



FINAL GEOTECHNICAL INVESTIGATION REPORT

FOR

**REMAINING EXTENT OF PORTION 46,58,59 OF THE FARM
ELANDSHEUWEL 436 IQ**

PREPARED FOR:

HOUSING DEVELOPMENT AGENCY

JOB NO: VG25098

DATE: JUNE 2025

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VERIFICATION PAGE

TITTLE	FINAL GEOTECHNICAL INVESTIGATION REPORT FOR REMAINING EXTENT OF PORTION 46,58,59 OF THE FARM ELANDSHEUWEL 436 IQ, JB MARKS LOCAL MUNICIPALITY, NORTHWEST PROVINCE		
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EXECUTIVE SUMMARY

The geotechnical investigation was conducted by Vhuluvhi Group for the Housing Development Agency on Portions 46, 58, and 59 of the Farm Elandsheuwel 436 IQ, located in the Grimbeek Park Area of JB Marks Local Municipality, North West Province. The purpose of the investigation was to characterise the subsurface conditions and provide appropriate foundation recommendations for a proposed residential housing development. The study involved a desktop review, trial pits, laboratory testing, and in-situ testing to evaluate soil properties and geotechnical constraints.

The site lies on an exceptionally gentle slope, ranging from 0.35% to 0.48%, with elevations between 1324 m and 1330 m above mean sea level. These gradients are flat to support effective surface runoff, which may result in localised ponding, especially during heavy rainfall. The area, previously cleared for agriculture, is in between two streams. This topographical and hydrological setting increases the need for engineered drainage solutions to manage stormwater and reduce water-related foundation risks.

Geologically, the site is underlain by transported soils of Quaternary age, overlying residual shales interbedded with quartzite, hornfels, and limestone. The transported soils, typically encountered from the surface to depths of 0.4 to 1.0 m, are characterised as soft to firm, clayey silts and sands. These soils exhibit low to medium heave potential, based on plasticity indices ranging from 8% to 12%, and are strongly acidic and highly corrosive toward concrete and steel. The residual shales, encountered below the transported soils, are moist, firm, and display a slicken-sided structure, a sign of shear movement. These residual shales are fine- to coarse-grained with low to medium plasticity and possess a medium heave potential due to the presence of expansive clay minerals.

Significant groundwater seepage was observed in many of the trial holes, with depths ranging from 1.0 to 2.5 m. This poses a geotechnical concern as it reduces the shear strength of the soils, complicates foundation construction, and necessitates temporary dewatering during construction as well as permanent subsurface drainage solutions in the long term.

Laboratory testing included Atterberg limits, grading analysis, oedometer tests, and pH and conductivity assessments. The results revealed generally moderate plasticity and compressibility in both the transported and residual soils. No collapsible or highly compressible soils were encountered. However, the transported soils were found to be extremely corrosive, making them unsuitable for direct contact with concrete or steel; hence, the recommendation to use HDPE pipes for underground services.

Geotechnical assessments concluded that the soils are suitable for development but pose moderate risks due to expansiveness and corrosiveness. The site was classified as H1 for transported soils and H2 for residual shales under the NHBRC guidelines, indicating low to medium potential for heave. Dynamic Cone Penetrometer (DCP) tests confirmed soft to firm consistencies in the upper horizons, transitioning to medium-dense conditions in the residual shales.

For lightly to moderately loaded structures, reinforced concrete raft foundations and soil rafts are recommended, with proper drainage, compaction, and moisture protection measures. For heavily loaded structures, such as multi-storey buildings or community facilities, a hybrid foundation system combining deep piles and suspended slabs or stiffened rafts is advised. These systems will help accommodate soil movement and provide the structural capacity required, especially in zones affected by groundwater seepage and expansive clay behaviour.

In conclusion, while the site presents several geotechnical challenges such as expansive clays, shallow groundwater, and soil corrosiveness, these can be effectively mitigated through appropriate foundation design, moisture management, and quality control during construction. It is also recommended that all excavations be inspected by a competent person to confirm consistency with the geotechnical conditions described and to adapt design measures if unforeseen conditions are encountered. The site is considered suitable for development provided that the engineering recommendations outlined in the report are followed diligently.

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1. INTRODUCTION

On the 12th of March 2025, Housing Development Agency appointed Vhuluvhi Group for Tender No: HDA/NW/2024/043, titled “The appointment of a service provider to undertake township establishment for the creating of the three integrated and sustainable human settlement developments in the Grimbeek Park Area, within the Jurisdiction of JB Marks Local Municipality, Northwest Province”.

As part of the scope of work, a near-surface geotechnical investigation to be conducted within the Grimbeek Park Area and it should be noted that the whole of Portion 59 comprises of surface water and it was not practical to enter and do a geotechnical investigation. The proposed development will comprise a residential development and associated infrastructure.

The work was undertaken in accordance with the site geotechnical code of practice, 1st Edition, South African Institution of Civil Engineering – Geotechnical Division, January 2010.

1.1. DATABASE

- “2626 West Rand” - Geological Maps
- “2627CA - POTCHESTROOM” - Topographical Map

1.2. OBJECTIVES OF THE STUDY

The objectives of the investigation were to complete a near-surface geotechnical investigation that would provide sufficient geotechnical data for the detailed design of the proposed development :

- Identify the soil profile to a depth of approximately 3.00m using a TLB or refusal, and conduct a Hand Dynamic Cone Penetrometer
- Determine the engineering parameters of the near-surface soils.
- Recommend site-specific foundations for the structures.
- Classify the site according to NHBRC Guidelines
- Comment on any geotechnical problems that may impact the construction.

2. FACTUAL REPORT

2.1. DESKTOP STUDY

Prior to the commencement of any fieldwork, a desktop study was conducted on the data obtained from previous investigations by other consultants.

The 1:250,000 geological maps, “2626 West Rand”, were consulted in order to determine the regional and local geology. To supply information regarding the topography of the site, the 1:50,000 topographical maps, “2627CA Potchefstroom” were referenced.

2.2. FIELDWORK – DOLOMITE STABILITY INVESTIGATION

On May 7th, 2025, a field investigation was conducted, and twenty-two (22) trial holes were excavated using a TLB. The Vhuluvhi group’s engineering geologist set out the trial hole positions in the field to provide information and coordinated them using a hand-held GPS. The following samples were deemed necessary to be taken for laboratory testing: -

Foundation Indicator	9
CBR Test	6
Single Oedometer	3
PH and Conductivity	6

Each trial hole “deemed” safe to enter was internally profiled by an engineering geologist according to the “Guidelines for soil and rock logging in South Africa”, sampled as necessary, and then loosely backfilled. The site plan, which appears in Appendix A, indicates the trial holes’ positions

2.3. Site Description

Grimbeek Park is situated in the northern outskirts of Potchefstroom, within the North West Province of South Africa. The area falls within a semi-urban to suburban context and has been undergoing steady residential development. It is part of a growing

residential node characterized by low- to medium-density housing, reflecting Potchefstroom's expansion towards the north.

The vegetation within the site has been cleared, and the land is currently being utilised as agricultural land, and the site is situated within two perennials streams.

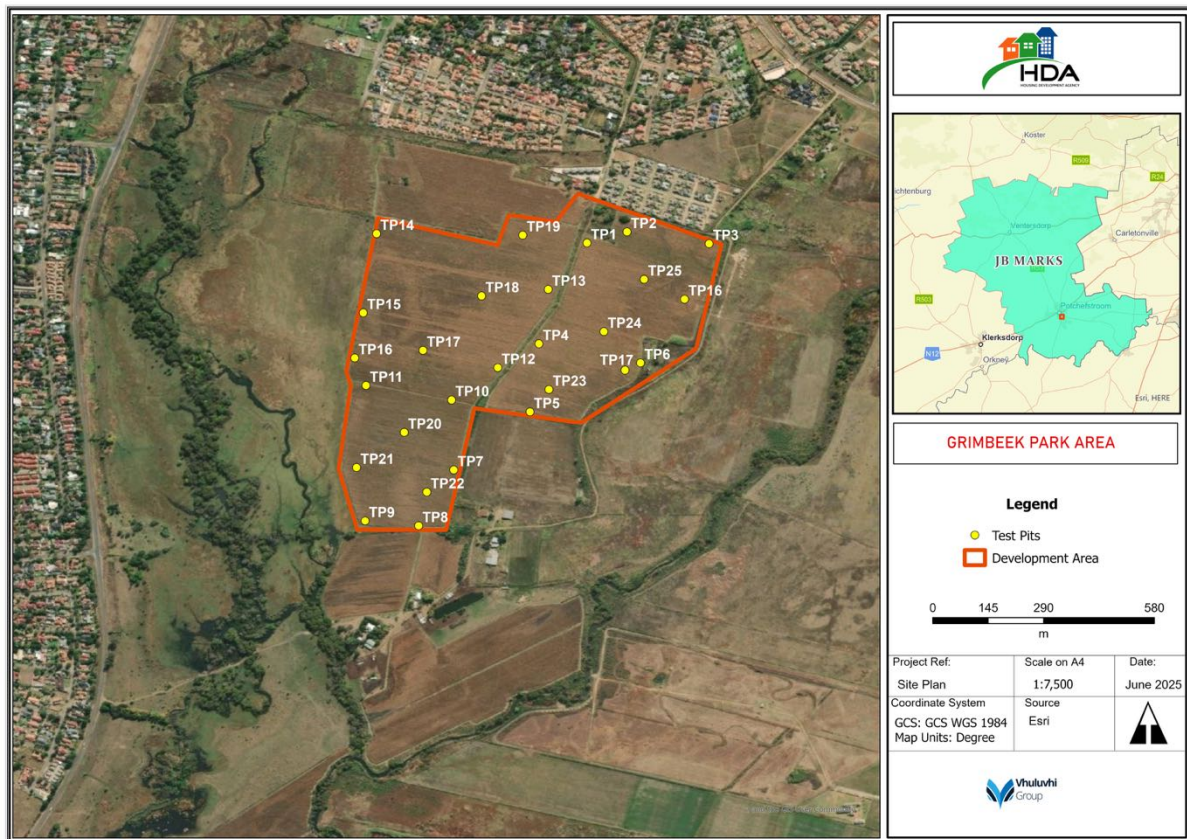


Figure 1.1: Google imagery of the site showing excavated trial holes

2.1. SITE TOPOGRAPHY

The site is located within the remaining extent of Portions 46, 58, and 59 of the farm Elandsheuwel 436IQ, and is situated at elevations ranging between 1324 m and 1330 m above mean sea level (amsl). The topography is characterised by an exceptionally gentle slope, with gradients varying between 0.35% and 0.48%, sloping generally towards the south and southwest.

These minimal gradients are insufficient to facilitate effective natural surface water runoff, which may lead to localised ponding or water accumulation, especially during periods of high rainfall. From a development perspective, the low slope angles are not inherently favourable, as they may necessitate extensive earthworks, cut-and-fill

operations, and engineered drainage solutions to establish suitable platforms for infrastructure and buildings.

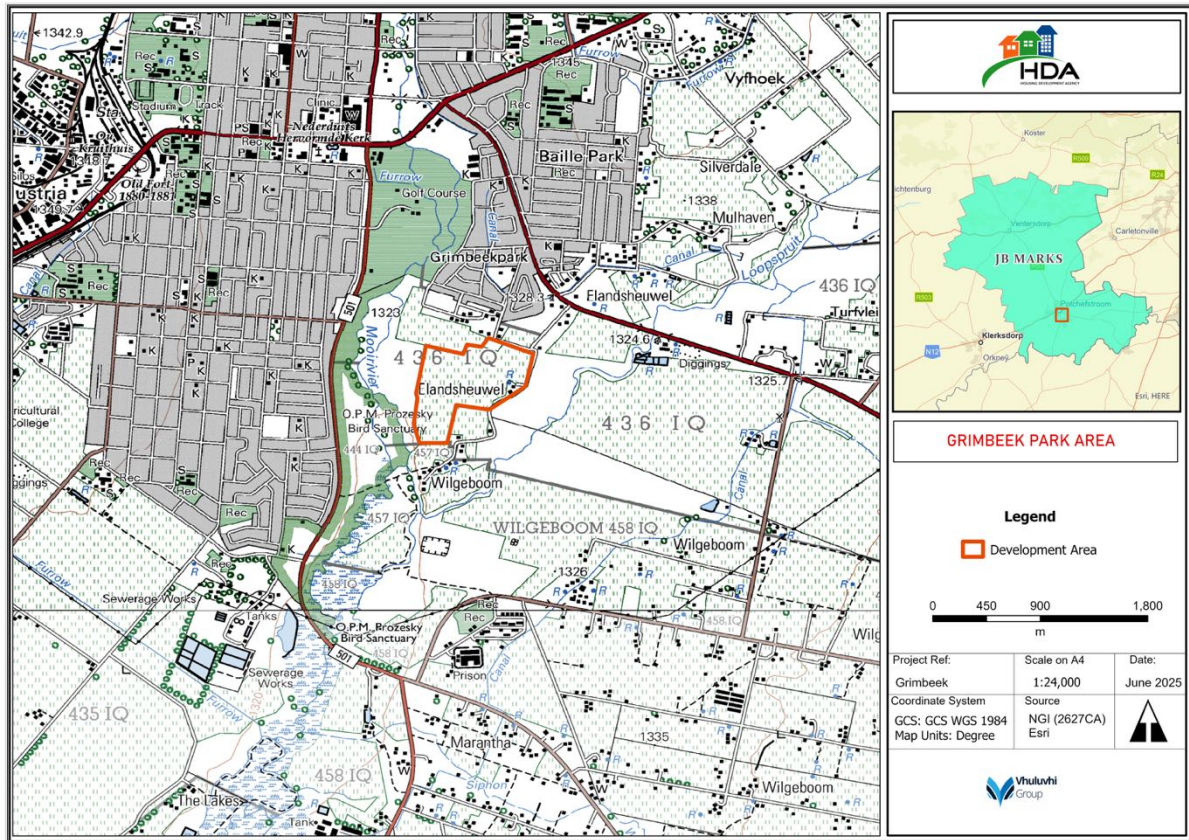


Figure 1.2: Topographical map of the site

2.2. SITE GEOLOGY

A desktop geological review indicates that the site is overlain by transported soil, which is alluvium in nature of Quaternary age, and underlain by shales interbedded with quartzites, hornfels and limestones.

Although the regional geology includes dolerite and syenite dykes of varying ages that commonly crosscut the granite suite, no such intrusions were observed on site. Based on regional experience, the depth of weathering in the shale rocks is highly variable, often marked by the presence of cornerstone remnants. Patches of highly kaolinised residual soils are also known to occur.

Field observations suggest that the in situ residual shales has been recently blanketed by a layer of transported soils, which is alluvium in nature.

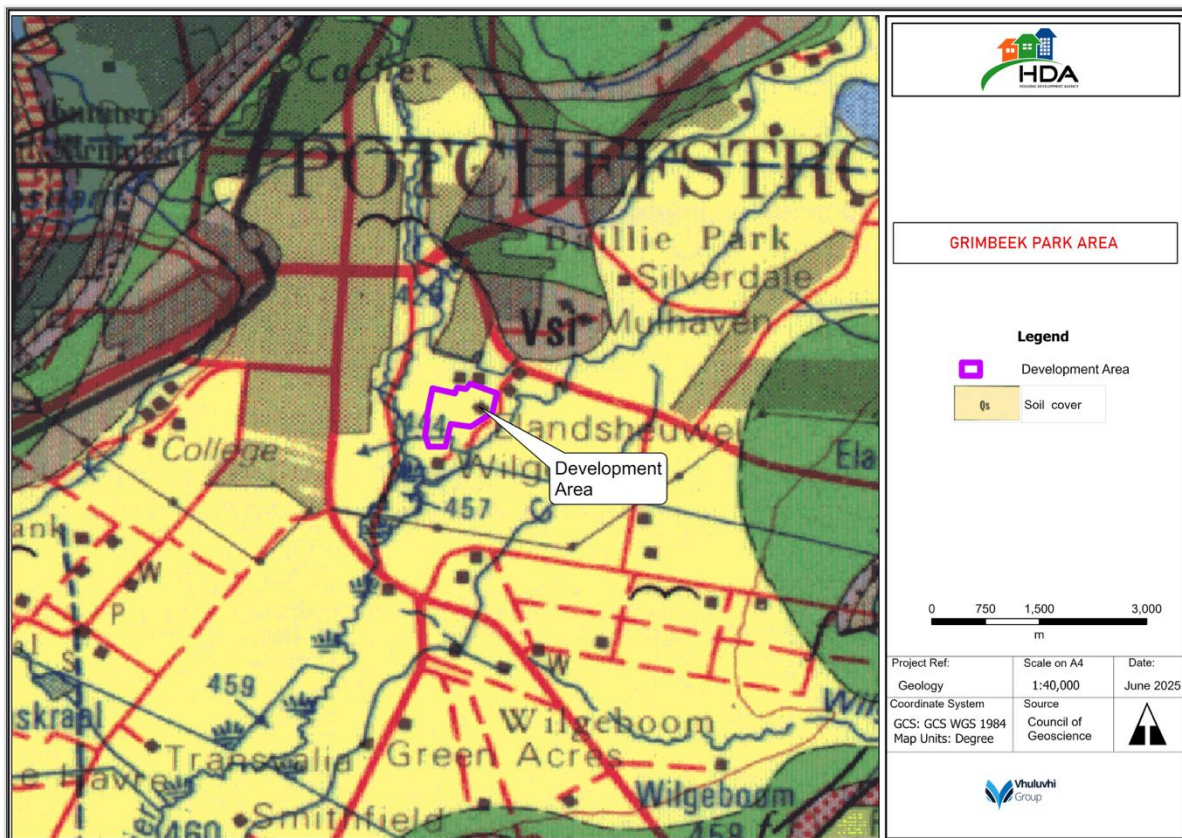


Figure 1.3: Geological map of the site

2.3. GEOHYDROLOGY AND CLIMATE

The region receives between 566mm and 620mm of rainfall per year, most of which falls during brief but intense storms during the summer months from November to March.

Various climatic environments influence the weathering of bedrock and residual soil development is best represented by Weinert's climatic N-value, and thus the climatic regime plays a fundamental role in the development of the soil profile and the weathering of rock.

Weinert (1964) demonstrated that chemical decomposition is the predominant mode of rock weathering in areas where the climatic "N-value" is less than 5. In areas where the climatic N-value is between 5 and 10, disintegration is the predominant form of weathering, although some chemical decomposition of the primary rock minerals still takes place. Where the climatic N-value is greater than 10, secondary minerals do not develop appreciably, and all weathering occurs by mechanical disintegration of the rock. Weinert's climatic N-value for the site is less than 5, and thus, this implies that decomposition is the predominant form of weathering

2.4. OBSERVATIONS

While the nature of the soils encountered in the test pits is relatively uniform in terms of the type of material, there is a reasonable degree of variation in the thicknesses of the various horizons. Table 1 gives the test pit depth and whether or not there was water seepage encountered in the trial holes.

Table 1 – Trail Pit Depths			
TP No	Depth of Hole (m)	Nature of Material at Base of Pit	Water Seepage
1	No Refusal @ 3.00m	Firm: Residual Shales	Moderate Water Seepage @ bottom
2	No Refusal @ 3.00m	Firm: Residual Shales	Moderate Water Seepage @ 1.7m
3	Partial Refusal @ 2.60m	Firm: Residual Shales	Strong Water Seepage @ 2.0m
4	Partial Refusal @ 1.90m	Firm: Residual Shales	Moderate Water Seepage @ 1.5m
5	No Refusal @ 3.00m	Firm: Residual Shales	Moderate Water Seepage @ 2.5m
6	No Refusal @ 3.00m	Firm: Residual Shales	No Water Seepage
7	Partial Refusal @ 2.20m	Firm: Residual Shales	No Water Seepage
8	Partial Refusal @ 2.60m	Firm: Residual Shales	No Water Seepage
9	Partial Refusal @ 2.70m	Firm: Residual Shales	No Water Seepage
10	Partial Refusal @ 2.70m	Firm: Residual Shales	Moderate Water Seepage @ 2.5m
11	Partial Refusal @ 2.40m	Firm: Residual Shales	No Water Seepage
12	Partial Refusal @ 2.00m	Firm: Residual Shales	Moderate Water Seepage @ 1.8m
13	Partial Refusal @ 2.40m	Firm: Residual Shales	No Water Seepage
14	Partial Refusal @ 2.40m	Firm: Residual Shales	Moderate Water Seepage @ 1.2m
15	Partial Refusal @ 1.90m	Firm: Residual Shales	Moderate Water Seepage @ 1.0m
16	Partial Refusal @ 2.60m	Firm: Residual Shales	Moderate Water Seepage @ 2.0m

Table 1 – Trail Pit Depths			
TP No	Depth of Hole (m)	Nature of Material at Base of Pit	Water Seepage
17	Partial Refusal @ 2.80m	Firm: Residual Shales	Moderate Water Seepage @ 1.90m
18	Partial Refusal @ 2.90m	Firm: Residual Shales	Moderate Water Seepage @ 2.00m
19	No Refusal @ 3.00m	Firm: Residual Shales	Moderate Water Seepage @ bottom
20	Partial Refusal @ 2.40m	Firm: Residual Shales	No Water Seepage
21	Partial Refusal @ 2.70m	Firm: Residual Shales	No Water Seepage
22	Partial Refusal @ 2.20m	Firm: Residual Shales	No Water Seepage

2.5. LABORATORY TESTING

Disturbed samples, 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 to determine the geo-mechanical properties of the relevant soil horizon.

