forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Geotechnical Assessment Study for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Geotechnical Assessment Study for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province
Specialist Company Name	**Lilibara Projects**
Specialist Name	**Limpho Alphonse Phatela**
Specialist Identity Number	**8010286107181**
Specialist Qualifications:	**Engineering Geologist**
Professional affiliation/registration:	**Pr Sci Nat. 400229/14**
Physical address:	**13 Baobab,**
Postal address:	**Noordwyk,**
Postal address	**Midrand, 1687**
Telephone	**01178412170**
Cell phone	**0725874271**
E-mail	**Lphatela@gmail.com**

2. DECLARATION BY THE SPECIALIST

I, Limpho Alphonse Phatela_ declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Lilibara Projects_

Name of Company:

28 - SEPTEMBER 2025

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ _Limpho Alphonse Phatela_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Lilibara Projects_

Name of Company

28 - SEPTEMBER 2025

Date

Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date. 2025.09.28

Date

SOUTH AFRICAN POLICE SERVICE
DETECTIVE SERVICES
2025 -09- 28
MIDRAND
SUID-AFRIKAANSE POLISIEDIENS

FINAL GEOTECHNICAL INVESTIGATION REPORT ON THE RANDWATER PROJECT: B19 SLUDGE PIPELINE PHASE 2 ZUIKERBOSCH-VEREENIGING

REPORT DATE: NOVEMBER 2016

PREPARED FOR: **WAX ENGINEERING CONSULTANTS (PTY) LTD** **ELECTRICAL AND MECHANICAL**	**PREPARED BY:** **LILIBARA PROJECTS (PTY) LTD** **CIVIL ENGINEERING AND PROJECT MANAGEMENT**
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Executive summary

Wax Engineering Consultants (Pty) Ltd Electrical and Mechanical appointed the Geotechnical Consultants, Lilibara Projects (Pty) Ltd, to conduct geotechnical investigations for Randwater Project: B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging.

The regional geology along the B19 Sludge Pipeline has been retrieved from the geology map (1:250 000 scale) Sheet 2626 West-Rand. The pipeline route is underlain by predominately mudrock that have been indurated into khaki brown blotch orange and calcareous white sandy clayey silts of firm soil consistency forming concealed geological contacts with sandy shales that are weakly cemented light brown speckled yellow firm clayey sandy silt soils, interpreted as Quaternary soils deposits Aeolian / Hillwash soils.

The material along the pipeline route is classified as soft in accordance to SANS 1200D based on the test pits excavated to 3m depth therefore pipe trenches can be excavated using a Tractor-Loader-Backhoe (TLB). It should be noted however that this conclusion is based on test pits spaced at 250m centres and material properties between the test pits are extrapolated.

Unstable trench or test pit side walls were encountered in some of the test pits. It is thus recommended that the sidewalls of excavations be either battered back to 1 (vertical) to 2 (horizontal) or shored to ensure stability of the sides of the excavations.

De-watering during pipeline installation will be required in areas where groundwater seepage was encountered.

Corrosion protection of steel elements will be required because the soils are moderately corrosive.

Laboratory test results indicate that the material excavated for installation of the pipeline is unsuitable for use as pipe bedding. Suitable material will have to be imported from commercial sources in the vicinity of the project area.

Road crossings shall be done through soft material and trenchless or open trench methods of construction can be used for excavations at the crossings.

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1 B19 Sludge Pipeline Project Introductions

1.1 Terms of Reference

Wax Engineering Consultants (Pty) Ltd Electrical and Mechanical (the Client) appointed the Geotechnical Consultants, Lilibara Projects (Pty) Ltd, to conduct geotechnical investigations for Randwater Project: B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging.

1.2 Project Information

The following information was made available by the Client and used in the study, also presented within **Annexure A.**

- JEFFERES & GREEN report number 2940. Prepared by March 2012 as draft version 01 for project titled: ***Rand Water B19 Pipeline Geotechnical Report****. Authored by Ryan Freese Engineering geologist consultant at Jefferes & Green.*
- RAND WATER. B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging Layout Plan CH 0.000m - CH 4964.792m. Drawn by W.K and checked by A. Mur. Drawing RW201501/ LAY/ 01, issued for information purpose only.
- Drawing No. P4444-3-67-VSL-005. B19 Sludge Pipeline Phase 2 LS1. Bosch Munitech.
- Drawing No. RW201501/ SLS / 01. B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging Plan and Longitudinal Section CH 0.000m - CH 2000.000m.
- Drawing No. RW201501 / SLS / 02. B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging Plan and Longitudinal Section CH 2000.000m - CH 4000.000m.
- Drawing No. RW201501/ SLS / 03. B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging Plan and Longitudinal Section CH 4000.000m - CH 4964.792m.

2 Geotechnical Scope of Work for B19 Sludge Pipeline

2.1 Geotechnical Investigation Stages

The geotechnical investigations were carried out in stages as indicated below.

Stage 1: Desktop study

Desktop study i.e. topographical maps, aerial photographs and existing records were studied to gain information on the general topography, prominent geological features, anticipated geotechnical behaviour of the ground along the pipeline route etc.

Stage 2: Field Work

This involved excavation of test pits, test pits profiling and obtaining of soil samples from the test pits for material classification and geotechnical evaluation in order to enable safe and economical design and construction of the pipeline.

Stage 3: Preparation of detailed geotechnical report

This stage involves;

- analysis of the results of the field data and laboratory tests results to provide information on excavatability, excavation stability, suitability of materials for pipe bedding etc.
- interpretation of data for use in the design.
- highlighting areas which could potentially present challenges during construction and providing solutions for such areas.

The geotechnical investigations were performed in accordance with the Code for Practice for Geotechnical Site Investigation published by South African Institute for Civil Engineers (January, 2010).

2.2 Expected geotechnical outputs

The Client provided the geotechnical investigations outputs as follows;

- *Conduct field investigations for ±8 km pipeline for 600 mm diameter steel pipeline by means of exploration trial pits excavated by an excavator. The depth of trial pits shall be 4m and at every 250m along the proposed pipeline.*

- *Geotechnical survey to be conducted on either side of all the pipe jacking crossings required.*

- *Provide the detailed description and recommendation on the stratigraphy at all anticipated pipe jack crossings.*

- *Study the usability of trench materials as bedding and selected backfill.*

- *Identify the alternative potential sources of construction materials, either in areas adjacent to the pipeline or commercial sources.*

- *Conduct soil Resistivity surveys for the entire route of the pipeline*

- *Provide recommendations on areas where the pipeline route pass through the soils with high collapsible grain structure, expansive and sink hole characteristics.*

- *Demarcate all areas of high water table, and provide recommendations and procedures for dewatering.*

- *Carry out laboratory tests on the Grading (sieve analysis and Atterberg limits), Chemical Analysis (soil and ground Water including Acid Mine Drainage (AMD)) , Moisture sensitivity analysis(Mod AASHTO), Oedometer test (stress deformation analysis) and compatibility factor tests etc.*

- *Provide excavation and backfill quantities (soft and rock) and quantities for soiled and imported materials as per SANS 1200 DB and SANS 1200 LB.*

- *Provide soil profile on the final long section that will be given to by Rand Water (RW) in DWG format.*

- *Provide trench excavations and backfilling details specific for the project.*

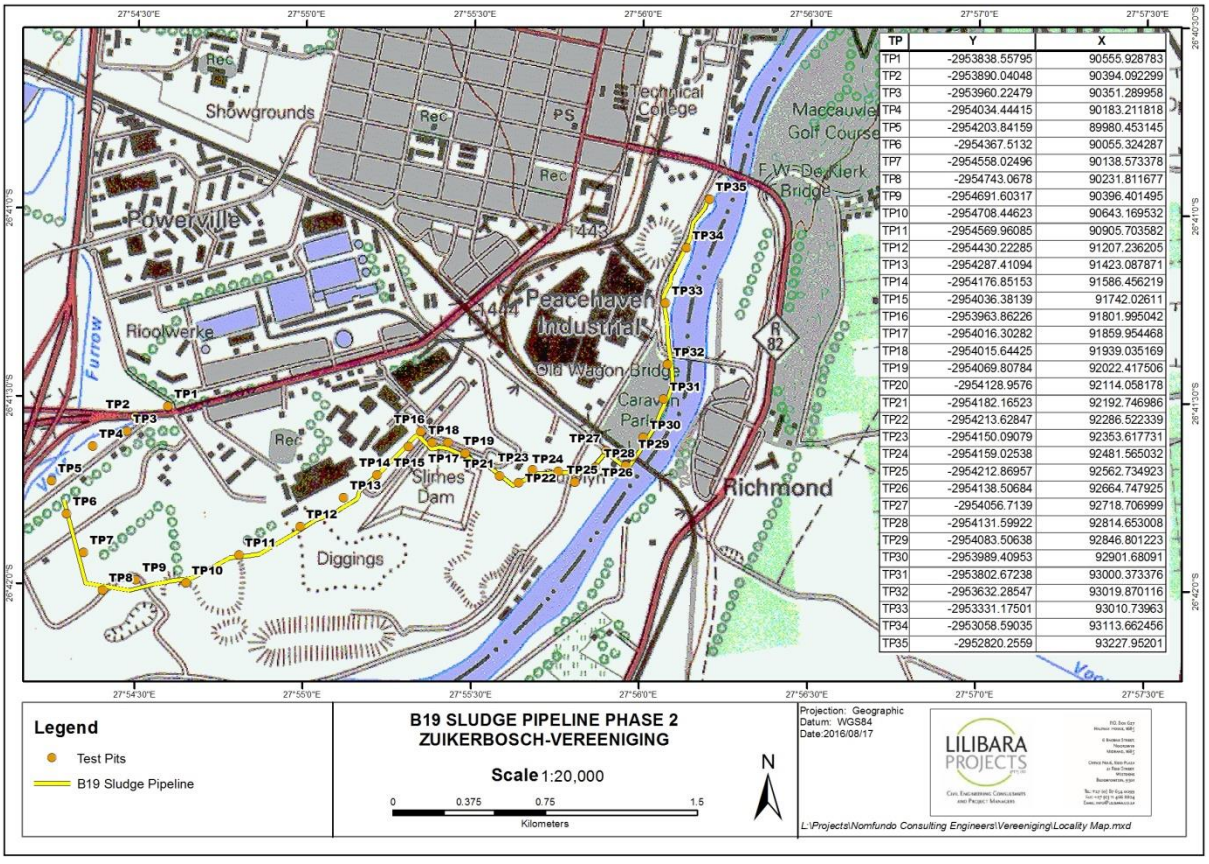
3 Location B19 Sludge Pipeline

Lilibara Project (Pty) Ltd has visited the site within the month of July and August to establish site access and conduct the geotechnical test pits excavation along the proposed B19 Sludge Pipeline.

3.1 Site location

B19 Sludge Pipeline and the areas trans-versed by B19 Sludge Pipeline has been presented within **Figure 1 Locality Map for B19 Sludge Pipeline**. The pipeline is drawn in light yellow colour and the dark yellow orange circles represent the geotechnical test pits spaced at 250m centre to centre.

Test pit number (TP1), coordinates, Latitude 26°41'31.59"S Longitude 27°54'35.53"E, located at Rand Water Treatment Works located at the perimeter fence entrance to the Rand Water plant in Vereeniging (Chainage 0.0m), and TP 35 is located at the Vaal River Chamber Connection point adjacent to the Vaal River (Chainage 6053.7m), Latitude 26°40'57.88"S Longitude 27°56'11.90"E.



TP	Y	X
TP1	-2953838.55795	90555.928783
TP2	-2953890.04048	90394.092299
TP3	-2953960.22479	90351.289958
TP4	-2954034.44415	90183.211818
TP5	-2954203.84159	89980.453145
TP6	-2954367.5132	90055.324287
TP7	-2954558.02496	90138.573378
TP8	-2954743.0678	90231.811677
TP9	-2954691.60317	90396.401495
TP10	-2954708.44623	90643.169532
TP11	-2954569.96085	90905.703582
TP12	-2954430.22285	91207.236205
TP13	-2954287.41094	91423.087871
TP14	-2954176.85153	91586.456219
TP15	-2954036.38139	91742.02611
TP16	-2953963.86226	91801.995042
TP17	-2954016.30282	91859.954468
TP18	-2954015.64425	91939.035169
TP19	-2954069.80784	92022.417506
TP20	-2954128.9576	92114.058178
TP21	-2954182.16523	92192.746986
TP22	-2954213.62847	92286.522339
TP23	-2954150.09079	92353.617731
TP24	-2954159.02538	92481.565032
TP25	-2954212.86957	92562.734923
TP26	-2954138.50684	92664.747925
TP27	-2954056.7139	92718.706999
TP28	-2954131.59922	92814.653008
TP29	-2954083.50638	92846.801223
TP30	-2953989.40953	92901.68091
TP31	-2953802.67238	93000.373376
TP32	-2953632.28547	93019.870116
TP33	-2953331.17501	93010.73963
TP34	-2953058.59035	93113.662456
TP35	-2952820.2559	93227.95201

Figure 1: Locality Map for B19 Sludge Pipeline

3.2 Site Access B19 Sludge Pipeline Route

The site is located in Vereeniging, the Central Business District of Vereeniging which is situated south east of Johannesburg and accessible along R59 Dual Carriage Way that connects Vaal and Johannesburg. In Vereeniging, the B19 Sludge Pipeline route is accessible along the intersection of R42 Voortrekker Street/Barrage Road and R82 Victoria Avenue. The B19 Sludge Pipeline route is presented by test pit locations (marked as TP) along the route in the Google Earth Image, Figure 2 below.

Figure 2: Google Earth B19 Sludge Pipeline

3.3 Topography along the B19 Sludge Pipeline

The detailed site topography along the B19 Sludge Pipeline has been presented in RAND WATER. B19 Sludge Pipeline Phase 2 Zuikerbosch-Vereeniging Layout Plan, Drawing no. RW201501/ LAY/ 01, issued for information purpose only.

The physiographical descriptors for the B19 Sludge Pipeline are describe as rolling and irregular plains of fairly low relief with high percentage of near-level land and no high steep slope. Several areas along the route are underlain by ash and mine dump backfill.

4 Geotechnical Investigation Results on B19 Sludge Pipeline

Lilibara Projects (Pty) Ltd completed field work along the B19 Sludge Pipeline route during the month of July – August 2016.

Tractor Loader Backhoe, manufactured by VOLVO was used for excavation of the test pits. The test pits were excavated to the reach of the TLB and logged by an experienced engineering geologist.

Excavation of geotechnical test pits along B19 Sludge Pipeline, **Rand Water Plant, taken by G, Rabodiba**

Picture taken at Rand Water Treatment Works, Test Pit number 1, Chainage 0.0m.

4.1 Test Pit Chainage and Coordinates for B19 Sludge Pipeline

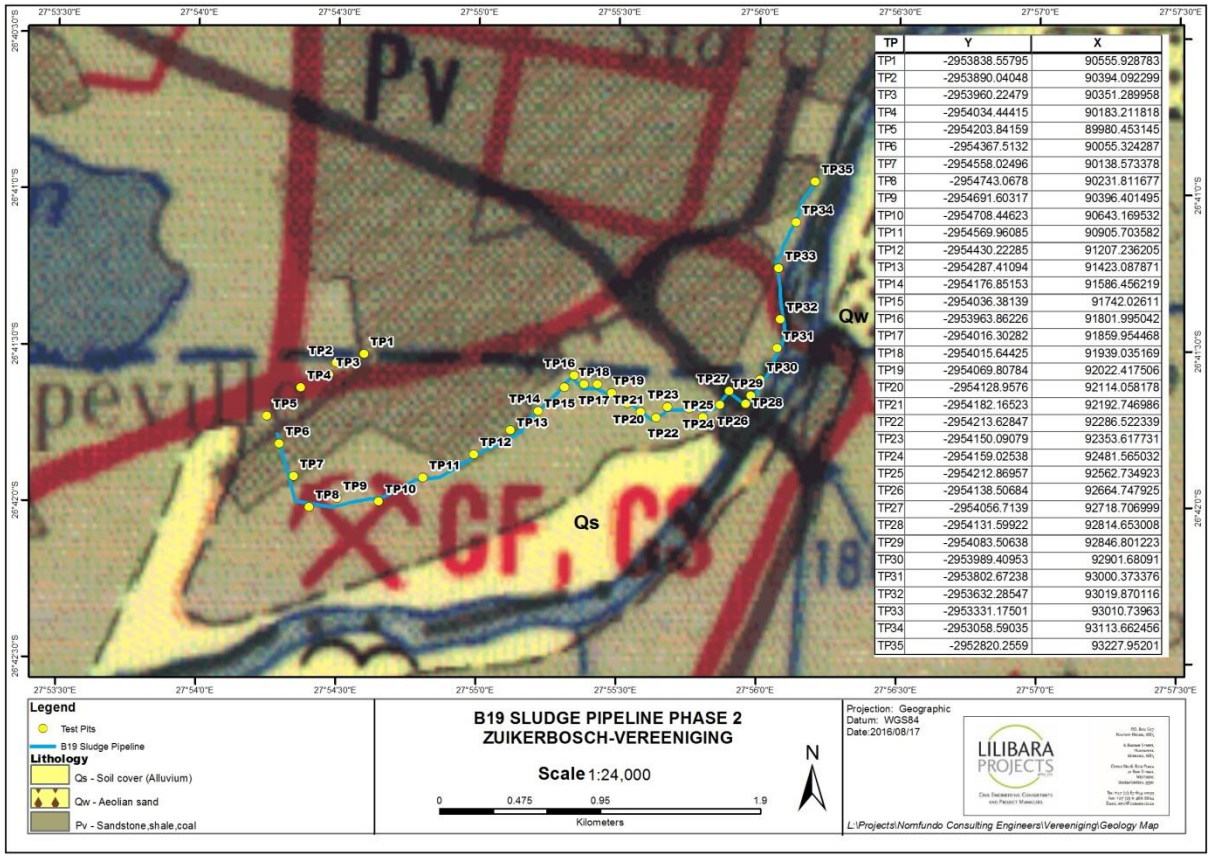
Table 1: Geotechnical test pits chainages and coordinates for B19 Sludge Pipeline.

CHAINANGE (m)	TEST PIT NO	COORDINATES	
		LATITUDE	LONGITUDE
263.5	TP1 (RandWater Treatment Works)	26°41'31.59"S	27°54'35.53"E
369.1	TP2	26°41'33.30"S	27°54'29.69"E
499.9	TP3	26°41'35.59"S	27°54'28.16"E
647.0	TP4	26°41'38.04"S	27°54'22.10"E
957.0	TP5	26°41'43.59"S	27°54'14.81"E
1076.5	TP6	26°41'48.89"S	27°54'17.56"E
1310.5	TP7	26°41'55.06"S	27°54'20.62"E
1538.0	TP8	26°42'1.05"S	27°54'24.04"E
1703.2	TP9	26°41'59.34"S	27°54'29.98"E
1951.2	TP10	26°41'59.83"S	27°54'38.91"E
2240.2	TP11	26°41'55.27"S	27°54'48.37"E
2590.4	TP12	26°41'50.66"S	27°54'59.24"E
2855.6	TP13	26°41'45.97"S	27°55'7.01"E
3077.0	TP14	26°41'42.34"S	27°55'12.89"E
3254.0	TP15	26°41'37.74"S	27°55'18.48"E
3333.2	TP16	26°41'35.37"S	27°55'20.63"E
3411.2	TP17	26°41'37.06"S	27°55'22.74"E
3510.4	TP18	26°41'37.02"S	27°55'25.60"E
3602.1	TP19	26°41'38.76"S	27°55'28.63"E
3704.3	TP20	26°41'40.66"S	27°55'31.96"E
3798.3	TP21	26°41'42.37"S	27°55'34.82"E
3913.5	TP22	26°41'43.37"S	27°55'38.22"E
3999.5	TP23	26°41'41.29"S	27°55'40.63"E
4116.1	TP24	26°41'41.55"S	27°55'45.26"E
4209.1	TP25	26°41'43.28"S	27°55'48.21"E
4345.3	TP26	26°41'40.84"S	27°55'51.88"E
4428.3	TP27	26°41'38.17"S	27°55'53.81"E
4535.8	TP28	26°41'40.58"S	27°55'57.30"E
4601.8	TP29	26°41'39.01"S	27°55'58.45"E
4728.4	TP30	26°41'35.94"S	27°56'0.41"E
4945.7	TP31	26°41'29.85"S	27°56'3.93"E
5111.7	TP32	26°41'24.31"S	27°56'4.59"E
5419.7	TP33	26°41'14.53"S	27°56'4.18"E
5686.7	TP34	26°41'5.65"S	27°56'7.83"E
6053.7	TP35 (Vaal River Chamber Connection)	26°40'57.88"S	27°56'11.90"E

4.2 Site Geology for B19 Sludge Pipeline

The site geology has been retrieved from the regional geology map Sheet 2626 West Rand published by Council for Geosciences at a Scale of 1:250 000. West-Rand. 1986. Compiled by Keyser, N. from mapping by Nel, L. T (1931-34), Von Backstrom, J. W., (1949), Anhaeusser, C. R. (EGRU circular 62, 1971), Bredell, J.H. (1974-5) *et al*.

Sheet 2626 West Rand Geology Map showing the pipeline route is presented in Figure 3 below.



TP	Y	X
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TP33	-2953331.17501	93010.73963
TP34	-2953058.59035	93113.662456
TP35	-2952820.2559	93227.95201

Figure 3: Regional Geology Sheet 2626 West Rand for B19 Sludge Pipeline

The regional geology along the B19 Sludge Pipeline has been retrieved from the geology map Sheet 2626 West-Rand at scale of 1:250 000. The regional geology is presented in **Table 2: Regional Geology for B19 Sludge Pipeline from Sheet 2626 West Rand** below.

Table 2: Regional Geology for B19 Sludge Pipeline from Sheet 2626 West.

SUPERGROUP	GROUP	FORMATIONS	ROCKTYPES
Quaternary		Quaternary (Qs)	Soil cover Alluvium
		Quaternary (Qa)	Soil cover Aeolian sand
Karoo Supergroup	Ecca Group (Pe): Rock types; shale, mudstone, sandstone	Volksrust (Pvo)	Shale
		Vryheid (Pv)	Sandstone, shale, coal
		Pietermaritzburg (Pp)	Shale
	Dwyka Group (C-Pd)		Tillite, sandstone, mudstone, shale

4.3 Soil horizons along B19 Sludge Pipeline

The geotechnical soil profile and photographs for the soil horizons encountered within the B19 Sludge Pipeline have been presented in the **Annexure C** – Soil profiles and **Annexure D** – Soil Photographs.

Table 3 and 4 below provide summary of the test pits data for the B19 Sludge Pipeline.

Table 3: Soil horizons along B19 Sludge Pipeline.

TEST PIT NUMBER	CHAINAGE	LAYER THICKNESSES (m)																				
		TRANSPORTED SOILS												RESIDUAL SOILS								
	(m)	Topsoil/ Organic (From – to)			Fill, Ash/brick rubble (From – to)			Alluvium (From – to)			Ferruginous Hillwash (From – to)			Ferruginous residual mudstone (From – to)			Calcareous residual mudstone (From – to)			Ferruginous residual sandy shale (From – to)		
TP1	263.5	0.0	-	0.2							0.2	-	1.0	1.0	-	2.2	2.2	-	3.0		-	
TP2	369.1	0.0	-	0.2	0.2	-	0.5		-		0.5	-	1.0	1.0	-	2.0	2.0	-	3.0		-	
TP3	499.9	0.0	-	0.2	0.2	-	0.5		-		0.5	-	1.1	1.1	-	2.0	2.0	-	3.0		-	
TP4	647.0	0.0	-	0.1	0.1	-	1.0		-		1.0	-	1.5	1.5	-	2.2	2.2	-	3.0		-	
TP5	957.0	0.0	-	0.1	0.1	-	0.8		-		0.8	-	2.2	2.2	-	3.0		-			-	
TP6	1076.5	0.0	-	0.2							0.2	-	1.0	1.0	-	1.9	1.9	-	3.0		-	
TP7	1310.5	0.0	-	0.2							0.2	-	1.0	1.0	-	1.9	1.9	-	2.8		-	
TP8	1538.0	0.0	-	0.6	0.6	-	0.9		-			-		0.9	-	2.0	2.0	-	3.0		-	
TP9	1703.2	0.0	-	0.2							0.2	-	0.9	0.9	-	2.0	2.0	-	3.0		-	
TP10	1951.2	0.0	-	0.2							0.2	-	1.2	1.2	-	1.9	1.9	-	2.8		-	
TP11	2240.2	0.0	-	0.1	0.1	-	1.5		-		1.5	-	2.0	2.0	-	2.5	2.5	-	3.0		-	
TP12	2590.4	0.0	-	0.2							0.2	-	1.0	1.0	-	2.2	2.2	-	3.0		-	
TP13	2855.6	0.0	-	0.1	0.1	-	1.0		-		1.0	-	1.8							1.8	-	3.0
TP14	3077.0	0.0	-	0.1	0.1	-	1.8		-		1.8	-	2.5							2.5	-	3.0
TP15	3254.0	0.0	-	0.1	0.1	-	1.8		-		1.8	-	2.5							2.5	-	3.0
TP16	3333.2	0.0	-	0.1	0.1	-	2.0		-			-									-	
TP17	3411.2	0.0	-	0.3	0.3	-	2.0	2.0	-	3.0		-									-	
TP18	3510.4	0.0	-	0.3	0.3	-	1.3	1.3	-	2.0		-								2.0	-	3.0
TP19	3602.1	0.0	-	0.2	0.2	-	1.0	1.0	-	2.0		-								2.0	-	3.0
TP20	3704.3	0.0	-	0.2		-		0.2	-	2.0	2.0	-	2.6							2.6	-	3.0
TP21	3798.3	0.0	-	0.2		-		0.2	-	1.6	1.6	-	2.6							2.6	-	3.0
TP22	3913.5	0.0	-	0.2							0.2	-	0.8							0.8	-	3.0
TP23	3999.5	0.0	-	0.3							0.3	-	1.0							1.0	-	3.0
TP24	4116.1	0.0	-	0.2							0.2	-	0.9							0.9	-	3.0
TP25	4209.1	0.0	-	0.2		-		0.2	-	0.9		-								0.9	-	3.0
TP26	4345.3	0.0	-	0.2		-		0.2	-	1.0		-								1.0	-	3.0
TP27	4428.3	0.0	-	0.2		-		0.2	-	1.0		-								1.0	-	3.0
TP28	4535.8	0.0	-	0.2		-		0.2	-	0.8		-								0.8	-	3.0
TP29	4601.8	0.0	-	0.2		-		0.2	-	0.7		-								0.7	-	3.0
TP30	4728.4	0.0	-	0.2		-		0.2	-	0.7		-								0.7	-	3.0
TP31	4945.7	0.0	-	0.2		-		0.2	-	1.4	1.4	-	2.4							2.4	-	2.8
TP32	5111.7	0.0	-	0.2	0.2	-	1.1		-			-								1.1	-	3.0
TP33	5419.7	0.0	-	0.2	0.2	-	1.2		-			-								1.2	-	3.0
TP34	5686.7	0.0	-	0.2	0.2	-	1.2		-			-								1.2	-	3.0
TP35	6053.7	0.0	-	0.1		-		0.1	-	0.9		-								0.9	-	5.0

Table 4: Test Pits summary table.

TEST PIT NUMBER	CHAINAGE	EXCAVATED TEST PIT SUMMARY			
		TRENCH DEPTH	SEEPAGE	SIDEWALLS	SAMPLES TAKEN
	(m)	(m)	(m)	Stability	Bulk (ModAASHTO & CBR); Disturbed (Atterberg Limits & pH-Conductivity)
TP1	263.5	3.0	none	stable	Disturbed and bulk samples taken at 0.15--0.5m & 0.5--1.0m & 1.0--2.2m &2.2--2.6m.
TP2	369.1	3.0	none	stable	none
TP3	499.9	3.0	none	stable	none
TP4	647.0	3.0	none	stable	Disturbed soils samples taken at 0.1--1.0m.
TP5	957.0	3.0	none	stable	Disturbed soils samples taken at 2.2--3.0m.
TP6	1076.5	3.0	none	stable	none
TP7	1310.5	2.8	none	stable	Disturbed samples taken at 0.2--1.0m & 1.0--2.8m.
TP8	1538.0	3.0	none	stable	none
TP9	1703.2	3.0	none	stable	none
TP10	1951.2	2.8	none	stable	Disturbed and bulk samples taken at 0.2--1.2m & 1.2--3.0m.
TP11	2240.2	3.0	none	stable	none
TP12	2590.4	3.0	none	stable	Disturbed soils samples taken at 0.4--1.0m & 1.0--3.0m.
TP13	2855.6	3.0	none	stable	Bulk and disturbed soils samples taken 0.1--0.6m & 0.6--1.0m & 1.0--1.8 & 1.8--3.0m.
TP14	3077.0	3.0	3.0	1.2-1.8	Disturbed soils samples taken 0.1--1.2m & 1.8--3.0m.
TP15	3254.0	3.0	3.0	1.2-1.8	none
TP16	3333.2	2.0	none	stable	none
TP17	3411.2	3.0	2.0	stable	none
TP18	3510.4	3.0	1.3	stable	Bulk and disturbed soils samples taken 2.0--3.0m.
TP19	3602.1	3.0	1.3	stable	none
TP20	3704.3	3.0	none	stable	none

TEST PIT NUMBER	CHAINAGE	EXCAVATED TEST PIT SUMMARY			
		TRENCH DEPTH	SEEPAGE	SIDEWALLS	SAMPLES TAKEN
	(m)	(m)	(m)	Stability	Bulk (ModAASHTO & CBR); Disturbed (Atterberg Limits & pH-Conductivity)
TP21	3798.3	3.0	none	stable	none
TP22	3913.5	3.0	none	stable	none
TP23	3999.5	3.0	none	stable	Bulk and disturbed soils samples taken at 1.0--3.0m.
TP24	4116.1	3.0	none	stable	none
TP25	4209.1	3.0	none	stable	none
TP26	4345.3	3.0	none	stable	Disturbed soils samples taken at 1.0--3.0m.
TP27	4428.3	3.0	none	stable	none
TP28	4535.8	3.0	none	stable	Bulk and disturbed soils samples taken 0.8--3.0m.
TP29	4601.8	3.0	none	stable	Bulk and disturbed soils samples taken 0.7--3.0m.
TP30	4728.4	3.0	none	stable	Bulk and disturbed soils samples taken 0.5--3.0m.
TP31	4945.7	2.8	none	stable	Bulk and disturbed soils samples taken at 0.8--2.8m.
TP32	5111.7	3.0	none	stable	Bulk and disturbed soils samples taken at 0.2--3.0m.
TP33	5419.7	3.0	none	stable	none
TP34	5686.7	3.0	none	stable	Bulk and disturbed soils samples taken at 0.4--1.2m & 1.2--2.6m & 2.6--3.0m.
TP35	6053.7	5.0	none	stable	Disturbed soils samples taken at 0.3--1.0m & 1.0--5.0m.

4.4 Laboratory tests

The following laboratory tests were performed by Geostrada which is a SANAS accredited laboratory;

- Foundation indicators (sieve analysis and Atterberg limits)
- California Bearing Ratio (CBR)
- Moisture/density relationship
- pH and conductivity

The detailed laboratory results are presented in **Annexure E** of this report.

It should be noted that not all the tests stated in the terms of reference were conducted. This is because the indicator tests showed that the in-situ material on which the pipe will be laid was poor (G9 or worse in accordance with TRH14 classification) due to high content of silt and clay therefore should be removed and replaced with imported material. Hence, further testing of this material would be a futile exercise.

Table 5: Laboratory test results summary table.

TEST PIT NO	CHAINAGE (m)	DEPTH (m) From - to	%GRAVEL	%SAND	%SILT	% CLAY	ACTIVITY	% SOIL MORTAR	COARSE SAND RATIO	LL%	PL%	PI%	PIw%	LS%	GM	UC	CC	US CS	TRB	VAN DER MERWE'S SOIL ACTIVITY CHART
TP1	263.5	0.15 - 0.5	1	46	14	39	0.8	99	0.08	52	21	31	28.2	11	0.42	34	0	CH	A-7-6	High
TP1	263.5	0.5 - 1	10	40	13	37	1.2	90	0.1	67	22	45	36.5	12	0.67	36	0	CH	A-7-6	Very High
TP1	263.5	1 - 2.2	2	27	20	51	0.7	98	0.05	60	26	34	31.6	15.5	0.35	10	0.1	CH	A-7-6	High
TP1	263.5	2.2 - 2.6	17	20	17	46	0.8	83	0.05	62	26	36	28.4	15.5	0.75	23	23	CH	A-7-6	High
TP4	647.0	0.1 - 1	36	41	20	3	2	64	0.31	36	30	6	2.6	2	1.67	157	0.9	SM	A-1-b	Low
TP5	957.0	2.2 - 3	27	39	13	21	0.8	73	0.14	35	19	16	10.1	8.5	1.19	147	0.4	SC	A-6	Low
TP7	1310.5	0.2 - 1	0	41	19	40	0.8	100	0.05	54	21	33	31.4	13	0.31	31	0	CH	A-7-6	Very High
TP10	1951.2	0.2 - 1.2	9	45	17	29	0.8	91	0.11	41	18	23	18.6	10	0.75	61	0	CL	A-7-6	Medium
TP10	1951.2	1.2 - 3	5	42	16	37	0.7	95	0.08	45	18	27	23.5	11	0.57	37	0	CL	A-7-6	High
TP13	2855.6	0.1 - 0.6	36	41	18	5	1.2	64	0.22	37	31	6	3	3.5	1.56	221	0.5	SM	A-2-4	Low
TP13	2855.6	0.6 - 1	24	53	18	5	1.6	76	0.33	33	25	8	4.1	3.5	1.47	256	3.7	SM	A-2-4	Low
TP13	2855.6	1 - 1.8	2	62	17	19	0.6	98	0.18	26	14	12	9.6	5.5	0.77	89	0.9	SC	A-6	Low
TP13	2855.6	1.8 - 3	7	45	16	32	0.6	93	0.16	36	18	18	14	8	0.74	61	0	CL	A-6	Low
TP14	3077.0	0.1 - 1.2	53	33	11	3	1	47	0.32	38	35	3	1	1.5	2.03	286	1.1	GM	A-1-b	Low
TP14	3077.0	1.8 - 3	6	40	29	25	0.6	94	0.14	31	17	14	11.3	7	0.57	33	0.1	CL	A-6	Low - Medium
TP16	3333.2	0.2 - 3	17	47	24	12	0.9	83	0.18	30	19	11	7.5	5.5	1.09	111	1	SC	A-6	Low
TP18	3510.4	2 - 3	0	33	28	39	1	100	0.01	58	20	38	37.6	10.5	0.12	19	0.1	CH	A-7-6	Very High
TP20	3704.3	0.8 - 1.8	4	43	29	24	0.7	96	0.05	34	18	16	14.6	6	0.46	34	0.1	CL	A-6	Medium
TP20	3704.3	1.8 - 3	0	24	35	41	0.8	100	0.01	52	21	31	30.7	13	0.14	9	0.1	CH	A-7-6	High - Very High
TP21	3798.3	0.6 - 1	1	34	35	30	0.7	99	0.02	35	15	20	19.4	5.5	0.22	18	0.1	CL	A-6	Medium

TEST PIT NO	CHAINAGE (m)	DEPTH (m) From - to	%GRAVEL	%SAND	%SILT	% CLAY	ACTIVITY	% SOIL MORTAR	COARSE SAND RATIO	LL%	PL%	PI%	PIw%	LS%	GM	UC	CC	USCS	TRB	VAN DER MERWE'S SOIL ACTIVITY CHART
TP21	3798.3	1.8 - 3	0	27	42	31	0.7	100	0.02	38	17	21	20.6	9.5	0.19	9	0.1	CL	A-6	Medium - High
TP23	3999.5	1 - 3	2	51	24	23	0.5	98	0	26	14	12	11.8	5.5	0.39	35	0.9	CL	A-6	Low - Medium
TP26	4345.5	1 - 3	1	31	38	30	0.8	99	0.04	41	17	24	22.8	9.5	0.22	10	0.1	CL	A-7-6	Medium - High
TP29	4601.8	0.7 - 3	1	88	6	5	1.8	99	0.64	19	10	9	3.2	2.5	1.52	47	5.3	SC	A-2-4	Low
TP30	4728.4	0.5 - 3	1	73	13	13	0.7	99	0.31	22	13	9	6.1	3.5	1	154	8.1	SC	A-2-4	Low
TP31	4945.7	0.8 - 2.8	0	60	25	15	0.8	100	0.15	25	13	12	10.2	3.5	0.67	61	1.7	SC	A-6	Low - Medium
TP34	5686.7	0.4 - 1.2	34	41	21	4	0	66	0.29	N/A	N/A	N/A	N/A	0	1.58	154	0.5	SM	A-2-7	Low
TP34	5686.7	1.2 - 2.6	41	36	10	13	0.8	59	0.17	21	11	10	4.9	4.5	1.66	1172	3.1	SC	A-2-4	Low
TP34	5686.7	2.6 - 3	52	30	8	10	1	48	0.17	21	11	10	4	4.5	1.9	5213	1.6	GC	A-2-4	Low
TP35	6053.7	0.3 - 1	2	30	35	33	0.7	98	0.03	39	16	23	21.9	8.5	0.34	17	0.1	CL	A-6	Medium - High
TP35	6053.7	1 - 3	22	38	19	21	0.6	78	0.12	27	14	13	9	7.5	1.09	108	0.4	SC	A-6	Low

Description of symbols

LL = Liquid Limit
PL = Plasticity Limit
PI = Plasticity Index
PIw = Weighted PI
LS = Linear Shrinkage
GM = Grading Modulus
UC = Uniformity Coefficient
CC = Coefficient of Curvature
USCS = Unified Soil Classification System
TRB = Committee on Classification of Materials for Subgrades and Granular Type Roads of the Highway Research Board / AASHTO Classification system

Table 6: Laboratory test results summary table.

TEST PIT NO	CHAINAGE (m)	DEPTH (m) From - to	MODAASHTO		CALIFORNIA BEARING RATIO							TRH14
			Max.dry density kg/m3	Optimum moisture %	%swell	90%	93%	95%	97%	98%	100%	G-CLASS
TP1	263.5	1.0 - 2.6	1622	13.9	13.4	0.6	0.7	0.8	0.8	0.8	0.9	Less than G9
TP10	1951.2	0.2 - 1.2	1814	12	3.1	0.4	0.5	0.6	0.7	0.8	1.1	Less than G9
TP10	1951.2	1.2 - 3.0	1730	14.5	4.9	0.3	0.4	0.4	0.4	0.4	0.4	Less than G9
TP13	2855.6	0.1 - 0.6	1613	11.7	0.6	4	7	10	14	18	26	G9
TP13	2855.6	0.6 - 1.0	1817	15.4	0.3	3	8	16	30	40	75	G9
TP18	3510.4	2.0 - 3.0	1744	12.2	5.9	0.8	0.8	0.9	0.9	1	1	Less than G9
TP23	3999.5	1.0 - 3.0	1788	9.8	2.9	0.6	1.4	2.2	3.8	5	8	Less than G9
TP29	4601.8	0.7 - 3.0	2005	6.8	0	6.6	12	20	30	38	60	G8
TP31	4945.7	0.8 - 2.8	2011	8.1	0.1	2.3	6	11	21	29	43	Less than G9
TP31	4945.7	0.8 - 2.8	1904	8.4	0.1	1.1	2.3	4	5.5	7	10	Less than G9
TP34	5686.7	1.2 - 2.6	2049	8.2	0.3	1	3.2	7.1	16	23	51	Less than G9

Table 7: pH and Conductivity results for B19 Sludge Pipeline

Test pit	Chainage (m)	Depth From - to	pH value	Conductivity (siemens/meter)
TP1	263.5	1 – 2.6	7.94	0.1046
TP10	1951.2	0.2 – 1.2	7.49	0.0758
TP10	1951.2	1.2 – 3.0	7.3	0.1217
TP13	2855.6	0.1 – 0.6	9.22	0.1228
TP13	2855.6	0.6 – 1.0	9.05	0.13
TP13	2855.6	1.0 – 1.8	6.57	0.1046
TP13	2855.6	1.8 – 3.0	6.41	0.1071
TP34	5686.7	1.2 – 2.6	7.74	0.0687
TP34	5686.7	2.6 – 3.0	7.9	0.0721

4.5 Existing Geological Conditions

4.6 Soil Cover, Quaternary Deposits

This soil cover consists of various soil materials of variable origin that has been transported and deposited by the adjacent river, in the last 1.8 Ma. These alluvial sediments are generally deep, non-cohesive (sandy) to cohesive (silty) deposits, with lateral variation across the flood plain.

Due to the nature of their deposition these soils have a loose consistency. The loose nature of the soils may lead to settlement of foundations and instability problems during excavation. The loose and voided nature also means that these soils are highly permeable.

4.7 Aeolian Sand, Quaternary Deposits

These deposits represent young (<1.8 Ma) sandy soils that have undergone transportation and deposition by wind. The deposits are derived from the weathering products of the Karoo Supergroup and typically have a loose, voided, non-cohesive structure susceptible to settlement and collapse potential. Due to their loose, voided nature these soils may be highly permeable.

4.8 Vryheid Formation, Ecca Group, Karoo Supergroup

The bedrock geology consists of sedimentary rock units of the Vryheid Formation of the Karoo Supergroup. The Karoo Supergroup represents a sedimentary sequence and makes up South Africa's largest occurring rock group at surface. The Vryheid Formation is a mixture of sandstone, conglomerates and shales derived from a deltaic ingress and regress in the Palaeozoic Era.

Dolerite intrusions are common within the Vryheid Formation, however no intrusions are indicated on the geological map in close proximity to the pipeline route. The Vryheid Formation is generally upward coarsening and in the western part of Gauteng Province it is thought to have been deposited by linear coastline cycles.

The deposition of the Vryheid Formation involved fluvial processes and these remnant structures can be seen in the rock, such as paleo-ripples and pebble immature sandstone sediments. Sandstone

(and less commonly shale) rock can lead to excavation difficulties for the pipeline trench in areas underlain at shallow depth by the Karoo Supergroup bedrock.

4.9 Groundwater Seepage

Much of the pipeline is located within close proximity to the Vaal River, and is at risk of inundation during major flooding of the river.

For period on which the trenches where open, there was groundwater seepage observed within the test pits summarised within **Table 21: Groundwater Seepage within B19 Sludge Pipeline.**

Table 8: Groundwater Seepage along B19 Sludge Pipeline

TEST PIT NUMBER	CHAINAGE (m)	DEPTH TRENCH (m)	SEEPAGE (m)	SIDEWALLS Stability
TP14	3077.0	3.0	3.0	1.2-1.8 (unstable)
TP15	3254.0	3.0	3.0	1.2-1.8 (unstable)
TP17	3411.2	3.0	2.0	stable
TP18	3510.4	3.0	1.3	stable
TP19	3602.1	3.0	1.3	stable
TP24	4116.1	3.0	3.0	stable
TP25	4209.1	3.0	3.0	stable
TP26	4345.3	3.0	3.0	stable
TP27	4428.3	3.0	3.0	stable
TP28	4535.8	3.0	3.0	stable

Free standing water was encountered in a few of the test pits presented in figure 5 and 6 below.

The water logged areas also overlain by dumped ash, presumably transported and dumped by previous contractors for the construction of haulage roads.

The study was conducted in the month of July to August, which is a dry season and several test pits within the study only showed slightly moist conditions. Water seepage could be experienced in these test pits during rainy season.

