ERF 878

RIEBEEK KASTEEL

REPORT ON

SUBGRADE CONDITIONS FOR ROADS
AND
GEOTECHNICAL CONDITIONS FOR SERVICES

REF. 1-176721
28 July 2021

R. A. BRADSHAW
& ASSOCIATES cc
Consulting Engineering
Geologists

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REPORT ON
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1. INTRODUCTION

Rezoning and subdivision of Erf 878 in Riebeek Kasteel has been completed and civil engineering design for the roads and services for the proposed housing development is in progress.

Geotechnical data is now required for the civil designs and Mr R. van Dyk of KLS Consulting Engineers, the Civil Engineers for the project, therefore requested R.A. Bradshaw & Associates cc to investigate the subgrade conditions for the roads and the geotechnical conditions for services. The potential use of materials on the site for layerworks and fill was also to be assessed. No investigations for the structural components of the project were required.

A proposal for the investigations was e-mailed to Mr van Dyk on 23 June 2021. Authorisation to proceed with the investigations was received on 30 June from Mr R. Geldenhuys of Silver Solutions 3371 cc, the developers of the Estate.

This report presents the results of the site investigations, which were undertaken on 15 July 2021, and the associated laboratory testing.

2. DESCRIPTION OF THE SITE AND THE ROAD NETWORK

2.1. The Site

The site comprises an irregular, polygonal shaped, approximately 11Ha parcel of farmland that is located in the southeastern outskirts of Riebeek Kasteel.

Kerk Straat and two commercial properties abut the western boundary of the site and existing residential erven and a stream abut the northern boundary. Existing residential erven stand along the entire eastern boundary and a smallholding and vineyards abut the southern boundary.

Topographically the site can be sub-divided into two areas.

- The southern approximately half of the site is dominated by a conical hill which is located in the central southern part of this area. The ground slopes to the northwest, the north and the east from the top of the hill. The ground slopes at gradients in the approximate range 1:23 to 1:5 with the steepest gradients on the northern and eastern sides of the hill.

  An approximately 8m wide road/track has been excavated at 170m to 171m elevation around the western, northern and eastern sides of the conical hill. The southeastern end of this road passes steeply downhill through a narrow strip of land to link up with Fontein Street.

  A second road/track, which is less well defined, was constructed at approximately 150.5m elevation around the lower, northern slopes of the hill.

- The northern approximately half of the site comprises what is assumed to be an alluvial wash area in which the slope falls more gently generally northeastwards at a gradient of approximately 1:16.

A 7m diameter, round, water-filled, reservoir stands approximately centrally within the northern half of the site. This dam is fed by a spring which runs in a trench that extends back to the western boundary (see Figure 1).

A second, small trench also occurs centrally near the northern boundary of the site.

The occurrence of various old fences and a water trough is evidence of the previous farming activities on the property.

At the time of the investigations, a thick covering of grass and weeds occurred in the lower northern half of the site. The grassed area extends up the southwestern side of the conical hill, but the majority of the hill and therefore the southern part of the site was covered by fynbos.

Exotic trees (mainly wattle) stand in isolated places on the site but there is a small grove of trees and bushes on the lower southwestern slope of the conical hill.

A period of heavy rainfall had preceded the site investigations and the ground, particularly in the lower lying areas of the site, was sodden. Surface water was evident in small areas along the western boundary and near the extreme northeastern corner of the site.

2.2. The Road Network

The 1.7km road network will comprise 10m and 13m wide roads.

Entrance to the site will be in two places off Fontein Street with another entrance off Kerk Straat .

Services including water, storm water and sewer will be provided as part of the development.

Y 9900

X 3695400

X 3695700

TP1

TP2

TP3

TP4

TP5

TP6

TP7

TP8

TP9

TP10

TP11

TP12

TP13

TP14

TP15

TP16

Northern Soil Profile

Southern Soil Profile

Ditch

Reservoir

Drainage ditch

Right of Way 6.91m

Road 5.04m

Road 5.04m

STORMWATER TO DISCHARGE INTO STREAM

CONNECT FOUL SEWER TO EXISTING NETWORK

CONNECT FOUL SEWER TO EXISTING NETWORK

CONNECT WATER RETICULATION TO EXISTING NETWORK

CONNECT STORMWATER TO EXISTING NETWORK

CONNECT FOUL SEWER TO EXISTING NETWORK

CONNECT STORMWATER TO EXISTING NETWORK

Fontein Street

Church Street

Legend

Trial pit

----Approx contact between Northern & Southern Soil Profiles

FIGURE 1
LAYOUT OF TRIAL PITS
Scale: 1:1750 (A3)

3. OUTLINE OF THE INVESTIGATIONS

3.1. Trial Pitting

Sixteen trial pits were excavated with a digger/loader at the positions shown on Figure 1. The pits were excavated to depths of approximately 1m. The pits were positioned in the road reserves and road intersections using a hand-held GPS with a nominal accuracy of 3m.

The soils exposed in the pits were described according to standard South African practice and the descriptions of the soil profiles are presented in Appendix A of this report. The GPS coordinates of the pits are also presented on the soil profile sheets.

3.2. Laboratory Testing

Six bulk samples of representative soil types across the site were taken for roads indicator and mod/CBR tests.

The laboratory test sheets are presented in Appendix B.

4. RESULTS OF THE INVESTIGATIONS

Two generalised soil profiles occur on the site and their distribution coincides approximately with the topographic sub-divisions highlighted in Section 2.1. The detailed descriptions of the soil types and their origins are provided on the soil profile sheets in Appendix A and the information is summarised below. The schematic distribution of the soil types in the trial pits is shown in Figure 2.

4.1. The Southern Soil Profile

The Southern Soil Profile comprises thinly developed, commonly gravelly, colluvial soils over cohesive transported and residual Malmesbury soils and/or weathered Malmesbury bedrock.

- **Clayey gravelly sand:** Colluvial, slightly gravelly sand extended to a depth of 0.3m in TP1 and TP2. The sample from TP2 had a plasticity index of 6 and a fines content of 18%. Grass roots were present to depths of 0.15m.

- **Clayey sandy gravel:** Clayey sandy fine to medium gravel with coarse gravel was encountered below the gravelly sand in TP2 and from surface in TP8, TP9 and TP11. Two layers of this soil were commonly developed with the upper layer coloured khaki brown and very slightly clayey whereas the lower layer is mustard coloured and it has greater clay content. Where present, the total thickness of these layers varied from 0.35m to 0.85m.

- **Clayey silt:** Light grey, generally blotched maroon, transported and mainly residual clayey silt that was derived from completely weathered Malmesbury Group schist underlies the transported gravelly soils at depths ranging from 0.3m to 1.15m. The thickness of this layer of soil is unknown and it might not be developed everywhere. The soils contain scattered pieces of highly weathered, very soft rock schist.

