

GEOSET CC

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RAADGEWENDE OMGEWINGS- EN INGENIEURSGEOLOE

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PORTION 214, 269 & RE 60, WATERKLOOF 305 JQ,

PHASE 1 ENGINEERING GEOLOGICAL INVESTIGATION

to DETERMINE the POTENTIAL for TOWNSHIP DEVELOPMENT

on PORTION 214, 269 & RE 60, WATERKLOOF 305 JQ,

RUSTENBURG, NORTHWEST PROVINCE.

Georeference: 2528CA Rustenburg East

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REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED IN RUSTENBURG, PORTION 214, 269 & RE 60, WATERKLOOF 305 JQ, NORTHWEST PROVINCE.

Executive Summary

A phase 1 engineering geological investigation with reference to GFSH-2 specification was conducted on the proposed development site on Portions 214, 269 & the Remainder of Portion 60, Waterkloof 305 JQ, Rustenburg, Northwest Province, with the aim to assess aspects such as geology, relief and subsoil conditions which may influence the planned urban development in the area. The site is underlain by Kroondal Norite of the Rustenburg Layered Suite, Bushveld Complex, which is covered by recent sandy soil. The mechanical properties of the soil layers were determined by means of laboratory tests performed on disturbed samples taken during the profiling of seven trial pits. The obtained site information is evaluated with regard to the development of residential masonry structures by the application of standard evaluation techniques. Development zonation for township development according to the NHBC and SAIEG were done, indicating the geotechnical conditions of the site. Zoning of the site revealed a zone with constraints regarding the **highly collapse** and **consolidation** as well as the **expansive** potential of the soil, and **special construction** and **foundation techniques** will be required. Site drainage and plumbing and service precautions must be used. A small portion is situated within the **flood line** and development should be restricted to outside this area. These proposed mitigation measures will be sufficient to successfully address the anticipated geotechnical problems and ensure the sustainable development as planned.

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- Figure 2: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Geology Map.
- Figure 3: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Engineering Geological Zone Map with Geology and Test Positions on Google Image.

APPENDIX B: SOIL PROFILES

Soil Profiles Tabled Summary
Soil Profile Descriptions
Soil Profile Photographs

APPENDIX C: LABORATORY RESULTS

Table A: Summary of Lab results
STL Laboratory Results Summary Table
STL Laboratory Results

APPENDIX D: TABULAR EXPLANATION OF ZONING

Extract from: THE SOUTH AFRICAN INSTITUTE OF ENGINEERING GEOLOGISTS (SAIEG), 1997.
Guidelines for Urban Engineering Geological Investigations.

Table 1. Categories of Urban Engineering Geological Investigation

Table 2. Geotechnical Classification for Urban Development:
Partridge, Wood & Brink (1993)

Table 3. Residential Site Class Designations:
SAICE, SAIEG & NHBRC (1995)

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REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED ON PORTION 214, 269 & THE REMAINDER OF PORTION 60, WATERKLOOF 305 JQ, RUSTENBURG, NORTHWEST PROVINCE.

1. INTRODUCTION AND TERMS OF REFERENCE

On request of Dr Dawie Bos of Maxim Townplanners in Rustenburg, an engineering geological investigation was conducted for the proposed development on the property on Portions 214, 269 & the Remainder of Portion 60, Waterkloof 305 JQ, Rustenburg, Northwest Province. Our quotation was accepted by Dr Bos on behalf of the owners of the holdings, and communication between us the abovementioned parties lead to the field work, commencing in November 2020.

The aim of this investigation was to identify any possible engineering geological problems before commencement of proper township proclamation.

This report is based on the an in-situ evaluation of all the representative soil horizons within the ground profile, visual results of the site visit and other relative exposed geotechnical properties on site and derived from interpretation of laboratory results.

Portions 214, 269 & the Remainder of Portion 60, Waterkloof 305 JQ, approximately 36 ha in size, was investigated. It is situated southwest of the Waterfall Mall and the N4 and adjacent east the road R30 to Magaliesburg and Johannesburg.

Figures 1 to 3 in Appendix A delineates the site.

2. INFORMATION USED IN THE STUDY

The following was consulted during the investigation:

- 1.3.1 The geological map 2526 Rustenburg. Scale 1:250 000. The Geological Survey of South Africa.
- 1.3.2 The topography map 2528 CA Rustenburg East, with a scale of 1:50 000. The Chief Directorate: Surveys and Land Information, Mowbray.
- 1.3.3 A Google Areal Map with contours from Maxim Planning used as base map for the investigation.

3. SITE DESCRIPTION

3.1 PHYSIOGRAPHY

3.1.1 Topography

The site is located on a steep slope towards the east towards the Hex River. It is situated at between 1164 and 1173 metres above mean sea level.

3.1.2 Climate

The region is characterized by summer rainfall with thunderstorms, with annual low rainfall figures of 685 mm (Rustenburg Agriculture) and 703 mm (Buffelspoort), recorded at the closest weather station to the site. Winters are dry with frost common. The warmest months are normally December and January and the coldest months are June and July.

An analysis of the data confirms a Weinert's N-Value in the order of 2,4 for Rustenburg. The mechanical disintegration of rocks will therefore not be dominant over chemical decomposition, and deep soil horizons will be expected in areas of poor drainage, underlain by igneous rocks.

Storm water drainage and road pavement design must incorporate the climatic extremes above as well as the relative flatness of the area.

3.1.3 Vegetation

The area is typically characterized by Sourish Mixed Bushveld Veld of the *tropical bush and savanna* (bushveld) *veld type* (Acocks, 1988).

The site itself is covered by sparse grasslands of which some was used as agriculture land, and some indigenous trees are present on site.

4. NATURE OF INVESTIGATION

4.1 SITE INVESTIGATION

All available information was studied before and during the site visit.

The investigation commenced with a desk study, where all relevant information is collected and compiled on a base map. The site was divided into land forms, after which the accuracy of the information was checked by means of a field visit.

Test pits were dug and the position of the test pits are represented in FIGURE 2 (Appendix A). The soil profiles were described according to the methods described by Jennings *et al* (Jennings 1973). This method describes each horizon in terms of moisture content, colour, consistency, structure, type of soil and origin of the soil.

Disturbed samples of the soil materials were taken for laboratory analysis and grading of the soils were determined by sieve and hydrometer analysis, resulting in cumulative grading curves.

The mechanical properties of the soil material are described in terms of the liquid limit and plasticity index (determined by means of the Atterberg Limit tests) and the linear shrinkage. These values can be used to calculate the potential expansiveness of the soils, and to evaluate the materials for use as construction material. The consistency of a soil is described by means of its Atterberg limits, where the effect of a change in the moisture content on the consistency of a cohesive soil is measured. According to Cernica (1982) these tests are useful "mostly for soil identification and classification". It can also be used to determine the mechanical properties of

cohesive soil material¹.

The linear shrinkage test to determine the percentage shrinkage that can be expected, is performed by wetting a soil to approximately its liquid limit and drying the resultant paste in a linear shrinkage mould.

The potential expansiveness of a soil depends upon its clay content, the type of clay mineral, its chemical composition and mechanical character. A material is potentially expansive if it exhibits the following properties (Kantey and Brink, 1952):

- a clay content greater than 12 percent,
- a plasticity index of more than 12,
- a liquid limit of more than 30 percent, and
- a linear shrinkage of more than 8 percent.

The potential expansiveness (low, medium, high, very high) is calculated by means of Van der Merwe's method (Van der Merwe, 1964), where the equivalent plasticity index versus the clay content of the material is plotted on a graph divided into heave categories. If any sample in the study area classifies as potentially expansive, the amount of heave or mobilization in mm measured on the surface will be calculated.

4.2 LABORATORY TESTS

Samples for foundation indicator tests (GFSH-2) were reduced according to the limited variability of the geotechnical character and simplicity of the site.

No free swell tests were done as all these areas usually falls within the drainage features and outside the proposed development area. No consolidometer tests were done as it was impossible to secure any undisturbed soil samples required for these tests. No soil chemistry samples were tested as all new developments use synthetic pipes not reactive to soil aggressiveness.

¹

Note that cohesionless soils (i.e. sandy material) cannot be tested for plasticity or collapse potential as this material does not contain enough fines to exhibit consistency. The taking of undisturbed samples is not possible due to disintegration.

5. SITE GEOLOGY AND GROUNDWATER CONDITIONS

5.1 Geology

The site is underlain by Kroondal Norite of the Rustenburg Layered Suite, Bushveld Complex, which is covered by recent sandy soil.

Surficial recent soil cover or deposits include the colluvium and alluvium covering the lithology.

No dolomite occurs in the area and no stability investigation is required (the necessity is usually determined by the Council for Geoscience).

5.2 Groundwater Conditions

Plate flow is the dominant drainage pattern on site, and no drainage channel intersects the site. Drainage occurs in an easterly direction towards the Hex River, then northwards towards the Bospoort Dam and eventually into the Crocodile River.

The permanent water table on site is deeper than 1,5m below ground surface.

Evidence in the form of nodular ferricrete indicates that a seasonal perched water table may occur within the hillwash.

Although no seepage towards the Hex River was encountered, the presence of ferricrete and perennial fluctuations of ground water are expected on site, indicating that a seasonal perched water table may exist.

Storm water diversion measures such as ponding pools are recommended to control peak flows during thunderstorms. All embankments must be adequately compacted and planted with grass to stop any excessive erosion and scouring of the landscape.

Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures

6. GEOTECHNICAL EVALUATION

6.1 ENGINEERING AND MATERIAL CHARACTERISTICS

6.1.1 SOIL PROFILES

Sixteen test pits were described and sampled and tested at the accredited laboratory of Specialised Testing Laboratory (STL) in Pretoria.

All terrain land forms or mapping units were extensively sampled and more than adequate representative characterization of each unit took place.

The soil profiles with accompanied plates are represented in Appendix B.

Typical profile

Slightly moist, light orange, very loose, open textured, clayey sand. Hillwash.

Slightly moist, orange, speckled black & red, soft, intact clayey sand with quartz gravel.

Slightly moist, reddish brown mottled grey, stiff, intact, sandy clay. Residual highly weathered norite.

No problems regarding excavatability can be expected on site, and no problems are foreseen for excavations where pneumatic tools, a competent TLB and blasting will be required to reach installation depths for services across the site.

To ensure the stability of excavations, it will need standard sidewall protection in excavations exceeding 1,5m.

6.1.2 LABORATORY RESULTS

The heave potential of some of the materials on site are classified as low to medium expansive according to Van der Merwe's method of heave estimation. The laboratory tests indicated a highly collapse potential and compressibility of the hillwash with a low (4 samples) to medium (4 samples) expansive potential, and 1 sample had a highly expansive potential (according to the method of Van der Merwe, 1964).

The material had an expected range of total soil movement measured at surface as collapse in excess of 10 up to 15 mm, with a site specific classification of C2H1. The laboratory results indicated that 5 samples had a clay content of more than 12% ranging from 4 to 43%, with linear shrinkage percentages of 0 to 14.5% and plasticity indexes of non-plastic and slightly plastic up to 30 and liquid limits determined between 19 and 53, indicating the potential settlement of the soil.

The Unified classification was mainly A-2-4 (3 samples) as sand and gravel with low plasticity silt fines SC to SM (1 sample): clayey or silty sand or silty clayey silt sand mixtures and as A-4 to A-6 (1 samples each) as low to medium compressible silt to, and two samples had a classification of A-7-6 as highly compressible, highly volume change clay, according to the PRA classification.

The uniformity of the laboratory results confirms the variety of character of the transported hillwash.

No mining activities on the site or history of mining or contaminated land on site were encountered. The site is located away from mining activities and in an inactive area regarding seismic activity.

Due to the level of development almost surrounding the area, the likelihood for the development of borrow pits on site are low.

All road building and construction materials will be sourced from established commercial activities in and around Rustenburg.

6.2 SLOPE STABILITY AND EROSION

The potential for lateral soil movement or erosion is medium, and the loose silty sand and gravel can be washed away during thunderstorms.

Local slope instability within opened trenches and the possible collapse of open pit side walls, as well as slope instability is expected within open excavations, and all open excavations exceeding 1,5m in depth must be supported and inspected by a competent person to verify the stability of possible bedding planes.

6.3 EXCAVATION CLASSIFICATION WITH RESPECT TO SERVICES

No problems regarding excavatability to 1,5m in depth can be expected with no shallow rock or sub outcrop areas identified on site. The material was classified as soft excavation as it is easily excavated by hand, and it was classified as soft in restricted and non-restricted excavation (SANS 1200 D). Hard rock excavation may be encountered deeper than 2,2m, and pneumatic tools, and a competent TLB, and even blasting may be required to reach installation depths for services.

To ensure the stability of excavations, it will need standard sidewall protection in excavations exceeding 1,5m.

6.4 IMPACT OF THE GEOTECHNICAL CHARACTER OF THE SITE ON SUBSIDY HOUSING DEVELOPMENTS

During the engineering geological investigation, it is essential to determine and quantify the extent of potential problems associated with the area (addressed in **bold** below), before proper township proclamation.

The ideal conditions for urban development may be listed as follows:

- * A smooth surface gradient with slopes less than 12°. Accessibility should not be restricted by topography (plateau areas).
- * No potential for slope instability features - landslides, mud flows.
- * Easy excavation for foundations and installation of services (normal depth of 1,5 m required).
- * Foundations above the ground water level or perched water table, with not too low permeability.
- * Development above the 1:50 year flood line, preferably outside the 1:100 year **flood line**.
- * Adequate surface and subsurface drainage conditions, with minimal erosion potential.
- * No presence of problematic soils, for example **heaving clays, compressible clays, sand with some collapse potential**, or dispersive soils, that will require expensive remedial measures.
- * No potential for surface subsidence due to the presence of dolomite

(sinkholes) or undermining.

- * No damaging differential subsidence or movement (less than 5mm total movement at the surface allowed).
- * The site should be placed away from potential pollutants such as waste disposal sites.

6.4.1 EVALUATION FOR URBAN DEVELOPMENT

Although no seepage was encountered, the presence of ferricrete and perennial fluctuations of ground water are expected on site, indicating that a seasonal perched water table may exist.

Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures.

The site contains highly compressible and collapsible soil, and foundations will need special treatment to withstand movement associated with the variable moisture content of the soil.

No problems regarding excavatability was encountered on the site.

Retaining walls as well as slope stabilization measures are recommended on all constructed embankments exceeding 1,5m.

Storm water diversion measures such as ponding pools are recommended to control peak flows during thunderstorms.

All embankments must be adequately compacted and planted with grass to stop any excessive erosion and scouring of the landscape.

7. **SITE CLASSIFICATION**

By grouping together all the land facets with the same geotechnical characteristics, the site can be divided into development zones, this being the main objective or result of a phase 1 engineering geological investigation. Each zone can therefore be defined as a grouping of areas with specific geotechnical properties placing similar constraints upon development. With the above-mentioned criteria in mind, the study area can be divided into typical development zones for residential development (SAICE, SAIEG & NHBRC, 1995):

Land suitable for development: Standard foundation techniques and normal construction with normal site drainage and standard building practice will be adequate for development.

Land suitable for development with precaution or risk: A few precautionary measures for problematic soils in this zone are necessary before urban development can be initiated, with a higher than normal cost implication to overcome geotechnical constraints. The risk of restricted excavatability for the placing of services induces a higher cost for development.

Land not suitable for development typically comprises of the drainage features that are susceptible to annual flooding below the 1:50 year flood line, and is also associated with perched water tables. Land in close proximity of unstable ground such as a potential slope failure or mud flow induced by rainfall is also not suitable for development.

On account of the field observations, laboratory results, previous experience and engineering properties of the soil, it is zoned as follows (SAIEG,1997 - See tabular explanation of classification in Appendix D):

7.1 Engineering Geological Zonation

Geotechnical Zonation with Site Class Designation

Special Development:

Site Class C2H1:

Hillwash comprising highly collapsible and compressible soil with thickness in excess of 0,75m, with more than 10mm movement measured at surface, underlain by highly weathered norite characterizes this zone and the majority of the site. Foundations will therefore require special foundation techniques such as proper compaction techniques and lightly reinforced strip footings with articulation joints at all internal and external doors and openings with light reinforcement (brickforce) in masonry or even soil replacement by an engineered fill soil raft with G5 quality or better or even stiffened strip footings or stiffened or cellular rafts with articulation joints or solid lightly reinforced masonry. Site drainage and plumbing and service precautions must be used. It is classified as C2H1 in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995).

Site Class PQ:

Backfilled areas and waste dumps need to be rehabilitated by using a G5 quality material or better and compacted to suit engineer's specification before construction can take place.

Undevelopable:

Site Class PD/H2:

Areas within the 1:50 year flood line can be reduced by installing a drainage channel, but development should take place outside these areas or at least 32m from the centre of the river. The highly expansive clay is also associated with these areas with an expected range of up to 30 mm of total soil movement measured at surface, with foundation solutions including stiffened or cellular rafts, piled construction or soil replacement with a soil raft.

The geotechnical problems encountered will require modified normal to special foundation techniques and construction, and proper standard compaction techniques and drainage is required.

8. **FOUNDATION RECOMMENDATIONS AND SOLUTIONS**

8.1 **Consolidation or collapse settlement**

Site Class C (Estimated total Settlement of less than 5mm):

Normal Construction:

Minor collapse settlement requires normal construction (strip footing and slab on the ground) with compaction in foundation trenches and good site drainage.

Site Class C1 (Estimated total Settlement of between 5 and 10mm):

Modified normal construction:

Reinforced strip footing and slab on the ground.
 Articulation joints at some internal and all external doors and openings.
 Light reinforcement in masonry.
 Site drainage and service/plumbing precautions recommended.
 Foundation pressure not to exceed 50 kPa (single storey buildings).

Compaction of in situ soils below individual footings:

Remove in situ material below foundations to a depth and width of 1,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
 Normal construction with light reinforcement in strip foundation and masonry.

Deep strip foundations

Normal construction with drainage precaution.
 Founding on a competent horizon below problem horizon.

Soil Raft

Remove in situ material to 1,0m beyond perimeter of building to a depth and width of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
 Normal construction with lightly reinforced strip footings and masonry.

Site Class C2 (Estimated total Settlement of more than 10mm):

Stiffened strip footings, stiffened or cellular raft

Stiffened strip footings or stiffened or cellular raft with articulation joints or solid lightly reinforced masonry
 Bearing pressure not to exceed 50 kPa.
 Fabric pressure not to exceed 50 kPa.
 Site drainage and service/plumbing precautions.

Deep strip foundations

See C1

Compaction of in situ soils below individual footings

See C1

Piled or pier foundations

Reinforced concrete ground beams or solid slabs on piled or pier foundations.
 Ground slabs with fabric reinforcement.
 Good site drainage.

