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FINAL REPORT (PART - 1) 375 MW ACME SWITCHYARD

NCD/G/RPPL/4536(3)/2023

22 April 2023

Renew Power Pvt Ltd.,

Sub : G(D) 4536 Conducting Geotechnical Investigation for the Proposed 375MW ACME Switchyard Area at Village Rampuriya, Tehsil Sahgada, District Jaisalmer, Rajasthan

INTRODUCTION

ReNew Power Pvt Ltd are in the process of constructing a 375 ACME Switchyard Area at Village Rampuriya, Tehsil Sahgada, District Jaisalmer, Rajasthan.

SCOPE OF WORK

The stipulated scope of work for switch year consisted of conducting boreholes down to a maximum depth of 3m below the existing ground level in soil/refusal/rock strata at four locations, conducting electrical resistivity tests at six locations and conducting thermal resistivity test in four samples collected from the site.

This **report** is based on the geotechnical investigations results for a part of the investigations i.e. along with the results and analysis of the investigations and the recommendations thereof.

BOREHOLE INVESTIGATION :

All the four boreholes had been progressed down to the stipulated depth of 3m below the existing ground level. The refusal depth, termination depths and coordinates of the four are as follows :

BHNo.	Refusal depth (m) below EGL	Termination Depth (m) below EGL	Boreholes Coordinates (m)	
			X	Y
1	1.5	3	759166.488	2933126.102
2	2	3	759107.881	2933141.629
3	1.5	3	759150.598	2933187.253
4	2	3	759020.119	2933266.609

The results of the boreholes investigations indicate that the subsoil strata generally consists of silty sand with significant percentages of gravel down to the depth of refusal strata below which substrata consists of highly weathered sandstone/ conglomerate down to the depth investigated i.e. 3m below the existing ground level. The grain size distributions of the soil samples in the four boreholes have been presented in the form of grain size analysis curves in fig. 4.

Ground water table had not been encountered in any of the boreholes down to the depth investigated i.e. 3m below the existing ground level.

The standard penetration test values (N-values) vary between 25 and 99. The observed N-values indicate that the subsoil is in a medium dense state down to the depth of refusal strata.

The subsoil strata is generally non-plastic soils down to the depth of refusal strata except for occasional thin layers of low plastic soils inbetween in some boreholes.

The proposed structures are supporting structures for Substation Utility. Considering this, medium heavy can be anticipated on the foundations. Based on the above results and the probable loads on the foundations, the following recommendations are being made.

RECOMMENDATION :

Considering the above, the proposed structures can be supported **over Isolated/ Strip footings**.

Type of Foundations	=	Isolated/ Strip Footings
Depth of Foundation	=	1.5m below the existing ground level
Allowable Settlement	=	50mm
Net Allowable Bearing Pressure	=	

Width of foundation (m)	1.5	3
Net Allowable Bearing Pressure (t/m²)	16	20

ELECTRICAL RESISTIVITY TESTS:

Six electrical tests had been conducted at site. The results of the electrical resistivity tests along with the coordinates of the test locations are as follows :

ERT No	Electrical Resistivity (Ω - m)	ERT Coordinate (m)	
		X	Y
1	147.5	759056.8646	2933261.1608
2	145.7	759014.1476	293321.5393
3	122.8	759111.6178	2933209.9005
4	125.2	759166.3611	2933158.6401
5	201.1	759166.3611	2933158.6401
6	182.8	759123.6441	2933113.0165

SOIL THERMAL RESISTIVITY TEST:

Undisturbed soil samples were collected from two different location at 0.75m and 1.05m depths. The sample depth and coordinates of the TRT samples have been given below:

TRT No	Depth (m) of Undisturbed Soil Sample Below EGL	TRT Coordinate (m)	
		X	Y
TRT1a	0.75	759154.474	2933084.15
TRT1b	1.05		
TRT2a	0.75	759197.191	2933129.773
TRT2b	1.05		

The results of the soil thermal resistivity test (TRT) are given in the form of table.

TRT No.	Depth Below NGL (m)	Grain Size Distribution (%)				Bulk Density (g/cm ³)	Moisture Content (%)	Dry Density (g/cm ³)	Thermal Resistivity (°C-cm/W) at in-situ Moisture Content
		GR	SD	ST	CL				
TRT1a	0.75	38	45	17	0	1.98	3	1.92	17.3
TRT1b	1.05	33	49	18	0	2.11	3.1	2.05	15.8
TRT2a	0.75	38	40	22	0	2	3.8	1.92	16.1
TRT2b	1.05	33	45	22	0	2.18	6	2.06	15.6

We hope you find this in order.

Thanking you,

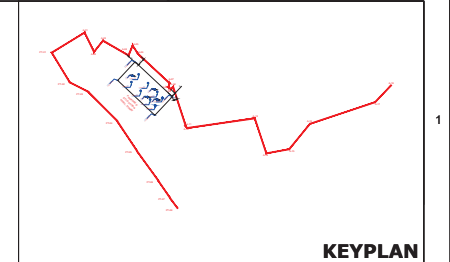
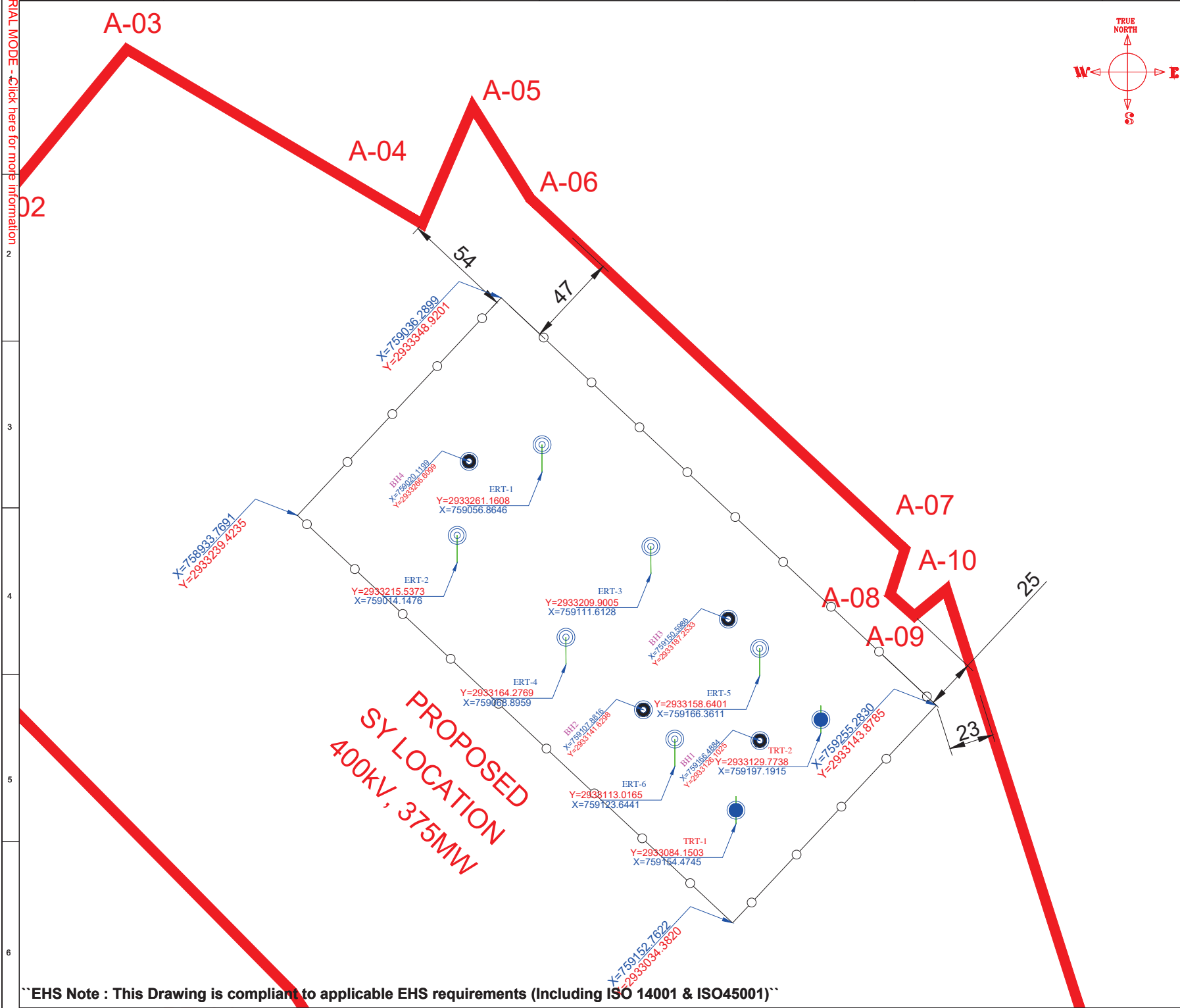
Yours sincerely,