Figure 4: Water Logged Areas along the B19 Sludge Pipeline _ TP 13 to TP 20

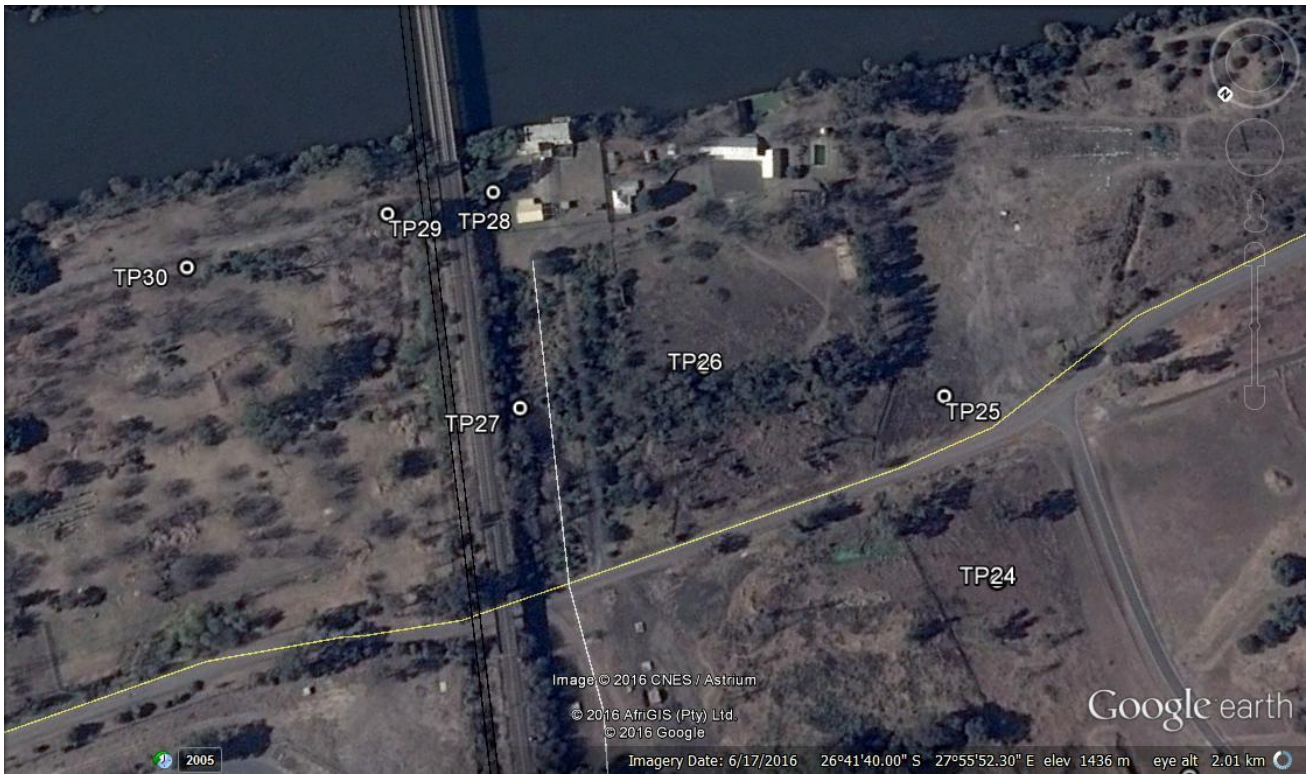


Figure 5: Water Logged Areas along the B19 Sludge Pipeline _ TP 24 to TP 28

The groundwater seepage encountered along the B19 Sludge Pipeline as well as surface runoff mean that the excavations will be flooded during construction. Dewatering of the pipe excavations shall therefore be required so that material and pipe placing can continue without disruption.

4.10 Excavatability

Excavation classification of the material along the pipeline route has been carried out in accordance with SANS 1200D in non-restricted areas as indicated below.

- Soft excavation
- Intermediate excavation
- Hard rock excavation
- Boulder excavation class A
- Boulder excavation class B

The excavation is classified as soft to at least 5m depth. Excavation of this would require manual excavation with shovels and picks or use of a TLB. The table below summarises the Classes of excavation anticipated along the pipeline route.

Table 9: Classes of excavation for B19 Sludge pipeline

TEST PIT NUMBER	CHAINANGE (m)	DEPTH OF EXCAVATION (m)	CLASSES OF EXCAVATIONS B19 SLUDGE PIPELINE				
			Soft excavation	Intermediate excavation	Hard rock excavations	Boulder excavation Class A	Boulder excavation Class B
TP1 (RandWater Treatment Works)	263.5	3.0	yes	n/a	n/a	n/a	n/a
TP2	369.1	3.0	yes	n/a	n/a	n/a	n/a
TP3	499.9	3.0	yes	n/a	n/a	n/a	n/a
TP4	647.0	3.0	yes	n/a	n/a	n/a	n/a
TP5	957.0	3.0	yes	n/a	n/a	n/a	n/a
TP6	1076.5	3.0	yes	n/a	n/a	n/a	n/a
TP7	1310.5	2.8	yes	n/a	n/a	n/a	n/a
TP8	1538.0	3.0	yes	n/a	n/a	n/a	n/a
TP9	1703.2	3.0	yes	n/a	n/a	n/a	n/a
TP10	1951.2	2.8	yes	n/a	n/a	n/a	n/a
TP11	2240.2	3.0	yes	n/a	n/a	n/a	n/a
TP12	2590.4	3.0	yes	n/a	n/a	n/a	n/a
TP13	2855.6	3.0	yes	n/a	n/a	n/a	n/a
TP14	3077.0	3.0	yes	n/a	n/a	n/a	n/a
TP15	3254.0	3.0	yes	n/a	n/a	n/a	n/a
TP16	3333.2	3.0	yes	n/a	n/a	n/a	n/a
TP17	3411.2	3.0	yes	n/a	n/a	n/a	n/a
TP18	3510.4	3.0	yes	n/a	n/a	n/a	n/a
TP19	3602.1	3.0	yes	n/a	n/a	n/a	n/a
TP20	3704.3	3.0	yes	n/a	n/a	n/a	n/a
TP21	3798.3	3.0	yes	n/a	n/a	n/a	n/a

TEST PIT NUMBER	CHAINANGE (m)	DEPTH OF EXCAVATION (m)	CLASSES OF EXCAVATIONS B19 SLUDGE PIPELINE				
			Soft excavation	Intermediate excavation	Hard rock excavations	Boulder excavation Class A	Boulder excavation Class B
TP22	3913.5	3.0	yes	n/a	n/a	n/a	n/a
TP23	3999.5	3.0	yes	n/a	n/a	n/a	n/a
TP24	4116.1	3.0	yes	n/a	n/a	n/a	n/a
TP25	4209.1	3.0	yes	n/a	n/a	n/a	n/a
TP26	4345.3	3.0	yes	n/a	n/a	n/a	n/a
TP27	4428.3	3.0	yes	n/a	n/a	n/a	n/a
TP28	4535.8	3.0	yes	n/a	n/a	n/a	n/a
TP29	4601.8	3.0	yes	n/a	n/a	n/a	n/a
TP30	4728.4	3.0	yes	n/a	n/a	n/a	n/a
TP31	4945.7	2.8	yes	n/a	n/a	n/a	n/a
TP32	5111.7	3.0	yes	n/a	n/a	n/a	n/a
TP33	5419.7	3.0	yes	n/a	n/a	n/a	n/a
TP34	5686.7	3.0	yes	n/a	n/a	n/a	n/a
TP35 (Vaal River Chamber Connection)	6053.7	5.0	yes	n/a	n/a	n/a	n/a

Percentage of excavation class	Soft excavation 100%	Intermediate excavation 0%	Hard rock excavation 0%	Boulder excavation Class A = 0%	Boulder excavation Class B = 0%

5 Engineering Behavior

5.1 Soil Classification and Behavior

According to the laboratory test results, the anticipated engineering properties and behavior of the soil along the pipeline is provided in the table below.

Table 10: Soil properties along the pipe length

Test Pit No. /Chainage	Soil Classification	Expected behavior	Remarks
TP1 to TP4/Ch.264 to Ch.647	CH (Inorganic clays of high plasticity)	The high plasticity clay soil has high swell potential when exposed to moisture. This could result in excessive swell pressures on the pipe base as well as sidewalls.	The clay layer below at the bottom of the trench should be excavated and replaced with inert granular material. The distance between the pipe and trench wall should also be increased beyond what the standard requires, alternatively a rigid pipe should be used.
TP4 to TP5/ Ch.647 to Ch.957	SM (Silty sands, sand-silt mixtures), SC (Clayey sands, sand-clay mixtures)	The silty sand and clayey silt soil has low swell potential.	No precautions required on the pipe foundation. Side walls to be battered to avoid soil collapse into the excavation.
TP5 to TP10/Ch.957 to Ch.1951	CH (Inorganic clays of high plasticity), CL (Inorganic clays of low to medium plasticity)	The low to high plasticity clay soil exhibits medium low to high swell potential when exposed to moisture. This could result in excessive swell pressures on the pipe base as well as sidewalls.	The clay below at the bottom of the trench should be excavated and replaced with inert granular material. The distance between the pipe and trench wall should also be increased beyond what the standard

			requires, alternatively a rigid pipe should be used.
TP10 to TP18/Ch.1951 to Ch.3510	SM (Silty sands, sand-silt mixtures), SC (Clayey sands, sand-clay mixtures), CL (Inorganic clays of low to medium plasticity)	The profile consists of silty sand, clayey sand and low plasticity clay. The swell potential is low to medium. Upper section between TP 13 to TP 19 consists of ASH fill. Groundwater was also encountered in this section.	The pipe foundation should be stable and only requires ripping and re-compaction before pipe bedding is placed. Dewatering of the trench will be required during excavation.
TP18 to TP28/Ch.3510 to Ch.4536	CH (Inorganic clays of high plasticity), CL (Inorganic clays of low to medium plasticity)	The medium to high plasticity clay soil exhibits medium low to high swell potential when exposed to moisture. This could result in excessive swell pressures on the pipe base as well as sidewalls. Groundwater was also encountered in this section (TP 24 to TP28).	The clayey material at the bottom of the trench should be excavated and replaced with inert granular material. The distance between the pipe and trench wall should also be increased beyond what the standard requires, alternatively a rigid pipe should be used. Dewatering of the trench will be required during excavation.
TP28 to TP34/Ch.4536 to Ch.5686.7	SC (Clayey sands, sand-clay mixture), SM (Silty sands, sand-silt mixtures)	The clayey and silty sand exhibits low swell potential.	Pipe foundation treatment will require reaping and re-compaction. Sidewalls will have to be battered to avoid soil collapse into the excavation.

TP34 to TP35/Ch.5686.7 to Ch.6053.7	CL (Inorganic clays of low to medium plasticity)	The medium to high plasticity clay soil exhibits medium low to high swell potential when exposed to moisture. This could result in excessive swell pressures on the pipe base as well as sidewalls.	The clayey material at the bottom of the trench should be excavated and replaced with inert granular material. The distance between the pipe and trench wall should also be increased beyond what the standard requires, alternatively a rigid pipe should be used. Dewatering of the trench will be required during excavation.

The geotechnical parameters of the soils along the pipeline have been estimated for the purposes of designing associated structures along the pipeline, e.g. valve chambers, etc. The soil on the pipe invert consists of low plasticity clays, high plasticity clays, silty sand and clayey sands as indicated in the table above. These values are provided in the table below;

5.2 Geotechnical parameters

Table 11: Geotechnical parameters for design

Soil Classification	Cohesion (kPa)	Angle of Friction (degrees)	Elastic Modulus E - MPa	Bearing Capacity (kPa)
CH and CL Inorganic clays	20 - 50	20 - 25	10 - 20	50 - 100

SM and SC (Silty and clayey sands)	0	30 - 32	10 - 25	50 - 100

5.3 Trench stability

Although the trenches were vertical and did not collapse during g excavation, the trenches will be open for much longer during placing of the pipeline hence, it is recommended that the sidewalls of excavations be battered back to 1 (vertical) to 1.5 (horizontal) where wet conditions exist. In dry conditions, 1 (vertical) to 1 (horizontal) slopes can be used. If vertical slopes are excavated, shoring be used to ensure stability of the sides of the excavations.

5.4 Material Usability

The material obtained from the test pits indicate that it is unsuitable for use as backfill and general fill for the pipeline due to high content of silt and clay which results in low strength and high plasticity index. Even though Rand Water allows a higher value of 15 for plasticity index compared to SANS standards which allows 6 for selected backfill, it will be difficult to excavate and separate the material with PI of 15 or less as it appears in patches from different places along the pipeline route. Suitable material for backfill and selected fill will have to be obtained from commercial sources. The material is however suitable as general backfill provided oversized material, bigger than 150mm diameter is removed.

5.5 Compaction Next to Existing Structures

Stability next to existing pipeline and other adjacent structures should be ensured during compaction of the pipe bedding, selected and general backfill material.

Maximum size of equipment based on permissible vibration level is provided in the Table below.

Commercial and industrial buildings maybe able to tolerate a large vibration level of 20 mm/second.

Conversely, historical buildings and buildings with existing cracks would typically be tolerate significant less vibration 2 to 4 mm/second.

The table is based on a permissible peak particle velocity of 10 mm/second.

Table 12: Minimum recommended distance from vibrating rollers (adopted after Tynan, 1973).

Roller class	Weight range	Minimum distance to nearest building
Very light	<1.25 tonne	Not restricted for normal road use, 3.0 m
Light	1 – 2 tonnes	Not restricted for normal road use, 5.0 m
Light to medium	2 – 4 tonnes	5 – 10 m
Medium to heavy	4 – 6 tonnes	Not advised for city and suburban streets 10 – 20m
Heavy	7 – 11 tonnes	Not advised for built up areas 20 – 40 m

5.6 Corrosivity

Corrosion potential of the soils on which the pipeline will be laid was assessed from the results obtained from pH and conductivity testing. The results indicate that the material is moderately corrosive and therefore corrosion protection would have to be provided for the steel pipe and concrete structures mix designs of concrete structures should allow for the corrosive nature of the soil.

Engineering and Exploration Geophysical Services, a geophysical exploration specialist company, were appointed to conduct soil resistivity survey to determine the corrosivity of the soil.

The report indicates that the soil corrosion potential is mostly moderate with a few areas being either severe or mild.

The results of the resistivity survey are included in Annexure G of this report.

6 Crossings

Crossings along the pipeline route are indicated below. Two test pits were excavated on either side of major road crossings while one test pit was excavated for minor roads.

Crossing	Chainage (m)	Test Pit No.	Description
Road crossing 1	263.5	1	Minor road crossing
Road crossing 2	369.1 and 499.9	2 and 3	Major road crossing
Road crossing 3	3913.5	22	Minor road crossing
Road crossing 4	3999.5	23	Minor road crossing
Road crossing 5	4209.1	25	Minor road crossing
Railway bridge crossing 1	4535.8 and 4601.8	28, 29	Difficult access

Road crossing 6	5111.7	32	Minor road crossing

Major road means a lot with a high traffic volume and a minor road has low traffic volume.

The geotechnical conditions at the crossings are described below.

Road crossing 1 – Test Pit No. 1

The soil profile down the test pit is as follows;

Depth below ground level	**Material description**
0m to 0.2m	Clayey sandy silt with roots. **Topsoil**.
0.2m to 0.5m	Sandy clayey silt with roots. **Hillwash**
0.5m to 1.0m	Firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
1.0m to 2.2m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Ferruginous Residual Mudstone**.
2.2m to 2.6m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Calcareous Residual Mudstone**.
2.6m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Calcareous Residual Mudstone**.

Road crossing 2 – Test Pit No.2

Depth below ground level	**Material description**
0m to 0.2m	Clayey sandy silt with roots. **Topsoil**.
0.2m to 0.5m	Soft, pinhole, sandy clayey silt with roots. **Fill**.

0.5m to 1.0m	Soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.
1.0m to 2.0m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Ferruginous Residual Mudstone**.
2.0m to 2.7m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Calcareous Residual Mudstone**.
2.7m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Calcareous Residual Mudstone**.

Road crossing 2 – Test Pit No.3

Depth below ground level	**Material description**
0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.2m to 0.5m	Soft, pinhole, sandy clayey silt with roots. **Fill**.
0.5m to 1.1m	Soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.
1.1m to 2.0m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Ferruginous Residual Mudstone**.
2.0m to 2.5m	Firm, weakly cemented, sandy clayey silt with ferricrete concretion. **Calcareous Residual Mudstone.**
2.5m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Calcareous Residual Mudstone**.

Road crossing 3 – Test Pit No.22

Depth below ground level	**Material description**

0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.2m to 0.8m	Soft, weakly cemented, clayey sandy silt with ferricrete concretion. **Hillwash**.
0.8m to 2.5m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.
2.5m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.

Road crossing 4 – Test Pit No.23

Depth below ground level	**Material description**
0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.2m to 0.4m	Soft, weakly cemented, clayey sandy silt with ferricrete concretion. **Hillwash**.
0.4m to 1.0m	Soft, weakly cemented, clayey sandy silt with ferricrete concretion. **Hillwash**.
1.0m to 2.2m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.
2.2m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.

Road crossing 5 – Test Pit No.25

Depth below ground level	**Material description**
0m to 0.2m	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

0.2m to 0.4m	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.4m to 0.9m	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
0.9m to 2.0m	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.0m to 3.0m	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

Railway Crossing No. 1 – Test Pit 28

Depth below ground level	**Material description**
0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.2m to 0.5m	Soft, clayey sandy silt. **Alluvium**.
0.6m to 0.8m	Soft, weakly cemented, clayey sandy silt with ferricrete concretions. **Alluvium**.
0.8m to 2.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretions. **Ferruginous Sandy Shale**.
2.0m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretions. **Ferruginous Sandy Shale**.

Railway Bridge Crossing No. 1 – Test Pit 29

Depth below ground level	**Material description**
0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

0.2m to 0.5m	Soft, clayey sandy silt. **Alluvium**.
0.6m to 0.7m	Soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
0.7m to 2.2m	Firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.2m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale.**

Road crossing 6 – Test Pit No.32

Depth below ground level	**Material description**
0m to 0.2m	Firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.2m to 0.6m	Soft, weakly cemented, clayey sandy silt with ferricrete concretion. **Hillwash**.
0.6m to 1.1m	Loose, pinhole, sandy ash. **Fill.**
1.1m to 2.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.
2.0m to 3.0m	Firm, weakly cemented, clayey sandy silt with ferricrete concretion. **Ferruginous Sandy Shale**.

It is anticipated that soft ground conditions will be encountered at all the crossings above and trenchless technology, e.g. horizontal directional drilling or pipe jacking can be used for construction of the pipeline across major road crossings. This trenchless technology can also be used for minor road crossings. Alternatively, open trenches can be used for minor crossing roads with low traffic volumes but these will require temporary road diversion during construction.

Access under the railway bridge crossing is difficult for machine excavation. Excavation might have to be done using picks and shovels in this area.

There was no groundwater seepage encountered in any of the test pits excavated at the crossings and no test pit sidewall collapse was encountered.

7 Material Quantities

The total length of the pipeline is 6.054 km and the diameter is 600mm according to the information provided by the Client. Average depth of the pipeline excavation is 2m below ground level. Pipe bedding, selected fill and general fill volume requirement calculations are based on SANS 1200LB.

Table 13: Excavation Classes

SECTION	AVERAGE TRENCH DEPTH (m)	SOFT EXCAVATION (VOLUME m3) (percentage)
Pipeline Route	2.2	60,884

Battering of trench walls will vary between:

- 1V:1.5H in wet soil conditions
- 1V:1H in dry soil conditions.

60˚ battering of trench walls was assumed for the calculation of required bedding volumes along the entire pipe length.

The pipe bedding volume requirements are summarised in the Table below.

PIPELINE LENGTH (m)	BEDDING		SELECTED FILL		BACKFILL	
	PER METRE PIPE LENGTH (m^3/m)	TOTAL (m^3)	PER METRE PIPE LENGTH (m^3/m)	TOTAL (m^3)	PER METRE PIPE LENGTH (m^3/m)	TOTAL (m^3)
6054	2.0	12,053	0.85	5,146	7.2	43,685

8 Materials Sources

As stated previously, the material encountered along the pipeline route are unsuitable for use as bedding and selected fill, hence these materials should be obtained from commercial sources. Such source was identified within 10km radius of the site and it is called Afrimat.

Test results were requested to confirm suitability of the material for backfill and the material is indeed suitable. The test results from Afrimat are attached in Annexure E of this report.

9 Conclusions and Recommendations

The regional geology along the B19 Sludge Pipeline has been retrieved from the geology map Sheet 2626 West-Rand at scale of 1:250 000, it is therefore underlined by predominately mudrock that have been indurated into khaki brown blotch orange and calcareous white sandy clayey silts of firm soil consistency forming concealed geological contacts with sandy shales that are weakly cemented light brown speckled yellow firm clayey sandy silt soils, interpreted as Quaternary soils deposits Aeolian / Hillwash soils.

The material along the pipeline route is classified as soft and can be excavated manually using picks and shovels or mechanically using a tractor-loader-backhoe (TLB).

The material along the pipeline route is generally classified as G9 or worse due to high content of silt and clay hence it is unsuitable for use as pipe bedding and selected fill and can only be used as general backfill. Suitable material will have to be obtained from commercial sources.

Unstable trench or test pit side walls were encountered. It is thus recommended that the sidewalls of excavations be either battered back to 1 (vertical) to 1.5 (horizontal) where wet conditions exist. In dry conditions, 1 (vertical) to 1 (horizontal) slopes can be used. If vertical slopes are excavated, shoring be used to ensure stability of the sides of the excavations.

De-watering of the trenches during construction will be required in some sections along the pipeline route where groundwater was encountered.

pH and conductivity test results indicated that the soils are moderately corrosive hence measures against corrosion protection of steel elements should be provided. However, resistivity testing shall also be carried out to confirm the corrosive potential of the material.

REPORT ANNEXURES

Annexure A - Google Earth Test Pit Positions

Annexure B - Test Pits Profiles

Annexure C - Test Pits Photographs

Annexure D - Laboratory Test Results

Annexure E - Material Sources Test Results

Annexure F - Longitudinal Sections

Annexure G - Soil Resistivity Survey Report

RESPONSE TO THE SCOPE OF WORK

- *Conduct field investigations for ±8 km pipeline for 600 mm diameter steel pipeline by means of exploration trial pits excavated by an excavator. The depth of trial pits shall be 4m and at every 250m along the proposed pipeline. The test pits have been excavated at 250m spacing, to 3.0m depth which is the maximum reach of a TLB. The depth is considered adequate since the pipe will be placed at an average depth of 2m depth. 4m deep test pits would require use of an excavator which would increase the cost significantly because of higher hourly rate as well as slower travelling speed compared to a TLB.*

- *Geotechnical survey to be conducted on either side of all the pipe jacking crossings required. Discussed in section 6 (Crossings) of the report.*

- *Provide the detailed description and recommendation on the stratigraphy at all anticipated pipe jack crossings. Discussed in section 6 (Crossings) of the report.*

- *Study the usability of trench materials as bedding and selected backfill. Discussed in section 5.4 (Material Usability) of the report.*

- *Identify the alternative potential sources of construction materials, either in areas adjacent to the pipeline or commercial sources. Discussed in section 8 (Material Sources) of the report.*

- *Conduct soil Resistivity surveys for the entire route of the pipeline. Included as Annexure G in the report.*

- *Provide recommendations on areas where the pipeline route pass through the soils with high collapsible grain structure, expansive and sink hole characteristics. No soils with high collapsible grain were encountered. Sinkholes are encountered on dolomitic ground and the pipeline route is not situated on dolomites. There are areas where potentially expansive clay is encountered and these would require replacing the expansive material with inert granular material. See section 5.1 (Soil Classification and behavior) of the report.*

- *Demarcate all areas of high water table, and provide recommendations and procedures for dewatering. These areas have been identified and indicated in section 4.9 (Groundwater seepage) of the report and also shown on the long section drawing.*

- *Carry out laboratory tests on the Grading (sieve analysis and Atterberg limits), Chemical Analysis (soil and ground Water including Acid Mine Drainage (AMD)) , Moisture sensitivity analysis(Mod AASHTO), Oedometer test (stress deformation analysis) and compatibility factor tests etc. Sieve analysis including Atterberg Limits have been conducted. These indicated that the material along the pipeline route was unsuitable to use as bedding and selected fill and should therefore be excavated and replaced with suitable material. As a results, there was no need to do further testing on these materials as it would be a fruitless exercise. See section 4.4 (Laboratory Testing) of the report.*

- *Provide excavation and backfill quantities (soft and rock) and quantities for soiled and imported materials as per SANS 1200 DB and SANS 1200 LB. Discussed in section 7 (Material Quantities) of the report.*

- *Provide soil profile on the final long section that will be given to by Rand Water (RW) in DWG format. Iincluded as Annexure F in the report.*

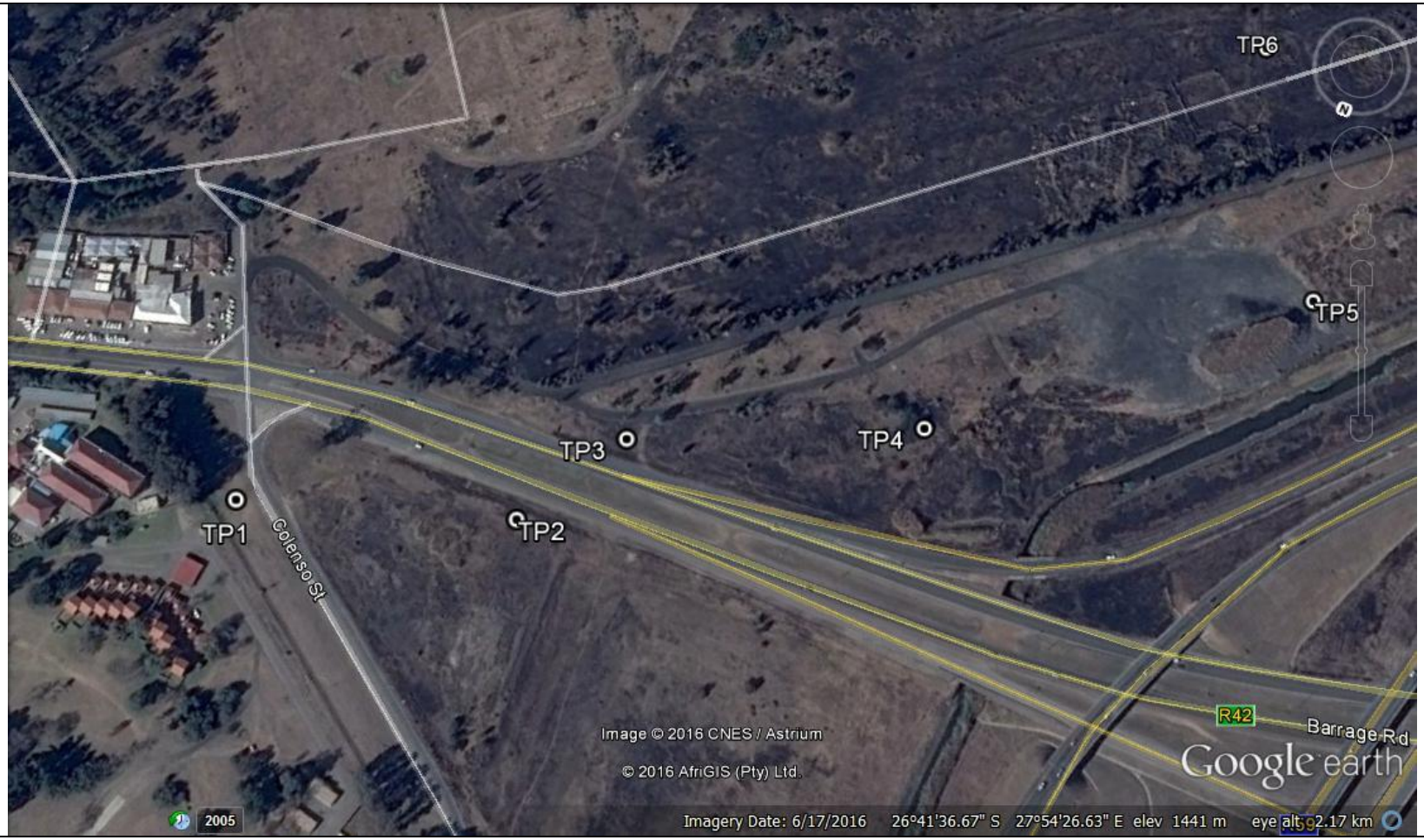
- *Provide trench excavations and backfilling details specific for the project. Provided in section 5.3 (Trench stability) and section 5.4 (Material Usability) of the report.*

ANNEXURE A

GOOGLE EARTH TEST PITS POSTIONS

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP1 – TP6



TP2 – TP5


TP5
TP3
TP4
TP2
R59
N
Sybrand Van Niekerk Fwy
R42
Barrage Rd
Image © 2016 CNES / Astrium
© 2016 AfriGIS (Pty) Ltd.
Google earth
2005
Imagery Date: 6/17/2016 26°41'38.73" S 27°54'17.39" E elev 1437 m eye alt 2.17 km

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CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP5 - TP7

TP7 – TP9


Clay mining area
TP9
TP8
TP7
Image © 2016 CNES / Astrium
© 2016 AfriGIS (Pty) Ltd.
Google earth
2005
Imagery Date: 6/17/2016 26°42'01.19" S 27°54'15.17" E elev 1439 m eye alt 2.16 km

TP9 – TP11


TP11
TP10
Clay mining area
TP9
Image © 2016 CNES / Astrium
© 2016 AfriGIS (Pty) Ltd.
Google earth
2005
Imagery Date: 6/17/2016 26°41'59.75" S 27°54'37.15" E elev 1442 m eye alt 2.16 km

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TP11 – TP14

LILIBARA PROJECTS (PTY) LTD
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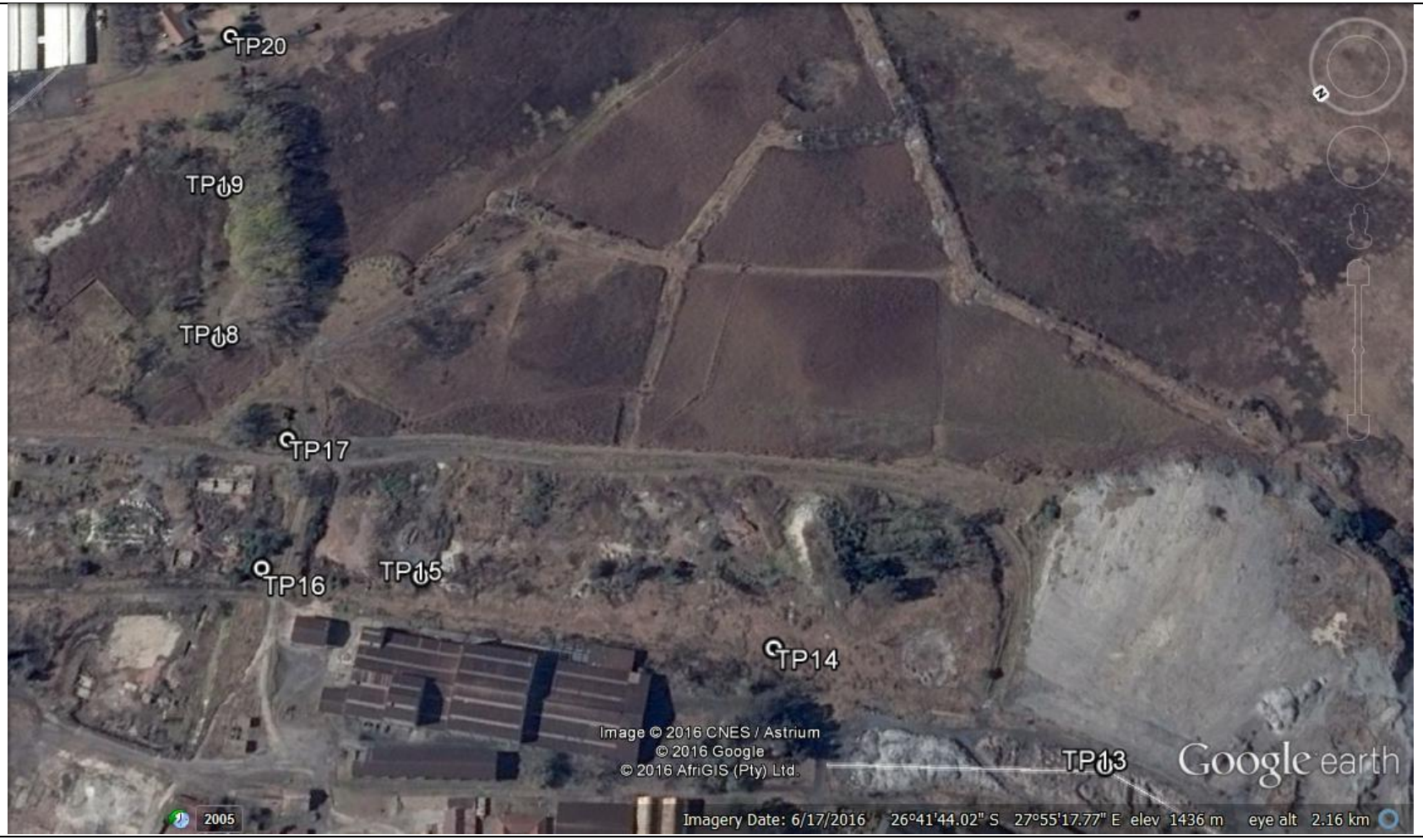
TP13 – TP20



LILIBARA PROJECTS (PTY) LTD
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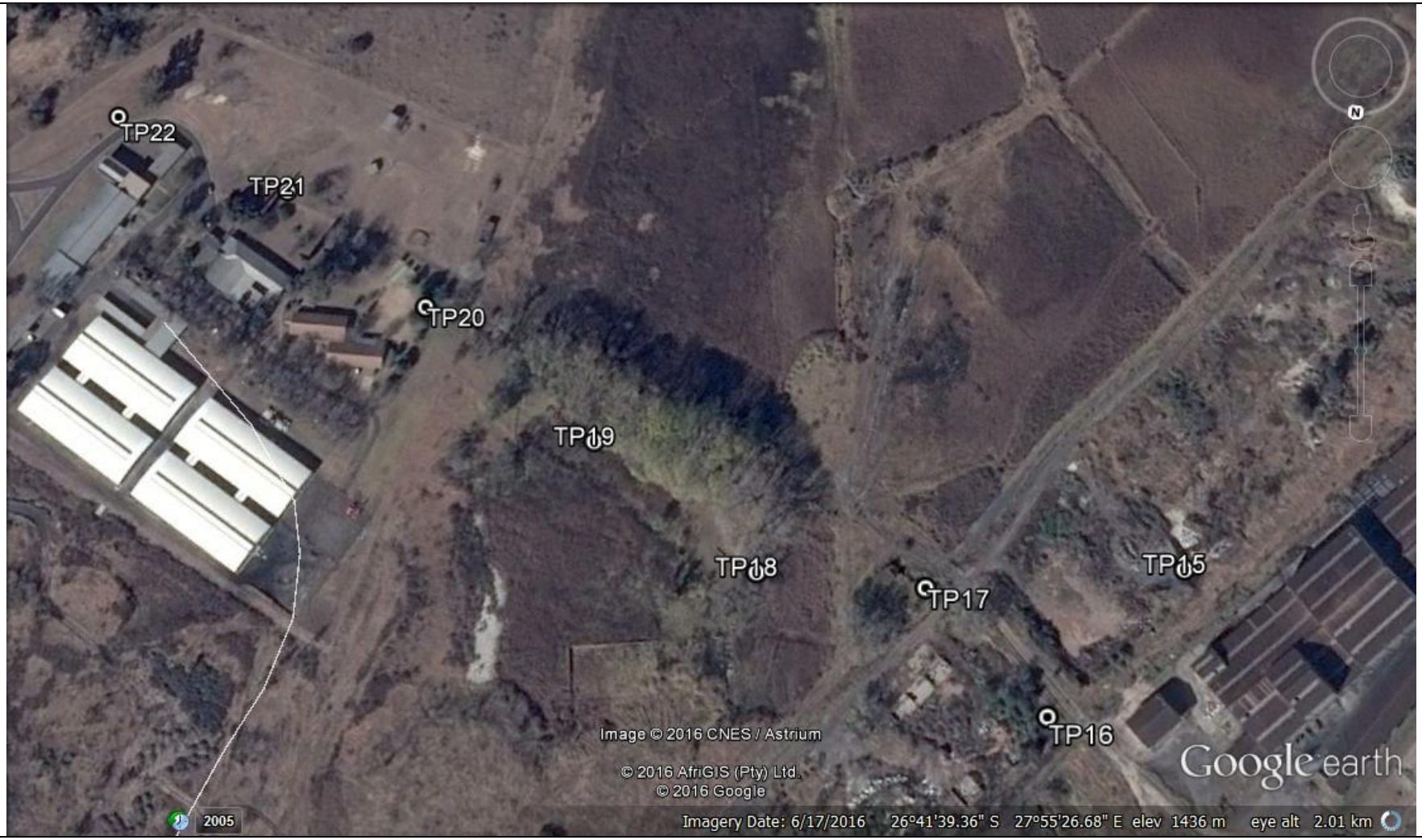
TP15 – TP22



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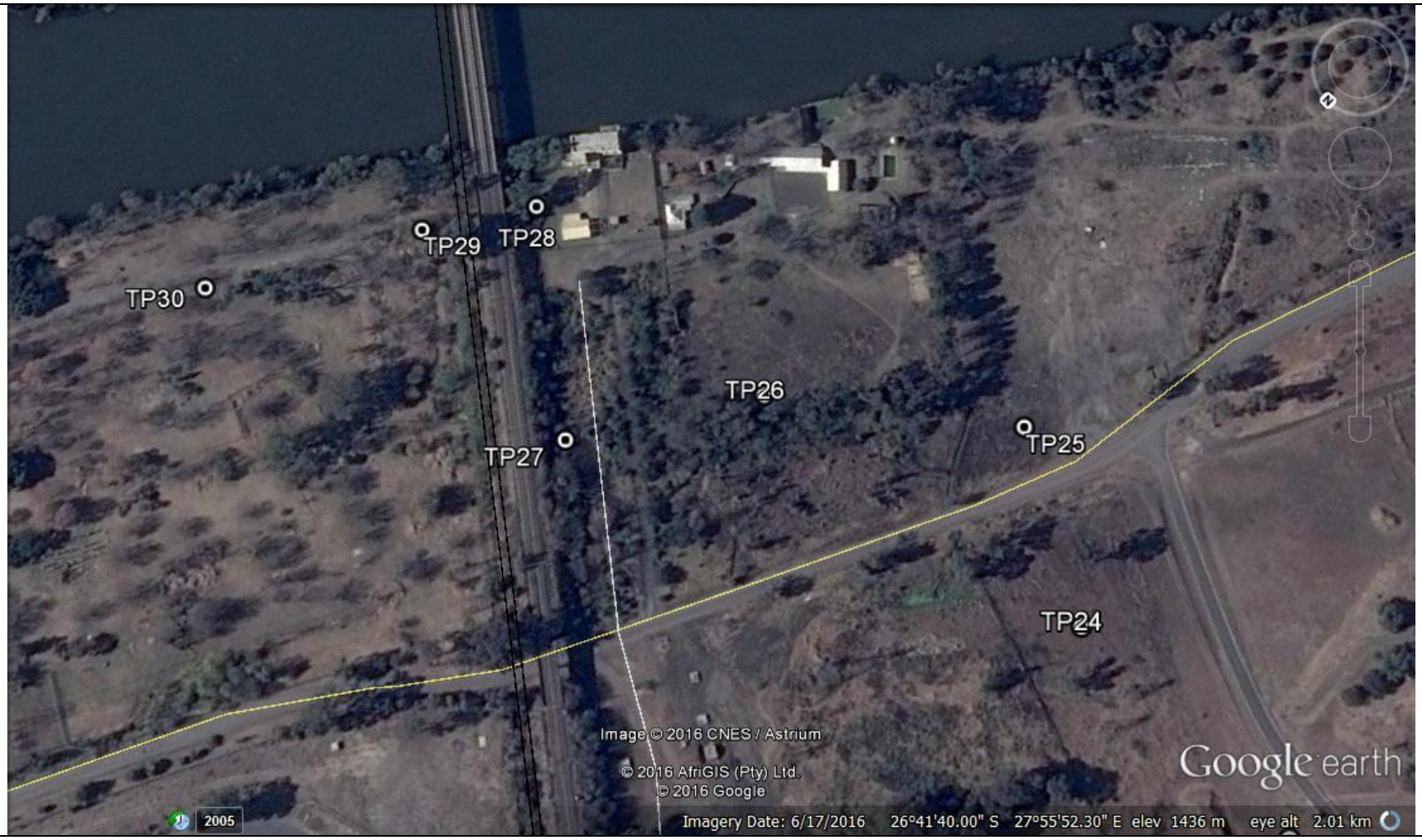
TP20 – TP26

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP24 – TP30



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TP26 – TP32

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TP31 – TP35

ANNEXURE B

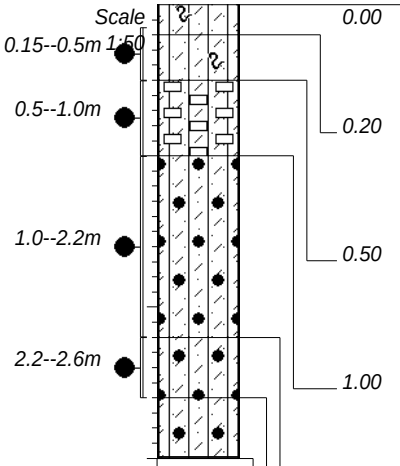
TESTS PITS PROFILES

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 1
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.50	
	Slightly moist, khaki brown mottled white speckled black, firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
1.00	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.20	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.60	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed and bulk samples taken at 0.15--0.5m & 0.5--1.0m & 1.0--2.2m & 2.2--2.6m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 1

LILIBARA PROJECTS (PTY) LTD
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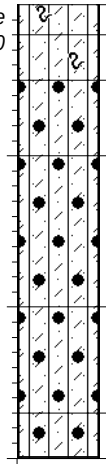
WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 2
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, soft, pinhole, sandy clayey silt with roots. **Fill**.
0.50	
	Slightly moist, brown, soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.
1.00	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.00	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.70	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 2

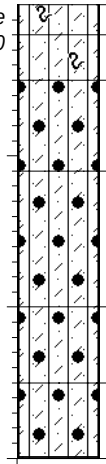
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 3
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, soft, pinhole, sandy clayey silt with roots. **Fill**.
0.50	
	Slightly moist, brown, soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.
1.10	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.00	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.50	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

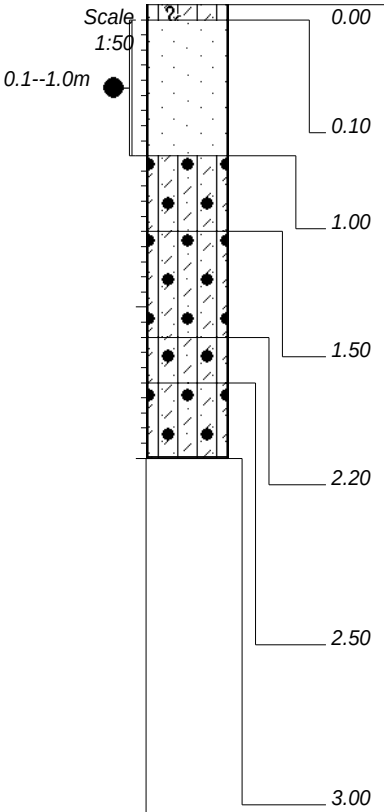
HOLE No: TP 3

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 4
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Slightly moist, black mottled khaki, loose, pinhole, sandy ASH. **Fill**.

Slightly moist, brown, soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.

Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.

Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.

Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed soils samples taken at 0.1--1.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

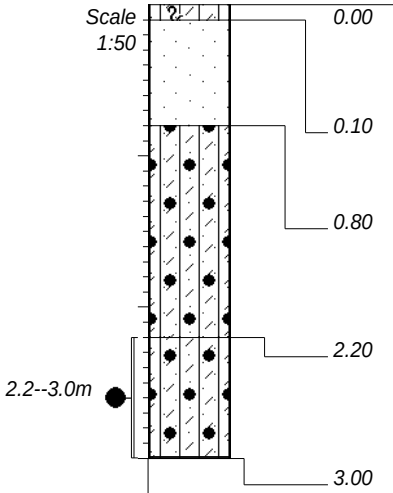
HOLE No: TP 4

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 5
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 0.10: Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

0.10 – 0.80: Slightly moist, black mottled khaki, loose, pinhole, sandy ASH. **Fill**.

