

IPELEGENG EXTENSION 12, SCHWEIZER RENEKE

**PHASE 1 ENGINEERING GEOLOGICAL INVESTIGATION
to DETERMINE the POTENTIAL for TOWNSHIP DEVELOPMENT
FOR
IPELEGENG EXTENSION 12, SCHWEIZER RENEKE, NORTHWEST PROVINCE.**

Georeference: 2725AB Schweizer Reneke

GEOSET cc

CK 1999/65610/23

Engineering geologist:

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

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REPORT ON THE PHASE 1 ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED FOR IPELEGENG EXTENSION 12, SCHWEIZER RENEKE, NORTHWEST PROVINCE.

Executive Summary

A phase 1 engineering geological investigation with reference to GFSH-2 specification was conducted on the proposed development site for Ipelegeng Extension 12, Schweizer Reneke, 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 Archean granite and gneiss of the Archean Basement Complex, from the oldest time span in the Randian Erathem. Surficial deposits include the hillwash and aeolian sand covering the lithology. The mechanical properties of the soil layers were determined by means of laboratory tests performed on disturbed samples taken during the profiling of trial pits. The obtained site information is evaluated with regard to the development of masonry structures by the application of standard evaluation techniques. Development zonation for township development according to the NHBRC and SAIEG guidelines were done, indicating the geotechnical conditions of the site. Zoning of the site revealed zones with constraints regarding the **collapsible**, **compressible** and **expansive properties** of the soil. It was classified as C2 to C1H1 and CR and it requires **modified normal to special construction** with proper compaction techniques and site drainage provision as described. Some problems with localized granite rock outcrop, sub outcrop and core stones can be expected with inflated cost of **excavations** for the installation of services. These proposed mitigation measures will be sufficient to successfully address the anticipated geotechnical problems and to ensure the sustainable development as planned.

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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

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Partridge, Wood & Brink (1993)

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APPENDIX E: DATA INPUT SHEETS

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED AT IPELEGENG EXTENSION 12, SCHWEIZER RENEKE, NORTHWEST PROVINCE.

1. INTRODUCTION AND TERMS OF REFERENCE

On request of Mr Koot Raubenheimer of Maxim Planning Solutions in Klerksdorp, a phase 1 engineering geological investigation with reference to GFSH-2 specification was conducted for the proposed development on the property in Ipelegeng Extension 12, Schweizer Reneke, Mamusa Local Municipality, Northwest Province, and communication between us and the abovementioned parties lead to the field work, commencing in July 2020.

The aim of this investigation was to identify and evaluate 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.

The proposed development site is on a portion of the farm Sweizer Renek Townlands 62 HO, northwest of Swizer Reneke, approximately 345 hectares in total size.

Figures 1 to 4 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 2724 Christiana. Scale 1:250 000. The Geological Survey of South Africa.
- 1.3.2 The topography map 2725AB Sweizer Reneke. Scale 1:50 000. The Chief Directorate: Surveys and Land Information, Mowbray.
- 1.3.3 Google map satellite image, used as base field map.

3. SITE DESCRIPTION

3.1 PHYSIOGRAPHY

3.1.1 Topography

The site is located on a shallow slope towards the northeast. It is situated at between 1302 (at the dam) and 1320 metres above mean sea level.

3.1.2 Climate

The region is characterized by summer rainfall with thunderstorms, with annual low rainfall figures of 546mm at Wolmaransstad and 550mm at Schweizer Reneke, 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 6 for Sweizer Reneke. The mechanical disintegration of rocks will therefore not be dominant over chemical decomposition, and shallow 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 Kalahari thornveld *veld type* (Acocks, 1988).

The site itself is covered by sparse grasslands of which some was used as agriculture land, and some typical indigenous trees such as *Acacia erioloba* (Kameeldoring) 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 representative disturbed samples were collected and tested. The position of the test pits are represented in FIGURE 4 (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. The gradings 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.

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.

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

Although minimum requirements for areas of 345ha required at least 34 samples for foundation indicator tests (GFSH-2), it was reduced to 28 according to the limited variability of the geotechnical character and simplicity of the entire site, as well as the similar limited excavatability on site.

No free swell tests were done as all these possible areas falls within the drainage features and outside the planned developable areas.

No consolidometer tests were done as it was impossible to secure any undisturbed soil sample required for these tests.

No soil chemistry samples were tested as all new developments use synthetic pipes not reactive to soil aggressiveness.

The disturbed samples taken during the investigation were tested by the accredited laboratory of SPECIALISED TESTING LABORATORY in Pretoria to determine their physical properties. Indicator tests include grading analyses of each sample taken, the determination of Atterberg limits and linear shrinkage, and compaction tests.

The results are represented in Appendix C.

5. SITE GEOLOGY AND GROUNDWATER CONDITIONS

5.1 Geology

The site is underlain by Archean granite and gneiss of the Archean Basement Complex, from the oldest time span in the Randian Erathem. Surficial deposits include the colluvium and Aeolian sand covering the lithology. Locally a transported layer of diamondiferous river terrace gravel was encountered on the centre portion of the site, which was possibly economically mined in the past.

No dolomite occurs in the area and no stability investigation is required.

5.2 Groundwater Conditions

Plate flow is the dominant drainage pattern on site, and a prominent drainage channel intersects the site. Drainage occurs in a southerly direction and then eastwards towards the Wentzel Dam and then the Harts River.

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

6. GEOTECHNICAL EVALUATION

6.1 ENGINEERING AND MATERIAL CHARACTERISTICS

6.1.1 SOIL PROFILES

According to your generic specification GFSH-2, the minimum number of test pits for an area of 345ha is calculated to 103 test pits, but according to the specification of SAIEG in our document on Guidelines for Urban Engineering Geological Investigation, 1997, Table 1 (Appendix D), at least 30 test pits should be adequate for areas with a low variable geotechnical character, such as this site. The similar

excavatability and geotechnical character limited the extra digging of test pits and sampling. 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 of expansive material with site Class H2R/2C2F

Slightly moist, dark reddish brown to reddish brown, loose to dense, intact silty sand or clayey sand. Aeolian sand.

Abundant, well rounded to sub rounded, small & medium, lava & quartz pebbles matrix supported in the above matrix. Pebble marker. Overall consistency is loose to dense or soft to stiff.

Slightly moist, dark reddish brown, loose, intact sandy clay or clayey sandy gravel of residual highly to moderately weathered granite.

Refusal of TLB on granite.

Some minor problems regarding excavatability to 1,5m can be expected on site, but a competent TLB may be required to reach installation depths for services in some places.

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

6.1.2 LABORATORY RESULTS

Although minimum requirements for areas of 345 ha required at least 34 samples for foundation indicator tests (GFSH-2), it was reduced to 28 samples according to the limited variability of the geotechnical character and the land forms and simplicity of the entire site. All terrain land forms or mapping units were extensively sampled with more than adequate representative characterization of each identified zone or unit.

Clay percentages ranged from 14 to 33% for the 6 samples taken from the hillwash, with plasticity indexes ranging from 14 up to 25 and linear shrinkage percentages of up to 12%. The PRA classification was mainly A-6 (4 samples) as low to medium compressibility clay to A-7-6 (2 samples) as highly compressible high volume change clay. The Unified classification was mainly SC as clayey sand with one sample as CL as inorganic clay of low to medium plasticity, gravelly, sandy or silty clay, lean clay.

The expected low clay percentages ranged from 1 to 11% for the aeolian sand, with plasticity indexes ranging from not plastic or slightly plastic to 20 and linear shrinkage percentages of 0 up to 8,5% and low liquid limits of not possible to determine up to 34. The PRA classification was mainly A-2-4 (24 samples of the aeolian sand) as sand & gravel with low plasticity silt fines with 4 samples of the hillwash as. The Unified classification was SM to SC as mainly silty sand to clayey sand.

The sample from the highly weathered residual lava had a low clay percentage of 9% as expected, but a high liquid limit of 51 and a plasticity index of 22.

Mining activities on site and in the area were found, and evidence of gravel sieving with panning of alluvial diamonds indicated activity that left heaps of reworked gravel on the western and eastern portions of the site.

The site is located far from any present mining activities and in an inactive area regarding seismic activity.

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

The colluvium comprising silty sand on site has a low clay percentage and may be found fit for use in the building industry, and as backfilling for the placement bedding of service pipes.

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

6.2 SLOPE STABILITY AND EROSION

The potential for lateral soil movement or erosion is medium to high, and the Aeolian loose silty clayey sand may also be washed away during thunderstorms. Except for local slope instability within opened trenches and the possible collapse of open pit side walls, no other slope instability is expected within these relative flat areas. All open excavations exceeding 1,5m in depth must be supported.

6.3 EXCAVATION CLASSIFICATION WITH RESPECT TO SERVICES

No problems regarding excavatability can be expected on the site, with no outcrop and sub outcrop areas classified as hard rock excavation. The entire site 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), but a competent TLB will be needed to reach installation depths in excess of 1,5m for services in some places, specially during the dry season.

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.
- * 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 and the presence of perennial fluctuations of ground water were encountered on site, we expect 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 slightly to medium expansive sandy clayey soil, and highly collapsible aeolian sand, and foundations will need special treatment to withstand movement associated with the variable moisture content of the soil.

Minor problems regarding excavatability in excess of 1,5m can be expected on portions of the site. Some problems with localized granite rock outcrop, sub outcrop and core stones can be expected with inflated cost of **excavations** for the installation of services.

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

Special Development:

Site Class C2/2A:

Highly collapsible soil of aeolian origin with thickness in excess of 0,75m, with more than 10mm movement measured at surface characterizes this zone. Foundations will therefore require special foundation techniques such as proper compaction techniques combined with 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. Site drainage and plumbing and service precautions must be used. It is classified as C2 in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995), and 2A according to the classification for urban development (Partridge, Wood & Brink).

Site Class C1H1/2A2C:

Medium collapsible soil of aeolian origin underlain by medium expansive and compressible soil with up to 15mm movement measured at surface characterizes this zone. Foundations will therefore require modified normal 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. Site drainage and plumbing and service precautions must be used. It is classified as C1H1 in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995), and 2A2C after the classification for urban development (Partridge, Wood & Brink).

Special Development with Risk**Site Class CR/1A3F:**

Granite rock outcrop and shallow rock granite or core stones characterize these localized zones and it will require special tools to reach installation depths for services, inducing a higher than normal cost.

Site Class PQ:

Borrow pits and quarries or areas where spoil or building rubble were dumped need to be rehabilitated by backfilling them with an engineered fill of G5 quality or better, compacted in layers before any development can take place.

Undevelopable:**Site Class PD/3L:**

This zone comprises the drainage feature within the 1:100 year flood line, and development should be restricted to outside these areas that may also exhibit a more clayey soil with medium expansive properties.

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 surface
or 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 shallow slope less than 6% towards the northeast.

Plate flow is the dominant drainage pattern on site, and no drainage channel intersects the site. Drainage occurs in a northeasterly direction towards the Harts River and the Wentzel Dam.

Seepage and the presence of perennial fluctuations of ground water were not encountered on site, but a seasonal perched water table may exist. A ferruginised profile indicates that some perennial water level fluctuations occur.

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 relative shallow residual rock, 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 345 hectares, Ipelegeng Extension12, Schweizer Reneke, was investigated to determine the engineering geological properties that will influence township proclamation.
2. The site is underlain by Archean granite and gneiss of the Archean Basement Complex, from the oldest time span in the Randian Erathem. Surficial deposits include the hillwash and aeolian sand covering the lithology.
3. Some problems are foreseen regarding the excavatability to 1,5m depth on site, and localized granite rock outcrop, sub outcrop and core stones can be expected with inflated cost of **excavations** for the installation of services.
4. Zoning of the site revealed zones with constraints regarding the **expansive and collapsible properties** of the material. It classified as follows:

Special Development:

Site Class C2/2A: Highly collapsible soil of aeolian origin with thickness in excess of 0,75m, with more than 10mm movement measured at surface characterizes this zone. Foundations will therefore require special foundation techniques such as proper compaction techniques combined with 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. Site drainage and plumbing and service precautions must be used. It is classified as C2 in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995), and 2A according to the classification for urban development (Partridge, Wood & Brink).

Site Class C1H1/2A2C: Medium collapsible soil of aeolian origin underlain by medium expansive and compressible soil with up to 15mm movement measured at surface characterizes this zone. Foundations will therefore require modified normal 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. Site drainage and plumbing and service precautions must be used. It is classified as C1H1 in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995), and 2A2C after the classification for urban

development (Partridge, Wood & Brink).

Special Development with Risk

Site Class CR/1A3F: Granite rock outcrop and shallow rock granite or core stones characterize these localized zones and it will require special tools to reach installation depths for services, inducing a higher than normal cost.

Site Class PQ: Borrow pits and quarries or areas where spoil or building rubble were dumped need to be rehabilitated by backfilling them with an engineered fill of G5 quality or better, compacted in layers before any development can take place.

Undevelopable:

Site Class PD/3L: This zone comprises the drainage feature within the 1:100 year flood line, and development should be restricted to outside these areas that may also exhibit a more clayey soil with medium expansive properties

5. These proposed mitigation measures will be sufficient to successfully address the anticipated geotechnical problems and to ensure the sustainable development as planned.

6. **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:



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B.Sc. (Hons)(Enggeol.)(Pret.)

11. BIBLIOGRAPHY

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APPENDICES

APPENDIX A: FIGURES

- Figure 1: Ipelegeng Extension12, Schweizer Reneke: Regional Locality Map.
Figure 2: Ipelegeng Extension12, Schweizer Reneke: Topography Map.
Figure 3: Ipelegeng Extension12, Schweizer Reneke: Geology Map.
Figure 4: Engineering Geological Zone Map with 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

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

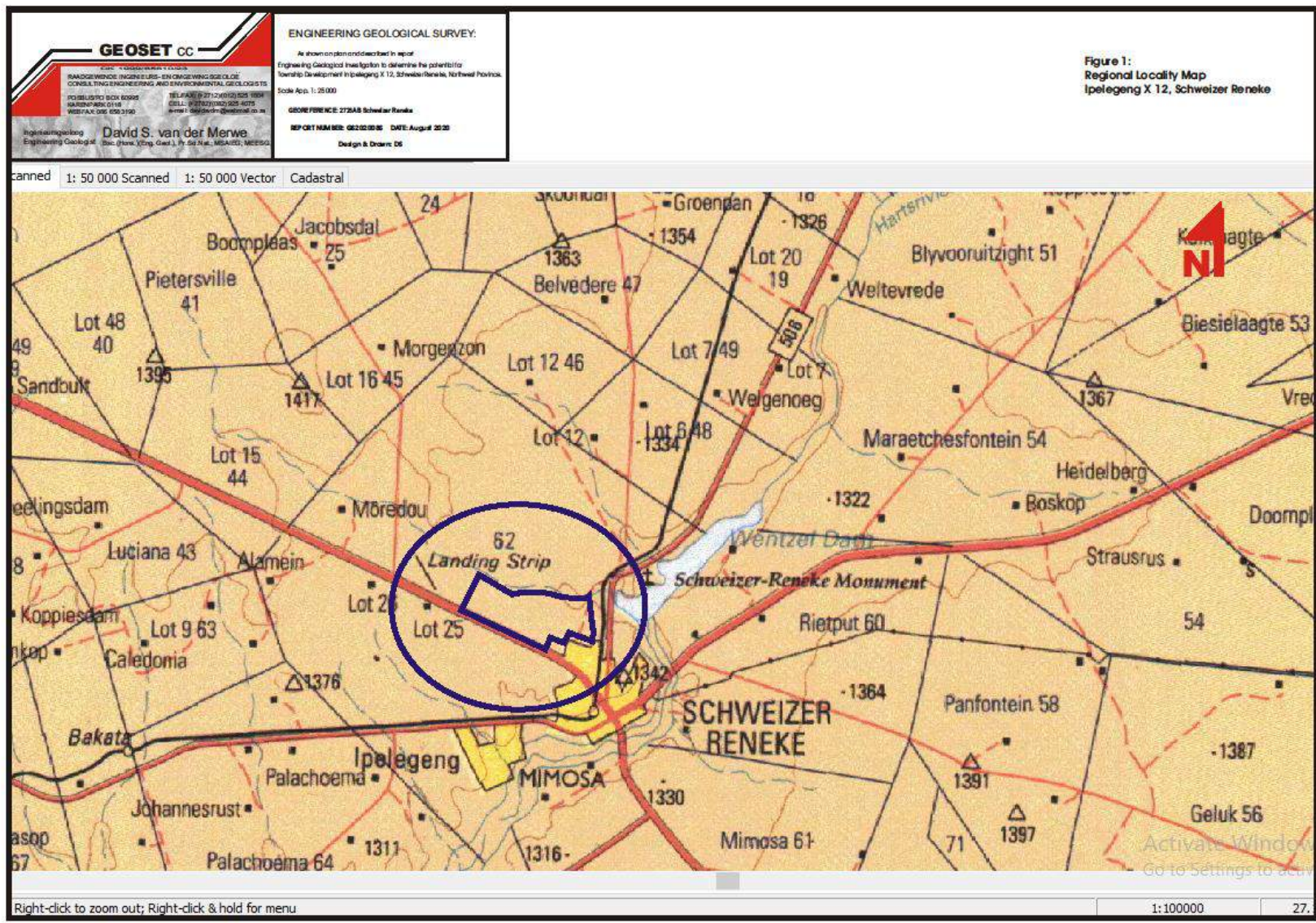
Table 2. Geotechnical Classification for Urban Development:
Partridge, Wood & Brink (1993)