Y.S. Rana

Executive Consultant

encls :

1. Borehole location plan
2. Compile Soil Profile
3. Soil Profile Tables
4. Grain Size Analysis Curves
5. Electrical Resistivity Plots
6. Thermal Resistivity Plots

[illegible]

SOIL PROFILE			Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan										
			B.H. Location :			Water Table : N.E.			Term. Depth : 3			B.H. No.: 1	
N - Value	Depth (m)	Soil Description	Grain Size Analysis				Atterberg Limits		In-situ properties		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	φ (°)
25	0.0	Yellowish brown silty sand	30	47	23	0	Non	Plastic	Tube	bent	-	-	-
	0.5	Yellowish brown silty sand with gravel											
	1.0												
	1.5	Refusal strata in the form of Conglomerate											
31	3cm	From 1.5m to 3m depth, continue in rock profile table											

ROCK PROFILE		Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan											Location :					
		B.H. Size : Nx				Water Table (m): N.E.				Term. Depth (m): 3			B.H. No. : 1					
Depth (m)	Strata Description	No. of Core Pieces of Size (cm)				Core Recovery (%)				RQD (%)	Run Time (min)	Unit Weight (g/cm³)	Porosity (%)	Water Absorption (%)	Unconfined Compressive Strength (kg/cm²)	Point Load Strength (kg/cm²)	Remarks	
		<10	10-25	25-75	>75	20	40	60	80									100
1.5	Whitish yel. br. conglomerate (Gravel & pebble with silty sand)	6	0	0	0						17	0	35	2.46	0.93	0.61	910	N=30 /2cm at 2.5m depth
2.5																		
3.0		Whitish br. greyish conglomerate (Gravel & pebble with silty sand)	3	0	0		0						10	0	12			
																		Highly weathered rock

SOIL PROFILE			Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan									
			B.H. Location :			Water Table : N.E.		Term. Depth : 3.2m		B.H. No.: 2		
N - Value	Depth (m)	Soil Description	Grain Size Analysis				Atterberg		In-situ		Triaxial Test	
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density (g/cm³)	Water Cont (%)	Type	c (kg/cm²) φ (°)
84 52 13cm	0.0	Yellowish brown silty sand	7	37	41	15	29	19	1.86	10.5	-	-
	0.5											
	1.0	Reddish yel. br. clayey sandy silt with gravel										
	1.5	Change of the strata										
	2.0	Refusal strata in the form of conglomerate										
		From 2m to 3m depth, continue in rock profile table										

ROCK PROFILE		Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan										Location :					
		B.H. Size : Nx				Water Table (m): N.E.				Term. Depth (m): 3.2m			B.H. No. : 2				
Depth (m)	Strata Description	No. of Core Pieces of Size (cm)				Core Recovery (%)				RQD (%)	Run Time (min)	Unit Weight (g/cm³)	Porosity (%)	Water Absorption (%)	Unconfined Compressive Strength (kg/cm²)	Point Load Strength (kg/cm²)	Remarks
		<10	10-25	25-75	>75	20	40	60	80	100							
2.0	-																
	Whitish reddish. br. conglomerate (Gravel & pebble with silty sand)	0	0	0	0					0	0	13					N=30/4cm at 2.5m depth
2.5	-																
	Reddish greyish whitish Sandstone	9	0	0	0					57	0	30	2.66	6.67	4.51		234
3.2	-																Highly weathered rock

SOIL PROFILE			Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan										
			B.H. Location :		Water Table : N.E.			Term. Depth : 3m			B.H. No.: 3		
N - Value	Depth (m)	Soil Description	Grain Size Analysis				Atterberg		In-situ		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	φ (°)
66 33 4cm	0.0	Yellowish brown silty sand	23	51	26	0	Non	Plastic	Tube	bent	-	-	-
	0.5	Reddish brown silty sand with gravel											
	1.0												
	1.5	Refusal strata in the form of conglomerate											
		From 1.5m to 3m depth, continue in rock profile table											