0.80 – 2.20: Slightly moist, brown, soft, intact, clayey sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.

2.20 – 3.00: Slightly moist, reddish mottled orange, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed soils samples taken at 2.2--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 5

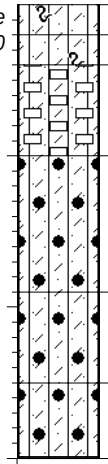
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 6
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.40	
	Slightly moist, khaki brown mottled white speckled black, firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
1.00	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
1.90	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.50	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

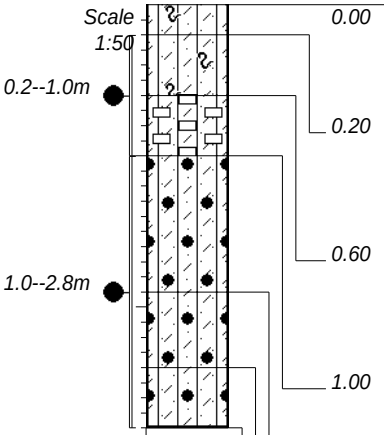
HOLE No: TP 6

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 7
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.60	
	Slightly moist, khaki brown mottled white speckled black, firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
1.00	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
1.90	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.40	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.80	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed samples taken at 0.2--1.0m & 1.0--2.8m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 7

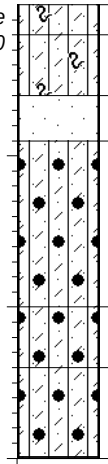
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 8
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, dark brown, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.60	
	Slightly moist, black mottled khaki, loose, pinhole, sandy ASH. **Fill**.
0.90	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.00	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.40	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 8

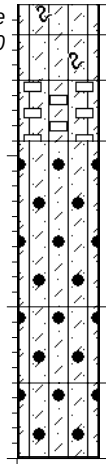
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 9
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.50	
	Slightly moist, khaki brown mottled white speckled black, firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
0.90	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.00	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.50	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

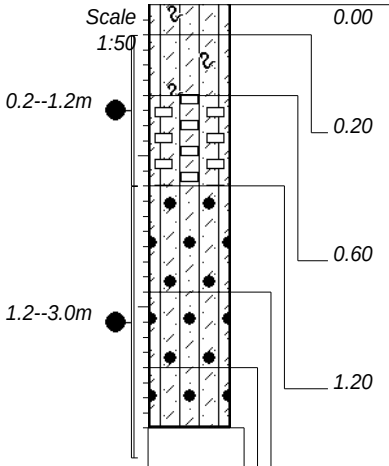
HOLE No: TP 9

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP 10
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, black mottled khaki, firm, pinhole, sandy clayey silt with roots. **Hillwash**.
0.60	
	Slightly moist, khaki brown mottled white speckled black, firm, pinhole, clayey sandy silt with calcrete concresion. **Ferruginous Hillwash**.
1.20	
	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
1.90	
	Slightly moist, khaki brown blotched white speckled yellow, firm, weakly cemented, sandy clayey silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.40	
	Slightly moist, khaki brown blothced white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
2.80	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed and bulk samples taken at 0.2--1.2m & 1.2--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:57
TEXT : ..TPITS\RandWaterTP110.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP 10

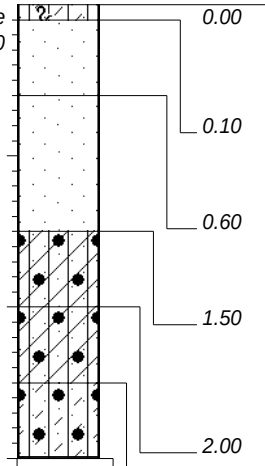
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.10	Slightly moist, black mottled grey, loose, pinhole, sandy ASH. **Fill**.
0.60	Slightly moist, white speckled grey, loose, pinhole, sandy ASH. **Fill**.
1.50	Slightly moist, brown speckled yellow, soft, intact, clay sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.
2.00	Slightly moist, khaki brown mottled white, firm, weakly cemented, sandy clay silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.
2.50	Slightly moist, khaki brown speckled white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

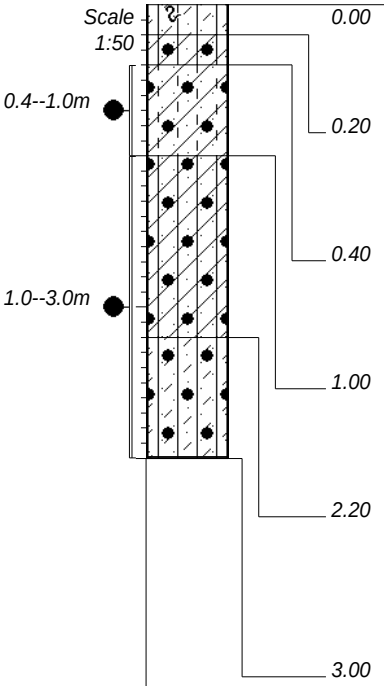
HOLE No: TP11

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Slightly moist, brown speckled yellow, soft, intact, clay sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.

Slightly moist, black, soft, slickensided, sandy silty clay with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.

Slightly moist, brown speckled yellow, firm, weakly cemented, sandy clay silt with ferricrete concresion. **Ferruginous Redisual Mudstone**.

Slightly moist, khaki brown speckled white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Calcareous Redisual Mudstone**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Disturbed soils samples taken at 0.4--1.0m & 1.0--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/07/29
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

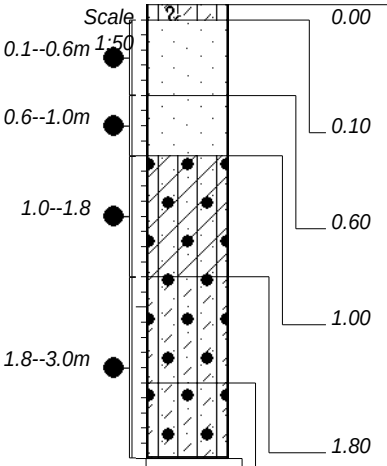
HOLE No: TP12

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Slightly moist, black mottled grey, loose, pinhole, sandy ASH. **Fill**.

Slightly moist, white speckled grey, loose, pinhole, sandy ASH. **Fill**.

Slightly moist, brown speckled yellow, soft, intact, clay sandy silt with subrounded fine ferricrete concretions. **Ferruginous Hillwash**.

Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

Slightly moist, khaki brown speckled white blotched yellow orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage encountered.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken 0.1--0.6m & 0.6--1.0m & 1.0--1.8 & 1.8--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

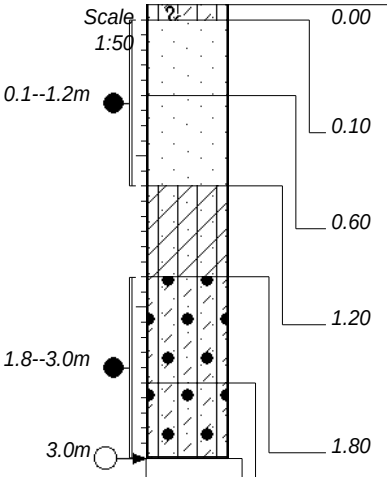
HOLE No: TP13

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP14
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.10	
	Slightly moist, black mottled grey, loose, pinhole, sandy ASH. **Fill**.
0.60	
	Slightly moist, white speckled grey, loose, pinhole, sandy ASH. **Fill**.
1.20	
	Slightly moist, brown speckled yellow, soft, intact, clay sandy silt with subangular bricks. **Fill**.
1.80	
	Moist, brown mottled orange, soft, clayey sandy silt with ferricrete concresion. **Hillwash**.
2.50	
	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) Groundwater seepage encountered at 3.0m.
3) Sidewalls unstable at 1.2-1.8m.
4) Disturbed soils samples taken 0.1--1.2m & 1.8--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

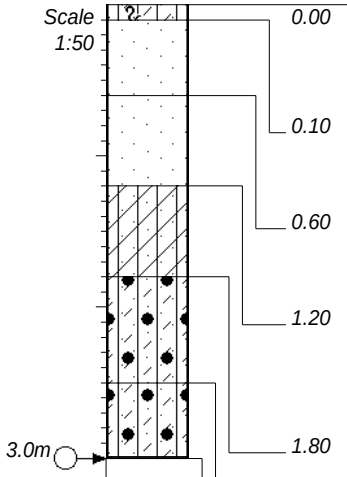
HOLE No: TP14

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP15
Sheet 1 of 1

JOB NUMBER: 000



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.10	Slightly moist, black mottled grey, loose, pinhole, sandy ASH. **Fill**.
0.60	Slightly moist, white speckled grey, loose, pinhole, sandy ASH. **Fill**.
1.20	Slightly moist, brown speckled yellow, soft, intact, clay sandy silt with subangular bricks. **Fill**.
1.80	Moist, brown mottled orange, soft, clayey sandy silt with ferricrete concresion. **Hillwash**.
2.50	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) Groundwater seepage encountered at 3.0m.
3) Sidewalls unstable at 1.2-1.8m.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP15

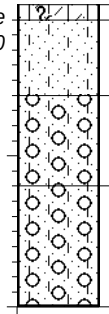
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP16
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.10	Slightly moist, black mottled yellow, loose, pinhole, silty sand. **Fill**.
0.60	Slightly moist, brown speckled yellow orange, loose to medium dense, pinhole, silty sand with scattered subrounded quartz gravel. **Fill**.
1.20	Slightly moist, white speckled grey, medium dense, pinhole, silty sand with scattered subrounded quartz gravel. **Fill**.
2.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Diffult excavationn of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

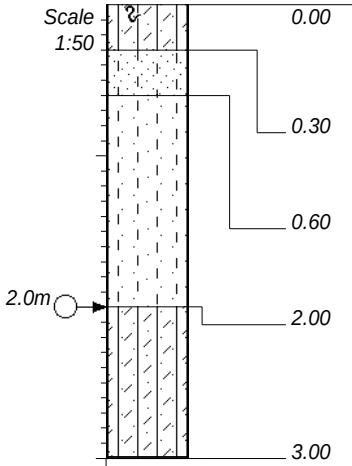
HOLE No: TP16

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP17
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 0.30: Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

0.30 – 0.60: Slightly moist, black, loose, pinhole, silty sand. **Fill**.

0.60 – 2.00: Moist, grey speckledwhite, loose, pinhole, silty sandy ash. **Fill**.

2.00 – 3.00: Very moist to wet, brown speckled grey, soft, sandy clayey silt. **Alluvium**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) Groundwater seepage at 2.0m.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

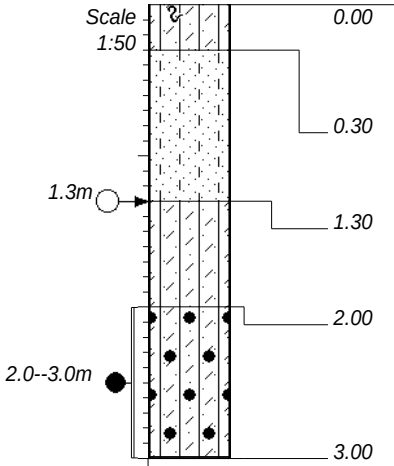
HOLE No: TP17

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP18
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Slightly moist, grey black, loose, pinhole, silty sand ash. **Fill**.

Very moist to wet, brown speckled grey, soft, sandy clayey silt. **Alluvium**.

Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) Groundwater seepage at 1.3m.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken 2.0--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

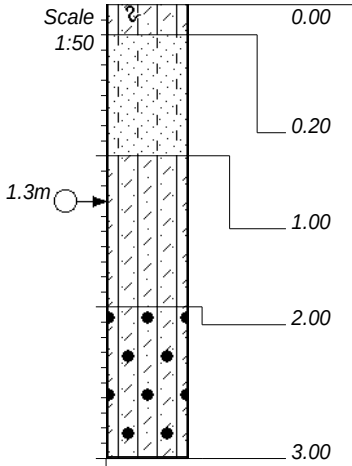
HOLE No: TP18

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP19
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Slightly moist, grey black, loose, pinhole, silty sand ash. **Fill**.

Very moist to wet, brown speckled grey, soft, sandy clayey silt. **Alluvium**.

Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) Groundwater seepage at 1.3m.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP19

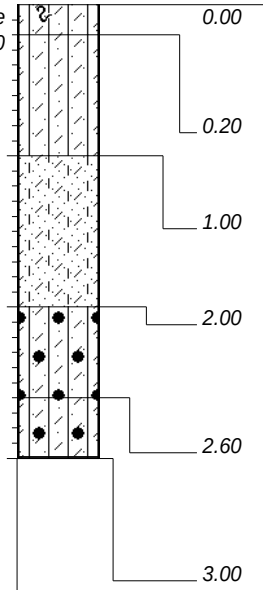
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP20
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	Moist, grey black, soft, pinhole, sandy clayey silt. **Alluvium**.
1.00	Moist, brown speckled grey, soft, silty clayey sand. **Alluvium**.
2.00	Moist, brown mottled orange, soft, clayey sandy silt with ferricrete concresion. **Hillwash**.
2.60	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:58
TEXT : ..PITS\RandWaterTP1120.txt

ELEVATION :
X-COORD :
Y-COORD :

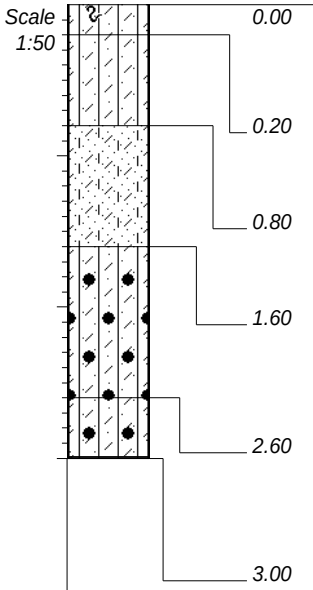
HOLE No: TP20

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP21
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Moist, grey black, soft, pinhole, sandy clayey silt. **Alluvium**.

Moist, brown speckled grey, soft, silty clayey sand. **Alluvium**.

Moist, brown mottled orange, soft, clayey sandy silt with ferricrete concresion. **Hillwash**.

Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

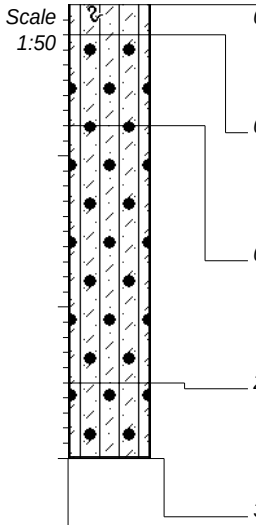
HOLE No: TP21

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP22
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Moist, brown mottled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.

Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

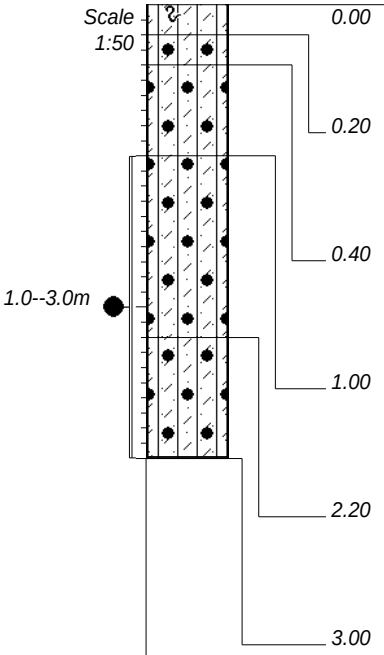
HOLE No: TP22

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP23
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Moist, brown speckled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
0.40	
	Moist, brown mottled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
1.00	
	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.20	
	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken at 1.0--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

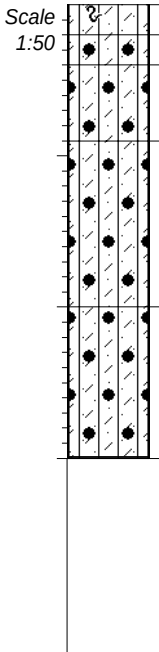
HOLE No: TP23

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP24
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Moist, brown speckled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
0.40	
	Moist, brown mottled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
0.90	
	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00	
	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP24

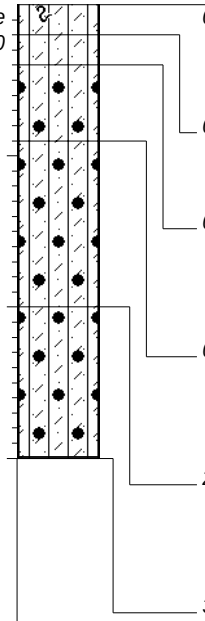
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP25
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.40	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
0.90	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP25

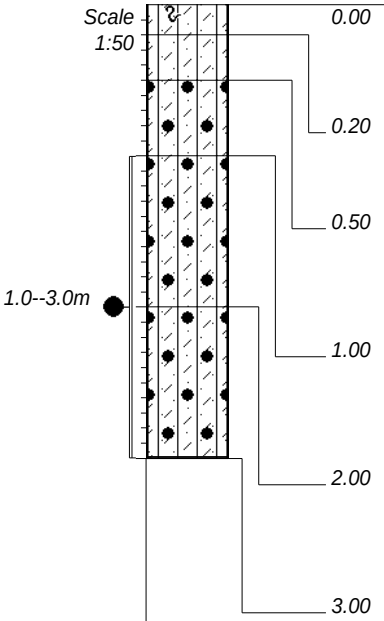
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP26
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00 – 0.20	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20 – 0.50	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.50 – 1.00	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
1.00 – 2.00	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00 – 3.00	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Disturbed soils samples taken at 1.0--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP26

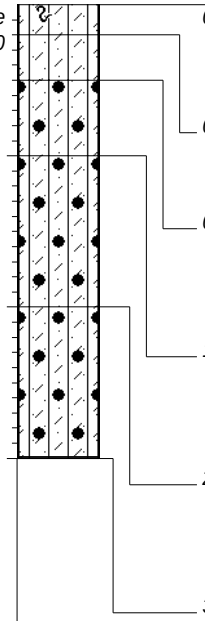
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP27
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.50	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
1.00	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

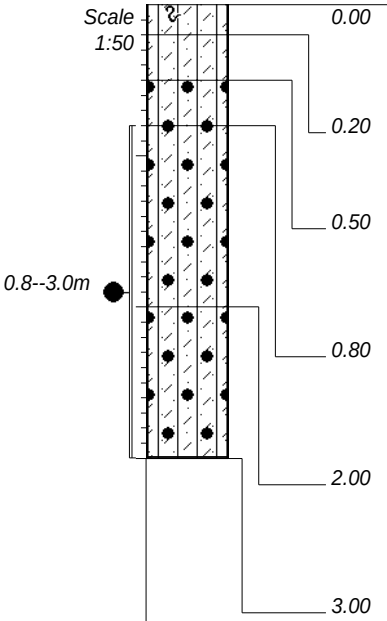
HOLE No: TP27

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 0.20	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20 – 0.50	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.50 – 0.80	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
0.80 – 2.00	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00 – 3.00	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken 0.8--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

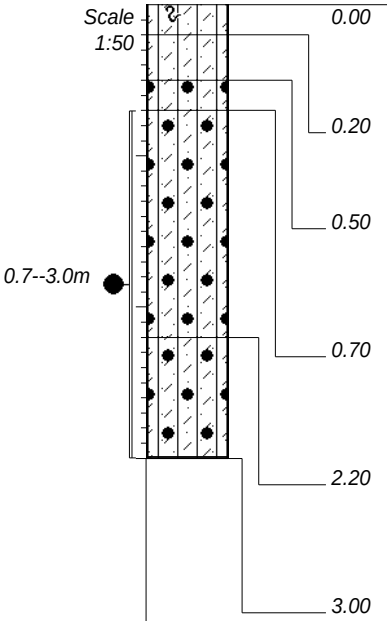
HOLE No: TP28

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP29
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Moist, black, soft, clayey sandy silt. **Alluvium**.

Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.

Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken 0.7--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

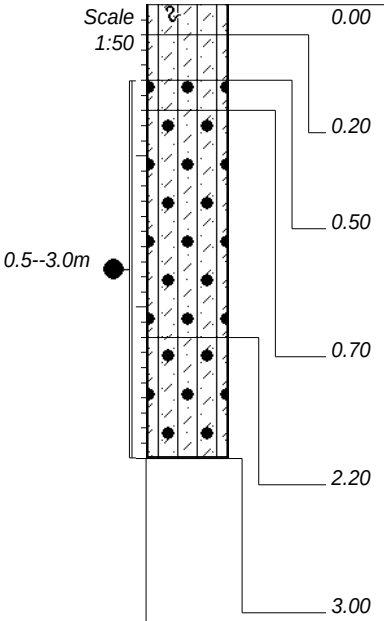
HOLE No: TP29

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP30
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Moist, black, soft, clayey sandy silt. **Alluvium**.
0.50	
	Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.
0.70	
	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.20	
	Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken 0.5--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 19:59
TEXT : ..PITS\RandwaterTP2130.txt

ELEVATION :
X-COORD :
Y-COORD :

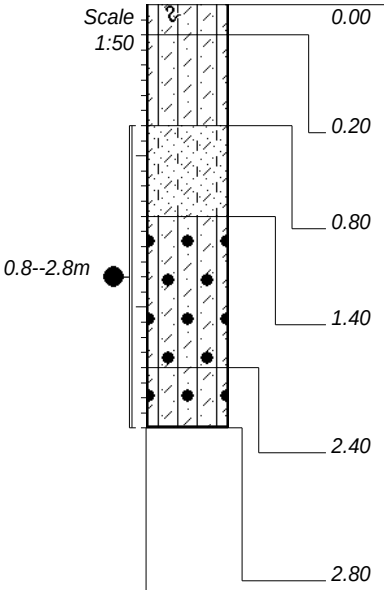
HOLE No: TP30

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP31
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Moist, grey black, soft, pinhole, sandy clayey silt. **Alluvium**.
0.80	
	Moist, brown speckled grey, soft, silty clayey sand. **Alluvium**.
1.40	
	Moist, brown mottled orange, soft, clayey sandy silt with ferricrete concresion. **Hillwash**.
2.40	
	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.80	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken at 0.8--2.8m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

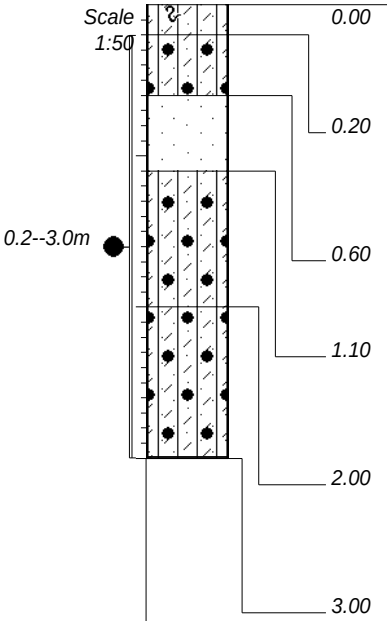
HOLE No: TP31

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP32
Sheet 1 of 1

JOB NUMBER: 000



0.00	
	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	
	Slightly moist, brown mottled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
0.60	
	Slihgly moist, white speckled grey, loose, pinhole, sandy ash. **Fill**.
1.10	
	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
2.00	
	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken at 0.2--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP32

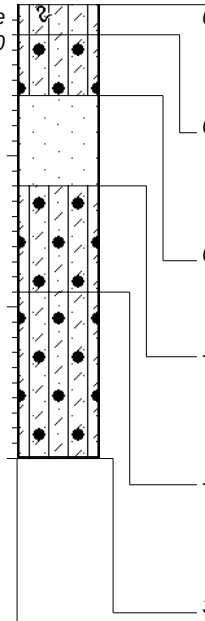
LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP33
Sheet 1 of 1

JOB NUMBER: 000

Scale 1:50



0.00	Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.
0.20	Slightly moist, brown mottled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.
0.60	Slihgly moist, white speckled grey, loose, pinhole, sandy ash. **Fill**.
1.20	Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
1.90	Slightly moist, brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.
3.00	

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) No soils samples taken.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

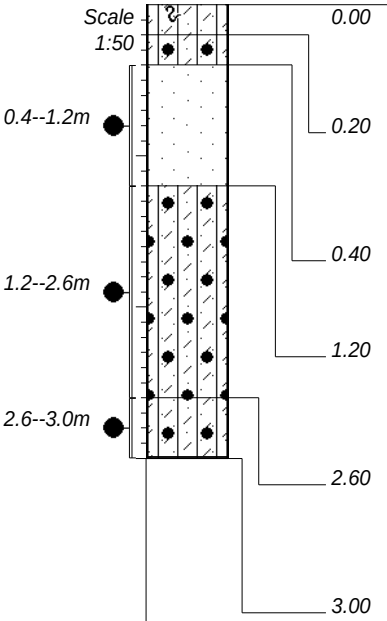
HOLE No: TP33

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP34
Sheet 1 of 1

JOB NUMBER: 000



Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

Moist, brown speckled orange, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Hillwash**.

Slihgly moist, white speckled grey, loose, pinhole, sandy ash. **Fill**.

Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Bulk and disturbed soils samples taken at 0.4--1.2m & 1.2--2.6m & 2.6--3.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

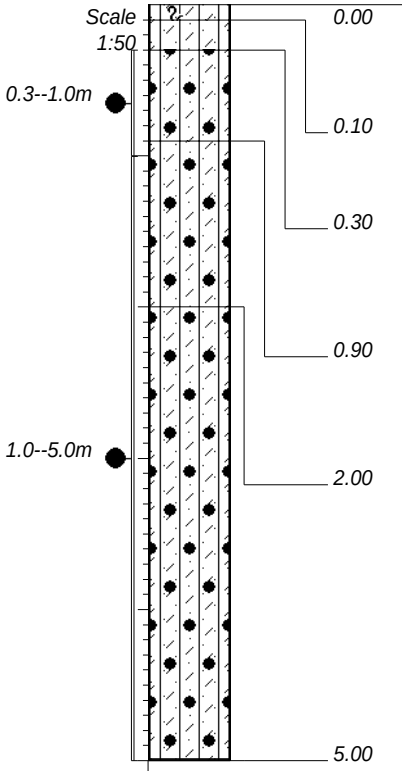
HOLE No: TP34

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

HOLE No: TP35
Sheet 1 of 1

JOB NUMBER: 000



0.00 – 0.10: Slightly moist, brown, firm, pinhole voided, clayey sandy silt with roots. **Topsoil**.

0.10 – 0.30: Moist, black, soft, clayey sandy silt. **Alluvium**.

0.30 – 0.90: Moist, black, soft, weakly cemented, clayey sandy silt with ferricrete concresion. **Alluvium**.

0.90 – 2.00: Slightly moist, khaki brown mottled orange, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

2.00 – 5.00: Slightly moist, khaki mottled olive, firm, weakly cemented, clayey sandy silt with ferricrete concresion. **Ferruginous Sandy Shale**.

NOTES

1) Tractor loader backhoe used for the excavations.
2) No groundwater seepage.
3) Sidewalls stable.
4) Disturbed soils samples taken at 0.3--1.0m & 1.0--5.0m.
5) Excavated to maximum reach of the machine.

CONTRACTOR :
MACHINE : TLB
DRILLED BY :
PROFILED BY : G. Rabodiba Pr.Sci.Nat
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : Trench
DATE :
DATE : 2016/08/07
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP35

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

WAX ENGINEERING (PTY) LTD
RANDWATER PROJECT: B19 SLUDGE PIPELINE
PHASE 2 ZUIKERBOSCH-VEREENIGING

LEGEND
Sheet 1 of 1

JOB NUMBER: 000

	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAYEY	{SA09}
	FERRICRETE	{SA24}
Name ●	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}

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

INCLINATION :
DIAM :
DATE :
DATE :
DATE : 27/09/2016 20:00
TEXT : ..PITS\RandwaterTP3135.txt

ELEVATION :
X-COORD :
Y-COORD :

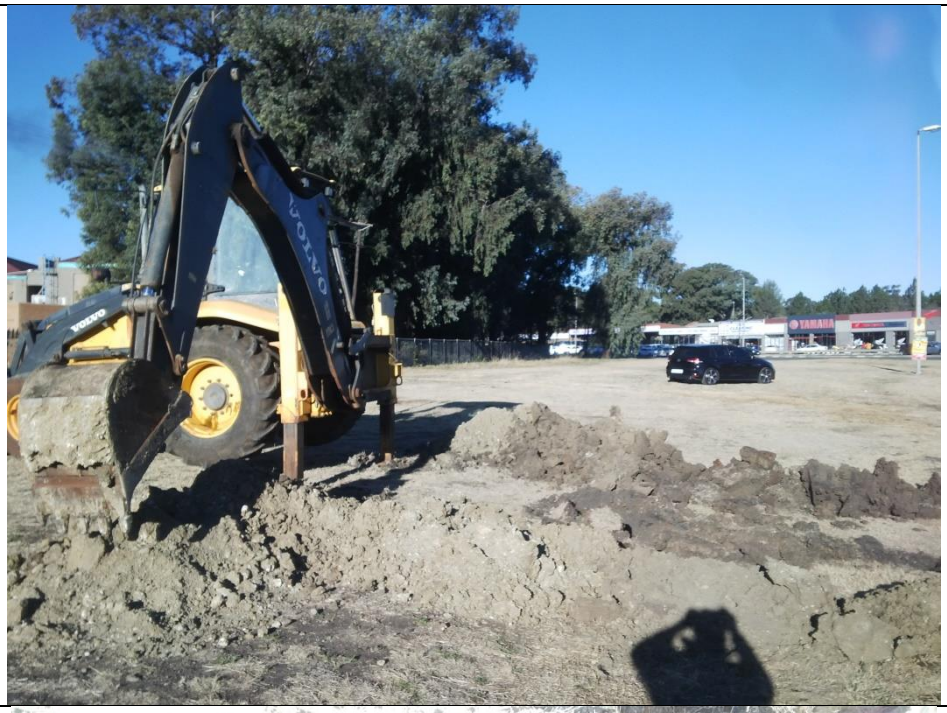
LEGEND
SUMMARY OF SYMBOLS

ANNEXURE C

TEST PITS PHOTOGRAPHS

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP 1


TP 1

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP2


TP2

TP3

TP3

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP4


TP4

TP5


TP5

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TP6

TP6

TP7

TP7

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP8

TP8

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP9


TP9

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP10


TP10

TP 11

TP 11

TP12

TP12

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP13


TP13

TP14

TP14

TP15

TP15

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP16

TP16

LILIBARA PROJECTS (PTY) LTD
CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP17


TP17

TP18

TP18

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP19

TP19

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP20


TP20

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP 21

TP 21

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP22

TP22

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP23

TP23

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP24

TP24

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

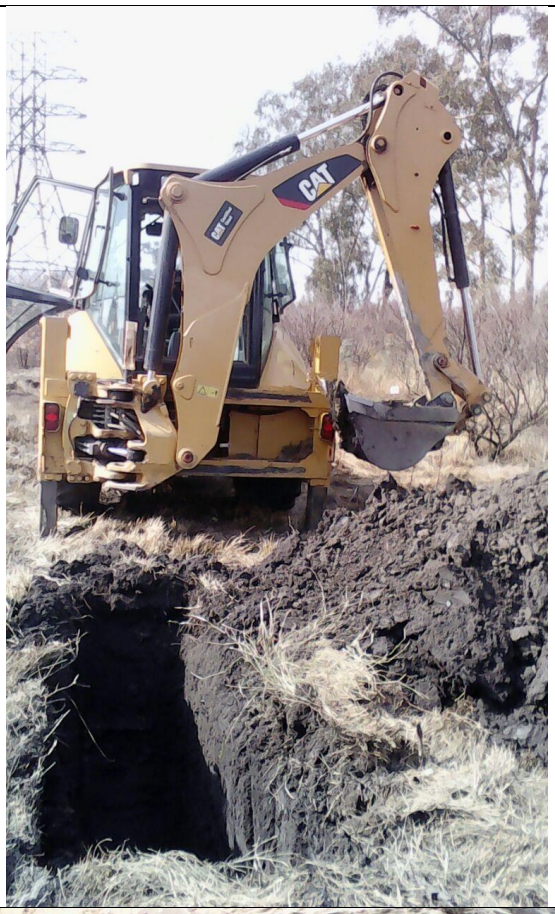
TP25

TP25

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP26



TP26

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP27

TP27

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP28

TP28

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP29

TP29

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP30

TP30

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP 31

TP 31

TP32

TP32

TP33

TP33

LILIBARA PROJECTS (PTY) LTD

CIVIL ENGINEERING CONSULTANTS AND PROJECT MANAGERS

TP34

TP34

TP35

TP35

ANNEXURE D

LABORATORY TEST RESULTS

T0023

GEOSTRADA
engineering materials laboratory

FOUNDATION INDICATOR TEST RESULTS - REP COM 7

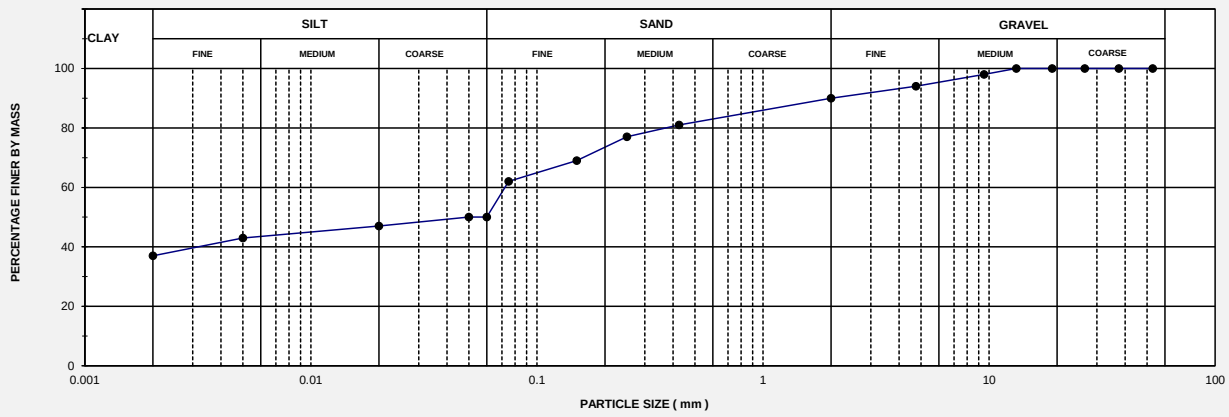
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7724**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP1**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.5 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**Black speckled khakhi brown sandy silty**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**81**
63.0	**100**	0.250	**77**
53.0	**100**	0.150	**69**
37.5	**100**	0.075	**62**
26.5	**100**	0.060	**50**
19.0	**100**	0.050	**50**
13.2	**100**	0.020	**47**
9.5	**98**	0.005	**43**
4.75	**94**	0.002	**37**
2.00	**90**		

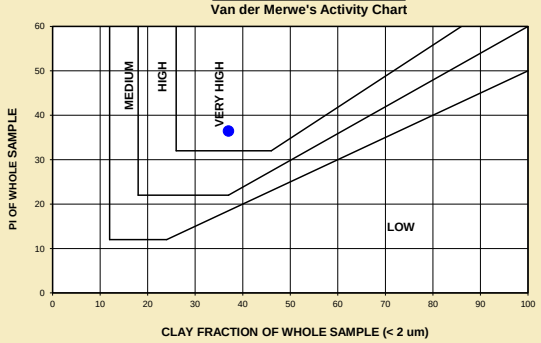
ATTERBERG LIMITS		
Liquid Limit	(%)	**67**
Plastic Limit	(%)	**22**
Plasticity Index	(%)	**45**
Weighted PI	(%)	**36.5**
Linear Shrinkage	(%)	**12.0**
Grading Modulus		**0.67**
Uniformity coefficient		**36**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**10**
% Sand	**40**
% Silt	**13**
% Clay	**37**
Activity	**1.2**
% Soil Mortar	**90**
Coarse Sand Ratio	**0.10**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

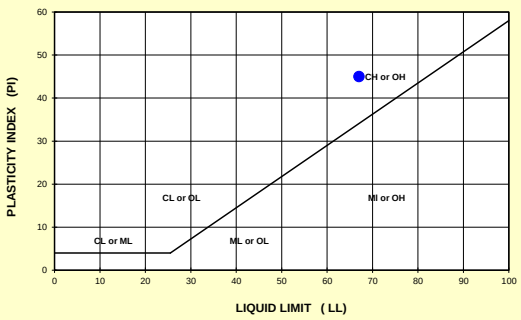
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

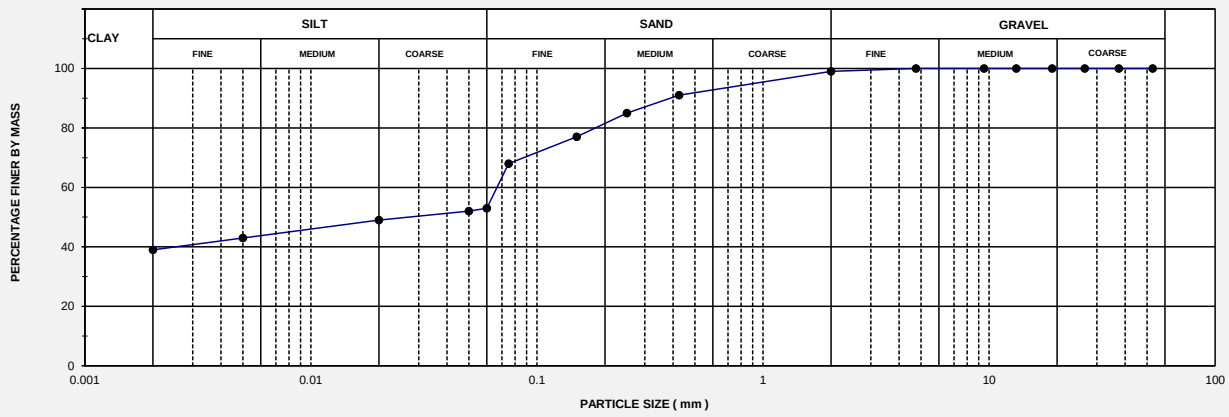
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7723**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP1**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.15 - 0.5**	**Section:**		**Client Ref No:**	
Description:	**Black sandy silty clay (Hillwash)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**91**
63.0	**100**	0.250	**85**
53.0	**100**	0.150	**77**
37.5	**100**	0.075	**68**
26.5	**100**	0.060	**53**
19.0	**100**	0.050	**52**
13.2	**100**	0.020	**49**
9.5	**100**	0.005	**43**
4.75	**100**	0.002	**39**
2.00	**99**		

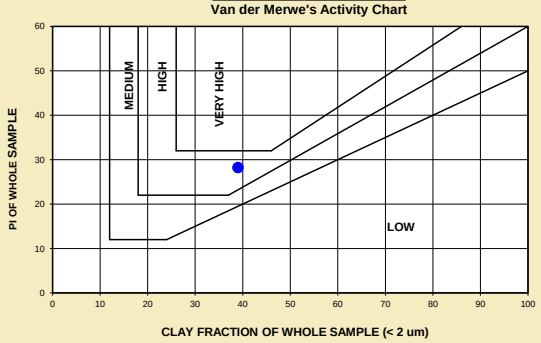
ATTERBERG LIMITS		
Liquid Limit	(%)	**52**
Plastic Limit	(%)	**21**
Plasticity Index	(%)	**31**
Weighted PI	(%)	**28.2**
Linear Shrinkage	(%)	**11.0**
Grading Modulus		**0.42**
Uniformity coefficient		**34**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**1**
% Sand	**46**
% Silt	**14**
% Clay	**39**
Activity	**0.8**
% Soil Mortar	**99**
Coarse Sand Ratio	**0.08**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

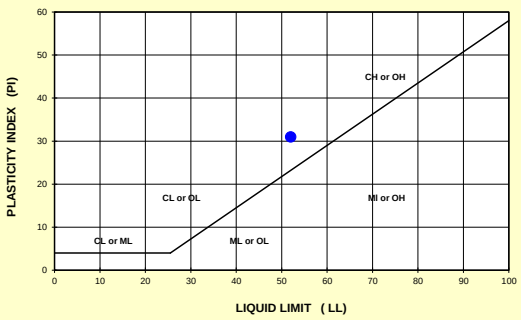
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

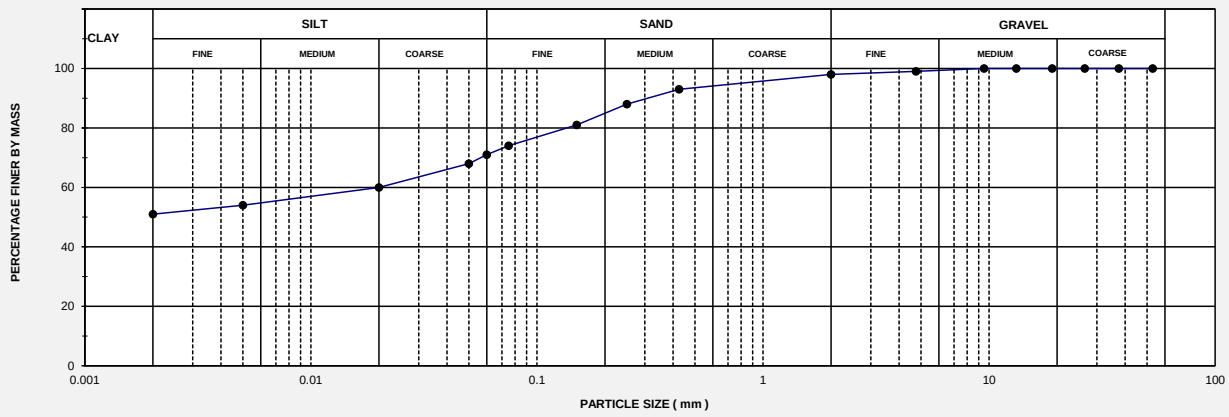
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7725**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP1**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.0 - 2.2**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white sandy cla**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**93**
63.0	**100**	0.250	**88**
53.0	**100**	0.150	**81**
37.5	**100**	0.075	**74**
26.5	**100**	0.060	**71**
19.0	**100**	0.050	**68**
13.2	**100**	0.020	**60**
9.5	**100**	0.005	**54**
4.75	**99**	0.002	**51**
2.00	**98**		

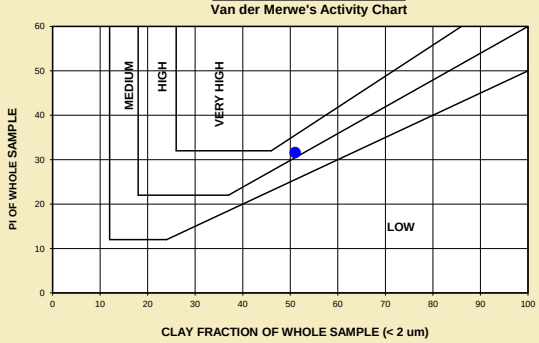
ATTERBERG LIMITS		
Liquid Limit	(%)	**60**
Plastic Limit	(%)	**26**
Plasticity Index	(%)	**34**
Weighted PI	(%)	**31.6**
Linear Shrinkage	(%)	**15.5**
Grading Modulus		**0.35**
Uniformity coefficient		**10**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**2**
% Sand	**27**
% Silt	**20**
% Clay	**51**
Activity	**0.7**
% Soil Mortar	**98**
Coarse Sand Ratio	**0.05**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

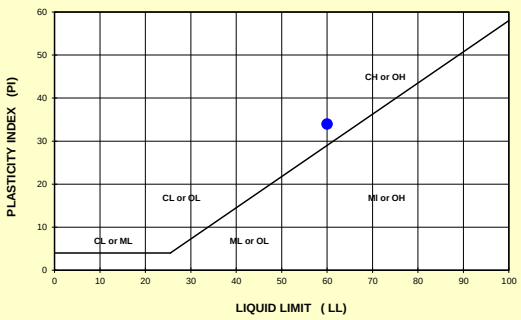
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