  The sample from TP11 had a plasticity index of 11 and a fines content of 41%.

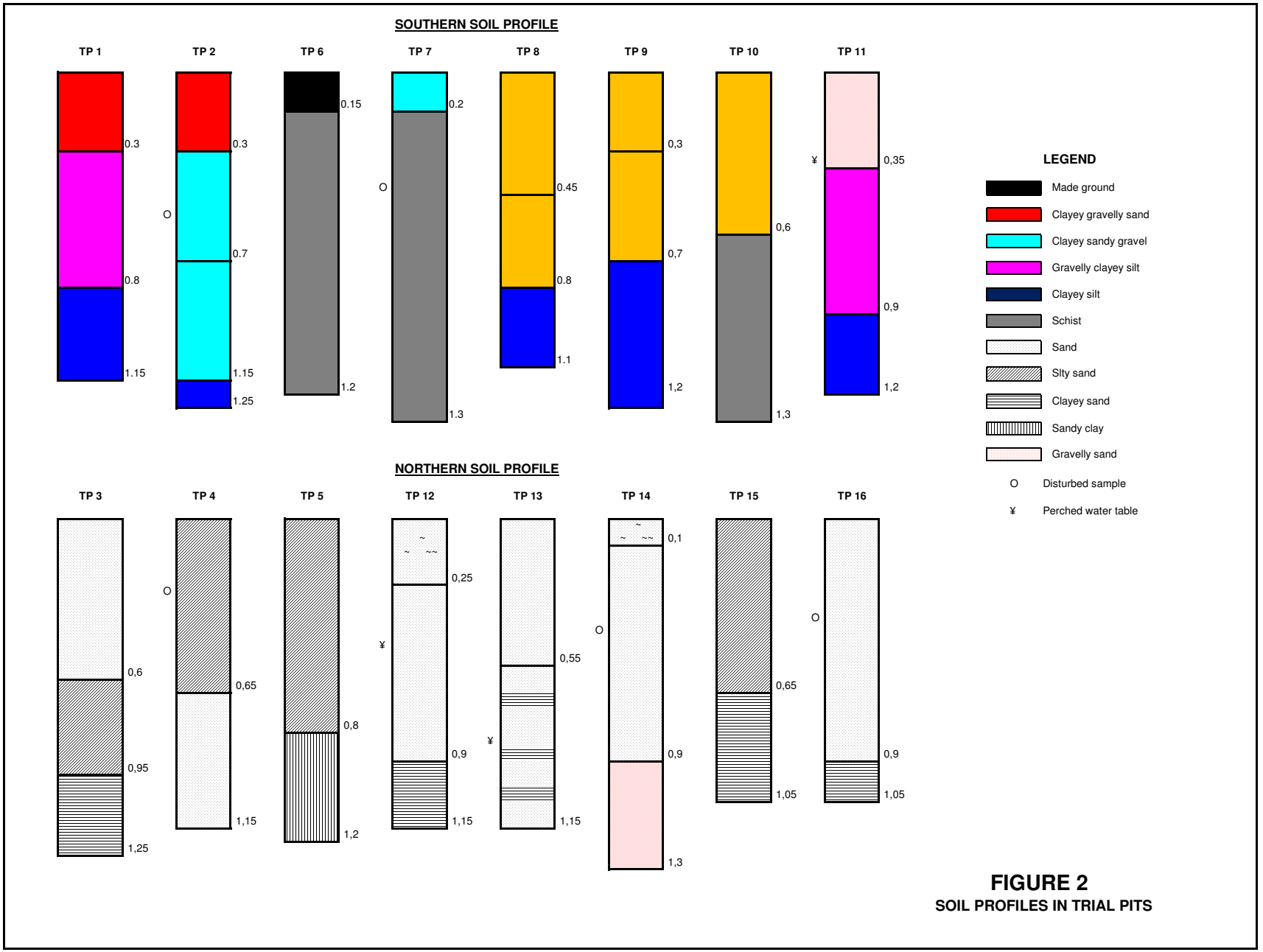


FIGURE 2

SOIL PROFILES IN TRIAL PITS

The soils grade rapidly downwards into weathered schist bedrock.

- **Schist:** Schist was encountered below a thin (0.15m and 0.2m) layer of made ground in TP6 and TP7 and below colluvial sandy clay in TP10. The former two pits were located on the road/track around the conical hill and the overlying transported gravelly soil had been removed.

  The material sampled in TP7 was soil-like in places and it had a plasticity index of 8 and fines content of 31%.

  At the depths encountered, the schist was variably weathered but commonly highly or highly to moderately weathered and it was a highly fractured and/or fissile, very soft or soft rock but becoming medium hard towards a depth of 1.3m in the base of TP7.

4.2. The Northern Soil Profile

The Northern Soil Profile is completely different to the profile in the southern parts of the site and it is characterised by an assemblage of sandy and silty sandy soils underlain at shallow depth by cohesive soil. All these soils are transported and their origin is assumed to be alluvial wash, but local alluvium and topsoil are also present.

- **Sand and silty sand:** Thin layers of very slightly silty, fine to medium sand and/or silty fine to medium sand extended to depths between 0.55m to more than 1.15m in the trial pits. The soils were generally very moist or wet. No DCP testing was undertaken and the relative density of the soils was estimated visually and ranged from loose to medium dense, but the soils will densify slightly in summer when the soil moisture decreases significantly.

  The sample of sand from TP14 was slightly plastic but the sand from TP16 had a plasticity index of 5. These soils are cohesionless with grading moduli of 0.93 and 0.7 and fines contents (material finer than 0.075mm) of 28% and 39% respectively. The silty sand encountered in TP4 had a plasticity index of 6 and it was also cohesionless with a grading modulus of 0.69 and a fines content of 44%. This soil should therefore strictly be termed sandy silt.

  Alluvial, fine to coarse sand with scattered fine to medium gravel was encountered at a depth of 0.9m in TP14.

- **Cohesive soils:** Slightly clayey and clayey, fine to medium sand, which is also probably alluvial wash, occurs below the surficial sandy soils. This soil is currently stiff and the thickness of the layer is unknown.

  Sandy clay/very clayey, fine to medium sand occurred at a depth of 0.8m below a layer of silty sand in TP5 and interlayered sand and clayey sand occurred at a depth of 0.55m below a layer of sand in TP13.

4.3. Groundwater

Unusually, given the generally sodden state of the site at the time of the site investigations, perched groundwater was only recorded in three trial pits, TP11, TP12 and TP16. This might be partly due to the shallow depth of the trial pits and the short time they were left open. However, shallow perched groundwater should be anticipated until construction occurs and probably also afterwards.

Seepage to surface was noted during the site investigations next to TP2 and also in a larger area near TP16.