- Foundation Indicator Tests

These tests are used to determine the soil type, assess its potential for heave, and indicate its suitability for use in pavement layers.

- Corrosiveness Tests (pH and Conductivity)

These tests are used to assess the potential for soils to corrode concrete and steel.

- Collapsible Potential Tests

This test was used to assess the soil's potential to collapse under load.

For more accurate determination and classification purposes, particle size distribution and Atterberg Limits tests were conducted on representative samples of the various soil horizons below the site. The results are summarised in Table 2 below:-

Table 2 – Summary of Indicator Test Result						
TP No	Depth (m)	Material	PI (%)	Grading Modulus	Linear Shrinkage	Activity
TP01	1.00 - 2.40	Sandy Clay : Residual Shales	12	0.67	6.0	Medium
TP05	0.70 - 3.00	Clayey Sand: Residual Shales	11	0.82	5.5	Medium
TP08	0.70 – 2.60	Gravelly Sand: Residual Shales	7	1.32	3.5	Low
TP09	0.40 – 2.70	Clayey Sand: Residual Shales	8	0.62	4.0	Low
TP12	0.75 – 2.00	Sandy Silty: Residual Shales	8	0.80	4.0	Low
TP14	0.50 – 2.40	Clayey Sand: Residual Shales	10	1.06	5.0	Low
TP16	0.60 – 2.60	Clayey Sand: Residual Shales	7	1.07	3.5	Low
TP18	0.60 – 2.90	Clayey Sand: Residual Shales	7	0.77	3.5	Low
TP20	0.80 – 2.40	Sandy Gravel: Residual Shales	7	2.05	3.5	Low
TP22	0.50 – 2.20	Gravelly Sand: Residual Shales	3	1.33	1.5	Low

A summary of the single oedometer Test results is shown in Table 3 below.

Table 3: Single Oedometer Tests						
TP No.	Depth (m)	Material	Dry Density (kg/m ³)	Specific Gravity	MC (%)	Initial Voids Ratio
TP15	0.80 – 2.40	Residual Shales	1259	2.655	11.6	1.109
TP11	0.90 – 1.0	Residual Shales	1497	2.687	22.0	0.795
TP07	0.80 – 2.0	Residual Shales	1302	2.630	21.6	1.019
TP10	0.80 – 2.0	Residual Shales	1378	2.729	16.3	0.981
TP19	1.20 – 1.60	Residual Shales	1049	2.565	46.0	1.444

A summary of pH and conductivity Test results is shown in Table 4 below.

Table 4 – Summary of pH and Conductivity Test Results						
TP No	Depth (m)	Material	pH	Conductivity (mS/m)	Degree of Corrosion	Degree of Acidity
TP01	0.00 - 1.00	Transported soils	4.16	0.0381	Very Corrosive	Strongly Acidic
TP05	0.00 – 0.80	Transported soils	5.88	0.0229	Very Corrosive	Moderately Acidic
TP09	0.00 - 0.40	Transported Soils	5.22	0.0262	Very Corrosive	Strongly Acidic
TP14	0.00 – 0.60	Transported Soils	6.13	0.0131	Extremely Corrosive	Moderately Acidic
TP16	0.00 – 0.60	Transported Soils	4.76	0.0338	Very Corrosive	Strongly Acidic
TP22	0.00 – 0.50	Transported Soils	4.11	0.0381	Very Corrosive	Strongly Acidic

To determine the suitability of any excavated soils for use as a general fill or selected layers in earthworks, several CBR tests were carried out on bulk samples collected during the fieldwork. These results are presented in Table 5 below:

Table 5 – Summary of Laboratory Test Results – (Roads & Earthworks)									
TP No	Depth (m)	Material	PI (%)	GM	CBR Value @ % Mod AASHTO				COLT O Class
					90%	93%	95 %	100 %	
TP01	0.00 – 1.00	Sandy Clay: Transported soils	12	0.67	2	4	5	12	>G9
TP09	0.00 – 0.40	Sandy Clay: Transported soils	11	0.82	2	5	8	28	>G9
TP16	0.00 – 0.60	Clayey Sand: Transported soils	8.0	1.57	7	13	19	51	G8
TP22	0.00 – 0.50	Sandy Clay: Transported soils	8	1.05	4	7	10	21	G9

3. GEOTECHNICAL ASSESSMENTS

The geotechnical assessment of the site is required to provide a broad overview and classification of the suitability of the land for the proposed development and outline geotechnical constraints to the development of the area. The following constraints, as proposed by Partridge, Wood and Brink, have to be considered for the classification of sites for urban development as highlighted in Table 4.

- Extensive soil profile.
- Collapsible/compressible soil profile.
- Erodibility of the soil profile.
- Excavatability.
- Undermined ground.
- Instability of areas of soluble rock.
- Steep slopes.
- Unstable natural slopes.
- Seismic activity; and
- Areas subject to flooding.

The constraints listed above are discussed individually in the following sections.

3.1. EXPANSIVE SOIL PROFILE

The results of the grading and indicator tests are summarised in Table 2, overleaf. The residual and transported soils on this site are essentially fine-grained to coarse-grained clayey, silty, gravelly sands, which exhibit a plastic nature. These soils thus have a low to medium heave potential.

Using the method proposed by Van Der Merwe, all horizons are classified as having a low to medium heave potential in terms of the degree of expansiveness.

3.2. CORROSIVENESS OF SOILS

Two samples of soil were subjected to a variety of tests to assess the potential of the soil to corrode steel and concrete.

The test results suggest that the transported soils are strongly acidic and will thus be very corrosive to extremely corrosive towards the buried steel and concrete, and thus HDPE pipes are recommended to be used for services on this site.

3.3. COLLAPSIBLE / COMPRESSIBILITY

Collapsible soils are soils that exhibit a collapsible nature, are often pin-hole, and exhibit an open-textured structure in most instances. This type of soil has an expected range of total soil movements between 5mm to 10mm. and an assumed differential settlement of a maximum of 50%, and no collapsible soils were encountered on this site.

Compressible soils are materials that are fine-grained soils (clayey silts and clayey sands of low plasticity), sands, and sandy and gravelly soils. No compressible soils were encountered on this site.

3.4. ERODIBILITY OF SOIL PROFILES

The soil in the upper reaches of the profile is probably not erodible if subjected to high water velocity, as it is generally cohesive. Though this site has a moderate to high water table, and as a result, subsurface erosion will occur, and measures will need to be taken to control this.

3.5. EXCAVATABILITY

The excavation characteristics of the different soil horizons have been evaluated according to the South African Bureau of Standards standardised 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. For specific excavation requirements, refer to the soil profiles.

Table 5: Excavation Data (SANS 1200 D)	
Soft Excavation	Very loose/very soft through to dense or stiff.
intermediate excavation	Very dense/very stiff through to very soft rock
hard excavation	Soft rock or better

The soils in this site are classified as "Soft to Immediate excavation" to an average depth of 3.0m, and it is expected that the soils below a depth of 3.0m will be classified as "hard excavation" and power tools and blasting will be required to excavate this material to the desired depths.

It is recommended that the sides of any excavations deeper than 1.5m should be sloped to 1:1.5, to ensure sufficient slope stability to prevent collapse of the sidewalls. During periods of heavy rainfall, however, the sides of the excavations should be regularly examined to ensure the safety of the excavation for personnel and equipment working in them

3.6. UNDERMINING

The area within the vicinity of the site does not currently have any known undermining problems, and thus the area is not undermined.

3.7. INSTABILITY OF AREAS OF SOLUBLE ROCK

The site is classified as non-dolomitic land.

3.8. SLOPE STABILITY / STEEP SLOPE

The site has a gentle slope but is not considered undevelopable as a result. It is envisaged that the development will require the construction of deep areas of cut and so this factor is considered necessary to consider.

Where deep cuts have been constructed, such exposed surfaces that are not protected will be highly susceptible to erosion. It is therefore imperative that all exposed cut and surface drainage faces are protected by engineered designs.

Slope stability can only be enhanced by well-designed engineering works, such as controlled stormwater drainage. Where it is required to construct slopes between properties, it is recommended that slopes of 1:3 (vertical: horizontal) or flatter are adopted. Should it be necessary to construct retaining walls, it is recommended that an internal angle of friction of 30 degrees should be adopted in calculating thrust force values.

Cut slopes should preferably not be left unprotected and should be supported using a reinforced concrete retaining wall or, preferably by more flexible means such as Terraforce walls or gabions. If left exposed, slopes in their materials will tend to be prone to instability and erosion.

3.9. SEISMIC ACTIVITY

According to Fernandez and Guzman, the area investigated is classified as having a seismic intensity of between V and VI on the modified Mercalli scale (MMS) with a 90% probability of not being exceeded during a 100-year recurrence period. An earthquake with an intensity of V on the MMS is described as having the following characteristics:

- It can be felt outdoors, and its direction is estimated.
- Sleepers are awakened.
- Liquids are disturbed, and some are spilled.
- Small, unstable objects are displaced or upset.

- Door's swing, close or open.
- Shutters and pictures move, and
- Pendulum clocks stop, start or change rate.

The expected peak ground acceleration values associated with these magnitudes of the earthquake are:

- Horizontal acceleration: 32 to 56 cm/s²
- Vertical acceleration to 18 cm/s²

The peak ground acceleration values indicate low intensity of seismic activity. No special seismic design measures are therefore required.

3.10. SITE GROUNDWATER

Significant groundwater seepage was observed within the residual soils during trial pitting. The presence of groundwater at shallow depths poses several geotechnical challenges, including reduced shear strength of the soils, potential instability of excavation sidewalls, and complications during foundation construction. During construction, temporary dewatering measures such as sump pumping or well-point systems should be implemented to control groundwater inflow into excavations.

In areas where groundwater flow is persistent or excessive, the installation of subsurface drainage systems such as French drains or perforated pipes will be required as a long-term solution to manage groundwater levels around the structure

Foundation systems solutions should include appropriate waterproofing on foundations to avoid moisture ingress.

To enhance ground conditions in highly saturated areas, soil improvement techniques such as replacement of weak soils, incorporation of geotextiles, or chemical stabilisation using lime or cement may be beneficial. These interventions can increase bearing capacity and reduce settlement risks

4. INTERPRETATIVE REPORT

4.1. DISCUSSION OF RESULTS – TEST PITS

The typical soil profile across the sites has been generated based on fieldwork done by Vhuluvhi Group on site: -

4.1.1. TRANSPORTED SOILS

This horizon is characterised by transported material, which is alluvium in nature. It has been encountered in all trial holes from a minimum depth of 400mm, and has been depicted as Moist, Light brownish/ greyish, Soft, Clay Silty / Silty Clay.

Laboratory results conducted on this sample suggest that the material has a low to medium heave potential, with a plasticity index of between 8% and 12%, is reasonably fine to coarse grained in texture, with a grading modulus of between 0.67 and 1.57.

CBR Test conducted on these soils suggest that these materials classify between G8 and >G9, and having a maximum dry density of between 1733kg/m³ and 1888kg/m³.

These soils should not be used for any backfill in their current state, and stabilisation is suggested.

pH and conductivity test results suggest that this material is strongly acidic and very corrosive to extremely corrosive towards buried steel and concrete.

4.1.2. RESIDUAL SHALES

The residual shales were encountered in all trial holes from a minimum depth of 3.0m and have been depicted as moist, yellowish brown, speckled grey and black, firm, silty sand clay, slickensided.

Laboratory results conducted on this sample suggest that the material has a low heave potential, with a plasticity index of between 3% and 12%, is reasonably fine to coarse grained in texture, with a grading modulus of between 0.67 and 2.05.

The residual shales observed on site exhibit a slicken-sided structure, indicative of shear movement and potential weakness planes within the soil mass. These soils are classified as having a medium heave potential, primarily due to the presence of expansive clay minerals within the weathered shale matrix. As such, they are susceptible to volume changes in response to moisture fluctuations, particularly during seasonal wetting and drying cycles.

This behaviour can lead to differential settlements, especially beneath lightly loaded structures such as residential buildings, where uneven expansion or shrinkage across the footprint may induce structural distortion or damage. Special consideration should therefore be given to foundation design, with emphasis on accommodating potential heave and reducing moisture ingress around structures.

4.2. GEOTECHNICAL MAPPING OF THE SITE

In order to map the geotechnical characteristics of the underlying soils, the classification method proposed by The Joint Structural Division of SAICE, and IstructE The Code of Practice entitled “Foundations and Superstructures for Single Storey Residential Buildings of Masonry Construction” as described in Table 7 below.

Table 7: Residential site class designations				
Typical Founding Material	Character of Founding Material	Expected Range of Total Soil Movements (Mm)	Assumed Differential Movement (% of Total)	Site Class
Rock (excluding mud rocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	<7,5	50%	H
		7,5-15	50%	H1
		15-30	50%	H2
		>30	50%	H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSIBLE SOILS	<5,0	75%	C
		5,0-10	75%	C1
		>10	75%	C2

Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOIL	<10 10-20 >20	50% 50% 50%	S S1 S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip, Land fill, Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	VARIABLE	VARIABLE		P

Based on the visual inspection of the soil horizons made during the site investigation and the Laboratory Test results, the site was classified as H1/H2.

Transported Soils – H1

Residual Shales – H2

4.3. DYNAMIC CONE PENETROMETER (DCP) TESTS

Ten (10) Dynamic Cone Penetrometer (DCP) tests were carried out to supplement the information obtained from the trial pits and confirm the consistency of the sub-surface layers.

- The transported soils intersected on site, and the DCP results suggest that they are generally soft/ loose to medium dense/firm with a minor dense.
- The residual shales were intersected and show a medium dense/firm consistency.
- The DCP has a limitation of 1m depth and therefore couldn't reach the bottom of the residual shales, though the soil profiling indicates that these soils are medium dense in consistency and exhibit an expansive nature.

DCP data should be treated with caution, especially for the gravelly soils, which can indicate apparent high estimated bearing capacity values due to slow penetration. The slow penetration rate can be attributed to the scattered gravels of the decomposing parent rock; hence the derived bearing capacity values can be misleading and should be treated with caution during design.

4.4. FOUNDATION RECOMMENDATIONS (LIGHT TO MEDIUM LOADED STRUCTURES)

Based on the field investigation and laboratory results, we can deduce that the site is underlain by heaving transported soils and residual shales.

The following engineered foundation solutions are based on the soil profiles and laboratory testing results.

4.4.1. REINFORCED CONCRETE RAFT

To spread loads evenly and resist differential movement or withstand differential settlements, a reinforced concrete raft foundation solution, designed by a suitably qualified structural engineer, should be considered.

All foundations should be inspected by a competent person to ensure that all the recommendations made in this report are complied with accurately. All foundation is isolated from direct soil moisture fluctuations as much as possible, and all underground cable trenches should be flexible-jointed and allow for minor movements.

Proper drainage control should be implemented, including perimeter and subsurface drains, site grading to divert surface water away, and as well as waterproofing.

4.4.2. SOIL RAFT

Remove all or part of the expansive horizon to 1.0m beyond the perimeter of the structure and replace it with inert backfill compacted to 93 per cent MOD AASHTO density at -1 per cent to +2 per cent of optimum moisture content.

Normal construction with lightly reinforced strip footings and lightly reinforcement in masonry if the residual movements are <5 mm or construction or construction type appropriate to residual movements. Site drainage and plumbing service precautions should be implemented.

4.5. FOUNDATION RECOMMENDATIONS (HEAVILY LOADED STRUCTURES)

For heavily loaded structures constructed on these heaving residual shales, foundation design must consider the potential for significant volume changes due to seasonal moisture fluctuations. These soils are prone to swelling when wet and shrinking when dry, resulting in differential heave and causing structural distress and as such, conventional shallow foundations are generally not recommended.

Taking into account the groundwater seepage on site, a hybrid system combining piles and a suspended slab or stiffened raft offers a robust solution, providing both load-bearing capacity and flexibility to accommodate ground movement. It is critical to implement moisture control measures, such as surface drainage, perimeter paving, and moisture barriers, to limit fluctuations in soil moisture content.

4.6. GENERAL

Although every effort has been made to ensure the accuracy of the information contained in this report, the results are based on fieldwork. It is thus possible that localised 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 to verify that the materials thus exposed are not at variance with those described in the report and that they meet design criteria.

To avoid the potential of differential settlement, it is recommended that foundations for individual structures should not be placed in or on differing foundation materials.

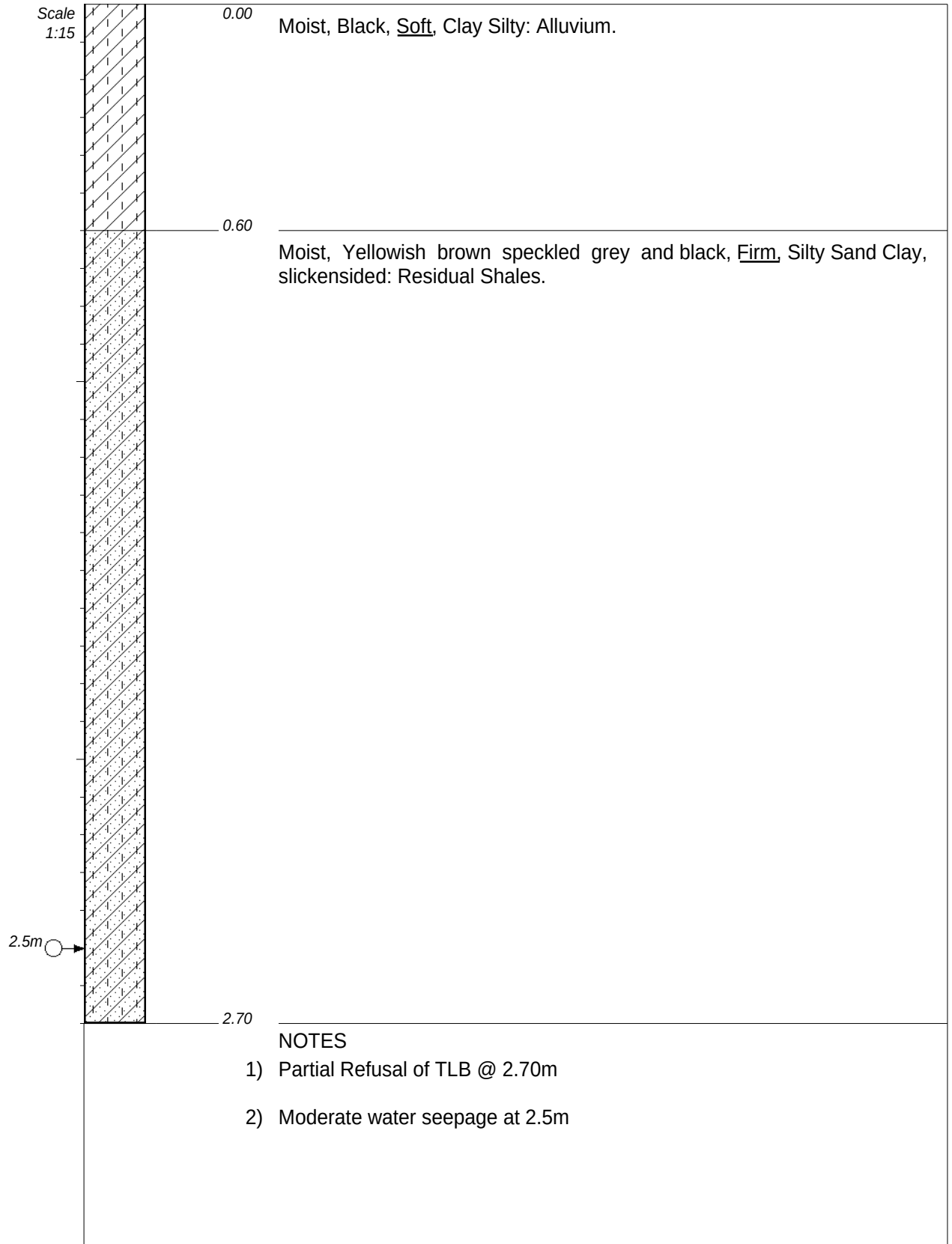
4.7. CONSTRUCTION MONITORING & QUALITY CONTROL

It is recommended that all foundations be inspected by a competent person, prior to placing any concrete. Regular checks on the quality and compaction of the backfill to the terraces should be made.

