DE HEUS INDUSTRIAL DEVELOPMENT

Portion 15 of Portion 1 of the Farm Bultfontyn
Middelburg, EC
Geotechnical Investigation Report

SOUTHERN GEOTECHNICAL ENGINEERING

Southern Geotechnical Engineering

July 2021

TITLE: **PROPOSED INDUSTRIAL DEVELOPMENT FOR DE HEUS PORTION 15 OF PORTION 1 OF FARM BULTFONTYN MIDDELBURG, EC**

Geotechnical Investigation Report

CLIENT: **DE HEUS (PTY) LTD.**

P.O. Box 663
Mossel Bay
6500

PREPARED BY: **Southern Geotechnical Engineering**

P.O. Box 1687
Brooklyn Square
0075

DATE: July 2021

REFERENCE NUMBER: 2037/01

PROJECT TEAM:

Fieldwork & report: Pieter Oosthuizen Pr. Eng.
Geotechnical Engineer

STATUS: Final

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1. INTRODUCTION AND TERMS OF REFERENCE

Southern Geotechnical Engineering (SGE) was appointed by MDCC (Pty) Ltd, acting on behalf of De Heus (Pty) Ltd, to undertake a geotechnical investigation for the proposed industrial development to be situated on Portion 15 of Portion 1 of the Farm Bultfontyn, situated just outside of Middelburg in the Eastern Cape Province.

The following was received via email correspondence and consulted during the geotechnical investigation and the preparation of this report:

- "***Geotechnical Engineering Services – Project Specification***" prepared by MDCC.
- "***Site Layout Option B1f***"; Drawing number 2000 Rev 3W prepared by MDCC.
- "***Land Use Plan Layout***"; Drawing number 4669/2003 prepared by MDCC.
- "***Locality Plan***"; Drawing number 4669/2004 prepared by MDCC.

2. THE SITE AND PROPOSED DEVELOPMENT

The site of the proposed industrial development is situated approximately 3.8 km south west of the town of Middelburg and just off to the south of National Road N10.

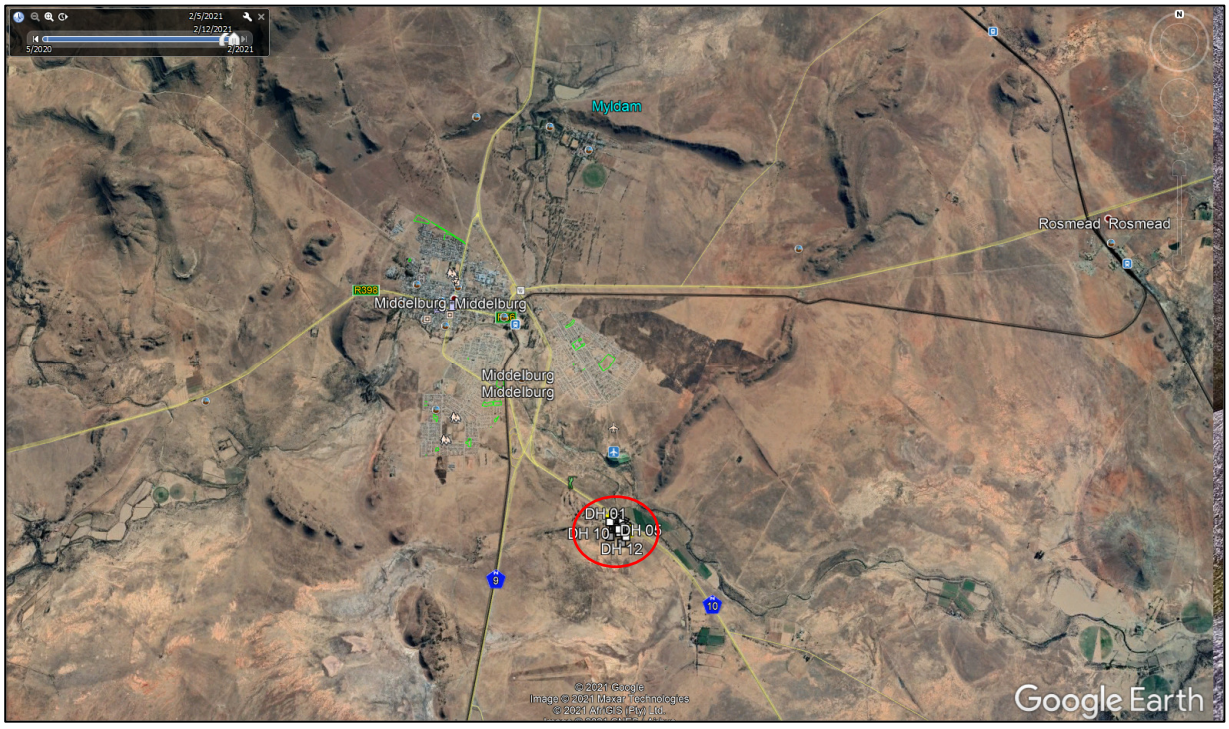


Figure 1: Location of site area (red circle).

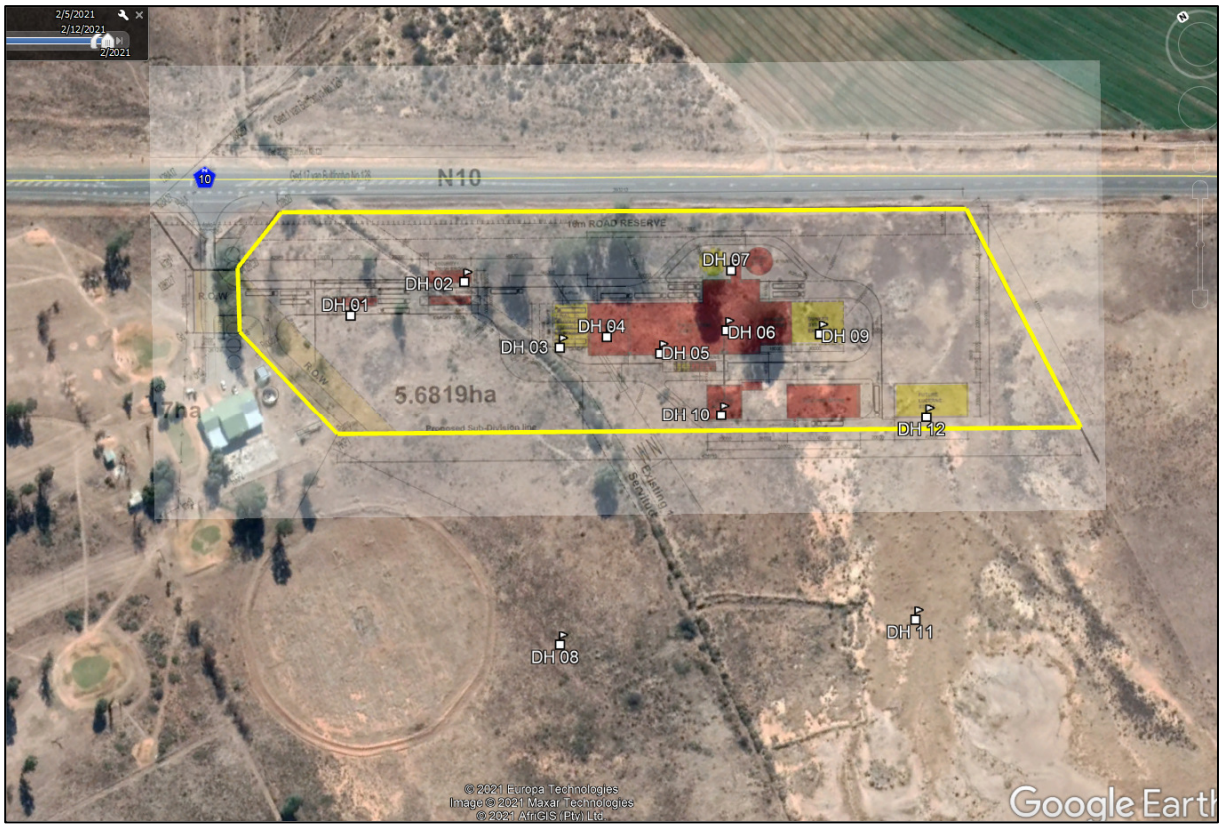


Figure 2: Aerial view of site area also indicating approximate test pit positions.

The site area is relatively flat and currently covered by a green field grass covering following recent rains (See Photograph 1 below). A prominent linear drainage feature cuts across the site area from north to south (apparently to be backfilled prior to development). A few tall eucalyptus and other trees flank the north eastern (along Road N10), and north western peripheries of the site area. Remnants of a partially completed cricket pitch is situated to the south west of the study area. The remainder of the study area is almost devoid of structural development, apart from a few derelict vehicle ramps, broken up concrete slabs, backfilled excavations, and disturbed surfaces.

A currently dry and flat sandy '*erosion'* area with little to no vegetation is located south and south-east of the study area. At the time of the investigation, the '*erosion*' area was covered in a loose, sandy soil which is sparsely vegetated.

Photograph 1: General view of site area currently mostly covered by green field grass. Note large trees in background closest to golf course and Road N10.

The proposed development will comprise conventional road and parking area construction with a dedicated pavement design. Structures will comprise conventional shallow reinforced concrete footings for buildings, except for the Bunker Storage System which will be founded around 4.0m below current NGL levels. The development will comprise the following separate units:

- Access Roads and parking areas,
- Truck Wash Bay,
- Weigh Bridge,
- Final product store,
- Production area,
- Overhead bulk bins,
- Bunker system,
- Lucerne Milling building and Store.

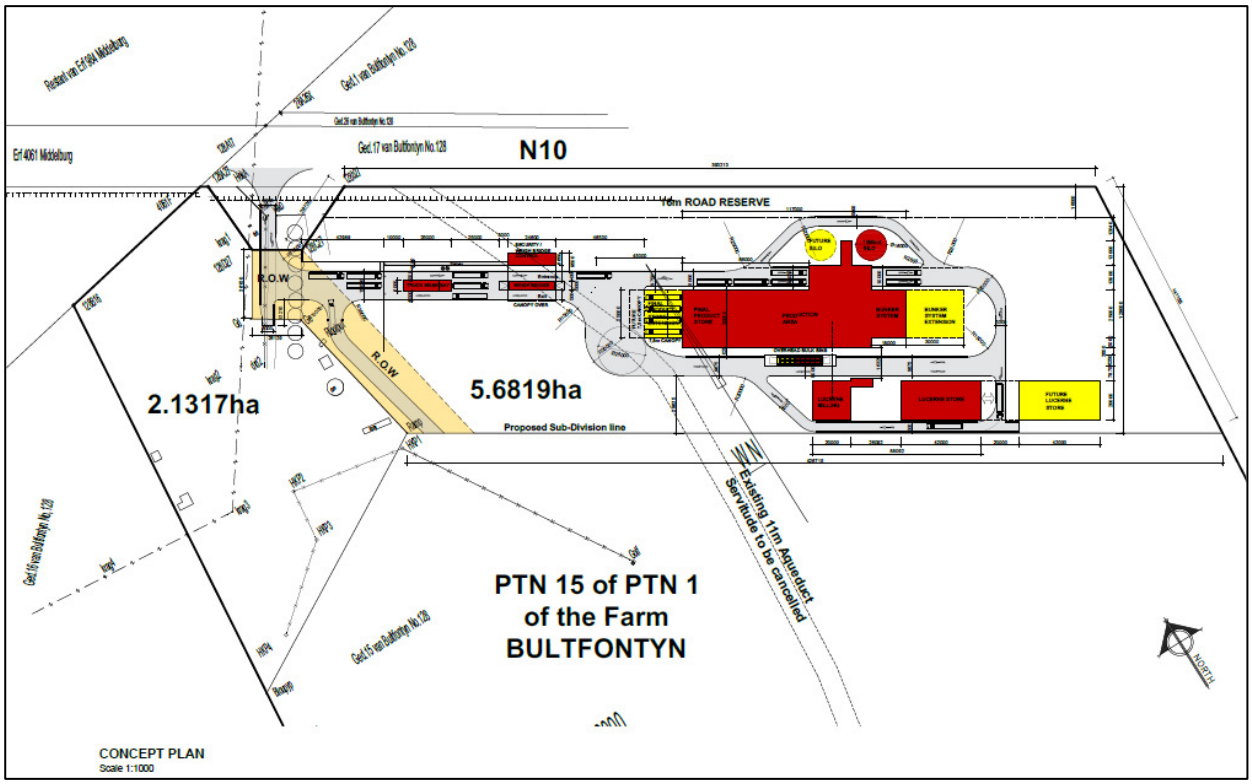


Figure 3: Proposed site layout plan.