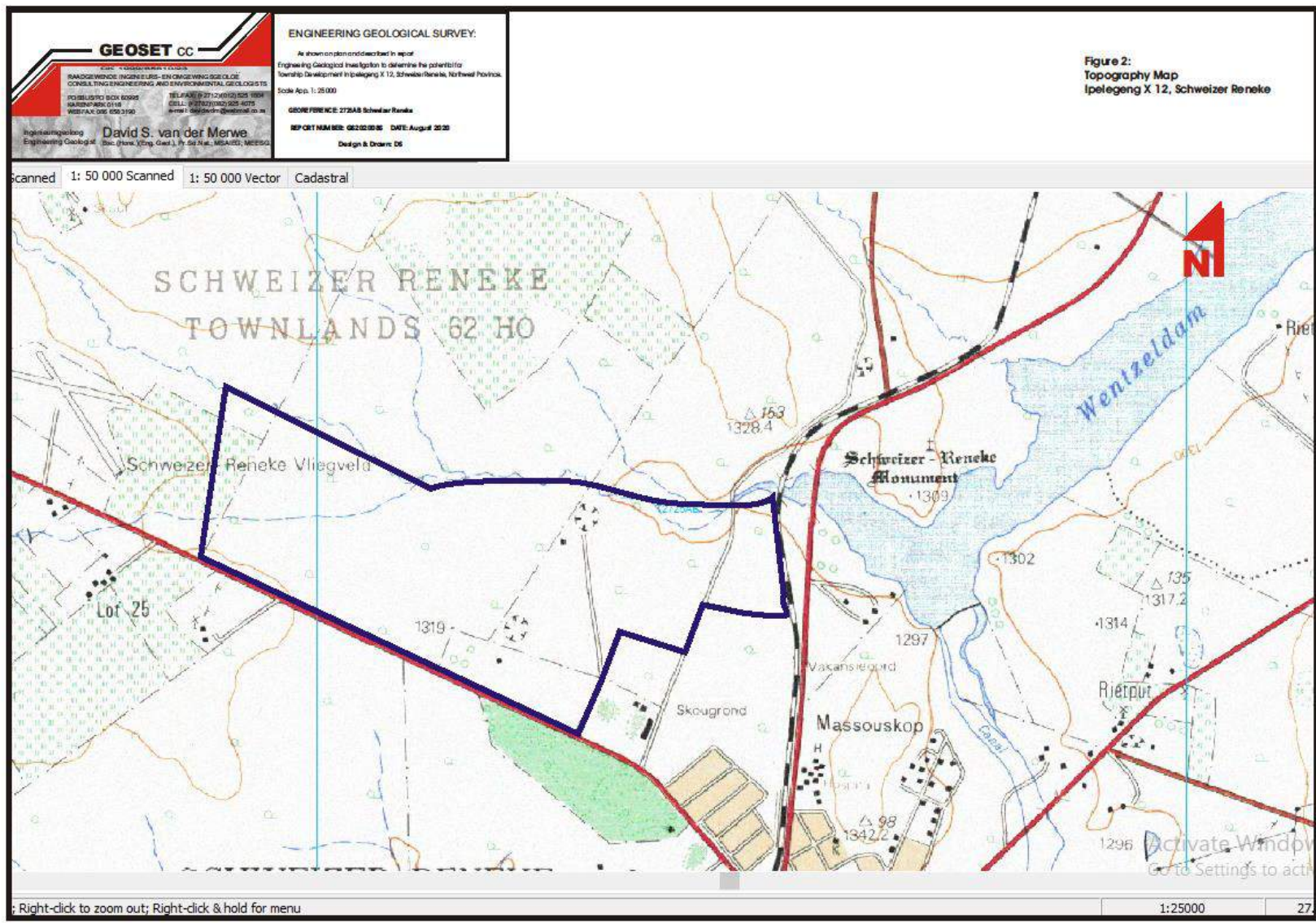
Table 3. Residential Site Class Designations:
SAICE, SAIEG & NHBRC (1995)

APPENDIX E: DATA INPUT SHEETS

APPENDIX A: FIGURES

- Figure 1: Ipelegeng Extension12, Schweizer Reneke: Regional Locality Map.
- Figure 2: Ipelegeng Extension12, Schweizer Reneke: Topography Map.
- Figure 3: Ipelegeng Extension12, Schweizer Reneke: Geology Map.
- Figure 4: Engineering Geological Zone Map with Test Positions on Google Image.



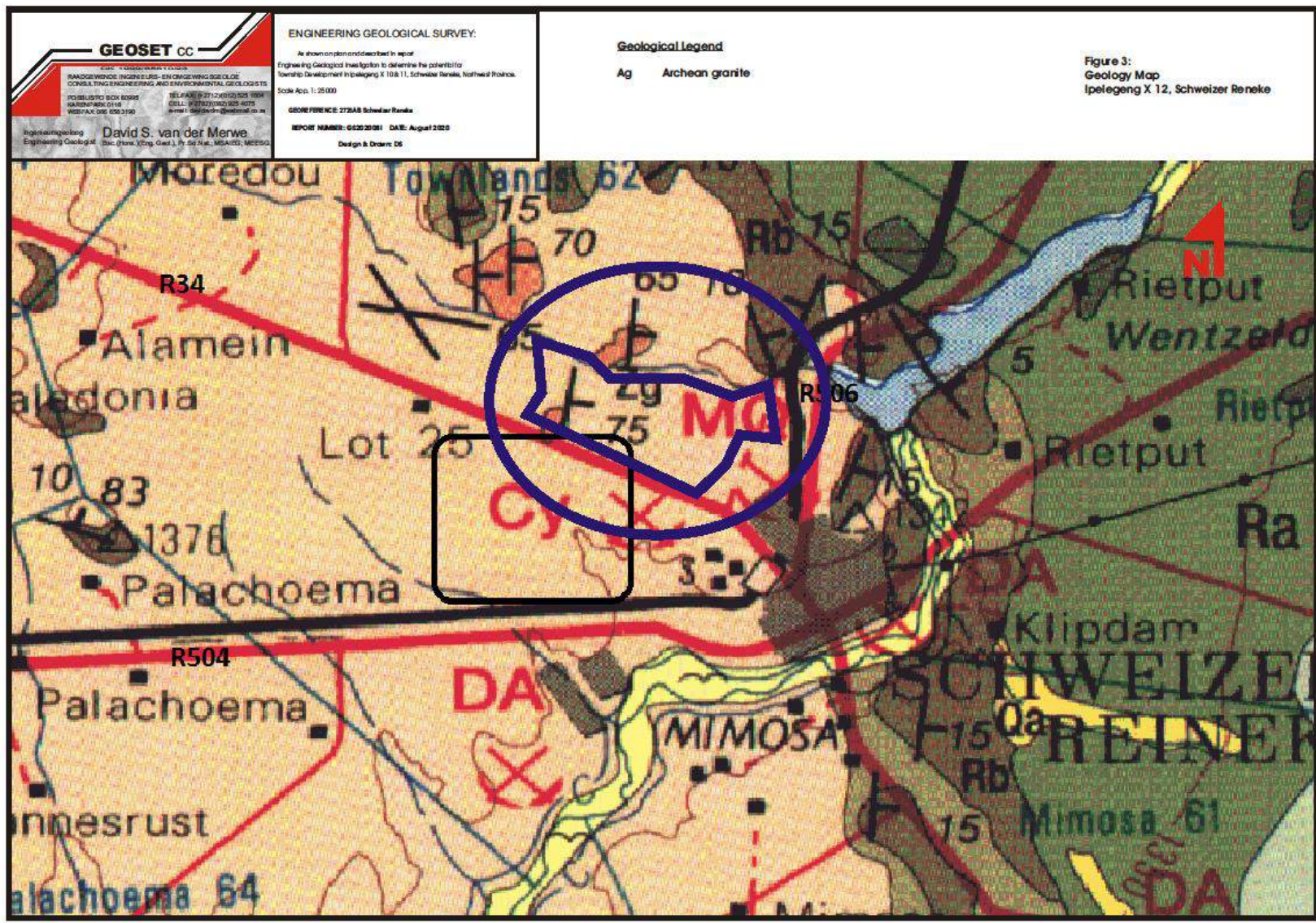


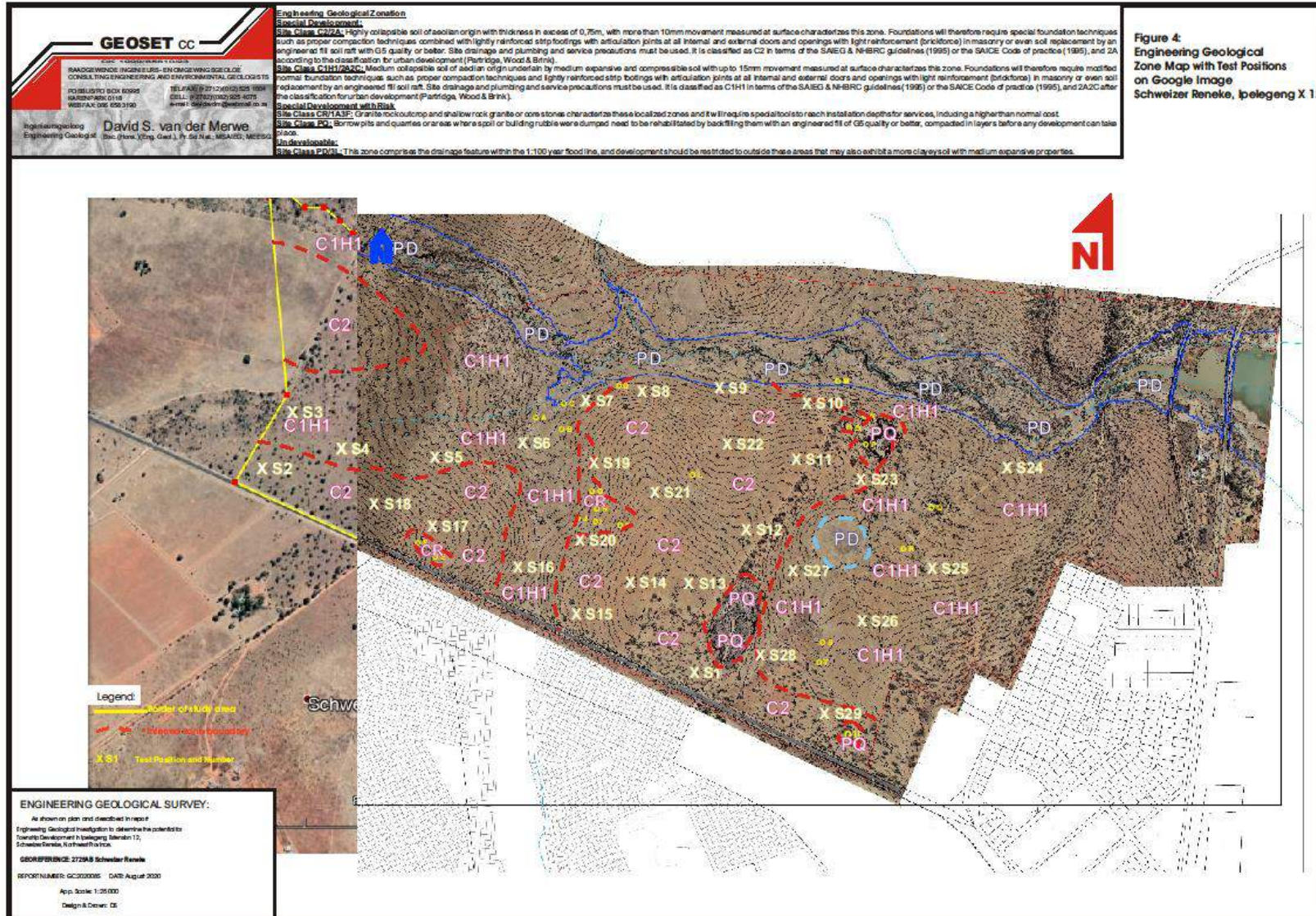
GEOSET CC
 ENGINEERING GEOLOGICAL SURVEY:
 As shown on plan and described in report:
 Engineering Geological Investigation to determine the potential for
 Township Development in the leging X 12, Schweizer Reneke, Northern Province.
 Scale App. 1: 25 000
 GEO REFERENCE: 2728AB Schweizer Reneke
 REPORT NUMBER: GE020206 DATE: August 2020
 Design & Drawn: DG

David S. van der Merwe
 Engineering Geologist
 (Lic. (Pract. Eng. Geol.), Pr. Eng. No. 1684/05, MCEGSO)

Figure 2:
 Topography Map
 Ipelegeng X 12, Schweizer Reneke

Scanned 1: 50 000 Scanned 1: 50 000 Vector Cadastral






APPENDIX B: SOIL PROFILES


Soil Profiles Tabled Summary


Soil Profile Descriptions


Soil Profile Photographs


<u>Test</u>	<u>Samples</u>	<u>Aeolian</u>	<u>Hillwash</u>	<u>Calcrete</u>	<u>Residual granite</u>	<u>Site</u>	<u>Remarks</u>
<u>Pit</u>	<u>Depth</u>	<u>Depth</u>	<u>Depth</u>	<u>Depth</u>	<u>Depth</u>	<u>Class</u>	
Nr	m	0m to m	to m	to m	to m		
S 1	0,8	2,4			2,6	C2	Refusal on slightly weathered granite
S 2	0,6	1,8			2,0	C2	Refusal on slightly weathered granite
S 3	0,5		0,7		1,3	C1H1	Refusal on slightly weathered granite
S 4	0,8		0,8		1,2	C1H1	Refusal on slightly weathered granite
S 5	0,7		0,9		1,3	C1H1	Refusal on slightly weathered granite
S 6			0,3		1,7	C1H1	Refusal on calcified granite
S 7	0,7		0,3		1,7	C1H1	Refusal on calcified granite
S 8	0,4	1,2			1,4	C2	Refusal on slightly weathered granite
S 9	0,5	0,8			1,1	C2	Refusal on granite
S 10	0,6	0,8			1,1	C2	Refusal on granite
S 11	1,0	2,2			2,3	C2	Refusal on slightly weathered granite
S 12	0,6	2,4			2,6	C2	Refusal on slightly weathered granite
S 13	0,7	2,8			3,0	C2	Refusal on slightly weathered granite
S 14	1,0	2,6			2,0	C2	Refusal on slightly weathered granite
S 15	0,8	2,0			2,2	C2	Refusal on slightly weathered granite
S 16	0,3		0,6		0,9	C1H1	Refusal on granite
S 17	0,4	0,7		2,0	2,2	C2	Refusal on slightly weathered granite
S 18	0,5	0,9			1,3	C2	Refusal on calcified granite
S 19	0,3	0,4			0,5	CR	Refusal on slightly weathered granite
S 20	0,3	0,4			0,6	CR	Refusal on slightly weathered granite
S 21	0,1	3,0			3,2	22	Refusal on slightly weathered granite
S 22	0,7	1,2	2,1		2,2	C2	Refusal on slightly weathered granite
S 23	0,6	2,0			2,5	C2	Refusal on slightly weathered granite
S 24	0,3		0,6			C1H1	Refusal on dry clay
S 25	0,3&1,2		0,9	1,9	2,0	C1H1	Refusal on slightly weathered granite
S 26	1,2		1,0			C1H1	Refusal on dry clay
S 27	0,4		0,5		1,0	C1H1	Refusal on calcified granite
S 28	0,3		0,5		0,7	C1H1	Refusal on slightly weathered granite
S 29		2,0				C2	Refusal on slightly weathered granite
A						CR	Granite rock outcrop
B						CR	Granite rock outcrop
C						CR	Granite rock outcrop
D						CR	Granite rock outcrop
E						CR	Granite rock outcrop
F						CR	Granite rock outcrop
G						CR	Granite rock outcrop
H						CR	Granite rock outcrop
I						CR	Granite rock outcrop
J						CR	Granite rock boulders
K						CR	Granite rock boulders & outcrop
L						CR	Granite rock boulders & outcrop
M						CR	Granite rock outcrop
N						CR	Granite rock boulders & outcrop
O						CR	Granite rock boulders & outcrop in quarry
P						CR	Granite rock boulders & outcrop in quarry
Q						CR	Rifle range
R						PD	Pan
S						CR	Granite rock outcrop
T						CR	Granite rock outcrop
U						CR	Soil dumping
28 Disturbed samples were taken.							
No water was encountered in any test pit							
AJCB 3CX 4X2 TLB was supplied by Sandveld.							
Almost all the test pits were dug to the refusal depth of the TLB, usually in granite.							
The moisture content of the soil profiles were usually described as dry and sometimes as slightly moist.							
The aeolian sand usually consisted of silty sand and calcrete gravel.							
The consistency of the soil increased with increasing depth and was described as loose to dense with refusal on granite as medium hard rock.							
Refusal on the granite was noted in all test pits, with an average refusal depth of 1,86m.							
Please note the GPS coordinates on each photo for specific reference.							