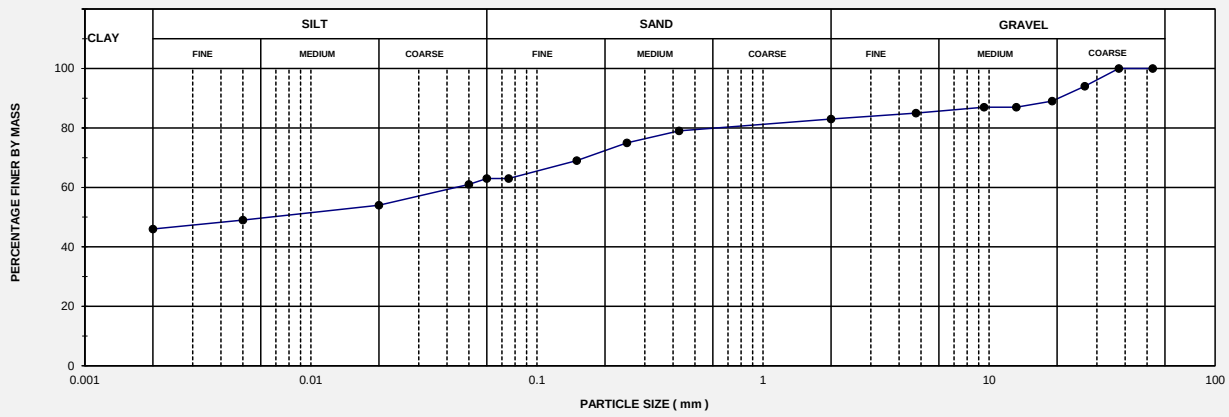
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7726**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP1**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**2.2 - 2.6**	**Section:**		**Client Ref No:**	
Description:	**Khakhi mottled grey & orange sandy clay**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**79**
63.0	**100**	0.250	**75**
53.0	**100**	0.150	**69**
37.5	**100**	0.075	**63**
26.5	**94**	0.060	**63**
19.0	**89**	0.050	**61**
13.2	**87**	0.020	**54**
9.5	**87**	0.005	**49**
4.75	**85**	0.002	**46**
2.00	**83**		

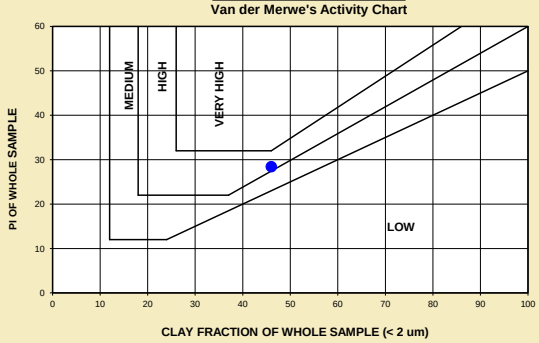
ATTERBERG LIMITS		
Liquid Limit	(%)	**62**
Plastic Limit	(%)	**26**
Plasticity Index	(%)	**36**
Weighted PI	(%)	**28.4**
Linear Shrinkage	(%)	**15.5**
Grading Modulus		**0.75**
Uniformity coefficient		**23**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**17**
% Sand	**20**
% Silt	**17**
% Clay	**46**
Activity	**0.8**
% Soil Mortar	**83**
Coarse Sand Ratio	**0.05**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

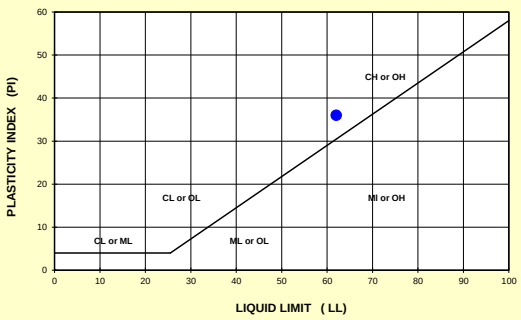
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7728**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP4**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.1 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**Grey speckled white silty sand ASH (Fill)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**44**
63.0	**100**	0.250	**40**
53.0	**100**	0.150	**32**
37.5	**100**	0.075	**25**
26.5	**100**	0.060	**23**
19.0	**96**	0.050	**22**
13.2	**92**	0.020	**19**
9.5	**90**	0.005	**7**
4.75	**78**	0.002	**3**
2.00	**64**		

ATTERBERG LIMITS

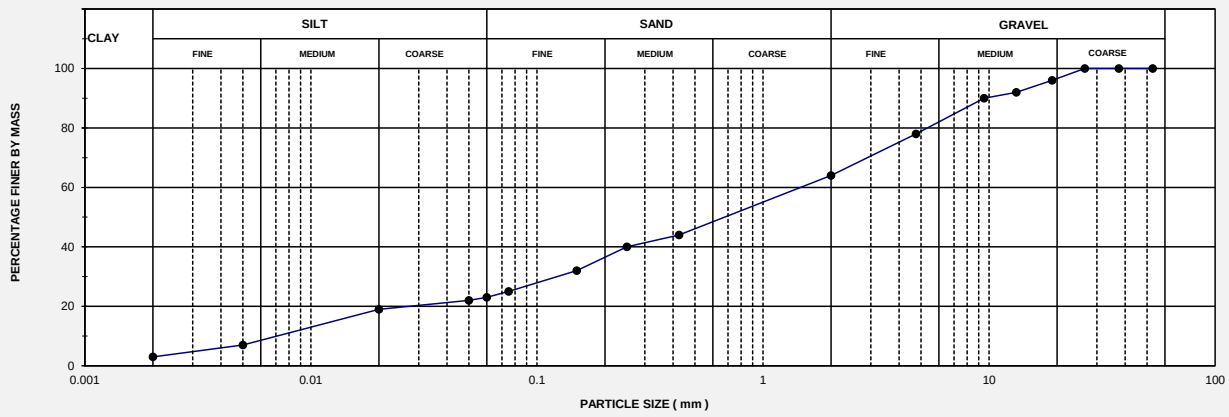
Liquid Limit	(%)	**36**
Plastic Limit	(%)	**30**
Plasticity Index	(%)	**6**
Weighted PI	(%)	**2.6**
Linear Shrinkage	(%)	**2.0**
Grading Modulus		**1.67**
Uniformity coefficient		**157**
Coefficient of curvature		**0.9**

Remarks:

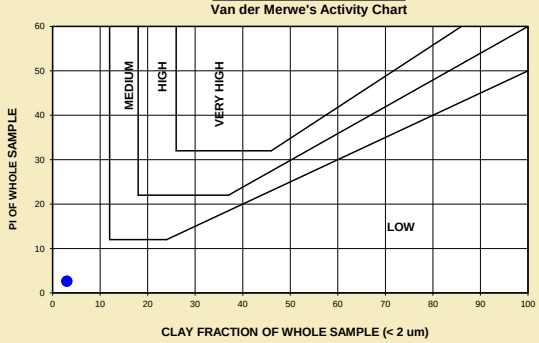
SOIL CLASSIFICATION

% Gravel	**36**
% Sand	**41**
% Silt	**20**
% Clay	**3**
Activity	**2.0**
% Soil Mortar	**64**
Coarse Sand Ratio	**0.31**
TRB Classification	**A - 1 - b**
Unified Classification	**SM**

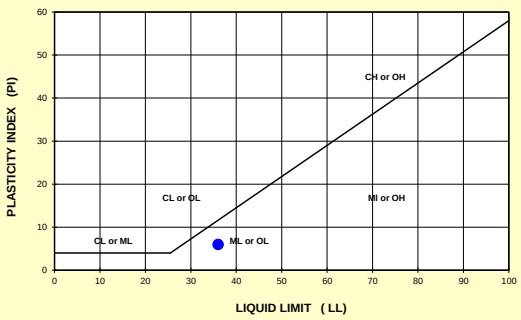
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

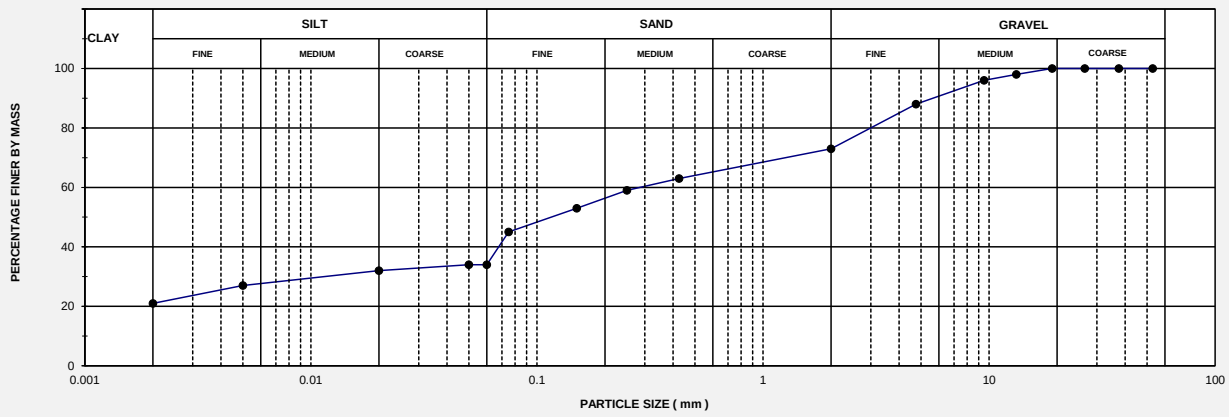
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7729**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP5**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**2.2 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Red blotched black sandy silty clay (Resi**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**63**
63.0	**100**	0.250	**59**
53.0	**100**	0.150	**53**
37.5	**100**	0.075	**45**
26.5	**100**	0.060	**34**
19.0	**100**	0.050	**34**
13.2	**98**	0.020	**32**
9.5	**96**	0.005	**27**
4.75	**88**	0.002	**21**
2.00	**73**		

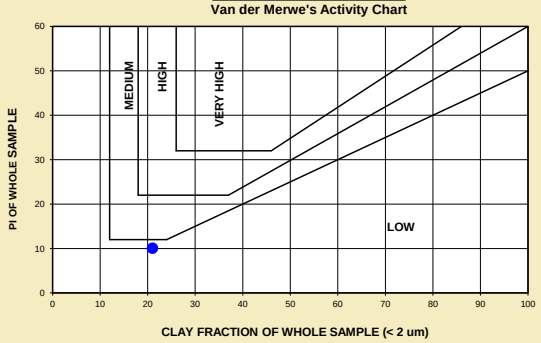
ATTERBERG LIMITS		
Liquid Limit	(%)	**35**
Plastic Limit	(%)	**19**
Plasticity Index	(%)	**16**
Weighted PI	(%)	**10.1**
Linear Shrinkage	(%)	**8.5**
Grading Modulus		**1.19**
Uniformity coefficient		**147**
Coefficient of curvature		**0.4**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**27**
% Sand	**39**
% Silt	**13**
% Clay	**21**
Activity	**0.8**
% Soil Mortar	**73**
Coarse Sand Ratio	**0.14**
TRB Classification	**A - 6**
Unified Classification	**SC**

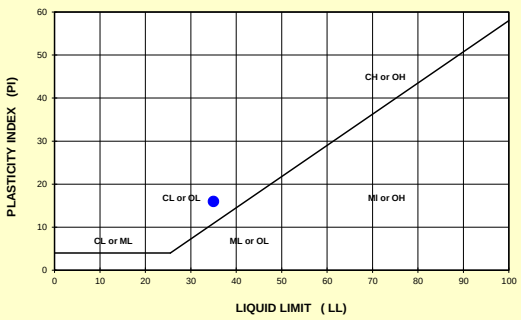
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

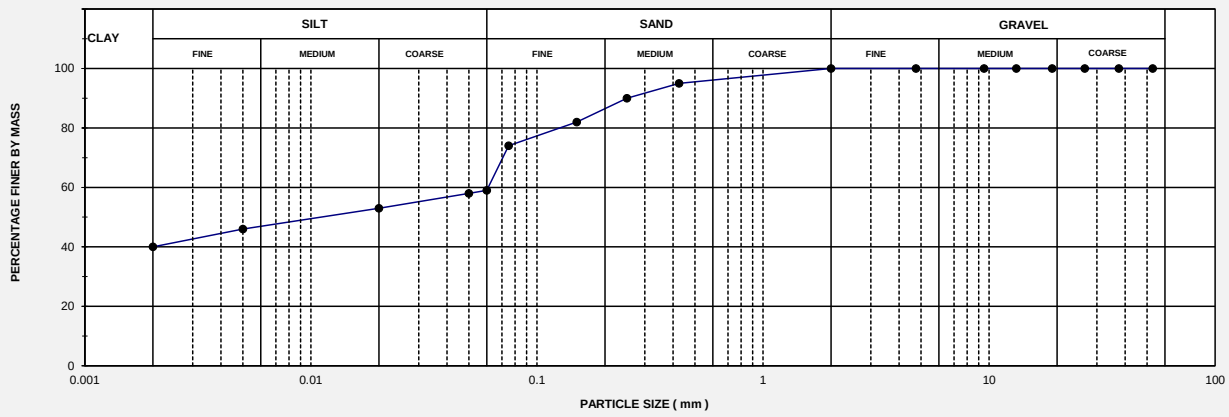
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7730**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP7**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.2 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**Black speckled khakhi brown sandy silty**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**95**
63.0	**100**	0.250	**90**
53.0	**100**	0.150	**82**
37.5	**100**	0.075	**74**
26.5	**100**	0.060	**59**
19.0	**100**	0.050	**58**
13.2	**100**	0.020	**53**
9.5	**100**	0.005	**46**
4.75	**100**	0.002	**40**
2.00	**100**		

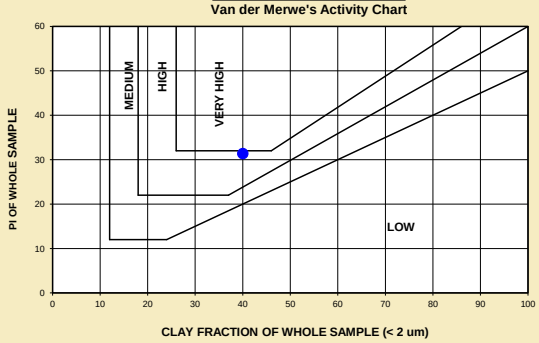
ATTERBERG LIMITS		
Liquid Limit	(%)	**54**
Plastic Limit	(%)	**21**
Plasticity Index	(%)	**33**
Weighted PI	(%)	**31.4**
Linear Shrinkage	(%)	**13.0**
Grading Modulus		**0.31**
Uniformity coefficient		**31**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**0**
% Sand	**41**
% Silt	**19**
% Clay	**40**
Activity	**0.8**
% Soil Mortar	**100**
Coarse Sand Ratio	**0.05**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

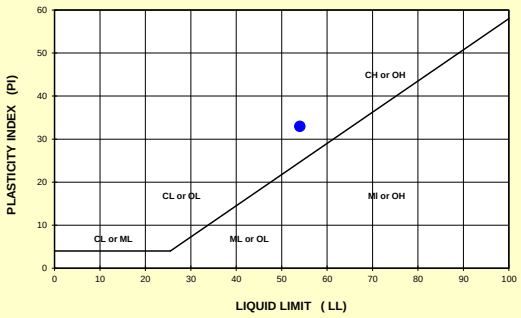
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

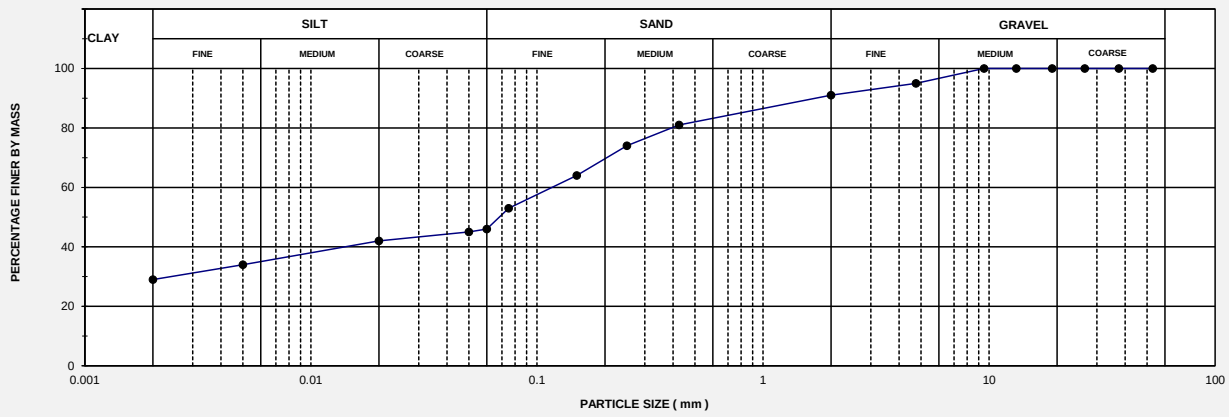
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7731**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP10**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.2 - 1.2**	**Section:**		**Client Ref No:**	
Description:	**Orange yellow speckles silty sand ferricr**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**81**
63.0	**100**	0.250	**74**
53.0	**100**	0.150	**64**
37.5	**100**	0.075	**53**
26.5	**100**	0.060	**46**
19.0	**100**	0.050	**45**
13.2	**100**	0.020	**42**
9.5	**100**	0.005	**34**
4.75	**95**	0.002	**29**
2.00	**91**		

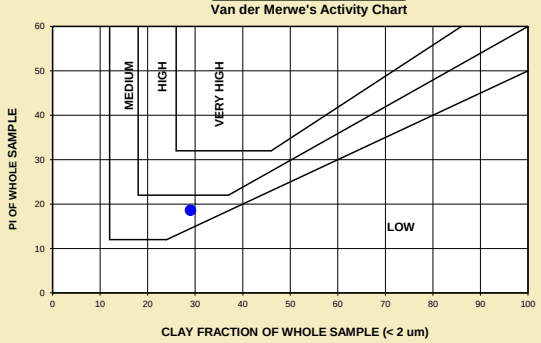
ATTERBERG LIMITS		
Liquid Limit (%)		**41**
Plastic Limit (%)		**18**
Plasticity Index (%)		**23**
Weighted PI (%)		**18.6**
Linear Shrinkage (%)		**10.0**
Grading Modulus		**0.75**
Uniformity coefficient		**61**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**9**
% Sand	**45**
% Silt	**17**
% Clay	**29**
Activity	**0.8**
% Soil Mortar	**91**
Coarse Sand Ratio	**0.11**
TRB Classification	**A - 7 - 6**
Unified Classification	**CL**

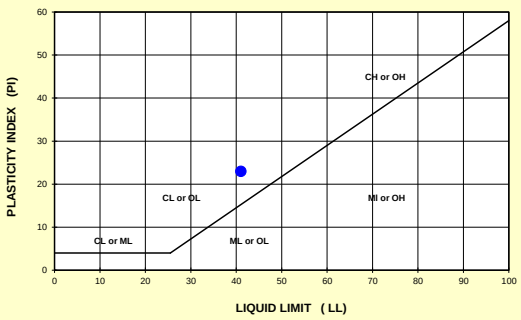
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

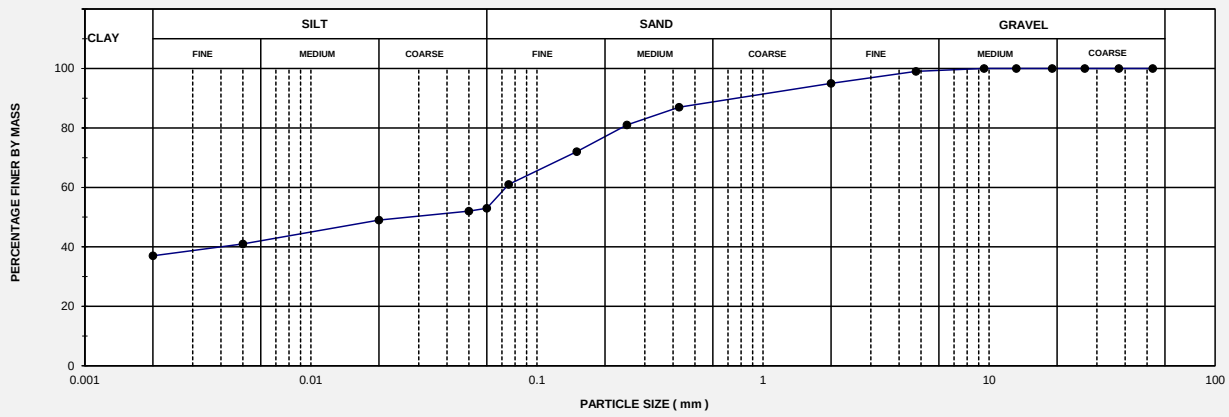
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7732**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP10**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.2 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white mottled g**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**87**
63.0	**100**	0.250	**81**
53.0	**100**	0.150	**72**
37.5	**100**	0.075	**61**
26.5	**100**	0.060	**53**
19.0	**100**	0.050	**52**
13.2	**100**	0.020	**49**
9.5	**100**	0.005	**41**
4.75	**99**	0.002	**37**
2.00	**95**		

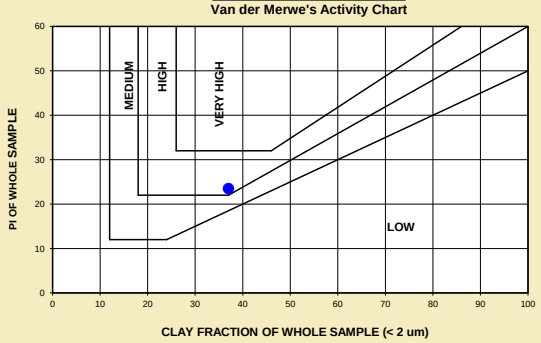
ATTERBERG LIMITS		
Liquid Limit	(%)	**45**
Plastic Limit	(%)	**18**
Plasticity Index	(%)	**27**
Weighted PI	(%)	**23.5**
Linear Shrinkage	(%)	**11.0**
Grading Modulus		**0.57**
Uniformity coefficient		**37**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**5**
% Sand	**42**
% Silt	**16**
% Clay	**37**
Activity	**0.7**
% Soil Mortar	**95**
Coarse Sand Ratio	**0.08**
TRB Classification	**A - 7 - 6**
Unified Classification	**CL**

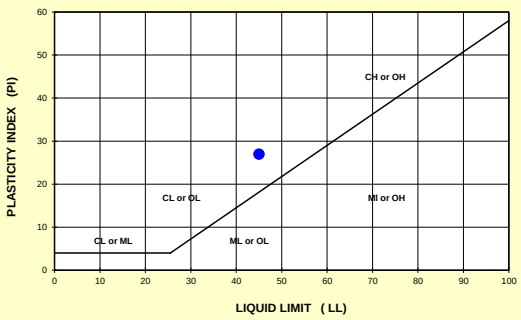
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

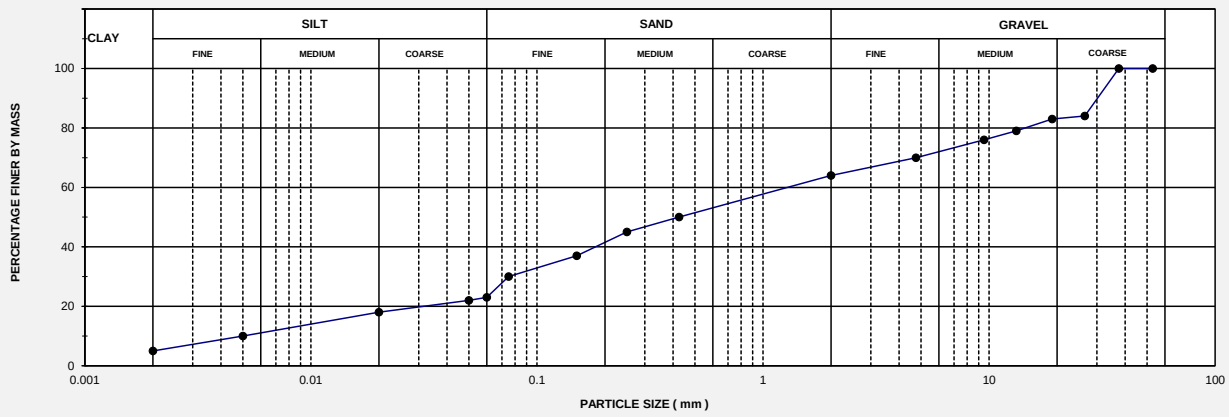
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7733**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP13**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.1 - 0.6**	**Section:**		**Client Ref No:**	
Description:	**Dark grey silty sand ASH (Fill)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**50**
63.0	**100**	0.250	**45**
53.0	**100**	0.150	**37**
37.5	**100**	0.075	**30**
26.5	**84**	0.060	**23**
19.0	**83**	0.050	**22**
13.2	**79**	0.020	**18**
9.5	**76**	0.005	**10**
4.75	**70**	0.002	**5**
2.00	**64**		

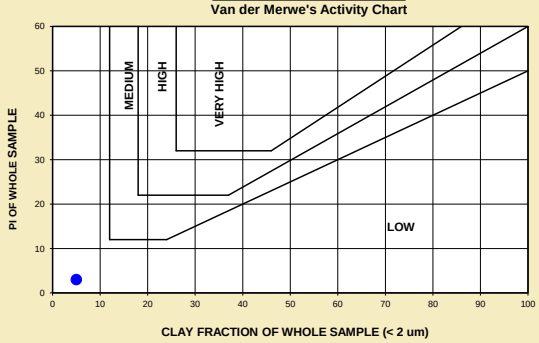
ATTERBERG LIMITS		
Liquid Limit	(%)	**37**
Plastic Limit	(%)	**31**
Plasticity Index	(%)	**6**
Weighted PI	(%)	**3.0**
Linear Shrinkage	(%)	**3.5**
Grading Modulus		**1.56**
Uniformity coefficient		**221**
Coefficient of curvature		**0.5**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**36**
% Sand	**41**
% Silt	**18**
% Clay	**5**
Activity	**1.2**
% Soil Mortar	**64**
Coarse Sand Ratio	**0.22**
TRB Classification	**A - 2 - 4**
Unified Classification	**SM**

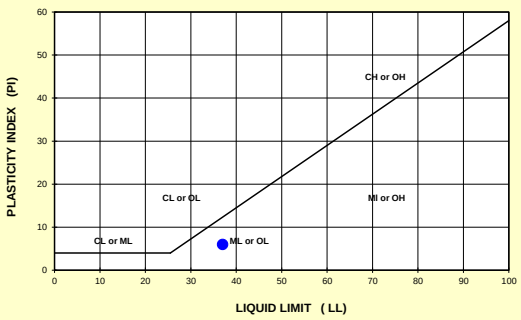
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7734**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP13**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.6 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**White speckled grey ASH (Fill)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**51**
63.0	**100**	0.250	**41**
53.0	**100**	0.150	**33**
37.5	**100**	0.075	**26**
26.5	**100**	0.060	**23**
19.0	**92**	0.050	**22**
13.2	**87**	0.020	**19**
9.5	**85**	0.005	**13**
4.75	**81**	0.002	**5**
2.00	**76**		

ATTERBERG LIMITS

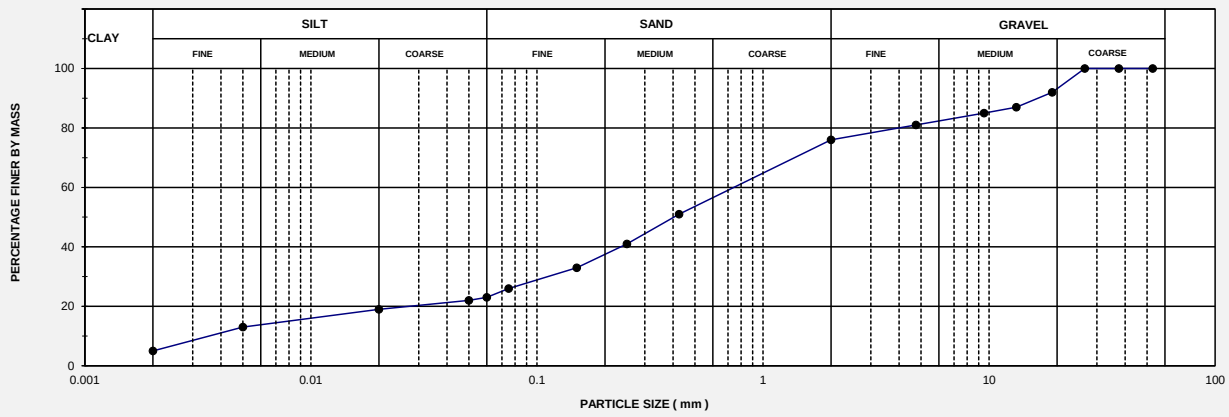
Liquid Limit	(%)	**33**
Plastic Limit	(%)	**25**
Plasticity Index	(%)	**8**
Weighted PI	(%)	**4.1**
Linear Shrinkage	(%)	**3.5**
Grading Modulus		**1.47**
Uniformity coefficient		**256**
Coefficient of curvature		**3.7**

Remarks:

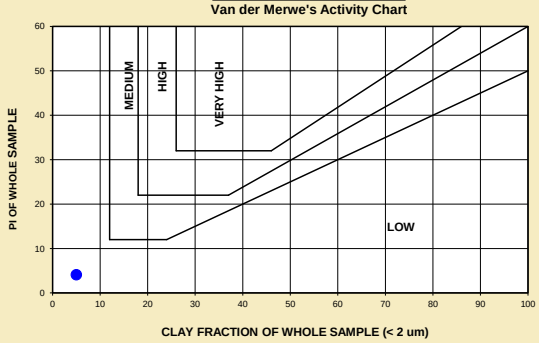
SOIL CLASSIFICATION

% Gravel	**24**
% Sand	**53**
% Silt	**18**
% Clay	**5**
Activity	**1.6**
% Soil Mortar	**76**
Coarse Sand Ratio	**0.33**
TRB Classification	**A - 2 - 4**
Unified Classification	**SM**

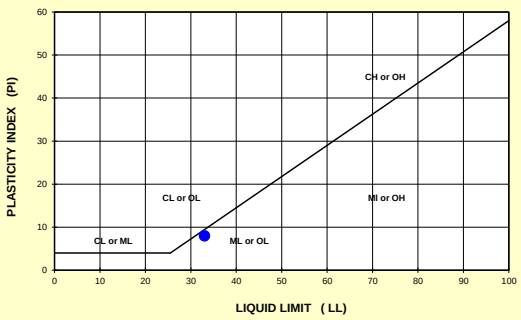
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

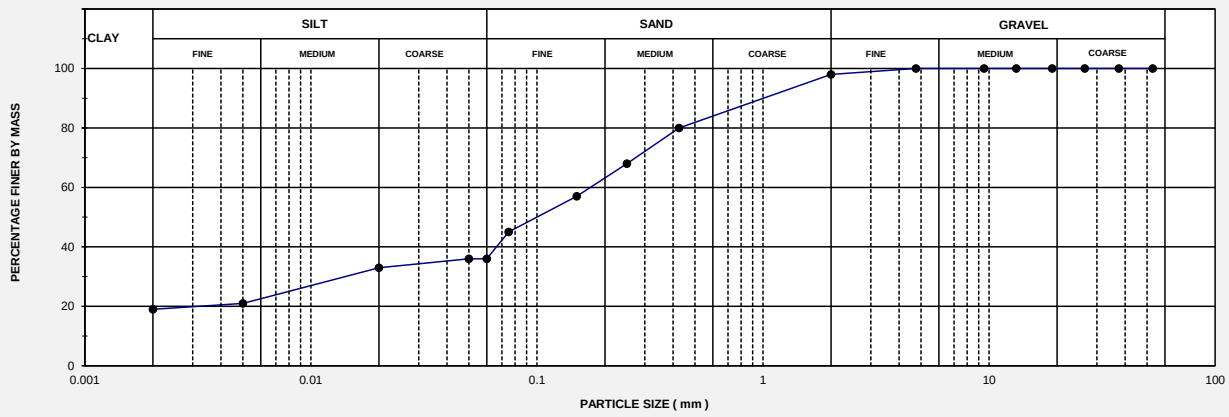
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7735**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP13**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.0 - 1.8**	**Section:**		**Client Ref No:**	
Description:	**Dark brown speckled yellow clayey silty s**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**80**
63.0	**100**	0.250	**68**
53.0	**100**	0.150	**57**
37.5	**100**	0.075	**45**
26.5	**100**	0.060	**36**
19.0	**100**	0.050	**36**
13.2	**100**	0.020	**33**
9.5	**100**	0.005	**21**
4.75	**100**	0.002	**19**
2.00	**98**		

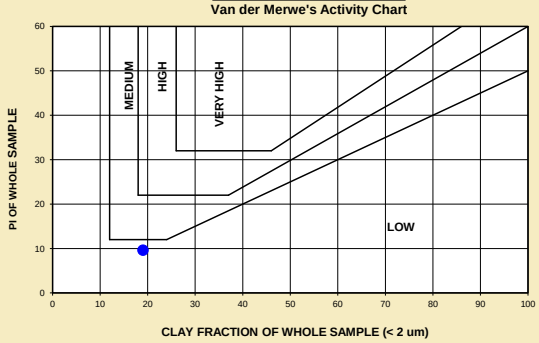
ATTERBERG LIMITS		
Liquid Limit (%)		**26**
Plastic Limit (%)		**14**
Plasticity Index (%)		**12**
Weighted PI (%)		**9.6**
Linear Shrinkage (%)		**5.5**
Grading Modulus		**0.77**
Uniformity coefficient		**89**
Coefficient of curvature		**0.9**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**2**
% Sand	**62**
% Silt	**17**
% Clay	**19**
Activity	**0.6**
% Soil Mortar	**98**
Coarse Sand Ratio	**0.18**
TRB Classification	**A - 6**
Unified Classification	**SC**

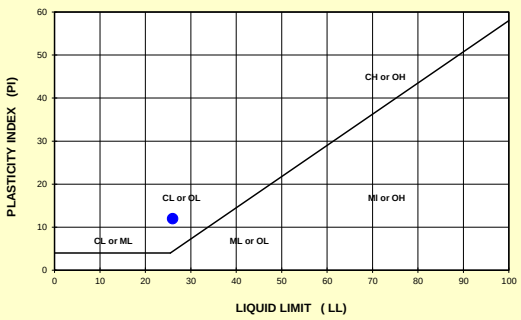
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

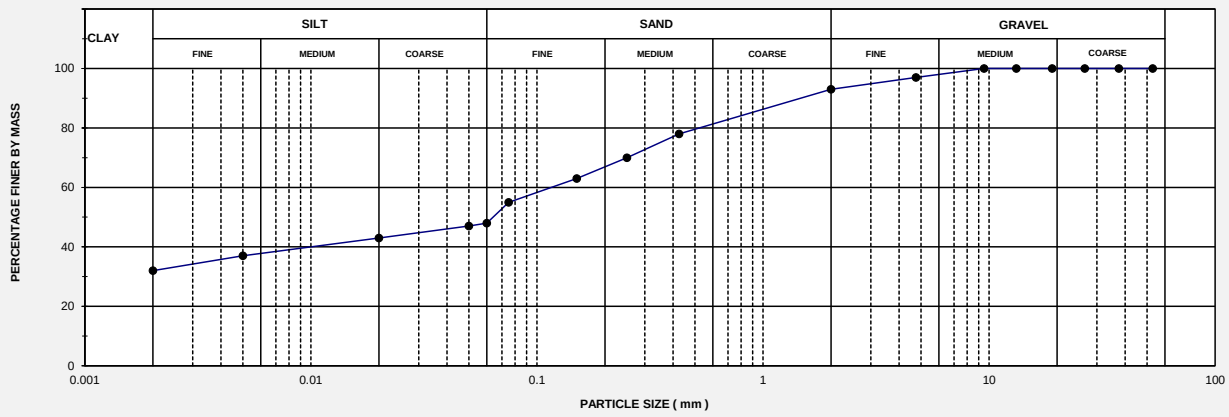
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7736**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP13**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.8 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Yellow speckled black grey clayey silty sa**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**78**
63.0	**100**	0.250	**70**
53.0	**100**	0.150	**63**
37.5	**100**	0.075	**55**
26.5	**100**	0.060	**48**
19.0	**100**	0.050	**47**
13.2	**100**	0.020	**43**
9.5	**100**	0.005	**37**
4.75	**97**	0.002	**32**
2.00	**93**		

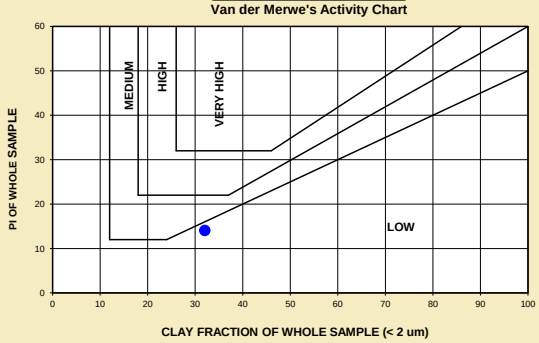
ATTERBERG LIMITS		
Liquid Limit	(%)	**36**
Plastic Limit	(%)	**18**
Plasticity Index	(%)	**18**
Weighted PI	(%)	**14.0**
Linear Shrinkage	(%)	**8.0**
Grading Modulus		**0.74**
Uniformity coefficient		**61**
Coefficient of curvature		**0.0**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**7**
% Sand	**45**
% Silt	**16**
% Clay	**32**
Activity	**0.6**
% Soil Mortar	**93**
Coarse Sand Ratio	**0.16**
TRB Classification	**A - 6**
Unified Classification	**CL**

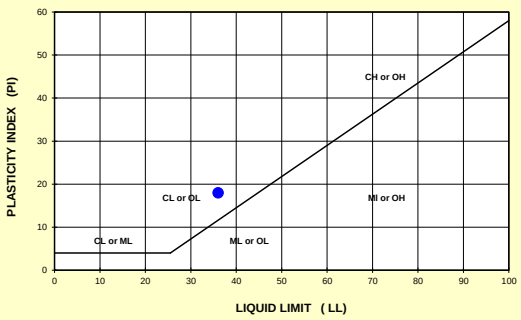
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7737**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP14**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.1 - 1.2**	**Section:**		**Client Ref No:**	
Description:	**Grey speckled white silty sand ASH (Fill)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**32**
63.0	**100**	0.250	**28**
53.0	**100**	0.150	**22**
37.5	**100**	0.075	**18**
26.5	**96**	0.060	**14**
19.0	**89**	0.050	**13**
13.2	**80**	0.020	**11**
9.5	**72**	0.005	**6**
4.75	**58**	0.002	**3**
2.00	**47**		

ATTERBERG LIMITS

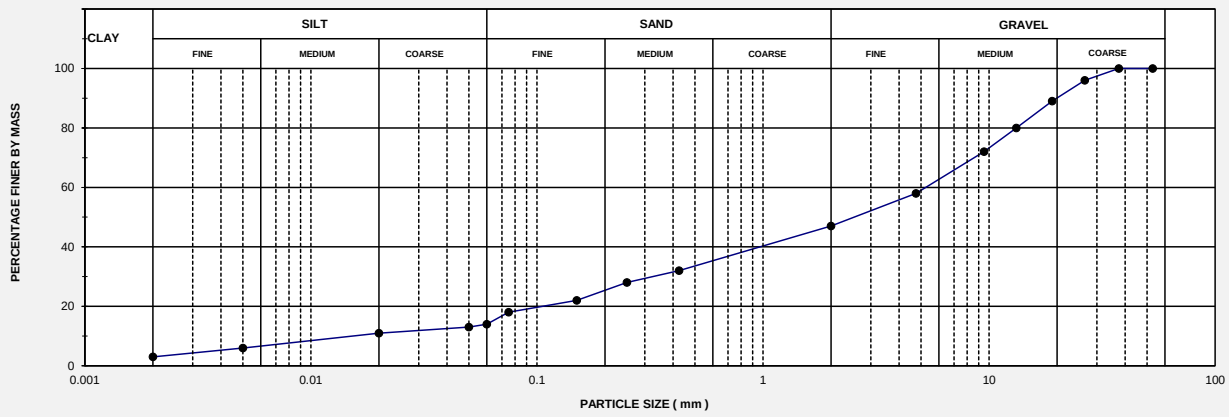
Liquid Limit	(%)	**38**
Plastic Limit	(%)	**35**
Plasticity Index	(%)	**3**
Weighted PI	(%)	**1.0**
Linear Shrinkage	(%)	**1.5**
Grading Modulus		**2.03**
Uniformity coefficient		**286**
Coefficient of curvature		**1.1**

Remarks:

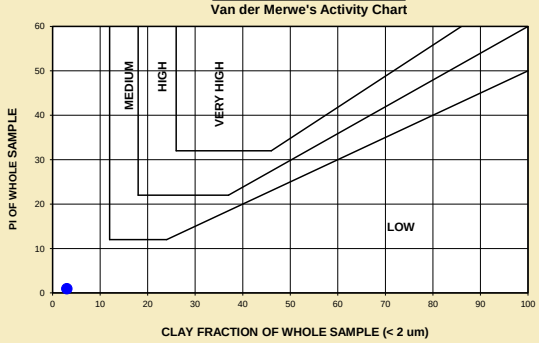
SOIL CLASSIFICATION

% Gravel	**53**
% Sand	**33**
% Silt	**11**
% Clay	**3**
Activity	**1.0**
% Soil Mortar	**47**
Coarse Sand Ratio	**0.32**
TRB Classification	**A - 1 - b**
Unified Classification	**GM**

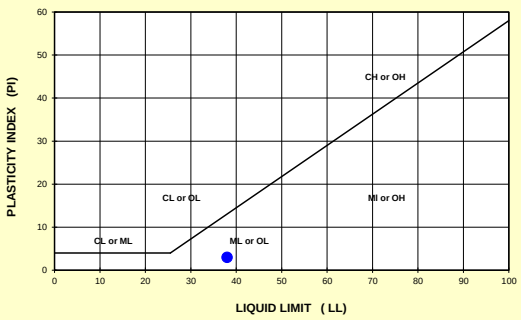
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

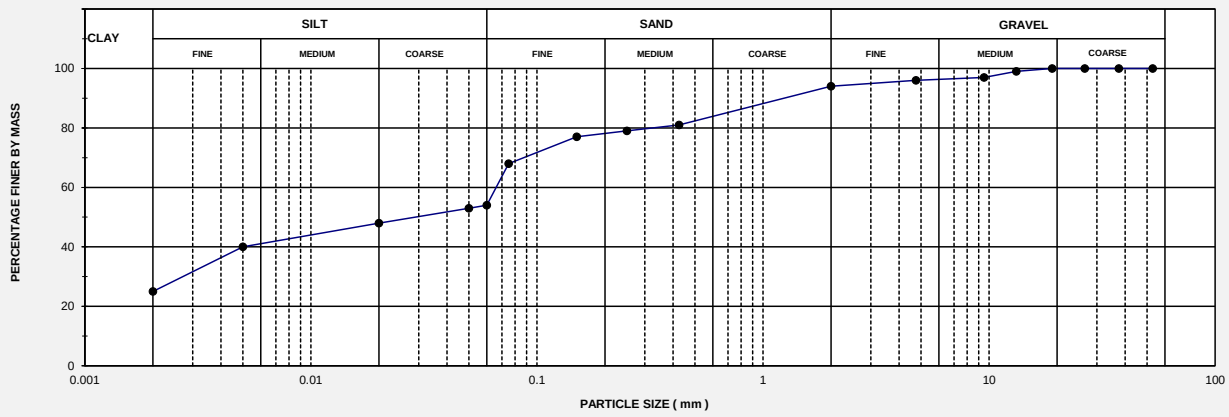
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7738**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP14**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.8 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Reddish brown speckled yellow clayey si**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**81**
63.0	**100**	0.250	**79**
53.0	**100**	0.150	**77**
37.5	**100**	0.075	**68**
26.5	**100**	0.060	**54**
19.0	**100**	0.050	**53**
13.2	**99**	0.020	**48**
9.5	**97**	0.005	**40**
4.75	**96**	0.002	**25**
2.00	**94**		