Soil Raft

See C1

8.2 Expansive Soil**Site Class H (Estimated total heave of less than 7.5mm):**Soil tested as medium expansive with a clay layer thickness of up to 0,3m from surface**Normal construction:**

Minor heave requires normal construction (strip footing and slab on the ground) with site drainage and service/plumbing precautions recommended.

Site Class H1 (Estimated total heave of between 7.5 and 15mm):Tested as medium expansive with a clay layer thickness of between 0,45 to 0,85m from surface,or a highly expansive clay layer of between 0,3 and 0,4m in thickness from surfaceor a clay layer with a very high expansive potential of up to 0.3m.**Modified normal:**

Lightly reinforced strip footings.

Articulation joints at all internal/external doors and openings

Light reinforcement in masonry.

Site drainage and plumbing/service precautions.

Or soil raft:

Remove all or part of expansive horizon to 1,0m beyond the perimeter of the construction 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 masonry.

Site drainage and plumbing/service precautions.

Site Class H2 (Estimated total heave of between 15 and 30mm):Tested as medium expansive with a clay layer thickness of between 0,85 to 2,0m,
or highly expansive of between 0,4 and 0,85m in thickness measured from surface,
or a clay layer with a very high expansive potential of between 0.3 and 0.4m.**Soil raft:**

See H1.

Stiffened or cellular raft:

Articulation joints or solid lightly reinforced masonry.

Site drainage and plumbing/service precautions.

Piled construction:

Piled foundation with suspended floor slabs with or without ground beams.

Site drainage and plumbing/service precautions.

Split construction:

Combination of reinforced brickwork/blockwork and full movement joints.

Suspended floors or fabric reinforced ground slabs.

Site drainage and plumbing/service precautions.

9. **DRAINAGE**

The site is located on a steep slope more than 10% towards the north.

Plate flow is the dominant drainage pattern on site, and no drainage channel intersects the site. Drainage occurs in an easterly direction towards the Hex River, and then northwards towards the Bospoort Dam and the Crocodile River.

A ferruginised profile indicates that some perennial water level fluctuations may occur, indicating that a seasonal perched water table may exist

Ground water in the form of seepage was not intersected in any test pits during the investigation, but some problems are foreseen and normal water tightening techniques such as damp course on foundation levels are required.

The expected high permeability of the silty sand may lead to leachate from sanitation systems to reach the ground water, and with the nodular ferricrete, a closed water borne sewage system is recommended.

Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures.

Storm water diversion measures such as ponding pools are recommended to control peak flows during thunderstorms.

All embankments must be adequately compacted and planted with grass to stop any excessive erosion and scouring of the landscape.

10. **CONCLUSIONS**

1. A site of approximately 36ha, Portions 214, 269 & the Remainder of Portion 60, Waterkloof 305 JQ, Rustenburg, was investigated to determine the engineering geological properties that will influence township proclamation.
2. The site is underlain by Kroondal Norite of the Rustenburg Layered Suite, Bushveld Complex, which is covered by recent sandy soil. No dolomite occurs in the area and no stability investigation will be required.
3. No problems are foreseen regarding the **excavatability** to 1,5m depth.
4. Zoning of the site revealed a zone with constraints regarding the **highly collapse** and **consolidation** as well as the **expansive** potential of the soil, and **special construction** and **foundation techniques** will be required. All open excavations exceeding 1,5m in depth must be supported and inspected by a competent person to verify the stability of possible bedding planes
5. It was zoned as follows:

Geotechnical Zonation with Site Class Designation

Special Development:

Site Class C2H1: Hillwash comprising highly collapsible and compressible soil with thickness in excess of 0,75m, with more than 10mm movement measured at surface, underlain by highly weathered norite characterizes this zone and the majority of the site. Foundations will therefore require special foundation techniques such as proper compaction techniques and lightly reinforced strip footings with articulation joints at all internal and external doors and openings with light reinforcement (brickforce) in masonry or even soil replacement by an engineered fill soil raft with G5 quality or better or even stiffened strip footings or stiffened or cellular rafts with articulation joints or solid lightly reinforced masonry. Site drainage and plumbing and service precautions must be used. It is classified as C2H1 in terms of the SAIEG & NHBRG guidelines (1995) or the SAICE Code of practice (1995).

Site Class PQ: Backfilled areas and waste dumps need to be rehabilitated by using a G5 quality material or better and compacted to suit engineer's specification before construction can take place.

Undevelopable:

Site Class PD/H2: Areas within the 1:50 year flood line can be reduced by installing a drainage channel, but development should take place outside these areas or at least 32m from the centre of the river. The highly expansive clay is also associated with these areas with an expected range of up to 30 mm of total soil movement measured at surface, with foundation solutions including stiffened or cellular rafts, piled construction or soil replacement with a soil raft.

6. These proposed mitigation measures will be sufficient to successfully address the anticipated geotechnical problems and to ensure the sustainable development as planned.
7. **This investigation was done to reveal the geotechnical properties on site with the techniques as described to form our opinion. Although every possible factor during the investigation was dealt with, it is possible to encounter variable local conditions. This will require the inspection of foundations by a competent person to verify expected problems.**

Engineering geologist:

A handwritten signature in black ink, appearing to read 'D. Van der Merwe', written over a horizontal line.

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APPENDICES

APPENDIX A: FIGURES

- Figure 1: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Locality Map.
- Figure 2: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Geology Map.
- Figure 3: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Engineering Geological Zone Map with Geology and Test Positions on Google Image.

APPENDIX B: SOIL PROFILES

Soil Profiles Tabled Summary
Soil Profile Descriptions
Soil Profile Photographs

APPENDIX C: LABORATORY RESULTS

Table A: Summary of Lab results
STL Laboratory Results Summary Table
STL Laboratory Results

APPENDIX D: TABULAR EXPLANATION OF ZONING

Extract from: THE SOUTH AFRICAN INSTITUTE OF ENGINEERING GEOLOGISTS (SAIEG), 1997.
Guidelines for Urban Engineering Geological Investigations.

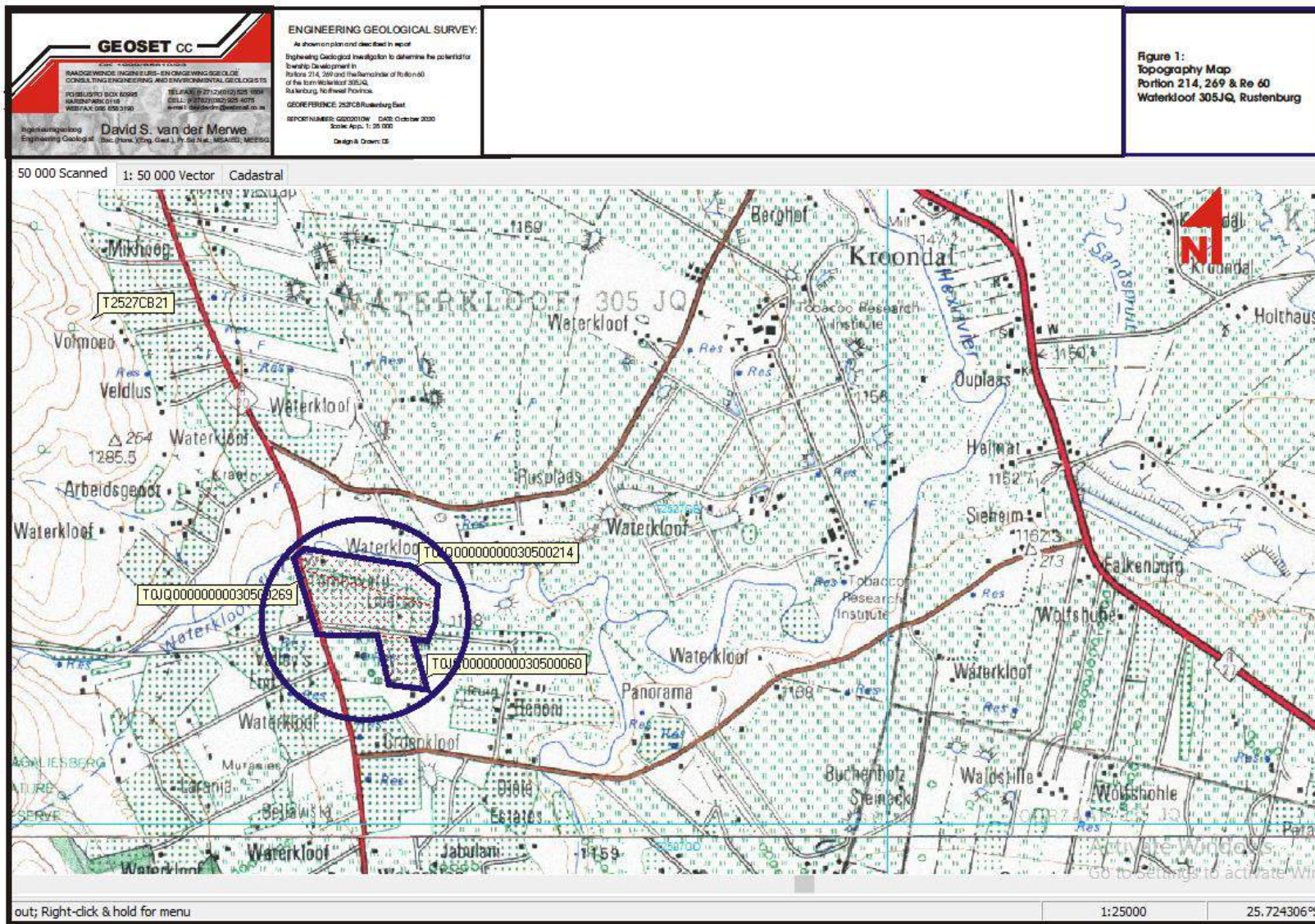
Table 1. Categories of Urban Engineering Geological Investigation

