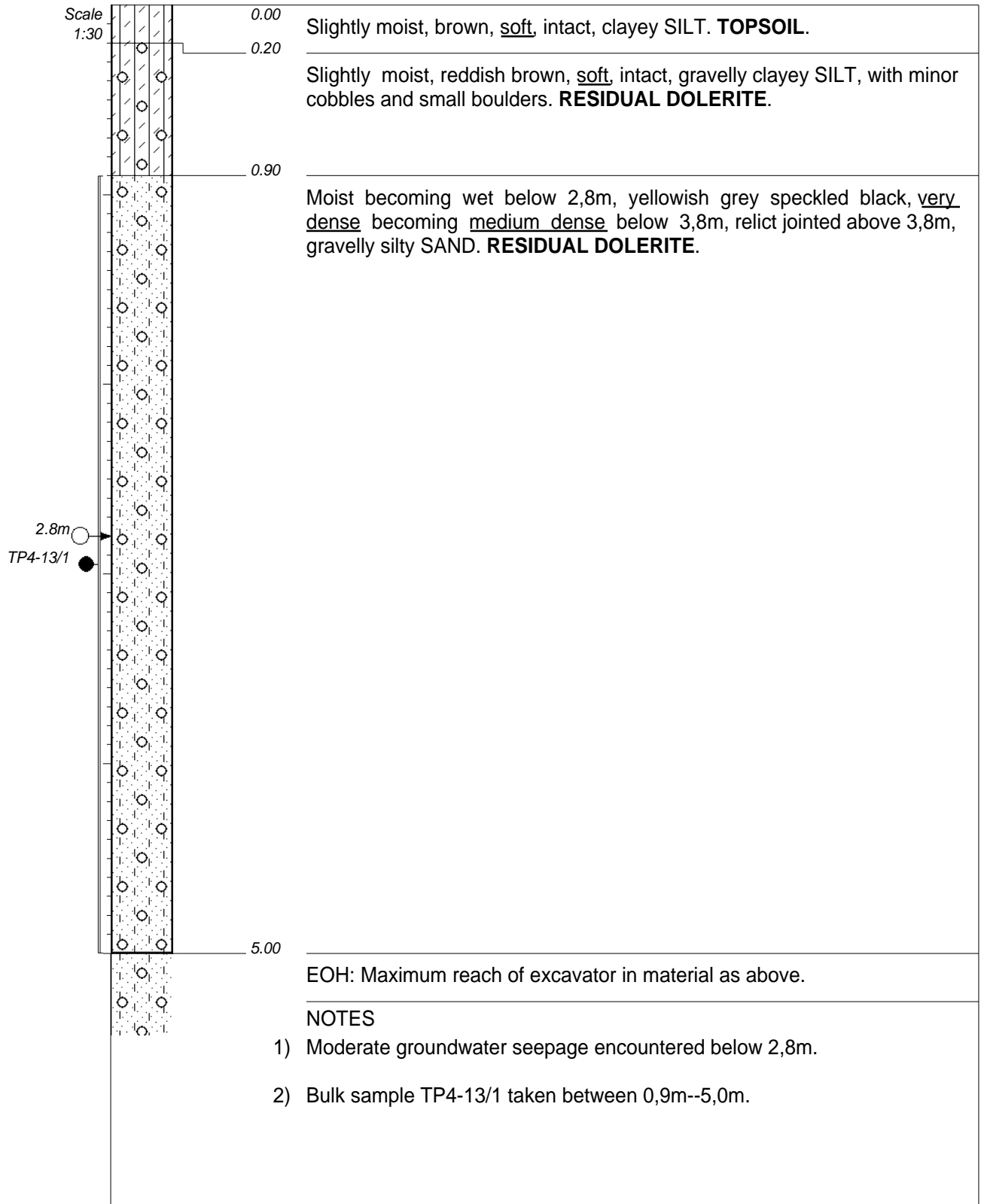


GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

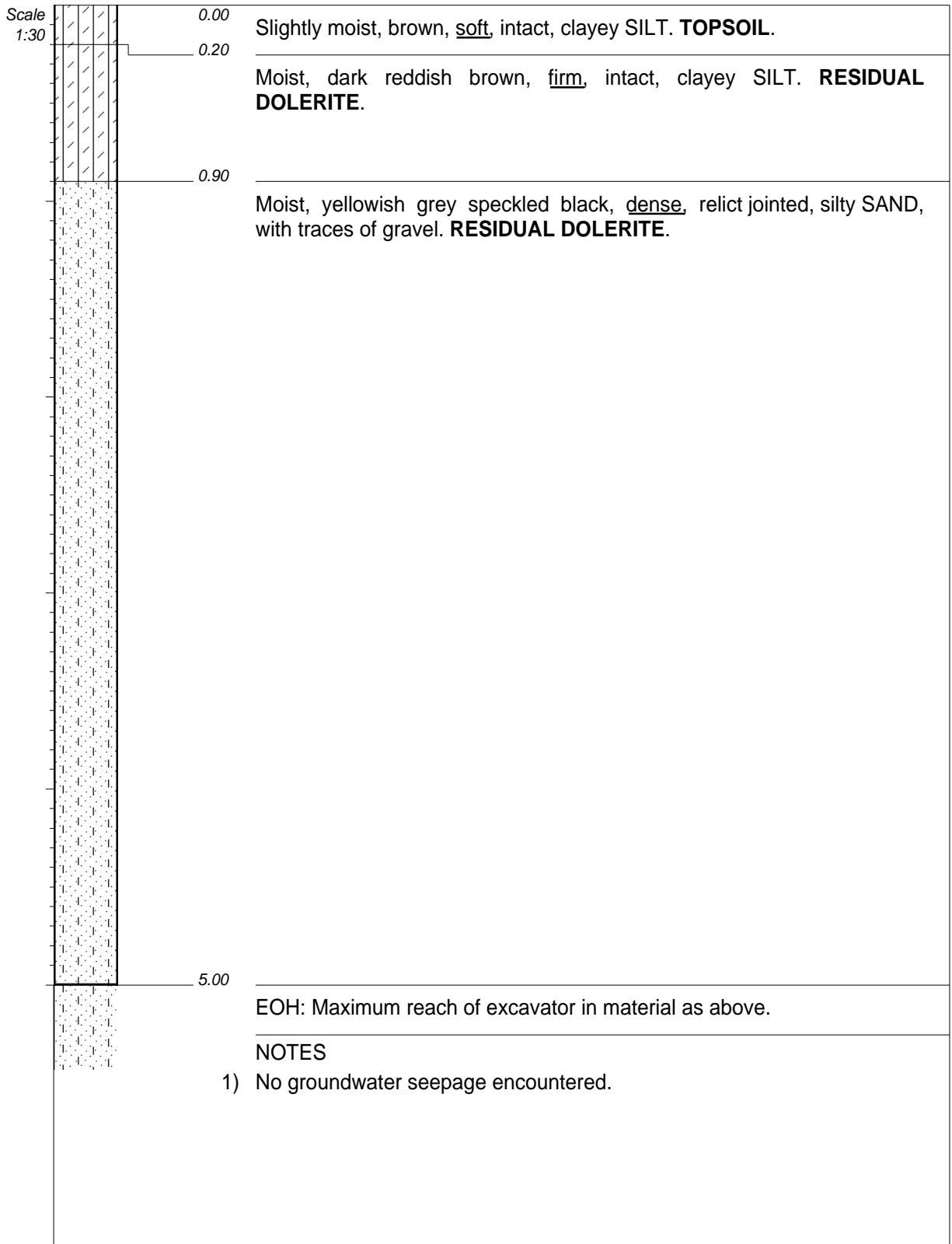
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2974331
Y-COORD : 9568

HOLE No: TP4-13

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

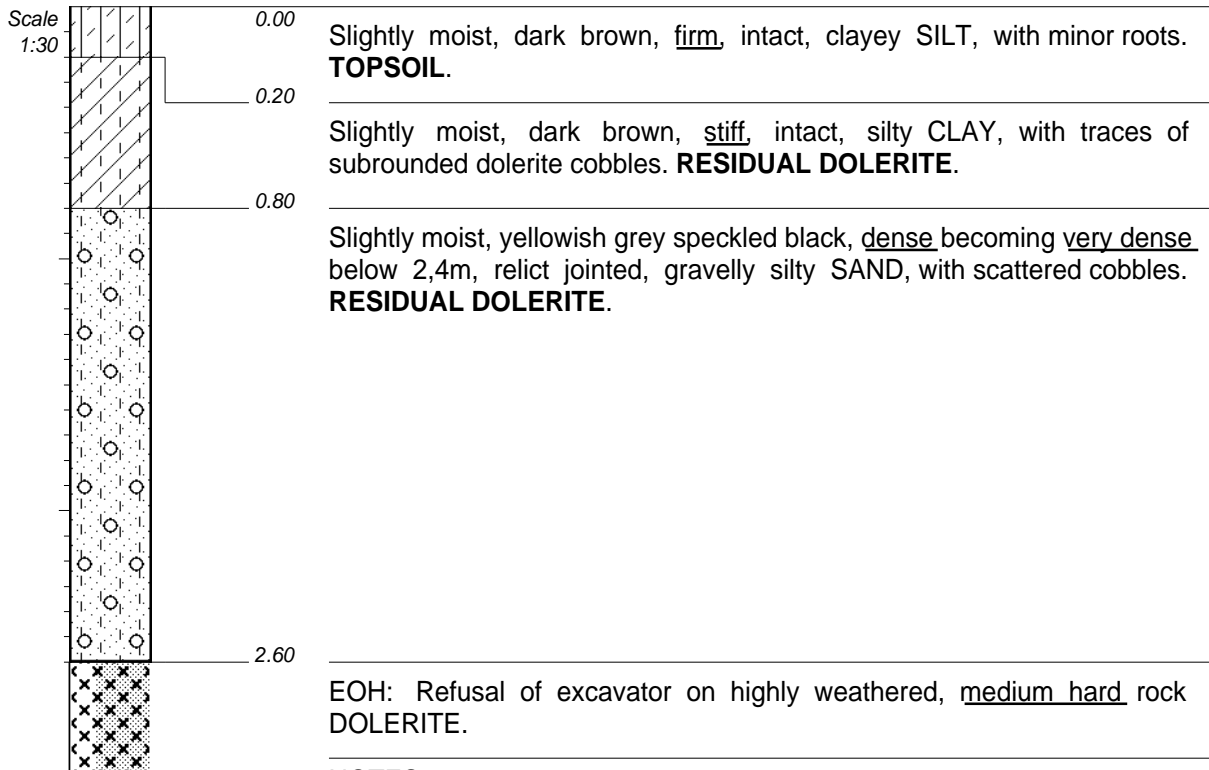
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X-COORD : 2974471
Y-COORD : 9405

HOLE No: TP4-14

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



NOTES

- 1) No groundwater seepage encountered.

CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2974681
Y-COORD : 9262

TYPE SET BY : EM
SETUP FILE : KPTP8.SET

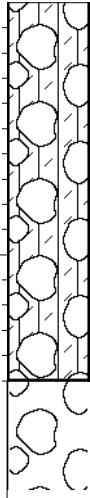
DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

HOLE No: TP4-15

GEOTECHNICAL INVESTIGATION

JOB: 3010020413

Scale
1:30



0.00

Moist, reddish brown blotched yellow, soft, intact, clayey SILT, with abundant boulders and cobbles. **RESIDUAL DOLERITE.**

1.50

EOH: Refusal of excavator on dolerite BOULDERS.

NOTES

- 1) No groundwater seepage encountered.

CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2974887
Y-COORD : 9118

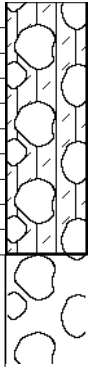
HOLE No: TP4-16

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413

Scale
1:30



0.00

Moist, reddish brown blotched yellow, soft, intact, clayey SILT, with abundant boulders and cobbles. **RESIDUAL DOLERITE.**

1.00

EOH: Refusal of excavator on BOULDERS up to 0,6m diameter.

NOTES

- 1) No groundwater seepage encountered.

CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

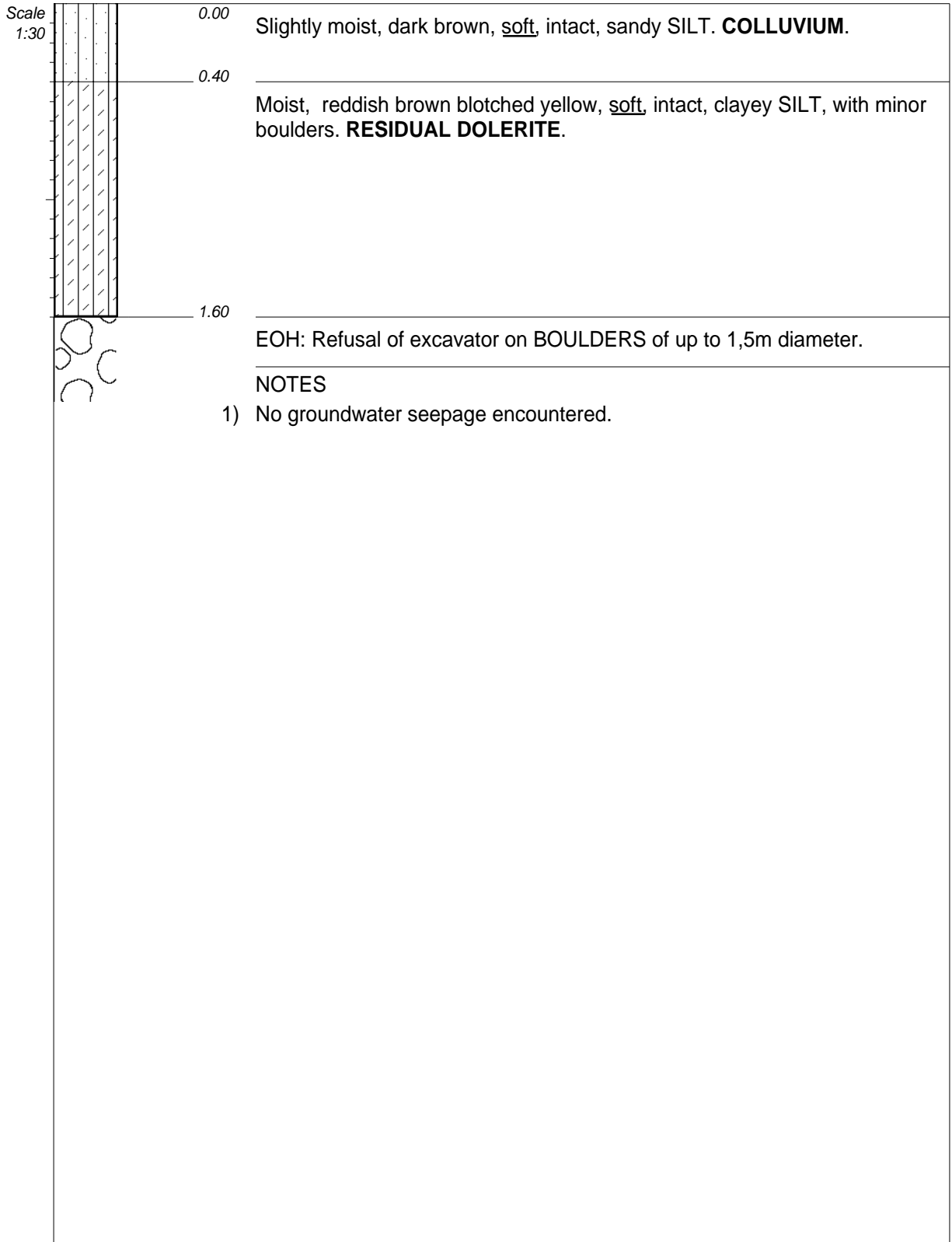
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975097
Y-COORD : 8977

HOLE No: TP4-17

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : Excavator
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

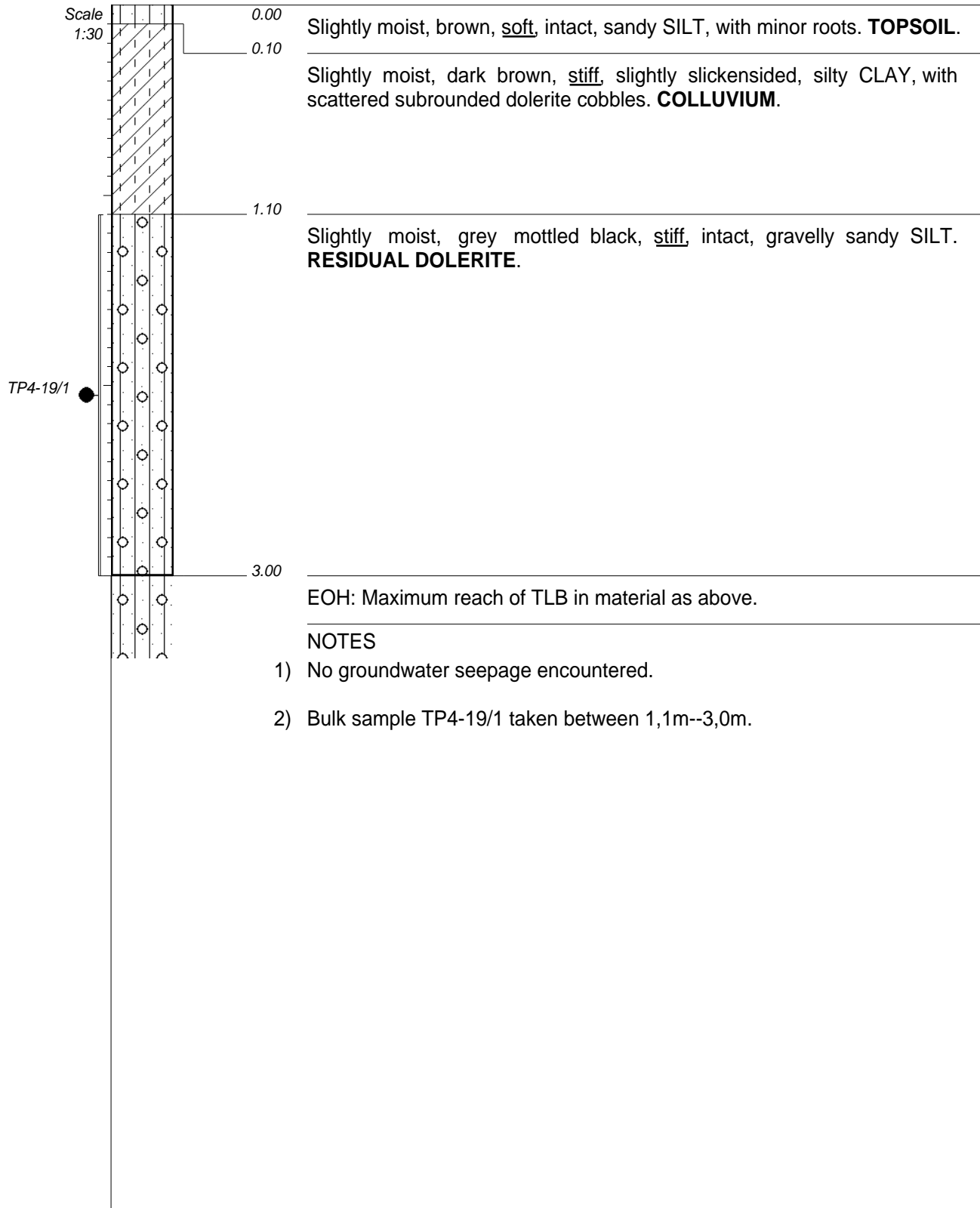
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975304
Y-COORD : 8836

HOLE No: TP4-18

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975508
Y-COORD : 8697

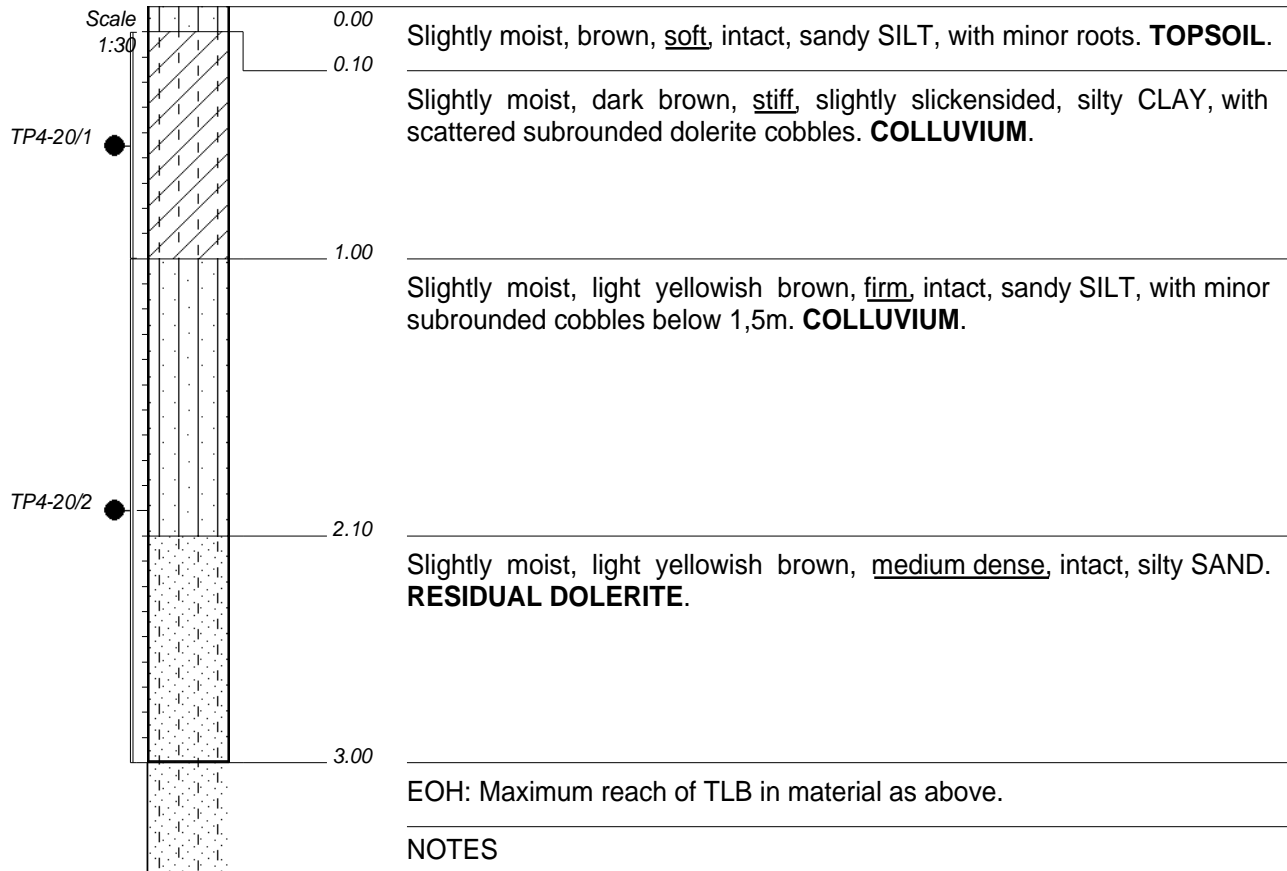
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

HOLE No: TP4-19

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



NOTES

- 1) No groundwater seepage encountered.
- 2) Bulk sample TP4-20/1 taken between 0,1m--1,0m.
- 3) Small bag sample TP4-20/2 taken between 1,0m--3,0m.

CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

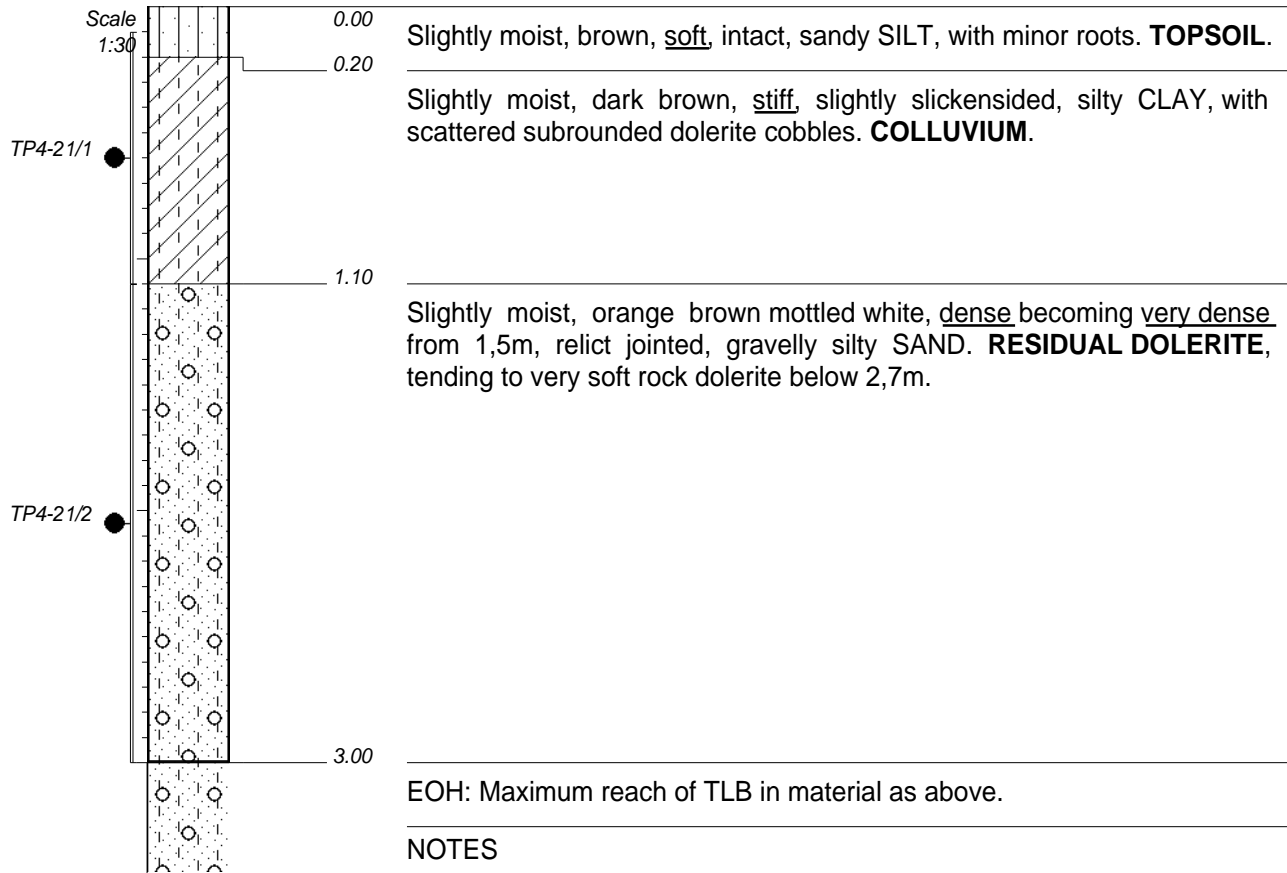
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975712
Y-COORD : 8553

HOLE No: TP4-20

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



NOTES

- 1) No groundwater seepage encountered.
- 2) Small bag sample TP4-21/1 taken between 0,1m--1,1m.
- 3) Bulk sample TP4-21/2 taken between 1,1m--3,0m.

CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

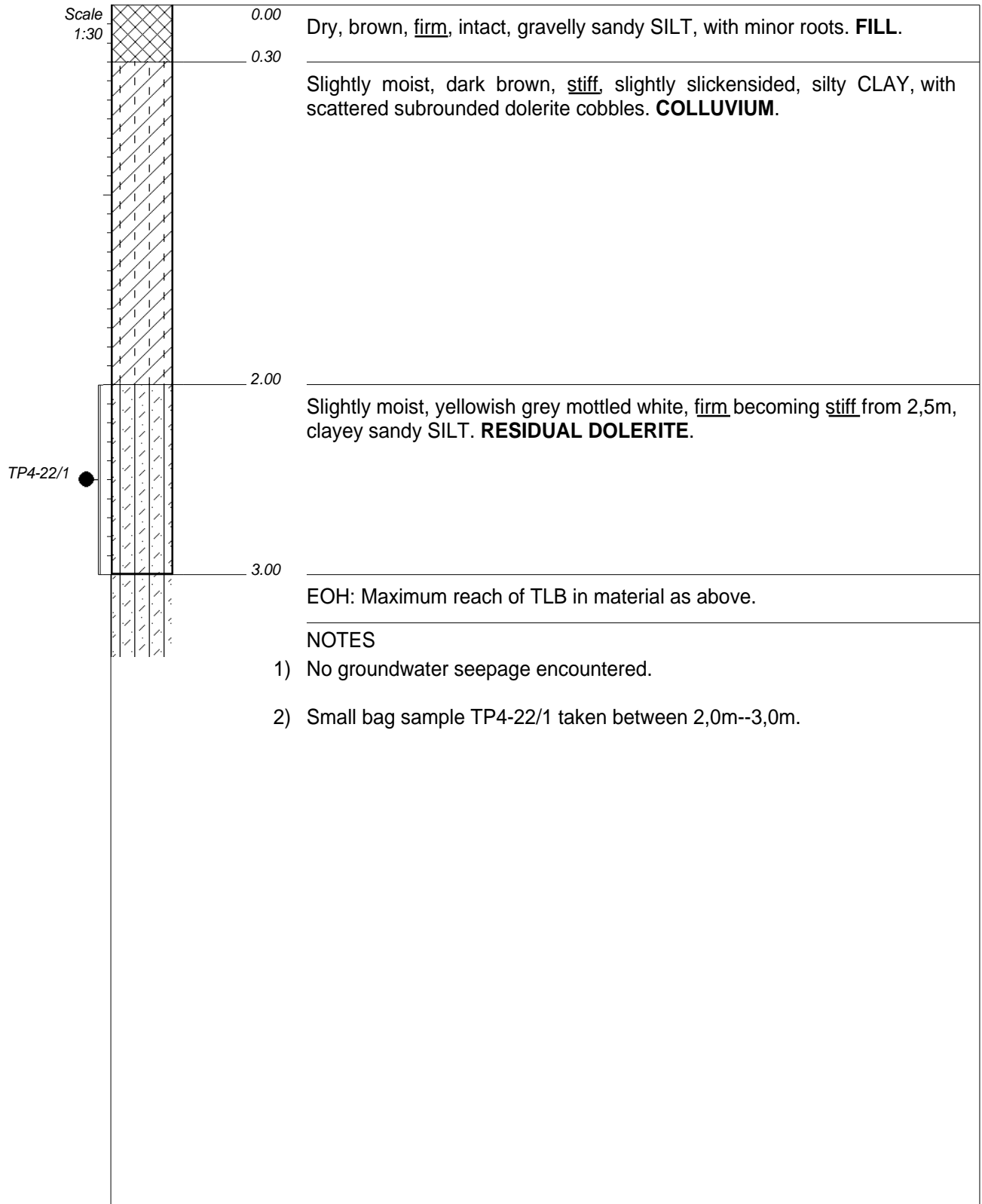
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975836
Y-COORD : 8359

HOLE No: TP4-21

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975935
Y-COORD : 8123

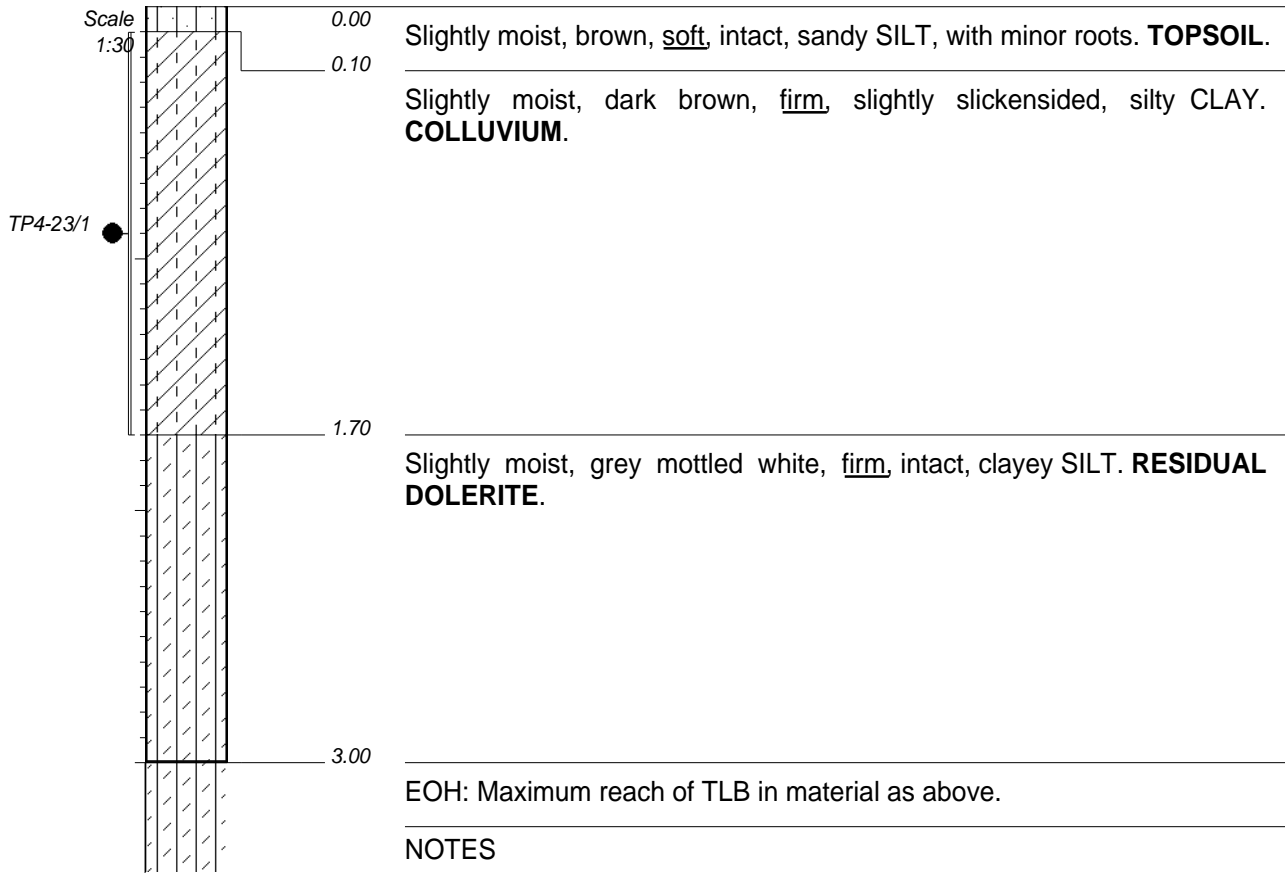
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

HOLE No: TP4-22

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



EOH: Maximum reach of TLB in material as above.

NOTES

- 1) No groundwater seepage encountered.
- 2) Bulk sample TP4-23/1 taken between 0,1m--1,7m.

CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM
TYPE SET BY : EM
SETUP FILE : KPTP8.SET

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

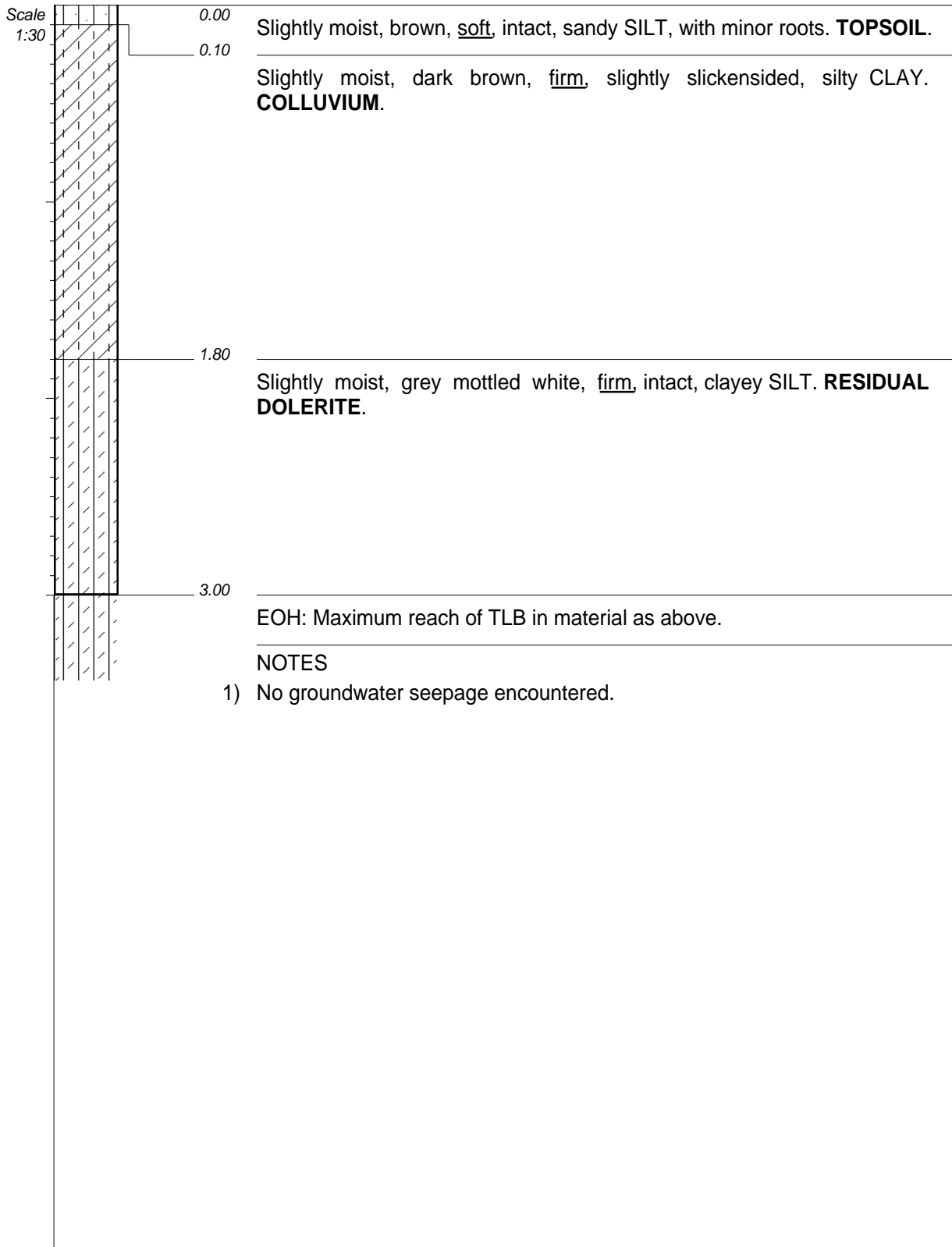
COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2975968
Y-COORD : 7870

HOLE No: TP4-23

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

GEOTECHNICAL INVESTIGATION

JOB: 3010020413



CONTRACTOR : Client
MACHINE : TLB
DRILLED BY :
PROFILED BY : MKM

INCLINATION :
DIAM :
DATE :
DATE : 18-22 February 2019

COORDINATE SYSTEM : WGS84 (Lo27)
X-COORD : 2976024
Y-COORD : 7736

TYPE SET BY : EM
SETUP FILE : KPTP8.SET

DATE : 17/05/2019 11:29
TEXT : C:\WP51\PROFILES\OJFTP.TXT

HOLE No: TP4-24

APPENDIX C

BOREHOLE LOGS AND CORE PHOTOGRAPHS

HOLE No: BH01
Sheet 1 of 2

JOB: 301-00204/13

ROCK FABRIC	GRAIN SIZE	JOINT ROUGHNESS	ROCK HARDNESS
MF -massive	FG -fine grained	SLJ-slickensided	EHR-extremely hard rock
BF -bedded	MG -medium grain	SJ -smooth	VHR-very hard rock
FF -foliated	CG -coarse grain	RJ -rough	HR -hard rock
CF -cleaved			MHR-medium hard rock
SF -schistose	JOINT SPACING	JOINT SHAPE	SR -soft rock
GF -gneissose	VCJ-very close spacg	CUR-curvilinear	VSR-very soft rock
LF -laminated	CJ -close spacing	PLA-planar	
	MJ -medium spacing	UND-undulating	
	WJ -wide spacing	STE-stepped	
	VWJ-very wide spacng	IRR-irregular	



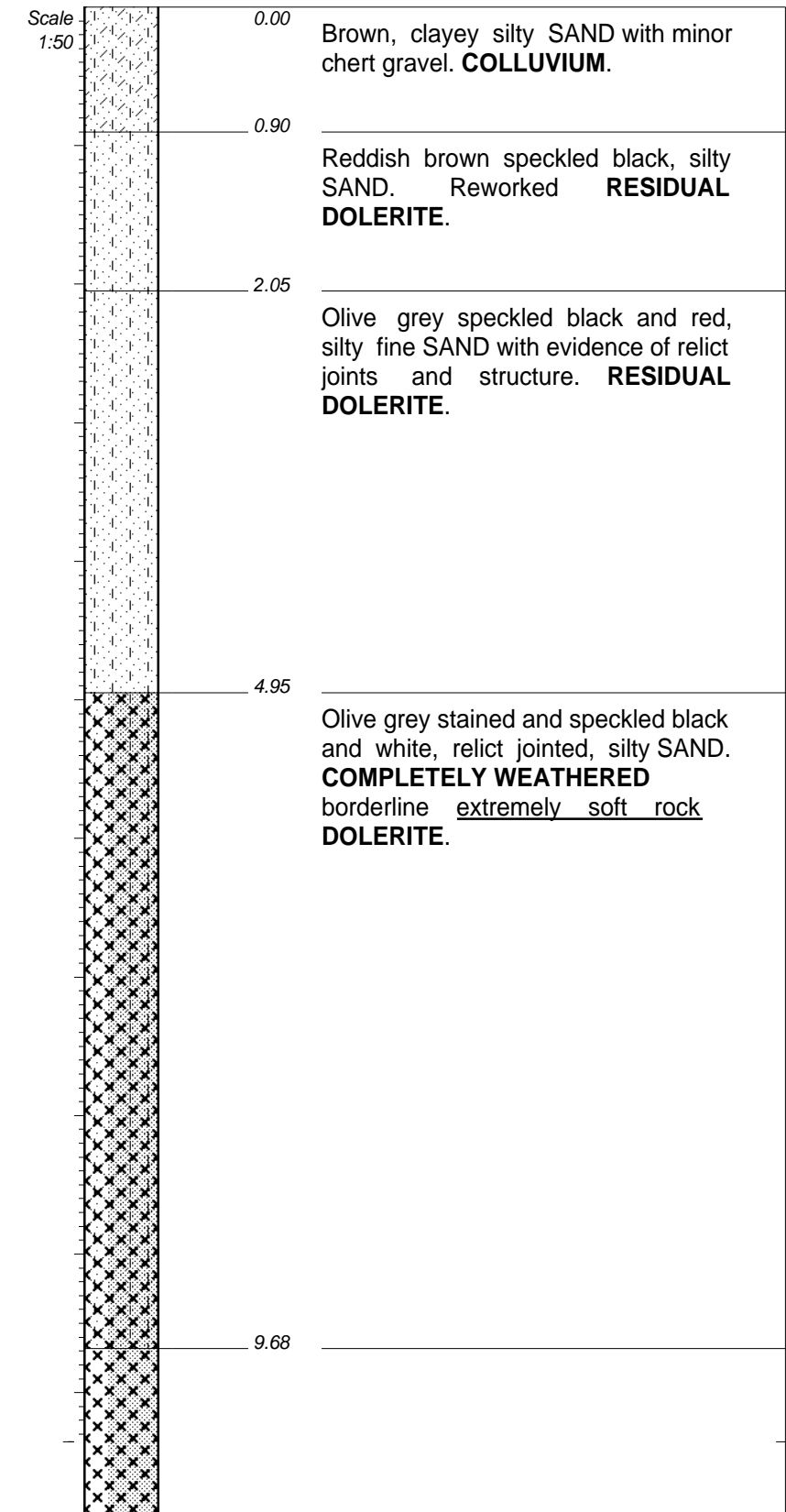
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH01
Sheet 1 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

CG	MF	-	-	1 2	10 30	CJ CJ	RJ RJ	SILT Fe-Ox SILT Fe-Ox	1 1	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,75	84	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,5	73	0	-	N/A
										1,95	SPT	N=17	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,0	92	0	-	N/A
										3,45	SPT	N=22	N/A	N/A
										4,5	100	0	-	N/A
										4,95	SPT5	N=27	N/A	N/A
										6,0	96	0	-	N/A
										6,45	SPT	N=44	N/A	N/A
										7,5	100	0	-	N/A
										9,58	75	0	-	N/A



HOLE No: BH01
Sheet 2 of 2

JOB: 301-00204/13

ROCK FABRIC	GRAIN SIZE	JOINT ROUGHNESS	ROCK HARDNESS
MF -massive	FG -fine grained	SLJ-slickensided	EHR-extremely hard rock
BF -bedded	MG -medium grain	SJ -smooth	VHR-very hard rock
FF -foliated	CG -coarse grain	RJ -rough	HR -hard rock
CF -cleaved			MHR-medium hard rock
SF -schistose	JOINT SPACING	JOINT SHAPE	SR -soft rock
GF -gneissose	VCJ-very close spacg	CUR-curvilinear	VSR-very soft rock
LF -laminated	CJ -close spacing	PLA-planar	
	MJ -medium spacing	UND-undulating	
	WJ -wide spacing	STE-stepped	
	VWJ-very wide spacng	IRR-irregular	



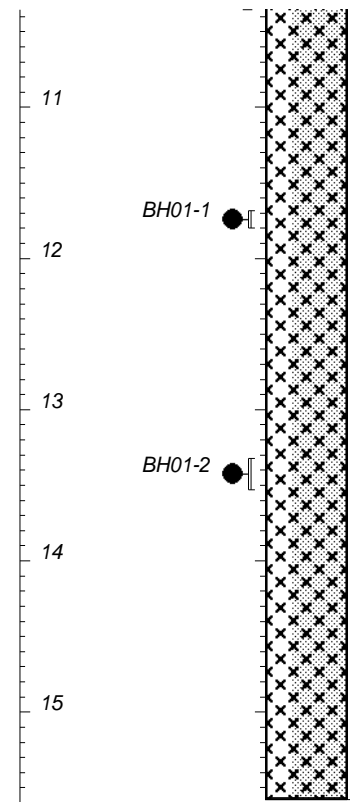
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH01
Sheet 2 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
				3	60	MJ	RJ	SILT Fe-Ox	1	11,08	100	93	0	>20
										12,58	99	95	18	>20
										14,08	97	97	14	>20
										15,58	100	100	0	>20



Highly weathered, olive grey speckled and stained black, coarse grained, extremely closely to closely jointed, very soft to soft rock DOLERITE with completely weathered zones along joints comprising extremely soft rock material. Material loss can possibly be accounted to extremely soft material washed from joints.

- Notes:**
- Possible CaCO or CaSO staining along joints.
 - Samples BH01-1 and BH01-2 taken from 11,68m to 11,80m and 13,32m to 13,53m.

- NOTES**
- NM: Not measurable.
 - NA: Not applicable.
 - Sample BH01-1 taken between 11,68m--11,80m.
 - Sample BH01-2 taken between 13,32m--13,53m.

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
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DEPTH Scale 1:50

CONTRACTOR : Geospektrum Services
MACHINE : XY100
DRILLED BY :
PROFILED BY : PvR
TYPE SET BY : PvR
SETUP FILE : KPBHCO08.SET

INCLINATION : Vertical
DIAM : N-size
DATE : 03 OCT 2018 to 09 OCT 2018
DATE : 10 OCT 2018
DATE : 23/01/2019 08:47
TEXT : C\WP51\PROFILES\OFIPVR.TXT

COORDINATE SYSTEM : WGS84 (Lo29)
X-COORD : 2652,753
Y-COORD : 2652,887

HOLE No: BH01

HOLE No: BH02
Sheet 1 of 2

JOB: 301-00204/13

ROCK FABRIC	GRAIN SIZE	JOINT ROUGHNESS	ROCK HARDNESS
MF -massive	FG -fine grained	SLJ-slickensided	EHR-extremely hard rock
BF -bedded	MG -medium grain	SJ -smooth	VHR-very hard rock
FF -foliated	CG -coarse grain	RJ -rough	HR -hard rock
CF -cleaved			MHR-medium hard rock
SF -schistose	JOINT SPACING	JOINT SHAPE	SR -soft rock
GF -gneissose	VCJ-very close spacg	CUR-curvilinear	VSR-very soft rock
LF -laminated	CJ -close spacing	PLA-planar	
	MJ -medium spacing	UND-undulating	
	WJ -wide spacing	STE-stepped	
	VWJ-very wide spacng	IRR-irregular	



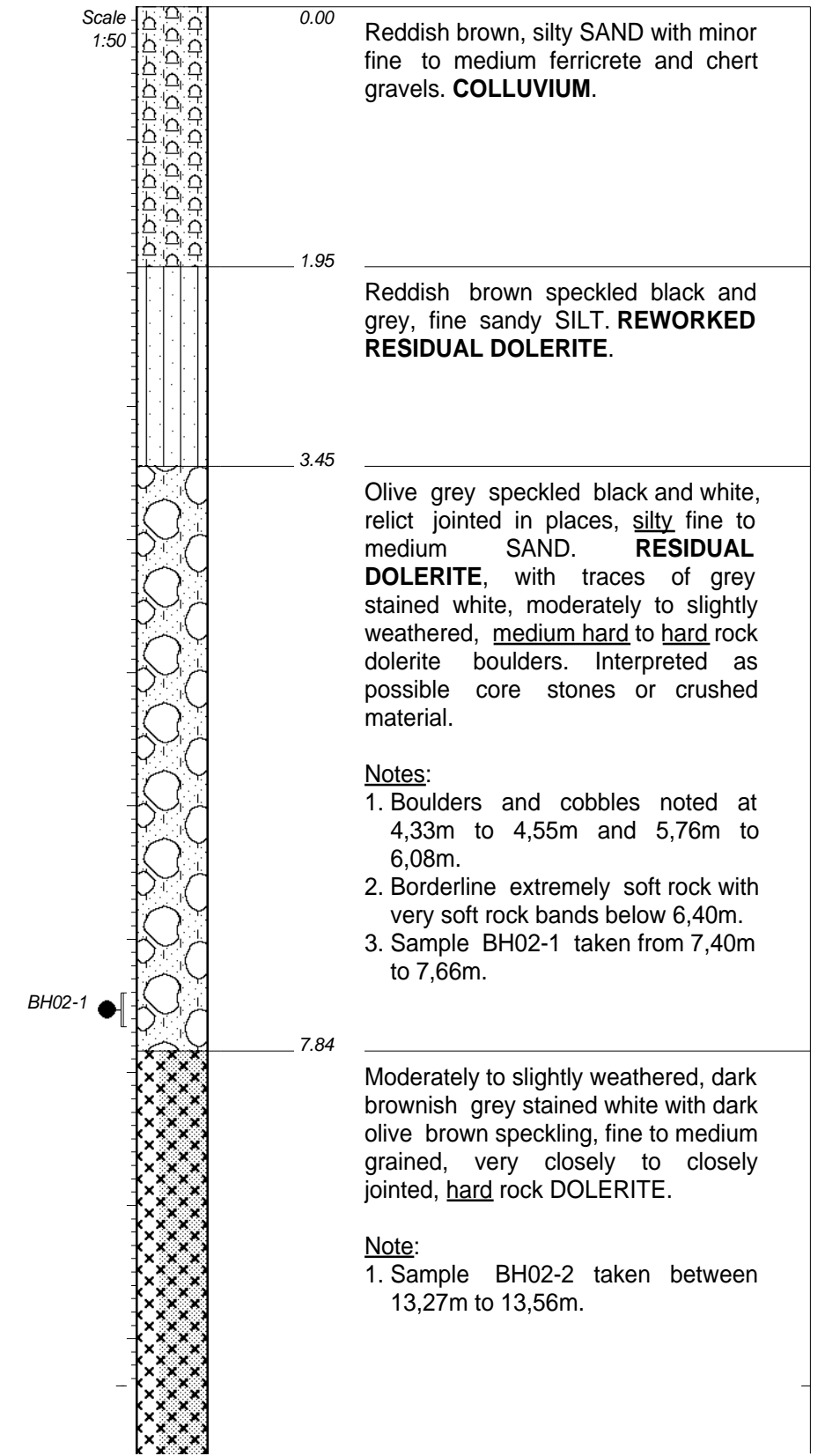
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH02
Sheet 1 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,75	95	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,5	40	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,95	SPT	N=19	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,0	100	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,45	SPT	N=17	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,5	80	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,0	100	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,5	95	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,73	SPT	N=REF	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9,56	81	74	55	8



HOLE No: BH02
Sheet 2 of 2

JOB: 301-00204/13

ROCK FABRIC
MF -massive
BF -bedded
FF -foliated
CF -cleaved
SF -schistose
GF -gneissose
LF -laminated

GRAIN SIZE
FG -fine grained
MG -medium grain
CG -coarse grain

JOINT ROUGHNESS
SLJ-slickensided
SJ -smooth
RJ -rough

ROCK HARDNESS
EHR-extremely hard rock
VHR-very hard rock
HR -hard rock
MHR-medium hard rock
SR -soft rock
VSR-very soft rock

JOINT SPACING
VCJ-very close spacg
CJ -close spacing
MJ -medium spacing
WJ -wide spacing
VWJ-very wide spacng

JOINT SHAPE
CUR-curvilinear
PLA-planar
UND-undulating
STE-stepped
IRR-irregular



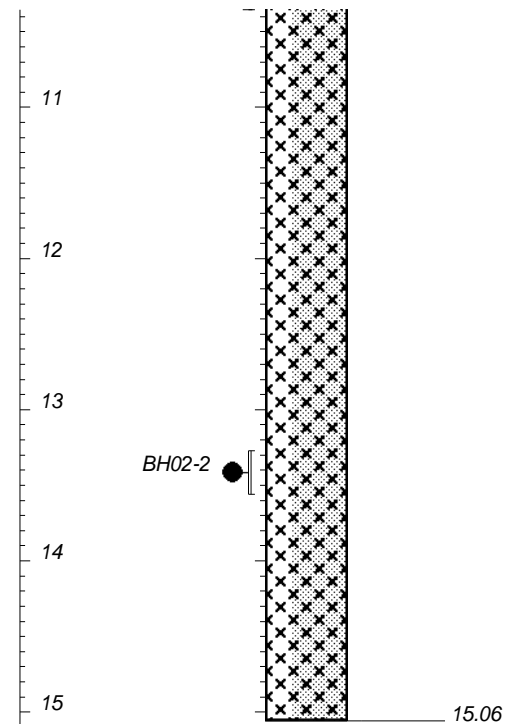
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH02
Sheet 2 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
FG MG	MF	-	-	1	15	VCJ	RJ	SILT Fe-Ox	<1	11,06	89	89	31	19
				2	30	CJ	RJ	SILT Fe-Ox	<1					
				3	45	CJ	RJ	SILT Fe-Ox	<1	12,06	50	50	33	3
				4	60	MJ	RJ	SILT Fe-Ox	<1					
										13,56	93	93	73	8
										15,06	100	100	88	8



- NOTES
- 1) NA: Not applicable.
 - 2) NM: Not measurable.
 - 3) Sample BH02-1 taken between 7,40m--7,66m.
 - 4) Sample BH02-2 taken between 13,27m--13,56m.

CONTRACTOR : Geospektrum Services
MACHINE : XY100
DRILLED BY :
PROFILED BY : PvR
TYPE SET BY : PvR
SETUP FILE : KPBHCO08.SET

INCLINATION : Vertical
DIAM : N-size
DATE : 03 OCT 2018 to 09 OCT 2018
DATE : 10 OCT 2018
DATE : 23/01/2019 08:47
TEXT : C:\WP51\PROFILES\OFIPVR.TXT

COORDINATE SYSTEM : WGS84 (Lo29)
X-COORD : 2652,732
Y-COORD : 2653,067

HOLE No: BH02

HOLE No: BH03
Sheet 1 of 2

JOB: 301-00204/13

ROCK FABRIC GRAIN SIZE JOINT ROUGHNESS ROCK HARDNESS
 MF -massive FG -fine grained SLJ-slickensided EHR-extremely hard rock
 BF -bedded MG -medium grain SJ -smooth VHR-very hard rock
 FF -foliated CG -coarse grain RJ -rough HR -hard rock
 CF -cleaved MHR-medium hard rock
 SF -schistose JOINT SPACING JOINT SHAPE SR -soft rock
 GF -gneissose VCJ-very close spacg CUR-curvilinear VSR-very soft rock
 LF -laminated CJ -close spacing PLA-planar
 MJ -medium spacing UND-undulating
 WJ -wide spacing STE-stepped
 VWJ-very wide spacng IRR-irregular



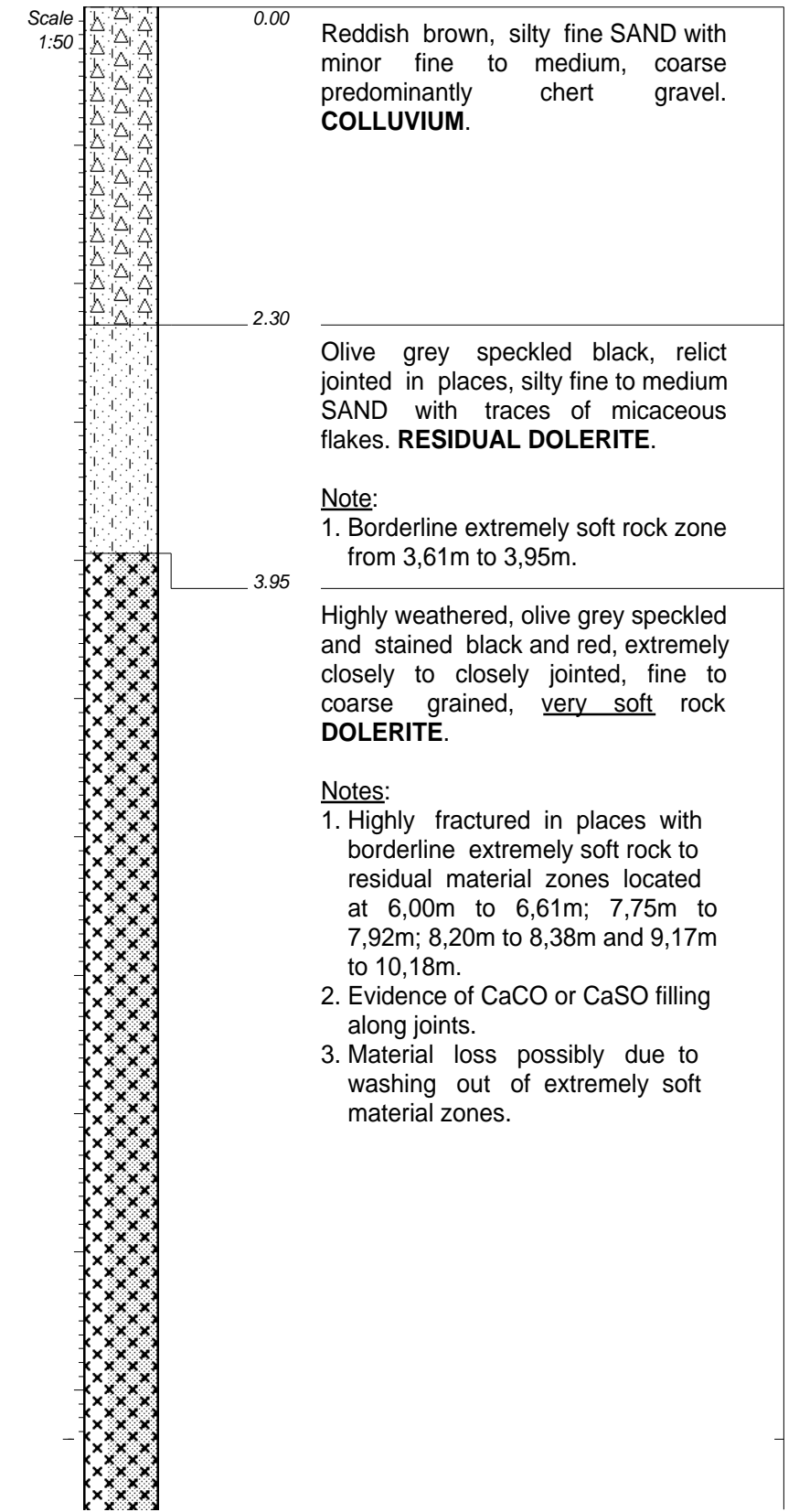
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH03
Sheet 1 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,75	100	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,5	100	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,95	SPT	N=18	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,0	89	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,45	SPT	N=59	N/A	N/A
FG MG	MF	-	-	1	30	VCJ	RJ	SILT Fe-Ox	1	4,5	100	54	11	7
				2	45	CJ	RJ	SILT Fe-Ox	1	4,75	SPT	N=REF	N/A	N/A
				3	60	MJ	RJ	SILT Fe-Ox	1	6,0	96	96	0	>20
				4	80	VWJ	RJ	SILT Fe-Ox	<1	6,29	SPT	N=REF	N/A	N/A
										8,05	55	49	0	>20
										9,55	95	42	0	>20



HOLE No: BH03
Sheet 2 of 2

JOB: 301-00204/13

ROCK FABRIC	GRAIN SIZE	JOINT ROUGHNESS	ROCK HARDNESS
MF -massive	FG -fine grained	SLJ-slickensided	EHR-extremely hard rock
BF -bedded	MG -medium grain	SJ -smooth	VHR-very hard rock
FF -foliated	CG -coarse grain	RJ -rough	HR -hard rock
CF -cleaved			MHR-medium hard rock
SF -schistose	JOINT SPACING	JOINT SHAPE	SR -soft rock
GF -gneissose	VCJ-very close spacg	CUR-curvilinear	VSR-very soft rock
LF -laminated	CJ -close spacing	PLA-planar	
	MJ -medium spacing	UND-undulating	
	WJ -wide spacing	STE-stepped	
	VWJ-very wide spacng	IRR-irregular	



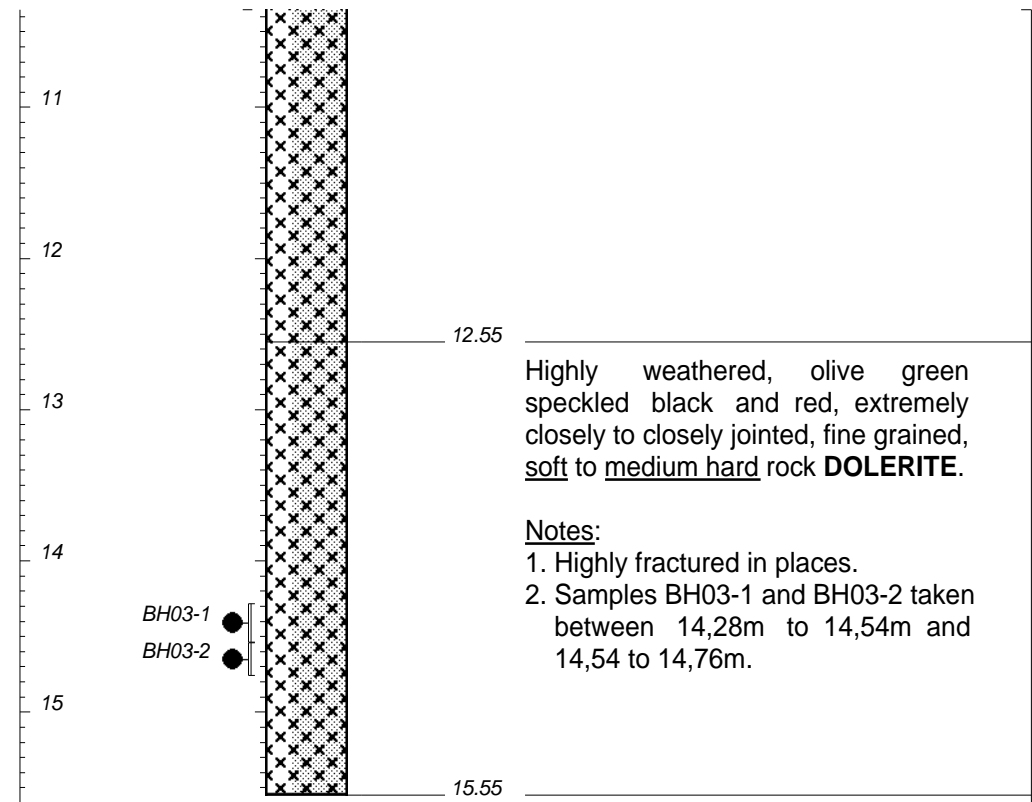
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH03
Sheet 2 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
										11,05	94	52	0	8
										12,55	87	87	0	>20
FG MG	MF	-	-	1	20	CJ	RJ	SILT Fe-Ox	<1	14,05	100	100	27	>20
				2	30	MJ	RJ	SILT Fe-Ox	<1					
				3	45	MJ	RJ	SILT Fe-Ox	1					
				4	85	VWJ	RJ	Fe-Ox	<1					
										15,55	100	100	31	>20



Highly weathered, olive green speckled black and red, extremely closely to closely jointed, fine grained, soft to medium hard rock **DOLERITE**.

