GEOTECHNICAL INVESTIGATON REPORT

LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

MOUNT OF LEBANON

(Revision 0)

REPARED FOR : **KREDO**

PREPARED BY : **SATCON, GEOTECHNICAL ENGINEERING**

17-026- RPT-01 REV 0 *OCTOBER 10, 2017*

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KREDO

BEIRUT

ATTENTION: PROFESSOR GEBRAN KARAM

SUBJECT : Geotechnical Investigation Report

LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

Dear Sir,

Enclosed is our factual report for the geotechnical investigation campaign carried out at the above mentioned project site.

The soil conditions and results of field and laboratory testing are submitted herein.

Should we be of any further help, please feel free to call us.

Very Truly Yours

Kassim Saleh

17-026-RPT-01 REV 0	10/10/2017	APPROVED ISSUE

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I. INTRODUCTION

At the request of **KREDO, SATCON** carried out a geotechnical investigation campaign at the location of a slope failure in the vicinity of a secondary road stretch between **KFARSELWAN** and **TARSHISH** in **MOUNT LEBANON**.

The purpose of the investigation is to identify the subsurface conditions and to determine an estimate of the physical and mechanical characteristics of the subsurface soil/rock at the problematic road stretch, in order to provide the necessary information ***for further remedial measures***. As such, three coring boreholes were drilled to a depth of 15.0m each from existing ground levels. In Situ Standard Penetration test and laboratory tests were also carried out as a part of the investigation.

This ***factual*** report presents the results of the geotechnical investigation, including the borehole logs and in situ and laboratory test results.

II. SITE AND PROJECT DESCRIPTIONS

SITE DESCRIPTION

The road under consideration is situated in a mountainous agricultural area. It is about 6.0m wide and it is a part of a very steep hillside sloping down from the south to the north.

The scope of the investigation covers an about 20.0m long stretch of this road along with a small area located to the south.

The site area has been subject to severe ground movements. Cracks resulting from these movements are visible at ground surface especially in the northern vicinity of the site.

Surface and subsurface water streams are abundantly present in the site area.

The site location and topographic plans are presented in **Appendix A.**

Figure 1: The Site

III. WORK DESCRIPTION

FIELD WORKS

Three coring boreholes were drilled between the 21st and 23rd of September 2017, to a depth of 15.0m each. The three boreholes are nearly perpendicular to the longitudinal axis of the road.

The drilling was advanced using wash boring techniques with an 86mm double core barrel.

The drilling rig consisted of **CMV 1000** chain mounted machine.

Standard Penetration Tests (SPT) were performed at selected locations in the boreholes.

The borehole locations are shown on the survey plan in **APPENDIX A**.

CORING

Drilling was advanced using coring. Coring was carried out utilizing a double tube, swivel type, 86mm.O.D core barrel equipped with tungsten carbide bit in accordance with ASTM 2113-70 "Diamond Core Drilling for Site Investigation". Coring was carried out at 1.5m intervals (where possible). The core barrel was withdrawn from the hole at the end of every interval and samples recovered were placed in special core boxes for visual description and determination of % TCR, % SCR, and % RQD.

% TCR (TOTAL CORE RECOVERY) is the % ratio of the total length of core recovered (rock and soil) to the length of drilling interval.

% SCR (SOLID CORE RECOVERY) is the % ratio of the solid full diameter core pieces to the length of drilling interval.

% RQD (ROCK QUALITY DESIGNATIONS) is the % ratio of the sum of the lengths of core pieces 10cm. or longer to the length of drilling interval.

All samples recovered were visually described on site, then properly sealed and transported to the laboratory for further observation.

The borehole logs are presented in **Appendix B**.

The core box photographs are presented in **Appendix C.**

The core records are plotted against borehole depths and presented in **Appendix D.**

STANDARD PENETRATION TESTS (SPT)

Where soft formation was encountered, the Standard Penetration Test (SPT) was done at selected interval. It was carried out in accordance with ASTM D-1586. In this test a split sampler tube having a 50 mm. outer diameter is driven in the soil by means of a 62.5Kg weight freely falling from a height of 76 cm. The number of blows needed for penetration of the sampler for 150 mm. is recorded for 3 intervals (for a total of 450 mm.) The number of blows needed for the last 300 mm of penetration is considered to be the Standard Penetration Value (N), which is an indication of the relative density of cohesionless soils and consistency of cohesive soils. If penetration of the sampler could not be achieved in 50 blows, refusal is reported and actual penetration of sampler is recorded.

The results of the SPT tests are presented on the borehole logs in **Appendix B.**

LABORATORY WORKS

Laboratory tests were performed on selected samples obtained from the borings to aid in the classification of the soil and to determine their engineering properties. Tests were carried out in accordance with the relevant ASTM standards. The tests performed are listed in **Table 1**:

Table 1.List of Performed Laboratory Tests.

DESCRIPTION	QUANTITY
Uniaxial Compressive Strength on Rock (ASTM D 7012)	**4**
Particle Size Analysis (ASTM D 422)	**10**
Atterberg Limits (ASTM D 4318)	**10**

The laboratory test results are presented in **Appendix E** along with a summary.

IV. GROUND CONDITIONS

GEOLOGY

According to the geological map of ZAHLE, the site surface is underlain by SANDSTONE and lignite of the CRETACEOUS age (C1) followed by KESERWAN LIMESTONE of the SEQUANIEN age (J6).

No faults or any geological features are present in the site area.

The geological plan of the site area is presented in **Appendix A.**

SUBSURFACE CONDITIONS

Interpretation of the boring records revealed that the ground conditions below the existing site surface generally consist of interbedding clayey SAND and sandy CLAY underlain by SANDSTONE. The soil layers have thicknesses varying between 7.5m and 10.5m. It shall be mentioned that the change in colors in a single layer of soil may be the result of the ground movements taking place in the site area.

A 2.0m thick layer of MADE GROUND was encountered at the top of borehole BH01. This layer consists of cobbles of basalt and limestone with clay.

Three thin layers of MARL (less than 0.6m) were encountered within the CLAY in the lower part of borehole BH01 and within the SAND in borehole BH02.

THE SAND

The SAND was encountered in layers having thicknesses between 1.0m and 8.0m. The SAND can be described as dense to very dense yellowish, greyish, and light to dark brown/ beige and light olive green/ white/ red clayey SAND. The SAND was found to be occasionally silty.

Figure 1 shows the variation of SPT N- values with depth in SAND and CLAY formations.

Three Particle Size Analysis tests performed on selected samples from the SAND formation gave fine contents between 46% and 48%.

Three Atterberg Limit tests carried out on the above selected samples gave plasticity index between 0 and 19.80%.

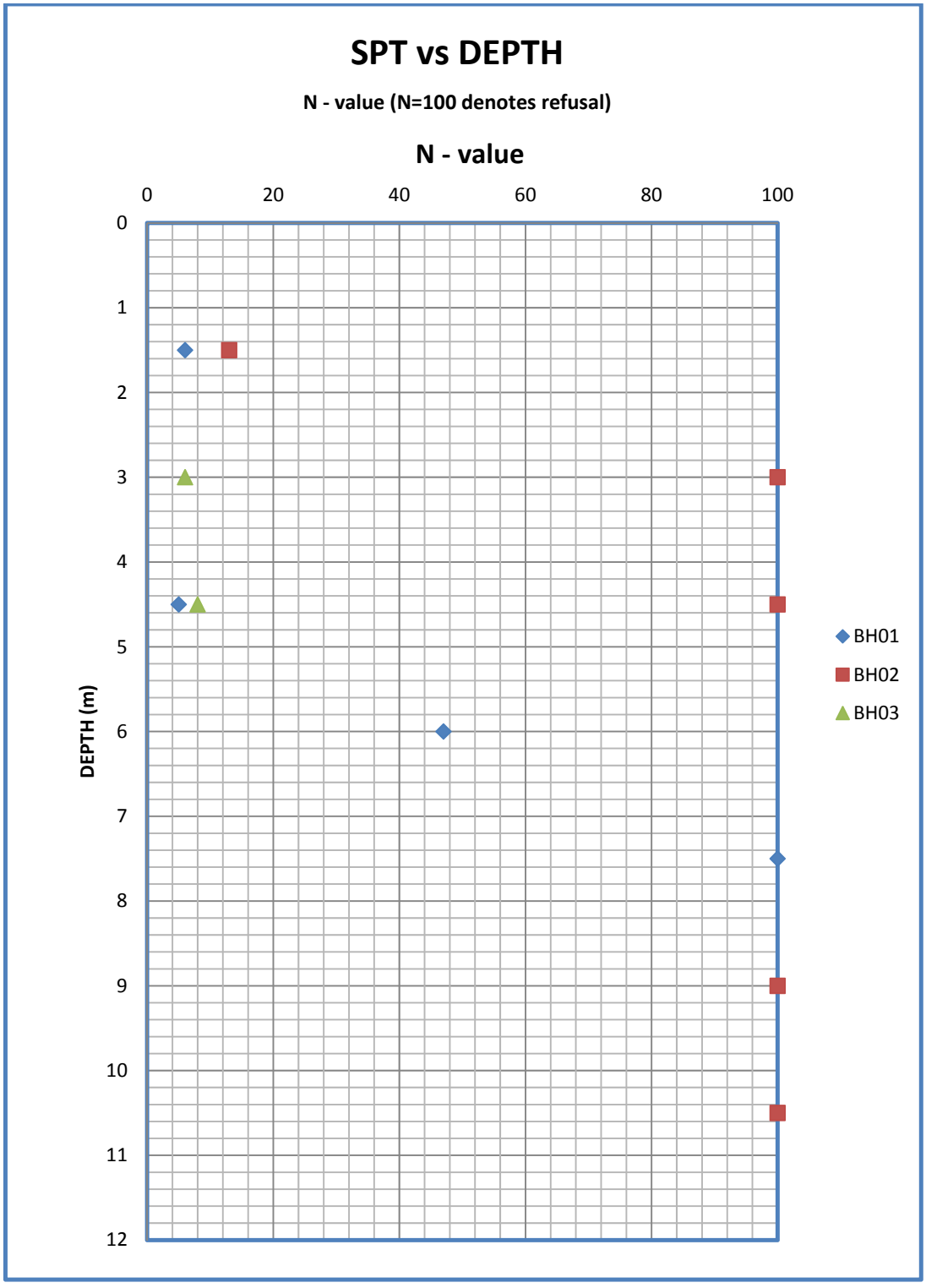


Figure 2: SPT plot

THE CLAY

The CLAY was generally encountered within the clayey SAND formation in the three drilled boreholes and beneath the SANDSTONE formation in borehole BH01. It was found in layers having thicknesses between 1.5m and 3.5m. The CLAY can be described as medium stiff light brown/ grey (sandy) CLAY with cobbles of basalt in occasional places.

Four SPT N- values conducted in the CLAY formation gave N- values between 5 & refusal (Figure **1**).

Three Particle Size Analysis tests performed on selected samples from the CLAY formation gave fine contents between 45% and 90%.

Three Atterberg Limit tests carried out on the above selected samples gave plasticity index values between 8.72% and 30.54%.

THE SANDSTONE

The SANDSTONE was encountered in the lower part of borehole BH01 and at the bottom of boreholes BH02 and BH03. It can be described as weak to moderately strong beige/ brownish yellow/ yellowish beige/ greyish brown very closely to closely fractured SANDSTONE with occasional pockets of clayey sand.

Four Uniaxial Compressive Strength tests carried out on selected samples from the SANDSTONE gave strength values between 4340Kpa and 13240Kpa.

WATER CONDITIONS

A standpipe piezometer was installed in each of the drilled boreholes for ground water level monitoring. Flushing water used during drilling was pumped out of the boreholes. The piezometers were monitored over a period of one week. Ground water was encountered at levels of 1608.0mAD, 1612.0mAD, and 1613.0mAD in borehole BH01, BH02, and BH03 respectively.

V. ENGINEERING ANALYSIS

SOIL PARAMETERS

Based on our previous experience with similar ground formations and on the results of the laboratory tests carried out, the recommended soil parameters for the formations encountered are listed in **Table 4**.

Table 2. Recommended Soil Parameter

PARAMETER	SYMBOL (UNIT)	SAND	CLAY	SANDSTONE
Cohesion	**C (KPa)**	**10**	**55**	**120**
Angle of internal Friction	**Ø (o)**	**30**	**10**	**20**
Unit weight (dry)	**γ (KN/m^3)**	**16**	**18**	**22**
Young's Modulus	**KPa**	**30,000**	**25,000**	**80,000**
Poisson's Ratio	υ	**0.3**	**0.35**	**0.25**

VI. CLOSURE

In conclusion, this report is based on data collected from drilling three boreholes down to a maximum depth of 15.0m from current ground surface at the time of investigation, and on results of laboratory and in situ tests conducted on representative samples of soil encountered. We believe this report reflects the actual situation on site. However, if during construction, some variations were observed, our office shall be notified to assess the situation and amend our recommendations accordingly.

APPENDIX A

SITE LOCATION PLAN

BOREHOLE LOCATION & TOPOGRAPHIC PLAN

GEOLOGICAL PLAN

SOIL PROFILES

NOTES :

REV.	DATE	DESCRIPTION	APP.
a	10/10/17	Geotechnical Report	

SATCON - GEOTECHNICAL ENGINEERING

AKBEIH, SAIDA-TYRE COASTAL ROAD, ZAHRANI TEL: 07260978, 03666016

CLIENT:

KREDO

PROJECT

LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

TITLE

SITE LOCATION PLAN

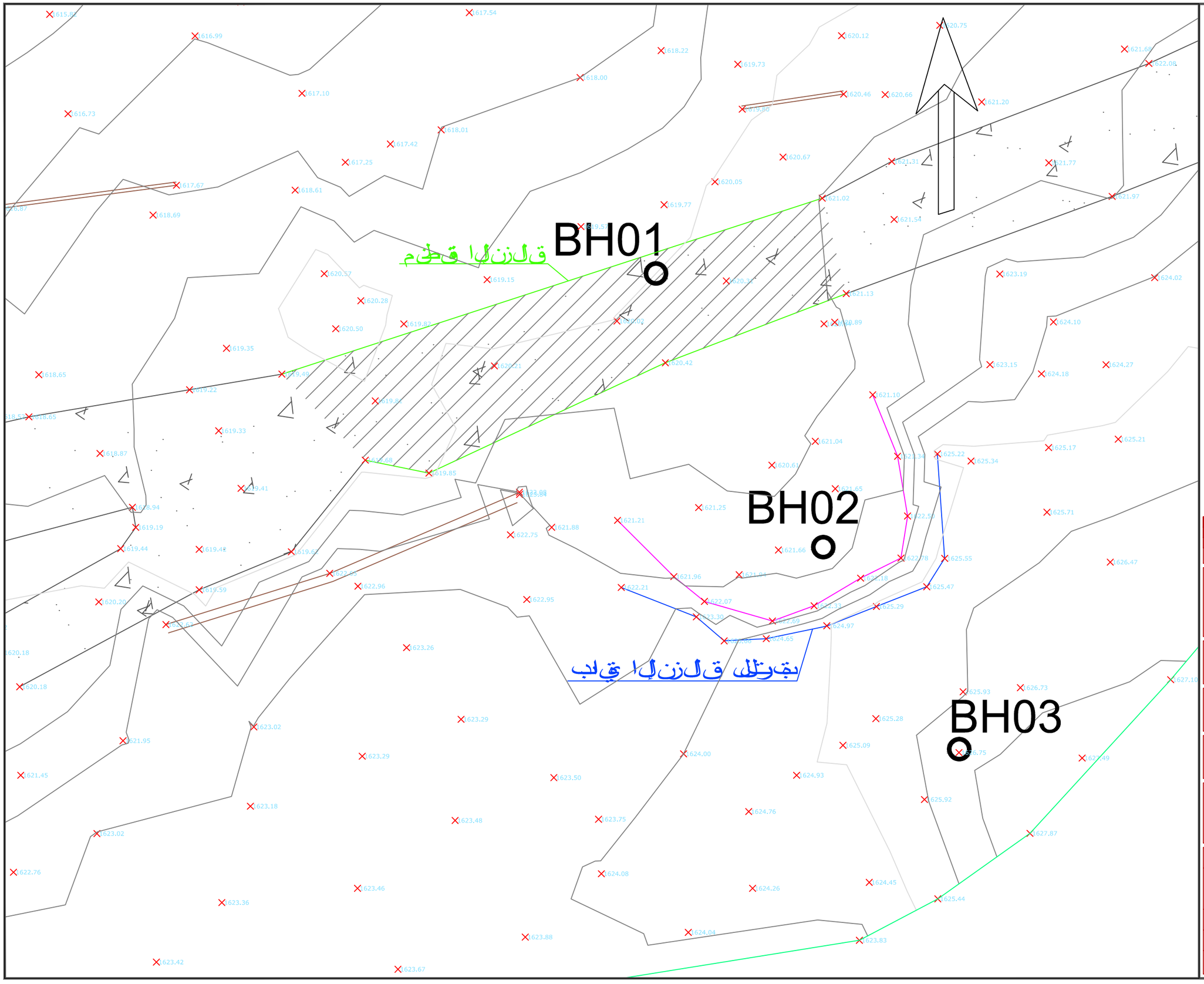
DRAWN	DESIGNED	CHECKED	APPROVED
M.T.	M.T.	M.S.	K.S.

