GEOTECHNICAL INVESTIGATION FOR: SANTA CENTRE & MAHALA PARK, KIMBERLEY, NORTHERN CAPE PROVINCE

FINAL REPORT

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EXECUTIVE SUMMARY

At the request of KMSD Engineering Consultants cc, Phatela Geoconsulting (Pty) Ltd carried out a geotechnical investigation for proposed RDP housing development and infrastructure at Santa Centre and Mahala Park near Kimberley, in Northern Cape Province. The proposed site is an extension of Galeshewe Township, just adjacent to Kimberley town. The area's coordinates in Longitude and Latitude, Datum WGS 84 are 28°43'05.5"S and 24°44'56.1"E respectively.

The geotechnical investigation was carried out in three stages, which were a desktop study, geotechnical profiling of test pits and DCP tests as well as testing of soil samples at materials laboratory in Kimberley.

Geologically, the site is underlain by a mantle of fill and residual soils overlying either dolerite or shale bedrocks.

The site is categorised as **Intermediate Favourable Class** for the construction of the RDP houses provided cognisance is taken of the following geotechnical constraints:

- Excavation requirements on shallow bedrock,
- Areas of potentially expansive

The development of the township therefore requires certain precautionary measures as prescribed in the foundation design and constructions in accordance with South African National Standard (SANS 10400-H: 2012 Edition 3). Part H; Foundations, The application of the National Building Regulations.

Given the shallowness of the bedrock and low activity of the clay in residual soil , the recommended foundation construction types in accordance with South African National Standard (SANS 10400-H: 2012 Edition 3). Part H; is normal foundations

The site is dominated by shallow bedrock of which at some areas it is exposed on surface therefore "Hard excavation class" can be anticipated at any point throughout the site especially when it comes to trench excavations.

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

1 INTRODUCTION

This report provides factual and interpretive details of geotechnical investigations carried out at Santa Centre and Mahala Park informal settlements near Kimberley in Northern Cape Province. The purpose of the investigation was to explore the subsurface conditions in order to determine the characteristics of the soil, its expected behaviour upon loading and to provide recommendations including suitable foundations for proposed single storey RDP houses as well as suitability of the ground for trench excavation for the purpose of pipeline networks.

The investigations commenced with a desktop study followed by fieldwork which entailed excavation of the tests pits across the site using a Tractor-Loader-Backhoe (TLB); profiling of the test pits and exposures by an engineering geologist; retrieval of soil samples from the test pits to be tested at a soils laboratory as well as performing in-situ Dynamic Cone Penetrometer tests.

The report provides details of method of investigations, results obtained, geotechnical assessment, site characterisation, foundations solutions as well as recommendations.

1.1 Terms of Reference

Santa Centre and Mahala Park comprise of informal settlement therefore Phatela Geoconsulting (Pty) Ltd was as a result appointed by KMSD Engineering Consultants cc to conduct the geotechnical investigation at the area to give recommendations with regard to founding conditions and site characterisation for pipeline trenches.

1.2 Scope of Work

The scope of work as agreed with the Client was as follows;

- Excavation of test pits on areas at the area. Test pits to be logged by an engineering geologist in accordance with Guidelines for Soil and Rock Logging in SA by ABA Brink and RMH Bruin, 2002. Excavation could only be done on designated areas whereby it was deemed safe to do so without damaging the existing properties.
- Obtaining of soil samples from the test pits for testing at soils laboratory.
- Presentation of field data and laboratory data. This should include photos, profiles, DCPs results and laboratory test results.
- Analysis of results and production of the Geotechnical Investigation Report.

1.3 Available Information

- KMSD Engineering Consultants cc provided background of the project
- Physical address of the site was provided.
- Approximate extent of the site
- Guidance by the local representative to indicate safe areas to excavate

1.4 Limitations

There are shacks throughout most of the site. This made it difficult to excavate at some of the places lest damage to the properties and existing buried water pipeline.

2 LOCALITY

Santa Centre and Mahala Park are informal settlements forming extension of Galeshewe Township. This township that is near Kimberley is within Sol Plaatje Local Municipality under the Jurisdiction of Frances Baard District Municipality.

The actual site is situated just about 3km from Kimberley CBD towards north-western direction. Santa Centre shares a boundary with Sasol fuel station on the north-west end. Barkly Road marks the end of Santa Centre on the eastern side. Mahala Park shares the immediate gravel street with Santa Centre and is flanked by the George Kekana Secure Care School on the south-western end. **Figure 1 below** shows a general combined outline of Santa Centre and Mahala Park sites. The site coordinates in Longitude and Latitude, Datum WGS 84 are 28°43'05.5"S and 24°44'56.1"E respectively.

Figure 1 : Aerial view image of the proposed sites extracted from Google Earth

2.1 Site Description

Santa Centre and Mahala Park are informal settlements comprising of shacks. The two adjacent sites are an extension of a well developed Galeshewe Township. The shacks are distributed in a semi-orderly manner although at some parts the streets are inaccessible with excavation machines.

There are communal water taps sparsely distributed throughout the two areas. Electricity is available within those settlements with power lines visible overhead.

Most of the ground is covered with fill soil while other areas have visible patches of the bedrock. The gravel streets connect to the schools, government institutions, town and other parts of the greater township.

2.2 Topography

The proposed site is situated on a generally flat terrain. **Figure 2 below** shows a topographical locality map for the study area at scale of 1:50 000 extracted from 2824DA Barkly West. The widely spaced contours lines show the flatness of the terrain.

Figure 2 : An extract of a topographic map where the proposed sites are situated

2.3 Climate

According to SA Explorer, Kimberley usually receives about 283mm of rain per year, whereby most rainfall takes place mainly in summer. The minimum rainfall (0mm) occurs in July with the maximum (59mm) in March. The monthly distribution of average daily highest temperatures shows that the average midday temperatures for Kimberley range from 18°C in June to 32°C in January. The region is the coldest during July whereby temperatures drop to 0.3°C on average during the night. **Figure 3 below** shows graphs with approximate average temperatures and rainfall in Kimberley.

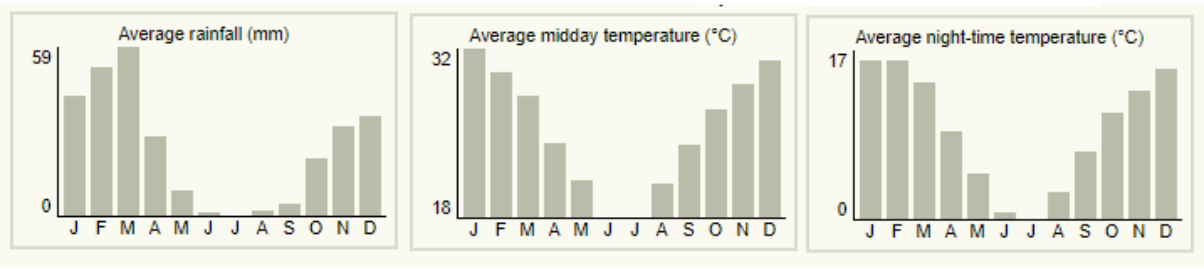

Figure 3: Various graphs illustrating climate at the Kimberley

3 METHODS OF INVESTIGATION

The geotechnical study was carried out in three phases; ***desktop study***, ***field work*** which comprised of excavation and profiling of test pits and mapping as well as dynamic cone penetration (DCP) tests. The third phase was ***laboratory testing*** of soil samples. The details of each stage are explained below.

3.1 Desktop Study

The desktop study comprised of studying of geological maps to confirm the anticipated geology and geotechnical properties of the soils. This information was used to provide guidance on appropriate soil tests to be performed. The desktop study also involved location of the area using Google Earth in order to get an appreciation of the site and to prepare accordingly for the investigations, as well as studying of topography and any other provided information.

3.2 Test Pits Excavation and Mapping

Seven test pits, designated TP1 through TP7, were excavated using a TLB, aimed to 3.0m depth or refusal, in order to investigate subsurface soil and bedrock conditions. The subsurface investigation focuses on the moisture, colour, consistency, soil structures, soil type and origin of the soil. In the case of bedrock, the focus would mainly be on colour, weathering, existing structures, rock hardness, type of rock and its origin.

Whereby the rock outcrop was visible it was also mapped and described according to its characteristics. Such areas were termed as exposures (EXP) and a total of four exposures designated EXP1 through EXP4 were identified.

The positions of the test pits and exposures were recorded using a Garmin GPS handset and are pinned on the Google Earth image on **Figure 4 below**. All areas were profiled by an engineering geologist and their respective photographs are included in **Appendix A** of this report.

Figure 4: **Positions of test pits ,exposures and DCP's pinned on Google Earth image**

3.3 Dynamic Cone Penetration Test

Fourteen Dynamic Cone Penetration (DCP) tests, designated DCP1 through DCP14, were carried out at the positions as shown on **Table 1 below**. The DCP tests were aimed to final depths of 1 metre below existing ground level unless whereby refusal occurred before then. The results of the DCP tests, comprising plots of blow counts per 100mm advance and allowable bearing capacity parameters against depth, are given in **APPENDIX B**.

Table 1: List of DCP points with their respective positions and depths

DCP No.	Coordinates		Advanced depth(m)	Refusal (m)
	Longitude	Latitude		
DCP 1	28°42'55.6"S	24°44'59.3"E	0.70	0.70
DCP 2	28°42'58.3"S	24°45'03.2"E	0.50	0.50
DCP 3	28°43'00.5"S	24°45'01.9"E	0.30	0.30
DCP 4	28°43'06.9"S	24°45'02.0"E	0.80	0.80
DCP 5	28°43'05.7"S	24°44'00.3"E	0.90	0.90
DCP 6	28°43'05.5"S	24°44'56.1"E	0.50	0.50
DCP 7	28°42'54.7"S	24°44'59.9"E	0.80	0.80
DCP 8	28°42'55.7"S	24°45'0.43"E	0.90	0.90
DCP 9	28°42'59.8"S	24°45'3.30"E	0.40	0.40
DCP 10	28°43'06.9"S	24°44'59.4"E	0.40	0.40
DCP 11	28°43'4.41"S	24°45'02.7"E	0.80	0.80
DCP 12	28°43'6.50"S	24°45'03.8"E	0.70	0.70
DCP 13	28°43'8.50"S	24°45'59.5"E	0.60	0.60
DCP 14	28°43'54.8"S	24°45'02.2"E	0.50	0.50

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3.4 Laboratory Testing

Disturbed bulk soil was sampled by the engineering geologist and sent to soil laboratory, Simlab Laboratory, for testing in Kimberley.

The following laboratory tests were conducted on representative samples from site:

- Foundation Indicators; Particle Size distribution and Atterberg Limits
- Moisture content
- Mod AASHTO moisture/density relationship and CBR
- Electric Conductivity
- pH

4 INVESTIGATIONS RESULTS

4.1 Geology

The Geological Map Series, sheet number 2824 Kimberley, published at a scale of 1:250 000 by Council for Geosciences indicate that Kimberley is situated on the area that is underlain by shale of Prince Albert Formation under Ecca Group of the Karoo Supergroup. Aeolian sand and calcrete cover a significant part of the region. Dolerite sills and dykes intrude the formation both on local and regional scale. **Figure 5 below** shows an extract of the geological map series of a region where the proposed sites are situated.

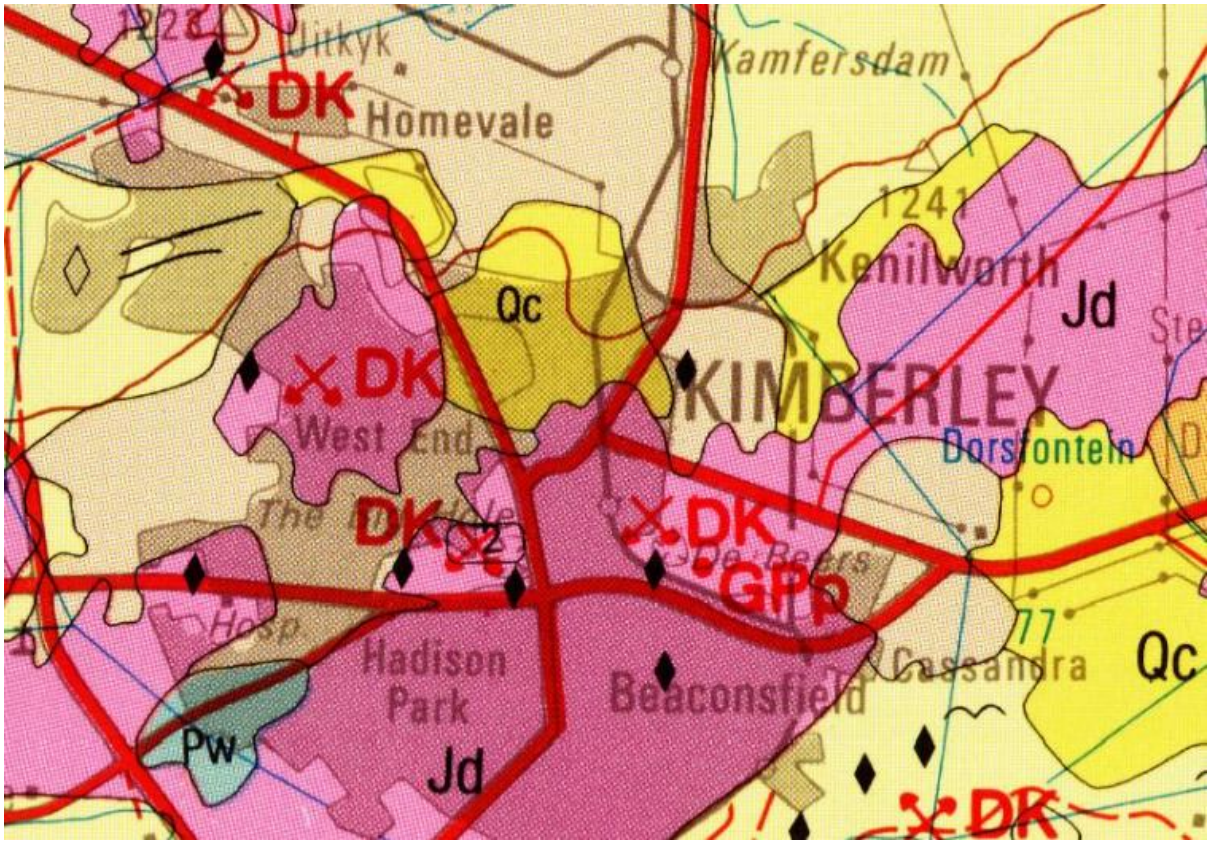


Figure 5: Regional geology of the area where the sites are situated extracted from Sheet 2824 Kimberley Geological Map

4.2 Local Geology

Upon profiling of the seven test pits and four exposures, the site was observed to be underlain by a mantle of a fill, residual soil and two types of bedrock. **Table 2 below** shows a summary of each test pit and exposure profile log whereby **Appendix A** will show full details.

Table 2: Summary of test pits and exposures logs

Test Pit No.	Co-ordinates		Test Pit Depth (m)	Fill Depth (m)	Residual dolerite, Depth (m)	Shale/ Dolerite Bedrock Depth (m)	Sample Obtained Depth (m)	Water seepage Depth (m)	Refusal depth (m)
	Longitude	Latitude							
TP 1	28°42'55.6"S	24°44'59.3"E	0.80	0.0-0.70	None	0.7-0.80	None	None	0.80
TP 2	28°42'58.3"S	24°45'03.2"E	0.80	0.0-0.20	None	0.2-0.80	None	None	0.80
TP 3	28°43'00.5"S	24°45'01.9"E	0.40	None	0.0-0.20	0.2-0.40	None	None	0.40
TP 4	28°43'06.9"S	24°45'02.0"E	0.80	0.0-0.20	0.2-0.70	0.7-0.80	0.2-0.70	None	0.80
TP 5	28°43'05.7"S	24°44'58.5"E	None	None	None	0.0-0.20	None	None	0.20
TP 6	28°43'05.7"S	24°44'00.3"E	0.90	0.0-0.80	0.8-0.90	0.9-0.90	0.8-0.90	None	0.90
TP 7	28°43'05.5"S	24°44'56.1"E	0.50	0.0-0.50	None	None	0.0-0.50	None	0.50
EXP 1	28°43'03.5"S	24°45'00.4"E	0.10	None	None	0.0-0.10	None	None	0.10
EXP 2	28°43'06.9"S	24°44'57.2"E	0.10	None	None	0.0-0.10	None	None	0.10
EXP 3	28°45'58.1"S	24°45'00.4"E	0.10	None	None	0.0-0.10	None	None	0.10
EXP 4	28°42'59.8"S	24°45'02.3"E	0.10	None	None	0.0-0.10	None	None	0.10

4.2.1 Fill material

This is soil material that was transported to the current location due to human activity. At Santa Centre and Mahala Park, such fill material generally comprised of slightly moist, orangey brown speckled dark gray, loose to medium dense, intact, gravelly sand with dolerite cobbles, pieces of papers and plastics. This soil horizon was identified at depths of between 0.20 and 0.80m from surface with average thickness of about 0.5m.

4.2.2 Residual dolerite

Residual soil is such soil that is directly derived from weathering of the underlying bedrock and should have similar geochemistry as the parent bedrock. On this particular site, the existing residual soil is formed as a result of a complete weathering of the underlying dolerite bedrock.

The residual soil was observed at depths of between 0.20 and 0.70m from surface with average thickness of about 0.30m. This residual soil mantle comprised of slightly moist, reddish brown speckled dark gray, soft, intact, gravelly clay with dolerite cobbles and boulders.

4.2.3 Bedrocks

Two types of bedrock existed on the area. The first one was a dark gray stained orangey brown, highly to medium weathered, closely fractured, soft to hard dolerite bedrock. Such bedrock was identified in test pits at depths of between 0.20m and 0.90m, however, on three exposures such dolerite rock formed outcrop on surface.