- Notes:**
- Highly fractured in places.
 - Samples BH03-1 and BH03-2 taken between 14,28m to 14,54m and 14,54 to 14,76m.

- NOTES**
- NA: Not applicable.
 - NM: Not measurable.
 - Sample BH03-1 taken between 14,28m--14,54m.
 - Sample BH03-2 taken between 14,54m--14,76m.

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
------------	-------------	------------------	------------------	---------------	-----------------	------------	-----------------	---------------	---------------------	---------	-------------	--------------	-------	----------------

CONTRACTOR : Geospektrum Services
MACHINE : XY100
DRILLED BY :
PROFILED BY : PvR
TYPE SET BY : PvR
SETUP FILE : KPBHCO08.SET

INCLINATION : Vertical
DIAM : N-size
DATE : 03 OCT 2018 to 09 OCT 2018
DATE : 10 OCT 2018
DATE : 23/01/2019 08:47
TEXT : C:\WP51\PROFILES\OFIPVR.TXT

COORDINATE SYSTEM : WGS84 (Lo29)
X-COORD : 2652,707
Y-COORD : 2653,280

HOLE No: BH03

HOLE No: BH04
Sheet 1 of 2

JOB: 301-00204/13

ROCK FABRIC	GRAIN SIZE	JOINT ROUGHNESS	ROCK HARDNESS
MF -massive	FG -fine grained	SLJ-slickensided	EHR-extremely hard rock
BF -bedded	MG -medium grain	SJ -smooth	VHR-very hard rock
FF -foliated	CG -coarse grain	RJ -rough	HR -hard rock
CF -cleaved			MHR-medium hard rock
SF -schistose	JOINT SPACING	JOINT SHAPE	SR -soft rock
GF -gneissose	VCJ-very close spacg	CUR-curvilinear	VSR-very soft rock
LF -laminated	CJ -close spacing	PLA-planar	
	MJ -medium spacing	UND-undulating	
	WJ -wide spacing	STE-stepped	
	VWJ-very wide spacng	IRR-irregular	



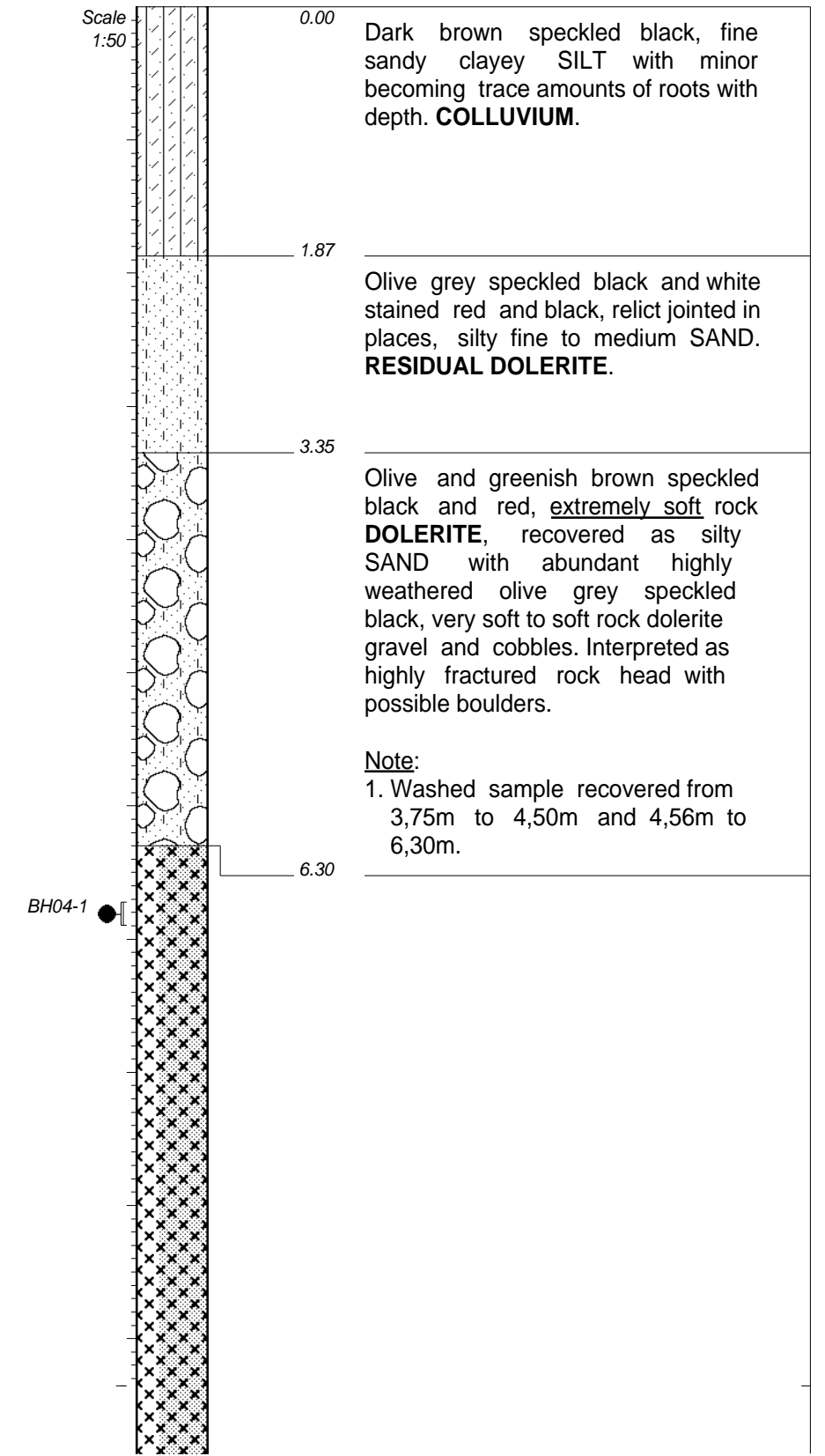
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH04
Sheet 1 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,75	80	0	-	-N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,5	67	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,95	SPT	N=17	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,0	46	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,35	SPT	N=REF	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,75	88	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,5	51	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4,65	SPT	N=REF	N/A	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6,3	63	0	-	N/A
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8,0	94	94	44	>20
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9,5	45	45	7	7
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11,0	81	81	10	18



HOLE No: BH04
Sheet 2 of 2

JOB: 301-00204/13

ROCK FABRIC GRAIN SIZE JOINT ROUGHNESS ROCK HARDNESS
 MF -massive FG -fine grained SLJ-slickensided EHR-extremely hard rock
 BF -bedded MG -medium grain SJ -smooth VHR-very hard rock
 FF -foliated CG -coarse grain RJ -rough HR -hard rock
 CF -cleaved SF -schistose JOINT SPACING JOINT SHAPE MHR-medium hard rock
 SF -schistose VCJ-very close spacg CUR-curvilinear SR -soft rock
 GF -gneissose CJ -close spacing PLA-planar VSR-very soft rock
 LF -laminated MJ -medium spacing UND-undulating
 WJ -wide spacing STE-stepped
 VWJ-very wide spacng IRR-irregular



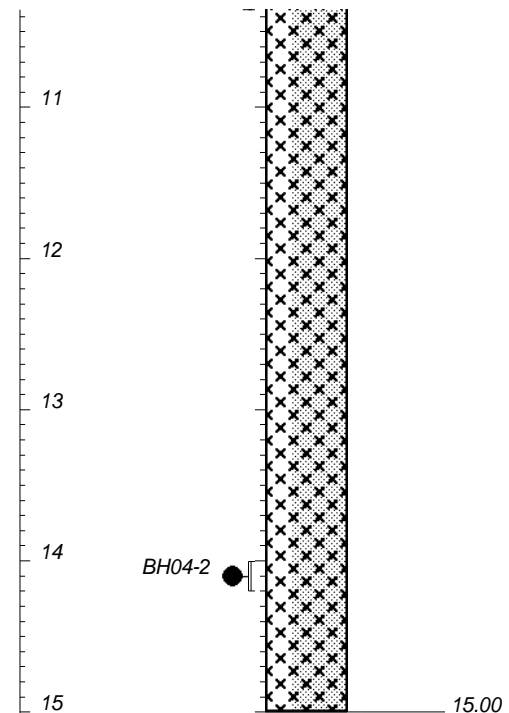
KAREERAND TAILINGS STORAGE FACILITY
PHASE 2

HOLE No: BH04
Sheet 2 of 2

GEOTECHNICAL INVESTIGATION

JOB: 301-00204/13

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
MG CG	MF	-	-	1	30	MJ	RJ	SILT Fe-Ox	1					
				2	45	MJ	RJ	SILT Fe-Ox	1					
				3	70	MJ	RJ	SILT Fe-Ox	1	12,5	95	95	31	20
				4	80	WJ	RJ	SILT Fe-Ox	1	14,0	100	100	43	16
										15,0	94	94	43	8



Highly weathered with completely weathered zones along joints, olive green stained black, orange and white along joints, coarse grained, very closely jointed to closely jointed, very soft to soft rock below 13,95m **DOLERITE**.

- Notes:
1. Highly fractured and altered zones along joints.
 2. Wash sample recovered from 8,00m to 8,26m.
 3. Evidence of possible CaCo or CaSO staining.
 4. Samples BH04-1 and BH04-2 taken from 6,72m to 6,90m and 14,00m to 14,20m.

- NOTES
- 1) NA: Not applicable.
 - 2) NM: Not measurable.
 - 3) Sample BH04-1 taken between 6,72m--6,90m.
 - 4) Sample BH04-2 taken between 14,00m--14,20m.

Grain Size	Rock Fabric	Fabric Spac (mm)	Fabric Inc (deg)	Joint Set No.	Joint Inc (Deg)	Joint Spac	Micro Roughness	Joint Filling	Fill Thickness (mm)	Depth m	Mat recov %	Rock recov %	RQD %	Frac Freq No/m
------------	-------------	------------------	------------------	---------------	-----------------	------------	-----------------	---------------	---------------------	---------	-------------	--------------	-------	----------------

CONTRACTOR : Geospektrum Services
 MACHINE : XY100
 DRILLED BY :
 PROFILED BY : PvR
 TYPE SET BY : PvR
 SETUP FILE : KPBHCO08.SET

INCLINATION : Vertical
 DIAM : N-size
 DATE : 03 OCT 2018 to 09 OCT 2018
 DATE : 10 OCT 2018
 DATE : 23/01/2019 08:47
 TEXT : C\WP51\PROFILES\OFIPVR.TXT

COORDINATE SYSTEM : WGS84 (Lo29)
 X-COORD : 2652,676
 Y-COORD : 2653,556

HOLE No: BH04

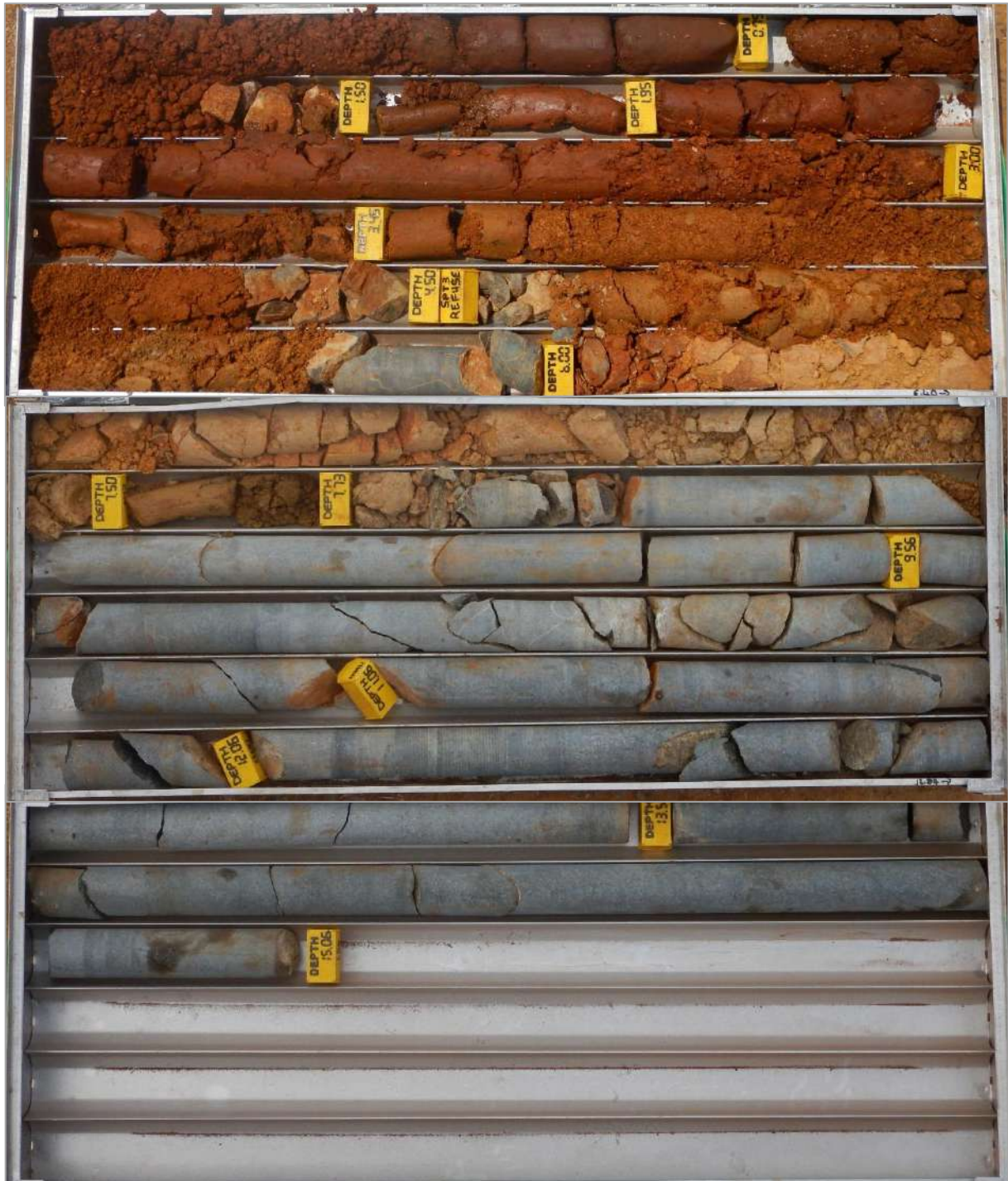
KAREERAND TAILINGS STORAGE FACILITY
TSF EXTENSION AND ASSOCIATED STRUCTURES

BOREHOLE CORE PHOTOGRAPHS

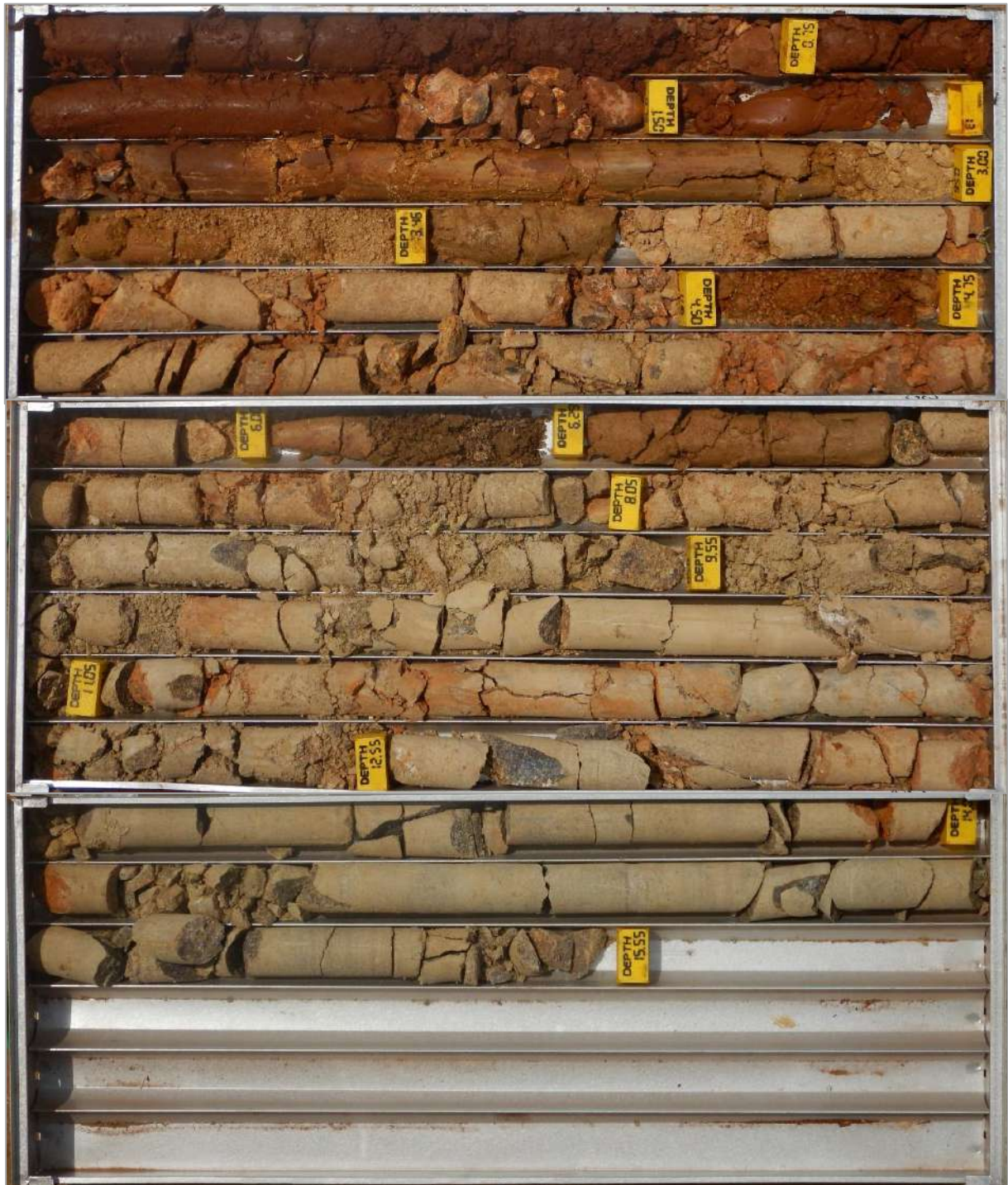
BH1



BH2



BH3



BH4



APPENDIX D1

SOIL LABORATORY TEST RESULTS - FEASIBILITY PHASE



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP3/1
Lab no 7/2542

Project Karee Rand Mega
Depth (m) 0.5-3.4

Job no 2017-C-568
Date 30-06-2017

Initial Sample Parameters

Sample Condition	-	Remoulded to 95% Proctor density
MDD (Proctor)	kg / m ³	1324
OMC	%	24.6
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information

Moisture Content	Before	%	41.8
	After	%	39.8
Dry Density	Kg/m ³		1211
Initial Void Ratio	-		1.018
Relative Density (SG)	-		2.4435 - Determined
Initial Degree of Saturation	%		100.3
Final B Parameter	-		0.96
Co-efficient of Permeability	Min.	m/s	1.4E-10
	Max.	m/s	4.7E-10
	Ave.	m/s	2.6E-10



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP5/1
Lab no 7/2543

Project Karee Rand Mega
Depth (m) 0.6-3.2

Job no 2017-C-568
Date 29-06-2017

Initial Sample Parameters

Sample Condition	-	Remoulded to 95% Proctor density
MDD (Proctor)	kg / m ³	1562
OMC	%	10.5
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information

Moisture Content	Before	%	13.8
	After	%	26.2
Dry Density	Kg/m ³		1480
Initial Void Ratio	-		0.788
Relative Density (SG)	-		2.647 - Determined
Initial Degree of Saturation	%		46.3
Final B Parameter	-		0.96
Co-efficient of Permeability	Min.	m/s	5.1E-08
	Max.	m/s	1.2E-07
	Ave.	m/s	8.0E-08



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP13/2
Lab no 7/2547

Project Karee Rand Mega
Depth (m) 1.1-2.3

Job no 2017-C-568
Date 07-07-2017

Initial Sample Parameters

Sample Condition	-	Remoulded to 95% Proctor density
MDD (Proctor)	kg / m ³	1626
OMC	%	13.6
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information

Moisture Content	Before	%	17.6
	After	%	27.6
Dry Density	Kg/m ³		1470
Initial Void Ratio	-		0.731
Relative Density (SG)	-		2.545 - Determined
Initial Degree of Saturation	%		61.4
Final B Parameter	-		0.98
Co-efficient of Permeability	Min.	m/s	1.5E-08
	Max.	m/s	3.9E-08
	Ave.	m/s	2.3E-08



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP22/1
Lab no 7/2550

Project Karee Rand Mega
Depth (m) 1.2-1.9

Job no 2017-C-568
Date 31-07-2017

Initial Sample Parameters		
Sample Condition	-	Remoulded to 95% Proctor density
MDD (Mod. AASHTO)	kg / m ³	1537
OMC	%	16.7
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information			
Moisture Content	Before	%	26.9
	After	%	29.9
Dry Density		Kg/m ³	1431
Initial Void Ratio		-	0.700
Relative Density (SG)		-	2.4325 - Determined
Initial Degree of Saturation		%	93.5
Final B Parameter		-	0.96
Co-efficient of Permeability	Min.	m/s	3.8E-10
	Max.	m/s	1.0E-09
	Ave.	m/s	7.3E-10



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP24/1
Lab no 7/2552

Project Karee Rand Mega
Depth (m) 0.3-1.4

Job no 2017-C-568
Date 16-08-2017

Initial Sample Parameters		
Sample Condition	-	Remoulded to 95% Proctor density
MDD (Proctor)	kg / m ³	1532
OMC	%	16.5
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information			
Moisture Content	Before	%	22.3
	After	%	31.5
Dry Density	Kg/m ³		1389
Initial Void Ratio	-		0.912
Relative Density (SG)	-		2.657 - Determined
Initial Degree of Saturation	%		64.9
Final B Parameter	-		0.98
Co-efficient of Permeability	Min.	m/s	1.1E-10
	Max.	m/s	1.4E-09
	Ave.	m/s	5.5E-10



Flexible Wall Permeability Test

**BS 1377
Part 6**

Client Knight Piesold
Sample no TP25/1
Lab no 7/2554

Project Karee Rand Mega
Depth (m) 0.3-1.5

Job no 2017-C-568
Date 29-06-2017

Initial Sample Parameters

Sample Condition	-	Remoulded to 95% Proctor density
MDD (Proctor)	kg / m ³	1586
OMC	%	17.0
Consolidation Pressure	kPa	100
Pressure Difference	kPa	10

Test Information

Moisture Content	Before	%	18.5
	After	%	24.6
Dry Density	Kg/m ³		1458
Initial Void Ratio	-		0.687
Relative Density (SG)	-		2.4605 - Determined
Initial Degree of Saturation	%		66.4
Final B Parameter	-		0.97
Co-efficient of Permeability	Min.	m/s	3.2E-11
	Max.	m/s	2.4E-10
	Ave.	m/s	9.6E-11

APPENDIX D2

SOIL LABORATORY TEST RESULTS - DESIGN PHASE



MATROLAB

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg No.: 2003/029180/07 - VAT Reg No.: 4040210587

256 Brander street, Jan Niemand Park, Pretoria.
P.O. Box 912387 Silverton, 0127
Tel. : 012-800 1299
Fax. : 012-800 3034
Email : auke.keijser@sgs.com

TEST RESULTS

Client: Knight Piesold
Address: PO Box 72292
Lynnwood Ridge
0040
Attention: Jaco van Tonder

Project : Kareerand TSF Phase 2
Your Ref : 301-00204/13
Our Ref : 2012
Date Reported : 28-11-2018

FALLING HEAD PERMEABILITY TEST METHOD: KH HEAD Volume 2

SAMPLE	Depth (m)	Actual Dry Density	Actual Moisture Content	Actual Compaction	Permeability (m/s)
G18-0677 (TP2-06/2)	1,3-2,4	1412	17.9%	94.6%	8.67E-08
G18-0678 (TP2-06/3)	2,4-3,1	1536	14.8%	94.0%	7.62E-07
G18-0680 (TP2-08)	1,3-2,8	1371	20.3%	94.8%	3.73E-08
G18-0686 (TP2-16/2)	1,6-3,1	1506	16.5%	94.7%	7.62E-07

Remarks : Only material passing the 4,75 mm sieve was used for testing, due to equipment boundary conditions

Form: C1 Program ver 2.4

For SGS Matrolab (Pty) Ltd.

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 - CIVIL ENGINEERING SERVICES -
 Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210597
 a SANAS Accredited Testing Laboratory, No.

256 Brander Street, Jan Niemand Park, Pretoria
 PO Box 912387, Silverton, 0127
 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : anne@sgs.com

TEST RESULTS

KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

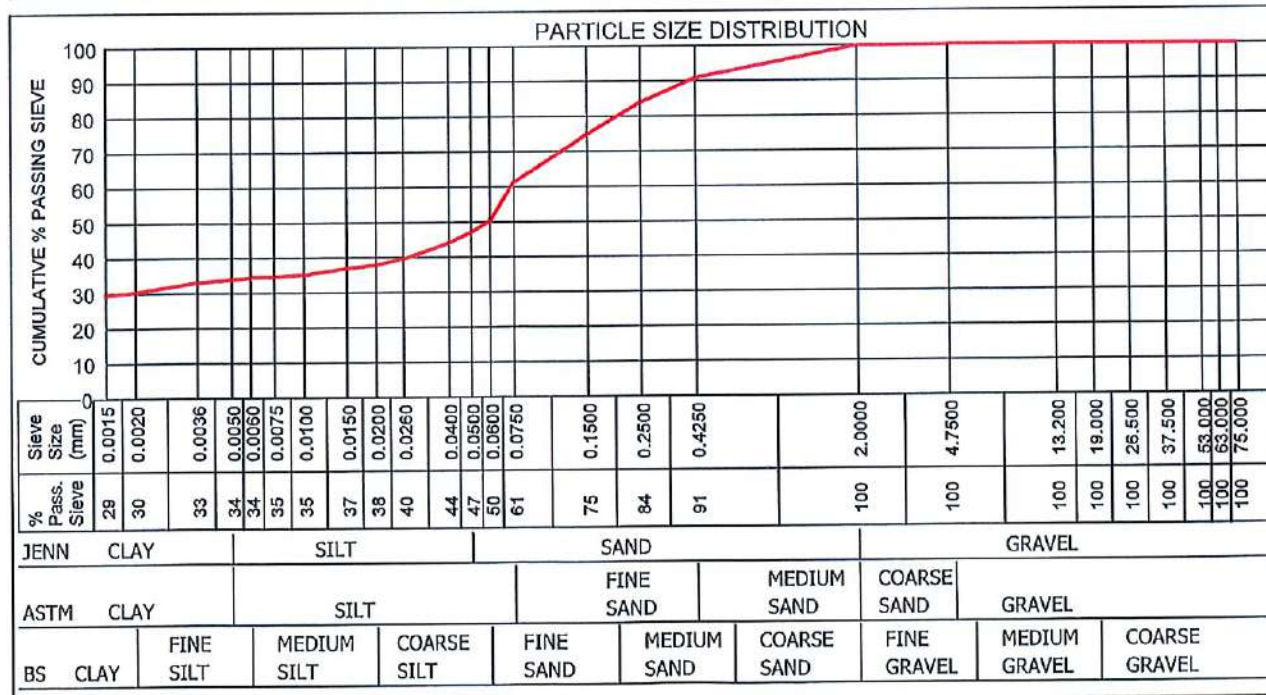
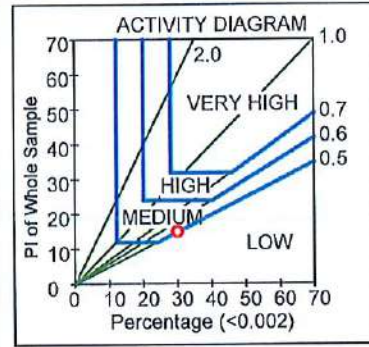
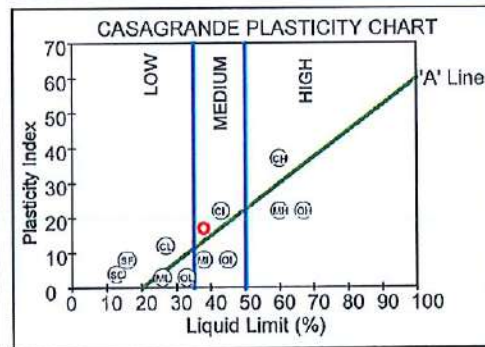
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3853
 Hole No. : TP2-01/1
 Depth : 0-800
 Liquid Limit (%) : 38
 Plasticity Index : 17
 Linear Shrinkage (%) : 8.0
 PI of Whole Sample : 15
 P.R.A. Classification : A-6(8)
 Unified Soil Classification: CL
 Activity : 0.50
 Heave Classification : MEDIUM
 Grading Modulus : 0.48
 Percentage (<0.002) : 30.0
 Moisture Content (%) : 17.0

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	33.9	13.3	52.7	0.2	SANDY CLAY
Astm	33.9	27.3	38.8	0.1	SANDY CLAY
British Standard	30.3	20.0	49.5	0.2	SANDY CLAY



Remarks : Sampled by client
 G18-0672

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory :

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 - CIVIL ENGINEERING SERVICES -
 Reg.No.: 2003/021980/07 - VAT, Reg.No.: 4040210587
 a SANAS Accredited Testing Laboratory, No.

256 Brander Street, Jan Niebrand Park, Pretoria
 PO Box 912387, Silverton, 0127
 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : anneljie.verwey@sgs.com

TEST RESULTS

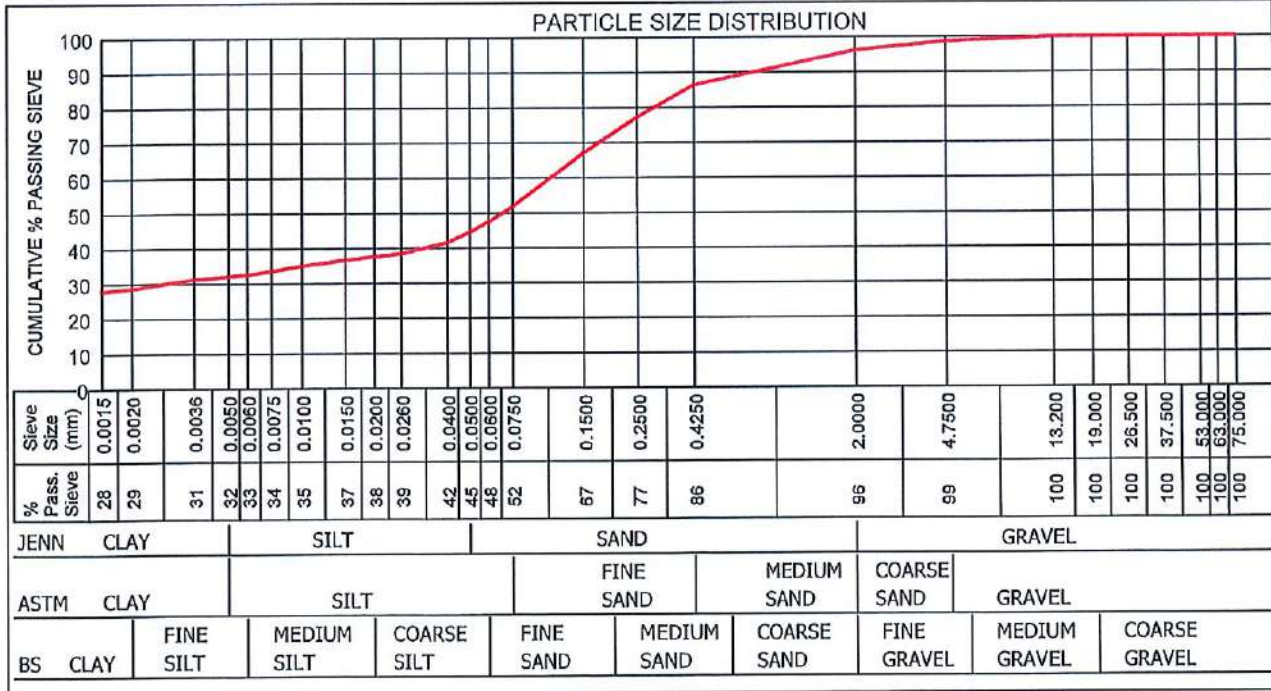
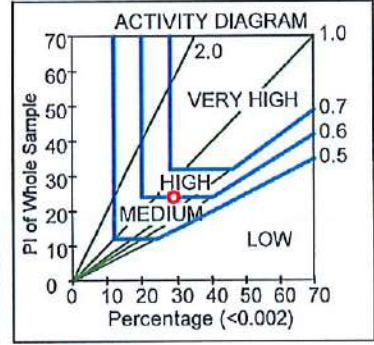
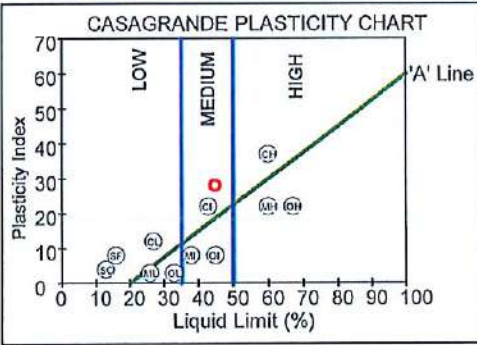
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3854
 Hole No. : TP2-01/2
 Depth : 800-1100
 Liquid Limit (%) : 45
 Plasticity Index : 28
 Linear Shrinkage (%) : 12.5
 PI of Whole Sample : 24
 P.R.A. Classification : A-7-6(10)
 Unified Soil Classificati: CL
 Activity : 0.83
 Heave Classification : HIGH
 Grading Modulus : 0.66
 Percentage (<0.002) : 29.0
 Moisture Content (%) : 17.6

Material Description : Alluvium SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	32.0	12.6	51.7	3.8	SANDY CLAY
Astm	32.0	19.6	47.1	1.3	SANDY CLAY
British Standard	28.6	18.9	48.7	3.8	CLAYEY SAND



Remarks : Sampled by client
 G18-0673

FORM: A6

Technical Signatory:

4.4.0(SGS)(2016.08.31)

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

256 Brander Street, Jan Niemand Park, Pretoria
 PO Box 912387, Silverton, 0127
 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : anneljie.verwey@sgs.com

TEST RESULTS

KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

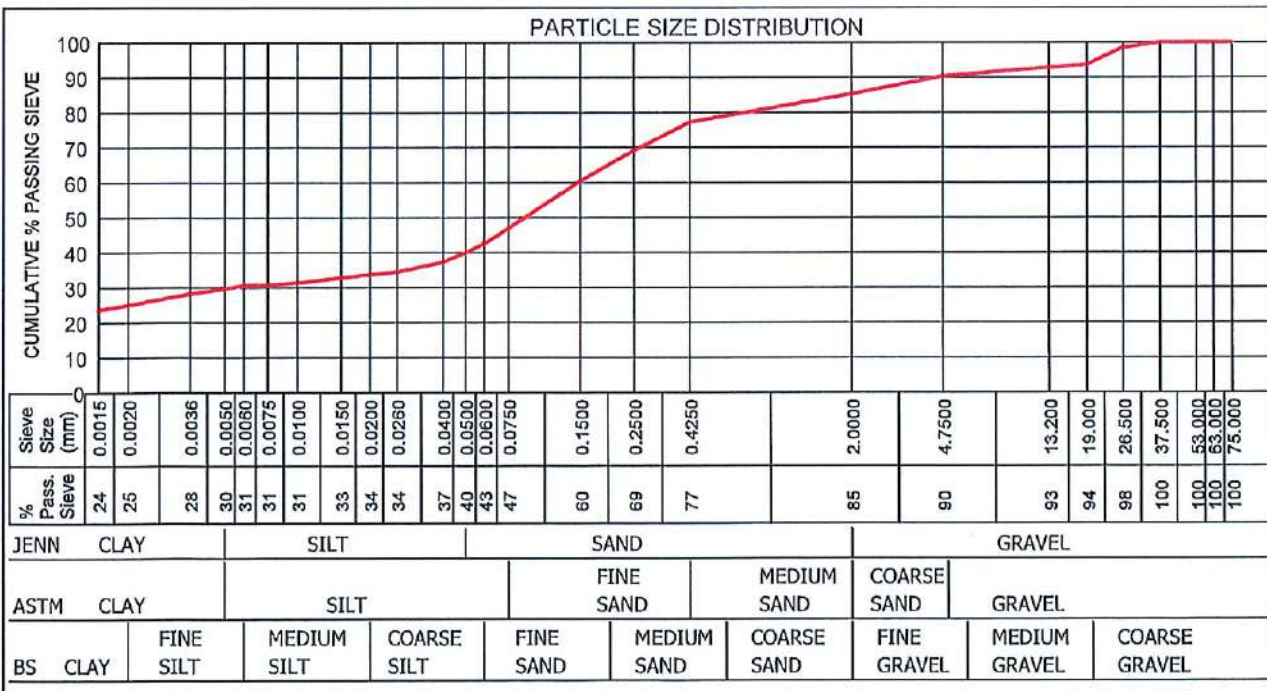
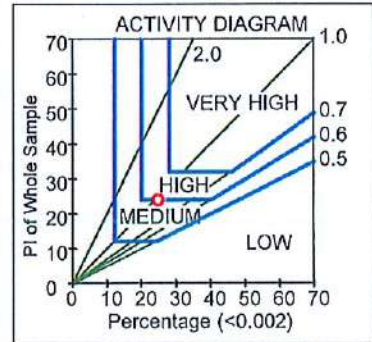
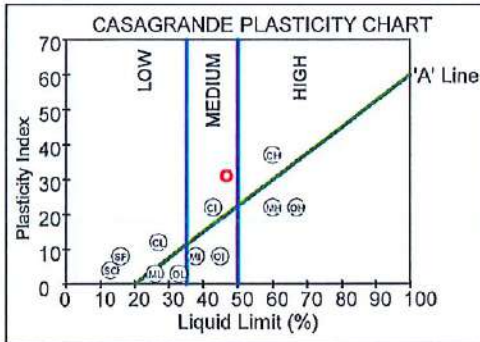
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3855
 Hole No. : TP2-01/3
 Depth : 1100-2000
 Liquid Limit (%) : 47
 Plasticity Index : 31
 Linear Shrinkage (%) : 12.5
 PI of Whole Sample : 24
 P.R.A. Classification : A-7-6(9)
 Unified Soil Classificati: SC
 Activity : 0.96
 Heave Classification : HIGH
 Grading Modulus : 0.91
 Percentage (<0.002) : 25.0
 Moisture Content (%) : 20.4

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	29.6	10.3	45.5	14.6	SANDY CLAY
Astm	29.6	17.2	43.5	9.6	SANDY CLAY
British Standard	25.1	17.5	42.8	14.6	CLAYEY SAND



Remarks : Sampled by client
 G18-0674

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory :

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 PO Box 912387, Silverton, 0127
 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : anneljie.verwey@sgs.com

TEST RESULTS

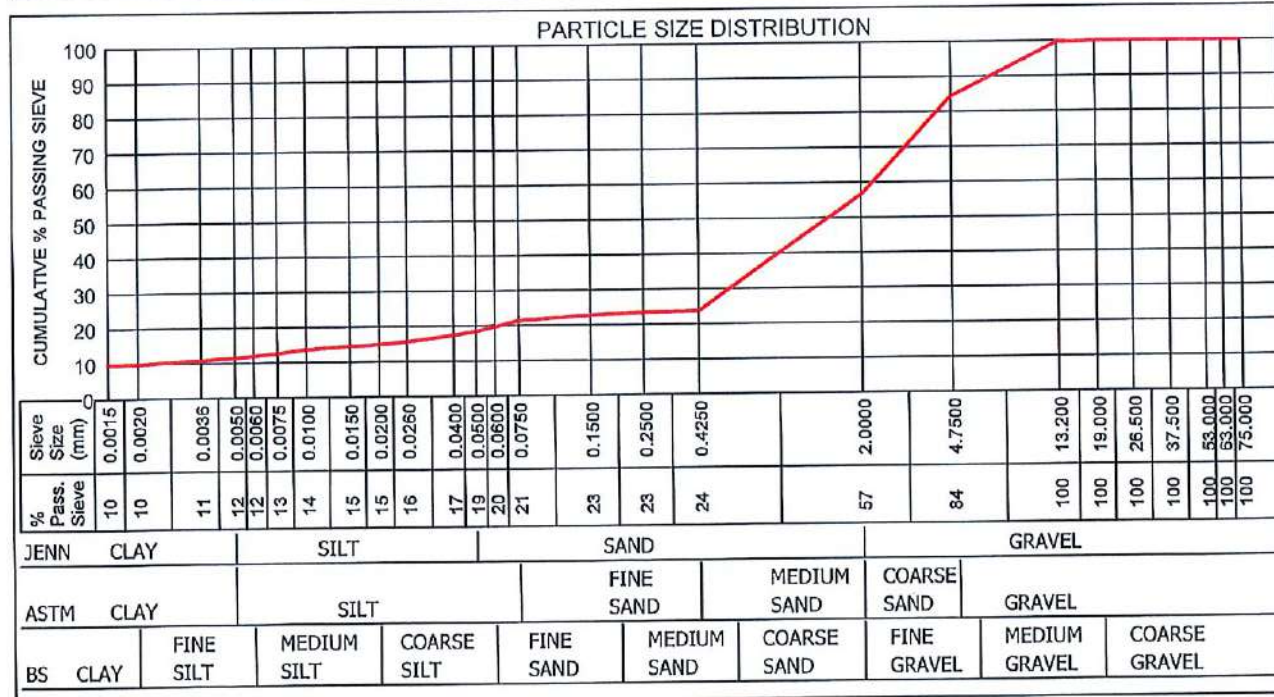
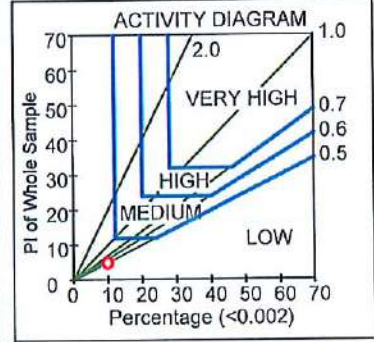
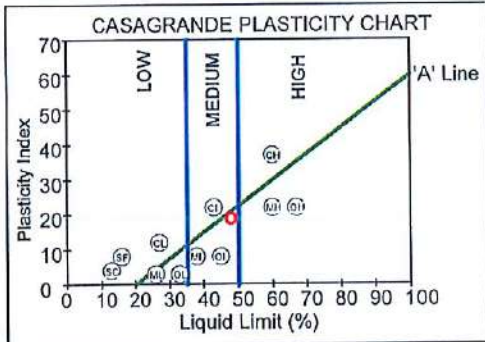
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3856
 Hole No. : TP2-02/1
 Depth : 800-2800
 Liquid Limit (%) : 48
 Plasticity Index : 19
 Linear Shrinkage (%) : 8.5
 Pl of Whole Sample : 5
 P.R.A. Classification : A-2-7(1)
 Unified Soil Classificati: SM
 Activity : 0.50
 Heave Classification : LOW
 Grading Modulus : 1.98
 Percentage (<0.002) : 10.0
 Moisture Content (%) : 12.0

Material Description : SILTY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	11.5	7.0	38.2	43.3	CLAYEY SAND
Astm	11.5	9.9	63.0	15.6	SILTY SAND
British Standard	9.9	9.8	37.0	43.3	SILTY SAND



Remarks : Sampled by client
 G18-0675

FORM: A6

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TEST RESULTS

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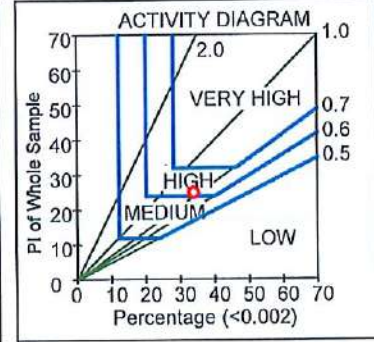
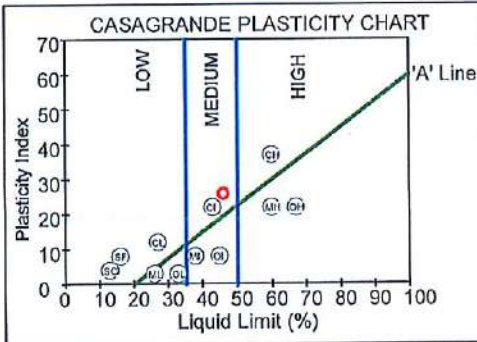
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

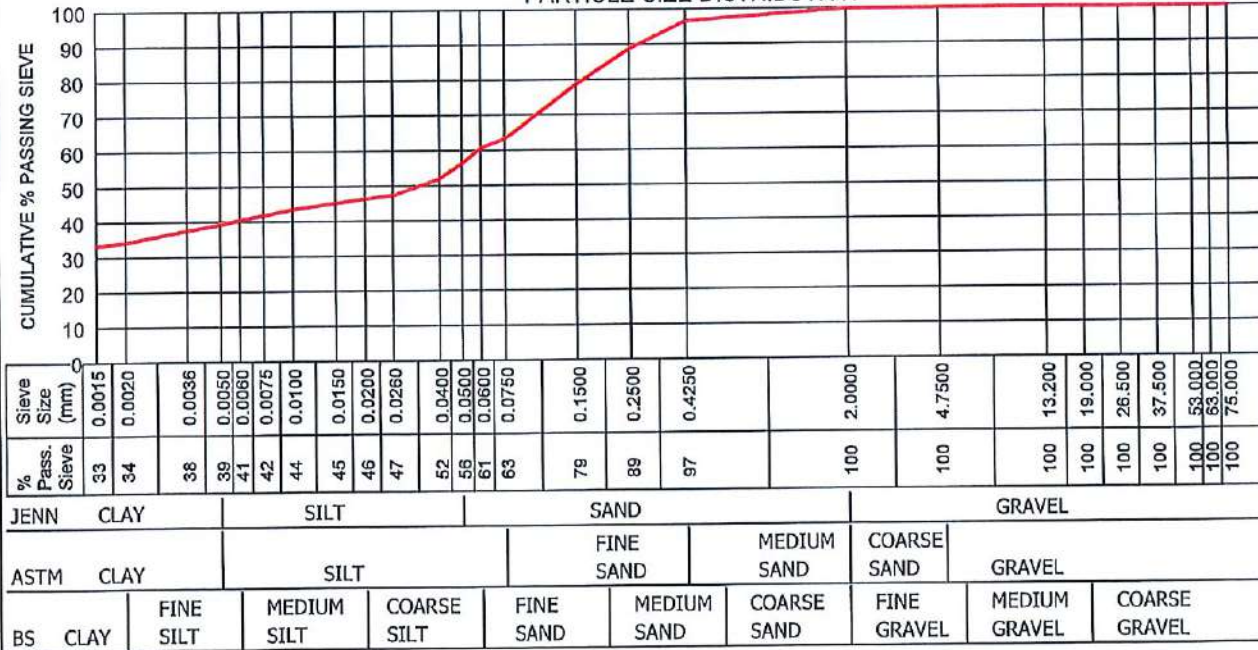
Sample No. : 8/3857
 Hole No. : TP2-06/1
 Depth : 0-1300
 Liquid Limit (%) : 46
 Plasticity Index : 26
 Linear Shrinkage (%) : 13.0
 PI of Whole Sample : 25
 P.R.A. Classification : A-7-6(13)
 Unified Soil Classificati: CL
 Activity : 0.74
 Heave Classification : HIGH
 Grading Modulus : 0.40
 Percentage (<0.002) : 34.0
 Moisture Content (%) : 13.9

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	39.4	17.0	43.5	0.1	SANDY CLAY
Astm	39.4	23.9	36.8	0.0	SANDY CLAY
British Standard	34.3	26.5	39.1	0.1	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client
 G18-0676

FORM: A6

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LYNNWOOD RIDGE
0040
Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2

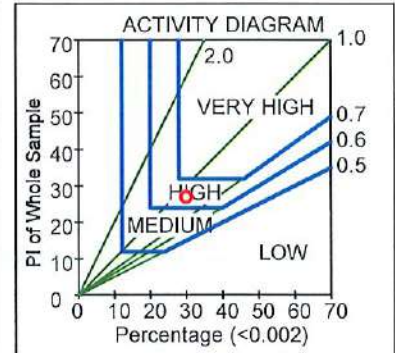
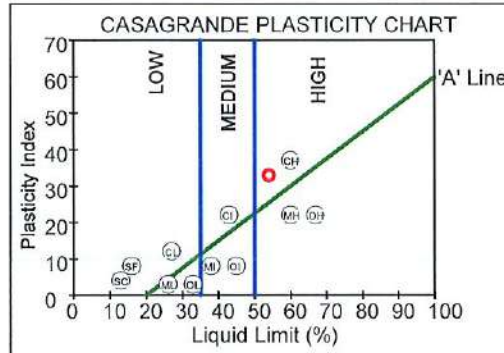
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Our Ref : PL/23763
Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

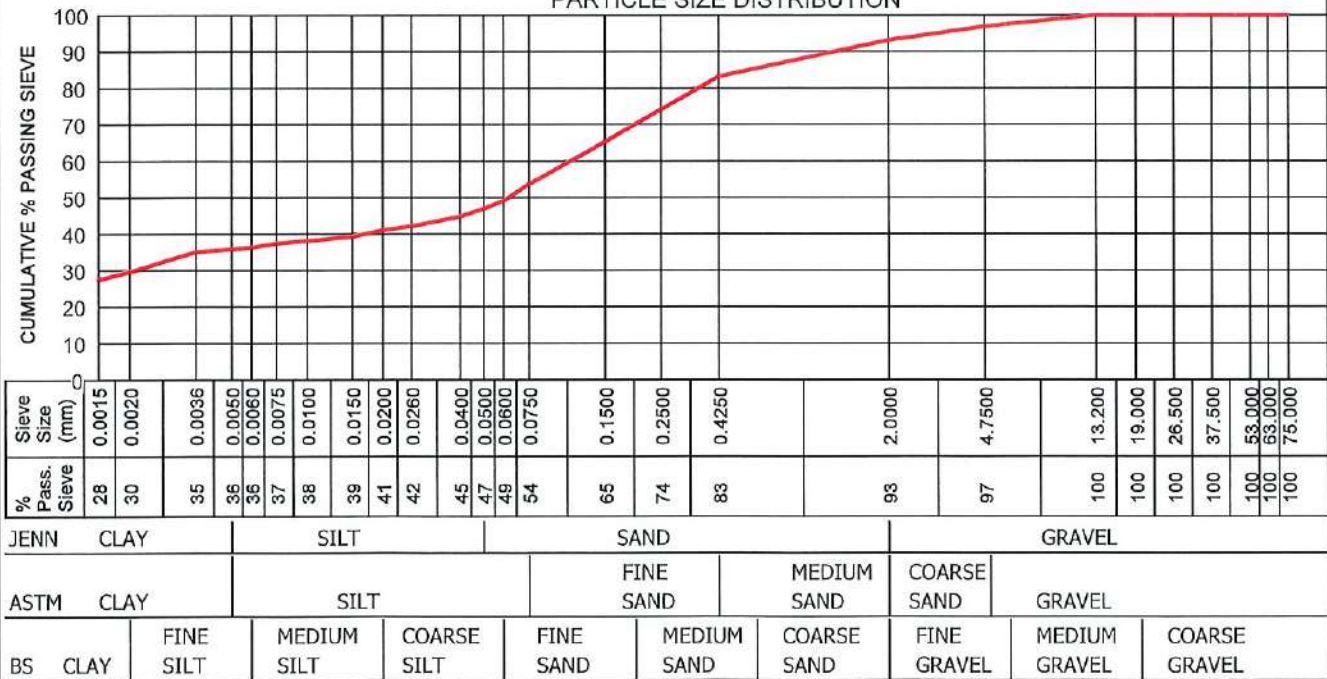
Sample No. : 8/3858
Hole No. : TP2-06/2
Depth : 1300-2400
Liquid Limit (%) : 54
Plasticity Index : 33
Linear Shrinkage (%) : 15.0
PI of Whole Sample : 27
P.R.A. Classification : A-7-6(13)
Unified Soil Classificati: CH
Activity : 0.90
Heave Classification : HIGH
Grading Modulus : 0.70
Percentage (<0.002) : 30.0
Moisture Content (%) : 13.0

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	35.9	11.1	46.2	6.8	SANDY CLAY
Astm	35.9	17.7	43.3	3.1	SANDY CLAY
British Standard	29.8	19.3	44.0	6.8	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.
G18-0677

FORM: A6

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

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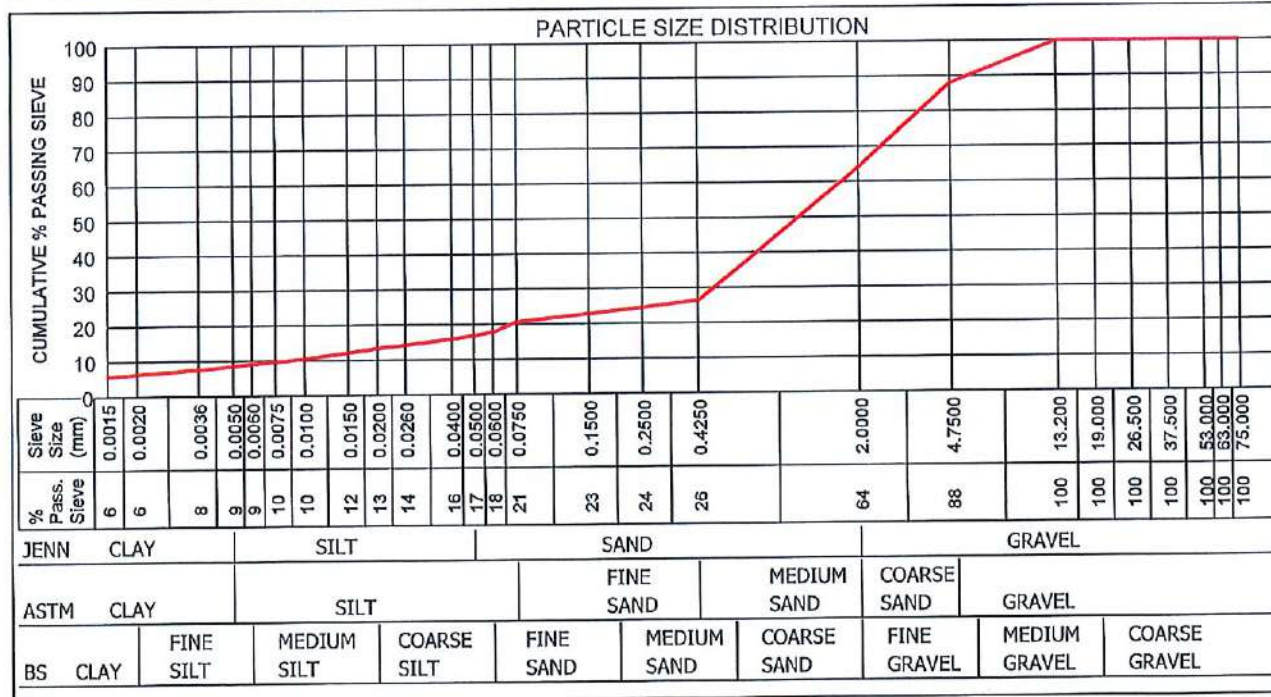
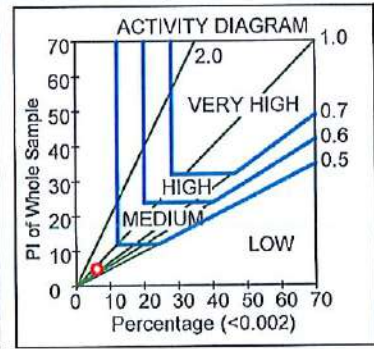
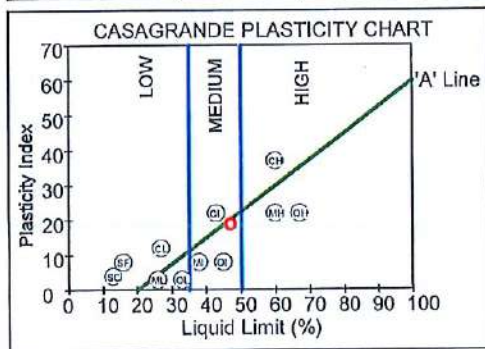
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3859
 Hole No. : TP2-06/3
 Depth : 2400-3100
 Liquid Limit (%) : 47
 Plasticity Index : 19
 Linear Shrinkage (%) : 7.0
 PI of Whole Sample : 5
 P.R.A. Classification : A-2-7(1)
 Unified Soil Classification: SM
 Activity : 0.83
 Heave Classification : LOW
 Grading Modulus : 1.89
 Percentage (<0.002) : 6.0
 Moisture Content (%) : 11.4

Material Description : SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	8.6	8.3	47.6	35.6	SILTY SAND
Astm	8.6	12.1	67.5	11.9	SILTY SAND
British Standard	6.4	11.5	46.6	35.6	SILTY SAND



Remarks : Sampled by client
 G18-0678

FORM: A6

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TEST RESULTS

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 0040
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2

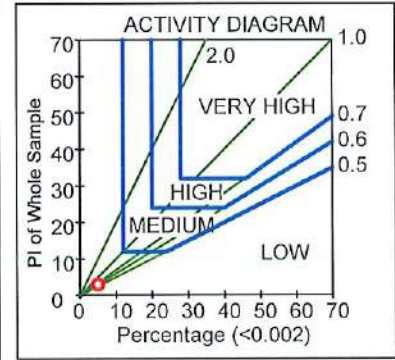
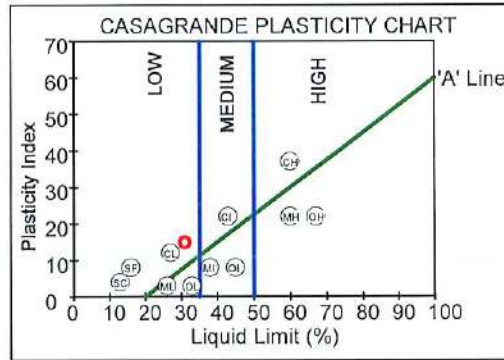
Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