3. GEOTECHNICAL FIELDWORK

Fieldwork was undertaken on 10 February 2021 and consisted of the excavation, profiling and sampling of 12 test pits located across the site development area. Ten test pits were positioned within the footprint of the plant areas whilst two test pits were excavated to the south of the plant area. All the test pit positions were noted with a handheld GPS unit and the positions are included in Appendix C.

The 12 test pits were named *DH01 to DH12.* All the test pits except DH09 were excavated with a TLB to a maximum depth of around 2.8m or until refusal conditions were encountered. Test pit DH09 positioned within the footprint of the bunker were advanced to a depth of 4.0m below surrounding ground level. All the test pits were backfilled with the excavated spoils and loosely compacted with the bucket of the TLB.

The test pits were profiled by a geotechnical engineer and samples were collected and submitted for laboratory testing at LTG Civil Services in Pretoria. Laboratory testing comprised the following:

- Foundation Indicator: Sieve and hydrometer analyses plus Atterberg limits,
- Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) determination,
- California Bearing Ratio (CBR) testing.

The detailed soil profiles are included in Appendix A whilst the laboratory test results are included in Appendix B. The test pit excavations were also photographed (see Appendix D).

4. RESULTS OF THE INVESTIGATION

4.1. Published geology of the area

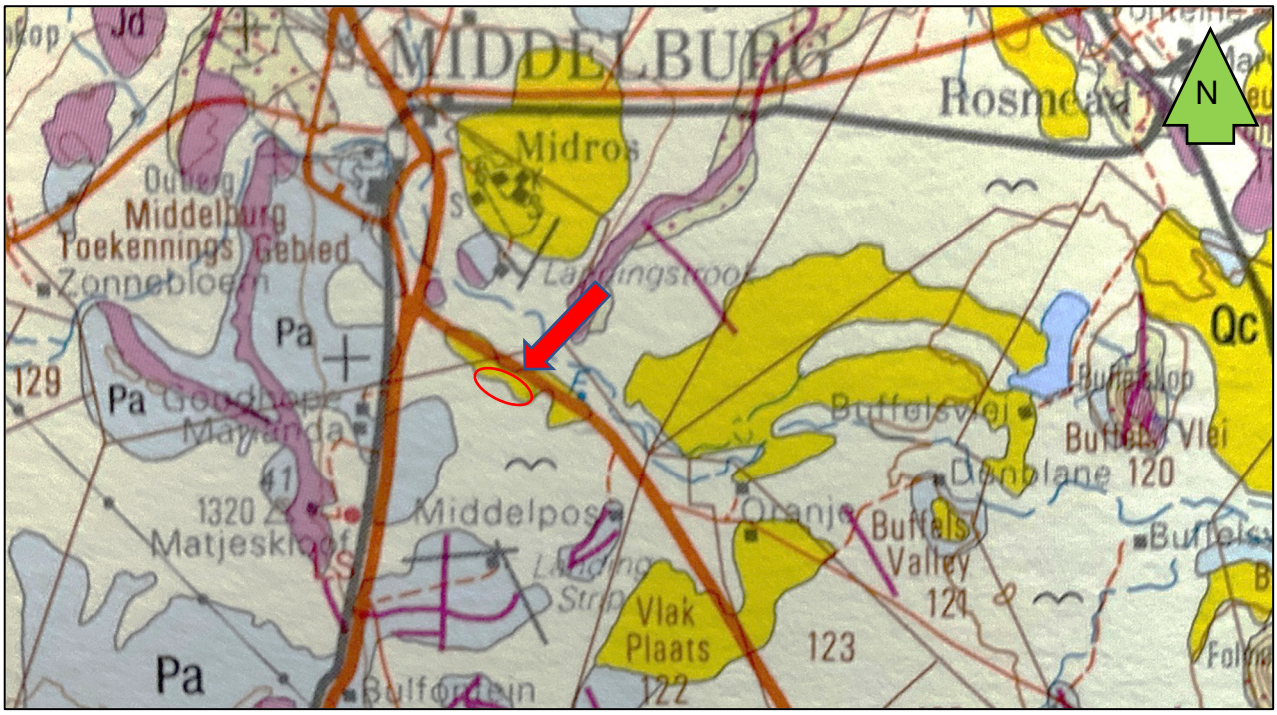


Figure 4: Extract from the 1:25 000 scale geological map 3124 Middelburg.

According to the 1:250 000 scale geological map 3124 Middelburg, the site is underlain by calcrete (symbol ***Qc*** in dark yellow), and alluvium and colluvium (symbol ⌒⌒ in light yellow). Other geological formations around the site but not shown to directly underly the site include ***Jd*** in purple (intrusive dolerite formations), and ***Pa*** in light blue (red, purple and grey mudstone with subordinate sandstone).

The site is situated in a dry region with a Weinert N-value exceeding a value of 5 suggesting mechanical weathering processes will be dominant (as opposed to chemical weathering.

4.2. Near-surface soil conditions

The following Table summarises the different soil layers that were encountered within the twelve test pits.

Table 1: Summary of geological conditions encountered within the test pits.

TP No.	Depth to base of layer (m below current ground level)					Final depth / termination conditions
	Topsoil with plant roots	***Colluvium***	***Pedogenic (calcrete)***	***Lacustrine***	***Alluvium***	
DH 01	0.3	-	2.8 +	-	-	2.8m stopped / not yet refusal
DH 02	0.1	-	1.0 1.5 2.8 +	-	1.1 1.6	2.8m stopped / not yet refusal
DH 03	0.3	1.8	2.8 +	-	-	2.8m stopped / not yet refusal
DH 04	0.3	2.8 +	-	-	-	2.8m stopped / not yet refusal
DH 05	0.4	-		2.8 +	-	2.8m stopped / not yet refusal
DH 06	0.3	2.5	-	-	2.8 +	2.8m stopped / not yet refusal
DH 07	0.3	2.8 +	-	-	-	2.8m stopped / not yet refusal
DH 08	0.4	2.8 +	-	-	-	2.8m stopped / not yet refusal
DH 09	0.4	3.0 +	-	-	4.0 +	4.0m stopped / not yet refusal
DH 10	0.4	-	2.8 +	-	-	2.8m stopped / not yet refusal
DH 11	0.4	-	-	2.8 +	-	2.8m stopped /

TP No.	Depth to base of layer (m below current ground level)					Final depth / termination conditions
	Topsoil with plant roots	***Colluvium***	***Pedogenic (calcrete)***	***Lacustrine***	***Alluvium***	
						not yet refusal
DH 12	0.3	-	-	2.8 +	-	2.8m stopped / not yet refusal

NYR *= Not yet refusal conditions*; ***NE*** *= Not encountered.*

General notes:

- No groundwater was encountered within any of the test pit excavations.
- All test pit excavations were assessed as inherently stable.

The site is underlain by a relatively uniform soil profile. All test pits were stopped within transported soils (pedogenic, colluvium and alluvium). None of the test pits encountered residual soils or bedrock formations. The following soil layers were identified within the test pit excavations:

TOPSOIL WITH PLANT ROOTS:

Encountered at all 12 test pits as a thinnish surface layer.

Layer thickness: Min. 0.1m; Average 0.33m; Max. 0.4m.

Typically described as: *Dry to slightly moist, pale orange brown, loose to medium dense, cracked, slightly voided, clayey SAND containing fine plant and grass roots.*

COLLUVIUM:

Encountered at 6 of the 12 test pits as a relatively thick, near-surface soil layer.

Layer thickness: Min. 1.5m; Average 2.3m; Max. 2.6m.

Typically described as: *Dry to slightly moist, pale light orange to pinkish brown slightly blotched off white, loose, voided, fine, slightly silty fine sand with occasional soft calcareous nodules and gravels.*

PEDOGENIC (CALCRETE):

Encountered at 4 of the 12 test pits as a relatively thick, near-surface soil layer.

Layer thickness: Min. 1.0m; Average 2.2m; Max. More than 2.5m.

Typically described as: *Dry to slightly moist, pale light orange to reddish brown blotched off white, medium dense to dense with depth, soft, calcareous gravels and small nodules in a fine sandy matrix.*

LACUSTRINE DEPOSITS:

Coinciding with the '*erosion*' areas with a sparse vegetation cover.
Encountered at 3 of the 12 test pits from surface (DH 05, DH 11 and DH 12).
Layer thickness extends from surface to maximum depth reach of TLB and deeper.

Typically described as: *Dry to slightly moist, pale light orange brown, slightly blotched off white, `firm to `stiff, silty/sandy clay with some soft calcareous nodules and gravels;*

ALLUVIUM:

Encountered at 2 of the 12 test pits at depth (bases of Test Pits DH 06 and DH 09), underlying colluvium and pedogenic soils. At Test pit DH 02 alluvium was encountered as two thin 'lenses' of granular material.

Min. depth to 1.1m (thin 'lens'); Max. depth to 4.0m.
Typically encountered as either loosely packed rounded pebbles and cobbles in a coarse, clean sandy matrix (DH02 and DH06), or a clean sand (DH 09).

Photographs 2 and 3: Example of weakly developed pedogenic materials.

Photographs 4 and 5: Example of colluvium soils.

Photographs 6: Example of alluvium encountered at some test pits at depth.

4.3. Laboratory test results

4.3.1. Foundation Indicator tests:

The results of foundation indicator testing are summarised in the following table:

Table 2: Summary of foundation indicator test results.

TP No.	Sample depth (mbgl)	Description	Plasticity Index (%)	Liquid Limit	Grading modulus	% clay	Potential expansiveness
DH01	0.3 – 2.8	Clayey gravel	9	31	2.5	2.4	Low
DH03	0.3 – 1.8	Silty sand	3	22	1.1	7.8	Low
DH05	0.5 – 1.5	Inorganic clay	20	44	0.3	26.8	Medium
DH08	0.5 – 1.5	Silty/clayey sand	5	26	1.0	10.3	Low
DH09	1.8 – 4.0	Silty/clayey sand	6	22	1.3	7.3	Low
DH11	1.0 – 1.5	Inorganic clay	26	48	0.2	26.36	Medium/high
DH12	1.0 – 2.8	Inorganic clay	13	33	0.6	18.2	Low/medium

% clay defined as material smaller than 0.002mm.

All colluvium and pedogenic soils are relatively coarse grained with low PI and LL values translating into a *LOW* potential expansiveness. Lacustrine soils are much finer-grained with a higher percentage clayey sized particles, higher PI and LL values and were generally rated as *MEDIUM* expansive (*Medium* to *High* in one case).

Although not sampled and tested, alluvium deposits will similarly be LOW in potential expansiveness.

4.3.2. Strength and compaction tests:

The results of strength and compaction testing are summarised in the following table:

Table 3: Summary of strength and compaction test results.

TP No.	Sample depth *(mbgl)*	Material origin	Plasticity Index *(%)*	Grading modulus	MDD *(kg/m3)*	OMC *(%)*	COLTO
DH01	0.3 – 2.8	Pedogenic	9	2.5	1862	10.2	G6
DH03	0.3 – 1.8	Colluvium	3	1.1	1978	11.6	G7
DH05	0.5 – 1.5	Lacustrine	20	0.3	1728	11.9	< G9
DH09	1.8 – 4.0	Colluvium	6	1.3	1971	7.9	G8
DH12	1.0 – 2.8	Lacustrine	13	0.6	1889	13.6	< G9

Pedogenic soils with high percentages of calcrete gravels and nodules can generally be expected to comply with G6 to G7 quality. Similarly, colluvium soils containing less calcrete materials are generally expected to comply with G7 to G8 quality. Lacustrine deposits are much finer grained with more clayey sized particles and do NOT comply with the requirements of a G9 class material.

5. GEOTECHNICAL EVALUATION

5.1. Groundwater conditions

No groundwater was encountered during the investigation. As such the depth to the permanent ground water level is unknown. However, it is considered unlikely that any groundwater will be encountered to a minimum depth of say 3.0m to 4.0m below current ground levels. Test pit excavation DH 09 also did not encounter groundwater in the upper 4.0m of the soil profile.