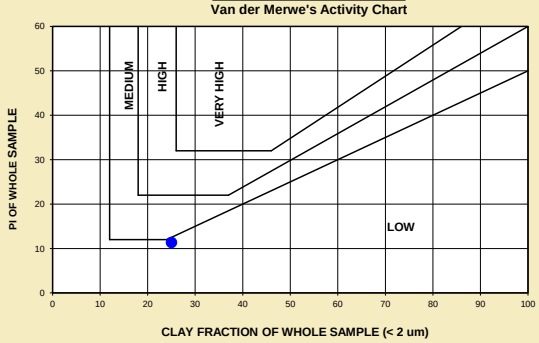
ATTERBERG LIMITS		
Liquid Limit	(%)	**31**
Plastic Limit	(%)	**17**
Plasticity Index	(%)	**14**
Weighted PI	(%)	**11.3**
Linear Shrinkage	(%)	**7.0**
Grading Modulus		**0.57**
Uniformity coefficient		**33**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**6**
% Sand	**40**
% Silt	**29**
% Clay	**25**
Activity	**0.6**
% Soil Mortar	**94**
Coarse Sand Ratio	**0.14**
TRB Classification	**A - 6**
Unified Classification	**CL**

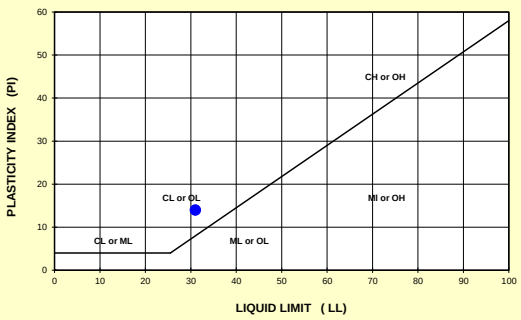
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7739**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP16**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.2 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Reddish brown speckled yellow silty san**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**68**
63.0	**100**	0.250	**63**
53.0	**100**	0.150	**52**
37.5	**100**	0.075	**40**
26.5	**100**	0.060	**36**
19.0	**99**	0.050	**35**
13.2	**97**	0.020	**31**
9.5	**95**	0.005	**18**
4.75	**90**	0.002	**12**
2.00	**83**		

ATTERBERG LIMITS

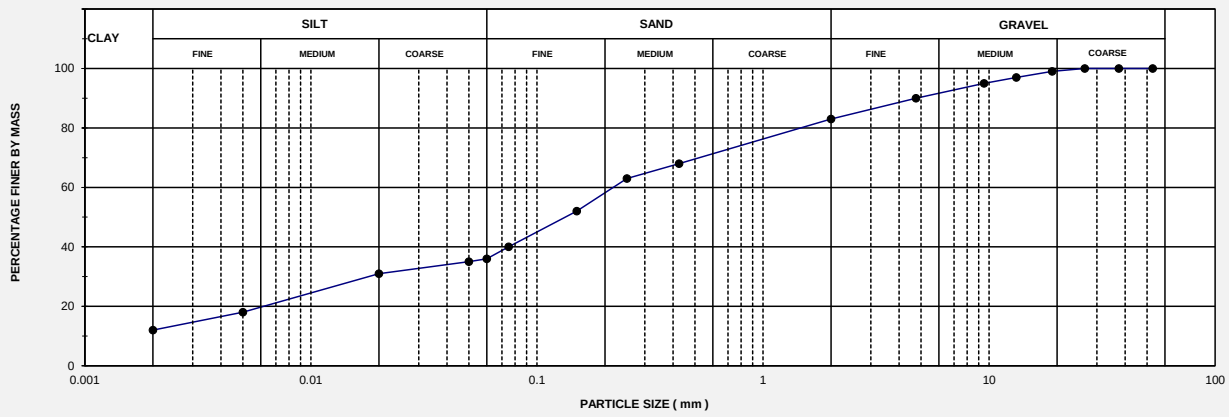
Liquid Limit	(%)	**30**
Plastic Limit	(%)	**19**
Plasticity Index	(%)	**11**
Weighted PI	(%)	**7.5**
Linear Shrinkage	(%)	**5.5**
Grading Modulus		**1.09**
Uniformity coefficient		**111**
Coefficient of curvature		**1.0**

Remarks:

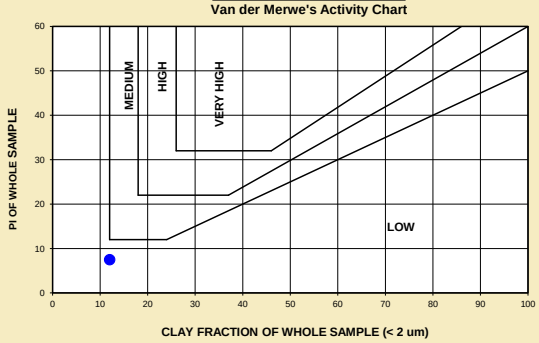
SOIL CLASSIFICATION

% Gravel	**17**
% Sand	**47**
% Silt	**24**
% Clay	**12**
Activity	**0.9**
% Soil Mortar	**83**
Coarse Sand Ratio	**0.18**
TRB Classification	**A - 6**
Unified Classification	**SC**

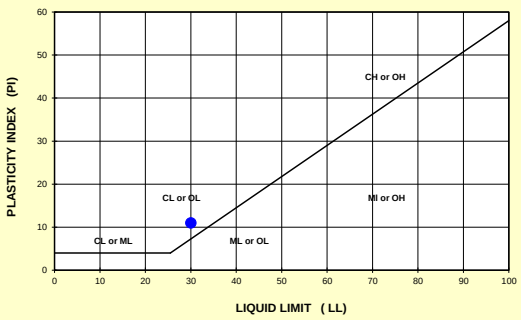
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

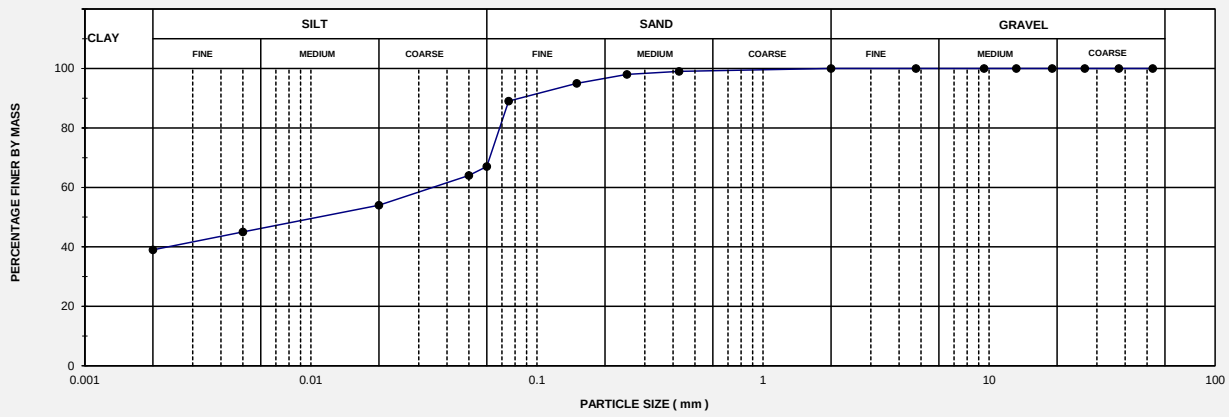
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7740**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP18**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**2.0 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white mottled g**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**99**
63.0	**100**	0.250	**98**
53.0	**100**	0.150	**95**
37.5	**100**	0.075	**89**
26.5	**100**	0.060	**67**
19.0	**100**	0.050	**64**
13.2	**100**	0.020	**54**
9.5	**100**	0.005	**45**
4.75	**100**	0.002	**39**
2.00	**100**		

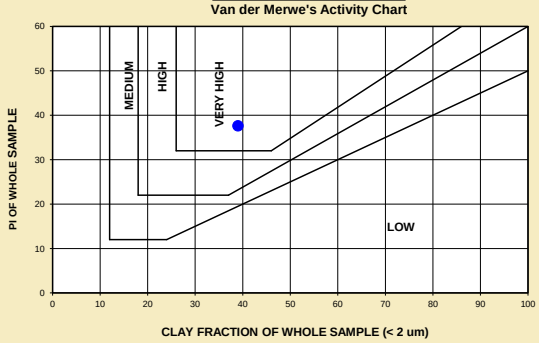
ATTERBERG LIMITS		
Liquid Limit	(%)	**58**
Plastic Limit	(%)	**20**
Plasticity Index	(%)	**38**
Weighted PI	(%)	**37.6**
Linear Shrinkage	(%)	**10.5**
Grading Modulus		**0.12**
Uniformity coefficient		**19**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**0**
% Sand	**33**
% Silt	**28**
% Clay	**39**
Activity	**1.0**
% Soil Mortar	**100**
Coarse Sand Ratio	**0.01**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

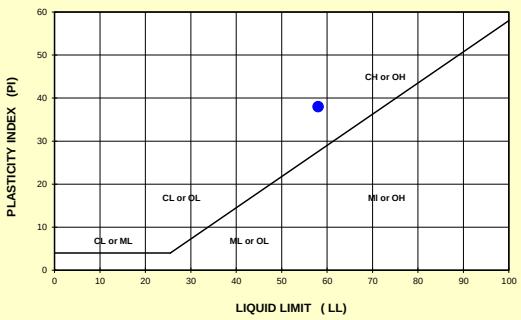
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7741**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP20**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.8 - 1.8**	**Section:**		**Client Ref No:**	
Description:	**Brown speckled black grey clayey silt sar**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**91**
63.0	**100**	0.250	**88**
53.0	**100**	0.150	**83**
37.5	**100**	0.075	**67**
26.5	**100**	0.060	**53**
19.0	**100**	0.050	**51**
13.2	**100**	0.020	**46**
9.5	**100**	0.005	**34**
4.75	**99**	0.002	**24**
2.00	**96**		

ATTERBERG LIMITS

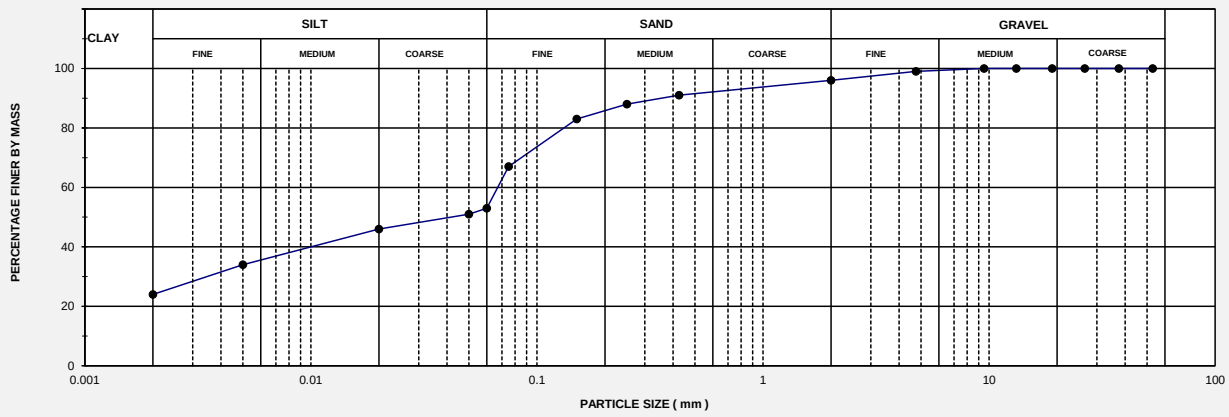
Liquid Limit	(%)	**34**
Plastic Limit	(%)	**18**
Plasticity Index	(%)	**16**
Weighted PI	(%)	**14.6**
Linear Shrinkage	(%)	**6.0**
Grading Modulus		**0.46**
Uniformity coefficient		**34**
Coefficient of curvature		**0.1**

Remarks:

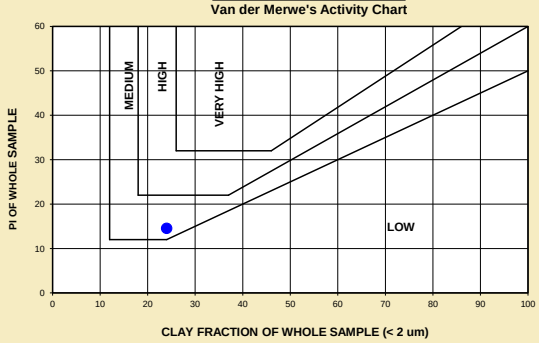
SOIL CLASSIFICATION

% Gravel	**4**
% Sand	**43**
% Silt	**29**
% Clay	**24**
Activity	**0.7**
% Soil Mortar	**96**
Coarse Sand Ratio	**0.05**
TRB Classification	**A - 6**
Unified Classification	**CL**

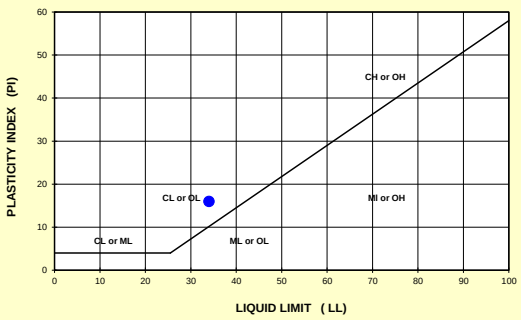
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

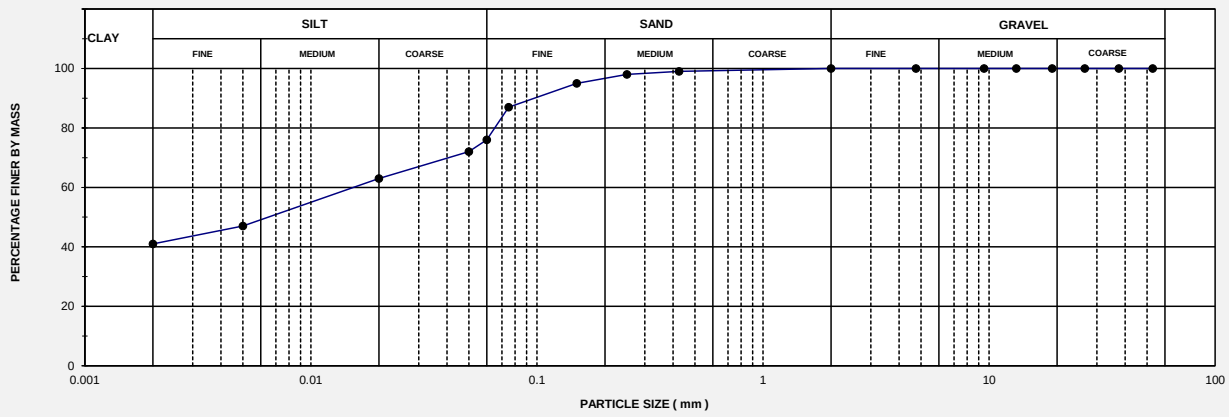
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7742**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP20**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.8 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Black sandy silty clay (Alluvium)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**99**
63.0	**100**	0.250	**98**
53.0	**100**	0.150	**95**
37.5	**100**	0.075	**87**
26.5	**100**	0.060	**76**
19.0	**100**	0.050	**72**
13.2	**100**	0.020	**63**
9.5	**100**	0.005	**47**
4.75	**100**	0.002	**41**
2.00	**100**		

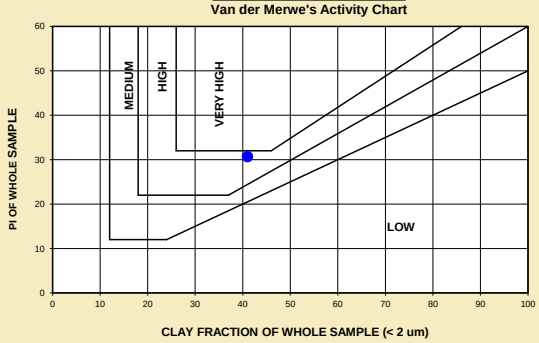
ATTERBERG LIMITS		
Liquid Limit	(%)	**52**
Plastic Limit	(%)	**21**
Plasticity Index	(%)	**31**
Weighted PI	(%)	**30.7**
Linear Shrinkage	(%)	**13.0**
Grading Modulus		**0.14**
Uniformity coefficient		**9**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**0**
% Sand	**24**
% Silt	**35**
% Clay	**41**
Activity	**0.8**
% Soil Mortar	**100**
Coarse Sand Ratio	**0.01**
TRB Classification	**A - 7 - 6**
Unified Classification	**CH**

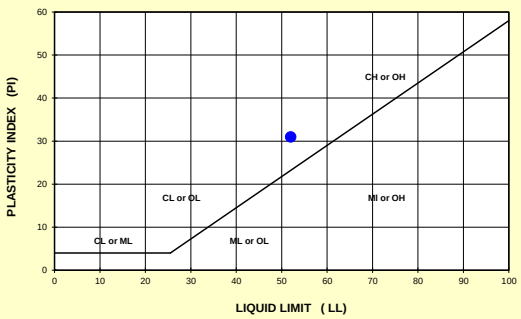
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7743**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP21**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.6 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**Brown speckled black grey clayey silty sa**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**97**
63.0	**100**	0.250	**95**
53.0	**100**	0.150	**92**
37.5	**100**	0.075	**82**
26.5	**100**	0.060	**65**
19.0	**100**	0.050	**63**
13.2	**100**	0.020	**57**
9.5	**100**	0.005	**47**
4.75	**100**	0.002	**30**
2.00	**99**		

ATTERBERG LIMITS

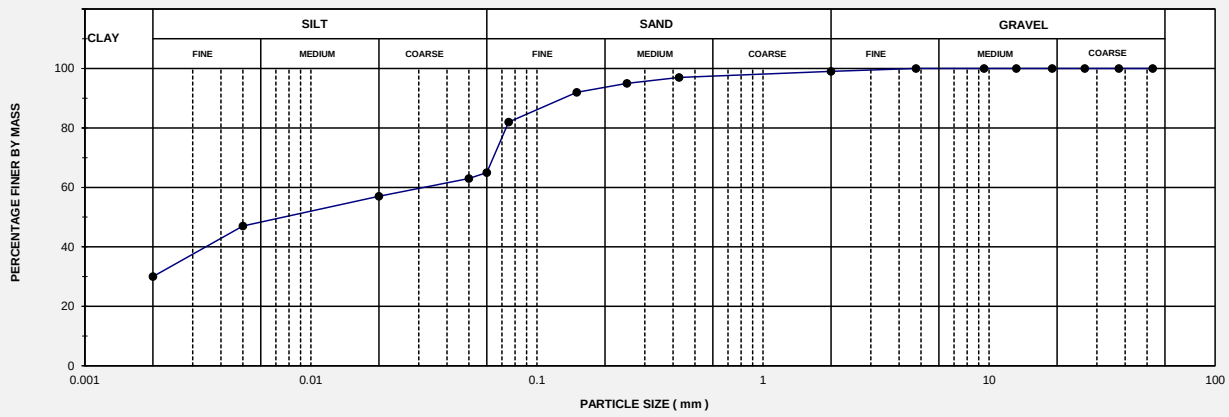
Liquid Limit	(%)	**35**
Plastic Limit	(%)	**15**
Plasticity Index	(%)	**20**
Weighted PI	(%)	**19.4**
Linear Shrinkage	(%)	**5.5**
Grading Modulus		**0.22**
Uniformity coefficient		**18**
Coefficient of curvature		**0.1**

Remarks:

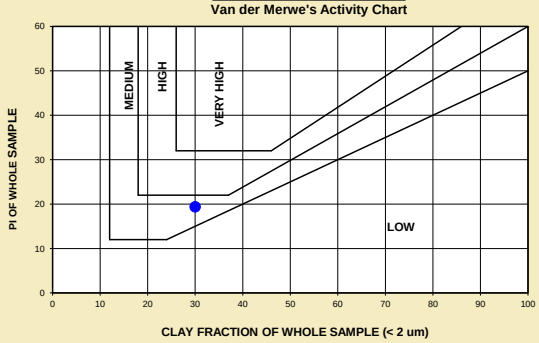
SOIL CLASSIFICATION

% Gravel	**1**
% Sand	**34**
% Silt	**35**
% Clay	**30**
Activity	**0.7**
% Soil Mortar	**99**
Coarse Sand Ratio	**0.02**
TRB Classification	**A - 6**
Unified Classification	**CL**

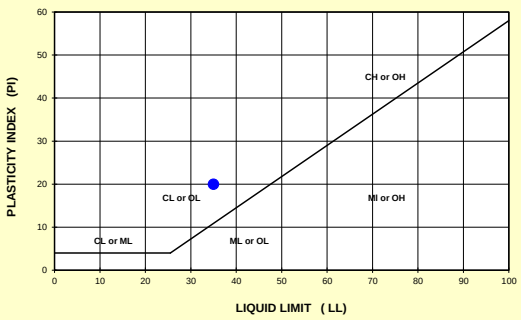
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

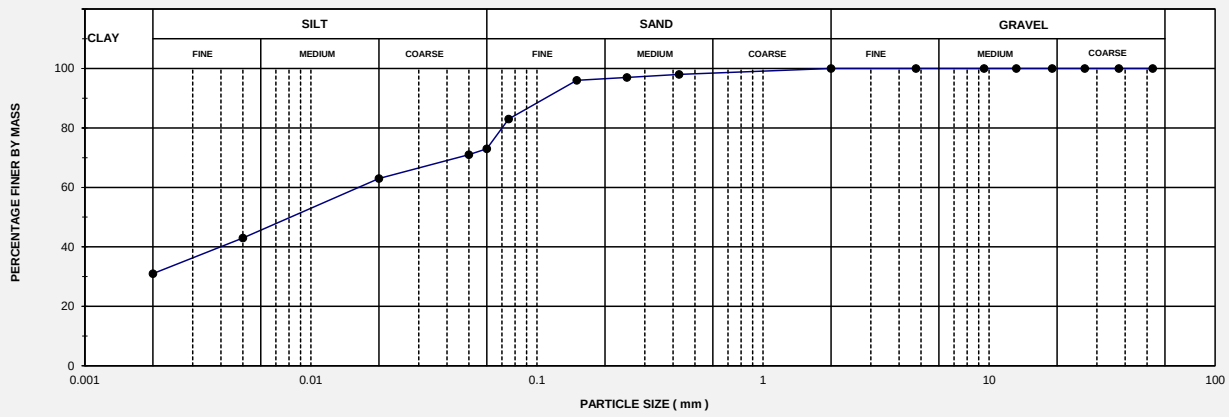
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7744**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP21**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.8 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white mottled g**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**98**
63.0	**100**	0.250	**97**
53.0	**100**	0.150	**96**
37.5	**100**	0.075	**83**
26.5	**100**	0.060	**73**
19.0	**100**	0.050	**71**
13.2	**100**	0.020	**63**
9.5	**100**	0.005	**43**
4.75	**100**	0.002	**31**
2.00	**100**		

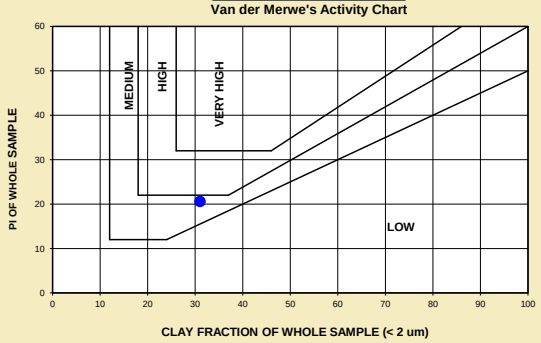
ATTERBERG LIMITS		
Liquid Limit	(%)	**38**
Plastic Limit	(%)	**17**
Plasticity Index	(%)	**21**
Weighted PI	(%)	**20.6**
Linear Shrinkage	(%)	**9.5**
Grading Modulus		**0.19**
Uniformity coefficient		**9**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**0**
% Sand	**27**
% Silt	**42**
% Clay	**31**
Activity	**0.7**
% Soil Mortar	**100**
Coarse Sand Ratio	**0.02**
TRB Classification	**A - 6**
Unified Classification	**CL**

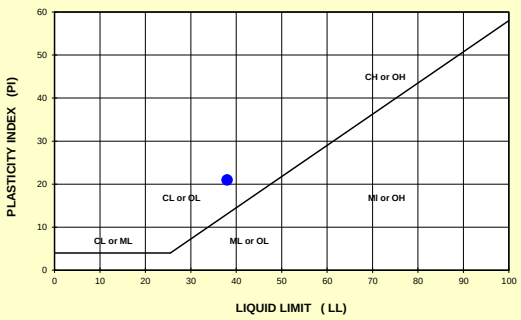
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

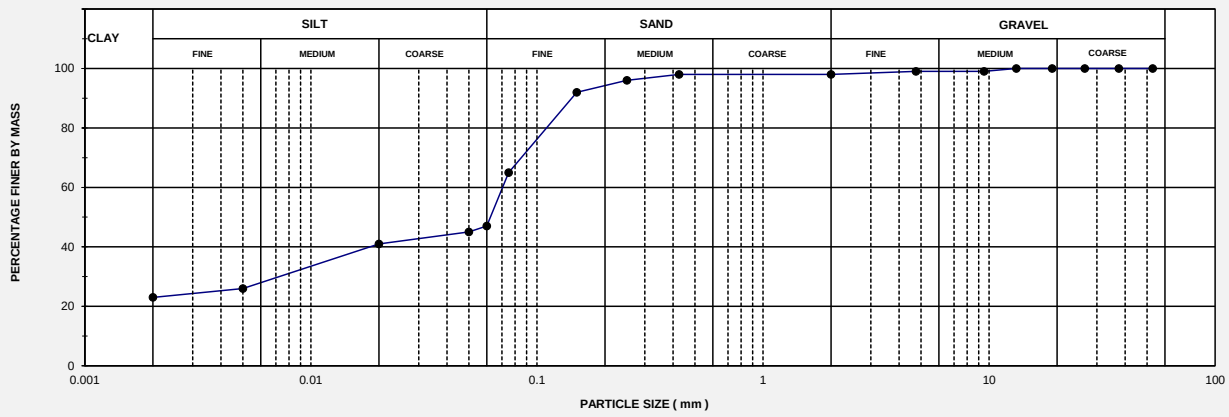
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7745**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP23**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.0 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white mottled g**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**98**
63.0	**100**	0.250	**96**
53.0	**100**	0.150	**92**
37.5	**100**	0.075	**65**
26.5	**100**	0.060	**47**
19.0	**100**	0.050	**45**
13.2	**100**	0.020	**41**
9.5	**99**	0.005	**26**
4.75	**99**	0.002	**23**
2.00	**98**		

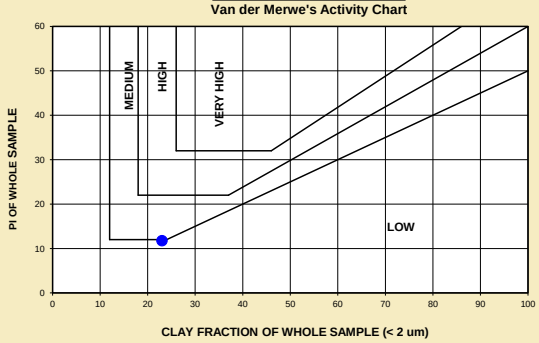
ATTERBERG LIMITS		
Liquid Limit	(%)	**26**
Plastic Limit	(%)	**14**
Plasticity Index	(%)	**12**
Weighted PI	(%)	**11.8**
Linear Shrinkage	(%)	**5.5**
Grading Modulus		**0.39**
Uniformity coefficient		**35**
Coefficient of curvature		**0.9**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**2**
% Sand	**51**
% Silt	**24**
% Clay	**23**
Activity	**0.5**
% Soil Mortar	**98**
Coarse Sand Ratio	**0.00**
TRB Classification	**A - 6**
Unified Classification	**CL**

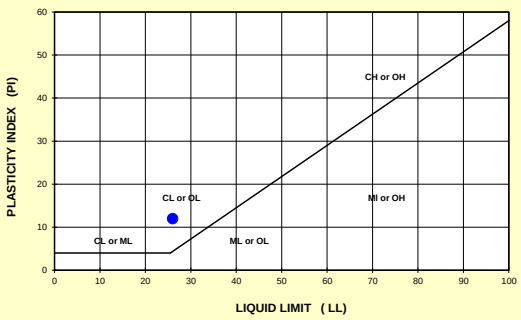
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

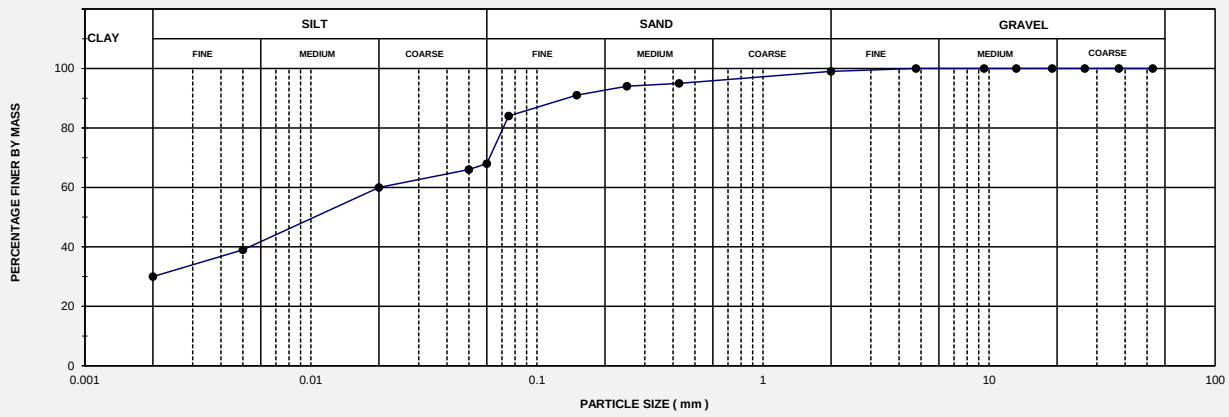
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7746**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP26**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.0 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi blotched calcrete white mottled g**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**95**
63.0	**100**	0.250	**94**
53.0	**100**	0.150	**91**
37.5	**100**	0.075	**84**
26.5	**100**	0.060	**68**
19.0	**100**	0.050	**66**
13.2	**100**	0.020	**60**
9.5	**100**	0.005	**39**
4.75	**100**	0.002	**30**
2.00	**99**		

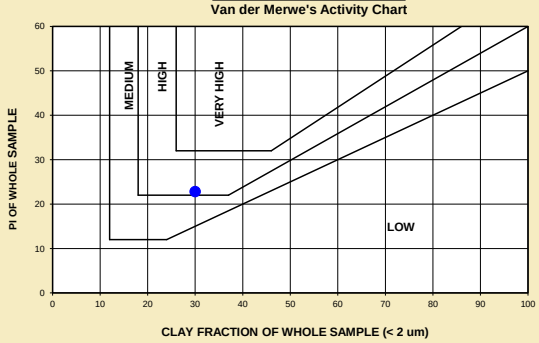
ATTERBERG LIMITS		
Liquid Limit	(%)	**41**
Plastic Limit	(%)	**17**
Plasticity Index	(%)	**24**
Weighted PI	(%)	**22.8**
Linear Shrinkage	(%)	**9.5**
Grading Modulus		**0.22**
Uniformity coefficient		**10**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**1**
% Sand	**31**
% Silt	**38**
% Clay	**30**
Activity	**0.8**
% Soil Mortar	**99**
Coarse Sand Ratio	**0.04**
TRB Classification	**A - 7 - 6**
Unified Classification	**CL**

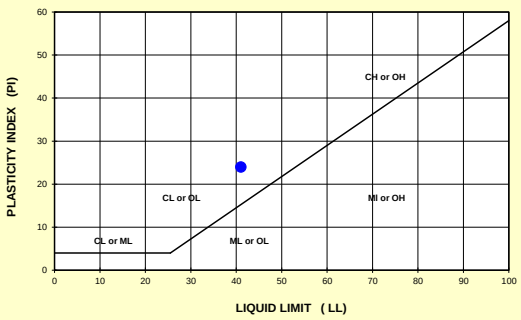
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

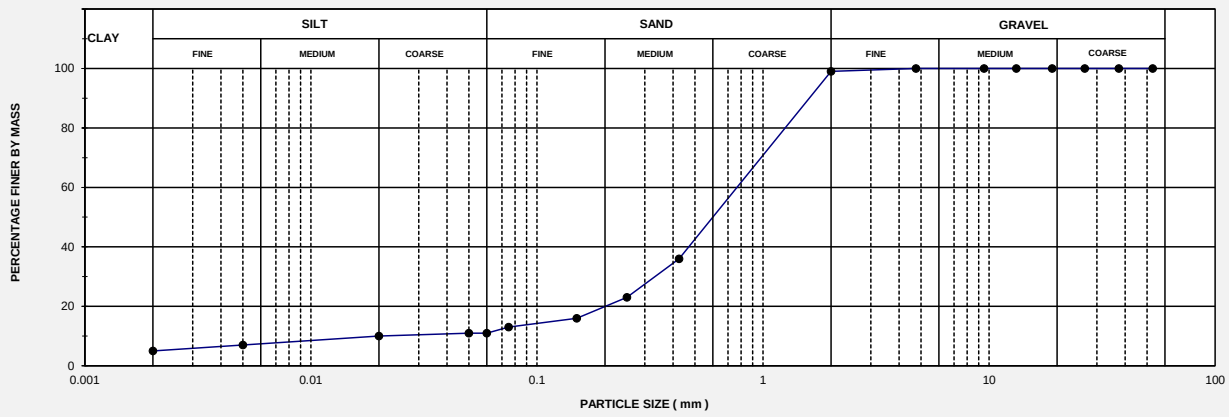
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7748**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP29**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.7 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Yellow speckled black grey clayey silty s**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**36**
63.0	**100**	0.250	**23**
53.0	**100**	0.150	**16**
37.5	**100**	0.075	**13**
26.5	**100**	0.060	**11**
19.0	**100**	0.050	**11**
13.2	**100**	0.020	**10**
9.5	**100**	0.005	**7**
4.75	**100**	0.002	**5**
2.00	**99**		

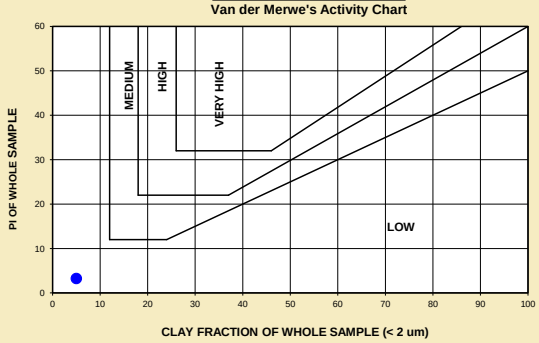
ATTERBERG LIMITS		
Liquid Limit (%)		**19**
Plastic Limit (%)		**10**
Plasticity Index (%)		**9**
Weighted PI (%)		**3.2**
Linear Shrinkage (%)		**2.5**
Grading Modulus		**1.52**
Uniformity coefficient		**47**
Coefficient of curvature		**5.3**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**1**
% Sand	**88**
% Silt	**6**
% Clay	**5**
Activity	**1.8**
% Soil Mortar	**99**
Coarse Sand Ratio	**0.64**
TRB Classification	**A - 2 - 4**
Unified Classification	**SC**

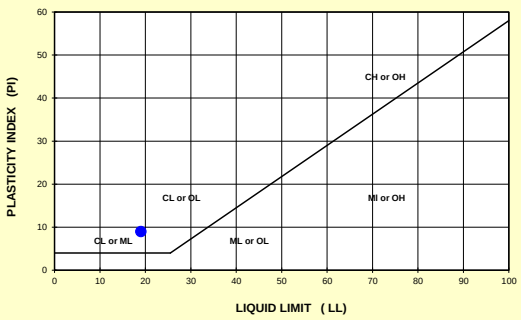
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

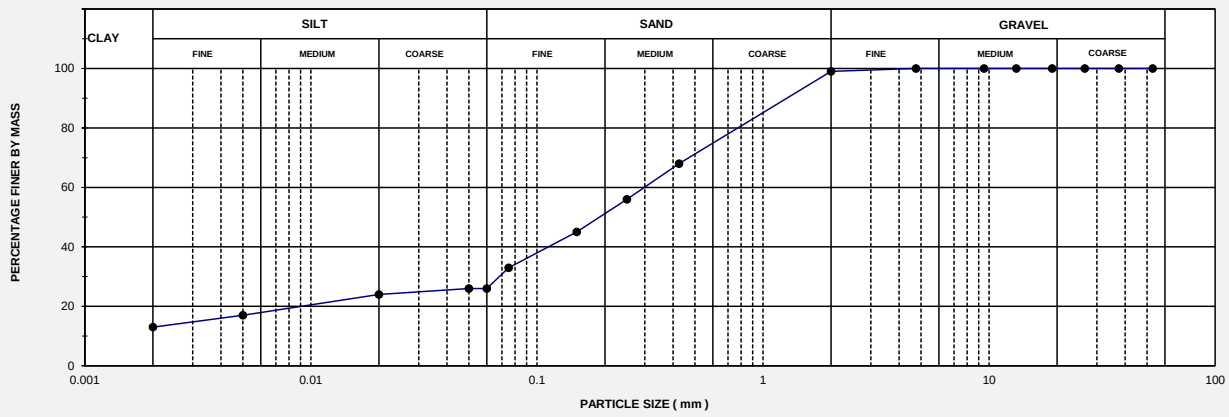
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7749**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP30**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.5 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Yellow speckled black grey clayey silty s**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**68**
63.0	**100**	0.250	**56**
53.0	**100**	0.150	**45**
37.5	**100**	0.075	**33**
26.5	**100**	0.060	**26**
19.0	**100**	0.050	**26**
13.2	**100**	0.020	**24**
9.5	**100**	0.005	**17**
4.75	**100**	0.002	**13**
2.00	**99**		

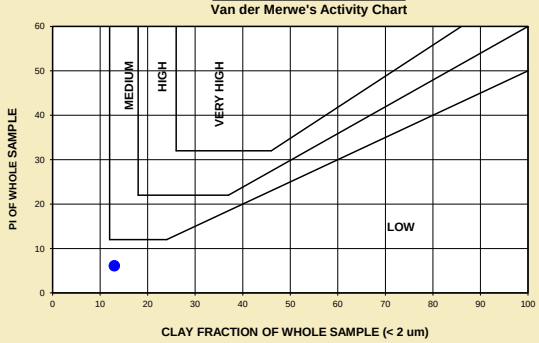
ATTERBERG LIMITS		
Liquid Limit (%)		**22**
Plastic Limit (%)		**13**
Plasticity Index (%)		**9**
Weighted PI (%)		**6.1**
Linear Shrinkage (%)		**3.5**
Grading Modulus		**1.00**
Uniformity coefficient		**154**
Coefficient of curvature		**8.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**1**
% Sand	**73**
% Silt	**13**
% Clay	**13**
Activity	**0.7**
% Soil Mortar	**99**
Coarse Sand Ratio	**0.31**
TRB Classification	**A - 2 - 4**
Unified Classification	**SC**

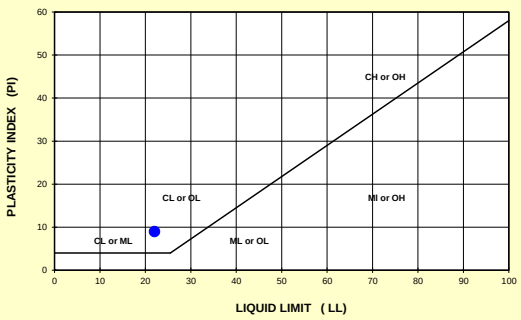
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

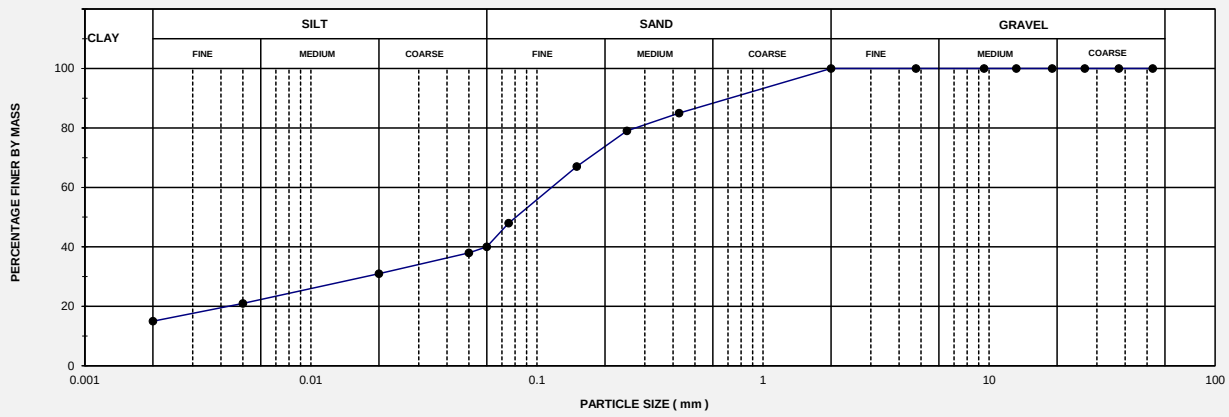
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7750**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP31**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.8 - 2.8**	**Section:**		**Client Ref No:**	
Description:	**Yellow speckled black grey clayey silty s**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**85**
63.0	**100**	0.250	**79**
53.0	**100**	0.150	**67**
37.5	**100**	0.075	**48**
26.5	**100**	0.060	**40**
19.0	**100**	0.050	**38**
13.2	**100**	0.020	**31**
9.5	**100**	0.005	**21**
4.75	**100**	0.002	**15**
2.00	**100**		

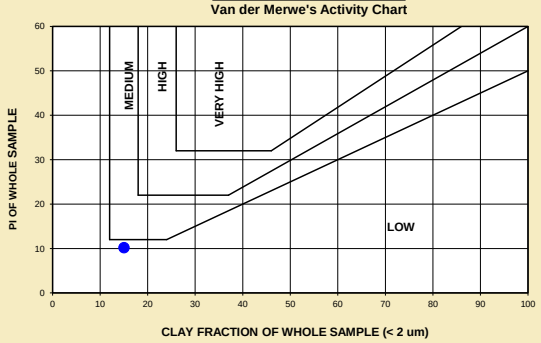
ATTERBERG LIMITS		
Liquid Limit	(%)	**25**
Plastic Limit	(%)	**13**
Plasticity Index	(%)	**12**
Weighted PI	(%)	**10.2**
Linear Shrinkage	(%)	**3.5**
Grading Modulus		**0.67**
Uniformity coefficient		**61**
Coefficient of curvature		**1.7**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**0**
% Sand	**60**
% Silt	**25**
% Clay	**15**
Activity	**0.8**
% Soil Mortar	**100**
Coarse Sand Ratio	**0.15**
TRB Classification	**A - 6**
Unified Classification	**SC**

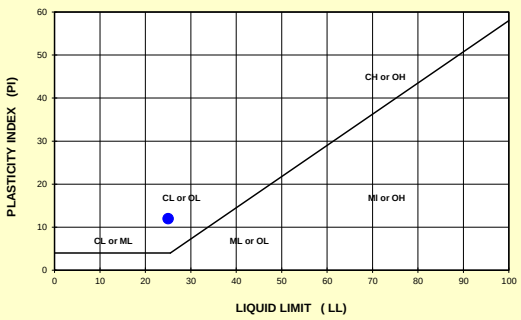
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7752**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP34**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.4 - 1.2**	**Section:**		**Client Ref No:**	
Description:	**Grey speckled white silty sand ASH (Fill)**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS

Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**47**
63.0	**100**	0.250	**43**
53.0	**100**	0.150	**36**
37.5	**100**	0.075	**29**
26.5	**100**	0.060	**25**
19.0	**100**	0.050	**23**
13.2	**95**	0.020	**19**
9.5	**89**	0.005	**8**
4.75	**79**	0.002	**4**
2.00	**66**		