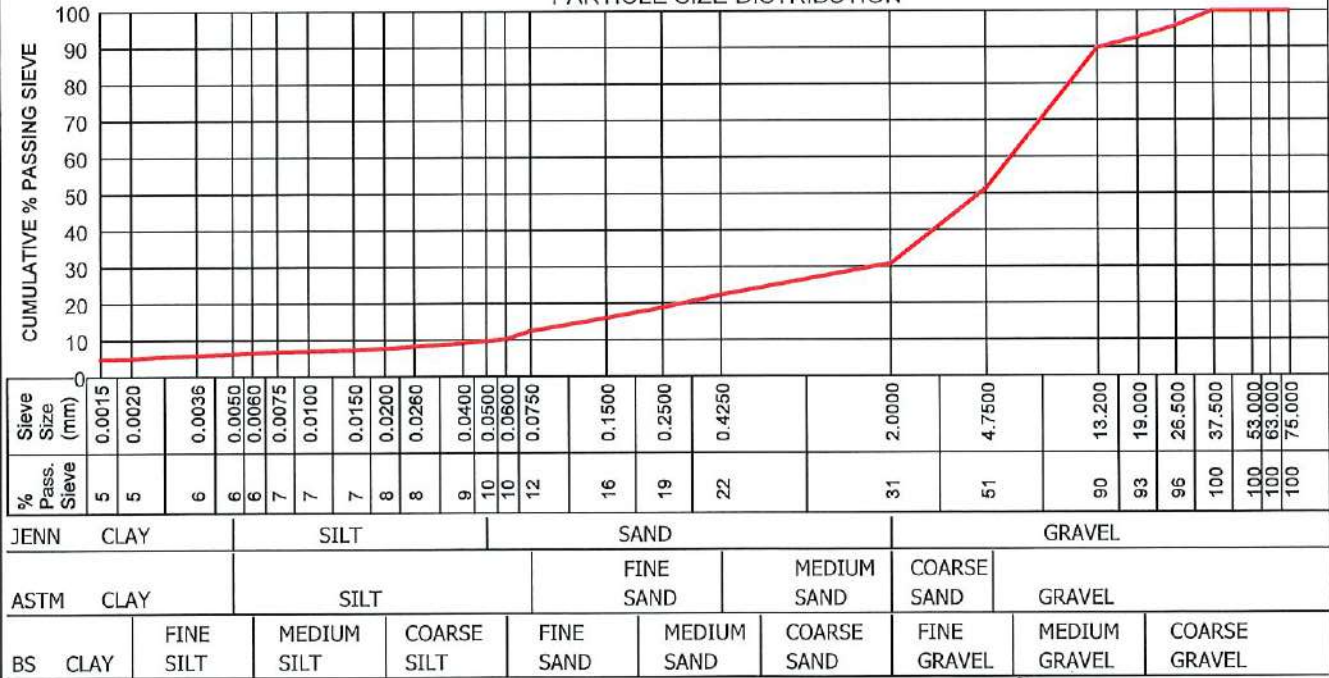
Sample No.	: 8/3860
Hole No.	: TP2-07
Depth	: 300-2500
Liquid Limit (%)	: 31
Plasticity Index	: 15
Linear Shrinkage (%)	: 7.0
PI of Whole Sample	: 3
P.R.A. Classification	: A-2-6(0)
Unified Soil Classification	: SW-SC
Activity	: 0.60
Heave Classification	: LOW
Grading Modulus	: 2.35
Percentage (<0.002)	: 5.0
Moisture Content (%)	: 5.4

Material Description : SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	6.2	3.5	21.2	69.1	CLAYEY SAND
Astm	6.2	6.2	38.8	48.7	SILTY SAND
British Standard	5.1	5.1	20.6	69.1	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.
 G18-0679

FORM: A6

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 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : annofie.verwey@sgs.com

TEST RESULTS

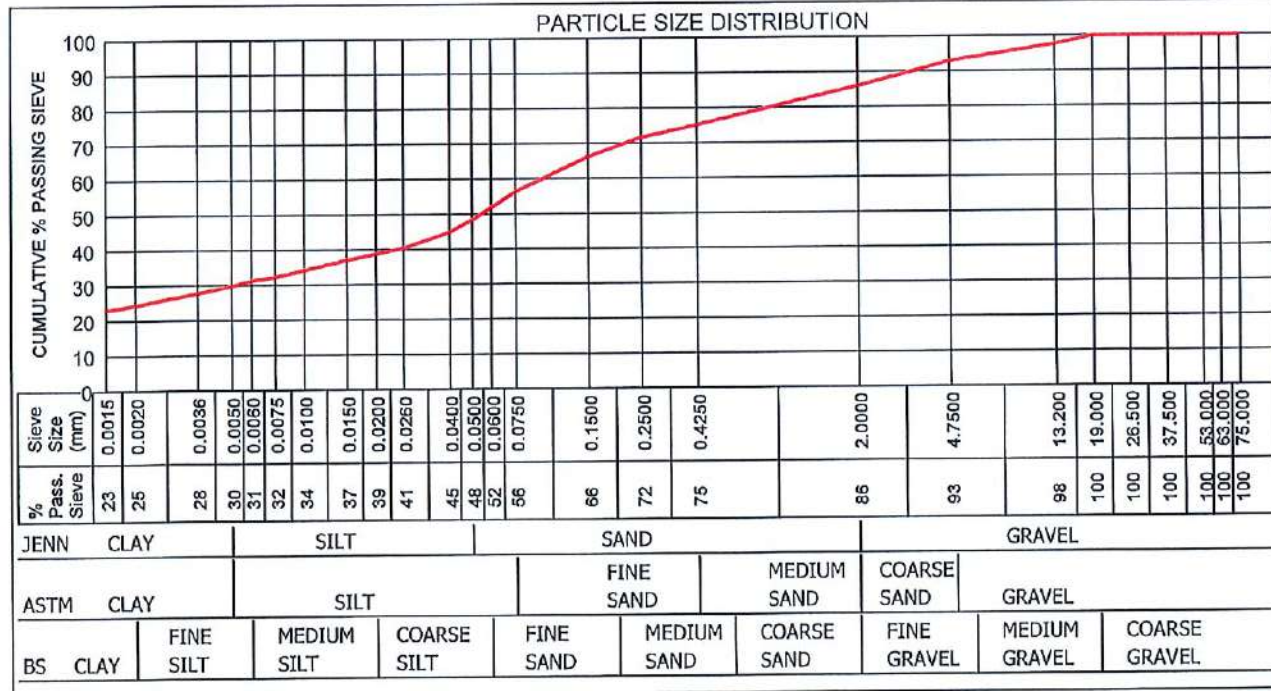
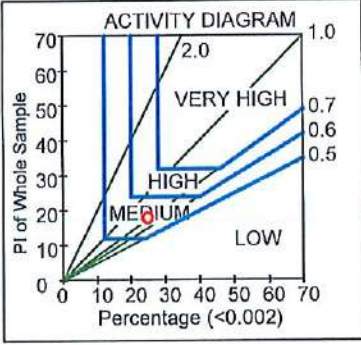
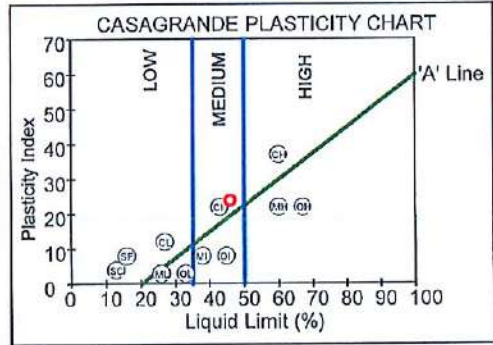
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3861
 Hole No. : TP2-08
 Depth : 1300-2800
 Liquid Limit (%) : 46
 Plasticity Index : 24
 Linear Shrinkage (%) : 11.0
 PI of Whole Sample : 18
 P.R.A. Classification : A-7-6(10)
 Unified Soil Classificati: CL
 Activity : 0.72
 Heave Classification : MEDIUM
 Grading Modulus : 0.83
 Percentage (<0.002) : 25.0
 Moisture Content (%) : 19.7

Material Description : SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	29.9	18.5	37.7	13.8	SANDY CLAY
Astm	29.9	26.5	36.6	7.0	SANDY CLAY
British Standard	24.5	27.5	34.2	13.8	CLAYEY SAND



Remarks : Sampled by client
 G18-0680

FORM: A6

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 Fax : (012) 800 3043
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TEST RESULTS

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 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2

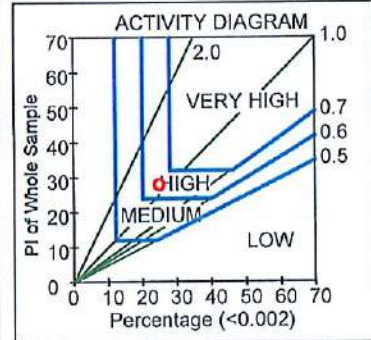
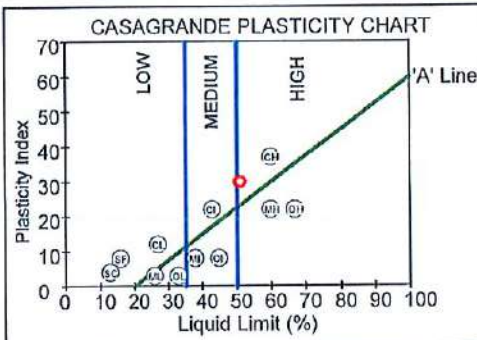
Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

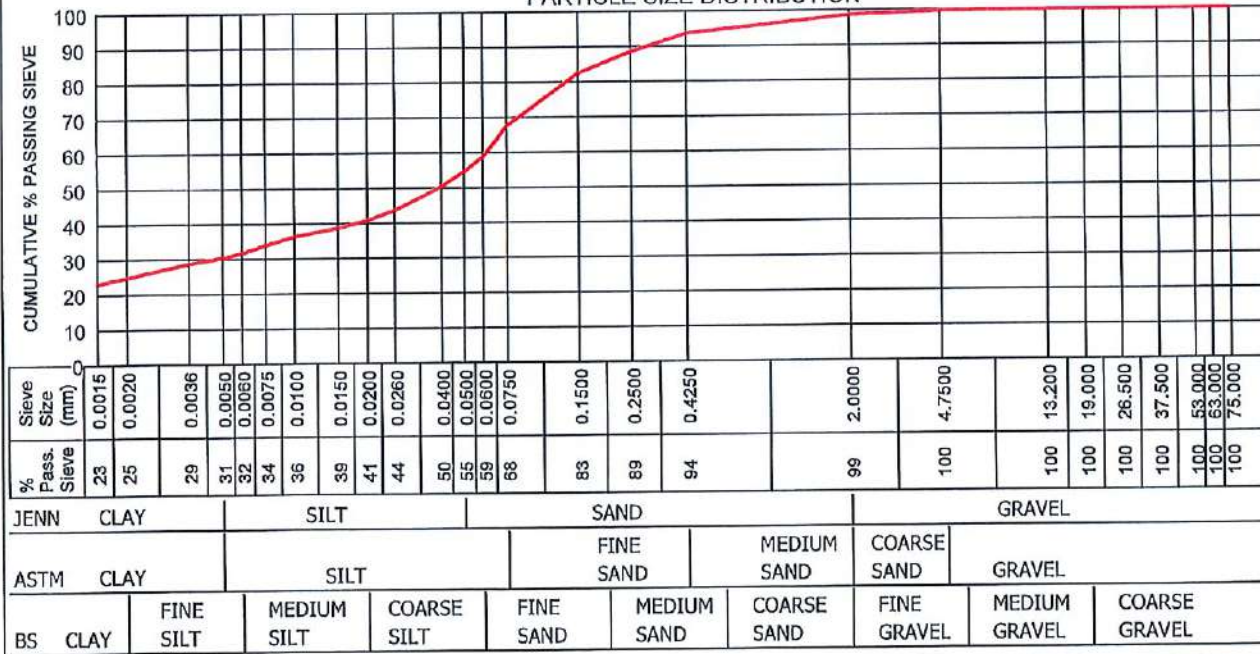
Sample No. : 8/3862
 Hole No. : TP2-10/1
 Depth : 0-1000
 Liquid Limit (%) : 51
 Plasticity Index : 30
 Linear Shrinkage (%) : 14.0
 PI of Whole Sample : 28
 P.R.A. Classification : A-7-6(16)
 Unified Soil Classificati: CH
 Activity : 1.12
 Heave Classification : HIGH
 Grading Modulus : 0.39
 Percentage (<0.002) : 25.0
 Moisture Content (%) : 34.2

Material Description : SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.5	24.1	44.1	1.3	SANDY CLAY
Astm	30.5	37.2	32.0	0.3	SANDY CLAY
British Standard	25.0	34.0	39.8	1.3	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client
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FORM: A6

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TEST RESULTS

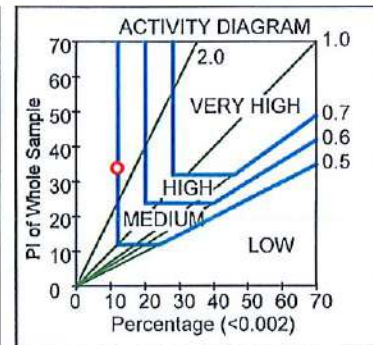
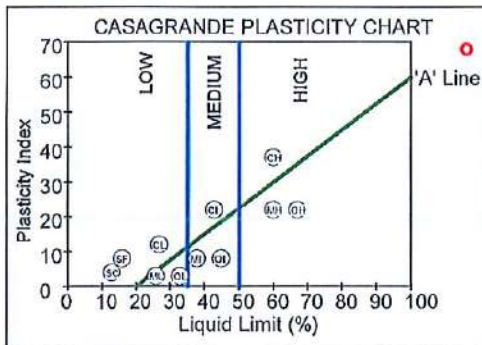
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

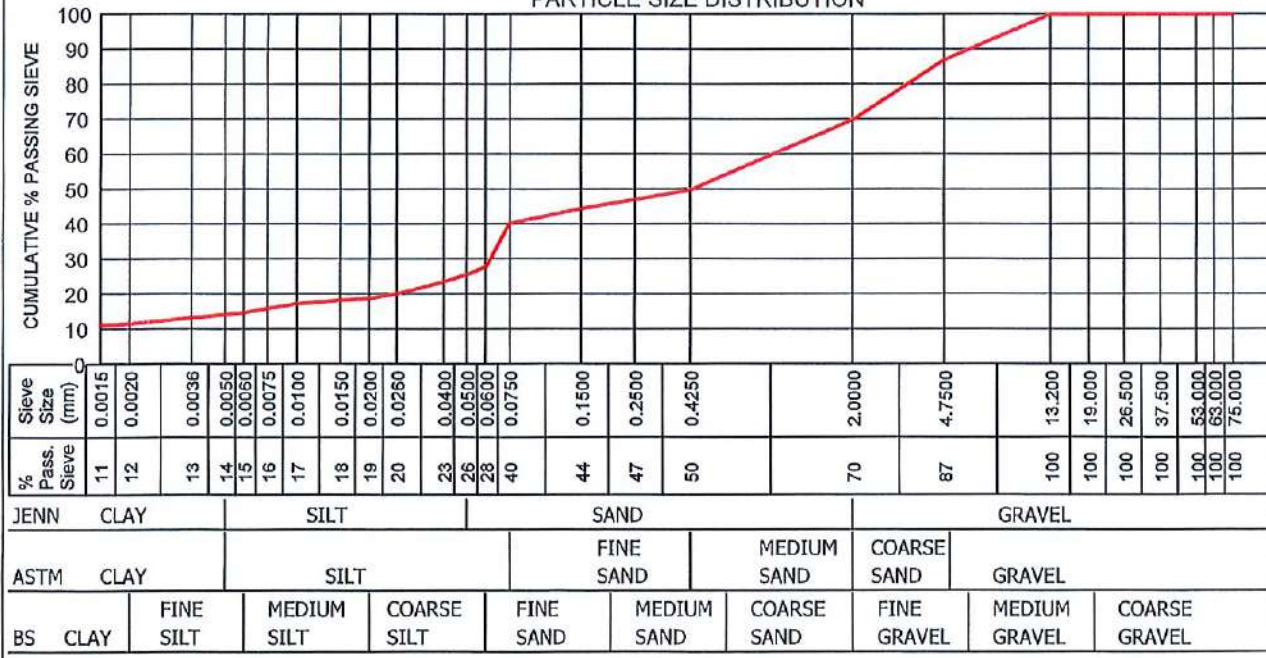
FOUNDATION INDICATOR (ASTM: D422)

Sample No.	: 8/3863
Hole No.	: TP2-10/2
Depth	: 1000-1500
Liquid Limit (%)	: 116
Plasticity Index	: 68
Linear Shrinkage (%)	: 19.0
PI of Whole Sample	: 34
P.R.A. Classification	: A-7-5(6)
Unified Soil Classificati	: SM
Activity	: 2.83
Heave Classification	: MEDIUM
Grading Modulus	: 1.40
Percentage (<0.002)	: 12.0
Moisture Content (%)	: 32.4

Material Description : SILTY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	14.1	11.5	44.4	30.0	CLAYEY SAND
Astm	14.1	26.1	46.7	13.1	SILTY SAND
British Standard	11.6	16.2	42.2	30.0	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client
 G18-0682

FORM: A6

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TEST RESULTS

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 SOUTH AFRICA
 Attention: Jaco van Tonder

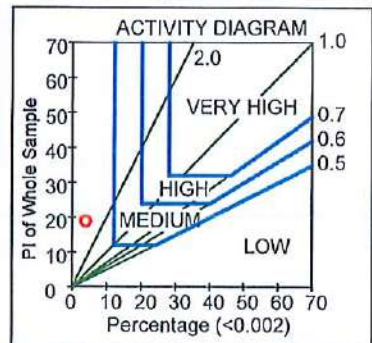
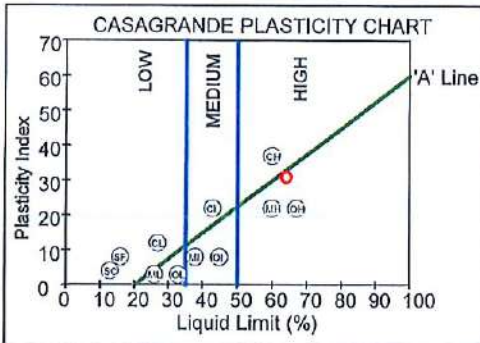
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

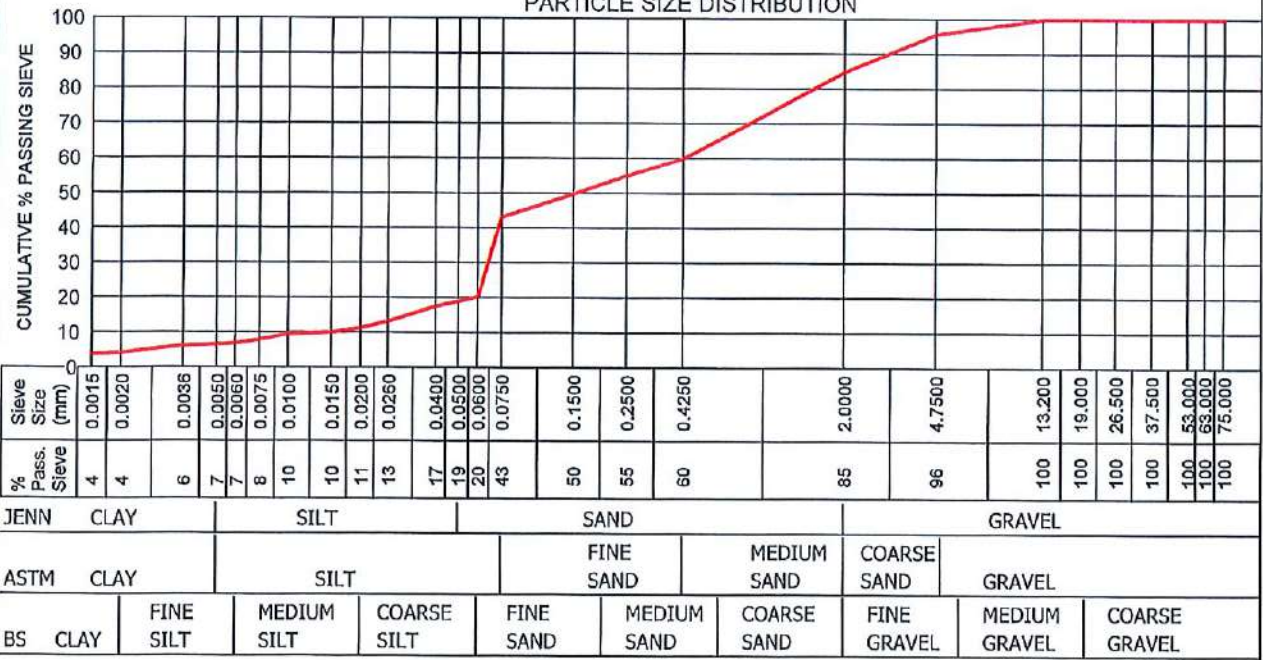
Sample No. : 8/3864
 Hole No. : TP2-10/3
 Depth : 1500-2300
 Liquid Limit (%) : 64
 Plasticity Index : 31
 Linear Shrinkage (%) : 13.5
 PI of Whole Sample : 19
 P.R.A. Classification : A-7-5(8)
 Unified Soil Classificati: SM
 Activity : 4.75
 Heave Classification : LOW
 Grading Modulus : 1.12
 Percentage (<0.002) : 4.0
 Moisture Content (%) : 21.4

Material Description : SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	6.6	12.4	65.9	15.1	SILTY SAND
Astm	6.6	36.5	52.6	4.3	SILTY SAND
British Standard	4.2	16.2	64.5	15.1	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client
 G18-0683

FORM: A6

4.4.0(SGS)(2016.08.31)

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TEST RESULTS

KNIGHT PIESOLD
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 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

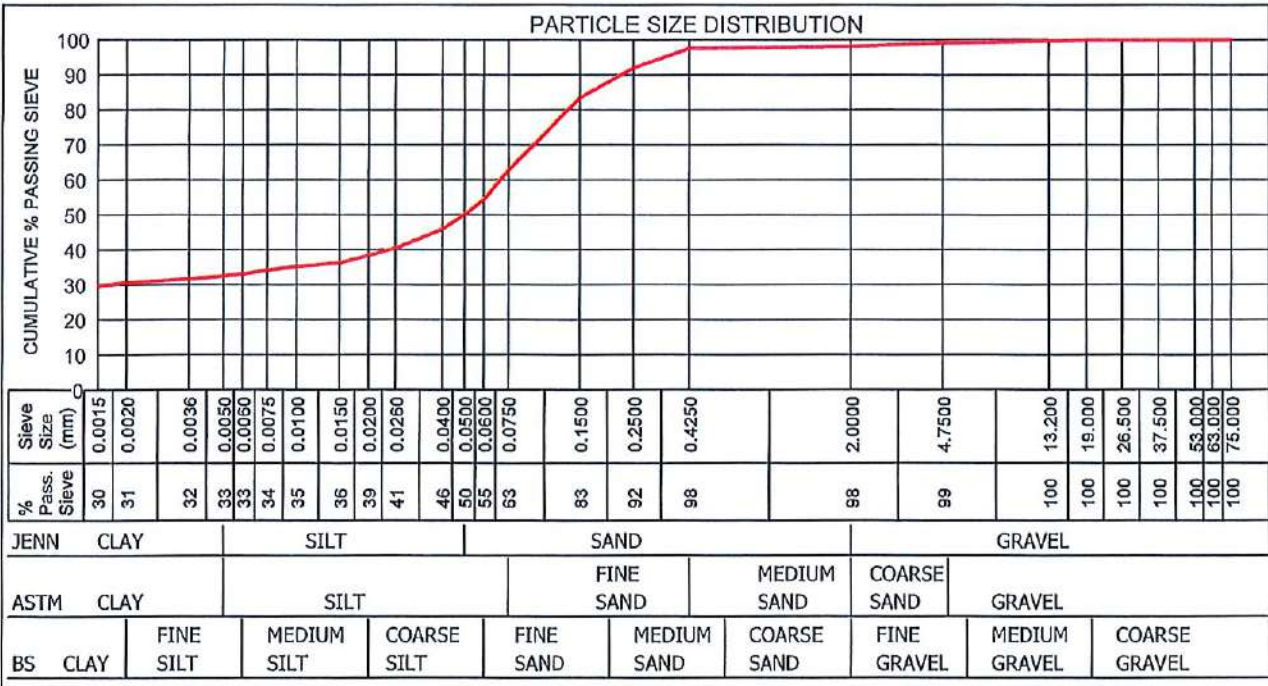
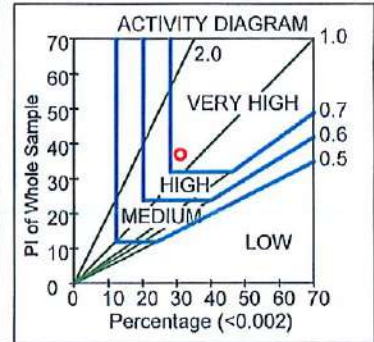
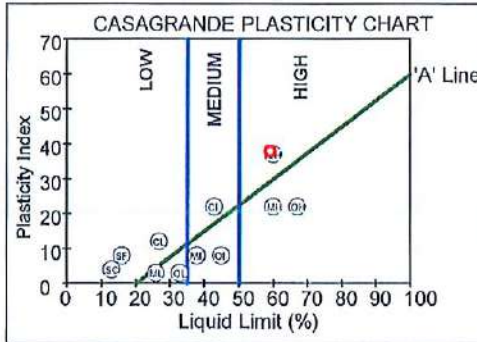
Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3865
 Hole No. : TP2-12/1
 Depth : 0-500
 Liquid Limit (%) : 59
 Plasticity Index : 38
 Linear Shrinkage (%) : 17.0
 PI of Whole Sample : 37
 P.R.A. Classification : A-7-6(16)
 Unified Soil Classification: CH
 Activity : 1.19
 Heave Classification : VERY HIGH
 Grading Modulus : 0.41
 Percentage (<0.002) : 31.0
 Moisture Content (%) : 32.0

Material Description : SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	32.5	17.7	48.0	1.8	SANDY CLAY
Astm	32.5	30.2	36.5	0.8	SANDY CLAY
British Standard	30.6	23.9	43.7	1.8	SANDY CLAY



Remarks : Sampled by client
 G18-0684

FORM: A6

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 PO Box 912387, Silverton, 0127
 Tel. : (012) 8001299
 Fax : (012) 800 3043
 Email : anneljie.verwey@sgs.com

TEST RESULTS

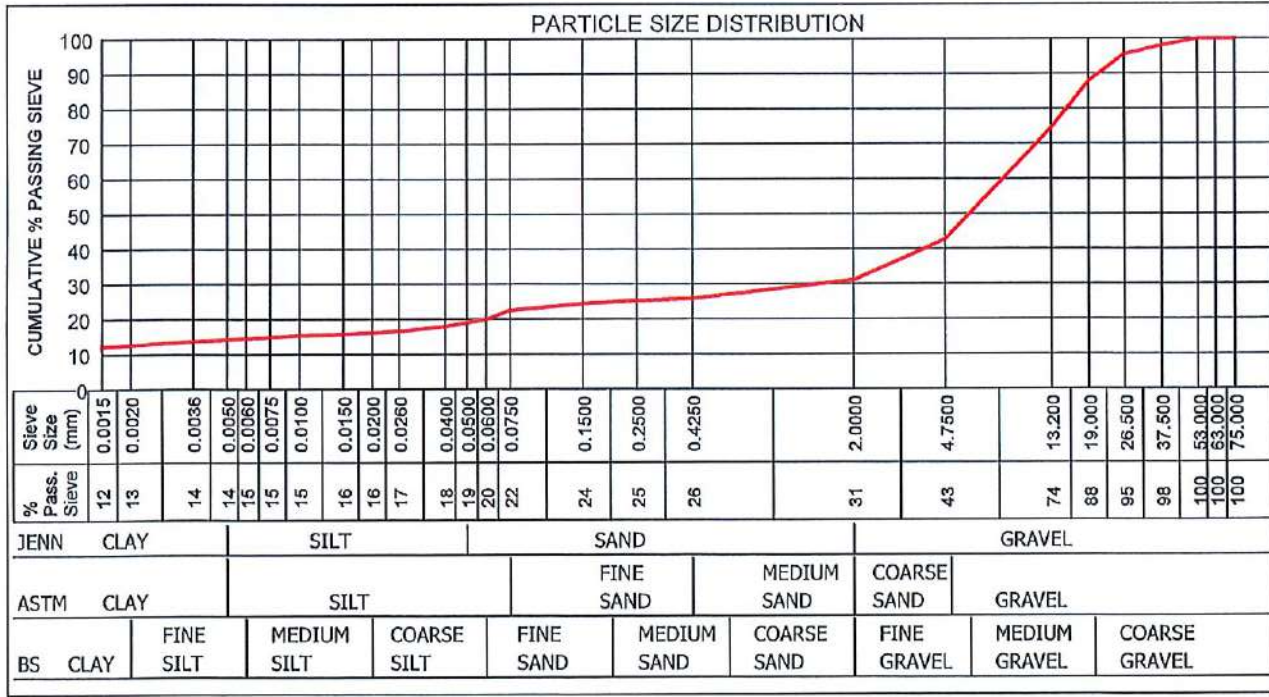
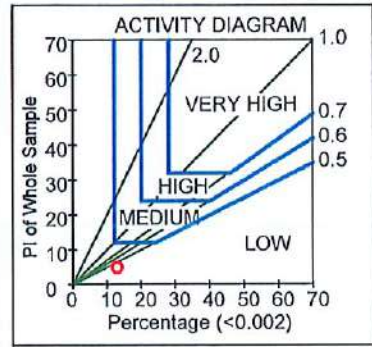
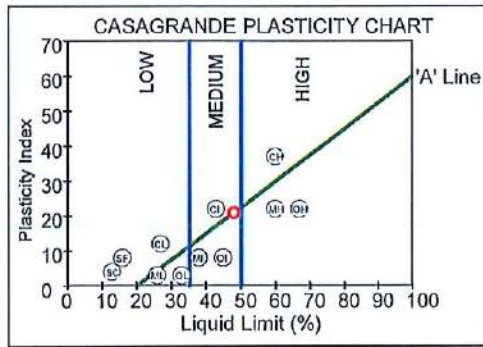
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3866
 Hole No. : TP2-16/1
 Depth : 700-1600
 Liquid Limit (%) : 48
 Plasticity Index : 21
 Linear Shrinkage (%) : 10.0
 PI of Whole Sample : 5
 P.R.A. Classification : A-2-7(1)
 Unified Soil Classificati: GC
 Activity : 0.38
 Heave Classification : LOW
 Grading Modulus : 2.21
 Percentage (<0.002) : 13.0
 Moisture Content (%) : 6.4

Material Description : SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	14.3	4.8	12.1	68.8	SANDY CLAY
Astm	14.3	8.2	20.3	57.2	SANDY CLAY
British Standard	12.7	7.3	11.1	68.8	SANDY CLAY



Remarks : Sampled by client
 G18-0685

FORM: A6

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 Fax : (012) 800 3043
 Email : anneljie.verwey@sgs.com

TEST RESULTS

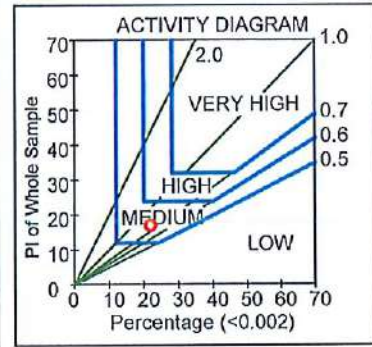
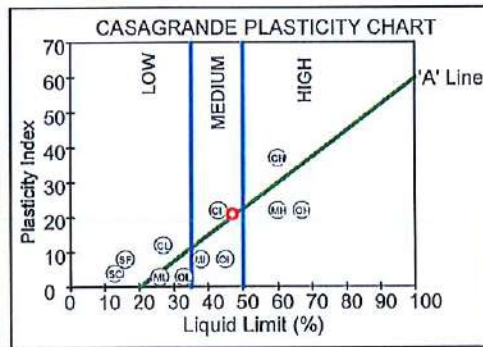
KNIGHT PIESOLD
 PO BOX 72292
 0040 LYNNWOD RIDGE
 SOUTH AFRICA
 Attention: Jaco van Tonder

Project : KAREERAND TSF PHASE 2
 Your Ref : KHHRO18/522
 Our Ref : PL/23763
 Date Reported : 15.10.2018

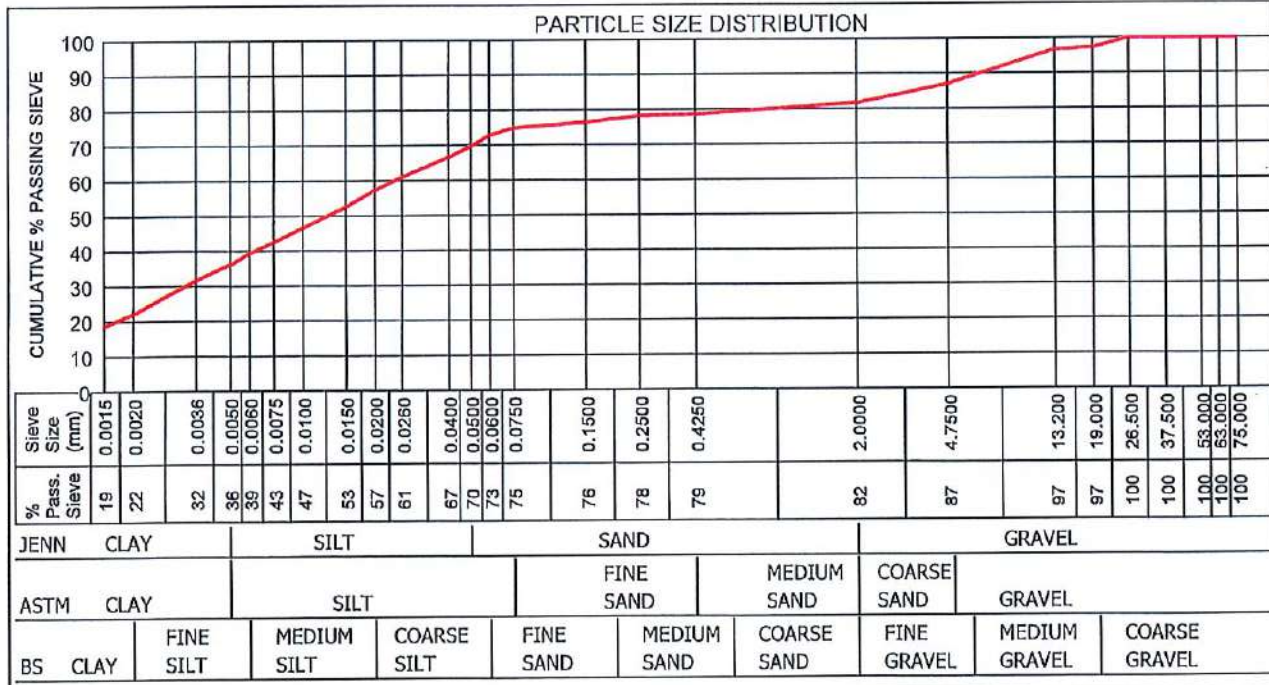
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : 8/3867
 Hole No. : TP2-16/2
 Depth : 1600-3100
 Liquid Limit (%) : 47
 Plasticity Index : 21
 Linear Shrinkage (%) : 9.5
 PI of Whole Sample : 17
 P.R.A. Classification : A-7-6(14)
 Unified Soil Classificati: CL
 Activity : 0.77
 Heave Classification : MEDIUM
 Grading Modulus : 0.64
 Percentage (<0.002) : 22.0
 Moisture Content (%) : 12.8

Material Description : SILTY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	36.3	33.5	12.0	18.3	SILTY CLAY
Astm	36.3	38.6	12.1	13.0	SILTY CLAY
British Standard	22.3	50.7	8.8	18.3	CLAYEY SILT



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client
 G18-0686

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 a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street, Jan Nieand Park, Pretoria.
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 Tel. : (012) 800 1299
 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

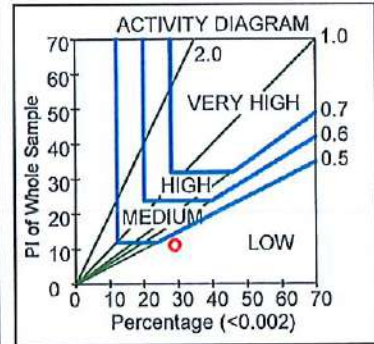
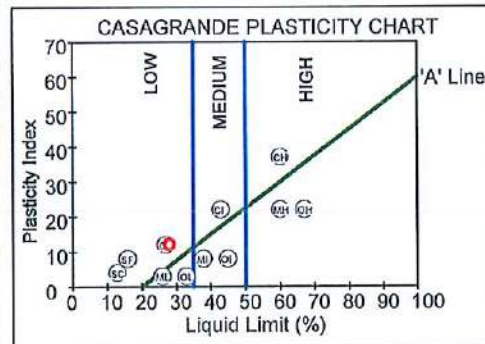
Project : Karee Rand Diversion (301-00204/13)

Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

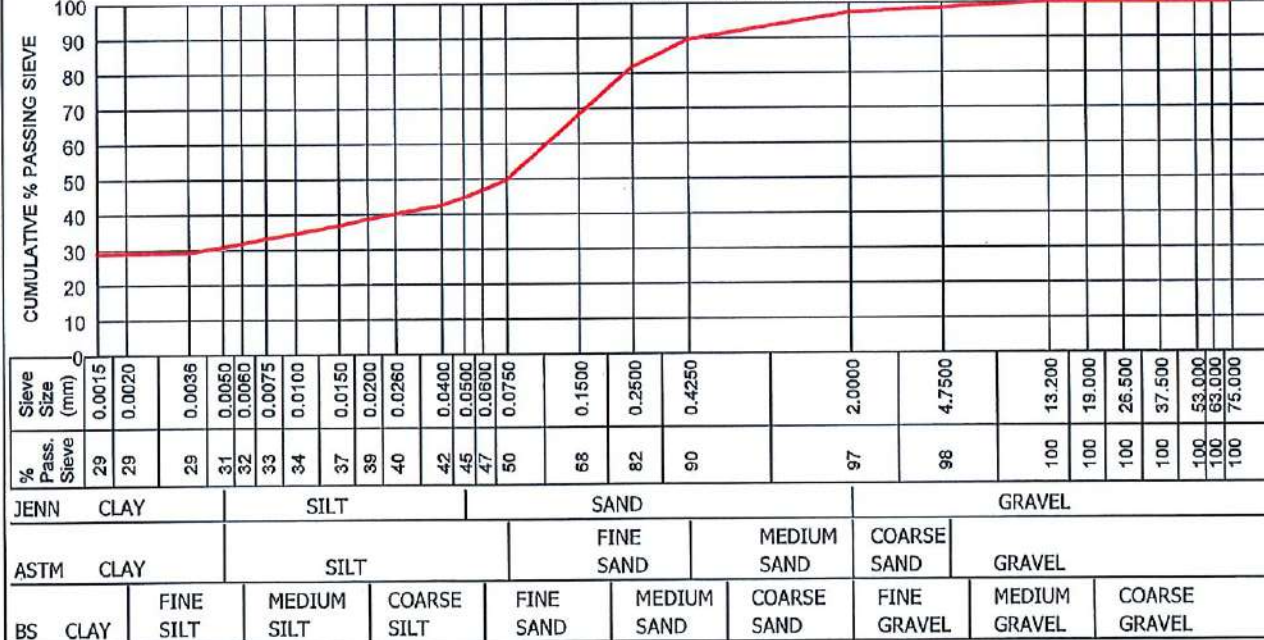
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0013(048)
 Hole No. : TP1/1
 Depth : 300-1300
 Liquid Limit (%) : 28
 Plasticity Index : 12
 Linear Shrinkage (%) : 5.0
 Pl of Whole Sample : 11
 P.R.A. Classification : A-6(4)
 Unified Soil Classificati: SC
 Activity : 0.38
 Heave Classification : LOW
 Grading Modulus : 0.63
 Percentage (<0.002) : 29.0
 Moisture Content (%) : 8.2

Material Description : Colluvium SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.6	14.0	52.6	2.8	SANDY CLAY
Astm	30.6	18.9	48.9	1.6	SANDY CLAY
British Standard	28.8	17.9	50.4	2.8	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

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LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

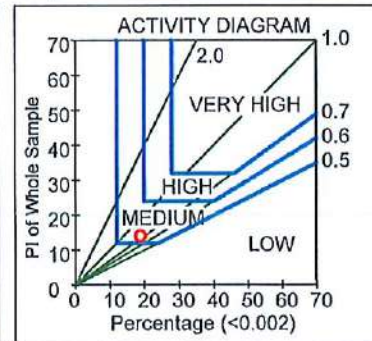
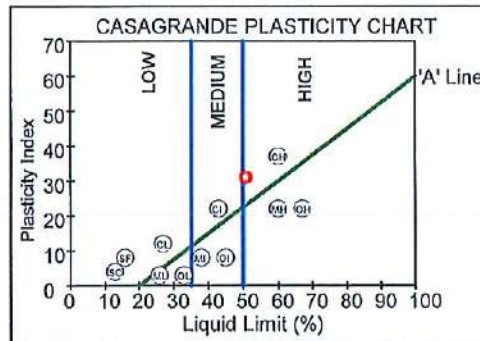
Your Ref : 556/18
Our Ref : PLJ24422
Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

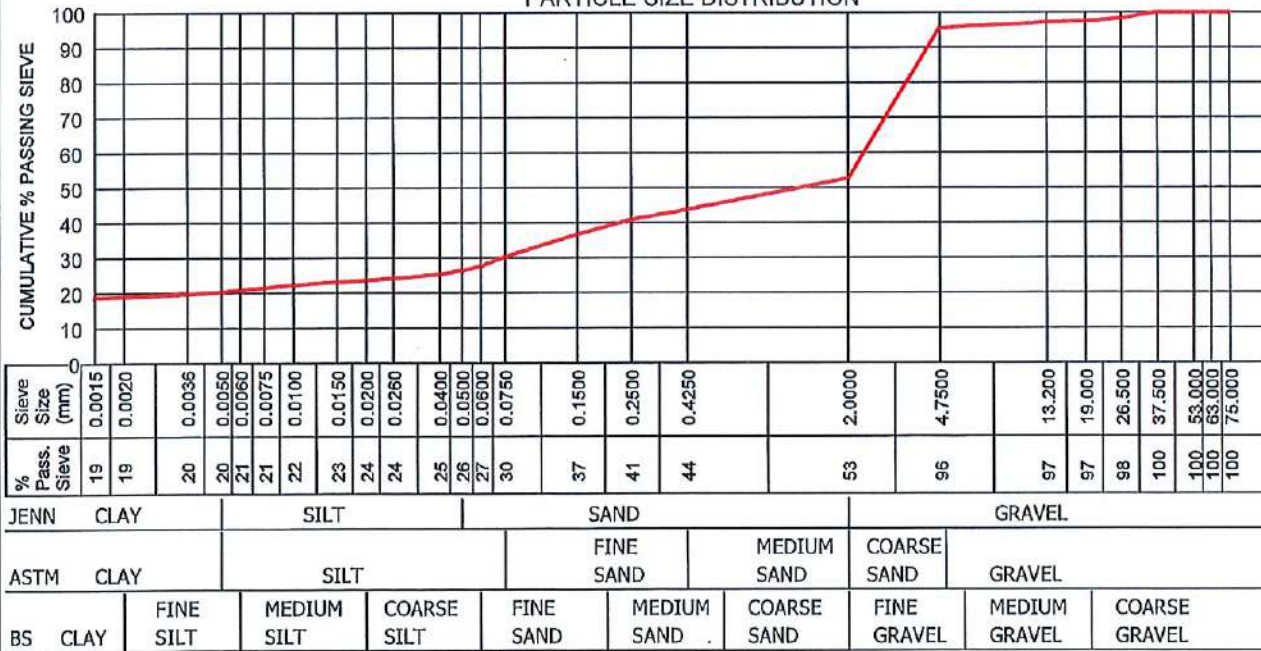
Sample No. : G19-0014(049)
Hole No. : TP1/2
Depth : 1300-3100
Liquid Limit (%) : 51
Plasticity Index : 31
Linear Shrinkage (%) : 13.5
PI of Whole Sample : 14
P.R.A. Classification : A-2-7(3)
Unified Soil Classification: SC
Activity : 0.74
Heave Classification : MEDIUM
Grading Modulus : 1.73
Percentage (<0.002) : 19.0
Moisture Content (%) : 16.4

Material Description : Ferruginised Colluvium CLAYEY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	20.3	6.0	26.2	47.4	SANDY CLAY
Astm	20.3	9.9	65.4	4.4	CLAYEY SAND
British Standard	19.0	8.5	25.1	47.4	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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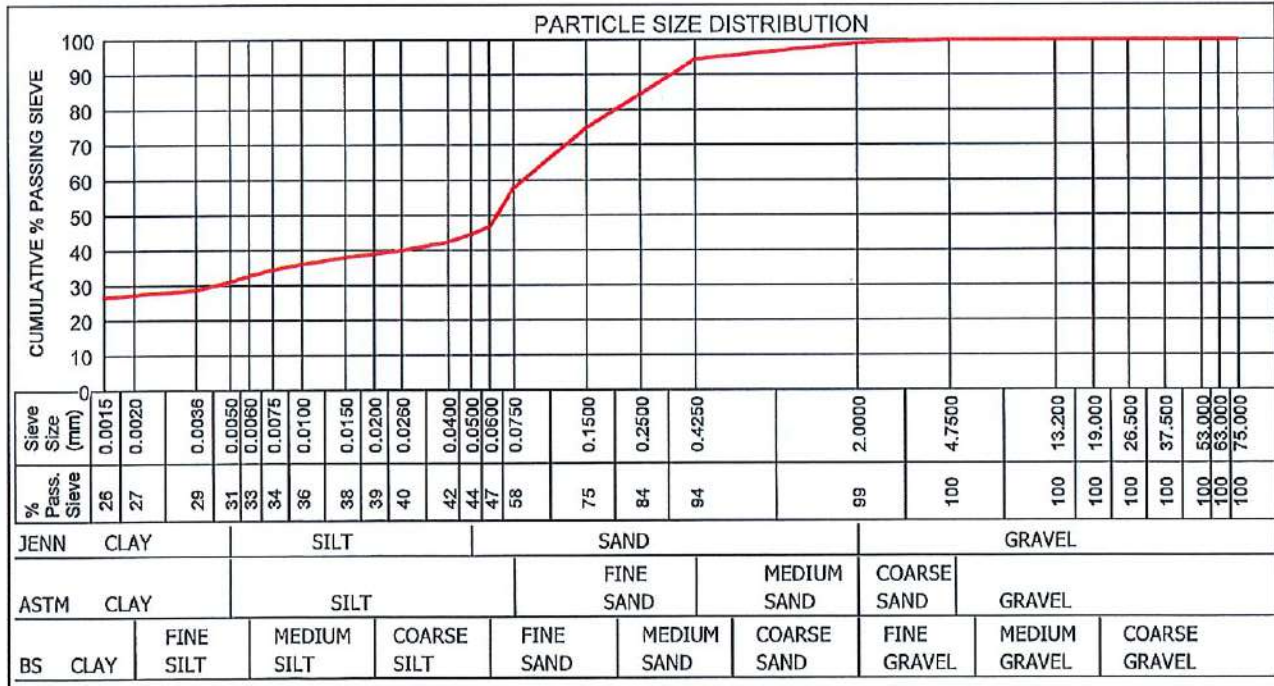
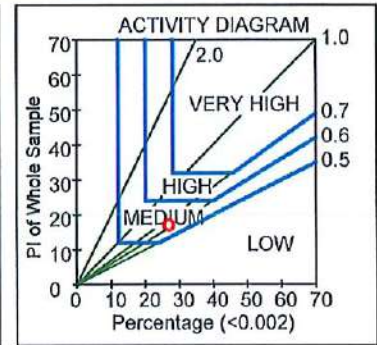
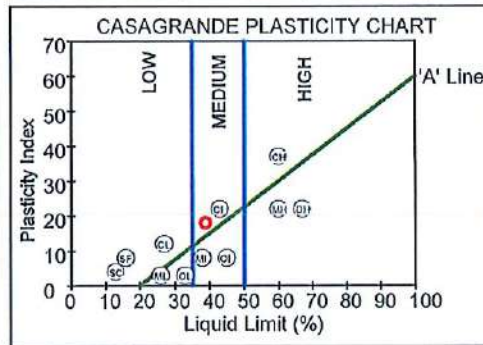
KNIGHT PIESOLD CONSULTING
P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)
Your Ref : 556/18
Our Ref : PL/24422
Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0015(050)
Hole No. : TP2/1
Depth : 0-2500
Liquid Limit (%) : 39
Plasticity Index : 18
Linear Shrinkage (%) : 8.5
PI of Whole Sample : 17
P.R.A. Classification : A-6(8)
Unified Soil Classificati: CL
Activity : 0.63
Heave Classification : MEDIUM
Grading Modulus : 0.49
Percentage (<0.002) : 27.0
Moisture Content (%) : 13.3

Material Description : Alluvium SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.9	13.6	54.5	1.0	SANDY CLAY
Astm	30.9	26.6	42.5	0.0	SANDY CLAY
British Standard	27.3	19.5	52.2	1.0	CLAYEY SAND



Remarks : Sampled by client.

FORM: A6

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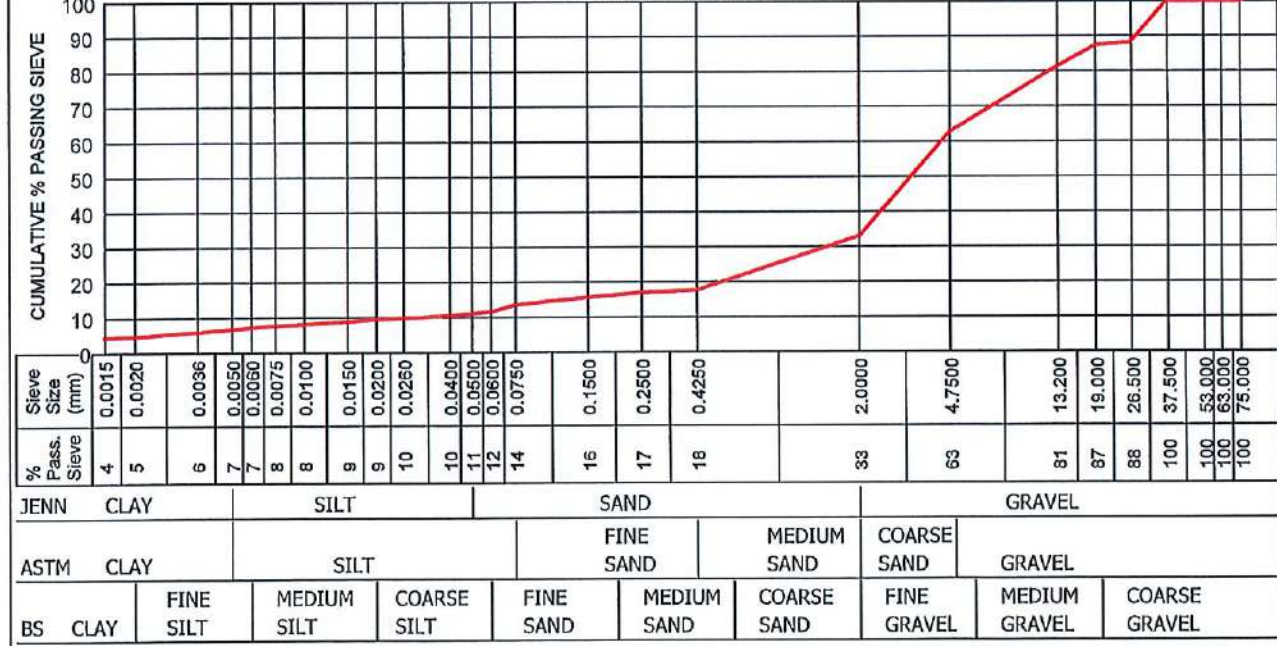
TEST RESULTS

KNIGHT PIESOLD CONSULTING P.O BOX 72292 LYNNWOOD RIDGE 0040 Attention: Mr Keneth Matokoka	Project : Karee Rand Diversion (301-00204/13) Your Ref : 556/18 Our Ref : PL/24422 Date Reported : 04.02.2019
---	--

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0016(051) Hole No. : TP3/1 Depth : 1400-3100 Liquid Limit (%) : 60 Plasticity Index : 27 Linear Shrinkage (%) : 10.0 Pl of Whole Sample : 5 P.R.A. Classification : A-2-7(0) Unified Soil Classificati: SM Activity : 1.00 Heave Classification : LOW Grading Modulus : 2.35 Percentage (<0.002) : 5.0 Moisture Content (%) : 23.3	Material Description : Alluvium SILTY SAND <table border="1"> <thead> <tr> <th></th> <th>Clay (%)</th> <th>Silt (%)</th> <th>Sand (%)</th> <th>Gravel (%)</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Jennings</td> <td>6.7</td> <td>4.3</td> <td>22.1</td> <td>66.9</td> <td>CLAYEY SAND</td> </tr> <tr> <td>Astm</td> <td>6.7</td> <td>6.8</td> <td>49.1</td> <td>37.4</td> <td>SILTY SAND</td> </tr> <tr> <td>British Standard</td> <td>4.7</td> <td>7.0</td> <td>21.5</td> <td>66.9</td> <td>SILTY SAND</td> </tr> </tbody> </table>		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification	Jennings	6.7	4.3	22.1	66.9	CLAYEY SAND	Astm	6.7	6.8	49.1	37.4	SILTY SAND	British Standard	4.7	7.0	21.5	66.9	SILTY SAND
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification																				
Jennings	6.7	4.3	22.1	66.9	CLAYEY SAND																				
Astm	6.7	6.8	49.1	37.4	SILTY SAND																				
British Standard	4.7	7.0	21.5	66.9	SILTY SAND																				

PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

FORM: A6

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TEST RESULTS

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LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

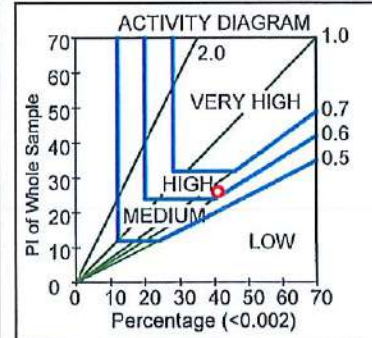
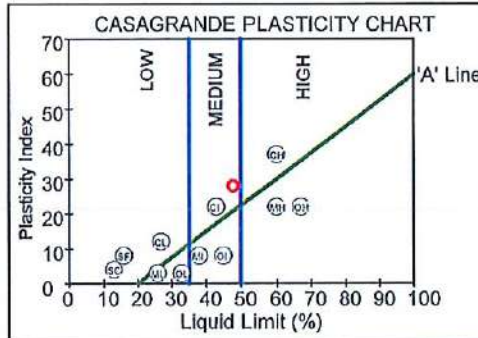
Your Ref : 556/18
Our Ref : PL/24422
Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

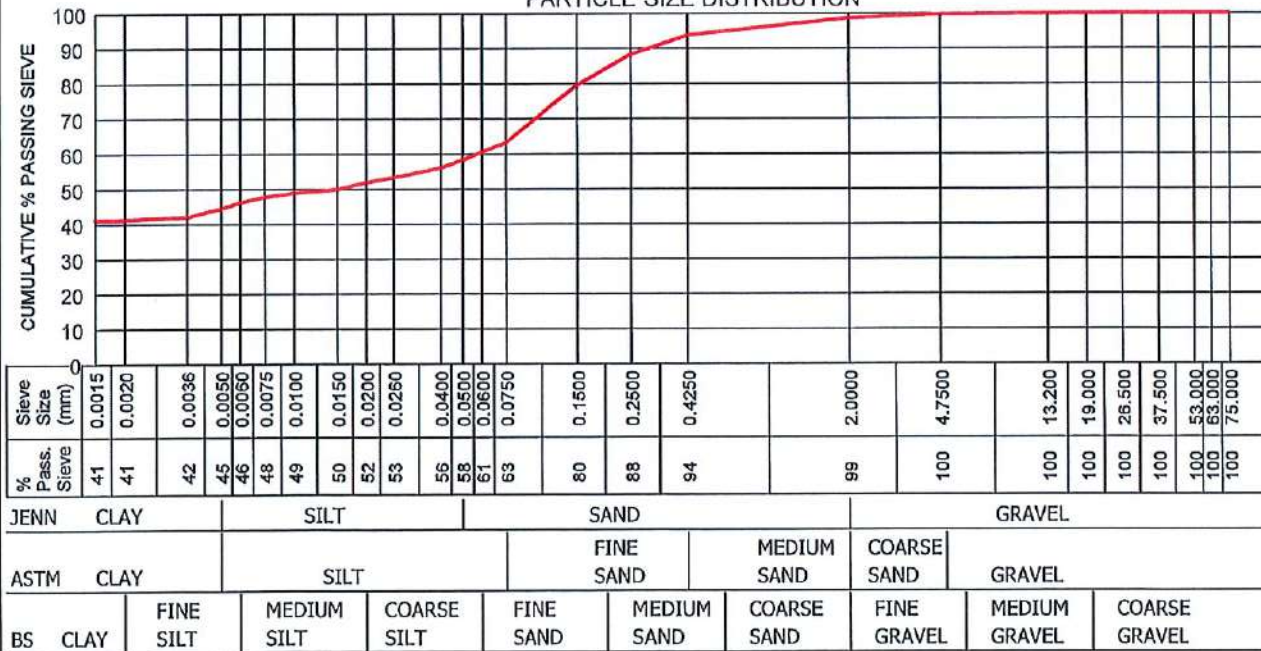
Sample No. : G19-0017(052)
Hole No. : TP4/1
Depth : 0-1700
Liquid Limit (%) : 48
Plasticity Index : 28
Linear Shrinkage (%) : 10.5
PI of Whole Sample : 26
P.R.A. Classification : A-7-6(14)
Unified Soil Classificati: CL
Activity : 0.63
Heave Classification : HIGH
Grading Modulus : 0.44
Percentage (<0.002) : 41.0
Moisture Content (%) : 12.1

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	44.5	13.8	40.3	1.4	SANDY CLAY
Astm	44.5	18.6	36.5	0.3	SANDY CLAY
British Standard	41.4	19.3	38.0	1.4	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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TEST RESULTS

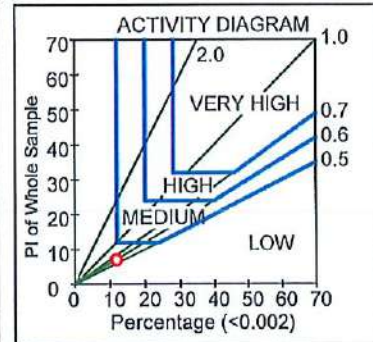
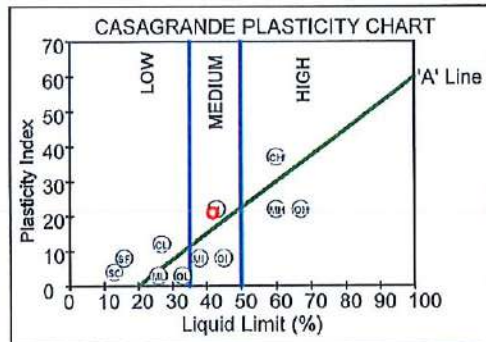
KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)
 Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

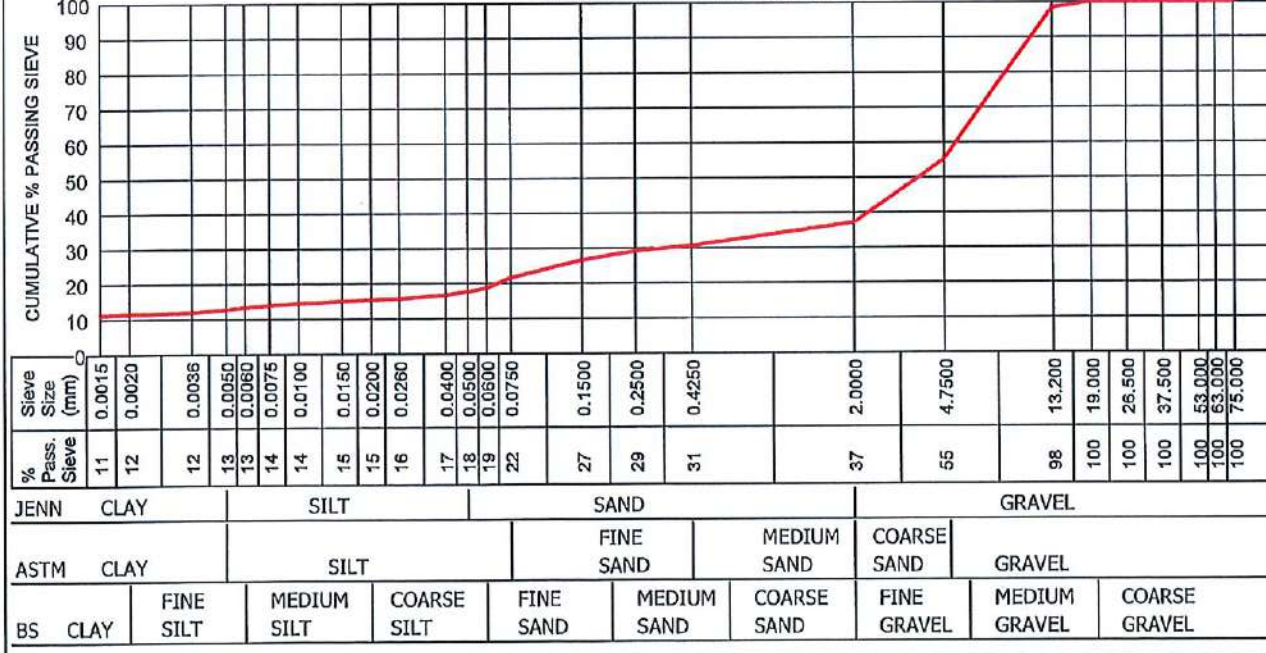
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0018(053)
 Hole No. : TP6/1
 Depth : 400-1700
 Liquid Limit (%) : 42
 Plasticity Index : 21
 Linear Shrinkage (%) : 9.5
 PI of Whole Sample : 7
 P.R.A. Classification : A-2-7(1)
 Unified Soil Classificati: SC
 Activity : 0.58
 Heave Classification : LOW
 Grading Modulus : 2.10
 Percentage (<0.002) : 12.0
 Moisture Content (%) : 10.7

Material Description : Nodular Ferricrete CLAYEY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	12.8	4.9	19.5	62.9	SANDY CLAY
Aslm	12.8	8.7	33.5	45.0	CLAYEY SAND
British Standard	11.5	7.2	18.4	62.9	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31) Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

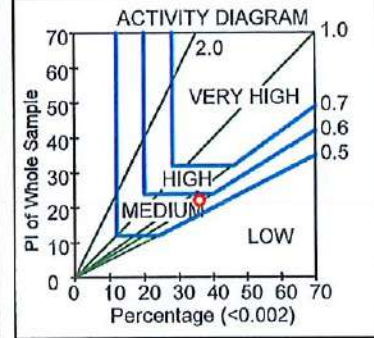
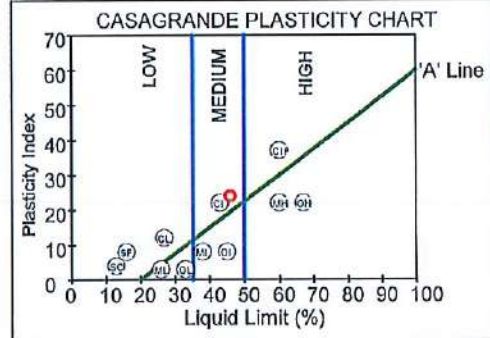
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0019(054)
 Hole No. : TP8/1
 Depth : 1000-1800
 Liquid Limit (%) : 46
 Plasticity Index : 24
 Linear Shrinkage (%) : 11.5
 Pl of Whole Sample : 22
 P.R.A. Classification : A-7-6(14)
 Unified Soil Classificati: CL
 Activity : 0.61
 Heave Classification : MEDIUM
 Grading Modulus : 0.37
 Percentage (<0.002) : 36.0
 Moisture Content (%) : 19.2

Material Description : Residual Andesite SILTY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	43.2	21.7	33.2	1.9	SANDY CLAY
Astm	43.2	28.6	28.0	0.3	SILTY CLAY
British Standard	36.4	31.9	29.9	1.9	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Sieve Size (mm)	% Pass. Sieve	JENN	CLAY	SILT	SAND	GRAVEL
0.0015	36					
0.0020	36					
0.0036	40					
0.0050	43					
0.0060	46					
0.0075	48					
0.0100	51					
0.0150	53					
0.0200	55					
0.0260	57					
0.0400	62					
0.0500	65					
0.0600	68					
0.0750	72					
0.1500	84					
0.2500	89					
0.4250	93					
2.0000	98					
4.7500	100					
13.200	100					
19.000	100					
26.500	100					
37.500	100					
53.000	100					
63.000	100					
75.000	100					

Remarks : Sampled by client.

