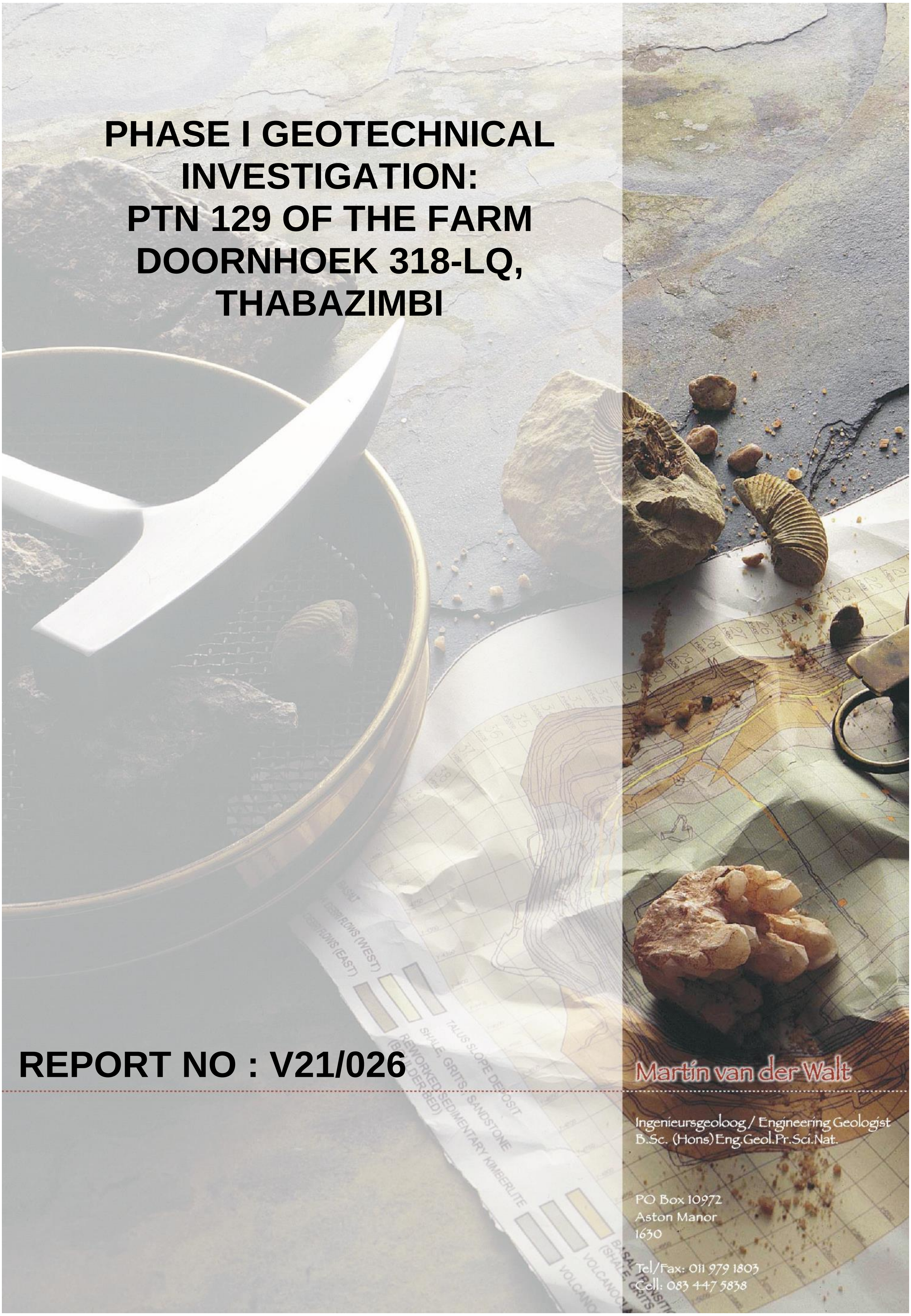

PHASE I GEOTECHNICAL INVESTIGATION: PTN 129 OF THE FARM DOORNHOEK 318-LQ, THABAZIMBI

REPORT NO : V21/026

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PHASE I GEOTECHNICAL INVESTIGATION: PORTION 129 OF THE FARM DOORNHOEK 318-LQ, THABAZIMBI

For

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Report No: V21/026 **June 2021**

ABSTRACT

A Phase I Geotechnical Investigation has been conducted for the proposed township establishment and related residential development on ***PORTION 129 OF THE FARM DOORNHOEK 318-LQ***. This proposed township is located within the area of jurisdiction of the Thabazimbi Local Municipality, Waterberg District Municipality in the Limpopo Province.

The objectives of the investigation may be summarised as follows:

- To determine the geology and relevant mechanical properties of the soil and rock horizons underlying the site.
- To zone the site according to development suitability and to provide the NHBRC soils classification for each zone.
- To provide general foundation recommendations for the proposed structural development.
- To comment on the excavation characteristics of the materials underlying the site for the installation of services.
- To comment on the potential usage of the materials for use in layer works in paving and roads.
- To comment on site water management aspects particularly pertaining to shallow groundwater or seepage.

The geotechnical evaluation is based on the observations and interpretations on site as well as on the results of the laboratory tests. The site was tentatively divided into two geotechnical zones as indicated on the google image named as the ***Geotechnical Map (V21/026/2)*** in ***Appendix A***.

- ♦ **Zone A:** The north-western approximately half of the site consists of this zone where a moderately thick layer ***(1,25m thick on average)*** of potentially moderately collapsible and slightly compressible soil underlain by very soft rock ferricrete was encountered. The ***NHBRC*** classification is ***C1/S/R***. Structures may be founded as follows:
  - Modified normal construction.
  - Deep strip foundations.
  - Powerful machine or pneumatic equipment for excavation of service trenches.

  Structures should be articulated and reinforcement incorporated in masonry and site drainage with service and plumbing precautions implemented.

- ♦ **Zone B:** The south-eastern approximately half of the site consists of this zone where a thick layer ***(2,1m thick on average)*** of potentially moderately to highly collapsible and slightly compressible soil was encountered. The ***NHBRC*** classification is ***C2/S***. Structures may be founded as follows:
  - Stiffened concrete or cellular rafts.
  - Pad and pier foundations.
  - Dynamic compaction.

  Structures should be articulated and reinforcement incorporated in masonry and site drainage with service and plumbing precautions implemented.

PORTION 129 OF THE FARM DOORNHOEK 318-LQ as investigated, is considered suitable for the proposed township establishment and related residential development from a geotechnical perspective provided that the recommendations made in this report are implemented and/or adhered too.

Table of Contents

TABLES

APPENDICES

PHASE I GEOTECHNICAL INVESTIGATION: PORTION 129 OF THE FARM DOORNHOEK 318-LQ, THABAZIMBI

1. INTRODUCTION

At the request of the developer the undersigned conducted a Phase I Geotechnical Investigation for the proposed township establishment and related residential development on ***PORTION 129 OF THE FARM DOORNHOEK 318-LQ***. This proposed township is located within the area of jurisdiction of the Thabazimbi Local Municipality, Waterberg District Municipality in the Limpopo Province.

The objectives of the investigation may be summarized as follows:

- To determine the geology and relevant mechanical properties of the soil and rock horizons underlying the site.
- To zone the site according to development suitability and to provide the NHBRC soils classification for each zone.
- To provide general foundation recommendations for the proposed structural development.
- To comment on the excavation characteristics of the materials underlying the site for the installation of services.
- To comment on the potential usage of the materials for use in layer works in paving and roads.
- To comment on site water management aspects particularly pertaining to shallow groundwater or seepage.

2. AVAILABLE INFORMATION

The following sources were consulted in the evaluation of the site.

- Published Geological Map sheet 2426 Thabazimbi at a scale of 1:250,000.
- Topographical Map sheet 2427 CB Thabazimbi at a scale of 1:50,000.
- Locality plan and layout provided by the engineer.