5. REFERENCES

- 1) Jennings JE et al . "Revised Guide to Soil profiling for Civil Engineering Purposes in Southern Africa" - Civil Engineer in South Africa , January 1973
- 2) Van der Merwe DH . "The prediction of heave from the Plasticity Index and percentage clay fraction of soils" - Civil Engineer in South Africa Vol 6, 1964
- 3) TRH 14, "Guidelines for Road Construction Materials" - NITRR, 1985
- 4) Jennings, J and Knight, K. (1975). A guide to construction on or with materials exhibiting additional settlement due to "collapse" of grain structure. Proceedings of the Sixth Regional Conference on Soil Mechanics and Foundation Engineering. Durban
- 5) SANS 1936 Parts 1, 2 and 3: 2012 Development of Dolomitic Land
- 6) Proposed method for dolomite land hazard risk assessment in South Africa. Buttrick, Van Schalkwyk, Kleywegt, and Watermeyer. Journal of South African Institution of Civil Engineering 43(2) and 44(3).2001
- 7) The method of scenario supposition for stability evaluation of sites on dolomitic land in South Africa. Buttrick and Van Schalkwyk. 1995
- 8) Application of the method of scenario supposition risk evaluation technique for the assessment of the stability of sites underlain by dolomite in South Africa. Calitz. 1995
- 9) Problems of soils in South Africa - State of the Art - Dolomite. Wagener. 1985
- 10) Construction methods on dolomitic land. Van der Berg. 1996
- 11) Watermeyer RB, Buttrick DB, Trollip NYG, Gerber AA, Pieterse N (2008) A performance-based approach to the development of dolomite land"

APPENDIX A



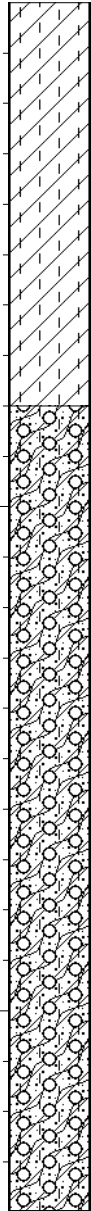
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP10

Scale
1:15

0.00

Moist, Light brownish, Soft, Clay Silty: Alluvium.

0.80

Moist, Yellowish brown speckled grey and black, Stiff, Silty Sand Clay with occasional quartzite gravels, slickensided: Residual Shales.

2.40

NOTES

- 1) Partial Refusal of TLB @ 2.40m
- 2) No water seepage

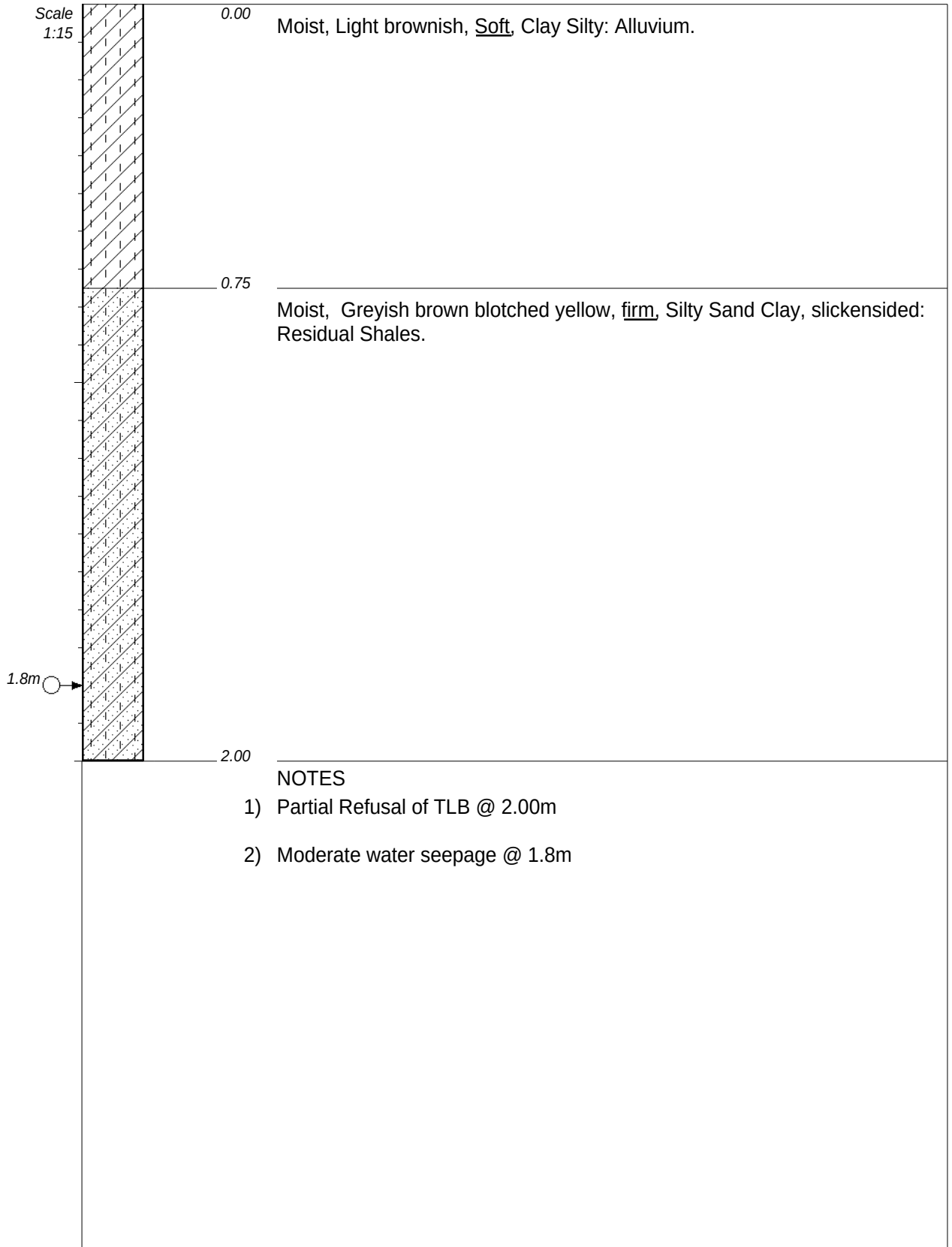
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DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP11



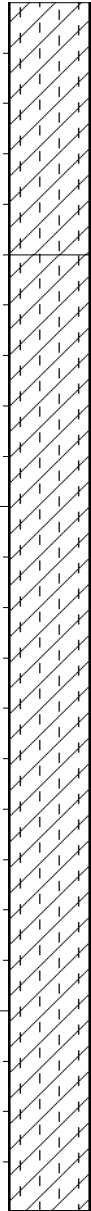
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DIAM :
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP12

Scale
1:15

0.00

Moist, Light brownish, Soft, Silty Clay: Alluvium.

0.50

Moist, Yellowish, firm, Silty Clay, slickensided: Residual Shales.

2.40

NOTES

- 1) Partial Refusal of TLB @ 2.40m
- 2) No water seepage

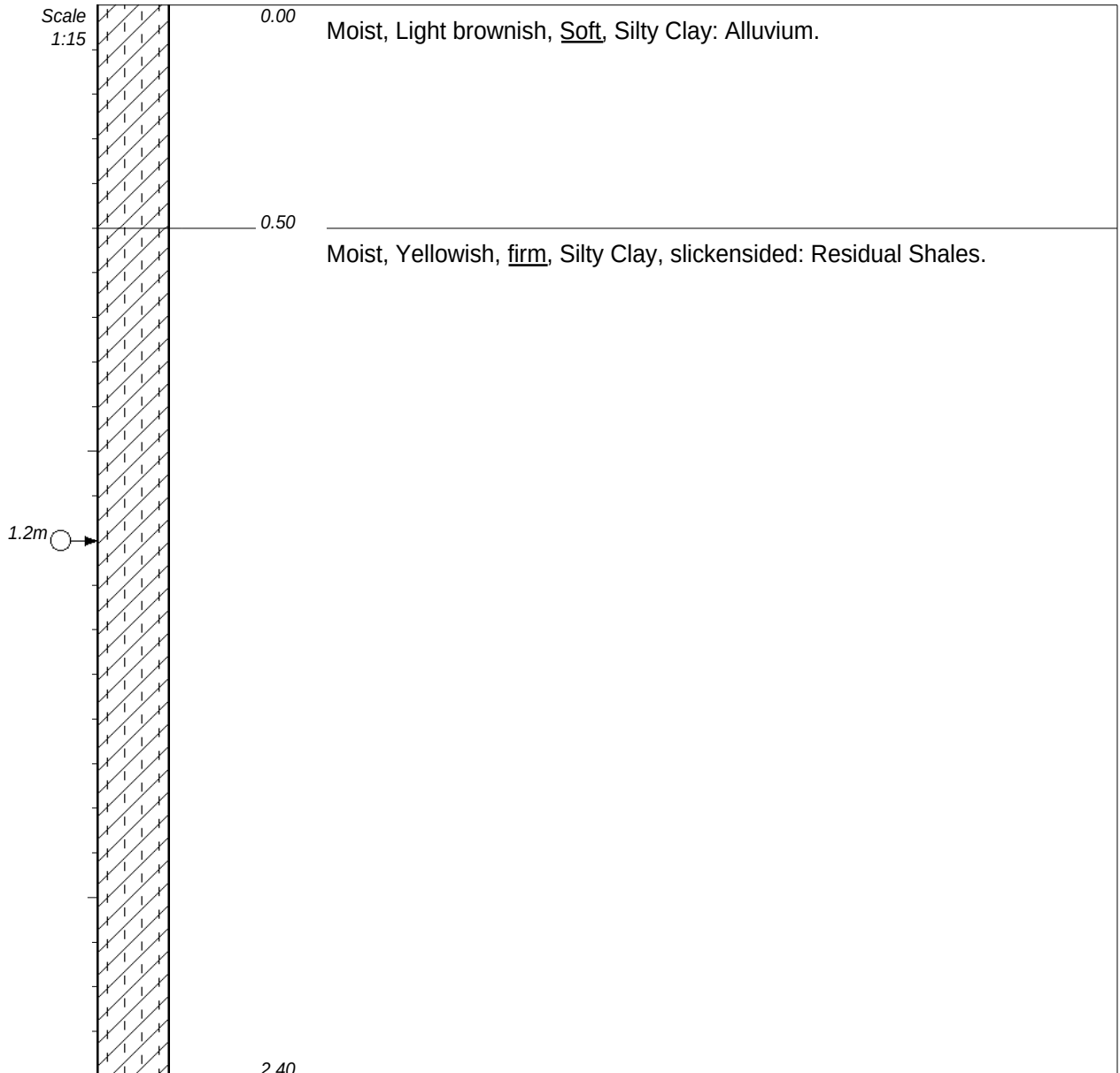
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DIAM :
DATE : 07/05/2025
DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP13

**NOTES**

- 1) Partial Refusal of TLB @ 2.40m
- 2) Moderate water seepage @ 1.2m

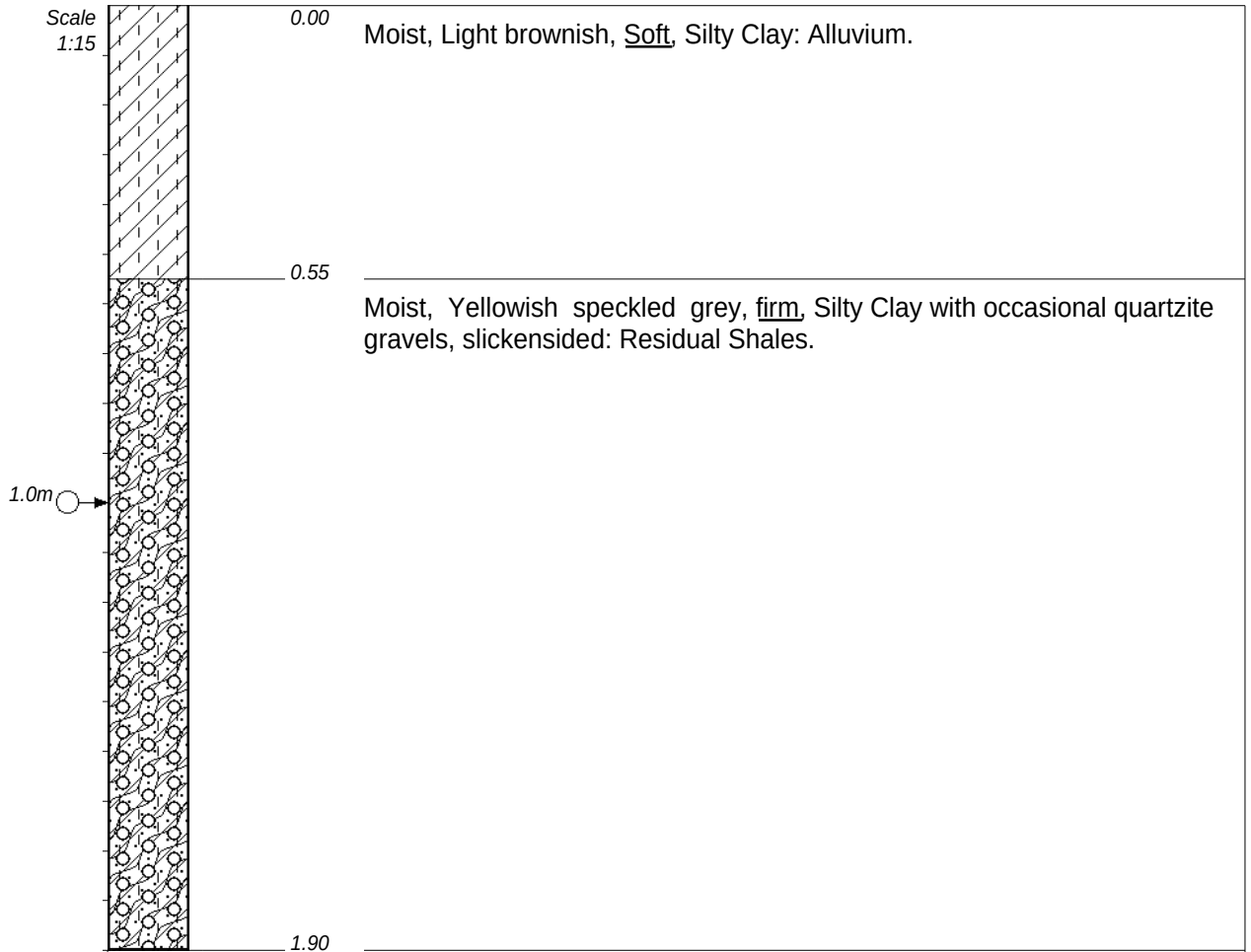
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP14



NOTES

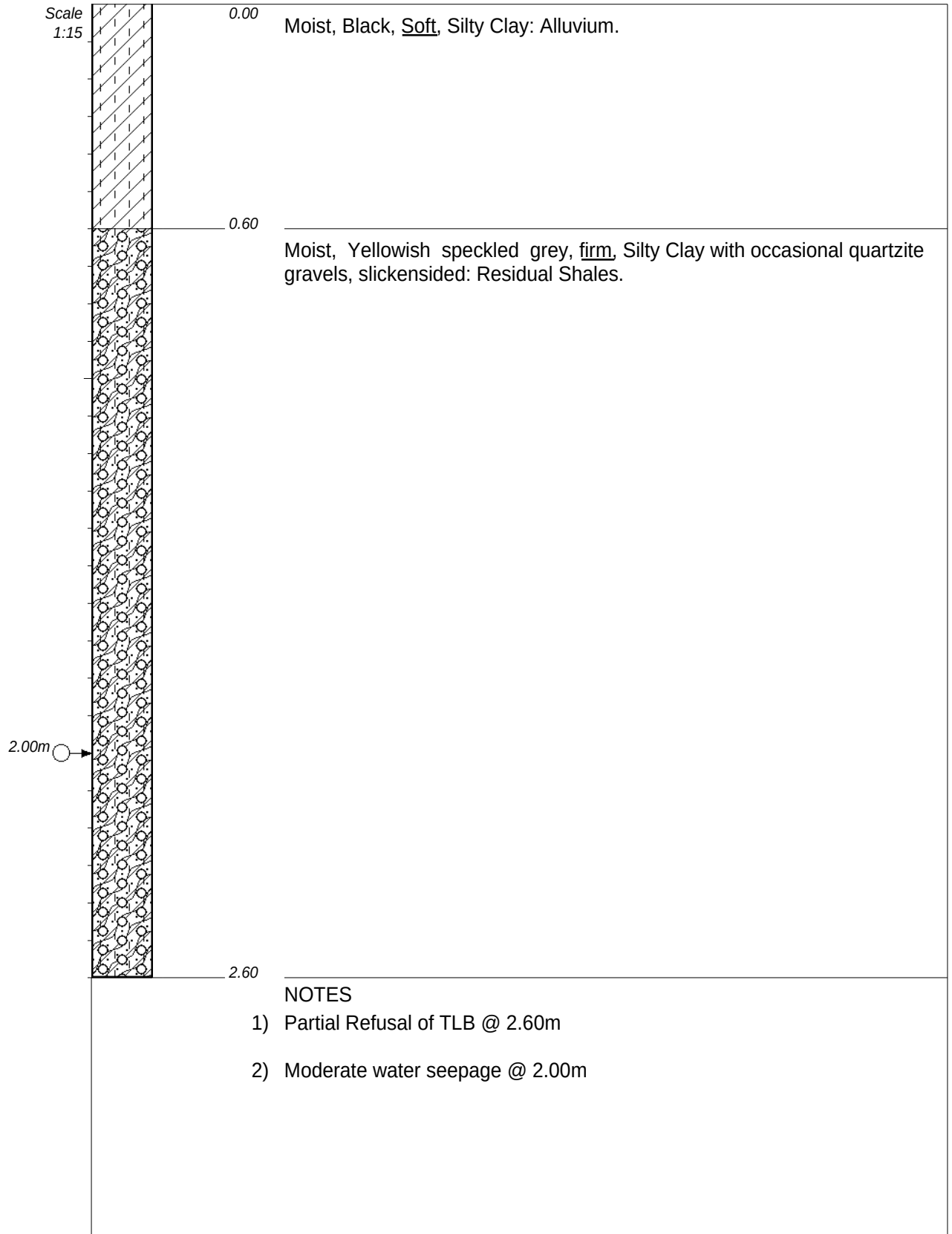
- 1) Partial Refusal of TLB @ 1.90m
- 2) Moderate water seepage @ 1.0m

CONTRACTOR :
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TYPE SET BY : OL
SETUP FILE : STANDARD.SET

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DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP15



