भारत हेवी इलेक्ट्रिकल्स लिमिटेड
(भारत सरकार का उपक्रम)
BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)

TCN - 04

Ref: PSER:SCT:BRM-E1261:TCN-04 Date: 09-12-2011

Sub	Tender change notice (TCN) 04.	
Job	Design, engineering, procurement, supply, erection, commissioning, operation and maintenance of Construction Power Distribution System and Temporary Illumination System For 2x250 MW, Unit # 8 & 9 Barauni TPP,Bihar.	
Ref	1.0	Tender no PSER:SCT:BRM-E1261:11
	2.0	BHEL's NIT, vide reference no PSER:SCT:BRM-E1261:2587, dated 15-11-2011.
	3.0	BHEL's TCN-01,vide reference no PSER:SCT:BRM-E1261:TCN-01, dated 16-11-2011.
	4.0	BHEL's TCN-02,vide reference no PSER:SCT:BRM-E1261:TCN-02, dated 19-11-2011.
	5.0	BHEL's TCN-03,vide reference no PSER:SCT:BRM-E1261:TCN-03, dated 06-12-2011.
	6.0	Other references (if any).

With reference to above, following points, relevant to tender, may please be noted and complied with while submitting offer.

1.0 Due date of submission of offer is extended from 09-12-2011 to 13-12-2011.
2.0 The clarifications furnished to bidder's queries' are attached in Annexure-A.
3.0 Revised `No deviation certificate' as per enclosed Annexure-2. Bidder to submit `No deviation certificate' as per attached format only.
4.0 All other terms & conditions shall remain unchanged.

Thanking you,

Yours faithfully,
for BHARAT HEAVY ELECTRICALS LTD

ENGR (SCT)

Encl
As above.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)
POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091
फैक्स/Fax : (033) 23211960 फोन/Phone : बोर्ड/EPABX : 23211798/ 1691

ANNEXURE - 2

FORMAT FOR NO DEVIATION CERTIFICATE
(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector - Eastern Region,
Plot no 9/1, DJ Block, Sector – II, Salt Lake City,
Kolkata – 700 091

Sub	No Deviation Certificate.	
Job	Design, engineering, procurement, supply, erection, commissioning, operation and maintenance of Construction Power Distribution System and Temporary Illumination System For 2x250 MW, Unit # 8 & 9 Barauni TPP,Bihar.	
Ref	1.0	Tender no PSER:SCT:BRM-E1261:11
	2.0	BHEL's NIT, vide reference no PSER:SCT:BRM-E1261:2587, dated 15-11-2011.
	3.0	BHEL's TCN-01, vide reference no PSER:SCT:BRM-E1261:TCN-01, dated 16-11-2011.
	4.0	BHEL's TCN-02, vide reference no PSER:SCT:BRM-E1261:TCN-02, dated 19-11-2011.
	5.0	BHEL's TCN-03, vide reference no PSER:SCT:BRM-E1261:TCN-03, dated 06-12-2011.
	6.0	BHEL's TCN-04, vide reference no PSER:SCT:BRM-E1261:TCN-04, dated 09-12-2011.
	7.0	All other pertinent issues till date.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed/ modified the tender documents as appeared in the website/ issued by you and in case of such observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT. We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification, integrity pact (if applicable) and acceptance to reverse auctioning process.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

Annexure-A to (TCN) 04.

Sub	Annexure-A to (TCN) 04.
Job	Design, engineering, procurement, supply, erection, commissioning, operation and maintenance of Construction Power Distribution System and Temporary Illumination System For 2x250 MW, Unit # 8 & 9 Barauni TPP,Bihar.
Ref.	Tender no PSER:SCT:BRM-E1261:11