3. SITE DESCRIPTION

PTN 129 Doornhoek 318-LQ is located approximately 2,5km north-east of the Thabazimbi town center. Entrance to the site is via a severely pot-holed and corrugated road present along the south-eastern boundary. The northern boundary consists of a residential development, the north-western boundary of a tar road and related road reserve whilst the remaining boundaries consists of other portions of the farm Doornhoek.

The site is undeveloped at present and covered with veld grass and indigenous trees. The site has a gentle slope towards the south-east. The exact locality of ***PTN 129 Doornhoek 318-LQ*** is indicated on the google image named as the ***Locality Map (V21/026/1)*** in ***Appendix A***.

4. GEOLOGY

According to the available geological map sheet 2426 Thabazimbi at a scale of 1:250 000 ***PTN 129 Doornhoek 318-LQ*** is underlain by sediments (quartzite that is partly ferruginous and shale with subordinate conglomerate) of the Timeball Hill Formation of the Pretoria Group belonging to the Transvaal Supergroup. The rock is sequentially overlain by residual, pedogenic and transported soils.

The site is blanketed by a thick layer of sandy hillwash underlain by a pebble marker, both classed as Recent Deposits. No residual soil or rock was encountered in the test pits. A dense to very dense ferricrete layer was generally encountered below the transported soil to the maximum excavated depth of the test pits. No boulders or sub/rock outcrop was observed on surface during the investigation.

A pebble marker was encountered across the site and this represents the most recent major geological marker in the soil profile and occurs at the base of the transported soil. This is generally a zone of high permeability as it contains abundant gravel.

5. INVESTIGATION PROCEDURE

5.1 Fieldwork

The site investigation was carried out during May 2021 and comprised the excavation of seven test pits with a Case 580 Super R TLB supplied by the developer. The test pits were positioned to cover the site to obtain the data to achieve the objectives outlined above. An engineering geologist inspected the test pits and recorded soil profiles using standard procedures. The test pit positions are indicated on the google image named as the ***Geotechnical Map (V21/026/2)*** in ***Appendix A*** whilst the soil profiles are included in ***Appendix B***.

5.2 Laboratory Testing

Small disturbed samples as well as an undisturbed (block) sample, representative of the soils encountered, were retrieved from the test pits and submitted to a commercial soils laboratory for testing. The following tests were performed in order to determine the mechanical properties of the soil.

- **Indicator Tests**
  These were carried out to determine the particle distribution and plasticity of the soils. The grading was carried out to 0,002mm in order to determine the clay percentage in the soil.
- **Collapse Potential Test**
  A collapse potential test was conducted on the thick hillwash to determine the amount of collapse and consolidation settlement that could be expected.

The depth of the samples is indicated on the relevant profile sheets in ***Appendix B*** and the test results are included in ***Appendix C***.

6. GEOTECHNICAL EVALUATION

6.1 Collapsible/Compressible Soil

6.1.1 Collapse Settlement

The site is blanketed by a layer of variable thickness of red brown hillwash that is considered to exhibit a collapsible grain structure and should therefore be regarded as being potentially collapsible and/or compressible. Soils with a collapsible grain structure consist of sand grains held apart by clay bridges that form an open, honeycomb type structure. When dry, these soils appear to have a high strength, however when subjected to simultaneous loading and saturation the clay bridges lose strength and the soil collapses into a denser state resulting in sudden settlement.

An undisturbed sample of the hillwash was retrieved and submitted to collapse potential testing according to the method as advocated by Jennings 1975. A summary of the collapse potential test is provided below in ***Table 1***.

Table 1: Summary of Collapse Potential Test

TP	Depth (m)	Description	Dry Density (kg/m^3)	Collapse Potential (%)		Compressibility (%)		Rating Jennings (CP)
				50kPa	200kPa	50kPa	200kPa	
TP1	0.6	Loose to medium dense, voided, silty SAND; hillwash.	1467	3.4	12.6	1.3	3.7	Moderate Trouble **(50kPa)** Severe Trouble **(200kPa)**

Analysis of the results indicates that the hillwash is moderately to highly collapsible and slightly compressible when subject to structural load. The pebble marker of loose to medium dense consistency is also considered to be potentially collapsible and/or compressible. The soil profile as exposed on site to an ***average depth of 1,7m,*** is not considered an adequate founding medium in its natural state and appropriate foundation recommendations are provided in section 6.3.

6.1.2 Normal (consolidation) Settlement

Excessive normal settlement is likely to occur where a thick layer of hillwash is encountered particularly if these soils have a high moisture content (**S_r > 30%**). Normal settlement generally does not pose a serious problem if the settlement is not excessive, is uniform and takes place during construction. Problems also occur when the settlement is uneven when structures are founded partly on competent and partly on soft foundation soils. This uneven settlement known as differential settlement, results in structural distress.

6.2 Expansive Soil

The hillwash consists of a sand with a moderate silt but very low clay content as was confirmed by the results of the laboratory tests. The results indicate that the site soils tested are potentially ***"low"*** in the degree of expansiveness and therefore no problems with regards to potentially expansive soils are anticipated. The indicator test results are summarized in ***Table 2***.

6.3 Foundations

Foundation recommendations for the proposed residential development are provided in this section. This is based on the observations and interpretations on site as well as on the results of the laboratory tests. The site was tentatively divided into two geotechnical zones as indicated on the google image named as the ***Geotechnical Map (V21/026/2)*** in ***Appendix A***.

- **Zone A**

The north-western approximately half of the site consists of this zone where a moderately thick layer ***(1,25 thick on average)*** of potentially moderately collapsible and slightly compressible soil underlain by very soft rock ferricrete was encountered. This zone is classified as ***Class C1/S/R*** according to the National Home Builders Registration Council's Standards and Guidelines (NHBRC) of 1999. This classification indicates that total settlement of ***5 to 10mm*** is estimated with differential settlement assumed to equal 75% of the estimated total. Class ***R*** indicates that difficult excavation is expected ***within 1,5m*** of surface.

The following foundation recommendations may be considered for conventional single and double-storey structures utilizing the maximum permissible bearing pressure indicated.

Modified Normal Construction

- Structures may be placed on continually reinforced (top and bottom) strip footings at a depth of ***0,6m*** below surface after wetting and compaction of the base of the foundation trench to 95% Mod AASHTO density utilizing a maximum allowable bearing pressure of ***50kPa***.
- Minimum foundation width assumed to be ***0,6m***.
- All layers of brickwork in the plinth should be reinforced with brick force and thereafter every fourth course to at least four reinforced courses above all openings such as doors and windows.
- Structures should be articulated at strategic points as determined by a structural engineer to cater for differential settlement.
- Material below ground floor slabs should be removed to a depth of ***0,45m*** and replaced in 150mm layers compacted to 95% Mod AASHTO density at optimum moisture content.
- Floor slabs should be mesh reinforced (residential) and isolated from the main structure.
- A ***1,5m wide paved strip (impervious)*** must be placed around the entire structure and sloped to avoid accumulation of water near the structure.
- All yard walls, steps etc. should be isolated from the main structure to allow independent movement.
- All wet services should be flexible in design to accommodate movement where entering or leaving structures.
- Storm water should be effectively captured and led well away from all structures.
- No ponding of surface water should be allowed to occur adjacent to foundations both during as well as after construction.

Table 2: Summary of Indicator Tests

Test Pit	Depth (m)	Material	LL	PI	LS	GM	% Gravel	% Sand	% Silt	% Clay	Unified Soil Class	Activity
TP 1	0.2 - 1.9	Loose to medium dense, voided, silty SAND; hillwash.	20	6	3.0	1.44	0	83	14	3	SM - SC	Low
TP 4	0.1 - 1.2	Loose to medium dense, voided, silty SAND; hillwash.	-	NP	0.0	0.97	1	72	24	3	SC	Low

Key to Table 2:

LL	Liquid Limit
PI	Plasticity Index
NP	Non-plastic
LS	Linear Shrinkage
GM	Grading Modulus

Deep Strip Foundations

- Structures may be placed at an average depth of ***1,25m*** below surface on dense ferricrete utilizing normal construction techniques.
- A maximum allowable bearing pressure of ***100kPa*** may be utilized on the dense ferricrete. The thickness of the ferricrete could not be established nor the quality of the material below.
- Material below ground floor slabs should be removed to a depth of ***0,45m*** and replaced as described above.
- Floor slabs should be mesh reinforced (residential) and isolated from the main structure.
- A ***1,5m wide paved strip (impervious)*** must be placed around the entire structure and sloped to avoid accumulation of water near the structure.
- All yard walls, steps etc. should be isolated from the main structure to allow independent movement.
- Site drainage with service and plumbing precautions as described above.
- Adequate side wall/slope protecting measures should be implemented to ensure a safe working environment.