Water, which was assumed to be groundwater, was flowing along the ditch leading to the round reservoir and it is possible that seepage also occurs at or near this structure.

The reason that the trench to the east of TP14 was excavated is unknown but it too might be related to seepage.

4.4. CBR and Plasticity Index of the Soils

The CBR and plasticity indices of the six samples are summarised in Table 1 overleaf.

From Table 1, it is apparent that the sands and silty sands are classified as G7 and worse than G9 materials, the clayey sandy gravel is a G8 material. The gravelly clay silty soils and the schist are both worse than G9 materials.

It is thus apparent that the subgrade conditions are generally worse than G9 quality in both the Southern and Northern Soil Profiles and the layerworks for roads should be designed for these poor subgrade conditions.

5. GEOTECHNICAL ASSESSMENT

5.1. Site Clearance and Preparation

Site clearance and preparation for road construction will include but not necessarily be limited to the following:

- The positions of all the trial pits should be identified before any clearing or construction commences and the loose backfill should be removed and replaced with sand that is compacted to at least 95% of mod ASSHTO dry density to avoid having soft ‘spots’ below the roads.

- Felling and removal of trees and their stumps.

- Removal of the grass and fynbos vegetation including roots. Exposures in the trial pits indicated that root growth extends to a depth of at least 150mm but the depth varies and an average of 75mm to 100mm would generally be applicable with roots extending to greatest depth in the Northern Soil Profile and in the southwestern parts of the Southern Soil Profile.

TABLE 1 RESULTS OF CBR TESTS

Soil Type	*Trial Pit*	*Depth (m)*	*Mod A.A.S.H.T.O. Data*		*C.B.R. at*					*Maximum Swell (%)*	*Plasticity Index*	*COLTO Classification*
			M.D.D. (kg/m^3)	**O.M.C. (%)**	**100%**	**98%**	**95%**	**93%**	**90%**			
Clayey sandy gravel	TP2	0.2-0.7	2190	6.8	32	22	15	10	6	0.0	6	G8
Silty sand	TP4	0.3-0.65	2068	8.2	29	19	10	6	3	0.3	6	<G9
Schist	TP7	0.2-0.8	1972	12.0	12	10	8	7	5	0.8	8	G9
Gravelly clayey silt	TP11	0.35-0.9	1847	14.3	8	6	4	3	1	1.4	11	<G9
Sand	TP14	0.2-0.9	1854	9.0	40	22	8	4	2	0.0	S-P	<G9
Sand	TP16	0.2-0.9	2030	7.4	69	31	22	16	9	0.1	5	G7

- Removing various fences and remnant fence poles.

- It is anticipated that the surficial soils in the Northern Soil Profile would become waterlogged after periods of rainfall and it would not be possible to drive wheeled vehicles around the site without some form of pioneering such as placement of crushed gravel or rubble.

5.2. Preparation of the Subgrade

Subgrade preparation should be relatively straightforward in the Southern Soil Profile for those parts of the internal roads in the area near TP1 and TP2 and downslope from TP9. The composition of the subgrade will vary with combinations of gravelly colluvium, silty soils and schist occurring because the road bed must be cut into the cross fall in places. Preparation of the newly exposed subgrade would include in-situ compaction to a minimum of 95% of mod AASHTO maximum dry density to ensure a subgrade of generally G9 quality.

The section of internal road from just to the east of TP2 rises over the edge of and onto the existing road/track that then passes over TP6 and TP7 and eventually runs over the eastern edge of the existing embankment fill near TP8 before joining the steeply, easterly sloping section of the road that runs to the southeastern exit/entrance off/onto the property. The material in the filled portion on the downslope side of the track apparently comprises a mixture of clayey sandy gravel, residual Malmesbury soil and weathered schist. The quality of workmanship and the degree of compaction of this fill are unknown and it is recommended that the fill is re-worked, and a small bench or benches are constructed onto which the new engineered fill can then be placed.

In the Northern Soil Profile, the subgrade will mainly comprise alluvial wash sands and silty sands over clayey soils. Subgrade preparation will be impossible at present because of the high moisture content and local free water in the surficial soils. The soils will merely pump if compaction is attempted. Installation of the recommended drainage will assist in drying out the soils, but the process will be very slow and potentially impractical as a quick solution. Ideally therefore, construction, particularly in this part of the sit, should be conducted during the dry period of the year. The newly exposed ‘dry’ subgrade should then be compacted to 95% of mod density to ensure generally G9 subgrade conditions.

5.3. Subsurface Drainage

With a gravelly soil overlying effectively impermeable residual cohesive soils and weathered bedrock in the Southern Soil Profile, a seasonal perched water table would probably develop at the contact between the coarse surficial soils and the underlying soil and bedrock. Given the steepness of the slopes in this area and the proximity of the erven and houses to the roads, installation of conventional subsurface drainage upslope of the roads is probably not viable, but water flow could occur at the contact when the contact is exposed in cuttings and a toe drain will therefore be essential.

The typical profile of sandy soils over cohesive soils in the Northern Soil Profile has and will give rise to a perched water table with groundwater flow at or near the contact between the two soil types. Conventional subsurface drainage must therefore be provided next to all roads. The invert of the drains should be placed below the contact between the two soil types, i.e. typically at or below a depth of 0.9m to ensure that the water is intercepted. A fin-type drain should be

considered. The construction of the drains should commence in the lower parts of the site and progress upslope.

The nature of the spring is not fully understood and formal surface and possibly subsurface drainage measures will probably be required to control and direct flows.

Ad hoc additions to the planned formal subsurface drainage layout for the site might be required to intersect and/or control seepage flows.

5.4. Excavation Conditions

The trial pitting indicated that all materials to a depth of at least 1.3m can be excavated with a digger/loader. The excavation would be classified as Soft Excavation Class according to SANS 1200D, grading to Intermediate Excavation Class in places towards the bottom of this depth range.

To avoid disputes over classification, measurement and payment, Soft and Intermediate Excavation Classes should be combined into one excavation class for this project and that all materials that can be excavated with a twenty-tonne excavator should fall within this project specific class.

5.5. Stability of Excavated and Embankment Slopes

The designs for the roads and the services have not been completed to date and the depth and extent of excavations are unknown but is assumed to be no deeper than 1.5m.

The following batters are provided as guidelines for temporary cut slopes in the two soil profiles:

Southern Soil Profile		*Northern Soil Profile*	
Depth of Cut	*Batter*	*Depth of Cut*	*Batter*
0 to 1m	Vertical	0 to 1m	Vertical
1m to 1.5m	1:0.5	1m to 1.5m	1:1

The following comments and recommendations should be noted in relation to the temporary cut slopes:

- The stability of cut slopes should be checked by a competent person immediately after excavation and routinely thereafter.

- No surcharging of the cut slopes by, for example, excavated material, construction equipment, construction materials or vehicles shall be allowed.