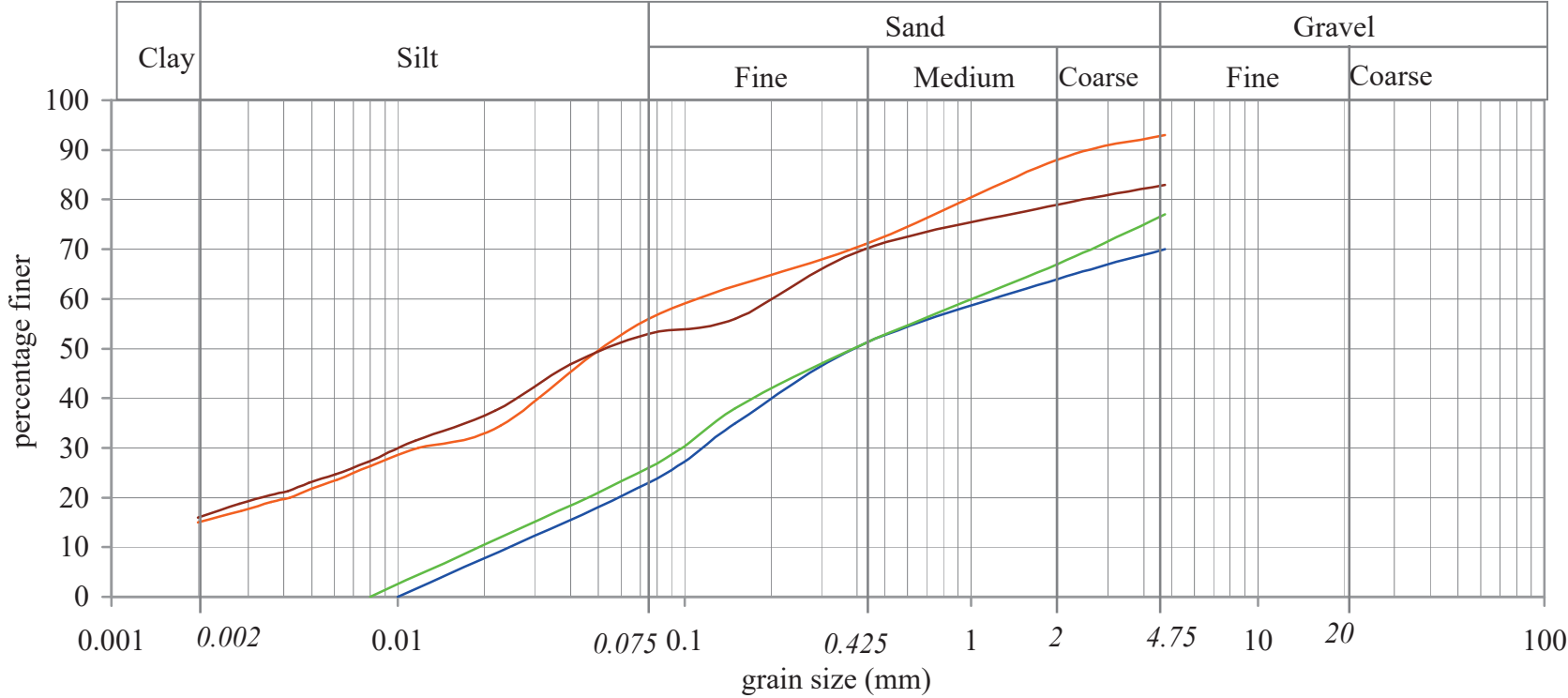
ROCK PROFILE		Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan										Location :						
		B.H. Size : Nx				Water Table (m): N.E.			Term. Depth (m): 3m			B.H. No. : 3						
Depth (m)	Strata Description	No. of Core Pieces of Size (cm)				Core Recovery (%)				Run Time (min)	Unit Weight (g/cm³)	Porosity (%)	Water Absorption (%)	Unconfined Compressive Strength (kg/cm²)	Point Load Strength (kg/cm²)	Remarks		
		<10	10-25	25-75	>75	20	40	60	80								100	
1.5	-																	
	Whitish reddish br. conglomerate	0	0	0	0						0	0	35				N=41/6cm at 2.5m depth	
2.5	-																	
	Pinkish whitish Sandstone	10	1	0	0						98	20	30	2.63	5.32	3.48	381	Highly to moderately weathered rock
3.0	-																	

SOIL PROFILE			Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan																							
			B.H. Location :			Water Table : N.E.			Term. Depth : 3			B.H. No.: 4														
N - Value	Depth (m)	Soil Description	Grain Size Analysis				Atterberg		In-situ		Triaxial Test															
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	φ (°)													
99	0.0	Yellowish brown silty sand	17	30	37	16	32	21	1.76	4.2	-	-	-													
	0.5																									
	1.0	Reddish brown clayey sandy silt with gravel																								
	1.5																									
	2.0	Refusal strata in the form of conglomerate																								
56	2.0	From 2m to 3m depth, continue in rock profile table																								
15cm																										

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ROCK PROFILE		Project : Proposed Project 375MW ACME Village Rampuriya, Tehsil Sahgada, Dist Jaisalmer, Rajasthan											Location :					
		B.H. Size : Nx				Water Table (m): N.E.				Term. Depth (m): 3m			B.H. No. : 4					
Depth (m)	Strata Description	No. of Core Pieces of Size (cm)				Core Recovery (%)				RQD (%)	Run Time (min)	Unit Weight (g/cm³)	Porosity (%)	Water Absorption (%)	Unconfined Compressive Strength (kg/cm²)	Point Load Strength (kg/cm²)	Remarks	
		<10	10-25	25-75	>75	20	40	60	80	100								
2.0	Pinkish reddish whitish Sandstone	6	0	0	0						35	0	23	2.54	10.6	6.98	130	N=33/2cm at 2.5m depth
2.5	Reddish brownish whitish Sandstone	9	1	0	0						100	39	30	2.86	6.26	4.26	208	Highly to moderately weathered rock
3.0																		

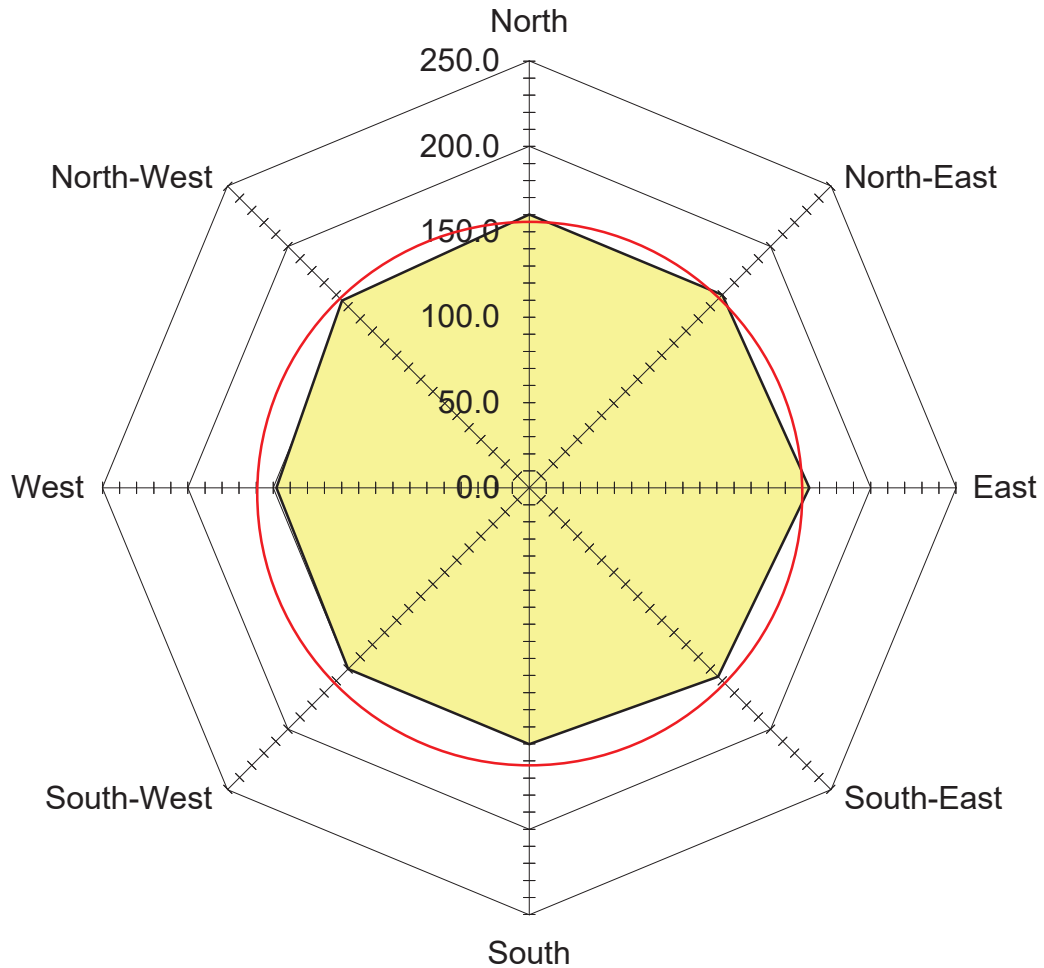
Grain Size Analysis Curves (refer paragraph no. 7.3.1)