Soil Profile Nr: S5		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Eddy		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			Slightly moist, light brown, stiff, shattered, clayey sand. Hillwash.
0.6			
0.7		●	
0.8		S5-0,7	
0.9			
1.0			
1.1			
1.2			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
1.3			Highly weathered granite
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S5-0,7			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S5


Soil Profile Nr: S6		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 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.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			Slightly moist, light brown, stiff, shattered, clayey sand. Hillwash.
0.3			
0.4			
0.5			
0.6			
0.7			
0.8			
0.9			
1.0			Slightly moist, khaki speckled grey & white, stiff, shattered, sandy clay & calcrete grav
1.1			Highly weathered calcified granite
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. No sample			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S6


Soil Profile Nr: S7		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Eddy		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			Slightly moist, light brown, stiff, shattered, clayey sand. Hillwash.
0.3			
0.4			
0.5			
0.6			
0.7		●	
0.8		S7-0,7	
0.9			
1.0			Slightly moist, khaki speckled grey & white, stiff, shattered, sandy clay & calcrete grav
1.1			Highly weathered calcified granite
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S7-0,7			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S7


Soil Profile Nr: S8		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3			
0.4		●	
0.5		S8-0,4	
0.6			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.7			
0.8			
0.9			
1.0			
1.1			
1.2			
1.3			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
1.4			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S8-0,4			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S8


Soil Profile Nr: S10		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Eddy		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			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.5		S10-0,6	
0.6		●	
0.7			
0.8			
0.9			
1.0			Slightly moist, khaki speckled grey & white, stiff, shattered, sandy clay.
1.1			Highly weathered granite
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S10-0,6			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S10

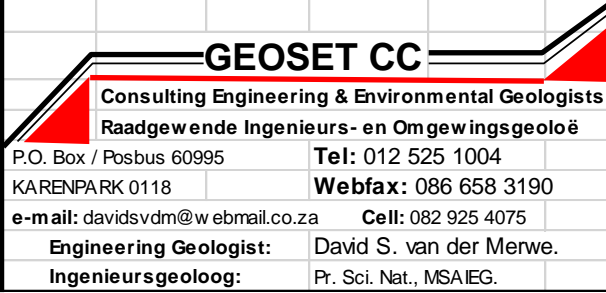
Soil Profile Nr: S11		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgevingsgeoloë	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4		P.O. Box / Posbus 60995	Tel: 012 525 1004
TLB Operator: Eddy		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		S11-1,0	
1.0		●	
1.1			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			
2.1			
2.2			
2.3			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay. Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S11-0,4			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S11


Soil Profile Nr: S12		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 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.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S12-0,6	
0.8			
0.9			
1.0			
1.1			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
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			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay. Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S12-0,6			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S12


Soil Profile Nr: S13			
DATE: 21 July 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: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S13-0,7	
0.9			
1.0			
1.1			
1.2			
1.3			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
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			
2.7			
2.8			
2.9			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
3.0			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S13-0,7			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34,59" E
			Soil Profile Nr: S13


Soil Profile Nr: S14			
DATE: 21 July 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: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S14-0,7	
1.0		●	
1.1			
1.2			
1.3			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
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			
2.7			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
2.8			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S14-1,0			
Lat/long		X Coord: 7° 10'36,32" S	
WGS84 datum		Y Coord: 5° 18'34,59" E	
			Soil Profile Nr: S14


Soil Profile Nr: S15		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S15-0,8	
1.0			
1.1			
1.2			
1.3			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			
2.1			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
2.2			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S15-0,8			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34,59" E
			Soil Profile Nr: S15


Soil Profile Nr: S17			
DATE: 21 July 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: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3			
0.4	●		Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.5		S17-0,4	
0.6			
0.7			
0.8			
0.9			
1.0			
1.1			
1.2			
1.3			Slightly moist, yellow, loose, intact, clayey sandy gravel.
1.4			Highly weathered granite.
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			
2.1			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
2.2			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S17-0,4			
Lat/long		X Coord: 7° 10'36,32" S	
WGS84 datum		Y Coord: 15° 18'34,59" E	
			Soil Profile Nr: S17


Soil Profile Nr: S18		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3			
0.4		S18-0,5	Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.5		●	
0.6			
0.7			
0.8			
0.9			
1.0			
1.1			Slightly moist, khaki speckled grey & white, stiff, shattered, sandy clay.
1.2			Highly weathered calcified granite
1.3			
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S18-0,5			
Lat/long WGS84 datum	X Coord:	27° 10'36,32" S	
	Y Coord:	25° 18'34,59" E	
			Soil Profile Nr: S18

Soil Profile Nr: S19		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2		S19-0,3	
0.3	●		Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.4			
0.5			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay. Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S19-0,3			
Lat/long		X Coord: 7° 10'36,32" S	
WGS84 datum		Y Coord: 5° 18'34,59" E	
			Soil Profile Nr: S19

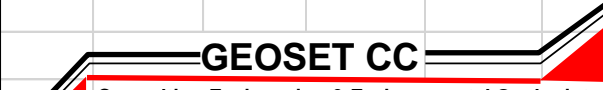
Soil Profile Nr: S20		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2		S20-0,3	
0.3		●	Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
0.4			
0.5			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
0.6			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S20-0,3			
Lat/long		X Coord: 7° 10'36,32" S	
WGS84 datum		Y Coord: 5° 18'34,59" E	
			Soil Profile Nr: S20


Soil Profile Nr: S21		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S21-1,0	
1.0		●	
1.1			
1.2			
1.3			
1.4			Slightly moist, red brown, very loose, open textured, silty sand. Aeolian sand.
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			
2.1			
2.2			
2.3			
2.4			
2.5			
2.6			
2.7			
2.8			
2.9			
3.0			
3.1			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
3.2			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S21-1,0			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S21


Soil Profile Nr: S22		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 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.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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			Slightly moist, red brown, very loose, open textured, silty sand. Aeolian sand.
0.7		●	
0.8		S22-0,7	
0.9			
1.0			
1.1			
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			Slightly moist, grey white, loose open texture silty sand. Hillwash.
1.8			
1.9			
2.0			
2.1			
2.2			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay. Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S22-0,7			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S22


Soil Profile Nr: S23		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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		S23-0,7	
0.9			
1.0			
1.1			Dry, red brown, very loose, open textured, silty sand. Aeolian sand.
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			
2.1			
2.2			
2.3			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
2.4			Slightly weathered granite.
2.5			
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S23-0,3			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34,59" E
			Soil Profile Nr: S23



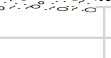
Soil Profile Nr: S24		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KARENPAK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3		●	Dry, khaki speckled grey & white, stiff, shattered, sandy clay. Hillw ash.
0.4		S24-0,3	
0.5			
0.6			
Notes:			
1. Refusal on dry clay.			
2. No groundwater was intersected.			
3. ● Disturbed sample S24-0,3			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S24

Soil Profile Nr: S25		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3		●	
0.4		S25-0,3	Dry, dark red, stiff, shattered, sandy clay. Hillw ash.
0.5			
0.6			
0.7			
0.8			
0.9			
1.0			
1.1			
1.2		●	
1.3		S25-1,2	Moist, khaki speckled grey & red, soft, shattered, sandy clay.
1.4			Highly w eathered granite
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay. Slightly w eathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S25-0,5 & 1,2			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S25

Soil Profile Nr: S26		 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: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3			
0.4		●	Dry, dark red, stiff, shattered, sandy clay. Hillw ash.
0.5		S26-0,4	
0.6			
0.7			
0.8			
0.9			
1.0			
Notes:			
1. Refusal on dry clay.			
2. No groundwater was intersected.			
3. ● Disturbed sample S26-0,4			
Lat/long WGS84 datum	X Coord:	27° 10'36,32" S	
	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S26

Soil Profile Nr: S27		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 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.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3			Dry, khaki speckled grey & w hite, stiff, shattered, sandy clay. Hillw ash.
0.4		●	
0.5		S27-0,4	
0.6			
0.7			
0.8			Slightly moist, khaki speckled grey & w hite, stiff, shattered, sandy clay.
0.9			Highly w eathered calcified granite
1.0			
Notes:			
1. Refusal on calcified granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S27-0,4			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34.59" E	
			Soil Profile Nr: S27

Soil Profile Nr: S28		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 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.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3		●	Dry, khaki speckled grey & white, stiff, shattered, sandy clay. Hillw ash.
0.4		S28-0,3	
0.5			
0.6			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
0.7			Slightly weathered granite.
Notes:			
1. Refusal on calcified granite.			
2. No groundwater was intersected.			
3. ● Disturbed sample S28-0,3			
Lat/long		X Coord:	27° 10'36,32" S
WGS84 datum		Y Coord:	25° 18'34.59" E
			Soil Profile Nr: S28

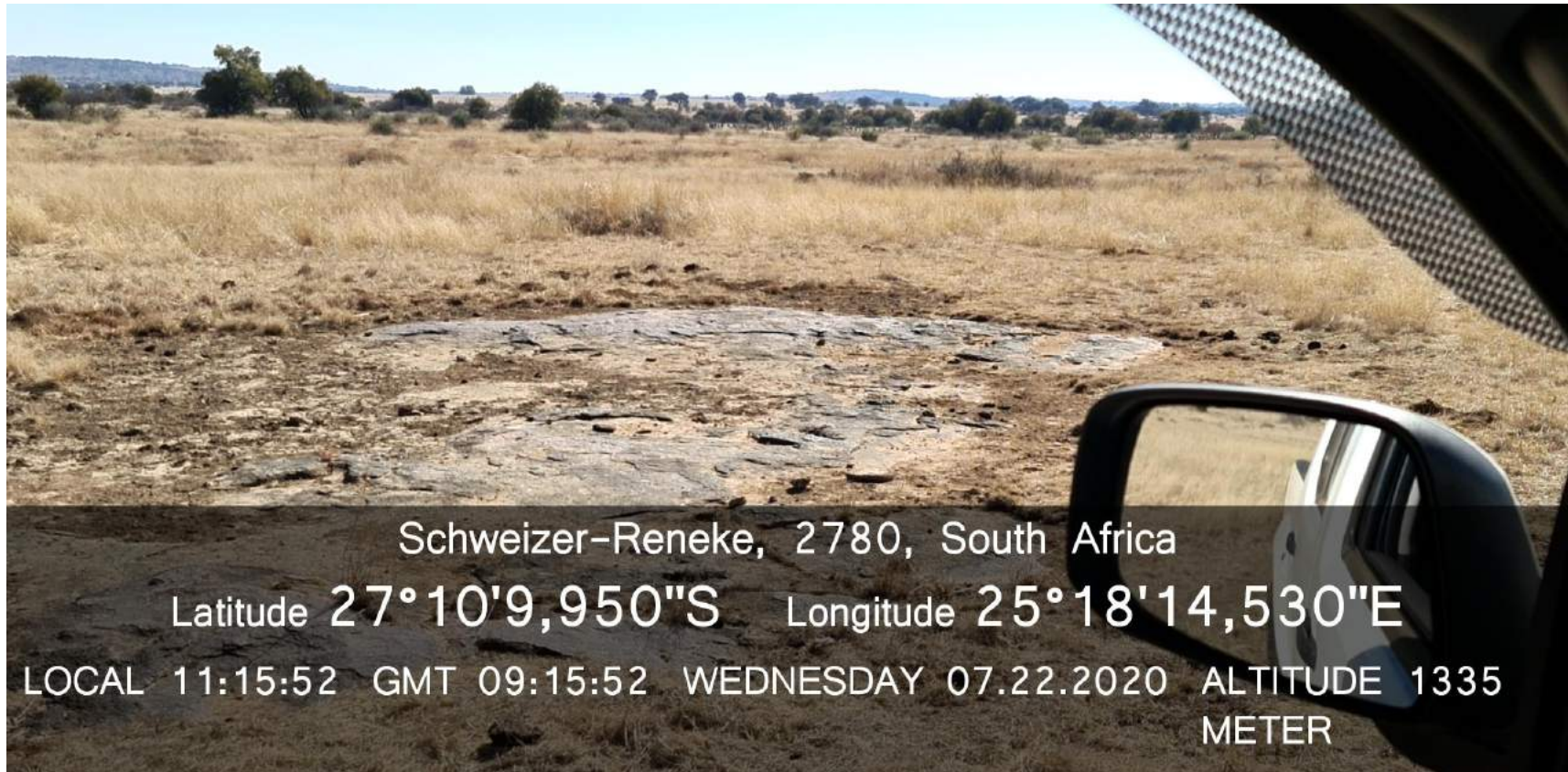
Soil Profile Nr: S29		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KAREN PARK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 21 July 2020			
JOB NR: GS202008S			
PROJECT NAME: Ipelegeng X12			
Town: Schweizer Reneke			
CLIENT: Maxim: King & Associates			
TLB Contractor: Built it			
TLB Machine: CAT 416D 4X4			
TLB Operator: Eddy			
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			
1.1			Dry, orange brown, very loose, open textured, silty sand. Aeolian sand.
1.2			
1.3			
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			Slightly moist, khaki speckled grey & black, stiff, shattered sandy clay.
2.1			Slightly weathered granite.
Notes:			
1. Refusal on granite.			
2. No groundwater was intersected.			
3. No sample			
Lat/long	X Coord:	27° 10'36,32" S	
WGS84 datum	Y Coord:	25° 18'34,59" E	
			Soil Profile Nr: S29











Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'9,950''S$ Longitude $25^{\circ}18'14,530''E$