PROJECT NO: 17-026

DATE:	LOT NO:	LOT AREA:	SCALE :
10-10-17	..	KFARSELWAN	

PROJECT LOCATION: KFARSELWAN

SHEET NO. 17-026-GE-01



NOTES :

REV.	DATE	DESCRIPTION	APP.
a	10/10/17	Geotechnical Report	

SATCON - GEOTECHNICAL ENGINEERING

AKBEIH, SAIDA-TYRE COASTAL ROAD, ZAHRANI TEL: 07260978, 03666016

CLIENT:
KREDO

PROJECT
LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

TITLE
TOPOGRAPHIC AND BOREHOLE LOCATION PLAN

DRAWN	DESIGNED	CHECKED	APPROVED
M.T.	M.T.	M.S.	K.S.

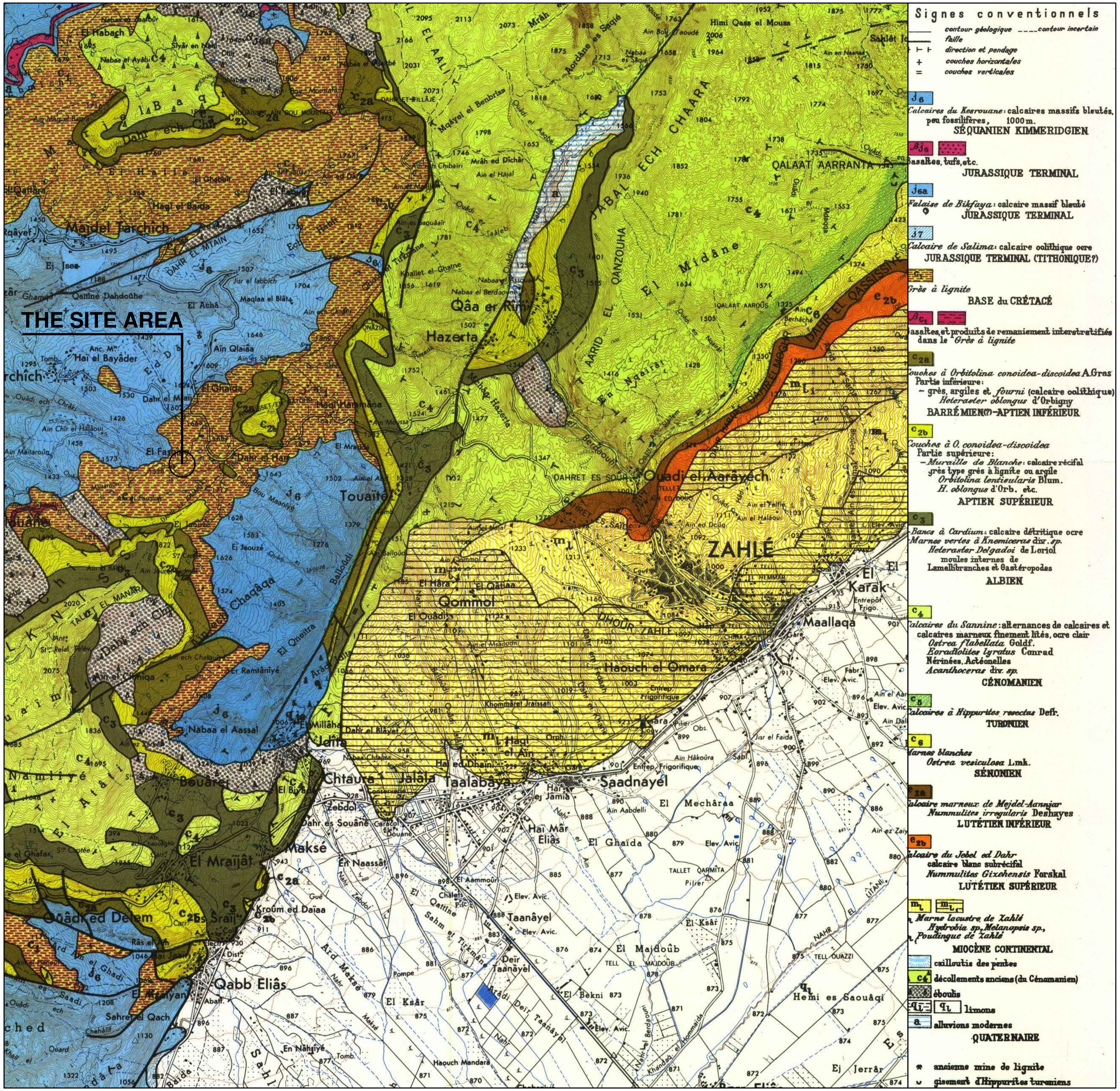
PROJECT NO: 17-026

DATE:	LOT NO:	LOT AREA:	SCALE :
10-10-17	..	KFARSELWAN	

PROJECT LOCATION:
KFARSELWAN

SHEET NO.
17-026-GE-02

NOTES :



REV.	DATE	DESCRIPTION	APP.
a	10/10/17	Geotechnical Report	

SATCON - GEOTECHNICAL ENGINEERING

AKBEIH, SAIDA-TYRE COASTAL ROAD, ZAHRANI TEL: 07260978, 03666016

CLIENT:

KREDO

PROJECT

LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

TITLE

GEOLOGICAL PLAN

DRAWN	DESIGNED	CHECKED	APPROVED
M.T.	M.T.	M.S.	K.S.

PROJECT NO: 17-026

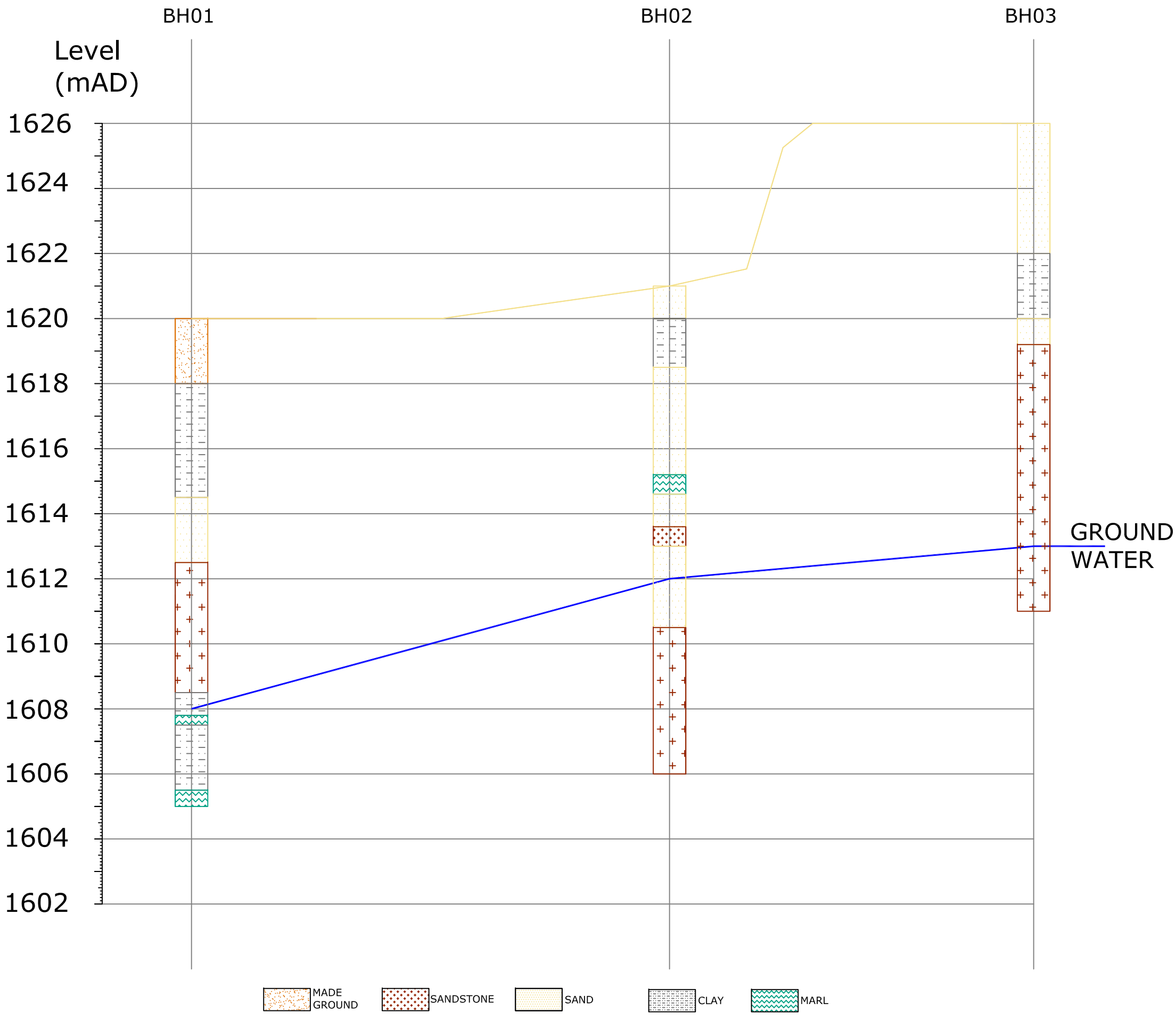
DATE:	LOT NO:	LOT AREA:	SCALE :
10-10-17	--	KFARSELWAN	

PROJECT LOCATION:

KFARSELWAN

SHEET NO.

17-026-GE-03



NOTES :

REV.	DATE	DESCRIPTION	APP.
a	10/10/17	Geotechnical Report	

SATCON - GEOTECHNICAL ENGINEERING

AKBEIH, SAIDA-TYRE COASTAL ROAD, ZAHRANI TEL: 07260978, 03666016

CLIENT:

KREDO

PROJECT

LANDSLIDE ON KFARSELWAN- TARSHISH ROAD

TITLE

SOIL PROFILE

DRAWN	DESIGNED	CHECKED	APPROVED
M.T.	M.T.	M.S.	K.S.

PROJECT NO: 17-026

DATE:	LOT NO:	LOT AREA:	SCALE :
10-10-17	--	KFARSELWAN	

PROJECT LOCATION: KFARSELWAN

SHEET NO. 17-026-GE-04

APPENDIX B

BOREHOLE LOGS

SYMBOLS

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	**KREDO**	**FILE NO.:** 17-026	**BOREHOLE NO.:** **BH01**
PROJECT:	**LAND SLIDE ON KFARSELWAN TARSHISH ROAD**		
LOCATION:	KFARSELWAN	**Elevation (m):** 1620	**SHEET:** 1 **OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:** Rotary	**BOREHOLE DEPTH (m):** 15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):** 86	**DATE STARTED:** **21/09/2017**
ENGINEER:	K.S.	**DRILLER:** N.A.	**DATE FINISHED:** **22/09/2017**

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					MADE GROUND: cobbles of basalt and limestone with clay		57%	8%	0%		No Flushing water loss
2			2,3,3 N=6								
3					medium stiff light brown sandy CLAY with sand		67%	0%	0%		
4							27%	0%	0%		
5			3,3,2 N=5		ditto, no sand						
6							81%	0%	0%		
7			18,21,26 N=47		dense yellowish, greyish, and dark brown silty SAND		38%	0%	0%		
8			50/0cm Refusal		light brown SAND with cobbles of basalt						Casing down to 7.5m
					hard grey CLAY with sand		83%	0%	0%		
9					weak brownish beige very closely to closely fractured SANDSTONE						
10							87%	12%	7%		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	KREDO	**FILE NO.:**	17-026	**BOREHOLE NO.:**	BH01
PROJECT:	LAND SLIDE ON KFARSELWAN TARSHISH ROAD				
LOCATION:	KFARSELWAN	**Elevation (m):**	1620	**SHEET:** 2	**OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):**	86	**DATE STARTED:**	21/09/2017
ENGINEER:	K.S.	**DRILLER:**	N.A.	**DATE FINISHED:**	22/09/2017

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					moderately strong very closely to closely fractured SANDSTONE with pockets of clayey sand		87%	12%	7%		
12					hard brown CLAY		77%	35%	35%		
13					hard grey MARL						
14					hard brown CLAY		93%	0%	0%		
15					beige sandy MARL		93%	0%	0%		
16											
17											
18											
19											
20											
					End of Borehole at 15.0m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	KREDO	**FILE NO.:**	17-026	**BOREHOLE NO.:**	BH02
PROJECT:	LAND SLIDE ON KFARSELWAN TARSHISH ROAD				
LOCATION:	KFARSELWAN	**Elevation (m):**	1621	**SHEET:**	1 **OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):**	86	**DATE STARTED:**	22/09/2017
ENGINEER:	K.S.	**DRILLER:**	N.A.	**DATE FINISHED:**	22/09/2017

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					light brown clayey SAND		57%	0%	0%		No Flushing water loss
2			3,5,8 N=13		light to yellowish brown CLAY with sand		100%	0%	0%		
3			23,50/7cm Refusal		light and yellowish brown gravely SAND with occasional cobbles of sandstone						Casing down to 3.0m
4							55%	4%	0%		
5			21,27,50/8cm Refusal				59%	0%	0%		
6					grey clayey MARL						
					yellowish beige clayey MARL						
7					beige and light olive green clayey SAND		90%	0%	0%		
8					brown and yellow very closely fractured SANDSTONE						
9					white SAND		18%	0%	0%		
10			50/8cm Refusal		very dense light and brown clayey SAND		60%	0%	0%		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	KREDO	**FILE NO.:**	17-026	**BOREHOLE NO.:**	BH02
PROJECT:	LAND SLIDE ON KFARSELWAN TARSHISH ROAD				
LOCATION:	KFARSELWAN	**Elevation (m):**	1621	**SHEET:** 2	**OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):**	86	**DATE STARTED:**	22/09/2017
ENGINEER:	K.S.	**DRILLER:**	N.A.	**DATE FINISHED:**	22/09/2017

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11			50/7cm Refusal		red SAND weak brownish and beigish yellow very closely to closely fractured SANDSTONE		60%	0%	0%		
12							73%	0%	0%		
13							79%	0%	0%		
14							80%	0%	0%		
15											
16											
17											
18											
19											
20											
					End of Borehole at 15.0m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	KREDO	**FILE NO.:**	17-026	**BOREHOLE NO.:**	BH03
PROJECT:	LAND SLIDE ON KFARSELWAN TARSHISH ROAD				
LOCATION:	KFARSELWAN	**Elevation (m):**	1626	**SHEET:**	1 **OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):**	86	**DATE STARTED:**	23/09/2017
ENGINEER:	K.S.	**DRILLER:**	N.A.	**DATE FINISHED:**	23/09/2017

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
1					loose dark brown to light olive green clayey SAND with cobbles of basalt		47%	0%	0%		No Flushing water loss
2											
3			2,3,3 N=6				59%	0%	0%		Casing down to 3.0m
4							63%	0%	0%		
5			3,4,4 N=8		medium stiff dark brown to light olive green sandy CLAY with cobbles of basalt						
6							90%	0%	0%		
7					loose dark brown to light olive green clayey SAND with cobbles of basalt		53%	0%	0%		
8					weak yellowish beige very closely to closely fractured SANDSTONE		80%	0%	0%		
9											
10							73%	0%	0%		