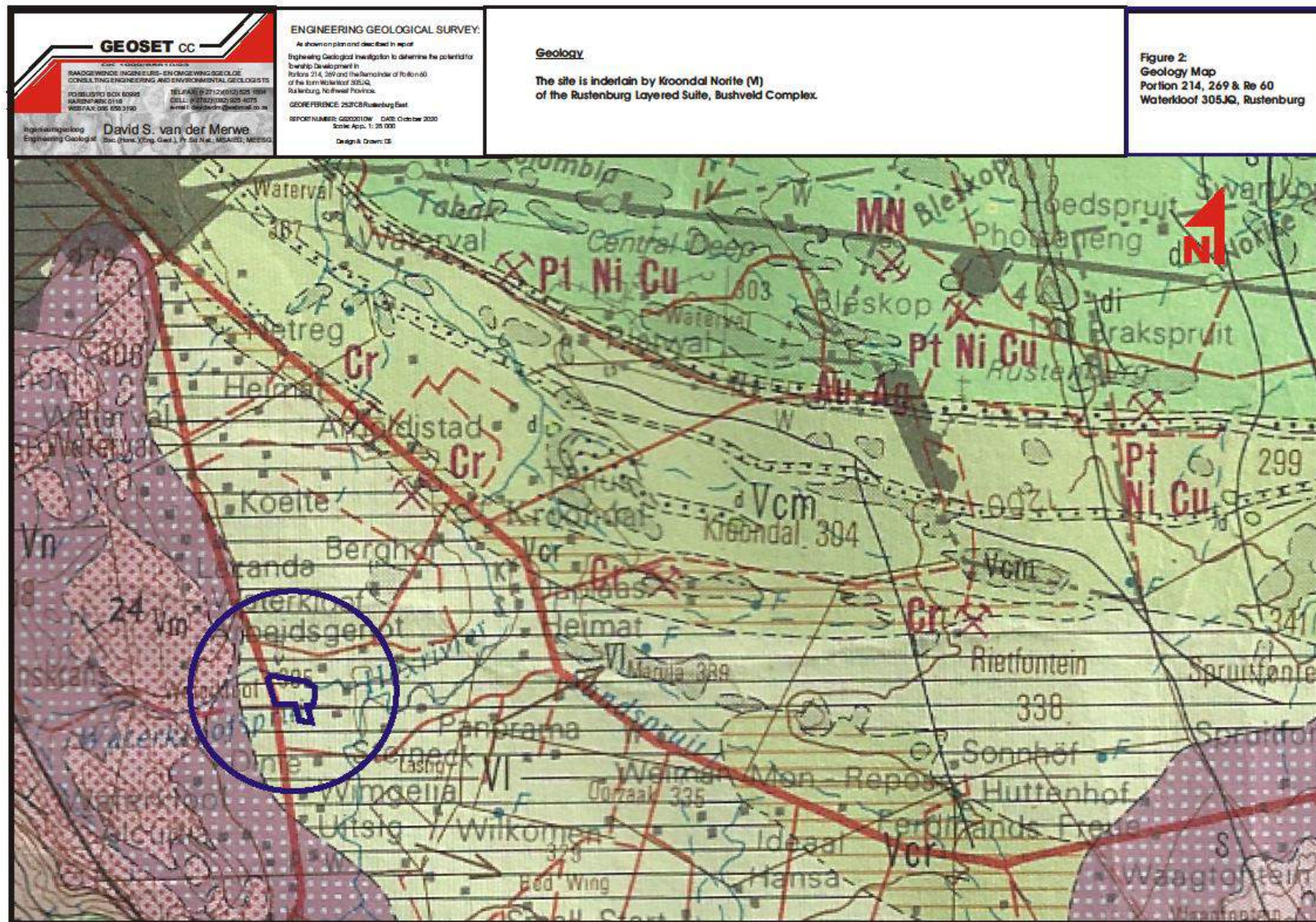
Table 2. Geotechnical Classification for Urban Development:
Partridge, Wood & Brink (1993)

Table 3. Residential Site Class Designations:
SAICE, SAIEG & NHBRC (1995)

APPENDIX A: FIGURES

- Figure 1: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Locality Map.
- Figure 2: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Geology Map.
- Figure 3: Rustenburg, Portion 214, 269 & Re 60, Waterkloof 305 JQ: Engineering Geological Zone Map with Geology and Test Positions on Google Image.





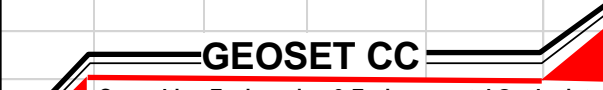
APPENDIX B: SOIL PROFILES

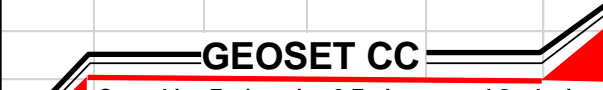
Soil Profiles Tabled Summary

Soil Profile Descriptions


Soil Profile Photographs


<u>Test</u>	<u>Samples</u>	<u>Hillwash</u>	<u>Pebble marker</u>	<u>Norite</u>	<u>Site</u>	<u>Remarks</u>
<u>Pit</u>	<u>Depth</u>	<u>Depth</u>	<u>Depth</u>	<u>Depth</u>	<u>Class</u>	
Nr	m	0m to m	0m to m	to m		
W 1	0,3	1,0		2,2	C2H1	End of hole in highly weathered norite.
W 2	0,3 & 2,0	1,0		2,2	C2H1	End of hole in highly weathered norite.
W 3	0,4 & 1,5	0,4		2,2	C2H1	End of hole in highly weathered norite.
W 4		1,2			C2H1	Quarry with loose clayey sand walls
W 5		1,2			C2H1	Quarry with loose clayey sand walls
W 6	0,6 & 2,0	0,3	1,5	2,2	C2H1	End of hole in highly weathered norite.
W 7	0,5	0,5	2,2		C2H1	End of hole in ferruginized pebble marker
W 8		1,0	2,2	2,8	C2H1	End of hole in highly weathered norite.
W 9	0,3	1,5	2,8		C2H1	End of hole in ferruginized pebble marker
W 10		1,5	2,8		C2H1	End of hole in ferruginized pebble marker
W 11		1,5	2,8		C2H1	End of hole in ferruginized pebble marker
W 12		0,5	2,2&3,0		C2H1	End of hole in ferruginized pebble marker
W 13			2,2&3,0		C2H1	End of hole in ferruginized pebble marker
W 14		0,5	2,2&3,0		C2H1	End of hole in ferruginized pebble marker
W 15		1,5	3,0		C2H1	End of hole in ferruginized pebble marker
W 16		1,5	3,0		C2H1	End of hole in ferruginized pebble marker
9 disturbed samples were taken.						
No water was encountered in any test pit						
A Bell 315 SL new TLB was supplied by Coastal Plant Hire, and operated by Daniel.						
All the test pits were dug to reach of the TLB in excess of 2,2m up, to 3m.						
The moisture content of the soil profiles were usually described as dry to slightly moist.						
The hillwash usually consisted clayey sand.						
The consistency of the soil increased with increasing depth and was described as very loose to loose.						
No refusal was noted in any test pits, with an average depth in excess of 2,2m.						


Soil Profile Nr: W1		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995 Tel: 012 525 1004	
TLB Operator: Daniel		KARENPAK 0118 Webfax: 086 658 3190	
		e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075	
		Engineering Geologist: David S. van der Merwe.	
		Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3		●	
0,4		W1-0,3	
0,5			Slightly moist, light orange, very loose, open textured, sand. Hillw ash.
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			Slightly moist, reddish brown mottled grey, loose to dense, open textured, clayey sand. Hillw ash.
1,7			
1,8			
1,9			
2,0			
2,1			
2,2			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. ● Disturbed sample W1-0,3.			
Lat/long		X Coord:	25° 44' 12,48" S
WGS84 datum		Y Coord:	27° 16' 10,34" E
			Soil Profile Nr: W1

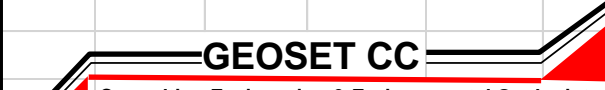
Soil Profile Nr: W3		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995 Tel: 012 525 1004	
TLB Operator: Daniel		KARENPAK 0118 Webfax: 086 658 3190	
		e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075	
		Engineering Geologist: David S. van der Merwe.	
		Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3		W3-0,4	Slightly moist, light orange, very loose, open textured, clayey sand. Hillwash.
0,4		●	
0,5			
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4		W3-1,5	
1,5		●	
1,6			Slightly moist, kaki brown mottled grey, stiff, intact, sandy clay.
1,7			Highly weathered norite.
1,8			
1,9			
2,0			
2,1			
2,2			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. ● Disturbed sample W3-0,4 & 1,5.			
Lat/long		X Coord:	25°44'12,48" S
WGS84 datum		Y Coord:	27°16'10,34" E
			Soil Profile Nr: W3