The design of foundations (whether soil or concrete) should be done in accordance and under supervision of a civil or structural engineer and the ***foundation*** recommendations given above should be verified during construction. Strict quality control is necessary during any compaction procedure to ensure that the desired result is achieved and densities/stiffness of the compacted soils must be controlled with suitable field tests. The design of first floor and upper slabs should take the estimated settlement into account.

It should be borne in mind that old septic tanks, French drains, swimming pools, duck/fish ponds or rubbish pits may be encountered in this zone and these would require special treatment prior to construction. This would involve excavation and backfilling with suitable inert material compacted in controlled layers.

❖ **Zone B**

The south-eastern approximately half of the site consists of this zone where a thick layer ***(2,1m thick on average)*** of potentially moderately to highly collapsible and slightly compressible soil was encountered. This zone is classified as ***Class C2/S*** according to the National Home Builders Registration Council’s Standards and Guidelines (NHBRC) of 1999. This classification indicates that total settlement of ***more than 10mm*** is estimated with differential settlement assumed to equal 75% of the estimated total.

The following foundation recommendations may be considered for conventional single and double-storey structures utilizing the maximum permissible bearing pressure indicated.

Stiffened Concrete or Cellular Rafts

- The structure/s may be placed on stiffened concrete or cellular raft foundations designed to accommodate the estimated settlement.
- Bearing and fabric pressure should not exceed ***50kPa*** but is at the discretion of the design engineer.
- Structures should be articulated at strategic points as determined by a structural engineer with light reinforced masonry.
- Ground floor slabs (residential) should be mesh reinforced and isolated from the main structure.

- A ***1,5m wide paved strip (impervious)*** must be placed around the entire structure and sloped to allow water to flow away from the structure.
- All yard walls, steps etc. should be isolated from the main structure to allow independent movement.
- All wet services should be flexible in design to accommodate movement where entering or leaving structures.
- Storm water should be effectively captured and led well away from all structures.
- No ponding of surface water should be allowed to occur adjacent to foundations both during as well as after construction.

Pad and Pier Foundations

- Structures may be founded on reinforced concrete ground beams supported on pad and pier foundations placed at an ***average depth of 2,1m*** below surface on dense ferricrete.
- A maximum allowable bearing pressure of ***100kPa*** may be utilized. The thickness of the ferricrete could not be established nor the quality of the material below.
- Alternatively, deep strip foundations may be considered.
- Material below ground floor slabs should be removed to a depth of ***0,60m*** and replaced in 150mm layers compacted to 95% Mod AASHTO density at optimum moisture content.
- Ground floor slabs (residential) should be mesh reinforced and isolated from the main structure.
- A ***1,5m wide paved strip (impervious)*** must be placed around the entire structure and sloped to avoid accumulation of water near the structure.
- All yard walls, steps etc. should be isolated from the main structure to allow independent movement.
- Site drainage with service and plumbing precautions as described above.
- Adequate side wall/slope protecting measures should be implemented to ensure a safe working environment.

Dynamic Compaction

- The thick layer of potentially collapsible and compressible soil could be densified with an impact or vibrating roller to create a ***"soil raft"*** to the required stiffness and depth under the footprint of the structure/s.
- The compaction should extend to a minimum width of ***2,0m beyond*** the footprint of structures. Alternatively, the entire zone could be compacted.
- For the compaction effort a method specification should be drawn up which should include adequate testing such as DCP tests, plate load testing or DPSH tests or similar to assess the compaction effort.
- Testing should be done before as well as after compaction to ensure that the required compaction effort and depth has been achieved.
- Structures may be placed on a light raft at shallow depth within this densified material designed to accommodate the estimated accepted/remaining settlement.
- The results of the compaction would dictate the allowable bearing pressure but should be in the order of ***150kPa*** for a compacted depth of ***1,5m below founding level***.
- Structures should be articulated at strategic points as determined by a structural engineer with light reinforced masonry.
- Ground floor slabs (residential) should be mesh reinforced and isolated from the main structure.
- A ***1,5m wide paved strip (impervious)*** must be placed around the entire structure and sloped to allow water to flow away from the structure.
- All yard walls, steps etc. should be isolated from the main structure to allow independent movement.
- All wet services should be flexible in design to accommodate movement where entering or leaving structures.
- Storm water should be effectively captured and led well away from all structures.

- No ponding of surface water should be allowed to occur adjacent to foundations both during as well as after construction.
- Adequate side wall/slope protecting measures should be implemented to ensure a safe working environment.

The design of foundations (whether soil or concrete) should be done in accordance and under supervision of a civil or structural engineer and the ***foundation*** recommendations given above should be verified during construction. Strict quality control is necessary during any compaction procedure to ensure that the desired result is achieved and densities/stiffness of the compacted soils must be controlled with suitable field tests. The design of first floor and upper slabs should take the estimated settlement into account.

It should be borne in mind that old septic tanks, French drains, swimming pools, duck/fish ponds or rubbish pits may be encountered in this zone and these would require special treatment prior to construction. This would involve excavation and backfilling with suitable inert material compacted in controlled layers.

6.4 Material Usage

Although no specific tests were conducted to determine the suitability of the material for use in layer works, the following are derived from the results of the indicator tests. The hillwash classifies as ***A-1/2*** according to the PRA system which indicates that this soil is potentially suitable for use as lower sub-grade in layer works. It is possible that the material strength could be improved with the addition of cement but this comment need to be confirmed with the relevant compaction and strength tests (Mod, CBR, UCS & ITS).

The roads and paved areas should be designed according to the anticipated traffic and axle loads bearing the estimated settlement of the roadbed into account. Adequate drainage should be provided to ensure that ponding of surface water on and in the vicinity of the roadbed is prevented. This would ensure that ingress water does not impact negatively on the strength of layer works. This is particularly important if interlocking paving blocks are used. No trees should be planted close to the road surface.

6.5 Shallow Seepage

Although the water table, whether perched or permanent was not encountered during the investigation, the necessary damp proofing precautions should be taken underneath all structures and provision will have to be made to prevent ingress of water beneath foundations.

The presence of ferruginous concretions and ferricrete in the soil profile is an indication of a seasonal fluctuating water table. The hillwash is considered to be highly permeable with the underlying ferricrete of dense or better consistency fairly impermeable and a perched water table could develop on this interface during the wet season.

Storm water from the higher-lying ground (north-west) should be adequately controlled and disposed of to prevent potential flooding/erosion of the lower-lying ground (south-east). The developer should take cognizance of this and ensure that the necessary precautions are taken to prevent problems both during as well as after construction.

6.6 Excavation Characteristics

The excavation characteristics of the different soil horizons encountered have been evaluated according to the South African Bureau of Standards standardized excavation classification for earthworks ***(SABS - 1200D)*** and earthworks ***(small works - SABS 1200DA)***. In terms of this classification and the in-situ soil/rock consistencies as profiled, the relationships given below are generally applicable.

1. "soft excavation" - very loose/very soft through to dense or stiff.
2. "intermediate excavation" - very dense/very stiff through to very soft rock.
3. "hard excavation" - soft rock or better.