LOCAL 11:15:52 GMT 09:15:52 WEDNESDAY 07.22.2020 ALTITUDE 1335
METER

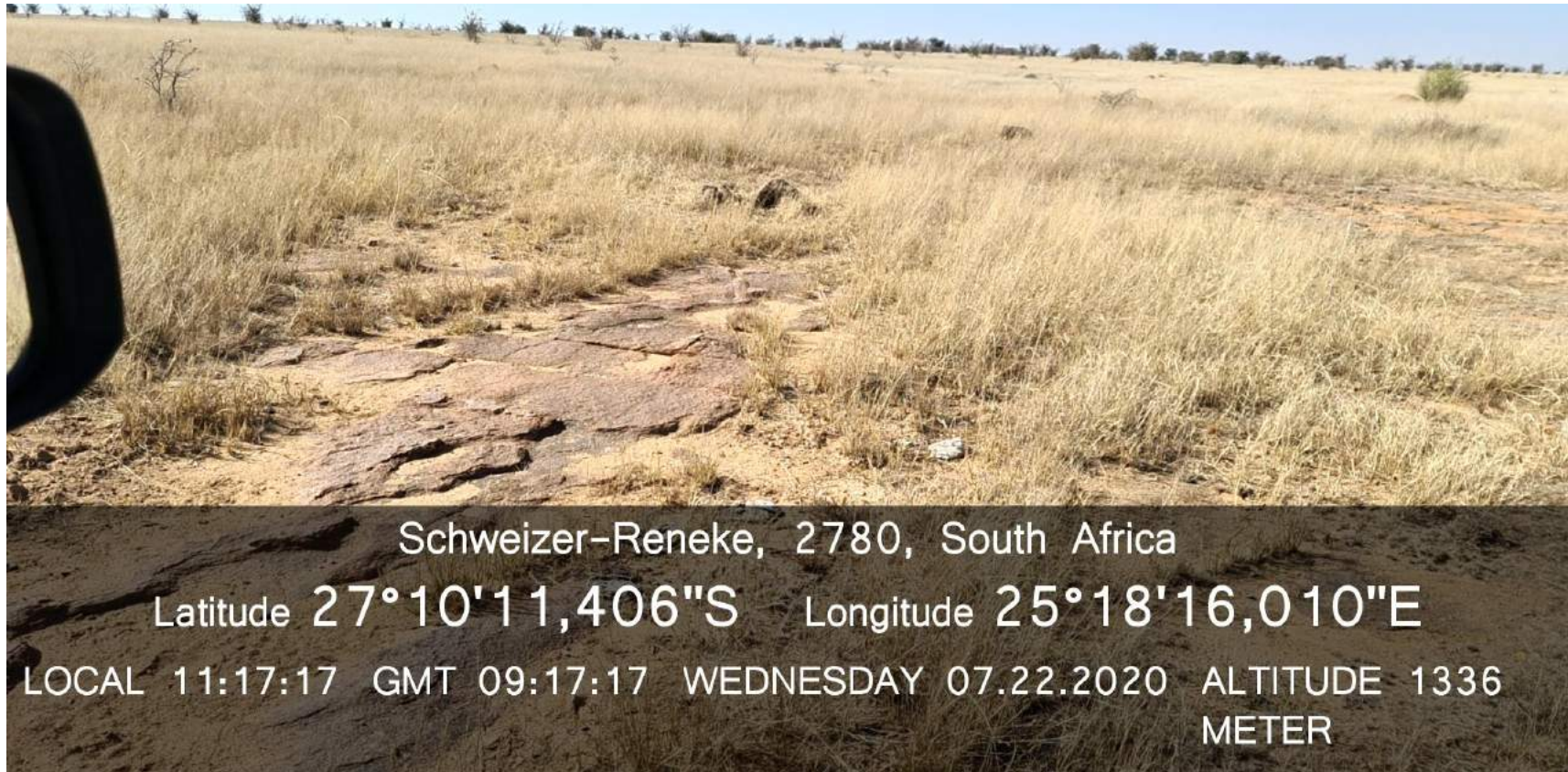


Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'9,950''S$ Longitude $25^{\circ}18'14,530''E$

LOCAL 11:16:01 GMT 09:16:01 WEDNESDAY 07.22.2020 ALTITUDE 1335
METER

60



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'11,406''S$ Longitude $25^{\circ}18'16,010''E$

LOCAL 11:17:17 GMT 09:17:17 WEDNESDAY 07.22.2020 ALTITUDE 1336
METER





Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'8,207''S$ Longitude $25^{\circ}18'19,097''E$

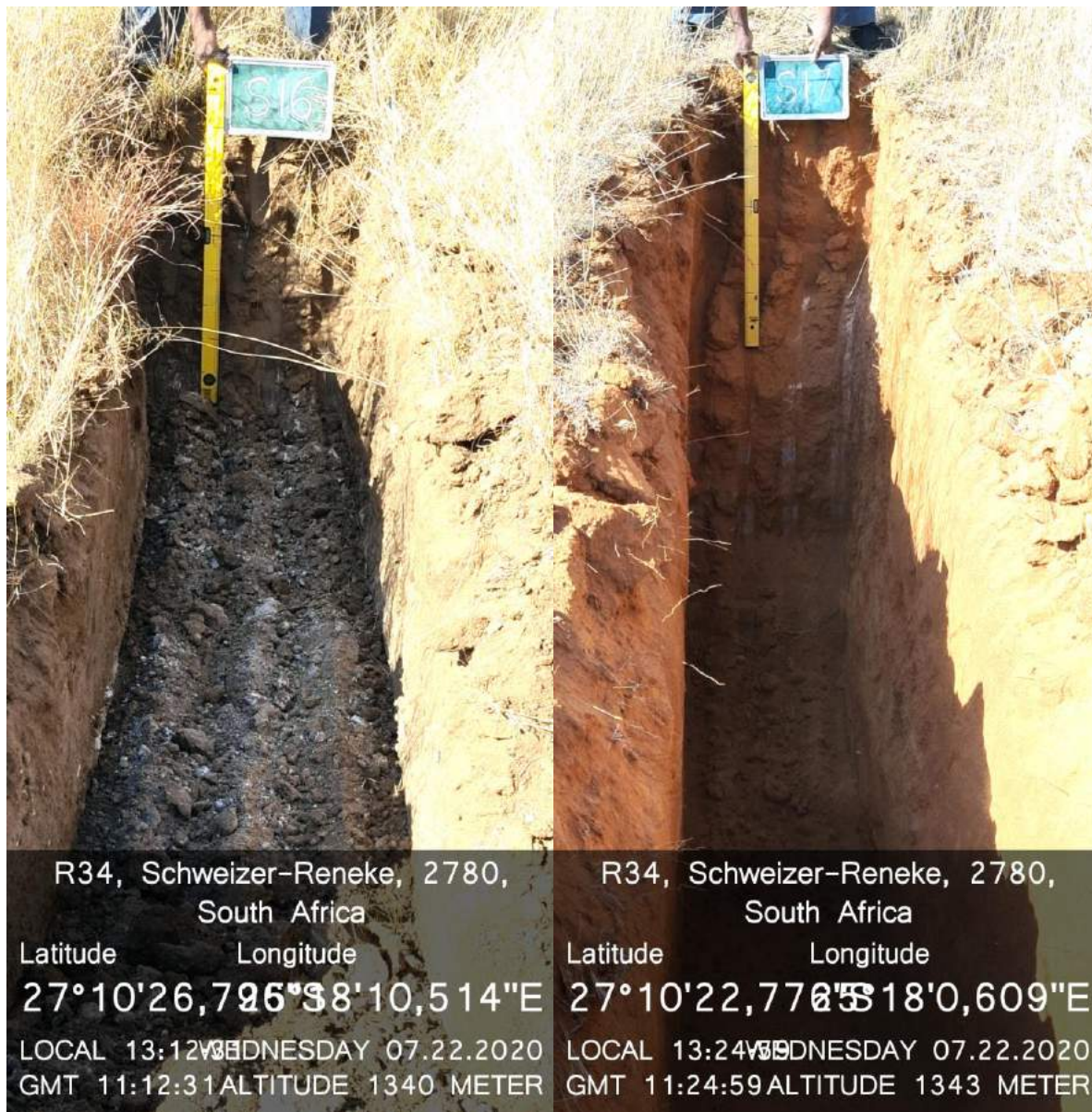
LOCAL 11:28:38 GMT 09:28:38 WEDNESDAY 07.22.2020 ALTITUDE 1340
METER













R34, Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'22,822''S$ Longitude $25^{\circ}18'0,570''E$

LOCAL 13:28:09 GMT 11:28:09 WEDNESDAY 07.22.2020 ALTITUDE 1347
METER



R34, Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'22,610''S$ Longitude $25^{\circ}17'57,878''E$

LOCAL 13:28:56 GMT 11:28:56 WEDNESDAY 07.22.2020 ALTITUDE 1348
METER



71



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'16,667''S$ Longitude $25^{\circ}18'18,666''E$

LOCAL 13:52:04 GMT 11:52:04 WEDNESDAY 07.22.2020 ALTITUDE 1341
METER

72



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'16,761''S$ Longitude $25^{\circ}18'18,630''E$

LOCAL 13:52:15 GMT 11:52:15 WEDNESDAY 07.22.2020 ALTITUDE 1341
METER

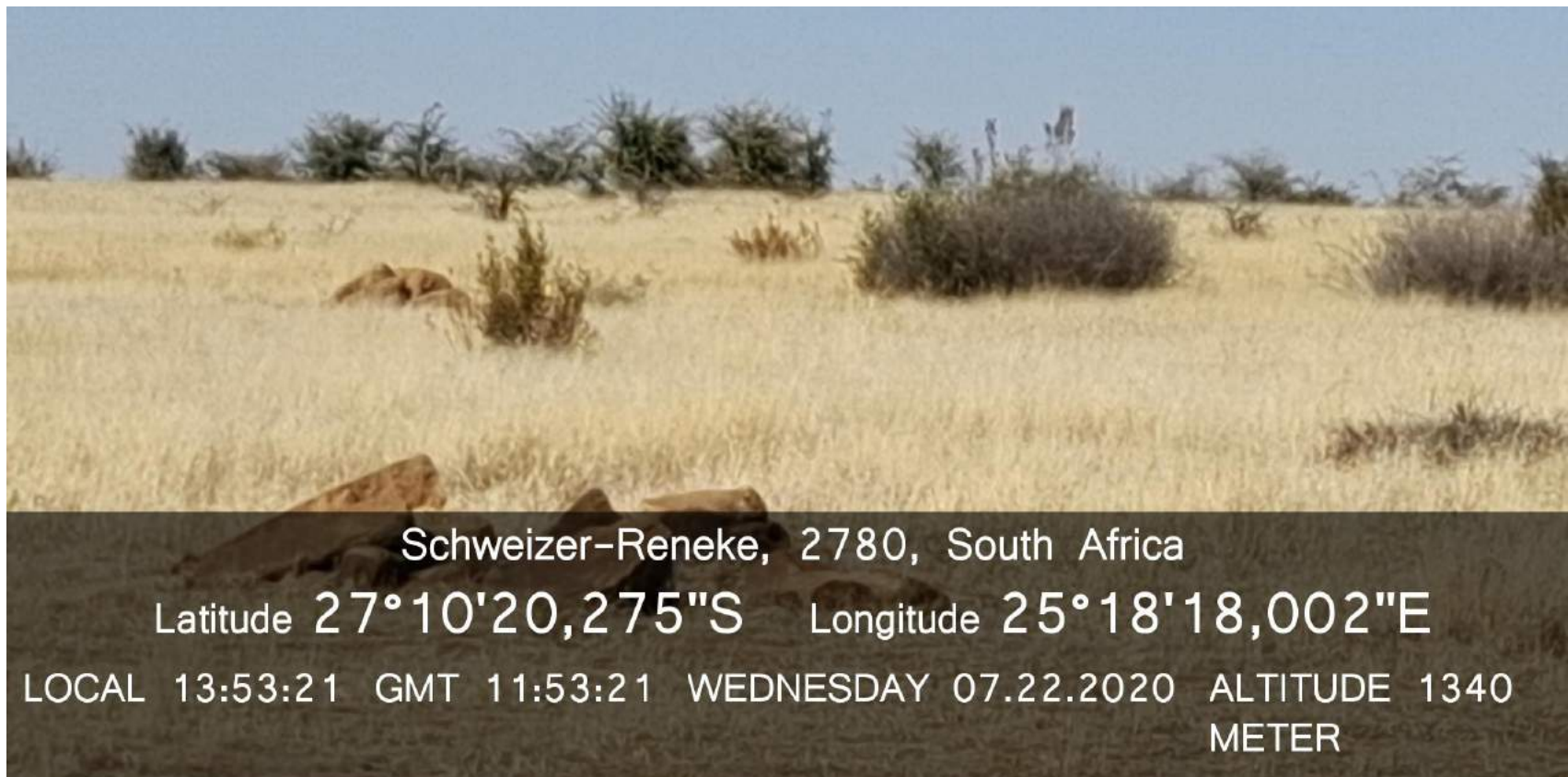
73



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'17,549''S$ Longitude $25^{\circ}18'18,476''E$

LOCAL 13:52:31 GMT 11:52:31 WEDNESDAY 07.22.2020 ALTITUDE 1341
METER



75



R34, Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'24,082''S$ Longitude $25^{\circ}18'17,737''E$

LOCAL 13:54:39 GMT 11:54:39 WEDNESDAY 07.22.2020 ALTITUDE 1343
METER





Schweizer-Reneke, 2780, South
Africa
Latitude Longitude
27°10'14,628"S 28°38'39,285"E
LOCAL 14:21:15 WEDNESDAY 07.22.2020
GMT 12:21:25 ALTITUDE 1356 METER

78



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'6,333''S$ Longitude $25^{\circ}18'55,752''E$

LOCAL 14:30:41 GMT 12:30:41 WEDNESDAY 07.22.2020 ALTITUDE 1334
METER



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'7,885''S$ Longitude $25^{\circ}18'55,374''E$

LOCAL 14:31:10 GMT 12:31:10 WEDNESDAY 07.22.2020 ALTITUDE 1336
METER



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'8,195''S$ Longitude $25^{\circ}18'55,212''E$

LOCAL 14:31:19 GMT 12:31:19 WEDNESDAY 07.22.2020 ALTITUDE 1335
METER



Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'8,620''S$ Longitude $25^{\circ}18'55,188''E$

LOCAL 14:31:51 GMT 12:31:51 WEDNESDAY 07.22.2020 ALTITUDE 1336
METER





Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'19,311''S$ Longitude $25^{\circ}19'6,262''E$

LOCAL 14:59:32 GMT 12:59:32 WEDNESDAY 07.22.2020 ALTITUDE 1332
METER





Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'25,732''\text{S}$ Longitude $25^{\circ}18'56,278''\text{E}$