The second type of bedrock was a greenish gray, slightly weathered, very close to closely fractured, laminated and thinly bedded, medium hard to hard shale bedrock of Ecca Group under Karoo Supergroup. This type of bedrock was identified at depths of between 0.20 and 0.80m below ground level. Shale rock was also identified on one exposure forming an outcrop.

A TLB machine was able to excavate through an average thickness of about 0.2m before refusal on both dolerite and shale bedrocks.

4.3 Seismicity

According to seismic hazard map derived from Council for Geoscience, particularly the seismic intensity map, Kimberley in general is located in class VI using Mercalli Scale. **Figure 6 below** shows a map of different seismic intensity across parts of Southern Africa extracted from Council for Geoscience report.

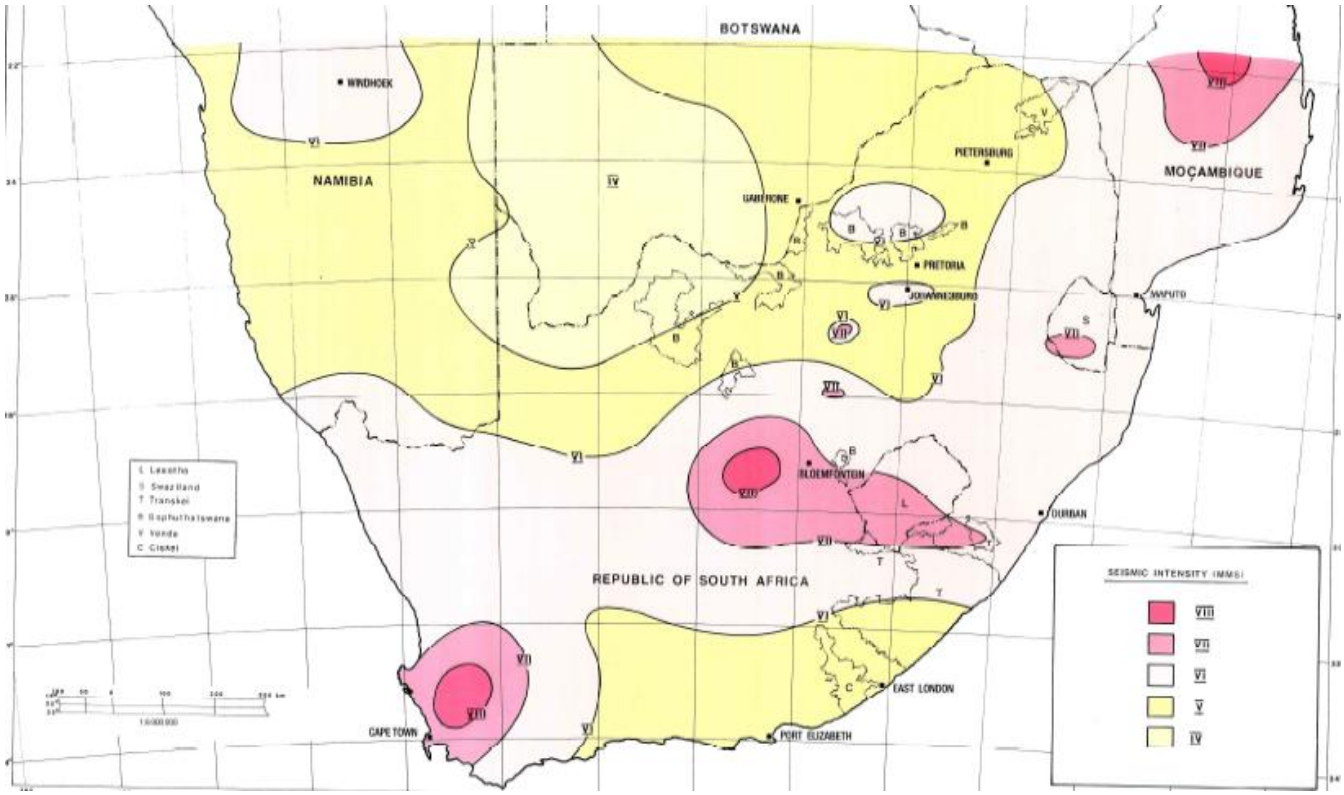


Figure 6: Seismic Intensity map of parts of Southern Africa

The Mercalli Scale is used to measure the intensity of an earthquake and its effects on people and structures .A level VI on Mercalli Scale categorises the impact of the seismic event as strong and can be felt by most people if not all, with heavy and/or unstable objects being broken or overturned and plasters fallen. **Table 3 below** shows varying classifications of Mercalli Scale intensities.

Table 3: Modified Mercalli scale intensities

I. Not felt	Not felt except by a very few under especially favourable conditions.
II. Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III. Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV. Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V. Moderate	**Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.**
VI. Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII. Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII. Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

4.4 Laboratory Test Results

Laboratory tests results are detailed in **Appendix C** and summarised in **Table 4** below.

Table 4: Summary of laboratory test results.

Descriptions	TP4	TP6	TP7
	0.2-0.8m	0.2-0.9m	0.0-0.5 m
Gravel (%)	46.0	43.0	13.0
Sand (%)	48.0	52.0	69.0
Silt (%)	6.0	5.0	10.0
Clay (%)	0	0	8.0
Liquid Limit (%)	0.0	30.0	0.0
Plasticity Index (%)	SP	4.0	NP
Linear Shrinkage (%)	0.8	2.0	0.0
Van der Merwe's potential swell	Low	Low	Low
Chemical Tests			
pH	5.06	7.7	7.5
Conductivity (Siemens/m)	0.2220	0.1917	0.2522
Compaction Tests			
Max. Dry Density (kg/m3)	2238	1997	1996
Optimum Moisture (%)	7.7	8.6	6.4
% Swell	0.0	0.0	0.0
100% ModAASHTO	13.0	10.0	52.0
98% ModAASHTO	11.0	9.0	42.0
97% ModAASHTO	17.4	8.0	30.0
93% ModAASHTO	9.0	1.5	24.0
90% ModAASHTO	8.0	7.0	17.0

5 GEOTECHNICAL ASSESSMENT

5.1 Groundwater

Groundwater seepage was not evident in all test pits and exposures. However, during periods of prolonged rainfall, particularly during the summer season, a marked in the occurrence and magnitude of groundwater seepage flow may be anticipated. Perched groundwater flows at the soil / rock interface may become more prolific during the rainy months.

5.2 Soil Expansivity

Expansive soil is the one that has clay with a high smectite mineral content. This mineral has the ability to absorb a high volume of water and that results in swelling of the soil also known as heave. When the moisture decreases, the soil will also decrease in volume and thus shrink. Structures that are constructed on expansive clays are destabilised by the heave effect. For this reason, the soil is normally taken to the laboratory to analyse its expansivity potential. The purpose of the Foundation Indicator tests at the laboratory is to determine the expansivity of the soil. On these sites, the laboratory results show that the soil has low swelling activity, therefore, there is no heave movement anticipated according to Van Der Merwe[1], 1975.

5.3 Excavatability

There are areas, underlain by either fill or residual soil, where excavation conditions can be categorized as ‘soft mechanical excavation’ according to SANS 1200D “Classification of material for machine excavation”. The areas with overburdens extend to minimum depths of about 0.20m and maximum depth of about 0.8m below ground level.

Nevertheless, there are some areas whereby bedrock is exposed on ground surface and therefore rendering “hard mechanical excavation.

It is therefore safe to anticipate “hard mechanical excavation” at any instance throughout the site because of undulating bedrocks at shallow depths.

[1] D.H Van Der Merwe (1964) The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp103-107

5.4 Bedding Material

In terms of the SANS 1200 LB (1983) concerning bedding requirements, buried pipelines require two types of selected material. Those selected materials are termed “Selected Granular Material” and “Selected Fill Material”.

In general, the “Selected Granular Material “is used as bedding material to support the pipe, while the “Selected Back Fill Material” is used as blanket material over the crown of the pipe. General Backfill material is placed above the blanket materials, up to ground level.

From the laboratory tests results of the materials encountered in the test pits:

- The following conclusions can be made regarding the suitability of the in situ materials for use as the bedding layers for the pipeline according to the requirements of SABS1200LB:
  - **None** of the insitu materials sampled meet the grading requirements for “Selected Granular Material” laid down in SABS 1200 LB (1983). Selected granular material is defined as *“granular, non-cohesive and singularly graded between 0.6mm and 19mm. The material must be free draining and have a compactability factor not exceeding 0.4”*. Therefore, all selected granular bedding material will need to be **imported** to the site.

  - The materials identified will also **not** be suitable for “Selected Fill” purposes. Selected fill is defined as *“a material with a Plasticity Index (PI) not exceeding 6, free from lumps, vegetation and stones of a diameter exceeding 30mm”*. Therefore, the selected fill materials will also need to be imported to the site.

All soil materials excavated from trenches may be used as general backfill over the selected layers.

5.5 Precautionary Measures

5.5.1 Bedding

- Bedding material for pipe placement shall not be a frost susceptible material.

- Before placing any bedding material, the bottom of the trench shall be hand raked ahead of the pipe laying operation to remove stones and lumps which will interfere with

smooth and complete bedding of the pipe.

- The specified bedding material shall then be placed in layer(s) the full width of the trench, each layer not exceeding eight inches in thickness loose measure, and compacted to 95% of maximum density as determined by AASHTO T 180 D, until the elevation of the plan grade for the pipe invert is attained.

- After the pipe has been laid and approved for covering, the specified bedding material shall be placed evenly on both sides of the pipe for the full width of the trench.

5.5.2 Stability of Trenches

The test pits were all near vertical and there was no evidence of side wall collapse while left open during that short period, therefore any possible trenches excavated to within the limits of the tests pit depths are expected to be stable. However, in cases where water ingress is encountered, or the trenches are left open for an extended period, there could be instability problems. In such case(s), the excavated trenches may have to be battered to stable angles or shored to avoid sidewall collapse.

5.5.3 Trench Safety

It is important to ensure that soil removed from the trench is placed no closer than 1.5m from the edge of the trench. It is generally required that trenches deeper than 1.5m be adequately shored where there is a possibility of collapse. With pipeline trenches in particular, there is a tendency to open the trench over large lengths thereby increasing the risk of sidewall collapse. In any event there must be provision for safe access not more than every 50m along the trench length.

Key issues regarding the stability of trench sidewalls are;-

- Soft wet soil conditions
- Surcharge loading at edges of trenches
- Groundwater seepage

- Rainwater runoff

Of these, both surcharge loading and control of rainwater runoff can be managed. Surcharge in the form of stockpiling of backfill, or trenching machinery (pipe laying rigs), must be placed well away from the edge of the trench.

5.5.4 Backfill and Erosion

The trench line can also become a route for continued erosive activity, and with time could develop into a donga feature with resultant failure of the pipeline. It is therefore important to vegetate the trench outline as soon as possible after a process of backfilling is complete.

Compaction of the general backfill over the selected backfill layer may be carried out in 150mm thick layers and compacted to minimum 93% MAASHTO density. This is critical to ensure that settlement over pipes and within trench outlines is limited.

5.6 Bearing Capacity

Dynamic Cone Penetration can assist in determining the estimated allowable safe bearing pressures (EASBP) of the soils. **Appendix B** shows that EASBP to one metre depth at on site lack consistency. However because the bedrock is very shallow, foundations can be placed on either shallow shale or dolerite bedrock. The bearing capacity of both bedrocks exceeds 600kpa.

5.7 Corrosivity

Acidity (pH) and electric conductivity of the soil contribute to the soil to have a corrosive characteristic. In general the higher the acidity and the electric conductivity of the soil, the higher is its corrosiveness. The results from the laboratory show that the soil at the proposed sites has a pH between 5.06 and 7.7 with electric conductivity between 0.1917 and 0.2522Siemens/m. From these figures, it can therefore be concluded that the soil be considered as mildly corrosive.

5.8 Geotechnical Classification

In terms of Geotechnical Classification of Urban Development, after Patridge, Wood and Brink, the area can be categorised as **Intermediate Favourable Class**. This class was selected based on the parameters discussed in **section 5** above and using **Table 5 below** as a guideline. **Intermediate Class** category means precautionary measures are to be taken as prescribed during design and construction.

Table 5: Geotechnical Classification for Urban Development (after Patridge, Wood and Brink)

	Constraint	Most Favourable (1)	Intermediate (2)	Least Favourable (3)
A	Collapsible Soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750mm in thickness *	Any collapsible horizon or consecutive horizons with a depth of more than 750mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1.5m below ground surface	Permanent or perched water table less than 1.5m below ground surface	Swamps and marshes
C	Active Soil	Low soil heave potential anticipated	Moderate soil heave potential anticipated	High soil-heave potential anticipated
D	Highly compressible soil	Low soil compressibility anticipated*	Moderate soil compressibility anticipated	High soil compressibility anticipated
E	Erodability of soil	Low	Intermediate	High
F	Difficulty of excavation to 1.5m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of the total volume
G	Undermined ground	Undermining at a depth greater than 240m below surface (except where total extraction mining has not occurred	Old undermined areas to a depth of 90 - 240m below surface where slope closure has ceased	Mining within less than 90 - 240m of surface or where total extraction mining has taken place
H	Stability : (Dolomite & Limestone)	Possibly stable. Areas of dolomite overlain by Karoo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated Inherent Risk Class 1	Potentially charecterised by instability. Anticipated Inherent Risk Classes 2 - 5	Known sinkholes and dolines. Anticipated Inherent Risk Classes 6 - 8
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less than 2 degrees (Natal & Western Cape) Slopes between 6 and 12 degrees and less than 2 degrees (all other regions)	More than 18 degrees (Natal and Western Cape) More than 12 degrees (all other regions)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100cm/s² within 50 years	Mining induced seismic activity more than 100cm/s²	Natural seismic activity more than 100cm/s²
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

5.9 Building Site Class

Classification of the proposed site has been carried out in accordance with NHBRC building codes and South African National Standard (SANS 10400-H: 2012 Edition 3). Part H; Foundations, The application of the National Building Regulations.

Given the parameters discussed in **section 5,** the residential site class designation for Santa Centre and Mahala Park is R/H. Normal strip footings placed on the bedrock may be most favourable given the shallowness of the bedrock.

In the event whereby the residual dolerite gets deeper than test pits depths, a normal construction footing may still be used because of the low activity of clay. No foundation may be placed on fill. **Table 6 below** shows different foundation options for each class.

Table 6: Foundation design, building procedures and precautionary measures

SITE CLASS	ESTIMATED TOTAL Heave (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
R	Negligible	Normal	• Normal strip footings
H	> 7.5	Normal	• Normal construction foundation. • Site drainage and plumbing/service precautions.

NOTE

1. Differential heave equals 50% of total heave.
2. The relaxation of some of these requirements, eg. the reduction or omission of reinforcement or articulation joints, may result in a Category 2 level of expected damage.

All foundation reinforcement should be designed by a Structural Engineer with the above points in mind.

Under no circumstances should the foundations be placed in fill, unless such fill is engineered for this purpose. Buildings should be positioned in the cut part of platforms to avoid founding in fill and to minimise founding costs.

In addition to the above, the following good building practice is recommended to minimise differential movements beneath foundations:

- All buildings should have a concrete surround, minimum width 1 metre, with falls away from the building to ensure drainage of stormwater away from the structure. This will prevent the ingress of water into the foundation soils.

- All roof water is to be collected via down pipes and discharged away and downslope of the building
- No flower beds or vegetation to be planted within 3 metres of any structure.
- Septic tanks and soakpits must not be located within 3 metres of the structure, downslope from structures

It is recommended that an experienced engineering geologist must inspect and approve all foundations excavations to confirm depth of founding and bearing pressure.

6 PRECAUTIONERY MEASURES

6.1 Drainage

A most important factor in the promotion of a stable site is the control and removal of both surface and groundwater from the site. It is important that the design of the stormwater management system allow for the drainage of accumulated surface water. Such water should be directed towards the natural drainage lines. Disposal of stormwater should in any case conform to the Local Authority's requirements. Points of discharge of piped stormwater should be carefully designed to limit erosion.

6.1.1 Surface Drainage

Surface drainage of building platforms should be designed to direct water away from fill edges to prevent overtopping of the fill crest and erosion of the fill embankment slopes. It is important that grassing of fill embankments be carried out as soon as possible after construction.

6.1.2 Sub-surface Drainage

The need for subsoil drains will have to be assessed on site during development. Where groundwater seepage is encountered during construction, these zones will need to be controlled with effective subsoil drains, particularly where water is likely to gain ingress into the structural layers of foundations. The occurrence of seepage at the base of housing platform cuts may also require similar treatment.

6.2 Vegetation

All trees should be regarded as potential source of damage to any housing developments. The following varieties are, however, particularly prone to causing damage:

a) All eucalyptus varieties;

b) Lombardy (Free State) poplars;

c) London planes;

d) Willows (Salix) of any type; and

e) Jacarandas.

The greatest risk of direct damage occurs close to the tree from the growth of the main trunk and roots, and diminishes rapidly with distance. The risk of damage can be minimized should precautions be taken when the distance from trees is less than given in **Table 7** derived from the *South African National Standard (SANS 10400-H: 2012 Edition 3). The Application of the National Building Regulations. Part H: Foundations.*

Table 7: Minimum distance between masonry and centre of trunks of young trees

Description	Minimum distance between buildings and trees (meters)		
	Mature height of tree		
	<8 m	8 m to 15 m	>15 m
Buildings other than single-storey buildings of lightweight construction (for example, timber framed)	-	0.5	1.2
Single-storey buildings of lightweight construction (for example, timber framed)	-	0.7	1.5
Free-standing masonry walls: - distance for prevention of all damage - distance which permits some movement and minor damage which might be tolerable	- -	1.0 -	- 2.0
Drains and underground services: - distance which permits some movement and minor damage which might be tolerable - less than 1 m deep - more than 1 m deep	- 0.5 -	0.5 1.5 1.0	1.0 3.0 2.0
In-situ concrete paths and driveways: - distance for prevention of all direct damage - distance which permits some movement and minor damage which might be tolerable	0.5 -	1.0 0.5	2.5 1.5
Paths and driveways with flexible surfaces, such as asphalt, shale or paving slabs: - distance for prevention of all direct damage - distance which permits some movement and minor damage which might be tolerable	0.7 -	1.5 0.5	3.0 1.0
Note: This table provides guidance on the proximity of young trees or new planting to allow for future growth. This should not be taken that construction work can occur at the specified distance from existing trees, as such work might damage the tree, or render it dangerous, but refers to the potential for future growth, either of a young tree or of planting occurring subsequent to construction.			