ATTERBERG LIMITS

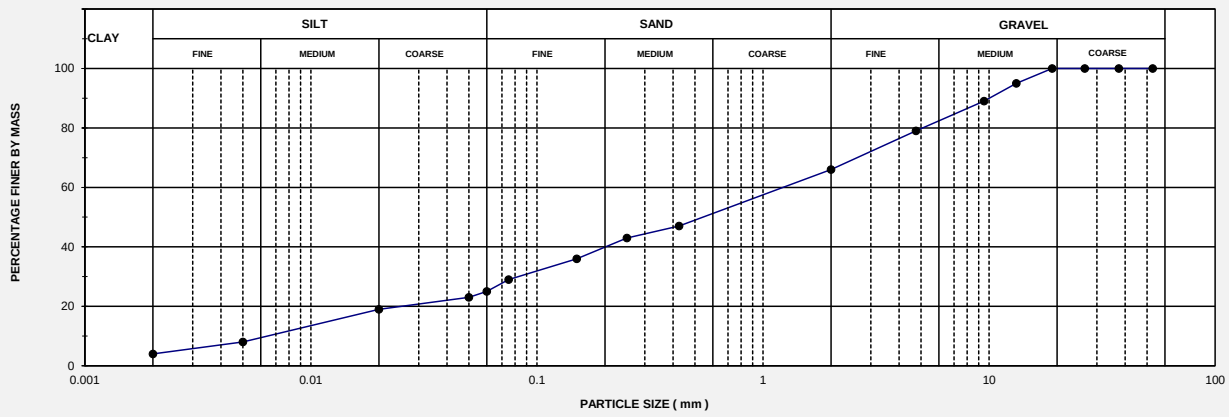
Liquid Limit	(%)	
Plastic Limit	(%)	
Plasticity Index	(%)	**NP**
Weighted PI	(%)	
Linear Shrinkage	(%)	**0.0**
Grading Modulus		**1.58**
Uniformity coefficient		**154**
Coefficient of curvature		**0.5**

Remarks:

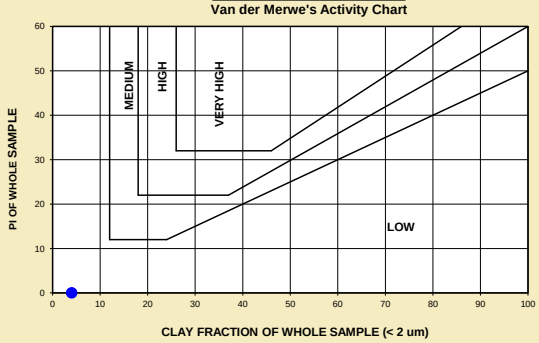
SOIL CLASSIFICATION

% Gravel	**34**
% Sand	**41**
% Silt	**21**
% Clay	**4**
Activity	**0.0**
% Soil Mortar	**66**
Coarse Sand Ratio	**0.29**
TRB Classification	**A - 2 - 7**
Unified Classification	**SM**

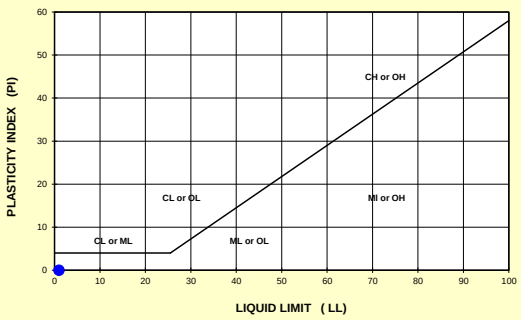
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

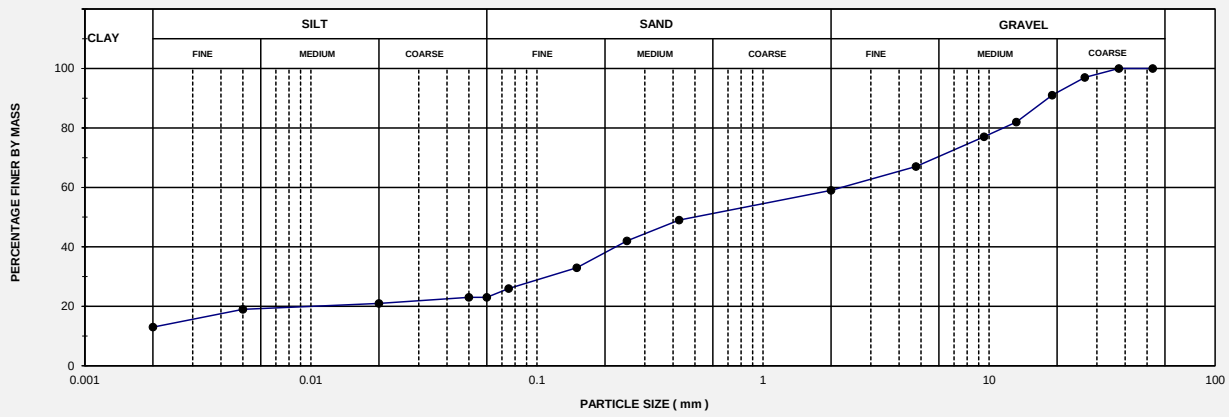
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7753**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP34**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.2 - 2.6**	**Section:**		**Client Ref No:**	
Description:	**Khakhi mottled yellow sandy clayey silt (I**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**49**
63.0	**100**	0.250	**42**
53.0	**100**	0.150	**33**
37.5	**100**	0.075	**26**
26.5	**97**	0.060	**23**
19.0	**91**	0.050	**23**
13.2	**82**	0.020	**21**
9.5	**77**	0.005	**19**
4.75	**67**	0.002	**13**
2.00	**59**		

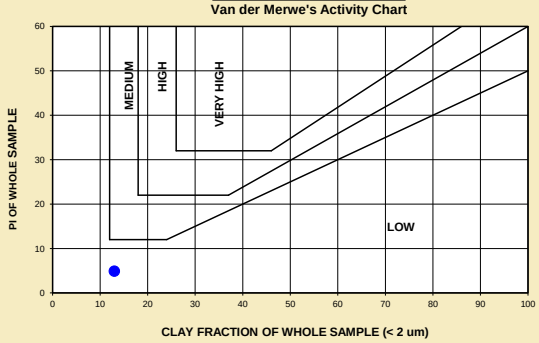
ATTERBERG LIMITS		
Liquid Limit	(%)	**21**
Plastic Limit	(%)	**11**
Plasticity Index	(%)	**10**
Weighted PI	(%)	**4.9**
Linear Shrinkage	(%)	**4.5**
Grading Modulus		**1.66**
Uniformity coefficient		**1172**
Coefficient of curvature		**3.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**41**
% Sand	**36**
% Silt	**10**
% Clay	**13**
Activity	**0.8**
% Soil Mortar	**59**
Coarse Sand Ratio	**0.17**
TRB Classification	**A - 2 - 4**
Unified Classification	**SC**

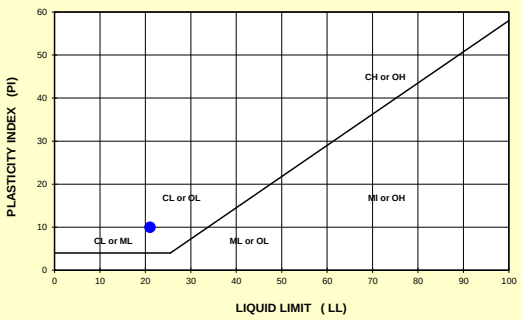
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

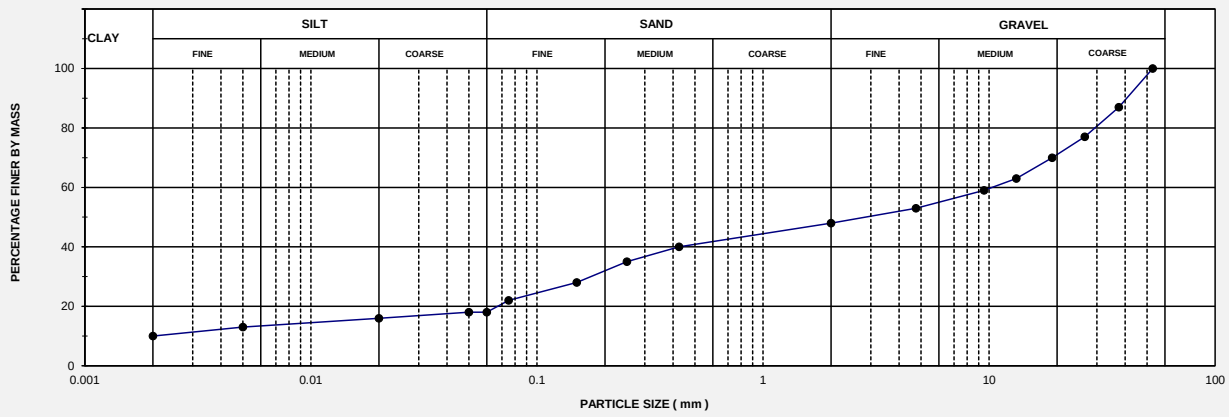
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7754**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP34**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**2.6 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi mottled yellow sandy clayey silt a**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**40**
63.0	**100**	0.250	**35**
53.0	**100**	0.150	**28**
37.5	**87**	0.075	**22**
26.5	**77**	0.060	**18**
19.0	**70**	0.050	**18**
13.2	**63**	0.020	**16**
9.5	**59**	0.005	**13**
4.75	**53**	0.002	**10**
2.00	**48**		

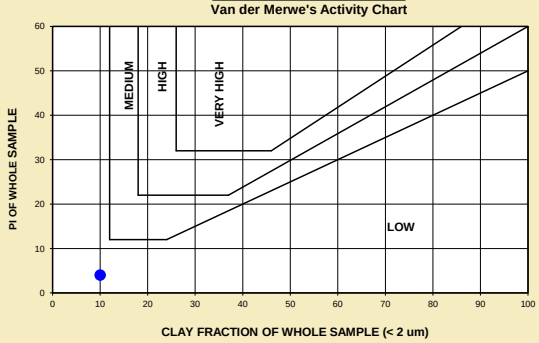
ATTERBERG LIMITS		
Liquid Limit (%)		**21**
Plastic Limit (%)		**11**
Plasticity Index (%)		**10**
Weighted PI (%)		**4.0**
Linear Shrinkage (%)		**4.5**
Grading Modulus		**1.90**
Uniformity coefficient		**5213**
Coefficient of curvature		**1.6**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**52**
% Sand	**30**
% Silt	**8**
% Clay	**10**
Activity	**1.0**
% Soil Mortar	**48**
Coarse Sand Ratio	**0.17**
TRB Classification	**A - 2 - 4**
Unified Classification	**GC**

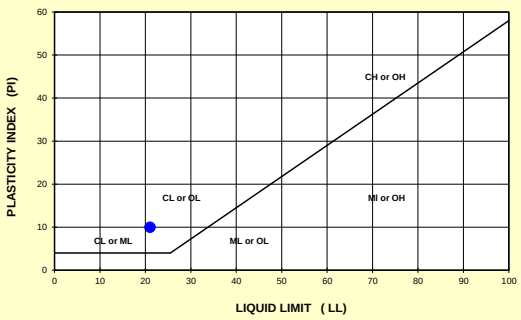
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

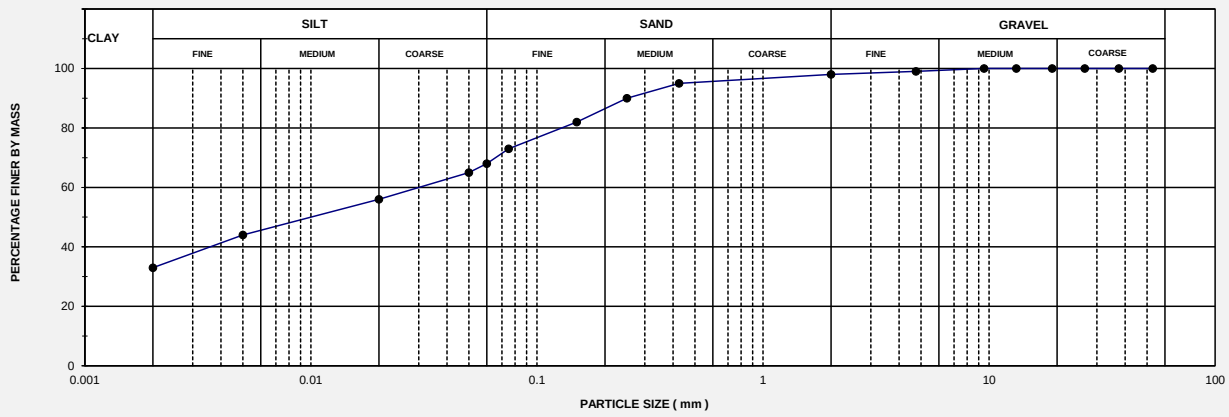
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7755**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP35**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**0.3 - 1.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi mottled yellow sandy clayey silt (I**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**95**
63.0	**100**	0.250	**90**
53.0	**100**	0.150	**82**
37.5	**100**	0.075	**73**
26.5	**100**	0.060	**68**
19.0	**100**	0.050	**65**
13.2	**100**	0.020	**56**
9.5	**100**	0.005	**44**
4.75	**99**	0.002	**33**
2.00	**98**		

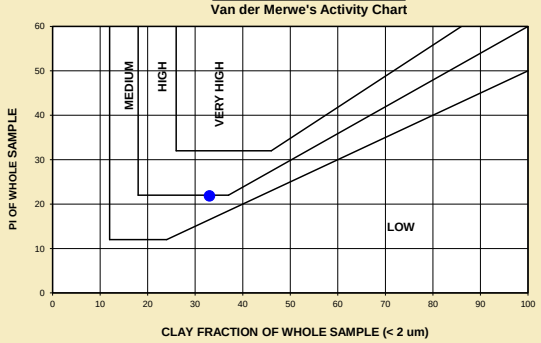
ATTERBERG LIMITS		
Liquid Limit	(%)	**39**
Plastic Limit	(%)	**16**
Plasticity Index	(%)	**23**
Weighted PI	(%)	**21.9**
Linear Shrinkage	(%)	**8.5**
Grading Modulus		**0.34**
Uniformity coefficient		**17**
Coefficient of curvature		**0.1**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**2**
% Sand	**30**
% Silt	**35**
% Clay	**33**
Activity	**0.7**
% Soil Mortar	**98**
Coarse Sand Ratio	**0.03**
TRB Classification	**A - 6**
Unified Classification	**CL**

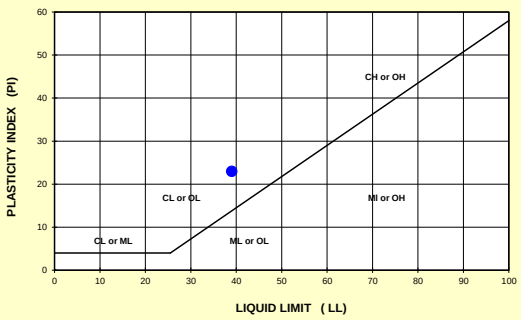
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



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FOUNDATION INDICATOR TEST RESULTS - REP COM 7

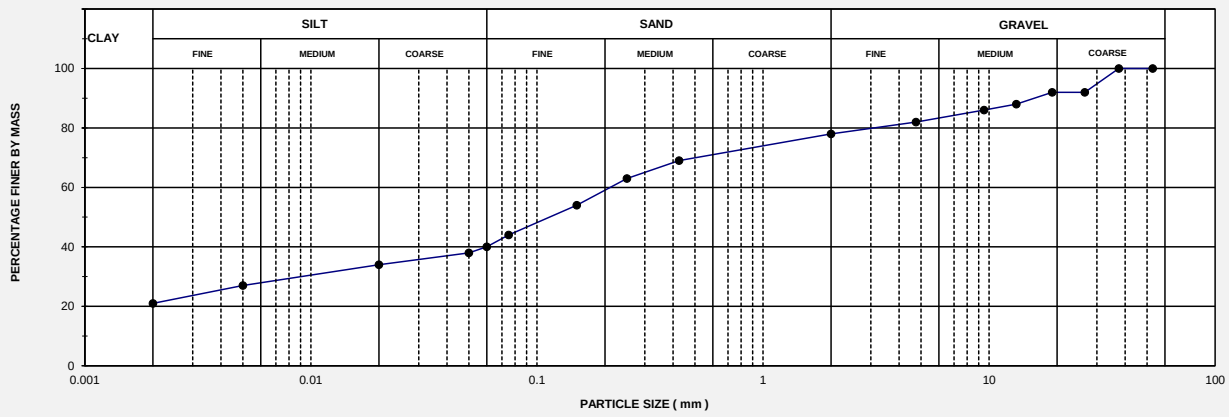
Client:	**Nomfundo Exploration**	**Source/Location:**		**Job No:**	**2016-C-991**
Project Name:	**Rand Water Pipeline Project in Vereenig.**	**Layer:**		**Sample No:**	**6/7756**
Project No:	**0**	**Lane:**		**Date:**	**02/09/2016**
Hole/TP No:	**TP35**	**Stabilizing Agent:**		**Test Method:**	**TMH1 A1, A5 & ASTM D422**
Depth (m):	**1.0 - 3.0**	**Section:**		**Client Ref No:**	
Description:	**Khakhi mottled yellow sandy clayey silt (I**	**Chainage:**		**GPS X:**	
Additional Info:		**Offset:**		**GPS Y:**	

SIEVE ANALYSIS			
Sieve (mm)	% Passing	Sieve (mm)	% Passing
75.0	**100**	0.425	**69**
63.0	**100**	0.250	**63**
53.0	**100**	0.150	**54**
37.5	**100**	0.075	**44**
26.5	**92**	0.060	**40**
19.0	**92**	0.050	**38**
13.2	**88**	0.020	**34**
9.5	**86**	0.005	**27**
4.75	**82**	0.002	**21**
2.00	**78**		

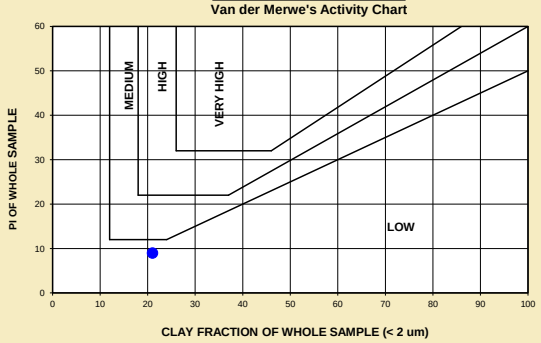
ATTERBERG LIMITS		
Liquid Limit	(%)	**27**
Plastic Limit	(%)	**14**
Plasticity Index	(%)	**13**
Weighted PI	(%)	**9.0**
Linear Shrinkage	(%)	**7.5**
Grading Modulus		**1.09**
Uniformity coefficient		**108**
Coefficient of curvature		**0.4**
Remarks:		

SOIL CLASSIFICATION	
% Gravel	**22**
% Sand	**38**
% Silt	**19**
% Clay	**21**
Activity	**0.6**
% Soil Mortar	**78**
Coarse Sand Ratio	**0.12**
TRB Classification	**A - 6**
Unified Classification	**SC**

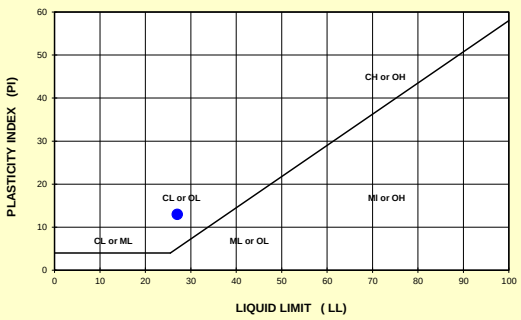
PARTICLE SIZE DISTRIBUTION



POTENTIAL EXPANSIVENESS
Van der Merwe's Activity Chart



CASAGRANDE 'A' LINE



T0023

GEOSTRADA
engineering materials laboratory

SUMMARY OF TEST RESULTS ON SOILS - REP COM 2

Client: Nomfundo Exploration **Project:** Rand Water Pipeline Project in Vereeniging **Ref No:** _____ **Job No:** 2016-C-991 **Date:** 02/09/2016

Sample No	Hole No / TP No	Depth (m)	Description	Percentage Passing Sieve (mm) - TMH1 A1, A5, ASTM D422 — Sieve Analysis																		Atterberg Limits (TMH1 A2-A4) < 0.425 mm			Maximum Dry Density (kg/m³) & OMC (%) (TMH1 A7)		CBR (Modified AASHTO) TMH1 A8							pH + Conductivity (TMH A20 & A21T)	
				53.0	37.5	26.5	19.0	13.2	9.5	4.75	2.00	0.425	0.250	0.150	0.075	0.060	0.050	0.020	0.005	0.002	GM	LL	PI	LS			% Swell	90%	93%	95%	97%	98%	100%	pH	S/m
6/7723	TP1	0.15 - 0.5	Black sandy silty clay (Hillwash)							100	99	91	85	77	68	53	52	49	43	39	0.42	52	31	11.0										
6/7724	TP1	0.5 - 1.0	Black speckled khakhi brown sandy silty clay (Hillwash)					100	98	94	90	81	77	69	62	50	50	47	43	37	0.67	67	45	12.0										
6/7725	TP1	1.0 - 2.2	Khakhi blotched calcrete white sandy clayey silt (Residual sandy shale)						100	99	98	93	88	81	74	71	68	60	54	51	0.35	60	34	15.5										
6/7726	TP1	2.2 - 2.6	Khakhi mottled grey & orange sandy clayey silt		100	94	89	87	87	85	83	79	75	69	63	63	61	54	49	49	0.75	62	36	15.5										
6/7727	TP1	1.0 - 2.6	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)	*No requested*																					1622	13.9	13.4	0.6	0.7	0.8	0.8	0.8	0.9	7.94	0.1046
6/7728	TP4	0.1 - 1.0	Grey speckled white silty sand ASH (Fill)			100	96	92	90	78	64	44	40	32	25	23	22	19	7	3	1.67	36	6	2.0										
6/7729	TP5	2.2 - 3.0	Red blotech black sandy silty clay (Residual sandy shale ferriginous)				100	98	96	88	73	63	59	53	45	34	34	32	27	21	1.19	35	16	8.5										
6/7730	TP7	0.2 - 1.0	Black speckled khakhi brown sandy silty clay (Hillwash)								100	95	90	82	74	59	58	53	46	40	0.31	54	33	13.0										
6/7731	TP10	0.2 - 1.2	Orange yellow speckles silty sand & ferricrete (Residual sandy shale ferriginous)						100	95	91	81	74	64	53	46	45	42	34	29	0.75	41	23	10.0	1814	12.0	3.1	0.4	0.5	0.6	0.7	0.8	1.1	7.49	0.0758
6/7732	TP10	1.2 - 3.0	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)						100	99	95	87	81	72	61	53	52	49	41	37	0.57	45	27	11.0	1730	14.5	4.9	0.3	0.4	0.4	0.4	0.4	0.4	7.3	0.1217
6/7733	TP13	0.1 - 0.6	Dark grey silty sand ASH (Fill)		100	84	83	79	76	70	64	50	45	37	30	23	22	18	10	5	1.56	37	6	3.5	1613	11.7	0.6	4	7	10	14	18	26	9.22	0.1228
6/7734	TP13	0.6 - 1.0	White speckled grey ASH (Fill)			100	92	87	85	81	76	51	41	33	26	23	22	19	13	5	1.47	33	8	3.5	1817	15.4	0.3	3	8	16	30	40	75	9.05	0.1300
6/7735	TP13	1.0 - 1.8	Dark brown speckled yellow clayey silty sand & ferricrete (Cemented Aeolin sands)							100	98	80	68	57	45	36	36	33	21	19	0.77	26	12	5.5			*No Sample*							6.57	0.1046
6/7736	TP13	1.8 - 3.0	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)						100	97	93	78	70	63	55	48	47	43	37	32	0.74	36	18	8.0			*No Sample*							6.41	0.1071
6/7737	TP14	0.1 - 1.2	Grey speckled white silty sand ASH (Fill)		100	96	89	80	72	58	47	32	28	22	18	14	13	11	6	3	2.03	38	3	1.5										
6/7738	TP14	1.8 - 3.0	Reddish brown speckled yellow clayey silty sand & ferricrete (Cemented Aeolian sands)				100	99	97	96	94	81	79	77	68	54	53	48	40	25	0.57	31	14	7.0										
6/7739	TP16	0.2 - 3.0	Reddish brown speckled yellow clayey silty sand & ferricrete (Cemented Aeolian sands)			100	99	97	95	90	83	68	63	52	40	36	35	31	18	12	1.09	30	11	5.5										
6/7740	TP18	2.0 - 3.0	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)								100	99	98	95	89	67	64	54	45	39	0.12	58	38	10.5	1744	12.2	5.9	0.8	0.8	0.9	0.9	1	1		
6/7741	TP20	0.8 - 1.8	Brown speckled black grey clayey silty sand (Hillwash)						100	99	96	91	88	83	67	53	51	46	34	24	0.46	34	16	6.0										
6/7742	TP20	1.8 - 3.0	Black sandy silty clay (Alluvium)								100	99	98	95	87	76	72	63	47	41	0.14	52	31	13.0										
6/7743	TP21	0.6 - 1.0	Brown speckled black grey clayey silty sand (Hillwash)							100	99	97	95	92	82	65	63	57	47	30	0.22	35	20	5.5										
6/7744	TP21	1.8 - 3.0	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)								100	98	97	96	83	73	71	63	43	31	0.19	38	21	9.5			*No Sample*								
6/7745	TP23	1.0 - 3.0	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)					100	99	99	98	98	96	92	65	47	45	41	26	23	0.39	26	12	5.5	1788	9.8	2.9	0.6	1.4	2.2	3.8	5	8.0		
6/7746	TP26	1.0 - 3.0	Khakhi blotched calcrete white mottled grey & orange sandy clayey silt (Residual sandy shale)							100	99	95	94	91	84	68	66	60	39	30	0.22	41	24	9.5										
6/7747	TP28	0.8 - 3.0	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)	*No Sample*																							*No Sample*							
6/7748	TP29	0.7 - 3.0	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)							100	99	36	23	16	13	11	11	10	7	5	1.52	19	9	2.5	2005	6.8	0.0	6.6	12	20	30	38	60		
6/7749	TP31	0.8 - 2.8	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)							100	99	68	56	45	33	26	26	24	17	13	1.00	22	9	3.5	2011	8.1	0.1	2.3	6	11	21	29	43		

Remarks:

T0023

GEOSTRADA
engineering materials laboratory

SUMMARY OF TEST RESULTS ON SOILS - REP COM 2

Client: Nomfundo Exploration **Project:** Rand Water Pipeline Project in Vereeniging **Ref No:** _____ **Job No:** 2016-C-991 **Date:** 02/09/2016

Sample No	Hole No / TP No	Depth (m)	Description	Percentage Passing Sieve (mm) - TMH1 A1, A5, ASTM D422																	Atterberg Limits (TMH1 A2-A4) < 0.425 mm			Maximum Dry Density (kg/m³) & OMC (%) (TMH1 A7)		CBR (Modified AASHTO) TMH1 A8							pH + Conductivity (TMH A20 & A21T)	
				Sieve Analysis																													
				53.0	37.5	26.5	19.0	13.2	9.5	4.75	2.00	0.425	0.250	0.150	0.075	0.060	0.050	0.020	0.005	0.002	GM	LL	PI	LS			% Swell	90%	93%	95%	97%	98%	100%	pH	S/m
6/7750	TP31	0.8 - 2.8	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)								100	85	79	67	48	40	38	31	21	15	0.67	25	12	3.5	1904	8.4	0.1	1.1	2.3	4	5.5	7	10		
6/7751	TP32	0.2 - 3.0	Yellow speckled black grey clayey silty sand (Cemented Aeolian sands)	*No Sample*																							*No Sample*							
6/7752	TP34	0.4 - 1.2	Grey speckled white silty sand ASH (Fill)				100	95	89	79	66	47	43	36	29	25	23	19	8	4	1.58		NP	0.0										
6/7753	TP34	1.2 - 2.6	Khakhi mottled yellow sandy clayey silt (Residual sandy shale)		100	97	91	82	77	67	59	49	42	33	26	23	23	21	19	13	1.66	21	10	4.5	2049	8.2	0.3	1.0	3.2	7.1	16	23	51	7.74	0.0687
6/7754	TP34	2.6 - 3.0	Khakhi mottled yellow sandy clayey silt and soft rock shale gravel (Residual sandy shale)	100	87	77	70	63	59	53	48	40	35	28	22	18	18	16	13	10	1.90	21	10	4.5			*No Sample*							7.90	0.0721
6/7755	TP35	0.3 - 1.0	Khakhi mottled yellow sandy clayey silt (Residual sandy shale)						100	99	98	95	90	82	73	68	65	56	44	33	0.34	39	23	8.5										
6/7756	TP35	1.0 - 3.0	Khakhi mottled yellow sandy clayey silt (Residual sandy shale)		100	92	92	88	86	82	78	69	63	54	44	40	38	34	27	21	1.09	27	13	7.5										

Remarks:

ANNEXURE E

COMMERCIAL SOURCES LABORATORY RESULTS

ROADLAB
Civil Engineering Materials Laboratory
(PTY) LTD • 1965/008083/07 • VAT No. 4660115884
Established 1965

HEAD OFFICE
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P O Box 1476 Germiston 1400
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E-mail: info@roadlab.co.za
www.roadlab.co.za

95/CLI001/01/0001/14 29/04/2014

Clinker Supplies (Pty) Ltd
P.O. Box 151
Alberton
1450

ATTENTION: **Mr.Paul Davies**

Dear Sir

Test Report: **CLINKER SUPPLIES: AGGREGATE TEST RESULTS (TRACK No.8006)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		14/A249	14/A250		REMARKS & NOTES		
CONTAINER USED FOR SAMPLING		Sampling Plastic Bag	Sampling Plastic Bag				
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry				
HOLE NO. / KM OR CHAINAGE		Not Specified	Not Specified				
ROAD NO OR NAME		Not Specified	Not Specified				
LAYER TESTED / SAMPLED FROM		Black Sand	Base Course				
DATE SAMPLED		27/11/2013	06/05/2014				
DATE RECEIVED		06/05/2014	06/05/2014				
CLIENTS MARKING		None	None				
REQUEST NO.		None	None				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Black Sand Pale Red Ash	Base Course		SPECIFICATION		
NOMINAL SIZE OF STONE					MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM	TMH 1 [B13]					-	
ACV (%) - DRY	[B1]					-	
10 % FACT (kN) - DRY	[B2]					-	
ACV (%) - WET	[B2]					-	
10 % FACT (kN) - WET	[B2]					-	
Ethylene Glycol Durability Index #						-	
Flakiness Index (%)	[B3]					-	
Organic Material (Y / N) #	[B6]					-	
Loose Bulk Density Kg/m3 #	[B9]	1.093	0.726			-	
Compacted Bulk Density Kg/m #	[B9]	1.152	0.776			-	
Bulking Factor #		1.05	1.07			-	
Soluble Sulfates (%) #	[B17]					-	
Ave.Least Dimension:(mm)	[B18(a)]					-	
Sand Equivalent (%) #	[B19]					-	
Relative density Kg/m3 #	) 8108b					-	
Conductivity (ms/m) #	[A21T]					-	
ARD (-4.75mm) Kg/m3	[B15]	3.958				-	
BRD (-4.75mm) Kg/m3	[B15]	3.572				-	
ARD (+4.75mm) Kg/m3	[B14]		2.026			-	
BRD (+4.75mm) Kg/m3	[B14]		1.697			-	
Mg2SO4 Soundness #	[839]					-	
Polished Stone Value #	[BS 812]					-	
Water absorption (%)	[B15]	2.7				-	
Water absorption (%)	[B14]		9.6			-	
Sample Method used	TMH 5 #	N/A	N/A			-	

- This is not a accredited test

Kind Regards

INTERIM
Mr Deon Juckers
Technical Signatory

INTERIM
Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested

Compiled By : Miss Trisha Padotan

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95/CLI001/01/0001/14 29/04/2014

Clinker Supplies (Pty) Ltd
P.O. Box 151
Alberton
1450

ATTENTION: **Mr.Paul Davies**

Dear Sir

Test Report: **CLINKER SUPPLIES: AGGREGATE TEST RESULTS (TRACK No.8006)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		14/A249	14/A250		REMARKS & NOTES		
CONTAINER USED FOR SAMPLING		Sampling Plastic Bag	Sampling Plastic Bag				
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry				
HOLE NO. / KM OR CHAINAGE		Not Specified	Not Specified				
ROAD NO OR NAME		Not Specified	Not Specified				
LAYER TESTED / SAMPLED FROM		Black Sand	Pale Red Ash				
DATE SAMPLED		27/11/2013	06/05/2014				
DATE RECEIVED		06/05/2014	06/05/2014				
CLIENTS MARKING		None	None				
REQUEST NO.		None	None				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Black Sand	Pale Red Ash		SPECIFICATION		
NOMINAL SIZE OF STONE					MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM TMH 1 [B13]						-	
ACV (%) - DRY [B1]						-	
10 % FACT (kN) - DRY [B2]						-	
ACV (%) - WET [B2]						-	
10 % FACT (kN) - WET [B2]						-	
Ethylene Glycol Durability Index #						-	
Flakiness Index (%) [B3]						-	
Organic Material (Y / N) # [B6]						-	
Loose Bulk Density Kg/m3 # [B9]		1.093	0.726			-	
Compacted Bulk Density Kg/n# [B9]		1.152	0.776			-	
Bulking Factor #		1.05	1.07			-	
Soluble Sulfates (%) # [B17]						-	
Ave.Least Dimension:(mm) [B18(a)]						-	
Sand Equivalent (%) # [B19]						-	
Relative density Kg/m3 #) 8108b						-	
Conductivity (ms/m) # [A21T]						-	
ARD (-4.75mm) Kg/m3 [B15]		3.958				-	
BRD (-4.75mm) Kg/m3 [B15]		3.572				-	
ARD (+4.75mm) Kg/m3 [B14]			2.025			-	
BRD (+4.75mm) Kg/m3 [B14]			1.705			-	
Mg2SO4 Soundness # [839]						-	
Polished Stone Value # [BS 812]						-	
Water absorption (%) [B15]		2.7					
Water absorption (%) [B14]			9.3			-	
Sample Method used TMH 5 #		N/A	N/A			-	

- This is not a accredited test

Kind Regards

Mr Deon Juckers
Technical Signatory

Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab

Compiled By : Miss Trisha Padotan

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95/CLI001/01/0001/14 29/04/2014

Clinker Supplies (Pty) Ltd
P.O. Box 151
Alberton
1450

ATTENTION: **Mr.Paul Davies**

Dear Sir

Test Report: **CLINKER SUPPLIES: AGGREGATE TEST RESULTS (TRACK No.8006)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		14/A249	14/A250		REMARKS & NOTES		
CONTAINER USED FOR SAMPLING		Sampling Plastic Bag	Sampling Plastic Bag				
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry				
HOLE NO. / KM OR CHAINAGE		Not Specified	Not Specified				
ROAD NO OR NAME		Not Specified	Not Specified				
LAYER TESTED / SAMPLED FROM		Black Sand	Base Course				
DATE SAMPLED		27/11/2013	06/05/2014				
DATE RECEIVED		06/05/2014	06/05/2014				
CLIENTS MARKING		None	None				
REQUEST NO.		None	None				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Black Sand Pale Red Ash	Base Course		SPECIFICATION		
NOMINAL SIZE OF STONE					MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM	TMH 1 [B13]					-	
ACV (%) - DRY	[B1]					-	
10 % FACT (kN) - DRY	[B2]					-	
ACV (%) - WET	[B2]					-	
10 % FACT (kN) - WET	[B2]					-	
Ethylene Glycol Durability Index #						-	
Flakiness Index (%)	[B3]					-	
Organic Material (Y / N) #	[B6]					-	
Loose Bulk Density Kg/m3 #	[B9]	1.093	0.726			-	
Compacted Bulk Density Kg/m #	[B9]	1.152	0.776			-	
Bulking Factor #		1.05	1.07			-	
Soluble Sulfates (%) #	[B17]					-	
Ave.Least Dimension:(mm)	[B18(a)]					-	
Sand Equivalent (%) #	[B19]					-	
Relative density Kg/m3 #	) 8108b					-	
Conductivity (ms/m) #	[A21T]					-	
ARD (-4.75mm) Kg/m3	[B15]	3.958				-	
BRD (-4.75mm) Kg/m3	[B15]	3.572				-	
ARD (+4.75mm) Kg/m3	[B14]		2.026			-	
BRD (+4.75mm) Kg/m3	[B14]		1.697			-	
Mg2SO4 Soundness #	[839]					-	
Polished Stone Value #	[BS 812]					-	
Water absorption (%)	[B15]	2.7				-	
Water absorption (%)	[B14]		9.6			-	
Sample Method used	TMH 5 #	N/A	N/A			-	

- This is not a accredited test

Kind Regards

INTERIM
Mr Deon Juckers
Technical Signatory

INTERIM
Mr Charel van Biljon
Laboratory Manager

Remarks :
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The samples were subjected to analysis according to TMH 1
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95/CLI001/01/0001/14 29/04/2014

Clinker Supplies (Pty) Ltd
P.O. Box 151
Alberton
1450

ATTENTION: **Mr.Paul Davies**

Dear Sir

Test Report: **CLINKER SUPPLIES: AGGREGATE TEST RESULTS (TRACK No.8006)**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		14/A249	14/A250		REMARKS & NOTES		
CONTAINER USED FOR SAMPLING		Sampling Plastic Bag	Sampling Plastic Bag				
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry				
HOLE NO. / KM OR CHAINAGE		Not Specified	Not Specified				
ROAD NO OR NAME		Not Specified	Not Specified				
LAYER TESTED / SAMPLED FROM		Black Sand	Pale Red Ash				
DATE SAMPLED		27/11/2013	06/05/2014				
DATE RECEIVED		06/05/2014	06/05/2014				
CLIENTS MARKING		None	None				
REQUEST NO.		None	None				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Black Sand	Pale Red Ash		SPECIFICATION		
NOMINAL SIZE OF STONE					MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM TMH 1 [B13]						-	
ACV (%) - DRY [B1]						-	
10 % FACT (kN) - DRY [B2]						-	
ACV (%) - WET [B2]						-	
10 % FACT (kN) - WET [B2]						-	
Ethylene Glycol Durability Index #						-	
Flakiness Index (%) [B3]						-	
Organic Material (Y / N) # [B6]						-	
Loose Bulk Density Kg/m3 # [B9]		1.093	0.726			-	
Compacted Bulk Density Kg/n# [B9]		1.152	0.776			-	
Bulking Factor #		1.05	1.07			-	
Soluble Sulfates (%) # [B17]						-	
Ave.Least Dimension:(mm) [B18(a)]						-	
Sand Equivalent (%) # [B19]						-	
Relative density Kg/m3 #) 8108b						-	
Conductivity (ms/m) # [A21T]						-	
ARD (-4.75mm) Kg/m3 [B15]		3.958				-	
BRD (-4.75mm) Kg/m3 [B15]		3.572				-	
ARD (+4.75mm) Kg/m3 [B14]			2.025			-	
BRD (+4.75mm) Kg/m3 [B14]			1.705			-	
Mg2SO4 Soundness # [839]						-	
Polished Stone Value # [BS 812]						-	
Water absorption (%) [B15]		2.7					
Water absorption (%) [B14]			9.3			-	
Sample Method used TMH 5 #		N/A	N/A			-	