LOCAL 15:12:26 GMT 13:12:26 WEDNESDAY 07.22.2020 ALTITUDE 1337
METER



Schweizer-Reneke, 2780, South
Africa

Latitude Longitude
27°10'30,225"S 28°55,987"E

LOCAL 15:20:49 WEDNESDAY 07.22.2020
GMT 13:20:49 ALTITUDE 1340 METER

Schweizer-Reneke, 2780, South
Africa

Latitude Longitude
27°10'27,629"S 28°45,991"E

LOCAL 15:32:24 WEDNESDAY 07.22.2020
GMT 13:32:24 ALTITUDE 1356 METER



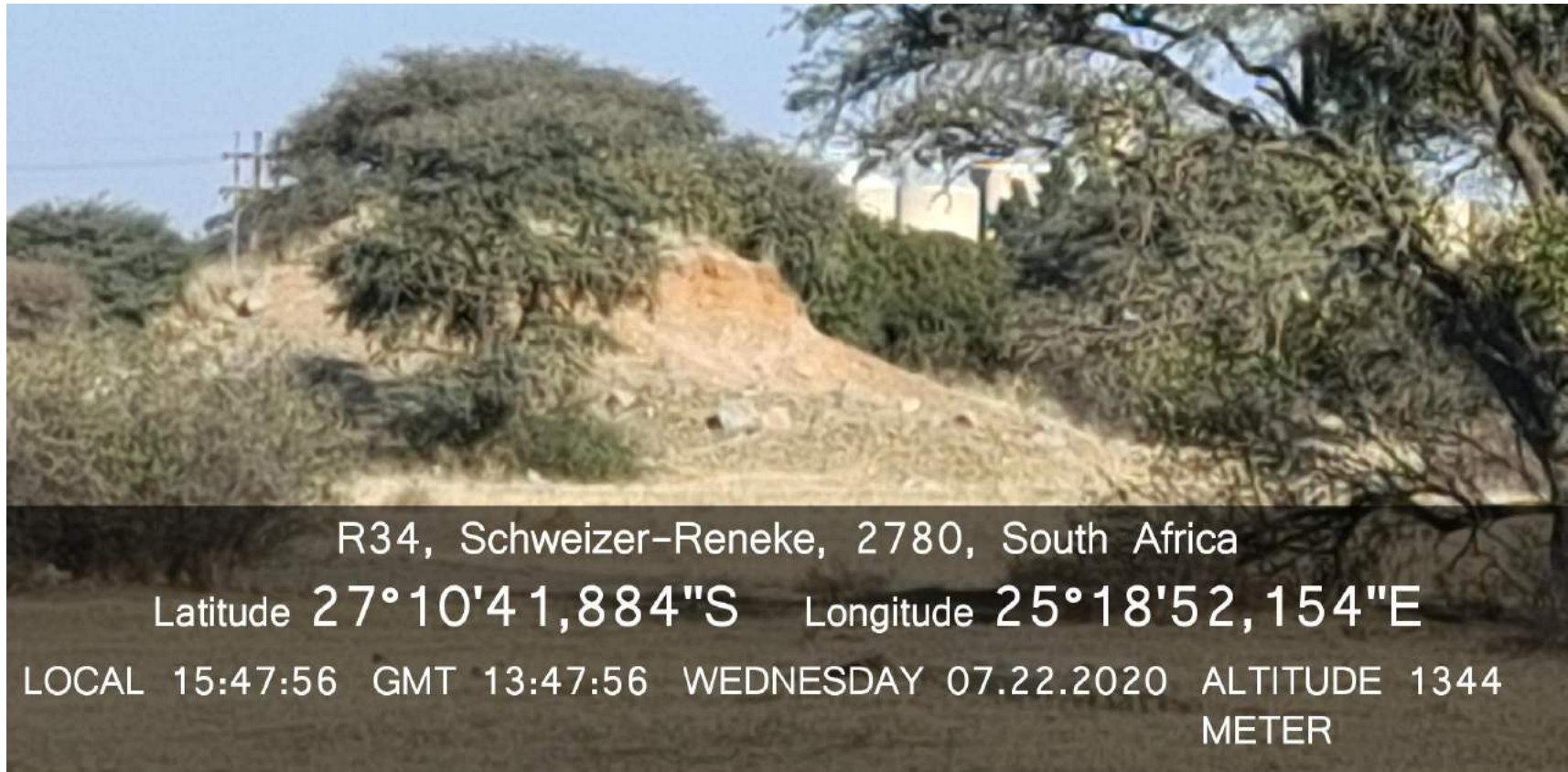




R34, Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'36,797''\text{S}$ Longitude $25^{\circ}18'49,117''\text{E}$

LOCAL 15:45:22 GMT 13:45:22 WEDNESDAY 07.22.2020 ALTITUDE 1343
METER



R34, Schweizer-Reneke, 2780, South Africa

Latitude $27^{\circ}10'41,884''S$ Longitude $25^{\circ}18'52,154''E$

LOCAL 15:47:56 GMT 13:47:56 WEDNESDAY 07.22.2020 ALTITUDE 1344
METER



R34, Schweizer-Reneke, 2780, South Africa
 Latitude Longitude
 27°10'41,903"S 28°52,384"E
 LOCAL 15:55 WEDNESDAY 07.22.2020
 GMT 13:55:03 ALTITUDE 1356 METER



Schweizer-Reneke, 2780, South Africa
 Latitude Longitude
 27°10'23,305"S 28°21,024"E
 LOCAL 14:00 WEDNESDAY 07.22.2020
 GMT 12:00:15 ALTITUDE 1347 METER

APPENDIX C: LABORATORY RESULTS

Table A: Summary of Lab results

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	S1	0.8	Silty sand	5	SM	A-2-4	0	NP	ND	L
2	S2	0.6	Silty sand	5	SM	A-2-4	0.5	SP	ND	L
3	S3	0.5	Silty clayey sand	17	SC	A-6	8.5	18	33	M
4	S4	0.8	Sandy clay	33	CL	A-7-6	12	23	44	M
5	S5	0.7	clayey sand	9	SC	A-7-6	12	25	50	L
6	S7	0.7	clayey sand	20	SC	A-6	6.5	14	30	M
7	S8	0.4	Silty sand	2	SM	A-2-4	0	NP	ND	L
8	S9	0.5	clayey sand	6	SC	A-4	4	9	24	L
9	S10	0.6	Silty sand	2	SM	A-2-4	0	NP	ND	L
10	S11	1.0	Silty sand	5	SM	A-2-4	0	NP	ND	L
11	S12	0.6	Silty sand	5	SM	A-2-4	0	NP	ND	L
12	S13	0.7	Silty sand	5	SM	A-2-4	0.5	SP	ND	L
13	S14	1.0	Silty sand	4	SM	A-2-4	0	NP	ND	L
14	S15	0.8	Silty sand	4	SM	A-2-4	0.5	SP	ND	L
15	S16	0.3	clayey sand	18	SC	A-6	6.5	15	35	M
16	S17	0.4	Silty sand	5	SM	A-2-4	0,5	SP	ND	L
17	S18	0.5	Silty sand	4	SM	A-2-4	0	NP	ND	L
18	S19	0.3	Silty sand	8	SC-SM	A-2-4	0	NP	ND	L
19	S20	0,3	Silty sand	4	SM	A-2-4	0	NP	ND	L
20	S21	0,1	Sand	2	SM	A-2-4	0	NP	ND	L
21	S22	0,7	Sand	2	SM	A-2-4	0	NP	ND	L
22	S23	0.6	Sand	5	SM	A-2-4	0	NP	ND	L
23	S24	0.3	Silty clayey sand	11	SC-SM	A-2-4	2.5	5	20	L
24	S25	0.3	clayey sand	14	SC	A-2-4	2.5	4	18	L
25	S25	1.2	clayey sand	21	SC	A-6	10.5	22	40	M
26	S26	0.4	Silty clayey sand	9	SC-SM	A-2-4	2	4	18	L
27	S27	0.4	clayey sand	9	SC	A-2-6	6.5	15	35	L
28	S28	0.3	clayey sand	11	SC	A-4	3.5	8	24	L
Material possibly expansive if value:				>12%			>8%	>12	>30	Exp?

Table A Legend

Unified

28 According to the revised ASTM-Standard on the "Unified Soil Classification System" (Weinert).

1 CL: Inorganic clay of low to medium plasticity, gravelly, sandy or silty clay, lean clay.

9 SC: clayey sand, poorly graded sand clay mixtures.

3 SC-SM: Clayey to silty sand: poorly graded sand silt clay mixtures

15 SM: Silty sand; poorly graded sand silt mixtures

PRA / AASHTO

28 "Public Roads Classification" (Brink, Partridge & Williams).

19 A-2-4: Sand & gravel with low plasticity silt fines.

1 A-2-6: sand & gravel with clay fines.

2 A-4: Low compressibility silt.

4 A-6: Low to medium compressibility clay.

2 A-7-6: High compressibility high volume change clay.

28 Expansiveness according to Van der Merwe's method (Brink, Partridge & Williams).

23 L: Low

5 M: Medium

0 H: High

A clayey material is potentially expansive if it exhibits the following properties (Kantey and Brink, 1952):

7 a clay content greater than 12 percent,

4 a linear shrinkage of more than 8 percent,

7 a plasticity index of more than 12, and

7 a liquid limit of more than 30 percent

12 NP: Not plastic: sandy material with no cohesion

4 SP: Slightly plastic: material with little cohesion

16 ND: not determined



Client Name: Geoset
 Project Name: Schweizer (pelegeng Ext. 12)
 Job Number: DVM-114
 Date: 18-Aug-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	S1	S2	S3	S4	S5	S7	S8	S9
Depth (m)	0.8	0.6	0.5	0.8	0.7	0.7	0.4	0.5
Lab No	DVM-114-1074	DVM-114-1075	DVM-114-1076	DVM-114-1077	DVM-114-1078	DVM-114-1079	DVM-114-1080	DVM-114-1081
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	98	100	100	100
9.5	100	100	100	100	95	100	100	100
6.7	100	100	99	99	93	100	100	100
4.75	100	100	98	98	92	100	99	100
2.00	98	99	96	95	85	98	96	99
1.00	83	86	83	87	75	89	83	93
0.425	69	70	72	76	64	79	67	83
0.250	63	64	67	73	58	74	54	75
0.150	54	54	61	68	51	65	40	64
0.075	21	24	42	52	36	38	14	36
0.060	16	18	34	44	28	33	10	26
0.050	13	15	31	42	26	30	8	23
0.035	9	9	27	38	22	26	5	20
0.020	8	8	26	36	18	24	4	17
0.006	6	6	21	34	11	22	3	11
0.002	5	5	17	33	9	20	2	6
GM	1.12	1.07	0.90	0.77	1.15	0.85	1.23	0.82

Atterberg Limits								
LL (%)	-	-	33	44	50	30	-	24
Pl (%)	NP	SP	18	23	25	14	NP	9
LS (%)	0.0	0.5	8.5	12.0	12.0	6.5	0.0	4.0

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: Schweizer (pelegeng Ext. 12)
 Job Number: DVM-114
 Date: 18-Aug-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	S10	S11	S12	S13	S14	S15	S16	S17
Depth (m)	0.6	1.0	0.6	0.7	1.0	0.8	0.3	0.4
Lab No	DVM-114-1082	DVM-114-1083	DVM-114-1084	DVM-114-1085	DVM-114-1086	DVM-114-1087	DVM-114-1088	DVM-114-1089
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
9.5	100	100	100	100	100	100	100	100
6.7	100	100	100	100	100	100	100	100
4.75	99	100	100	100	100	100	100	99
2.00	98	97	98	98	98	85	99	90
1.00	88	80	84	82	82	79	89	75
0.425	76	67	72	69	67	73	75	61
0.250	69	60	62	61	57	65	66	52
0.150	57	51	51	50	47	55	57	43
0.075	21	25	19	23	22	26	37	18
0.060	14	15	13	14	12	16	27	12
0.050	10	13	11	12	11	13	25	10
0.035	5	9	8	8	6	8	21	7
0.020	4	8	7	7	5	7	20	6
0.006	2	6	6	6	5	5	19	5
0.002	2	5	5	5	4	4	18	5
GM	1.05	1.11	1.11	1.10	1.13	1.16	0.89	1.31

Atterberg Limits								
LL (%)	-	-	-	-	-	-	35	-
PI (%)	NP	NP	NP	SP	NP	SP	15	SP
LS (%)	0.0	0.0	0.0	0.5	0.0	0.5	6.5	0.5

pH & Conductivity								
pH								
EC (S/m)								

MDD / OMC								
MDD (kg/m³)								
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: Schweizer (pelegeng Ext. 12)
 Job Number: DVM-114
 Date: 18-Aug-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	S18	S19	S20	S21	S22	S23	S24	S25
Depth (m)	0.3	0.3	0.3	1.0	0.7	0.6	0.3	0.3
Lab No	DVM-114-1090	DVM-114-1091	DVM-114-1092	DVM-114-1093	DVM-114-1094	DVM-114-1095	DVM-114-1096	DVM-114-1097
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
9.5	100	100	100	100	100	100	100	100
6.7	100	89	100	100	100	100	100	100
4.75	100	89	100	100	100	100	100	100
2.00	98	88	94	98	99	98	99	99
1.00	83	78	73	83	84	83	93	92
0.425	67	69	58	68	70	70	79	79
0.250	58	59	51	58	59	61	70	66
0.150	46	49	43	48	45	50	57	55
0.075	18	28	20	20	17	21	27	29
0.060	12	21	13	13	11	12	20	21
0.050	9	19	10	9	9	10	17	20
0.035	6	14	8	5	5	8	14	17
0.020	5	11	6	5	4	7	12	16
0.006	5	9	5	3	3	6	12	15
0.002	4	8	4	2	2	5	11	14
GM	1.17	1.15	1.28	1.14	1.14	1.11	0.95	0.93

Atterberg Limits								
LL (%)	-	20	-	-	-	-	20	18
Pl (%)	NP	5	NP	NP	NP	NP	5	4
LS (%)	0.0	3.0	0.0	0.0	0.0	0.0	2.5	2.5

pH & Conductivity								
pH								
EC (S/m)								

MDD / OMC								
MDD (kg/m³)								
OMC (%)								

CBR								
100%								
95%								
90%								
85%								
80%								
75%								
70%								
65%								
60%								
55%								
50%								
45%								
40%								
35%								
30%								
25%								
20%								
15%								
10%								
5%								
Swell (%)								

UCS (MPa)								
100%								
97%								
90%								

COLTO Classification								

Remarks:

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Client Name: Geoset
Project Name: Schweizer (pelegeng Ext. 12)
Job Number: DVM-114
Date: 18-Aug-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	525	526	527	528	
Depth (m)	1.2	0.4	0.4	0.3	
Lab No	DVM-114-1098	DVM-114-1099	DVM-114-1100	DVM-114-1101	
53.0	100	100	100	100	
37.5	100	100	100	100	
26.5	100	100	100	100	
19.0	100	100	100	100	
13.2	100	100	100	100	
9.5	100	100	100	100	
6.7	99	100	100	100	
4.75	98	100	100	100	
2.00	95	100	99	99	
1.00	88	93	88	93	
0.425	80	78	72	81	
0.250	74	69	61	70	
0.150	66	56	51	59	
0.075	48	26	28	35	
0.060	38	20	21	23	
0.050	35	17	19	21	
0.035	31	13	16	17	
0.020	28	11	14	16	
0.006	24	10	10	14	
0.002	21	9	9	11	
GM	0.77	0.96	1.01	0.85	

Atterberg Limits					
LL (%)	40	18	35	24	
Pl (%)	22	4	15	8	
LS (%)	10.5	2.0	6.5	3.5	

pH & Conductivity					
pH					
EC (S/m)					

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

CBR					
100%					
95%					
90%					
85%					
80%					
75%					
70%					
65%					
60%					
55%					
50%					
45%					
40%					
35%					
30%					
25%					
20%					
15%					
10%					
5%					
Swell (%)					

UCS (MPa)					
100%					
97%					
90%					

COLTO Classification					

Remarks: _____

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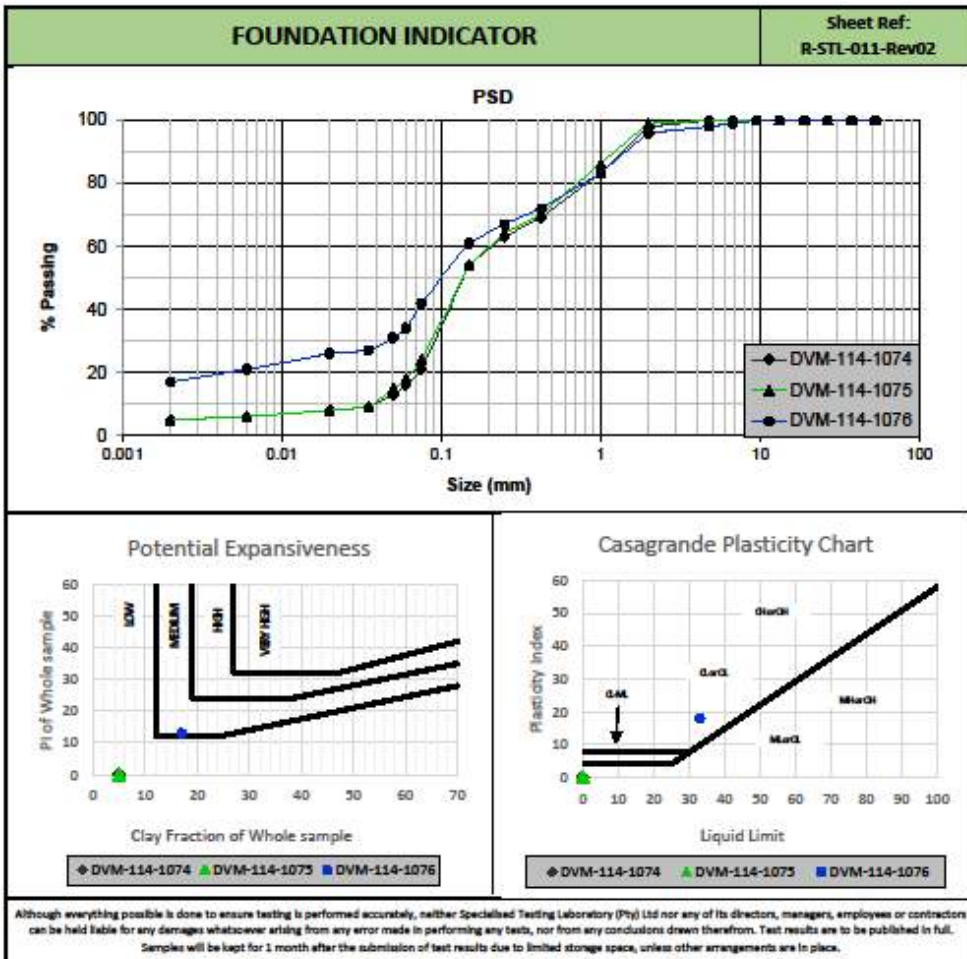


Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	S1	S2	S3	Sample	S1	S2	S3
Depth (m)	0.8	0.6	0.5	Depth (m)	0.8	0.6	0.5
Lab No	DVM-114-1074	DVM-114-1075	DVM-114-1076	Lab No	DVM-114-1074	DVM-114-1075	DVM-114-1076
53.0	100	100	100	Liquid Limit (%)	-	-	33
37.5	100	100	100	Plastic Limit (%)	-	-	15
26.5	100	100	100	Plasticity Index (%)	NP	SP	18
19.0	100	100	100	Linear Shrinkage (%)	0.0	0.5	8.5
13.2	100	100	100	PI of whole sample	-	-	13
9.5	100	100	100				
6.7	100	100	99	% Gravel	2	1	4
4.75	100	100	98	% Sand	82	81	62
2.00	98	99	96	% Silt	11	13	17
1.00	83	86	83	% Clay	5	5	17
0.425	69	70	72	Activity	0.0	0.0	1.1
0.250	63	64	67				
0.150	54	54	61	% Soil Mortar	98	99	96
0.075	21	24	42				
0.060	16	18	34	Grading Modulus	1.12	1.07	0.90
0.050	13	15	31	Moisture Content (%)	N / T	N / T	N / T
0.035	9	9	27	Relative Density (SG)*	2.65	2.65	2.65
0.020	8	8	26				
0.006	6	6	21	Unified (ASTM D2487)	SM	SM	SC
0.002	5	5	17	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 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.</small>							



Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



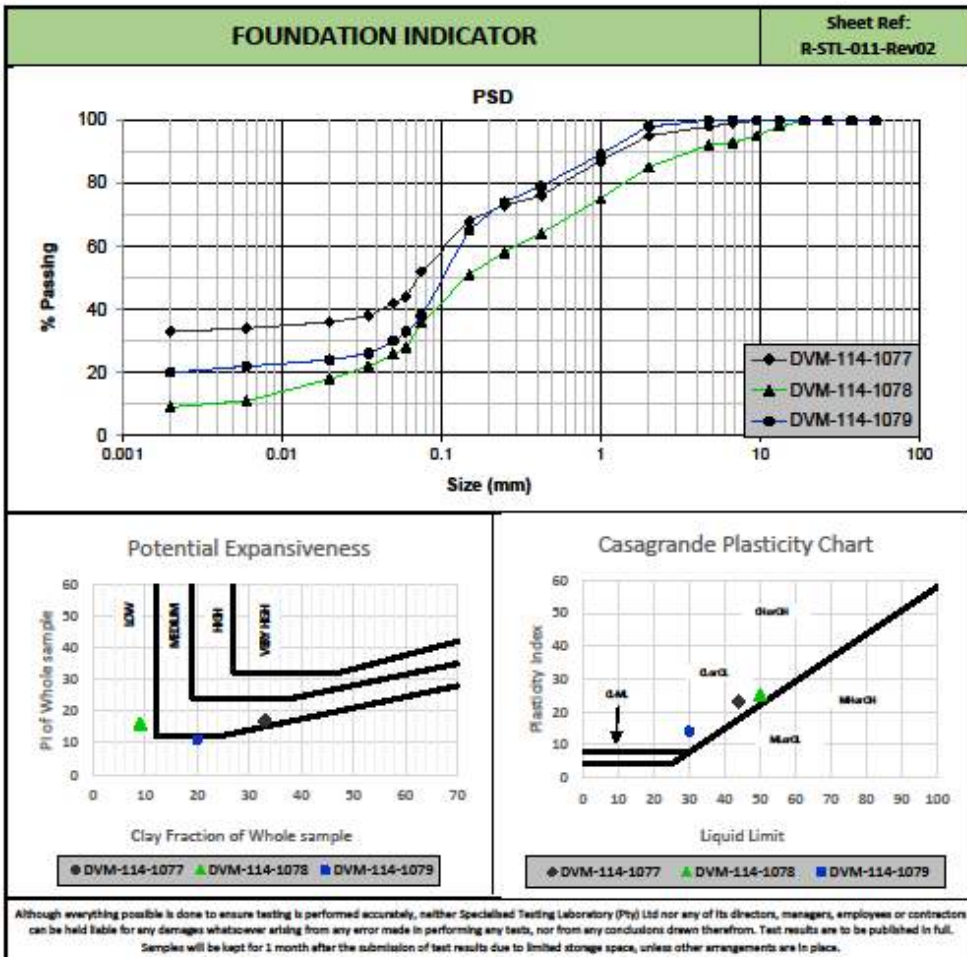


Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	S4	S5	S7	Sample	S4	S5	S7
Depth (m)	0.8	0.7	0.7	Depth (m)	0.8	0.7	0.7
Lab No	DVM-114-1077	DVM-114-1078	DVM-114-1079	Lab No	DVM-114-1077	DVM-114-1078	DVM-114-1079
53.0	100	100	100	Liquid Limit (%)	44	50	30
37.5	100	100	100	Plastic Limit (%)	21	25	16
26.5	100	100	100	Plasticity Index (%)	23	25	14
19.0	100	100	100	Linear Shrinkage (%)	12.0	12.0	6.5
13.2	100	98	100	PI of whole sample	17	16	11
9.5	100	95	100				
6.7	99	93	100	% Gravel	5	15	2
4.75	98	92	100	% Sand	51	57	65
2.00	95	85	98	% Silt	11	19	13
1.00	87	75	89	% Clay	33	9	20
0.425	76	64	79	Activity	0.7	2.8	0.7
0.250	73	58	74				
0.150	68	51	65	% Soil Mortar	95	85	98
0.075	52	36	38				
0.060	44	28	33	Grading Modulus	0.77	1.15	0.85
0.050	42	26	30	Moisture Content (%)	N / T	N / T	N / T
0.035	38	22	26	Relative Density (SG)*	2.65	2.65	2.65
0.020	36	18	24				
0.006	34	11	22	Unified (ASTM D2487)	CL	SC	SC
0.002	33	9	20	AASHTO (M145-91)	A - 7 - 6	A - 7 - 6	A - 6
Remarks: *: Assumed N / T: Not Tested							
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Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



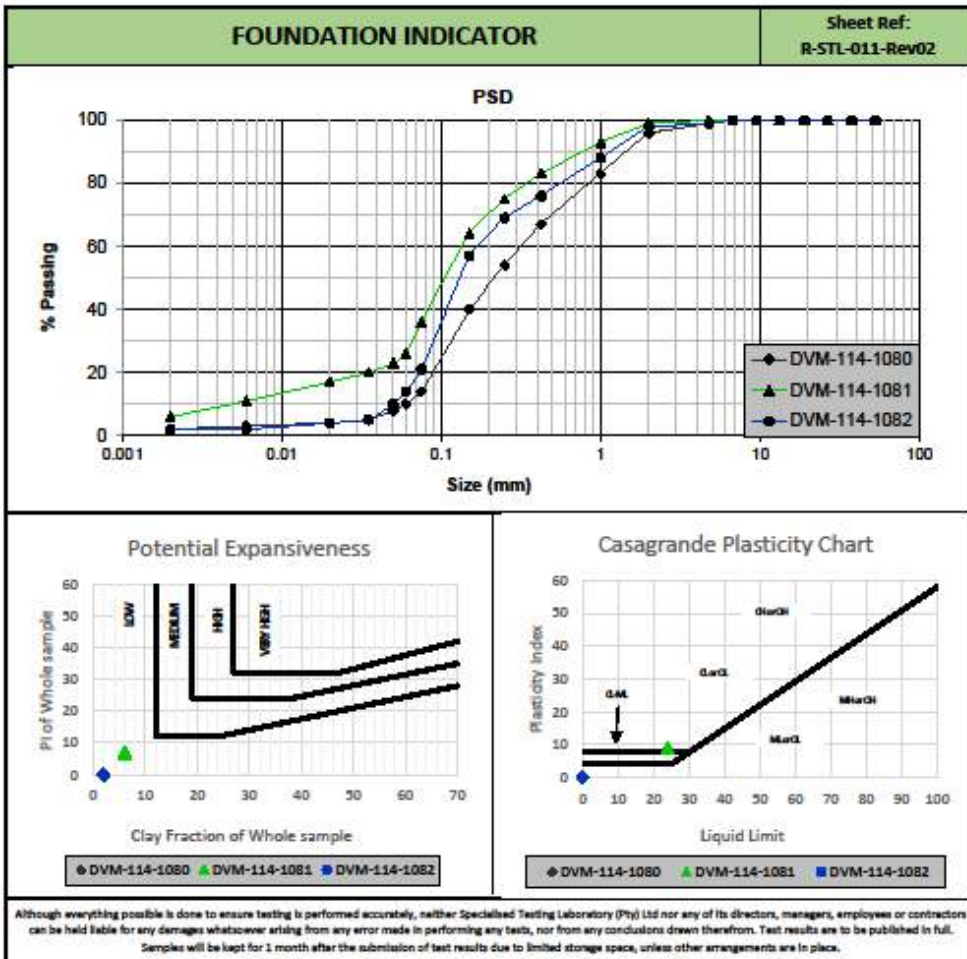


Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	58	59	510	Sample	58	59	510
Depth (m)	0.4	0.5	0.6	Depth (m)	0.4	0.5	0.6
Lab No	DVM-114-1080	DVM-114-1081	DVM-114-1082	Lab No	DVM-114-1080	DVM-114-1081	DVM-114-1082
53.0	100	100	100	Liquid Limit (%)	-	24	-
37.5	100	100	100	Plastic Limit (%)	-	15	-
26.5	100	100	100	Plasticity Index (%)	NP	9	NP
19.0	100	100	100	Linear Shrinkage (%)	0.0	4.0	0.0
13.2	100	100	100	PI of whole sample	-	7	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	4	1	2
4.75	99	100	99	% Sand	86	73	84
2.00	96	99	98	% Silt	8	20	12
1.00	83	93	88	% Clay	2	6	2
0.425	67	83	76	Activity	0.0	1.5	0.0
0.250	54	75	69				
0.150	40	64	57	% Soil Mortar	96	99	98
0.075	14	36	21				
0.060	10	26	14	Grading Modulus	1.23	0.82	1.05
0.050	8	23	10	Moisture Content (%)	N / T	N / T	N / T
0.035	5	20	5	Relative Density (SG)*	2.65	2.65	2.65
0.020	4	17	4				
0.006	3	11	2	Unified (ASTM D2487)	SM	SC	SM
0.002	2	6	2	AASHTO (M145-91)	A-2-4	A-4	A-2-4
Remarks: *: Assumed N / T: Not Tested							
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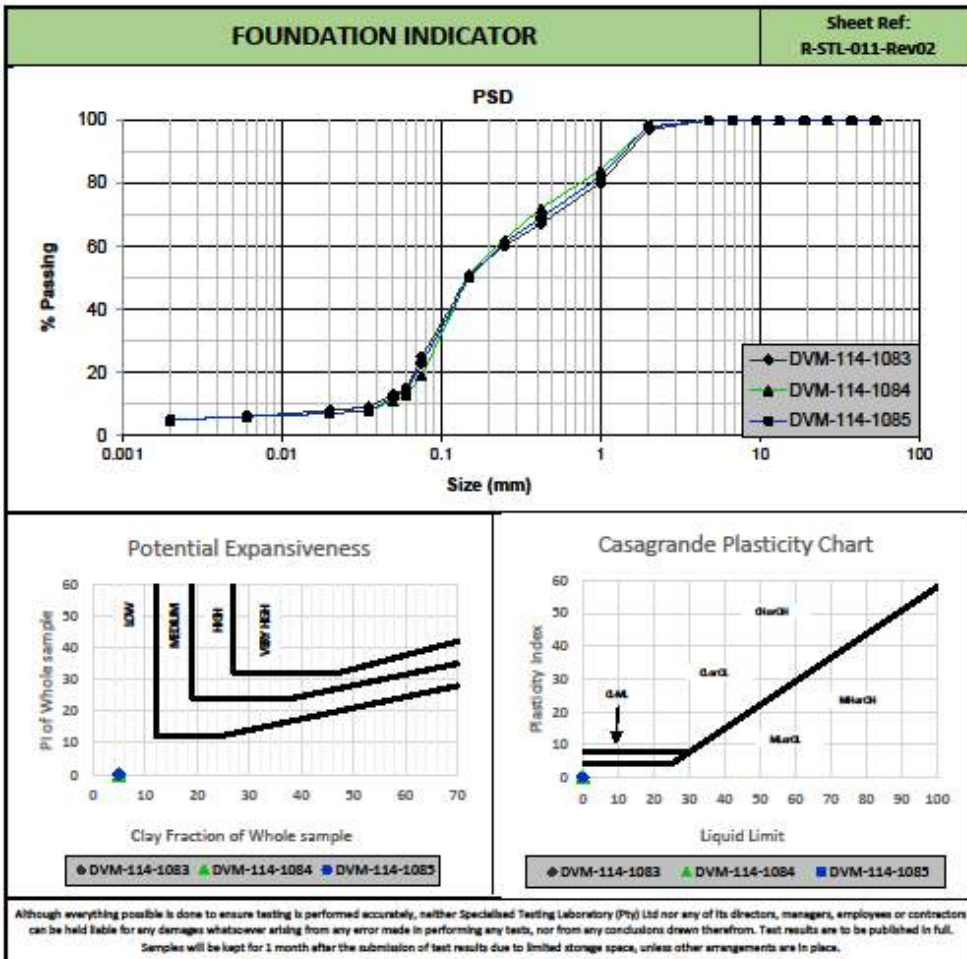