7 CONCLUSIONS AND RECOMMENDATIONS

The geotechnical investigation performed has indicated that the proposed area is suitable for the construction of the RDP houses and excavation of the trenches for a pipeline network.

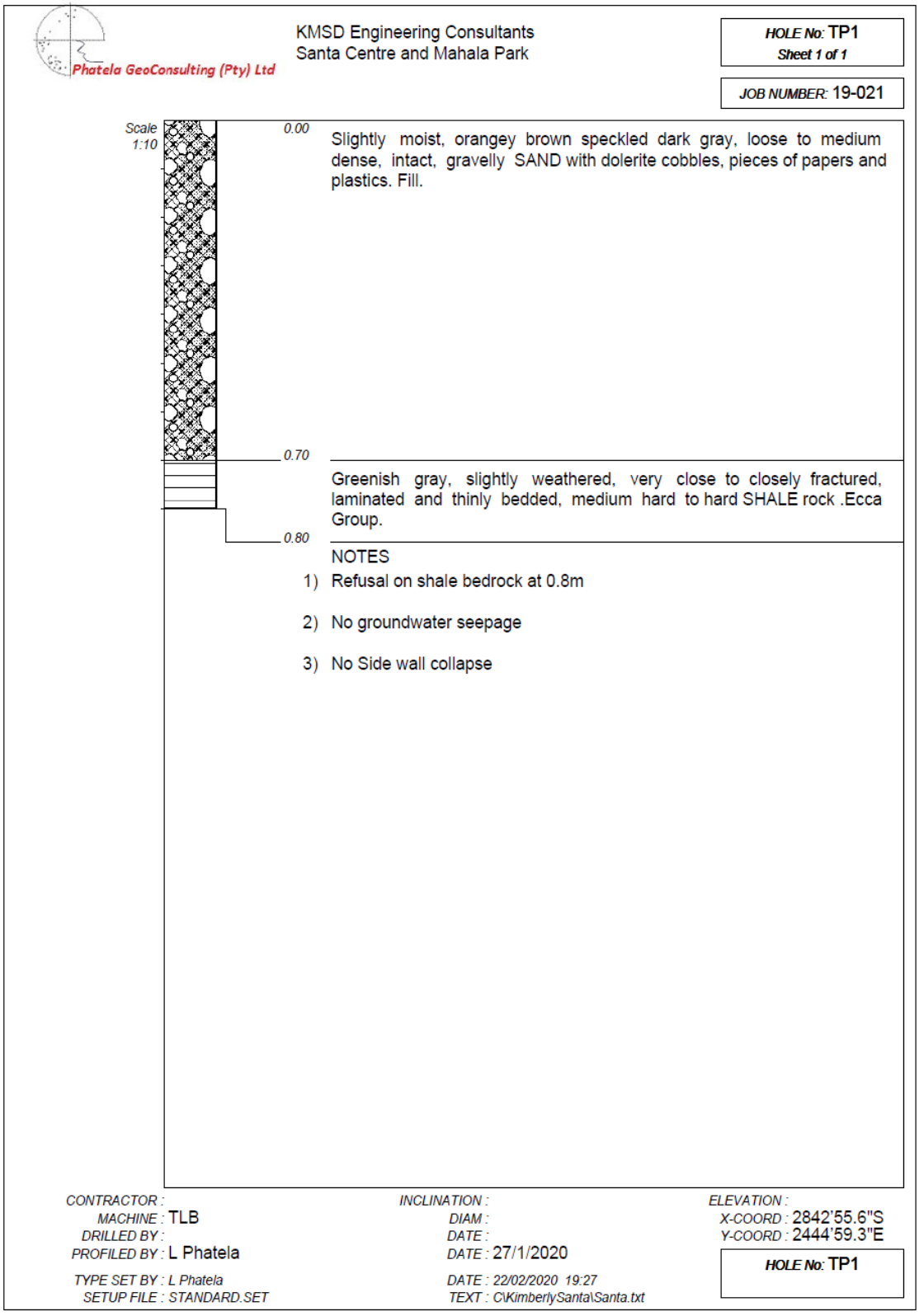
The geotechnical investigation carried out and discussed in the report is based on the assumption that single storey RDP houses will be constructed on the proposed site. Should this not be the case, further geotechnical investigations might have to be conducted.

The recommendations made are based on the information obtained from the seven test pits,four exposures and fourteen DCP's. It is possible that the ground profile varies at other areas on site where these investigations were not performed. Hence it is highly recommended that an experienced geologist or geotechnical engineer is engaged to assess the foundation conditions during construction to ensure that the ground conditions are as anticipated and to make recommendations if conditions change.

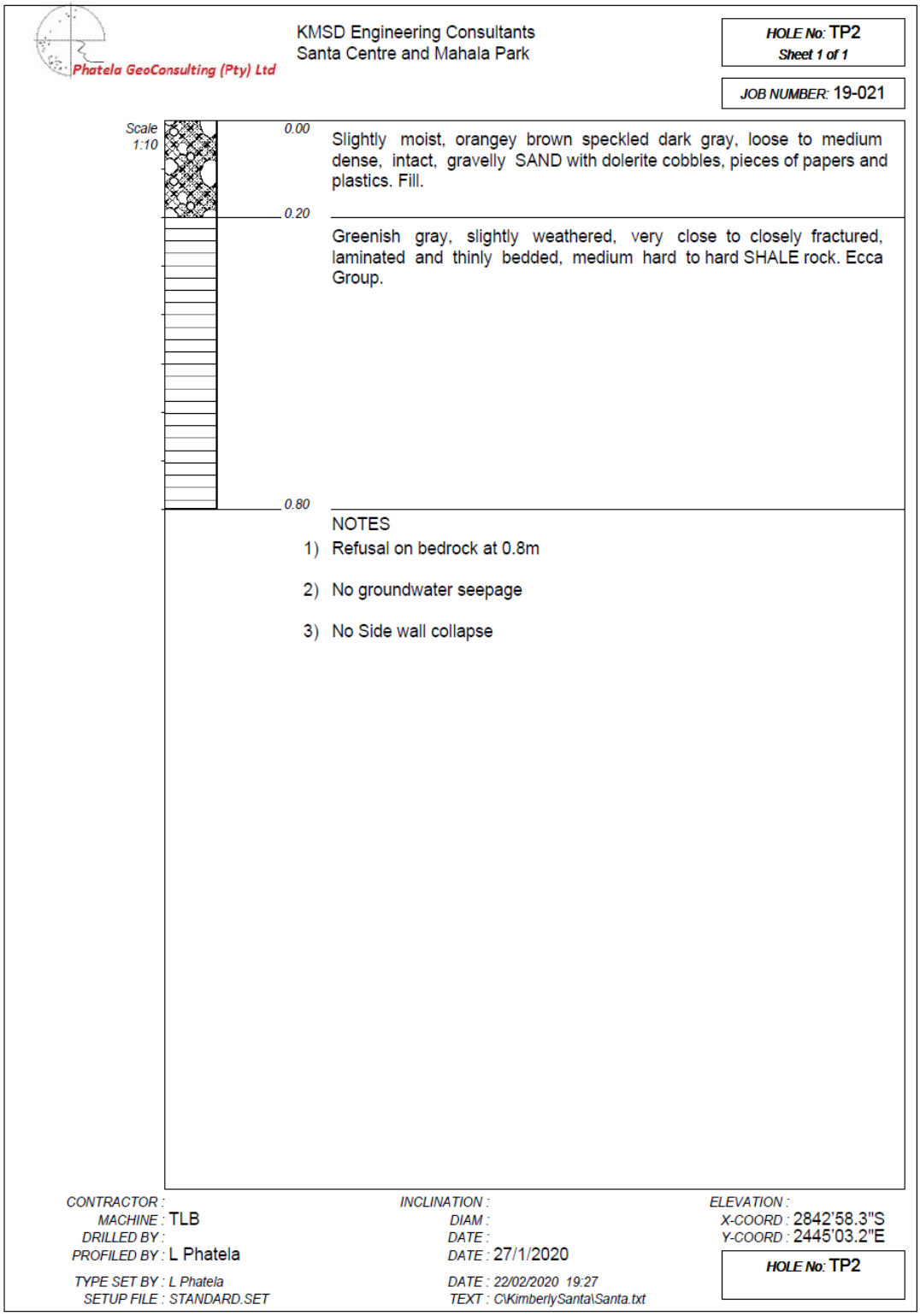
8 REFERENCES

- 1: 250 000 *Scale Geological Map. Sheet Sheet 2824 Kimberley*. Published by South African Council for Geoscience.
- 1:50 000 *Scale Topographic Map. Sheet* 2824DA *Barkly West*. Published by Surveys and Mapping.
- M Brandt(2011) *Seismic Hazard in South Africa*.Council for Geosciences
- Department of Public Works. *Identification of Problematic Soils in Southern Africa*. (PW2006/1).
- D.H Van Der Merwe (1964) The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer , pp103-107
- South African National Standards, Geotechnical Investigations for Township Development, SANS 634.
- South African National Standard (SANS 10400-H: 2012 EDITION 3). Part H; Foundations. *The application of the National Building Regulations*
- *www.google.com*
  http://www.saexplorer.co.za/south-africa/climate/kimberley_climate.asp

APPENDIX A: SOIL PROFILES



TP1


Phatela GeoConsulting (Pty) Ltd
KMSD Engineering Consultants
Santa Centre and Mahala Park
HOLE No: TP2
Sheet 1 of 1
JOB NUMBER: 19-021
Scale 1:10
0.00
Slightly moist, orangey brown speckled dark gray, loose to medium dense, intact, gravelly SAND with dolerite cobbles, pieces of papers and plastics. Fill.
0.20
Greenish gray, slightly weathered, very close to closely fractured, laminated and thinly bedded, medium hard to hard SHALE rock. Ecca Group.
0.80
NOTES
1) Refusal on bedrock at 0.8m
2) No groundwater seepage
3) No Side wall collapse
CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET
INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt
ELEVATION :
X-COORD : 2842'58.3"S
Y-COORD : 2445'03.2"E
HOLE No: TP2

TP2

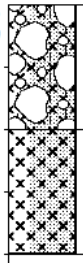
Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: TP3
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10



0.00 Slightly moist, reddish brown speckled dark gray, soft, intact, silty GRAVEL with dolerite cobbles and boulders.Residual dolerite.

0.20 Dark gray stained orangey brown, highly weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.

0.40

NOTES

1) Refusal on bedrock at 0.4m
2) No groundwater seepage
3) No Side wall collapse

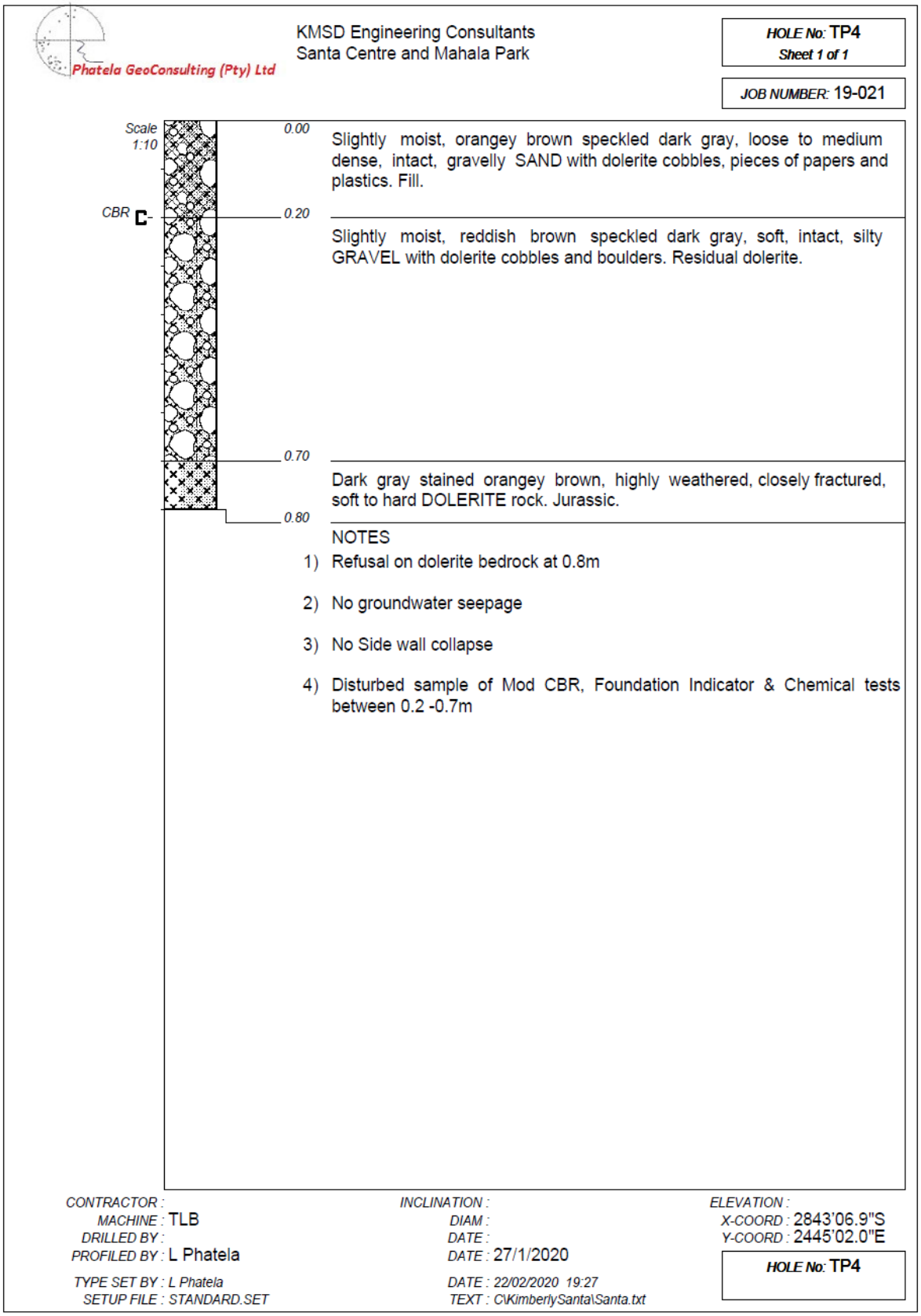
CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD : 2843'00.5"S
Y-COORD : 2445'01.9"E

HOLE No: TP3

TP3


Phatela GeoConsulting (Pty) Ltd
KMSD Engineering Consultants
Santa Centre and Mahala Park
HOLE No: TP4
Sheet 1 of 1
JOB NUMBER: 19-021
Scale 1:10
CBR
0.00
Slightly moist, orangey brown speckled dark gray, loose to medium dense, intact, gravelly SAND with dolerite cobbles, pieces of papers and plastics. Fill.
0.20
Slightly moist, reddish brown speckled dark gray, soft, intact, silty GRAVEL with dolerite cobbles and boulders. Residual dolerite.
0.70
Dark gray stained orangey brown, highly weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.
0.80
NOTES
1) Refusal on dolerite bedrock at 0.8m
2) No groundwater seepage
3) No Side wall collapse
4) Disturbed sample of Mod CBR, Foundation Indicator & Chemical tests between 0.2 -0.7m
CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET
INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt
ELEVATION :
X-COORD : 2843'06.9"S
Y-COORD : 2445'02.0"E
HOLE No: TP4

TP4

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: TP5
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10

0.00 Dark gray stained orangey brown, highly to medium weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.

0.20

NOTES

1) Refusal on bedrock at 0.2m
2) No groundwater seepage
3) No Side wall collapse

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD : 2843'05.7"S
Y-COORD : 2444'58.5"E

HOLE No: TP5

TP5

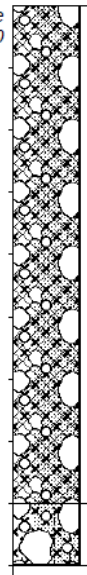
Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: TP6
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10



0.00 Slightly moist, orangey brown speckled dark gray, loose to medium dense, intact, gravelly SAND with dolerite cobbles, pieces of papers and plastics. Fill.

CBR C

0.80 Slightly moist, reddish brown speckled dark gray, soft, intact, silty GRAVEL with dolerite cobbles and boulders. Residual dolerite.