- This is not a accredited test

Kind Regards

Mr Deon Juckers
Technical Signatory

Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab

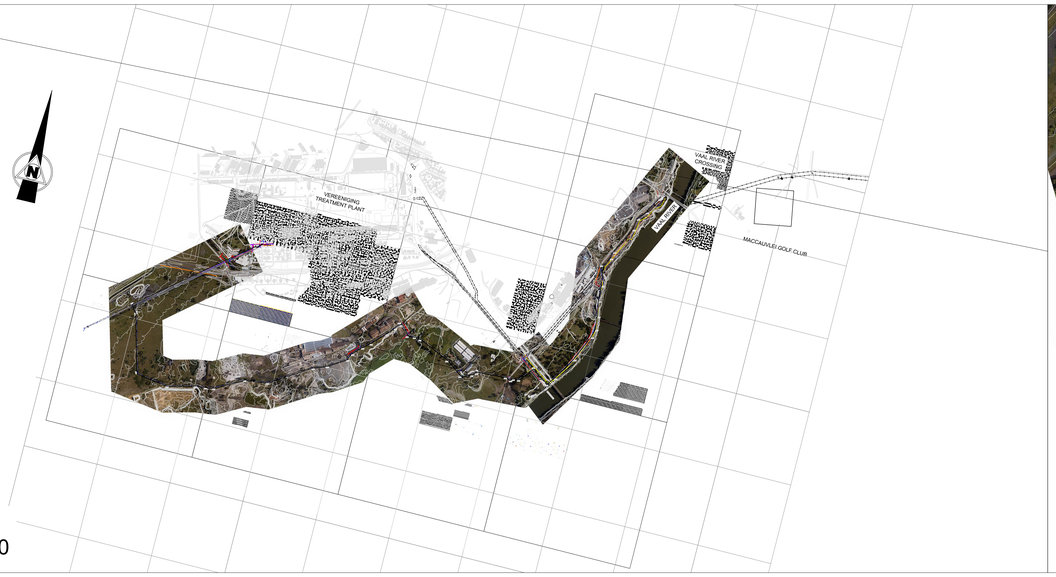
Compiled By : Miss Trisha Padotan

ANNEXURE F

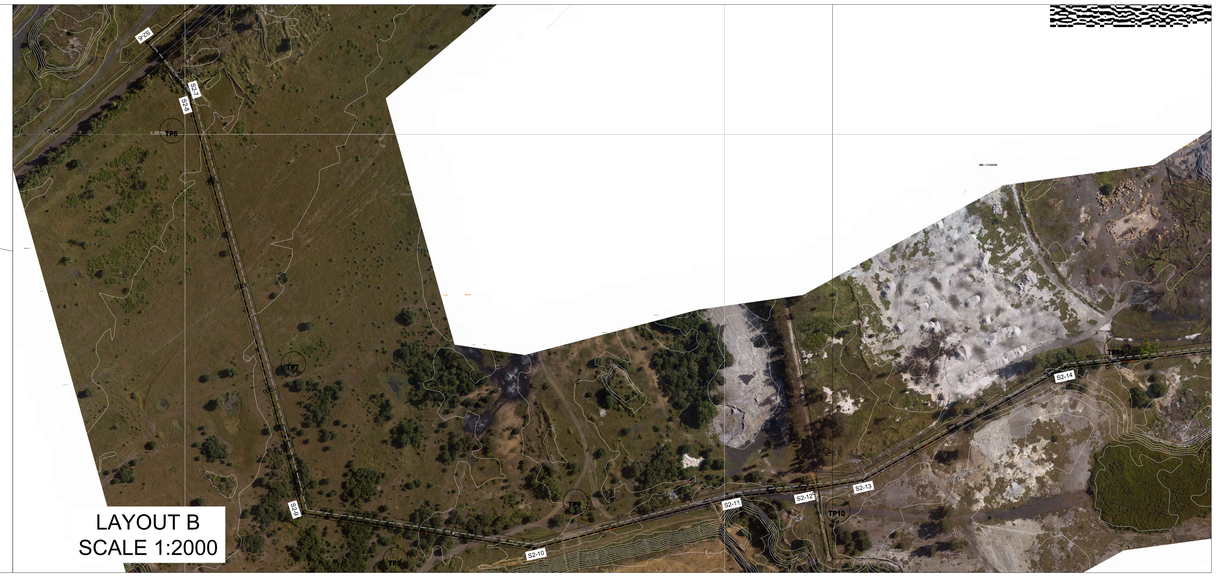
LONGITUDINAL SECTIONS

TEST RESULTS

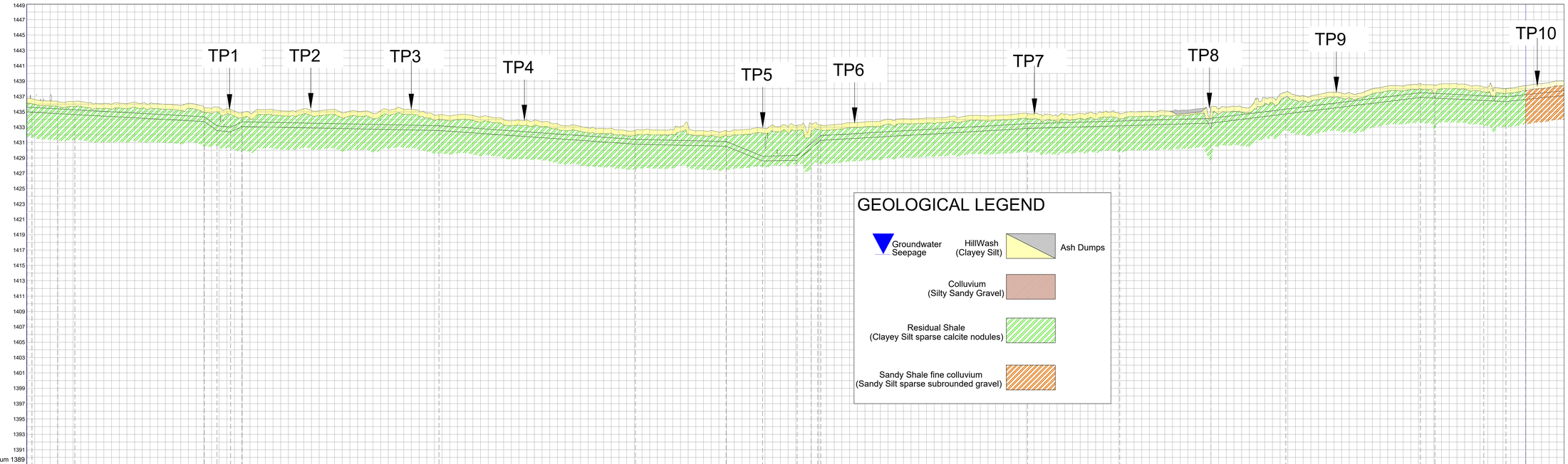
DRW No



LAYOUT A
SCALE 1:2000



LAYOUT B
SCALE 1:2000



HOR:1:2000
VERT:1:200
Datum 1389

Ground Level (m)	1458.111 1458.111 1458.132 1458.132 1458.472 1458.555 1458.328 1458.182 1455.552 1455.640 1455.640 1455.393 1454.955 1458.125 1454.629 1452.608 1453.110 1452.587 1452.882 1452.882 1453.279 1453.460 1453.388 1453.388 1453.095 1454.772 1454.824 1455.670 1457.581 1458.679 1458.444 1458.222 1458.181 1458.415
Ground Cover to Top of Pipe (m)	
Pipe Invert Level (m)	1456.408 1456.408 1456.707 1456.707 1456.646 1456.646 1453.767 1453.556 1453.556 1452.364 1453.078 1452.966 1450.780 1450.923 1450.924 1450.924 1429.693 1429.693 1429.693 1429.693 1432.831 1433.181 1433.181 1433.539 1434.723 1434.723 1436.873 1436.782 1436.782 1436.474 1436.474 1436.334 1436.092 1436.092
Cut from Ground to Trench Floor (m)	1.703 1.703 1.425 1.425 1.988 1.652 1.621 1.673 1.673 2.600 1.677 2.964 2.964 1.628 2.964 4.274 4.274 4.628 3.211 2.588 2.588 1.841 1.643 1.643 2.141 2.588 1.856 1.862 1.748 1.748 1.777 1.813
Horizontal Peg Distance (m)	0.482 20.000 40.000 60.000 62.213 80.000 100.000 120.000 140.000 160.000 180.000 200.000 220.000 230.702 240.000 260.000 264.691 278.637 300.000 320.000 340.000 360.000 380.000 400.000 420.000 440.000 460.000 480.000 500.000 520.000 538.597 540.000 560.000 580.000 600.000 620.000 640.000 660.000 680.000 700.000 720.000 740.000 760.000 780.000 791.362 800.000 820.000 840.000 860.000 880.000 900.000 909.565 920.000 940.000 956.873 960.000 980.000 1000.000 1001.798 1020.000 1040.000 1060.000 1080.000 1100.000 1120.000 1140.000 1160.000 1180.000 1200.000 1220.000 1240.000 1260.000 1280.000 1300.000 1320.000 1340.000 1360.000 1380.000 1400.000 1421.106 1440.000 1460.000 1480.000 1500.000 1520.000 1540.000 1560.000 1580.000 1600.000 1620.000 1640.000 1660.000 1680.000 1700.000 1720.000 1740.000 1760.000 1780.000 1800.000 1812.583 1820.000 1840.000 1860.000 1880.000 1884.833 1900.000 1920.000 1923.786 1940.000 1944.224 1960.000 1980.000 2000.000
Slope Peg Distance (m)	
Grade (Per 100m) (%)	0.543 % 0.543 % 0.543 % 2.113 % 1.250 % 2.113 % 0.200 % 0.699 % 0.218 % 4.058 % 0.000 % 8.459 % 0.573 % 0.293 % 0.293 % 1.227 % 1.227 % 0.484 % 0.484 % 1.053 % 1.053 %
Bend Reference	S2-2 (D) S2-3 (B) S2-4 (H) S2-5 (B) S2-6 (B) S2-7 (D) S2-8 (B) S2-9 (B) S2-10 (B) S2-11 (D) S2-12 (D) S2-13 (B)
Pipe Details	STEEL PIPE 620mm O.D. AP1 5L GRADE X42 WALL THICKNESS 10mm EPOXY LINING FIBRE REINFORCED BITUMINOUS COATING
Backfilling	CLASS C MATERIAL: BEDDING CRADLE OF COMPACTED SELECTED GRANULAR MATERIAL

LEGEND

- AIR VALVE WITHOUT ACCESS MANHOLE
- AIR VALVE WITH ACCESS M/H
- INLINE SLUICE VALVE
- INLINE BUTTERFLY VALVE
- SCOUR VALVE
- REFLUX VALVE
- PIPE JACKING
- PIPE BEND REFERENCE MARKER
- BEACON (BCN)
- PIPE LOCATOR TEST POINT (PLT)
- METER (M)
- ELECTRIC POLE (EP)
- TELEPHONE POLE (TP)
- FENCE
- SURVEY STATION

CATHODIC PROTECTION LEGEND :

- EXISTING CROSS BOND FACILITY
- NEW CROSS BOND FACILITY
- NEW CP SYSTEM
- EXISTING CP SYSTEM
- ZINC RIBBON
- EARTH MAT

NOTES:

1. ALL PEGS ARE 12mm ROUND IRON PEGS ON CENTRE LINE OF PIPELINE.
2. HORIZONTAL BENDS ARE SQUARE PEGS
3. OVER HEAD ELECTRICAL PYLONS - BEWARE OF UNDERGROUND EARTH STRAPS AND CABLES BETWEEN PYLONS
4. ENSURE ACCESS TO PROPERTIES ARE AVAILABLE WHERE DRIVEWAYS ARE AFFECTED
5. FOR CONCRETE ENCASEMENT REFER TO CIVIL DRAWINGS .....
6. ALL ATTEMPTS ARE UNDERTAKEN BY THE SURVEYOR TO LOCATE ALL AFFECTED SERVICES ABOVE AND BELOW GROUND, SURFACE. IT IS OF UTMOST IMPORTANCE THAT THE CONTRACTOR TAKE THE NECESSARY PRECAUTIONS WHEN EXCAVATING IN THE VICINITY OF SERVICES.

REVISIONS

No.	Date	Checked	Approved	Description
A	17-10-2016	A.M	A.M,	ISSUED FOR APPROVAL

REFERENCE DRAWINGS

Number	Title

RAND WATER

RAND WATER APPROVES THE DESIGN REQUIREMENTS ONLY
THE CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN

Box 1127
Johannesburg
2000
Tel: 011 682 -0911

L.W.Lange
(Pr. Eng.)
Senior Manager
Assets

SAP No		checked	
Contract No		Accepted	
Originator		Date	

Drawn By	W.K	Approved	Pr.Eng
Checked By	A.M	Registration No	
Date	17/10/2016	Date	

B19 SLUDGE PIPELINE PHASE 2
ZUIKERBOSCH - VEREENIGING
PLAN AND LONGITUDINAL SECTION
CH 0.000m - CH 1940.000m

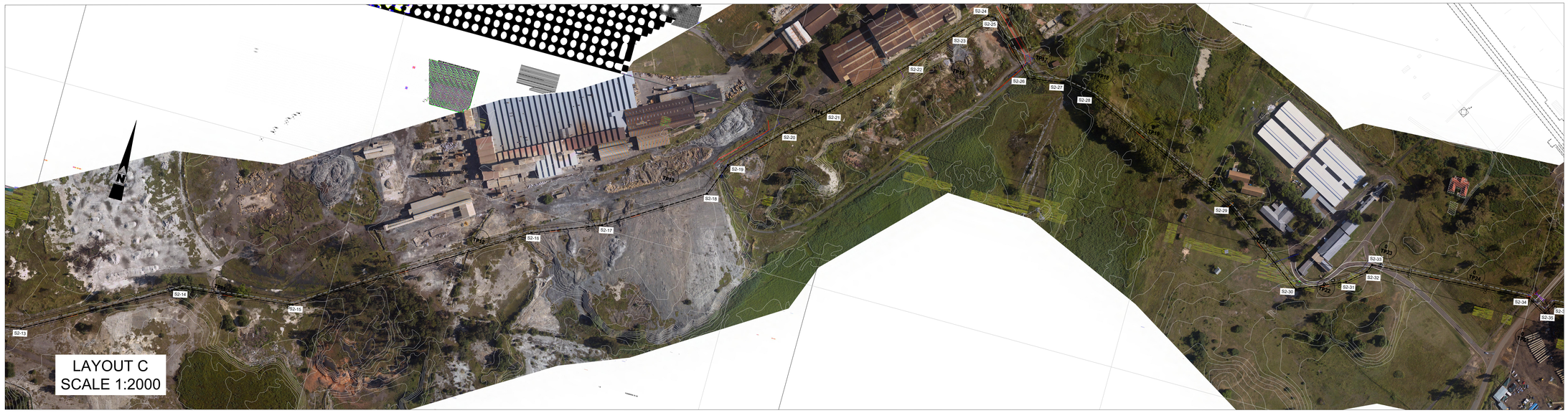
station | wks | doc.type | s

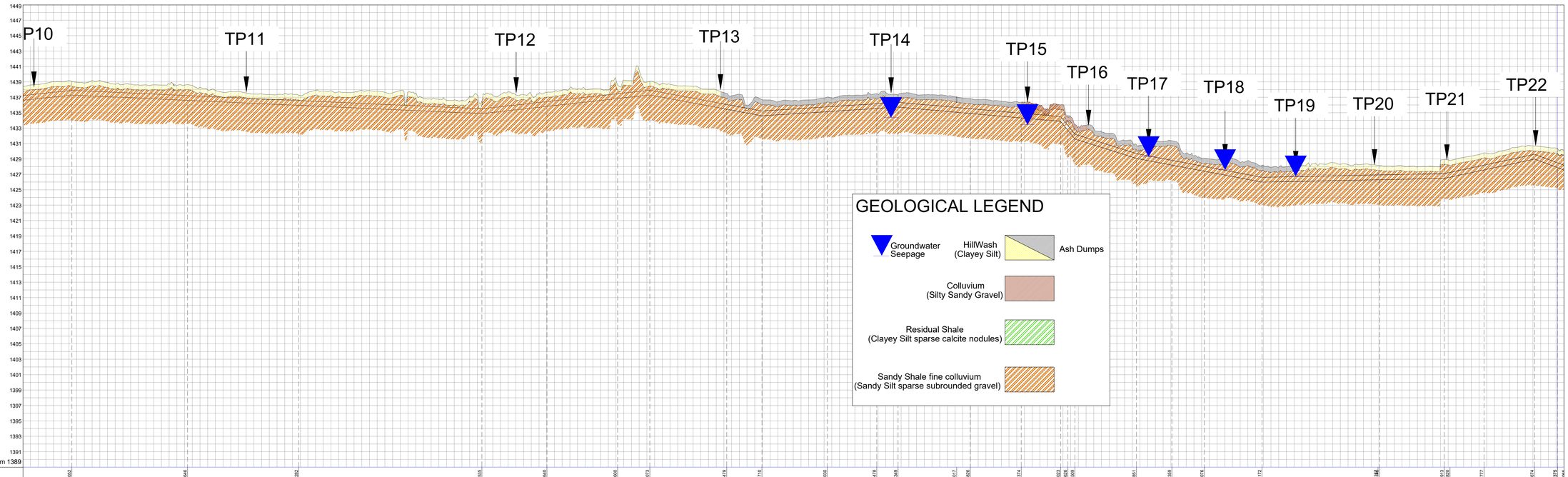
SCALE AS SHOWN

DRW No RW201501/SLS/01

Revision A

DRW No





HOR:1:2000
VERT:1:200

Ground Level (m)	1439.952 … 1429.325
Ground Cover to Top of Pipe (m)	
Pipe Invert Level (m)	1438.152 … 1427.525
Cut from Ground to Trench Floor (m)	1.771 … 1.800
Horizontal Peg Distance (m)	1960.000 … 3840.000
Slope Peg Distance (m)	
Grade (Per 100m) (%)	1.053 % … 0.200 % … 2.144 % … 3.600 %
Bend Reference	SP-14 (14) … SP-35 (35)
Pipe Details	STEEL PIPE 620mm O.D. AP1 5L GRADE X42 WALL THICKNESS 10mm EPOXY LINING FIBRE REINFORCED BITUMINOUS COATING
Backfilling	CLASS C MATERIAL: BEDDING CRADLE OF COMPACTED SELECTED GRANULAR MATERIAL

LEGEND

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- AIR VALVE WITH ACCESS M/H
- INLINE SLUICE VALVE
- INLINE BUTTERFLY VALVE
- SCOUR VALVE
- REFLUX VALVE
- PIPE JACKING
- PIPE BEND REFERENCE MARKER
- BEACON (BCN)
- PIPE LOCATOR TEST POINT (PLT)
- METER (METER No.)
- ELECTRIC POLE (EP)
- TELEPHONE POLE (TP)
- FENCE
- SURVEY STATION

CATHODIC PROTECTION LEGEND :

- EXISTING CROSS BOND FACILITY
- NEW CROSS BOND FACILITY
- NEW CP SYSTEM
- EXISTING CP SYSTEM
- ZINC RIBBON
- EARTH MAT

NOTES:

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REFERENCE DRAWINGS

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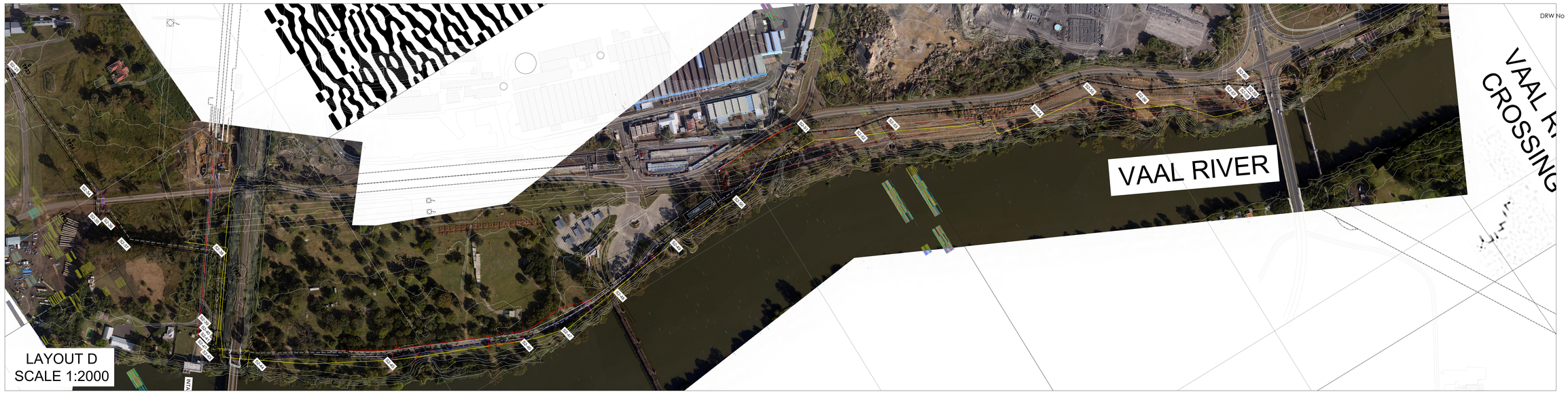
SAP No		checked	
Contract No		Accepted	
Originator		Date	

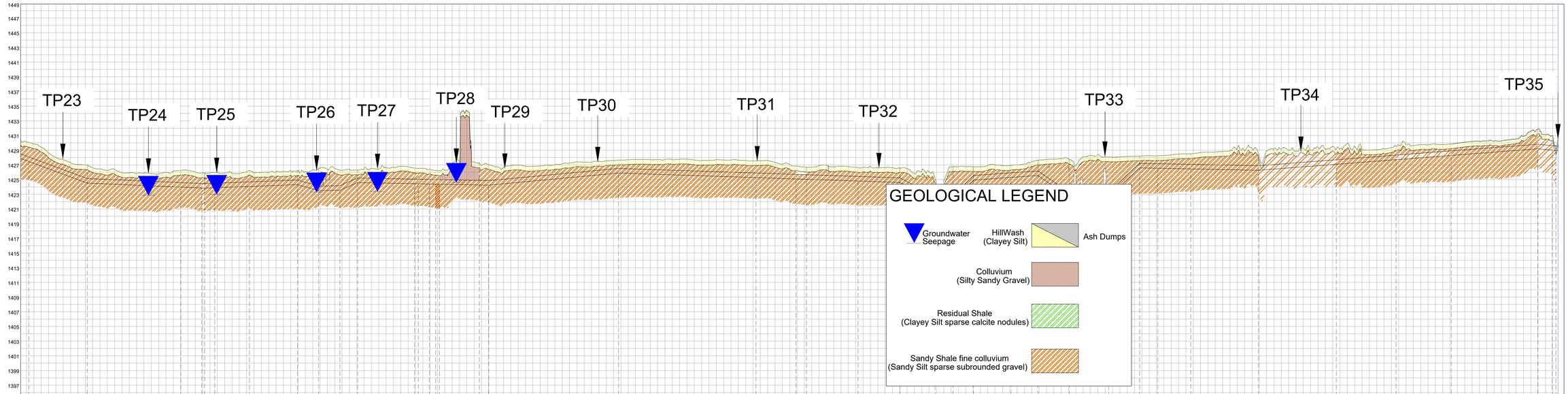
Drawn By	W.K	Approved	Pr.Eng
Checked By	A.M	Registration No	
Date	17/10/2016	Tel No	

B19 SLUDGE PIPE LINE PHASE 2
ZUIKERBOSCH - VEREENIGING
PLAN AND LONGITUDINAL SECTION
CH 1940.00m - CH 3940.00m

station | wks | doc.type | s

SCALE	AS SHOWN		
DRW No	RW201501/SLS/02	Revision	





LEGEND

- AIR VALVE WITHOUT ACCESS MANHOLE
- AIR VALVE WITH ACCESS M/H
- INLINE SLUICE VALVE
- INLINE BUTTERFLY VALVE
- SCOUR VALVE
- REFLUX VALVE
- PIPE JACKING
- PIPE BEND REFERENCE MARKER
- BEACON (BCN)
- PIPE LOCATOR TEST POINT (PLT)
- METER (M) — METER NO.
- ELECTRIC POLE (EP)
- TELEPHONE POLE (TP)
- FENCE
- SURVEY STATION

CATHODIC PROTECTION LEGEND :

- EXISTING CROSS BOND FACILITY
- NEW CROSS BOND FACILITY
- NEW CP SYSTEM
- EXISTING CP SYSTEM
- ZINC RIBBON
- EARTH MAT

NOTES:

1. ALL PEGS ARE 12mm ROUND IRON PEGS ON CENTRE LINE OF PIPELINE.
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L.W.Longe
(Pr. Eng.)
Senior Manager
Assets

SAP No		checked	
Contract No		Accepted	
Originator		Date	

Drawn By	W.K	Approved	Pr.Eng
Checked By	A.M	Registration No	
Date	17/10/2016		

B19 SLUDGE PIPELINE PHASE 2
ZUIKERBOSCH-VEREENIGING
PLAN AND LONGITUDINAL SECTION
CH 3940.00m - CH 6037.18m

station | wks | doc.type | s

SCALE	AS SHOWN
DRW No	RW201501/SLS/03
Revision	

ANNEXURE G

RESISTIVITY SURVEY REPORT

ENGINEERING & EXPLORATION GEOPHYSICAL SERVICES CC
CK94/10526/23 Geophysical Contractors
[redacted]

170 Jakaranda Street,
Doringkloof,
Gauteng,0157
012 - 6673369 (tel.) 6675186(fax)
E-mail: eegs@iafrica.com
25th November, 2016

Nomfundo Exploration & Consulting (Pty) Ltd,
43 Hadley Street,
Riviera,
Pretoria

Attn: Mr G.Rabodiba

Dear Sir,

B19 PIPELINE - SOIL RESISTIVITY SURVEY

1. Introduction

The results are given here of a soil resistivity survey carried out in Vereeniging along the route of the B19 pipeline. Fieldwork was performed in the week starting the 14th November. The survey consisted of thirty soundings, at positions indicated to E&EGS (Appendix 1). There was rainfall before and during the survey.

2. Instrumentation, data collection methods and reduction procedure

2.1 Instrumentation

The data were collected with an ABEM SAS1000 resistivity meter coupled to a 10-64 switch box. Resistivity measurements are obtained by injecting a current into the ground through two electrodes and measuring the resulting potential between another electrode pair. Measurements obtained when systematically increasing the electrode separation - a sounding - record apparent resistivity variations with depth, whilst a set of adjacent soundings provides lateral coverage. The ABEM automates the collection of such data sets.

2.2 Data collection

A Wenner configuration (equally spaced electrodes set in a line) was used for the resistivity imaging, as is required for this type of survey. A half-metre electrode separation was employed and the measurement range was ½, 1, 1½, and 2 metres, and then by one metre increments to 6 metres. Where space allowed the traverses were lain out perpendicular to the route to avoid coupling with any pipes already in place.

2.3 Data reduction and presentation

Any spikes (unrepresentative readings) were removed from the data with the aid of the program Res2Dinv, then the average resistance was calculated for each electrode separation. Apparent resistivity was calculated from average resistance. The data were also modelled.

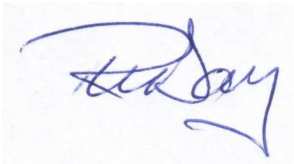
3. Results

The test site positions are shown on figure 1 whilst the data are tabulated and the models reproduced in Appendix 2. Although not directly equivalent to the tabulated values (apparent resistivity is an average or bulk sample of resistivity for a particular electrode separation) the following resistivity values may be used as a guide to corrosion potential:

- < 20 ohm metres – severe;
- 20-100 ohm metres – moderate;
- 100-300 ohm metres – mild;
- >300 ohm metres – unlikely.

By convention only, the depth that is assigned to a particular (apparent) resistivity value is equivalent to the electrode separation used to measure that value. A better indication of resistivity variations is obtained from the modelled data, and plotting the pipeline depth onto the models will assist in a final classification in areas that are particularly heterogeneous.

Yours sincerely,



R.W.Day. Pr.Sci.Nat.

Appendix 1

B19 Pipeline Soil Resistivity Survey

Traverse start and end points (Lo27 WGS84)

Line-St.	LoY	LoX
1-00	-93232	2952797
1-20	-93268	2952787
2-00	-93149	2952940
2-20	-93166	2952949
3-00	-93115	2953076
3-20	-93057	2953084
4-00	-93043	2953204
4-20	-93056	2953211
5-00	-92994	2953389
5-20	-93011	2953383
6-00	-93004	2953546
6-20	-93007	2953527
7-00	-93033	2953740
7-20	-93055	2953734
8-00	-92940	2953952
8-20	-92962	2953958
9-00	-92843	2954086
9-20	-92840	2954092
10-00	-92787	2954108
10-20	-92777	2954122
11-00	-92625	2954121
11-20	-92642	2954135
12-00	-92553	2954194
12-20	-92558	2954172
13-00	-92309	2954185
13-20	-92324	2954202
14-00	-92101	2954135
14-20	-92110	2954114
15-00	-91858	2954013
15-20	-91843	2954031

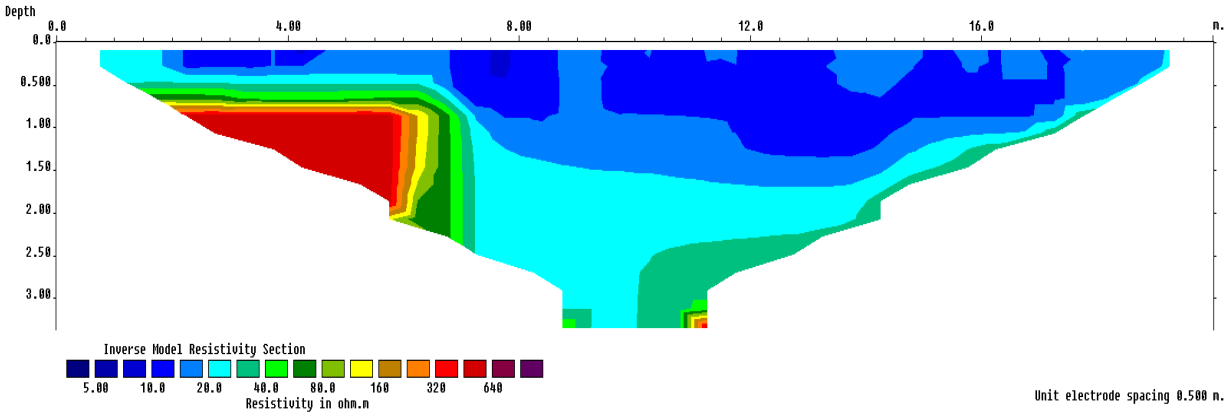
Line-St.	LoY	LoX
16-00	-91712	2954047
16-20	-91703	2954063
17-00	-91571	2954190
17-20	-91588	2954206
18-00	-91411	2954302
18-20	-91394	2954311
19-00	-91083	2954488
19-20	-91093	2954509
20-00	-90885	2954534
20-20	-90885	2954557
21-00	-90709	2954627
21-20	-90717	2954645
22-00	-90520	2954680
22-20	-90522	2954700
23-00	-90305	2954714
23-20	-90302	2954734
24-00	-90122	2954620
24-20	-90142	2954617
25-00	-90074	2954422
25-20	-90095	2954414
26-00	-90019	2954247
26-20	-90032	2954262
27-00	-90176	2954120
27-20	-90189	2954136
28-00	-90402	2953950
28-20	-90425	2953958
29-00	-90477	2953887
29-20	-90490	2953902
30-00	-90551	2953827
30-20	-90568	2953837

Appendix 2

B19 Pipeline Soil Resistivity Survey

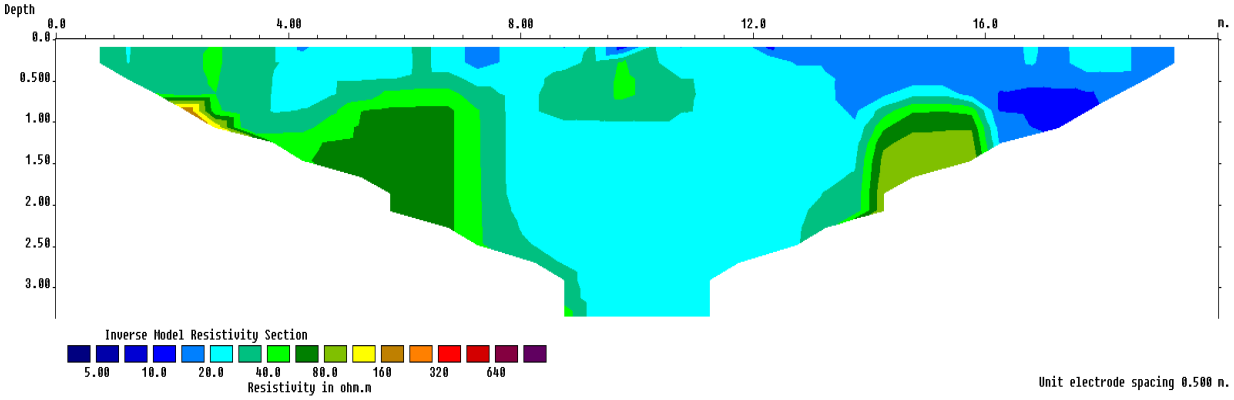
Tabulated and modelled results

Site 01



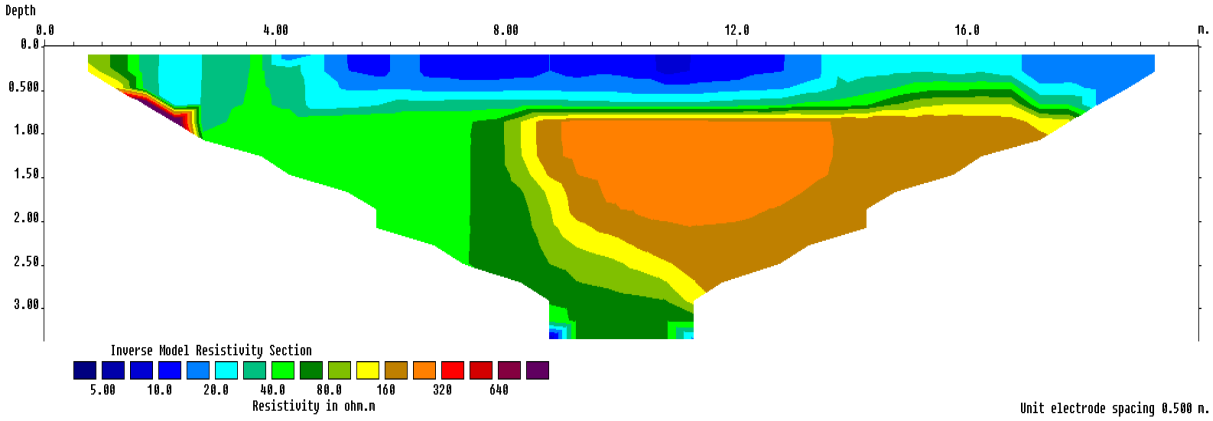
B19 Pipeline: 01 W-E		
A	**Count**	**App.Res.**
0.5	37	16.87
1	35	22.18
1.5	32	26.47
2	15	30.39
3	12	37.71
4	9	43.67
5	6	45.80
6	3	54.33

Site 02



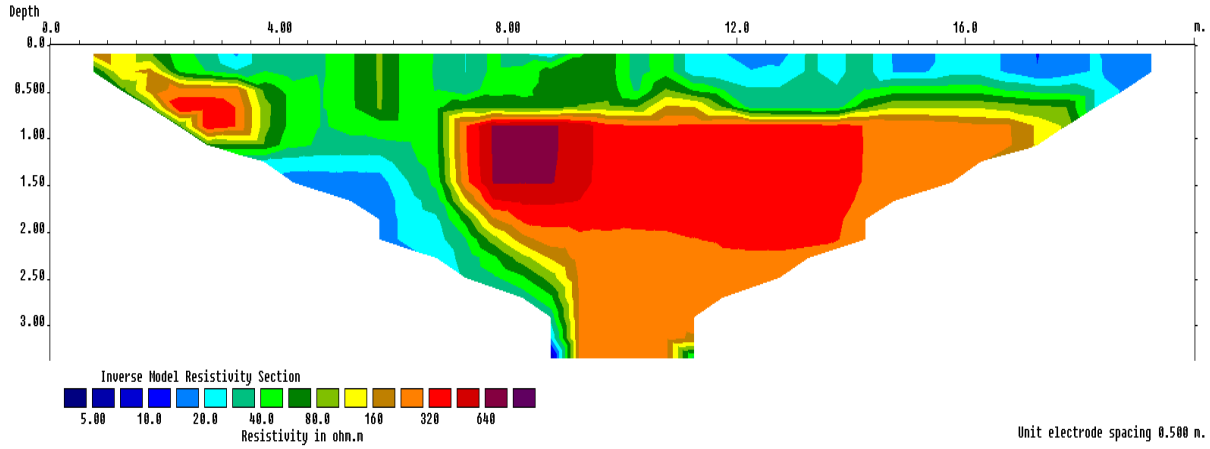
B19 Pipeline 02 W-E		
A	**Count**	**App.Res.**
0.5	37	25.08
1	35	28.34
1.5	32	30.80
2	15	32.31
3	12	33.87
4	9	34.65
5	6	34.61
6	3	35.47

Site 03



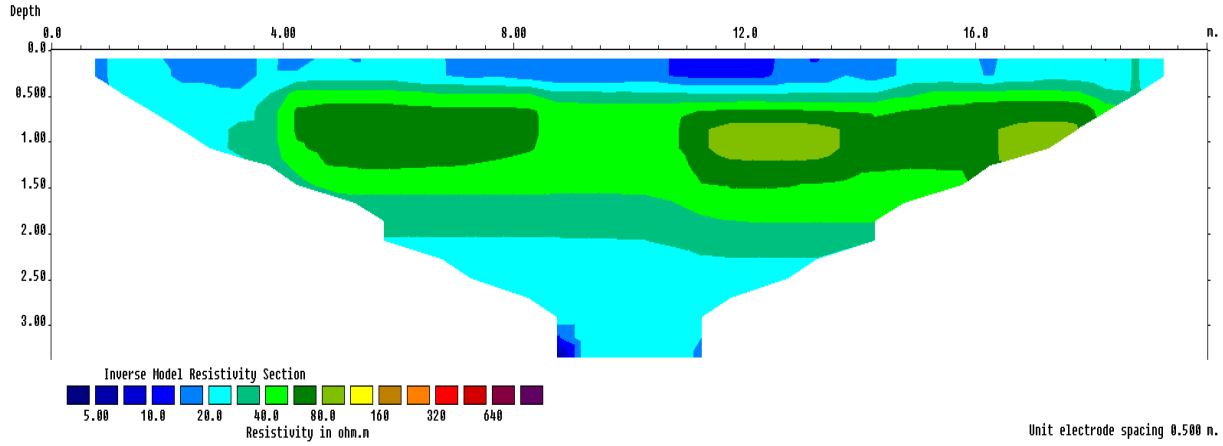
B19 Pipeline 03 W-E		
A	**Count**	**App.Res.**
0.5	37	27.87
1	35	37.84
1.5	32	43.88
2	15	50.08
3	12	56.13
4	9	55.00
5	6	48.46
6	3	44.99

Site 04



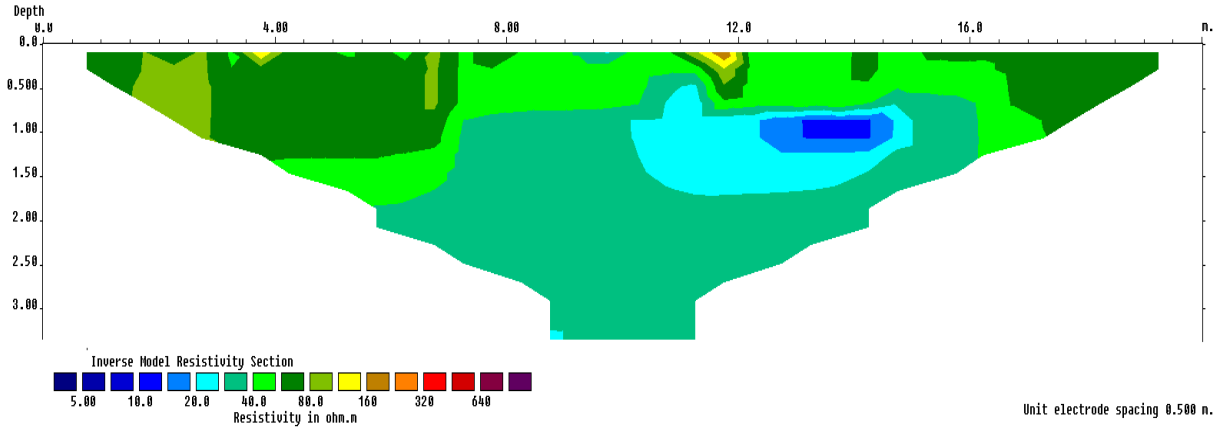
B19 Pipeline 04 W-E		
A	**Count**	**App.Res.**
0.5	37	42.70
1	35	56.76
1.5	32	65.64
2	15	72.15
3	12	81.73
4	9	79.45
5	6	76.19
6	3	72.68

Site 05



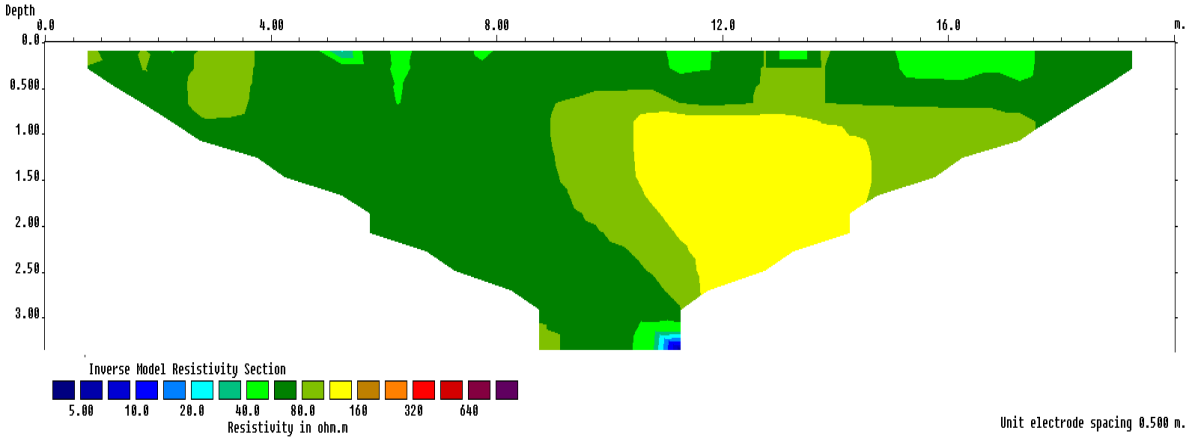
B19 Pipeline 05 W-E		
A	**Count**	**App.Res.**
0.5	37	22.79
1	35	30.93
1.5	32	34.16
2	15	34.64
3	12	32.57
4	9	28.54
5	6	23.92
6	3	20.52

Site 06



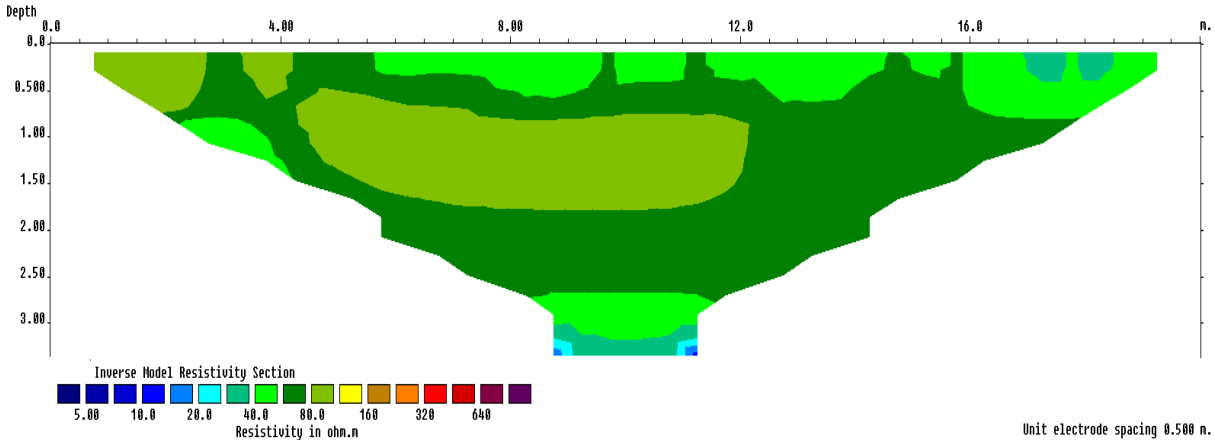
B19 Pipeline 06 N-S		
A	**Count**	**App.Res.**
0.5	37	56.85
1	35	51.62
1.5	32	44.81
2	15	40.65
3	12	35.97
4	9	33.88
5	6	31.86
6	3	29.79

Site 07



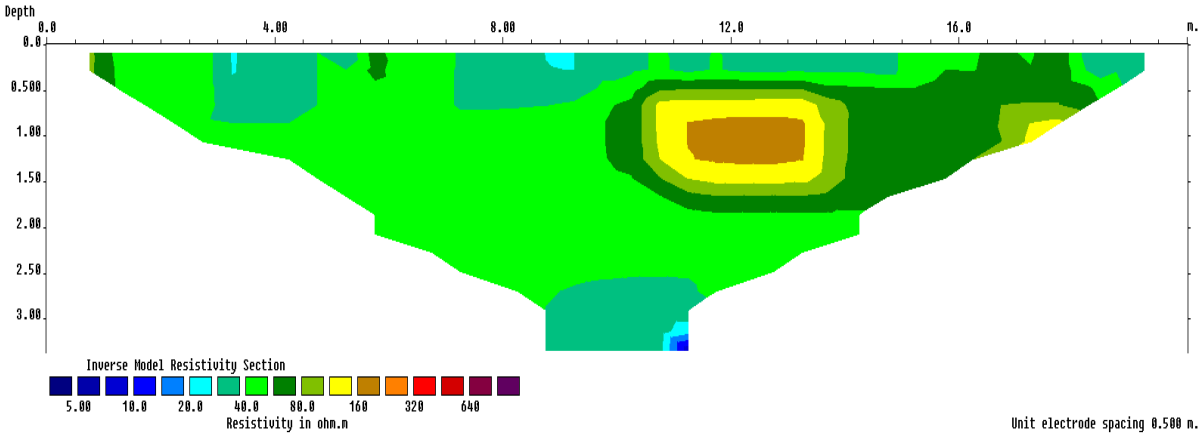
B19 Pipeline 07 W-E		
A	**Count**	**App.Res.**
0.5	37	68.21
1	35	74.37
1.5	32	77.32
2	15	77.83
3	12	77.01
4	9	73.85
5	6	69.78
6	3	60.25

Site 08



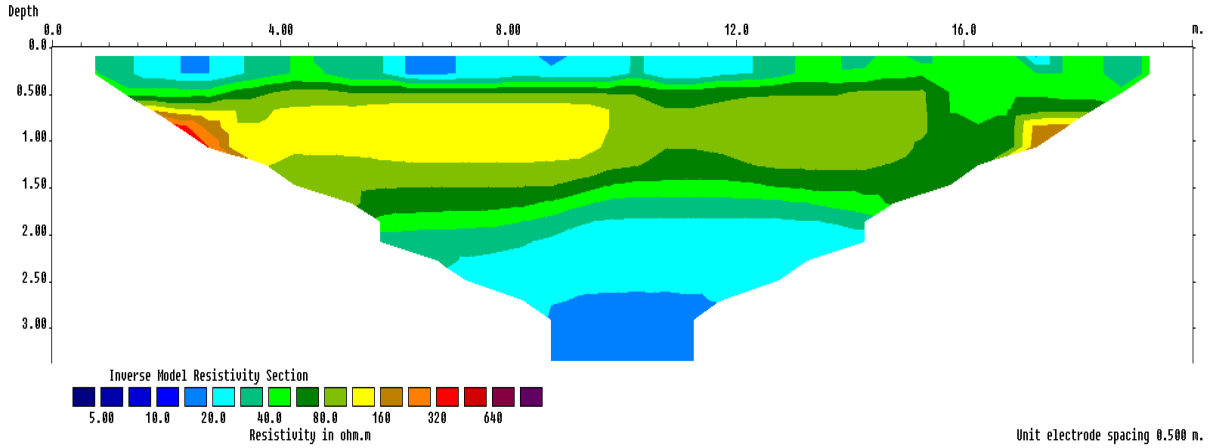
B19 Pipeline 08 W-E		
A	**Count**	**App.Res.**
0.5	37	59.90
1	35	63.49
1.5	32	64.00
2	15	62.47
3	12	55.86
4	9	46.56
5	6	37.57
6	3	32.13