A summary of the excavation/refusal depths as encountered in the test pits is provided below in ***Table 3*** but for detailed excavation characteristics refer to the soil profiles in ***Appendix B***. It is anticipated that for ***"soft to intermediate excavation"*** conventional earth moving equipment would suffice for the excavation of foundation and service trenches. The use of a powerful excavator, pneumatic equipment and/or limited blasting/chemical breakdown would most probably be required for the excavation of trenches in the areas described/inferred as ***"hard excavation"***.

Table 3: Summary of Excavation/Refusal Depths

TP	Maximum/Refusal Depth (m)	Material Description	Excavation Class at Maximum/Refusal Depth
TP 1	2.3 - not refusal, very slow progress.	Very dense ferricrete.	Intermediate.
TP 2	2.2 - not refusal, very slow progress.	Very dense ferricrete.	Intermediate.
TP 3	1.25 - refusal.	Very soft rock ferricrete.	Intermediate.
TP 4	1.4 - refusal.	Very soft rock ferricrete.	Intermediate.
TP 5	2.0 - not refusal, very slow progress.	Very dense ferricrete.	Intermediate.
TP 6	2.3 - not refusal, very slow progress	Very dense ferricrete	Intermediate.
TP 7	1.25 - refusal.	Very soft rock ferricrete.	Intermediate.

6.7 Stability of Excavations

Although none of the side walls of the test pits collapsed during the investigation, it is strongly recommended that all excavations ***exceeding 1,5m*** should be adequately stabilized to ensure a safe working environment. In general terms it is envisaged that stability to temporary excavation faces could be provided by either lateral support or by battering the excavation back to a suitable (stable) slope angle. Stability of battered slopes and lateral support measures should be designed by a registered professional engineer whose area of expertise includes large bulk excavations, and should be constructed by a specialist geotechnical contractor.

Seepage may result in the destabilizing of the soils above the seepage and special precautions may be required such as seepage cut-off trenches or sub-soil drains.

It is recommended that all constructed embankments ***exceeding 1,5m*** or as deemed necessary by the design engineers be stabilized and/or protected by means of retaining walls. Embankments and all terrace faces should be adequately compacted and protected from erosion and potential failure.

6.8 Undermined Ground

As far as could be established the site and immediate area is not undermined. However, the site is located in an area where open-cast mines have been established to mine iron-ore and it is thus possible that localized earth tremors due to the current/past mining activities could occur. According to the Seismic Hazard map for South Africa, the site fall within the ***"low"*** zone of expected peak ground acceleration with a 10% probability of being exceeded at least once in a 50-year period.

Township establishment and the proposed structural development may proceed without restrictions/problems due to potential undermining.

6.9 Erodability of the Soil Profile

The soil in the upper reaches of the profile is considered to be erodible if subjected to high water velocity, as it is generally cohesion-less. No erosion channels or gullies were observed on site during the investigation due to the abundance of vegetation.

7. GENERAL

Although every effort has been made to ensure the accuracy of the information contained in this report, the results are based upon fieldwork and limited laboratory testing only. It is thus possible that localized soil conditions at variance to those described in the report may be encountered.

It is recommended that the foundation excavations for each structure be inspected by a competent person during construction in order to verify that the materials thus exposed are not at variance with those described in the report and that it meets design criteria.

The ***foundation*** recommendations should be verified during construction. The placement of all material used as backfill must be controlled with suitable field tests to confirm that the required densities/stiffness are achieved during compaction and that the quality of the backfill material is within specification.

It remains the responsibility of the developer to obtain the latest requirements for enrolment of the site from the ***NHBRC*** prior to construction, if applicable.

PORTION 129 OF THE FARM DOORNHOEK 318-LQ as investigated, is considered suitable for the proposed township establishment and related residential development from a geotechnical perspective provided that the recommendations made in this report are implemented and/or adhered too.

M.J. van der Walt (Pr.Sci.Nat. & MSAIEG)
Engineering Geologist

8. REFERENCES

1. Guidelines for Urban Engineering Geological Investigations 1995. Published by SAIEG & SAICE.
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3. Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. Jennings, Brink & Williams. The Civil Engineer in SA, January 1973.
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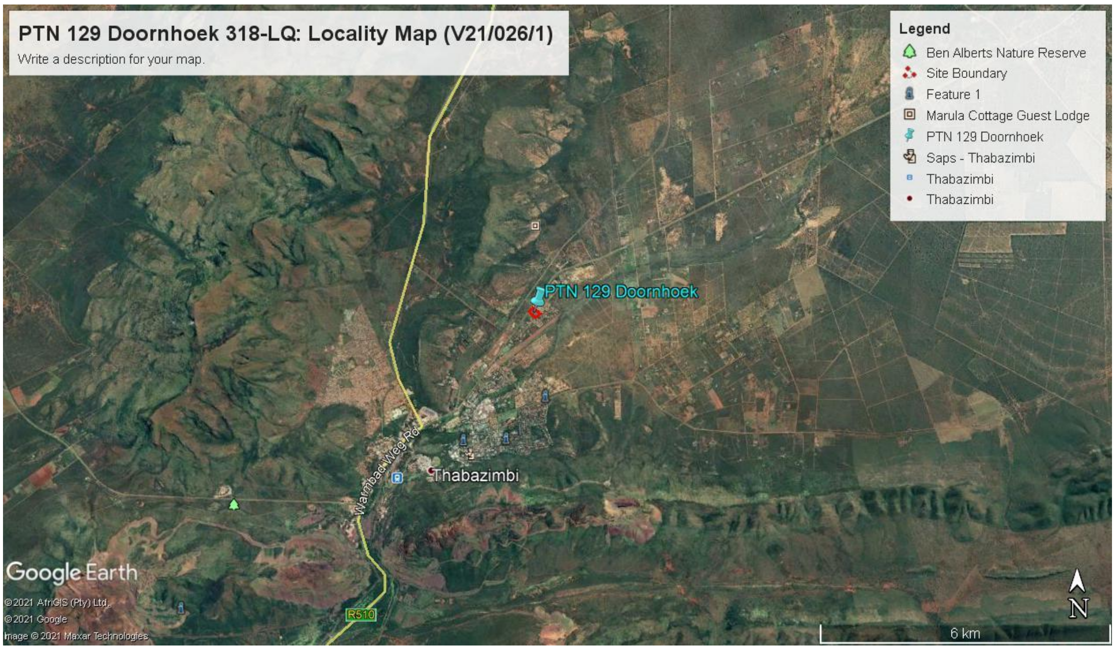
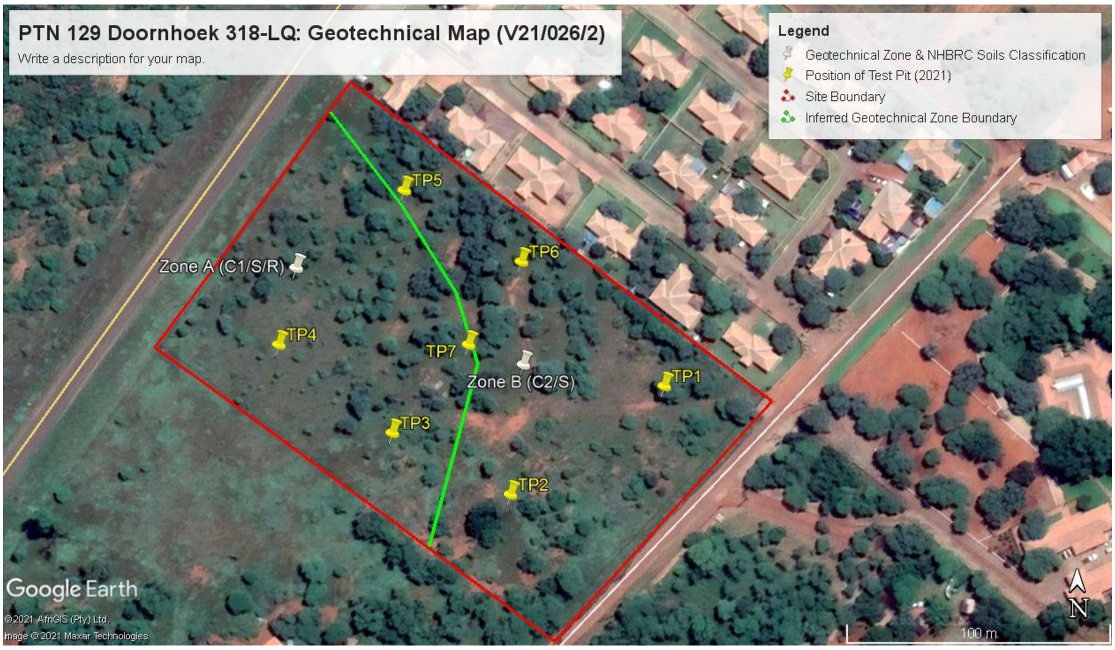
APPENDIX A
MAPS