0.90

NOTES

1) Refusal on a dolerite bedrock at 0.9m
2) No groundwater seepage
3) No Side wall collapse
4) Disturbed sample of Mod CBR , Foundation Indicator & Chemical tests between 0.8 -0.9m

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD : 2843'05.7"S
Y-COORD : 2444'00.3"E

HOLE No: TP6

TP6

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: TP7
Sheet 1 of 1

JOB NUMBER: 19-021

CBR
Scale 1:10

0.00		Slightly moist, reddish brown speckled dark gray, loose to medium dense, intact, slightly sandy GRAVEL. Fill.
0.50		

NOTES

1) Refusal on dolerite bedrock at 0.5m
2) No groundwater seepage
3) No Side wall collapse
4) Disturbed sample of Mod CBR , Foundation Indicator & Chemical tests between 0.0 -0.5m

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:42
TEXT : ..mberlySanta\SantaEXP.txt

ELEVATION :
X-COORD : 2843'05.5"S
Y-COORD : 2444'56.1"E

HOLE No: TP7

TP7

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: EXP 1
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10

0.00 Dark gray stained orangey brown, highly to medium weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.

0.10

NOTES

1) End of exposure on a dolerite bedrock at 0.1m

2) No groundwater seepage

3) No Side wall collapse

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD : 2843'03.5"S
Y-COORD : 2445'00.4"E

HOLE No: EXP 1

EXP1

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: EXP 2
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10

0.00 Dark gray stained orangey brown, highly to medium weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.

0.10

NOTES

1) End of exposure on a dolerite bedrock at 0.1m

2) No groundwater seepage

3) No Side wall collapse

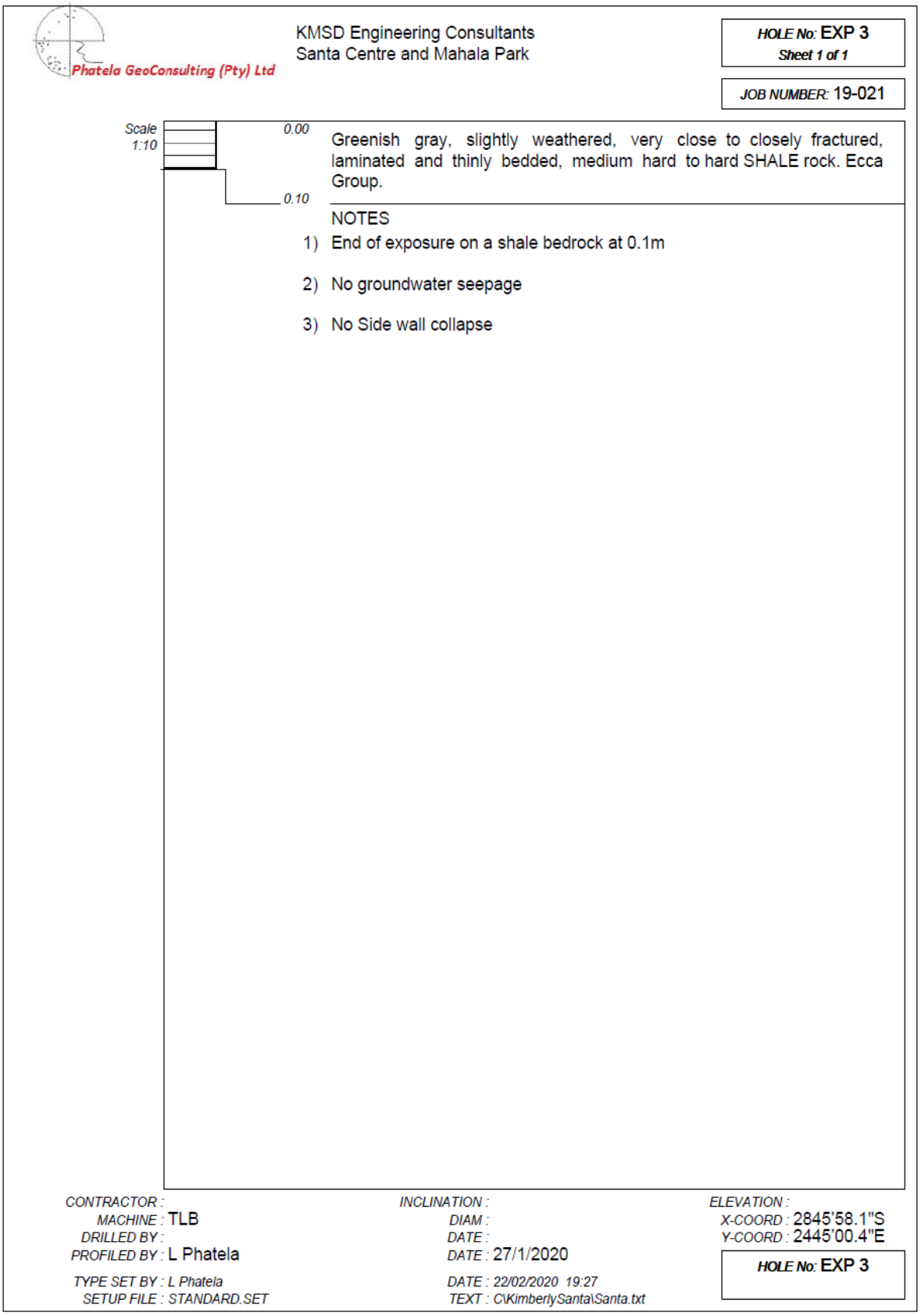
CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\Kimberly\Santa\Santa.txt

ELEVATION :
X-COORD : 2843'06.9"S
Y-COORD : 2444'57.2"E

HOLE No: EXP 2

EXP2


Phatela GeoConsulting (Pty) Ltd
KMSD Engineering Consultants
Santa Centre and Mahala Park
HOLE No: EXP 3
Sheet 1 of 1
JOB NUMBER: 19-021
Scale 1:10
0.00
Greenish gray, slightly weathered, very close to closely fractured, laminated and thinly bedded, medium hard to hard SHALE rock. Ecca Group.
0.10
NOTES
1) End of exposure on a shale bedrock at 0.1m
2) No groundwater seepage
3) No Side wall collapse
CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET
INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
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ELEVATION :
X-COORD : 2845'58.1"S
Y-COORD : 2445'00.4"E
HOLE No: EXP 3

EXP3

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

HOLE No: EXP 4
Sheet 1 of 1

JOB NUMBER: 19-021

Scale 1:10

0.00 Dark gray stained orangey brown, highly to medium weathered, closely fractured, soft to hard DOLERITE rock. Jurassic.

0.10

NOTES

1) End of exposure on a dolerite bedrock at 0.1m

2) No groundwater seepage

3) No Side wall collapse

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : L Phatela
TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 27/1/2020
DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD : 2842'59.8"S
Y-COORD : 2445'02.3"E

HOLE No: EXP 4

EXP4

Phatela GeoConsulting (Pty) Ltd

KMSD Engineering Consultants
Santa Centre and Mahala Park

LEGEND
Sheet 1 of 1

JOB NUMBER: 19-021

	BOULDERS	{SA01}
	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SILTY	{SA07}
	SHALE	{SA12}
	DOLERITE	{SA18}{SA42}
	FILL	{SA32}
	CHEMICAL SAMPLE	{SA39}
	COBBLES	{SA58}

Name C-

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

TYPE SET BY : L Phatela
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 22/02/2020 19:27
TEXT : C\KimberlySanta\Santa.txt

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

APPENDIX B: DYANAMIC CONE PENETRATION TESTS

EASBP FROM DCP

8kg Hammer 20mm point

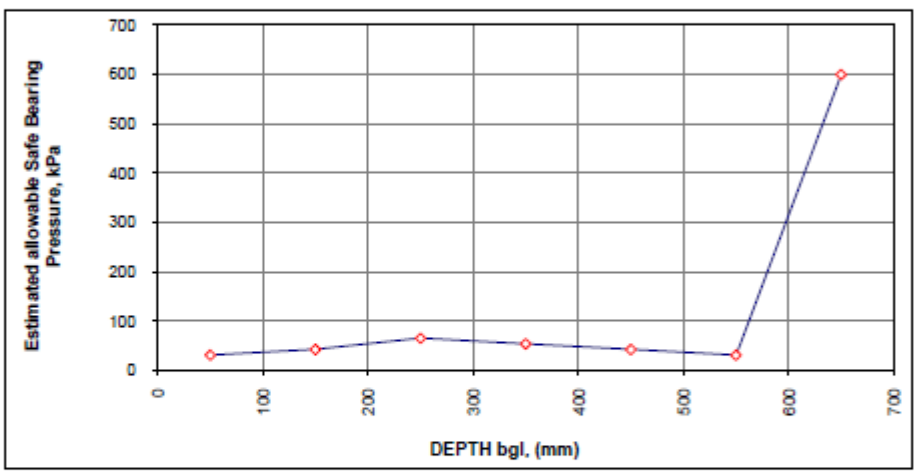
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 1 Location: 28°42'55.6"S 24°44'59.3"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal @700mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	2	150	50	2	3	43
3	200	300	250	4	250	25	5	7	66
4	300	400	350	3	350	33	4	5	54
5	400	500	450	2	450	50	2	3	43
6	500	600	550	1	550	100	1	0	31
7	600	700	650	50	650	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

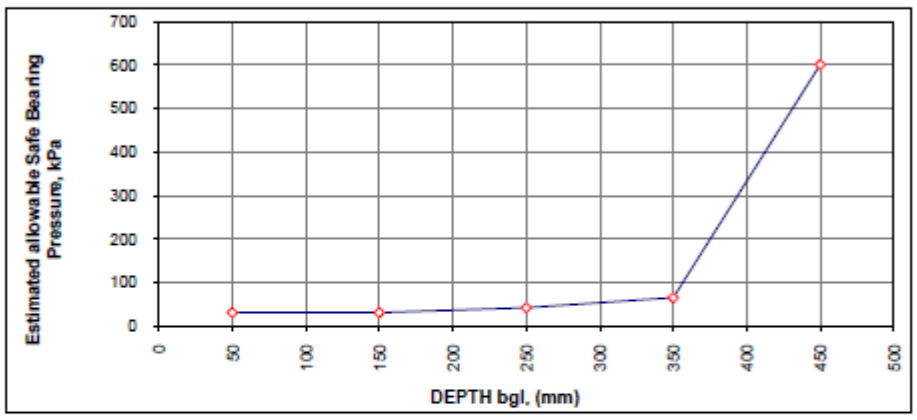
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 2 Location: 28°42'58.3"S 24°45'03.2"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal @400mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	1	150	100	1	0	31
3	200	300	250	2	250	50	2	3	43
4	300	400	350	4	350	25	5	7	66
5	400	500	450	50	450	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

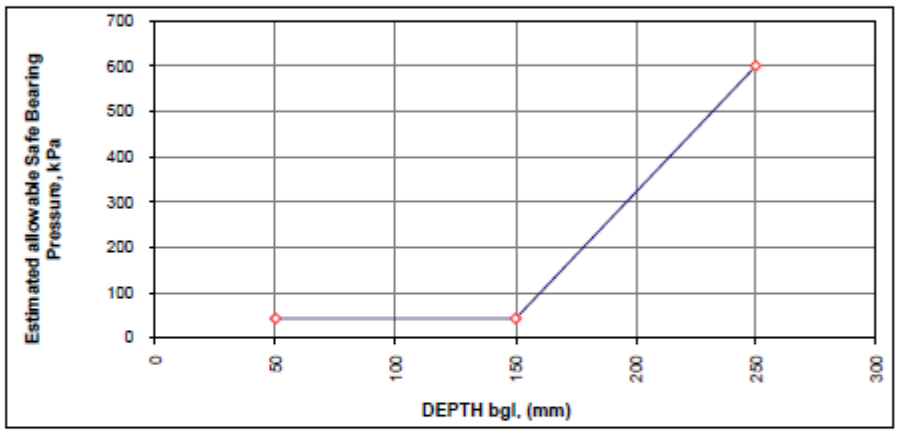
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 3 Location: 28°43'00.5"S 24°45'01.9"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@300mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	2	50	50	2	3	43
2	100	200	150	2	150	50	2	3	43
3	200	300	250	50	250	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

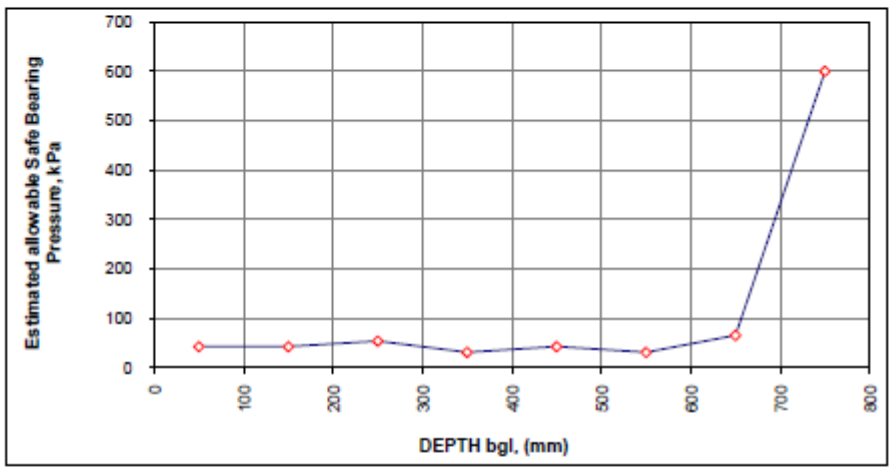
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 4 Location: 28°43'06.9"S 24°45'02.0"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal @800mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	2	50	50	2	3	43
2	100	200	150	2	150	50	2	3	43
3	200	300	250	3	250	33	4	5	54
4	300	400	350	1	350	100	1	0	31
5	400	500	450	2	450	50	2	3	43
6	500	600	550	1	550	100	1	0	31
7	600	700	650	4	650	25	5	7	66
8	700	800	750	50	750	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

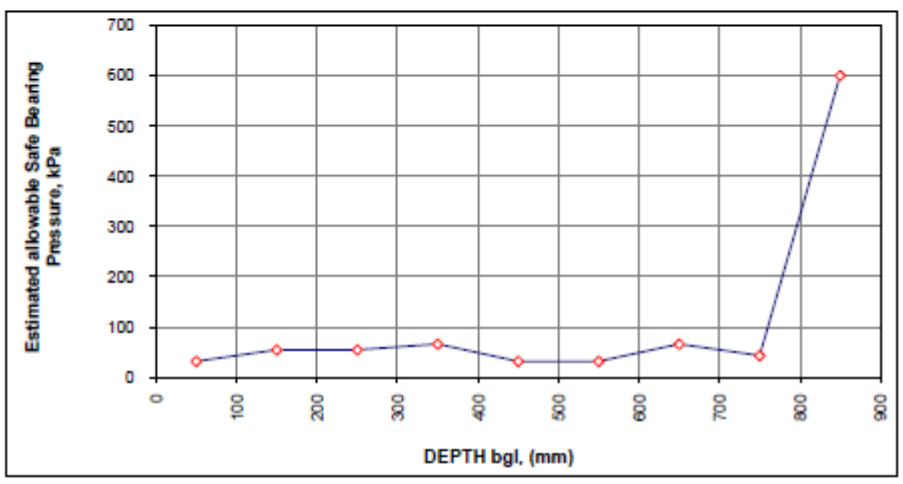
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 5 Location: 28°43'05.7"S 24°45'00.3"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal @900mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	3	150	33	4	5	54
3	200	300	250	3	250	33	4	5	54
4	300	400	350	4	350	25	5	7	66
5	400	500	450	1	450	100	1	0	31
6	500	600	550	1	550	100	1	0	31
7	600	700	650	4	650	25	5	7	66
8	700	800	750	2	750	50	2	3	43
9	800	900	850	50	850	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

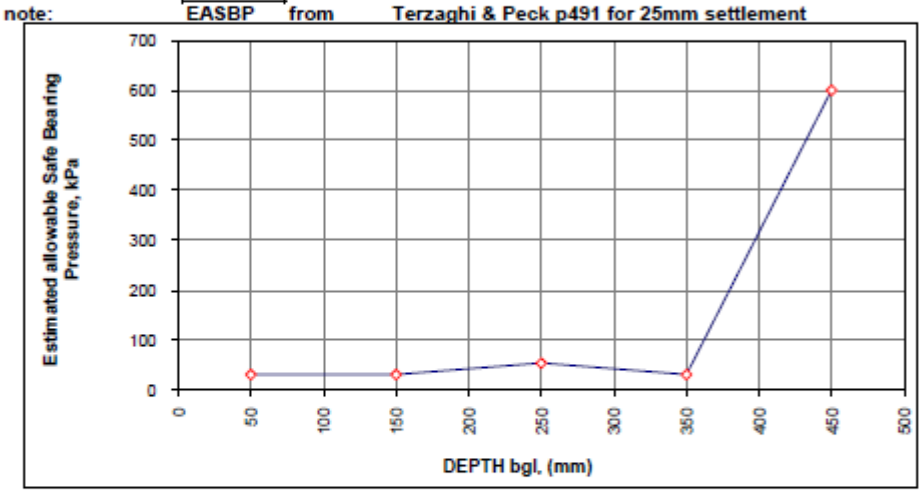
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 6 Location: 28°43'05.5"S 24°44'56.1"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal @500mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	1	150	100	1	0	31
3	200	300	250	3	250	33	4	5	54
4	300	400	350	1	350	100	1	0	31
5	400	500	450	50	450	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

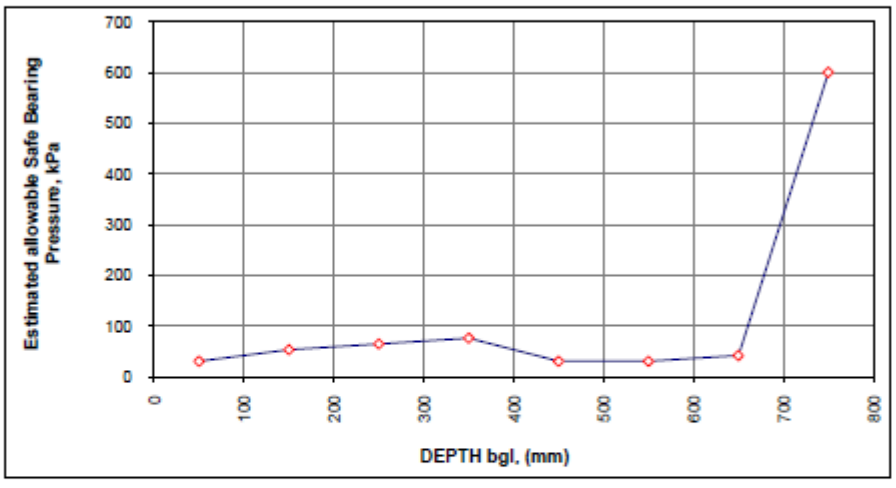
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Photela GeoConsulting (Pty) Ltd

DCP No: 7 Location: 28°42'54.7"S 24°44'59.9"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@800mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	3	150	33	4	5	54
3	200	300	250	4	250	25	5	7	66
4	300	400	350	5	350	20	6	9	77
5	400	500	450	1	450	100	1	0	31
6	500	600	550	1	550	100	1	0	31
7	600	700	650	2	650	50	2	3	43
8	700	800	750	50	750	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