The '*erosion*' areas in and around the site area will temporarily hold surface water following rainfall events. This standing water is however expected to rapidly drain into the subsoils because of the relatively high permeability of the near surface, sandy to clayey soils.

Generally, the relatively high permeability of the sandy to slightly clayey, near-surface soils will assist in minimising surface water run-off following rainfall events.

5.2. Excavation conditions

Based on the investigation conducted with a TLB, *soft* excavation condition can generally be expected to an average depth of at least 2.8m to 3.0m below current ground levels. ('Soft' excavation conditions as used here implying readily excavatable by hand, TLB and/or excavators say up to 20 ton). Test pit DH09 within the footprint of the bunker system was advanced to a depth of 4.0m without much difficulty.

Although only reached at a few test pits and near the maximum depth reach of the TLB, it is anticipated that alluvium materials (possibly mixture of cobbles, boulders, gravels and/or clean sands), must generally be expected across the site area at depths deeper than around 2.8m to 3.0m below current ground levels. Excavation conditions into these alluvium materials were not definitively quantified during this investigation.

5.3. Stability of excavations

The vertical walls of the test pit excavations were stable for the short period that it stood open and unsupported. However, during the construction phase, only very shallow excavations of say less than 1.0m deep can be cut vertically and left unsupported for some time. Deeper excavations must be battered sufficiently to retain long term stability to complete construction activities. The illustrative 5m deep excavation cut at a slope of 1:1 (as can be seen in Figure 5 below), realises a factor of safety of 1.3 and a probability of failure around 7%.

Temporary and permanent excavations of say deeper than 1.5m will most probably require some form of lateral support such as conventional or dry-stacked concrete block retaining walls, mesh reinforced shotcrete, soil nails or even post-tensioned anchors for very deep excavations.

5.4. Expansive soils

All soils outside of the '*erosion*' areas (colluvium, pedogenic and alluvium), can be expected to be ***Low*** to at worst ***Medium*** in potential expansiveness. Lacustrine soils within the footprint of the '*erosion*' areas are ***Medium*** to ***Highly*** expansive.

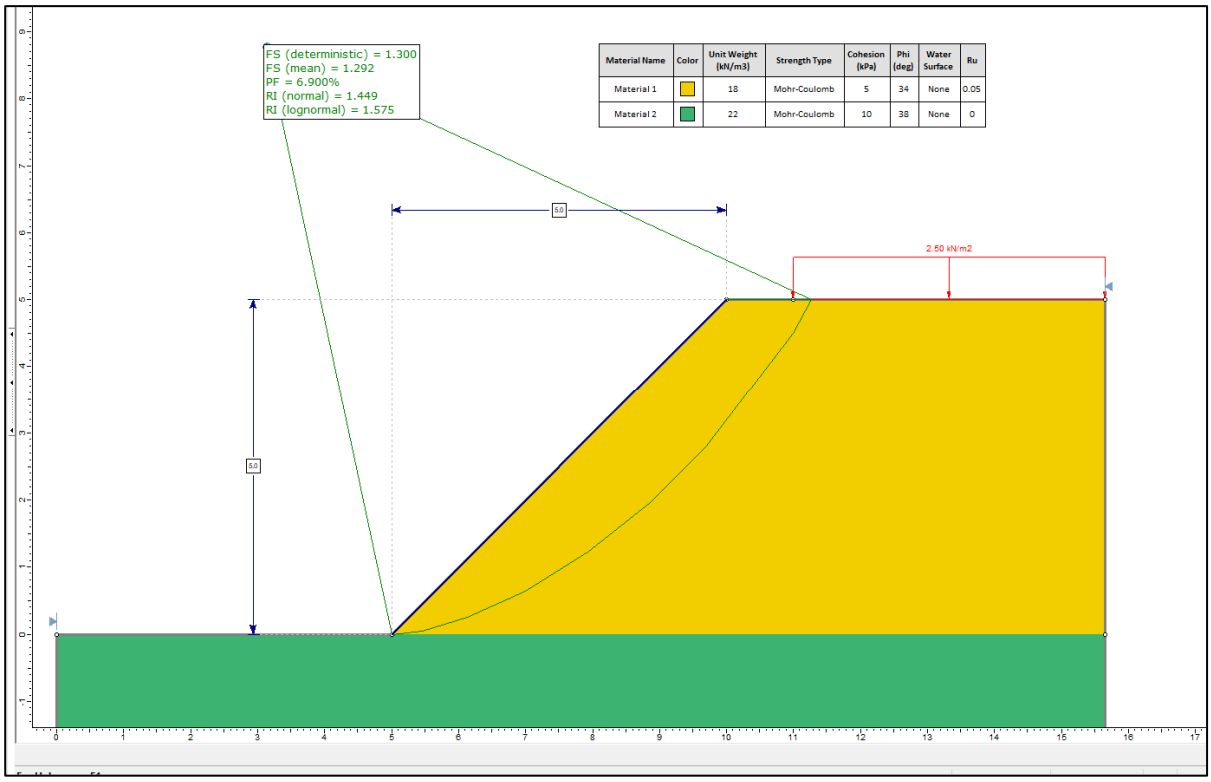


Figure 5: Illustrative stability of a 5m deep excavation cut at a 1:1 batter.

5.5. Collapsible / compressible soils

The site area outside of the *'erosion'* area footprints is mantled by a thick surface layer of transported colluvium and weakly developed pedogenic soils with an apparent loose to medium dense consistency. These soils display a voided soil structure and is considered collapsible (*the in-situ, sandy soils are too brittle / fragile to obtain an undisturbed sample needed to undertake collapse potential tests*).

5.6. In-situ soils to be used as construction material

Lacustrine soils within the '*erosion*' areas must NOT be used as a construction material and must be discarded / removed to spoil when excavated. Colluvium soils can be used as general (not structural) fill, and within lower selected subgrade layers. Pedogenic soils complying with G6 to G7 quality will be suitable as structural fill and within both lower and upper selected subgrade layers supporting roads and parking areas surfacing.

Due to the apparently haphazard spatial distribution across the site area, it may be difficult to separate colluvium soils (containing sparse or no calcrete), from pedogenic soils (containing appreciable volumes of calcrete material).

6. RECOMMENDATIONS

6.1. Initial considerations

6.1.1. Piling of structures are NOT recommended

Structures are expected to be moderately light and not overly settlement sensitive. Furthermore, there is a high probability that the site is at least partially (or totally) underlain by alluvium formations at depth, comprising cobbles, small boulders and clean sands, typically as horizontal 'lenses' inside the coarser materials. All these materials will serve to hamper auger excavation operations for the installation of conventional piles (such as Auger-Cast-In-Situ or Continuous Flight Auger type piles). Bridging these alluvium materials by specialised piling techniques and equipment will be prohibitively expensive.

6.1.2. Collapsible soils treated by High Energy Impact Compaction (HEIC)

The site area, outside of the '*erosion*' areas, is mantled by thick layers of potentially collapsible soils (colluvium and weakly developed pedogenic soils). This mode of deformation can be readily addressed/rectified by saturation (not just moistenening) of these potentially collapsible soils, followed by conventional compaction operations. Structures can be founded within this compacted stratum at a slightly reduced/adjusted soil allowable bearing capacity which will result in acceptable total and differential movements of the structure.

Considering the size and layout of the site, remedial measures to 'pre-collapse' the potentially collapsible soils mantling the site will most probably be best achieved by ***High Energy Impact Compaction (HEIC)*** of the entire site area prior to development (see recommendations that follow).

6.1.3. Highly expansive soils within '*erosion'* areas

Laboratory testing suggest that the '*erosion*' areas are underlain by highly expansive soils with a high plasticity and high percentage of clayey sized particles. It at all possible, structures must be located outside *'erosion'* areas to avoid large total and differential movements (large differential movements possible between structures situated on expansive lacustrine soils and collapsible colluvium soils).

The approximate extent of the 'erosion' areas is indicated in the drawing contained within Appendix C. However, due to the relatively wide spacing of test pits, the given delineation is just an indication. The actual delineation of the 'erosion' areas will have to be determined on site, preferably prior to the start of bulk earthworks.

6.2. Bulk earthworks

The following guidelines are given for the proposed ***HEIC*** operation in areas underlain by potentially collapsible soils:

- Remove the upper 100mm to 150mm thick surface layer of topsoil, vegetation and plant roots. This material can be temporarily stockpiled for later use in landscaping applications.

- Remove trees as required, including roots. The resulting 'craters' must be backfilled with excavated soils (obtained from other excavations on site), in maximum 300mm thick layers, with each layer compacted to a dense state with a 'Wacker' or pedestrian roller.

- The entire footprint area of the planned development must be impact rolled with a 25kJ, 3-sided Impact Roller. The number of passes must be determined to ensure minimal additional settlement with successive passes of the roller. The compacted soil must be at a soil moisture content enabling effective compaction. The optimum moisture content and number of passes must be confirmed by the contractor supplying the impact roller.

- Once the bulk compaction operation is completed, level building platforms can be constructed by means of cut to fill operations. As the site area is relatively flat, only moderate cut depths and fill heights are foreseen. Fill of at least G7 quality (colluvium

and pedogenic soils obtained from other excavations on site), must be placed in maximum 150mm thick layers (conventional smooth drum roller), or 500mm (impact roller), with each layer compacted to a minimum of 95% of Maximum Dry Density at OMC +/- 2%. Compaction of layerworks can be undertaken with either a minimum 15 ton smooth -drum roller operating in vibratory mode, or alternatively, a 15kJ, 5-sided impact roller (see suggested maximum layer thicknesses for each above).

6.3. Founding of structures

6.3.1. '*Erosion*' areas:

If possible, it is recommended that no structures be positioned within the '*erosion*' areas. '*Erosion*' areas are situated within the south-eastern corner of the study area and the general area around Test Pits DH11 and DH12. If unavoidable, structures to be placed within the *'erosion'* areas must be designed for H2 conditions implying estimated total heave between 15mm and 30mm. The most appropriate foundation system within the *'erosion'* areas will probably be a stiffened of cellular raft and/or soil raft type foundation.

6.3.2. Areas outside '*erosion*' area:

Assuming that the HEIC operation was successfully completed, the following generic guidelines are given for the founding of structures within areas underlain by collapsible soils:

- Excavate conventional spread type footing foundations (pad and strip) from top of platform level, sized considering an allowable bearing capacity of 175kPa. Foundation excavations must be at least 150mm deeper than underside of concrete foundation units.

- This -150mm level must be saturated (not just moistened), left to dry out to a workable consistency, and compacted to a minimum density of 95% of Maximum Dry Density at OMC +/-2%.

- The 150mm deep overcut must be backfilled in one layer with a minimum G5 material obtained from outside sources. This material must be compacted to at least 98% of Maximum Dry Density.

- Foundations must be constructed with at least nominal steel reinforcement and reinforcement in masonry around and below openings (doors and windows).

6.4. Founding of surface beds and floor slabs

Surface beds and floor slabs must be directly underlain by a minimum 150mm thick layer of G5 material, compacted to at least a density of 98% of Maximum Dry Density. The G5 layer can be founded directly on top of the compacted platform level (see bulk earthworks section above). If this surface was damaged / loosened during the construction phase, it must be re-ripped and compacted to 95% of MDD prior to placing the G5 layer. If it is required to raise the level of surface beds and floor slabs, the infill between top of (compacted) platform level and underside of G5 layer must be constructed with a minimum G7 material, placed and compacted in maximum 150mm thick layers.

6.5. Founding of roads / parking areas

6.5.1. Within footprint of building platform

The compacted platform level can serve as the upper selected subgrade layer. As such, additional structural road layerworks will comprise a C4 cement stabilised subbase layer and a G1 crushed stone base course layer with an asphalt surfacing. Alternatively, the C4 layer can be used to directly support interlocking concrete blocks, contained between kerbs and/or other non-movable structures. The thickness of asphalt and concrete blocks must be based on an analysis of the type, speed and frequency of vehicles that will frequent these roads.

6.5.2. Outside footprint of building platform

The impact rolled subgrade can serve as roadbed preparation. As such, additional structural road layerworks will comprise an upper selected subgrade layer (minimum G7 obtained from other excavations on site), overlain by a C4 cement stabilised subbase layer and lastly a G1 crushed stone base course layer with an asphalt surfacing. Alternatively, the C4 layer can be used to directly support interlocking concrete blocks, contained between kerbs and/or other non-movable structures. The thickness of asphalt and concrete blocks must be based on an analysis of the type, speed and frequency of

vehicles that will frequent these roads.