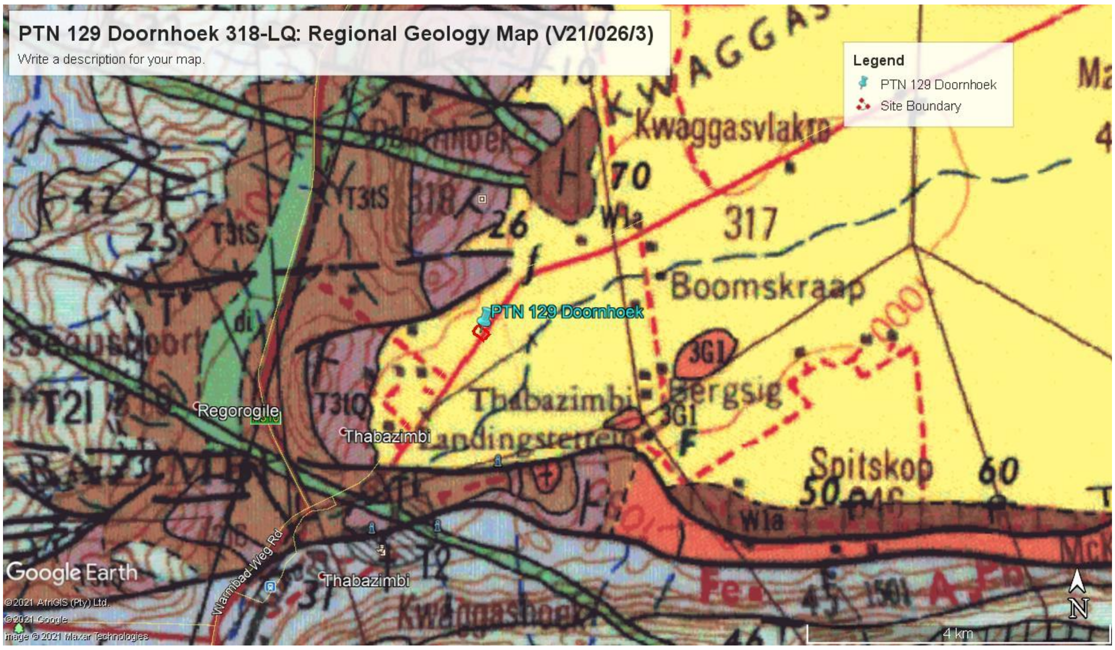
PTN 129 Doornhoek 318-LQ: Locality Map *(V21/026/1)*



PTN 129 Doornhoek 318-LQ: Geotechnical Map *(V21/026/2)*



PTN 129 Doornhoek 318-LQ: Regional Geology Map *(V21/026/3)*



Extract form published Geology Map Sheet 2426 Thabazimbi (1:250,000)

Qc (yellow) Surface deposits (recent) of Quaternary geological age.

T3tQ Quartzite (partly ferruginous), magnetic quartzite with subordinate sub-greywacke, Timeball Hill Formation, Pretoria Group, Transvaal Supergroup.

T3tS Shale and siltstone with local conglomerate, breccia and quartzite, Timeball Hill Formation, Pretoria Group, Transvaal Supergroup.

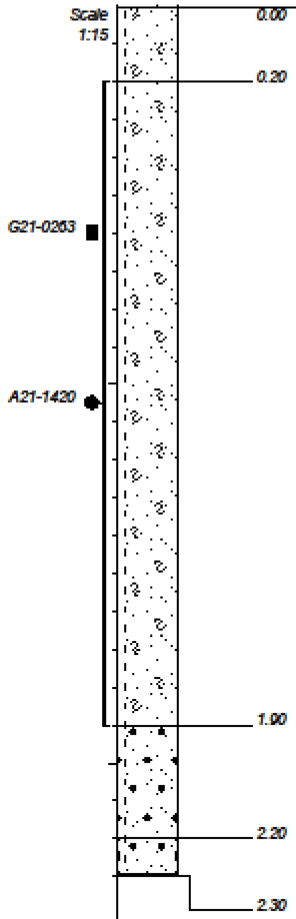
T2 Dolomite and chert, Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup.

APPENDIX B
SOIL PROFILES

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: V21/026



Dry, red brown, medium dense, intact, silty SAND with abundant grass roots; **topsoil**.

Slightly moist, red brown, loose to medium dense, voided, silty SAND with minor fine roots; **hillwash**.

Slightly moist, red brown occasionally speckled black, medium dense, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.

Dry, red brown stained red mottled black, dense, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES

1) Excavation terminated due to very slow progress on very dense ferricrete.
2) No water seepage observed.
3) Undisturbed sample G21-0263 taken from 0,6m.
4) Small disturbed sample A21-1420 taken from 0,2–1,9m.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW
TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION : Vertical
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021
DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718623
Y-COORD : 42698

HOLE No: TP1

D092 MJ van der Walt Engineering Geologist CC

dotPLOT 7022 PBpH07

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: V21/026

Scale 1:15

Depth (m)	Description
0.00 – 0.20	Dry, red brown, medium dense, intact, silty SAND with abundant grass roots; **topsoil**.
0.20 – 1.75	Slightly moist, red brown, loose to medium dense, voided, silty SAND with minor fine roots; **hillwash**.
1.75 – 2.10	Slightly moist, red brown occasionally speckled black, medium dense, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
2.10 – 2.20	Dry, red brown stained red mottled black, dense, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES

1) Excavation terminated due to very slow progress on very dense ferricrete.

2) No water seepage observed.

CONTRACTOR: Thaba Plant
MACHINE: Case 580 Super R
DRILLED BY:
PROFILED BY: MvdW
TYPE SET BY:
SETUP FILE: *MVDW_TP.SET*

INCLINATION:
DIAM: 650mm trench
DATE: 19 May 2021
DATE: 19 May 2021
DATE: 22/06/2021 18:27
TEXT: ..T7000\PROFILES\DOORN.TXT

ELEVATION:
X-COORD: 2718658
Y-COORD: 42643

HOLE No: TP2

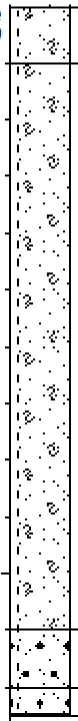
D092 MJ van der Walt Engineering Geologist CC — *dotPLOT 7022 PBpH07*

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP3
Sheet 1 of 1

JOB NUMBER: V21/026

Scale
1:10



0.00	Dry, red brown, medium dense, intact, silty SAND with abundant grass roots; **topsoil**.
0.10	Slightly moist, red brown, loose to medium dense, voided, silty SAND with minor fine roots; **hillwash**.
1.10	Slightly moist, red brown occasionally speckled black, loose to medium dense, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
1.20	Dry, red brown stained red mottled black, dense, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.
1.25	

NOTES

1) Refusal on very soft rock ferricrete.