Site 09



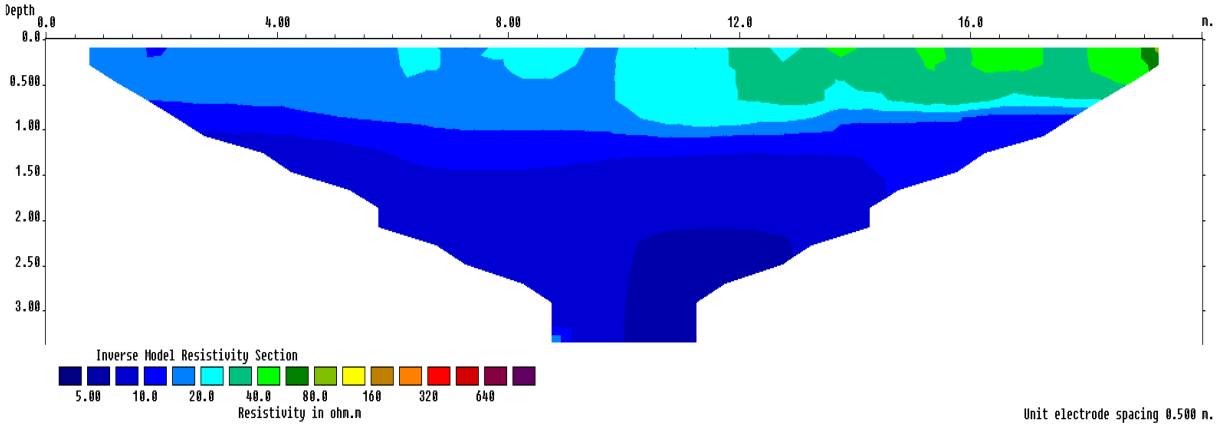
B19 Pipeline 09 W-E		
A	**Count**	**App.Res.**
0.5	29	46.52
1	28	52.91
1.5	26	54.13
2	11	51.75
3	8	48.22
4	7	41.34
5	5	37.09
6	3	32.62

Site 10



B19 Pipeline 10 N-S		
A	**Count**	**App.Res.**
0.5	37	38.40
1	35	52.58
1.5	32	56.99
2	15	57.22
3	12	51.13
4	9	42.13
5	6	34.20
6	3	30.31

Site 11



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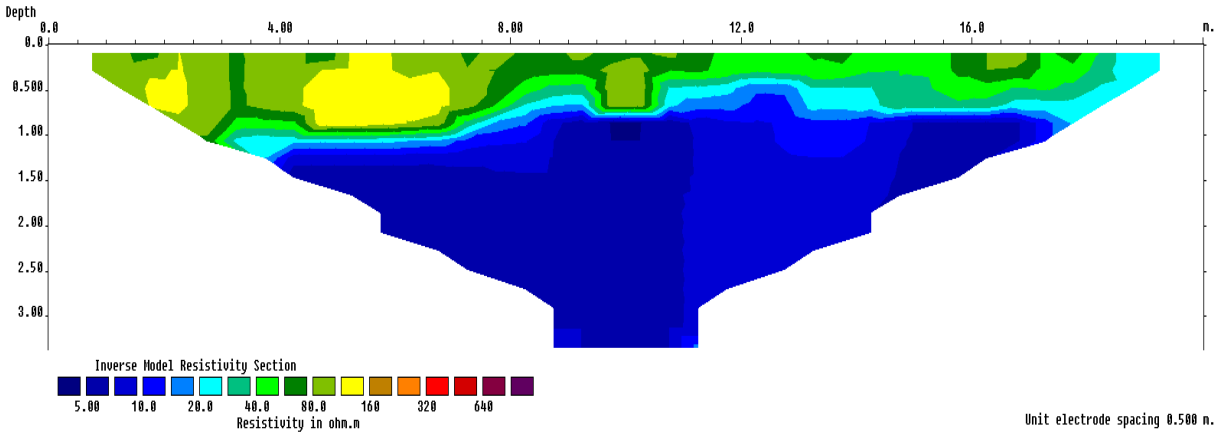
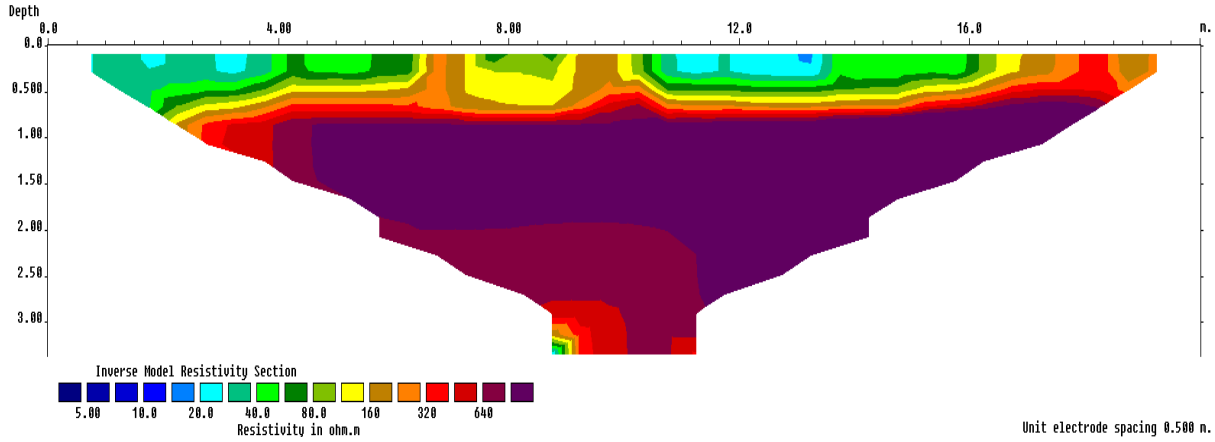
B19 Pipeline 11 W-E		
A	**Count**	**App.Res.**
0.5	37	23.69
1	35	19.29
1.5	32	15.58
2	15	13.26
3	12	10.66
4	9	9.70
5	6	9.75
6	3	10.28

Site 12



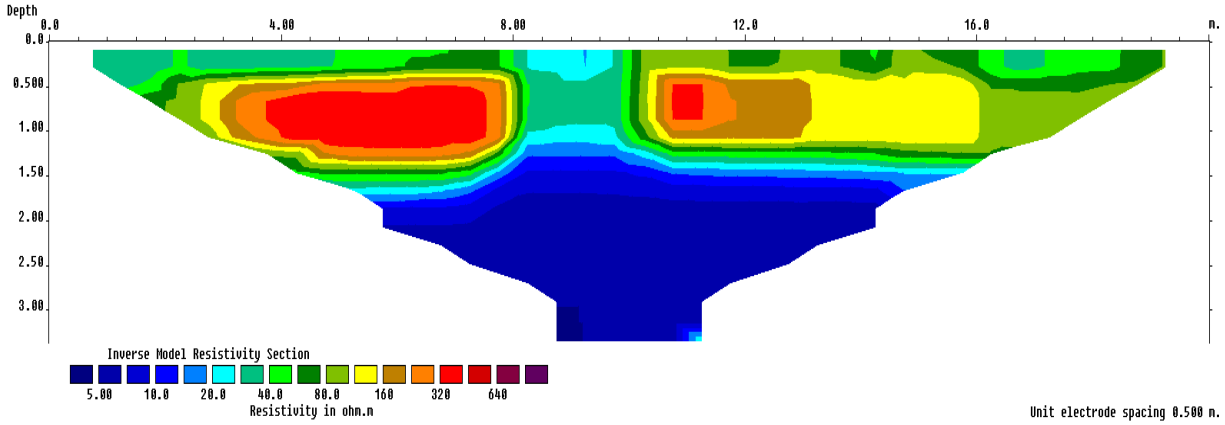
B19 Pipeline 12 N-S		
A	**Count**	**App.Res.**
0.5	37	61.37
1	35	43.66
1.5	32	27.53
2	15	18.02
3	12	10.81
4	9	9.32
5	6	9.11
6	3	9.41

Site 13



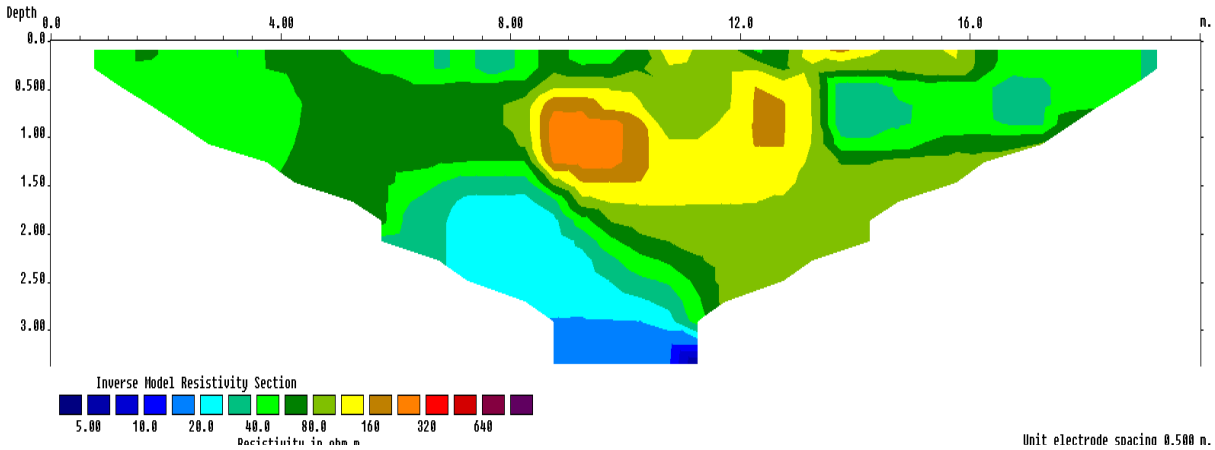
B19 Pipeline 13 W-E		
A	**Count**	**App.Res.**
0.5	37	110.51
1	35	181.65
1.5	32	230.06
2	15	265.69
3	12	303.82
4	9	346.70
5	6	413.81
6	3	394.73

Site 14



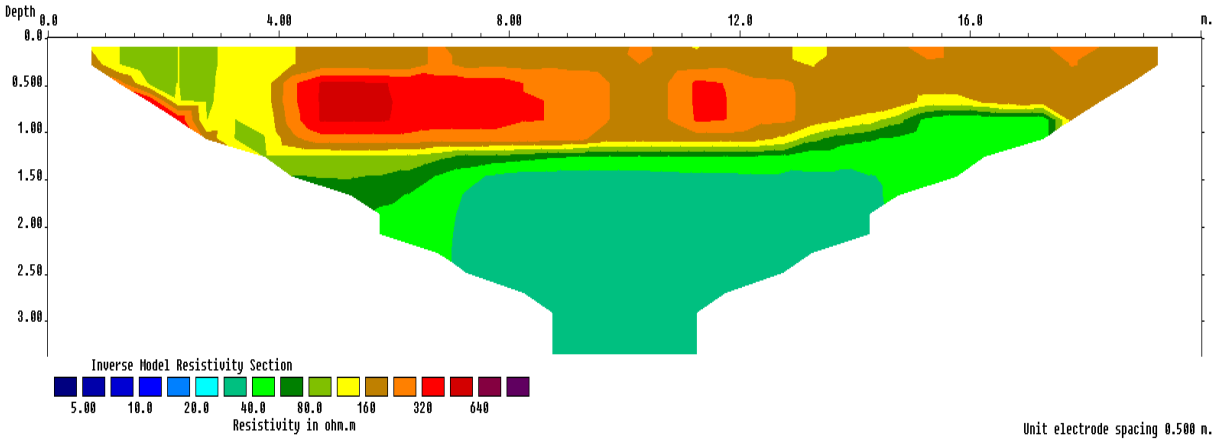
B19 Pipeline 14 N-S		
A	**Count**	**App.Res.**
0.5	37	63.20
1	35	78.51
1.5	32	73.59
2	15	59.76
3	12	34.71
4	9	23.34
5	6	17.39
6	3	14.83

Site 15



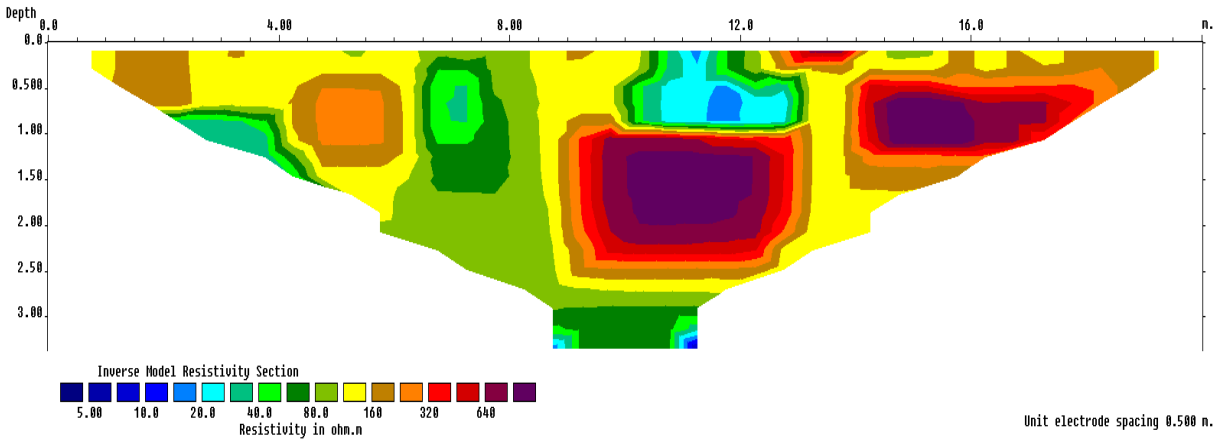
B19 Pipeline 15 N-S		
A	**Count**	**App.Res.**
0.5	37	61.25
1	35	64.96
1.5	32	66.20
2	15	63.47
3	12	51.38
4	9	40.98
5	6	33.32
6	2	27.34

Site 16



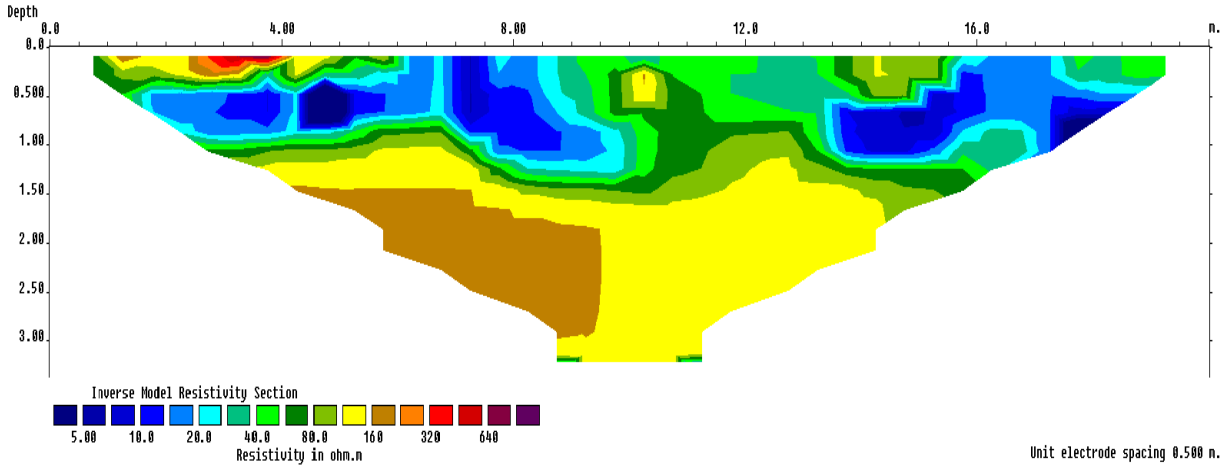
B19 Pipeline 16 N-S		
A	**Count**	**App.Res.**
0.5	37	185.98
1	35	178.63
1.5	32	145.51
2	15	114.30
3	12	73.56
4	9	54.69
5	6	44.79
6	3	41.21

Site 17



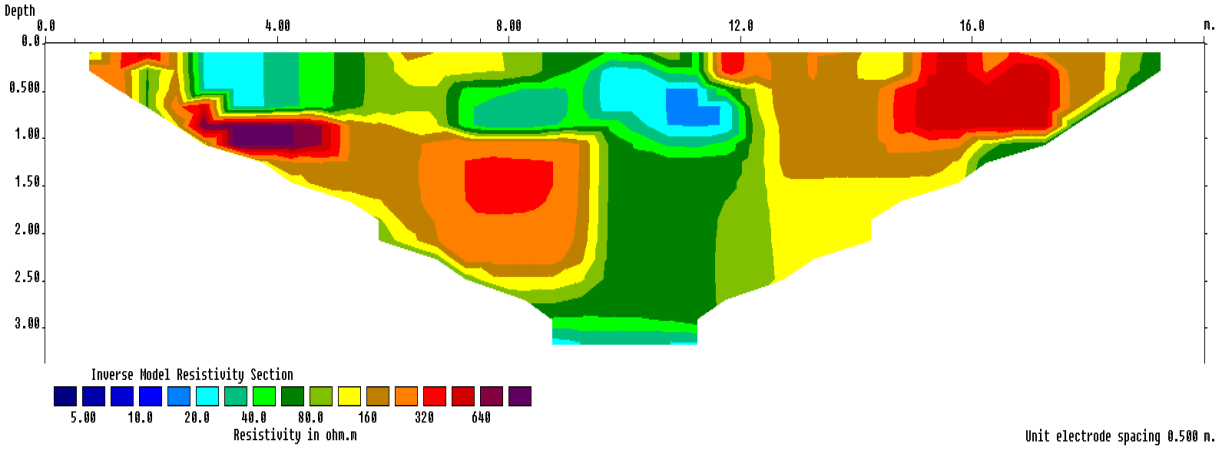
B19 Pipeline 17 W-E		
A	**Count**	**App.Res.**
0.5	37	136.36
1	35	142.57
1.5	32	138.72
2	15	130.10
3	12	116.16
4	9	87.51
5	6	62.26
6	3	37.13

Site 18



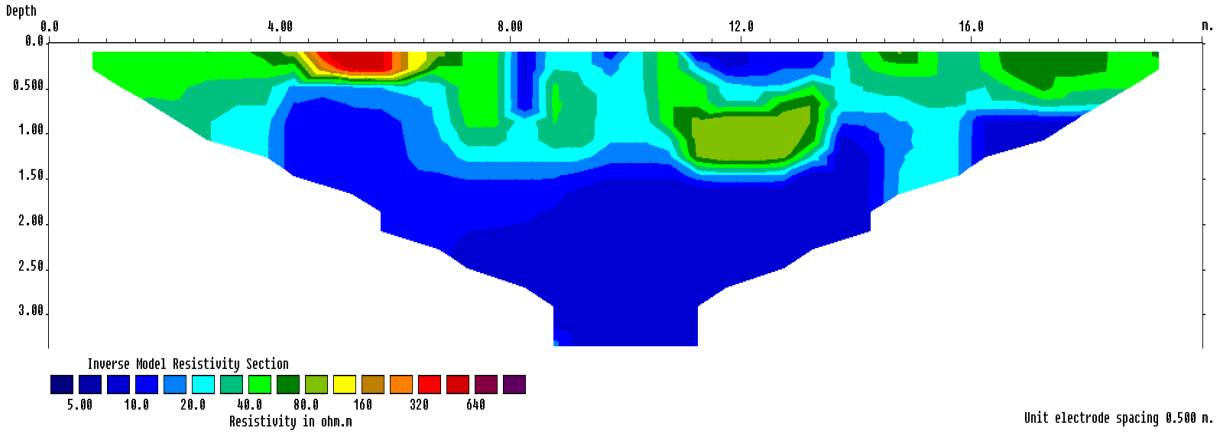
B19 Pipeline 18 W-E		
A	**Count**	**App.Res.**
0.5	37	43.72
1	35	30.77
1.5	32	34.11
2	15	37.74
3	12	42.32
4	9	41.99
5	6	38.82
6	3	37.21

Site 19



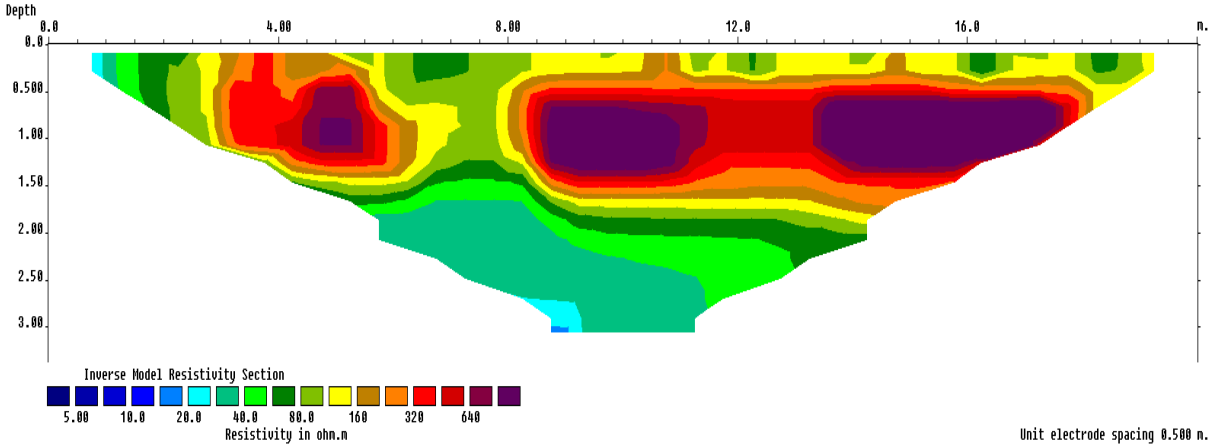
B19 Pipeline 19 N-S		
A	**Count**	**App.Res.**
0.5	37	133.92
1	35	123.45
1.5	32	109.80
2	15	96.61
3	12	79.62
4	9	61.57
5	6	41.91
6	2	30.38

Site 20



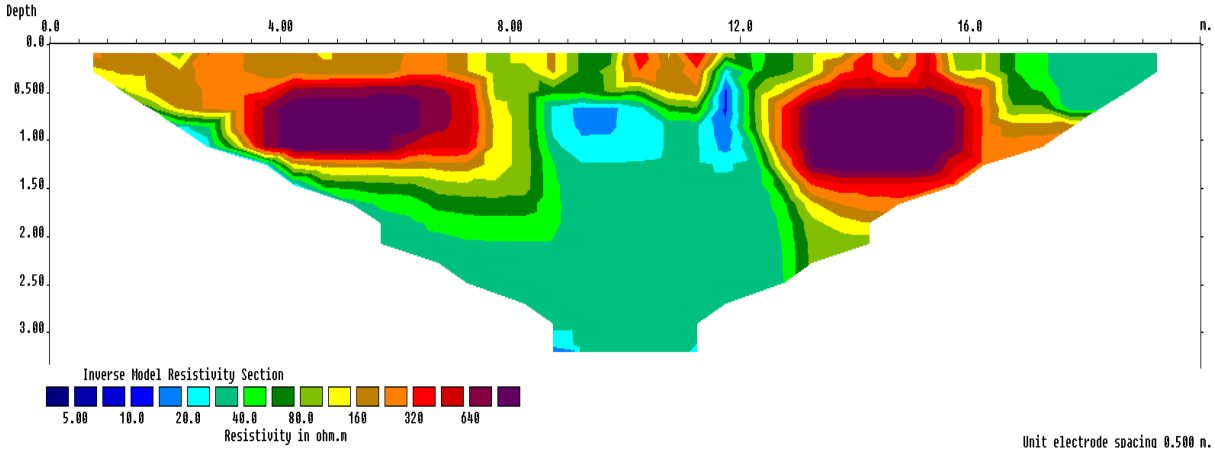
B19 Pipeline 20 N-S		
A	**Count**	**App.Res.**
0.5	37	41.36
1	35	27.00
1.5	32	21.81
2	15	18.22
3	12	14.93
4	9	12.16
5	6	11.50
6	3	11.76

Site 21



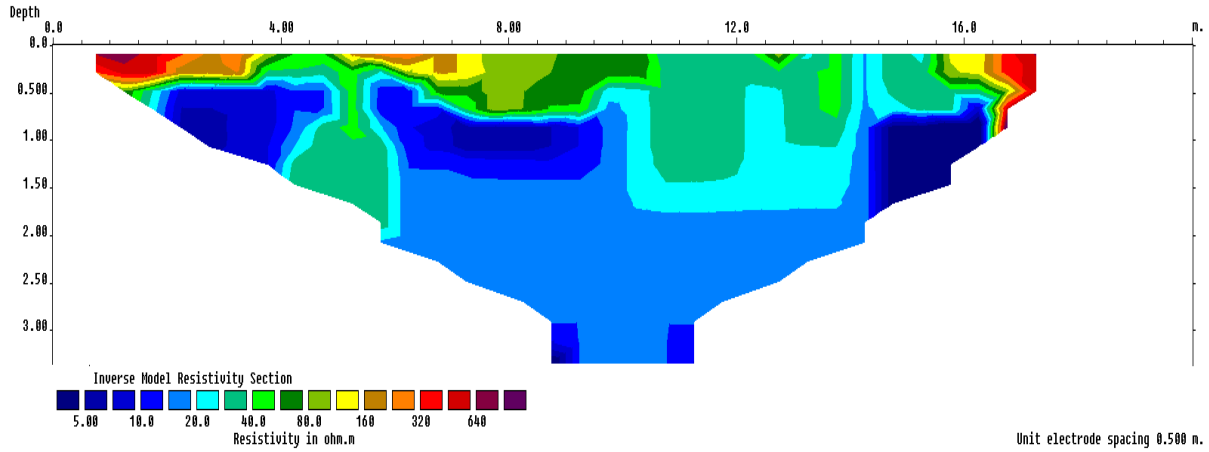
B19 Pipeline 21 N-S		
A	**Count**	**App.Res.**
0.5	37	151.86
1	35	203.77
1.5	32	225.50
2	15	214.83
3	12	172.14
4	9	128.49
5	6	99.76
6	3	63.51

Site 22



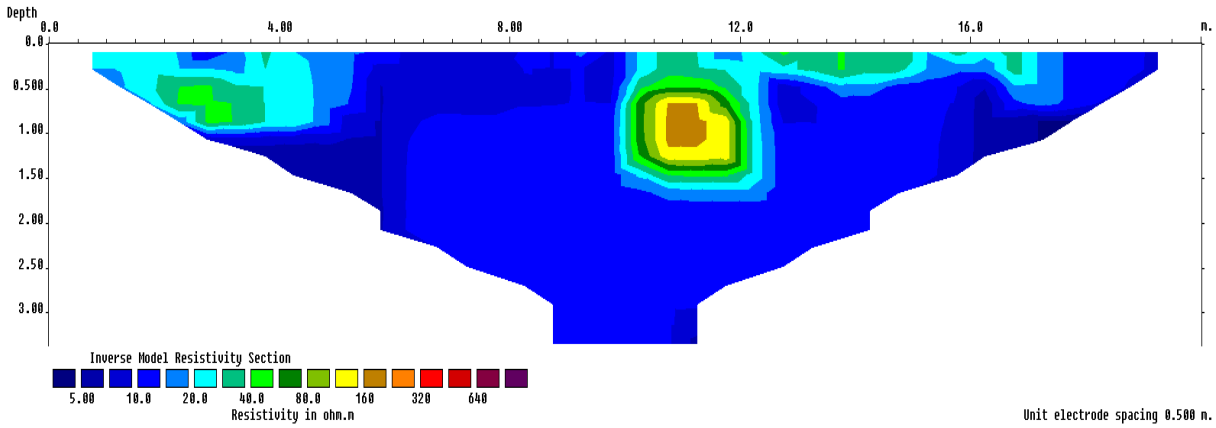
B19 Pipeline 22 N-S		
A	**Count**	**App.Res.**
0.5	37	153.75
1	35	168.10
1.5	32	154.38
2	15	123.92
3	12	73.49
4	9	52.35
5	6	32.06
6	3	22.97

Site 23



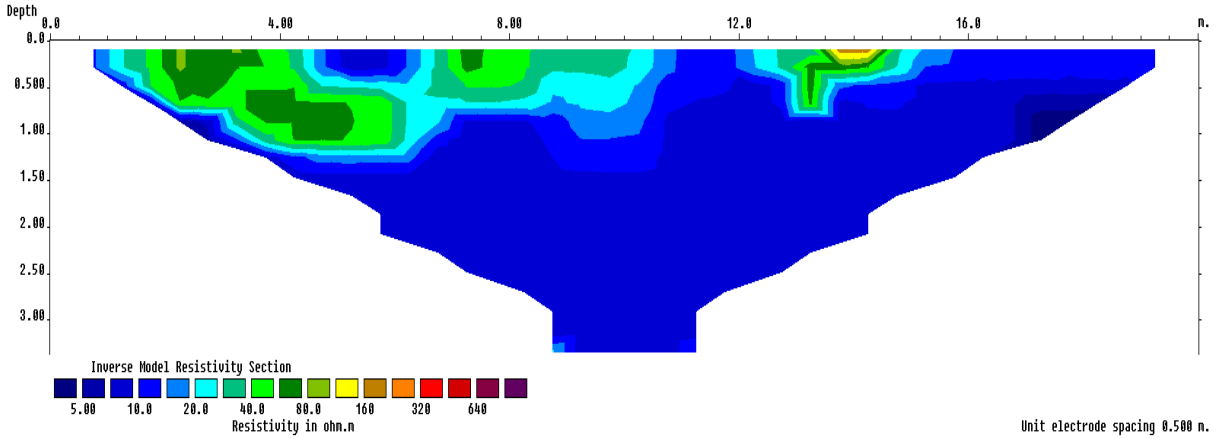
B19 Pipeline 23 N-S		
A	**Count**	**App.Res.**
0.5	37	123.58
1	35	59.67
1.5	32	30.58
2	15	21.10
3	12	14.35
4	9	12.21
5	6	10.92
6	3	11.49

Site 24



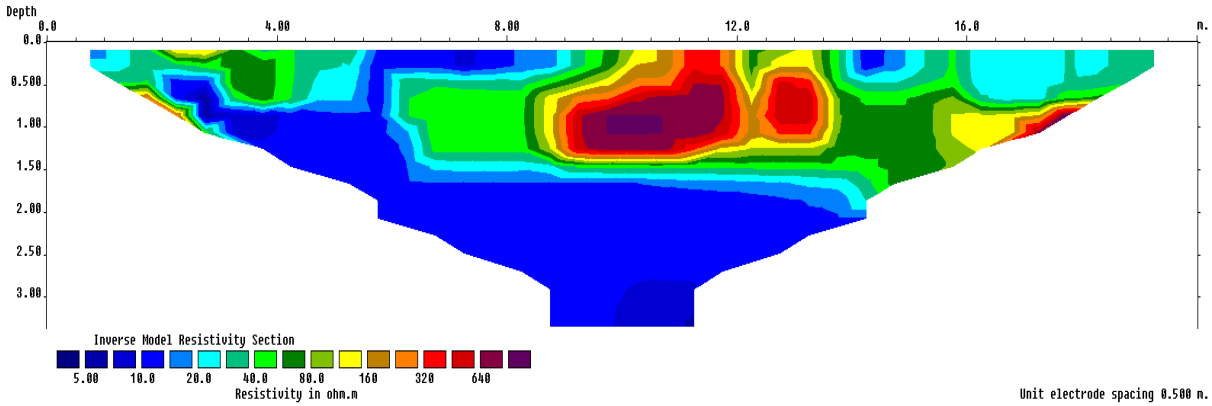
B19 Pipeline 24 W-E		
A	**Count**	**App.Res.**
0.5	37	17.14
1	35	15.42
1.5	32	13.77
2	15	12.58
3	12	11.10
4	9	10.02
5	6	10.35
6	3	10.64

Site 25



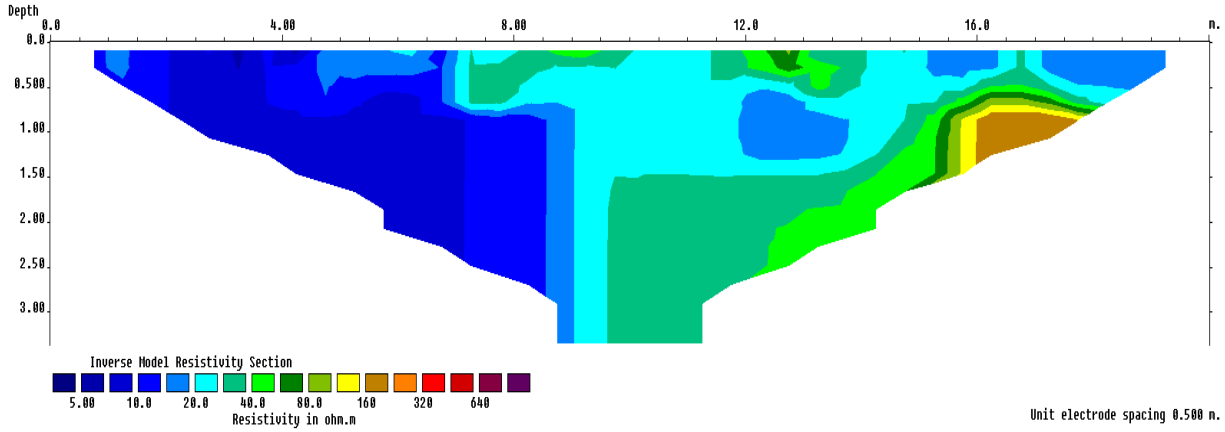
B19 Pipeline 25 W-E		
A	**Count**	**App.Res.**
0.5	37	23.92
1	35	17.24
1.5	32	14.72
2	15	13.21
3	12	10.82
4	9	10.34
5	6	10.73
6	3	11.34

Site 26



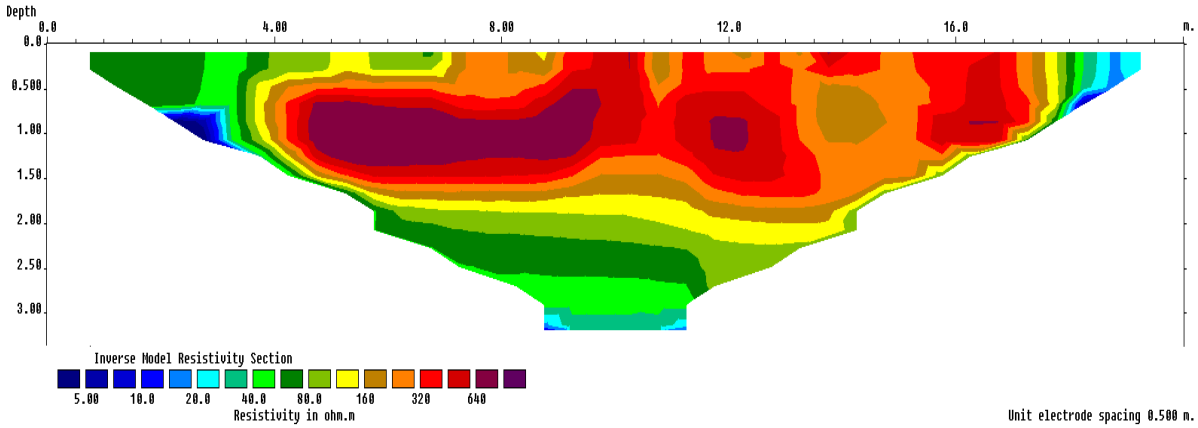
B19 Pipeline 26 NW-SE		
A	**Count**	**App.Res.**
0.5	37	56.87
1	35	64.15
1.5	32	58.80
2	15	50.36
3	12	37.78
4	9	28.56
5	6	24.31
6	3	24.96

Site 27



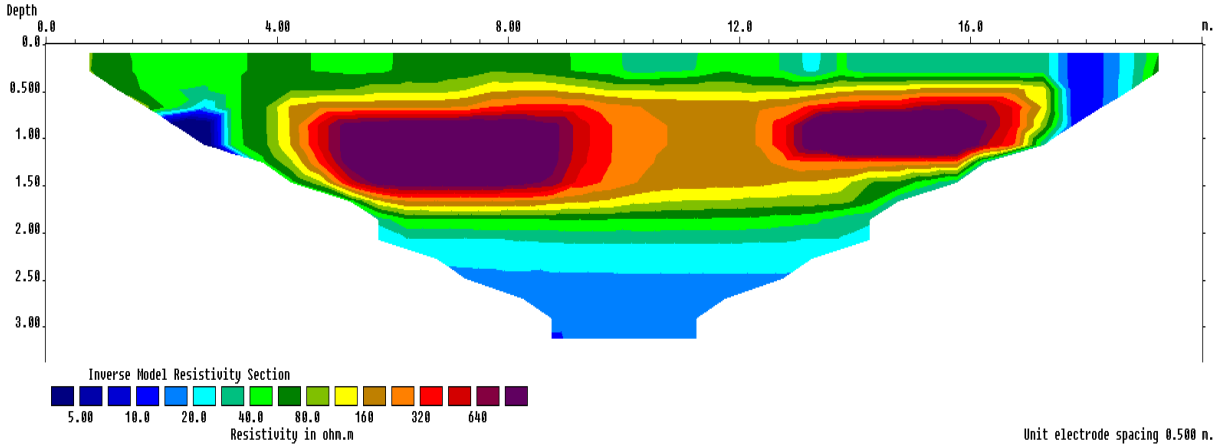
B19 Pipeline 27 NW-SE		
A	**Count**	**App.Res.**
0.5	37	21.59
1	35	22.28
1.5	32	23.48
2	15	24.26
3	12	25.03
4	9	25.59
5	6	27.21
6	3	28.14

Site 28



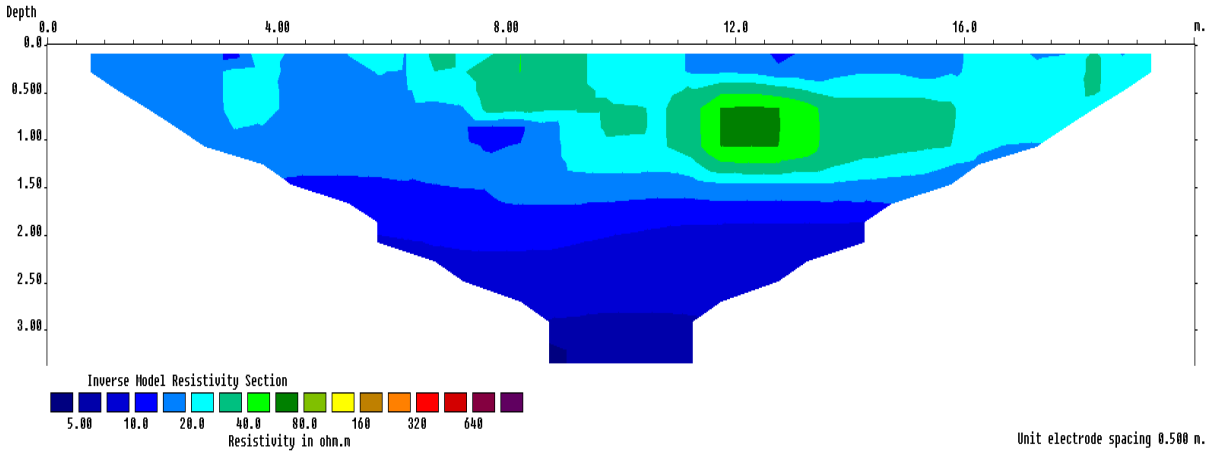
B19 Pipeline 28 W-E		
A	**Count**	**App.Res.**
0.5	37	215.28
1	35	230.46
1.5	32	223.92
2	15	193.09
3	12	125.70
4	9	70.63
5	6	37.00
6	3	15.15

Site 29

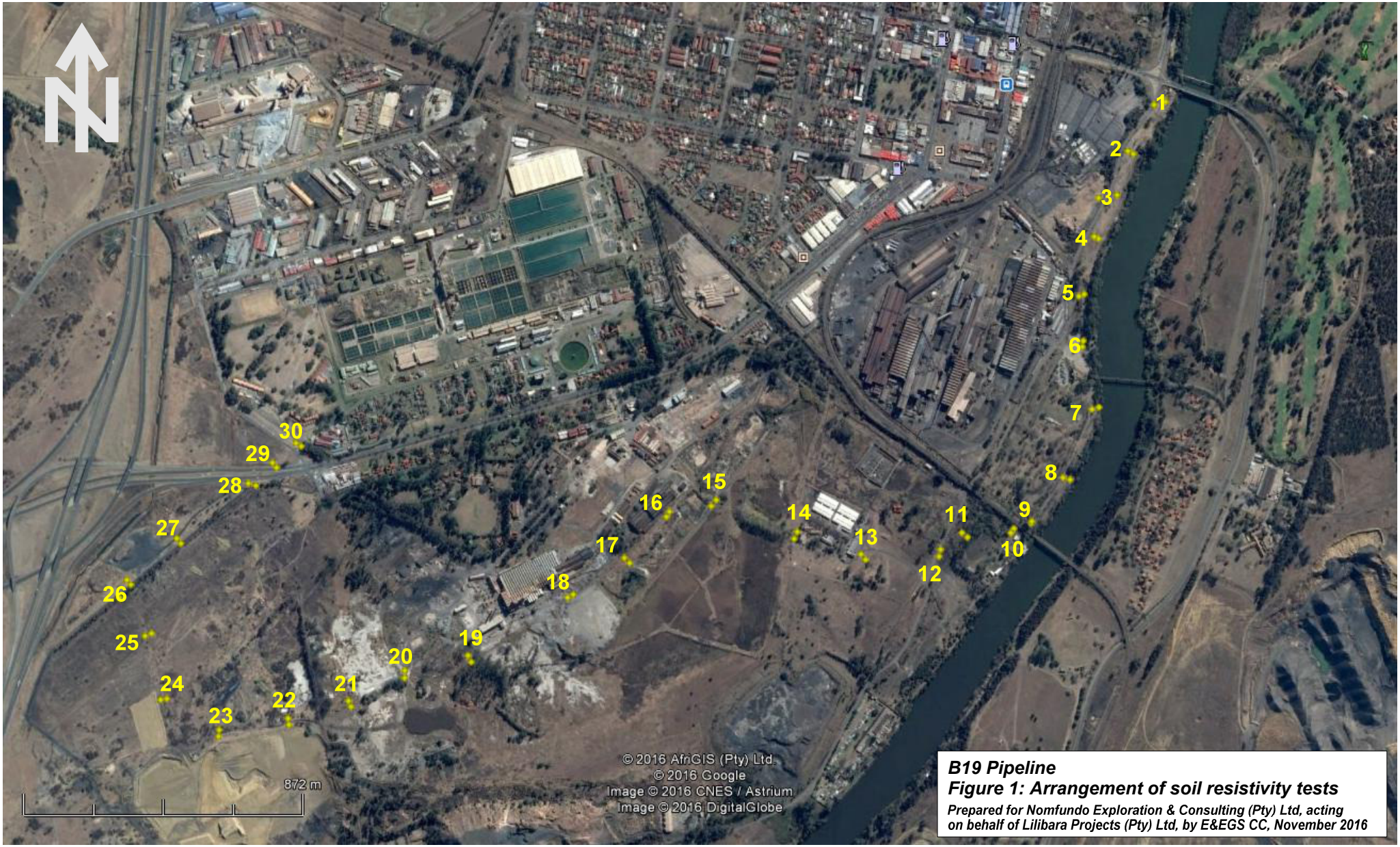


B19 Pipeline 29 W-E		
A	**Count**	**App.Res.**
0.5	37	56.99
1	35	83.69
1.5	32	104.94
2	15	111.56
3	12	92.68
4	9	67.03
5	6	36.22
6	3	15.61

Site 30



B19 Pipeline 30 W-E		
A	**Count**	**App.Res.**
0.5	37	21.90
1	35	21.63
1.5	32	19.95
2	15	17.55
3	12	13.23
4	9	10.15
5	6	8.49
6	3	7.56



B19 Pipeline

Figure 1: Arrangement of soil resistivity tests

Prepared for Nomfundo Exploration & Consulting (Pty) Ltd, acting on behalf of Lilibara Projects (Pty) Ltd, by E&EGS CC, November 2016