Soil Profile Nr: W7		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Daniel		KARENPAK 0118	Webfax: 086 658 3190
		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
		Engineering Geologist:	David S. van der Merwe.
		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			Slightly moist, light orange, very loose, open textured, clayey sand. Hillw ash.
0,4		W7-0,5	
0,5		●	
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			Slightly moist, orange, speckled black & red, soft, intact clayey sand with quartz grave
1,4			Pebblemarker
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			
2,2			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. ● Disturbed sample W7-0,6.			
Lat/long	X Coord:	25°44'12,48" S	
WGS84 datum	Y Coord:	27°16'10,34" E	
			Soil Profile Nr: W7


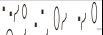














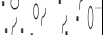







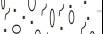


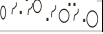



Soil Profile Nr: W8			
DATE: 28 October 2020		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			
0,4			
0,5			Slightly moist, light orange, very loose, open textured, clayey sand. Hillw ash.
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			Slightly moist, orange speckled black & red, soft, intact clayey sand with quartz gravel
1,7			& well rounded quartz pebbles & cobbles. Pebble marker.
1,8			
1,9			
2,0			
2,1			
2,2			
2,3			
2,4			
2,5			Slightly moist, kaki green speckled black, soft, intact sandy clay.
2,6			Residual highly weathered norite.
2,7			
2,8			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long	X Coord:	25°44'12,48" S	
WGS84 datum	Y Coord:	27°16'10,34" E	
			Soil Profile Nr: W8

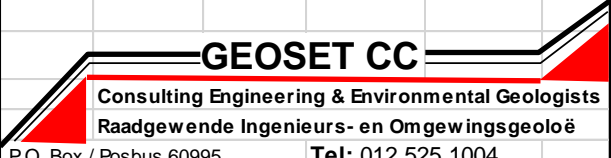
Soil Profile Nr: W9		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel		P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3		●	
0,4		W9-0,3	
0,5			
0,6			Dry to slightly moist, light brown to orange, very loose to loose, open textured,
0,7			clayey sand. Hillw ash.
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			Slightly moist, orange speckled red, loose, open textured, clayey sand with
2,2			ferricete nodules. Ferruginised pebble marker.
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. ● Disturbed sample W9-0,3.			
Lat/long	X Coord:	25°44'12,48" S	
WGS84 datum	Y Coord:	27°16'10,34" E	
			Soil Profile Nr: W9

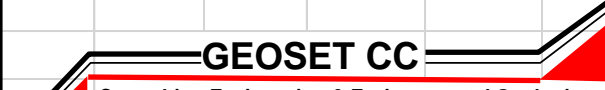
Soil Profile Nr: W10		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPARK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			
0,4			
0,5			
0,6			Dry to slightly moist, light brown to orange, very loose to loose, open textured, clayey sand. Hillw ash.
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			Slightly moist, orange speckled red, loose, open textured, clayey sand with ferricete nodules. Ferruginised pebble marker.
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long		X Coord:	25° 44' 12,48" S
WGS84 datum		Y Coord:	27° 16' 10,34" E
			Soil Profile Nr: W10


Soil Profile Nr: W11		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel			
Depth bngl (m)	Soil Profile Symbol		
0,1			
0,2			
0,3			
0,4			
0,5			
0,6			Dry to slightly moist, light brown to orange, very loose to loose, open textured, clayey sand. Hillwash.
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			Slightly moist, orange speckled red, loose, open textured, clayey sand with ferricrete nodules. Ferruginised pebble marker.
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long WGS84 datum	X Coord:	25°44'12,48" S	
	Y Coord:	27°16'10,34" E	
			Soil Profile Nr: W11

Soil Profile Nr: W12		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995 Tel: 012 525 1004	
TLB Operator: Daniel		KAREN PARK 0118 Webfax: 086 658 3190	
		e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075	
		Engineering Geologist: David S. van der Merwe.	
		Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			Dry to slightly moist, light brown to orange, very loose to loose, open textured,
0,3			clayey sand. Hillw ash.
0,4			
0,5			
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			Slightly moist, orange, speckled black & red, soft, intact clayey sand with quartz
1,5			gravel. Pebblemarker
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			Slightly moist, orange speckled red, loose, open textured, clayey sand with
2,7			ferricite nodules. Ferruginised pebble marker.
2,8			
2,9			
3,0			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long		X Coord:	25°44'12,48" S
WGS84 datum		Y Coord:	27°16'10,34" E
			Soil Profile Nr: W12

Soil Profile Nr: W13		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel		P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			
0,4			
0,5			
0,6			
0,7			
0,8			
0,9			
1,0			Moist, orange speckled black & red, soft, intact clayey sand w ith quartz gravel.
1,1			Pebblemarker
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			Slightly moist, orange speckled red, loose, open textured, clayey sand w ith ferricrete nodules. Ferruginised pebble marker.
2,7			
2,8			
2,9			
3,0			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long		X Coord:	25°44'12,48" S
WGS84 datum		Y Coord:	27°16'10,34" E
			Soil Profile Nr: W13

Soil Profile Nr: W14		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995 Tel: 012 525 1004	
TLB Operator: Daniel		KAREN PARK 0118 Webfax: 086 658 3190	
		e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075	
		Engineering Geologist: David S. van der Merwe.	
		Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			Dry to slightly moist, light brown to orange, very loose to loose, open textured,
0,3			clayey sand. Hillw ash.
0,4			
0,5			
0,6			
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			Slightly moist, orange, speckled black & red, soft, intact clayey sand with quartz grave
1,5			Pebblemarker
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			Slightly moist, orange speckled red, loose, open textured, clayey sand with
2,7			ferricete nodules. Ferruginised pebble marker.
2,8			
2,9			
3,0			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long		X Coord:	25°44'12,48" S
WGS84 datum		Y Coord:	27°16'10,34" E
			Soil Profile Nr: W14

Soil Profile Nr: W15		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 28 October 2020			
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4			
TLB Operator: Daniel			
P.O. Box / Posbus 60995			
KAREN PARK 0118		Webfax: 086 658 3190	
e-mail: davidsvdm@webmail.co.za		Cell: 082 925 4075	
Engineering Geologist:		David S. van der Merwe.	
Ingenieursgeoloog:		Pr. Sci. Nat., MSAIEG.	
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			
0,4			
0,5			
0,6			Dry to slightly moist, light brown to orange, very loose to loose, open textured, clayey sand. Hillwash.
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			Slightly moist, orange speckled red, loose, open textured, clayey sand with ferricrete nodules. Ferruginised pebble marker.
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3,0			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long	X Coord:	25°44'12,48" S	
WGS84 datum	Y Coord:	27°16'10,34" E	
			Soil Profile Nr: W15

Soil Profile Nr: W16			
DATE: 28 October 2020		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
JOB NR: GS202010W			
PROJECT NAME: Rustenburg			
Town: Waterkloof Ptn 214, 269 & Re 60			
CLIENT: Maxim Rustenburg			
TLB Contractor: Coastal Plant Hire			
TLB Machine: Bell 315 SL 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Daniel		KARENPAK 0118	Webfax: 086 658 3190
		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
		Engineering Geologist:	David S. van der Merwe.
		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0,1			
0,2			
0,3			
0,4			
0,5			
0,6			Dry to slightly moist, light brown to orange, very loose to loose, open textured, clayey sand. Hillwash.
0,7			
0,8			
0,9			
1,0			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2,0			
2,1			Slightly moist, orange speckled red, loose, open textured, clayey sand with ferricite nodules. Ferruginised pebble marker.
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3,0			
Notes:			
1. End of hole.			
2. No groundwater was intersected.			
3. No sample.			
Lat/long		X Coord:	25° 44' 12,48" S
WGS84 datum		Y Coord:	27° 16' 10,34" E
			Soil Profile Nr: W16



Empire Rd, South Africa

Latitude Longitude

25°44'12,724" S 27°36'10,271" E

LOCAL 11:55:08 WEDNESDAY 10.28.2020

GMT 09:55:08 ALTITUDE 1204 METER



Empire Rd, South Africa

Latitude Longitude

25°44'11,923" S 36°14,597" E

LOCAL 12:19:34 WEDNESDAY 10.28.2020

GMT 10:19:34 ALTITUDE 1204 METER



Empire Rd, South Africa
Latitude Longitude
25°44'15,288" S 36°18,510"E
LOCAL 12:38 WEDNESDAY 10.28.2020
GMT 10:38:23 ALTITUDE 1198 METER





Unnamed Road, South Africa

Latitude Longitude

25°44'26,790" S 36°29,443" E

LOCAL 12:52:36 WEDNESDAY 10.28.2020

GMT 10:52:36 ALTITUDE 0 METER



Unnamed Road, South Africa

Latitude Longitude

25°44'26,823" S 36°29,445" E

LOCAL 13:06:08 WEDNESDAY 10.28.2020

GMT 11:06:08 ALTITUDE 0 METER



Unnamed Road, South Africa

Latitude Longitude

25°44'26,854" S 36°29,265" E

LOCAL 13:18 WEDNESDAY 10.28.2020

GMT 11:18:31 ALTITUDE 0 METER



Dinie Estates Rd, South Africa
Latitude Longitude
25°44'29,208" S 36°19,978" E
LOCAL 13:32 WEDNESDAY 10.28.2020
GMT 11:32:40 ALTITUDE 1190 METER



Empire Rd, South Africa
Latitude Longitude
25°44'25,307" 307°36'18,641"E
LOCAL 13:44:49 WEDNESDAY 10.28.2020
GMT 11:44:49 ALTITUDE 1203 METER



Empire Rd, South Africa
Latitude Longitude
25°44'23,325" S 32°36'12,442" E
LOCAL 13:55 WEDNESDAY 10.28.2020
GMT 11:55:16 ALTITUDE 1204 METER