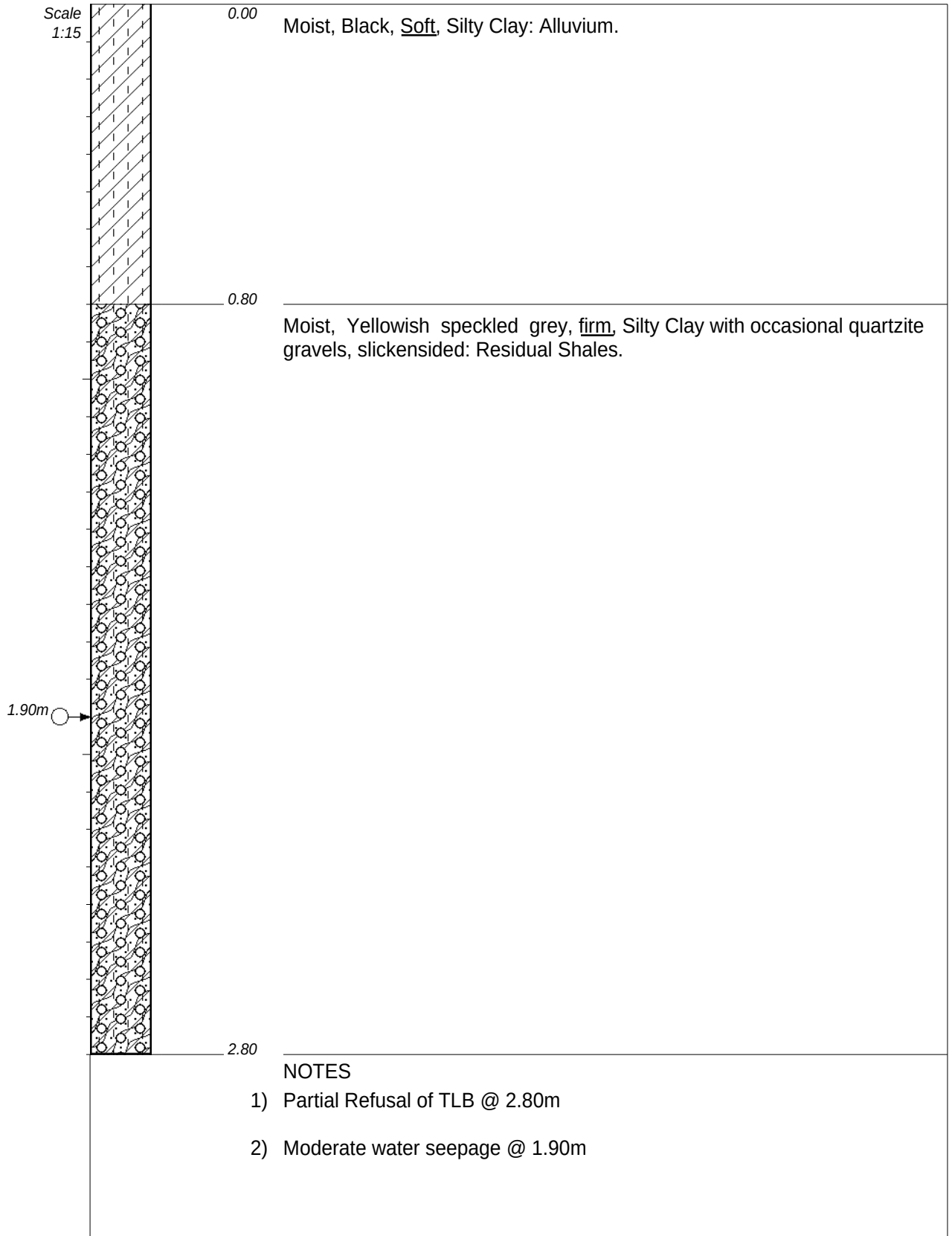
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DATE : 07/05/2025
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP16



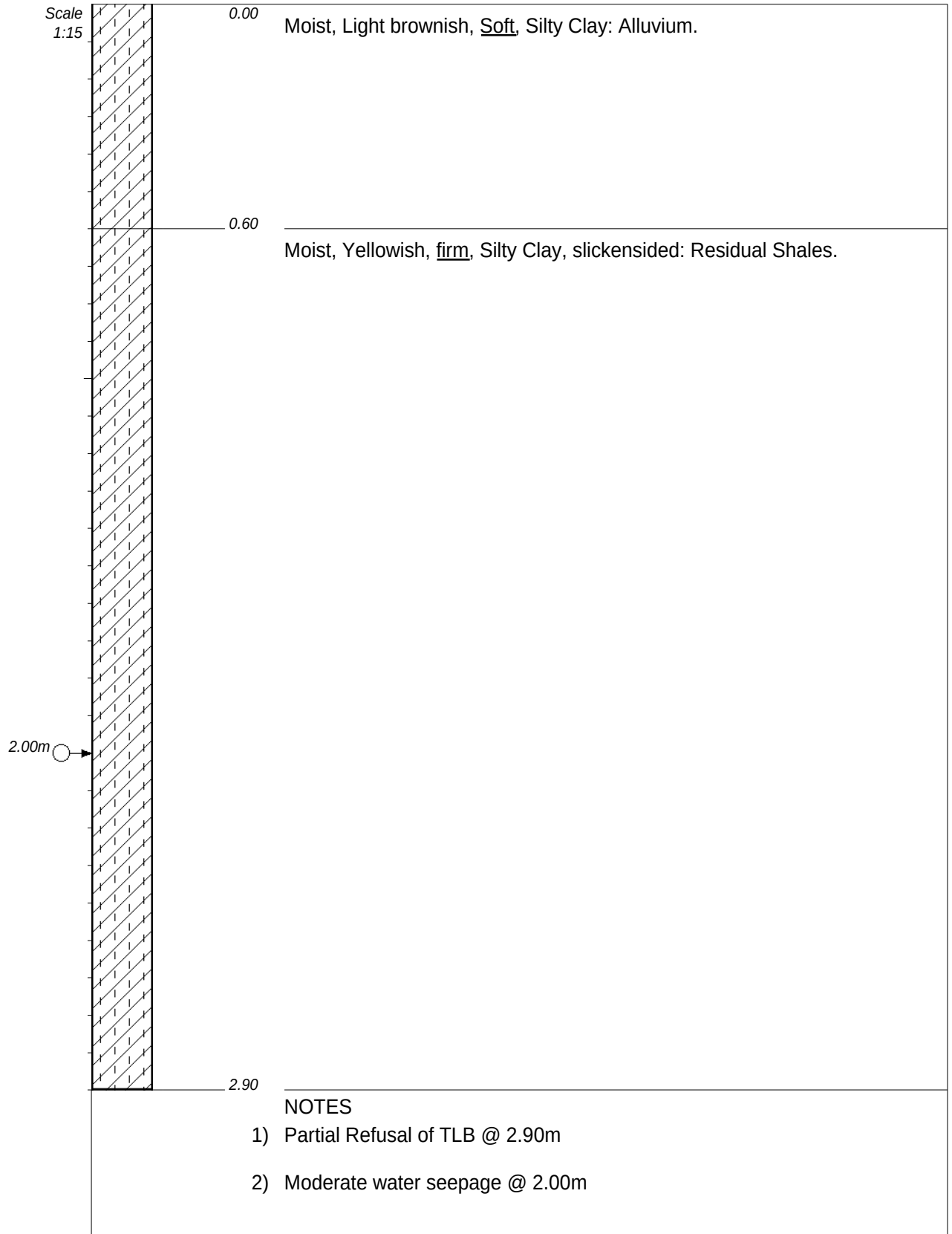
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP17



CONTRACTOR :
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PROFILED BY : OL

TYPE SET BY : OL
SETUP FILE : STANDARD.SET

INCLINATION :
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP18

Scale
1:15

0.00

Moist, Greyish brown, Soft, clayey silty sand: Alluvium.

1.00

Moist, Yellowish brown, Firm, Silty Clay, slickensided: Residual Shales.

3.00

NOTES

- 1) No Refusal of TLB @ 3.00m
- 2) Moderate Water Seepage at the bottom

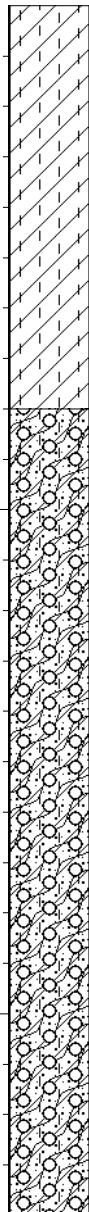
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TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP19

Scale
1:15


0.00

Moist, Light brownish, Soft, Clay Silty: Alluvium.

0.80

Moist, Yellowish brown speckled grey and black, Stiff, Silty Sand Clay with occasional quartzite gravels, slickensided: Residual Shales.

2.40

NOTES

- 1) Partial Refusal of TLB @ 2.40m
- 2) No water seepage

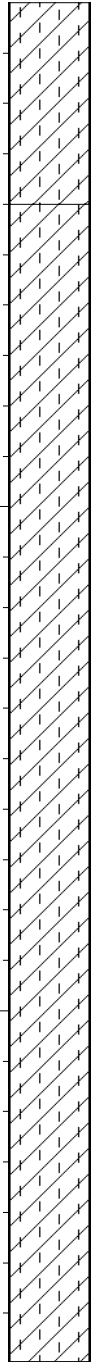
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP20

Scale
1:15

0.00

Moist, Light brownish, Soft, Clay Silty: Alluvium.

0.40

Moist, Yellowish brown speckled grey and black, Firm, slightly
ferruginised Silty Clay Sands, slickensided: Residual Shales.

2.70

NOTES

- 1) Partial Refusal of TLB @ 2.70m
- 2) No water seepage

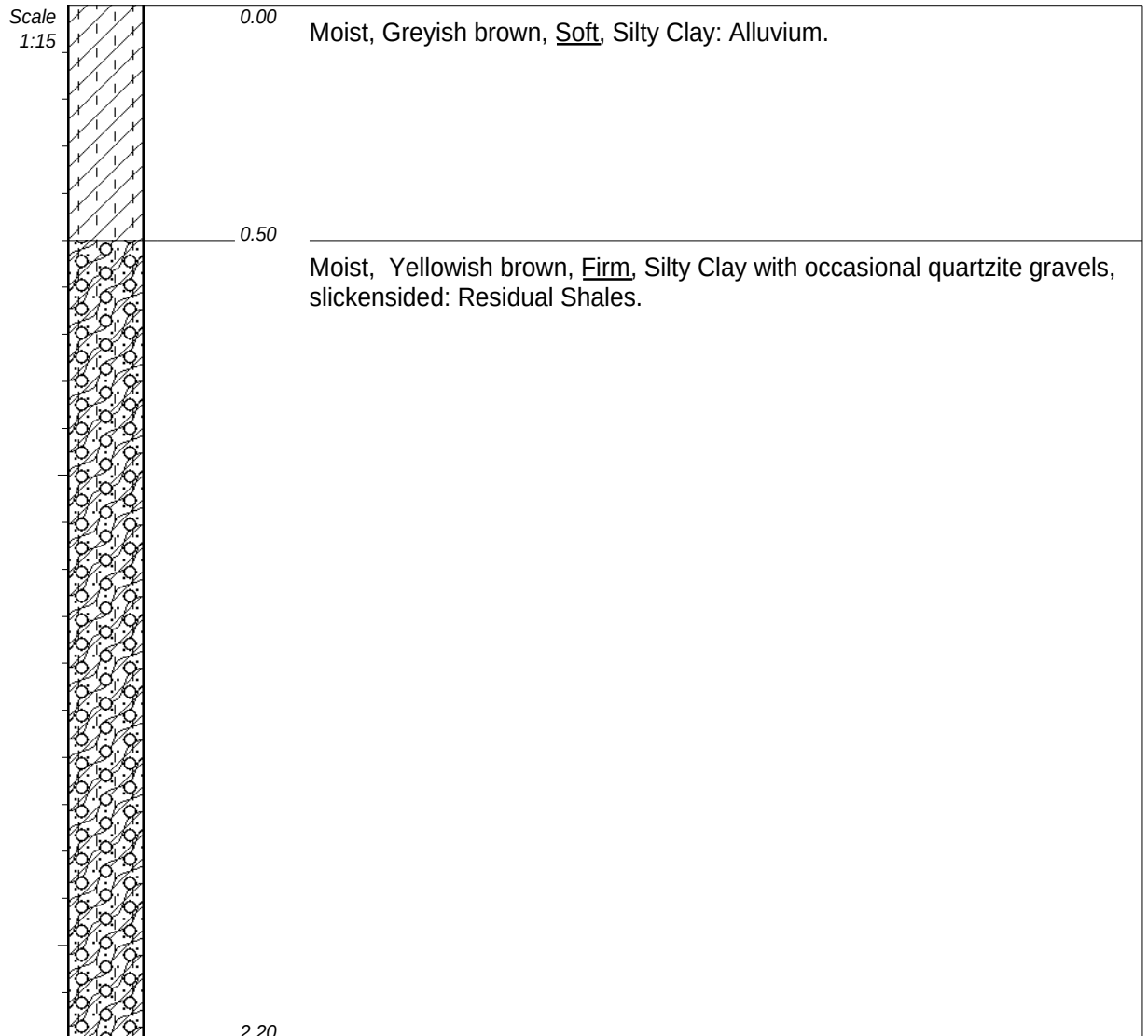
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DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP21


NOTES

- 1) Partial Refusal of TLB @ 2.20m
- 2) No water seepage

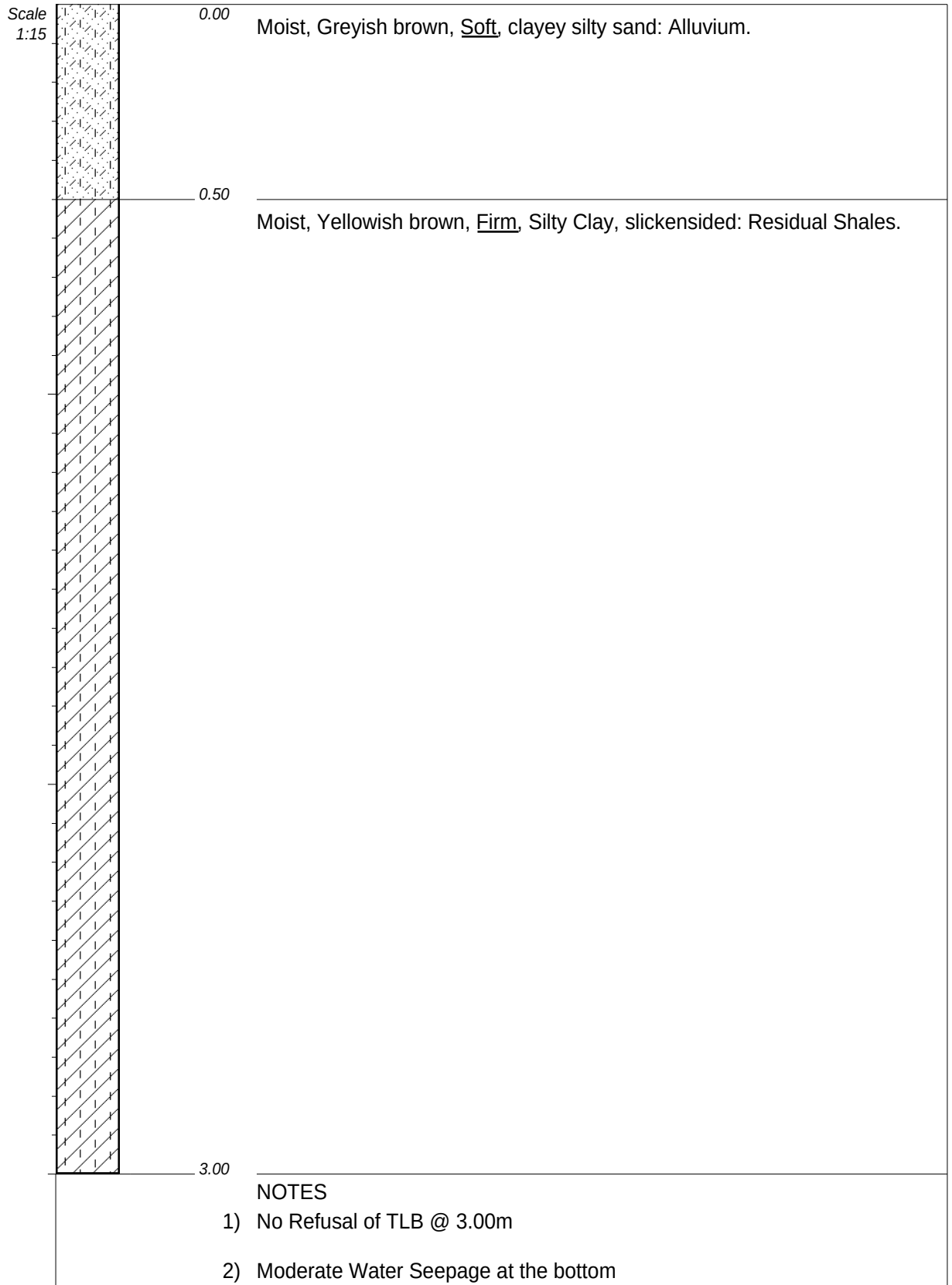
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP22



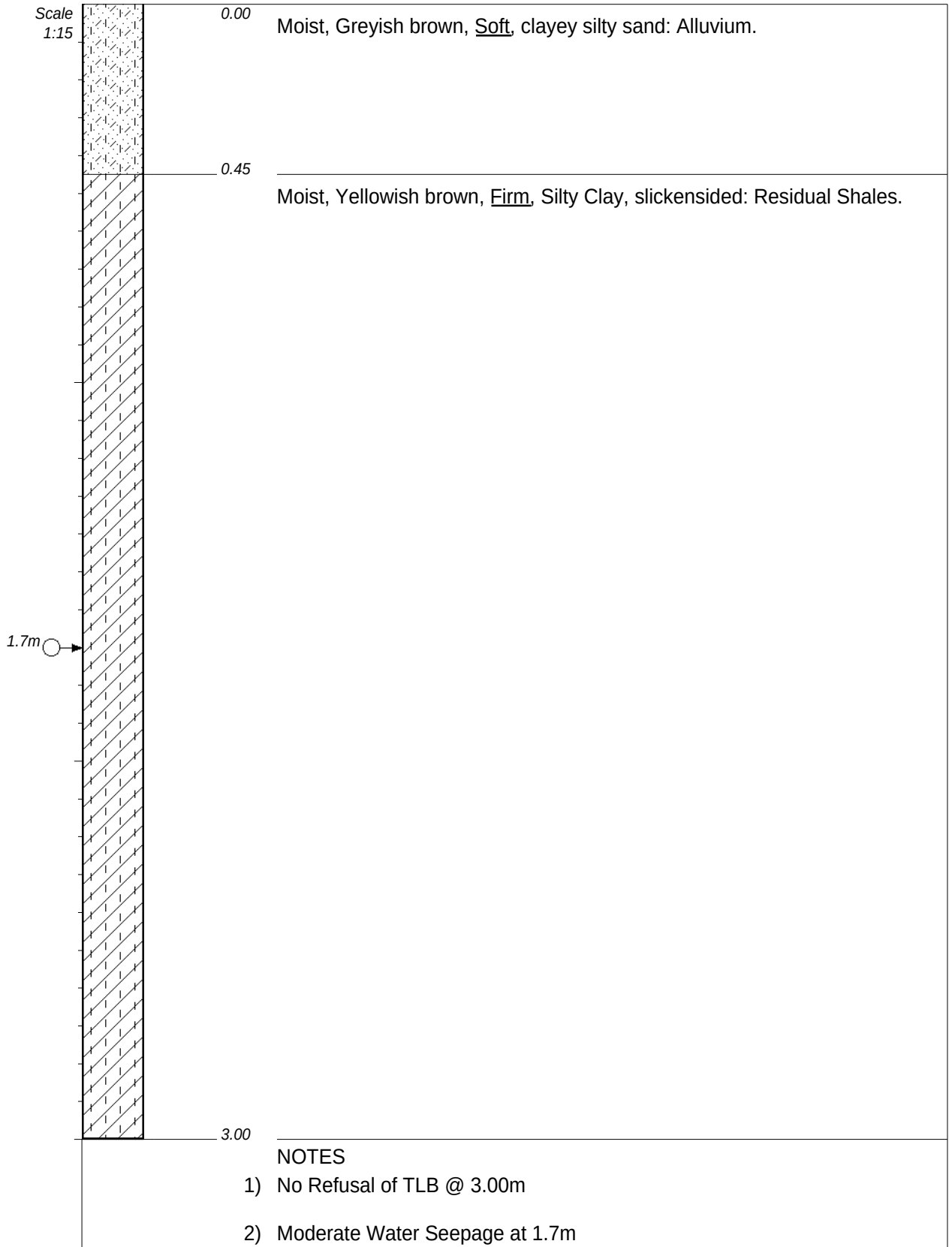
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP1