S.No	Volume No.	Clause No.	Bidder's Query	Clarification by BHEL
1.	---	---	Position of existing 33KV substation and 33kV supply point (for this package) is to be indicated in the plot plan.	There is no existing sub-station.
2.	IF	2.2.5	Areas indicated in the mentioned clause no. are not been shown in plot plan. The locations are necessary for fixing position of the11/0.415KV substations.	Plot plan attached. Exact location shall be finalized during execution.
3.	--do--	--do--	Approx. electrical load of areas indicated in this clause are required to decide the transformer ratings and number.	There will be 250KVA,500KVA, 1000KVA rating transformer of 11/.415KV.
4.	---	---	Tentative route of the 11kV ring main is required on the plot plan. It is not clear whether entire ring main will be created by Overhead ACSR or some parts of it are to be done by HV cables/AB cables due to misc. obstructions. Location and nature of such obstructions are also required. These information are very important to decide BOQ of 11kV ring main.	There will be requirement of underground cabling of 11KV,XLPE cable in some locations.
5.	---	---	Auto cad drawing of the plot plan (drawn in scale) is required for measuring distances for BOQ purpose.	DRAG NO. **PE-DG-374-100-M001 R1** ATTACHED
6.	---	---	Approx. soil resistivity value is required for preparing earthing system BOQ.	ATTACHED IN **APPENDIX-1 TO ANNEXURE-A.**
7.	---	---	Fault current and duration at 33kV supply point are required.	31.5 KA for 1 sec
8.	---	---	Feeder list and rating of feeders of all 415V LT DBs are required.	Incomer rating will be 800amp and six outgoing feeders in one DB(400A-2nos,250-2nos,125A-2nos)
9.	IF	2.2.18.9	Please clarify whether street lighting by LT AB cable is included in the scope. If yes, please indicate the approx. length and width of streets.	LT cable will be required for Lighting Mast and street poles.

S.No	Volume No.	Clause No.	Bidder's Query	Clarification by BHEL
10.	--do--	ANNEX URE-III	Kindly provide copy of the REC standards indicated in this section.	May refer REC website/ publications.
11.	--do--	--do--	Sl. no. 38 of this section indicates that 11kV ring main will be protected by Auto reclosures, whereas sl. no. 7 has specified 11kV VCB for outgoing feeders. Please clarify mismatch.	If 11KV VCB is provided for out going feeders,no auto reclosure is required.
12.	--do--	--do--	Sl. no. 3 of this section specifies transformer upto 100kVA rating only. Hence please clarify which standard is to be followed for 500kVA or above.	IS standard is to be followed
13.	--do--	--do--	Sl. no. 23 of this section specifies batteries for solar street lightings. Please indicate the legth of street for which such lighting will be required.	The distance between two poles will be around 22 mtrs.
14.	--do--	--do--	Sl. no. 32 of this section specifies 'Remote controlled load management' system. This requirement should be elaborated further, such as: 1. Exactly which CBs will be remote controlled. 2. Whether BHEL wants data acquisition only or they want remote control also. 3. How the CBs in LT DB will communicate with master control station in 33kV S/S – By FOC or by wireless means? 4. Scope does not include any I/O or RTU at LT substations. Then how the communication medium will be established? 5. Whether the master station at 33kV S/S will have HMI and server?	1. 33KV and 11KV breakers will be controlled from remote. 2. Data acquisition will not be required.Only control will be from remote. 3. Not required 4. Not required 5. No HMI and server are required for 33KV system
15.	--do--	--do--	Sl. no. 15 of this section specifies both HT and LT capacitors. To decide the ratings please provide the load power factor at LT DB s.	Power factor should be in the range of 0.8 to 0.9.

APPENDIX-1 TO ANNEXURE-A
REF. TCN-03 TO TENDER NO.
PSER:SCT:BRM-E1261:11

7. ELECTRICAL RESISTIVITY TESTS

7. ELECTRICAL RESISTIVITY TESTS

REPORT ON
EARTH RESISTIVITY TEST (ERT) FOR THE PROPOSED 2 x 250 MW UNITS AT BARAUNI TPS, PH-II, BIHAR.

INTRODUCTION:

Electrical resistivity survey was carried out at proposed 2X250 MW Units, of Barauni Thermal Power Station, PH-II, District Begusarai, Bihar on 14.09.2011 to 16.09.2011 using resistivity meter (model DDR2, IGIS) and following Indian standard at Fifteen (10) locations.

METHODOLOGY:

The survey was carried out with four electrodes arrangement commonly known as Wenner arrangement in Geophysical Resistivity Survey or Electrical Resistivity Survey using Indian standards IS 3043. In this method all four electrodes are placed in one line, the outer two electrodes are used as current electrodes (through which current inserted into the ground) whereas the inner ones are used for measuring potential differences. The distances between each of the consecutive electrodes (S) is kept constant and is progressively varied to reach the depth at which resistivity information is wanted. Suitable electrode spacing determine the conductivity of the top soil as well as the various subsurface layers occurring in the area under study. At each location (centre point), four sets of observations are taken for each electrode spacing (S). In N-S, E-W, NE-SW, and NW-SE directions nine different electrode spacing viz S = 1m, 2m, 5m and 10m have been used to know the nature of change of resistivity with depth.