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Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	511	512	513	Sample	511	512	513
Depth (m)	1.0	0.6	0.7	Depth (m)	1.0	0.6	0.7
Lab No	DVM-114-1083	DVM-114-1084	DVM-114-1085	Lab No	DVM-114-1083	DVM-114-1084	DVM-114-1085
53.0	100	100	100	Liquid Limit (%)	-	-	-
37.5	100	100	100	Plastic Limit (%)	-	-	-
26.5	100	100	100	Plasticity Index (%)	NP	NP	SP
19.0	100	100	100	Linear Shrinkage (%)	0.0	0.0	0.5
13.2	100	100	100	PI of whole sample	-	-	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	3	2	2
4.75	100	100	100	% Sand	82	85	84
2.00	97	98	98	% Silt	10	8	9
1.00	80	84	82	% Clay	5	5	5
0.425	67	72	69	Activity	0.0	0.0	0.0
0.250	60	62	61				
0.150	51	51	50	% Soil Mortar	97	98	98
0.075	25	19	23				
0.060	15	13	14	Grading Modulus	1.11	1.11	1.10
0.050	13	11	12	Moisture Content (%)	N / T	N / T	N / T
0.035	9	8	8	Relative Density (SG)*	2.65	2.65	2.65
0.020	8	7	7				
0.006	6	6	6	Unified (ASTM D2487)	SM	SM	SM
0.002	5	5	5	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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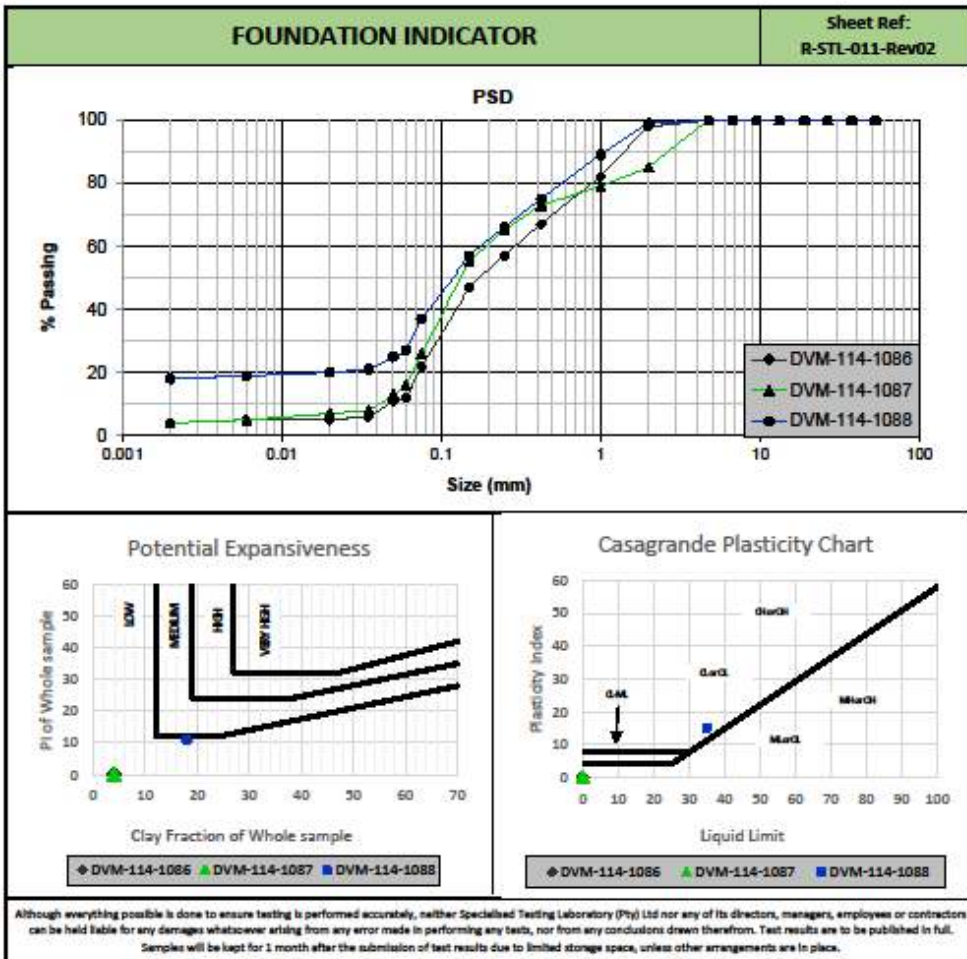


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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	514	515	516	Sample	514	515	516
Depth (m)	1.0	0.8	0.3	Depth (m)	1.0	0.8	0.3
Lab No	DVM-114-1086	DVM-114-1087	DVM-114-1088	Lab No	DVM-114-1086	DVM-114-1087	DVM-114-1088
53.0	100	100	100	Liquid Limit (%)	-	-	35
37.5	100	100	100	Plastic Limit (%)	-	-	20
26.5	100	100	100	Plasticity Index (%)	NP	SP	15
19.0	100	100	100	Linear Shrinkage (%)	0.0	0.5	6.5
13.2	100	100	100	PI of whole sample	-	-	11
9.5	100	100	100				
6.7	100	100	100	% Gravel	2	15	1
4.75	100	100	100	% Sand	86	69	72
2.00	98	85	99	% Silt	8	12	9
1.00	82	79	89	% Clay	4	4	18
0.425	67	73	75	Activity	0.0	0.0	0.8
0.250	57	65	66				
0.150	47	55	57	% Soil Mortar	98	85	99
0.075	22	26	37				
0.060	12	16	27	Grading Modulus	1.13	1.16	0.89
0.050	11	13	25	Moisture Content (%)	N / T	N / T	N / T
0.035	6	8	21	Relative Density (SG)*	2.65	2.65	2.65
0.020	5	7	20				
0.006	5	5	19	Unified (ASTM D2487)	SM	SM	SC
0.002	4	4	18	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 6
Remarks: *: Assumed N / T: Not Tested							
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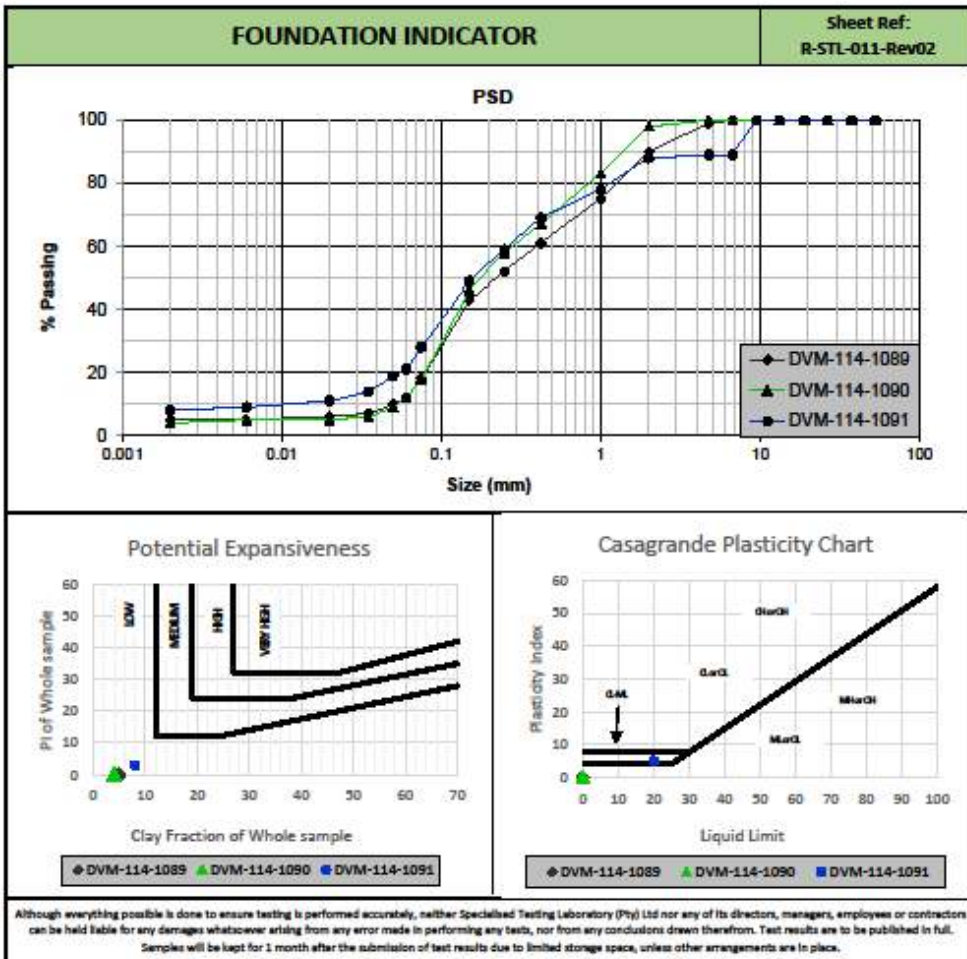


Client Name: Geoset
Project Name: Schweizer Ipelegeng Ext. 12
Job Number: DVM-114
Date: 2020-08-18
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	517	518	519	Sample	517	518	519
Depth (m)	0.4	0.5	0.3	Depth (m)	0.4	0.5	0.3
Lab No	DVM-114-1089	DVM-114-1090	DVM-114-1091	Lab No	DVM-114-1089	DVM-114-1090	DVM-114-1091
53.0	100	100	100	Liquid Limit (%)	-	-	20
37.5	100	100	100	Plastic Limit (%)	-	-	15
26.5	100	100	100	Plasticity Index (%)	SP	NP	5
19.0	100	100	100	Linear Shrinkage (%)	0.5	0.0	3.0
13.2	100	100	100	PI of whole sample	-	-	3
9.5	100	100	100				
6.7	100	100	89	% Gravel	10	2	12
4.75	99	100	89	% Sand	78	86	67
2.00	90	98	88	% Silt	7	8	13
1.00	75	83	78	% Clay	5	4	8
0.425	61	67	69	Activity	0.0	0.0	0.6
0.250	52	58	59				
0.150	43	46	49	% Soil Mortar	90	98	88
0.075	18	18	28				
0.060	12	12	21	Grading Modulus	1.31	1.17	1.15
0.050	10	9	19	Moisture Content (%)	N / T	N / T	N / T
0.035	7	6	14	Relative Density (SG)*	2.65	2.65	2.65
0.020	6	5	11				
0.006	5	5	9	Unified (ASTM D2487)	SM	SM	SC-SM
0.002	5	4	8	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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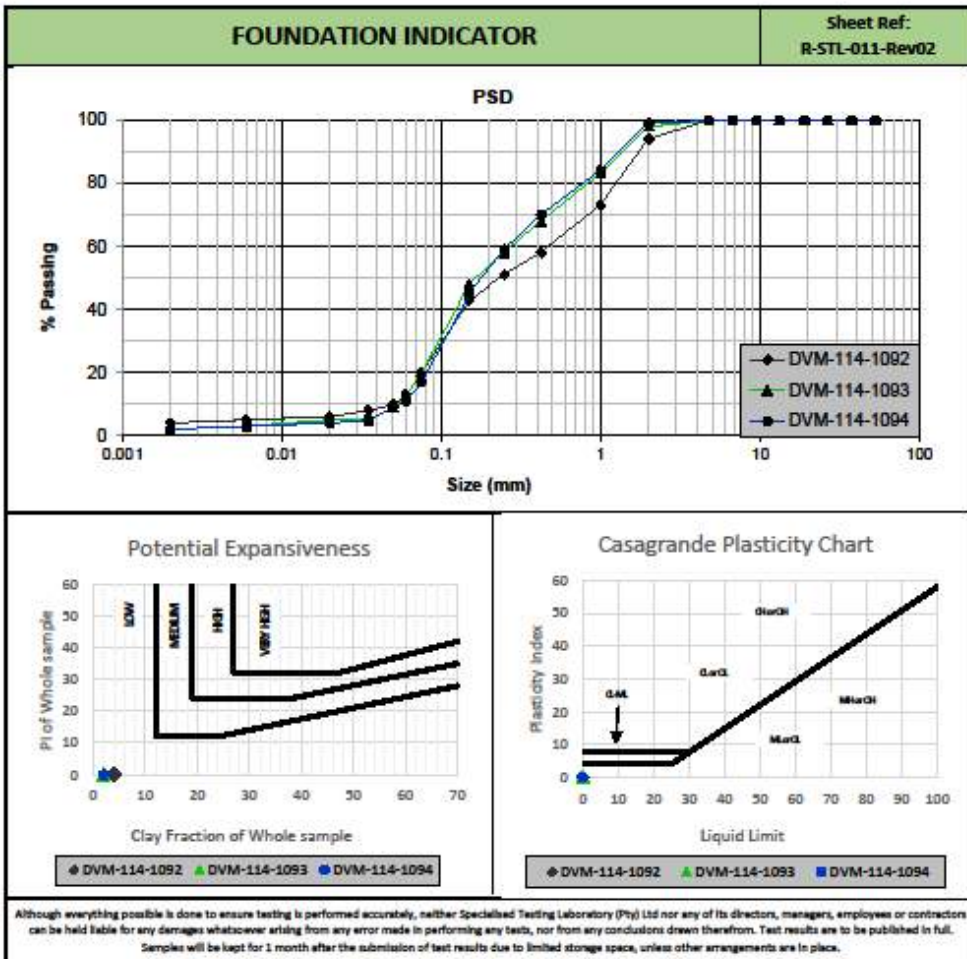


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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	S20	S21	S22	Sample	S20	S21	S22
Depth (m)	0.3	1.0	0.7	Depth (m)	0.3	1.0	0.7
Lab No	DVM-114-1092	DVM-114-1093	DVM-114-1094	Lab No	DVM-114-1092	DVM-114-1093	DVM-114-1094
53.0	100	100	100	Liquid Limit (%)	-	-	-
37.5	100	100	100	Plastic Limit (%)	-	-	-
26.5	100	100	100	Plasticity Index (%)	NP	NP	NP
19.0	100	100	100	Linear Shrinkage (%)	0.0	0.0	0.0
13.2	100	100	100	PI of whole sample	-	-	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	6	2	1
4.75	100	100	100	% Sand	81	85	88
2.00	94	98	99	% Silt	9	11	9
1.00	73	83	84	% Clay	4	2	2
0.425	58	68	70	Activity	0.0	0.0	0.0
0.250	51	58	59				
0.150	43	48	45	% Soil Mortar	94	98	99
0.075	20	20	17				
0.060	13	13	11	Grading Modulus	1.28	1.14	1.14
0.050	10	9	9	Moisture Content (%)	N / T	N / T	N / T
0.035	8	5	5	Relative Density (SG)*	2.65	2.65	2.65
0.020	6	5	4				
0.006	5	3	3	Unified (ASTM D2487)	SM	SM	SM
0.002	4	2	2	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