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	C _u
	1	0.5	Silty sand with gravel	30	47	23	0	1.2	0.024	50.0
	2	1	Clayey sandy silt withg gravel	7	37	41	15	0.12	-	-
	3	0.5	Silty sand with gravel	23	51	26	0	1.1	0.019	57.9
	4	1	Clayey sandy silt withg gravel	17	30	37	16	0.21	-	-

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Resistivity = radius of equivalent circle = 147.5 ohm-m



Polar Diagram

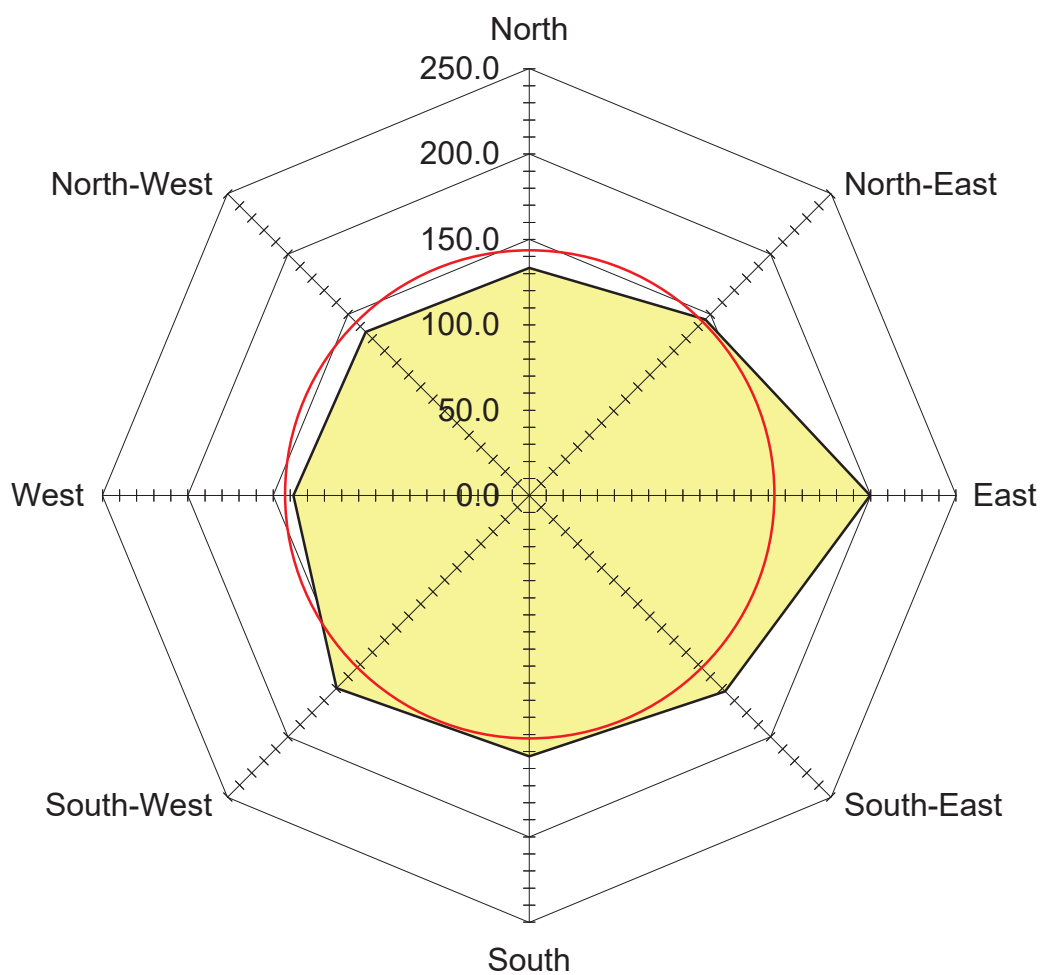
Electrical Resistivity Test - 1

(Refer paragraph no. 7.14.4)

G(D) 4536

5a

Resistivity = radius of equivalent circle = 145.7 ohm-m



Polar Diagram

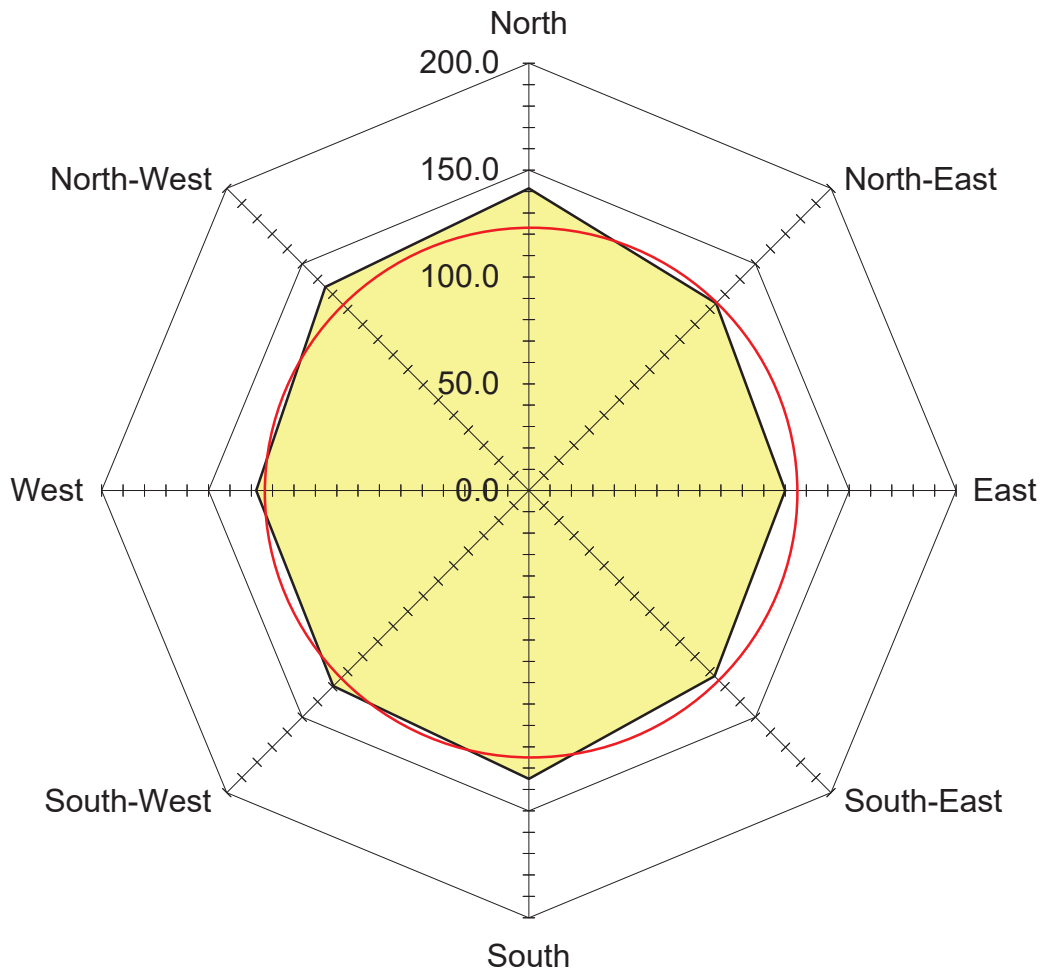
Electrical Resistivity Test - 2

(Refer paragraph no. 7.14.4)