- No workers shall enter the excavations if water occurs in them pending an evaluation of the stability by the competent person and the adoption of appropriate measures to ensure safe working conditions.

Permanent cut slopes in the Southern Soil Profile should be battered at 1:1 and vegetated and protected against concentrated stormwater flowing over the cut slopes

Embankment slopes in both soil profiles should be battered at 1:2 and also vegetated and protected against concentrated stormwater flowing over the embankment slopes.

Retaining walls would be required if steeper slopes are required in the cuttings or for embankments.

5.6. Use of On-site Materials for Construction Purposes

The gravelly soils in the Southern Soil Profile would be suitable for engineered fill in road embankments and a mixture of these soils and the residual soils and schist would also be suitable, albeit of a slightly poorer quality.

The sandy soils in the Northern Soil Profile will also be suitable for engineered fill in road embankments.

However, none of the soils on the site will be suitable for use in engineered fill if they are too wet.

Provision for should be made in the contract documents for compaction testing of the engineered fill (and for testing of the subgrade and layerworks). The use of DCP tests for checking the compaction is not appropriate in general for the soils on the site and provision should therefore be made for nuclear densimeter testing with supplementary mod compaction tests undertaken in a soils laboratory.

R. Bradshaw Pr.Sci.Nat.
R.A. BRADSHAW & ASSOCIATES cc

APPENDIX A

DESCRIPTIONS OF SOIL PROFILES IN TRIAL PITS
AND
RESULTS OF DCP TESTS

SOIL PROFILE

PROJECT: ERF 878,RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 1** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9976
X-COORD: 3695835

DEPTH (m)	DESCRIPTION
0.30	CLAYEY GRAVELLY SAND Very moist, khaki brown, loose, slightly clayey, fine gravelly sand. Colluvium. Roots to 0.15m depth.
0.80	GRAVELLY CLAYEY SILT Moist, mustard, firm to stiff, fissured and fractured, gravelly clayey silt with scattered pieces of highly weathered siltstone. Colluvium.
1.15	CLAYEY SILT Moist, light grey blotched maroon, very stiff, jointed, clayey silt. Residual Malmesbury soil with small patches of highly weathered rock.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

▽ WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: TP 2 **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9942
X-COORD: 3695750

	DEPTH (m)	DESCRIPTION
	: o :/: o : :/: : o: /: : : o :/: o : :/: : o: /: : : o :/: o : :/: : o: /: : : o :/: o : 0.30	CLAYEY GRAVELLY SAND Very moist, khaki brown, loose, slightly clayey, fine gravelly sand. Colluvium. Roots to 0.15m depth.
O 0.2-0.7m	O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: 0.70	CLAYEY SANDY GRAVEL Very moist, khaki brown, loose to medium dense, very slightly clayey, sandy fine to medium gravel with scattered coarse gravel. Colluvium.
	O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O 1.15	CLAYEY SANDY GRAVEL Very moist, mustard, stiff, clayey sandy, fine to medium gravel with scattered coarse gravel. Colluvium.
	o / o / o / o / o / o / 1.25	CLAYEY SILT Moist, light grey blotched maroon, very stiff, jointed, clayey silt. Residual Malmesbury soil with small patches of highly weathered rock.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 3** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 10024
X-COORD: 3695731

DEPTH (m)	DESCRIPTION
0.60	SAND Very moist, greyish brown, loose to medium dense, very slightly silty, fine to medium sand. Alluvial wash. Grass roots to 0.15m.
0.95	SILTY SAND Very moist, greyish brown, medium dense, silty, fine to medium sand. Alluvial wash (?).
1.25	CLAYEY SAND Moist, brown and orange brown, stiff, slightly clayey and clayey fine to medium sand. Alluvial wash (?).

Note: Surface seepage occurring 7m to southwest of the trial pit

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

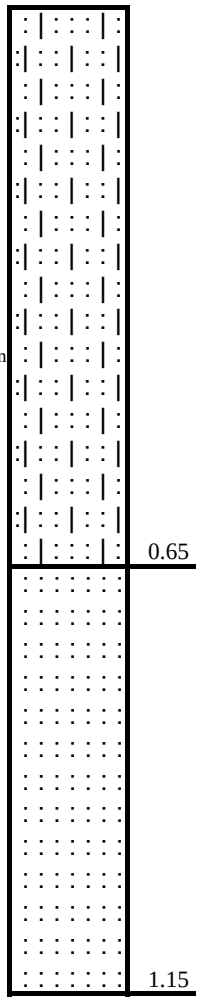
SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 4** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9977
X-COORD: 3695678

DEPTH (m)	DESCRIPTION
O 0.3-0.65m	SILTY SAND Very moist, greyish brown, medium dense, silty, fine to medium sand. Alluvial wash (?). Scattered roots to 0.1m.
0.65	SAND Very moist, greyish brown, medium dense, very slightly silty, fine to medium sand. Alluvial wash/colluvium (?).
1.15	



NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

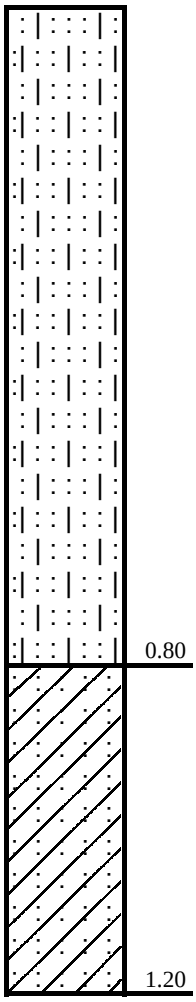
SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 5** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9928
X-COORD: 3695613

DEPTH (m)	DESCRIPTION
	SILTY SAND Very moist, greyish brown, medium dense, silty, fine to medium sand. Alluvial wash (?). Grass roots to 0.1m.
0.80	SANDY CLAY Moist, grey and yellow brown, stiff, slightly fissured, sandy clay/ very clayey, fine to medium sand. Alluvial wash (?).
1.20	



NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

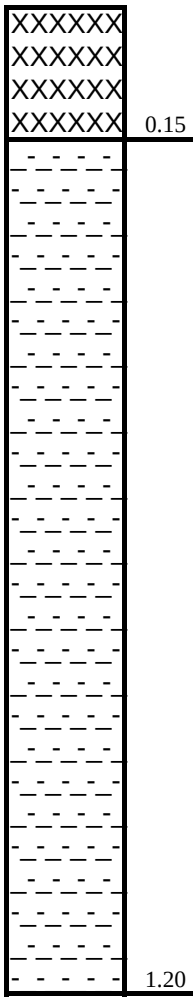
SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 6** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9860
X-COORD: 3695717