Empire Rd, South Africa

Latitude Longitude

25°44'19,423" S 36°16,587" E

LOCAL 14:05:32 WEDNESDAY 10.28.2020

GMT 12:05:32 ALTITUDE 1199 METER



Empire Rd, South Africa
Latitude Longitude
25°44'15,320" S 36°13,385" E
LOCAL 14:17:39 WEDNESDAY 10.28.2020
GMT 12:17:39 ALTITUDE 1204 METER



Empire Rd, South Africa
Latitude Longitude
25°44'15,718"S 16°8,908"E
LOCAL 14:30 WEDNESDAY 10.28.2020
GMT 12:30:09 ALTITUDE 1204 METER



Unnamed Road, South Africa

Latitude Longitude

25°44'36,929" S 36°21,258" E

LOCAL 14:39:40 WEDNESDAY 10.28.2020

GMT 12:39:40 ALTITUDE 0 METER



Empire Rd, South Africa

Latitude

Longitude

25°44'19,610"S 16°9,637"E

LOCAL 14:49:28 WEDNESDAY 10.28.2020

GMT 12:49:28 ALTITUDE 1197 METER

APPENDIX C: LABORATORY RESULTS

Table A: Summary of Lab results
STL Laboratory Results Summary Table
STL Laboratory Results

Table A Summary of Laboratory Results										
Stats	Nr	Depth m	Material Description and Origin	Clay %	Classification		% Linear Shrinkage	Plasticity Index	Liquid Limit	Expan- siveness
					Unified	PRA				
1	W1	0,3	Clayey sand	24	SC	A-6	9	18	32	M
2	W2	0,3	Silty sand	5	SM	A-2-4	0,5	SP	ND	L
3	W2	2,0	Sandy clay	43	CH	A-7-5	14,5	30	61	H
4	W3	0,4	Clayey sand	11	SC-SM	A-2-4	3	6	19	L
5	W3	1,5	Clayey sand	24	SC	A-7-6	14,5	29	53	M
6	W6	0,6	Sandy clay	38	CL	A-7-6	11	21	42	M
7	W6	2,0	Silty sand	9	SC	A-2-6	11,5	24	39	L/M
8	W7	0,5	Clayey sand	31	CL-ML	A-4	2,5	5	19	L
9	W9	0,3	Silty sand	4	SM	A-2-4	0	NP	ND	L
Material possibly expansive if value:				>12%			>8%	>12	>30	Exp?
Table A Legend										
Unified										
11	According to the revised ASTM-Standard on the "Unified Soil Classification System" (Weinert).									
1	ML: Inorganic silt & fine sand, silty or clayey fine sand with slight plasticity.									
2	CL: Inorganic clay of low to medium plasticity, gravelly, sandy or silty clay, lean clay.									
1	CH: Inorganic clay of high plasticity, fat clay.									
4	SC: clayey sand, poorly graded sand clay mixtures.									
3	SM: Silty sand; poorly graded sand silt mixtures									
PRA / AASHTO										
9	"Public Roads Classification" (Brink, Partridge & Williams).									
3	A-2-4: Sand & gravel with low plasticity silt fines.									
1	A-2-6: sand & gravel with clay fines.									
1	A-4: Low compressibility silt.									
1	A-6: Low to medium compressibility clay.									
1	A-7-5: High compressibility silty clay.									
2	A-7-6: High compressibility high volume change clay.									
Expansiveness according to Van der Merwe's method (Brink, Partridge & Williams).										
4	L: Low									
1	L/M: Low to medium expansiveness									
3	M: Medium									
1	H: High									
A clayey material is potentially expansive if it exhibits the following properties (Kantey and Brink, 1952):										
5	a clay content greater than 12 percent,									
5	a linear shrinkage of more than 8 percent,									
5	a plasticity index of more than 12, and									
5	a liquid limit of more than 30 percent									
1	NP: Not plastic: sandy material with no cohesion									
1	SP: Slightly plastic: material with little cohesion									
2	ND: not determined									



Client Name: Geoset
Project Name: Waterkloof
Job Number: DVM-139
Date: 04-Dec-20
Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	W1	W2	W2	W3	W3	W6	W6	W7
Depth (m)	0.3	0.3	2.0	0.4	1.5	0.6	2.0	0.3
Lab No	DVM-139-1338	DVM-139-1339	DVM-139-1340	DVM-139-1341	DVM-139-1342	DVM-139-1343	DVM-139-1344	DVM-139-1345
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	100	100	100	100	100	100	100	100
19.0	100	100	100	100	100	100	100	100
13.2	100	100	100	100	100	100	100	100
9.3	99	100	100	100	99	100	100	100
6.7	98	100	100	100	96	100	100	100
4.75	97	99	100	100	92	100	99	100
2.00	94	97	100	99	85	96	89	99
1.00	90	94	98	96	82	92	76	97
0.425	78	82	95	87	76	84	60	80
0.250	61	59	89	64	63	74	43	62
0.150	52	46	85	44	54	67	30	55
0.075	42	28	80	27	45	59	21	50
0.060	35	20	74	20	37	54	16	46
0.050	34	18	71	19	34	52	15	43
0.037	31	13	66	16	29	49	13	39
0.020	28	8	58	14	27	45	11	37
0.006	26	6	48	12	25	40	10	33
0.002	24	5	43	11	24	38	9	31
GM	0.86	0.93	0.25	0.87	0.94	0.61	1.30	0.71

Atterberg Limits

LL (%)	32	-	61	19	53	42	39	19
Pl (%)	18	SP	30	6	29	21	24	5
LS (%)	9.0	0.5	14.5	3.0	14.5	11.0	11.5	2.5

pH & Conductivity

pH								
EC (S/m)								

MDD / OMC

MDD (kg/m ³)								
OMC (%)								

CBR

100%								
98%								
97%								
95%								
93%								
90%								
Swell (%)								

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

--	--	--	--	--	--	--	--	--

Remarks:

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



Client Name: Geoset
Project Name: Waterkloof
Job Number: DVM-139
Date: 04-Dec-20
Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)							
Sample	WS						
Depth (m)	0.3						
Lab No	DVM-139-1346						
53.0	100						
37.5	100						
25.0	100						
19.0	100						
13.2	100						
9.5	100						
6.7	100						
4.75	100						
2.00	99						
1.00	96						
0.425	78						
0.250	54						
0.150	32						
0.075	15						
0.060	8						
0.050	6						
0.035	4						
0.020	4						
0.006	4						
0.002	4						
GM	1.08						

Atterberg Limits							
LL (%)	-						
Pl (%)	NP						
LS (%)	0.0						

pH & Conductivity							
pH							
EC (S/m)							

MDD / OMC							
MDD (kg/m ³)							
OMC (%)							

CBR							
100%							
95%							
90%							
85%							
80%							
Swell (%)							

UCS (MPa)							
100%							
97%							
90%							

COLTO Classification							

Remarks: _____

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



Client Name: Geoset
Project Name: Waterkloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

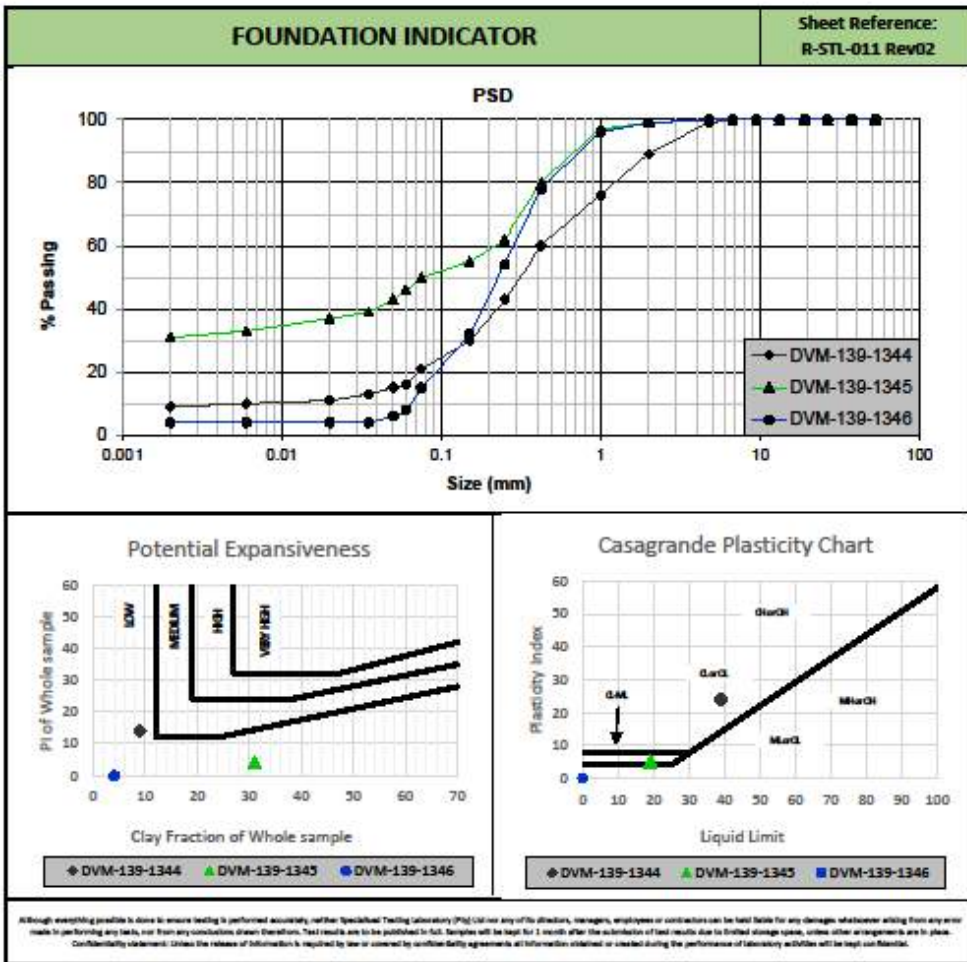
FOUNDATION INDICATOR				Sheet Reference: R-STL-011 Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	W1	W2	W2	Sample	W1	W2	W2
Depth (m)	0.3	0.3	2.0	Depth (m)	0.3	0.3	2.0
Lab No	DVM-139-1338	DVM-139-1339	DVM-139-1340	Lab No	DVM-139-1338	DVM-139-1339	DVM-139-1340
53.0	100	100	100	Liquid Limit (%)	32	-	61
37.5	100	100	100	Plastic Limit (%)	14	-	31
26.5	100	100	100	Plasticity Index (%)	18	SP	30
19.0	100	100	100	Linear Shrinkage (%)	9.0	0.5	14.5
13.2	100	100	100	PI of whole sample	14	-	29
9.5	99	100	100				
6.7	98	100	100	% Gravel	6	3	0
4.75	97	99	100	% Sand	59	77	26
2.00	94	97	100	% Silt	11	15	31
1.00	90	94	98	% Clay	24	5	43
0.425	78	82	95	Activity	0.8	0.0	0.7
0.250	61	59	89				
0.150	52	46	85	% Soil Mortar	94	97	100
0.075	42	28	80				
0.060	35	20	74	Grading Modulus	0.86	0.93	0.25
0.050	34	18	71	Moisture Content (%)	N / T	N / T	N / T
0.035	31	13	66	Relative Density (SG)*	2.65	2.65	2.65
0.020	28	8	58				
0.006	26	6	48	Unified (ASTM D2487)	SC	SM	CH
0.002	24	5	43	AASHTO (M145-91)	A - 6	A - 2 - 4	A - 7 - 5
Remarks: *: Assumed N / T: Not Tested							
<small>Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place. Confidentiality statement: Unless the release of information is required by law or covered by another safety agreement all information obtained or checked during the performance of laboratory activities will be kept confidential.</small>							