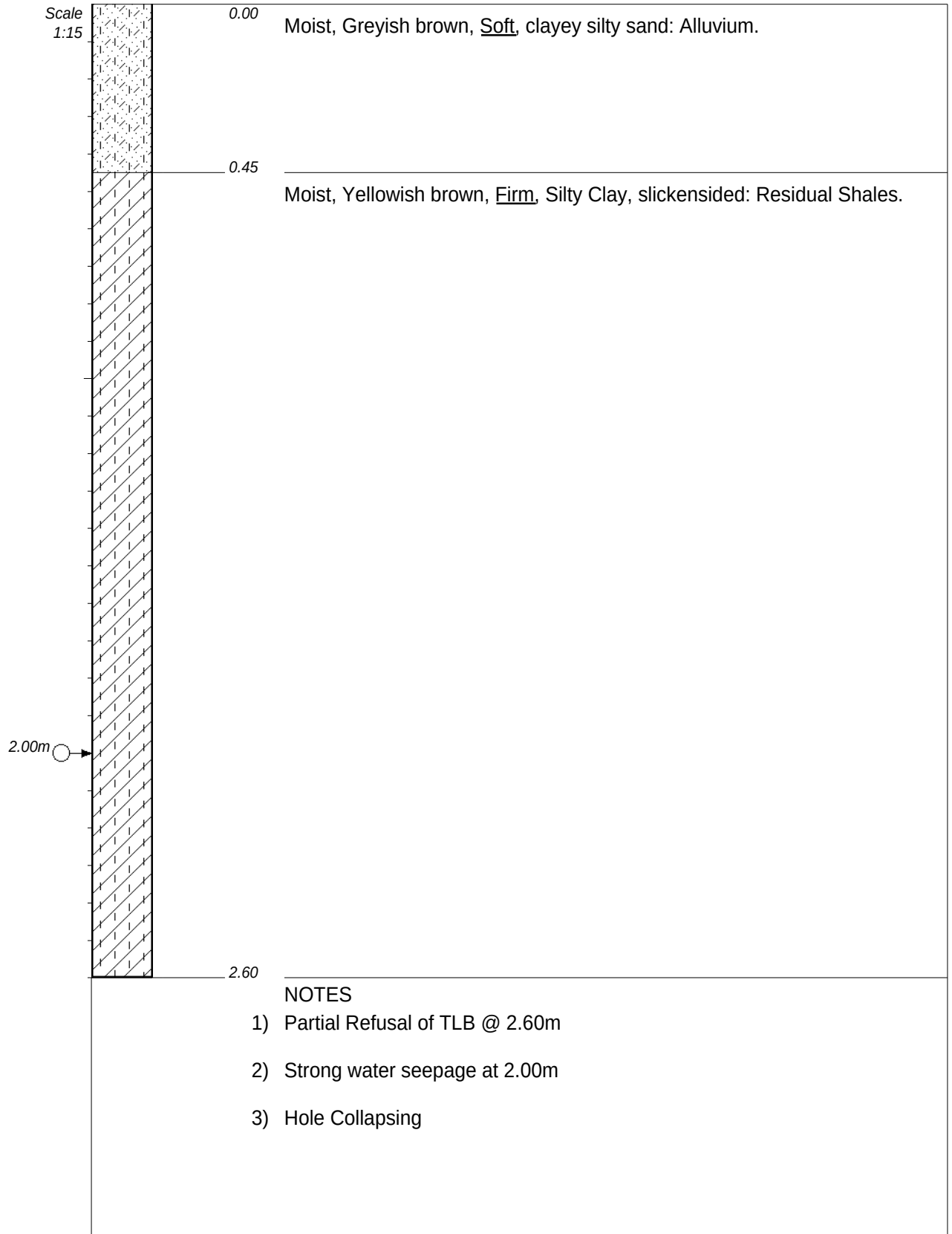
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP2



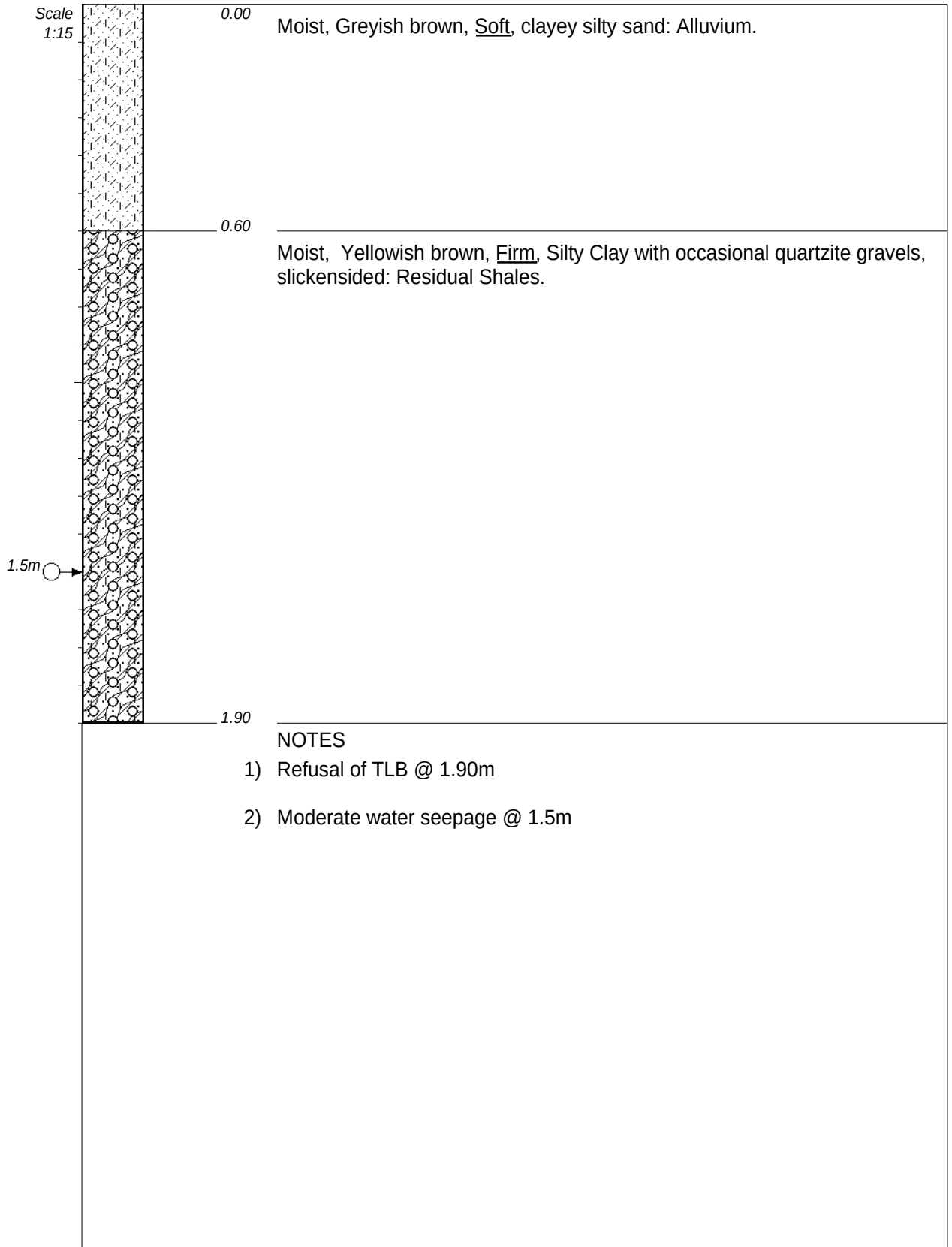
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP3



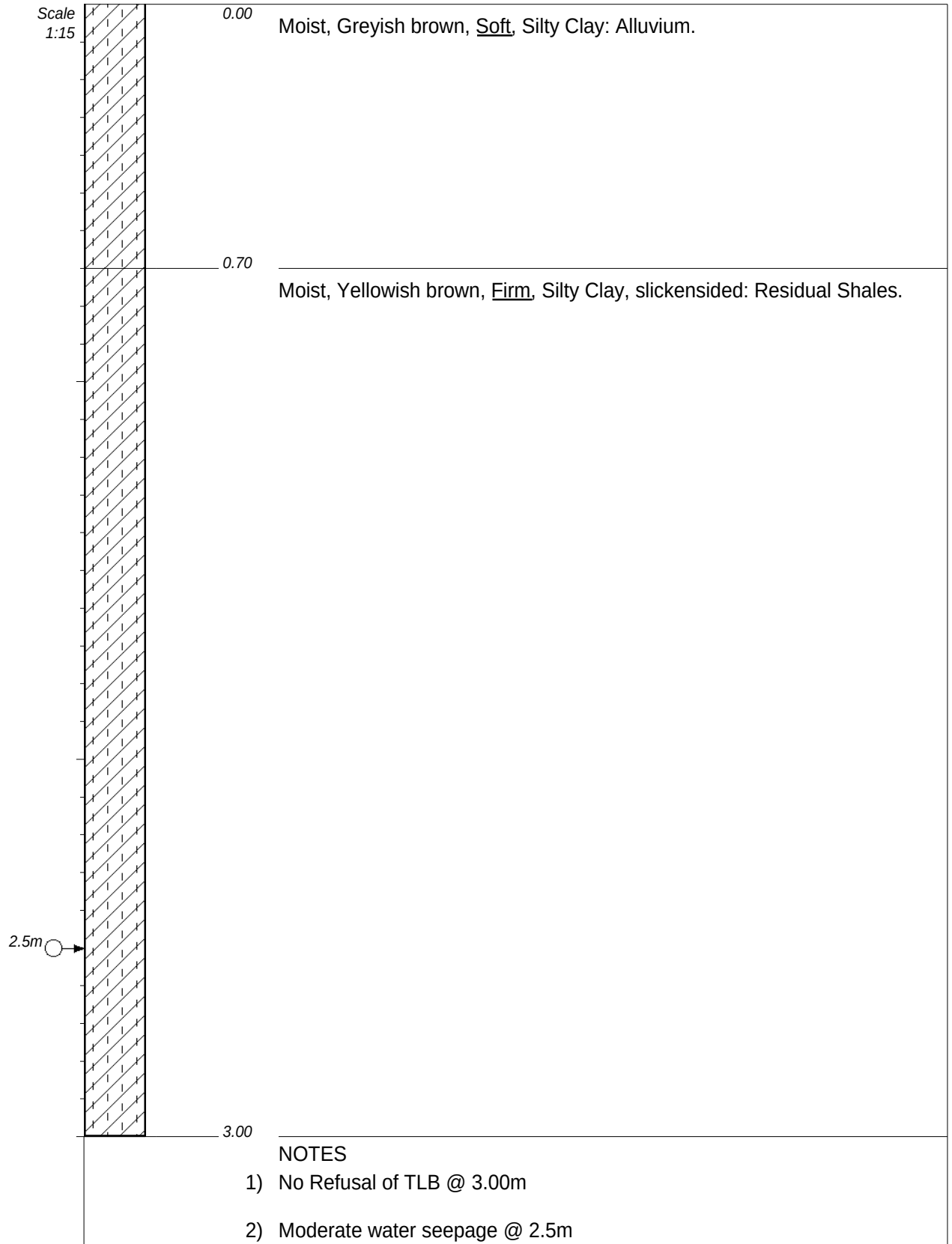
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP4



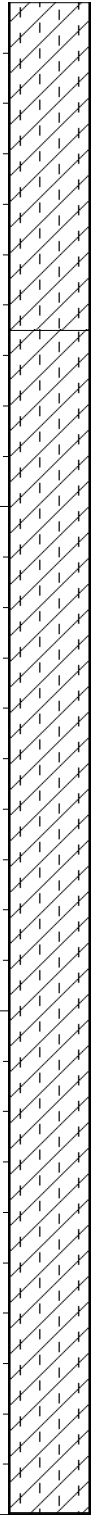
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INCLINATION :
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP5

Scale
1:15

0.00

Moist, Greyish brown, Soft, Silty Clay: Alluvium.

0.65

Moist, Yellowish brown blotched yellow and speckled black, Firm, Silty Clay, slickensided: Residual Shales.

3.00

NOTES

- 1) No Refusal of TLB @ 3.00m
- 2) No water seepage

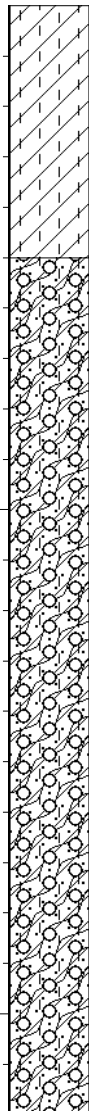
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP6

Scale
1:15

0.00

Moist, Greyish brown, Soft, Silty Clay: Alluvium.

0.50

Moist, Yellowish brown, Firm, Silty Clay with occasional quartzite gravels, slickensided: Residual Shales.

2.20

NOTES

- 1) Partial Refusal of TLB @ 2.20m
- 2) No water seepage

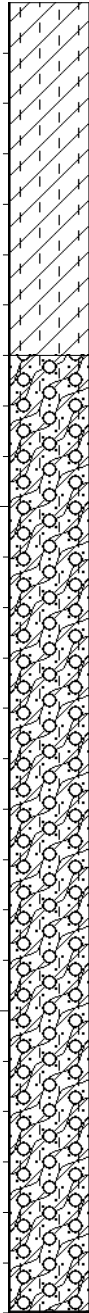
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INCLINATION :
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP7

Scale
1:15

0.00

Moist, Light brownish, Soft, Clay Silty: Alluvium.

0.70

Moist, Yellowish brown, Firm, Silty Clay with occasional quartzite gravels, slickensided: Residual Shales.

2.60

NOTES

- 1) Partial Refusal of TLB @ 2.60m
- 2) No water seepage

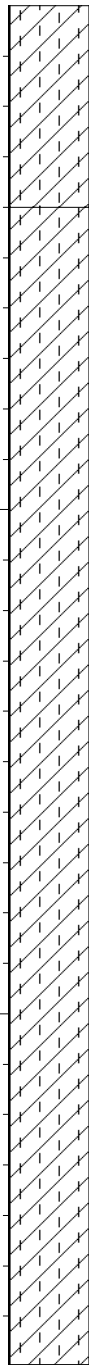
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DATE : 07/05/2025
DATE : 25/06/2025 16:23
TEXT : ..151\Downloads\HDA(2).txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP8

Scale
1:15

0.00

Moist, Light brownish, Soft, Clay Silty: Alluvium.

0.40

Moist, Yellowish brown speckled grey and black, Firm, slightly
ferruginised Silty Clay Sands, slickensided: Residual Shales.

2.70

NOTES

- 1) Partial Refusal of TLB @ 2.70m
- 2) No water seepage

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFIED BY : OL

TYPE SET BY : OL
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 07/05/2025
DATE : 07/05/2025
DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP9

	GRAVELS	{SA02}
	SAND	{SA04}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	QUARTZITE	{SA15}
6.5 	WATER SEEPAGE/water strike	{CH50}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

TYPE SET BY : OL
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 25/06/2025 16:23
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ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

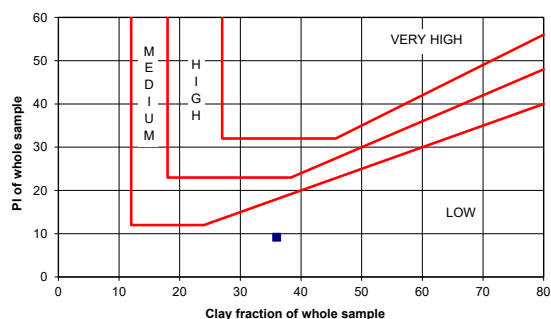
APPENDIX B

PARTICLE SIZE ANALYSIS

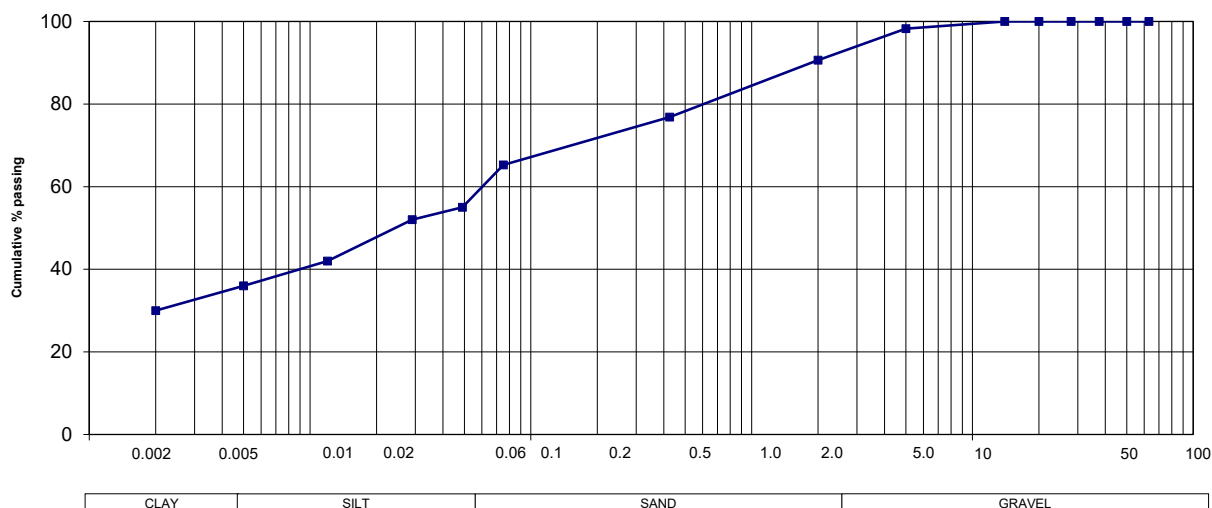
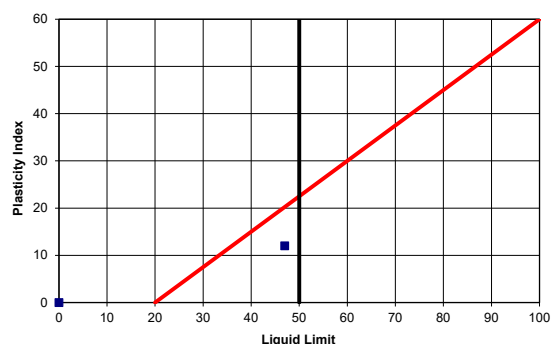
Sample No.	01
Soillab Sample No.	S25-0604-01
Depth (m)	1.00 - 2.40
Position	TP01
Material Description	LIGHT YELLOW SANDY CLAY
Relative density on < 2 mm (TMH1 A12T)	2.710
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	98
2.00 mm	91
0.425 mm	77
0.075 mm	65
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
49 µm	55
29 µm	52
12 µm	42
5 µm	36
2 µm	30
% Clay	36
% Silt	19
% Sand	36
% Gravel	9
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	47
Plasticity Index	12
Linear Shrinkage (%)	6.0
Grading Modulus	0.67
Classification	A-7-5 (8)
Unified Classification	ML
Chart Reference	

PROJECT : GRIMBEEK PARK AREA
JOB No. : S25-0604
DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



PARTICLE SIZE ANALYSIS

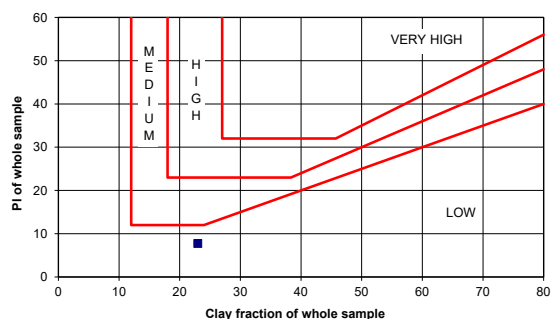
Sample No.	02
Soillab Sample No.	S25-0604-02
Depth (m)	0,70 - 3,00
Position	TP05
Material Description	DARK YELLOW CLAYEY SAND
Relative density on < 2 mm (TMH1 A12T)	2.505
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	100
2.00 mm	95
0.425 mm	70
0.075 mm	53
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
55 µm	45
33 µm	40
14 µm	29
6 µm	23
2 µm	20
% Clay	23
% Silt	22
% Sand	50
% Gravel	5
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	45
Plasticity Index	11
Linear Shrinkage (%)	5.5
Grading Modulus	0.82
Classification	A-7-5 (4)
Unified Classification	ML
Chart Reference	