DEPTH (m)	DESCRIPTION
0.15	MADE GROUND Very moist, orange brown, medium dense, made ground comprising a mixture of highly weathered schist and clayey gravelly silt. Scattered roots.
1.20	SCHIST Light grey, blotched and stained reddish brown, highly weathered, fissile, very soft rock schist



Note: Pit located on an old platform/road.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

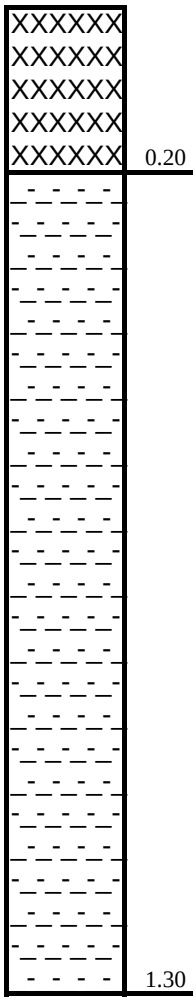
SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 7** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9770
X-COORD: 3695732

DEPTH (m)	DESCRIPTION
0.20	MADE GROUND Very moist, orange brown, medium dense, made ground comprising a mixture of highly weathered schist and clayey gravelly silt. Scattered roots.
O 0.2-0.8m	SCHIST Mustard grading to light grey, strongly blotched and stained reddish brown, very stiff residual soil to 0.4m then highly weathered, very soft rock to 0.75m then highly to moderately weathered, soft to medium hard rock schist. Rock is fissile and jointed.
1.30	



Note: Pit located on an old platform/road.
Machine excavating very slowly at 1.3m depth

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 8** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9736
X-COORD: 3695810

DEPTH (m)	DESCRIPTION
O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: 0.45	CLAYEY SANDY GRAVEL Very moist, khaki brown, loose to medium dense, very slightly clayey, sandy fine to medium gravel with scattered coarse gravel. Colluvium.
O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: O/:O:/:O :/:O:/:O/: 0.80	CLAYEY SANDY GRAVEL Very moist, mustard, stiff, clayey sandy, fine to medium gravel with scattered coarse gravel. Colluvium.
/ | / | / / | / | / | / | / | / | / | / 1.10	CLAYEY SILT Moist, light grey blotched maroon, very stiff, jointed, clayey silt grading to highly weathered, very soft rock schist at base of pit.

Note: Pit located at toe of embankment fill.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 9** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9718
X-COORD: 3695851

DEPTH (m)	DESCRIPTION
0.30	CLAYEY SANDY GRAVEL Very moist, khaki brown, loose to medium dense, very slightly clayey, sandy fine to medium gravel with scattered coarse gravel. Colluvium.
0.70	CLAYEY SANDY GRAVEL Very moist, mustard, stiff, clayey sandy, fine to medium gravel with scattered coarse gravel. Colluvium.
1.20	CLAYEY SILT Moist, light grey blotched maroon, very stiff, jointed, clayey silt. Residual Malmesbury soil with small patches of highly weathered rock.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

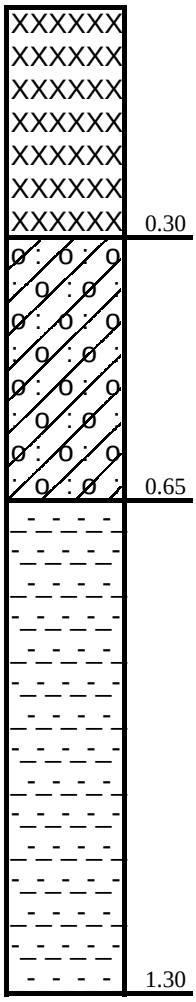
SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 10** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9861
X-COORD: 3695636

DEPTH (m)	DESCRIPTION
0.30	MADE GROUND Very moist, greyish brown, loose and medium dense, made ground comprising clayey fine and medium gravel.
0.65	GRAVELLY SANDY CLAY Slightly moist, mustard, very stiff, slightly fissured, slightly gravelly sandy clay. Colluvium.
1.30	SCHIST Khaki grey, moderately and highly weathered, highly fractured, very soft and soft rock schist.



NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 11** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9794
X-COORD: 3695614

DEPTH (m)	DESCRIPTION
0.35	SANDY GRAVEL Wet, khaki brown, loose, very slightly clayey, silty sandy, fine and medium gravel. Colluvium. Scattered roots.
O 0.35-0.9m 0.90	GRAVELLY CLAYEY SILT Moist, mustard, firm to stiff, fissured and fractured, gravelly clayey silt with scattered pieces of highly weathered siltstone. Colluvium.
1.20	CLAYEY SILT Moist, light grey blotched black, very stiff, jointed, clayey silt. Residual Malmesbury soil with small patches of highly weathered rock.

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 12** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9872
X-COORD: 3695584

DEPTH (m)	DESCRIPTION
0.25	ORGANIC-RICH SAND Very moist, dark grey, loose, slightly clayey and silty fine to medium sand with very fine, disseminated organic material. Topsoil. Roots to 0.1m.
¥ 0.5m	SAND Wet to very moist, light brown grading to greyish brown with depth, loose to medium dense, fine to medium sand becoming more silty with depth. Alluvial wash (?).
0.90	CLAYEY SAND Very moist, dark khaki grey, blotched orange brown, stiff, clayey fine to medium sand. Alluvial wash (?).
1.15	

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT:	ERF 878, RIEBEEK KASTEEL	**PROJECT NO:**	176721
HOLE NO:	**TP 13**	**DATE :**	15/7/2021
METHOD OF INVESTIGATION :	Digger/loader	**Y-COORD:**	9900
		X-COORD:	3695514

DEPTH (m)	**DESCRIPTION**
0.55	SAND Wet to very moist, light brown grading to greyish brown with depth, loose to medium dense, fine to medium sand becoming more silty with depth. Alluvial wash (?).
¥ 0.85m	INTERLAYERED SAND AND CLAYEY SAND Very moist and wet, greyish brown sand and dark khaki grey, blotched orange brown clayey sand. Loose and firm. Alluvial wash (?).
1.15	

Note: Sidewalls of pit collapsing

NOT TO SCALE

O	DISTURBED SAMPLE	V	WATER TABLE
[]	UNDISTURBED SAMPLE	¥	PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 14** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9960
X-COORD: 3695499

	DEPTH (m)	DESCRIPTION
	0.10	ORGANIC-RICH SAND Very moist, dark grey, loose, slightly clayey and silty fine to medium sand with very fine, disseminated organic material. Topsoil. Roots to 0.1m.
O 0.1-0.9m		SAND Very moist, light brown and light greyish brown, loose, very slightly silty, fine to medium sand. Alluvial wash (?).
	0.90	
		GRAVELLY SAND Very moist and wet, light brown, medium dense, fine to coarse sand with scattered fine to medium gravel. Alluvium (?).
	1.30	

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 15** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9878
X-COORD: 3695457

DEPTH (m)	DESCRIPTION
0.65	SILTY SAND Wet to moist with depth, dark grey, medium dense, very slightly organic, silty, fine to medium sand. Alluvial wash/topsoil (?).
1.05	CLAYEY SAND Slightly moist, light creamy grey, very stiff, slightly fissured, clayey, fine to medium sand. Alluvial wash (?).