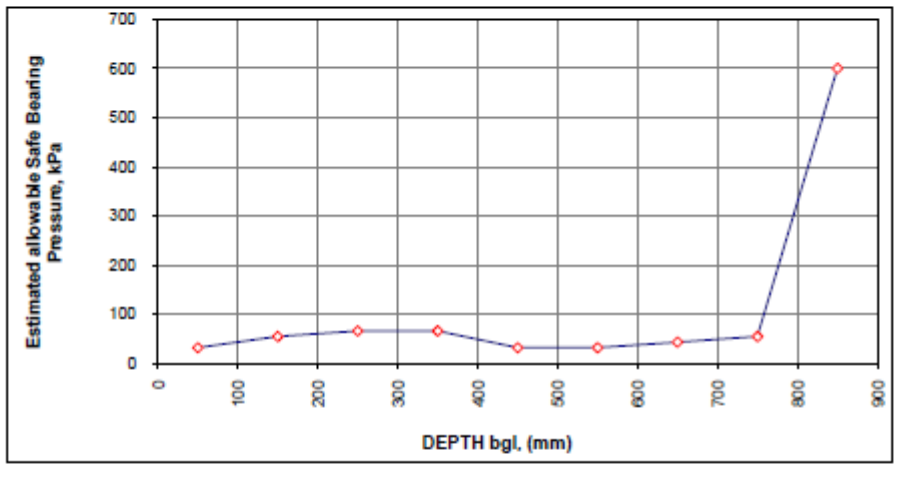
Photola GeoConsulting (Pty) Ltd

Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

DCP No: 8 Location: 28°42'55.7"S 24°45'0.43"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@900mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	3	150	33	4	5	54
3	200	300	250	4	250	25	5	7	66
4	300	400	350	4	350	25	5	7	66
5	400	500	450	1	450	100	1	0	31
6	500	600	550	1	550	100	1	0	31
7	600	700	650	2	650	50	2	3	43
8	700	800	750	3	750	33	4	5	54
9	800	900	850	50	850	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

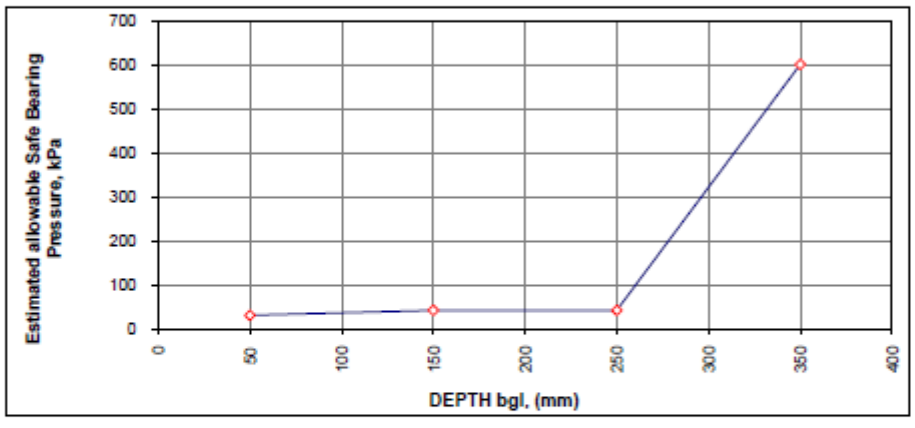
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 10 Location: 28°43'06.9"S 24°44'59.4"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@400mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	1	50	100	1	0	31
2	100	200	150	2	150	50	2	3	43
3	200	300	250	2	250	50	2	3	43
4	300	400	350	50	350	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

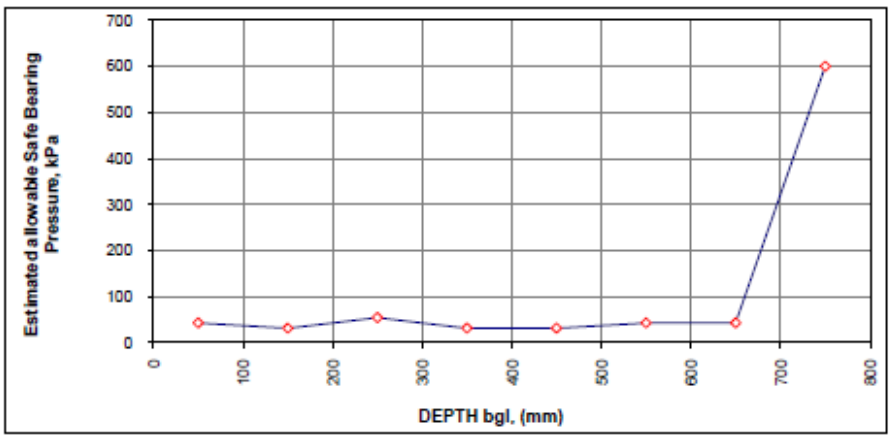
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 11 Location: 28°43'4.41"S 24°45'2.7"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@800mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	2	50	50	2	3	43
2	100	200	150	1	150	100	1	0	31
3	200	300	250	3	250	33	4	5	54
4	300	400	350	1	350	100	1	0	31
5	400	500	450	1	450	100	1	0	31
6	500	600	550	2	550	50	2	3	43
7	600	700	650	2	650	50	2	3	43
8	700	800	750	50	750	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

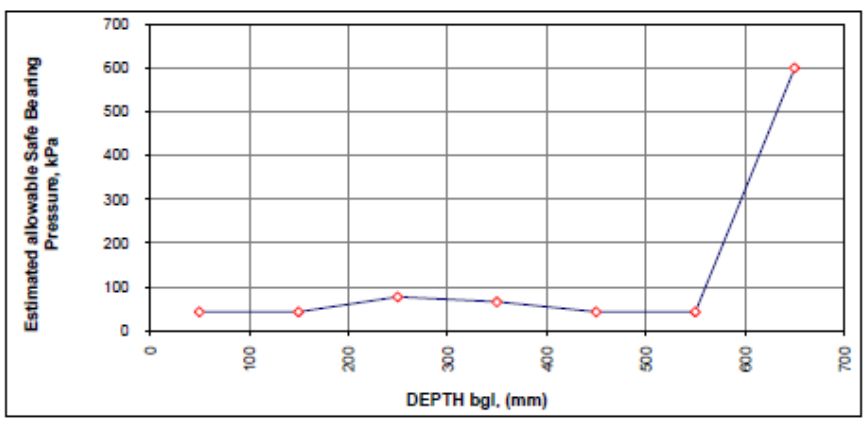
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 12 Location: 28°43'6.50"S 24°45'3.8"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@700mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	2	50	50	2	3	43
2	100	200	150	2	150	50	2	3	43
3	200	300	250	5	250	20	6	9	77
4	300	400	350	4	350	25	5	7	66
5	400	500	450	2	450	50	2	3	43
6	500	600	550	2	550	50	2	3	43
7	600	700	650	50	650	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

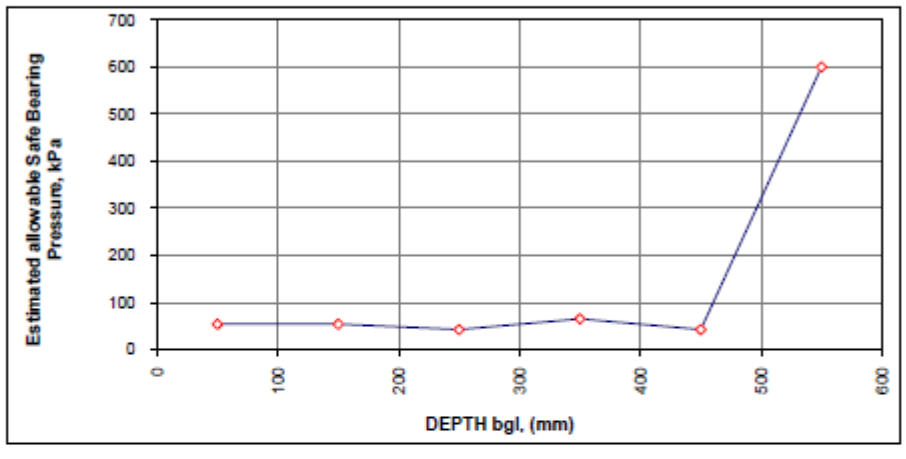
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 13 Location: 28°43'8.50"S 24°45'59.5"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@600mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	3	50	33	4	5	54
2	100	200	150	3	150	33	4	5	54
3	200	300	250	2	250	50	2	3	43
4	300	400	350	4	350	25	5	7	66
5	400	500	450	2	450	50	2	3	43
6	500	600	550	50	550	2	60	110	600

EASBP FROM DCP

8kg Hammer 20mm point

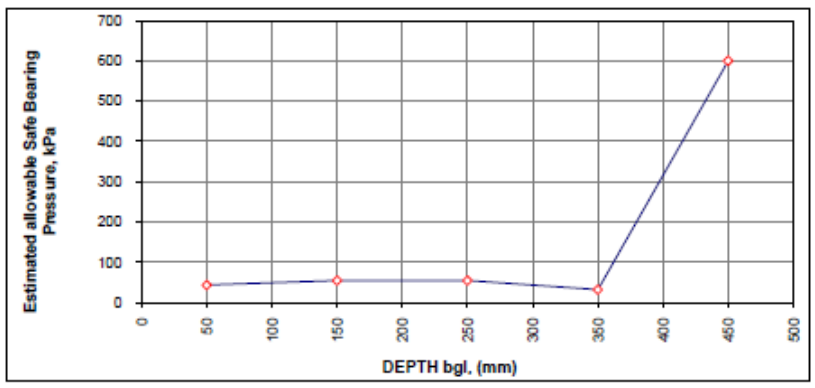
Job Name Santa Centre & Mahala Park

File No: 19-021 Job No: 19-021 Date of Test: Jan-20

Phatela GeoConsulting (Pty) Ltd

DCP No: 14 Location: 28°43'54.8"S 24°45'2.2"E

note: EASBP from Terzaghi & Peck p491 for 25mm settlement



Depth of hole in which DCP was taken : 0 mm below NGL

Applied Factor : 1 times Terzaghi's value SPT = 1.2 DN

Remarks : Refusal@500mm

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN Blows/100mm	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	100	50	2	50	50	2	3	43
2	100	200	150	3	150	33	4	5	54
3	200	300	250	3	250	33	4	5	54
4	300	400	350	1	350	100	1	0	31
5	400	500	450	50	450	2	60	110	600

APPENDIX C: LABORATORY TESTS RESULTS

Simlab (EDMS) BEPERK GEOTEGNIESE DIENSTE (PTY) LIMITED GEOTECHNICAL SERVICES
REG. No. 1987/004282/07 NLA No. 2012/187
1231, KIMBERLEY, 8300, SOUTH AFRICA. 3 Roper Street, KIMBERLEY, 8301
+27 (0) 53 832 2472 / 831 7560, f: +27 (0) 53 832 2472, e: simkby@simlab.co.za

*** PAGE CONTINUES FROM PAGE 1

DOCUMENT No.: 020/0103 (a)

CLIENT & PROJECT : PHATELA GEO CONSULTING - Kimberley - Galeshewe - Santa					DATE : 10/02/2020
HOLE No. / KM (Chainage)		TP 4	TP 6	TP 7	
MATERIAL DEPTH (m)		0.2 - 0.7	0.8 - 0.9	0.0 - 0.5	
SAMPLE / LABORATORY No.		020/0103	020/0104	020/0105	
MATERIAL DESCRIPTION		Light brown sand with weathered dolerite	Light brown sand with weathered dolerite	Reddish brown sand with dolerite	
* IN SITU FIELD MOISTURE (%)		2.1	2.3	2.2	
UNIFIED SOIL CLASSIFICATION					
TRH14 / * COLTO CLASSIFICATION		*G9	*G9	*G6	
SIEVE ANALYSIS, PERCENTAGE OF MATERIAL PASSING 0.075 mm SIEVE (SANS 3001-GR1, PR5 : 2011) - % PASSING SIEVES					
SIEVE ANALYSIS	63.0 mm	100	100		
	50.0 mm	95	94	100	
	37.5 mm	91	90	93	
	28.0 mm	84	85	93	
	20.0 mm	75	79	91	
	14.0 mm	71	72	911	
	5.00 mm	54	57	87	
	2.00 mm	39	37	82	
	0.425 mm	21	19	69	
	0.075 mm	6	5	18	
	0.002 mm	-	-	8	
SOIL MORTAR	COARSE SAND	46	48	16	
	FINE SAND	14 / 13 / 13	12 / 11 / 14	9 / 21 / 32	
	MATERIAL<0.075 mm	14	15	22	
GRADING MODULUS (GM)		2.34	2.39	1.31	
ATTERBERG LIMITS ANALYSIS (SANS 3001-GR10 : 2011), PH VALUE & CONDUCTIVITY (TMH 1 : 1986, METHOD A20 & A21T)					
ATTERBERG LIMITS PASSING SIEVE 0.425mm	L.L (%)	-	30	-	
	P.I. / L.S. (%)	S.P. / 0.8	4 / 2.0	N.P. / 0.0	
POTENTIAL EXPANSIVENESS (mm)		-	-	-	
pH VALUE / CONDUCTIVITY (Sm^{-1})		5.06 / 0.2220	5.05 / 0.1917	5.02 / 0.2522	
MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT, CALIFORNIA BEARING RATIO ANALYSIS (SANS 3001-GR30, GR40 : 2010) UNCONFINED COMPRESSIVE STRENGTH & INDIRECT TENSILE STRENGTH OF STABILISED MATERIAL (SANS 3001-GR53, GR54 : 2010)					
CBR / UCS / ITS DETERMINATION	MOD AASHTO	MAX DRY DENSITY (kg/m^3)	2238	1997	1996
		OPT MOISTURE (%)	7.7	8.6	6.4
		COMP MOISTURE (%)	7.7	8.5	6.4
		DRY DENSITY (kg/m^3)	2238	1997	1996
		CBR (%)	13	10	52
		SWELL (%)	0.0	0.0	0.0
		UCS (KPa)	-	-	-
		ITS (KPa)	-	-	-
	NRB	DRY DENSITY (kg/m^3)	2081	1836	1810
		CBR (%)	10	8	30
	PROCTOR	MAX DRY DENSITY (kg/m^3)	1985	1740	1770
		OPT MOISTURE (%)	-	-	-
		CBR (%)	8	7	17
	CBR	100%	13	10	52
		98%	11	9	42
		95%	10	8	30
		93%	9	8	24
		90%	8	7	17

Results reported relate only to the materials tested
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Classification/Rep/019

DRAWING LIST

COVER

3258-KP-001	KEY PLAN

PHASE 1: 66 ERVEN

3258-CIV-RD-001	ROAD PLAN & LONG SECTIONS
3258-CIV-LAY-001	WATER LAYOUT
3258-CIV-LAY-002	SEWER LAYOUT PLAN
3258-CIV-LAY-003	SEWER LONG SECTIONS

PHASE 2: 69 ERVEN

3258-CIV-RD-001	ROAD PLAN & LONG SECTIONS
3258-CIV-RD-002	ROAD PLAN & LONG SECTIONS
3258-CIV-SEW-001	SEWER PLAN & LONG SECTIONS
3258-CIV-SEW-002	SEWER PLAN & LONG SECTIONS
3258-CIV-WAT-001	WATER LAYOUT

TYPICAL DETAILS

3258-CIV-DET-001	BEDDING DETAILS
3258-CIV-DET-002	SEWER MANHOLE DETAILS
3258-CIV-DET-003	VALVE CHAMBER DETAILS
3258-CIV-DET-004	THRUSTBLOCK DETAILS
3258-CIV-DET-005	SEWER HOUSE CONNECTION DETAILS
3258-CIV-DET-006	WATER HOUSE CONNECTION DETAILS SHEET 1 OF 3
3258-CIV-DET-007	WATER HOUSE CONNECTION DETAILS SHEET 2 OF 3
3258-CIV-DET-008	WATER HOUSE CONNECTION DETAILS SHEET 3 OF 3
3258-CIV-DET-009	TYPICAL CROSS SECTION DETAIL
3258-NAME-001	NAMEBOARD