7. CONCLUDING REMARKS

A geotechnical investigation of this nature must by necessity has to rely on some interpolation between relatively widely spaced test positions and limited laboratory testing. As such it is possible that actual geological/geotechnical conditions encountered on site during the construction phase may be at variance to those described and assumed in this report. Should this situation occur, this office must be informed immediately for a re-assessment of our conclusions and recommendations.

APPENDIX A

SOIL PROFILES

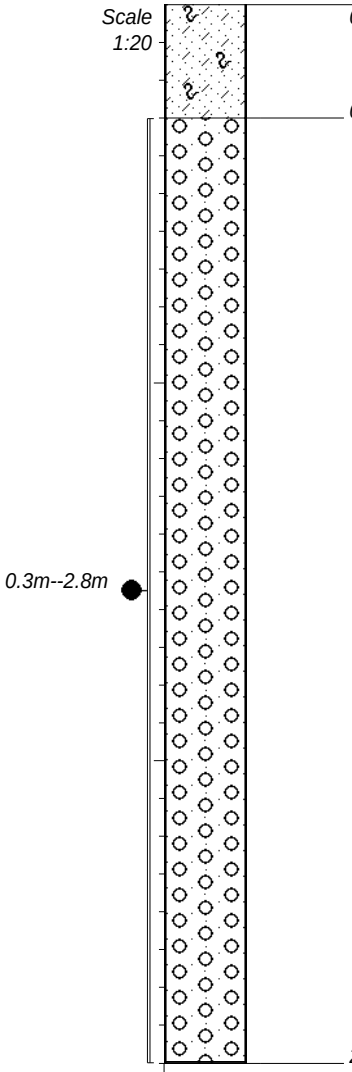
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 01
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Dry to slightly moist, pale brown, loose to medium dense, slightly cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.30 Dry, pale light orange to reddish brown blotched off white, medium dense to dense with depth, soft, calcareous gravels and small nodules in a fine sandy matrix. Weakly developed transported pedogenic.

2.80

NOTES

1) Stopped at 2.8m deep; Near refusal conditions.
2) No water seepage encountered.
3) Disturbed bulk sample taken from 0,3m--2,8m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION : Vertical
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 34.5
Y-COORD : E25 01 56.5

HOLE No: DH 01

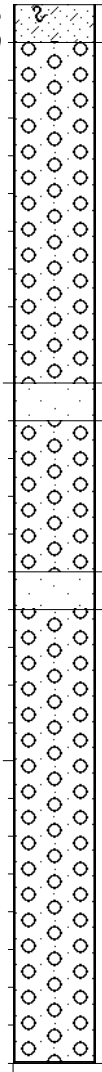
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 02
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00	Dry to slightly moist, pale brown, loose to medium dense, slightly cracked, slightly voided, clayey SAND containing roots; Topsoil.
0.10	Dry, pale light orange to reddish brown blotched off white, medium dense to dense with depth, soft, calcareous gravels and small nodules in a fine sandy matrix. Weakly developed transported pedogenic.
1.00	Dry, pale and light grey, rounded, plate-like, small pebbles in a minor sandy and gravely matrix. Overall consistency is loose; Alluvium.
1.10	Dry, pale light orange to reddish brown blotched off white, medium dense to dense with depth, soft, calcareous gravels and small nodules in a fine sandy matrix. Weakly developed transported pedogenic.
1.50	Dry, pale and light grey, rounded, plate-like, small pebbles in a minor sandy and gravely matrix. Overall consistency is loose; Alluvium.
1.60	Dry, pale light orange to reddish brown blotched off white, medium dense to dense with depth, soft, calcareous gravels and small nodules in a fine sandy matrix. Weakly developed transported pedogenic.
2.80	

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) No sample collected.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 35.1
Y-COORD : E25 01 59.0

HOLE No: DH 02

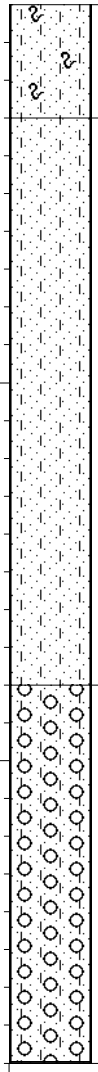
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 03
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Dry to slightly moist, pale light orange brown, very loose, voided, very fine, silty sand with plant roots; Topsoil.

0.30 Dry to slightly moist, pale light orange to pinkish brown slightly blotched off white, loose, voided, slightly silty fine sand with minor traces of soft calcareous nodules and gravels; Colluvium.

1.80 Dry to slightly moist, pale light orange to pinkish brown slightly blotched off white, medium dense, slightly silty fine sand with some soft calcareous nodules and gravels; Very weakly developed transported pedogenic.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) Disturbed bulk sample taken from 0,3m--1,8m.
4) Soft excavation conditions.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

ELEVATION :
X-COORD : S31 31 37.1
Y-COORD : E25 02 00.0

HOLE No: DH 03

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

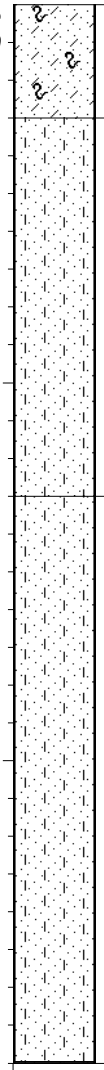
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 04
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Slightly moist, pale brown, loose to medium dense, slightly cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.30 Dry, pale light orange to pinkish brown slightly blotched off white, loose, voided, fine, slightly silty fine sand with minor traces of soft calcareous nodules and gravels; Colluvium.

1.30 Dry, pale light orange to pinkish brown slightly blotched off white, medium dense, slightly voided, slightly silty fine sand with minor traces of soft calcareous nodules and gravels; Colluvium.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) No sample collected.
4) Soft excavation conditions.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 37.4
Y-COORD : E25 02 01.0

HOLE No: DH 04

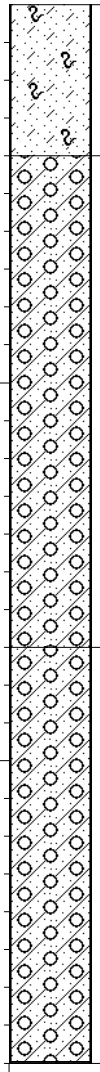
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 05
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Slightly moist, light orange brown, medium dense, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.40 Dry, pale light orange to pinkish brown slightly blotched off white, firm to stiff, clayey sand to sandy clay with some soft calcareous nodules and gravels; Lacustrine deposits.

1.70 Dry, pale light orange to pinkish brown slightly blotched off white, firm to stiff, clayey sand to sandy clay with some soft calcareous nodules and gravels; Lacustrine deposits.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) Disturbed bulk sample taken from 0,5m--1,5m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen
TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021
DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 38.2
Y-COORD : E25 02 01.8

HOLE No: DH 05

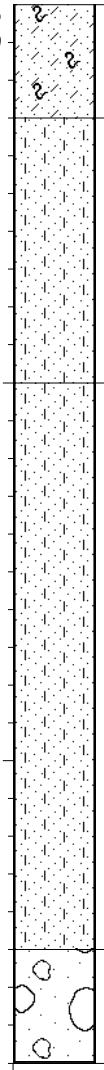
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 06
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Slightly moist, pale brown, loose to medium dense, slightly cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.30 Dry, pale light orange to pinkish brown slightly blotched off white, loose, voided, fine, slightly silty fine sand with traces of soft calcareous nodules and gravels; Colluvium.

1.00 Dry, pale light orange to pinkish brown slightly blotched off white, dense, voided, fine, slightly silty fine sand with traces of soft calcareous nodules and gravels; Colluvium.

2.50 Dry, pale and light grey, rounded, plate-like, pebbles and small rounded cobbles in a minor sandy and gravely matrix. Overall consistency is medium dense; Alluvium.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.

2) No water seepage encountered.

3) No sample collected.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 38.5
Y-COORD : E25 02 03.3

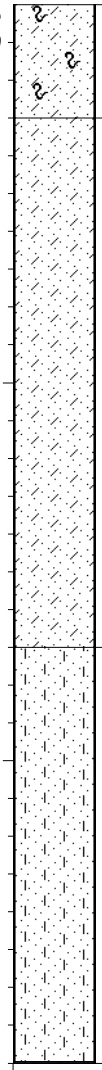
HOLE No: DH 06

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 07
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Dry to slightly moist, pale orange brown, loose, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.30 Dry, pale light orange to pinkish brown slightly blotched off white, dense, voided, clayey fine sand with traces of soft calcareous nodules and gravels; Colluvium.

1.70 Dry, pale orange brown slightly blotched off white, medium dense, voided, slightly silty fine sand with traces of soft calcareous nodules and gravels; Colluvium.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) No sample collected.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 37.6
Y-COORD : E25 02 04.1

HOLE No: DH 07

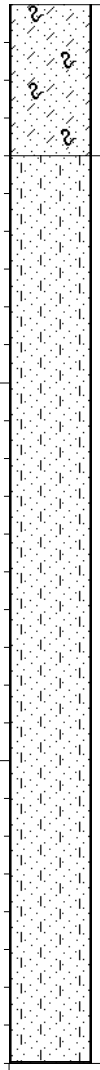
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 08
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.5m--1.5m

0.00 Slightly moist, light orange brown, medium dense, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.40 Dry to slightly moist, pale light orange brown slightly blotched off white, loose to medium dense, voided, silty fine sand with occasional soft calcareous nodules and gravels; Colluvium.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) Disturbed foundation indicator sample taken from 0,5m--1,5m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 41.8
Y-COORD : E25 01 56.5

HOLE No: DH 08

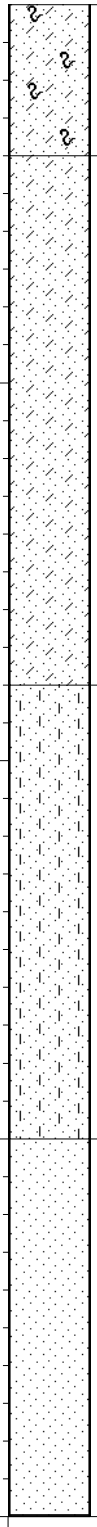
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 09
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Dry to slightly moist, pale orange brown, loose, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.40 Slightly moist, pale reddish brown, dense, voided, clayey fine sand with traces of soft calcareous nodules and gravels; Colluvium.

1.80 Slightly moist, pale orange brown slightly blotched off white, loose to medium dense with depth, voided, slightly silty fine sand with traces of soft calcareous nodules and gravels; Colluvium.

3.00 Slightly moist, pale orange brown, medium dense, fine clean sand; Alluvium.

4.00

NOTES

1) Stopped at 4.0m deep; Maximum depth reach. Not yet refusal.

2) No water seepage encountered.

3) Disturbed bulk sample taken from 1,8m--4,0m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 39.5
Y-COORD : E25 02 05.0

HOLE No: DH 09

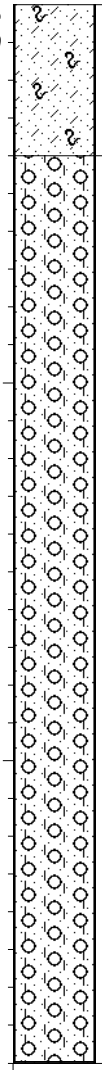
SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 10
Sheet 1 of 1

JOB NUMBER: 2037

Scale 1:20



0.00 Slightly moist, light orange brown, medium dense, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.40 Dry to slightly moist, pale light orange brown slightly blotched off white, loose to medium dense, voided, silty fine sand with soft calcareous nodules and gravels; Weakly developed transported pedogenic.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) No sample collected.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 39.8
Y-COORD : E25 02 02.2

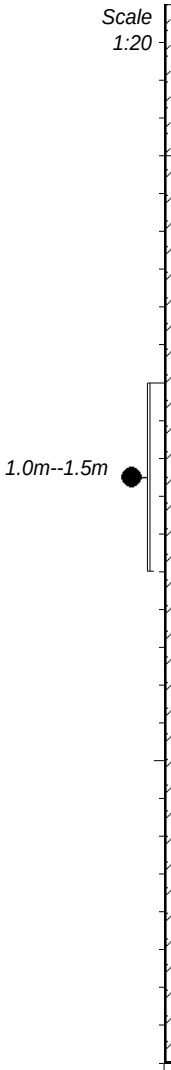
HOLE No: DH 10

SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 11
Sheet 1 of 1

JOB NUMBER: 2037



0.00 Slightly moist, light orange brown, medium dense, cracked, slightly voided, clayey SAND containing roots; Topsoil.

0.40 Dry to slightly moist, pale light orange brown slightly blotched off white, firm to stiff, silty/sandy clay with some soft calcareous nodules and gravels; Lacustrine deposits.