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 www.stlab.co.za

Client Name: Geoset
Project Name: Waterloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)





Client Name: Geoset
Project Name: Waterkloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

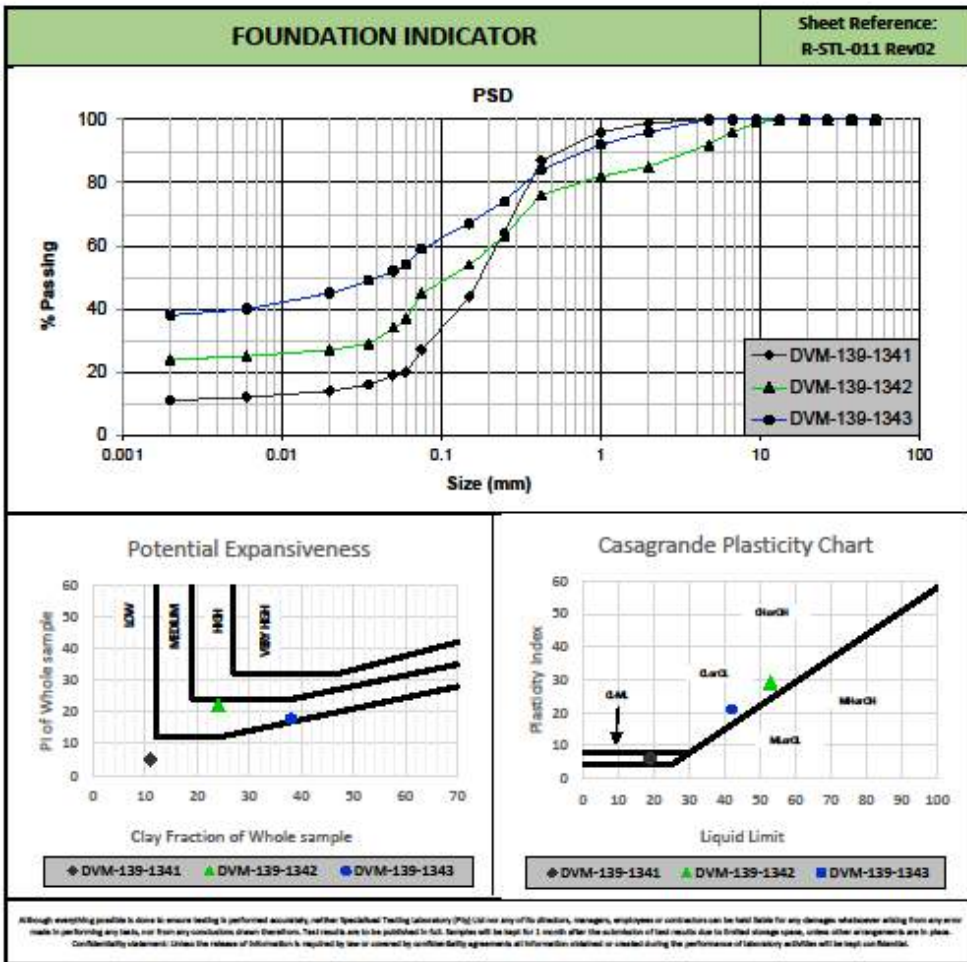
FOUNDATION INDICATOR				Sheet Reference: R-STL-011 Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	W6	W7	W9	Sample	W6	W7	W9
Depth (m)	2.0	0.5	0.3	Depth (m)	2.0	0.5	0.3
Lab No	DVM-139-1344	DVM-139-1345	DVM-139-1346	Lab No	DVM-139-1344	DVM-139-1345	DVM-139-1346
53.0	100	100	100	Liquid Limit (%)	39	19	-
37.5	100	100	100	Plastic Limit (%)	15	14	-
26.5	100	100	100	Plasticity Index (%)	24	5	NP
19.0	100	100	100	Linear Shrinkage (%)	11.5	2.5	0.0
13.2	100	100	100	PI of whole sample	14	4	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	11	1	1
4.75	99	100	100	% Sand	73	53	91
2.00	89	99	99	% Silt	7	15	4
1.00	76	97	96	% Clay	9	31	4
0.425	60	80	78	Activity	2.7	0.2	0.0
0.250	43	62	54				
0.150	30	55	32	% Soil Mortar	89	99	99
0.075	21	50	15				
0.060	16	46	8	Grading Modulus	1.30	0.71	1.08
0.050	15	43	6	Moisture Content (%)	N / T	N / T	N / T
0.035	13	39	4	Relative Density (SG)*	2.65	2.65	2.65
0.020	11	37	4				
0.006	10	33	4	Unified (ASTM D2487)	SC	CL-ML	SM
0.002	9	31	4	AASHTO (M145-91)	A - 2 - 6	A - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
<small>Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place. Confidentiality statement: Unless the release of information is required by law or covered by another safety agreement all information obtained or checked during the performance of laboratory activities will be kept confidential.</small>							



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 www.stlab.co.za

Client Name: Geoset
Project Name: Waterloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