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

SOIL PROFILE

PROJECT: ERF 878, RIEBEEK KASTEEL **PROJECT NO:** 176721

HOLE NO: **TP 16** **DATE :** 15/7/2021

METHOD OF INVESTIGATION : Digger/loader **Y-COORD:** 9841
X-COORD: 3695542

DEPTH (m)	DESCRIPTION
O 0.2-0.9m	SAND Wet to very moist, light brown grading to greyish brown with depth, loose to medium dense, very slightly organic, fine to medium sand becoming more silty with depth. Alluvial wash (?).
0.90	
	CLAYEY SAND Moist, dark grey, very stiff, slightly fissured, clayey sand. Alluvial wash (?).
1.05	

NOT TO SCALE

O DISTURBED SAMPLE

[] UNDISTURBED SAMPLE

V WATER TABLE

¥ PERCHED WATER TABLE

APPENDIX B

RESULTS OF LABORATORY TESTS

CONTROL GEOSCIENCES (PTY) LTD

CIVIL MATERIALS AND GEOTECHNICAL TESTING AND ENGINEERING

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CLIENT: RA Bradshaw & Associates
17 Midwood Avenue
Newlands
7700

ATT: Dick Bradshaw

PROJECT: Erf 878 Riebeek Kasteel

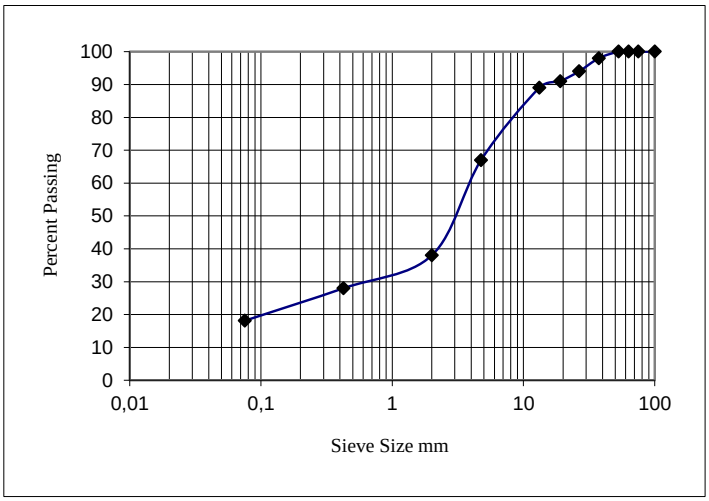
DATE: 27-06-2021

REF: L210723

ROAD INDICATOR TEST SUMMARY

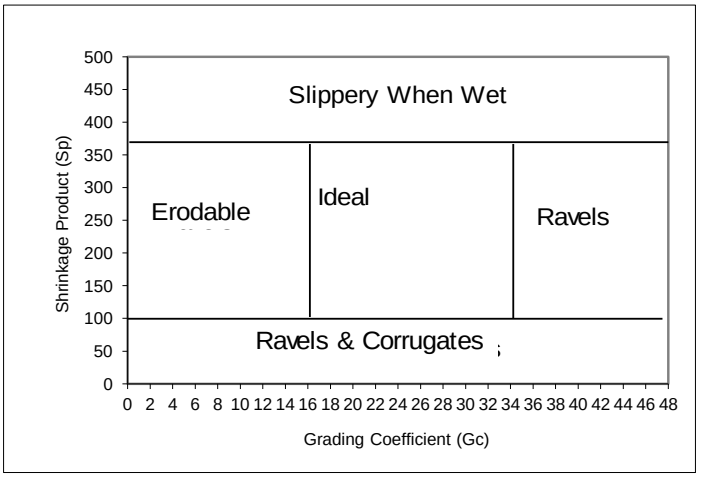
Client Ref. No.:		***Sample Number:***	33747
Client Sample Ref.:		***Sample Position:***	TP 2
Client Sample Ref.:		***Depth:***	0.2-0.7m
Client Sample Ref.:		***Sample Description:***	yellow olive gvl silt

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	100
37,5	98
26,5	94
19	91
13,2	89
4,75	67
2,00	38
0,425	28
0,075	18,1



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	21
Plastic Index	6
Linear Shrinkage	3,0

Grading Modulus (GM)	2,16
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
2190	6,8	**CBR Values**	32	22	15	10	6
						Max. %Swell	0

Technical Signatory: M Hofman

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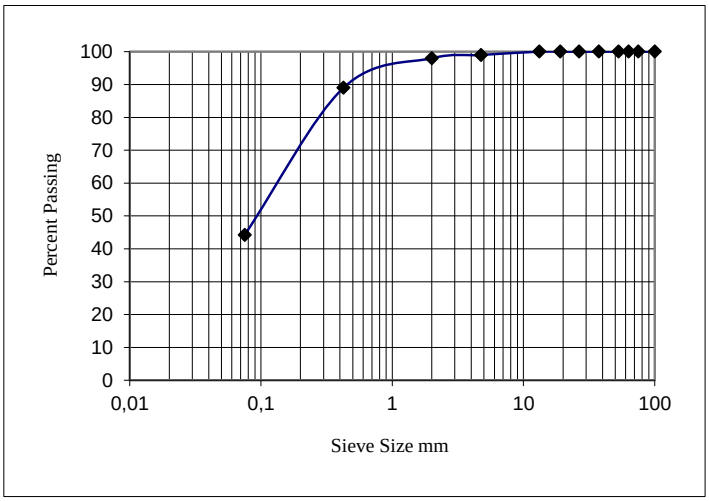
PROJECT: Erf 878 Riebeek Kasteel
DATE: 27-06-2021
REF: L210723

ROAD INDICATOR TEST SUMMARY

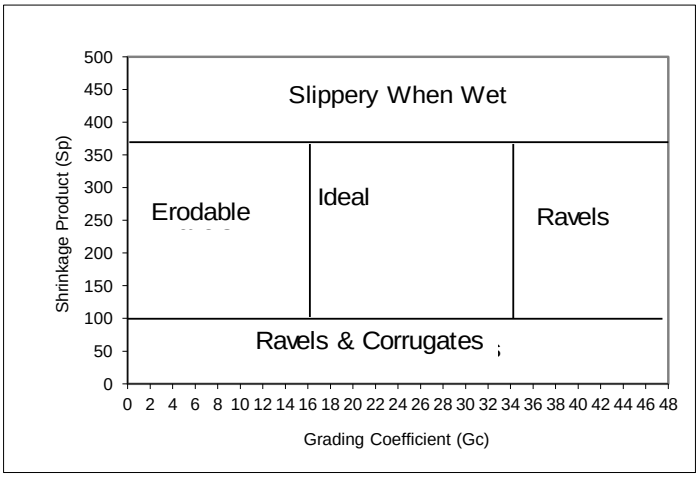
Client Ref. No.:		***Sample Number:***	33748
Client Sample Ref.:		***Sample Position:***	TP 4
Client Sample Ref.:		***Depth:***	0.3-0.65m
Client Sample Ref.:		***Sample Description:***	yellow olive silt