LOCALITY PLAN

No.	DATE	AMENDMENT	CHECKED BY
A	03/2020	FOR APPROVAL	DM

cad file name

NORTHERN CAPE CO-OPERATIVE
GOVERNANCE HUMAN SETTLEMENTS &
TRADITIONAL AFFAIRS

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KMSD ENGINEERING CONSULTANTS
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Kimberley
8301
Telephone : 087 940 3119
Facsimile : 086 265 4077
E-mail : admin@kmsd.co.za

discipline
CIVIL

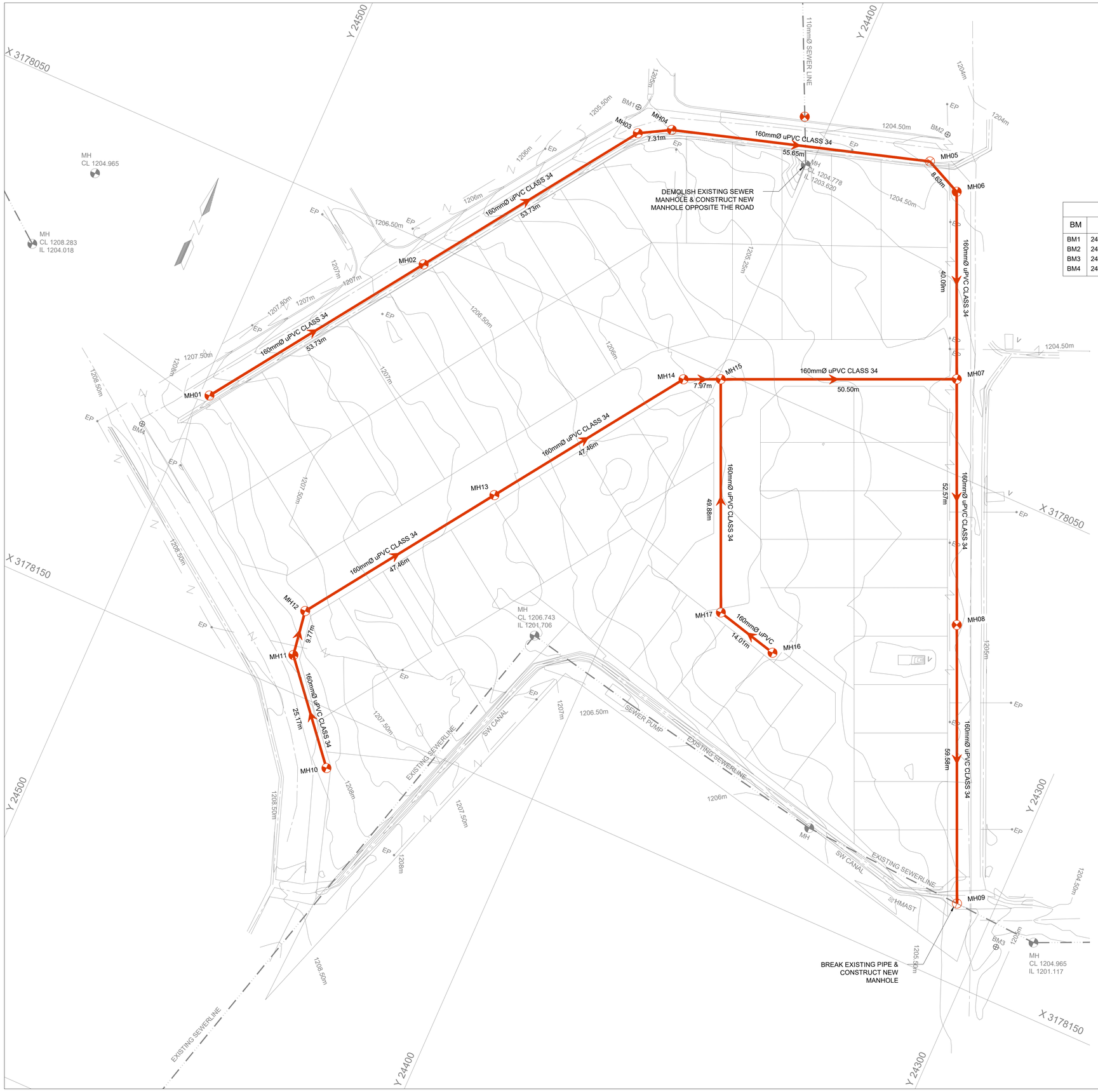
service
PROPOSED SERVICED
STANDS AT SANTA CENTRE

WCS number

drawing title
KEY PLAN

ref.no	designed: BD
scale: AS SHOWN	drawn: B.D
date: 03/2020	checked: DM
type number	

drawing number: 3258-KP-001 A1



LEGEND:

- PROPOSED SEWERLINE
- EXISTING SEWERLINE
- EXISTING WATERLINE
- EXISTING SEWER MANHOLE
- NEW SEWER MANHOLE
- DIRECTION OF FLOW

No.	DATE	AMENDMENT	CHECKED BY
A	03/2020	FOR APPROVAL	DM

BENCHMARK COORDINATE LIST - WG25

BM	Y	X	Z	DESCRIPTION
BM1	24 438.921	3 178 005.442	1205.240	12mm HOLE IN CONCRETE
BM2	24 376.030	3 177 984.108	1204.561	12mm HOLE IN TELKOM MH COVER
BM3	24 296.424	3 178 138.895	1204.996	12mm HOLE IN CONCRETE
BM4	24 508.750	3 178 110.288	1208.498	ROOF NAIL IN TAR

COORDINATE LIST

WGS84

Sewer Network		
MH No.	YLo	XLo
Constant:		
MH01	24498.011	3178098.932
MH02	24467.403	3178054.767
MH03	24436.795	3178010.602
MH04	24430.422	3178007.018
MH05	24377.155	3177990.905
MH06	24369.312	3177994.510
MH07	24353.113	3178031.180
MH08	24331.869	3178079.271
MH09	24307.795	3178133.769
MH10	24442.945	3178161.724
MH11	24459.165	3178142.474
MH12	24460.664	3178132.818
MH13	24433.629	3178093.810
MH14	24406.595	3178054.802
MH15	24399.304	3178051.582
MH16	24365.560	3178100.620
MH17	24379.153	3178097.214

PIPE DATA LIST

MH - MH	Distance
Sewer Network	(m)
MH01 - MH02	53.735
MH02 - MH03	53.735
MH03 - MH04	7.312
MH04 - MH05	55.651
MH05 - MH06	8.632
MH06 - MH07	40.089
MH07 - MH08	52.575
MH08 - MH09	59.578
MH10 - MH11	25.173
MH11 - MH12	9.772
MH12 - MH13	47.460
MH13 - MH14	47.460
MH14 - MH15	7.970
MH15 - MH07	50.497
MH16 - MH17	14.013
MH17 - MH15	49.883

cad file name

NORTHERN CAPE CO-OPERATIVE GOVERNANCE HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS

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53 Debeers Road
Kimberley
8301
Telephone : 087 940 3119
Facsimile : 086 265 4077
E-mail : admin@kmsd.co.za

discipline
CIVIL

service

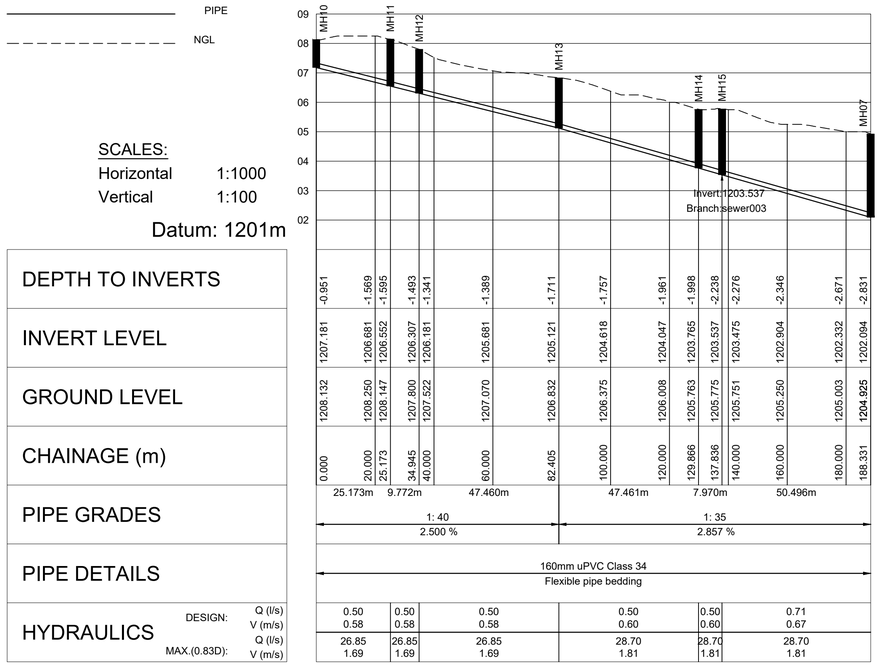
PROPOSED SERVICED STANDS AT SANTA CENTRE - PHASE 1_66ERFS

WCS number

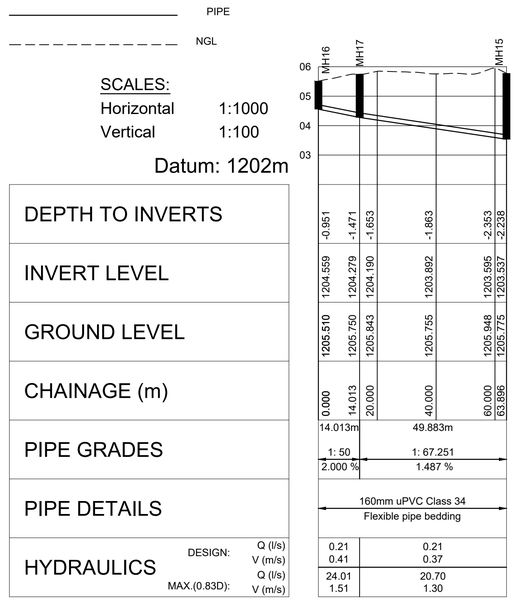
drawing title

SEWER LAYOUT PLAN

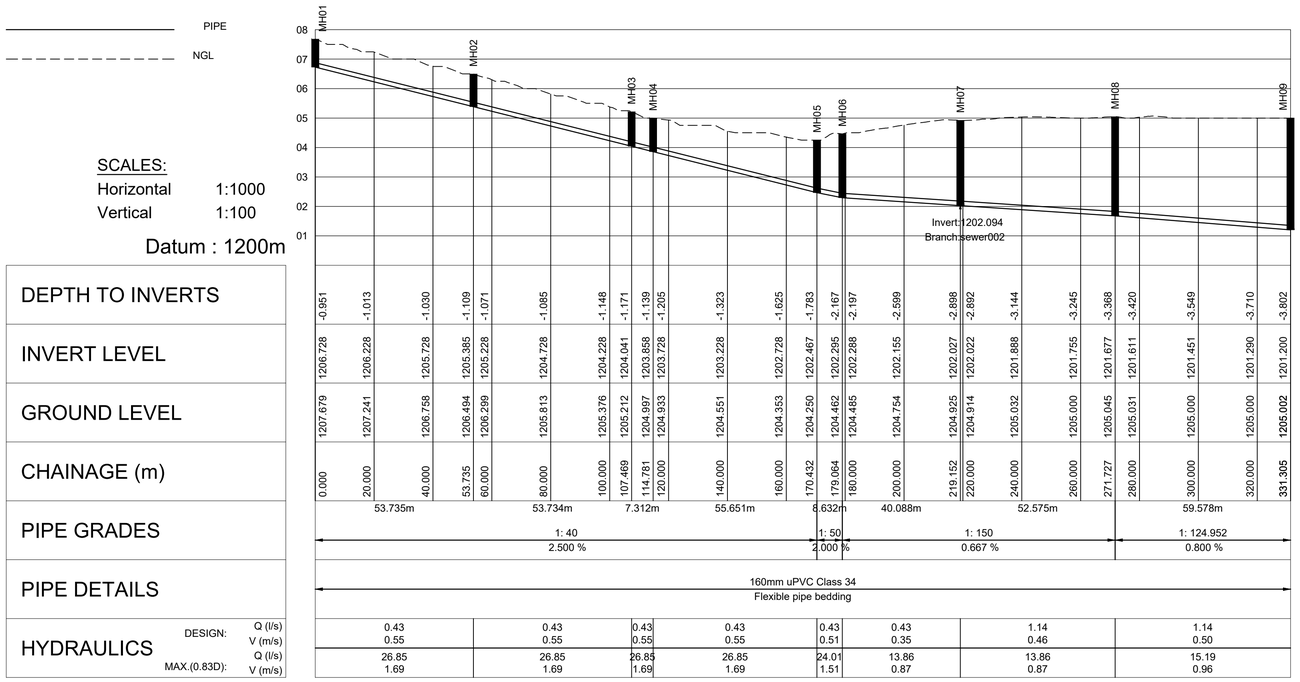
ref.no	designed: BD
scale: AS SHOWN	drawn: B.D
date: 03/2020	checked: DM
type number	
drawing number: 3258-CIV-LAY-002	A1



MH10 - MH07



MH16 - MH15



MH01 - MH09

No.	DATE	AMENDMENT	CHECKED BY
A	03/2020	FOR APPROVAL	DM

cad file name

NORTHERN CAPE CO-OPERATIVE
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discipline
CIVIL

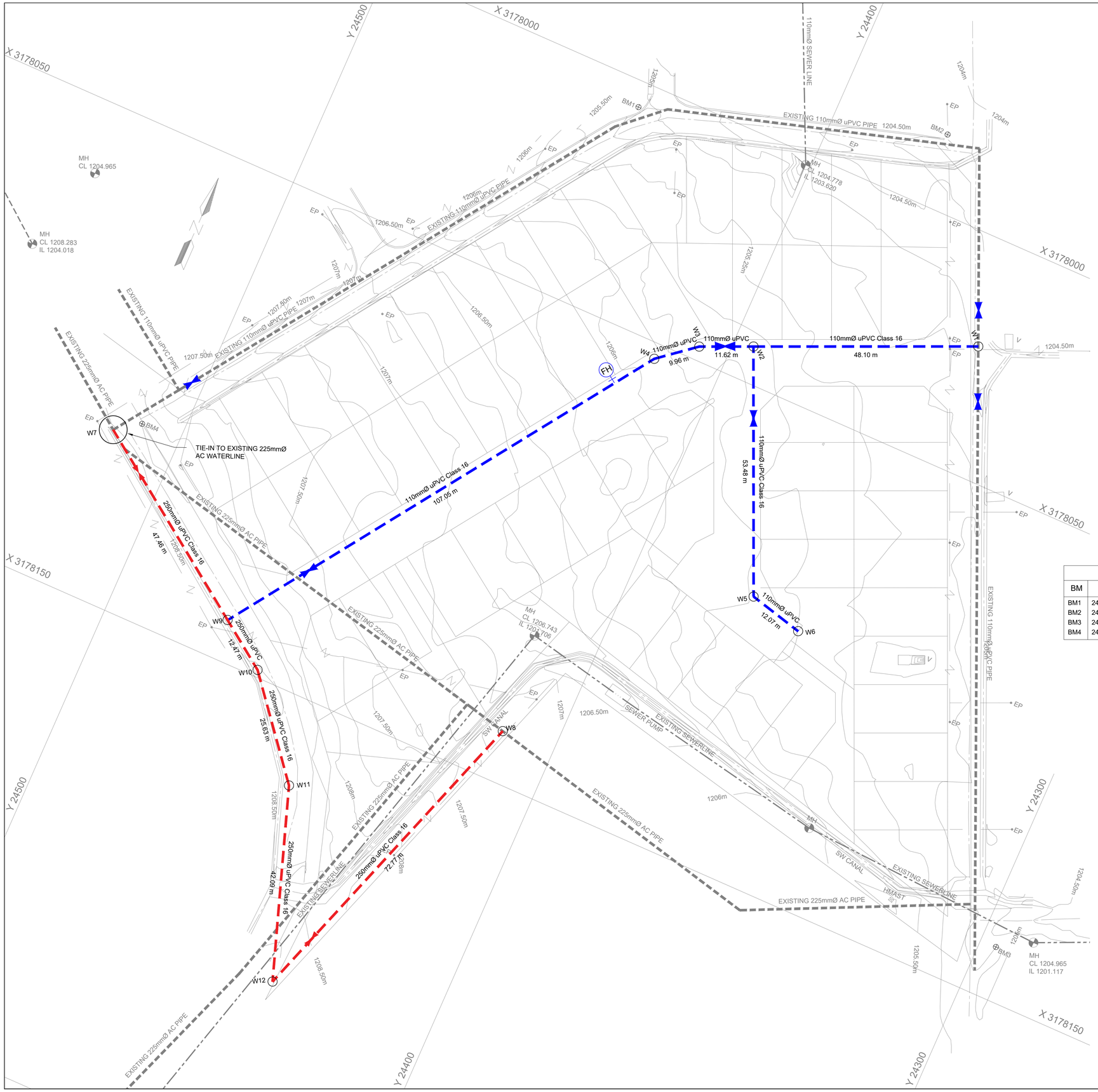
service
PROPOSED SERVICED STANDS AT SANTA CENTRE - PHASE 1_66ERFS

WCS number

drawing title
SEWER LONG SECTIONS

ref.no
designed BD
scale AS SHOWN
drawn B.D
date 03/2020
checked DM
type number

drawing number
3258-CIV-LAY-003
A1



LEGEND:

- NODES
- 110mmØ ISOLATION VALVE
- 250mmØ ISOLATION VALVE
- 110mmØ uPVC PIPE
- 250mmØ uPVC PIPE
- EXISTING WATERLINE
- EXISTING SEWERLINE

Coordinate List

Lo 27

WATER RETICULATION		
Node	YLo	XLo
Const:		
W1	24 351.730	3 178 022.913
W2	24 395.730	3 178 042.353
W3	24 406.356	3 178 047.048
W4	24 414.089	3 178 053.320
W5	24 374.118	3 178 091.267
W6	24 362.405	3 178 094.195
W7	24 513.896	3 178 113.946
W8	24 411.618	3 178 139.271
W9	24 475.095	3 178 141.281
W10	24 464.905	3 178 148.460
W11	24 448.764	3 178 168.370
W12	24 435.059	3 178 208.162

Pipe Data List

Node	-	Node	Length
WATER RETICULATION			(m)
W1	-	W2	48.10
W2	-	W3	11.62
W2	-	W5	53.48
W3	-	W4	9.96
W4	-	W9	107.05
W5	-	W6	12.07
W7	-	W9	47.46
W8	-	W12	72.77
W9	-	W10	12.47
W10	-	W11	25.63
W11	-	W12	42.09

BENCHMARK COORDINATE LIST - WG25

BM	Y	X	Z	DESCRIPTION
BM1	24 438.921	3 178 005.442	1205.240	12mm HOLE IN CONCRETE
BM2	24 376.030	3 177 984.108	1204.561	12mm HOLE IN TELKOM MH COVER
BM3	24 296.424	3 178 138.895	1204.996	12mm HOLE IN CONCRETE
BM4	24 508.750	3 178 110.288	1208.498	ROOF NAIL IN TAR