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TEST RESULTS

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P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

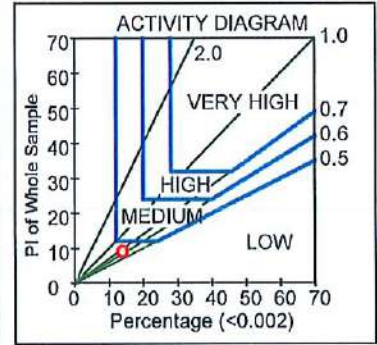
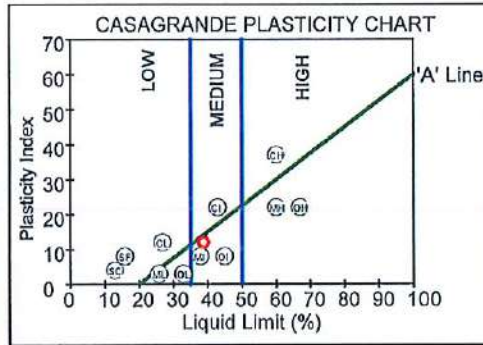
Your Ref : 556/18
Our Ref : PL/24422
Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

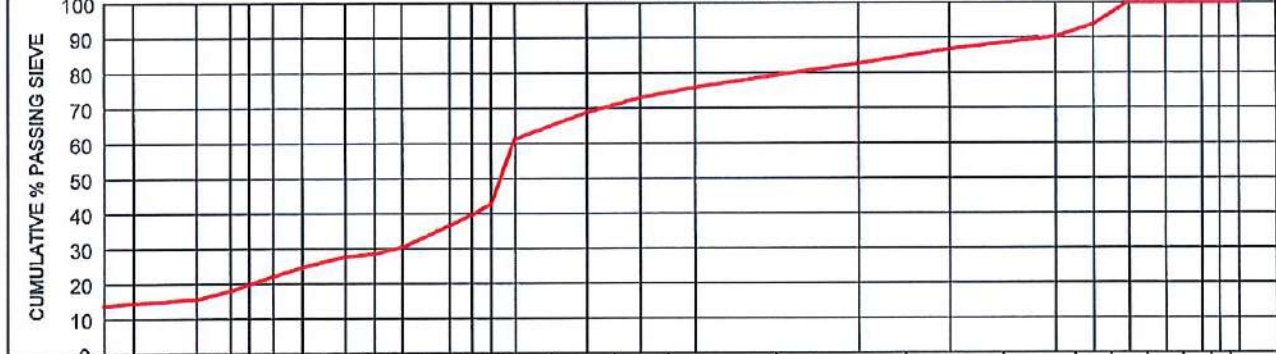
Sample No. : G19-0020(055)
Hole No. : TP8/2
Depth : 1800-3000
Liquid Limit (%) : 39
Plasticity Index : 12
Linear Shrinkage (%) : 5.5
PI of Whole Sample : 9
P.R.A. Classification : A-6(6)
Unified Soil Classificati: ML
Activity : 0.64
Heave Classification : LOW
Grading Modulus : 0.80
Percentage (<0.002) : 14.0
Moisture Content (%) : 19.1

Material Description : Residual Andesite CLAYEY SILT

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	18.0	21.6	43.1	17.3	CLAYEY SAND
Astm	18.0	43.1	25.6	13.3	CLAYEY SILT
British Standard	14.4	28.3	39.9	17.3	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0250	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	14	14	15	18	20	22	25	28	28	30	36	40	43	61	69	73	76	83	87	90	94	100	100	100	100	100
JENN	CLAY		SILT					SAND										GRAVEL								
ASTM	CLAY		SILT					FINE SAND					MEDIUM SAND			COARSE SAND		GRAVEL								
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL																

Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

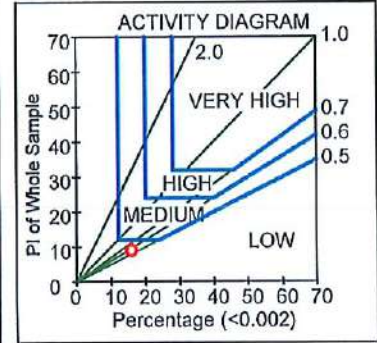
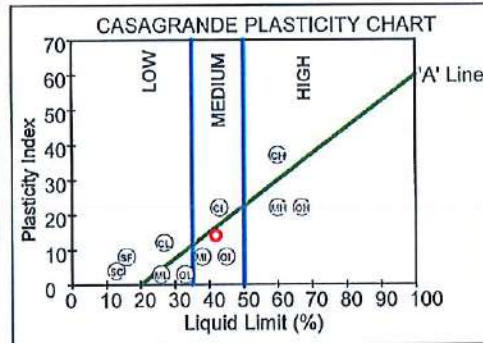
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

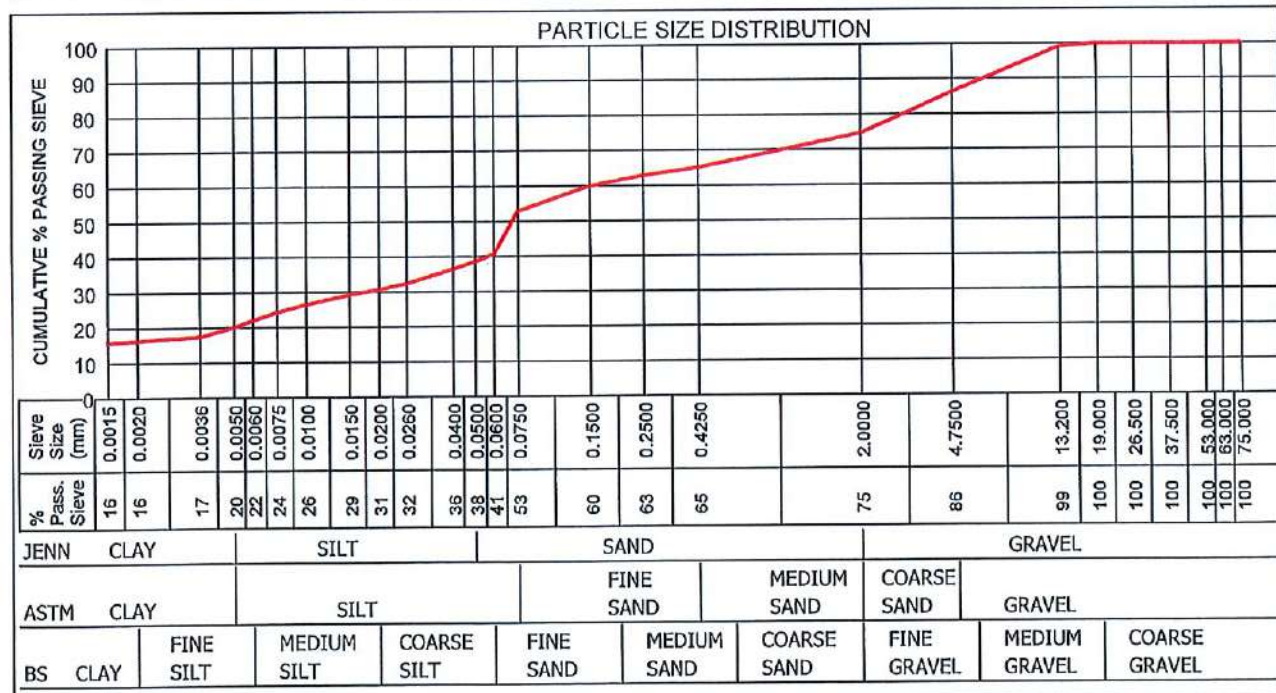
Sample No. : G19-0021(056)
 Hole No. : TP9/1
 Depth : 600-1900
 Liquid Limit (%) : 42
 Plasticity Index : 14
 Linear Shrinkage (%) : 5.5
 PI of Whole Sample : 9
 P.R.A. Classification : A-7-6(5)
 Unified Soil Classification: ML
 Activity : 0.56
 Heave Classification : LOW
 Grading Modulus : 1.07
 Percentage (<0.002) : 16.0
 Moisture Content (%) : 33.5

Material Description : Residual Andesite CLAYEY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	20.0	18.4	36.2	25.4	CLAYEY SAND
Astm	20.0	32.6	33.6	13.8	CLAYEY SAND
British Standard	16.2	24.4	34.0	25.4	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B. Van Niekerk / A. Verwey / S. Dewnath

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

256 Brander Street, Jan Niemand Park, Pretoria.
 P.O Box 912387, Silverton, 0127
 Tel. : (012) 800 1299
 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

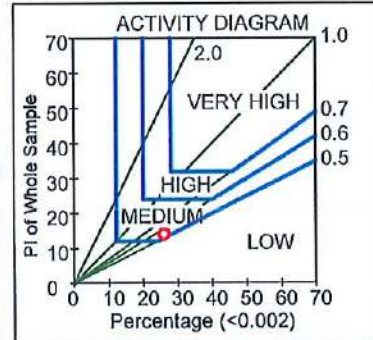
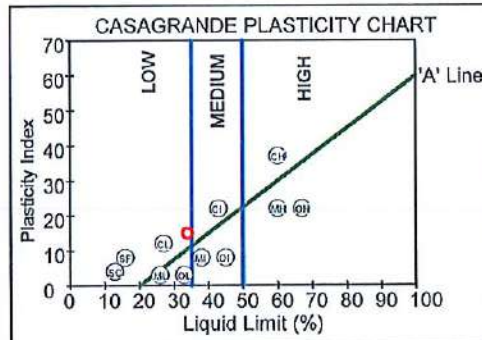
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

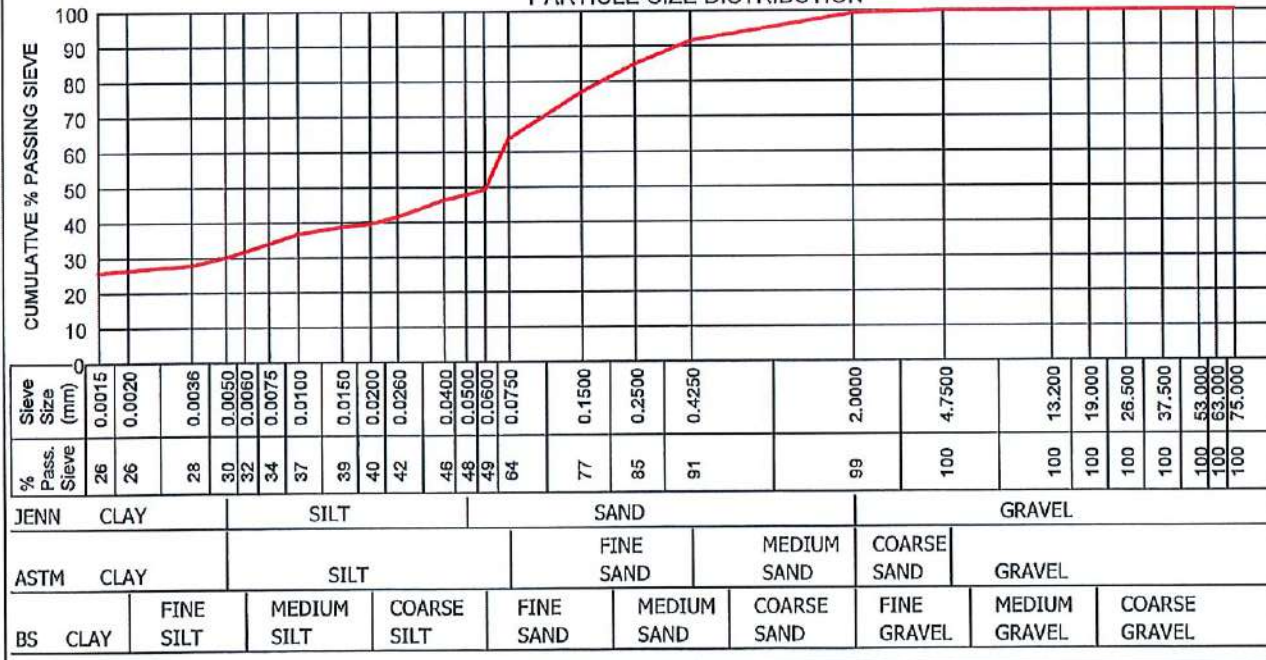
Sample No. : G19-0023(058)
 Hole No. : TP14/1
 Depth : 100-1500
 Liquid Limit (%) : 34
 Plasticity Index : 15
 Linear Shrinkage (%) : 7.0
 Pl of Whole Sample : 14
 P.R.A. Classification : A-6(8)
 Unified Soil Classificatt: CL
 Activity : 0.54
 Heave Classification : MEDIUM
 Grading Modulus : 0.46
 Percentage (<0.002) : 26.0
 Moisture Content (%) : 13.6

Material Description : Colluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.0	17.7	51.5	0.8	SANDY CLAY
Astm	30.0	33.5	36.5	0.0	SANDY CLAY
British Standard	26.4	22.7	50.0	0.8	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

FORM: A6

Technical Signatory : B. Van Niekerk / A. Verwey / S. Dewnath

4.4.0(SGS)(2016.08.31)

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 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

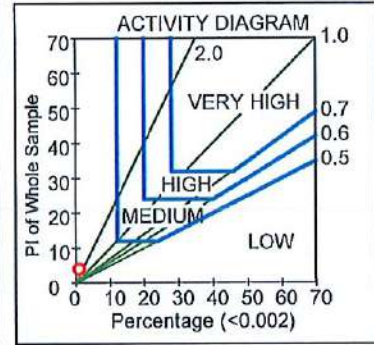
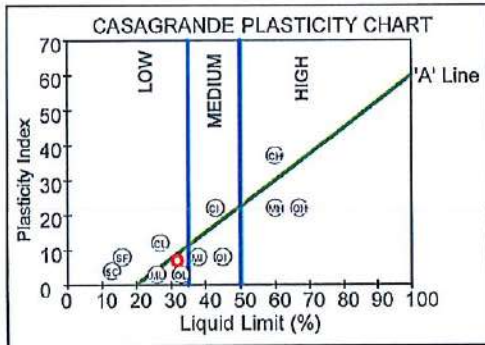
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

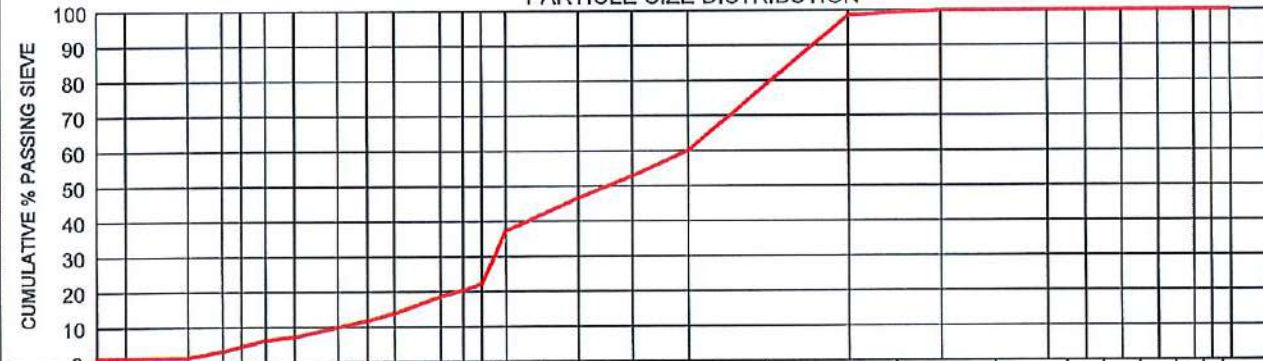
Sample No. : G19-0024(059)
 Hole No. : TP14/2
 Depth : 1500-3100
 Liquid Limit (%) : 32
 Plasticity Index : 7
 Linear Shrinkage (%) : 2.5
 PI of Whole Sample : 4
 P.R.A. Classification : A-4(0)
 Unified Soil Classificati: SM
 Activity : 4.00
 Heave Classification : LOW
 Grading Modulus : 1.04
 Percentage (<0.002) : 1.0
 Moisture Content (%) : 17.0

Material Description : Residual Dolerite SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	3.0	17.3	78.2	1.5	SILTY SAND
Astm	3.0	34.1	62.8	0.2	SILTY SAND
British Standard	1.2	20.9	76.4	1.5	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	1	1	1	3	4	6	7	10	12	14	18	20	22	37	47	53	60	99	100	100	100	100	100	100	100	100
JENN	CLAY		SILT				SAND										GRAVEL									
ASTM	CLAY		SILT				FINE SAND					MEDIUM SAND			COARSE SAND		GRAVEL									
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT		FINE SAND	MEDIUM SAND	COARSE SAND			FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL													

Remarks : Sampled by client.

FORM: A6

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

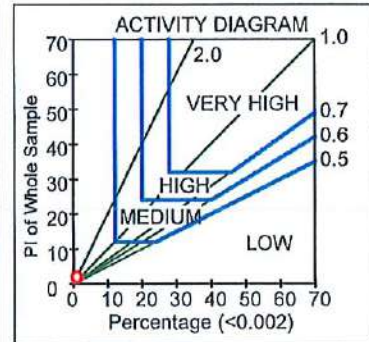
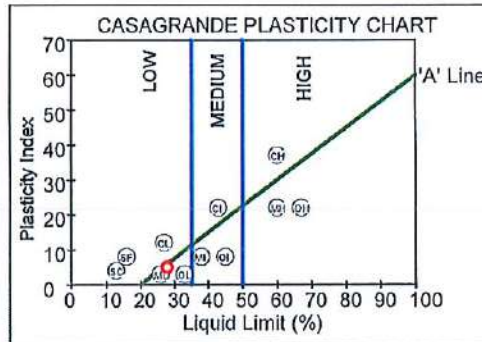
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

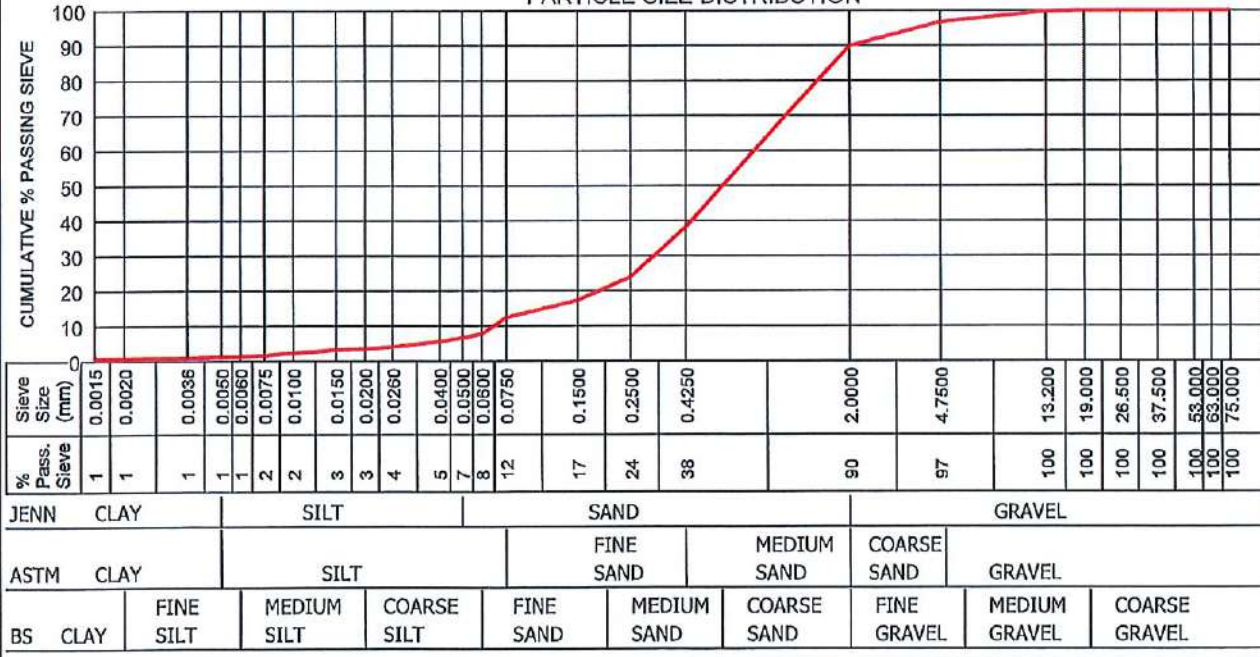
Sample No. : G19-0025(060)
 Hole No. : TP16/1
 Depth : 1000-2700
 Liquid Limit (%) : 28
 Plasticity Index : 5
 Linear Shrinkage (%) : 2.0
 PI of Whole Sample : 2
 P.R.A. Classification : A-1-b(0)
 Unified Soil Classification: SW-SM
 Activity : 2.00
 Heave Classification : LOW
 Grading Modulus : 1.60
 Percentage (<0.002) : 1.0
 Moisture Content (%) : 9.1

Material Description : Residual Dolerite SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	1.0	5.5	83.4	10.1	SAND
Astm	1.0	11.3	84.3	3.3	SAND
British Standard	0.8	6.9	82.3	10.1	SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S. Dewnath

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Client Knight Piesold
Sample no TP2-06/1
Lab no G18-0676

Project Kareerand TSF Phase 2
Depth (m) 0,0-1,3

Job no 2012 (301-00204/13)
Date 06-11-2018

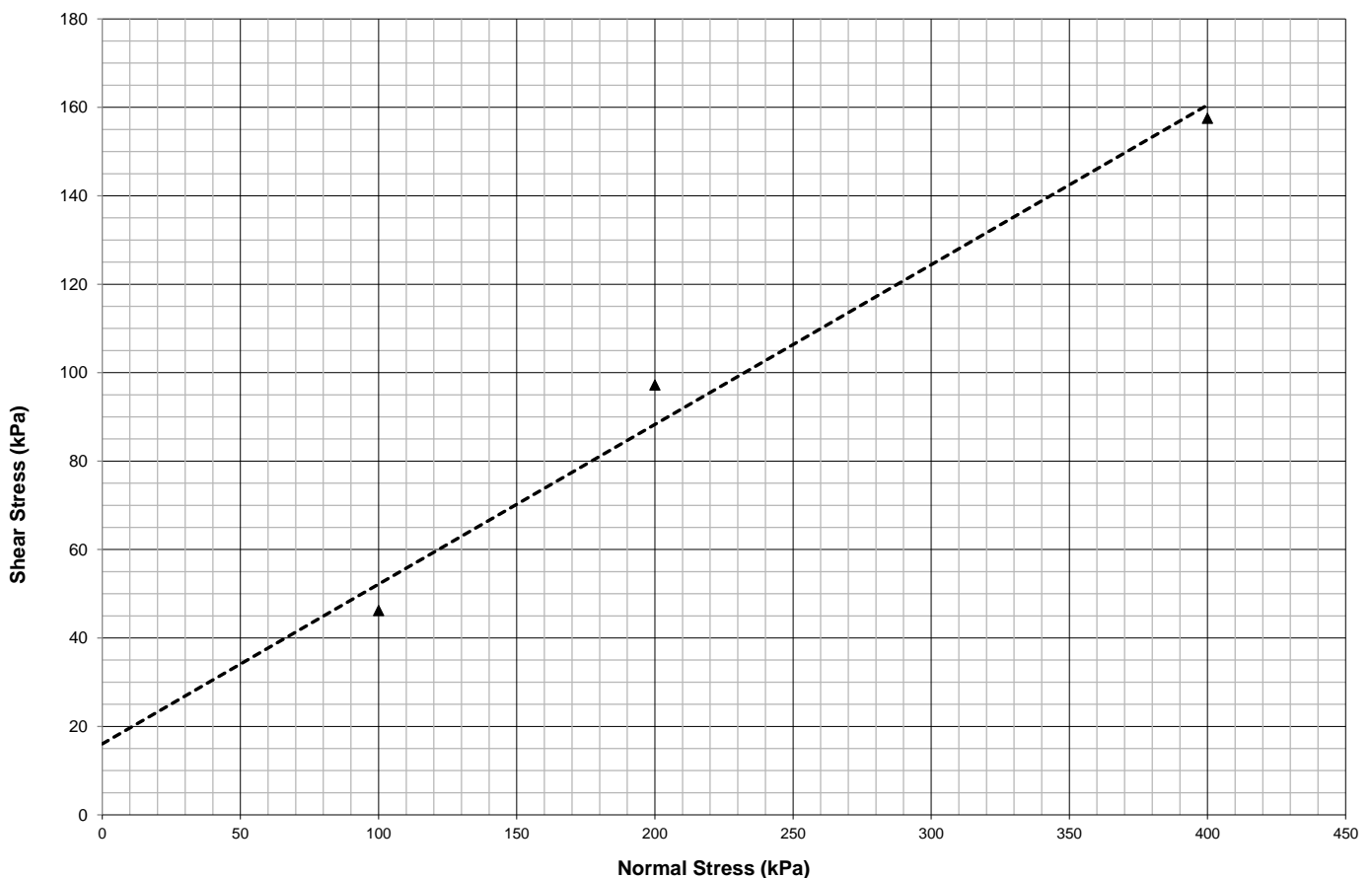
Test Information

Test Type	-	Slow Drained, at OMC
Sample Condition	-	Remoulded by hand to estimated OMC
Normal Stresses	kPa	100, 200, 400
Rate of Strain	mm/min	0.0120

Initial Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	18.1	17.9	18.0	Complete test specimen
Dry Density	Kg/m ³	1500	1502	1500	
Void Ratio	-	0.749	0.746	0.748	
Degree of Saturation	%	63.3	62.8	63.2	
Relative Density (SG)	-		2.622		Determined

Final Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	28.5	25.0	24.5	
Normal Stress	kPa	100	200	400	
Shear Stress	kPa	59	117	188	
Residual Stress	kPa	46	97	158	
Angle of Internal Friction	Deg.		20		Residual
Cohesion	kPa		16		Residual

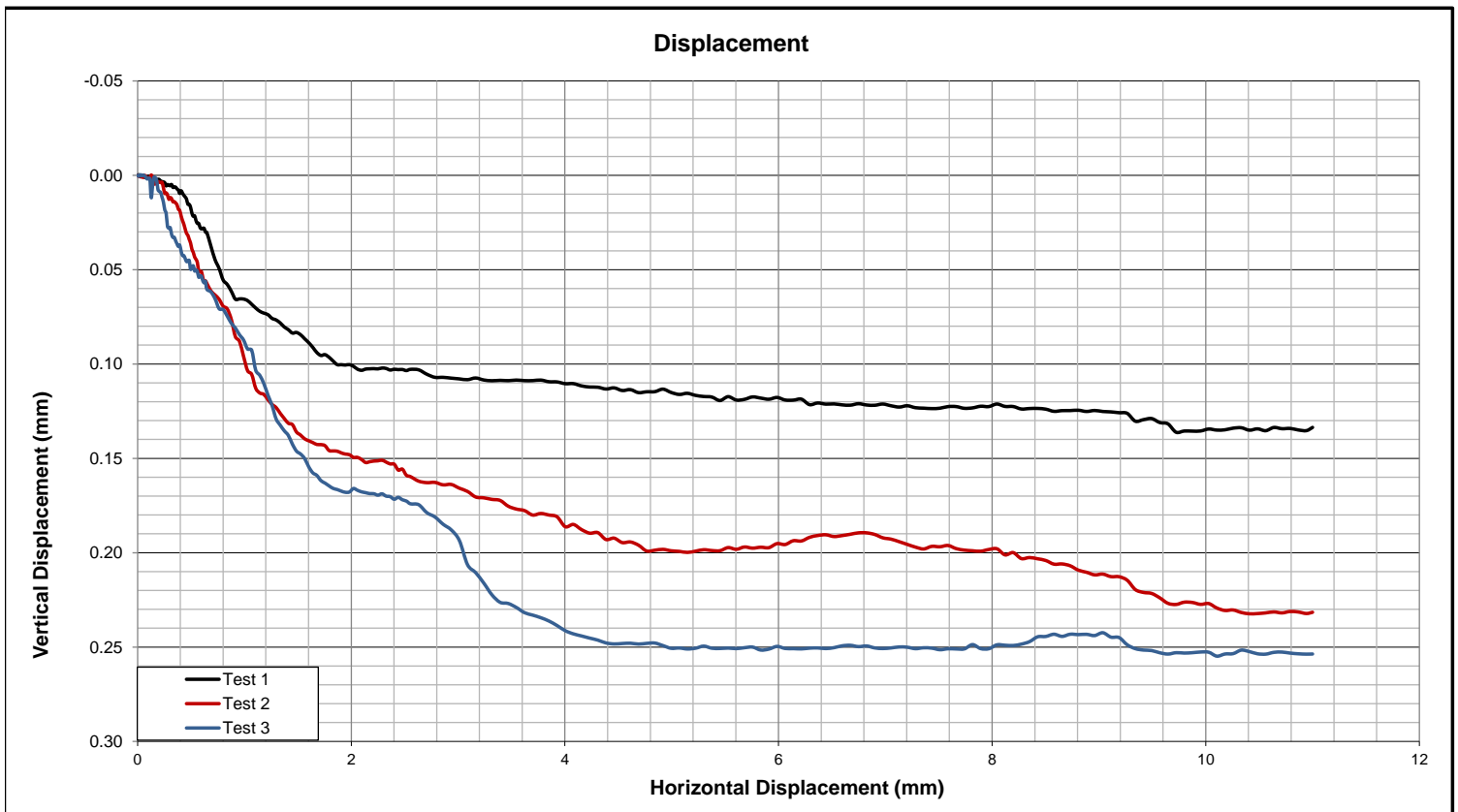
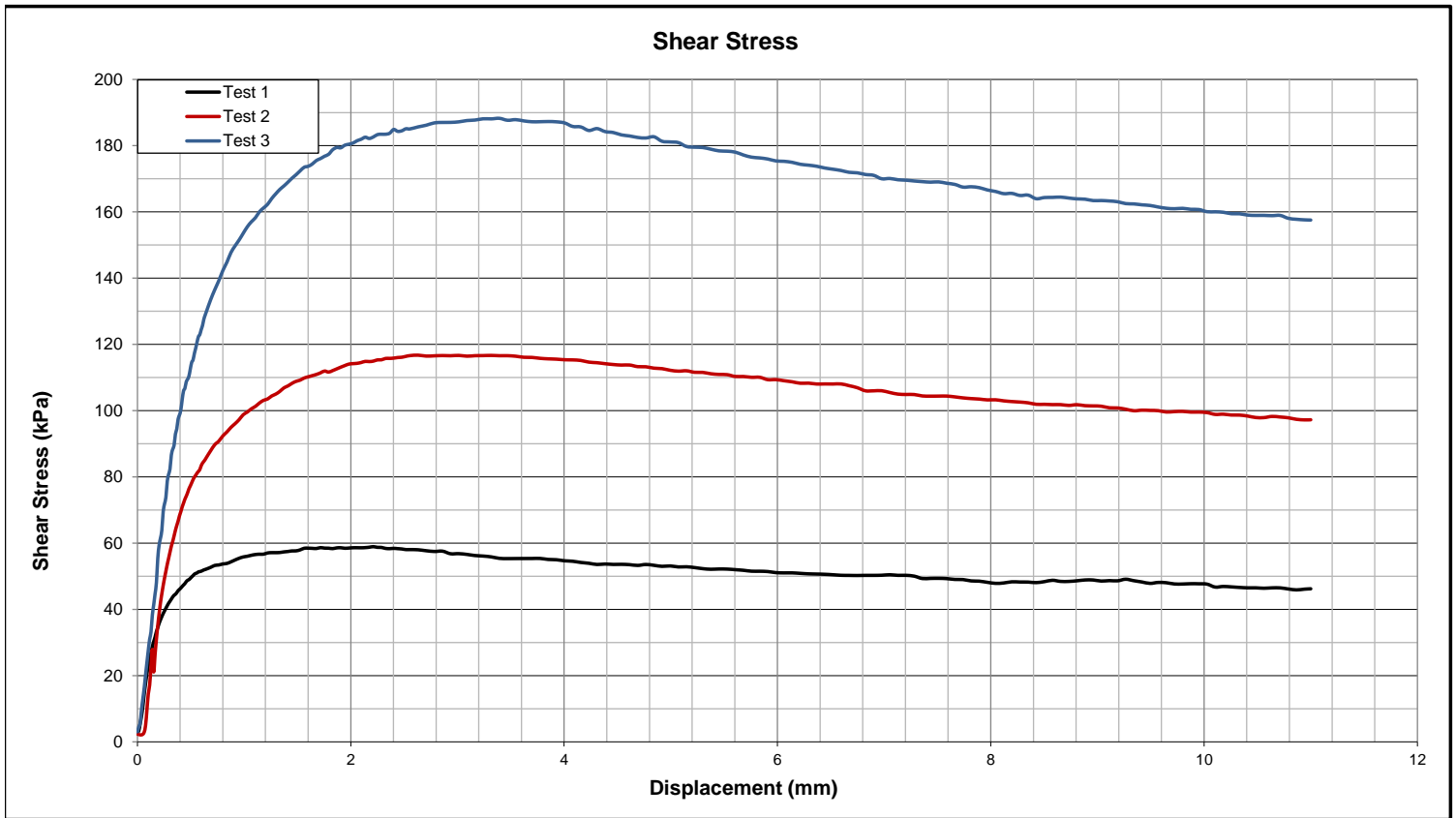
Stress Plot



Client Knight Piesold
Sample no TP2-06/1
Lab no G18-0676

Project Kareerand TSF Phase 2
Depth (m) 0,0-1,3

Job no 2012 (301-00204/13)
Date 06-11-2018



Client Knight Piesold	Project Kareerand TSF Phase 2	Job no 2012
Sample no TP2-06/1	Depth (m) 0.0-1,3	Date 08-01-2019
Lab no G18-0676		

Initial Sample Parameters		
Sample Condition	-	Remoulded by hand
Proctor	kg / m ³	1578
OMC	%	18.1
Consolidation Pressure	kPa	50
Pressure Difference	kPa	10

Test Information			
Moisture Content	Before	%	15.2
	After	%	29.9
Dry Density	Kg/m ³		1537
Initial Void Ratio	-		0.706
Relative Density (SG)	-		2.622 - Determined
Initial Degree of Saturation	%		56.4
Final B Parameter	-		1.00
Co-efficient of Permeability	Min.	m/s	1.27E-08
	Max.	m/s	2.98E-08
	Ave.	m/s	1.74E-08

Client Knight Piesold
Sample no TP2-06/2
Lab no G18-0677

Project Kareerand TSF Phase 2
Depth (m) 1,3-2,4

Job no 2012
Date 27-11-2018

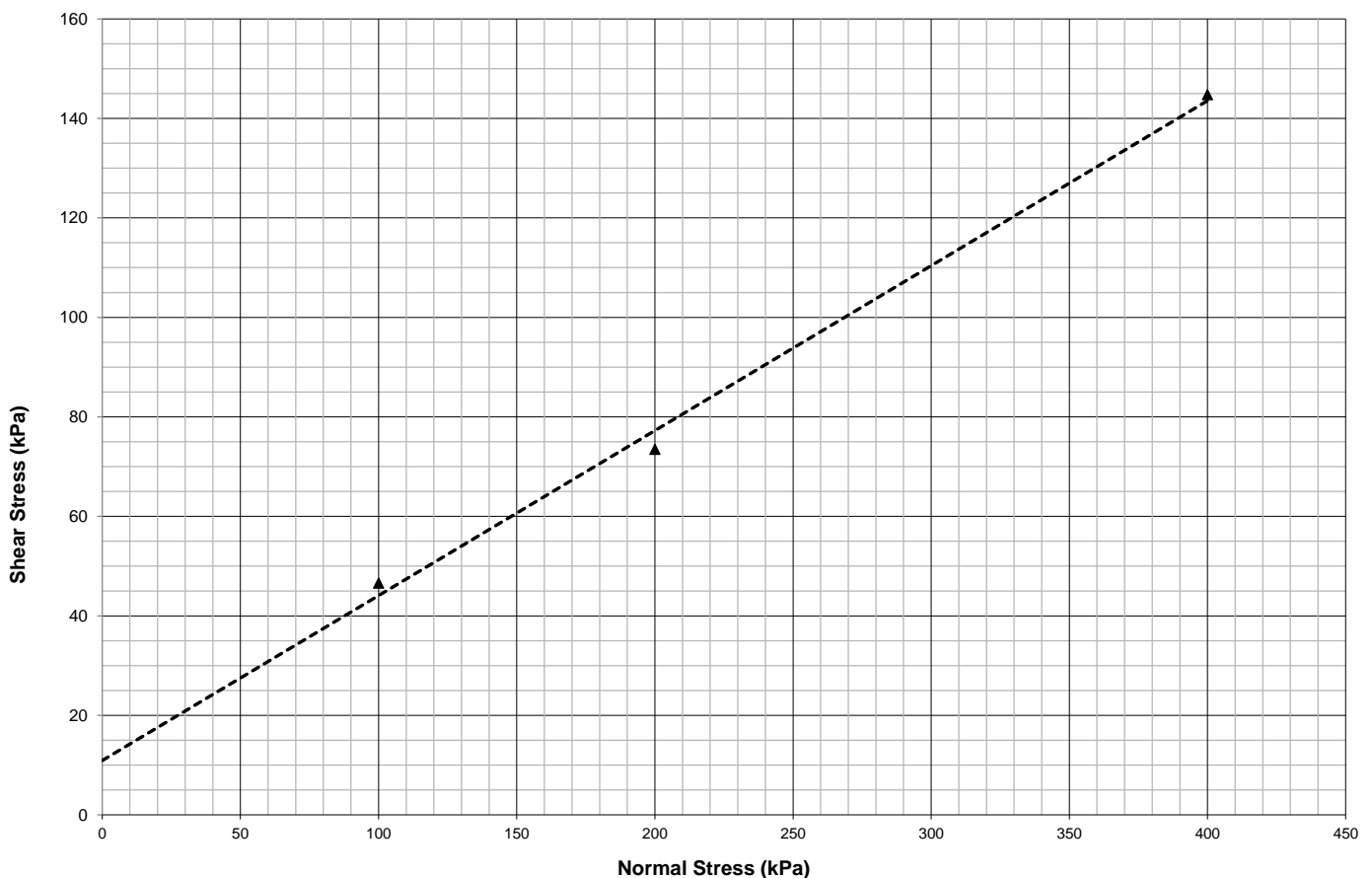
Test Information

Test Type	-	Slow Drained, saturated
Sample Condition	-	Remoulded by hand to estimated OMC
Normal Stresses	kPa	100, 200, 400
Rate of Strain	mm/min	0.0050

Initial Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	17.6	17.8	17.4	Complete test specimen
Dry Density	Kg/m ³	1418	1417	1421	
Void Ratio	-	0.900	0.902	0.896	
Degree of Saturation	%	52.7	53.1	52.4	
Relative Density (SG)	-		2.695		Determined

Final Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	36.3	33.9	33.5	
Normal Stress	kPa	100	200	400	
Shear Stress	kPa	53	89	167	
Residual Stress	kPa	47	73	145	
Angle of Internal Friction	Deg.		18		Residual
Cohesion	kPa		11		Residual

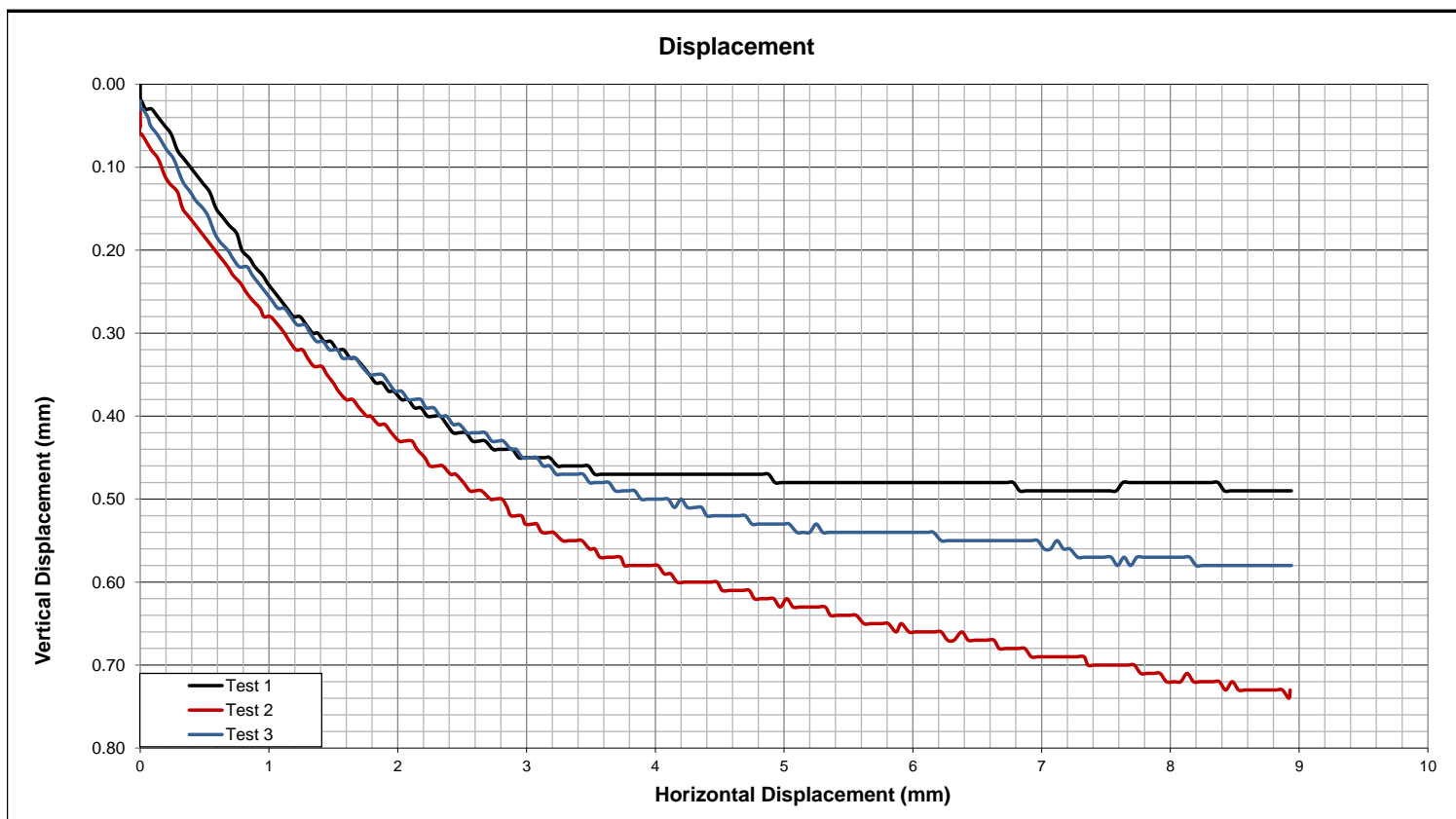
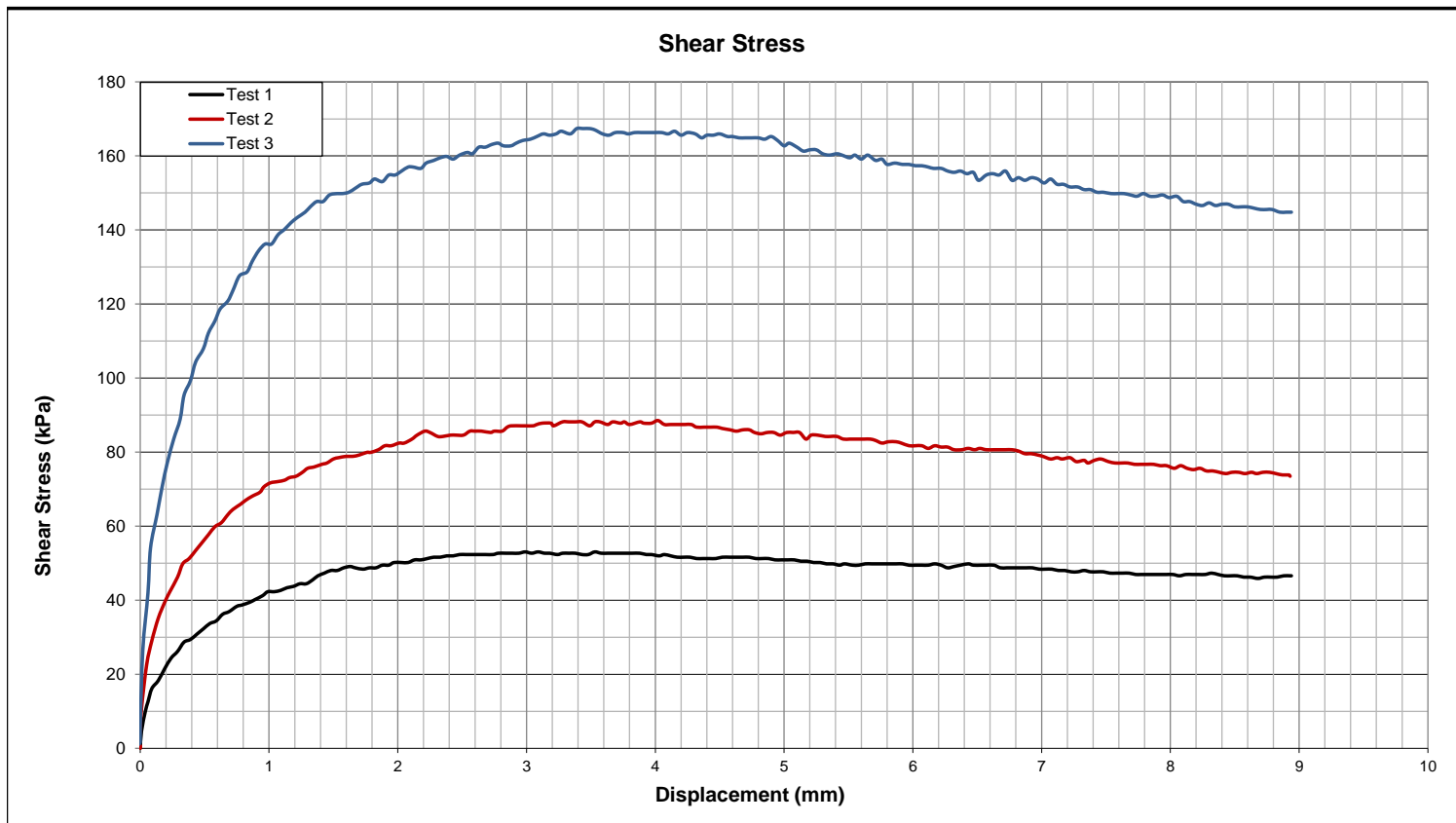
Stress Plot



Client Knight Piesold
 Sample no TP2-06/2
 Lab no G18-0677

Project Kareerand TSF Phase 2
 Depth (m) 1,3-2,4

Job no 2012
 Date 27-11-2018



Client Knight Piesold
Sample no TP2-06/3
Lab no G18-0678

Project Kareerand TSF Phase 2
Depth (m) 2,4-3,1

Job no 2012
Date 30-11-2018

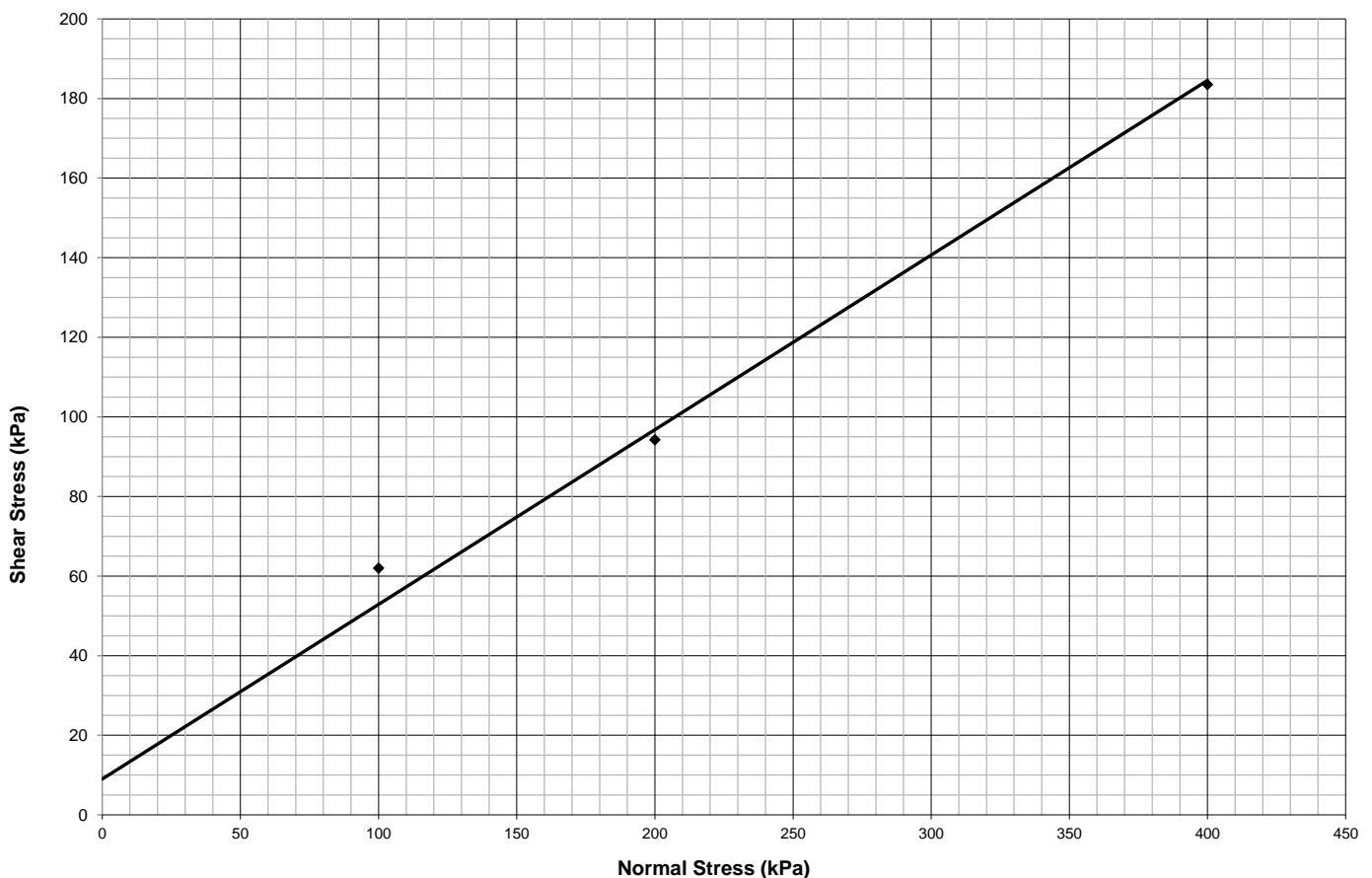
Test Information

Test Type	-	Slow Drained, saturated
Sample Condition	-	Remoulded by hand to estimated OMC
Normal Stresses	kPa	100, 200, 400
Rate of Strain	mm/min	0.0050

Initial Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	14.4	14.2	14.6	Complete test specimen
Dry Density	Kg/m ³	1553	1554	1548	
Void Ratio	-	0.801	0.799	0.806	
Degree of Saturation	%	50.3	49.6	50.7	
Relative Density (SG)	-		2.796		Determined

Final Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	24.0	25.3	21.0	
Normal Stress	kPa	100	200	400	
Shear Stress	kPa	62	94	184	
Residual Stress	kPa	Not Tested	Not Tested	Not Tested	
Angle of Internal Friction	Deg.	24			Peak
Cohesion	kPa	9			Peak

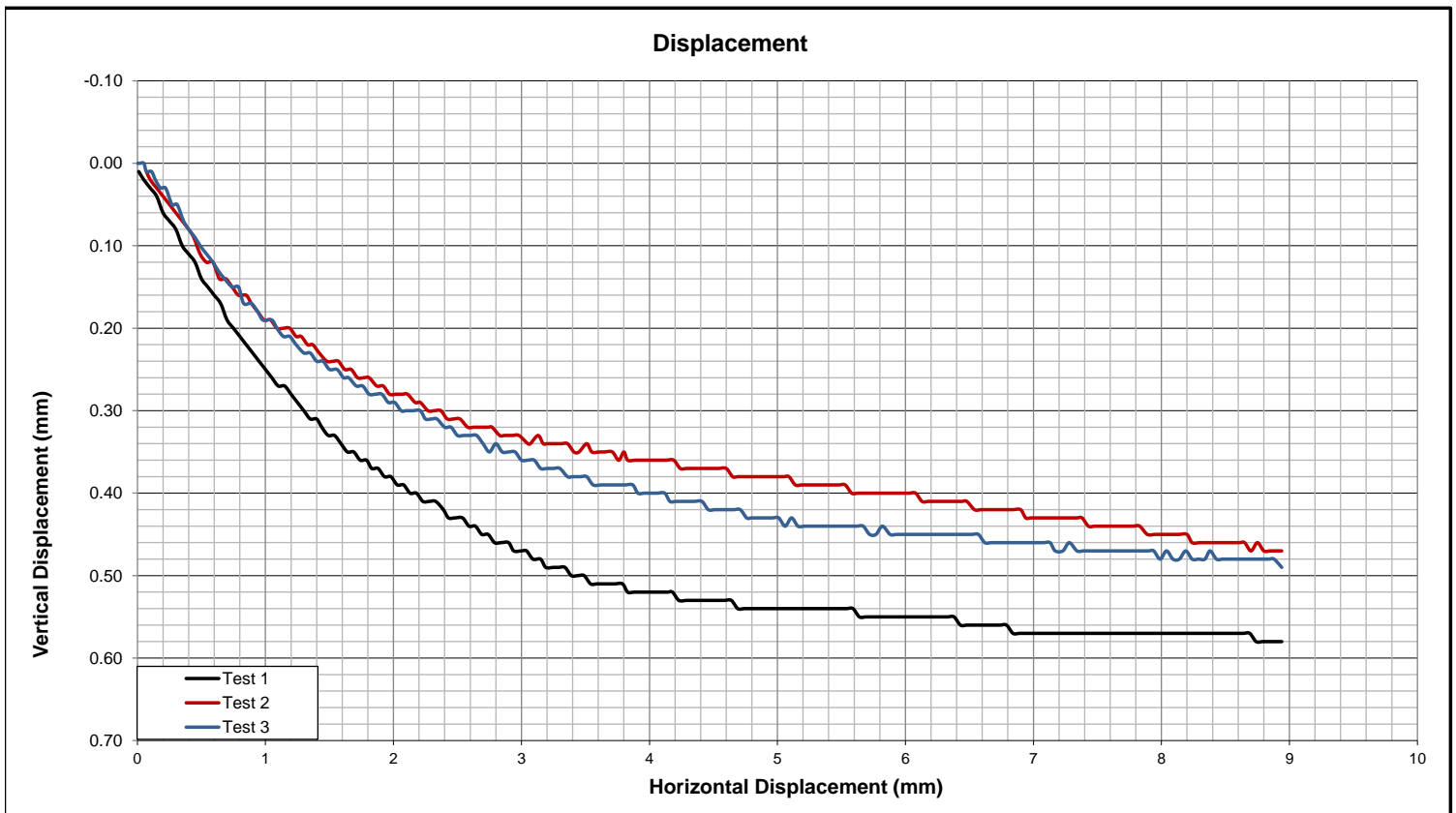
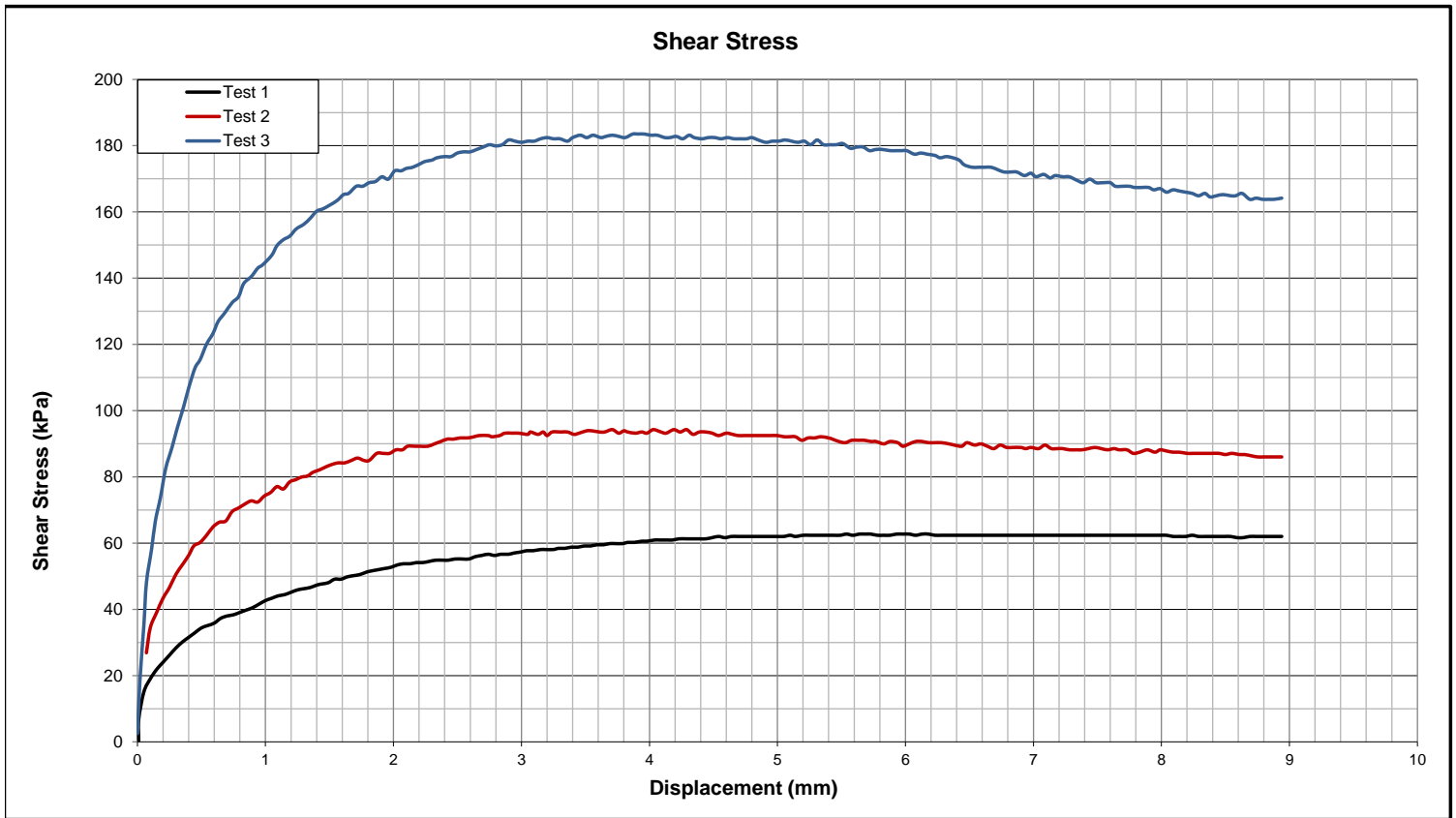
Stress Plot