2) No water seepage observed.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW

TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION :
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021

DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718626
Y-COORD : 42609

HOLE No: TP3

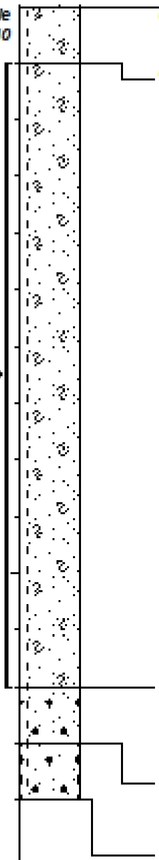
D092 MJ van der Walt Engineering Geologist CC *dotPLOT 7022 PBpH07*

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP4
Sheet 1 of 1

JOB NUMBER: V21/026

Scale
1:10



A21/1421

Depth (m)	Description
0.00–*0.10*	Dry, red brown, medium dense, intact, silty SAND with abundant grass roots; **topsoil**.
0.10–*1.20*	Slightly moist, red brown, loose to medium dense, voided, silty SAND with minor fine roots; **hillwash**.
1.20–*1.30*	Slightly moist, red brown occasionally speckled black, loose to medium dense, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
1.30–*1.40*	Dry, red brown stained red mottled black, very dense, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES

1) Refusal on very soft rock ferricrete.

2) No water seepage observed.

3) Small disturbed sample A21/1421 taken from 0,1–1,2m.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW

TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION :
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021

DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718603
Y-COORD : 42553

HOLE No: TP4

D092 MJ van der Walt Engineering Geologist CC

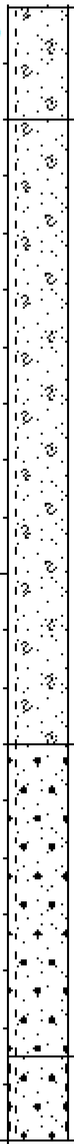
dotPLOT 7022 PBpH07

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP5
Sheet 1 of 1

JOB NUMBER: V21/026

Scale 1:10



Depth (m)	Description
0.00 – 0.20	Dry, red brown, <u>medium dense</u>, intact, silty SAND with abundant grass roots; **topsoil**.
0.20 – 1.30	Slightly moist, red brown, <u>loose</u> to <u>medium dense</u>, voided, silty SAND with minor fine roots; **hillwash**.
1.30 – 1.85	Slightly moist, red brown occasionally speckled black, <u>loose</u> to <u>medium dense</u>, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
1.85 – 2.00	Dry, red brown stained red mottled black, <u>dense</u>, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES
1) Excavation terminated due to very slow progress on very dense ferricrete.
2) No water seepage observed.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW

TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION :
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021

DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718549
Y-COORD : 42602

HOLE No: TP5

D092 MJ van der Walt Engineering Geologist CC
dotPLOT 7022 PBpH07

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: **TP6**
Sheet 1 of 1

JOB NUMBER: V21/026

Scale 1:15

Depth (m)	Description
0.00 – 0.20	Dry, red brown, <u>medium dense</u>, intact, silty SAND with abundant grass roots; **topsoil**.
0.20 – 1.65	Slightly moist, red brown, <u>loose</u> to <u>medium dense</u>, voided, silty SAND with minor fine roots; **hillwash**.
1.65 – 2.10	Slightly moist, red brown occasionally speckled black, <u>medium dense</u>, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
2.10 – 2.30	Dry, red brown stained red mottled black, <u>dense</u>, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES

1) Excavation terminated due to very slow progress on very dense ferricrete.

2) No water seepage observed.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW
TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION :
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021
DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718574
Y-COORD : 42645

HOLE No: **TP6**

D092 MJ van der Walt Engineering Geologist CC *dotPLOT 7022 PBpH07*

PTN 129 DOORNHOEK 318-LQ, THABAZIMBI
Phase I Geotechncial Investigation

HOLE No: TP7
Sheet 1 of 1

JOB NUMBER: V21/026

Scale 1:10

Depth (m)	Description
0.00 – 0.10	Dry, red brown, medium dense, intact, silty SAND with abundant grass roots; **topsoil**.
0.10 – 1.15	Slightly moist, red brown, loose to medium dense, voided, silty SAND with minor fine roots; **hillwash**.
1.15 – 1.20	Slightly moist, red brown occasionally speckled black, loose to medium dense, intact, silty SAND with occasional fine to coarse gravel and minor ferruginous concretions; **pebble marker**.
1.20 – 1.25	Dry, red brown stained red mottled black, dense, slightly cemented, silty SAND with minor ferruginous concretions; **ferricrete**.

NOTES

1) Refusal on very soft rock ferricrete.

2) No water seepage observed.

CONTRACTOR : Thaba Plant
MACHINE : Case 580 Super R
DRILLED BY :
PROFILED BY : MvdW

TYPE SET BY :
SETUP FILE : MVDW_TP.SET

INCLINATION :
DIAM : 650mm trench
DATE : 19 May 2021
DATE : 19 May 2021

DATE : 22/06/2021 18:27
TEXT : ..T7000\PROFILES\DOORN.TXT

ELEVATION :
X-COORD : 2718606
Y-COORD : 42625

HOLE No: TP7

D092 MJ van der Walt Engineering Geologist CC *dotPLOT 7022 PBpH07*

APPENDIX C
LABORATORY TEST RESULTS

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

T0025

TEST RESULTS

M.J VAN DER WALT

Attention: Mr. Loftie Eaton

Project : PTN Doornhoek -V21/026

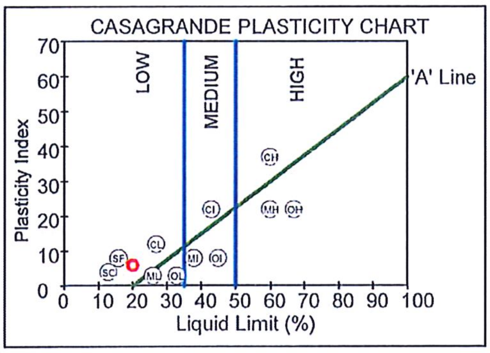
Your Ref :
Our Ref : PL38634
Date Reported : 09.06.2021

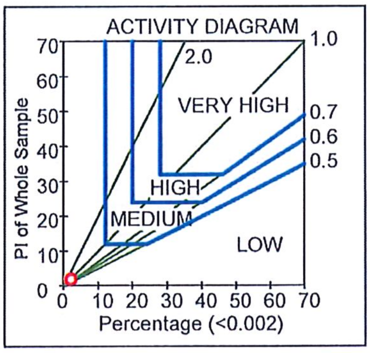
FOUNDATION INDICATOR (ASTM: D422)

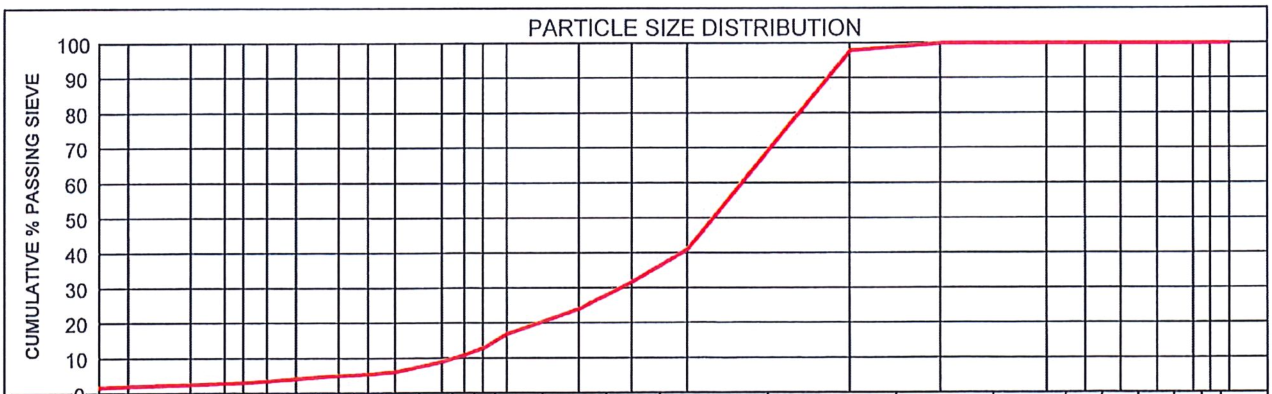
Sample No.	: A21-1420
Hole No.	: TP1
Depth	: 200-1900
Liquid Limit (%)	: 20
Plasticity Index	: 6
Linear Shrinkage (%)	: 3.0
PI of Whole Sample	: 2
P.R.A. Classification	: A-1-b(0)
Unified Soil Classificati:	SM-SC
Activity	: 1.00
Heave Classification	: LOW
Grading Modulus	: 1.44
Percentage (<0.002)	: 2.0
Moisture Content (%)	: 5.0