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON
SOIL STUDIES

BORING LOG

CLIENT:	KREDO	**FILE NO.:**	17-026	**BOREHOLE NO.:**	BH03
PROJECT:	LAND SLIDE ON KFARSELWAN TARSHISH ROAD				
LOCATION:	KFARSELWAN	**Elevation (m):**	1626	**SHEET:** 2	**OF:** 2
EQUIPMENT:	CMV 1000	**METHOD:**	Rotary	**BOREHOLE DEPTH (m):**	15.0
HOLE DAM. (mm):	127mm	**CORE DIAM. (mm):**	86	**DATE STARTED:**	23/09/2017
ENGINEER:	K.S.	**DRILLER:**	N.A.	**DATE FINISHED:**	23/09/2017

DEPTH (m)	SYMBOL	ST	SPT N blows	LT	DESCRIPTION OF MATERIAL	% FINES	TCR (%)	SCR (%)	R.Q.D (%)	UCS N/mm2	Remarks
11					ditto		73%	0%	0%		
12					weak light greyish brown to yellowish beige very closely to closely fractured SANDSTONE		100%	47%	23%		
13							80%	39%	9%		
14											
15							87%	0%	0%		
16											
17											
18											
19											
20											
					End of Borehole at 15.0m						

SPT	Standard Penetration Test	TCR	Total Core Recovery	ST	Sample Type
UCS	Unconfined Compressive Strength	RQD	Rock Quality Designation	SYM	Symbol
LT	Layer Thickness	SCR	Solid Core Recovery	WT	Water Table

N Number of blows from SPT. Where full 0.3m has not been achieved, the number of blows for the quoted penetration is given

SATCON

SOIL STUDIES

LEGEND

SOIL SYMBOL


GP


GP-GM


GM


GC


SW


SP


SP - SM


SM-SC


ML


CH-MH


OL


OH


PT


Fill Material


CLAY


CLAYwith Sand and Gravel

ROCK SYMBOL


Dolomite


Chalky Limestone


Calcarenite


Weak Chalky LIMESTONE


Sandy Limestone


Basalt / volcanics


Chert


CL


Creamy White LIMESTONE


Grainstone LIMESTONE


MARL


SANDSTONE


CLAYSTONE


Oolitic LIMESTONE


Micritic LIMESTONE


Mudstone


Gypsum


Siltstone

SAMPLERS


SPT (disturbed)


Shelby tube


Tricone


Double tube

OTHERS


Water Level

ROCK CLASSIFICATION

% RQD	Classification
<25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

GRANULAR SOILS

N-Value	Relative Density
< 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE SOIL

N-Value	Consistency
< 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very stiff
> 30	Hard

APPENDIX C

CORE BOX PHOTOGRAPHS


Kfar Selwan
BH01 Box 01
0 → 8.01m
1.50
3.00
4.50
6.00
7.30 → SPT:R


Kfar Selwan
BH01 Box 02
8.0 → 12.81m
10.50
12.00


Kfar Selwan
BH01 Box03
12.8 → 15.01 (m)


Kfar Selwan
BH02 Box01
0 → 6.2 (m)


Kfar Selwan
BH02 Box02
6.2 → 12.8 (m)


Kfar Selwan
BH02 Box03
12.8 → 15.0 (m)

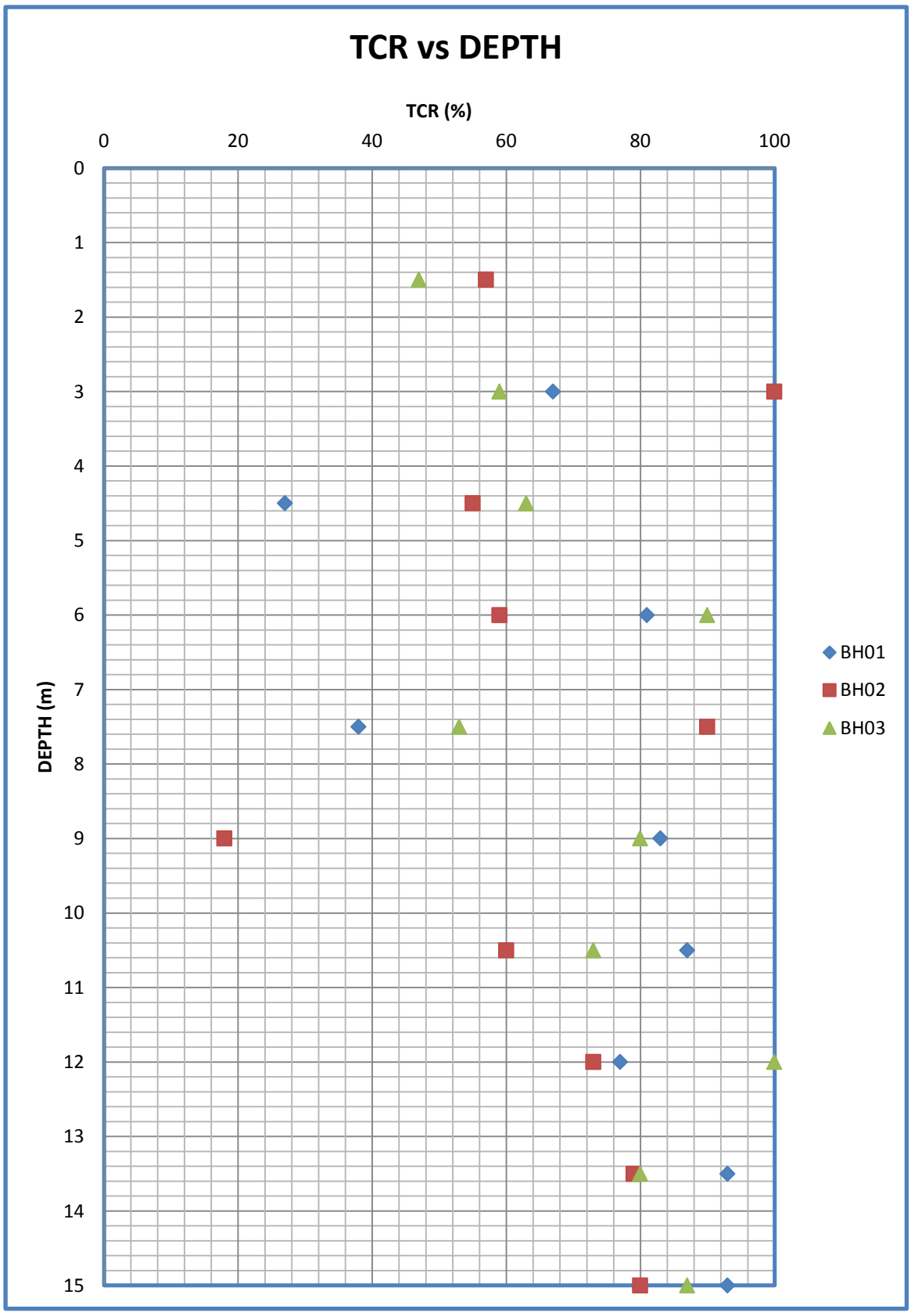

Kfar Selwan
BH03 Box01
0 → 7.0 (m)
0.00
1.50
3.00
4.50
6.00


Kfar Selwan
BH03 Box02
7.0 → 12.0 (m)
9.00
10.50
12.00


Kfar Selwan
BH03 Box03
12.0 → 15.0 mv
13.00
15.00

APPENDIX D

CORING PLOTS


TCR vs DEPTH
TCR (%)
0
20
40
60
80
100
DEPTH (m)
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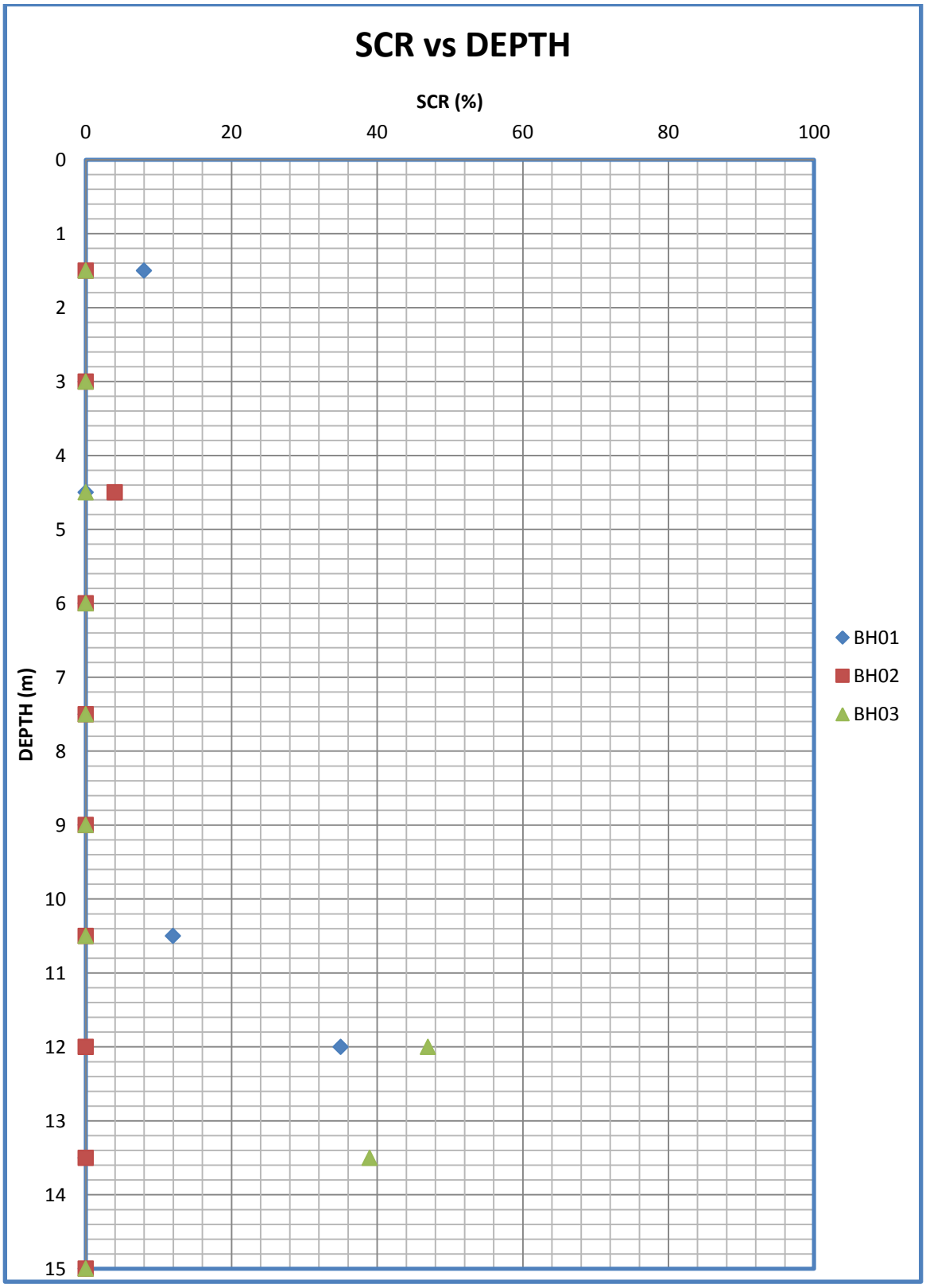
2
3
4
5
6
7
8
9
10
11
12
13
14
15
BH01
BH02
BH03


SCR vs DEPTH
SCR (%)
0
20
40
60
80
100
DEPTH (m)
0
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3
4
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9
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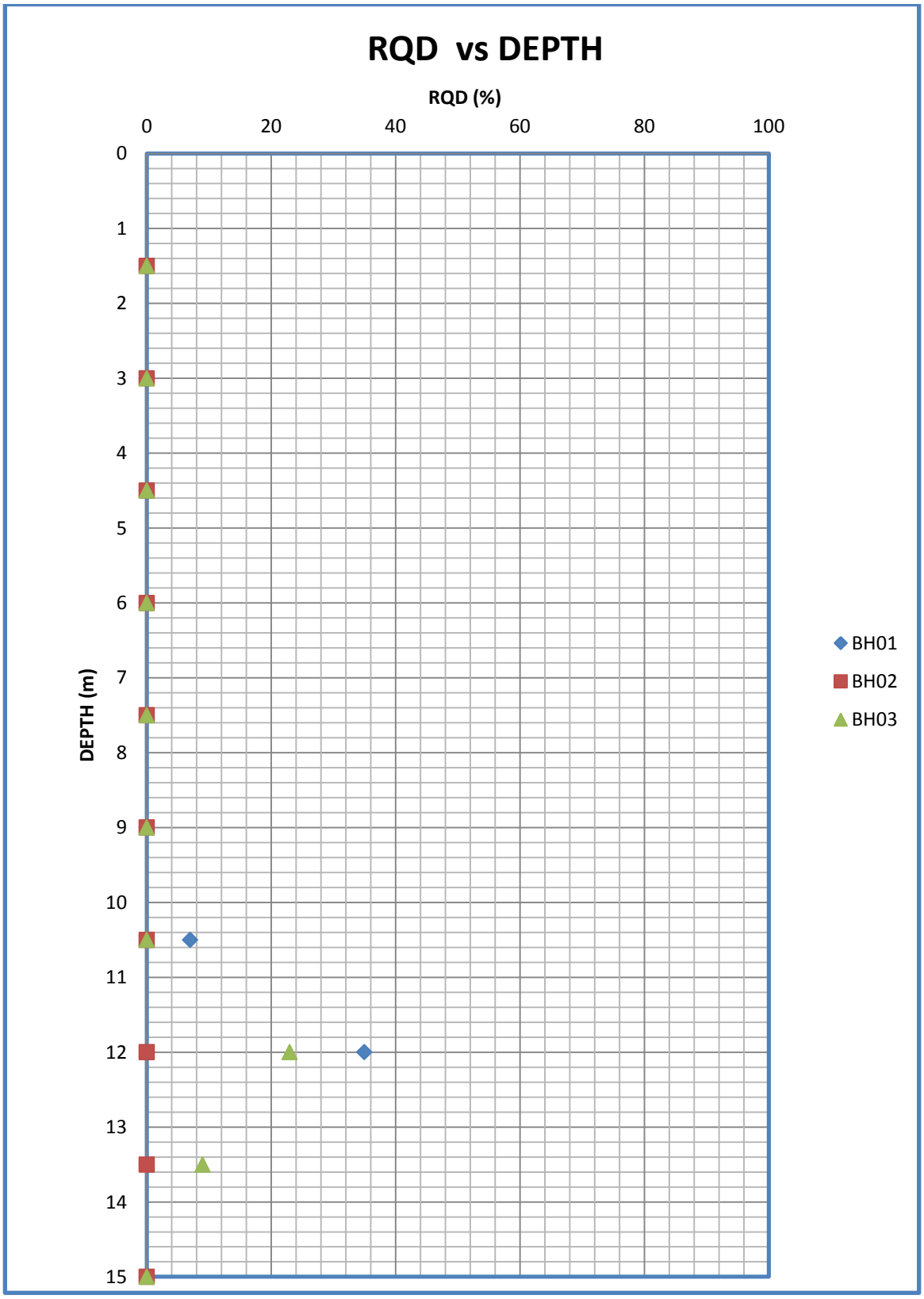
BH01
BH02
BH03


RQD vs DEPTH
RQD (%)
0
20
40
60
80
100
DEPTH (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
BH01
BH02
BH03

APPENDIX E

LABORATORY TEST SUMMARY

LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS

Location		Sieve Analysis			Density (GM/CC)	Water Content %	Atterberg Limits			Unconfined Compression			Uniaxial Compressive Strength (Kpa)
Borehole	Depth (m)	Gravel (%)	Sand (%)	Fines (%)			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Strength (Kpa)	Undrained Cohesion (Kpa)	Young Modulus (Kpa)	
BH01	4.0 - 4.5	3.58	16.90	79.52		37.14	33.91	19.29	14.62				
	5.0 - 5.5	0.00	9.63	90.37		44.23	57.68	27.14	30.54				
	5.5 - 6.0	0.72	53.60	45.69		17.67	N.P.	N.P.	N.P.				
	7.5 - 7.75	0.00	18.52	81.48	2.16	17.72	49.74	20.28	29.46	121.26	60.63	24,251.03	
	10.0 - 10.5	0.00	53.38	46.62	2.26	6.47	25.57	14.71	10.86	413.25	206.63	10,331.35	
	11.0 - 11.4				2.43								13,240
	12.0 - 12.5				2.24	14.14				1,308.45	654.23	19,825.02	
BH02	2.0 - 2.5	0.26	20.32	79.42	2.01	37.82	52.62	23.31	29.31	123.80	61.90	5,158.42	
	6.0 - 6.25	3.84	32.88	63.28		17.77	36.23	14.75	21.48				
	7.0 - 7.2	12.56	43.03	44.41		12.98	39.43	13.89	25.54				
	10.0 - 10.4				2.25	5.61				1200.79	600.4	31,599.78	
	13.8 - 14.0				2.04	3.71				972.9	486.45	30403.15	
BH03	4.0 - 4.5	0.00	24.93	75.07		39.52	30.46	21.73	8.72				
	6.5 - 6.8	1.85	50.39	47.76		16.59	33.11	13.31	19.80				
	9.2 - 9.5				2.12								4,340
	11.5 - 11.8				2.45								4,890
	13.6 - 13.8				2.12								4,350