PROJECT :GRIMBEEK PARK AREA

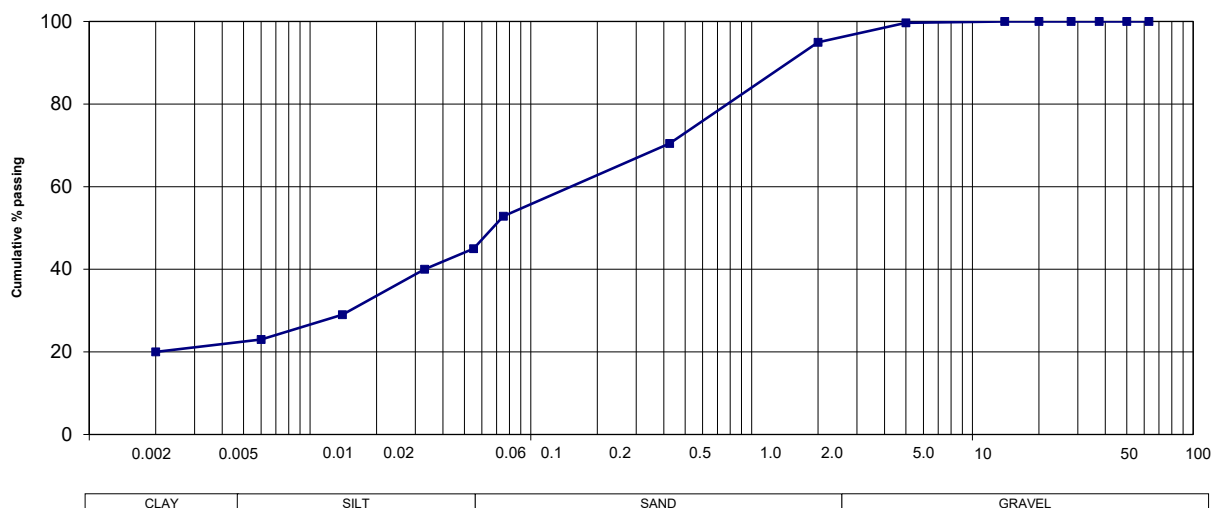
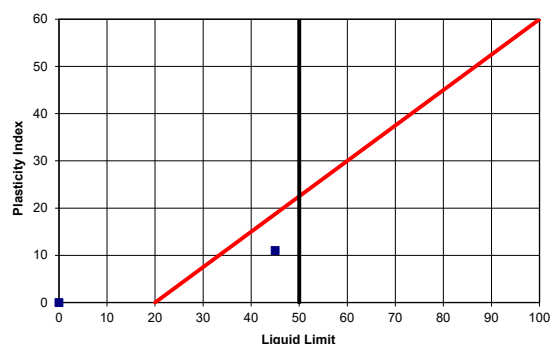
JOB No. : S25-0604

DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



PARTICLE SIZE ANALYSIS

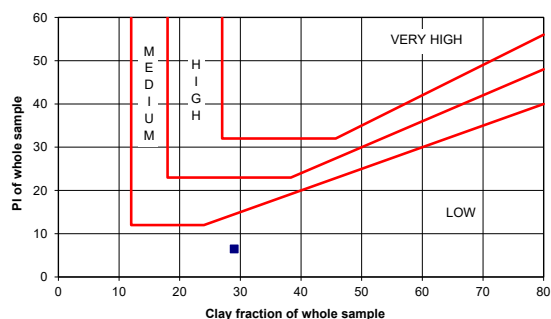
Sample No.	03
Soillab Sample No.	S25-0604-03
Depth (m)	0,40 - 2,70
Position	TP09
Material Description	LIGHT YELLOW CLAYEY SAND
Relative density on < 2 mm (TMH1 A12T)	2.626
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	99
5.0 mm	98
2.00 mm	93
0.425 mm	81
0.075 mm	64
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
53 µm	53
31 µm	48
13 µm	35
6 µm	29
2 µm	22
% Clay	29
% Silt	24
% Sand	40
% Gravel	7
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	36
Plasticity Index	8
Linear Shrinkage (%)	4.0
Grading Modulus	0.62
Classification	A-4 (4)
Unified Classification	ML
Chart Reference	

PROJECT : GRIMBEEK PARK AREA

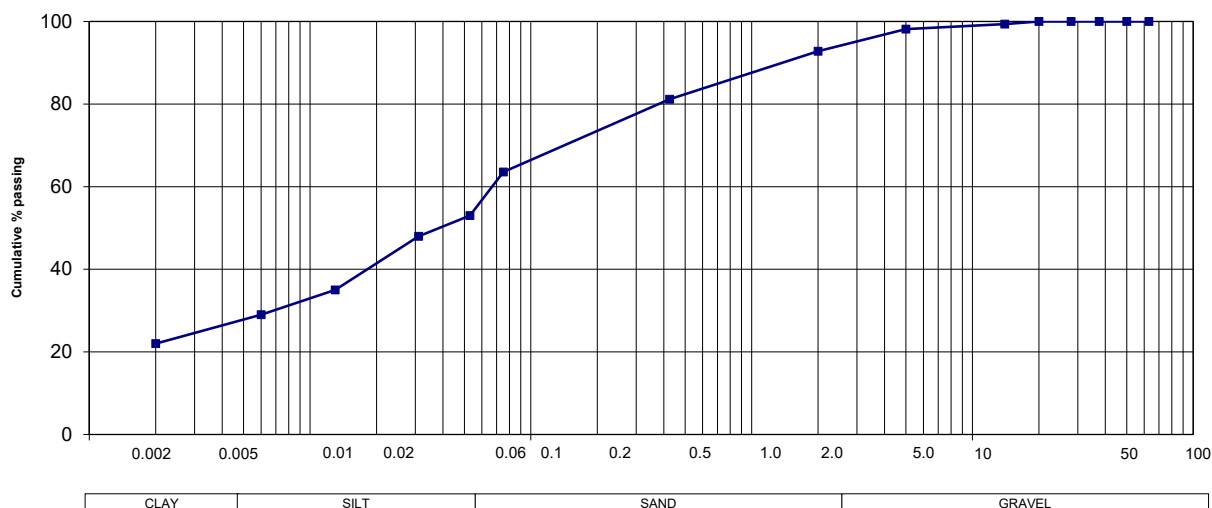
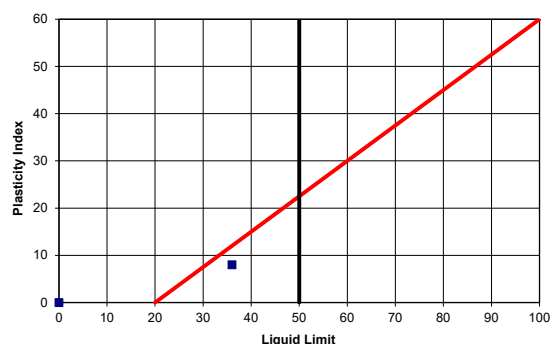
JOB No. : S25-0604

DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



PARTICLE SIZE ANALYSIS

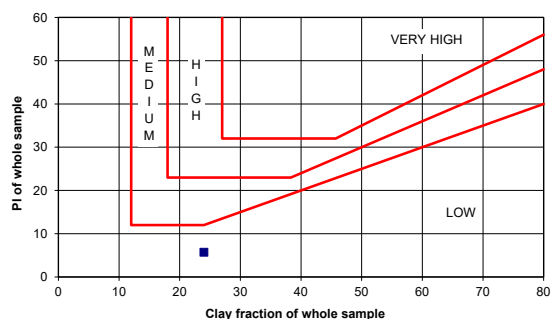
Sample No.	04
Soillab Sample No.	S25-0604-04
Depth (m)	0,75 - 2,00
Position	TP12
Material Description	LIGHT YELLOWISH SANDY SILT
Relative density on < 2 mm (TMH1 A12T)	2.613
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	98
20.0 mm	98
14.0 mm	96
5.0 mm	91
2.00 mm	83
0.425 mm	72
0.075 mm	65
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
50 µm	56
30 µm	50
13 µm	34
6 µm	24
2 µm	15
% Clay	24
% Silt	32
% Sand	27
% Gravel	17
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	43
Plasticity Index	8
Linear Shrinkage (%)	4.0
Grading Modulus	0.80
Classification	A-5 (5)
Unified Classification	ML
Chart Reference	

PROJECT : GRIMBEEK PARK AREA

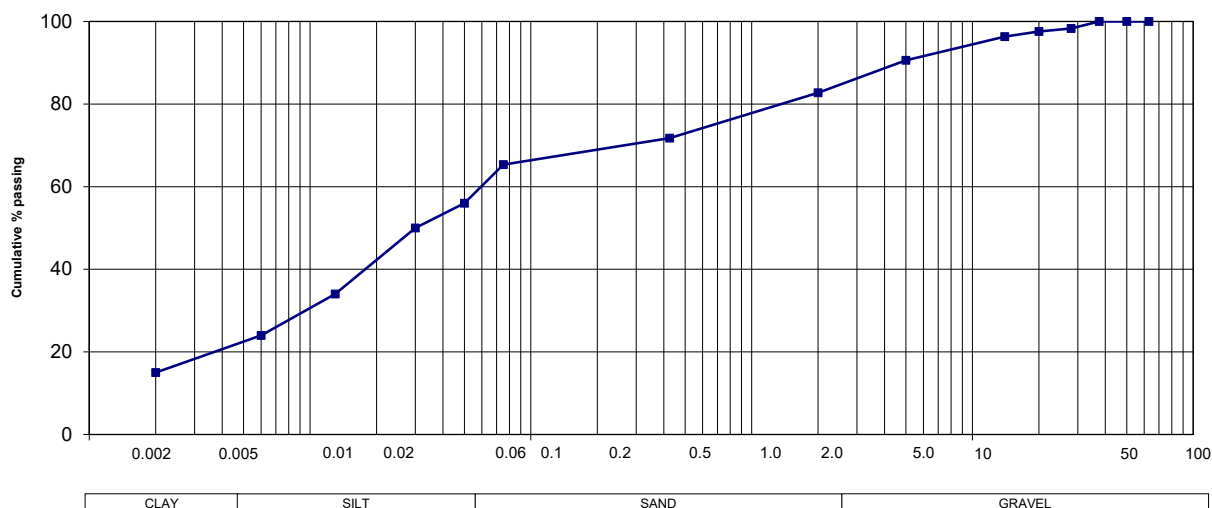
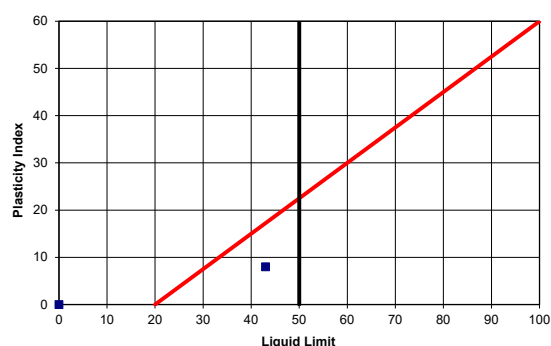
JOB No. : S25-0604

DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART

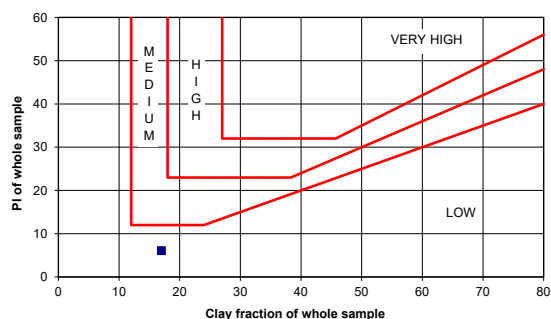


PARTICLE SIZE ANALYSIS

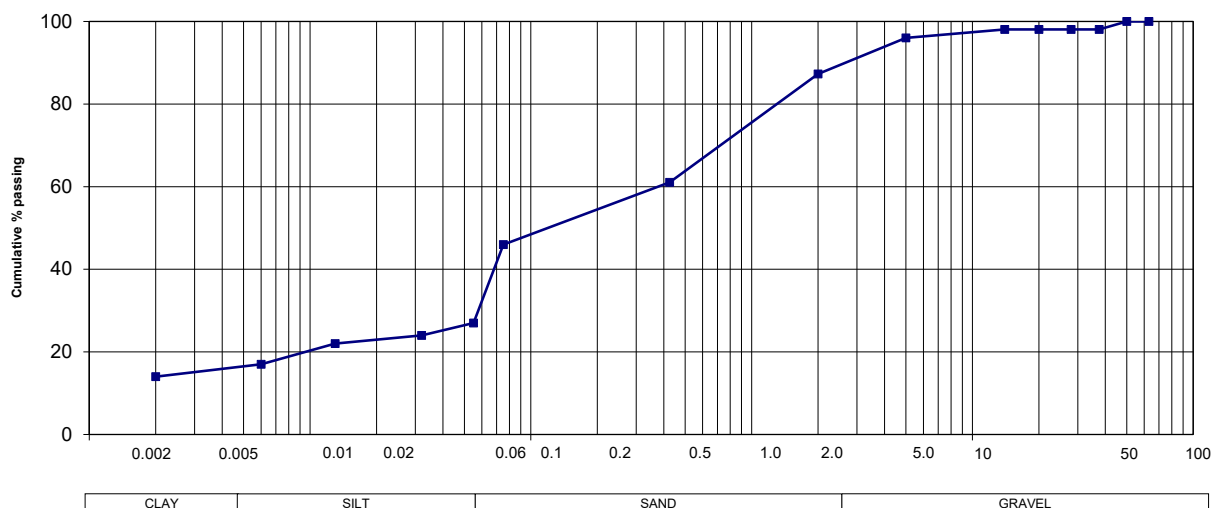
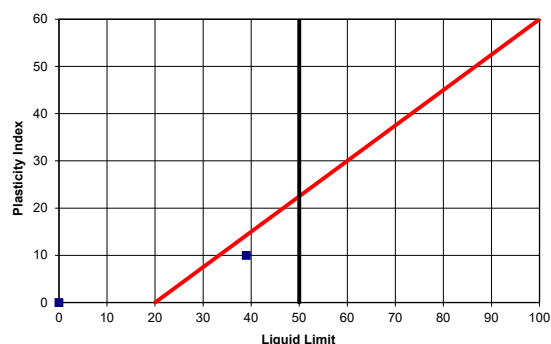
Sample No.	05
Soillab Sample No.	S25-0604-05
Depth (m)	0,50 - 2,40
Position	TP14
Material Description	LIGHT YELLOWISH CLAYEY SAND
Relative density on < 2 mm (TMH1 A12T)	2.753
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	98
28.0 mm	98
20.0 mm	98
14.0 mm	98
5.0 mm	96
2.00 mm	87
0.425 mm	61
0.075 mm	46
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
55 µm	27
32 µm	24
13 µm	22
6 µm	17
2 µm	14
% Clay	17
% Silt	10
% Sand	60
% Gravel	13
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	39
Plasticity Index	10
Linear Shrinkage (%)	5.0
Grading Modulus	1.06
Classification	A-4 (2)
Unified Classification	SM
Chart Reference	

PROJECT : GRIMBEEK PARK AREA
 JOB No. : S25-0604
 DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



PARTICLE SIZE ANALYSIS

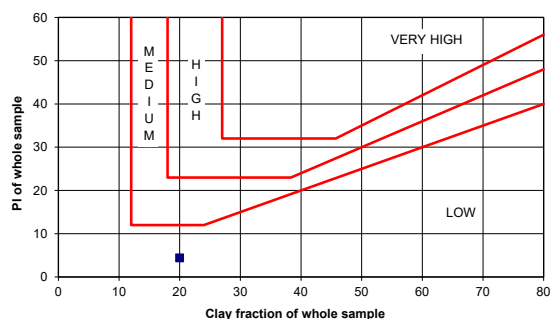
Sample No.	06
Soillab Sample No.	S25-0604-06
Depth (m)	0,60 - 2,60
Position	TP16
Material Description	LIGHT YELLOWISH CLAYEY SAND
Relative density on < 2 mm (TMH1 A12T)	2.663
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	97
2.00 mm	87
0.425 mm	63
0.075 mm	42
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
54 µm	35
32 µm	31
13 µm	23
6 µm	20
2 µm	17
% Clay	20
% Silt	15
% Sand	52
% Gravel	13
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	34
Plasticity Index	7
Linear Shrinkage (%)	3.5
Grading Modulus	1.07
Classification	A-4 (0)
Unified Classification	SM
Chart Reference	

PROJECT : GRIMBEEK PARK AREA

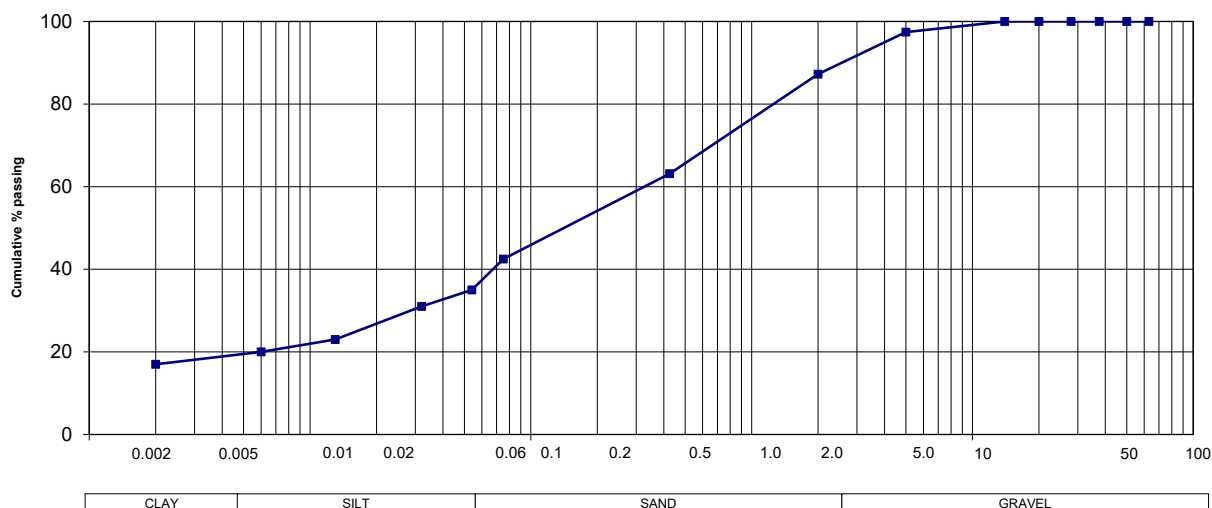
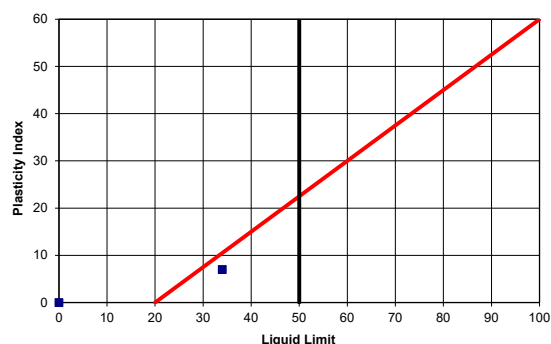
JOB No. : S25-0604

DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART

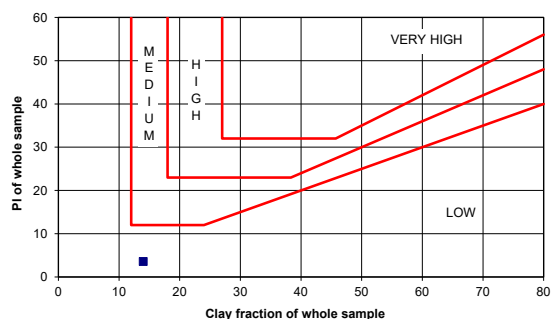


PARTICLE SIZE ANALYSIS

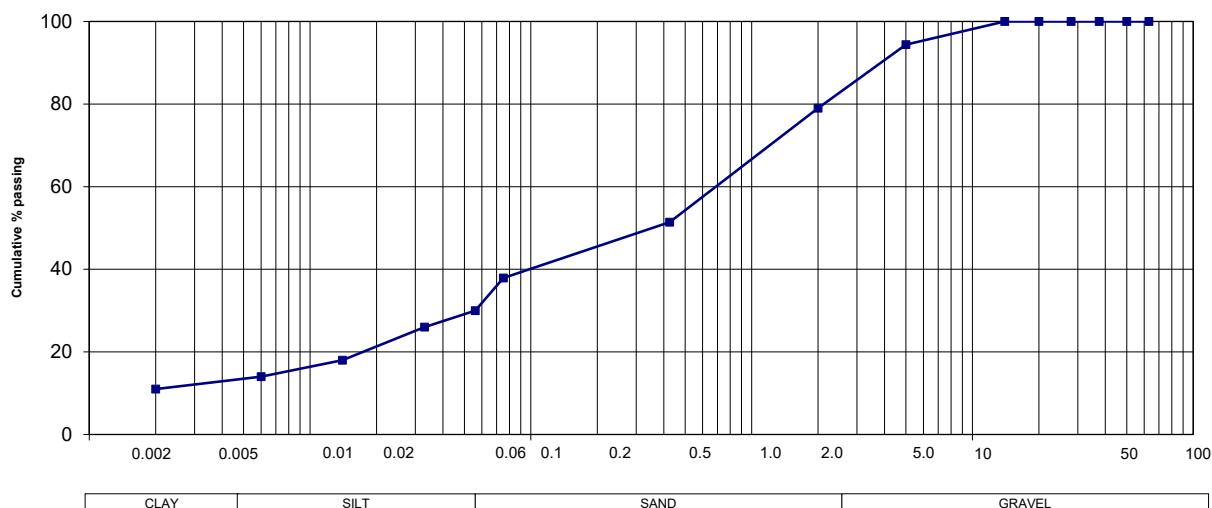
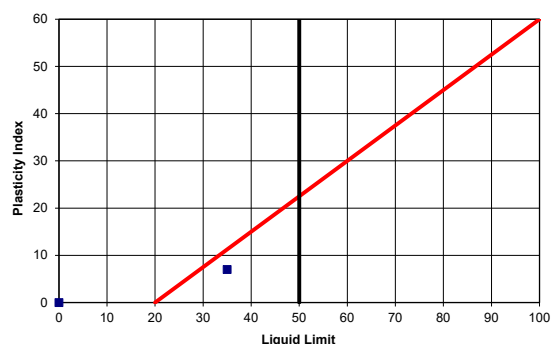
Sample No.	07
Soillab Sample No.	S24-0604-07
Depth (m)	0,70 - 2,60
Position	TP8
Material Description	LIGHT YELLOWISH GRAVELLY SAND
Relative density on < 2 mm (TMH1 A12T)	2.567
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	94
2.00 mm	79
0.425 mm	51
0.075 mm	38
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
56 µm	30
33 µm	26
14 µm	18
6 µm	14
2 µm	11
% Clay	14
% Silt	16
% Sand	49
% Gravel	21
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	35
Plasticity Index	7
Linear Shrinkage (%)	3.5
Grading Modulus	1.32
Classification	A-4 (0)
Unified Classification	SM
Chart Reference	

PROJECT : GRIMBEEK PARK AREA
 JOB No. : S25-0604
 DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART

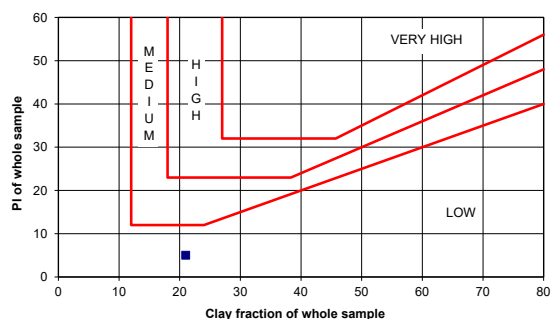


PARTICLE SIZE ANALYSIS

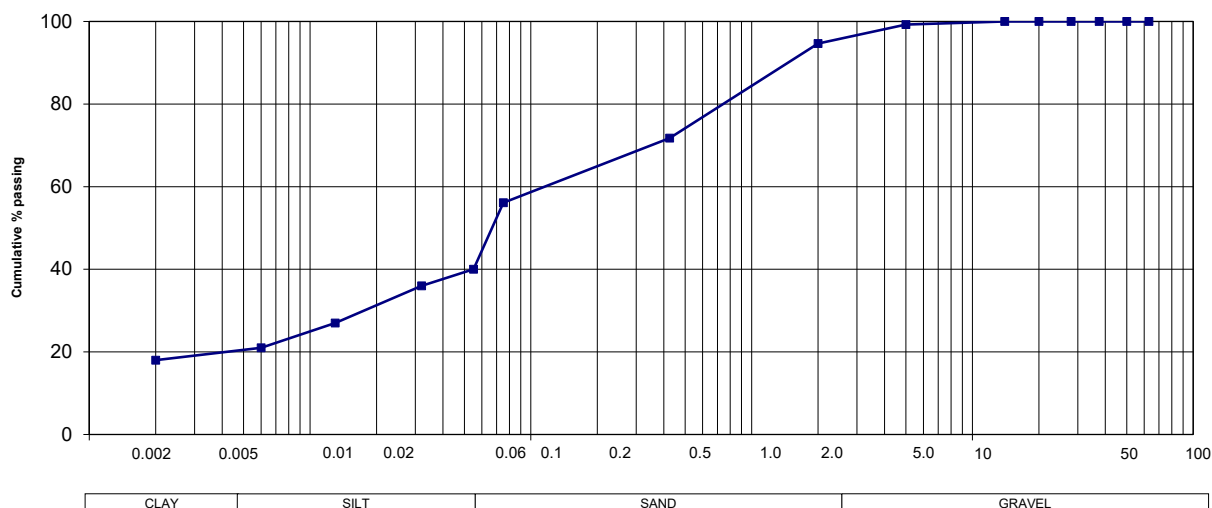
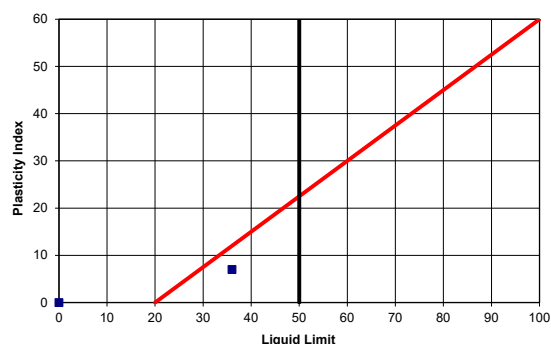
Sample No.	08
Soillab Sample No.	S24-0604-08
Depth (m)	0,60 - 2,90
Position	TP18
Material Description	LIGHT YELLOWISH CLAYEY SAND
Relative density on < 2 mm (TMH1 A12T)	2.614
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
5.0 mm	99
2.00 mm	95
0.425 mm	72
0.075 mm	56
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
55 µm	40
32 µm	36
13 µm	27
6 µm	21
2 µm	18
% Clay	21
% Silt	19
% Sand	55
% Gravel	5
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	36
Plasticity Index	7
Linear Shrinkage (%)	3.5
Grading Modulus	0.77
Classification	A-4 (3)
Unified Classification	ML
Chart Reference	

PROJECT : GRIMBEEK PARK AREA
JOB No. : S25-0604
DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



PARTICLE SIZE ANALYSIS

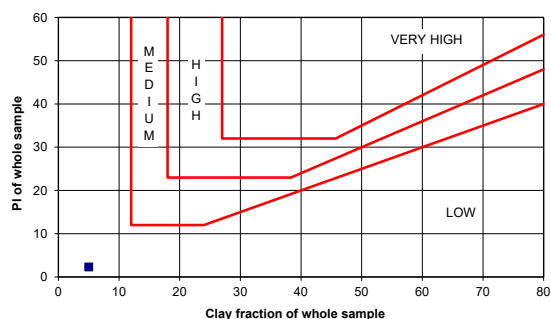
Sample No.	09
Soillab Sample No.	S24-0604-09
Depth (m)	0,80 - 2,40
Position	TP20
Material Description	YELLOWISH BROWN SANDY GRAVEL
Relative density on < 2 mm (TMH1 A12T)	2.607
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	97
37.5 mm	92
28.0 mm	84
20.0 mm	79
14.0 mm	76
5.0 mm	59
2.00 mm	44
0.425 mm	33
0.075 mm	18
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
60 µm	10
35 µm	9
14 µm	7
6 µm	5
2 µm	4
% Clay	5
% Silt	5
% Sand	34
% Gravel	56
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	25
Plasticity Index	7
Linear Shrinkage (%)	3.5
Grading Modulus	2.05
Classification	A-2-4 (0)
Unified Classification	GM & GC
Chart Reference	

PROJECT : GRIMBEEK PARK AREA

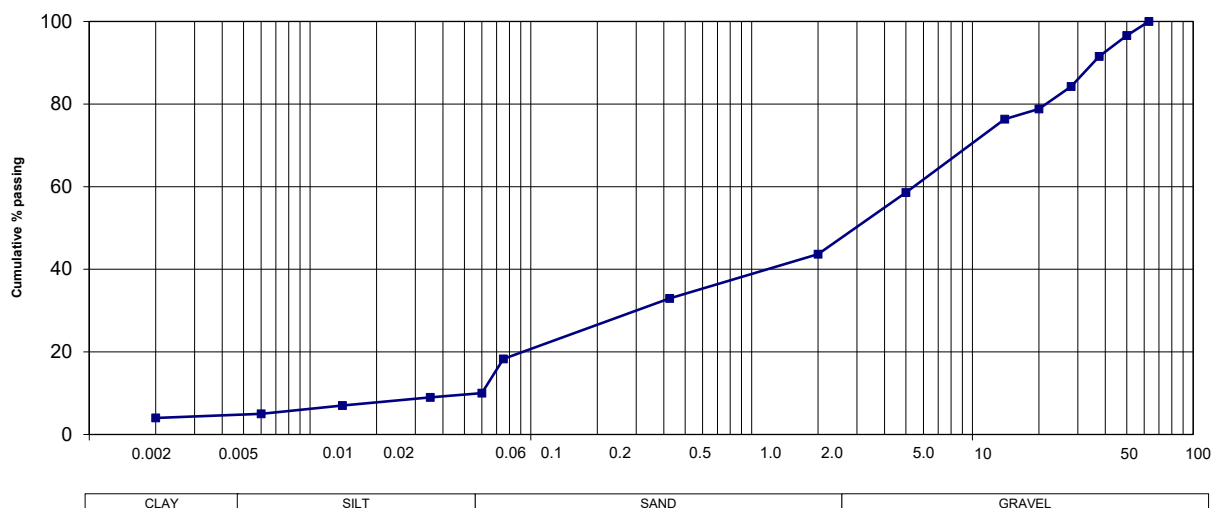
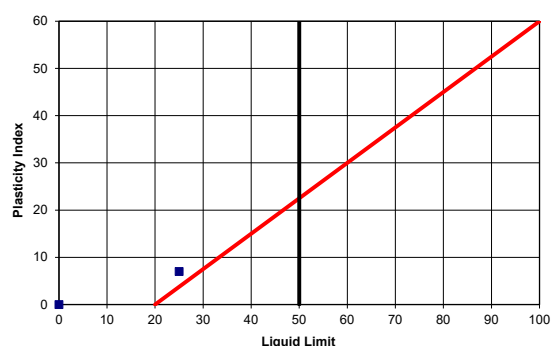
JOB No. : S25-0604

DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART

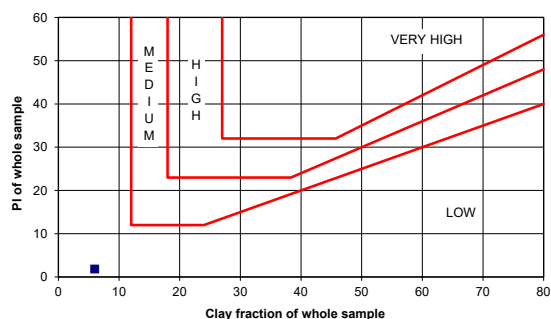


PARTICLE SIZE ANALYSIS

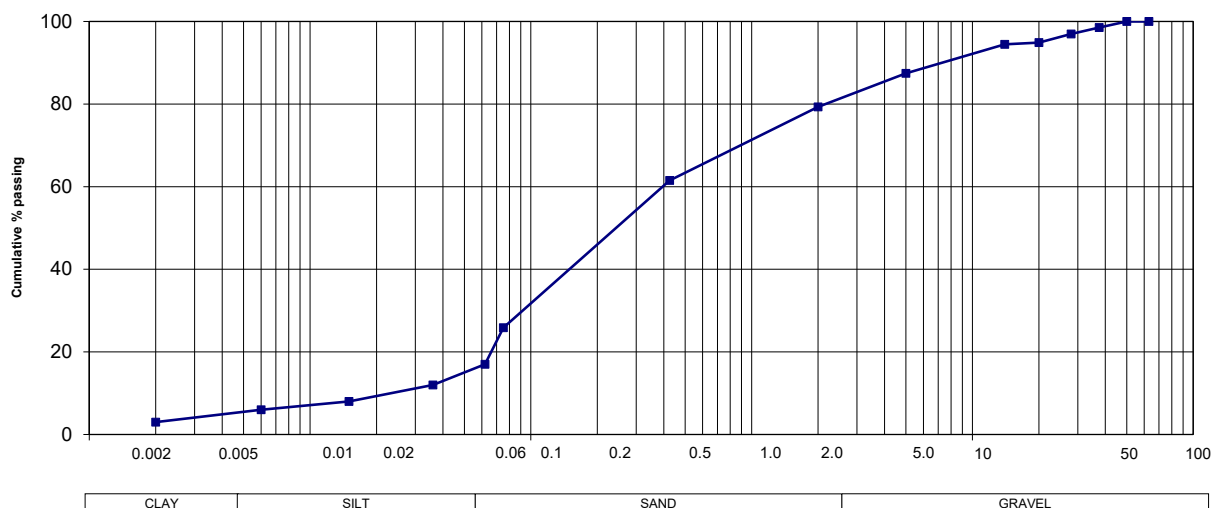
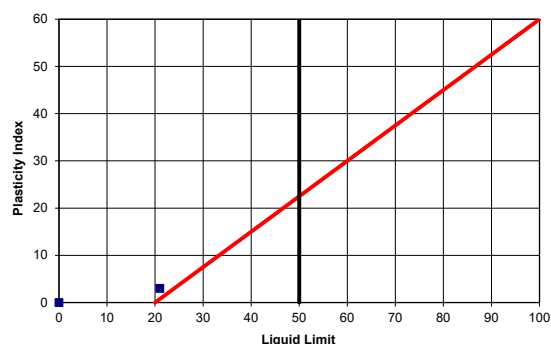
Sample No.	10
Soillab Sample No.	S24-0604-10
Depth (m)	0.50 - 2.20
Position	TP22
Material Description	YELLOWISH BROWN GRAVELLY SAND
Relative density on < 2 mm (TMH1 A12T)	2.575
Organic Material	
Moisture (%)	
SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1)	
63.0 mm	100
50.0 mm	100
37.5 mm	99
28.0 mm	97
20.0 mm	95
14.0 mm	94
5.0 mm	87
2.00 mm	79
0.425 mm	62
0.075 mm	26
HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3)	
62 µm	17
36 µm	12
15 µm	8
6 µm	6
2 µm	3
% Clay	6
% Silt	11
% Sand	62
% Gravel	21
ATTERBERG LIMITS (SANS 3001:GR10)	
Liquid Limit	21
Plasticity Index	3
Linear Shrinkage (%)	1.5
Grading Modulus	1.33
Classification	A-2-4 (0)
Unified Classification	SM
Chart Reference	

PROJECT : GRIMBEEK PARK AREA
 JOB No. : S25-0604
 DATE : 2025-06-01

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



Project Description

Client:	VHULUVHI GROUP	Soillab Job No.:	S24-0604
Job Description:	GRIMBEEK PARK AREA	Contract Number:	
Date:	2025/06/01	Reference Number:	

Sample Description

Soillab Sample No.:	S24-0604-11	S24-0604-12	S24-0604-13	S24-0604-14
Sample Description:	TP01	TP09	TP16	TP22
Sample Depth:	0,00 - 1,00	0,00 - 0,40	0,00 - 0,60	0,00 - 0,50
Material Description:	LIGHT GREYISH	DARK GREY	DARK GREYISH	LIGHT REDDISH ORANGE

Screen Analysis (% Passing) - SANS 3001-GR1

75,00 mm	100	100	100	100
63,00 mm	100	100	100	100
50,00 mm	100	100	100	100
37,50 mm	100	100	100	100
28,00 mm	100	100	100	100
20,00 mm	100	100	100	100
14,00 mm	100	100	98	100
5,00 mm	98	100	93	98
2,000 mm	91	95	77	87
0,425 mm	77	70	39	62
0,075 mm	65	53	27	46

Soil-mortar percentages - SANS 3001-PR5

Coarse Sand	2.000-0.425mm	15	26	49	29
Coarse Fine Sand	0.425-0.250mm	3	6	5	5
Medium Fine Sand	0.250-0.150mm	5	7	6	8
Fine Fine Sand	0.150-0.075mm	4	6	5	5
Silt and clay	<0.075mm	72	56	35	52

Constants

Grading Modulus	SANS 3001-PR5	0.67	0.82	1.57	1.05
Liquid Limit		47	45	35	35
Plasticity Index	SANS 3001-GR10	12	11	8	8
Linear Shrinkage		6.0	5.5	4.0	4.0

MOD AASHTO - SANS 3001-GR30

Max Dry Density (kg/m³)	1733	1748	1888	1883
Optimum Moisture Content (%)	13.5	12.6	11.6	13.7

CBR - SANS 3001-GR40

MOULD A					
Moulding Moisture Content (%)	13.4	12.9	11.5	13.5	
Dry Density (kg/m³)	1744	1751	1896	1896	
Relative Compaction	100.0	100.0	100.0	100.0	
CBR (%)	12	28	51	21	
% Swell	0.1	0.1	0.1	0.1	
MOULD B					
Dry Density (kg/m³)	1647	1661	1794	1790	
Relative Compaction	94.5	94.8	94.6	94.4	
CBR (%)	5	7	18	9	
% Swell	0.5	0.3	0.2	0.2	
MOULD C					
Dry Density (kg/m³)	1557	1570	1702	1695	
Relative Compaction	89.3	89.7	89.8	89.4	
CBR (%)	2	2	7	4	
% Swell	0.5	0.6	0.5	0.3	
CBR (%)					
100% Mod AASHTO	12	28	51	21	
98% Mod AASHTO	9	17	35	16	
97% Mod AASHTO	7	13	29	13	
95% Mod AASHTO	5	8	19	10	
93% Mod AASHTO	4	5	13	7	
90% Mod AASHTO	2	2	7	4	
COLTO Classification:	>G9	>G9	G8	G9	

	Project GRIMBEEK PARK AREA		Lab No :	31871
	Rd/Sect/Bp		Client No :	2300
	Layer/ Test pit		Date :	01/06/2025
				W.I.7.8.1(g)i
CHEMICAL ANALYSES				
HOLE & / SAMPLE No.	TP 01	TP 09	TP 16	TP 22
MATERIALS DESCRIPTION	DARK YELLOW BROWN	DARK YELLOWISH ORANGE SOIL	DARK YELLOW BROWN SOIL	DARK BROWN GRAVEL
DEPTH (m)	0,00-1,00	0,00-0,40	0,00-0,60	0,00-0,50
TMH 1: A20 PH	4,16	5,22	4,76	4,11
TMH 1: A21T Conductivity	0,0381	0,0262	0,0338	0,0381
HOLE & / SAMPLE No.	TP 05	TP 14		
MATERIALS DESCRIPTION	DARK BROWN GRAVEL	LIGHT YELLOWISH ORANGE GRAVEL		
DEPTH (m)	0,00-0,86	0,51-2,14		
TMH 1: A20 PH	5,88	6,13		
TMH 1: A21T Conductivity	0,0229	0,0131		
Remarks:			Date:	01/05/2025
			Technician:	

Oedometer

TMH 6 ST10

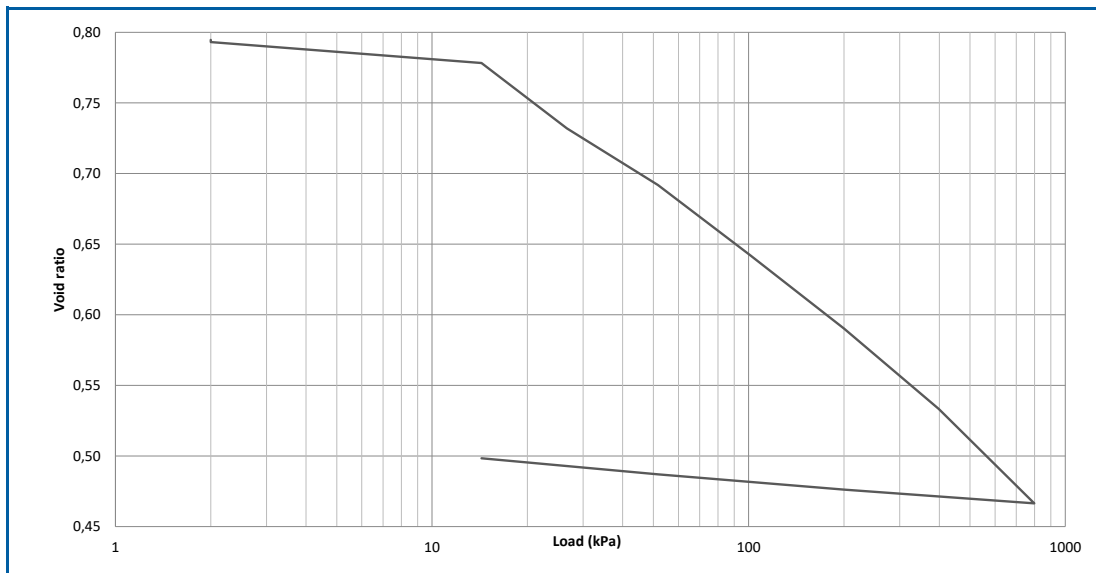
Project:	Grimbeek Park Area
Client:	Vhuluvhi Group
Geolab Job Nr:	S25-0670
Test Method:	TMH 6 ST10

Sample Nr:	TP11
Sample Depth:	900-1060
Date:	2025/06/01

Load kPa	Height mm	Void Ratio	m_v MPa ⁻¹
2,0	18,980	0,795	
2,0	18,964	0,793	
14,3	18,807	0,778	0,671
26,7	18,318	0,732	2,108
51,7	17,893	0,692	0,928
101,3	17,366	0,642	0,593
200,0	16,818	0,590	0,320
398,7	16,216	0,533	0,180
798,1	15,509	0,466	0,109
200,0	15,612	0,476	
51,7	15,726	0,487	
14,3	15,847	0,498	

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	-

	Initial	Final	
Sample Height:	18,98	15,85	mm
Sample Mass:	103,98	106,82	g
Dry Density:	1497	1793	kg/m ³
Density:	1826	2247	kg/m ³
Moisture Content:	22,0	25,3	%
Void Ratio:	0,795	0,498	
Specific Gravity:	2,687		Mg/m ³



* - m_v values provided are incremental and only valid for the specific load increment.