G(D) 4536

5b

Resistivity = radius of equivalent circle = 122.8 ohm-m



Polar Diagram

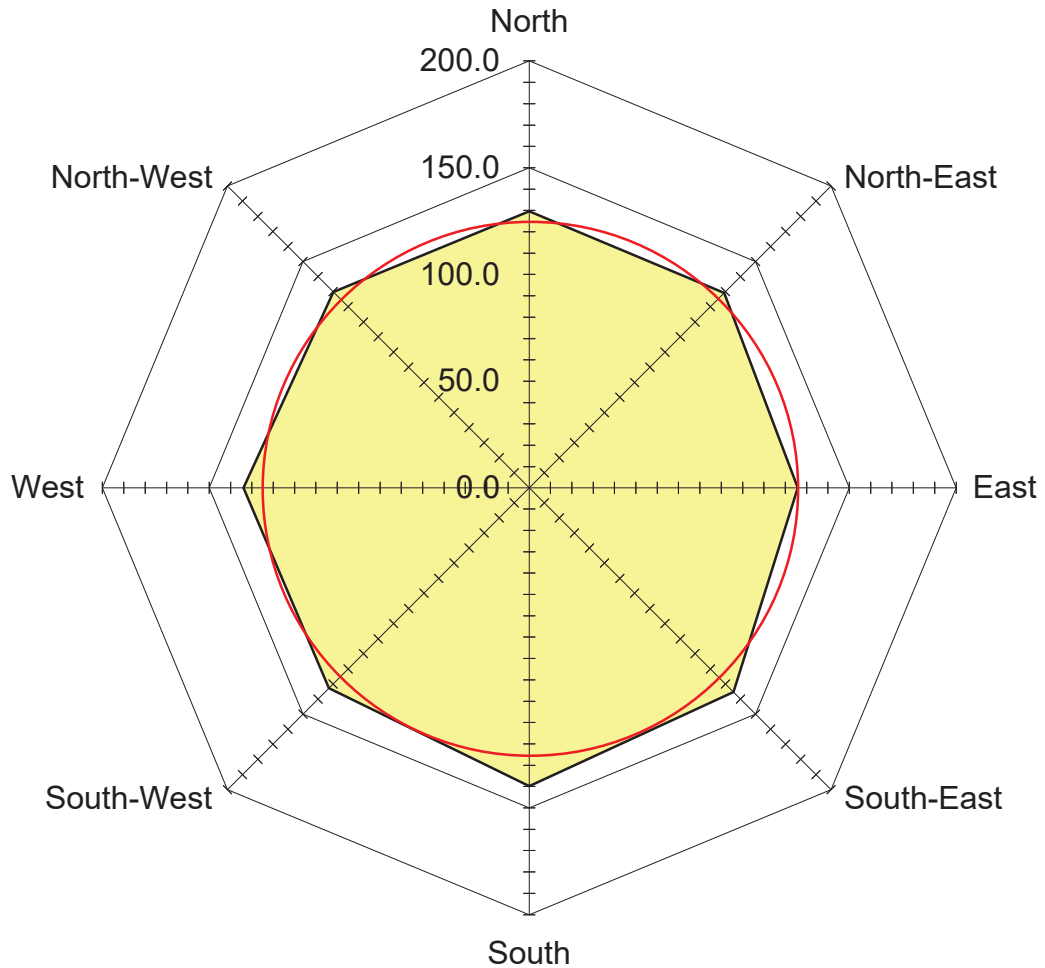
Electrical Resistivity Test - 3

(Refer paragraph no. 7.14.4)

G(D) 4536

5c

Resistivity = radius of equivalent circle = 125.2 ohm-m



Polar Diagram

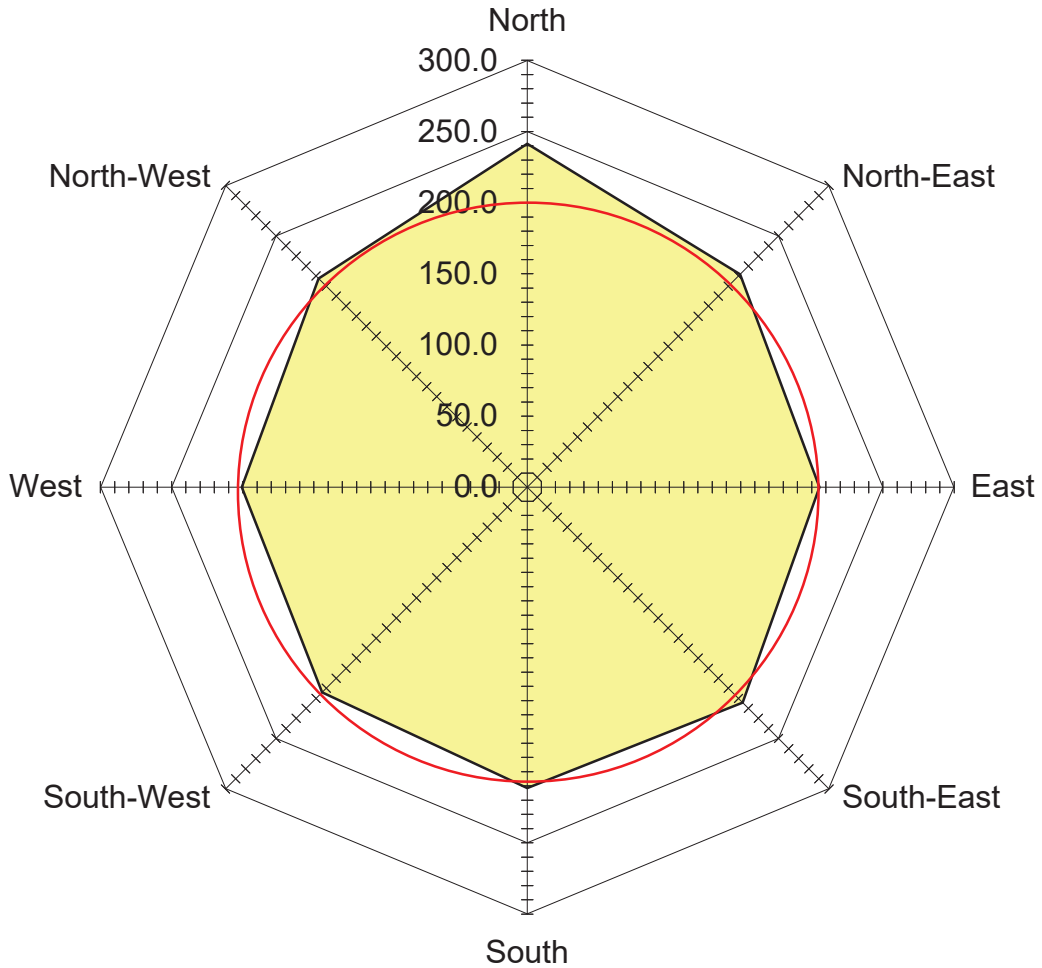
Electrical Resistivity Test - 4

(Refer paragraph no. 7.14.4)