Material Description : SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	2.8	8.1	87.0	2.0	SAND
Astm	2.8	14.0	83.1	0.0	SAND
British Standard	2.0	10.9	85.0	2.0	SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	2	2	3	3	3	3	4	5	5	6	9	11	13	17	24	32	41	98	100	100	100	100	100	100	100	100

JENN	CLAY	SILT		SAND			GRAVEL			
ASTM	CLAY	SILT		FINE SAND	MEDIUM SAND		COARSE SAND	GRAVEL		
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Replacement of test report dated 3.06.2021

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory / Martinus Schwartz/Lizette Breiting

SGS MATROLAB

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a SANAS Accredited Testing Laboratory, No. T0025

sanas Testing Laboratory T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

TEST RESULTS

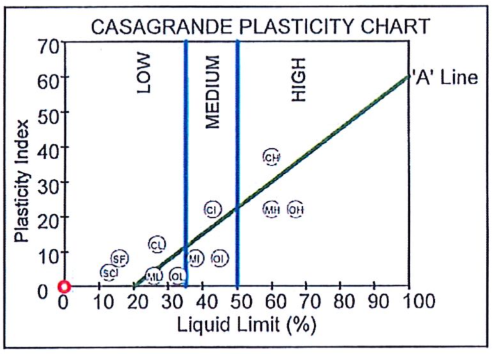
M.J VAN DER WALT	Project	: PTN 129 Doornhoek - V21/026
	Your Ref	:
	Our Ref	: PL/38776
Attention: Mr M.J van der Walt	Date Reported	: 03.06.2021

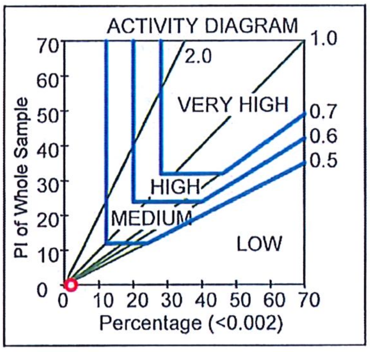
FOUNDATION INDICATOR (ASTM: D422)

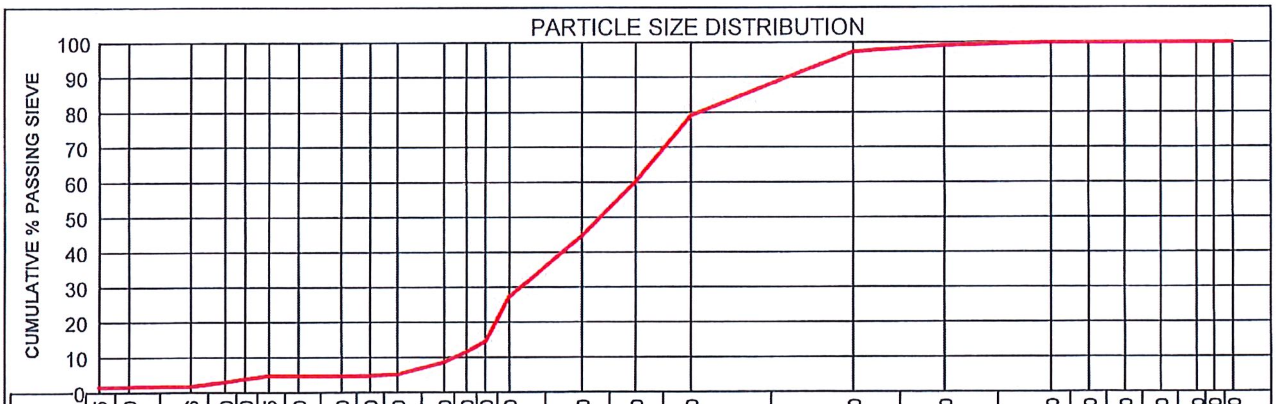
Sample No.	: A21/1421
Hole No.	: TP4
Depth	: 100-1200
Liquid Limit (%)	: -
Plasticity Index	: NP
Linear Shrinkage (%)	: 0.0
PI of Whole Sample	: 0
P.R.A. Classification	: A-2-4(0)
Unified Soil Classificati:	SC
Activity	: 0.00
Heave Classification	: LOW
Grading Modulus	: 0.97
Percentage (<0.002)	: 2.0
Moisture Content (%)	: 3.1

Material Description : SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	3.0	8.6	85.8	2.6	SAND
Astm	3.0	24.2	71.9	0.9	SILTY SAND
British Standard	1.6	13.0	82.8	2.6	SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	2	2	2	3	4	5	5	5	5	5	9	12	15	27	45	60	79	97	99	100	100	100	100	100	100	100

JENN	CLAY	SILT	SAND	GRAVEL

ASTM	CLAY	SILT	FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL

BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Martinus Schwartz/Lizette Breiting

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SGS MATROLAB

CONSOLIDATION TESTS: COLLAPSE POTENTIAL

BS 1377 Part 5

Client : M.J. VAN DER WALT **Project :** PTN 129 DOORNHOEK - V21/026 **Job no :** 23344

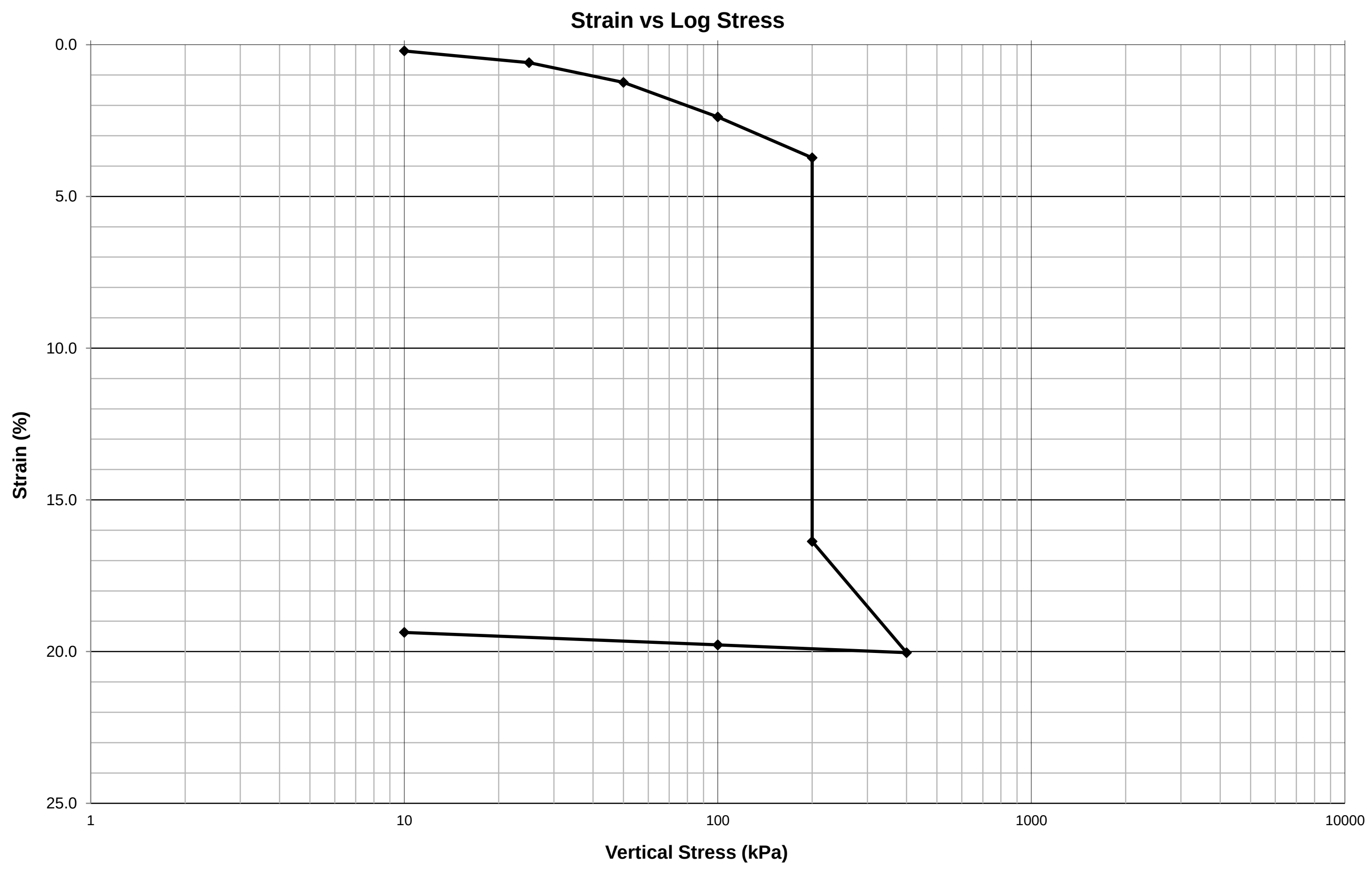
Sample no : TP 2 **Depth (m) :** 0.6 **Date :** 26/05/2021