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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	4.0 - 4.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	1	2	
Wt. of Container	11.09	11.03	
Wt. of Container + wet soil	12.17	12.69	
Wt. of Container + dry soil	11.99	12.43	
wt. of dry soil	0.90	1.40	
wt. of water	0.18	0.26	
moisture content w%	20.0	18.6	

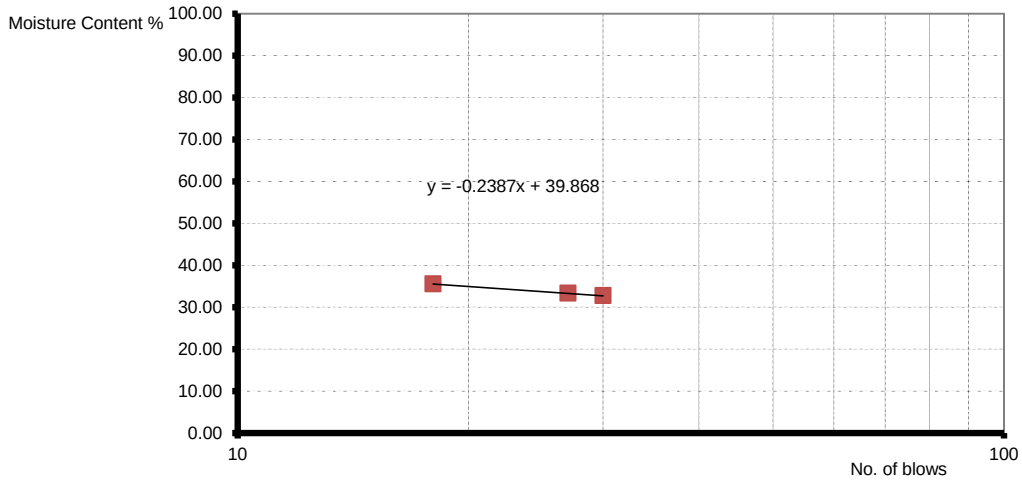
Plastic Limit = 19.29

LIQUID LIMIT DETERMINATION

Number of Blows	18	27	30
Container number	3	4	5
Weight of wet soil + container (g)	14.14	13.48	14.24
Weight of dry soil + container (g)	13.30	12.86	13.46
Weight of water in sample (g)	0.84	0.62	0.78
Weight of container (g)	10.94	11.00	11.08
Weight of dry soil (g)	2.36	1.86	2.38
% moisture	35.59	33.33	32.77

Liquid Limit = 33.91

Plasticity Index = 14.62



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	5.0 - 5.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	FAT CLAY
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	26	27	
Wt. of Container	10.94	11.03	
Wt. of Container + wet soil	11.79	11.82	
Wt. of Container + dry soil	11.61	11.65	
wt. of dry soil	0.67	0.62	
wt. of water	0.18	0.17	
moisture content w%	26.9	27.4	

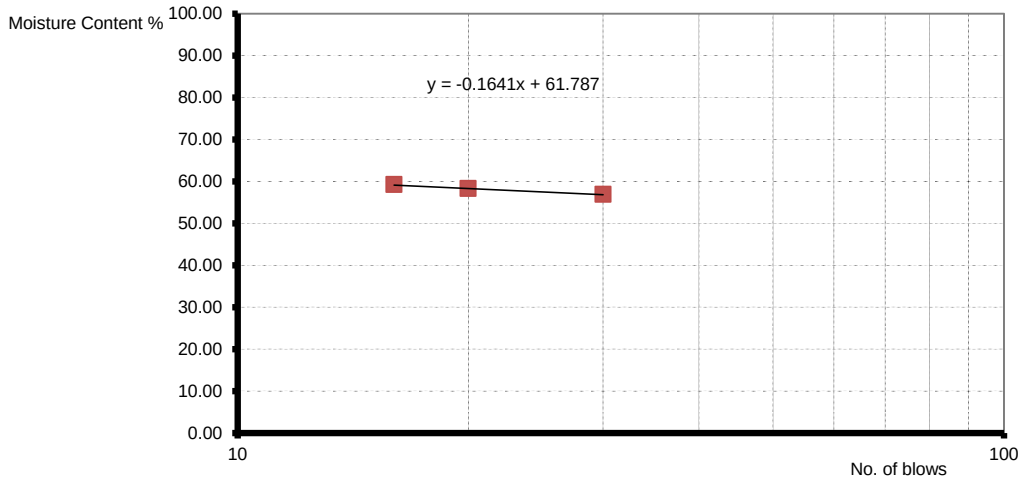
Plastic Limit = 27.14

LIQUID LIMIT DETERMINATION

Number of Blows	16	20	30
Container number	28	29	30
Weight of wet soil + container (g)	34.72	43.09	39.35
Weight of dry soil + container (g)	33.89	41.90	38.28
Weight of water in sample (g)	0.83	1.19	1.07
Weight of container (g)	32.49	39.86	36.40
Weight of dry soil (g)	1.4	2.04	1.88
% moisture	59.29	58.33	56.91

Liquid Limit = 57.68

Plasticity Index = 30.54



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	5.5 - 6.0 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	SILTY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.			
Wt. of Container			
Wt. of Container + wet soil			
Wt. of Container + dry soil			
wt. of dry soil			
wt. of water			
moisture content w%			

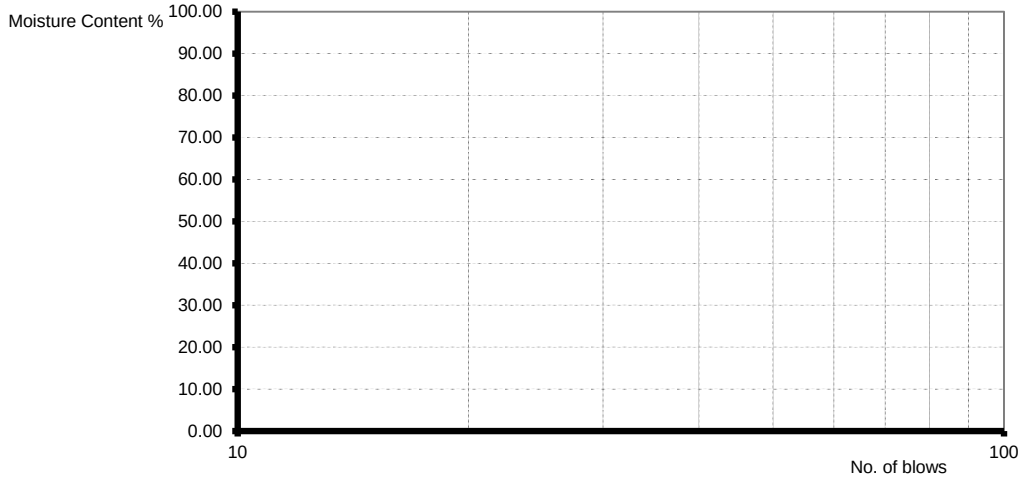
Plastic Limit = N.P.

LIQUID LIMIT DETERMINATION

Number of Blows			
Container number			
Weight of wet soil + container (g)			
Weight of dry soil + container (g)			
Weight of water in sample (g)			
Weight of container (g)			
Weight of dry soil (g)			
% moisture			

Liquid Limit = N.P.

Plasticity Index = N.P.



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	7.5 - 7.75 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	6	7	
Wt. of Container	10.99	4.76	
Wt. of Container + wet soil	12.08	5.69	
Wt. of Container + dry soil	11.90	5.53	
wt. of dry soil	0.91	0.77	
wt. of water	0.18	0.16	
moisture content w%	19.8	20.8	

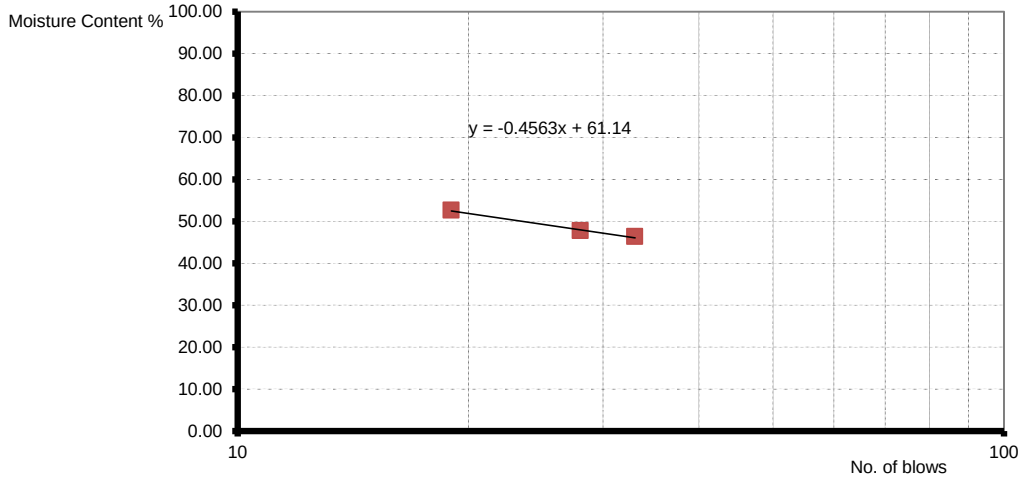
Plastic Limit = 20.28

LIQUID LIMIT DETERMINATION

Number of Blows	19	28	33
Container number	8	9	10
Weight of wet soil + container (g)	7.32	7.55	13.96
Weight of dry soil + container (g)	6.43	6.56	13.05
Weight of water in sample (g)	0.89	0.99	0.91
Weight of container (g)	4.74	4.49	11.09
Weight of dry soil (g)	1.69	2.07	1.96
% moisture	52.66	47.83	46.43

Liquid Limit = 49.74

Plasticity Index = 29.46



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	10.0 - 10.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	41	42	
Wt. of Container	11.87	25.7	
Wt. of Container + wet soil	12.72	26.33	
Wt. of Container + dry soil	12.61	26.25	
wt. of dry soil	0.74	0.55	
wt. of water	0.11	0.08	
moisture content w%	14.9	14.5	

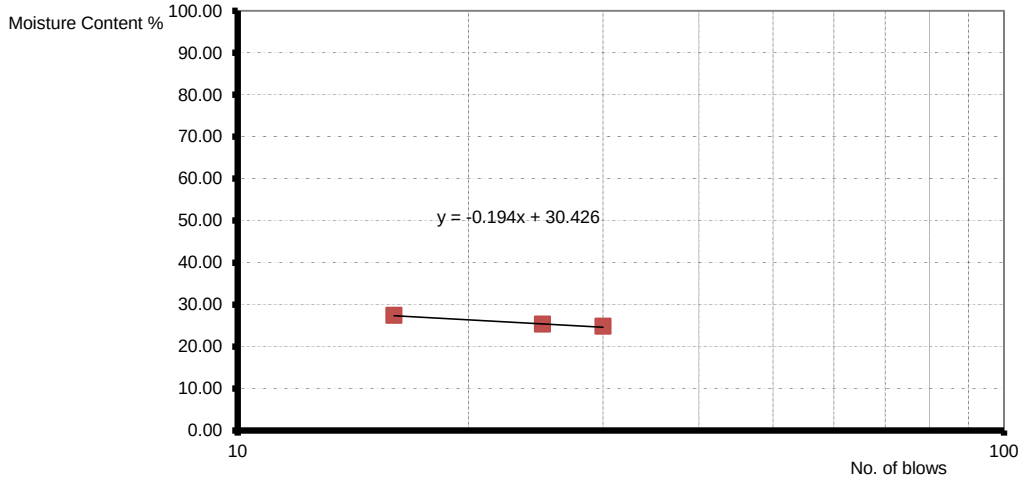
Plastic Limit = 14.71

LIQUID LIMIT DETERMINATION

Number of Blows	16	25	30
Container number	43	44	45
Weight of wet soil + container (g)	28.7	28.86	15.02
Weight of dry soil + container (g)	28.05	28.20	14.42
Weight of water in sample (g)	0.65	0.66	0.6
Weight of container (g)	25.68	25.59	12.00
Weight of dry soil (g)	2.37	2.61	2.42
% moisture	27.43	25.29	24.79

Liquid Limit = 25.57

Plasticity Index = 10.86



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	2.0 - 2.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	FAT CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	1	32	
Wt. of Container	36.52	34.82	
Wt. of Container + wet soil	37.1	35.51	
Wt. of Container + dry soil	36.99	35.38	
wt. of dry soil	0.47	0.56	
wt. of water	0.11	0.13	
moisture content w%	23.4	23.2	

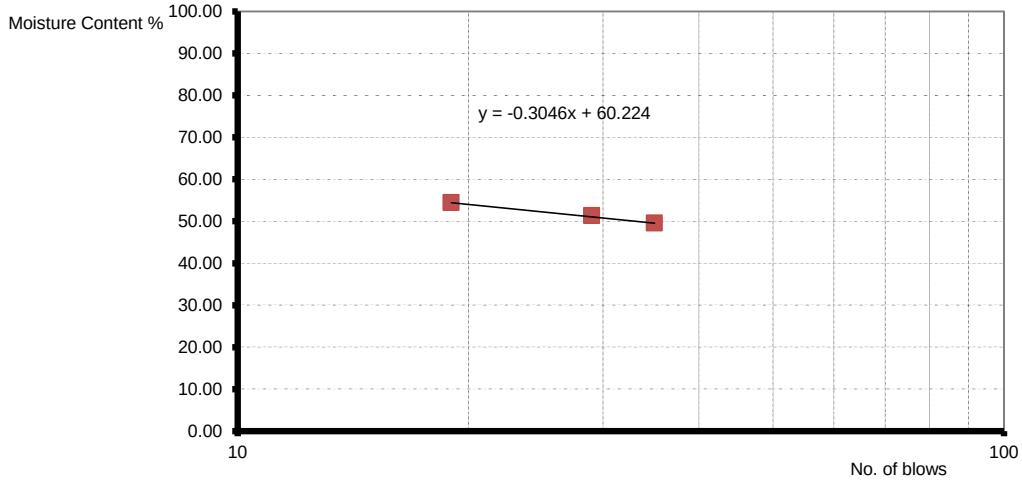
Plastic Limit = 23.31

LIQUID LIMIT DETERMINATION

Number of Blows	19	29	35
Container number	33	34	35
Weight of wet soil + container (g)	37.06	7.22	41.03
Weight of dry soil + container (g)	36.08	6.28	39.86
Weight of water in sample (g)	0.98	0.94	1.17
Weight of container (g)	34.28	4.45	37.50
Weight of dry soil (g)	1.8	1.83	2.36
% moisture	54.44	51.37	49.58

Liquid Limit = 52.62

Plasticity Index = 29.31



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	6.0 - 6.25 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	SANDY LEAN CLAY
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	46	47	
Wt. of Container	4.40	4.44	
Wt. of Container + wet soil	5.2	4.97	
Wt. of Container + dry soil	5.10	4.90	
wt. of dry soil	0.70	0.46	
wt. of water	0.1	0.07	
moisture content w%	14.3	15.2	