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	
26,5	
19	
13,2	100
4,75	99
2,00	98
0,425	89
0,075	44,2



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	17
Plastic Index	6
Linear Shrinkage	3,0

Grading Modulus (GM)	0,69
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
2068	8,2	**CBR Values**	29	19	10	6	3
						Max. %Swell	0,3

Technical Signatory: M Hofman

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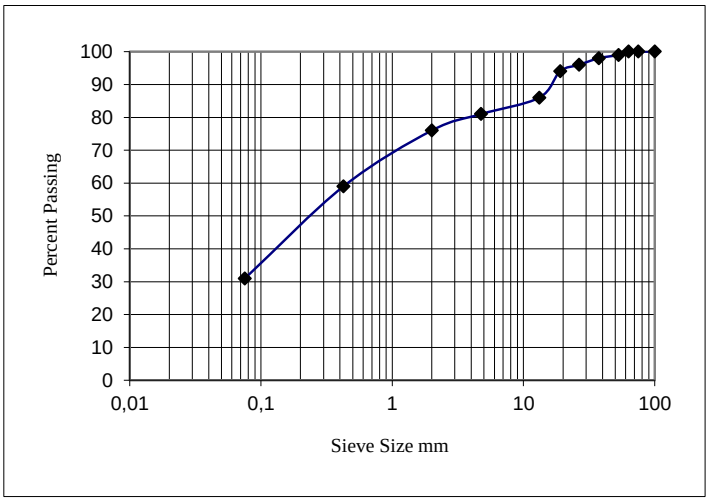
PROJECT: Erf 878 Riebeek Kasteel
DATE: 27-06-2021
REF: L210723

ROAD INDICATOR TEST SUMMARY

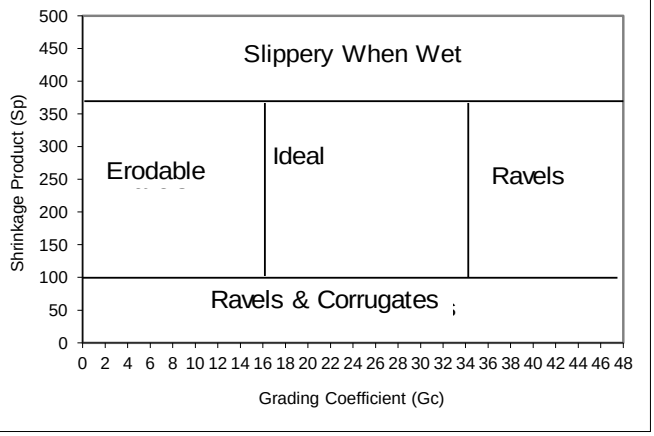
Client Ref. No.:		***Sample Number:***	33749
Client Sample Ref.:		***Sample Position:***	TP 7
Client Sample Ref.:		***Depth:***	0.2-0.8m
Client Sample Ref.:		***Sample Description:***	yellow gvl silt

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	100
53	99
37,5	98
26,5	96
19	94
13,2	86
4,75	81
2,00	76
0,425	59
0,075	30,9



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	28
Plastic Index	8
Linear Shrinkage	3,0

Grading Modulus (GM)	1,34
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
1972	12	**CBR Values**	12	10	8	7	5
						Max. %Swell	0,8

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ATT: Dick Bradshaw

PROJECT: Erf 878 Riebeek Kasteel

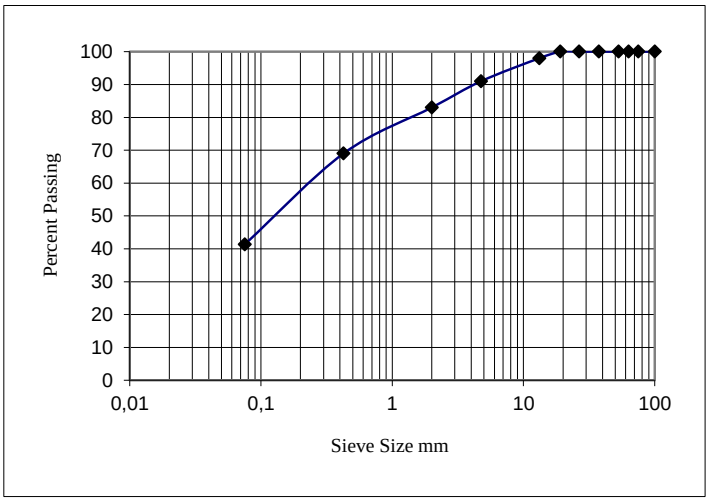
DATE: 27-06-2021

REF: L210723

ROAD INDICATOR TEST SUMMARY

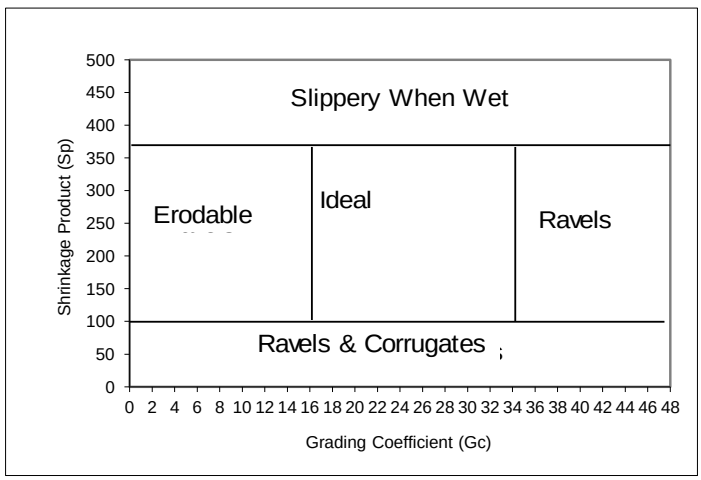
Client Ref. No.:		***Sample Number:***	33750
Client Sample Ref.:		***Sample Position:***	TP 11
Client Sample Ref.:		***Depth:***	0.35-0.9m
Client Sample Ref.:		***Sample Description:***	yellow olive silt

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	
26,5	
19	100
13,2	98
4,75	91
2,00	83
0,425	69
0,075	41,3



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	32
Plastic Index	11
Linear Shrinkage	6,0