Client Knight Piesold
 Sample no TP2-06/3
 Lab no G18-0678

Project Kareerand TSF Phase 2
 Depth (m) 2,4-3,1

Job no 2012
 Date 30-11-2018



Client Knight Piesold
Sample no TP2-08
Lab no G18-0680

Project Kareerand TSF Phase 2
Depth (m) 1,3-2,8

Job no 2012
Date 03-12-2018

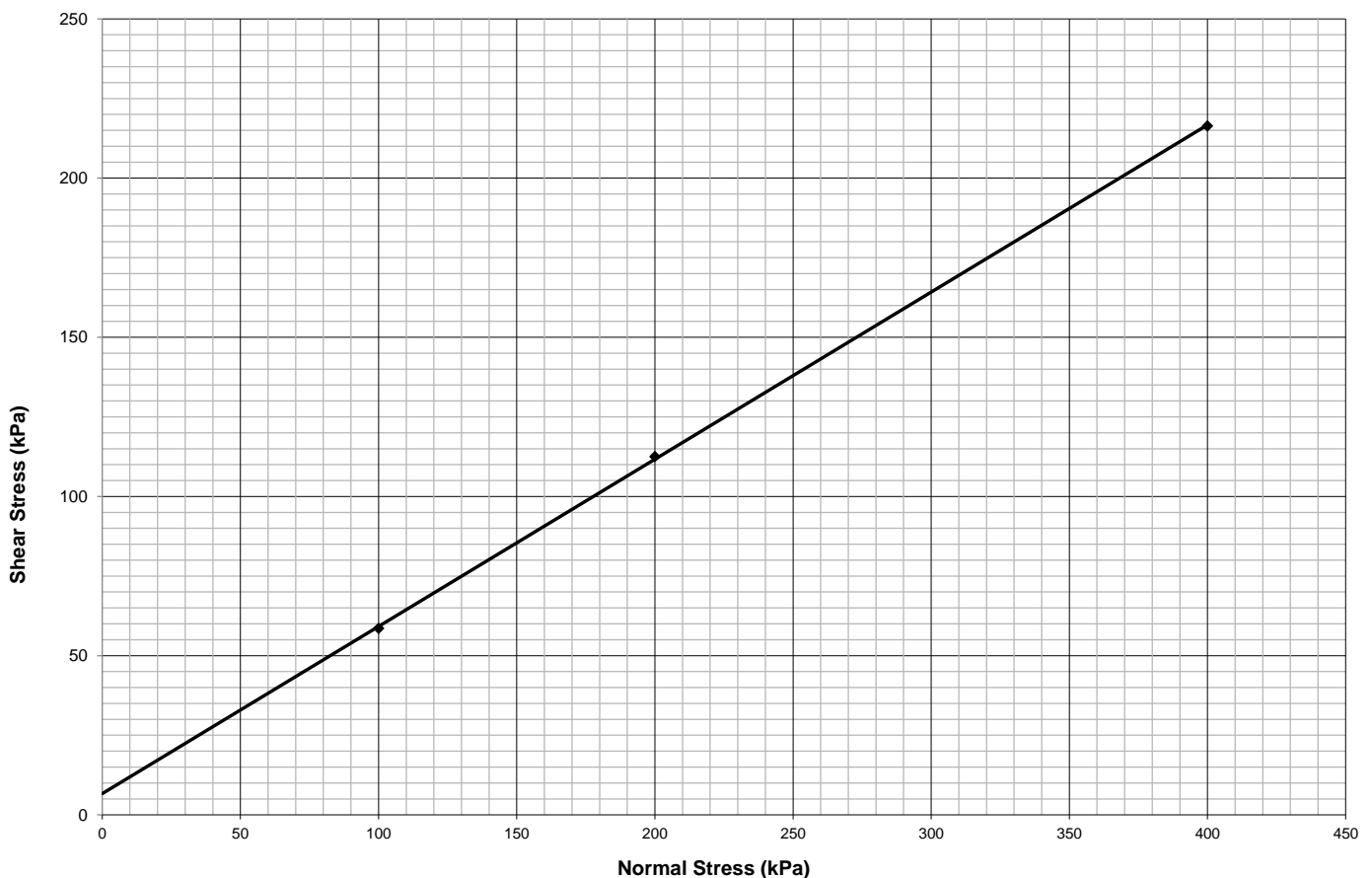
Test Information

Test Type	-	Slow Drained, saturated
Sample Condition	-	Remoulded by hand to estimated OMC
Normal Stresses	kPa	100, 200, 400
Rate of Strain	mm/min	0.0090

Initial Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	19.7	21.3	19.7	Complete test specimen
Dry Density	Kg/m ³	1392	1375	1393	
Void Ratio	-	0.957	0.982	0.956	
Degree of Saturation	%	56.2	59.0	56.0	
Relative Density (SG)	-		2.725		Determined

Final Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	28.4	29.7	26.9	
Normal Stress	kPa	100	200	400	
Shear Stress	kPa	59	113	216	
Residual Stress	kPa	Not Tested	Not Tested	Not Tested	
Angle of Internal Friction	Deg.	28			Peak
Cohesion	kPa	7			Peak

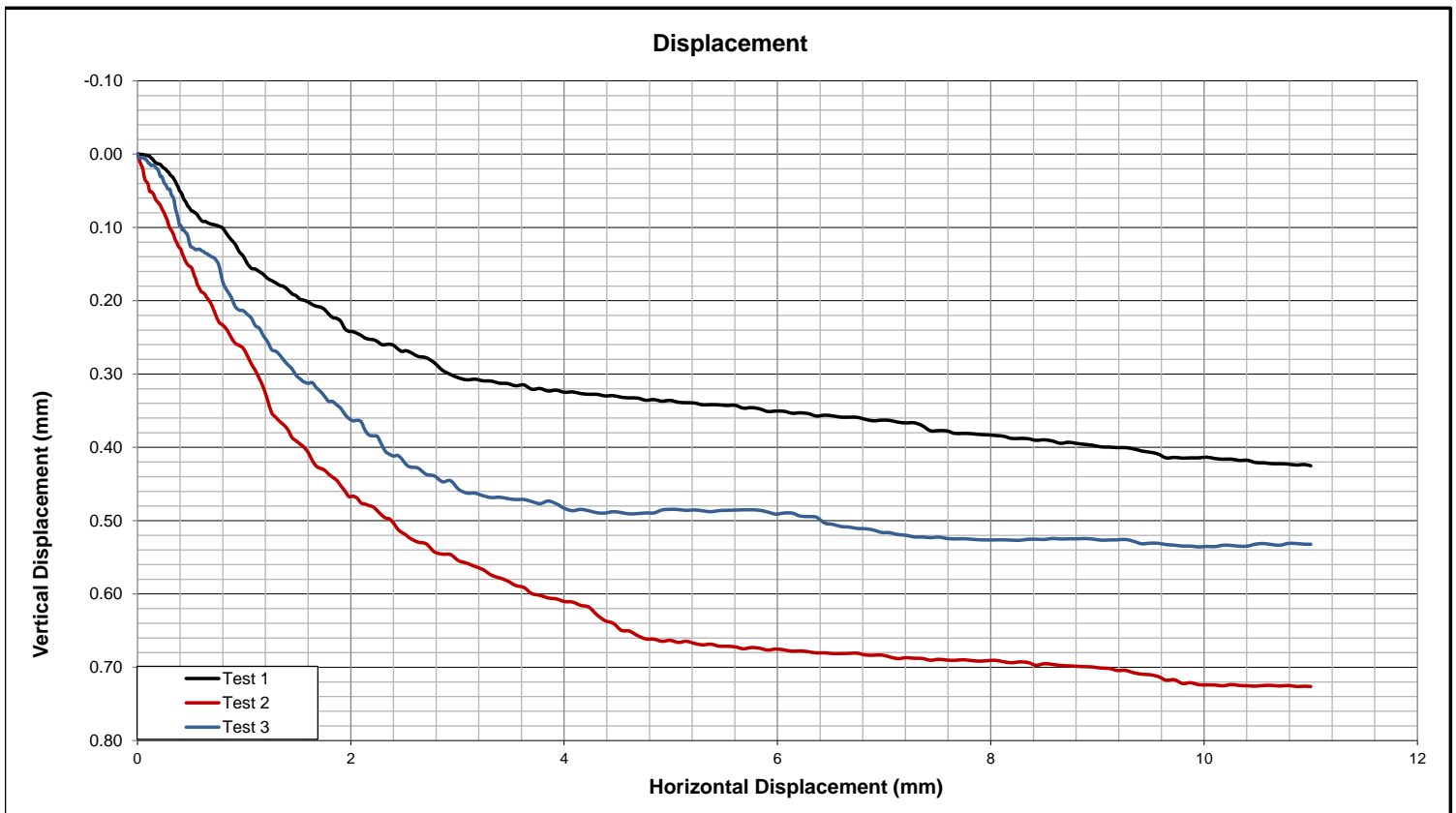
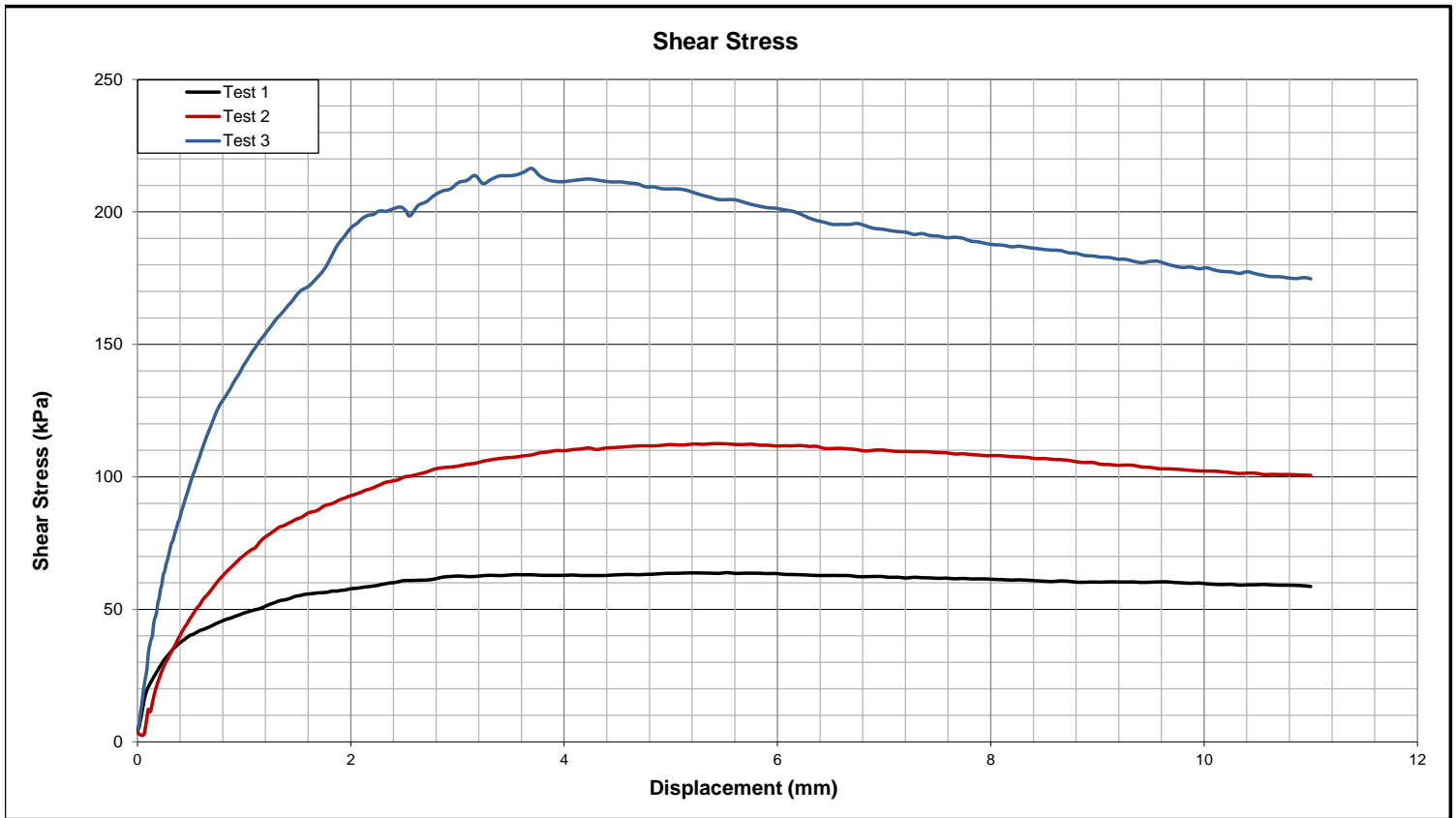
Stress Plot



Client Knight Piesold
 Sample no TP2-08
 Lab no G18-0680

Project Kareerand TSF Phase 2
 Depth (m) 1,3-2,8

Job no 2012
 Date 03-12-2018



Client Knight Piesold
Sample no TP2-12/1
Lab no G18-0684

Project Kareerand TSF Phase 2
Depth (m) 0.0-0.5

Job no 2012
Date 03-12-2018

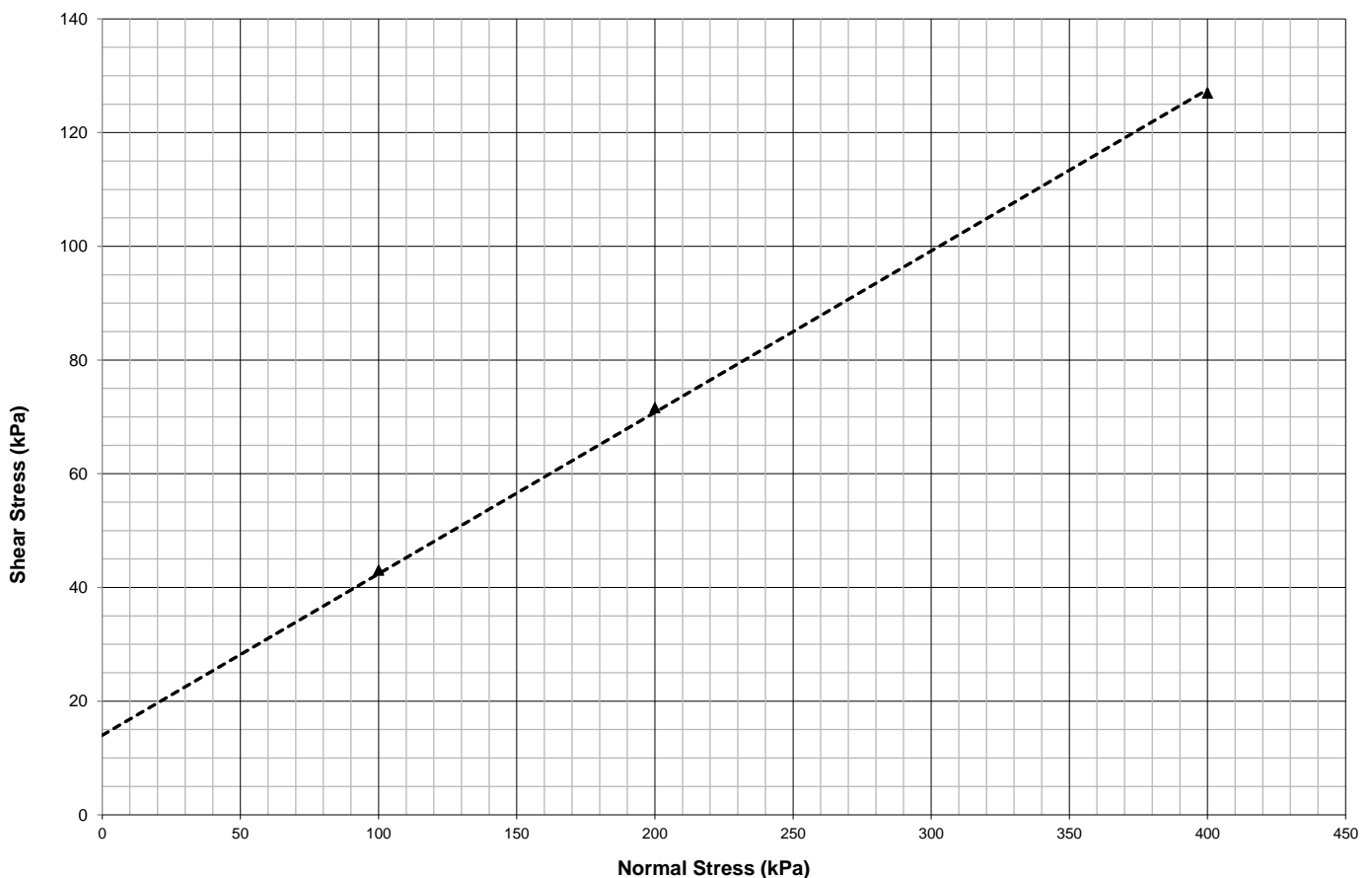
Test Information

Test Type	-	Slow Drained, saturated
Sample Condition	-	Remoulded by hand to estimated OMC
Normal Stresses	kPa	100, 200, 400
Rate of Strain	mm/min	0.0120

Initial Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	31.8	31.2	32.1	Complete test specimen
Dry Density	Kg/m ³	1302	1308	1299	
Void Ratio	-	1.087	1.078	1.092	
Degree of Saturation	%	79.5	78.7	79.9	
Relative Density (SG)	-	2.717			Determined

Final Sample Parameters	Unit	Test 1	Test 2	Test 3	Remarks
Moisture Content	%	40.5	37.3	34.4	
Normal Stress	kPa	100	200	400	
Shear Stress	kPa	66	98	151	
Residual Stress	kPa	43	72	127	
Angle of Internal Friction	Deg.	16			Residual
Cohesion	kPa	14			Residual

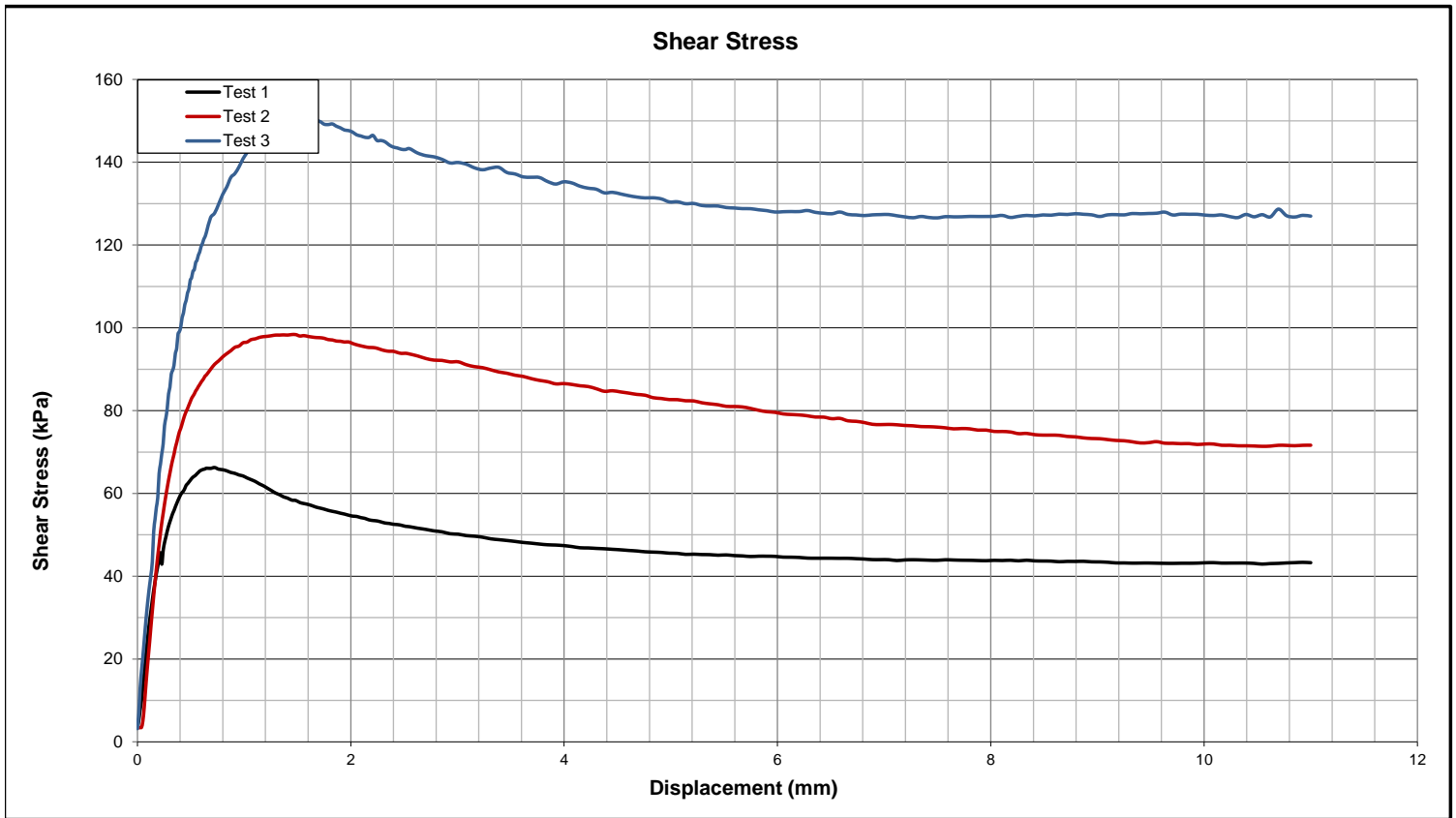
Stress Plot



Client Knight Piesold
 Sample no TP2-12/1
 Lab no G18-0684

Project Kareerand TSF Phase 2
 Depth (m) 0.0-0,5

Job no 2012
 Date 03-12-2018



Client Knight Piesold	Project Kareerand TSF Phase 2	Job no 2012
Sample no TP2-12/1	Depth (m) 0,0 - 0,5	Date 08-01-2019
Lab no G18-0684		

Initial Sample Parameters		
Sample Condition	-	Remoulded by hand
Proctor	kg / m ³	1379
OMC	%	22.9
Consolidation Pressure	kPa	50
Pressure Difference	kPa	10

Test Information			
Moisture Content	Before	%	29.2
	After	%	40.9
Dry Density		Kg/m ³	1265
Initial Void Ratio		-	1.148
Relative Density (SG)		-	2.717 - Determined
Initial Degree of Saturation		%	69.1
Final B Parameter		-	1.00
Co-efficient of Permeability	Min.	m/s	9.16E-09
	Max.	m/s	3.69E-08
	Ave.	m/s	1.97E-08



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a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No : 2019-S-34

Date Received : 09/01/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/050			
Field Number	G19-0015			
Client Reference	556/18			
Depth (m)	0-2500			
Position	TP2/1			
Coordinates	X Y			
Description	Alluvium			
Additional information	Sampled by client			
Calcrete/Crushed Stabilizing Agent	Natural			

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100		
	75 mm	100		
	63 mm	100		
	50 mm	100		
	37.5 mm	100		
	28 mm	100		
	20 mm	100		
	14 mm	100		
	5 mm	100		
	2 mm	99		
	0.425 mm	93		
Grading Modulus	0.075 mm	57		
		0.51		

Soil Mortar Analysis

Coarse Sand	2.0-0.425	6		
Coarse Fine Sand	0.425-0.250	10		
Medium Fine Sand	0.250-0.150	10		
Fine Fine Sand	0.150-0.075	17		
Silt and Clay	<0.075	57		

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	39		
Plasticity Index	%	18		
Linear Shrinkage	%	8.5		

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1666		
Optimum Moisture	%	15.7		

CBR SANS 3001: GR40

UCS

ITS

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
	@98%	2.5										
	@97%	2.3										
	@95%	1.8										
	@93%	1.5										
	@90%	1.1										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort	4.6											

Classifications

HRB	A-6(8)		
COLTO			
TRH14			

Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No. : 2019-S-34

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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/050	
Field Number	G19-0015	
Client Reference	556/18	
Depth (m)	0-2500	
Position	TP2/1	
Coordinates	X Y	
Description	Alluvium	
Additional information	Sampled by client	
Calcrete/Crushed Stabilizing Agent	Natural	

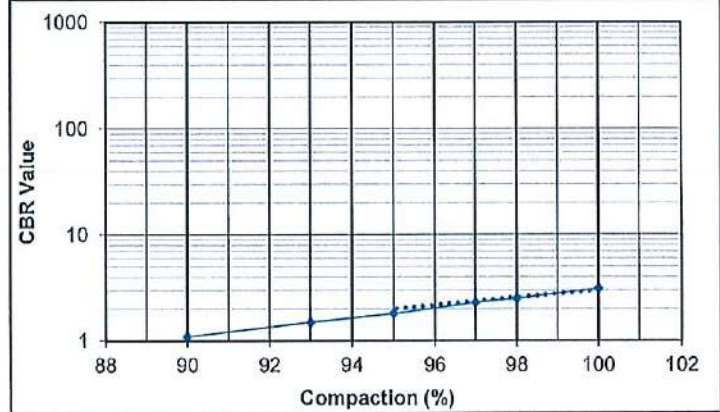
Laboratory No.	A9/050	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1666
OMC	%	15.7

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	16.8		
Dry Density	kg/m ³	1667	1584	1507
Compaction	%	100.0	95.0	90.4

Penetration Data				
CBR at	2.50 mm	3	2	1
	5.00 mm	3	2	1
	7.50 mm	2	2	1
Swell	%	4.6	5.5	5.6
Final Moisture (%)				

Sieve Analysis (Wet preparation) SANS 3001: GR1, GR2

Percentage Passing	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	100
	2 mm	99
	0.425 mm	93
	0.250 mm	84
	0.150 mm	74
	0.075 mm	57
Grading Modulus		0.5



Soil Mortar Analysis

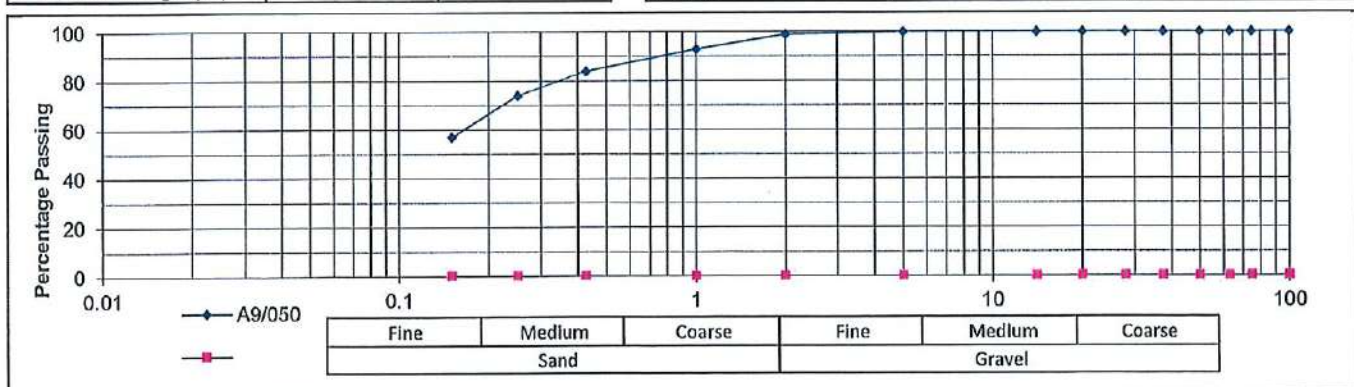
Coarse Sand	6
Coarse Fine Sand	10
Medium Fine Sand	10
Fine Fine Sand	17
Silt and Clay	57

Interpolated CBR Data		
CBR	@ 100%	3
	@ 98%	3
	@ 97%	2
	@ 95%	2
	@ 93%	2
	@ 90%	1
	@ SANS3001 Midpoint	2
	Mod. AASHTO	

Atterberg Limits SANS GR10, GR11, GR12

Liquid Limit (%)	39
Plasticity Index (%)	18
Linear Shrinkage (%)	8.5

Classifications	
HRB (AASHTO)	A-6(8)
COLTO	
TRH14	



Client : KNIGHT PIESOLD (PTY) LTD	Date Received : 09/01/2019
Project : Karee Rand Diversion (301-00204/13)	Date Reported : 07/02/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/051				
Field Number	G19-0016				
Client Reference	556/18				
Depth (m)	1400-3100				
Position	TP3/1				
Coordinates	X Y				
Description	Alluvium				
Additional information	Sampled by client				
Calcrete/Crushed Stabilizing Agent	Natural				

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	88			
	20 mm	87			
	14 mm	84			
	5 mm	74			
	2 mm	58			
	0.425 mm	49			
	0.075 mm	37			
Grading Modulus		1.56			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	16			
Coarse Fine Sand	0.425-0.250	5			
Medium Fine Sand	0.250-0.150	6			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	63			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	60			
Plasticity Index	%	27			
Linear Shrinkage	%	10			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1704			
Optimum Moisture	%	13			

CBR SANS 3001: GR40

UCS

ITS

Test Type			CBR			UCS			ITS			CBR			UCS			ITS			
			(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)				
Interpolated Data	@100%	Mod. AASHTO	2.4																		
	@ 98%		2.2																		
	@ 97%		2																		
	@ 95%		1.8																		
	@ 93%		1.6																		
	@ 90%		1.3																		
Value @ Mod. AASHTO effort																					
Swell (%) @ Mod. AASHTO effort			6.8																		

Classifications

HRB	A-7-5(4)				
COLTO					
TRH14					

• SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
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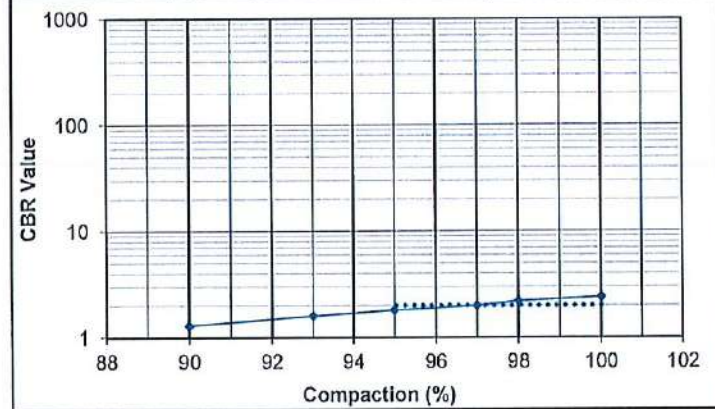
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/051
Field Number	G19-0016
Client Reference	556/18
Depth (m)	1400-3100
Position	TP3/1
Coordinates	X Y
Description	Alluvium
Additional information	Sampled by client
Calcrete/Crushed Stabilizing Agent	Natural

Laboratory No.	A9/051
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1704
OMC	% 13

California Bearing Ratio		SANS 3001: GR40	
Compaction Data			
Moisture	%	14.6	
Dry Density	kg/m ³	1682	1598 1512
Compaction	%	100.0	95.0 89.9
Penetration Data			
CBR at	2.50 mm	2	2 1
	5.00 mm	2	2 1
	7.50 mm	2	2 1
Swell	%	6.8	7.9 8.3
Final Moisture (%)			

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2	
Percentage Passing			
	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	88	
	20 mm	87	
	14 mm	84	
	5 mm	74	
	2 mm	58	
	0.425 mm	49	
	0.250 mm	46	
	0.150 mm	43	
	0.075 mm	37	
Grading Modulus		1.6	

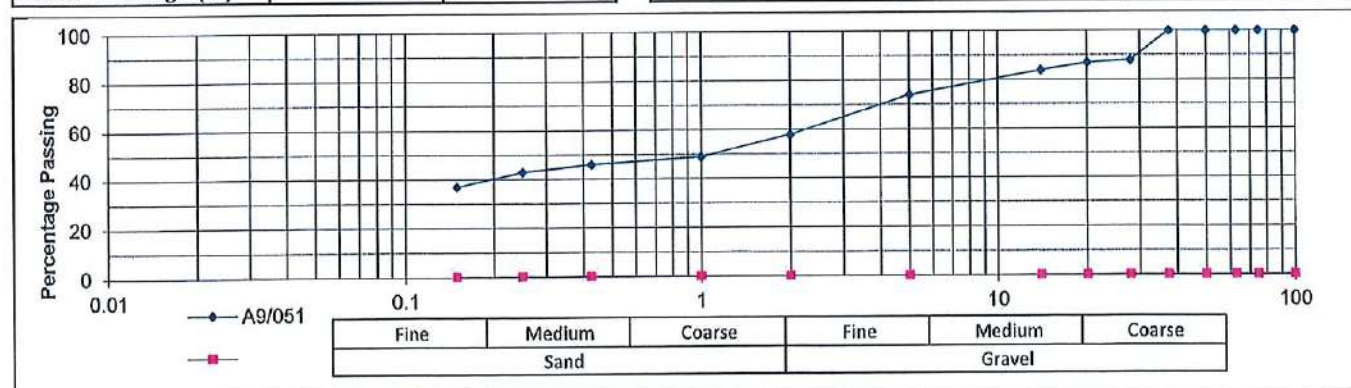


Interpolated CBR Data	
CBR	Mod. AASHTO
@ 100%	2
@ 98%	2
@ 97%	2
@ 95%	2
@ 93%	2
@ 90%	1
@ SANS3001 Midpoint	2

Soil Mortar Analysis	
Coarse Sand	16
Coarse Fine Sand	5
Medium Fine Sand	6
Fine Fine Sand	10
Silt and Clay	63

Atterberg Limits		SANS GR10, GR11, GR12	
Liquid Limit (%)	60		
Plasticity Index (%)	27		
Linear Shrinkage (%)	10.0		

Classifications	
HRB (AASHTO)	A-7-5(4)
COLTO	
TRH14	



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a SANAS Accredited Testing Laboratory No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
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MATERIALS TEST REPORT

Laboratory Number	A9/056			
Field Number	G19-0021			
Client Reference	556/18			
Depth (m)	600-1900			
Position	TP9/1			
Coordinates	X Y			
Description	Residual Andesite			
Additional information	Sampled by client			
Calcrete/Crushed Stabilizing Agent	Natural			

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	99			
	5 mm	86			
	2 mm	74			
0.425 mm	64				
0.075 mm	52				
Grading Modulus		1.1			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	14			
Coarse Fine Sand	0.425-0.250	3			
Medium Fine Sand	0.250-0.150	4			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	70			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	42			
Plasticity Index	%	14			
Linear Shrinkage	%	5.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1671			
Optimum Moisture	%	14.7			

CBR SANS 3001: GR40**UCS****ITS**

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	1.9										
	@98%	1.7										
	@97%	1.7										
	@95%	1.6										
	@93%	1.4										
	@90%	1.3										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort	4.4											

Classifications

HRB	A-7-6(5)			
COLTO				
TRH14				

Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No. : 2019-S-34

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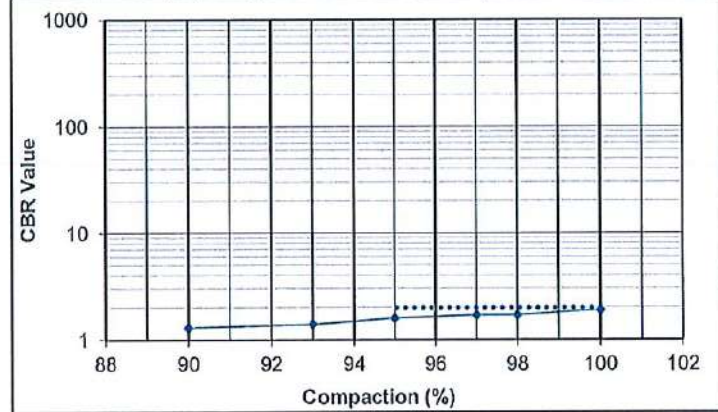
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/056
Field Number	G19-0021
Client Reference	556/18
Depth (m)	600-1900
Position	TP9/1
Coordinates	X Y
Description	Residual Andesite
Additional information	Sampled by client
Calcrete/Crushed	
Stabilizing Agent	Natural

Laboratory No.	A9/056
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1671
OMC	% 14.7

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	13.5		
Dry Density	kg/m ³	1687	1601	1538
Compaction	%	100.0	94.9	91.2
Penetration Data				
CBR at	2.50 mm	2	2	1
	5.00 mm	2	2	1
	7.50 mm	2	2	1
Swell	%	4.4	4.7	5.2
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2	
Percentage Passing			
	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	100	
	20 mm	100	
	14 mm	99	
	5 mm	86	
	2 mm	74	
	0.425 mm	64	
	0.250 mm	62	
	0.150 mm	59	
	0.075 mm	52	
Grading Modulus		1.1	

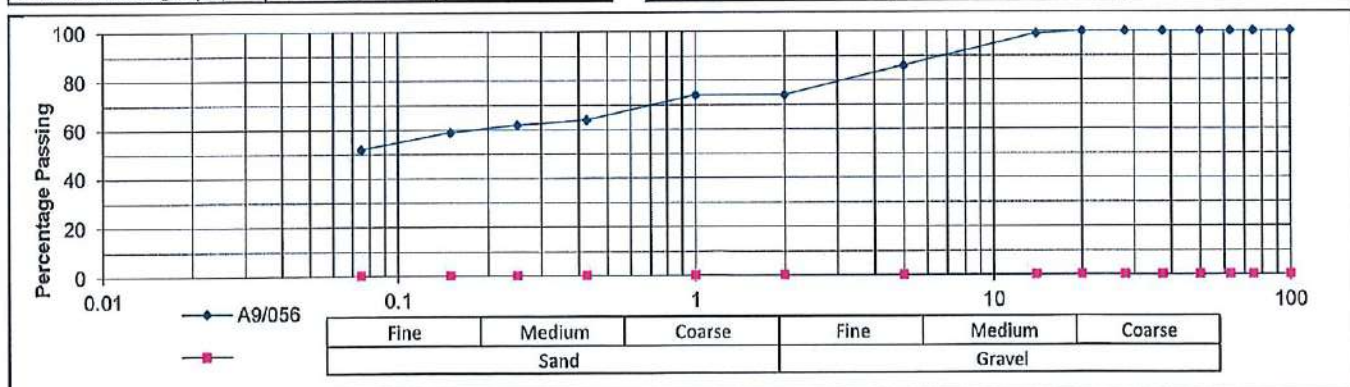


Soil Mortar Analysis	
Coarse Sand	14
Coarse Fine Sand	3
Medium Fine Sand	4
Fine Fine Sand	10
Silt and Clay	70

Interpolated CBR Data	
CBR	Mod. AASHTO
@ 100%	2
@ 98%	2
@ 97%	2
@ 95%	2
@ 93%	1
@ 90%	1
@ SANS3001 Midpoint	2

Atterberg Limits		SANS GR10, GR11, GR12	
Liquid Limit (%)	42		
Plasticity Index (%)	14		
Linear Shrinkage (%)	5.5		

Classifications	
HRB (AASHTO)	A-7-6(5)
COLTO	
TRH14	



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Client	: KNIGHT PIESOLD (PTY) LTD	Date Received	: 09/01/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/059		
Field Number	G19-0024		
Client Reference	556/18		
Depth (m)	1500-3100		
Position	TP14/2		
Coordinates	X Y		
Description	Residual Dolerite		
Additional information	Sampled by client		
Calcrete/Crushed Stabilizing Agent	Natural		

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	100			
	2 mm	99			
	0.425 mm	60			
0.075 mm	37				
Grading Modulus	1.04				

Soil Mortar Analysis

Coarse Sand	2.0-0.425	39			
Coarse Fine Sand	0.425-0.250	7			
Medium Fine Sand	0.250-0.150	6			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	37			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	32			
Plasticity Index	%	7			
Linear Shrinkage	%	2.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1880			
Optimum Moisture	%	14.8			

CBR SANS 3001: GR40

UCS

ITS

Test Type		Mod. AASHTO	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	
Interpolated Data	@100%	Mod. AASHTO	5.9												
	@98%		4.7												
	@97%		4.2												
	@95%		3.4												
	@93%		2.7												
	@90%		2												
Value @ Mod. AASHTO effort															
Swell (%) @ Mod. AASHTO effort			4.5												

Classifications

HRB	A-4(0)		
COLTO			
TRH14			

Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
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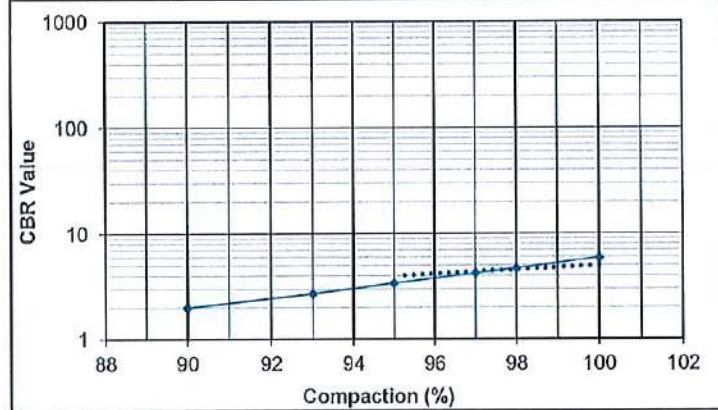
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/059
Field Number	G19-0024
Client Reference	556/18
Depth (m)	1500-3100
Position	TP14/2
Coordinates	X Y
Description	Residual Dolerite
Additional information	Sampled by client
Calcrete/Crushed	
Stabilizing Agent	Natural

Laboratory No.	A9/059
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1880
OMC	% 14.8

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	13.8		
Dry Density	kg/m ³	1894	1802	1705
Compaction	%	100.0	95.1	90.0
Penetration Data				
CBR at	2.50 mm	5	4	2
	5.00 mm	5	3	2
	7.50 mm	5	3	1
Swell	%	4.5	5.8	7.7
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2	
Percentage Passing			
100 mm	100		
75 mm	100		
63 mm	100		
50 mm	100		
37.5 mm	100		
28 mm	100		
20 mm	100		
14 mm	100		
5 mm	100		
2 mm	99		
0.425 mm	60		
0.250 mm	53		
0.150 mm	47		
0.075 mm	37		
Grading Modulus	1.0		

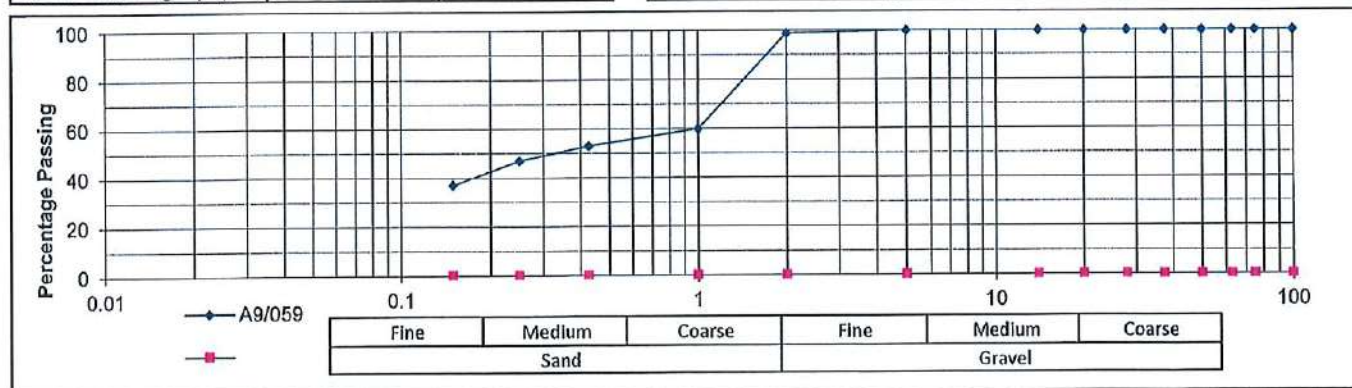


Soil Mortar Analysis	
Coarse Sand	39
Coarse Fine Sand	7
Medium Fine Sand	6
Fine Fine Sand	10
Silt and Clay	37

CBR	@ 100%	6
	@ 98%	5
	@ 97%	4
	@ 95%	3
	@ 93%	3
	@ 90%	2
	@ SANS3001 Midpoint	5

Atterberg Limits		SANS GR10,GR11,GR12	
Liquid Limit (%)	32		
Plasticity Index (%)	7		
Linear Shrinkage (%)	2.5		

HRB (AASHTO)	A-4(0)
COLTO	
TRH14	



Client	: KNIGHT PIESOLD (PTY) LTD	Date Received	: 09/01/2019
Project	: Karee Rand Diversion (301-00204/13)	Date Reported	: 07/02/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/060		
Field Number	G19-0025		
Client Reference	556/18		
Depth (m)	1000-2700		
Position	TP16/1		
Coordinates	X Y		
Description	Residual Dolerite		
Additional information	Sampled by client.		
Calcrete/Crushed Stabilizing Agent	Natural		

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	97			
	2 mm	90			
0.425 mm	38				
0.075 mm	12				
Grading Modulus		1.6			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	58			
Coarse Fine Sand	0.425-0.250	16			
Medium Fine Sand	0.250-0.150	7			
Fine Fine Sand	0.150-0.075	5			
Silt and Clay	<0.075	14			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	28			
Plasticity Index	%	5			
Linear Shrinkage	%	2			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1895			
Optimum Moisture	%	10.7			

CBR SANS 3001: GR40

UCS

ITS

Test Type		CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	41.6											
	@ 98%	27.8											
	@ 97%	22.7											
	@ 95%	15.2											
	@ 93%	10.1											
	@ 90%	5.5											
Value @ Mod. AASHTO effort													
Swell (%) @ Mod. AASHTO effort		0.2											

Classifications

HRB	A-1-b(0)		
COLTO	G8		
TRH14	G10		

SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No. : 2019-S-34

Date Received : 09/01/2019
 Date Reported : 07/02/2019
 Page No. : of

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/060
Field Number	G19-0025
Client Reference	556/18
Depth (m)	1000-2700
Position	TP16/1
Coordinates	X Y
Description	Residual Dolerite
Additional information	Sampled by client.
Calcrete/Crushed Stabilizing Agent	Natural

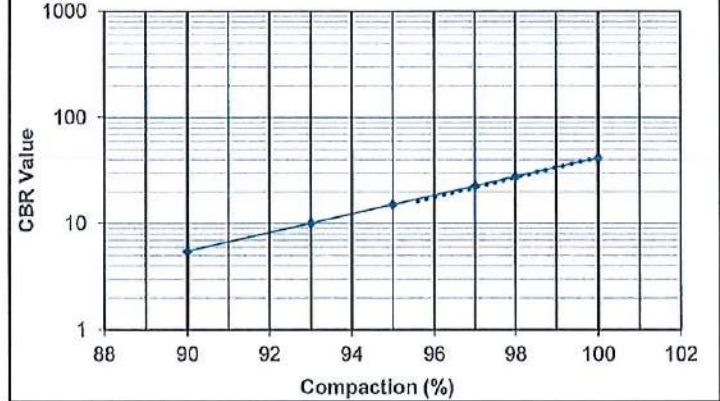
Laboratory No.	A9/060
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1895
OMC	% 10.7

California Bearing Ratio				SANS 3001: GR40
Compaction Data				
Moisture	%	11.4		
Dry Density	kg/m ³	1872	1788	1697
Compaction	%	100.0	95.5	90.7

Penetration Data				
CBR at	2.50 mm	42	16	6
	5.00 mm	50	15	6
	7.50 mm	48	15	5
Swell	%	0.2	0.4	0.7
Final Moisture (%)				

Sieve Analysis (Wet preparation) SANS 3001: GR1, GR2

Percentage Passing	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	97
	2 mm	90
	0.425 mm	38
	0.250 mm	24
	0.150 mm	17
	0.075 mm	12
Grading Modulus		1.6



Soil Mortar Analysis

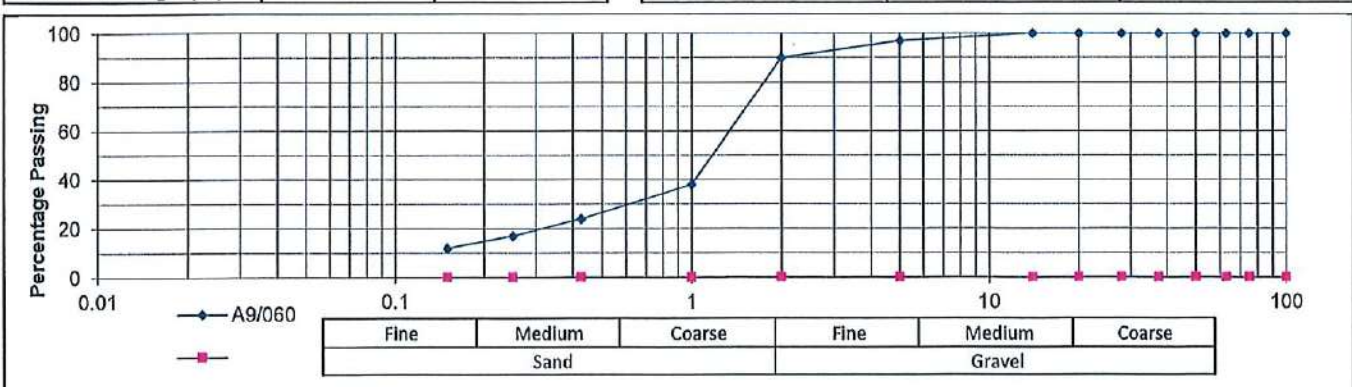
Coarse Sand	58
Coarse Fine Sand	16
Medium Fine Sand	7
Fine Fine Sand	5
Silt and Clay	14

Interpolated CBR Data			
CBR	@ 100%	Mod. AASHTO	42
	@ 98%		28
	@ 97%		23
	@ 95%		15
	@ 93%		10
	@ 90%		6
	@ SANS3001 Midpoint		27

Atterberg Limits SANS GR10, GR11, GR12

Liquid Limit (%)	28
Plasticity Index (%)	5
Linear Shrinkage (%)	2.0

Classifications	
HRB (AASHTO)	A-1-b(0)
COLTO	G8
TRH14	G10





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E-mail: info@matrolab.co.za Website: www.matrolab.co.za
Reg No.: 2003/029180/07 - VAT Reg No.: 4040210587



a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
Project :
Project No: 2019-S-34

Date Received: 09/01/2019
Date Reported: 17/01/2019
Page No. : of

MOISTURE DENSITY RELATIONSHIP

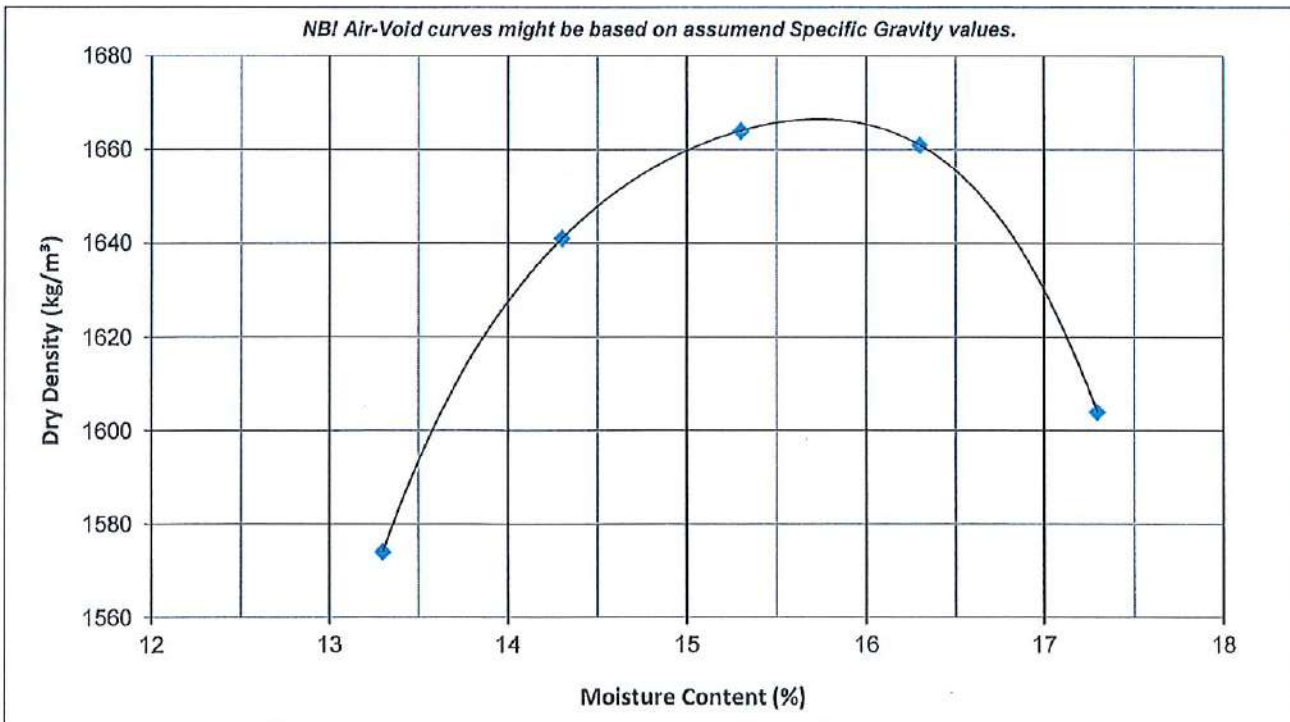
Laboratory Number	A9/050
Field Number	G19-0015
Client Reference	556/18
Depth (m)	0-2500
Position	TP2/1
Coordinates	X Y
Description	Alluvium
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1574	1641	1664	1661	1604
Moisture Content	%	13.3	14.3	15.3	16.3	17.3

Max. Dry Density	kg/m ³	1666
Optimum Moisture	%	15.7



a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project :
 Project No: 2019-S-34

Date Received: 09/01/2019
 Date Reported: 17/01/2019
 Page No. : of

MOISTURE DENSITY RELATIONSHIP

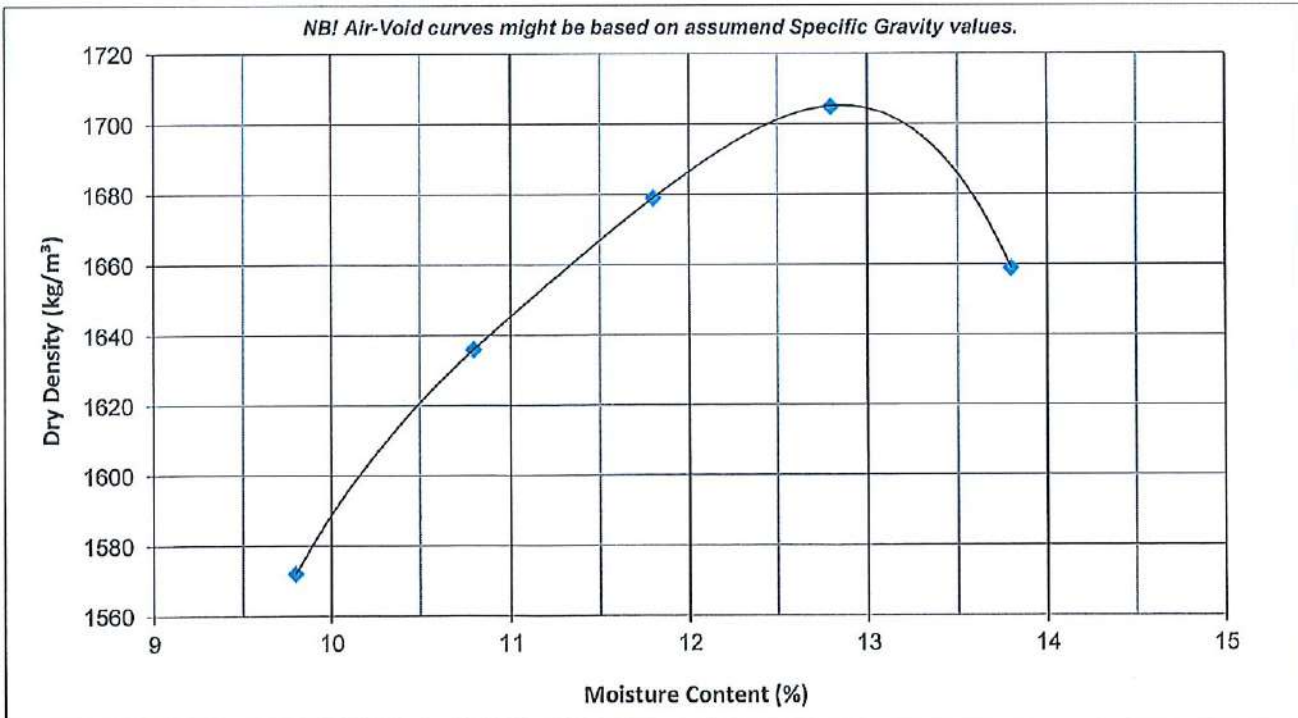
Laboratory Number	A9-051
Field Number	G19-0016
Client Reference	556/18
Depth (m)	1400-3100
Position	TP3/1
Coordinates	X Y
Description	Alluvium
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1572	1636	1679	1705	1659	
Moisture Content	%	9.8	10.8	11.8	12.8	13.8	

Max. Dry Density	kg/m ³	1704
Optimum Moisture	%	13



Client : KNIGHT PIESOLD (PTY) LTD
 Project :
 Project No: 2019-S-34

Date Received: 09/01/2019
 Date Reported: 17/01/2019
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MOISTURE DENSITY RELATIONSHIP

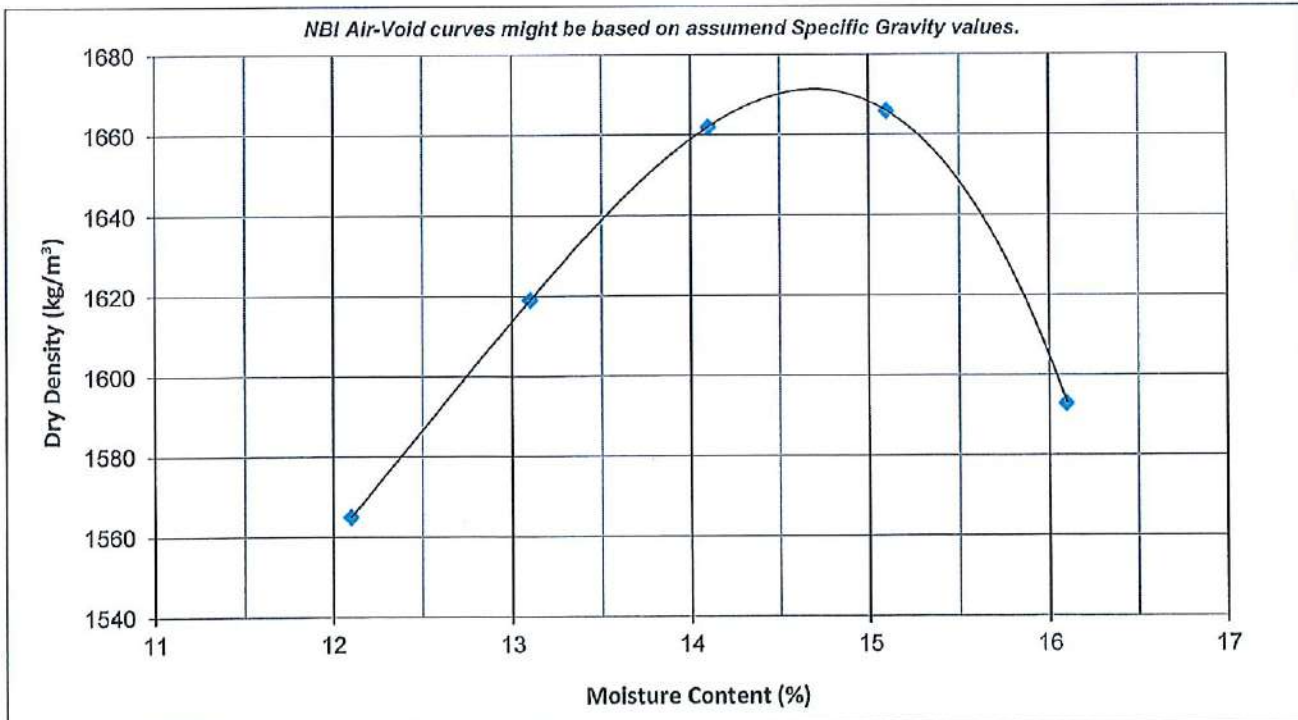
Laboratory Number	A9/056
Field Number	G19-0021
Client Reference	556/18
Depth (m)	600-1900
Position	TP9/1
Coordinates X	
Coordinates Y	
Description	Residual Andesite
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1565	1619	1662	1666	1593
Moisture Content	%	12.1	13.1	14.1	15.1	16.1

Max. Dry Density	kg/m ³	1671
Optimum Moisture	%	14.7



a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project :
 Project No: 2019-S-34

Date Received: 09/01/2019
 Date Reported: 17/01/2019
 Page No. : of

MOISTURE DENSITY RELATIONSHIP

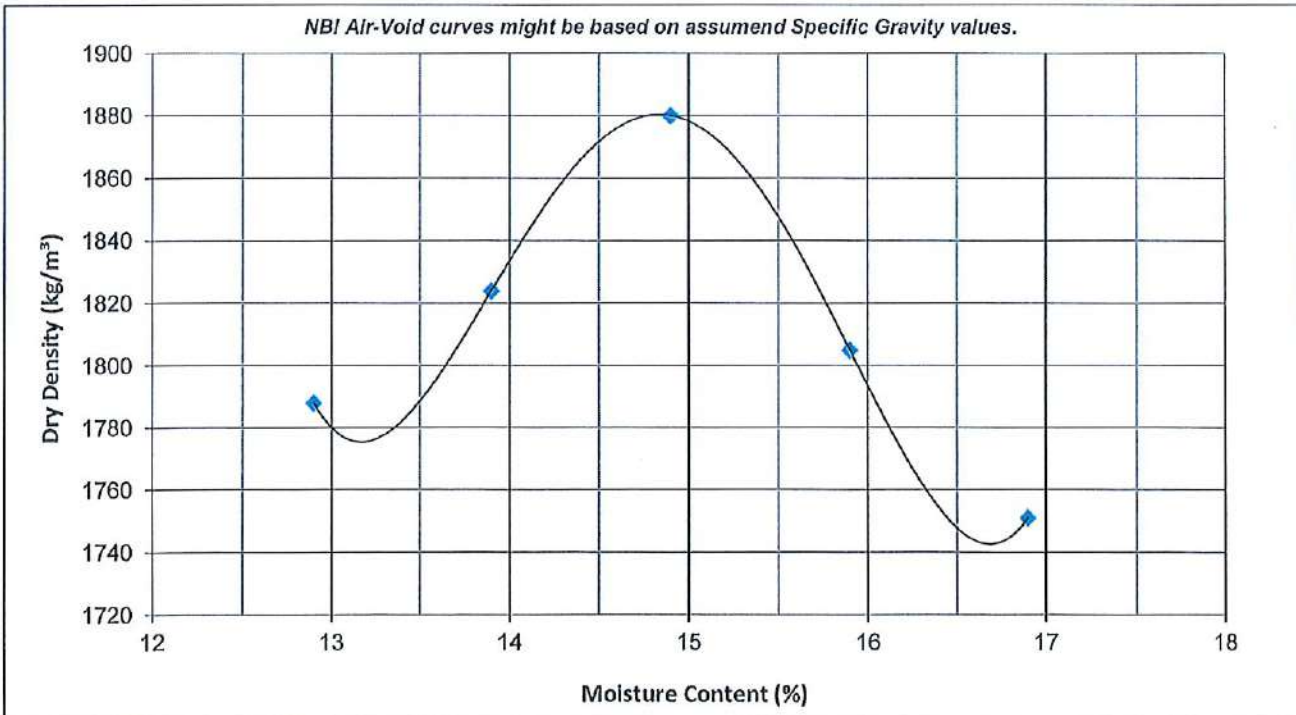
Laboratory Number	A9/059
Field Number	G19-0024
Client Reference	556/18
Depth (m)	1500-3100
Position	TP14/2
Coordinates	X Y
Description	Residual Dolerite
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1788	1824	1880	1805	1751	
Moisture Content	%	12.9	13.9	14.9	15.9	16.9	

Max. Dry Density	kg/m ³	1880
Optimum Moisture	%	14.8



Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project :
 Project No: 2019-S-34

Date Received: 09/01/2019
 Date Reported: 17/01/2019
 Page No. : of

MOISTURE DENSITY RELATIONSHIP

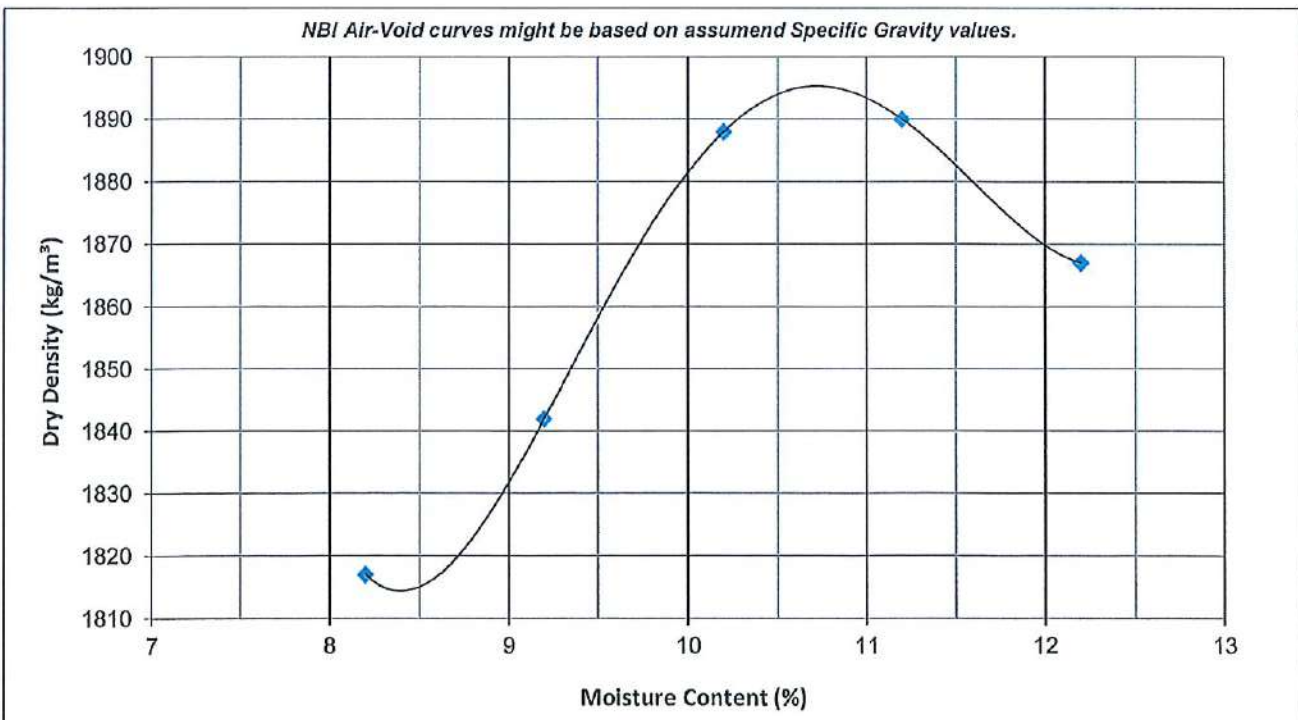
Laboratory Number	A9/060		
Field Number	G19-0025		
Client Reference	556/18		
Depth (m)	1000-2700		
Position	TP16/1		
Coordinates	X Y		
Description	Residual Dolerite		
Additional Information			
Calcrete / Crushed Stabilizing Agent	Natural		

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO		
--------------------	-----------------	--	--

Dry Density	kg/m ³	1817	1842	1888	1890	1867	
Moisture Content	%	8.2	9.2	10.2	11.2	12.2	

Max. Dry Density	kg/m ³	1895
Optimum Moisture	%	10.7



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Tel. : 012-800 1299
Fax. : 012-800 3034
Email : lizette.breiting@sgs.com

TEST RESULTS

CLIENT: KNIGHT PIESOLD CONSULTING
ADDRESS: P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Kenneth Matotoka

Project: Karee Rand Diversion (301-00204/13)

Your Ref: 556/18
Our Ref: PL/24422b

Date Reported: 04.02.2019

PROPERTIES OF AGGREGATE AND SAND

Test description	Sample Description Source Additional Info Client Ref No	Test method	Lab no UOM	A9/048	A9/049	A9/050	A9/051
				Colluvium TP1/1 (300-1300) G19-0013	Ferruginised Colluvium TP1/2 (1300-3100) G19-0014	Alluvium TP2/1 (0-2500) G19-0015	Alluvium TP3/1 (1400-3100) G19-0016
Clay Content		SANS 6244	%	27.7	31.9	17.2	29.6

Remarks: Sampled by client.