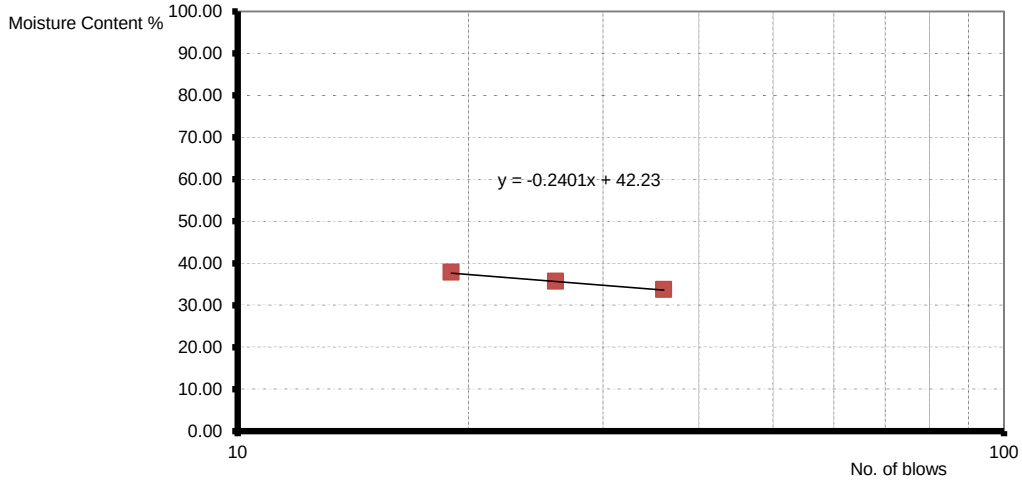
Plastic Limit = 14.75

LIQUID LIMIT DETERMINATION

Number of Blows	19	26	36
Container number	48	49	50
Weight of wet soil + container (g)	7.68	7.13	6.76
Weight of dry soil + container (g)	6.87	6.42	6.17
Weight of water in sample (g)	0.81	0.71	0.59
Weight of container (g)	4.73	4.43	4.42
Weight of dry soil (g)	2.14	1.99	1.75
% moisture	37.85	35.68	33.71

Liquid Limit = 36.23

Plasticity Index = 21.48



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	7.0 - 7.2 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	16	17	
Wt. of Container	11.07	10.97	
Wt. of Container + wet soil	12.134	12.07	
Wt. of Container + dry soil	12.01	11.93	
wt. of dry soil	0.94	0.96	
wt. of water	0.124	0.14	
moisture content w%	13.2	14.6	

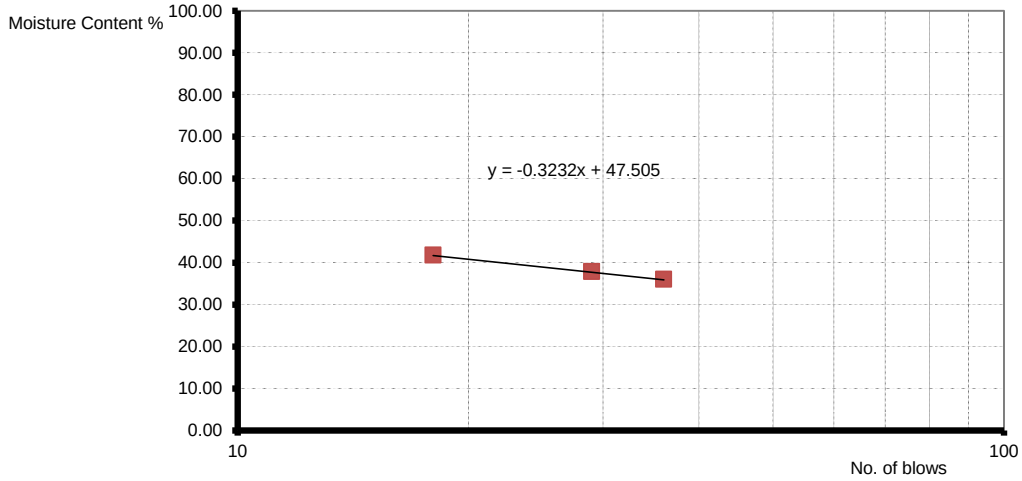
Plastic Limit = 13.89

LIQUID LIMIT DETERMINATION

Number of Blows	18	29	36
Container number	18	19	20
Weight of wet soil + container (g)	13.84	13.90	14.42
Weight of dry soil + container (g)	13.00	13.12	13.53
Weight of water in sample (g)	0.84	0.78	0.89
Weight of container (g)	10.99	11.06	11.06
Weight of dry soil (g)	2.01	2.06	2.47
% moisture	41.79	37.86	36.03

Liquid Limit = 39.43

Plasticity Index = 25.54



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	3
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	4.0 - 4.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	11	12	
Wt. of Container	11.04	11.02	
Wt. of Container + wet soil	12.4	12.46	
Wt. of Container + dry soil	12.16	12.20	
wt. of dry soil	1.12	1.18	
wt. of water	0.24	0.26	
moisture content w%	21.4	22.0	

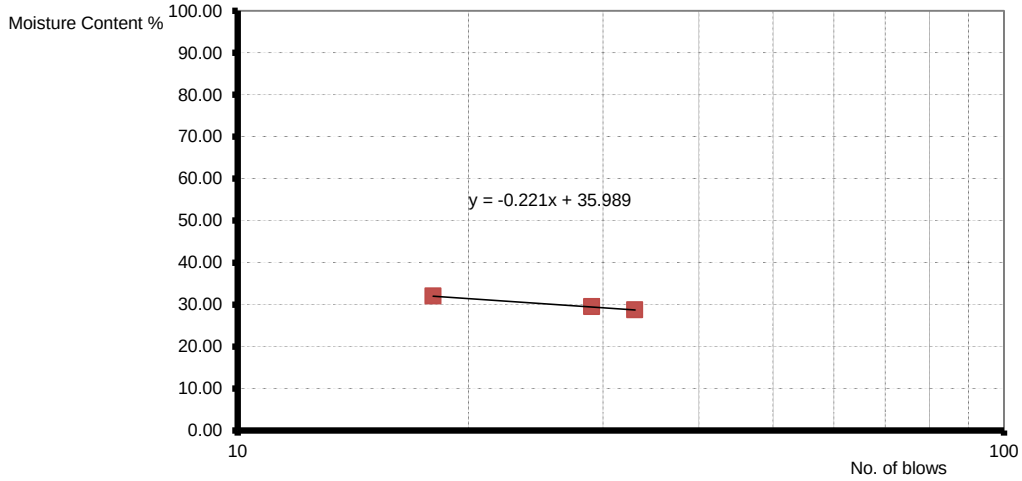
Plastic Limit = 21.73

LIQUID LIMIT DETERMINATION

Number of Blows	18	29	33
Container number	13	14	15
Weight of wet soil + container (g)	14.07	13.80	13.92
Weight of dry soil + container (g)	13.33	13.16	13.27
Weight of water in sample (g)	0.74	0.64	0.65
Weight of container (g)	11.02	10.99	11.01
Weight of dry soil (g)	2.31	2.17	2.26
% moisture	32.03	29.49	28.76

Liquid Limit = 30.46

Plasticity Index = 8.72



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ATTERBERG LIMITS DETERMINATION
ASTM D4318

CLIENT:	KREDO	**BOREHOLE NUMBER:**	3
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	6.5 - 6.8 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

PLASTIC LIMIT DETERMINATION

Container No.	36	37	
Wt. of Container	41.43	35.77	
Wt. of Container + wet soil	42.31	36.43	
Wt. of Container + dry soil	42.21	36.35	
wt. of dry soil	0.78	0.58	
wt. of water	0.1	0.08	
moisture content w%	12.8	13.8	

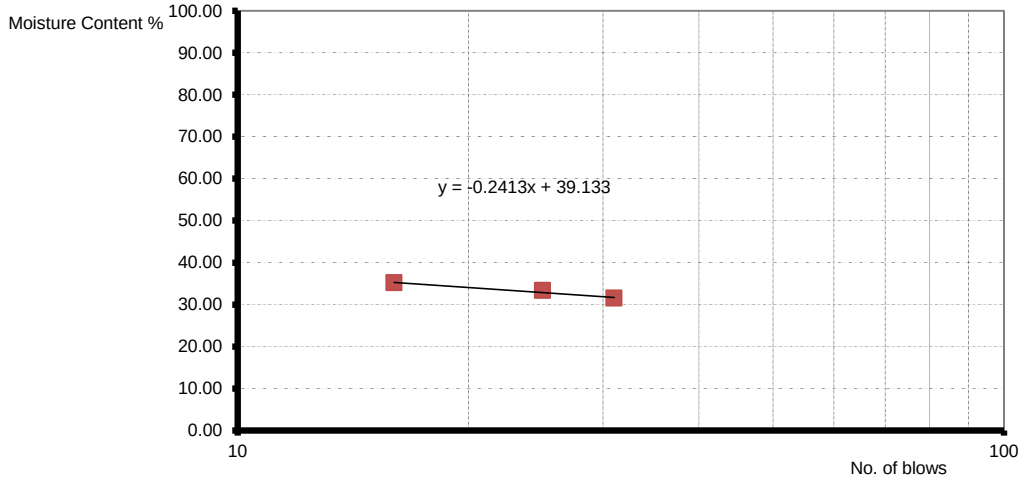
Plastic Limit = 13.31

LIQUID LIMIT DETERMINATION

Number of Blows	16	25	31
Container number	38	39	40
Weight of wet soil + container (g)	25.7	21.07	29.33
Weight of dry soil + container (g)	24.81	20.29	28.35
Weight of water in sample (g)	0.89	0.78	0.98
Weight of container (g)	22.28	17.95	25.24
Weight of dry soil (g)	2.53	2.34	3.11
% moisture	35.18	33.33	31.51

Liquid Limit = 33.11

Plasticity Index = 19.80



GRAIN SIZE ANALYSIS
ASTM D421

1ST FLOOR, SATCON HEADQUARTERS
AKBIEH, SAIDA-TYR COASTAL ROAD
ZAHRANI, LEBANON
TELEFAX:00961 7 26 09 78
MOBILE: 00961 3 74 74 72
website: www.satcon-sss.com
e-mail: info@satcon-sss.com

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	4.0 - 4.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

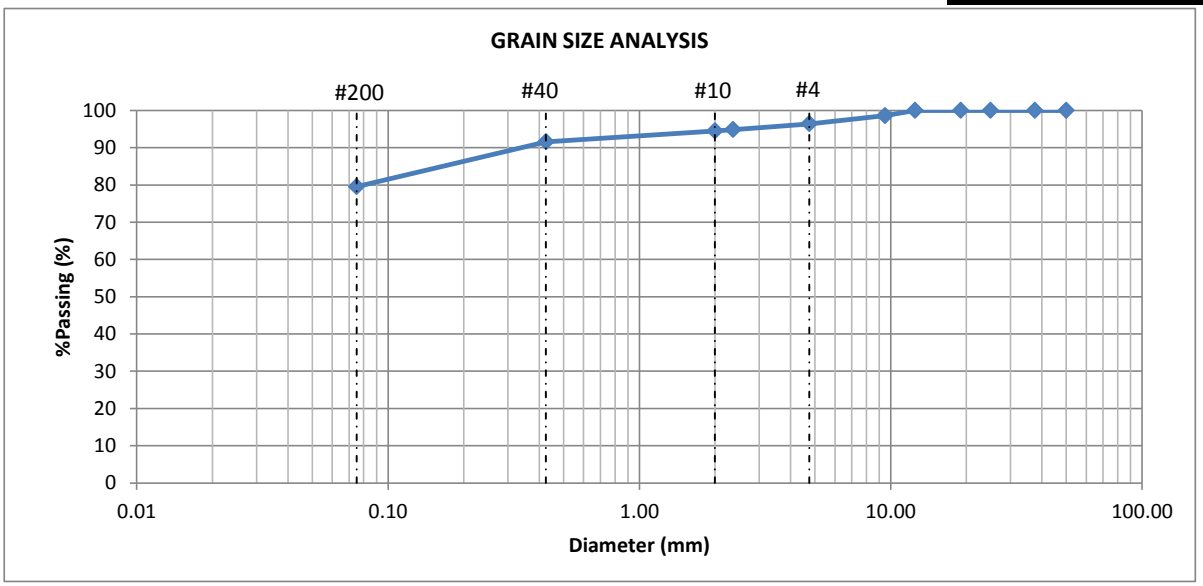
Weight of Tested Sample (g): 379.8

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50	5.3	1.40	1.40	98.60
4	**4.75**	8.3	2.19	3.58	96.42
8	**2.36**	6	1.58	5.16	94.84
10	**2.00**	1.3	0.34	5.50	94.50
40	**0.425**	11.1	2.92	8.43	91.57
200	**0.075**	45.8	12.06	20.48	79.52
PAN		0.5			

GRADING	
% Gravel <4.75mm	3.58 %
% Sand <4.75mm and >0.075mm	16.90 %
% Fines <0.075mm	79.52 %

Liquid Limit LL%	33.91
Plasticity Index PI%	14.62

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	5.0 - 5.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	FAT CLAY
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

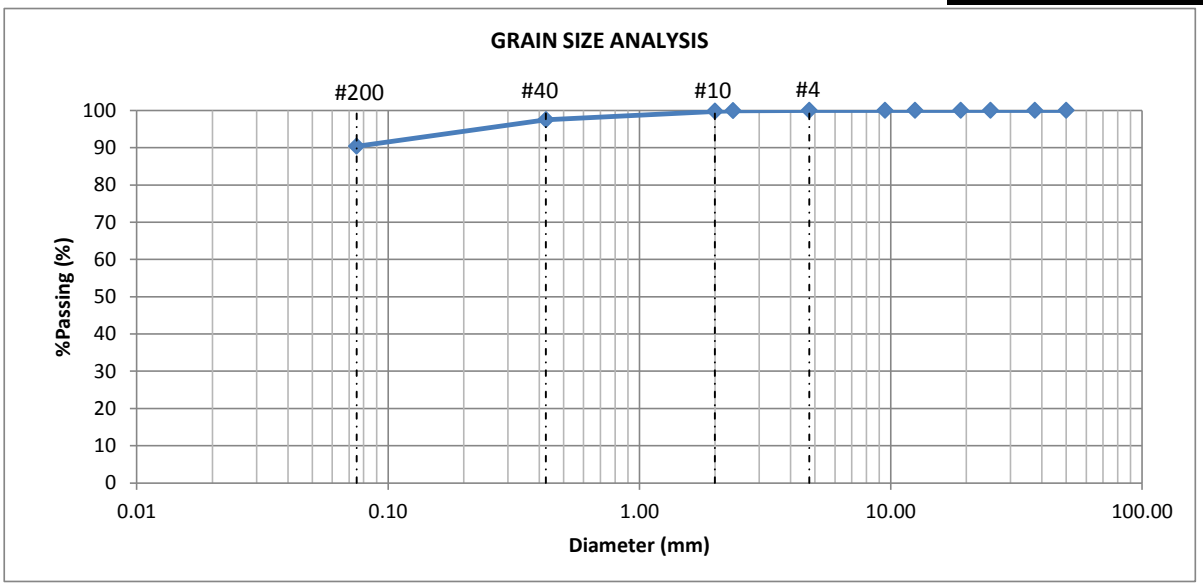
Weight of Tested Sample (g): 224.3

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**		0.00	0.00	100.00
8	**2.36**	0.2	0.09	0.09	99.91
10	**2.00**	0.3	0.13	0.22	99.78
40	**0.425**	5.1	2.27	2.50	97.50
200	**0.075**	16	7.13	9.63	90.37
PAN		0.4			

GRADING	
% Gravel <4.75mm	0.00 %
% Sand <4.75mm and >0.075mm	9.63 %
% Fines <0.075mm	90.37 %

Liquid Limit LL%	57.68
Plasticity Index PI%	30.54

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	5.5 - 6.0 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	SILTY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

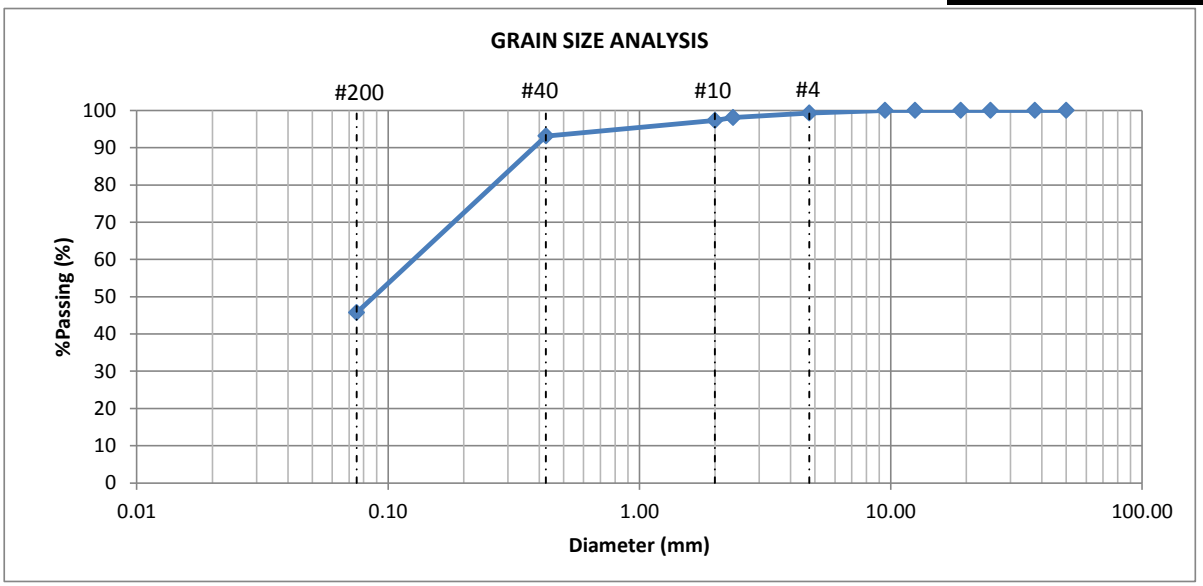
Weight of Tested Sample (g): 376.9

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**	2.7	0.72	0.72	99.28
8	**2.36**	4.5	1.19	1.91	98.09
10	**2.00**	2.9	0.77	2.68	97.32
40	**0.425**	15.8	4.19	6.87	93.13
200	**0.075**	178.8	47.44	54.31	45.69
PAN		1.2			

GRADING	
% Gravel <4.75mm	0.72 %
% Sand <4.75mm and >0.075mm	53.60 %
% Fines <0.075mm	45.69 %

Liquid Limit LL%	N.P.
Plasticity Index PI%	N.P.