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discipline: CIVIL

service: PROPOSED SERVICED STANDS AT SANTA CENTRE - PHASE 1_66ERFS

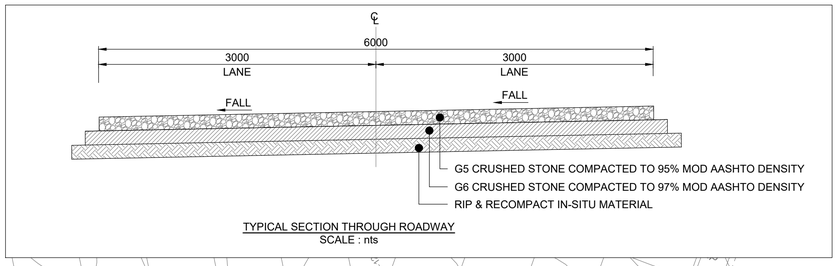
WCS number:

drawing title: WATER LAYOUT

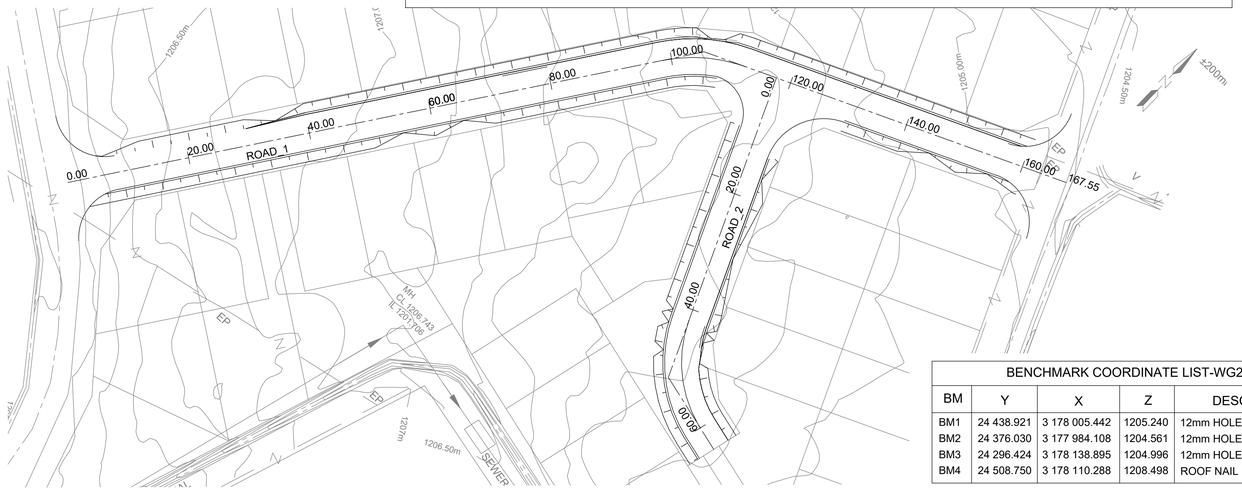
ref.no:
designed: BD
scale: AS SHOWN
drawn: B.D
date: 03/2020
checked: DM
type number:
drawing number: 3258-CIV-LAY-001

A1

PLAN LAYOUT
SCALE 2:1



TYPICAL SECTION THROUGH ROADWAY
SCALE : nts



LEGEND (NEW)

- GRAVEL ROAD
- NEW BRIDGE
- NEW CONCRETE EDGE BEAM
- NEW PIPE CULVERT
- NEW CONCRETE SIDE DRAIN

No.	DATE	AMENDMENT	CHECKED BY
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ROAD 1: HORIZONTAL ALIGNMENT DATA

Plno	Name	Y	X	Radius	Tr.In	Tr.Out	Defl.
1	START	24468.979	3178138.672	-	-	-	-
2	PI 1	24408.910	3178051.999	25.00	0.00	0.00	Right
3	END	24351.785	3178026.767	-	-	-	-

ROAD 2: VERTICAL ALIGNMENT DATA

Peg dist.	Elev.	BVc	EVc	CL	Grade(%)
0.000	1208.403	0.000	0.000	0.00	-3.445
42.569	1206.937	12.569	72.569	60.00	-1.945
125.505	1205.324	90.505	160.505	70.00	-1.272
167.548	1204.789	167.548	167.548	0.00	0.000

ROAD 2: HORIZONTAL ALIGNMENT DATA

Plno	Name	Y	X	Radius	Tr.In	Tr.Out	Defl.
1	START	24397.517	3178046.966	-	-	-	-
2	PI 1	24376.643	3178094.235	20.00	0.00	0.00	Left
3	END	24363.255	3178097.590	-	-	-	-

ROAD 2: VERTICAL ALIGNMENT DATA

Peg dist.	Elev.	BVc	EVc	CL	Grade(%)
0.000	1205.514	0.000	0.000	0.00	0.501
64.108	1205.835	64.108	64.108	0.00	0.000

BENCHMARK COORDINATE LIST-WG25

BM	Y	X	Z	DESCRIPTION
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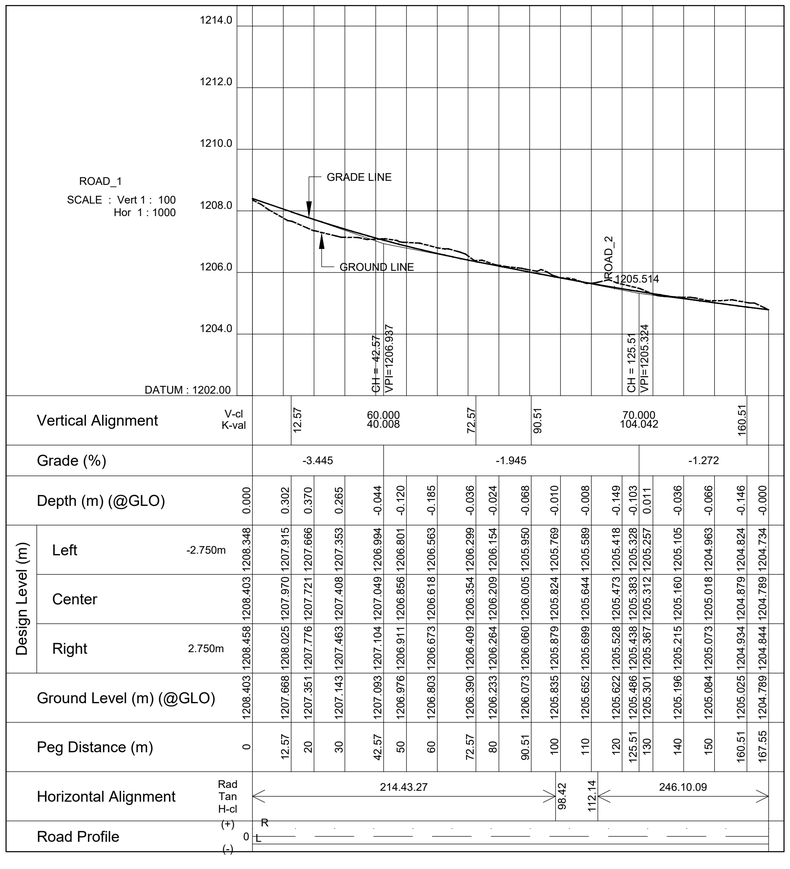

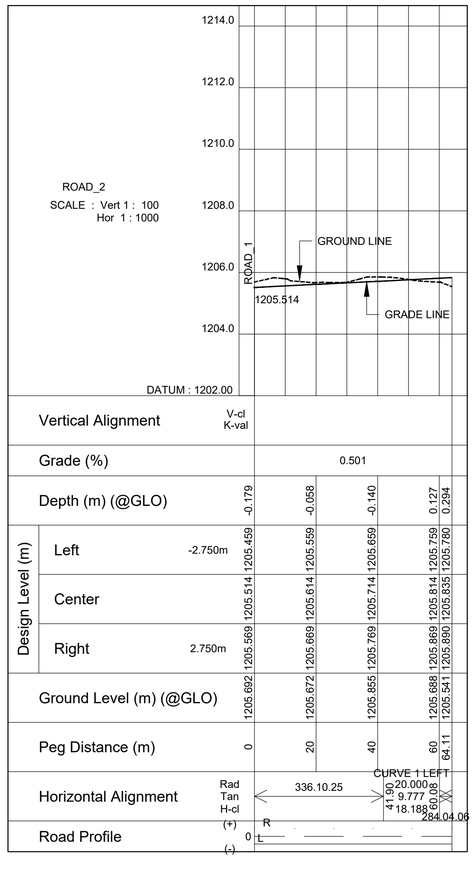

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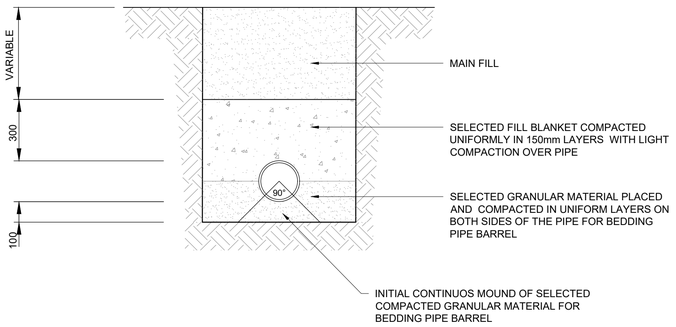
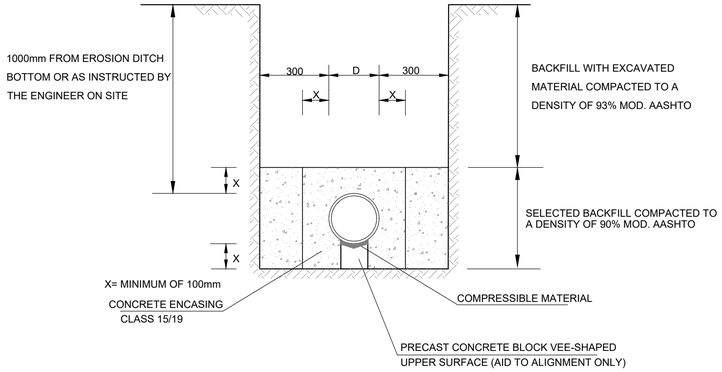
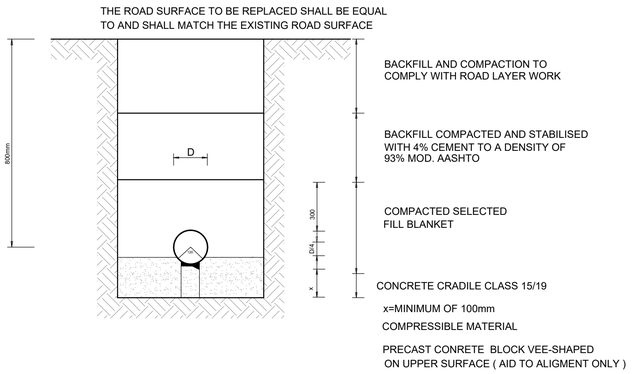


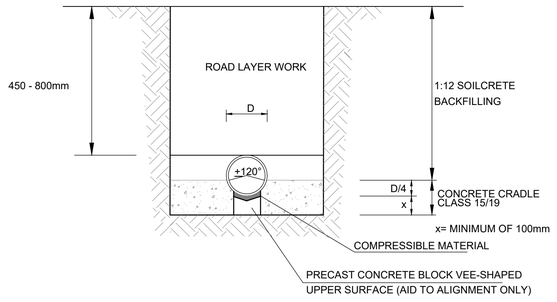
RIGID PIPE CLASS 'B' BEDDING



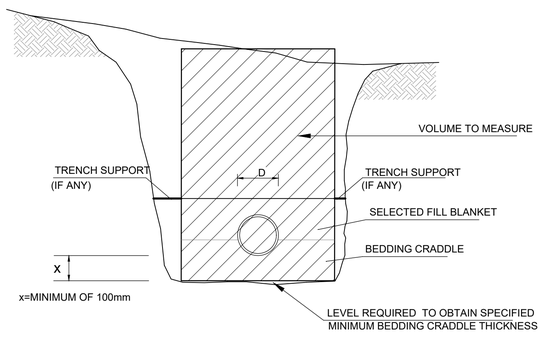
EROSION DITCH CROSSING



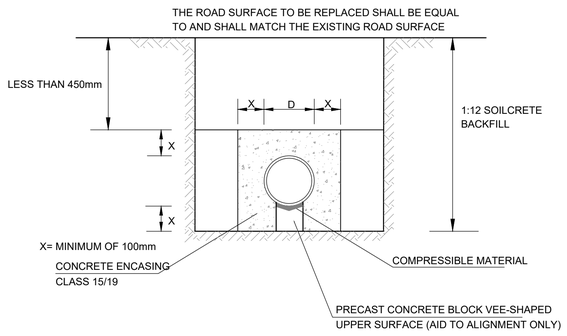
ROAD CROSSING : COVER > 800



ROAD CROSSING : COVER > 450mm < 800mm



MEASUREMENT OF BEDDING



ROAD CROSSING : COVER < 450mm

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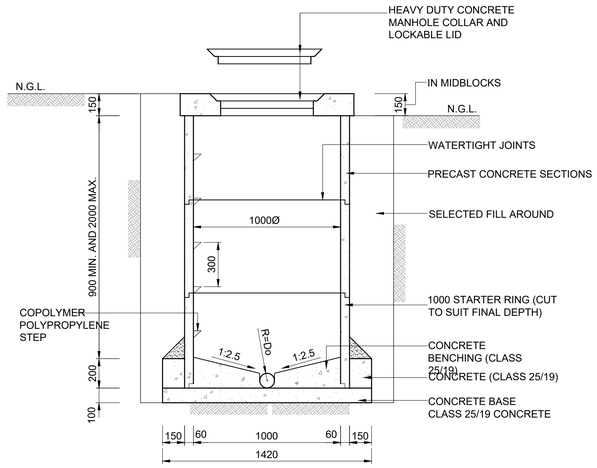
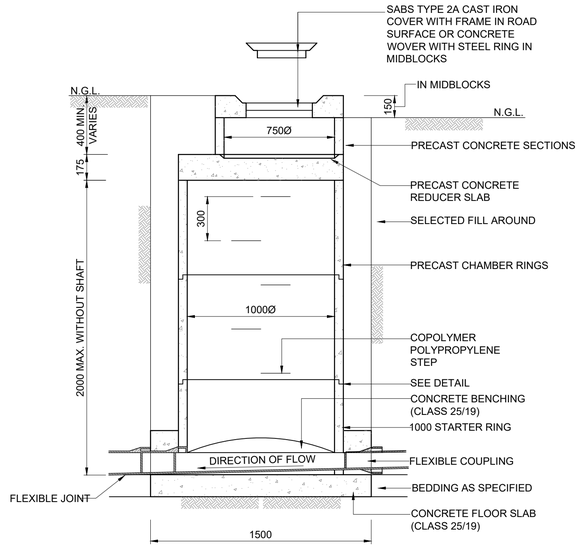


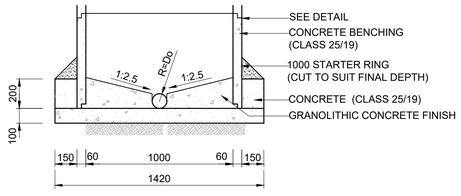
TYPICAL SECTION OF MANHOLE

SCALE 1:20



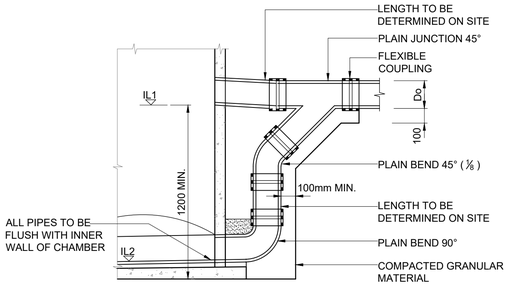
TYPICAL SECTION OF MANHOLE

SCALE 1:20



SECTION ELEVATION AT RIGHT ANGLES TO MAIN SEWERS

SCALE 1:20

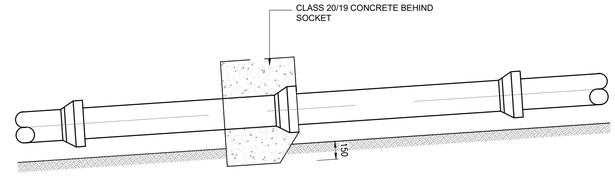


MANHOLE WITH HIGH INLET VERTICAL DROP TYPE

SCALE 1:20

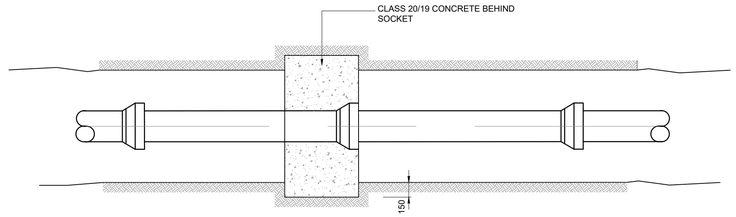
NOTES:

1. FLEXIBLE JOINTS :
   a) RUBBER RINGS COMPLYING WITH PART 1 OF SABS 974 TO BE USED FOR FLEXIBLE JOINTS
   b) FLEXIBLE JIUNTS TO BE TIGHT WITH NO SIGNS OF LEAKAGE WHEN TESTED ACCORDING TO SUBCLAUSE 4.4 OF SECTION LD OF PART 3 OF SABS 1200.
2. FIELD TESTS :
   a) AIR TESTS ACCORDING TO CLAUSE 7.2 OF SABS 1200 LD MUST BE CARRIED OUT BETWEEN MANHOLES DURING THE FOLLOWING PHASES OF CONSTRUCTION:
      i) AFTER THE PIPES HAVE BEEN LAID.
      ii) AFTER THE INITIAL BACKFILLING HAS BEEN COMPLETED.
   b) THE AIR TEST IS ONLY AN INDICATION OF ACCEPTANCE OF COMPLETED PORTION OF THE LINE AND IN ANY DISPUTE ARISING THE OUTCOME OF A WATER TEST WILL BE BINDING.
3. TRENCHES :
   a) EXCAVATION AND BACKFILLING OF TRENCHES TO COMPLY WITH SABS 1200 DB.
   b) BEDDING OF PIPES TO COMPLY WITH SABS 1200 LB.
   c) SEWERS TO BE PROTECTED AT ROAD CROSSINGS AS SHOWN ON THE TYPICAL PLAN FOR BEDDINGS.
   d) THE INFLOW OF STORMWATER IS TO BE PROHIBITED.
4. MANHOLES AND FITTINGS :
   a) ALL CONCRETE, BENCHING AND SEALERS SHALL COMPLY WITH SABS 1200 GA. OR SABS 1200 AS APPLICABLE.
   b) PRECAST CONCRETE SECTIONS TO COMPLY WITH SABS 1294.
   c) CLASSES OF CONCRETE :
      i) PRECAST CONCRETE SECTIONS - 30/19
      ii) ALL OTHER CONCRETE - 25/19
   d) CHANELLS IN MANHOLES TO BE LAID IN THE WET CONCRETE FLOOR AND THE FIRST PRECAST CONCRETE SECTION TO BE PLACED AND THE BENCHING COMPLETED WITHIN 24 HOURS AFTER CASTING THE CONCRETE FLOOR. NO DRIERS WILL BE PERMITTED FOR THE BENCHING. BENCHING TO BE STEEL TROWELLED TO A SMOOTH FINISH.
5. CONCRETE FOR MANHOLES TO BE CONSTRUCTED WITH DOLOMITE AGGREGATE AND SAND.
6. LEVELS OF MANHOLE COVERS :
   a) MIDBLOCK SEWERS : TOP OF FRAME MUST BE 150mm PROUD OF NATURAL GROUND LEVEL.
   b) SIDE WALK SEWERS : TOP OF FRAME MUST BE 150mm PROUD OF FINISHED GROUND LEVEL.
   c) FLOOD PLAINS : 500mm PROUD OF NATURAL GROUND LEVEL.
7. OVER EXCAVATION TO BE BACKFILLED WITH BEDDING MATERIAL ACCORDING TO SPECIFICATION FOR BEDDING MATERIAL.
8. uPVC HEAVY DUTY CLASS 34 TO SABS 791 WILL BE USED. MANHOLE CHANNELS, ETC. TO BE VITRIFIED CLAY EVEN IF uPVC ID USED IN RETICULATION.