Lab no : G21-0263

Sample Parameters		Unit	Value	Remarks	Test Remarks
Moisture Content	Before Test	%	5.0	Complete test specimen	Undisturbed sample
	After Test	%	16.8	Complete test specimen	Collapse Potential : 13.14%
Dry Density		Kg/m³	1467		
Void Ratio		-	0.814		
Degree of Saturation		%	16.5		
Initial Specimen Height		mm	20.0		
Relative Density (SG)		-	2.660	Determined	Soaked @200kPa

Test Parameters

Vertical Stress	kPa	10	25	50	100	200	200	400	100	10				
Time Elapsed	hr	1	1	1	1	1	24	1	1	1				
H_{100}	mm	19.959	19.881	19.752	19.524	19.255	16.726	15.993	16.044	16.126				
Strain	%	0.206	0.594	1.239	2.382	3.725	16.372	20.035	19.778	19.369				
Void Ratio	-	0.810	0.803	0.791	0.770	0.746	0.517	0.450	0.455	0.462				
Mv (1/Mpa)	-	-	0.2588	0.2598	0.2313	0.1376	-	0.219	0.0107	0.0566				



SGS MATROLAB

CONSOLIDATION TESTS: COLLAPSE POTENTIAL

BS 1377 Part 5

Client : M.J. VAN DER WALT **Project :** PTN 129 DOORNHOEK - V21/026 **Job no :** 23344

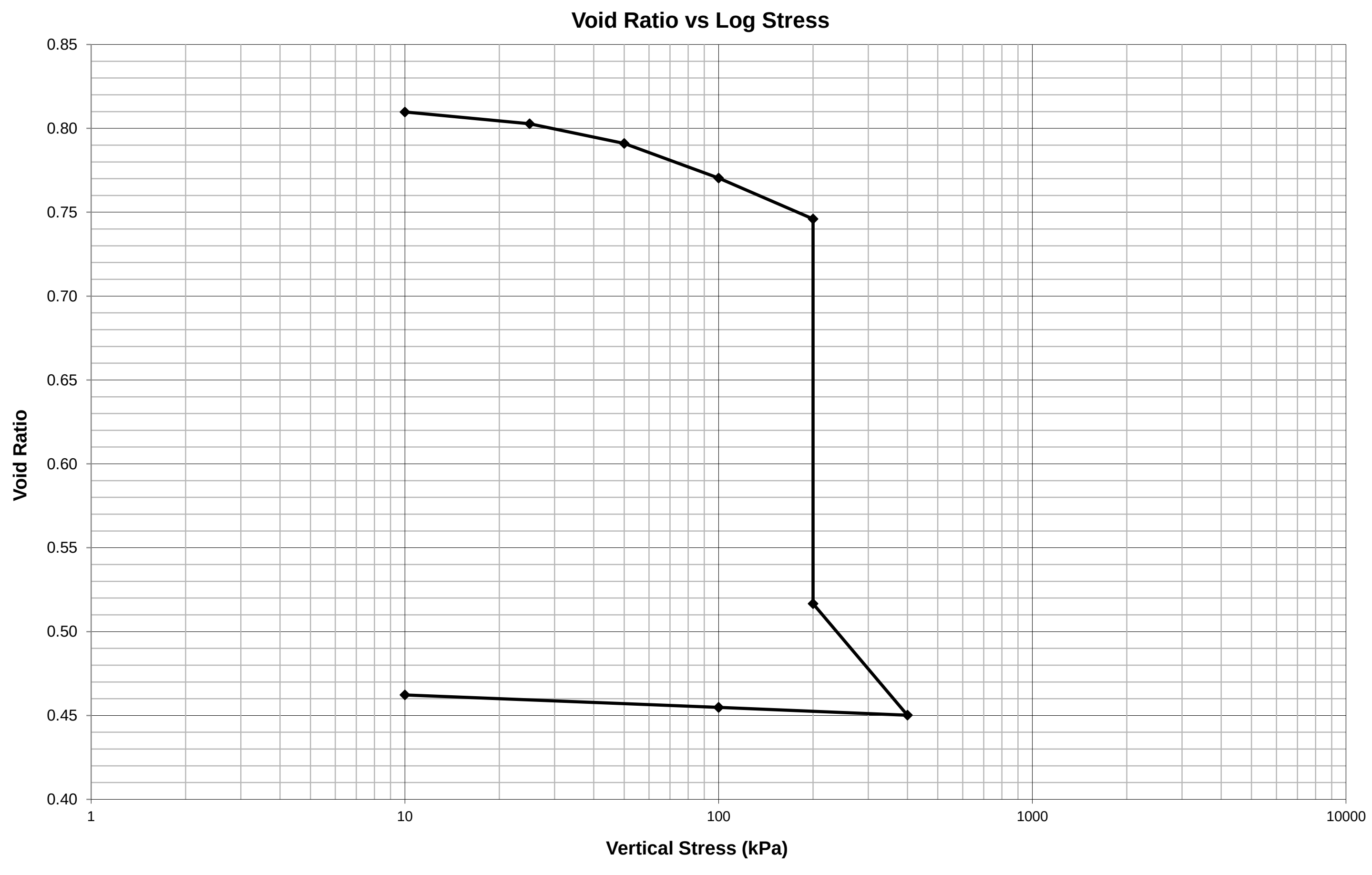
Sample no : TP 2 **Depth (m) :** 0.6 **Date :** 26/05/2021

Lab no : G21-0263

Sample Parameters		Unit	Value	Remarks	Test Remarks	
Moisture Content	Before Test	%	5.0	Complete test specimen	Undisturbed sample	
	After Test	%	16.8	Complete test specimen	Collapse Potential:	13.14%
Dry Density		Kg/m³	1467			
Void Ratio		-	0.814			
Degree of Saturation		%	16.5			
Initial Specimen Height		mm	20.0			
Relative Density (SG)		-	2.660	Determined	Soaked @200kPa	

Test Parameters

Vertical Stress	kPa	10	25	50	100	200	200	400	100	10				
Time Elapsed	hr	1	1	1	1	1	24	1	1	1				
H_{100}	mm	19.959	19.881	19.752	19.524	19.255	16.726	15.993	16.044	16.126				
Strain	%	0.206	0.594	1.239	2.382	3.725	16.372	20.035	19.778	19.369				
Void Ratio	-	0.810	0.803	0.791	0.770	0.746	0.517	0.450	0.455	0.462				
Mv (1/Mpa)	-	-	0.2588	0.2598	0.2313	0.1376	-	0.219	0.0107	0.0566				



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