G(D) 4536

5d

Resistivity = radius of equivalent circle = 201.1 ohm-m



Polar Diagram

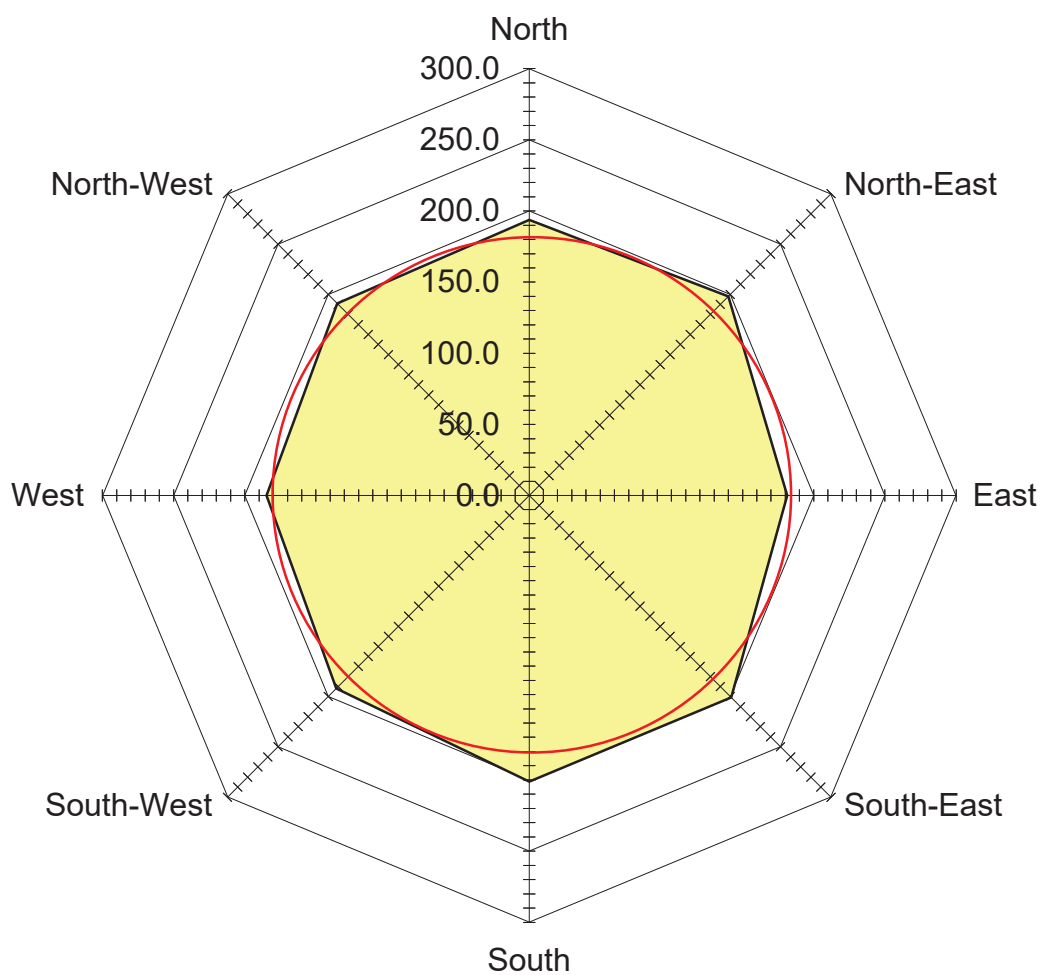
Electrical Resistivity Test - 5

(Refer paragraph no. 7.14.4)

G(D) 4536

5e

Resistivity = radius of equivalent circle = 182.8 ohm-m

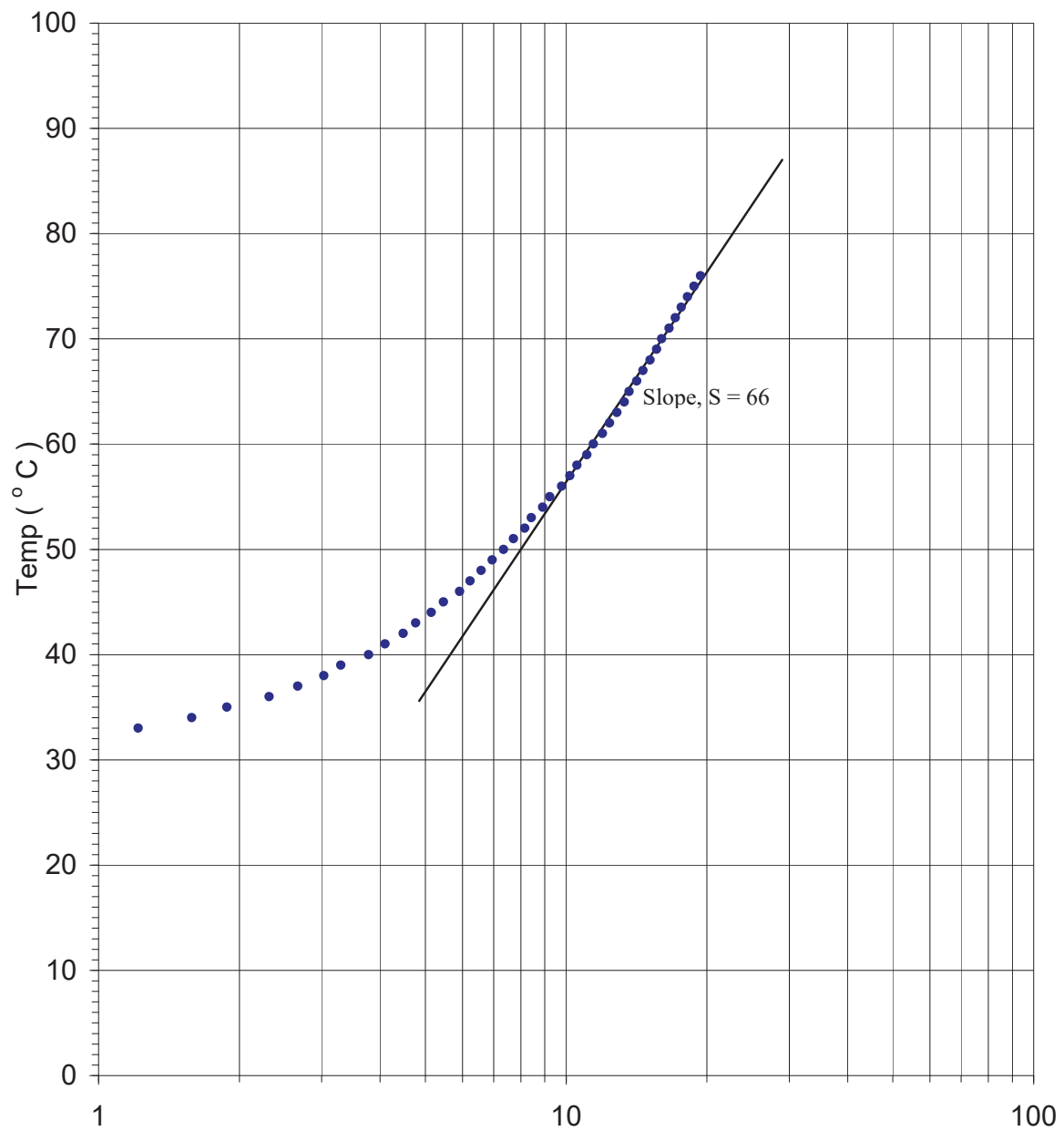


Polar Diagram

Electrical Resistivity Test - 6

(Refer paragraph no. 7.14.4)