2.80

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) Disturbed foundation indicator sample taken from 1,0m--1,5m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 45.0
Y-COORD : E25 02 03.4

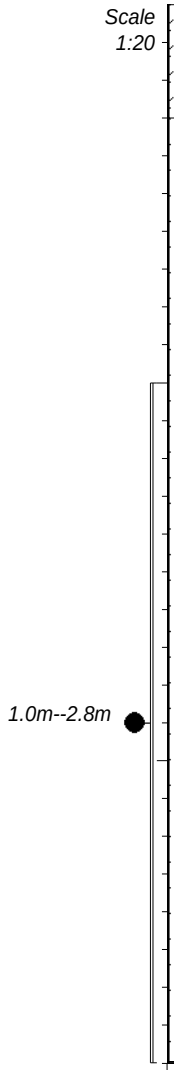
HOLE No: DH 11

SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

HOLE No: DH 12
Sheet 1 of 1

JOB NUMBER: 2037



Slightly moist, light orange brown, medium dense, cracked, slightly voided, clayey SAND containing roots; Topsoil.

Slightly moist to moist, pale light orange brown slightly blotched off white, firm to stiff, silty/sandy clay with some soft calcareous nodules and gravels; Lacustrine deposits.

NOTES

1) Stopped at 2.8m deep; Near maximum depth reach. Not yet refusal.
2) No water seepage encountered.
3) Disturbed bulk sample taken from 1,0m--2,8m.

CONTRACTOR : Campbell Scott
MACHINE : JCB 3CX TLB
DRILLED BY :
PROFILED BY : Pieter Oosthuizen

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 10/02/2021

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

ELEVATION :
X-COORD : S31 31 41.9
Y-COORD : E25 02 06.0

HOLE No: DH 12

SOUTHERN GEOTECHNICAL ENGINEERING

DE HEUS
PTN 15 of PTN 01 BULTFONTYN, MIDDELBURG EC

LEGEND
Sheet 1 of 1

JOB NUMBER: 2037

	GRAVELS	{SA02}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
Name ●	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}
	COBBLES	{SA58}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

TYPE SET BY : Pieter Oosthuizen
SETUP FILE : STANDARD.SET

DATE : 24/02/2021 14:47
TEXT : ..ialMiddelburg\DeHeus.txt

APPENDIX B

LABORATORY TEST RESULTS

LTG CIVIL SERVICES
Civil Engineering Materials Laboratory

1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 082 784 5667
info@Labworx.co.za www.labworx.co.za
Reg. No: 2003/007845/23 Vat No: 4500204070

Test Report

Attention :	Mr Pieter Oosthuizen	**Client :**	Southern Geotechnical Engineering
Project :	*De Heus*	**Contact No. :**	082 823 7794
Report Date :	23-02-2021	**Address :**	357 Olivier straat Waterkloof 0181
Pages :	8		
Report No. :	SGE/DH 21 02-001		

Herewith please find test results for your attention.

1. **Contents :** p 2 - 8 MDD/OMC, CBR & Foundation Indicator Results

2. **Deviation / Addition / Exclusion from test method / sampling method :** None

3. **Decision rule agreed on :** None

4. **Remarks :** Information typed in "*Italic*" font is supplied by the Client.

Hope you find all in order.

Regards,

Bernard Conradie
Technical Signatory

LTG CIVIL SERVICES
Civil Engineering Materials Laboratory

1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 | 082 784 5667
info@Labworx.co.za | www.labworx.co.za
Reg. No: 2003/007845/23 | Vat No: 4500204070

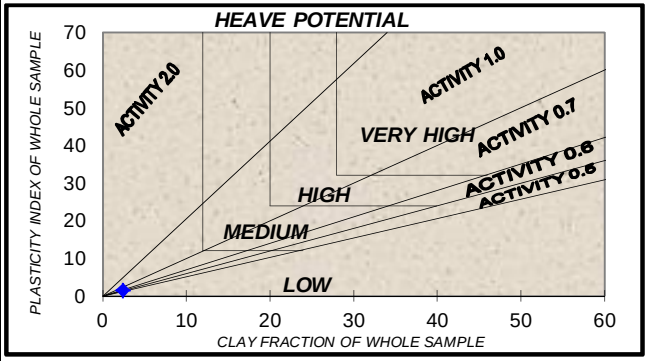
GRAVEL, SOIL AND SAND ANALYSIS REPORT

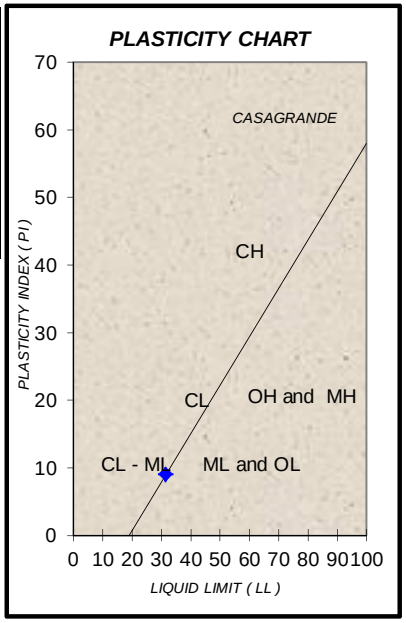
Report No.:	SGE/DH 21 02-001

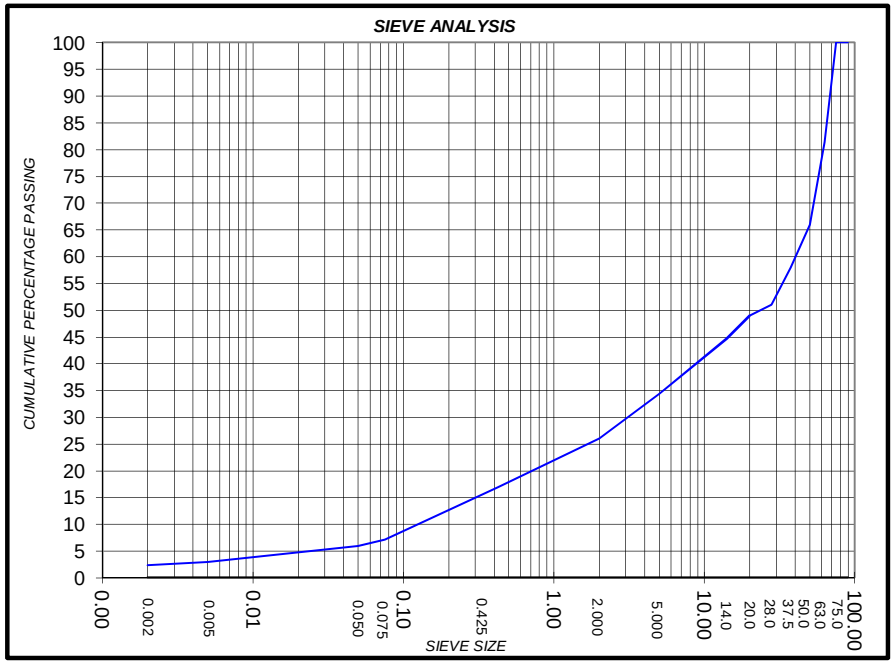
Project :	*De Heus*			**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering			**Report Date :**	22-02-2021
Your Reference :	*DH 01*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/116
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	**MDD / OMC** SANS 3001-GR20 & GR30		**Sieve Analysis** SANS 3001-GR1 *Cumulative percentage passing*														**Grading Modulus** SANS 3001-PR5	**Soil Mortar Analysis** *% of mat. <2,00 mm*				**Atterberg Limits** SANS 3001-GR10			**Classification**			
(Unified Soil Classification)	**Maximum Dry Density kg/m³**	**Optimum Moisture Content %**	**100.0mm**	**75.0mm**	**63.0mm**	**50.0mm**	**37.5mm**	**28.0mm**	**20.0mm**	**14.0mm**	**5.00mm**	**2.00mm**	**0.425mm**	**0.075mm**	**0.05 mm**	**0.005 mm**	**0.002 mm**		**Coarse - sand <2,0 >0,425mm**	**Fine - sand <0,425 >0,05mm**	**Silt <0,05 >0,005mm**	**Clay <0,005 mm**	**Liquid Limit %**	**Plasticity Index**	**Linear Shrinkage %**	**Unified Soil**	**Colto**	**US. Highway**	**Group Index**
Dark Brown Orange Well Graded Clayey Gravel	1862	10.2	-	100	81	66	58	51	49	45	34	26	17	7	6.0	3.0	2.4	2.5	35.1	42.0	11.3	11.6	31	9	4.1	GW/ GC	G6	A-2-4	0

GENERAL :		**CBR RESULTS :**	
Effective size :	0.124	SANS 3001-GR40	
Uniformity co-eff. :	325.7	**@ 100% comp. :**	56
Curvature co-eff. :	1.9	**@ 98% comp. :**	46
Oversize Index :	1082	**@ 97% comp. :**	41
Shrinkage Product :	70	**@ 95% comp. :**	34
Grading co-eff. :	8.6	**@ 93% comp. :**	25
Swell @ 100% :	0.24	**@ 90% comp. :**	16







REMARKS:

LTG CIVIL SERVICES
Civil Engineering Materials Laboratory

1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 | 082 784 5667
info@Labworx.co.za | www.labworx.co.za
Reg. No: 2003/007845/23 | Vat No: 4500204070

GRAVEL, SOIL AND SAND ANALYSIS REPORT

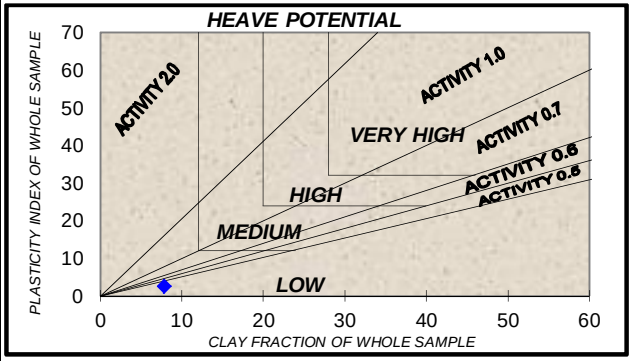
Report No.:	SGE/DH 21 02-001

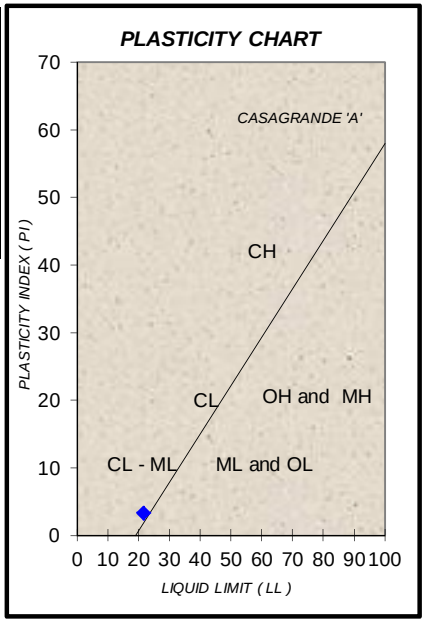
Project :	*De Heus*	**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering	**Report Date :**	22-02-2021