Oedometer

TMH 6 ST10

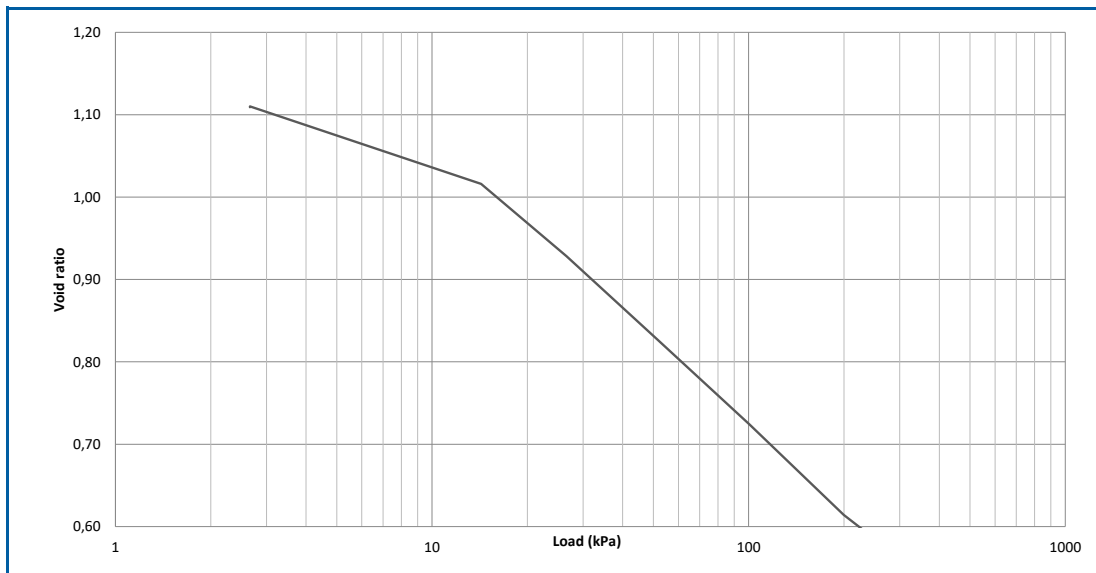
Project:	Grimbeek Park Area
Client:	Vhuluvhi Group
Geolab Job Nr:	S25-0670
Test Method:	TMH 6 ST10

Sample Nr:	TP15
Sample Depth:	800-2400
Date:	2025/06/01

Load kPa	Height mm	Void Ratio	m_v MPa ⁻¹
2,7	20,000	1,109	
2,7	20,01	1,110	
14,3	19,117	1,016	3,836
26,6	18,286	0,928	3,534
51,5	17,325	0,827	2,108
100,7	16,347	0,724	1,147
199,8	15,308	0,614	0,642
397,2	14,463	0,525	0,280
793,5	14,463	0,525	0,000
199,8	14,463	0,525	
51,5	14,463	0,525	
14,3	14,463	0,525	

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	-

	Initial	Final	
Sample Height:	20,00	14,46	mm
Sample Mass:	84,54	99,21	g
Dry Density:	1259	1741	kg/m ³
Density:	1405	2280	kg/m ³
Moisture Content:	11,6	31,0	%
Void Ratio:	1,109	0,525	
Specific Gravity:	2,655		Mg/m ³



* - m_v values provided are incremental and only valid for the specific load increment.

Oedometer

TMH 6 ST10

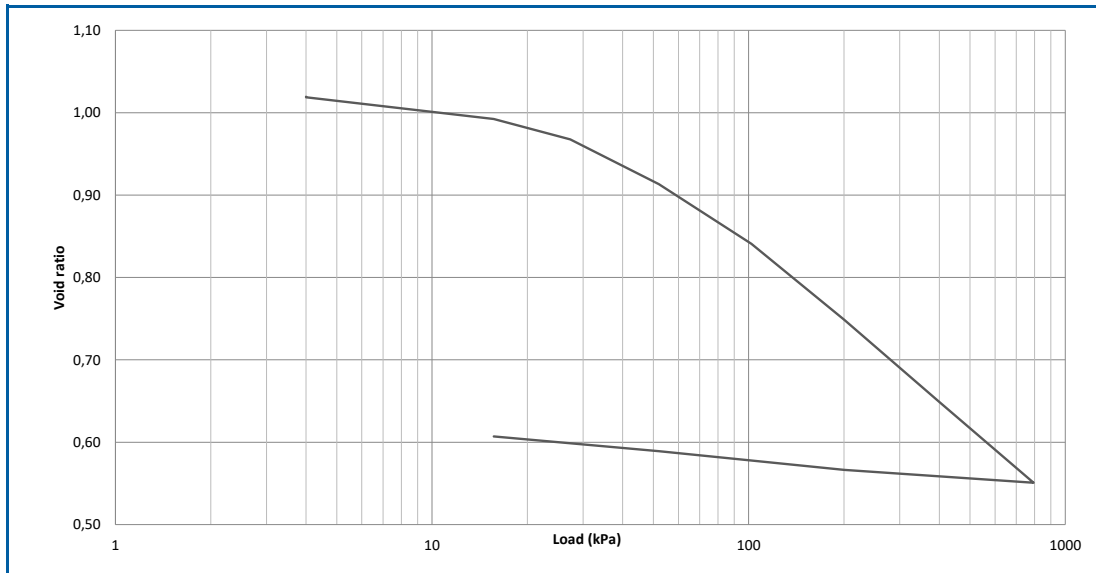
Project:	Grimbeek Park Area
Client:	Vhuluvhi Group
Geolab Job Nr:	S25-0670
Test Method:	TMH 6 ST10

Sample Nr:	TP07
Sample Depth:	860-2000
Date:	2025/06/01

Load kPa	Height mm	Void Ratio	m_v MPa ⁻¹
4,0	18,980	1,019	
4,0	18,973	1,019	
15,7	18,725	0,992	1,120
27,3	18,494	0,968	1,057
52,0	17,983	0,913	1,120
102,0	17,302	0,841	0,757
200,4	16,435	0,749	0,510
398,7	15,502	0,649	0,286
794,1	14,576	0,551	0,151
200,4	14,723	0,566	
52,0	14,936	0,589	
15,7	15,105	0,607	

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	-

	Initial	Final	
Sample Height:	18,98	15,11	mm
Sample Mass:	90,18	96,11	g
Dry Density:	1302	1636	kg/m ³
Density:	1584	2121	kg/m ³
Moisture Content:	21,6	29,6	%
Void Ratio:	1,019	0,607	
Specific Gravity:	2,630		Mg/m ³



* - m_v values provided are incremental and only valid for the specific load increment.

Oedometer

TMH 6 ST10

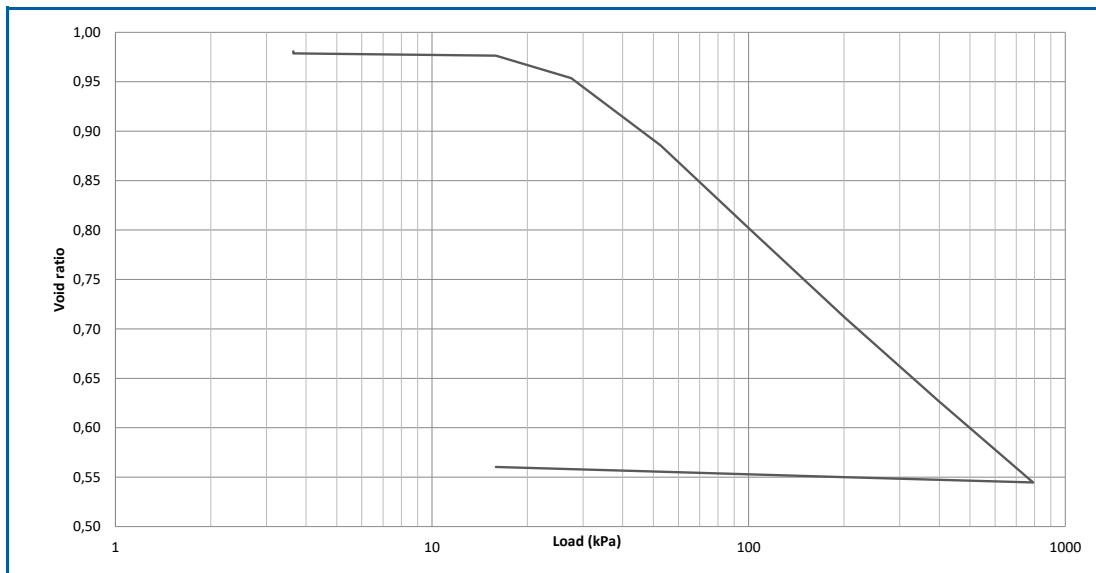
Project:	Grimbeek Park Area
Client:	Vhuluvhi Group
Geolab Job Nr:	S25-0670
Test Method:	TMH 6 ST10

Sample Nr:	TP10
Sample Depth:	800-200
Date:	2025/06/01

Load kPa	Height mm	Void Ratio	m_v MPa ⁻¹
3,6	19,520	0,981	
3,6	19,5	0,979	
15,9	19,476	0,976	0,100
27,5	19,252	0,954	0,991
52,7	18,582	0,886	1,382
101,8	17,736	0,800	0,928
200,2	16,872	0,712	0,495
397,7	16,036	0,627	0,251
791,5	15,222	0,545	0,129
200,2	15,274	0,550	
52,7	15,33	0,556	
15,9	15,376	0,560	

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	-

	Initial	Final	
Sample Height:	19,52	15,38	mm
Sample Mass:	94,4	100,83	g
Dry Density:	1378	1749	kg/m ³
Density:	1603	2174	kg/m ³
Moisture Content:	16,3	24,3	%
Void Ratio:	0,981	0,560	
Specific Gravity:	2,729		Mg/m ³



* - m_v values provided are incremental and only valid for the specific load increment.

Oedometer

TMH 6 ST10

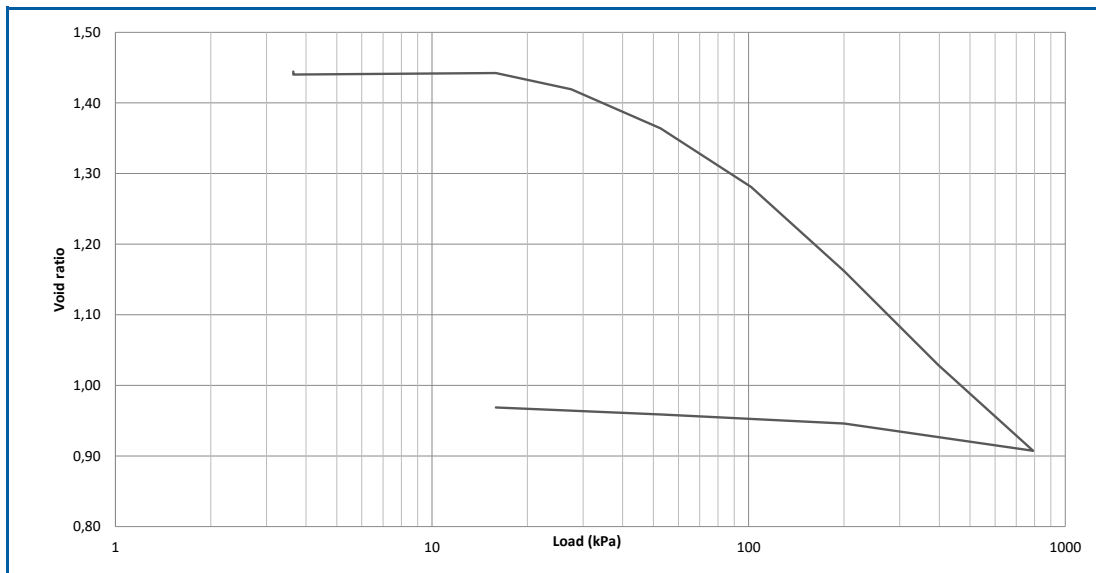
Project:	Grimbeek Park Area
Client:	Vhuluvhi Group
Geolab Job Nr:	S25-0670
Test Method:	TMH 6 ST10

Sample Nr:	TP19
Sample Depth:	1200-1610
Date:	2025/06/01

Load kPa	Height mm	Void Ratio	m_v MPa ⁻¹
3,6	19,520	1,444	
3,6	19,486	1,440	
15,9	19,504	1,442	-0,075
27,5	19,32	1,419	0,813
52,7	18,878	1,364	0,908
101,8	18,216	1,281	0,715
200,2	17,262	1,162	0,532
397,7	16,2	1,029	0,311
791,5	15,231	0,907	0,152
200,2	15,539	0,946	
52,7	15,641	0,959	
15,9	15,721	0,969	

Sampling Method:	Block
Disturbed/Undist:	Undisturbed
Remoulded To:	-

	Initial	Final	
Sample Height:	19,52	15,72	mm
Sample Mass:	90,2	95,06	g
Dry Density:	1049	1303	kg/m ³
Density:	1532	2004	kg/m ³
Moisture Content:	46,0	53,9	%
Void Ratio:	1,444	0,969	
Specific Gravity:	2,565		Mg/m ³



* - m_v values provided are incremental and only valid for the specific load increment.

APPENDIX C

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[illegible]

[illegible]

[illegible]

APPENDIX D



General Site Photos



General Site Photos



Portion 59 Surface Water



Portion 59 Surface Water



Soil Profile as observed in TP1



Soil Profile as observed in TP2



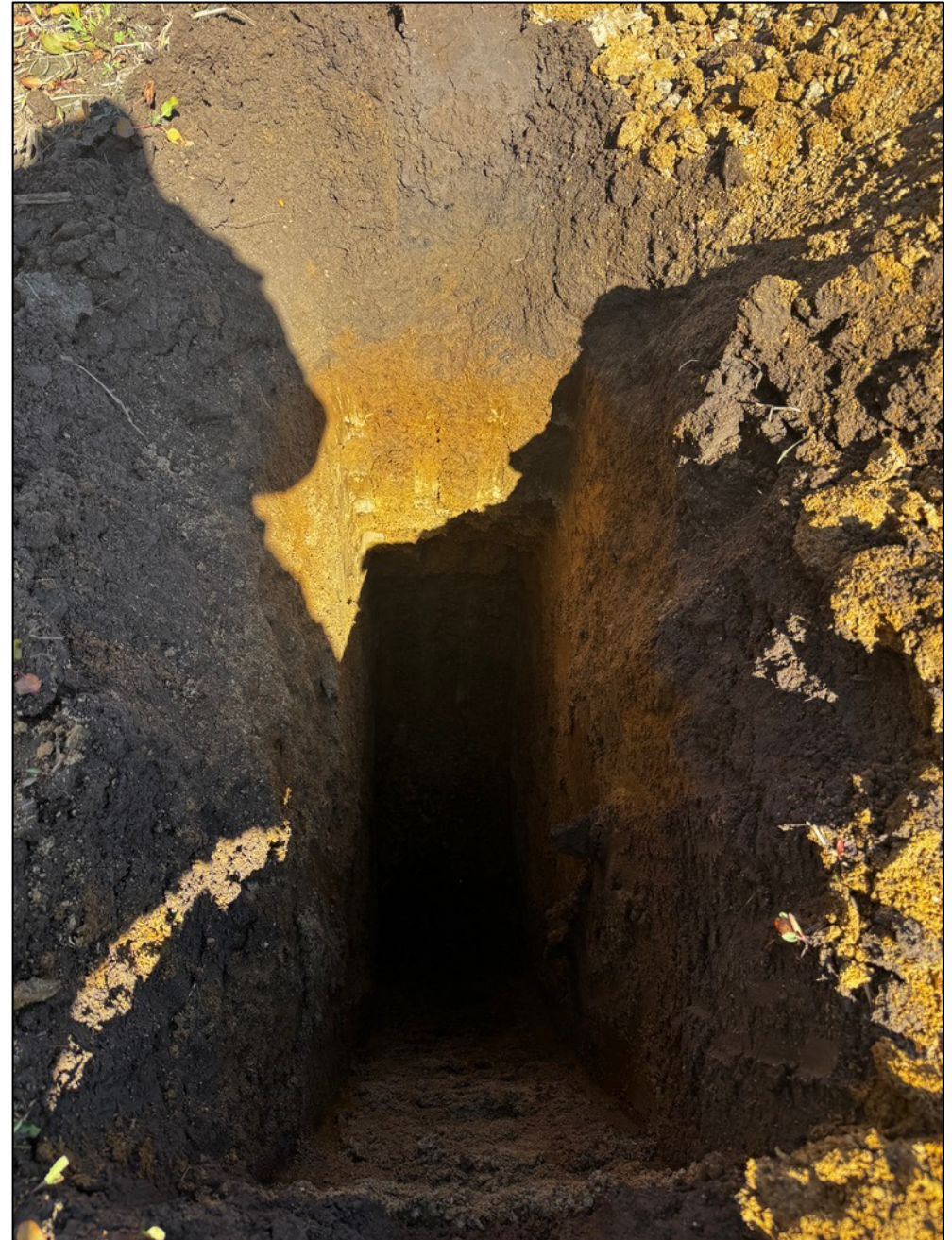
Soil Profile as observed in TP3



Soil Profile as observed in TP4



Soil Profile as observed in TP5



Soil Profile as observed in TP6



Soil Profile as observed in TP7



Soil Profile as observed in TP8



Soil Profile as observed in TP9



Soil Profile as observed in TP10



Soil Profile as observed in TP11



Soil Profile as observed in TP12



Soil Profile as observed in TP13



Soil Profile as observed in TP14



Soil Profile as observed in TP15



Soil Profile as observed in TP16



Soil Profile as observed in TP17



Soil Profile as observed in TP18



Soil Profile as observed in TP19



Soil Profile as observed in TP20



Soil Profile as observed in TP21



Soil Profile as observed in TP22