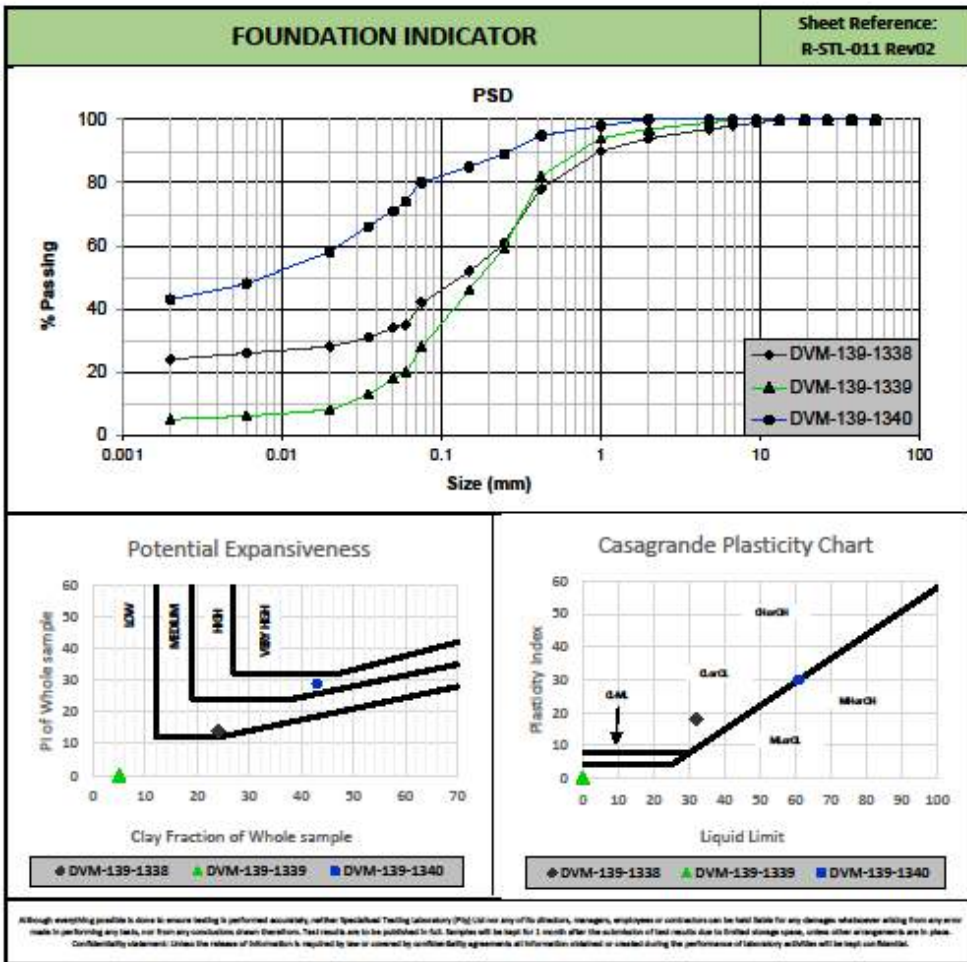


Client Name: Geoset
Project Name: Waterkloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Reference: R-STL-011 Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	W3	W3	W6	Sample	W3	W3	W6
Depth (m)	0.4	1.5	0.6	Depth (m)	0.4	1.5	0.6
Lab No	DVM-139-1341	DVM-139-1342	DVM-139-1343	Lab No	DVM-139-1341	DVM-139-1342	DVM-139-1343
53.0	100	100	100	Liquid Limit (%)	19	53	42
37.5	100	100	100	Plastic Limit (%)	13	24	21
26.5	100	100	100	Plasticity Index (%)	6	29	21
19.0	100	100	100	Linear Shrinkage (%)	3.0	14.5	11.0
13.2	100	100	100	PI of whole sample	5	22	18
9.5	100	99	100				
6.7	100	96	100	% Gravel	1	15	4
4.75	100	92	100	% Sand	79	48	42
2.00	99	85	96	% Silt	9	13	16
1.00	96	82	92	% Clay	11	24	38
0.425	87	76	84	Activity	0.6	1.2	0.6
0.250	64	63	74				
0.150	44	54	67	% Soil Mortar	99	85	96
0.075	27	45	59				
0.060	20	37	54	Grading Modulus	0.87	0.94	0.61
0.050	19	34	52	Moisture Content (%)	N / T	N / T	N / T
0.035	16	29	49	Relative Density (SG)*	2.65	2.65	2.65
0.020	14	27	45				
0.006	12	25	40	Unified (ASTM D2487)	SC-SM	SC	CL
0.002	11	24	38	AASHTO (M145-91)	A-2-4	A-7-6	A-7-6
Remarks: *: Assumed N / T: Not Tested							
<small>Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place. Confidentiality statement: Unless the release of information is required by law or covered by another safety agreement all information obtained or checked during the performance of laboratory activities will be kept confidential.</small>							



Client Name: Geoset
Project Name: Waterloof
Job Number: DVM-139
Date: 2020-12-04
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



APPENDIX D: TABULAR EXPLANATION OF ZONING

Extract from: THE SOUTH AFRICAN INSTITUTE OF ENGINEERING GEOLOGISTS (SAIEG), 1997.
Guidelines for Urban Engineering Geological Investigations.

Table 1. Categories of Urban Engineering Geological Investigation

Table 2. Geotechnical Classification for Urban Development:
Partridge, Wood & Brink (1993)

Table 3. Residential Site Class Designations:
SAICE, SAIEG & NHBRC (1995)

Table 1. CATEGORIES OF URBAN ENGINEERING GEOLOGICAL INVESTIGATION

Type	Planning Investigations		Urban Development Investigations		Specialised Investigations
	Regional Engineering Geological Mapping (REGM)	Mapping for Urban Planning	Urban Development Investigation	Urban Development Investigation	
Description					Specialised Geotechnical Investigation
Size of study area and field work	More than 1000 ha. Walk-over survey and limited test pits and soil sampling.	Less than 1000 ha. Walk-over survey.	Less than 10 ha. Test pits, trial holes and soil sampling.	More than 10 ha. Walk-over survey with trial pits and test holes and soil sampling.	Not relevant. Specific to type of specialised investigation.
Suggested number of test pits	A minimum of 3 test pits per land facet type.	None suggested. However, a limited number of test pits may be required at the discretion of the consultant.	Between 6 and 10 test pits.*	Between 1 and 6 test pits per 10 ha, depending on the size and variability of the area to as much as 1 test pit per hectare for highly variable sites.*	Dependent on the type of specialised investigation performed.
Mapping unit	Land systems and land facets.	Terrain types: 1 - most favourable 2 - intermediate 3 - least favourable	Soil classes: C, H, S and P and other (e.g. excavation, drainage features)	Soil classes: C, H, S and P and other (e.g. excavation, drainage features)	Not applicable.
Reference	Brink, Partridge and Williams (1982)	Partridge, Wood and Brink (1993)	SAICE Code of Practice (1995)	SAICE Code of Practice (1995)	Not relevant.
Consultants	Engineering geologists.	Engineering geologists and to a lesser extent geotechnical engineers.	Both engineering geologists and geotechnical engineers.	Both engineering geologists and geotechnical engineers.	Geotechnical engineers and to a lesser extent engineering geologists.

* Note that these figures are not intended to be absolute and should serve only as a guideline.

Table 2. GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

CONSTRAINT	Most favourable (1)	Intermediate (2)	Least favourable (3)
A Collapsible Soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness.*	Any collapsible horizon or consecutive horizons with a depth of more than 750 mm in thickness.	A least favourable situation for this constraint does not occur.
B Seepage	Permanent or perched water table more than 1,5 m below ground surface.	Permanent or perched water table less than 1,5 m below ground surface.	Swamps and marshes.
C Active soil	Low soil-heave potential predicted.*	Moderate soil heave potential predicted.	High soil-heave potential predicted.
D Highly compressible soil	Low soil compressibility expected.*	Moderate soil compressibility expected.	High soil compressibility expected.
E Erodability of soil	Low.	Intermediate.	High.
F Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume.	Rock or hardpan pedocretes between 10 and 40 % of the total volume.	Rock or hardpan pedocretes more than 40 % of the total volume.
G Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred.)	Old undermined areas to a depth of 100 m below surface where slope closure has ceased.	Mining within less than 100 m of surface or where total extraction mining has taken place.
H Instability in areas of soluble rock	Possibly unstable.	Probably unstable.	Known sinkholes and dolines.
I Steep slopes	Between 2 and 6 degrees (all regions).	Slopes between 6 and 18 degrees and less than 2 degrees (Natal and Western Cape). Slopes between 6 and 12 degrees and less than 2 degrees (all other regions).	More than 18 degrees (Natal and Western Cape). More than 12 degrees (all other regions).
J Areas of unstable natural slopes	Low risk.	Intermediate risk.	High risk (especially in areas subject to seismic activity).
K Areas subject to seismic activity	10% probability of an event less than 100 cm/s ² within 50 years.	Mining-induced seismic activity more 100 cm/s ² .	Natural seismic activity more than 100 cm/s ² .
L Areas subject to flooding	A "most favourable" situation for this constraint does not occur.	Areas adjacent to a known drainage channel or floodplain with slope less than 1%.	Areas within a known drainage channel or floodplain.

* These areas are designated as 1A, 1C, 1D, or 1F where localised occurrences of the constraint may arise.

Table 3. RESIDENTIAL SITE CLASS DESIGNATIONS (SAICE, 1995)

TYPICAL FOUNDATION MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine-grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	< 7,5	50%	H
		7,5 - 15	50%	H1
		15 - 30	50%	H2
		> 30	50%	H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSIBLE SOILS	< 5,0	75%	C
		5,0 - 10	75%	C1
		> 10	75%	C2
Fine-grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOIL	< 10	50%	S
		10 - 20	50%	S1
		> 20	50%	S2
Contaminated soils Controlled fill Dolomitic areas Land fill Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	VARIABLE	VARIABLE		P

NOTES:

1. The classifications C,H,R and S are not intended for dolomitic area sites unless specific investigations are carried out to assess the stability (risk of sinkholes and doline formation) of the dolomites. Where this risk is found to be acceptable, the site shall be designated as Class P (dolomitic areas).
2. Site classes are based on the assumption that differential movements, experienced by single-storey residential buildings, expressed as a percentage of the total soil movements are equal to about 50% for soils that exhibit expansive or compressive characteristics and 75% for soils that exhibit both compressible and collapse characteristics. Where this assumption is incorrect or inappropriate, the total soil movements must be adjusted so that the resultant different movement implied by the table is equal to that which is expected in the field.
3. In some instances, it may be more appropriate to use a composite description to describe a site more fully e.g. C1/H2 or S1 and/or H2. Composite Site Classes may lead to higher differential movements and result in design solutions appropriate to a higher range of differential movement e.g. a Class R/S1 site. Alternatively, a further site investigation may be necessary since the final design solution may depend on the location of the building on a particular site.
4. Where it is not possible to provide a single site designation and a composite description is inappropriate, sites may be given multiple descriptions to indicate the range of possible conditions e.g. H-H1-H2 or C1-C2.
5. Soft silts and clays usually exhibit high consolidation and low bearing characteristics. Structures founded on these horizons may experience high settlements and such sites should be designated as Class S1 or S2 as relevant and appropriate.
6. Sites containing contaminated soils include those associated with reclaimed mine land, land down-slope of mine tailings and old land fills.
7. Where a site is designated as Class P, full particulars relating to the founding conditions on the site must be provided.
8. Where sites are designated as being Class P, the reason for such classification shall be placed in brackets immediately after the suffix - i.e. P(contaminated soils). Under certain circumstances, composite description may be more appropriate - e.g. P(dolomite areas)-C1.
9. Certain fills may contain contaminants which present a health risk. The nature of such fill should be evaluated and should be clearly demarcated as such.