Test covered, not part of scope of accreditation

for SGS Matrolab (Pty) Ltd. Technical Signatory: B. van Niekerk/L. Breiting

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Fax. : 012-800 3034
Email : lizette.breitling@sgs.com

TEST RESULTS

Project: Karee Rand Diversion (301-00204/13)

CLIENT: KNIGHT PIESOLD CONSULTING
ADDRESS: P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Kenneth Matotoka

Your Ref: 556/18
Our Ref: PL/24422c
Date Reported: 04.02.2019

PROPERTIES OF AGGREGATE AND SAND

Test description	Sample Description Source Additional Info Client Ref No	Test method	Lab no UOM	A9/052	A9/053	A9/054	A9/055
				Alluvium TP4/1 (0-1700) G19-0017	Nodular Ferricrete TP6/1 (400-1700) G19-0018	Residual Andesite TP8/1 (1000-1800) G19-0019	Residual Andesite TP8/2 (1800-3000) G19-0020
Clay Content		SANS 6244	%	23.7	23.2	30.7	14.6

Remarks: Sampled by client.

Test covered, not part of scope of accreditation

for SGS Matrolab (Pty) Ltd. Technical Signatory: B. van Niekerk/L. Breitling

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 Tel. : 012-800 1299
 Fax. : 012-800 3034
 Email : lizette.breiting@sgs.com

TEST RESULTS

CLIENT: KNIGHT PIESOLD CONSULTING
 ADDRESS: P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Kenneth Matotoka

Project: Karee Rand Diversion (301-00204/13)

Your Ref: 556/18
 Our Ref: PL/24422d

Date Reported: 04.02.2019

PROPERTIES OF AGGREGATE AND SAND

Test description	Sample Description Source Additional Info Client Ref No	Test method	Lab no UOM	A9/056 Residual Andesite TP9/1 (600-1900) G19-0021	A9/058 Colluvium TP14/1 (100-1500) G19-0023	A9/059 Residual Andesite TP14/2 (1500-3100) G19-0024	A9/060 Residual Andesite TP16/1 (1000-2700) G19-0025
Clay Content		SANS 6244	%	23.9	29.5	8.5	5.3

Remarks: Sampled by client.

Test covered, not part of scope of accreditation

for SGS Matrolab (Pty) Ltd. Technical Signatory: B. van Niekerk/L. Breiting

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Tel. : 012-800 1299
Fax. : 012-800 3034
Email : lizette.breiting@sgs.com

TEST RESULTS

CLIENT: KNIGHT PIESOLD CONSULTING
ADDRESS: P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Kenneth Matotoka

Project: Karee Rand Diversion (301-00204/13)
Your Ref: 556/18
Our Ref: PL/24422a
Date Reported: 17.01.2019

PROPERTIES OF AGGREGATE AND SAND

Test description	Sample Description Source Additional Info Client Ref No	Test method	Lab no UOM	A9/065 Fill BTP19/1 G19-0030			
Organic Impurities		SANS 5832	L/S/D	Darker than ref.solution			

Remarks: Sampled by client.

Test covered, not part of scope of accreditation

for SGS Matrolab (Pty) Ltd. Technical Signatory: B. van Niekerk/L. Breiting

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TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

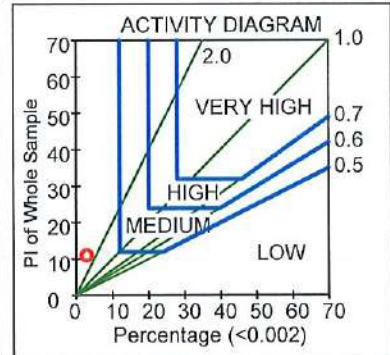
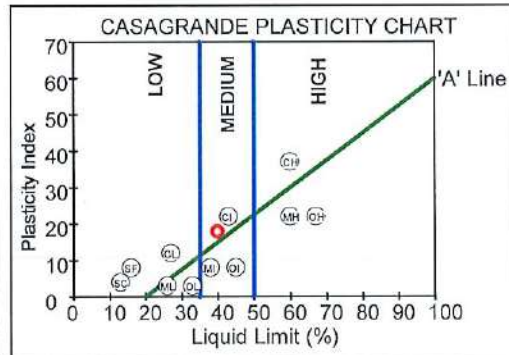
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 18.02.2019

FOUNDATION INDICATOR (ASTM: D422)

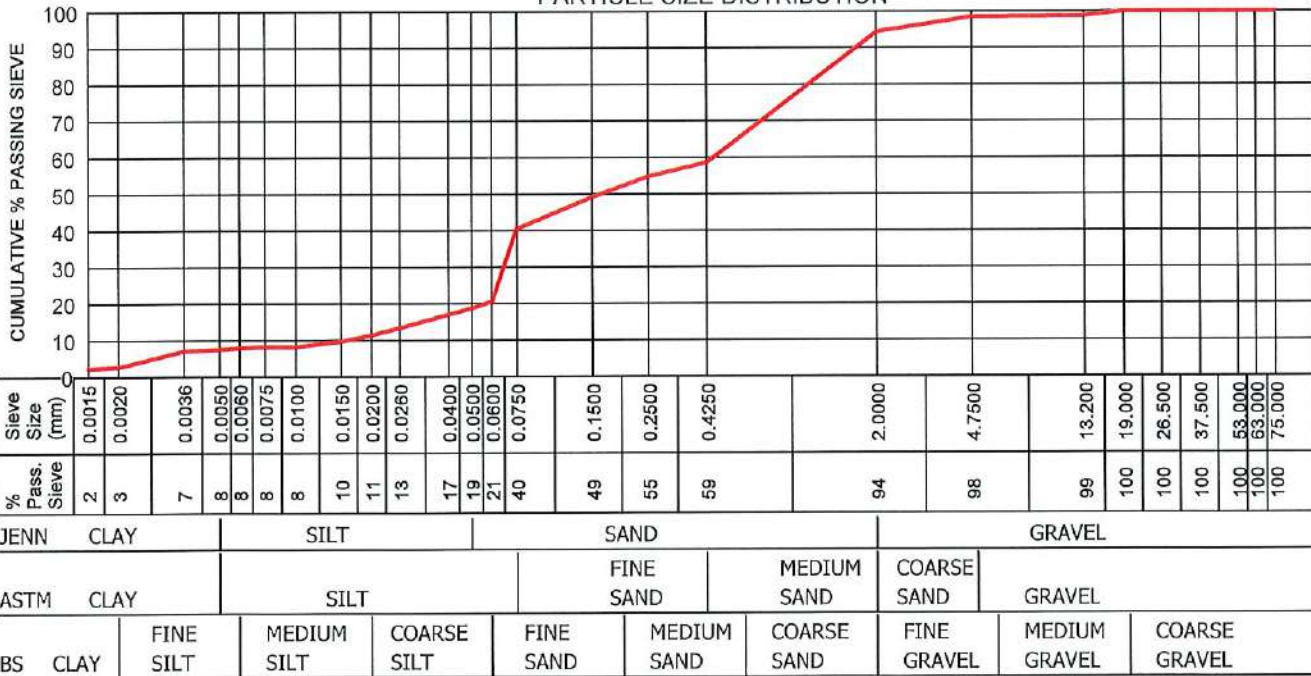
Sample No. : G19-0022(057)
 Hole No. : TP11/1
 Depth : 1800-3000
 Liquid Limit (%) : 40
 Plasticity Index : 18
 Linear Shrinkage (%) : 8.0
 PI of Whole Sample : 11
 P.R.A. Classification : A-6(3)
 Unified Soil Classificati: SC
 Activity : 3.67
 Heave Classification : LOW
 Grading Modulus : 1.07
 Percentage (<0.002) : 3.0
 Moisture Content (%) : 22.1

Material Description : Residual Dolerite SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	7.6	11.2	75.7	5.6	SAND
Astm	7.6	32.8	58.1	1.6	SILTY SAND
British Standard	2.8	17.7	73.9	5.6	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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 - CIVIL ENGINEERING SERVICES -
 Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
 a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street, Jan Nieand Park, Pretoria.
 P.O Box 912307, Silverton, 0127
 Tel. : (012) 800 1299
 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

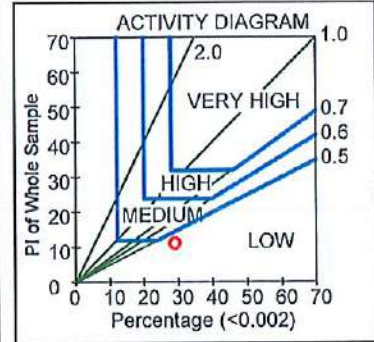
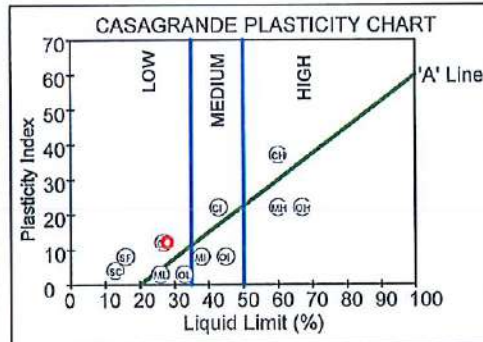
Project : Karee Rand Diversion (301-00204/13)

Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

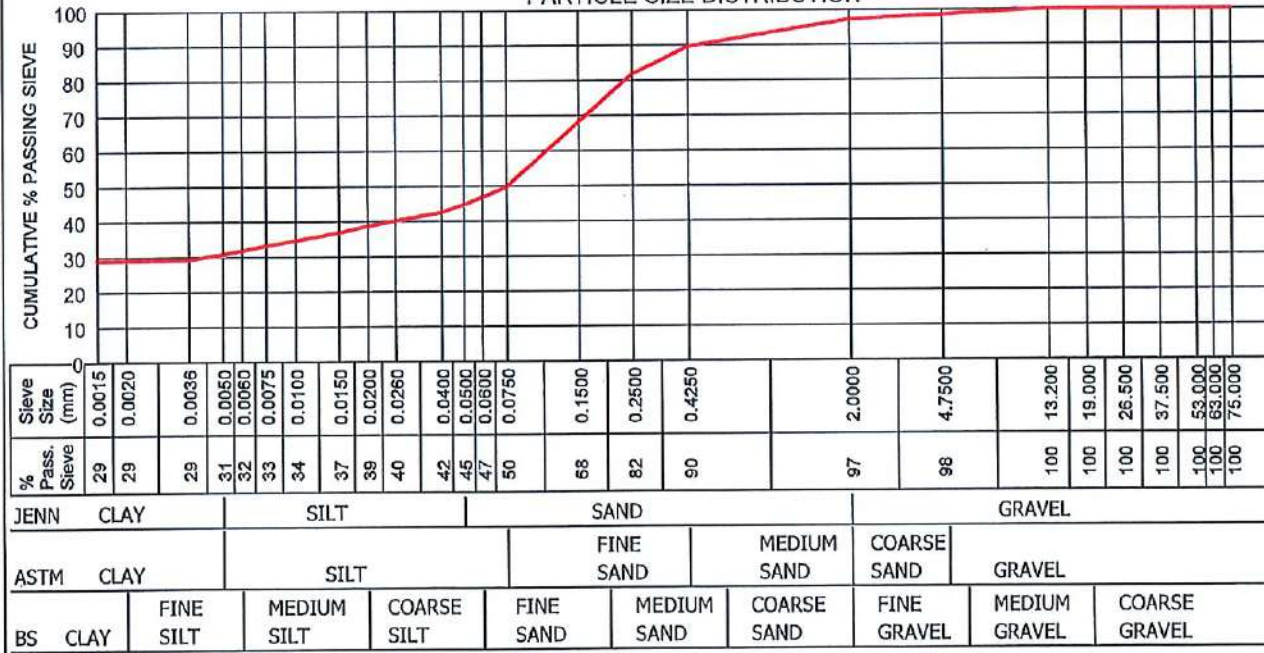
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0013(048)
 Hole No. : TP1/1
 Depth : 300-1300
 Liquid Limit (%) : 28
 Plasticity Index : 12
 Linear Shrinkage (%) : 5.0
 Pl of Whole Sample : 11
 P.R.A. Classification : A-6(4)
 Unified Soil Classificati: SC
 Activity : 0.38
 Heave Classification : LOW
 Grading Modulus : 0.63
 Percentage (<0.002) : 29.0
 Moisture Content (%) : 8.2

Material Description : Colluvium SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.6	14.0	52.6	2.8	SANDY CLAY
Astm	30.6	18.9	48.9	1.6	SANDY CLAY
British Standard	28.8	17.9	50.4	2.8	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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TEST RESULTS

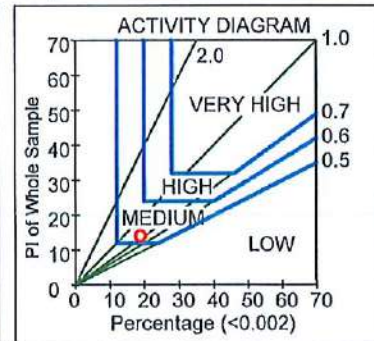
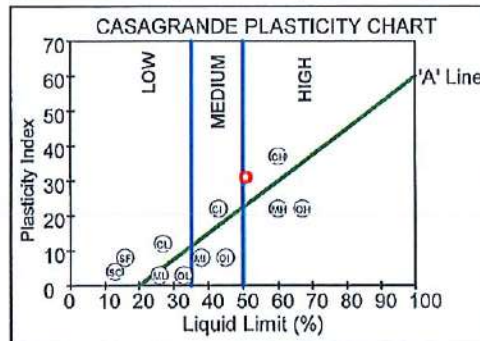
KNIGHT PIESOLD CONSULTING
P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)
Your Ref : 556/18
Our Ref : PLJ24422
Date Reported : 04.02.2019

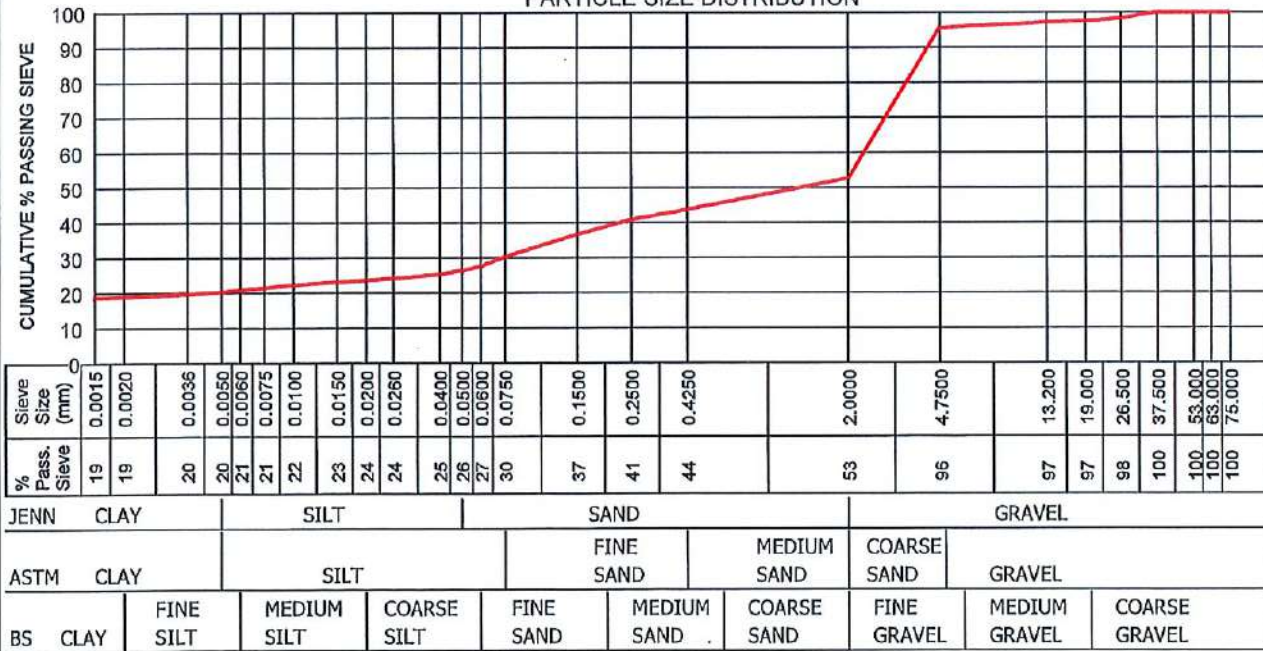
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0014(049)
Hole No. : TP1/2
Depth : 1300-3100
Liquid Limit (%) : 51
Plasticity Index : 31
Linear Shrinkage (%) : 13.5
PI of Whole Sample : 14
P.R.A. Classification : A-2-7(3)
Unified Soil Classification: SC
Activity : 0.74
Heave Classification : MEDIUM
Grading Modulus : 1.73
Percentage (<0.002) : 19.0
Moisture Content (%) : 16.4

Material Description : Ferruginised Colluvium CLAYEY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	20.3	6.0	26.2	47.4	SANDY CLAY
Astm	20.3	9.9	65.4	4.4	CLAYEY SAND
British Standard	19.0	8.5	25.1	47.4	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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TEST RESULTS

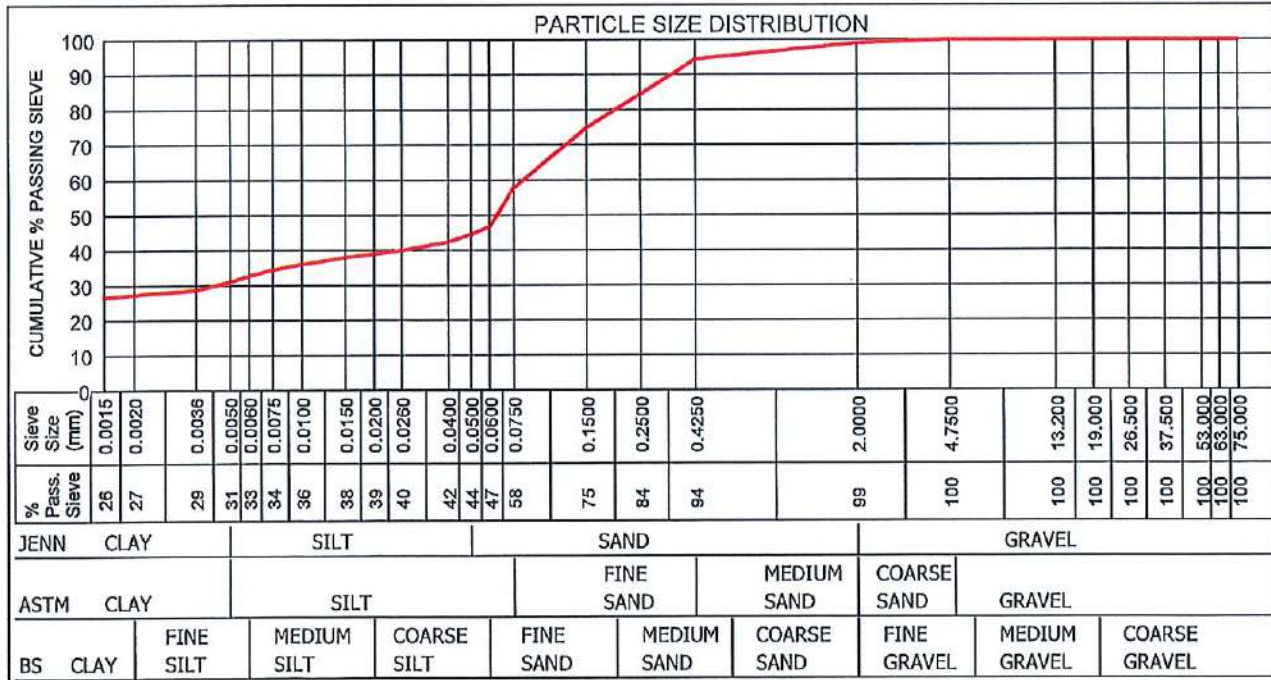
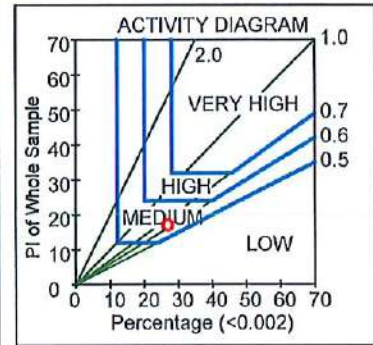
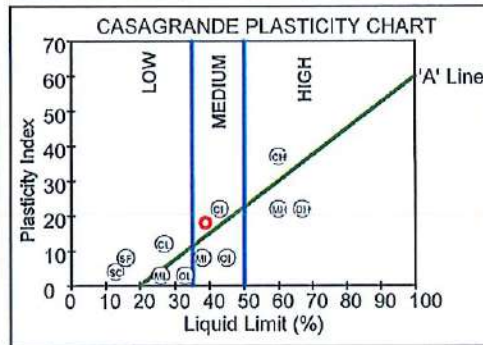
KNIGHT PIESOLD CONSULTING
P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)
Your Ref : 556/18
Our Ref : PL/24422
Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0015(050)
Hole No. : TP2/1
Depth : 0-2500
Liquid Limit (%) : 39
Plasticity Index : 18
Linear Shrinkage (%) : 8.5
PI of Whole Sample : 17
P.R.A. Classification : A-6(8)
Unified Soil Classificati: CL
Activity : 0.63
Heave Classification : MEDIUM
Grading Modulus : 0.49
Percentage (<0.002) : 27.0
Moisture Content (%) : 13.3

Material Description : Alluvium SANDY CLAY					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.9	13.6	54.5	1.0	SANDY CLAY
Astm	30.9	26.6	42.5	0.0	SANDY CLAY
British Standard	27.3	19.5	52.2	1.0	CLAYEY SAND



Remarks : Sampled by client.

FORM: A6

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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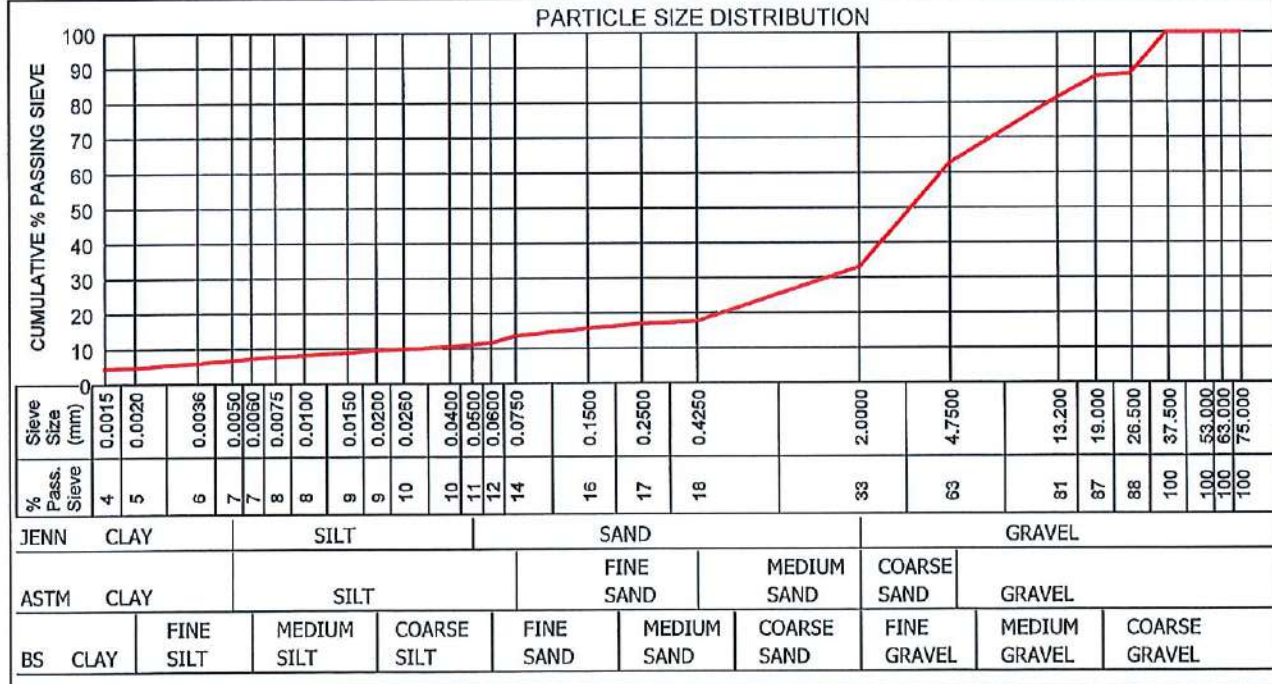
TEST RESULTS

KNIGHT PIESOLD CONSULTING P.O BOX 72292 LYNNWOOD RIDGE 0040 Attention: Mr Keneth Matokoka	Project : Karee Rand Diversion (301-00204/13) Your Ref : 556/18 Our Ref : PL/24422 Date Reported : 04.02.2019
---	--

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0016(051) Hole No. : TP3/1 Depth : 1400-3100 Liquid Limit (%) : 60 Plasticity Index : 27 Linear Shrinkage (%) : 10.0 Pl of Whole Sample : 5 P.R.A. Classification : A-2-7(0) Unified Soil Classificati: SM Activity : 1.00 Heave Classification : LOW Grading Modulus : 2.35 Percentage (<0.002) : 5.0 Moisture Content (%) : 23.3	Material Description : Alluvium SILTY SAND <table border="1"> <thead> <tr> <th></th> <th>Clay (%)</th> <th>Silt (%)</th> <th>Sand (%)</th> <th>Gravel (%)</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Jennings</td> <td>6.7</td> <td>4.3</td> <td>22.1</td> <td>66.9</td> <td>CLAYEY SAND</td> </tr> <tr> <td>Astm</td> <td>6.7</td> <td>6.8</td> <td>49.1</td> <td>37.4</td> <td>SILTY SAND</td> </tr> <tr> <td>British Standard</td> <td>4.7</td> <td>7.0</td> <td>21.5</td> <td>66.9</td> <td>SILTY SAND</td> </tr> </tbody> </table>		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification	Jennings	6.7	4.3	22.1	66.9	CLAYEY SAND	Astm	6.7	6.8	49.1	37.4	SILTY SAND	British Standard	4.7	7.0	21.5	66.9	SILTY SAND
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification																				
Jennings	6.7	4.3	22.1	66.9	CLAYEY SAND																				
Astm	6.7	6.8	49.1	37.4	SILTY SAND																				
British Standard	4.7	7.0	21.5	66.9	SILTY SAND																				

PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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TEST RESULTS

KNIGHT PIESOLD CONSULTING
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 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

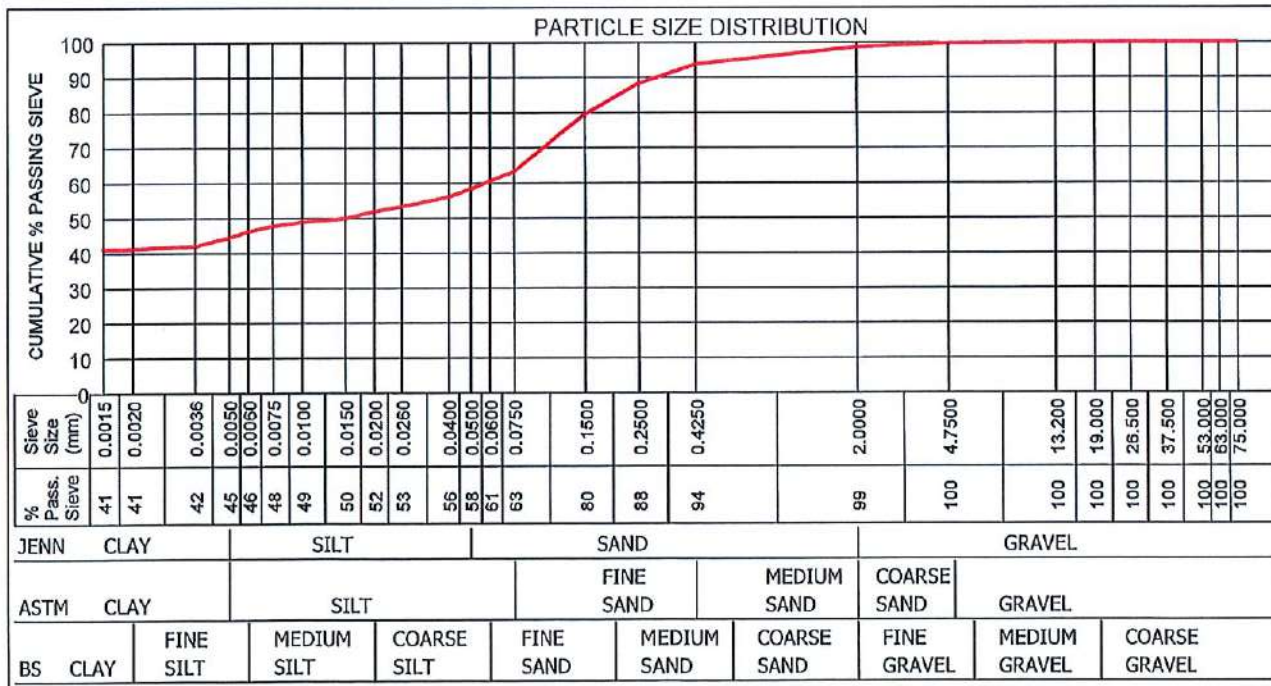
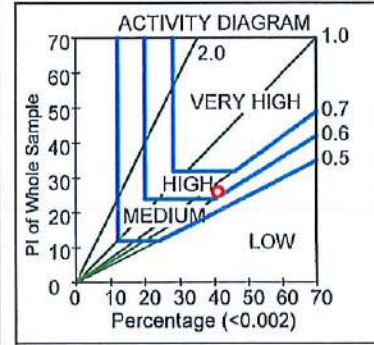
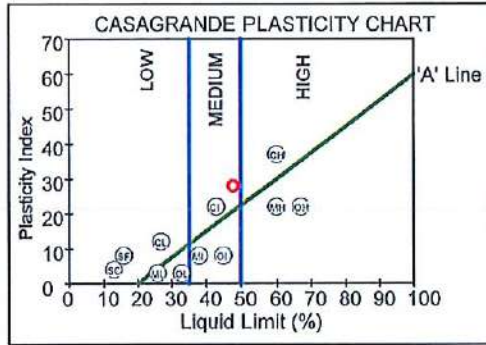
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0017(052)
 Hole No. : TP4/1
 Depth : 0-1700
 Liquid Limit (%) : 48
 Plasticity Index : 28
 Linear Shrinkage (%) : 10.5
 PI of Whole Sample : 26
 P.R.A. Classification : A-7-6(14)
 Unified Soil Classificati: CL
 Activity : 0.63
 Heave Classification : HIGH
 Grading Modulus : 0.44
 Percentage (<0.002) : 41.0
 Moisture Content (%) : 12.1

Material Description : Alluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	44.5	13.8	40.3	1.4	SANDY CLAY
Astm	44.5	18.6	36.5	0.3	SANDY CLAY
British Standard	41.4	19.3	38.0	1.4	SANDY CLAY



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TEST RESULTS

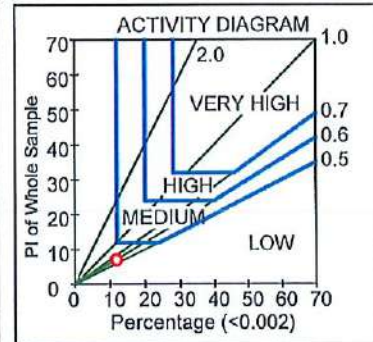
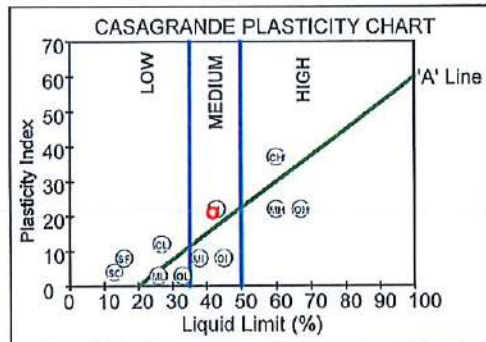
KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
 LYNNWOOD RIDGE
 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)
 Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

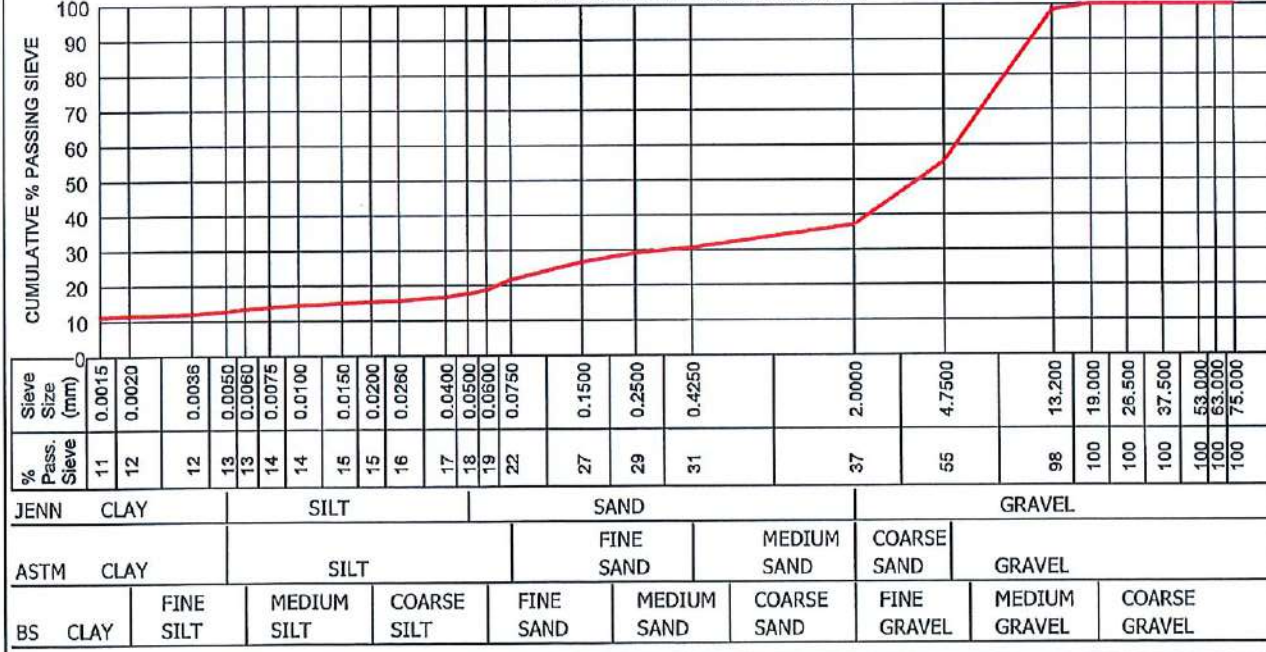
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0018(053)
 Hole No. : TP6/1
 Depth : 400-1700
 Liquid Limit (%) : 42
 Plasticity Index : 21
 Linear Shrinkage (%) : 9.5
 PI of Whole Sample : 7
 P.R.A. Classification : A-2-7(1)
 Unified Soil Classificati: SC
 Activity : 0.58
 Heave Classification : LOW
 Grading Modulus : 2.10
 Percentage (<0.002) : 12.0
 Moisture Content (%) : 10.7

Material Description : Nodular Ferricrete CLAYEY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	12.8	4.9	19.5	62.9	SANDY CLAY
Aslm	12.8	8.7	33.5	45.0	CLAYEY SAND
British Standard	11.5	7.2	18.4	62.9	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



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TEST RESULTS

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 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

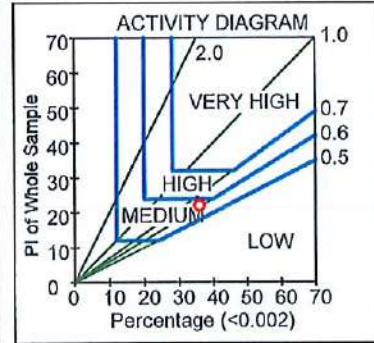
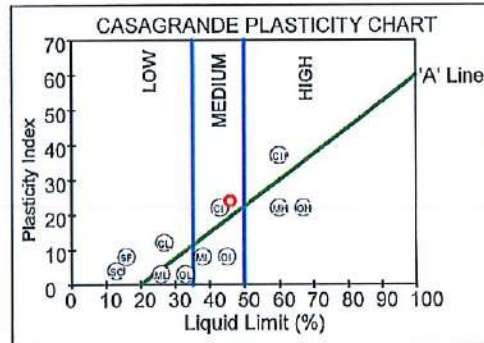
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

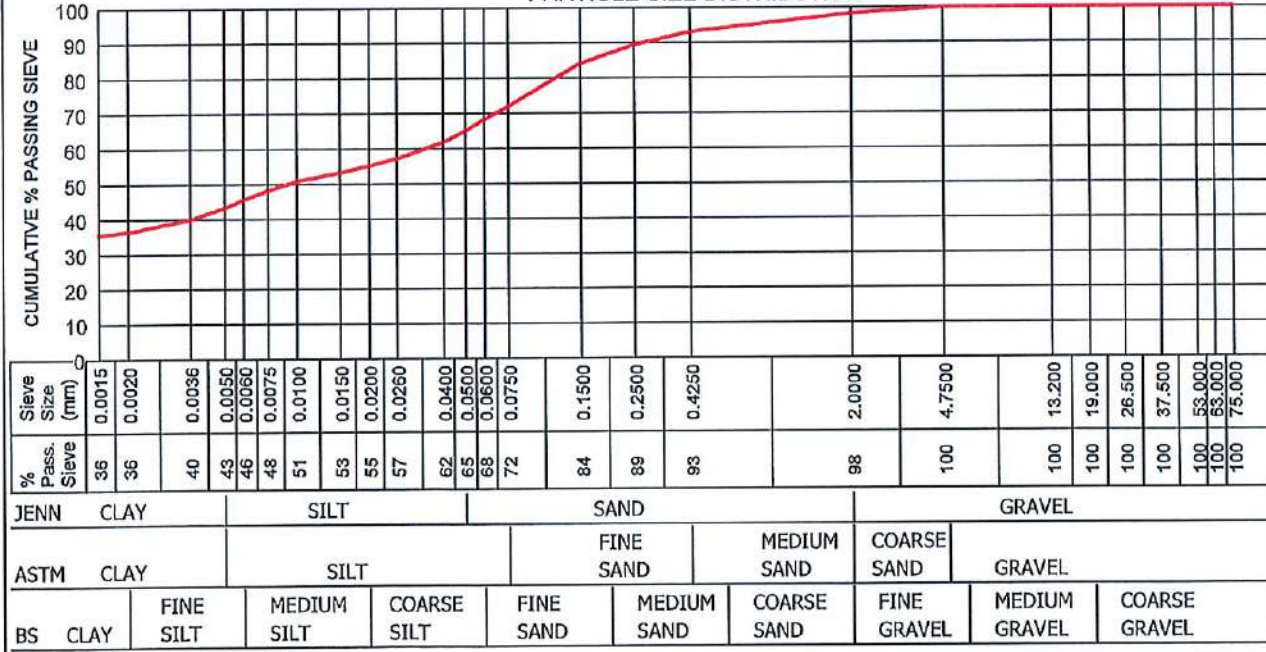
Sample No. : G19-0019(054)
 Hole No. : TP8/1
 Depth : 1000-1800
 Liquid Limit (%) : 46
 Plasticity Index : 24
 Linear Shrinkage (%) : 11.5
 Pl of Whole Sample : 22
 P.R.A. Classification : A-7-6(14)
 Unified Soil Classificati: CL
 Activity : 0.61
 Heave Classification : MEDIUM
 Grading Modulus : 0.37
 Percentage (<0.002) : 36.0
 Moisture Content (%) : 19.2

Material Description : Residual Andesite SILTY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	43.2	21.7	33.2	1.9	SANDY CLAY
Astm	43.2	28.6	28.0	0.3	SILTY CLAY
British Standard	36.4	31.9	29.9	1.9	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



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TEST RESULTS

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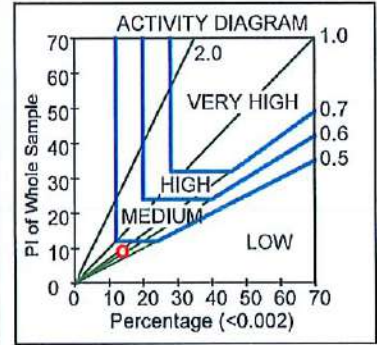
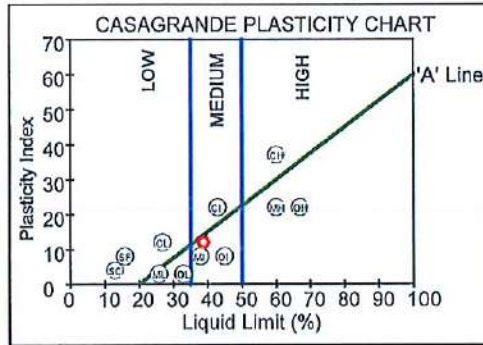
Project : Karee Rand Diversion (301-00204/13)

Your Ref : 556/18
Our Ref : PL/24422
Date Reported : 04.02.2019

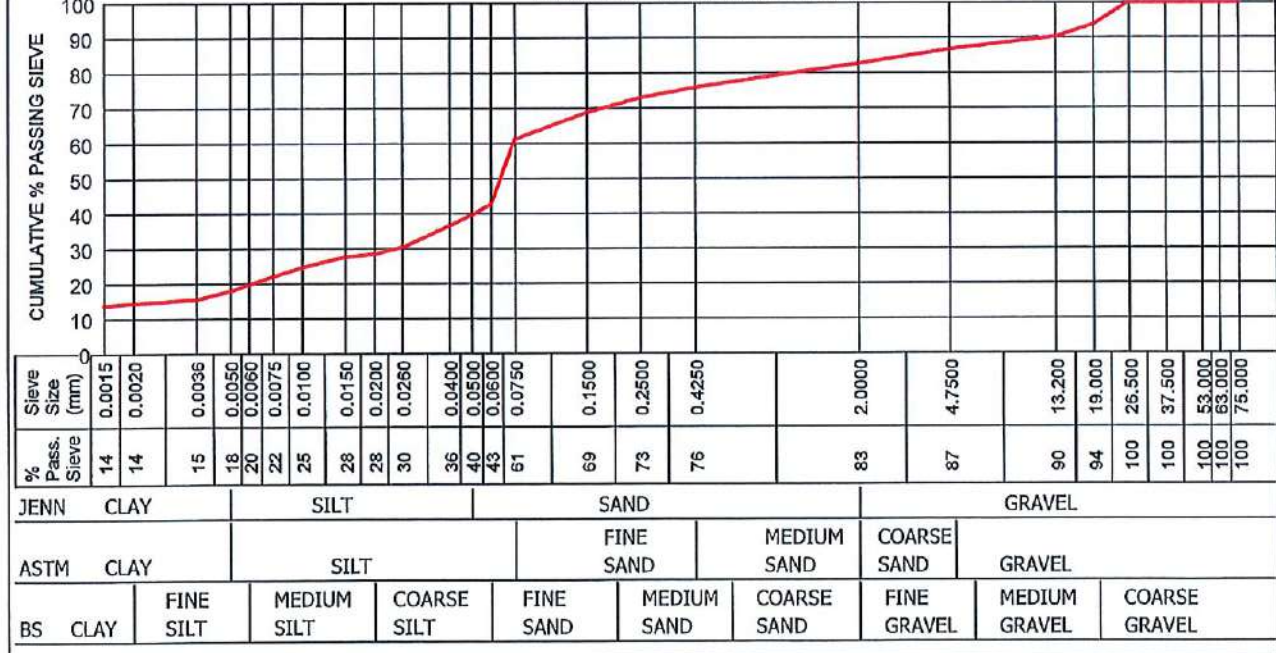
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0020(055)
Hole No. : TP8/2
Depth : 1800-3000
Liquid Limit (%) : 39
Plasticity Index : 12
Linear Shrinkage (%) : 5.5
PI of Whole Sample : 9
P.R.A. Classification : A-6(6)
Unified Soil Classificati: ML
Activity : 0.64
Heave Classification : LOW
Grading Modulus : 0.80
Percentage (<0.002) : 14.0
Moisture Content (%) : 19.1

Material Description : Residual Andesite CLAYEY SILT					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	18.0	21.6	43.1	17.3	CLAYEY SAND
Astm	18.0	43.1	25.6	13.3	CLAYEY SILT
British Standard	14.4	28.3	39.9	17.3	SILTY SAND



PARTICLE SIZE DISTRIBUTION



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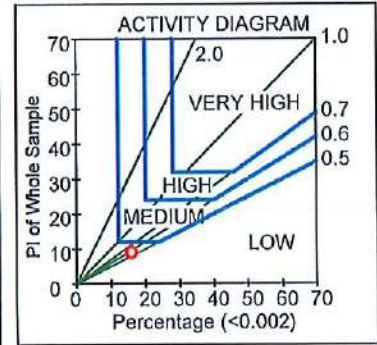
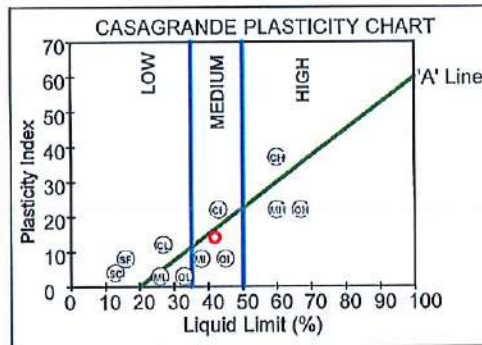
Project : Karee Rand Diversion (301-00204/13)

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 Our Ref : PL/24422
 Date Reported : 04.02.2019

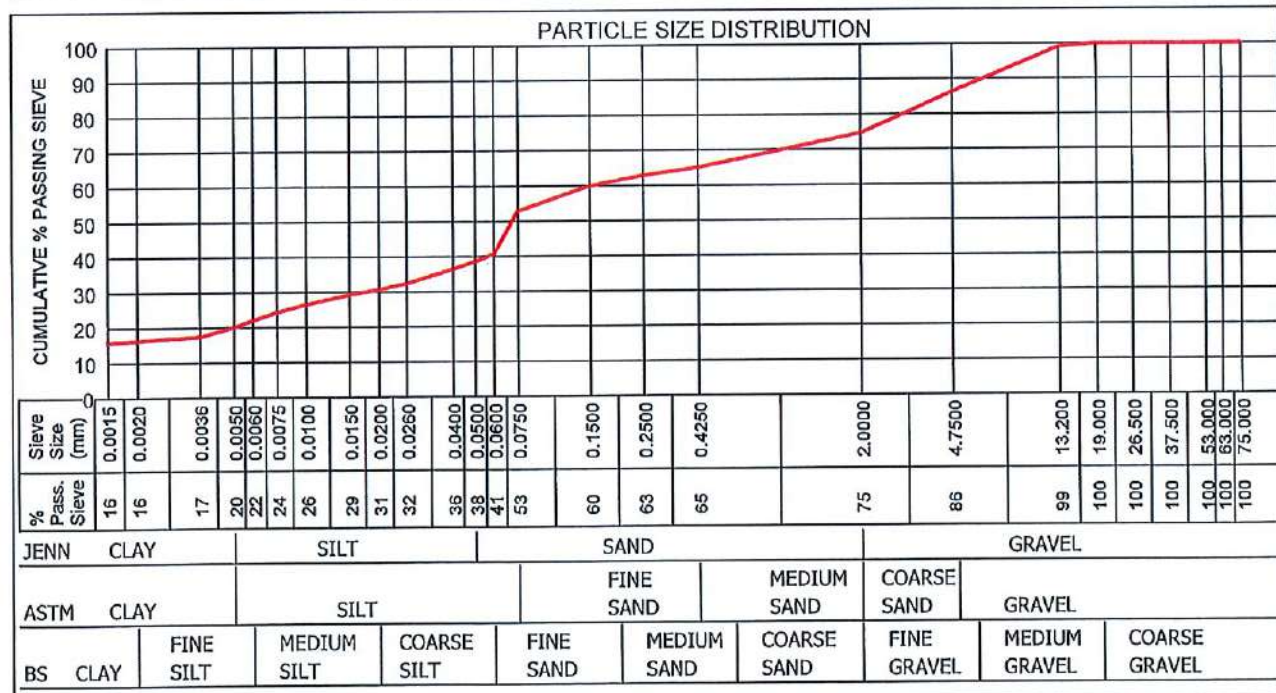
FOUNDATION INDICATOR (ASTM: D422)

Sample No. : G19-0021(056)
 Hole No. : TP9/1
 Depth : 600-1900
 Liquid Limit (%) : 42
 Plasticity Index : 14
 Linear Shrinkage (%) : 5.5
 PI of Whole Sample : 9
 P.R.A. Classification : A-7-6(5)
 Unified Soil Classification: ML
 Activity : 0.56
 Heave Classification : LOW
 Grading Modulus : 1.07
 Percentage (<0.002) : 16.0
 Moisture Content (%) : 33.5

Material Description : Residual Andesite CLAYEY SAND					
	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	20.0	18.4	36.2	25.4	CLAYEY SAND
Astm	20.0	32.6	33.6	13.8	CLAYEY SAND
British Standard	16.2	24.4	34.0	25.4	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



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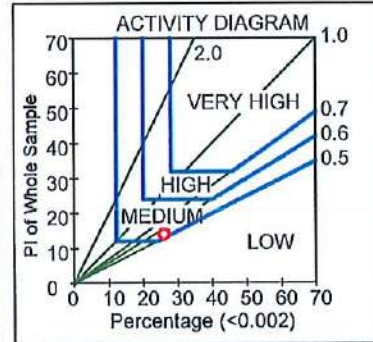
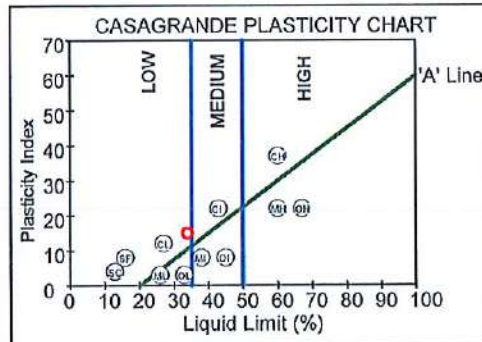
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

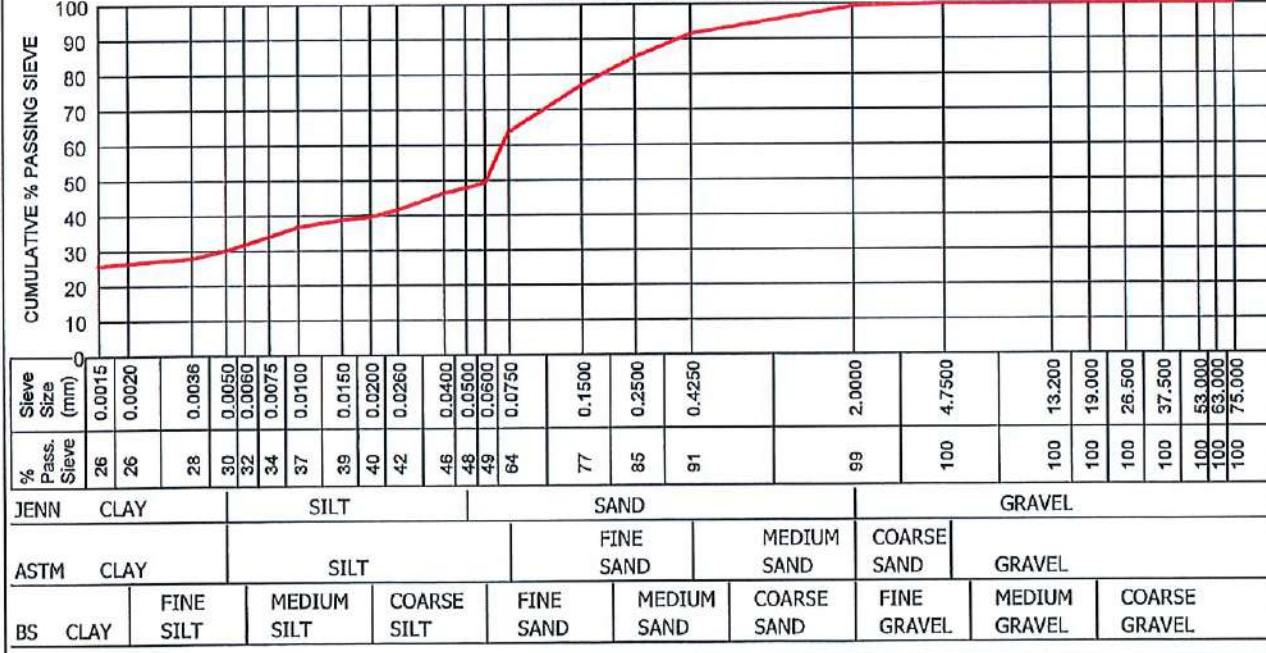
Sample No. : G19-0023(058)
 Hole No. : TP14/1
 Depth : 100-1500
 Liquid Limit (%) : 34
 Plasticity Index : 15
 Linear Shrinkage (%) : 7.0
 Pl of Whole Sample : 14
 P.R.A. Classification : A-6(8)
 Unified Soil Classificat: CL
 Activity : 0.54
 Heave Classification : MEDIUM
 Grading Modulus : 0.46
 Percentage (<0.002) : 26.0
 Moisture Content (%) : 13.6

Material Description : Colluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	30.0	17.7	51.5	0.8	SANDY CLAY
Astm	30.0	33.5	36.5	0.0	SANDY CLAY
British Standard	26.4	22.7	50.0	0.8	CLAYEY SAND



PARTICLE SIZE DISTRIBUTION



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TEST RESULTS

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 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

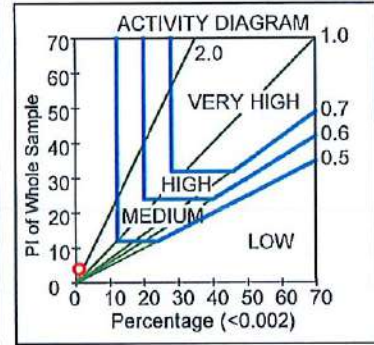
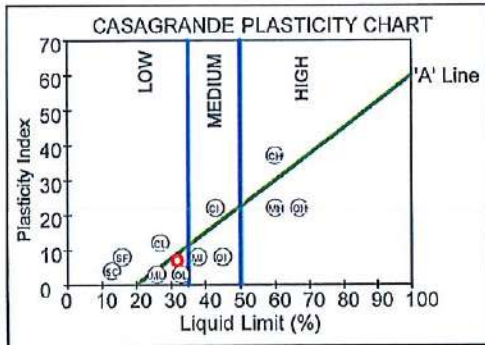
Your Ref : 556/18
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FOUNDATION INDICATOR (ASTM: D422)

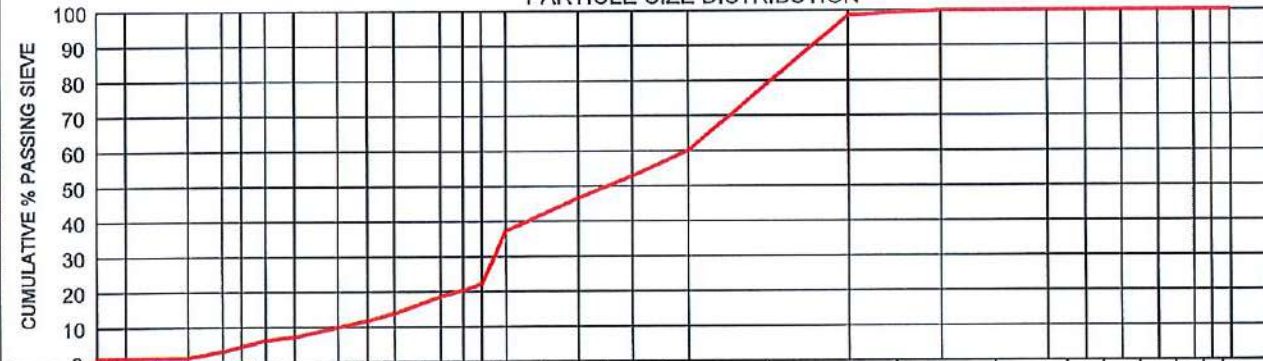
Sample No. : G19-0024(059)
 Hole No. : TP14/2
 Depth : 1500-3100
 Liquid Limit (%) : 32
 Plasticity Index : 7
 Linear Shrinkage (%) : 2.5
 PI of Whole Sample : 4
 P.R.A. Classification : A-4(0)
 Unified Soil Classificati: SM
 Activity : 4.00
 Heave Classification : LOW
 Grading Modulus : 1.04
 Percentage (<0.002) : 1.0
 Moisture Content (%) : 17.0

Material Description : Residual Dolerite SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	3.0	17.3	78.2	1.5	SILTY SAND
Astm	3.0	34.1	62.8	0.2	SILTY SAND
British Standard	1.2	20.9	76.4	1.5	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	1	1	1	3	4	6	7	10	12	14	18	20	22	37	47	53	60	99	100	100	100	100	100	100	100	100
JENN	CLAY		SILT				SAND										GRAVEL									
ASTM	CLAY		SILT				FINE SAND		MEDIUM SAND		COARSE SAND		COARSE SAND			GRAVEL										
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT		FINE SAND	MEDIUM SAND	COARSE SAND		FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL														

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 0040
 Attention: Mr Keneth Matokoka

Project : Karee Rand Diversion (301-00204/13)

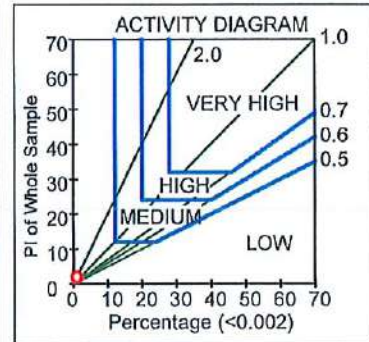
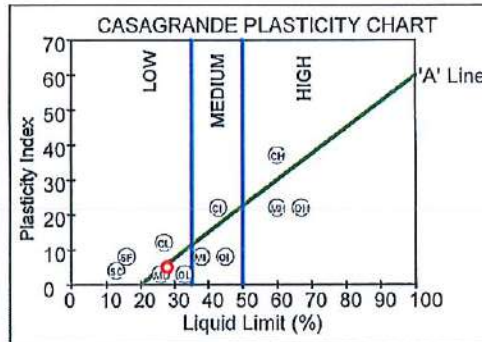
Your Ref : 556/18
 Our Ref : PL/24422
 Date Reported : 04.02.2019

FOUNDATION INDICATOR (ASTM: D422)

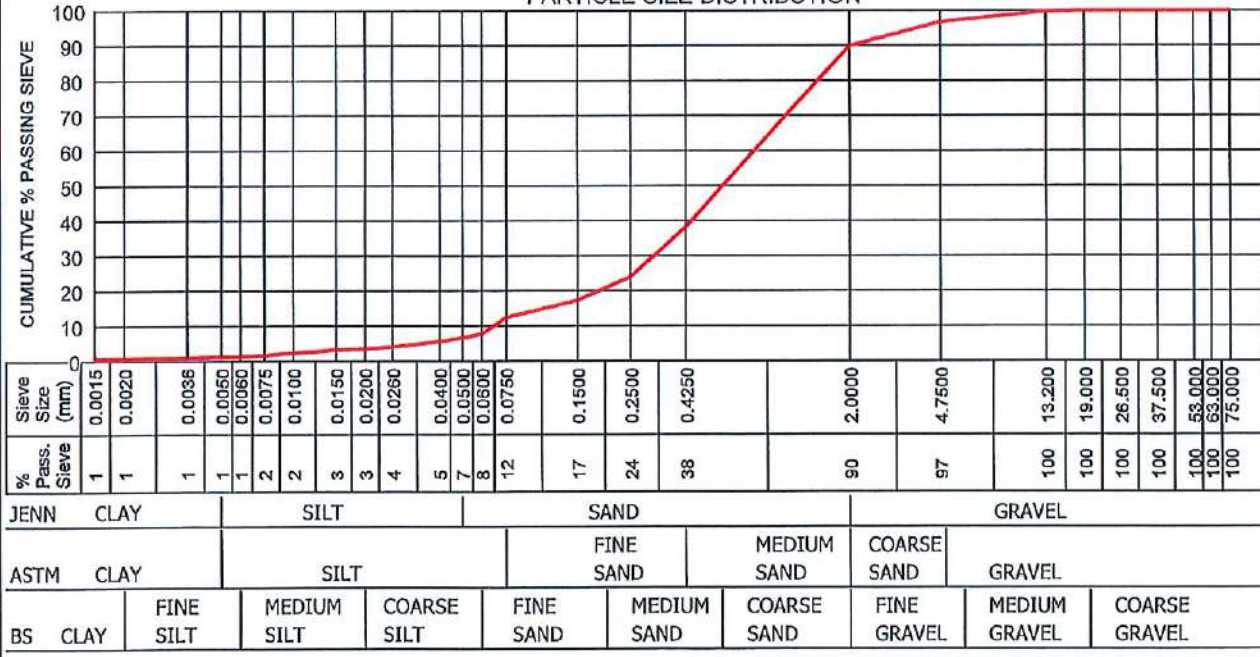
Sample No. : G19-0025(060)
 Hole No. : TP16/1
 Depth : 1000-2700
 Liquid Limit (%) : 28
 Plasticity Index : 5
 Linear Shrinkage (%) : 2.0
 PI of Whole Sample : 2
 P.R.A. Classification : A-1-b(0)
 Unified Soil Classification: SW-SM
 Activity : 2.00
 Heave Classification : LOW
 Grading Modulus : 1.60
 Percentage (<0.002) : 1.0
 Moisture Content (%) : 9.1

Material Description : Residual Dolerite SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	1.0	5.5	83.4	10.1	SAND
Astm	1.0	11.3	84.3	3.3	SAND
British Standard	0.8	6.9	82.3	10.1	SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.