Grading Modulus (GM)	1,07
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
1847	14,3	**CBR Values**	8	6	4	3	1
						Max. %Swell	1,4

Technical Signatory: M Hofman

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PROJECT: Erf 878 Riebeek Kasteel

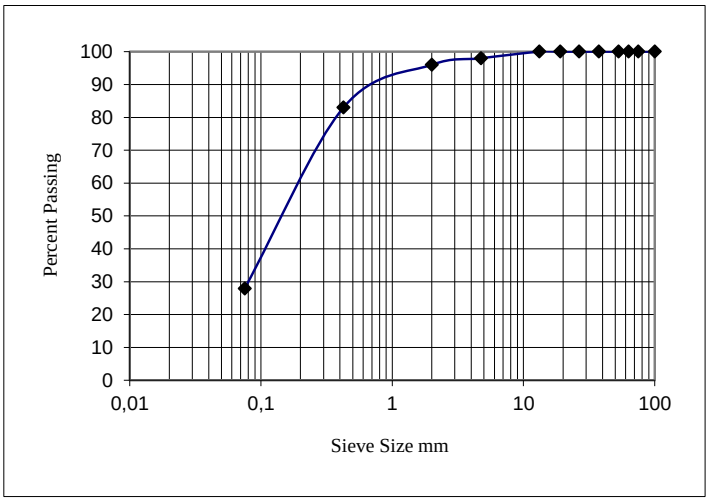
DATE: 27-06-2021

REF: L210723

ROAD INDICATOR TEST SUMMARY

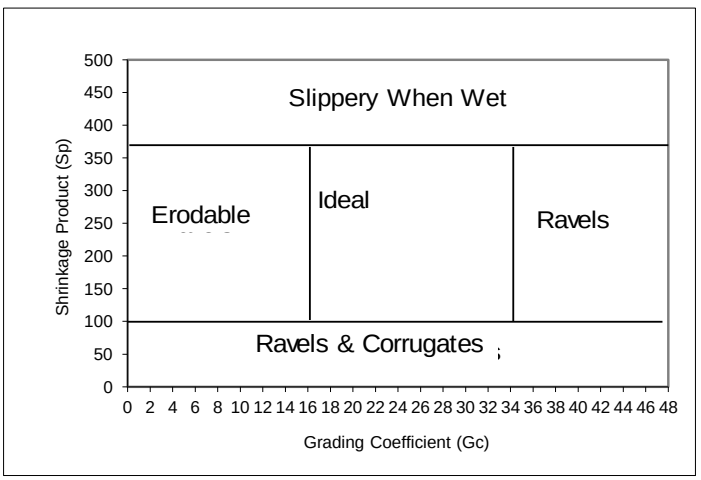
Client Ref. No.:		***Sample Number:***	33752
Client Sample Ref.:		***Sample Position:***	TP 14
Client Sample Ref.:		***Depth:***	0.1-0.9m
Client Sample Ref.:		***Sample Description:***	yellow olive silty sand

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	
26,5	
19	
13,2	100
4,75	98
2,00	96
0,425	83
0,075	27,9



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	
Plastic Index	S-P
Linear Shrinkage	

Grading Modulus (GM)	0,93
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	OMC	Percentage Compaction.	100%	98%	95%	93%	90%
1854	9	**CBR Values**	40	22	8	4	2
						Max. %Swell	0

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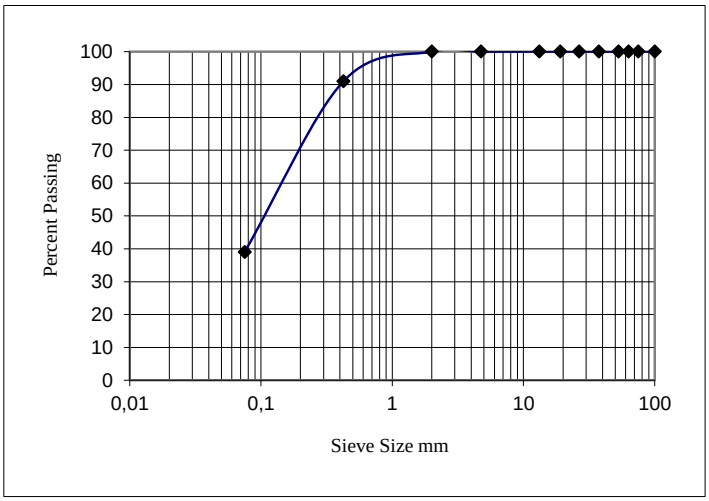
ATT: Dick Bradshaw

PROJECT: Erf 878 Riebeek Kasteel
DATE: 27-06-2021
REF: L210723

ROAD INDICATOR TEST SUMMARY

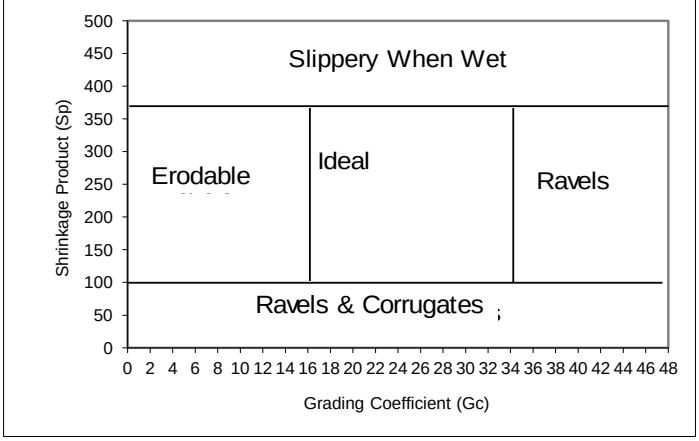
Client Ref. No.:		***Sample Number:***	33751
Client Sample Ref.:		***Sample Position:***	TP 16
Client Sample Ref.:		***Depth:***	0.2-0.9m
Client Sample Ref.:		***Sample Description:***	yellow olive silt

TMH 1 Method A1	
Sieve Analysis	
Sieve Size (mm)	**% Passing**
75	
63	
53	
37,5	
26,5	
19	
13,2	
4,75	
2,00	100
0,425	91
0,075	39



TMH 1 Methods A2, A3 & A4	
Atterberg limits	
Liquid Limit	13
Plastic Index	5
Linear Shrinkage	2,0

Grading Modulus (GM)	0,70
Oversized Index (Io)	
Shrinkage Product (Sp)	
Plastic Product (Pp)	
Grading Coefficient (Gc)	
Maximum size (mm)	



Maximum Dry Den.	**OMC**	**Percentage Compaction.**	**100%**	**98%**	**95%**	**93%**	**90%**
2030	7,4	**CBR Values**	51	39	22	16	9
						Max. %Swell	0,1

Technical Signatory: M Hofman