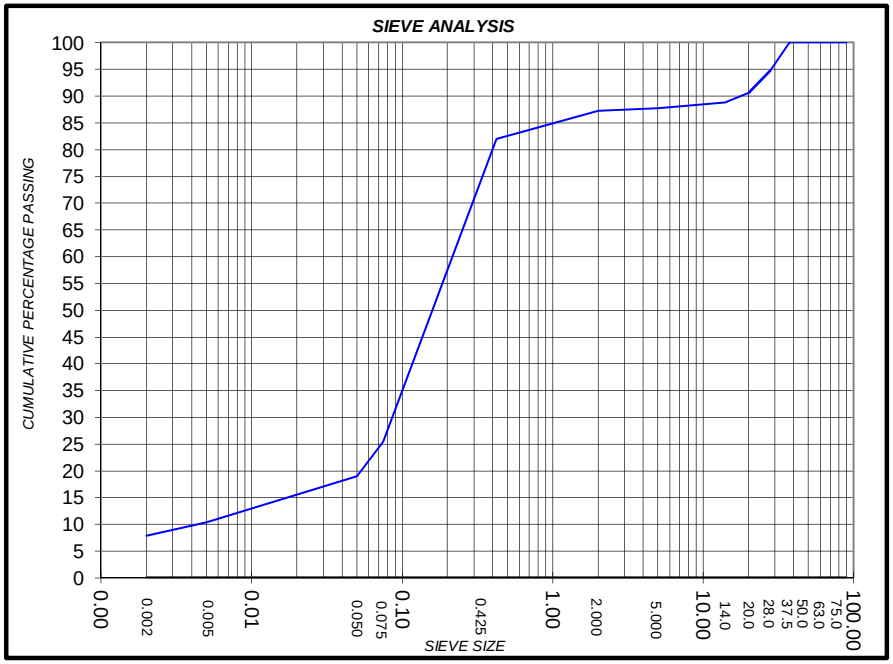
Your Reference :	*DH 03*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/117
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	***MDD / OMC*** *SANS 3001-GR20 & GR30*		**Sieve Analysis** SANS 3001-GR1 ***Cumulative percentage passing***														***Grading Modulus*** *SANS 3001-PR5*	***Soil Mortar Analysis % of mat. <2,00 mm***				**Atterberg Limits** SANS 3001-GR10			***Classification***			
(Unified Soil Classification)	***Maximum Dry Density kg/m³***	***Optimum Moisture Content %***	***100.0mm***	***75.0mm***	***63.0mm***	***50.0mm***	***37.5mm***	***28.0mm***	***20.0mm***	***14.0mm***	***5.00mm***	***2.00mm***	***0.425mm***	***0.075mm***	***0.05 mm***	***0.005 mm***	***0.002 mm***		***Coarse - sand <2,0 >0,425mm***	***Fine - sand <0,425 >0,05mm***	***Silt <0,05 >0,005mm***	***Clay <0,005 mm***	***Liquid Limit %***	***Plasticity Index***	***Linear Shrinkage %***	***Unified Soil***	***Colto***	***US. Highway***	***Group Index***
Dark Reddish Brown Silty Sand	1978	11.6	-	-	-	-	100	95	91	89	88	87	82	25	19.0	10.4	7.8	1.1	6.0	72.3	9.9	11.9	22	3	1.4	SM (d)	G7	A-2-4	0

GENERAL :		**CBR RESULTS :**	
Effective size :	0.004	SANS 3001-GR40	
Uniformity co-eff. :	49.7	**@ 100% comp. :**	41
Curvature co-eff. :	7.9	**@ 98% comp. :**	36
Oversize Index :	0	**@ 97% comp. :**	33
Shrinkage Product :	115	**@ 95% comp. :**	29
Grading co-eff. :	6.6	**@ 93% comp. :**	22
Swell @ 100% :	0.02	**@ 90% comp. :**	14







REMARKS:

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Civil Engineering Materials Laboratory

1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 | 082 784 5667
info@Labworx.co.za | www.labworx.co.za
Reg. No: 2003/007845/23 | Vat No: 4500204070

GRAVEL, SOIL AND SAND ANALYSIS REPORT

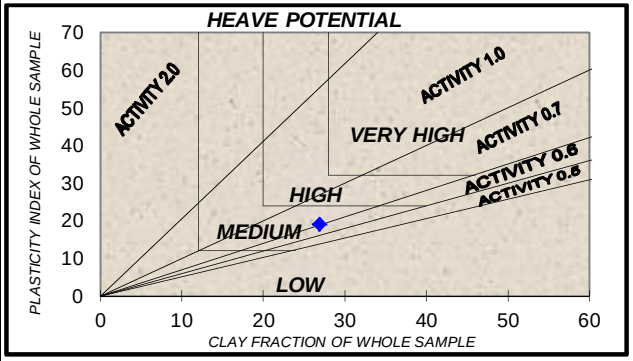
Report No.:	SGE/DH 21 02-001

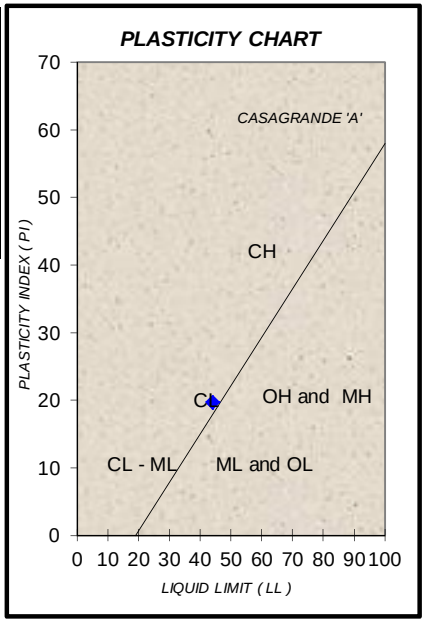
Project :	*De Heus*	**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering	**Report Date :**	22-02-2021

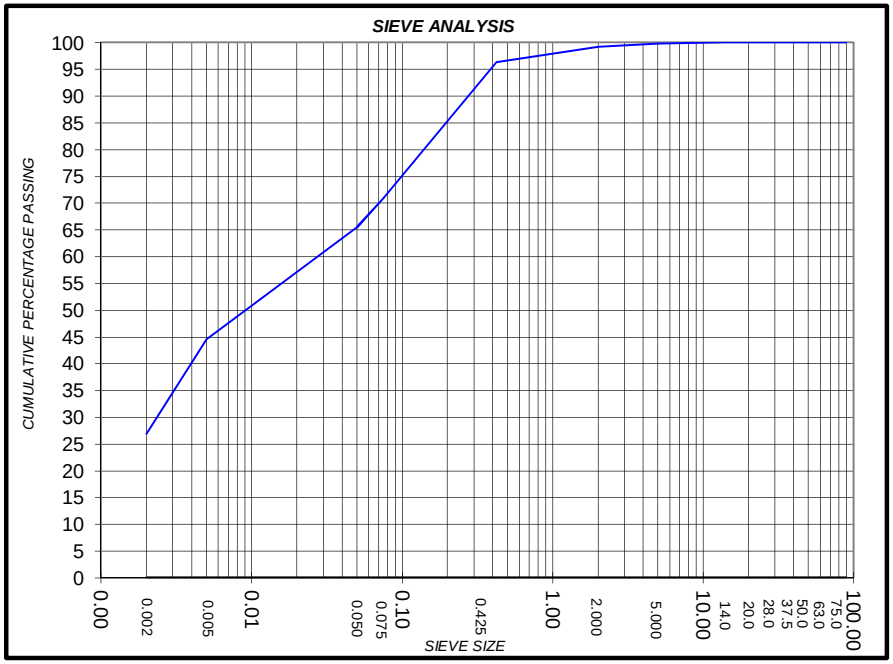
Your Reference :	*DH 05*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/118
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	***MDD / OMC*** *SANS 3001-GR20 & GR30*		**Sieve Analysis** SANS 3001-GR1 ***Cumulative percentage passing***														***Grading Modulus*** *SANS 3001-PR5*	***Soil Mortar Analysis*** ***% of mat. <2,00 mm***				**Atterberg Limits** SANS 3001-GR10			***Classification***			
(Unified Soil Classification)	***Maximum Dry Density kg/m³***	***Optimum Moisture Content %***	***100.0mm***	***75.0mm***	***63.0mm***	***50.0mm***	***37.5mm***	***28.0mm***	***20.0mm***	***14.0mm***	***5.00mm***	***2.00mm***	***0.425mm***	***0.075mm***	***0.05 mm***	***0.005 mm***	***0.002 mm***		***Coarse - sand <2,0 >0,425mm***	***Fine - sand <0,425 >0,05mm***	***Silt <0,05 >0,005mm***	***Clay <0,005 mm***	***Liquid Limit %***	***Plasticity Index***	***Linear Shrinkage %***	***Unified Soil***	***Colto***	***US. Highway***	***Group Index***
Dark Yellow Orange Inorganic Clay	1728	11.9	-	-	-	-	-	-	-	-	100	99	96	71	65.6	44.6	26.8	0.3	2.9	31.1	21.1	45.0	44	20	9.7	CL	<G9	A-7-6	12

GENERAL :		**CBR RESULTS :**	
Effective size :	<0.002	SANS 3001-GR40	
Uniformity co-eff. :	27.2	**@ 100% comp. :**	5
Curvature co-eff. :	0.2	**@ 98% comp. :**	4
Oversize Index :	0	**@ 97% comp. :**	4
Shrinkage Product :	936	**@ 95% comp. :**	3
Grading co-eff. :	0.8	**@ 93% comp. :**	2
Swell @ 100% :	4.01	**@ 90% comp. :**	2







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012 362 2352 | 082 784 5667
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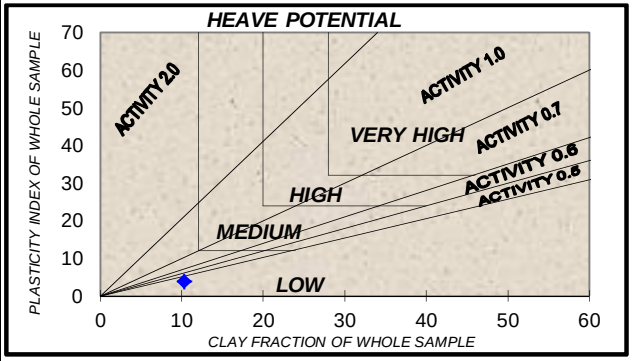
GRAVEL, SOIL AND SAND ANALYSIS REPORT

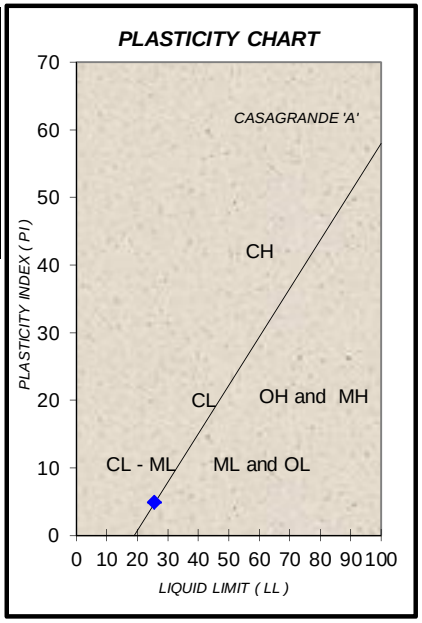
Report No.:	SGE/DH 21 02-001

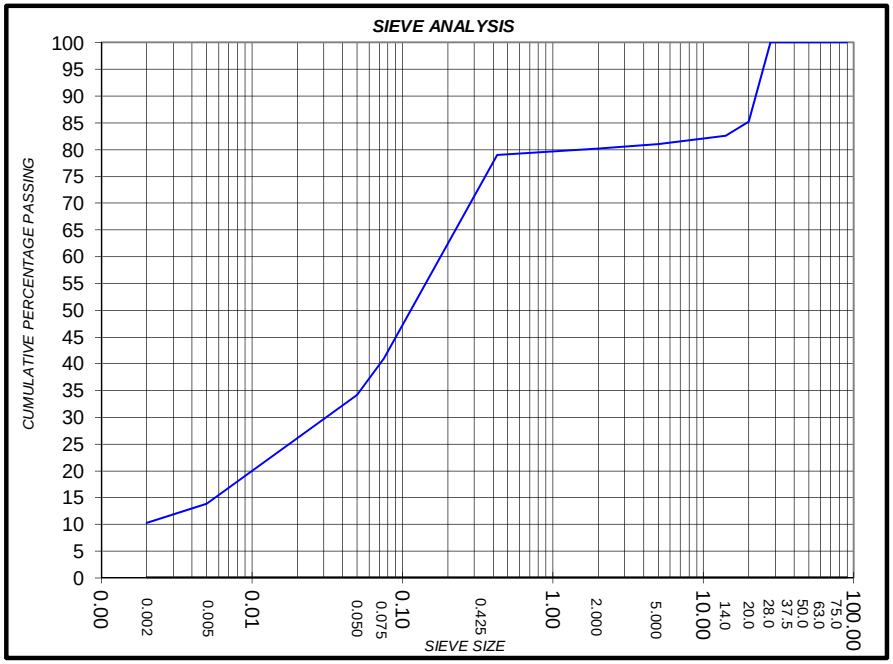
Project :	*De Heus*			**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering			**Report Date :**	22-02-2021
Your Reference :	*DH 08*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/119
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	MDD / OMC SANS 3001-GR20 & GR30		Sieve Analysis SANS 3001-GR1 Cumulative percentage passing														Grading Modulus SANS 3001-PR5	Soil Mortar Analysis % of mat. <2,00 mm				Atterberg Limits SANS 3001-GR10			Classification			
(Unified Soil Classification)	Maximum Dry Density kg/m³	Optimum Moisture Content %	100.0mm	75.0mm	63.0mm	50.0mm	37.5mm	28.0mm	20.0mm	14.0mm	5.00mm	2.00mm	0.425mm	0.075mm	0.05 mm	0.005 mm	0.002 mm		Coarse - sand <2,0 >0,425mm	Fine - sand <0,425 >0,05mm	Silt <0,05 >0,005mm	Clay <0,005 mm	Liquid Limit %	Plasticity Index	Linear Shrinkage %	Unified Soil	Colto	US. Highway	Group Index
Dark Yellow Orange Silty/Clayey Sand	-	-	-	-	-	-	-	100	85	83	81	80	79	41	34.2	13.8	10.3	1.0	1.4	55.9	25.4	17.2	26	5	2.3	SM/ SC	-	A-4	1