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Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No : 2019-S-34

Date Received : 09/01/2019
 Date Reported : 07/02/2019
 Page No. : of

MATERIALS TEST REPORT

Laboratory Number	A9/050			
Field Number	G19-0015			
Client Reference	556/18			
Depth (m)	0-2500			
Position	TP2/1			
Coordinates	X Y			
Description	Alluvium			
Additional information	Sampled by client			
Calcrete/Crushed Stabilizing Agent	Natural			

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100		
	75 mm	100		
	63 mm	100		
	50 mm	100		
	37.5 mm	100		
	28 mm	100		
	20 mm	100		
	14 mm	100		
	5 mm	100		
	2 mm	99		
	0.425 mm	93		
Grading Modulus	0.075 mm	57		
		0.51		

Soil Mortar Analysis

Coarse Sand	2.0-0.425	6		
Coarse Fine Sand	0.425-0.250	10		
Medium Fine Sand	0.250-0.150	10		
Fine Fine Sand	0.150-0.075	17		
Silt and Clay	<0.075	57		

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	39		
Plasticity Index	%	18		
Linear Shrinkage	%	8.5		

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1666		
Optimum Moisture	%	15.7		

CBR SANS 3001: GR40

UCS

ITS

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
	@ 98%	2.5										
	@ 97%	2.3										
	@ 95%	1.8										
	@ 93%	1.5										
	@ 90%	1.1										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort	4.6											

Classifications

HRB	A-6(8)		
COLTO			
TRH14			

Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
 Project No. : 2019-S-34

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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/050	
Field Number	G19-0015	
Client Reference	556/18	
Depth (m)	0-2500	
Position	TP2/1	
Coordinates	X Y	
Description	Alluvium	
Additional information	Sampled by client	
Calcrete/Crushed Stabilizing Agent	Natural	

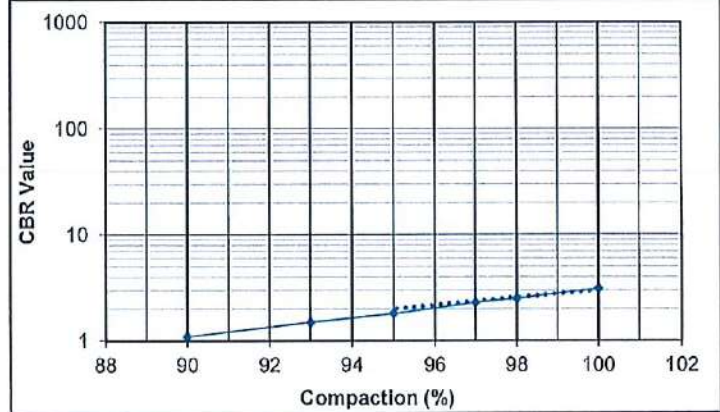
Laboratory No.	A9/050	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1666
OMC	%	15.7

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	16.8		
Dry Density	kg/m ³	1667	1584	1507
Compaction	%	100.0	95.0	90.4

Penetration Data				
CBR at	2.50 mm	3	2	1
	5.00 mm	3	2	1
	7.50 mm	2	2	1
Swell	%	4.6	5.5	5.6
Final Moisture (%)				

Sieve Analysis (Wet preparation) SANS 3001: GR1, GR2

Percentage Passing	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	100
	2 mm	99
	0.425 mm	93
	0.250 mm	84
	0.150 mm	74
	0.075 mm	57
Grading Modulus		0.5



Soil Mortar Analysis

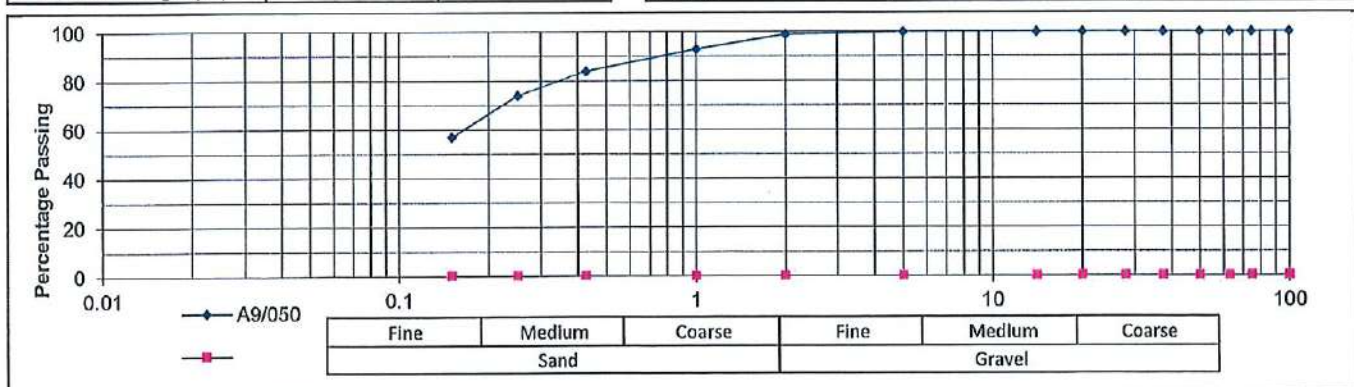
Coarse Sand	6
Coarse Fine Sand	10
Medium Fine Sand	10
Fine Fine Sand	17
Silt and Clay	57

Interpolated CBR Data		
CBR	@ 100%	3
	@ 98%	3
	@ 97%	2
	@ 95%	2
	@ 93%	2
	@ 90%	1
	@ SANS3001 Midpoint	2
	Mod. AASHTO	

Atterberg Limits SANS GR10, GR11, GR12

Liquid Limit (%)	39
Plasticity Index (%)	18
Linear Shrinkage (%)	8.5

Classifications	
HRB (AASHTO)	A-6(8)
COLTO	
TRH14	



Client	: KNIGHT PIESOLD (PTY) LTD	Date Received	: 09/01/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/051			
Field Number	G19-0016			
Client Reference	556/18			
Depth (m)	1400-3100			
Position	TP3/1			
Coordinates	X Y			
Description	Alluvium			
Additional information	Sampled by client			
Calcrete/Crushed Stabilizing Agent	Natural			

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	88			
	20 mm	87			
	14 mm	84			
	5 mm	74			
	2 mm	58			
	0.425 mm	49			
	0.075 mm	37			
Grading Modulus		1.56			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	16			
Coarse Fine Sand	0.425-0.250	5			
Medium Fine Sand	0.250-0.150	6			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	63			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	60			
Plasticity Index	%	27			
Linear Shrinkage	%	10			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1704			
Optimum Moisture	%	13			

CBR SANS 3001: GR40

UCS

ITS

Test Type	Interpolated Data	@100%	@98%	@97%	@95%	@93%	@90%	Mod. AASHTO	CBR	UCS	ITS	CBR	UCS	ITS	CBR	UCS	ITS
									(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)
									2.4								
									2.2								
									2								
									1.8								
									1.6								
									1.3								
									Value @ Mod. AASHTO effort								
									Swell (%) @ Mod. AASHTO effort	6.8							

Classifications

HRB	A-7-5(4)			
COLTO				
TRH14				

• SANAS Accredited Testing Laboratory No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
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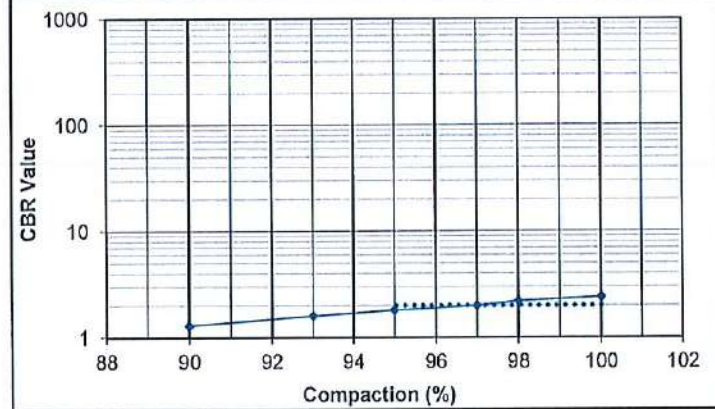
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/051
Field Number	G19-0016
Client Reference	556/18
Depth (m)	1400-3100
Position	TP3/1
Coordinates	X Y
Description	Alluvium
Additional information	Sampled by client
Calcrete/Crushed Stabilizing Agent	Natural

Laboratory No.	A9/051
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1704
OMC	% 13

California Bearing Ratio		SANS 3001: GR40	
Compaction Data			
Moisture	%	14.6	
Dry Density	kg/m ³	1682	1598 1512
Compaction	%	100.0	95.0 89.9
Penetration Data			
CBR at	2.50 mm	2	2 1
	5.00 mm	2	2 1
	7.50 mm	2	2 1
Swell	%	6.8	7.9 8.3
Final Moisture (%)			

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2	
Percentage Passing			
	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	88	
	20 mm	87	
	14 mm	84	
	5 mm	74	
	2 mm	58	
	0.425 mm	49	
	0.250 mm	46	
	0.150 mm	43	
	0.075 mm	37	
Grading Modulus		1.6	

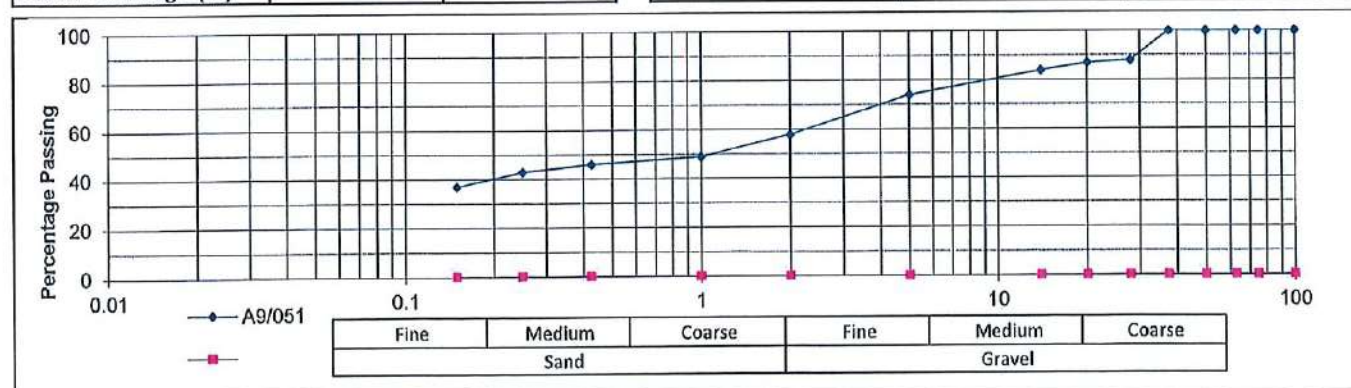


Interpolated CBR Data	
CBR	Mod. AASHTO
@ 100%	2
@ 98%	2
@ 97%	2
@ 95%	2
@ 93%	2
@ 90%	1
@ SANS3001 Midpoint	2

Soil Mortar Analysis	
Coarse Sand	16
Coarse Fine Sand	5
Medium Fine Sand	6
Fine Fine Sand	10
Silt and Clay	63

Atterberg Limits		SANS GR10, GR11, GR12	
Liquid Limit (%)	60		
Plasticity Index (%)	27		
Linear Shrinkage (%)	10.0		

Classifications	
HRB (AASHTO)	A-7-5(4)
COLTO	
TRH14	



**MATROLAB**

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a SANAS Accredited Testing Laboratory No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
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MATERIALS TEST REPORT

Laboratory Number	A9/056			
Field Number	G19-0021			
Client Reference	556/18			
Depth (m)	600-1900			
Position	TP9/1			
Coordinates	X Y			
Description	Residual Andesite			
Additional information	Sampled by client			
Calcrete/Crushed Stabilizing Agent	Natural			

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	99			
	5 mm	86			
	2 mm	74			
0.425 mm	64				
0.075 mm	52				
Grading Modulus		1.1			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	14			
Coarse Fine Sand	0.425-0.250	3			
Medium Fine Sand	0.250-0.150	4			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	70			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	42			
Plasticity Index	%	14			
Linear Shrinkage	%	5.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1671			
Optimum Moisture	%	14.7			

CBR SANS 3001: GR40**UCS****ITS**

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	1.9										
	@98%	1.7										
	@97%	1.7										
	@95%	1.6										
	@93%	1.4										
	@90%	1.3										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort	4.4											

Classifications

HRB	A-7-6(5)			
COLTO				
TRH14				

a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
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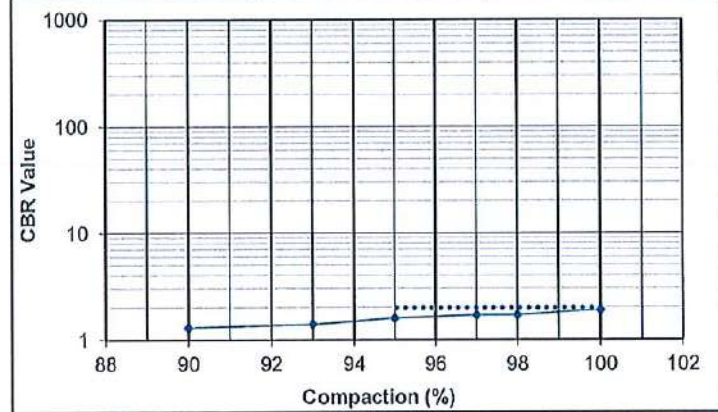
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/056	
Field Number	G19-0021	
Client Reference	556/18	
Depth (m)	600-1900	
Position	TP9/1	
Coordinates	X Y	
Description	Residual Andesite	
Additional information	Sampled by client	
Calcrete/Crushed		
Stabilizing Agent	Natural	

Laboratory No.	A9/056	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1671
OMC	%	14.7

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	13.5		
Dry Density	kg/m ³	1687	1601	1538
Compaction	%	100.0	94.9	91.2
Penetration Data				
CBR at	2.50 mm	2	2	1
	5.00 mm	2	2	1
	7.50 mm	2	2	1
Swell	%	4.4	4.7	5.2
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	100	
20 mm	100	
14 mm	99	
5 mm	86	
2 mm	74	
0.425 mm	64	
0.250 mm	62	
0.150 mm	59	
0.075 mm	52	
Grading Modulus	1.1	

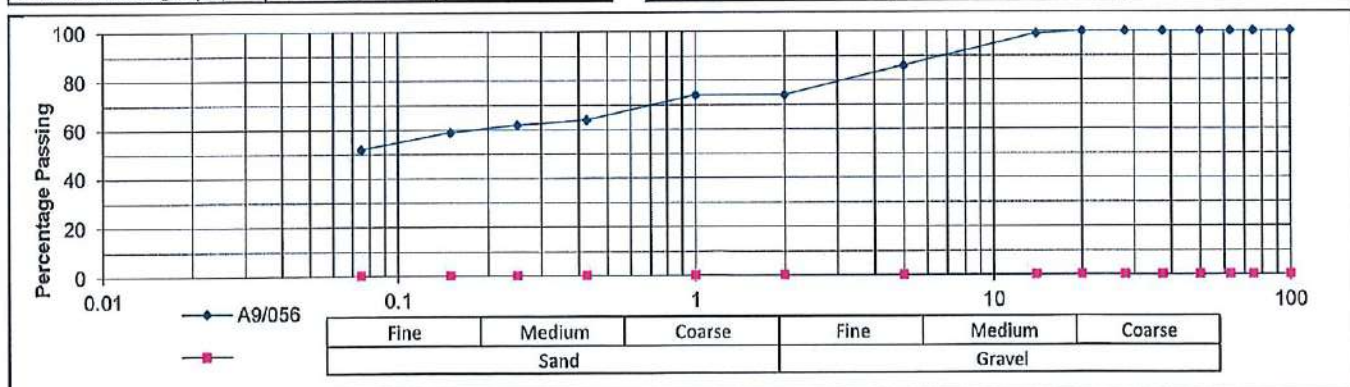


Soil Mortar Analysis	
Coarse Sand	14
Coarse Fine Sand	3
Medium Fine Sand	4
Fine Fine Sand	10
Silt and Clay	70

Interpolated CBR Data	
CBR	Mod. AASHTO
@ 100%	2
@ 98%	2
@ 97%	2
@ 95%	2
@ 93%	1
@ 90%	1
@ SANS3001 Midpoint	2

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)	42	
Plasticity Index (%)	14	
Linear Shrinkage (%)	5.5	

Classifications	
HRB (AASHTO)	A-7-6(5)
COLTO	
TRH14	



Client	: KNIGHT PIESOLD (PTY) LTD	Date Received	: 09/01/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/059		
Field Number	G19-0024		
Client Reference	556/18		
Depth (m)	1500-3100		
Position	TP14/2		
Coordinates	X Y		
Description	Residual Dolerite		
Additional information	Sampled by client		
Calcrete/Crushed Stabilizing Agent	Natural		

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	100			
	2 mm	99			
	0.425 mm	60			
0.075 mm	37				
Grading Modulus	1.04				

Soil Mortar Analysis

Coarse Sand	2.0-0.425	39			
Coarse Fine Sand	0.425-0.250	7			
Medium Fine Sand	0.250-0.150	6			
Fine Fine Sand	0.150-0.075	10			
Silt and Clay	<0.075	37			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	32			
Plasticity Index	%	7			
Linear Shrinkage	%	2.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1880			
Optimum Moisture	%	14.8			

CBR SANS 3001: GR40

UCS

ITS

Test Type		CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	5.9											
	@98%	4.7											
	@97%	4.2											
	@95%	3.4											
	@93%	2.7											
	@90%	2											
Value @ Mod. AASHTO effort													
Swell (%) @ Mod. AASHTO effort		4.5											

Classifications

HRB	A-4(0)		
COLTO			
TRH14			

Sanas Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
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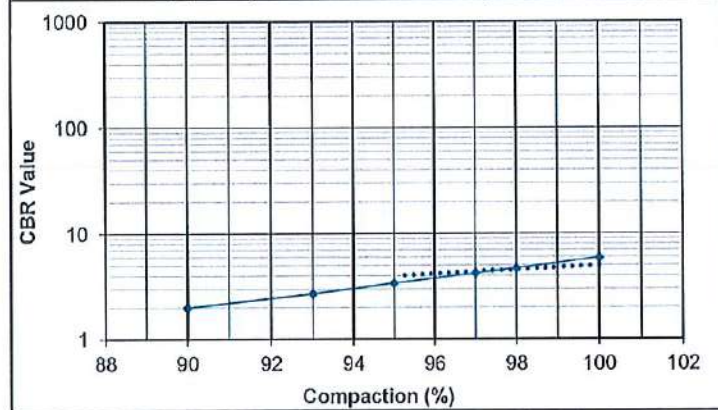
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/059
Field Number	G19-0024
Client Reference	556/18
Depth (m)	1500-3100
Position	TP14/2
Coordinates	X Y
Description	Residual Dolerite
Additional information	Sampled by client
Calcrete/Crushed Stabilizing Agent	Natural

Laboratory No.	A9/059
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1880
OMC	% 14.8

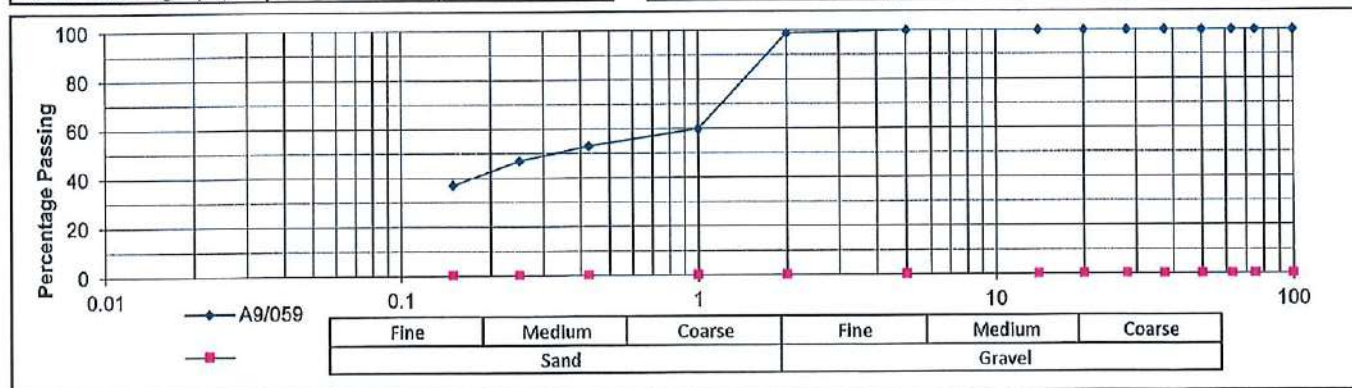
California Bearing Ratio		SANS 3001: GR40	
Compaction Data			
Moisture	%	13.8	
Dry Density	kg/m ³	1894	1802 1705
Compaction	%	100.0	95.1 90.0
Penetration Data			
CBR at	2.50 mm	5	4 2
	5.00 mm	5	3 2
	7.50 mm	5	3 1
Swell	%	4.5	5.8 7.7
Final Moisture (%)			

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2	
Percentage Passing			
	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	100	
	20 mm	100	
	14 mm	100	
	5 mm	100	
	2 mm	99	
	0.425 mm	60	
	0.250 mm	53	
	0.150 mm	47	
	0.075 mm	37	
Grading Modulus		1.0	



Soil Mortar Analysis	
Coarse Sand	39
Coarse Fine Sand	7
Medium Fine Sand	6
Fine Fine Sand	10
Silt and Clay	37

Atterberg Limits		SANS GR10,GR11,GR12	
Liquid Limit (%)	32		
Plasticity Index (%)	7		
Linear Shrinkage (%)	2.5		
HRB (AASHTO)		A-4(0)	
COLTO			
TRH14			



Client	: KNIGHT PIESOLD (PTY) LTD	Date Received	: 09/01/2019
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MATERIALS TEST REPORT

Laboratory Number	A9/060		
Field Number	G19-0025		
Client Reference	556/18		
Depth (m)	1000-2700		
Position	TP16/1		
Coordinates	X Y		
Description	Residual Dolerite		
Additional information	Sampled by client.		
Calcrete/Crushed Stabilizing Agent	Natural		

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	97			
	2 mm	90			
0.425 mm	38				
0.075 mm	12				
Grading Modulus		1.6			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	58		
Coarse Fine Sand	0.425-0.250	16		
Medium Fine Sand	0.250-0.150	7		
Fine Fine Sand	0.150-0.075	5		
Silt and Clay	<0.075	14		

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	28		
Plasticity Index	%	5		
Linear Shrinkage	%	2		

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1895		
Optimum Moisture	%	10.7		

CBR SANS 3001: GR40

UCS

ITS

Test Type		CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	41.6											
	@ 98%	27.8											
	@ 97%	22.7											
	@ 95%	15.2											
	@ 93%	10.1											
	@ 90%	5.5											
Value @ Mod. AASHTO effort													
Swell (%) @ Mod. AASHTO effort		0.2											

Classifications

HRB	A-1-b(0)		
COLTO	G8		
TRH14	G10		

SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
 Project : Karee Rand Diversion (301-00204/13)
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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	A9/060
Field Number	G19-0025
Client Reference	556/18
Depth (m)	1000-2700
Position	TP16/1
Coordinates	X Y
Description	Residual Dolerite
Additional information	Sampled by client.
Calcrete/Crushed Stabilizing Agent	Natural

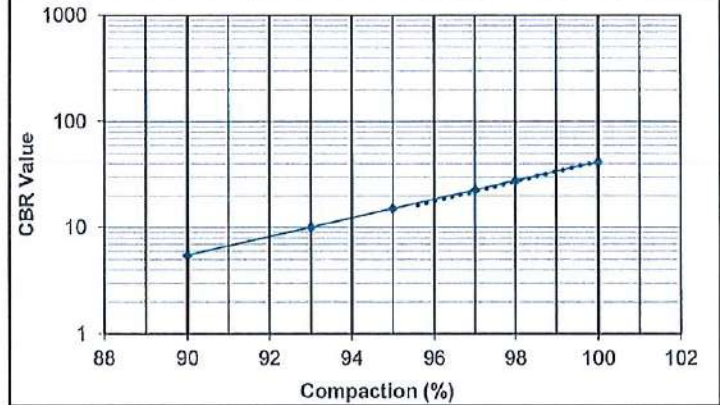
Laboratory No.	A9/060
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30
MDD	kg/m ³ 1895
OMC	% 10.7

California Bearing Ratio				SANS 3001: GR40
Compaction Data				
Moisture	%	11.4		
Dry Density	kg/m ³	1872	1788	1697
Compaction	%	100.0	95.5	90.7

Penetration Data				
CBR at	2.50 mm	42	16	6
	5.00 mm	50	15	6
	7.50 mm	48	15	5
Swell	%	0.2	0.4	0.7
Final Moisture (%)				

Sieve Analysis (Wet preparation) SANS 3001: GR1, GR2

Percentage Passing	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	97
	2 mm	90
	0.425 mm	38
	0.250 mm	24
	0.150 mm	17
	0.075 mm	12
Grading Modulus		1.6



Soil Mortar Analysis

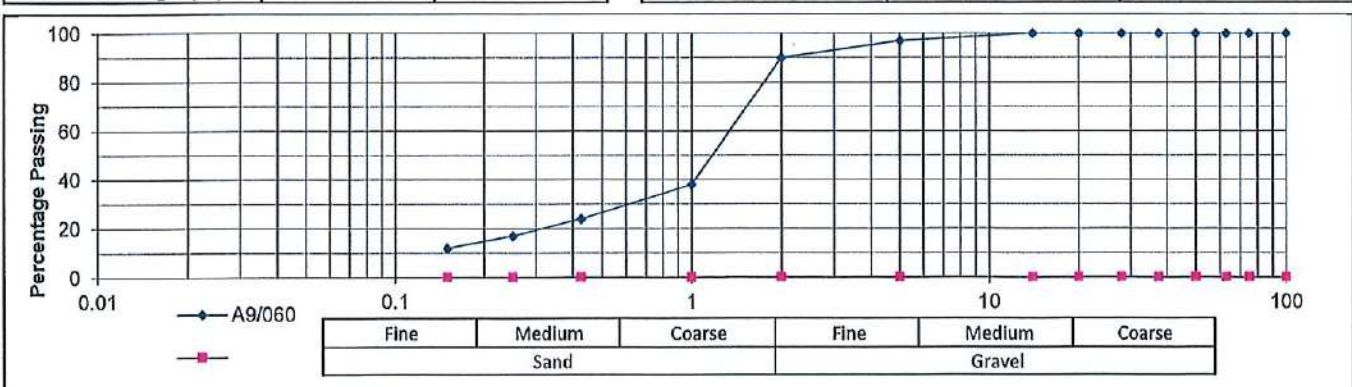
Coarse Sand	58
Coarse Fine Sand	16
Medium Fine Sand	7
Fine Fine Sand	5
Silt and Clay	14

Interpolated CBR Data	
CBR @	Mod. AASHTO
@ 100%	42
@ 98%	28
@ 97%	23
@ 95%	15
@ 93%	10
@ 90%	6
@ SANS3001 Midpoint	27

Atterberg Limits SANS GR10, GR11, GR12

Liquid Limit (%)	28
Plasticity Index (%)	5
Linear Shrinkage (%)	2.0

Classifications	
HRB (AASHTO)	A-1-b(0)
COLTO	G8
TRH14	G10





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E-mail: info@matrolab.co.za Website: www.matrolab.co.za
Reg No.: 2003/029180/07 - VAT Reg No.: 4040210587



a SANAS Accredited Testing Laboratory, No. T0025

Client : KNIGHT PIESOLD (PTY) LTD
Project :
Project No: 2019-S-34

Date Received: 09/01/2019
Date Reported: 17/01/2019
Page No. : of

MOISTURE DENSITY RELATIONSHIP

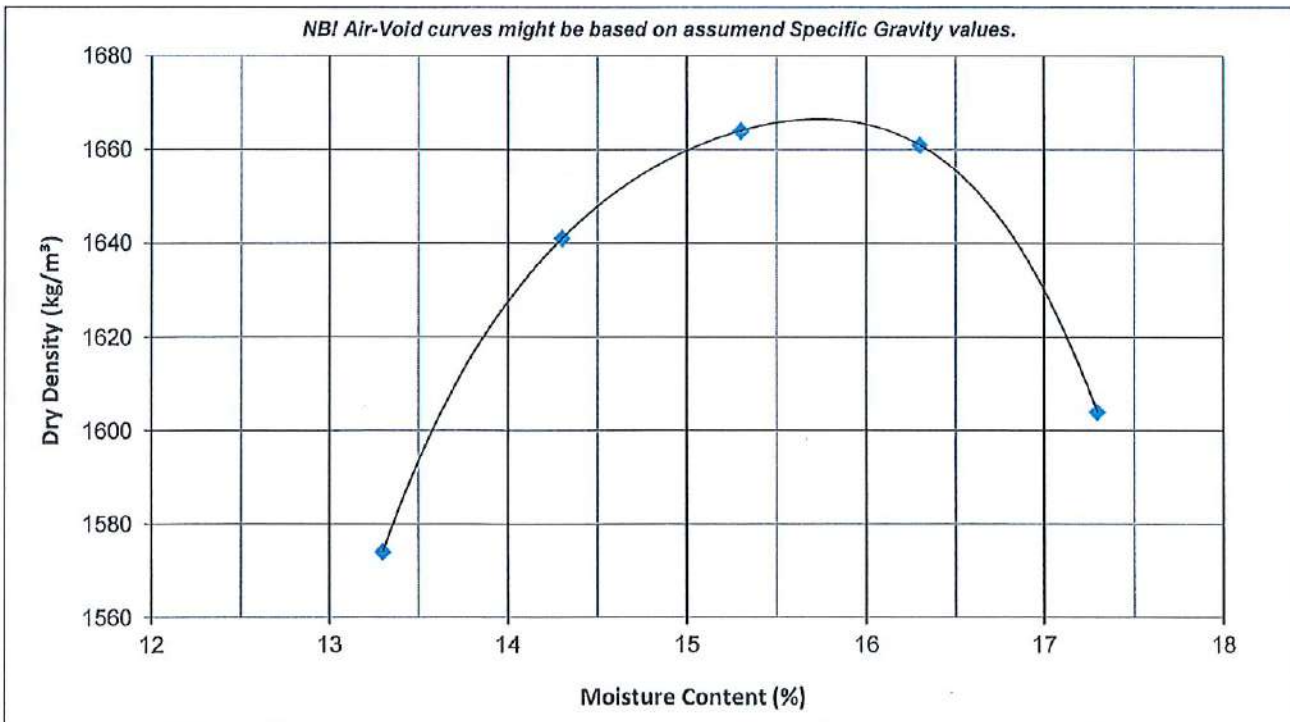
Laboratory Number	A9/050
Field Number	G19-0015
Client Reference	556/18
Depth (m)	0-2500
Position	TP2/1
Coordinates	X Y
Description	Alluvium
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1574	1641	1664	1661	1604
Moisture Content	%	13.3	14.3	15.3	16.3	17.3

Max. Dry Density	kg/m ³	1666
Optimum Moisture	%	15.7



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 Page No. : of

MOISTURE DENSITY RELATIONSHIP

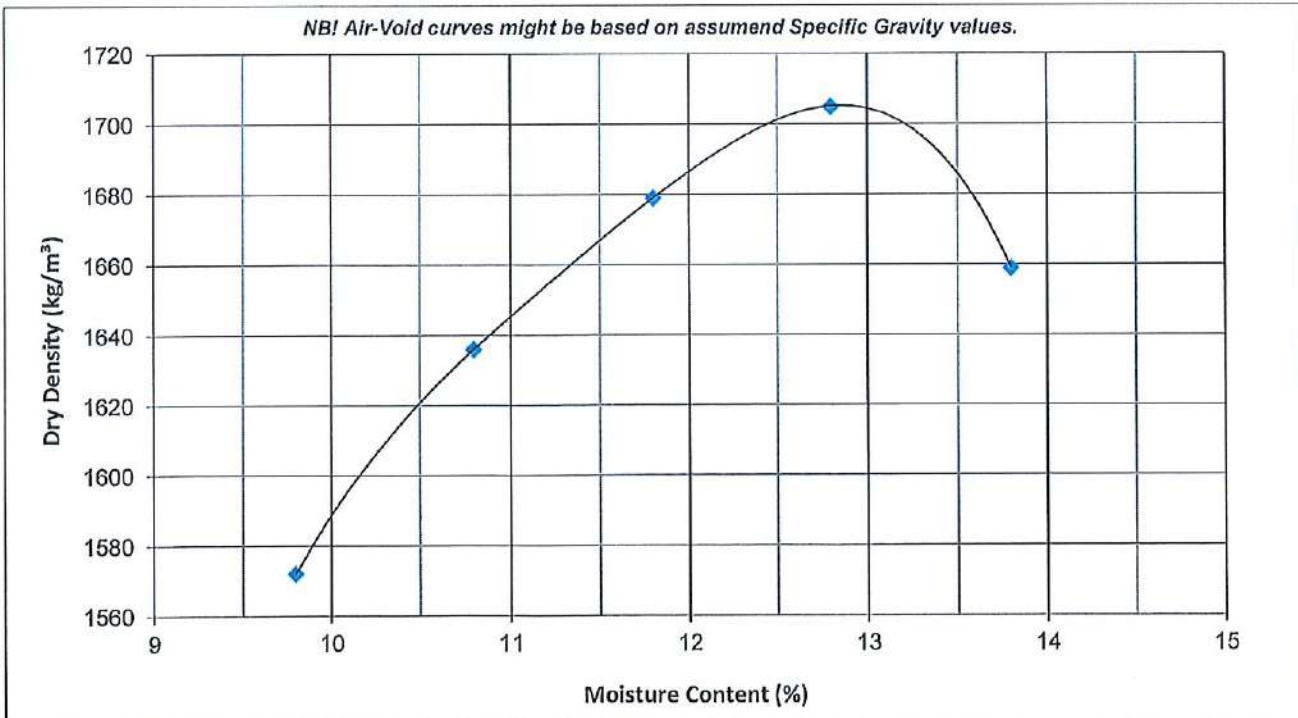
Laboratory Number	A9-051
Field Number	G19-0016
Client Reference	556/18
Depth (m)	1400-3100
Position	TP3/1
Coordinates	X Y
Description	Alluvium
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1572	1636	1679	1705	1659	
Moisture Content	%	9.8	10.8	11.8	12.8	13.8	

Max. Dry Density	kg/m ³	1704
Optimum Moisture	%	13



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MOISTURE DENSITY RELATIONSHIP

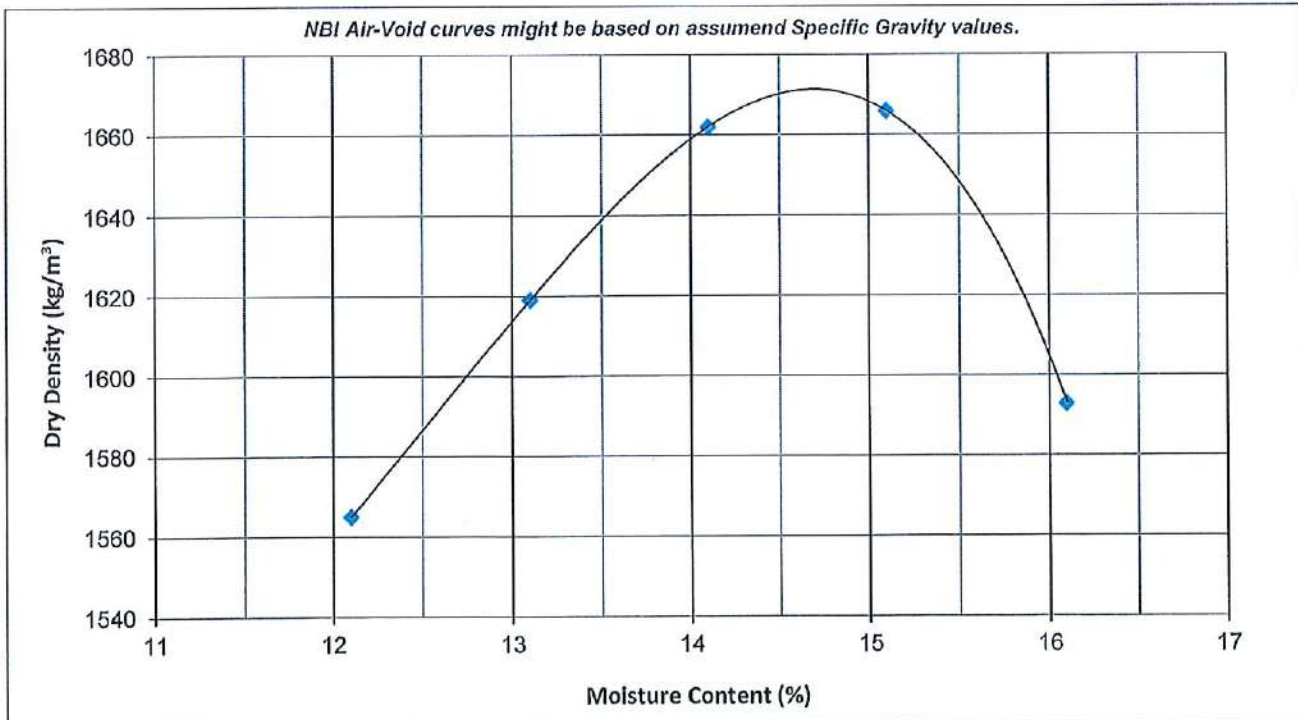
Laboratory Number	A9/056
Field Number	G19-0021
Client Reference	556/18
Depth (m)	600-1900
Position	TP9/1
Coordinates	X Y
Description	Residual Andesite
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1565	1619	1662	1666	1593
Moisture Content	%	12.1	13.1	14.1	15.1	16.1

Max. Dry Density	kg/m ³	1671
Optimum Moisture	%	14.7



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 Page No. : of

MOISTURE DENSITY RELATIONSHIP

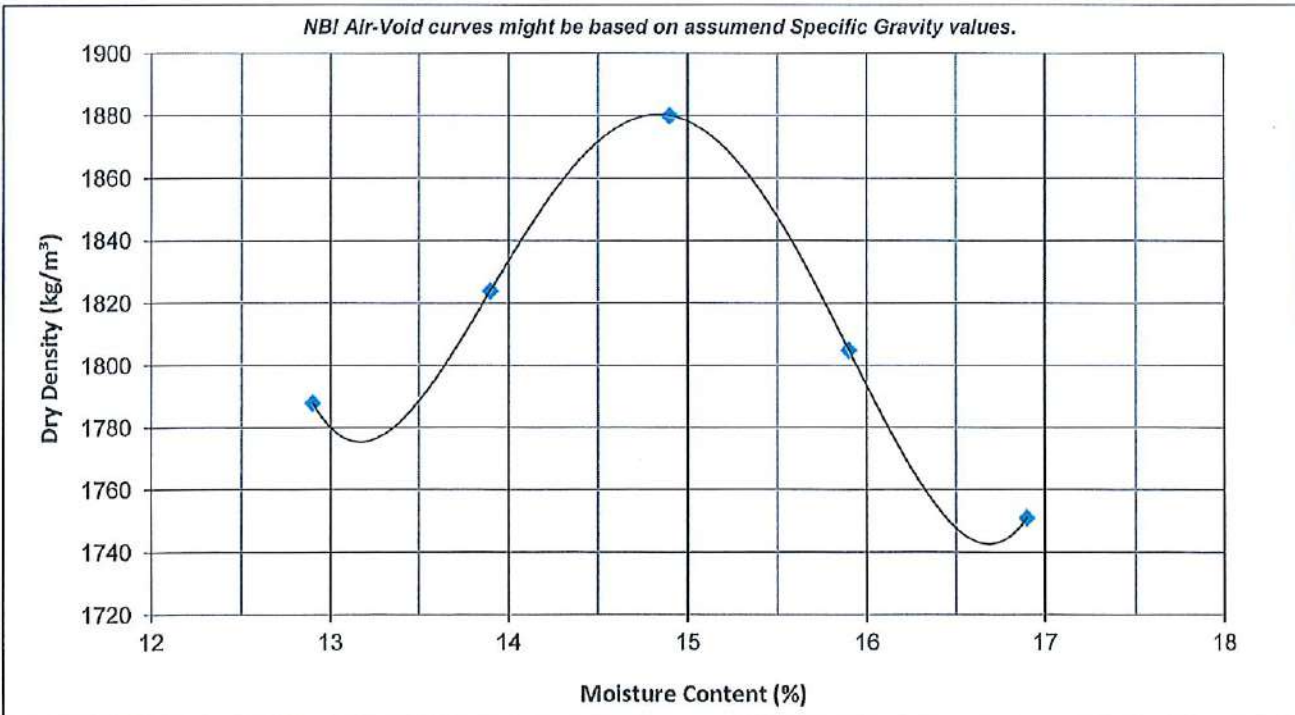
Laboratory Number	A9/059
Field Number	G19-0024
Client Reference	556/18
Depth (m)	1500-3100
Position	TP14/2
Coordinates	X Y
Description	Residual Dolerite
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1788	1824	1880	1805	1751	
Moisture Content	%	12.9	13.9	14.9	15.9	16.9	

Max. Dry Density	kg/m ³	1880
Optimum Moisture	%	14.8





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Project :
Project No: 2019-S-34

Date Received: 09/01/2019
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MOISTURE DENSITY RELATIONSHIP

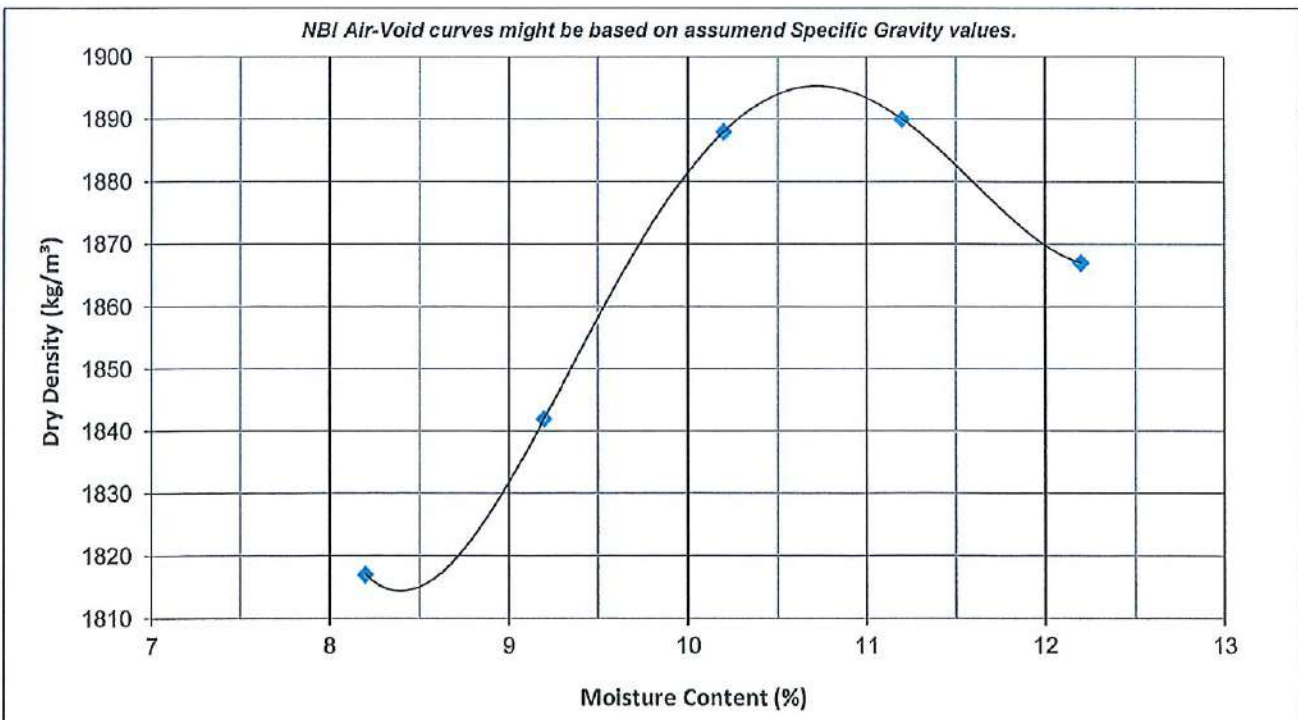
Laboratory Number	A9/060
Field Number	G19-0025
Client Reference	556/18
Depth (m)	1000-2700
Position	TP16/1
Coordinates	X Y
Description	Residual Dolerite
Additional Information	
Calcrete / Crushed Stabilizing Agent	Natural

Maximum Dry Density & Optimum Moisture Content - SANS 3001: GR30

Compactive Effort:	Modified AASHTO
--------------------	-----------------

Dry Density	kg/m ³	1817	1842	1888	1890	1867
Moisture Content	%	8.2	9.2	10.2	11.2	12.2

Max. Dry Density	kg/m ³	1895
Optimum Moisture	%	10.7



TEST RESULTS

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 Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

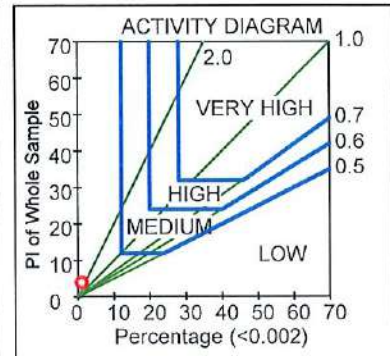
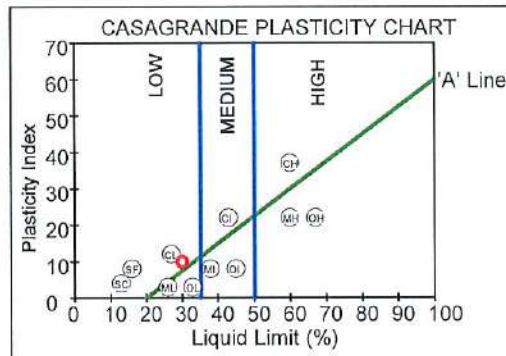
Your Ref : 2736
 Our Ref : PL/26790
 Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

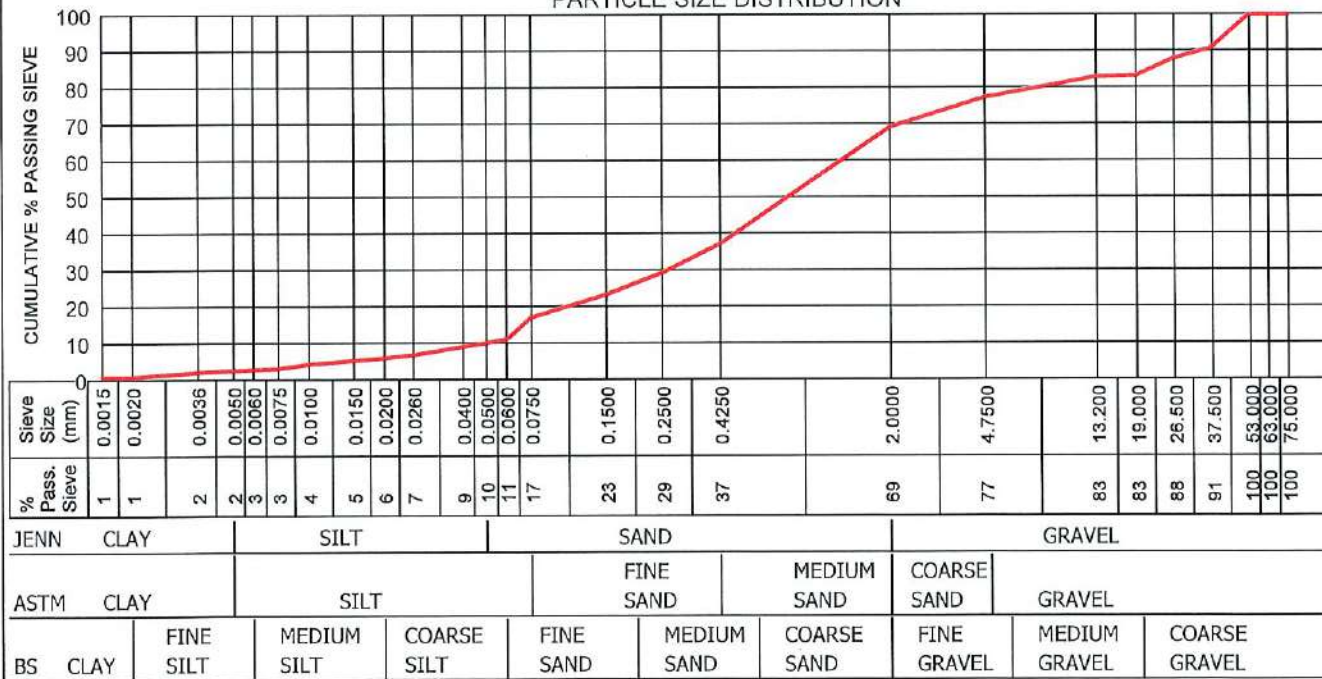
Sample No. : A9/709
 Hole No. : TP13/1
 Depth : 900-5000
 Liquid Limit (%) : 30
 Plasticity Index : 10
 Linear Shrinkage (%) : 6.0
 PI of Whole Sample : 4
 P.R.A. Classification : A-2-4(0)
 Unified Soil Classificati: SC
 Activity : 4.00
 Heave Classification : LOW
 Grading Modulus : 1.77
 Percentage (<0.002) : 1.0
 Moisture Content (%) : 18.9

Material Description : Residual Dolerite SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	2.5	7.5	59.3	30.7	SAND
Astm	2.5	14.5	60.3	22.7	SILTY SAND
British Standard	0.7	10.3	58.2	30.7	SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.
 G19-0103

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4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

TEST RESULTS

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LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

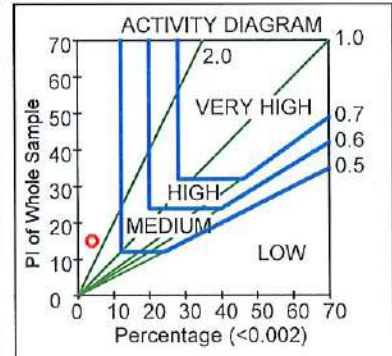
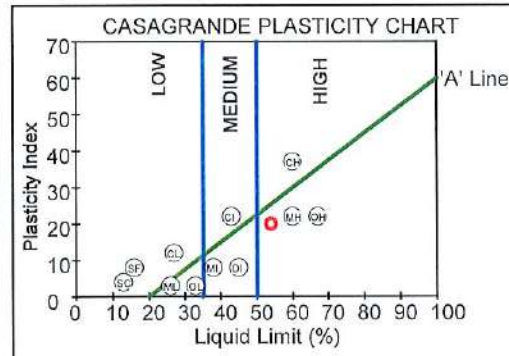
Your Ref : 2736
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Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

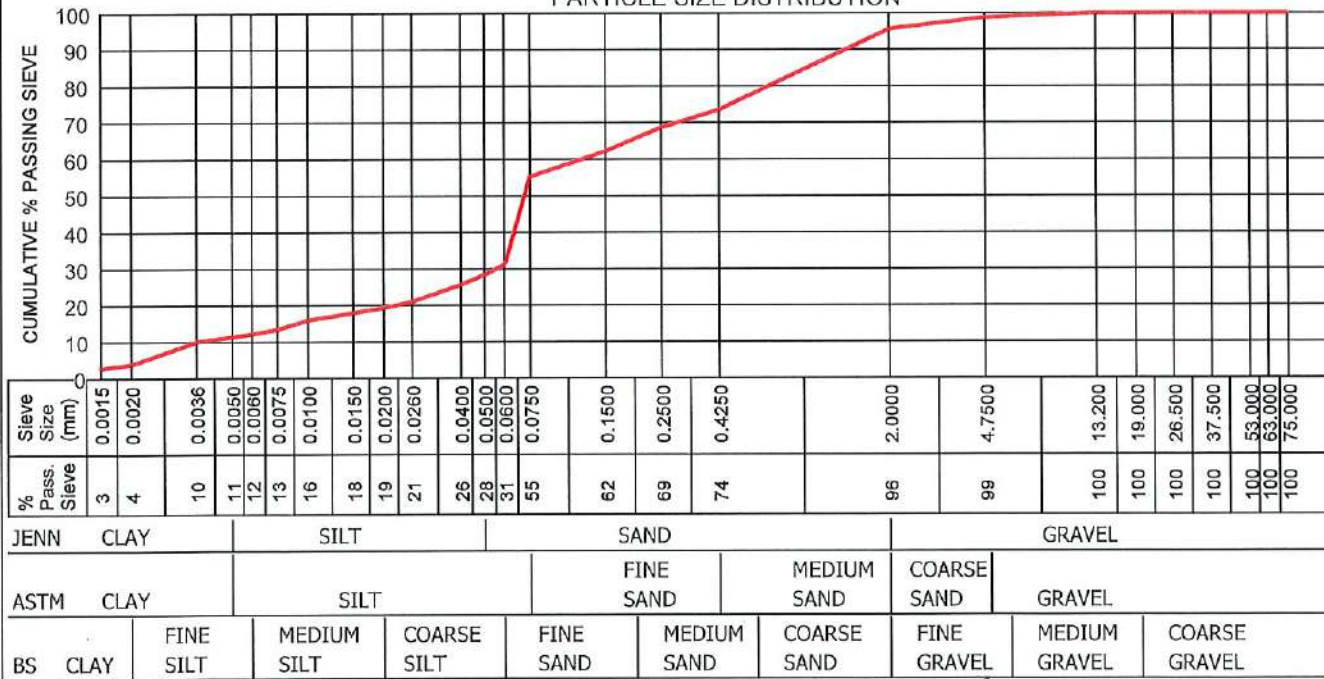
Sample No. : A9/710
Hole No. : TP19/1
Depth : 1100-3000
Liquid Limit (%) : 54
Plasticity Index : 20
Linear Shrinkage (%) : 11.0
PI of Whole Sample : 15
P.R.A. Classification : A-7-5(9)
Unified Soil Classificati: MH
Activity : 3.75
Heave Classification : LOW
Grading Modulus : 0.75
Percentage (<0.002) : 4.0
Moisture Content (%) : 13.1

Material Description : Residual Dolerite SANDY SILT

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	11.4	17.0	67.2	4.4	SILTY SAND
Astm	11.4	43.8	43.5	1.3	SANDY SILT
British Standard	4.0	27.3	64.4	4.4	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.
G19-0104

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

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Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