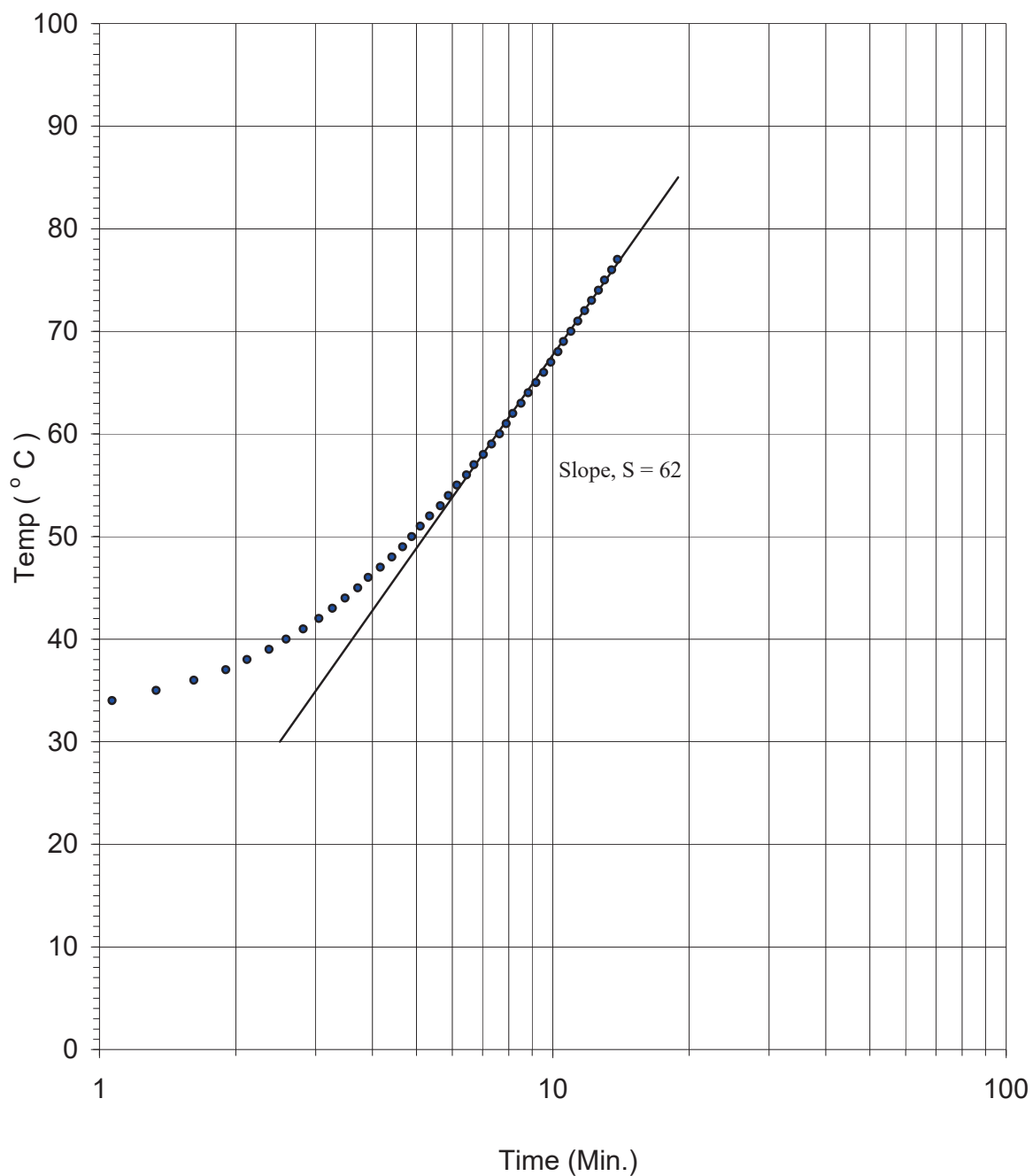
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Time (Min.)
Temperature vs Time Plot
(TRT1a at 0.75m Depth)