GENERAL :		CBR RESULTS :	
Effective size :	<0.002	SANS 3001-GR40	
Uniformity co-eff. :	178.6	**@ 100% comp. :**	-
Curvature co-eff. :	5.4	**@ 98% comp. :**	-
Oversize Index :	0	**@ 97% comp. :**	-
Shrinkage Product :	185	**@ 95% comp. :**	-
Grading co-eff. :	16.0	**@ 93% comp. :**	-
Swell @ 100% :	-	**@ 90% comp. :**	-







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1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 | 082 784 5667
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GRAVEL, SOIL AND SAND ANALYSIS REPORT

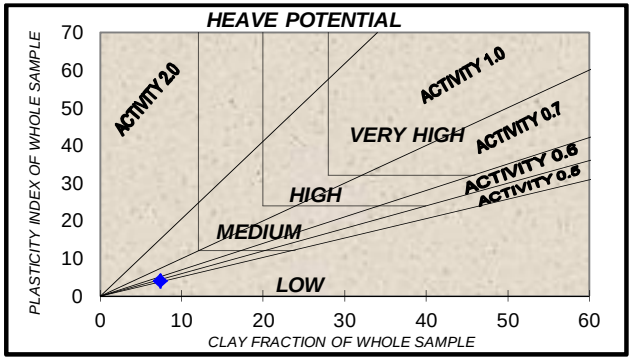
Report No.:	SGE/DH 21 02-001

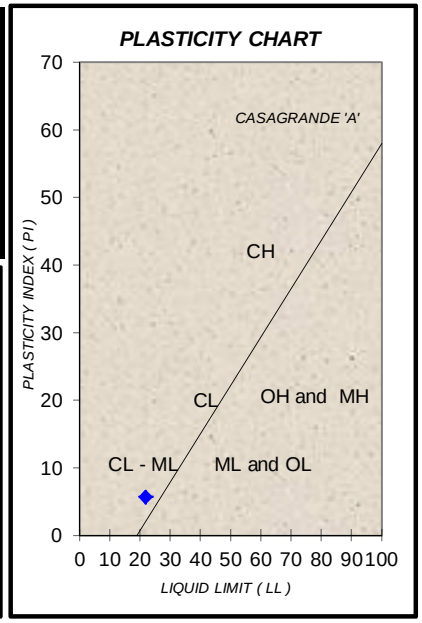
Project :	*De Heus*	**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering	**Report Date :**	22-02-2021

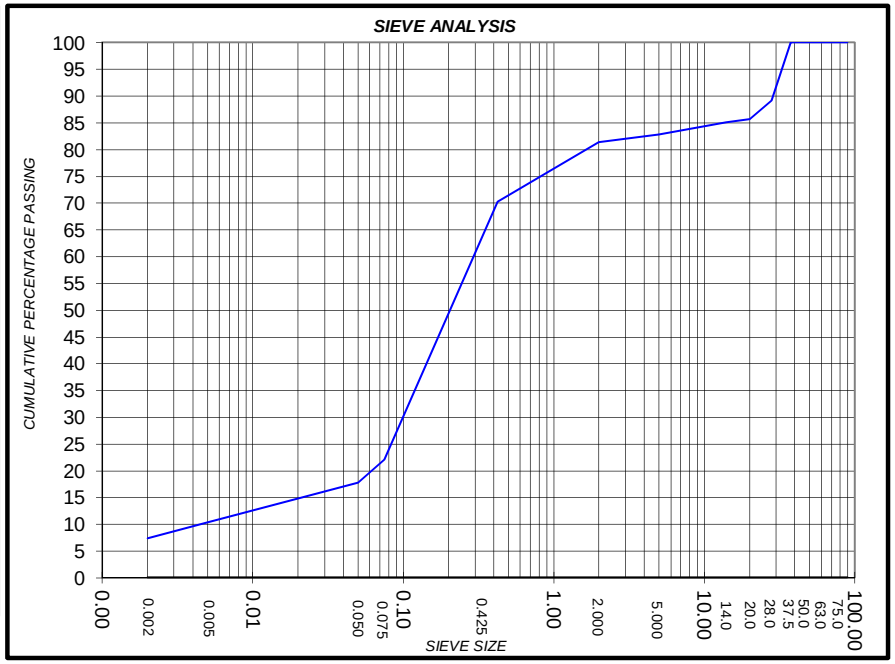
Your Reference :	*DH 09*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/120
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	**MDD / OMC** *SANS 3001-GR20 & GR30*		**Sieve Analysis** SANS 3001-GR1 *Cumulative percentage passing*														**Grading Modulus** *SANS 3001-PR5*	**Soil Mortar Analysis** *% of mat. <2,00 mm*				**Atterberg Limits** SANS 3001-GR10			**Classification**			
(Unified Soil Classification)	***Maximum Dry Density kg/m³***	***Optimum Moisture Content %***	***100.0mm***	***75.0mm***	***63.0mm***	***50.0mm***	***37.5mm***	***28.0mm***	***20.0mm***	***14.0mm***	***5.00mm***	***2.00mm***	***0.425mm***	***0.075mm***	***0.05 mm***	***0.005 mm***	***0.002 mm***		***Coarse - sand <2,0 >0,425mm***	***Fine - sand <0,425 >0,05mm***	***Silt <0,05 >0,005mm***	***Clay <0,005 mm***	***Liquid Limit %***	***Plasticity Index***	***Linear Shrinkage %***	***Unified Soil***	***Colto***	***US. Highway***	***Group Index***
Dark Brown Silty/Clayey Sand	1971	7.9	-	-	-	-	100	89	86	85	83	81	70	22	17.8	10.4	7.3	1.3	13.7	64.4	9.2	12.7	22	6	2.2	SM/ SC	G8	A-2-4	0

GENERAL :		**CBR RESULTS :**	
Effective size :	0.004	SANS 3001-GR40	
Uniformity co-eff. :	65.3	**@ 100% comp. :**	31
Curvature co-eff. :	7.5	**@ 98% comp. :**	25
Oversize Index :	0	**@ 97% comp. :**	22
Shrinkage Product :	157	**@ 95% comp. :**	18
Grading co-eff. :	6.4	**@ 93% comp. :**	13
Swell @ 100% :	0.49	**@ 90% comp. :**	8







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1350 Hartbeestspruit Street, Hatfield, Pretoria, 0083
012 362 2352 | 082 784 5667
info@Labworx.co.za | www.labworx.co.za
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GRAVEL, SOIL AND SAND ANALYSIS REPORT

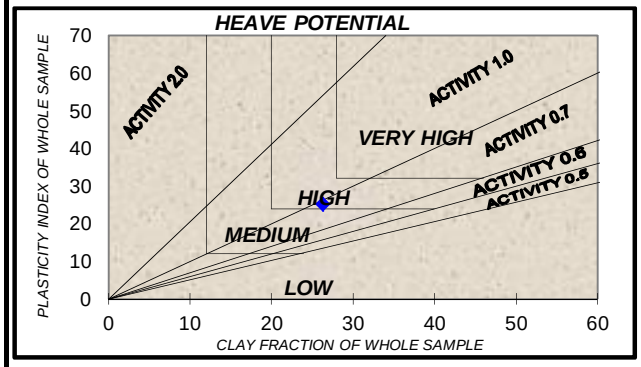
Report No.:	SGE/DH 21 02-001

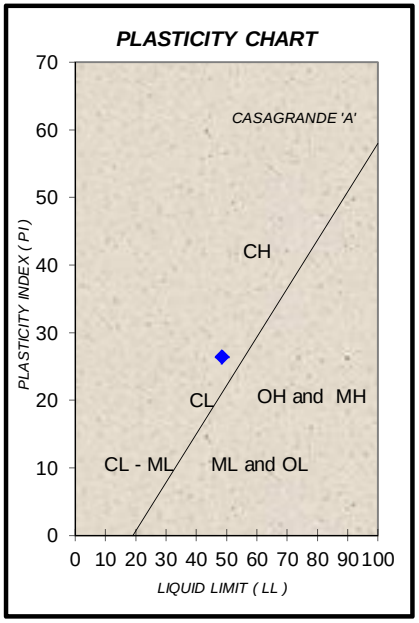
Project :	*De Heus*	**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering	**Report Date :**	22-02-2021

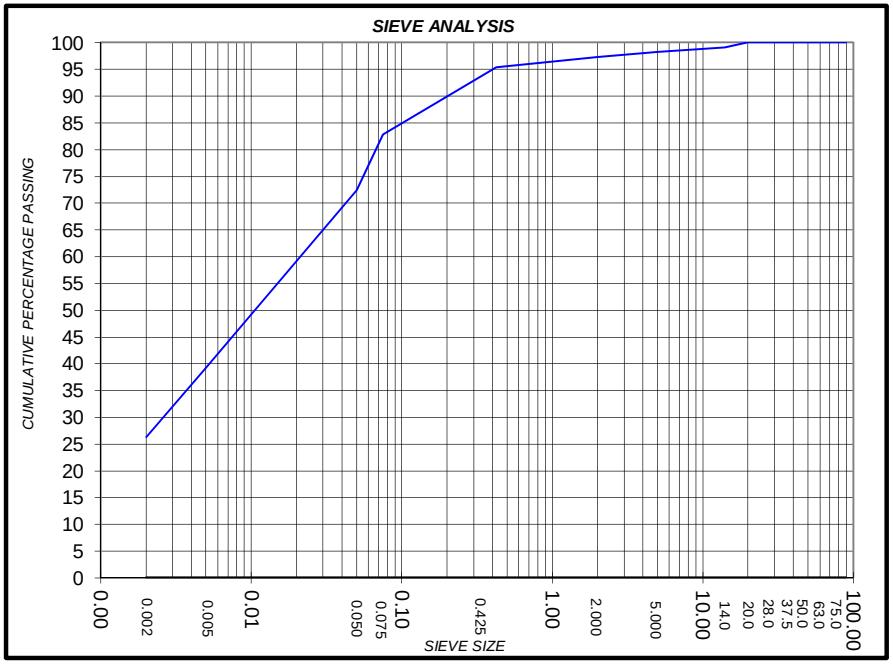
Your Reference :	*DH 11*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/121
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	**MDD / OMC** SANS 3001-GR20 & GR30		**Sieve Analysis** SANS 3001-GR1 **Cumulative percentage passing**														**Grading Modulus** SANS 3001-PR5	**Soil Mortar Analysis % of mat. <2,00 mm**				**Atterberg Limits** SANS 3001-GR10			**Classification**			
(Unified Soil Classification)	**Maximum Dry Density kg/m³**	**Optimum Moisture Content %**	**100.0mm**	**75.0mm**	**63.0mm**	**50.0mm**	**37.5mm**	**28.0mm**	**20.0mm**	**14.0mm**	**5.00mm**	**2.00mm**	**0.425mm**	**0.075mm**	**0.05 mm**	**0.005 mm**	**0.002 mm**		**Coarse - sand <2,0 >0,425mm**	**Fine - sand <0,425 >0,05mm**	**Silt <0,05 >0,005mm**	**Clay <0,005 mm**	**Liquid Limit %**	**Plasticity Index**	**Linear Shrinkage %**	**Unified Soil**	**Colto**	**US. Highway**	**Group Index**
Dark Yellow Orange Inorganic Clay	-	-	-	-	-	-	-	-	100	99	98	97	95	83	72.5	39.2	26.3	0.2	2.0	23.6	34.1	40.3	48	26	12.5	CL	-	A-7-6	16