C_U	-
C_C	-
USCS	-



REMARKS:

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ASAAD JAAFAR

APPROVED BY:
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CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	7.5 - 7.75 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

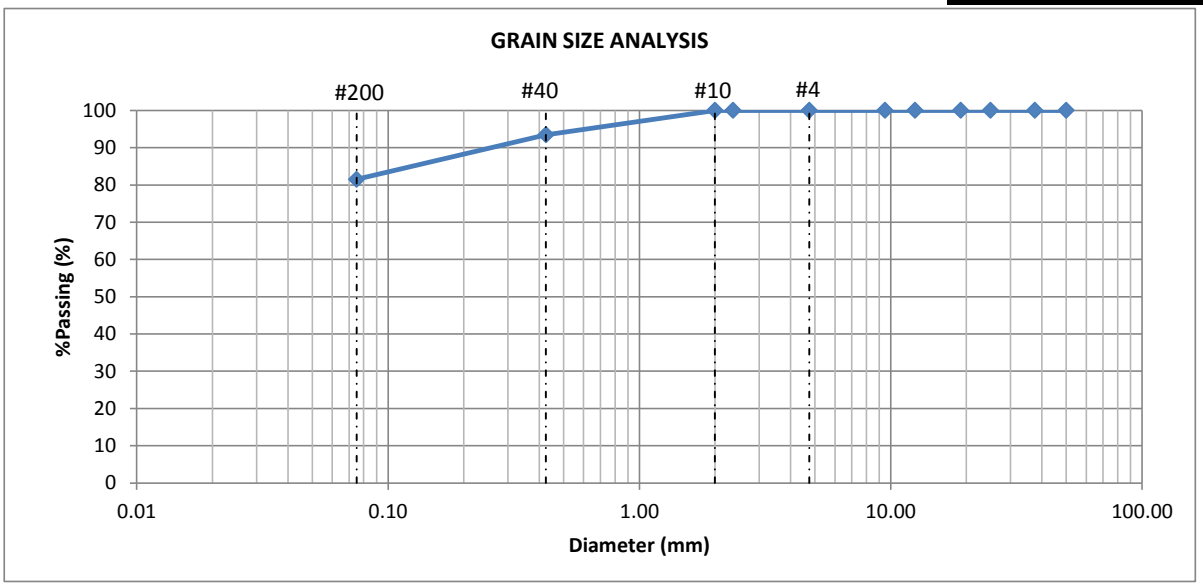
Weight of Tested Sample (g): 249.5

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**		0.00	0.00	100.00
8	**2.36**		0.00	0.00	100.00
10	**2.00**		0.00	0.00	100.00
40	**0.425**	16.4	6.57	6.57	93.43
200	**0.075**	29.8	11.94	18.52	81.48
PAN		0.7			

GRADING	
% Gravel <4.75mm	0.00 %
% Sand <4.75mm and >0.075mm	18.52 %
% Fines <0.075mm	81.48 %

Liquid Limit LL%	49.74
Plasticity Index PI%	29.46

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

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GRAIN SIZE ANALYSIS
ASTM D421

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	10.0 - 10.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

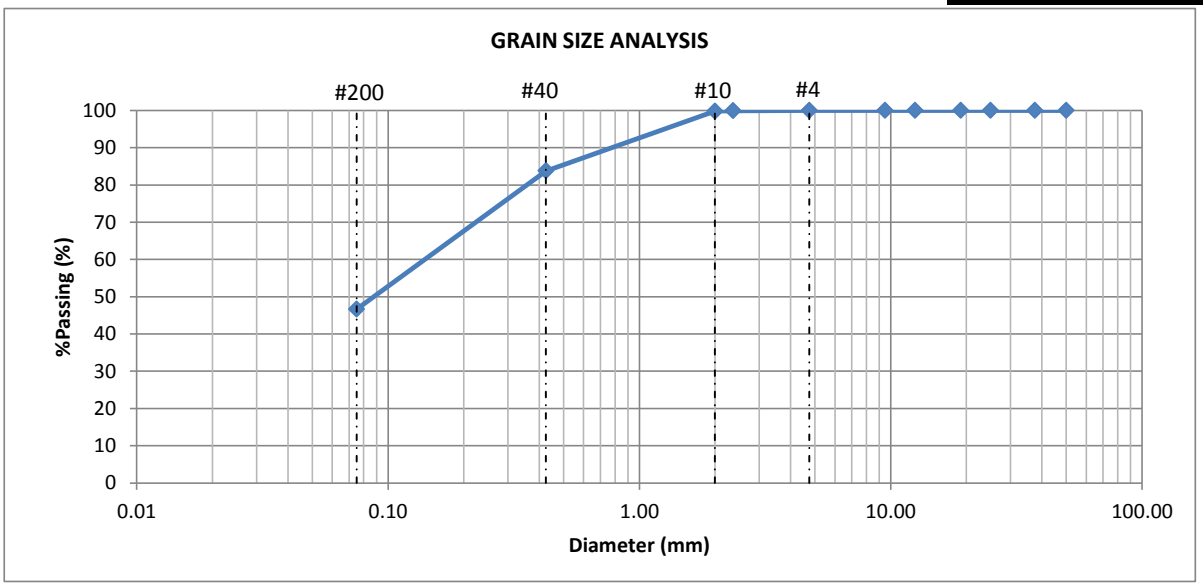
Weight of Tested Sample (g): 298.4

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**		0.00	0.00	100.00
8	**2.36**	0.2	0.07	0.07	99.93
10	**2.00**	0.4	0.13	0.20	99.80
40	**0.425**	47.8	16.02	16.22	83.78
200	**0.075**	110.9	37.16	53.38	46.62
PAN		1.9			

GRADING	
% Gravel <4.75mm	0.00 %
% Sand <4.75mm and >0.075mm	53.38 %
% Fines <0.075mm	46.62 %

Liquid Limit LL%	25.57
Plasticity Index PI%	10.86

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	2.0 - 2.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	FAT CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

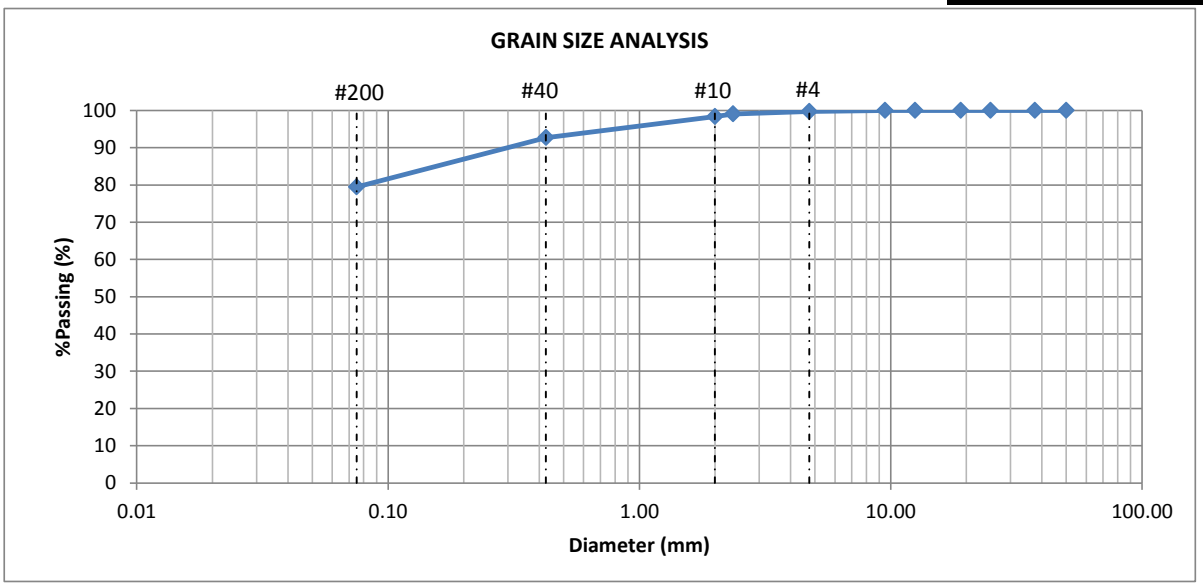
Weight of Tested Sample (g): 272.6

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**	0.7	0.26	0.26	99.74
8	**2.36**	1.9	0.70	0.95	99.05
10	**2.00**	1.9	0.70	1.65	98.35
40	**0.425**	15.4	5.65	7.30	92.70
200	**0.075**	36.2	13.28	20.58	79.42
PAN		0.6			

GRADING	
% Gravel <4.75mm	0.26 %
% Sand <4.75mm and >0.075mm	20.32 %
% Fines <0.075mm	79.42 %

Liquid Limit LL%	52.62
Plasticity Index PI%	29.31

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	6.0 - 6.25 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	SANDY LEAN CLAY
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

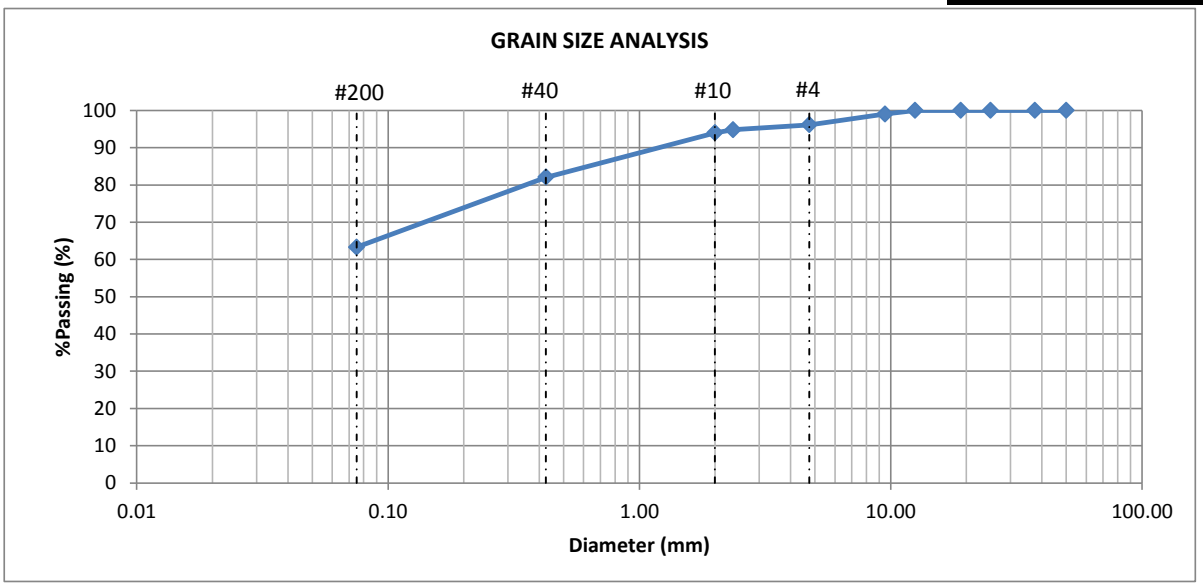
Weight of Tested Sample (g): 307.2

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50	3	0.98	0.98	99.02
4	**4.75**	8.8	2.86	3.84	96.16
8	**2.36**	4.1	1.33	5.18	94.82
10	**2.00**	2.6	0.85	6.02	93.98
40	**0.425**	36.6	11.91	17.94	82.06
200	**0.075**	57.7	18.78	36.72	63.28
PAN		1.7			

GRADING	
% Gravel <4.75mm	3.84 %
% Sand <4.75mm and >0.075mm	32.88 %
% Fines <0.075mm	63.28 %

Liquid Limit LL%	36.23
Plasticity Index PI%	21.48

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	7.0 - 7.2 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

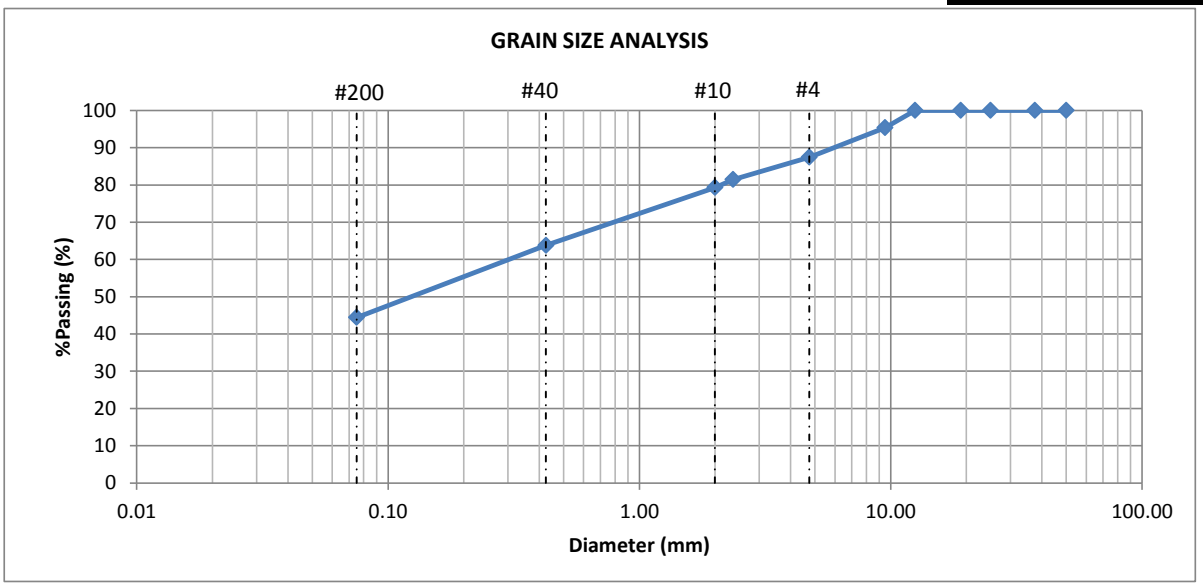
Weight of Tested Sample (g): 261.2

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50	12.2	4.67	4.67	95.33
4	**4.75**	20.6	7.89	12.56	87.44
8	**2.36**	15.6	5.97	18.53	81.47
10	**2.00**	5.6	2.14	20.67	79.33
40	**0.425**	40.6	15.54	36.22	63.78
200	**0.075**	50.6	19.37	55.59	44.41
PAN		1.1			

GRADING	
% Gravel <4.75mm	12.56 %
% Sand <4.75mm and >0.075mm	43.03 %
% Fines <0.075mm	44.41 %

Liquid Limit LL%	39.43
Plasticity Index PI%	25.54

C_U	-
C_C	-
USCS	-



REMARKS:

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ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	3
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	4.0 - 4.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