G(D)4536

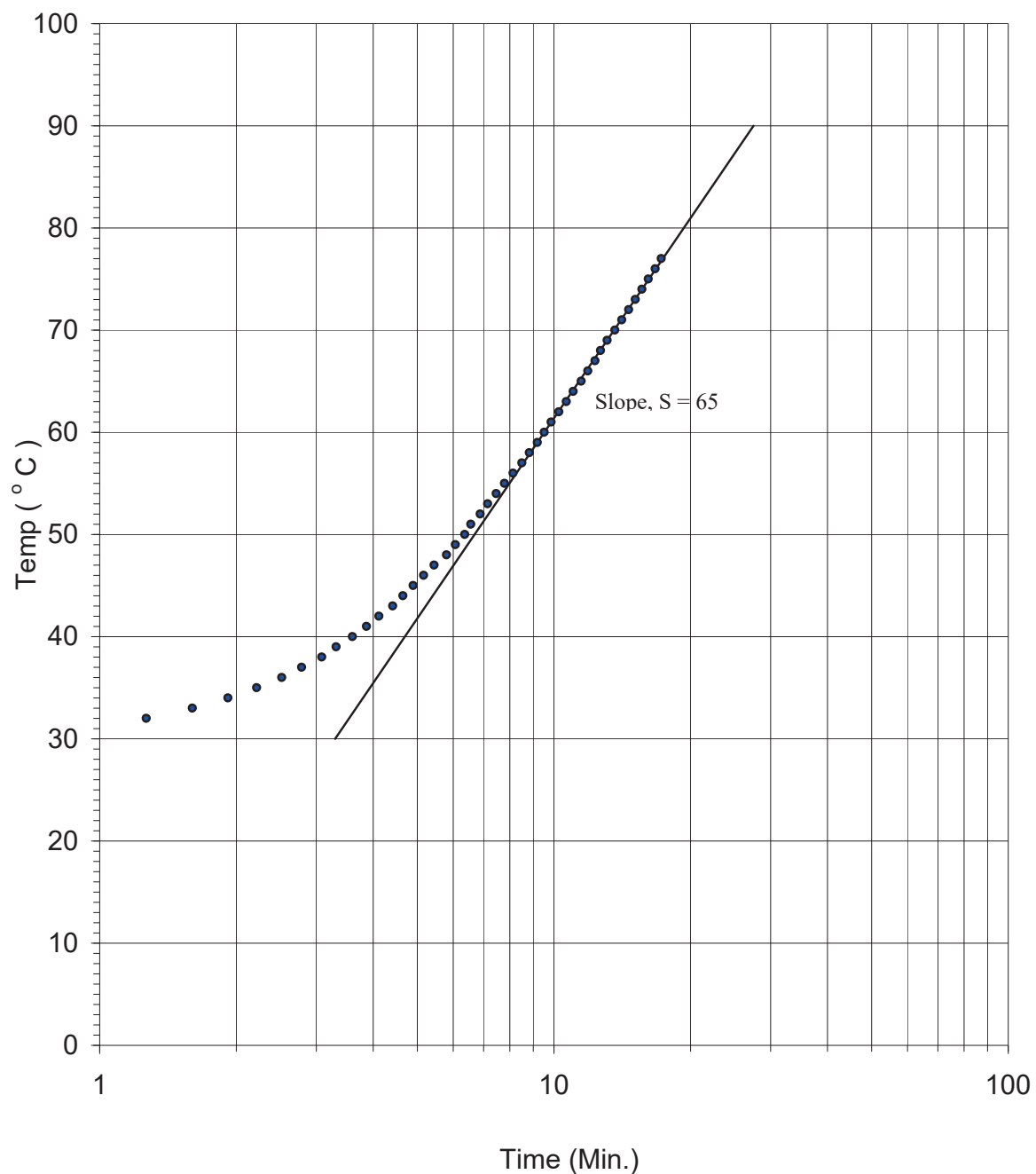
6a



**Temperature vs Time Plot
(TRT1b at 1.05m Depth)**

G(D)4536

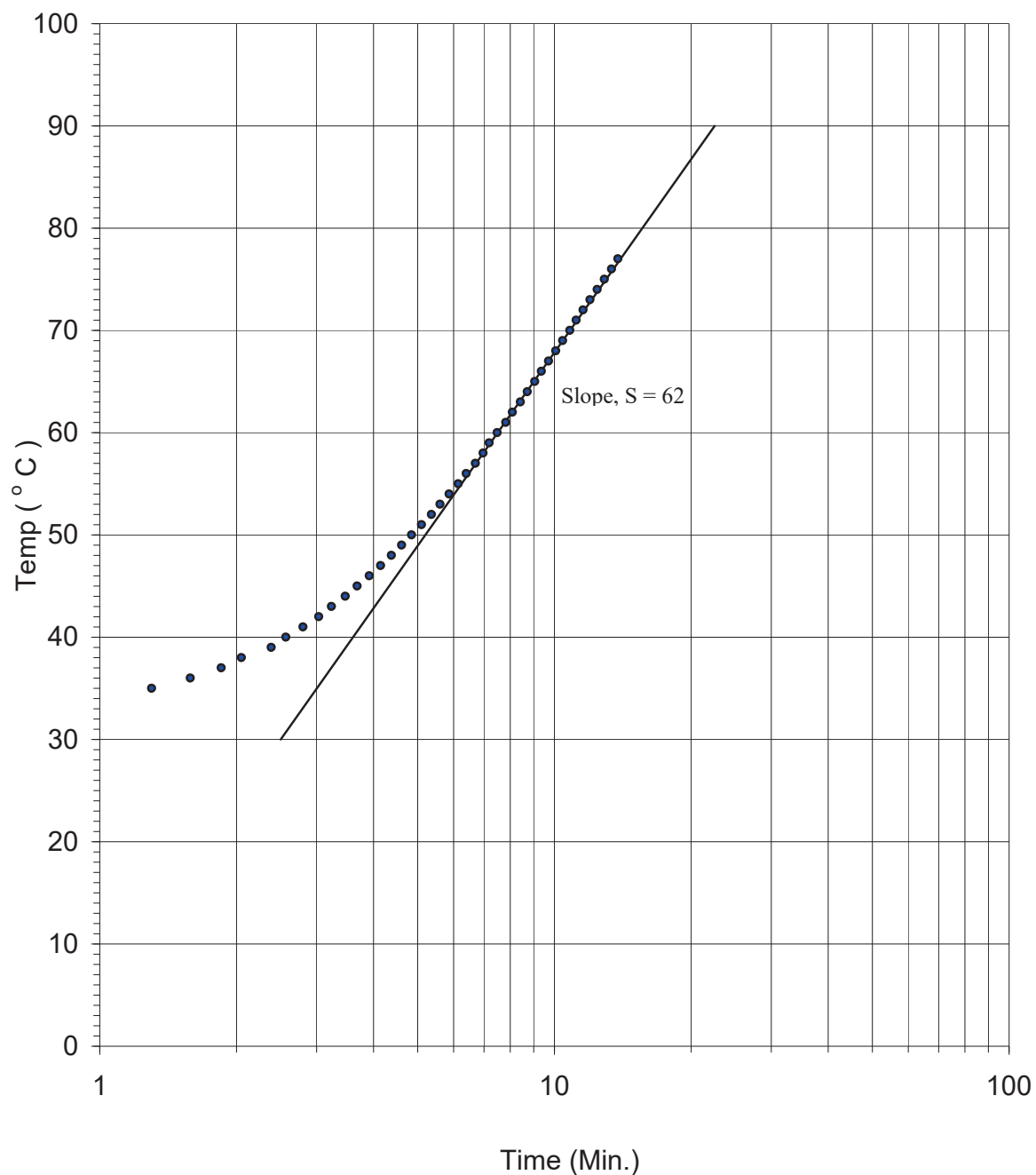
6b



**Temperature vs Time Plot
(TRT2a at 0.75m Depth)**

G(D)4536

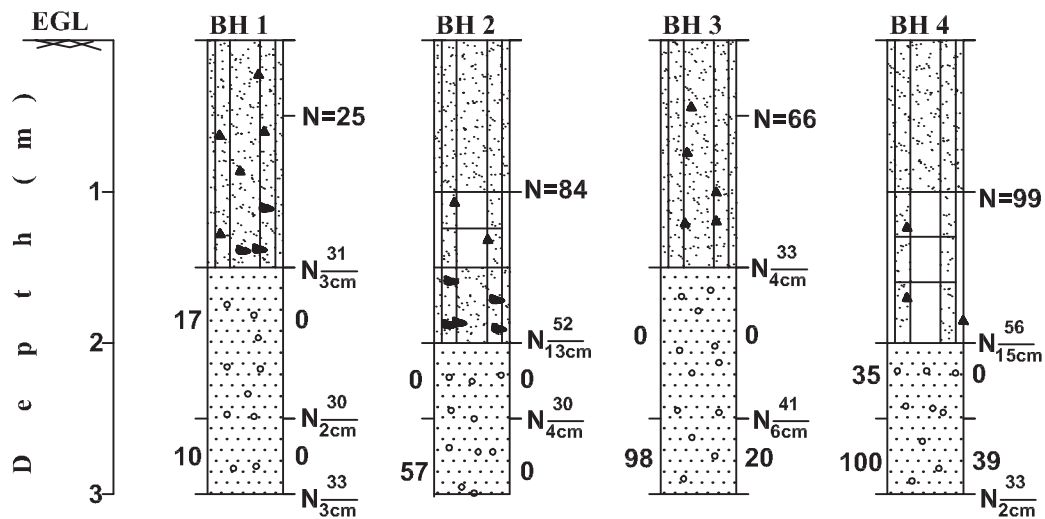
6c



**Temperature vs Time Plot
(TRT2b at 1.05m Depth)**

G(D)4536

6d



LEGEND



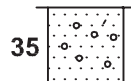
Yellowish brown silty sand
(23-41)% (37-47)%



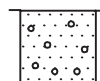
Yellowish brown clayey sandy silt with gravel
(15-16)% (30-37)% (41-37)% (7-17)%



Whitish/ reddish brown Conglomerate



35 Core recovery(%)



0 RQD(%)



N $\frac{33}{4cm}$ 33 blows for 4cm. penetration

Ground water table had not been encountered.

COMPILED SOIL/ ROCK PROFILE