GENERAL :		**CBR RESULTS :**	
Effective size :	<0.002	SANS 3001-GR40	
Uniformity co-eff. :	21.1	**@ 100% comp. :**	-
Curvature co-eff. :	0.3	**@ 98% comp. :**	-
Oversize Index :	0	**@ 97% comp. :**	-
Shrinkage Product :	1197	**@ 95% comp. :**	-
Grading co-eff. :	2.6	**@ 93% comp. :**	-
Swell @ 100% :	-	**@ 90% comp. :**	-







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GRAVEL, SOIL AND SAND ANALYSIS REPORT

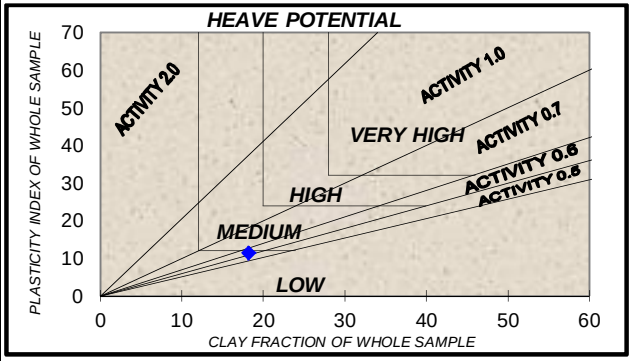
Report No.:	SGE/DH 21 02-001

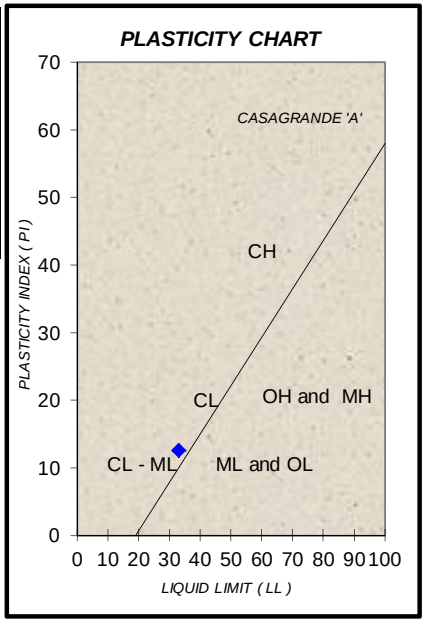
Project :	*De Heus*	**Date Received :**	11-02-2021
Client :	Southern Geotechnical Engineering	**Report Date :**	22-02-2021

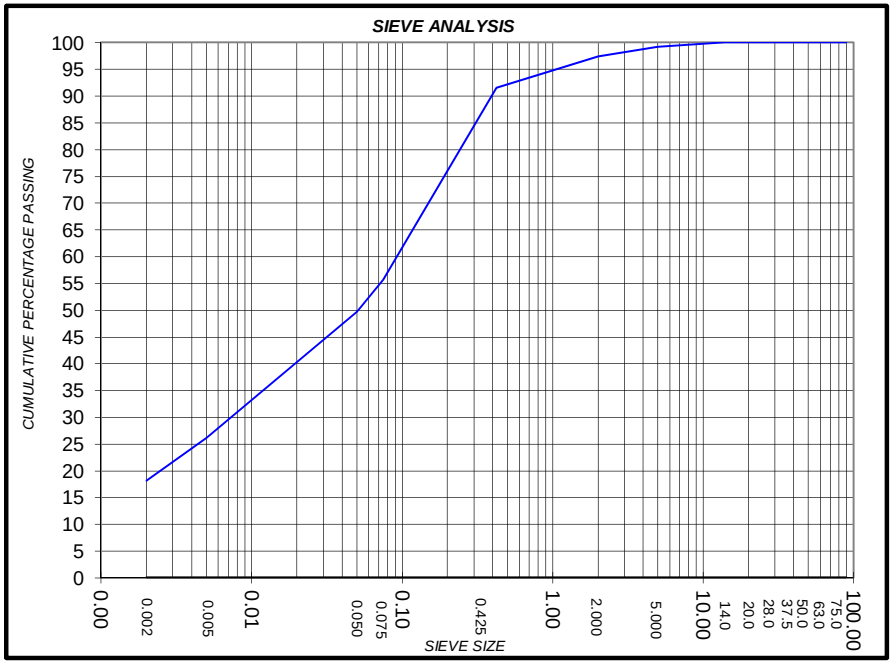
Your Reference :	*DH 12*	**Environmental Conditions :**	*Sunny / Hot*	**Sample No. :**	21/122
Sampled By :	Client			**Sampling Method :**	Not Specified

Description	***MDD / OMC*** *SANS 3001-GR20 & GR30*		**Sieve Analysis** SANS 3001-GR1 ***Cumulative percentage passing***														***Grading Modulus*** *SANS 3001-PR5*	***Soil Mortar Analysis % of mat. <2,00 mm***				**Atterberg Limits** SANS 3001-GR10			***Classification***			
(Unified Soil Classification)	***Maximum Dry Density kg/m³***	***Optimum Moisture Content %***	***100.0mm***	***75.0mm***	***63.0mm***	***50.0mm***	***37.5mm***	***28.0mm***	***20.0mm***	***14.0mm***	***5.00mm***	***2.00mm***	***0.425mm***	***0.075mm***	***0.05 mm***	***0.005 mm***	***0.002 mm***		***Coarse - sand <2,0 >0,425mm***	***Fine - sand <0,425 >0,05mm***	***Silt <0,05 >0,005mm***	***Clay <0,005 mm***	***Liquid Limit %***	***Plasticity Index***	***Linear Shrinkage %***	***Unified Soil***	***Colto***	***US. Highway***	***Group Index***
Dark Yellow Orange Inorganic Clay	1889	13.6	-	-	-	-	-	-	-	100	99	97	92	56	49.7	26.1	18.2	0.6	6.0	43.0	24.2	26.8	33	13	6.5	CL	<G9	A-6	5

GENERAL :		**CBR RESULTS :**	
Effective size :	<0.002	SANS 3001-GR40	
Uniformity co-eff. :	92.5	**@ 100% comp. :**	8
Curvature co-eff. :	0.6	**@ 98% comp. :**	6
Oversize Index :	0	**@ 97% comp. :**	6
Shrinkage Product :	595	**@ 95% comp. :**	4
Grading co-eff. :	2.6	**@ 93% comp. :**	4
Swell @ 100% :	1.82	**@ 90% comp. :**	3







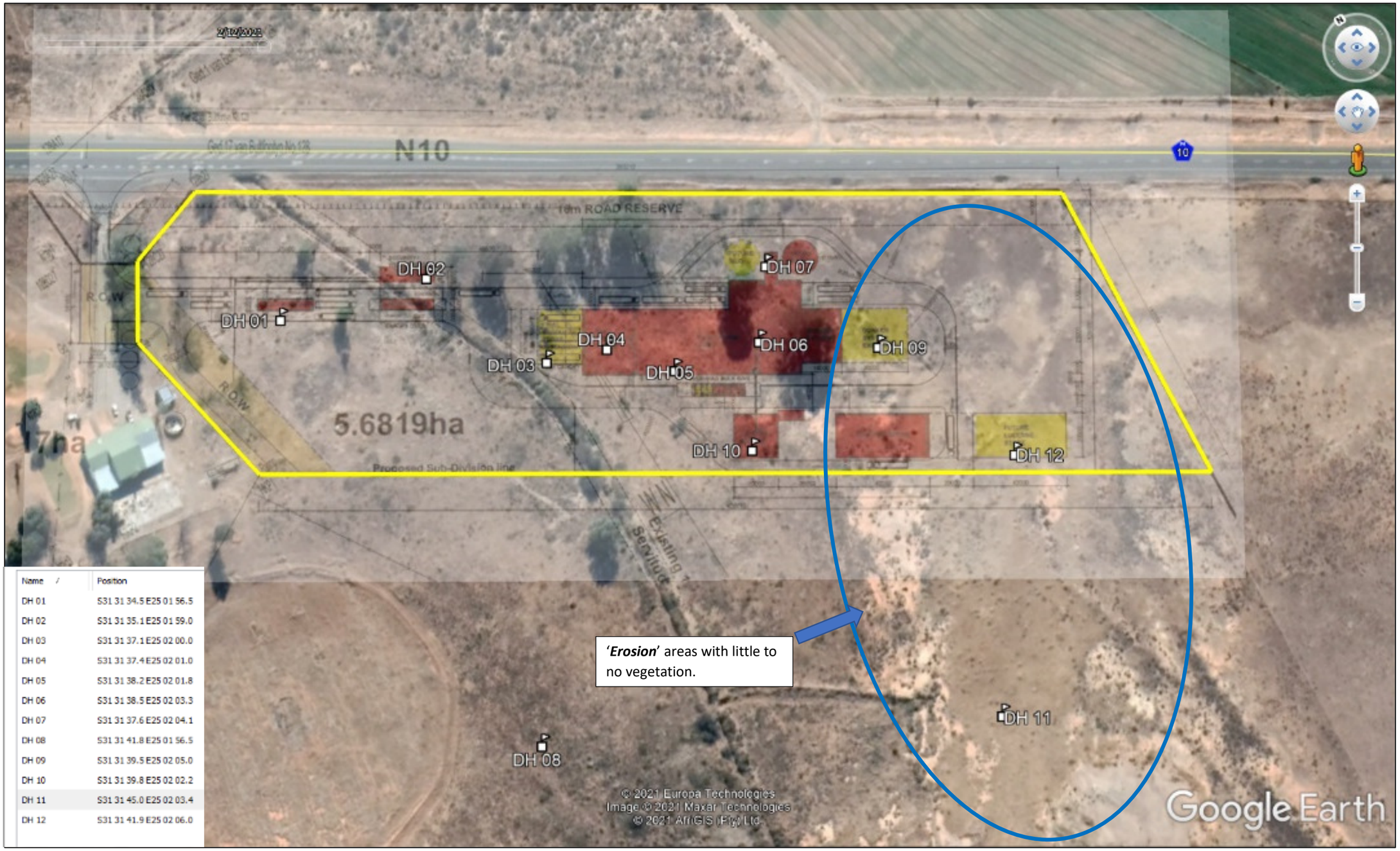
REMARKS:

APPENDIX C

TEST PIT POSITIONS

DE HEUS, MIDDELBURG, EASTERN CAPE

TEST PIT POSITIONS



Name	Position
DH 01	S31 31 34.5 E25 01 56.5
DH 02	S31 31 35.1 E25 01 59.0
DH 03	S31 31 37.1 E25 02 00.0
DH 04	S31 31 37.4 E25 02 01.0
DH 05	S31 31 38.2 E25 02 01.8
DH 06	S31 31 38.5 E25 02 03.3
DH 07	S31 31 37.6 E25 02 04.1
DH 08	S31 31 41.8 E25 01 56.5
DH 09	S31 31 39.5 E25 02 05.0
DH 10	S31 31 39.8 E25 02 02.2
DH 11	S31 31 45.0 E25 02 03.4
DH 12	S31 31 41.9 E25 02 06.0

APPENDIX D

TEST PIT PHOTOGRAPHS

DE HEUS INDUSTRIAL DEVELOPMENT - TEST PIT PHOTOGRAPHS

DE HEUS INDUSTRIAL DEVELOPMENT - TEST PIT PHOTOGRAPHS

DE HEUS INDUSTRIAL DEVELOPMENT - TEST PIT PHOTOGRAPHS

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