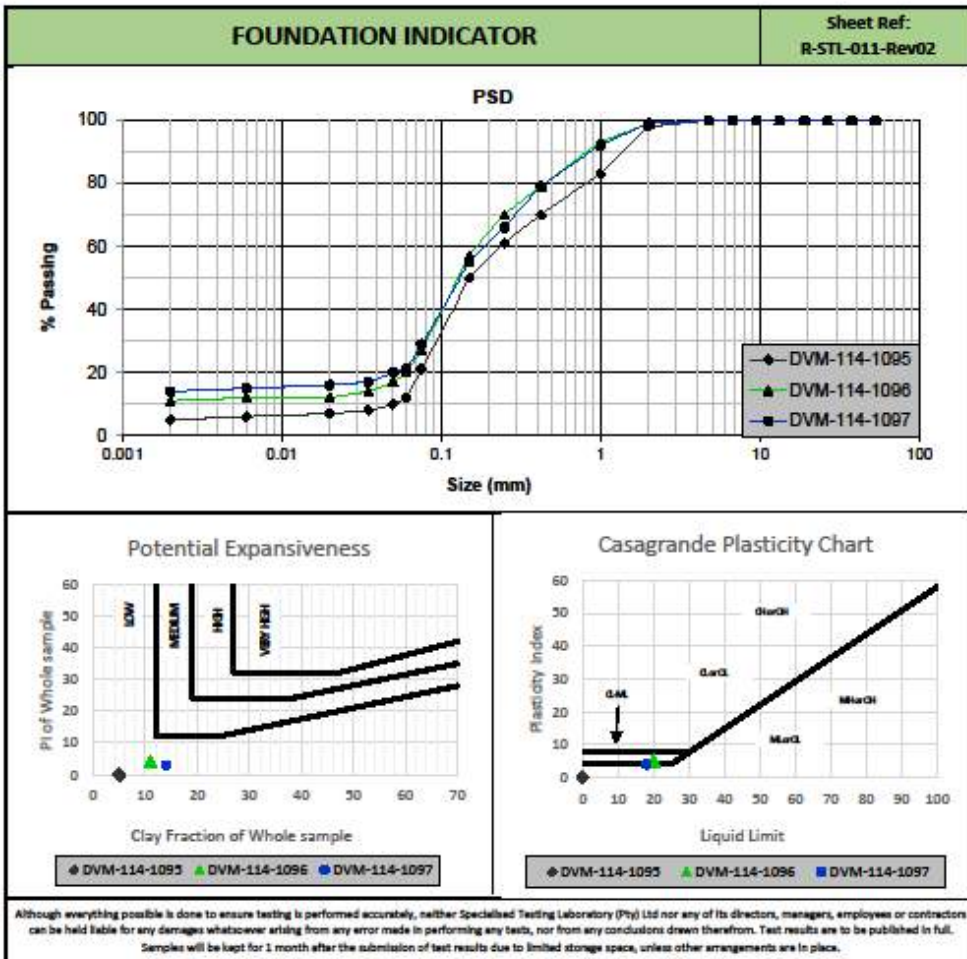


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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	S23	S24	S25	Sample	S23	S24	S25
Depth (m)	0.6	0.3	0.3	Depth (m)	0.6	0.3	0.3
Lab No	DVM-114-1095	DVM-114-1096	DVM-114-1097	Lab No	DVM-114-1095	DVM-114-1096	DVM-114-1097
53.0	100	100	100	Liquid Limit (%)	-	20	18
37.5	100	100	100	Plastic Limit (%)	-	15	14
26.5	100	100	100	Plasticity Index (%)	NP	5	4
19.0	100	100	100	Linear Shrinkage (%)	0.0	2.5	2.5
13.2	100	100	100	PI of whole sample	-	4	3
9.5	100	100	100				
6.7	100	100	100	% Gravel	2	1	1
4.75	100	100	100	% Sand	86	79	78
2.00	98	99	99	% Silt	7	9	7
1.00	83	93	92	% Clay	5	11	14
0.425	70	79	79	Activity	0.0	0.5	0.3
0.250	61	70	66				
0.150	50	57	55	% Soil Mortar	98	99	99
0.075	21	27	29				
0.060	12	20	21	Grading Modulus	1.11	0.95	0.93
0.050	10	17	20	Moisture Content (%)	N / T	N / T	N / T
0.035	8	14	17	Relative Density (SG)*	2.65	2.65	2.65
0.020	7	12	16				
0.006	6	12	15	Unified (ASTM D2487)	SM	SC-SM	SC-SM
0.002	5	11	14	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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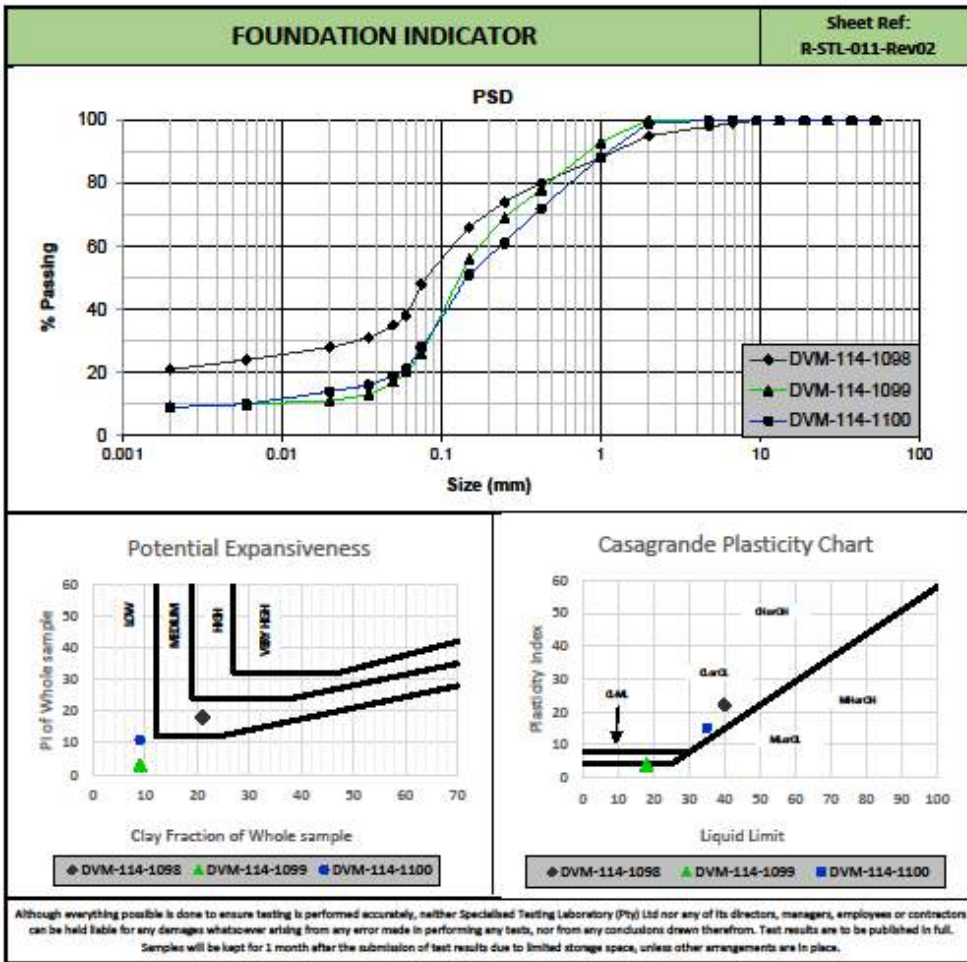


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FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02			
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	S25	S26	S27	Sample	S25	S26	S27
Depth (m)	1.2	0.4	0.4	Depth (m)	1.2	0.4	0.4
Lab No	DVM-114-1098	DVM-114-1099	DVM-114-1100	Lab No	DVM-114-1098	DVM-114-1099	DVM-114-1100
53.0	100	100	100	Liquid Limit (%)	40	18	35
37.5	100	100	100	Plastic Limit (%)	18	14	20
26.5	100	100	100	Plasticity Index (%)	22	4	15
19.0	100	100	100	Linear Shrinkage (%)	10.5	2.0	6.5
13.2	100	100	100	PI of whole sample	18	3	11
9.5	100	100	100				
6.7	99	100	100	% Gravel	5	0	1
4.75	98	100	100	% Sand	57	80	78
2.00	95	100	99	% Silt	17	11	12
1.00	88	93	88	% Clay	21	9	9
0.425	80	78	72	Activity	1.1	0.4	1.7
0.250	74	69	61				
0.150	66	56	51	% Soil Mortar	95	100	99
0.075	48	26	28				
0.060	38	20	21	Grading Modulus	0.77	0.96	1.01
0.050	35	17	19	Moisture Content (%)	N / T	N / T	N / T
0.035	31	13	16	Relative Density (SG)*	2.65	2.65	2.65
0.020	28	11	14				
0.006	24	10	10	Unified (ASTM D2487)	SC	SC-SM	SC
0.002	21	9	9	AASHTO (M145-91)	A - 6	A - 2 - 4	A - 2 - 6
Remarks: *: Assumed N / T: Not Tested							
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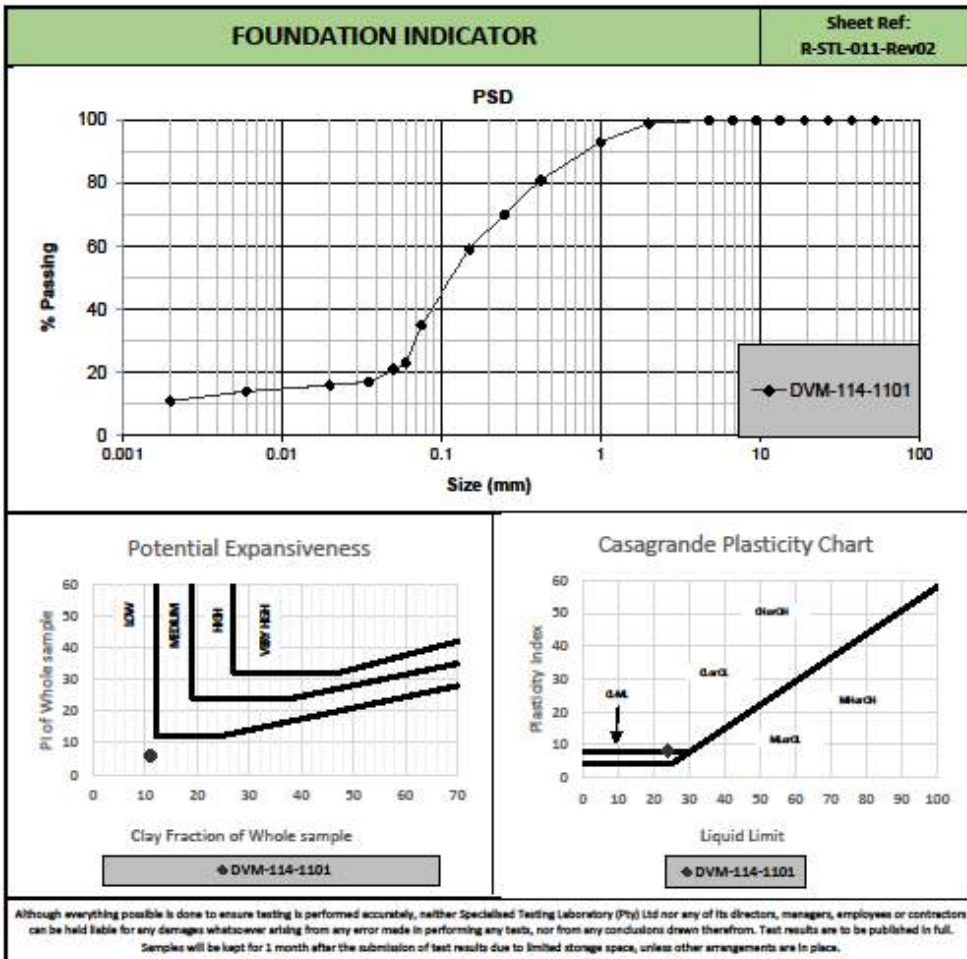


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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR				Sheet Ref: R-STL-011-Rev02	
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)			Atterberg Limits & Classification		
Sample	528		Sample	528	
Depth (m)	0.3		Depth (m)	0.3	
Lab No	DVM-114-1101		Lab No	DVM-114-1101	
53.0	100		Liquid Limit (%)	24	
37.5	100		Plastic Limit (%)	16	
26.5	100		Plasticity Index (%)	8	
19.0	100		Linear Shrinkage (%)	3.5	
13.2	100		PI of whole sample	6	
9.5	100				
6.7	100		% Gravel	1	
4.75	100		% Sand	76	
2.00	99		% Silt	12	
1.00	93		% Clay	11	
0.425	81		Activity	0.7	
0.250	70				
0.150	59		% Soil Mortar	99	
0.075	35				
0.060	23		Grading Modulus	0.85	
0.050	21		Moisture Content (%)	N / T	
0.035	17		Relative Density (SG)*	2.65	
0.020	16				
0.006	14		Unified (ASTM D2487)	SC	
0.002	11		AASHTO (M145-91)	A - 4	
Remarks: *: Assumed N / T: Not Tested					
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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(dolomitic 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.

APPENDIX E: DATA INPUT SHEETS

NORTH WEST PROVINCE HOUSING DEPARTMENT			
		PROJECT-LINKED /RURAL PROJECT (PLEASE INDICATE P or R IN BOX) <input type="text"/>	
SUBSIDY VARIATION CALCULATOR DATA INPUT SHEET			
			Version 1.10
Name of Project	Ipelegeng Extension 12		
Distance from nearest major centre in km (see list adjacent)	150 km	Name of Centre (Only Potchefstroom, Klerksdorp, Rustenburg, Mafikeng, Brits or Tshwane)	Klerksdorp
Total Number of houses in Project			
How many houses with this classification?			
Subsidy amount for this development ?			
1 VARIATION IN SITE CLASS			
Site Classification			
House Size Class (30-40m ²)			
Basic Site Class Designation (H1,C2,S1 etc or combination Please) (Dominant Mode)	C2		
Note that for a combination classification (i.e C1/S2) the designer must select the dominant mode that will be used for design purposes (Contributory Mode)	C2		
If the Site Classification is H3, what is the predicted differential movement?		N/A	
Is the Site Underlain By Dolomites?		No	
If so, what is the Dolomitic Area Designation?		N/A	
2 VARIATION IN SITE CONDITIONS			
2.1 Seepage/Ground Water			Yes/No
2.1.1 Does the Site have a water table less than 1m from the surface?			No
2.1.2 Does the Site have a water table less than 1,5m but more than 1m from the surface?			No
2.2 Soil Slope			
2.3.2 What is the average slope of the erf in %?			<6 %
2.3 Soil dispersion			Yes/No
2.3.3 Is the uppermost soil horizon classified as SP,SM, CL or CH in terms of the Unified Soil Classification System?			SM:80%
2.4 Difficulty of excavation			
What percentage of the uppermost soil horizon is classified as hard in terms SABS 1200 D?			40%
I certify that the above information is based on my assessment of the proposed housing site and that it is in my opinion representative of the General Site Conditions.			
Name:	David S vd Merwe	Signature	
Professional registration No	Pr. Sci. Nat.: 400057/96 MSAIEG: 93/154 NHBRC: Reg. Nr.600444	Date: 21 October 2020	
			

NORTH WEST PROVINCE HOUSING DEPARTMENT		
		PROJECT-LINKED /RURAL PROJECT (PLEASE INDICATE P or R IN BOX) <input type="text"/>
SUBSIDY VARIATION CALCULATOR DATA INPUT SHEET		
		Version 1.10
Name of Project	Ipelegeng Extension 12	
Distance from nearest major centre in km (see list adjacent)	150 km	Name of Centre (Only Potchefstroom, Klerksdorp, Rustenburg, Mafikeng, Brits or Tshwane) Klerksdorp
Total Number of houses in Project		
How many houses with this classification?		
Subsidy amount for this development ?		
1 VARIATION IN SITE CLASS		
Site Classification		
House Size Class (30-40m ²)		
Basic Site Class Designation (H1,C2,S1 etc or combination Please) (Dominant Mode)	C1H1	
Note that for a combination classification (i.e C1/S2) the designer must select the dominant mode that will be used for design purposes (Contributory Mode)	H1	
If the Site Classification is H3, what is the predicted differential movement?		N/A
Is the Site Underlain By Dolomites?		No
If so, what is the Dolomitic Area Designation?		N/A
2 VARIATION IN SITE CONDITIONS		
2.1 Seepage/Ground Water		Yes/No
2.1.1 Does the Site have a water table less than 1m from the surface?		No
2.1.2 Does the Site have a water table less than 1,5m but more than 1m from the surface?		No
2.2 Soil Slope		
2.3.2 What is the average slope of the erf in %?		<6 %
2.3 Soil dispersion		Yes/No
2.3.3 Is the uppermost soil horizon classified as SP,SM, CL or CH in terms of the Unified Soil Classification System?		CL 30% SM:30%
2.4 Difficulty of excavation		
What percentage of the uppermost soil horizon is classified as hard in terms SABS 1200 D?		40%
I certify that the above information is based on my assessment of the proposed housing site and that it is in my opinion representative of the General Site Conditions.		
Name:	David S vd Merwe	Signature 
Professional registration No	Pr. Sci. Nat.: 400057/96 MSAIEG: 93/154 NHBRC: Reg. Nr.600444	Date: 21 October 2020

NORTH WEST PROVINCE HOUSING DEPARTMENT			
		PROJECT-LINKED /RURAL PROJECT (PLEASE INDICATE P or R IN BOX) <input type="text"/>	
SUBSIDY VARIATION CALCULATOR DATA INPUT SHEET			
			Version 1.10
Name of Project	Ipelegeng Extension 12		
Distance from nearest major centre in km (see list adjacent)	150 km	Name of Centre (Only Potchefstroom, Klerksdorp, Rustenburg, Mafikeng, Brits or Tshwane)	Klerksdorp
Total Number of houses in Project			
How many houses with this classification?			
Subsidy amount for this development ?			
1 VARIATION IN SITE CLASS			
Site Classification			
House Size Class (30-40m ²)			
Basic Site Class Designation (H1,C2,S1 etc or combination Please) (Dominant Mode)	CR		
Note that for a combination classification (i.e C1/S2) the designer must select the dominant mode that will be used for design purposes (Contributory Mode)	R		
If the Site Classification is H3, what is the predicted differential movement?		N/A	
Is the Site Underlain By Dolomites?		No	
If so, what is the Dolomitic Area Designation?		N/A	
2 VARIATION IN SITE CONDITIONS			
2.1 Seepage/Ground Water			Yes/No
2.1.1 Does the Site have a water table less than 1m from the surface?			No
2.1.2 Does the Site have a water table less than 1,5m but more than 1m from the surface?			No
2.2 Soil Slope			
2.3.2 What is the average slope of the erf in %?			<6 %
2.3 Soil dispersion			Yes/No
2.3.3 Is the uppermost soil horizon classified as SP,SM, CL or CH in terms of the Unified Soil Classification System?			SM:50%
2.4 Difficulty of excavation			
What percentage of the uppermost soil horizon is classified as hard in terms SABS 1200 D?			70%
I certify that the above information is based on my assessment of the proposed housing site and that it is in my opinion representative of the General Site Conditions.			
Name:	David S vd Merwe	Signature	
Professional registration No	Pr. Sci. Nat.: 400057/96 MSAIEG: 93/154 NHBRC: Reg. Nr.600444	Date: 7 September 2020	
		