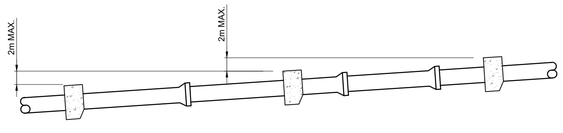
SECTION

SCALE 1:25



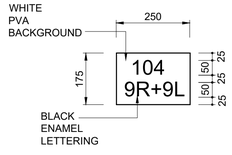
PLAN

SCALE 1:25



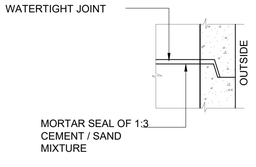
SPACING OF ANCHOR BLOCKS ON SLOPES STEEPER THAN 1:10

SCALE 1:25



PAINT MARKER FOR MAIN SEWER

SCALE 1:10



DETAIL OF MANHOLE PRECAST RING JOINT

SCALE 1:5

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SEWER MANHOLE DETAILS

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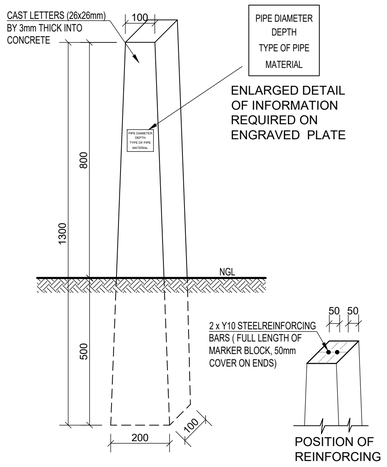
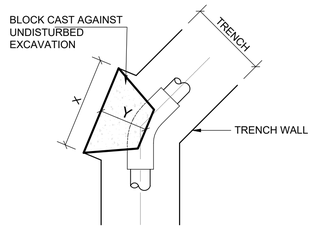


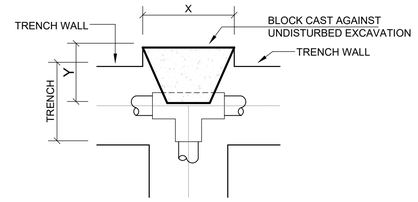
ENLARGED DETAIL
OF INFORMATION
REQUIRED ON
ENGRAVED PLATE

CONCRETE MARKER BLOCK
SCALE 1:10



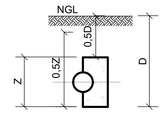
THRUST BLOCK FOR 45° BEND
SCALE 1:30

NOMINAL PIPE DIA. ø (mm)	AREA REQUIRED m²	DIMENSIONS (mm)				AREA PROVIDED m²	VOL (m³)
		D	Z	X	Y		
75	0.061	800	400	450	225	0.180	0.040
100	0.109	1 000	500	500	250	0.250	0.060
150	0.245	1 000	500	1000	500	0.500	0.250
200	0.435	1 200	600	1400	700	0.840	0.590
250	0.680	1 300	650	2000	1000	1.300	1.300
300	0.979	1 400	700	2600	1300	1.820	2.370
350+	SEE NOTE 5						

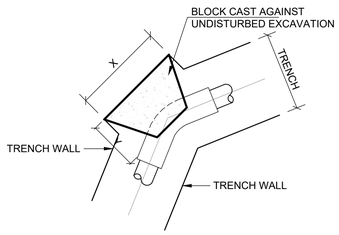


THRUST BLOCK FOR TEE-PIECE
SCALE 1:30

NOMINAL PIPE DIA. ø (mm)	AREA REQUIRED m²	DIMENSIONS (mm)				AREA PROVIDED m²	VOL (m³)
		D	Z	X	Y		
75	0.080	800	400	400	200	0.160	0.032
100	0.141	1 000	500	500	250	0.250	0.063
150	0.318	1 000	500	700	350	0.350	0.123
200	0.565	1 200	600	1000	500	0.600	0.300
250	0.883	1 300	650	1400	700	0.910	0.637
300	1.272	1 400	700	1900	950	1.330	1.264
350+	SEE NOTE 5						

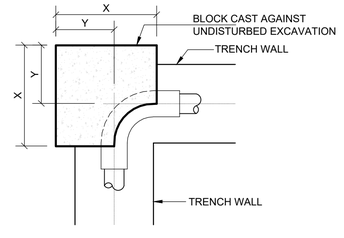


TYPICAL SECTION
SCALE 1:30



THRUST BLOCK FOR 22½° BEND
SCALE 1:10

NOMINAL PIPE DIA. ø (mm)	AREA REQUIRED m²	DIMENSIONS (mm)				AREA PROVIDED m²	VOL (m³)
		D	Z	X	Y		
75	0.031	800	400	400	200	0.1600	0.032
100	0.055	1 000	500	500	250	0.2500	0.063
150	0.124	1 000	500	500	250	0.2500	0.063
200	0.220	1 200	600	600	300	0.3600	0.108
250	0.344	1 300	650	650	325	0.4225	0.137
300	0.496	1 400	700	800	400	0.5600	0.224
350+	SEE NOTE 5						



THRUST BLOCK FOR 90° BEND
SCALE 1:30

NOMINAL PIPE DIA. ø (mm)	AREA REQUIRED m²	DIMENSIONS (mm)				AREA PROVIDED m²	VOL (m³)
		D	Z	X	Y		
75	0.113	800	400	450	225	0.18	0.065
100	0.201	1 000	500	500	250	0.25	0.100
150	0.451	1 000	500	1 000	500	0.50	0.402
200	0.803	1 200	600	1 400	700	0.84	0.945
250	1.254	1 300	650	2 000	1000	1.30	2.089
300	1.806	1 400	700	2 600	1 300	1.82	3.803
350+	SEE NOTE 5						

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discipline

CIVIL

service

PROPOSED SERVICED STANDS
AT SANTA CENTRE

WCS number

drawing title

THRUST BLOCK DETAILS

ref.no

designed
BD

scale
AS SHOWN

drawn
B.D

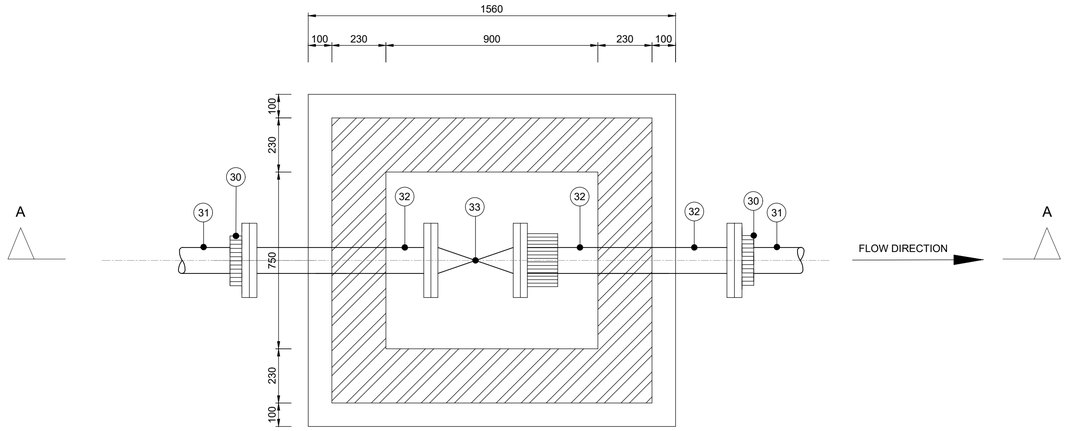
date
03/2020

checked
DM

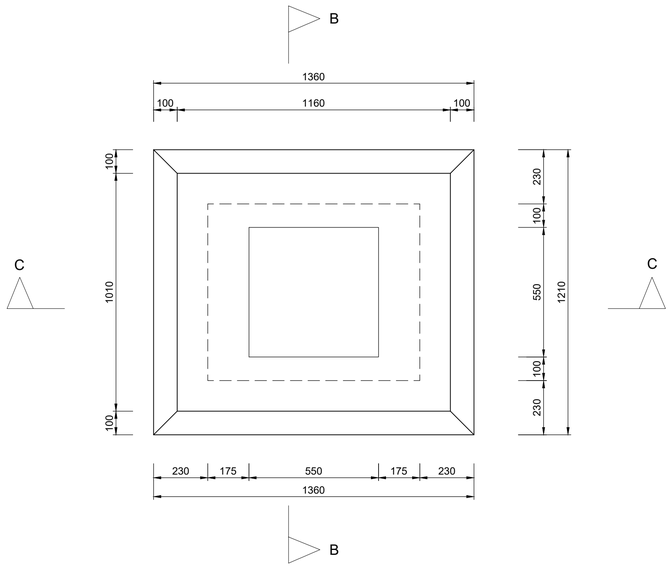
type number

drawing number
3258-CIV-DET-004

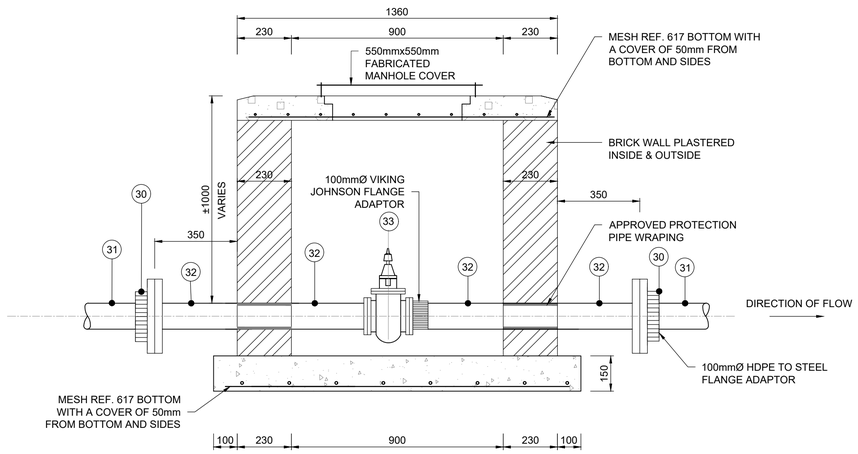
A1



PLAN
SCALE: 12.5



ROOF PLAN
SCALE: 12.5



SECTION A-A
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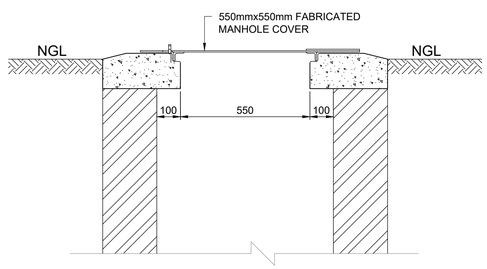

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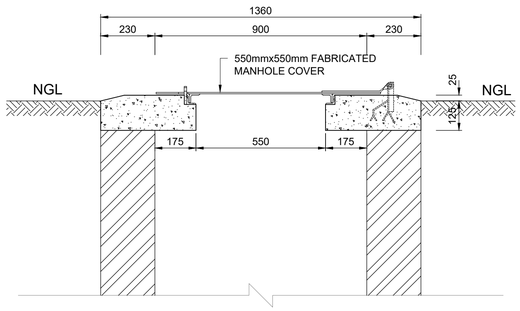

SECTION C-C
SCALE: 12.5

ITEM LIST

30	100mmØ HDPE TO STEEL FLANGE ADAPTOR
31	100mmØ HDPE PIPE
32	100mmØ GMS PIPE
33	ISOLATING VALVE

NOTAS:

1. ALL FLANGES TO SANS 1123 TABLE 1600/3.
2. ALL NUTS AND BOLTS GALVANIZED.
3. CONCRETE CLASS 20/19.
4. BRICKWORK 14 MPa BURNT CLAY BRICKS TO SANS 227 CONSTRUCTED IN 1:3 CEMENT MORTAR, BRICKFORCE EVERY 2nd COURSE.
5. VALVES CLOCKWISE CLOSING, NON RISING SPINDLE , RESILIENT SEAL TO SANS 664
6. DIMENSIONS MAY VARY DUE TO BRAND-SPECIFICATIONS.

No.	DATE	AMENDMENT	CHECKED BY
A	03/2020	FOR APPROVAL	DM

cad file name

NORTHERN CAPE CO-OPERATIVE
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TRADITIONAL AFFAIRS

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discipline
CIVIL

service

PROPOSED SERVICED
STANDS AT SANTA CENTRE

WCS number

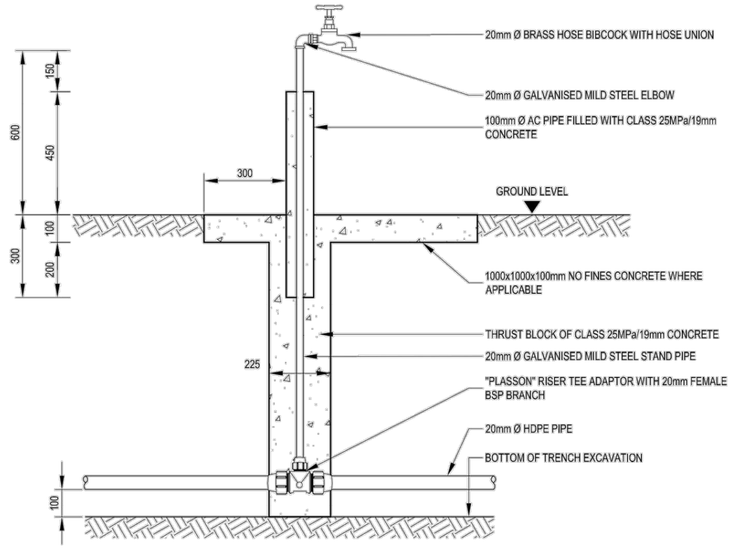
drawing title

VALVE CHAMBER DETAILS

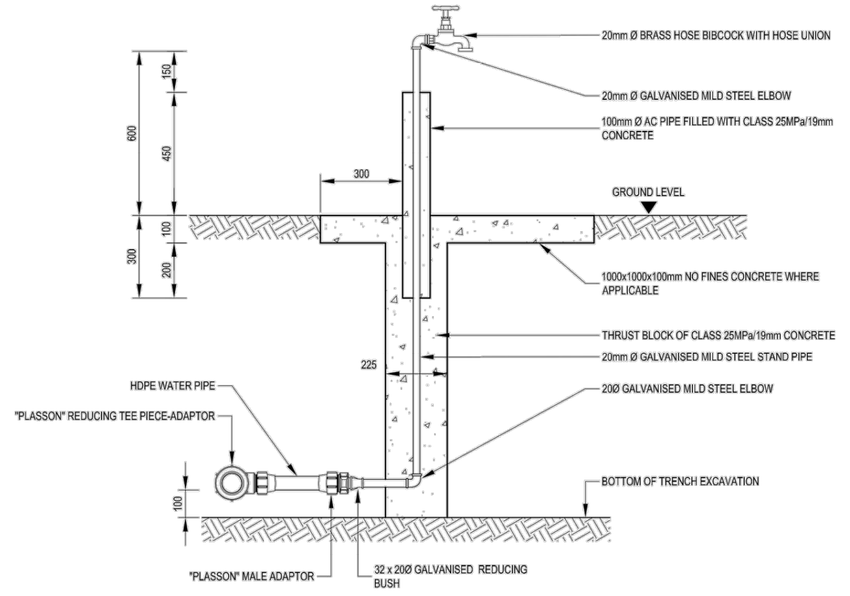
ref.no	designed: BD
scale: AS SHOWN	drawn: B.D
date: 03/2020	checked: DM
type number	

drawing number
3258-CIV-DET-003

A1



TYPICAL DETAIL OF GARDEN TAP (HDPE) WITH APRON



TYPICAL DETAIL OF GARDEN TAP (HDPE) WITH APRON DIRECTLY ON MAIN PIPE

No.	DATE	AMENDMENT	CHECKED BY
A	04/2021	FOR APPROVAL	DM

cad file name

NORTHERN CAPE CO-OPERATIVE GOVERNANCE HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS

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discipline
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service
PROPOSED SERVICED STANDS AT SANTA CENTRE

WCS number

drawing title
STANDPIPE DETAILS

ref.no	designed
	BD
scale	drawn
AS SHOWN	B.D
date	checked
04/2021	DM

type number

drawing number
3258-CIV-DET-010 A1