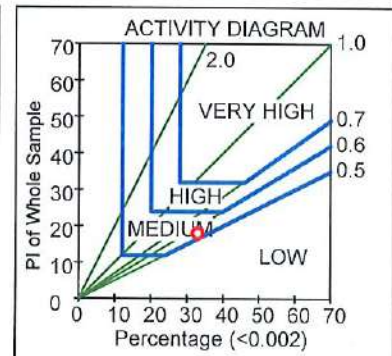
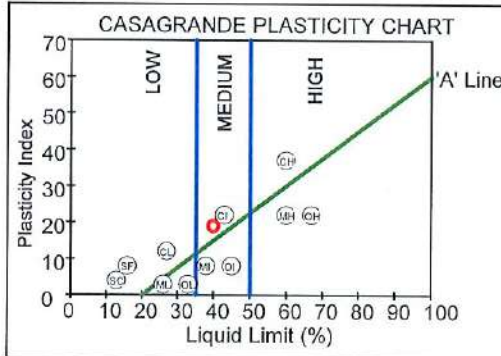
Your Ref : 2736
Our Ref : PL/26790
Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

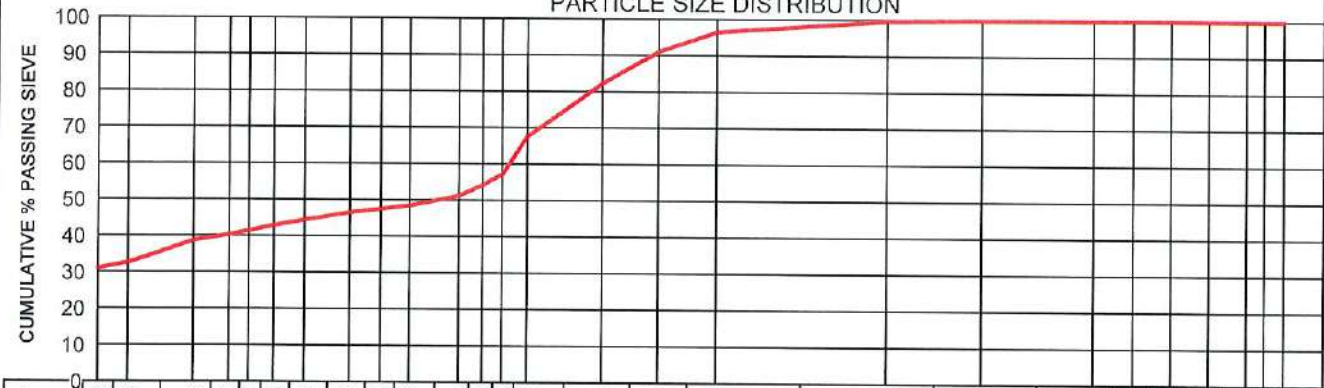
Sample No. : A9/711
Hole No. : TP20/1
Depth : 100-1000
Liquid Limit (%) : 40
Plasticity Index : 19
Linear Shrinkage (%) : 10.5
PI of Whole Sample : 18
P.R.A. Classification : A-6(10)
Unified Soil Classificati: CL
Activity : 0.55
Heave Classification : MEDIUM
Grading Modulus : 0.37
Percentage (<0.002) : 33.0
Moisture Content (%) : 14.0

Material Description : Colluvium SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	40.2	13.9	45.5	0.4	SANDY CLAY
Astm	40.2	27.2	32.6	0.0	SANDY CLAY
British Standard	32.5	24.7	42.4	0.4	SANDY CLAY



PARTICLE SIZE DISTRIBUTION



Sieve Size (mm)	0.0015	0.0020	0.0086	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	63.000	75.000		
% Pass. Sieve	31	33	39	40	41	43	44	46	47	48	51	54	57	67	82	91	96	100	100	100	100	100	100	100	100		
JENN	CLAY			SILT											SAND						GRAVEL						
ASTM	CLAY			SILT											FINE SAND		MEDIUM SAND		COARSE SAND		GRAVEL						
BS	CLAY			FINE SILT			MEDIUM SILT			COARSE SILT					FINE SAND		MEDIUM SAND		COARSE SAND		FINE GRAVEL		MEDIUM GRAVEL		COARSE GRAVEL		

Remarks : Sampled by client.
G19-0105

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TEST RESULTS

KNIGHT PIESOLD CONSULTING
P.O BOX 72292
LYNNWOOD RIDGE
0040
Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

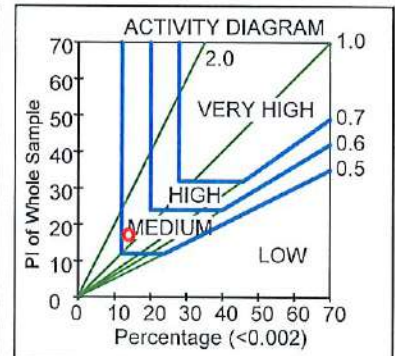
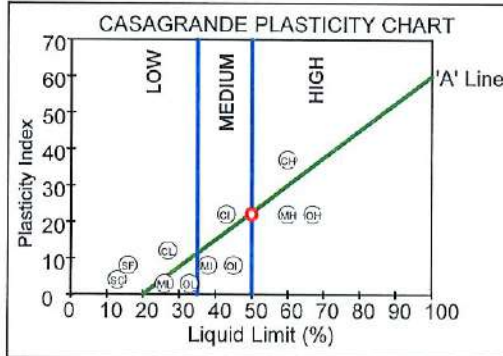
Your Ref : 2736
Our Ref : PL/26790
Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

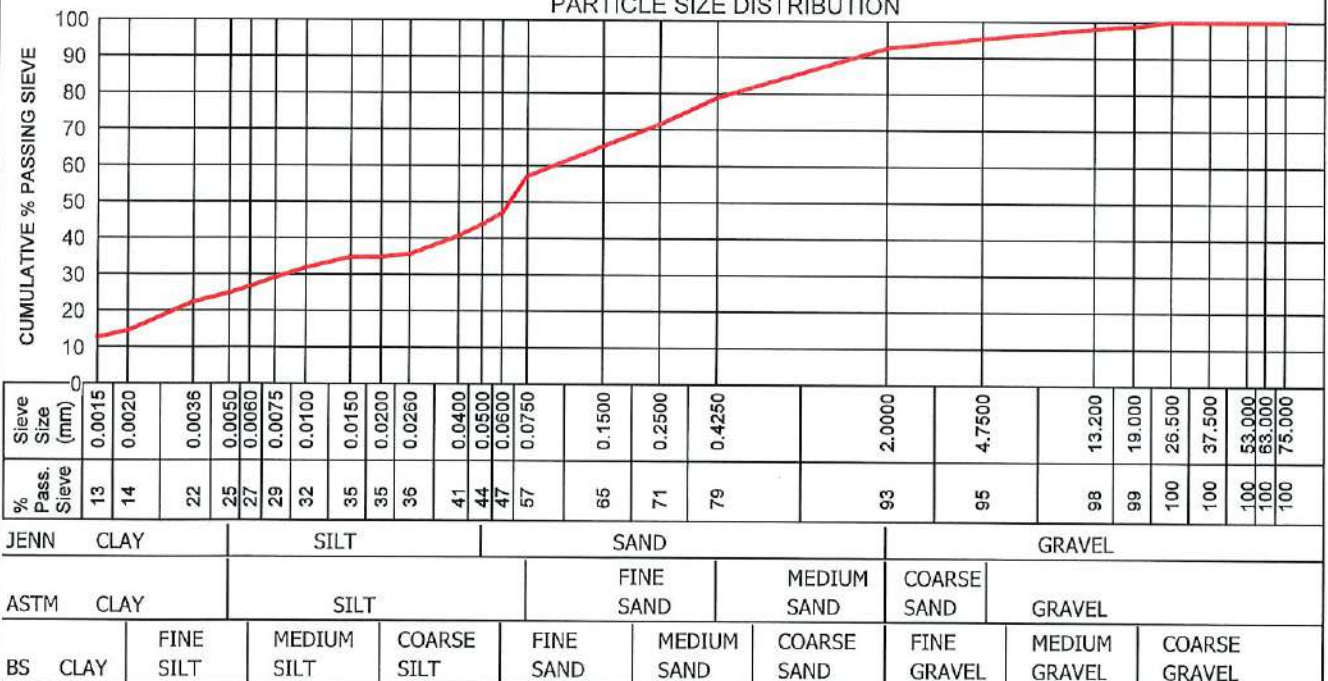
Sample No. : A9/712
Hole No. : TP20/2
Depth : 100-2100
Liquid Limit (%) : 50
Plasticity Index : 22
Linear Shrinkage (%) : 12.5
PI of Whole Sample : 17
P.R.A. Classification : A-7-6(10)
Unified Soil Classificati: MH
Activity : 1.21
Heave Classification : MEDIUM
Grading Modulus : 0.71
Percentage (<0.002) : 14.0
Moisture Content (%) : 17.8

Material Description : Colluvium CLAYEY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	24.8	18.9	48.8	7.4	CLAYEY SAND
Astm	24.8	32.2	38.2	4.8	CLAYEY SAND
British Standard	14.5	32.5	45.6	7.4	SILTY SAND



PARTICLE SIZE DISTRIBUTION



Remarks : Sampled by client.
G19-0106

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TEST RESULTS

KNIGHT PIESOLD CONSULTING
 P.O BOX 72292
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 0040
 Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

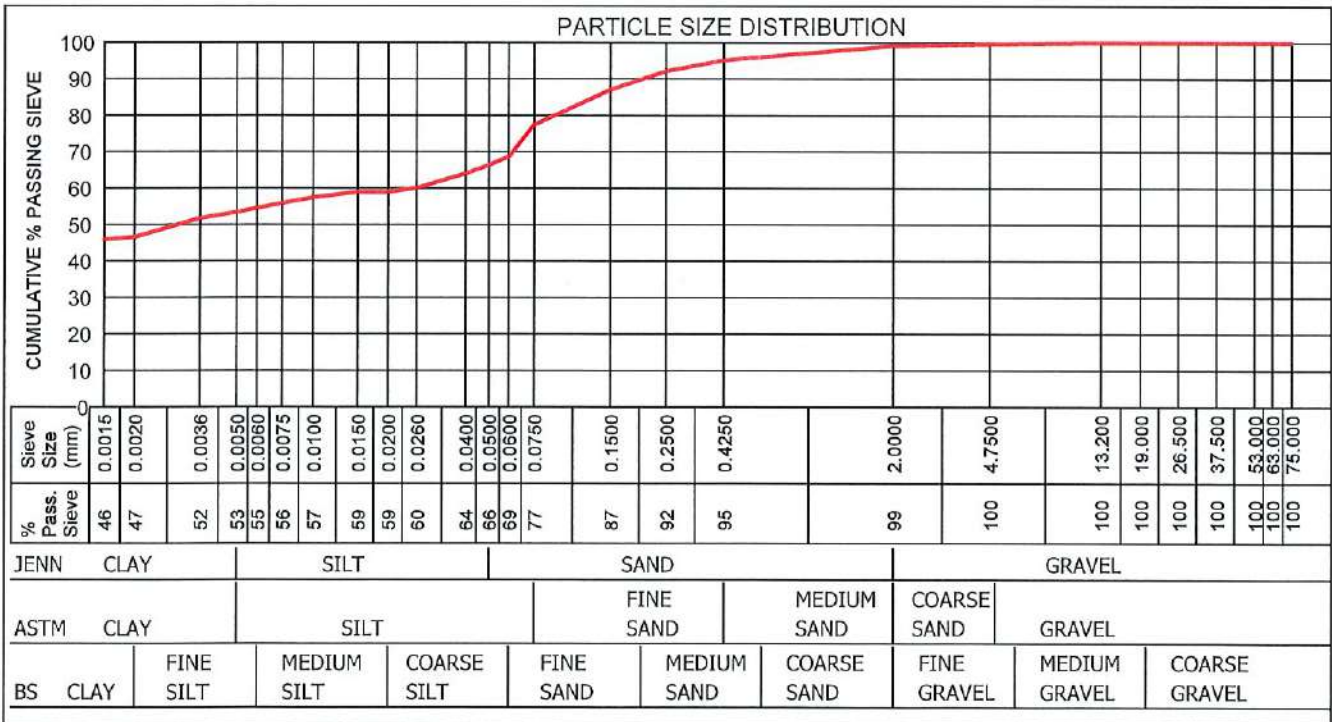
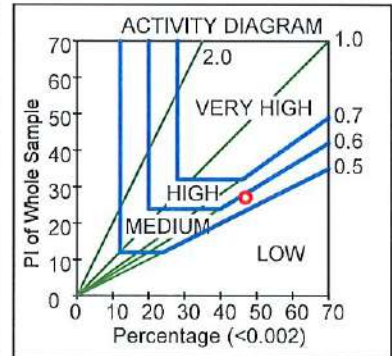
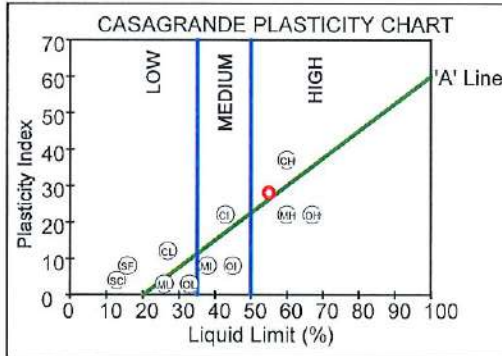
Your Ref : 2736
 Our Ref : PL/26790
 Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No.	: A9/713
Hole No.	: TP21/1
Depth	: 100-1100
Liquid Limit (%)	: 55
Plasticity Index	: 28
Linear Shrinkage (%)	: 12.0
PI of Whole Sample	: 27
P.R.A. Classification	: A-7-6(18)
Unified Soil Classificati:	CH
Activity	: 0.57
Heave Classification	: MEDIUM
Grading Modulus	: 0.29
Percentage (<0.002)	: 47.0
Moisture Content (%)	: 18.5

Material Description : Colluvium CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	53.4	13.0	32.7	0.9	CLAY
Astm	53.4	24.0	22.3	0.4	CLAY
British Standard	46.6	22.1	30.3	0.9	SANDY CLAY



Remarks : Sampled by client.
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Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

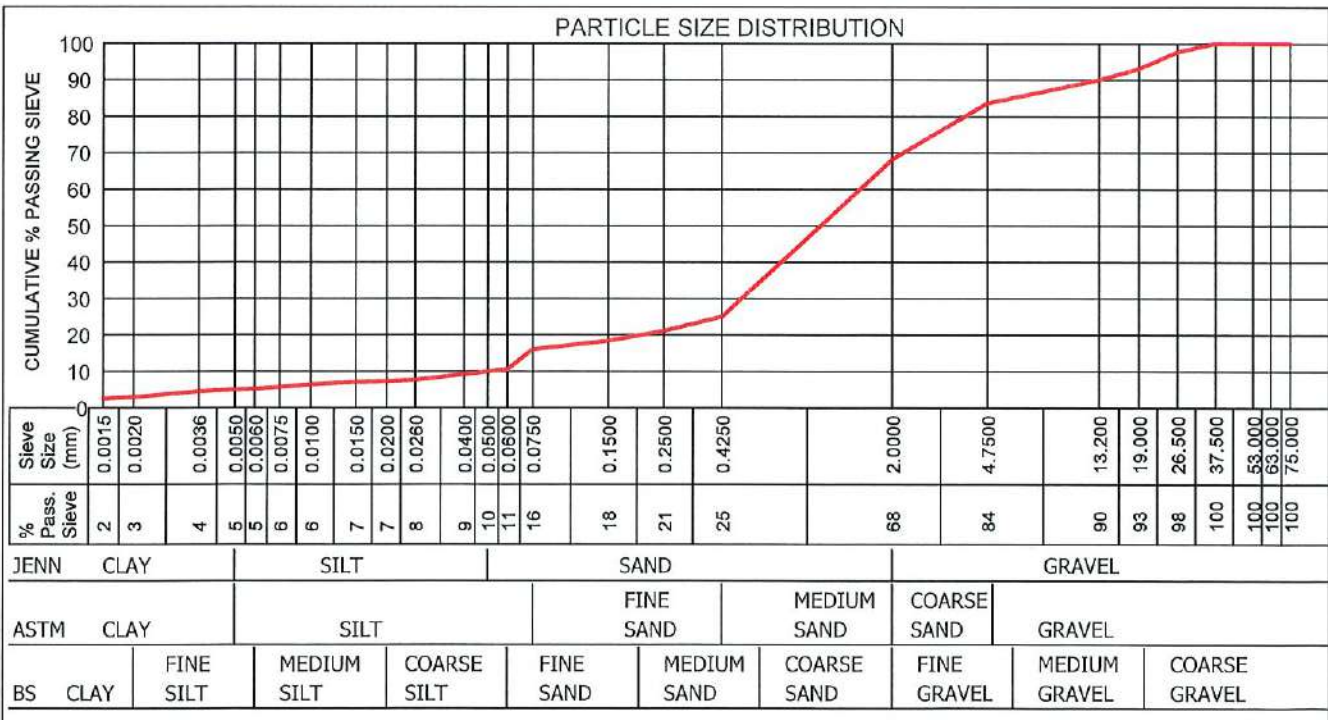
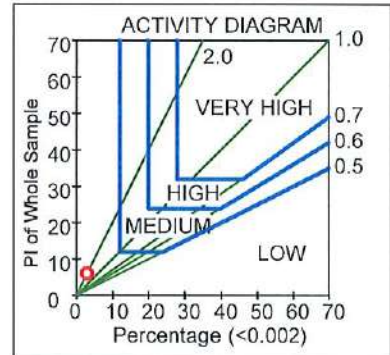
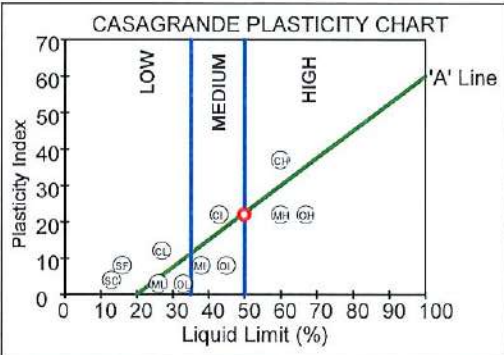
Your Ref : 2736
Our Ref : PL/26790
Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : A9/714
Hole No. : TP21/2
Depth : 1100
Liquid Limit (%) : 50
Plasticity Index : 22
Linear Shrinkage (%) : 11.0
PI of Whole Sample : 6
P.R.A. Classification : A-2-7(0)
Unified Soil Classificati: SM
Activity : 2.00
Heave Classification : LOW
Grading Modulus : 1.91
Percentage (<0.002) : 3.0
Moisture Content (%) : 7.3

Material Description : Residual Dolerite SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	4.9	5.0	58.5	31.6	SAND
Astm	4.9	11.1	67.6	16.4	SAND
British Standard	2.9	7.8	57.8	31.6	SAND



Remarks : Sampled by client.
G19-0108

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TEST RESULTS

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Attention: Mr Keneth Matoloka

Project : Kareerand Diversion New

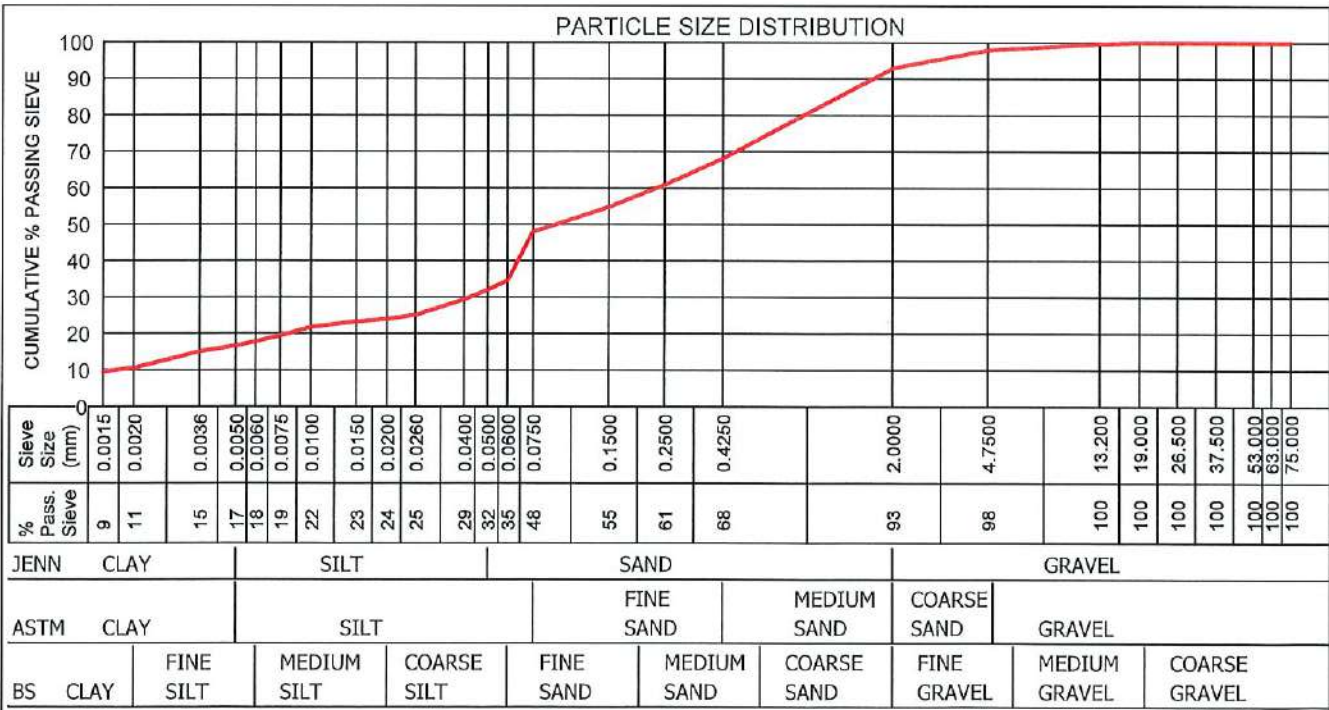
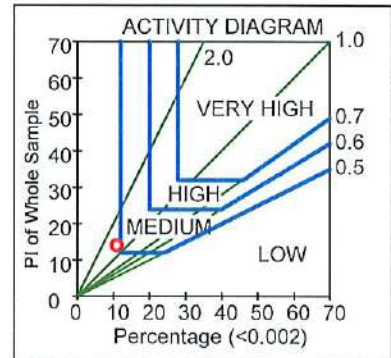
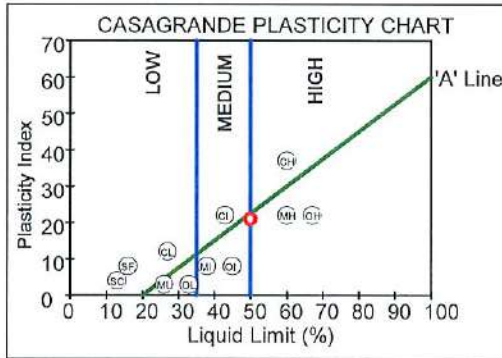
Your Ref : 2736
Our Ref : PL/26790
Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : A9/715
Hole No. : TP22/1
Depth : 2000-3000
Liquid Limit (%) : 50
Plasticity Index : 21
Linear Shrinkage (%) : 9.0
PI of Whole Sample : 14
P.R.A. Classification : A-7-6(7)
Unified Soil Classificati: SM
Activity : 1.27
Heave Classification : LOW
Grading Modulus : 0.91
Percentage (<0.002) : 11.0
Moisture Content (%) : 17.4

Material Description : Residual Dolerite SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	16.6	15.3	61.1	7.0	SILTY SAND
Astm	16.6	31.3	50.0	2.1	SILTY SAND
British Standard	10.5	24.0	58.4	7.0	SILTY SAND



Remarks : Sampled by client.
G19-0109

FORM: A6

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 Fax : (012) 800 3043
 Email : bennie.vanniekerk@sgs.com

TEST RESULTS

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 P.O BOX 72292
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 Attention: Mr Keneth Matotoka

Project : Kareerand Diversion New

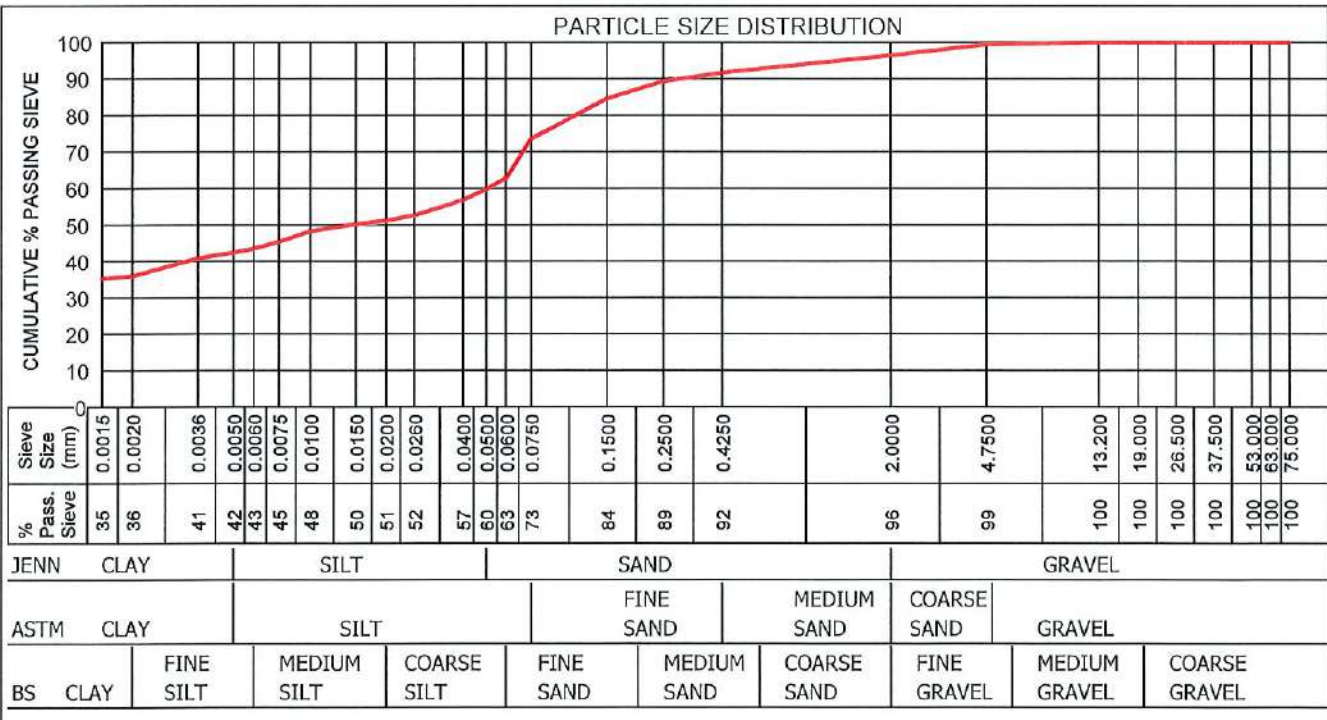
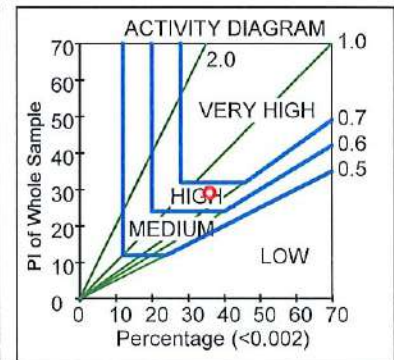
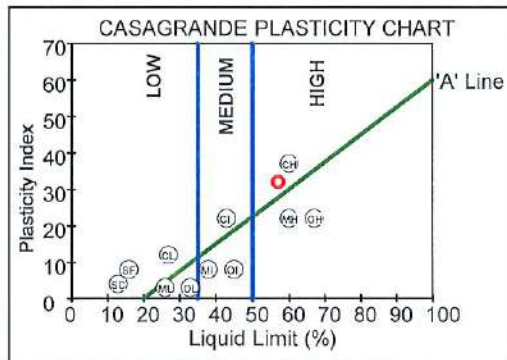
Your Ref : 2736
 Our Ref : PL/26790
 Date Reported : 09.04.2019

FOUNDATION INDICATOR (ASTM: D422)

Sample No. : A9/716
 Hole No. : TP23/1
 Depth : 100-1700
 Liquid Limit (%) : 57
 Plasticity Index : 32
 Linear Shrinkage (%) : 11.5
 PI of Whole Sample : 29
 P.R.A. Classification : A-7-6(19)
 Unified Soil Classificati: CH
 Activity : 0.81
 Heave Classification : HIGH
 Grading Modulus : 0.39
 Percentage (<0.002) : 36.0
 Moisture Content (%) : 16.1

Material Description : SILTY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	42.3	17.4	36.7	3.7	SANDY CLAY
Astm	42.3	31.1	25.9	0.6	SILTY CLAY
British Standard	35.9	26.9	33.6	3.7	SANDY CLAY



Remarks : Sampled by client.
 G19-0110

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

a SANAS Accredited Testing Laboratory, No. T0025

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MATERIALS TEST REPORT

Laboratory Number	A9/709				
Field Number					
Client Reference	G19-0103				
Depth (m)	900-5000				
Position	TP 13/1				
Coordinates	X Y				
Description	Residual Dolerite				
Additional information	Sampled by client.				
Calcrete/Crushed					
Stabilizing Agent	Natural				

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	91			
	28 mm	88			
	20 mm	83			
	14 mm	83			
	5 mm	77			
	2 mm	69			
	0.425 mm	36			
	0.075 mm	16			
Grading Modulus		1.79			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	48			
Coarse Fine Sand	0.425-0.250	11			
Medium Fine Sand	0.250-0.150	8			
Fine Fine Sand	0.150-0.075	9			
Silt and Clay	<0.075	24			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	30			
Plasticity Index	%	10			
Linear Shrinkage	%	6			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1761			
Optimum Moisture	%	11.7			

CBR SANS 3001: GR40

UCS

ITS

Test Type			CBR			UCS			ITS			CBR			UCS			ITS		
			(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)	(%)	(kPa)	(kPa)			
Interpolated Data	@100%	Mod. AASHTO	38.3																	
	@ 98%		29																	
	@ 97%		25.3																	
	@ 95%		19.2																	
	@ 93%		14.6																	
	@ 90%		9.6																	
Value @ Mod. AASHTO effort																				
Swell (%) @ Mod. AASHTO effort			0.8																	

Classifications

HRB	A-2-4(0)				
COLTO	G8				
TRH14	G9				

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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

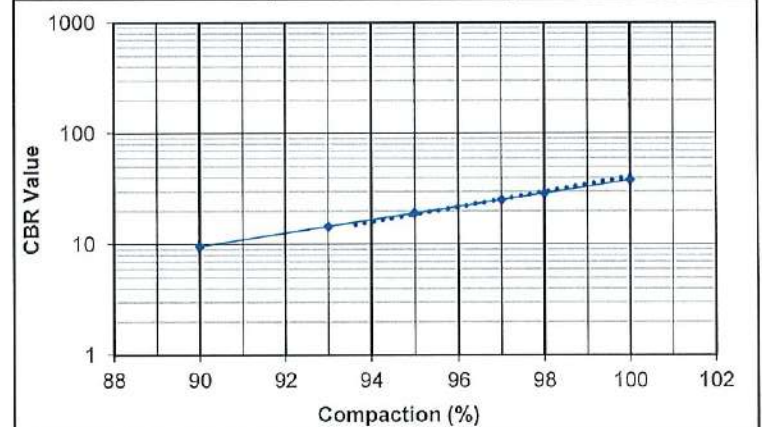
Laboratory No.	A9/709	
Field Number		
Client Reference	G19-0103	
Depth (m)	900-5000	
Position	TP 13/1	
Coordinates	X Y	
Description	Residual Dolerite	
Additional information	Sampled by client.	
Calcrete/Crushed Stabilizing Agent	Natural	

Laboratory No.	A9/709	
Maximum Dry Density & Optimum Moisture Content	SANS 3001: GR30	
MDD	kg/m ³	1761
OMC	%	11.7

California Bearing Ratio		SANS 3001: GR40	
Compaction Data			
Moisture	%	11.2	
Dry Density	kg/m ³	1791	1677 1592
Compaction	%	100.0	93.6 88.9

Penetration Data				
CBR at	2.50 mm	41	15	8
	5.00 mm	45	15	8
	7.50 mm	40	15	8
Swell	%	0.8	1.3	1.5
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	91	
28 mm	88	
20 mm	83	
14 mm	83	
5 mm	77	
2 mm	69	
0.425 mm	36	
0.250 mm	28	
0.150 mm	23	
0.075 mm	16	
Grading Modulus	1.8	

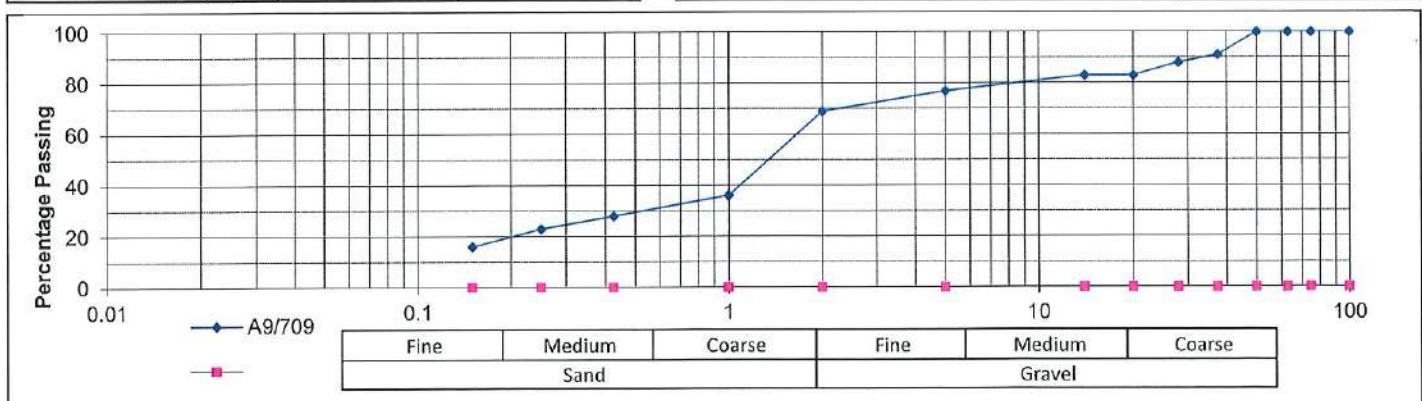


Interpolated CBR Data		
CBR	Mod. AASHTO	
@ 100%		38
@ 98%		29
@ 97%		25
@ 95%		19
@ 93%		15
@ 90%		10
@ SANS3001 Midpoint		25

Soil Mortar Analysis	
Coarse Sand	48
Coarse Fine Sand	11
Medium Fine Sand	8
Fine Fine Sand	9
Silt and Clay	24

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)	30	
Plasticity Index (%)	10	
Linear Shrinkage (%)	6.0	

Classifications	
HRB (AASHTO)	A-2-4(0)
COLTO	G8
TRH14	G9



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Laboratory Number	A9/710				
Field Number					
Client Reference	G19-0104				
Depth (m)	1100-3000				
Position	TP 19/1				
Coordinates	X Y				
Description	Residual Dolerite				
Additional information	Sampled by client.				
Calcrete/Crushed Stabilizing Agent	Natural				

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	99			
	2 mm	96			
	0.425 mm	73			
	0.075 mm	54			
Grading Modulus		0.77			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	24			
Coarse Fine Sand	0.425-0.250	5			
Medium Fine Sand	0.250-0.150	7			
Fine Fine Sand	0.150-0.075	7			
Silt and Clay	<0.075	57			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	54			
Plasticity Index	%	20			
Linear Shrinkage	%	11			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1597			
Optimum Moisture	%	12.3			

CBR SANS 3001: GR40

UCS

ITS

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	5										
	@ 98%	4.4										
	@ 97%	4.1										
	@ 95%	3.7										
	@ 93%	3.2										
	@ 90%	2.7										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort		1.3										

Classifications

HRB	A-7-5(9)				
COLTO					
TRH14					

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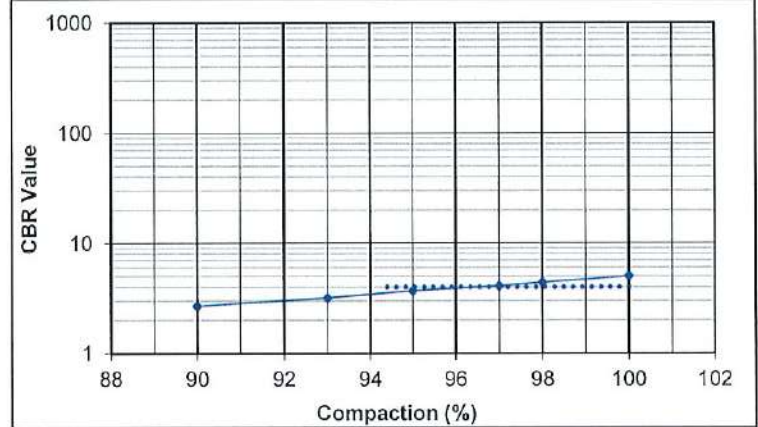
Laboratory No.	A9/710	
Field Number		
Client Reference	G19-0104	
Depth (m)	1100-3000	
Position	TP 19/1	
Coordinates	X Y	
Description	Residual Dolerite	
Additional information	Sampled by client.	
Calcrete/Crushed Stabilizing Agent	Natural	

Laboratory No.	A9/710	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1597
OMC	%	12.3

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	14.7		
Dry Density	kg/m ³	1731	1634	1557
Compaction	%	100.0	94.4	89.9

Penetration Data				
CBR at	2.50 mm	4	4	3
	5.00 mm	6	5	3
	7.50 mm	6	5	4
Swell	%	1.3	1.8	2.7
Final Moisture (%)				

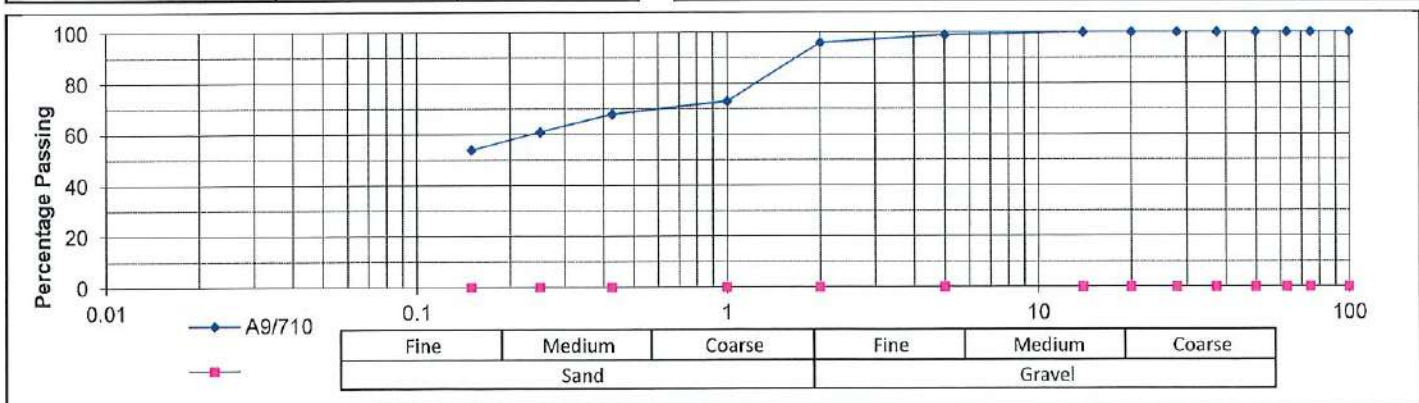
Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	99
	2 mm	96
	0.425 mm	73
	0.250 mm	68
	0.150 mm	61
	0.075 mm	54
Grading Modulus		0.8



Soil Mortar Analysis		
Coarse Sand		24
Coarse Fine Sand		5
Medium Fine Sand		7
Fine Fine Sand		7
Silt and Clay		57

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)		54
Plasticity Index (%)		20
Linear Shrinkage (%)		11.0

Interpolated CBR Data		
CBR	@ 100%	5
	@ 98%	4
	@ 97%	4
	@ 95%	4
	@ 93%	3
	@ 90%	3
	@ SANS3001 Midpoint	4



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MATERIALS TEST REPORT

Laboratory Number	A9/711				
Field Number					
Client Reference	G19-0105				
Depth (m)	100-1000				
Position	TP 20/1				
Coordinates	X Y				
Description	Colluvium				
Additional information	Sampled by client.				
Calcrete/Crushed Stabilizing Agent	Natural				

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	100			
	2 mm	100			
	0.425 mm	97			
	0.075 mm	68			
Grading Modulus		0.35			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	3			
Coarse Fine Sand	0.425-0.250	5			
Medium Fine Sand	0.250-0.150	9			
Fine Fine Sand	0.150-0.075	15			
Silt and Clay	<0.075	68			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	40			
Plasticity Index	%	19			
Linear Shrinkage	%	10.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1720			
Optimum Moisture	%	16			

CBR SANS 3001: GR40

UCS

ITS

Test Type		CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	7.3											
	@ 98%	6.3											
	@ 97%	5.8											
	@ 95%	5											
	@ 93%	4.3											
	@ 90%	3.4											
Value @ Mod. AASHTO effort													
Swell (%) @ Mod. AASHTO effort		2.6											

Classifications

HRB	A-6(11)				
COLTO					
TRH14					

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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

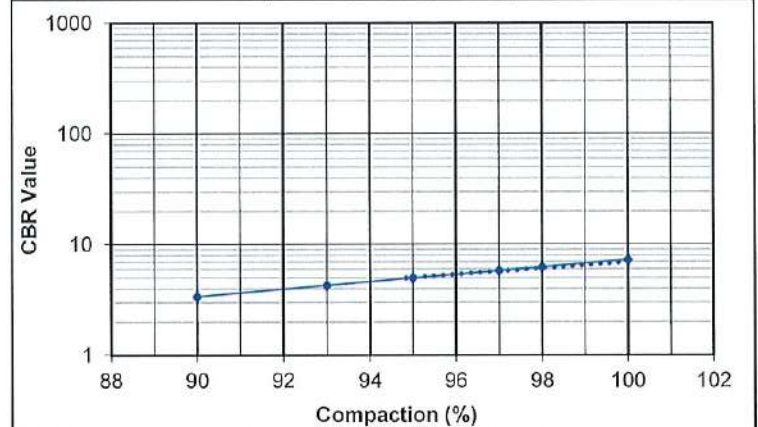
Laboratory No.	A9/711	
Field Number		
Client Reference	G19-0105	
Depth (m)	100-1000	
Position	TP 20/1	
Coordinates	X Y	
Description	Colluvium	
Additional information	Sampled by client.	
Calcrete/Crushed Stabilizing Agent	Natural	

Laboratory No.	A9/711	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1720
OMC	%	16

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	17.8		
Dry Density	kg/m ³	1487	1409	1353
Compaction	%	100.0	94.8	91.0

Penetration Data				
CBR at	2.50 mm	7	5	4
	5.00 mm	9	7	4
	7.50 mm	10	8	4
Swell	%	2.6	2.9	3.3
Final Moisture (%)				

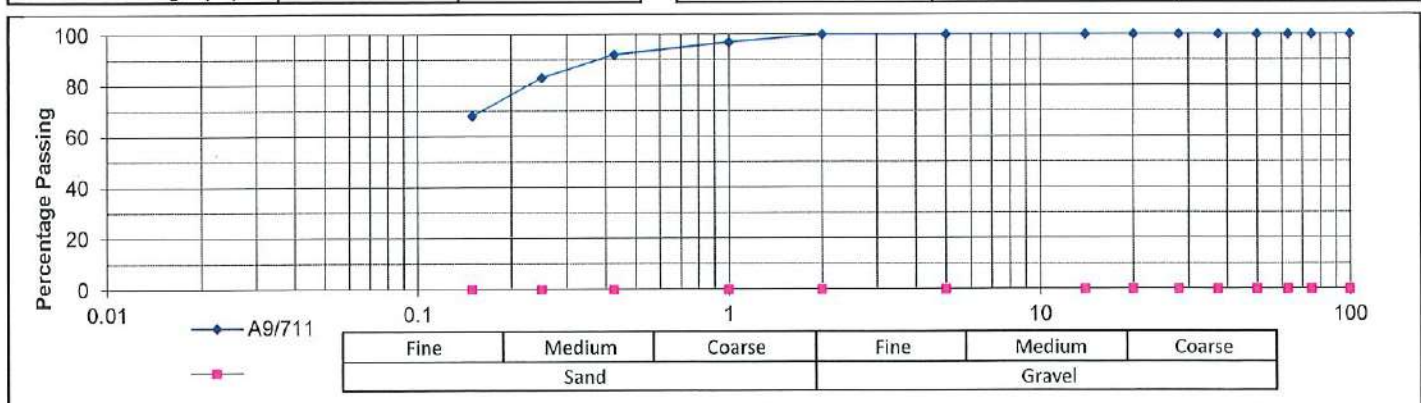
Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
100 mm	100	
75 mm	100	
63 mm	100	
50 mm	100	
37.5 mm	100	
28 mm	100	
20 mm	100	
14 mm	100	
5 mm	100	
2 mm	100	
0.425 mm	97	
0.250 mm	92	
0.150 mm	83	
0.075 mm	68	
Grading Modulus	0.4	



Interpolated CBR Data		
CBR	Mod. AASHTO	
@ 100%	7	
@ 98%	6	
@ 97%	6	
@ 95%	5	
@ 93%	4	
@ 90%	3	
@ SANS3001 Midpoint	6	

Soil Mortar Analysis	
Coarse Sand	3
Coarse Fine Sand	5
Medium Fine Sand	9
Fine Fine Sand	15
Silt and Clay	68

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)	40	
Plasticity Index (%)	19	
Linear Shrinkage (%)	10.5	
Classifications		
HRB (AASHTO)	A-6(11)	
COLTO		
TRH14		



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MATERIALS TEST REPORT

Laboratory Number	A9/714		
Field Number			
Client Reference	G19-0108		
Depth (m)	1100		
Position	TP 21/2		
Coordinates	X Y		
Description	Residual Dolerite		
Additional information	Sampled by client.		
Calcrete/Crushed Stabilizing Agent	Natural		

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	98			
	20 mm	94			
	14 mm	91			
	5 mm	84			
	2 mm	68			
	0.425 mm	23			
	0.075 mm	15			
Grading Modulus		1.94			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	66			
Coarse Fine Sand	0.425-0.250	5			
Medium Fine Sand	0.250-0.150	4			
Fine Sand	0.150-0.075	3			
Silt and Clay	<0.075	22			

Atterberg Limits

SANS GR10,GR11,GR12

Liquid Limit	%	50			
Plasticity Index	%	22			
Linear Shrinkage	%	11			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1991			
Optimum Moisture	%	8.7			

CBR SANS 3001: GR40

UCS

ITS

Test Type		CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	11.8											
	@ 98%	8.2											
	@ 97%	6.8											
	@ 95%	4.7											
	@ 93%	3.3											
	@ 90%	1.9											
Value @ Mod. AASHTO effort													
Swell (%) @ Mod. AASHTO effort		1.2											

Classifications

HRB	A-2-7(0)		
COLTO			
TRH14			

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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

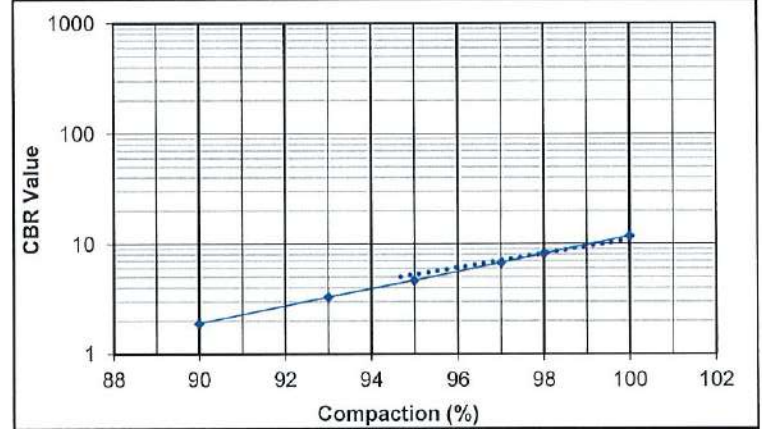
Laboratory No.	A9/714	
Field Number		
Client Reference	G19-0108	
Depth (m)	1100	
Position	TP 21/2	
Coordinates	X Y	
Description	Residual Dolerite	
Additional information	Sampled by client	
Calcrete/Crushed		
Stabilizing Agent	Natural	

Laboratory No.	A9/714	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1991
OMC	%	8.7

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	6.7		
Dry Density	kg/m ³	2014	1906	1811
Compaction	%	100.0	94.6	89.9

Penetration Data				
CBR at	2.50 mm	11	5	2
	5.00 mm	10	4	2
	7.50 mm	10	4	3
Swell	%	1.2	1.6	2
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	98
	20 mm	94
	14 mm	91
	5 mm	84
	2 mm	68
	0.425 mm	23
	0.250 mm	19
	0.150 mm	17
	0.075 mm	15
Grading Modulus		1.9

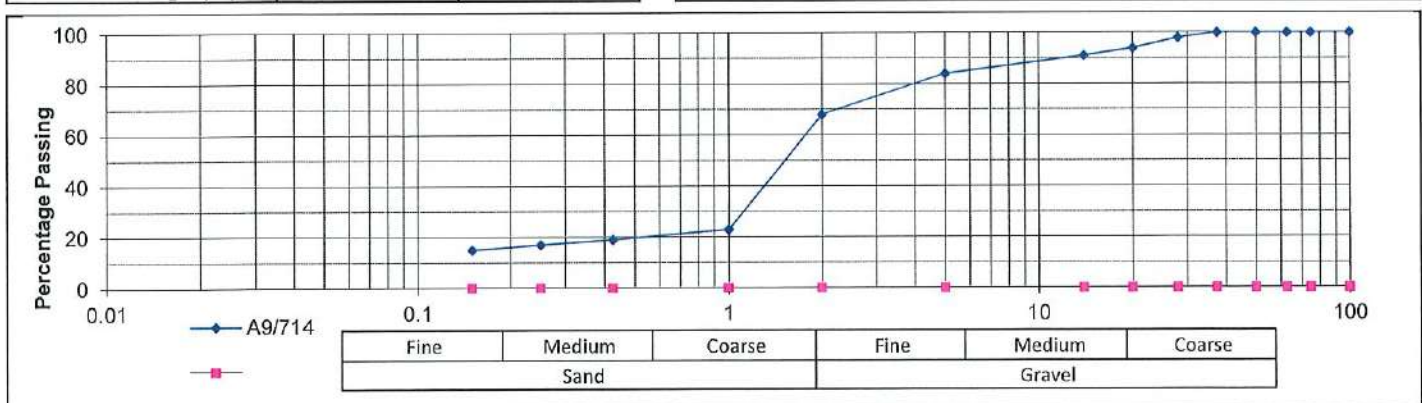


Interpolated CBR Data		
CBR	Mod. AASHTO	
@ 100%		12
@ 98%		8
@ 97%		7
@ 95%		5
@ 93%		3
@ 90%		2
@ SANS3001 Midpoint		7

Soil Mortar Analysis	
Coarse Sand	66
Coarse Fine Sand	5
Medium Fine Sand	4
Fine Fine Sand	3
Silt and Clay	22

Classifications	
HRB (AASHTO)	A-2-7(0)
COLTO	
TRH14	

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)	50	
Plasticity Index (%)	22	
Linear Shrinkage (%)	11.0	



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MATERIALS TEST REPORT

Laboratory Number	A9/716				
Field Number					
Client Reference	G19-0110				
Depth (m)	100-1700				
Position	TP 23/1				
Coordinates	X				
	Y				
Description					
Additional information	Sampled by client				
Calcrete/Crushed Stabilizing Agent	Natural				

Sieve Analysis (Wet preparation)

SANS 3001: GR1, GR2

Percentage Passing	100 mm	100			
	75 mm	100			
	63 mm	100			
	50 mm	100			
	37.5 mm	100			
	28 mm	100			
	20 mm	100			
	14 mm	100			
	5 mm	99			
	2 mm	96			
	0.425 mm	91			
	0.075 mm	73			
Grading Modulus		0.4			

Soil Mortar Analysis

Coarse Sand	2.0-0.425	5			
Coarse Fine Sand	0.425-0.250	3			
Medium Fine Sand	0.250-0.150	5			
Fine Fine Sand	0.150-0.075	11			
Silt and Clay	<0.075	76			

Atterberg Limits

SANS GR10, GR11, GR12

Liquid Limit	%	57			
Plasticity Index	%	32			
Linear Shrinkage	%	11.5			

Maximum Dry Density & Optimum Moisture Content

SANS 3001: GR30

Max. Dry Density	kg/m ³	1557			
Optimum Moisture	%	13.9			

CBR SANS 3001: GR40

UCS

ITS

Test Type	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)	CBR (%)	UCS (kPa)	ITS (kPa)
Interpolated Data	@100%	1.7										
	@98%	1.5										
	@97%	1.4										
	@95%	1.3										
	@93%	1.1										
	@90%	1										
Value @ Mod. AASHTO effort												
Swell (%) @ Mod. AASHTO effort		0										

Classifications

HRB	A-7-6(20)				
COLTO					
TRH14					

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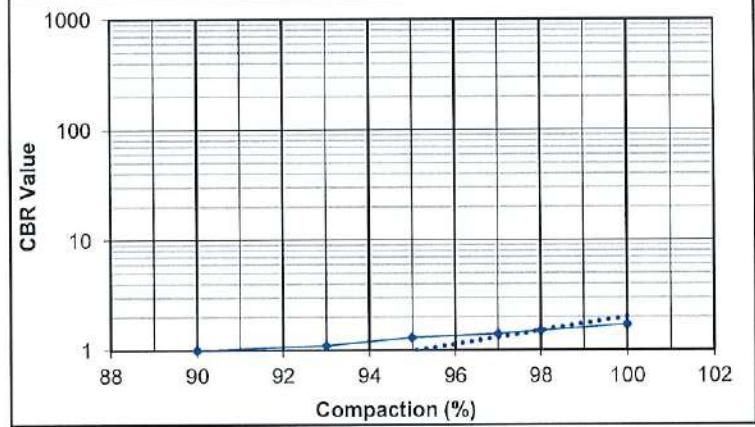
Laboratory No.	A9/716	
Field Number		
Client Reference	G19-0110	
Depth (m)	100-1700	
Position	TP 23/1	
Coordinates	X	
	Y	
Description		
Additional information	Sampled by client.	
Calcrete/Crushed Stabilizing Agent	Natural	

Laboratory No.	A9/716	
Maximum Dry Density & Optimum Moisture Content		SANS 3001: GR30
MDD	kg/m ³	1557
OMC	%	13.9

California Bearing Ratio		SANS 3001: GR40		
Compaction Data				
Moisture	%	12.8		
Dry Density	kg/m ³	1571	1494	1417
Compaction	%	100.0	95.1	90.2

Penetration Data				
CBR at	2.50 mm	2	1	1
	5.00 mm	2	1	1
	7.50 mm	1	1	1
Swell	%	0	0	0
Final Moisture (%)				

Sieve Analysis (Wet preparation)		SANS 3001: GR1, GR2
Percentage Passing		
	100 mm	100
	75 mm	100
	63 mm	100
	50 mm	100
	37.5 mm	100
	28 mm	100
	20 mm	100
	14 mm	100
	5 mm	99
	2 mm	96
	0.425 mm	91
	0.250 mm	88
	0.150 mm	84
	0.075 mm	73
Grading Modulus		0.4

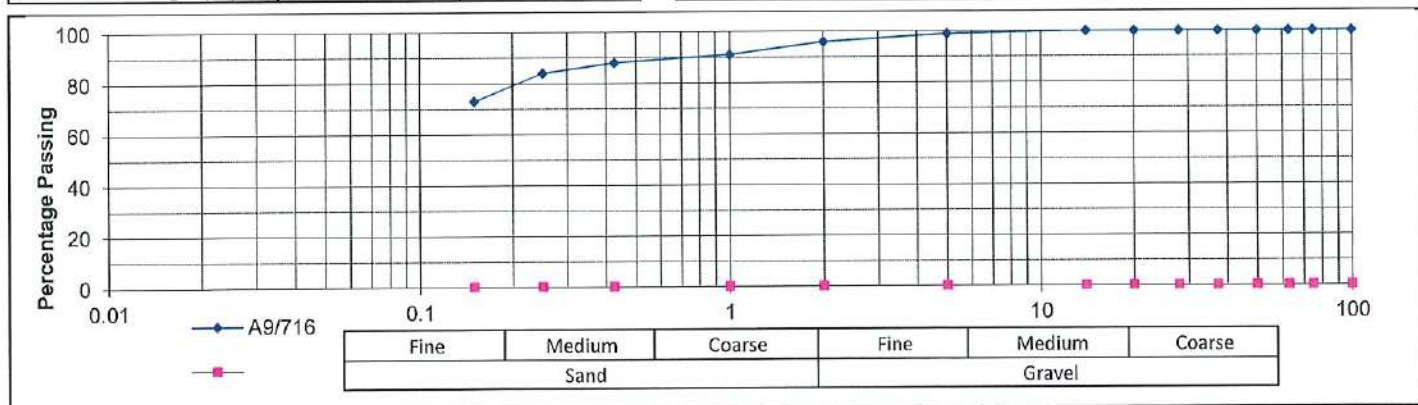


Interpolated CBR Data		
CBR	Mod. AASHTO	
@ 100%		2
@ 98%		2
@ 97%		1
@ 95%		1
@ 93%		1
@ 90%		1
@ SANS3001 Midpoint		2

Soil Mortar Analysis	
Coarse Sand	5
Coarse Fine Sand	3
Medium Fine Sand	5
Fine Fine Sand	11
Silt and Clay	76

Classifications	
HRB (AASHTO)	A-7-6(20)
COLTO	
TRH14	

Atterberg Limits		SANS GR10, GR11, GR12
Liquid Limit (%)	57	
Plasticity Index (%)	32	
Linear Shrinkage (%)	11.5	



APPENDIX E

ROCK LABORATORY TEST RESULTS

Issued by:

ROCKLAB

(ROCK MECHANICS & EXCAVATION LABORATORIES)

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RESULTS OF ROCK PROPERTIES TESTS

Sampling Site: Kareerand TSF Phase 2

BY

DR J. F. CHEN

Submitted to:

KNIGHT PIESOLD (PTY) Ltd.

7 NOVEMBER 2018

C O N T E N T S

- TABLE 1 - RESULTS OF UNIAXIAL COMPRESSIVE STRENGTH TESTS
- TABLE 2 - RESULTS OF UNIAXIAL COMPRESSIVE STRENGTH TESTS
WITH ELASTIC MODULUS & POISSON RATIO MEASUREMENTS
BY MEANS OF STRAIN GAUGES
- APPENDIX 1 DIAGRAM OF STRESS VIA STRAIN FOR UCM TESTS
- APPENDIX 2 FAILURE CODES OF ROCK COMPRESSION TESTS

TABLE 1 RESULTS OF UNIAXIAL COMPRESSIVE STRENGTH TESTS



Client: Knight Piesold

Sampling site: Kareerand TSF Phase 2

07-11-2018

SPECIMEN PARTICULARS					SPECIMEN DIMENSIONS					SPECIMEN TEST RESULTS			
Rocklab Specimen No.	Borehole No	Sample No	Depth m	Rock Type	Diameter mm	Height mm	Ratio of Height to Diameter	Mass g	Density g/cm ³	Failure Load kN	Strength (UCS) MPa	Failure Code	Note
UCS-01	BH 01	BH01/01	11.68 - 11.80	Highly weathered dolerite	51.10	90.6	1.8	403.86	2.17	2.57	1.3	0B	1
UCS-03	BH 02	BH02/02	13.27 - 13.56	Moderate to slightly weathered dolerite	51.95	139.0	2.7	872.95	2.96	311.20	146.8	0B	

Note: All tests were conducted according to the ISRM's (International Society for Rock Mechanics) specification.
 Failure code - refers to Appendix 2
 1 - Sample was weathered

TABLE 2 RESULTS OF UNIAXIAL COMPRESSION TESTS WITH ELASTIC MODULUS & POISSON RATIO MEASUREMENTS BY MEANS OF STRAIN GAUGES



Client: Knight Piesold

Sampling site: Kareerand TSF Phase 2

07-11-2018

SPECIMEN PARTICULARS					SPECIMEN DIMENSIONS					SPECIMEN TEST RESULTS								
Rocklab Specimen No	Borehole ID	Sample ID	Depth m	Rock Type	Diameter mm	Height mm	Ratio of Height to diameter	Mass g	Density g/cm ³	Failure Load kN	Strength (UCS) MPa	Tangent Elastic Modulus @ 50% UCS GPa	Secant Elastic Modulus @ 50% UCS GPa	Poisson's Ratio Tangent @ 50% UCS	Poisson's Ratio Secant @ 50% UCS	Linear Axial Strain at Failure mm/mm	Failure Code	Note
UCM-02	BH 02	BH02/01	7.40 - 7.66	Moderate to slightly weathered dolerite	52.06	134.3	2.6	844.7	2.96	345.5	162.3	93.7	91.8	0.22	0.25	0.001727	1B	
UCM-04	BH 04	BH04/01	6.72 - 6.90	Highly weathered dolerite	51.76	126.4	2.4	630.2	2.37	2.0	0.9						0B	1

Note: All tests were conducted according to the ISRM's Specification.

Failure codes refer to Appendix 2

1 - Sample was weathered and deformation measurements were not successful

APPENDIX 1

STRESS VIA STRAIN CURVES FOR UCM TESTS