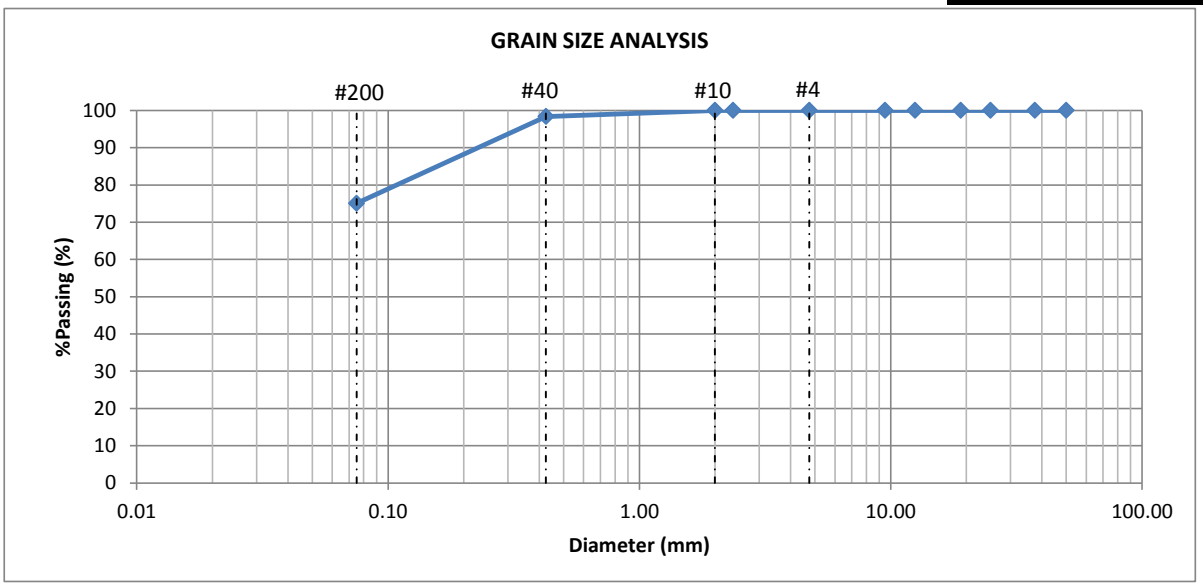
Weight of Tested Sample (g): 264.7

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50		0.00	0.00	100.00
4	**4.75**		0.00	0.00	100.00
8	**2.36**		0.00	0.00	100.00
10	**2.00**		0.00	0.00	100.00
40	**0.425**	4.3	1.62	1.62	98.38
200	**0.075**	61.7	23.31	24.93	75.07
PAN		1.5			

GRADING	
% Gravel <4.75mm	0.00 %
% Sand <4.75mm and >0.075mm	24.93 %
% Fines <0.075mm	75.07 %

Liquid Limit LL%	30.46
Plasticity Index PI%	8.72

C_U	-
C_C	-
USCS	-



REMARKS:

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ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

GRAIN SIZE ANALYSIS
ASTM D421

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CLIENT:	KREDO	**BOREHOLE NUMBER:**	3
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	6.5 - 6.8 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	5/10/2017

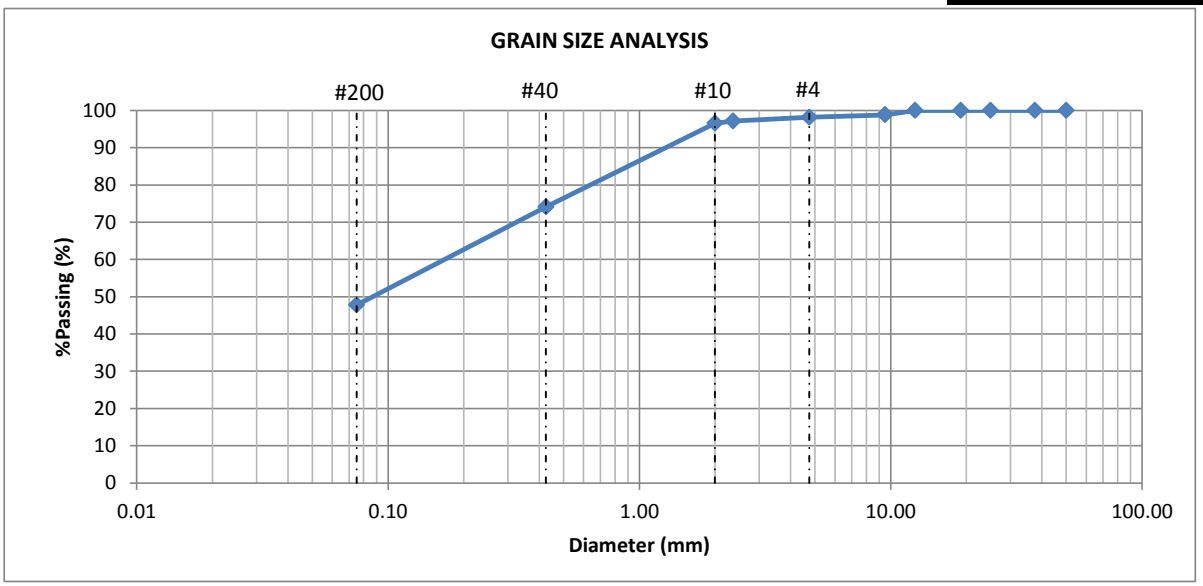
Weight of Tested Sample (g): 308.0

Sieve No.	Diameter (mm)	Wt. Retained	% Retained	% Cum. Retained	%Passing
	50.00		0	0	100.00
	37.50		0.00	0.00	100.00
	25.00		0.00	0.00	100.00
	19.00		0.00	0.00	100.00
	12.50		0.00	0.00	100.00
	9.50	3.6	1.17	1.17	98.83
4	**4.75**	2.1	0.68	1.85	98.15
8	**2.36**	3.1	1.01	2.86	97.14
10	**2.00**	1.7	0.55	3.41	96.59
40	**0.425**	69.2	22.47	25.88	74.12
200	**0.075**	81.2	26.36	52.24	47.76
PAN		1.1			

GRADING	
% Gravel <4.75mm	1.85 %
% Sand <4.75mm and >0.075mm	50.39 %
% Fines <0.075mm	47.76 %

Liquid Limit LL%	33.11
Plasticity Index PI%	19.80

C_U	-
C_C	-
USCS	-



REMARKS:

TESTED BY:
ASAAD JAAFAR

APPROVED BY:
MAHA SALEH

UNCONFINED COMPRESSIVE STRENGTH
ASTM 2166

1ST FLOOR, SATCON HEADQUARTERS
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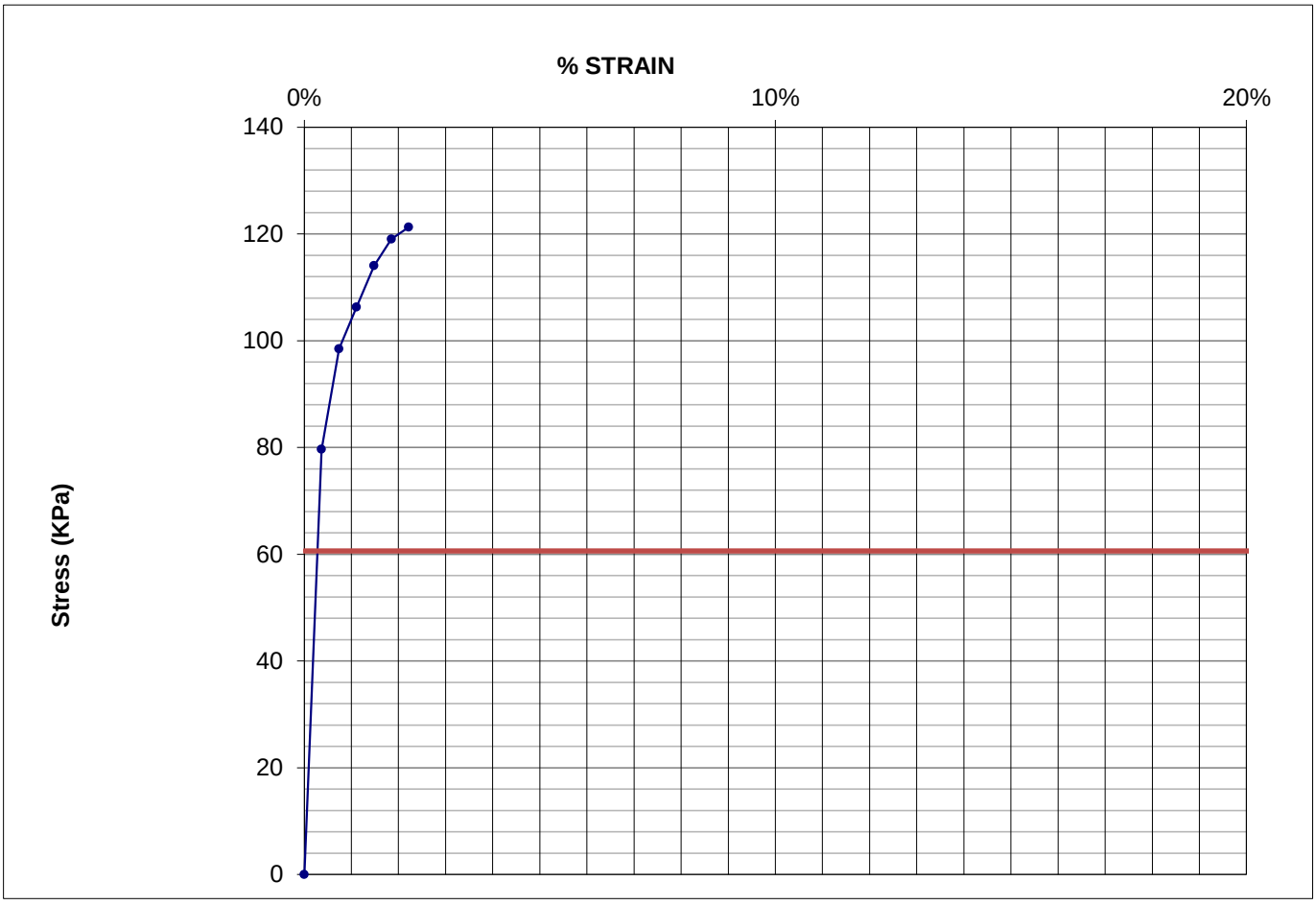
e-mail: info@satcon-sss.com

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	7.5 - 7.75 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	LEAN CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	67.99 mm	**LENGTH**	135.1 mm
WT	1081.1 g	**UNIT WEIGHT**	21.63 KN/m^3
AREA	3628.772479 mm^2	**VOLUME**	490247.1618 mm^3
WATER CONTENT%	17.54		



q_{ult} (Kpa)=	121.26
c_u (Kpa)=	60.63
E_{50} (KN/m^2)=	24251.03

REMARKS:

TESTED BY: ASAAD JAAFAR

APPROVED BY: MAHA SALEH

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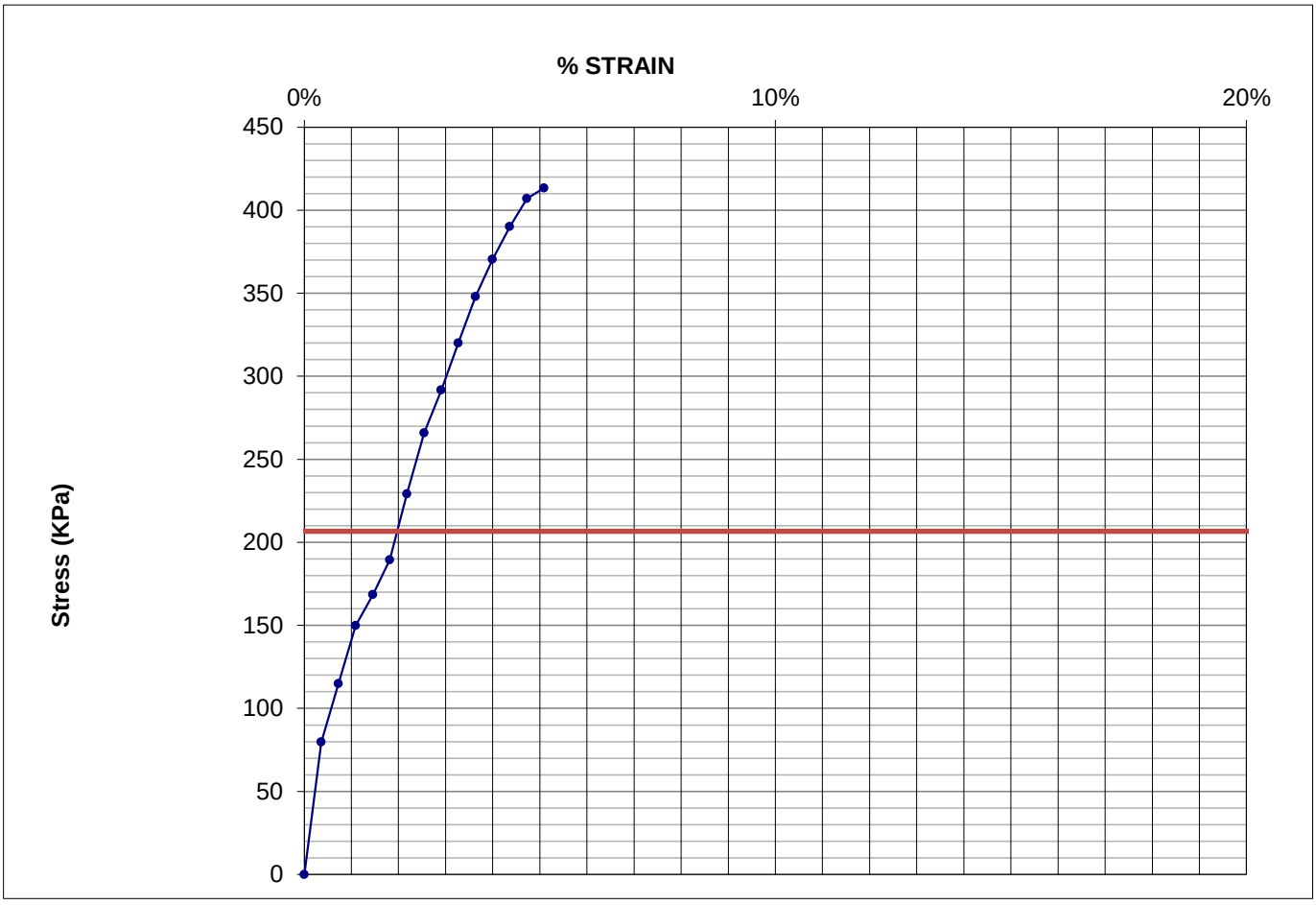
UNCONFINED COMPRESSIVE STRENGTH
ASTM 2166

CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	10.0 - 10.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	CLAYEY SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	67.99 mm	**LENGTH**	137.57 mm
WT	1148.6 g	**UNIT WEIGHT**	22.57 KN/m^3
AREA	3628.772479 mm^2	**VOLUME**	499210.2299 mm^3
WATER CONTENT%	6.92		



q_{ult} (Kpa)=	413.25
c_u (Kpa)=	206.63
E_{50} (KN/m^2)=	10331.35

REMARKS:

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UNCONFINED COMPRESSIVE STRENGTH
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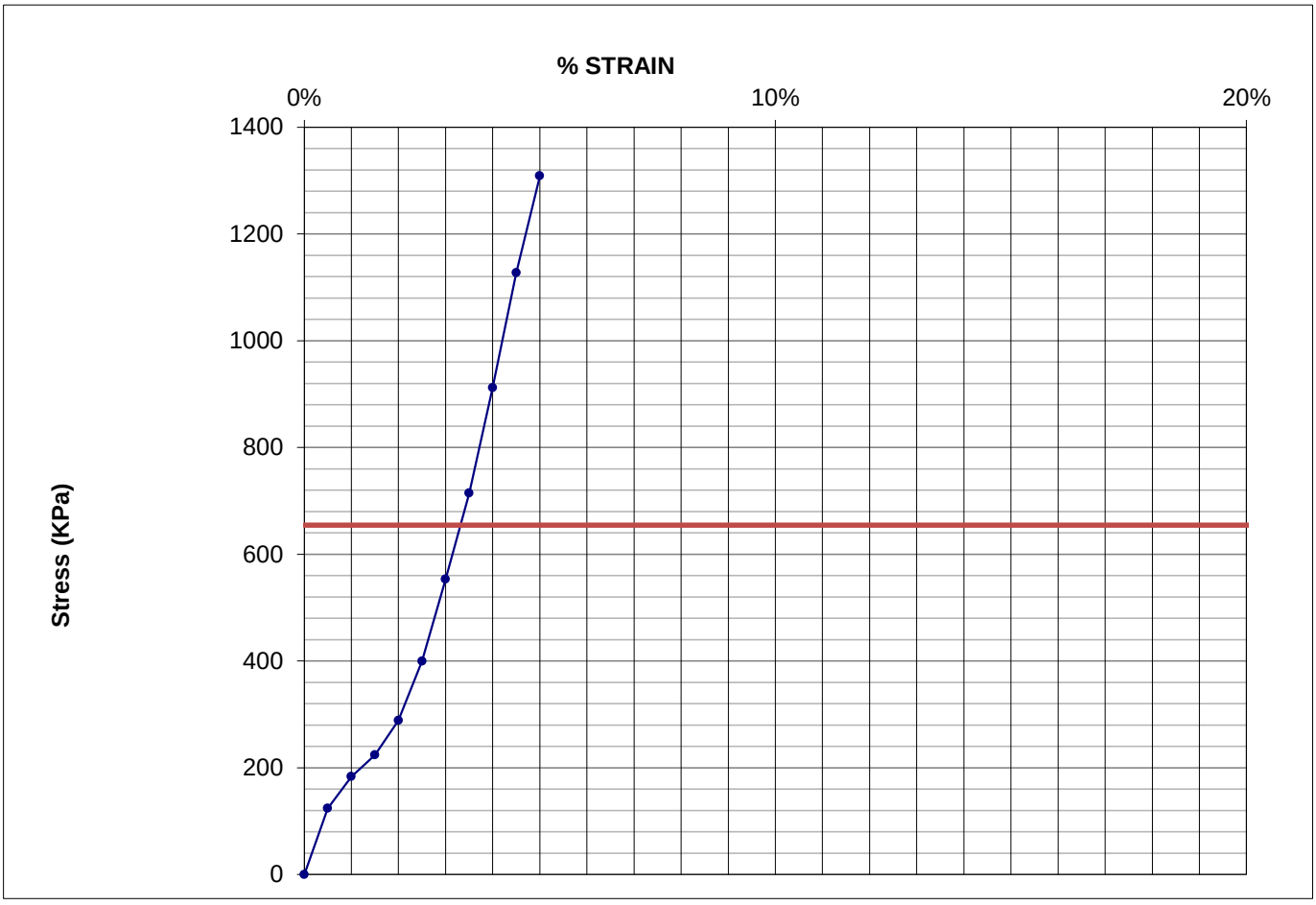
CLIENT:	KREDO	**BOREHOLE NUMBER:**	1
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	12.0 - 12.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	64.8 mm	**LENGTH**	99.99 mm
WT	752.6 g	**UNIT WEIGHT**	22.40 KN/m^3
AREA	3296.2464 mm^2	**VOLUME**	329591.6775 mm^3
WATER CONTENT%	14.14		



q_{ult} (Kpa)=	1308.45
c_u (Kpa)=	654.23
E_{50} (KN/m^2)=	19825.02

REMARKS:

TESTED BY: ASAAD JAAFAR

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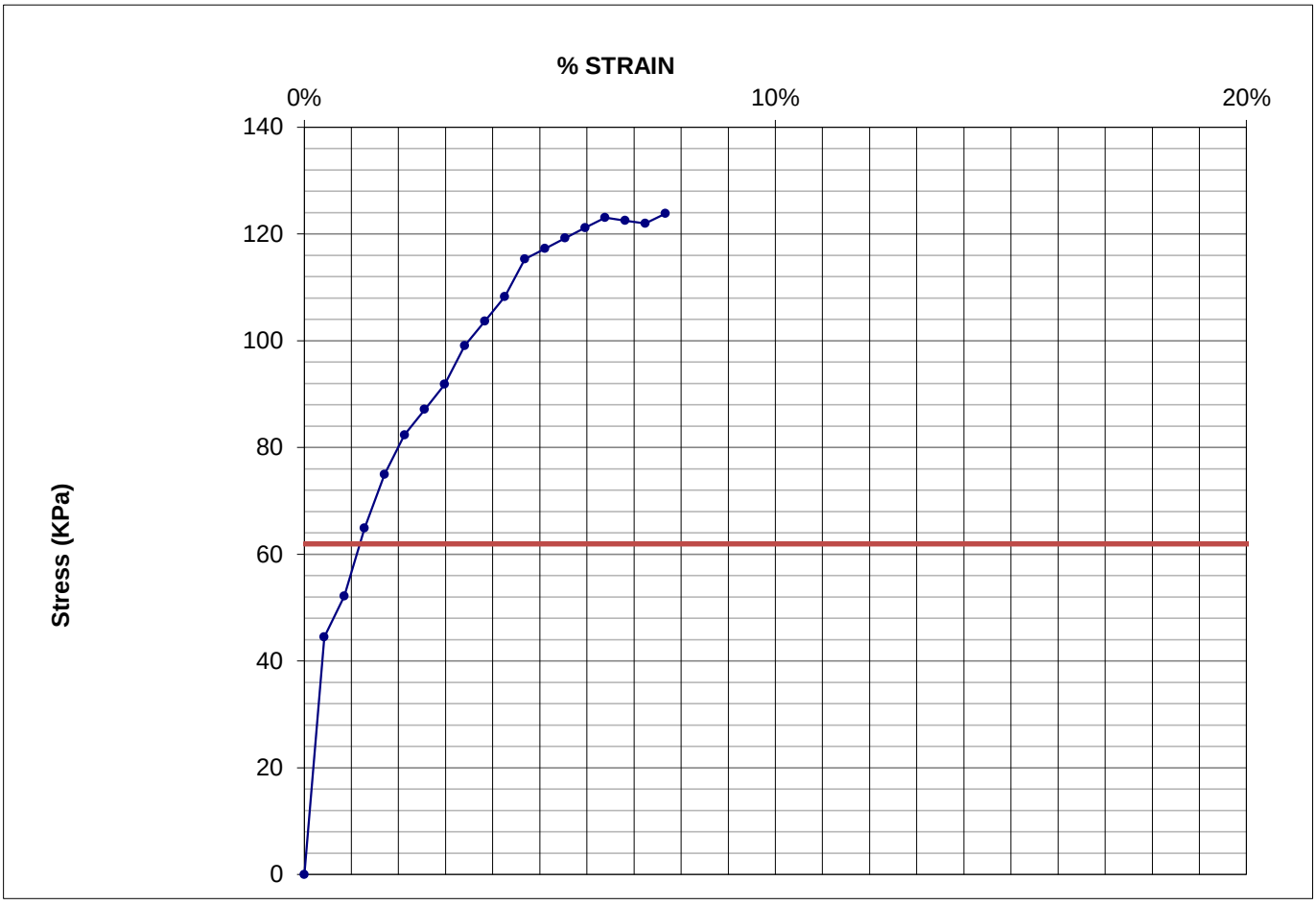
UNCONFINED COMPRESSIVE STRENGTH
ASTM 2166

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	2.0 - 2.5 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	FAT CLAY WITH SAND
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	69.61 mm	**LENGTH**	117.43 mm
WT	913.6 g	**UNIT WEIGHT**	20.06 KN/m^3
AREA	3803.758399 mm^2	**VOLUME**	446675.3487 mm^3
WATER CONTENT%	35.29		



q_{ult} (Kpa)=	123.80
c_u (Kpa)=	61.90
E_{50} (KN/m^2)=	5158.42

REMARKS:

TESTED BY: ASAAD JAAFAR

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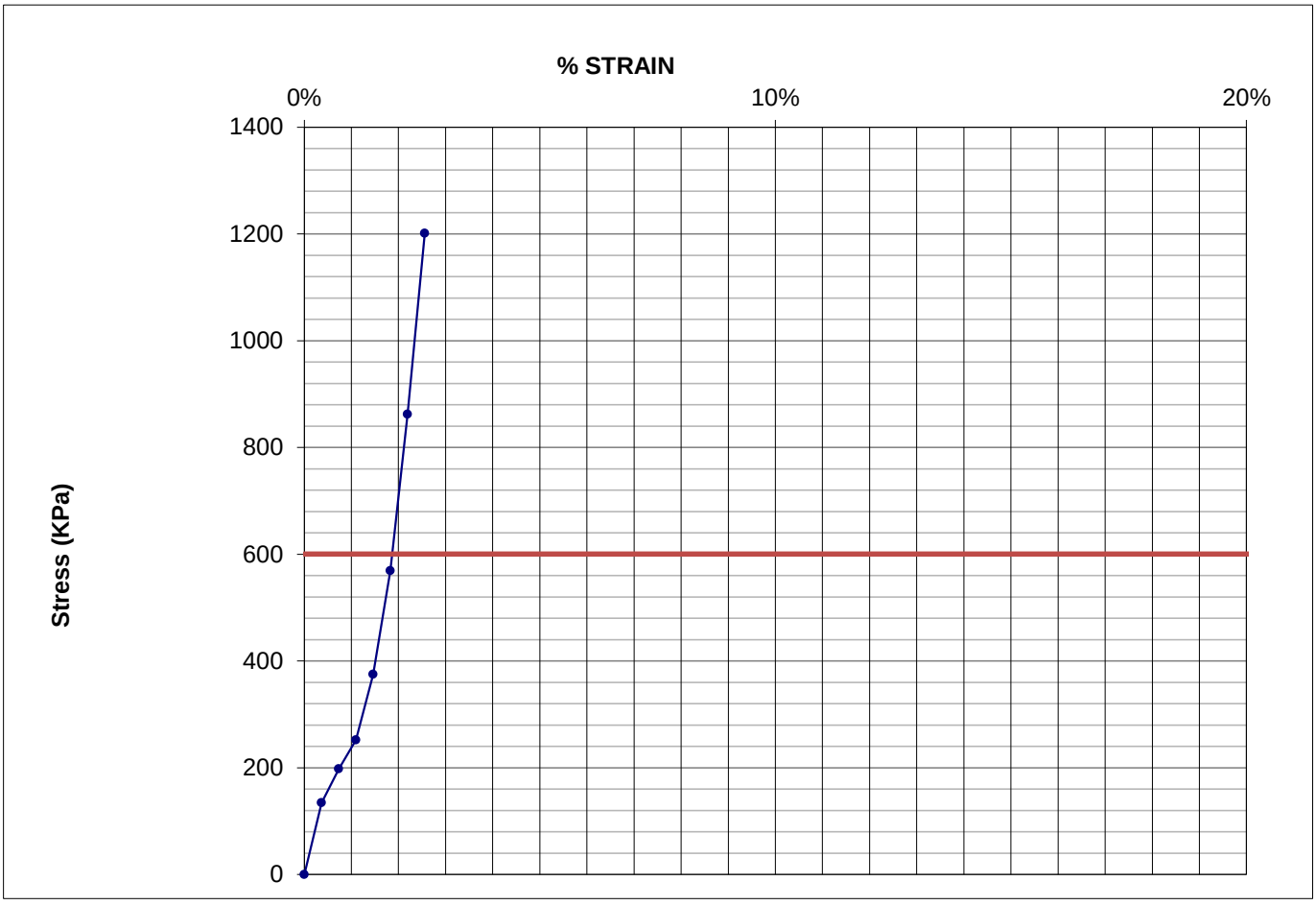
UNCONFINED COMPRESSIVE STRENGTH
ASTM 2166

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	10.0 - 10.4 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	65.97 mm	**LENGTH**	136.85 mm
WT	1071.4 g	**UNIT WEIGHT**	22.48 KN/m^3
AREA	3416.352107 mm^2	**VOLUME**	467527.7858 mm^3
WATER CONTENT%	5.61		



q_{ult} (Kpa)=	1200.79
c_u (Kpa)=	600.40
E_{50} (KN/m^2)=	31599.78

REMARKS:

TESTED BY: ASAAD JAAFAR

APPROVED BY: MAHA SALEH

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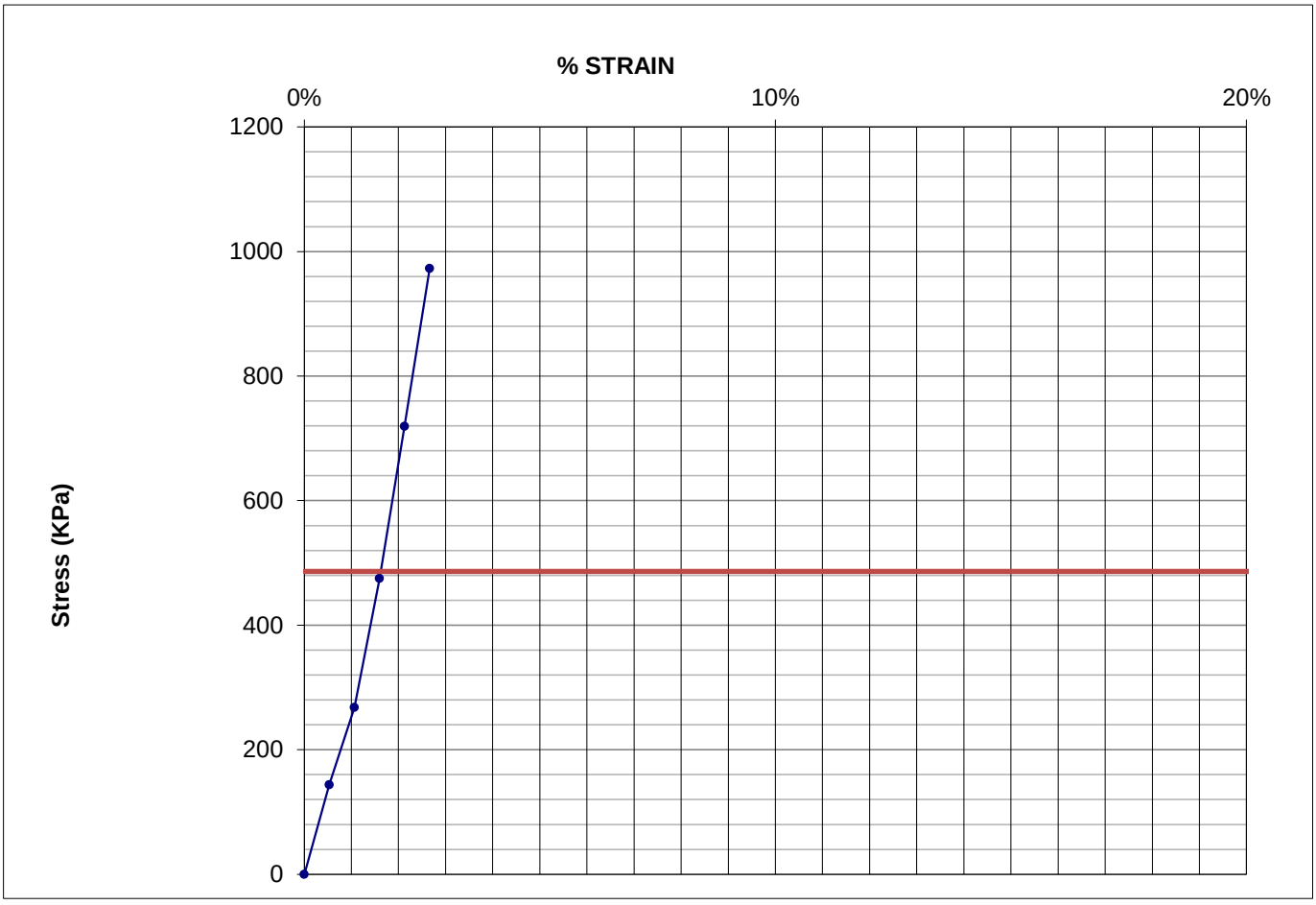
UNCONFINED COMPRESSIVE STRENGTH
ASTM 2166

CLIENT:	KREDO	**BOREHOLE NUMBER:**	2
PROJECT:	LANDSLIDE ON KFARSELWAN - TARSHISH ROAD	**DEPTH OF SAMPLE:**	13.8 - 14.0 m
PROJECT NO.:	17-026	**SAMPLE DESCRIPTION:**	
LOCATION:	KFARSELWAN	**DATE TESTED:**	05/10/2017

DIAMETER	64.36 mm	**LENGTH**	93.95 mm
WT	634.7 g	**UNIT WEIGHT**	20.38 KN/m^3
AREA	3251.634536 mm^2	**VOLUME**	305491.0647 mm^3
WATER CONTENT%	3.71		



q_{ult} (Kpa)=	972.90
c_u (Kpa)=	486.45
E_{50} (KN/m^2)=	30403.15

REMARKS:

TESTED BY: ASAAD JAAFAR

APPROVED BY: MAHA SALEH