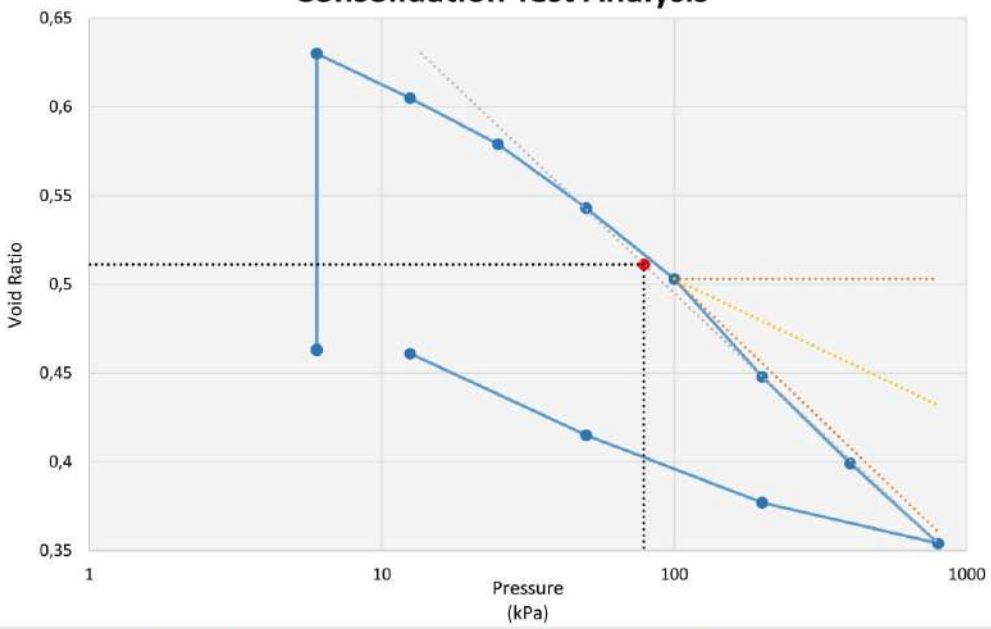
Single Oedometer "Consolidation" Test

Undisturbed Sample UNTP8

Load Increment (kPa)		6	12,5	25	50	100	200	400	800
Void Ratio	Loading	0,630	0,605	0,579	0,543	0,503	0,448	0,399	0,354
	Unloading	-	0,461	-	0,415	-	0,377	-	-

Horizons	H1	H2	H3	H4	H5	H6	Inferred In-situ Overburden (kPa)
Final Depth (m)	1,5						
Moisture Content (%)	16,3						
Dry Density (kg/m^3)	1850						
Bulk Density (kg/m^3)	2150						
Overburden (kPa)	31,605						**31,6**

Consolidation Test Analysis



Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,567		
	Loaded	0,579	0,543	0,503
a		0,0018	0,0013	0,0009
Mv		1,1766	0,8266	0,5956
Oedometer Settlement		14,56	20,46	29,48
*Settlement Range (mm)	Lower	11	15	22
	Upper	15	21	31

Preconsolidation State	
Pressure (kPa)	Void Ratio
78,8	0,511
Overconsolidated	

Factor of Safety	1,5
Foundation Width (m)	0,6

** the settlement range presented above assumes a **depth of influence** factor of 1.5 times the presented foundation width (below the foundation level)*

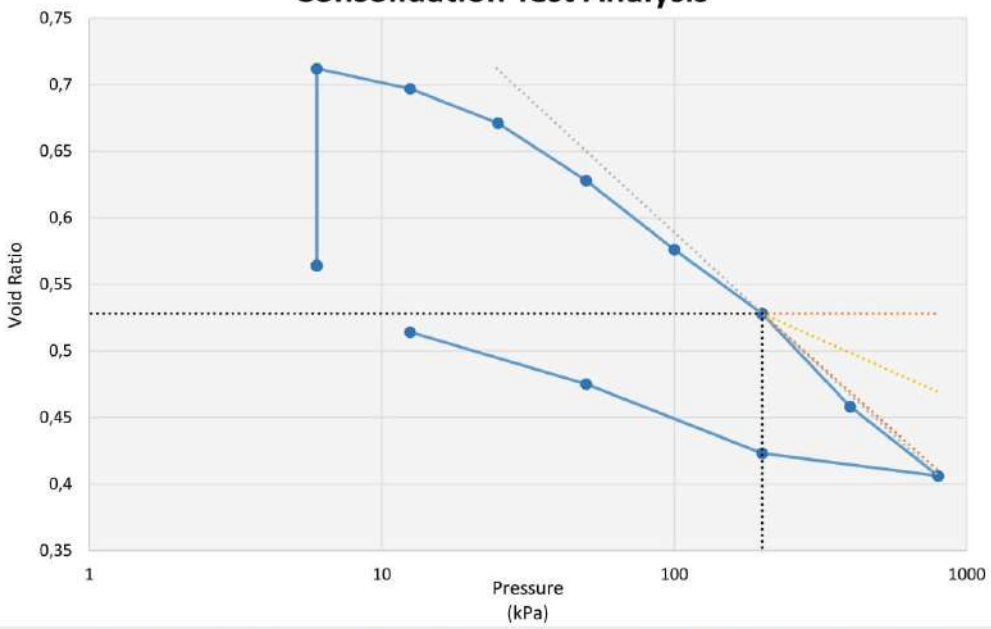
Single Oedometer "Consolidation" Test

Undisturbed Sample UNTP27

Load Increment (kPa)		6	12,5	25	50	100	200	400	800
Void Ratio	Loading	0,712	0,697	0,671	0,628	0,576	0,528	0,458	0,406
	Unloading	-	0,514	-	0,475	-	0,423	-	-

Horizons	H1	H2	H3	H4	H5	H6	Inferred In-situ Overburden (kPa)
Final Depth (m)	1,5						
Moisture Content (%)	21,2						
Dry Density (kg/m^3)	1730						
Bulk Density (kg/m^3)	2100						
Overburden (kPa)	30,87						30,9

Consolidation Test Analysis



Bearing Load (kPa)		25	50	100
Void Ratio	In-situ (e^0)	0,658		
	Loaded	0,671	0,628	0,576
a		0,0022	0,0016	0,0012
Mv		1,3444	0,9433	0,7147
Oedometer Settlement		16,64	23,35	35,38
*Settlement Range (mm)	Lower	12	18	27
	Upper	17	25	37

Preconsolidation State	
Pressure (kPa)	Void Ratio
200,0	0,528
Overconsolidated	

Factor of Safety	1,5
Foundation Width (m)	0,6

** the settlement range presented above assumes a **depth of influence** factor of 1.5 times the presented foundation width (below the foundation level)*