Apparent resistivity is determined by the formula

$$\rho = 2\pi SR = \rho_a \text{ (in case of inhomogenous medium)}$$

Where S = distance between the two consecutive electrodes & ρ (apparent resistivity) corresponds to a point at the centre of electrode spread.

R = Observed resistance.

The mean value of the resistivity estimated was taken as the representative one.

GEOLOGY:

In this area top layer mainly covered with filled material which consist of fly ash upto a depth of about 6.00m from the ground surface. Below the top surface, sand layer is obtained.

Summarized result of the resistivity measurements at different locations in the area are given in the following tables.

It may be indicated here that in case of highly resistive formations, current penetrates much deeper into the earth than when the subsurface formations are conducting. Further, in the present investigation only apparent resistivity is measured which may be taken (as a first approximation) as the weighted average of the true resistivity of the subsurface formations in which current lines flow.

APPARENT RESISTIVITY VALUES

IERT No. 01 (N =79784.00, E = 100339.00, RL = 48.525M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	600.69	516.88	467.35	560.59	536.38
2	2	205.20	200.49	192.32	223.12	205.28
3	5	44.79	85.18	85.57	78.57	73.53
4	10	49.19	65.53	43.84	44.16	50.68

Mean Resistivity at IERT-01 is 216.47 Ohm - m.

IERT No. 02 (N =79687.00, E = 100583.00, RL = 46.455M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	899.47	962.37	919.91	937.21	929.74
2	2	336.88	271.51	462.58	422.35	373.33
3	5	29.23	37.40	36.93	39.52	35.77
4	10	29.18	27.42	23.14	26.43	26.54

Mean Resistivity at IERT-02 is 341.35 Ohm - m.

IERT No. 03 (N =79478.00, E = 100654.00, RL = 45.770M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	330.22	249.08	238.55	252.38	267.56
2	2	171.26	208.66	212.43	1789.12	595.37
3	5	101.28	98.22	89.73	118.65	101.97
4	10	52.49	48.24	50.13	47.61	49.62

Mean Resistivity at IERT-03 is 253.63 Ohm - m.

IERT No. 04 (N =79602.00, E = 100478.00, RL = 47.246M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	418.28	445.33	444.23	546.76	463.65
2	2	238.83	272.77	255.17	183.52	237.57
3	5	64.98	70.01	60.97	70.48	66.61
4	10	23.87	30.96	27.67	26.15	27.16

Mean Resistivity at IERT-04 is 198.75 Ohm - m.

IERT No. 05 (N =79602.00, E = 100263.00, RL = 48.350M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	412.15	411.37	408.38	419.07	412.74
2	2	208.66	197.66	150.84	221.23	194.60
3	5	80.70	61.29	79.75	51.86	68.40
4	10	37.56	42.58	36.93	33.63	37.68

Mean Resistivity at IERT-05 is 178.35 Ohm - m.

IERT No. 06 (N =79540.00, E = 100263.00, RL = 47.778M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	171.72	172.50	180.21	174.86	174.82
2	2	159.32	190.12	181.95	173.78	176.29
3	5	59.95	43.06	42.90	49.11	48.76
4	10	30.96	20.12	29.23	22.00	25.58

Mean Resistivity at IERT-06 is 106.36 Ohm - m.

IERT No. 07 (N =79542.00, E = 100453.00, RL = 47.272M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	167.94	78.00	81.14	90.10	104.30
2	2	121.30	115.64	119.41	113.44	117.45
3	5	52.65	78.65	60.27	86.12	69.42
4	10	19.66	21.01	18.05	15.63	18.59

Mean Resistivity at IERT-07 is 77.44 Ohm - m.

IERT No. 08 (N =79483.00, E = 100170.00, RL = 47.197M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	56.14	67.93	59.50	49.89	58.37
2	2	33.03	37.24	37.33	40.92	37.13
3	5	18.54	24.52	23.02	23.57	22.41
4	10	8.40	10.12	18.23	15.98	13.18

Mean Resistivity at IERT-08 is 32.77 Ohm - m.

IERT No. 09 (N =79629.00, E = 100627.00, RL = 45.915M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	376.46	355.38	287.77	228.33	311.99
2	2	80.64	83.05	87.20	64.58	78.87
3	5	30.72	44.24	37.09	28.92	35.24
4	10	28.36	28.66	24.15	23.05	26.06

Mean Resistivity at IERT-09 is 113.04 Ohm - m.

IERT No. 10 (N =79747.00, E = 100611.00, RL = 46.112M)

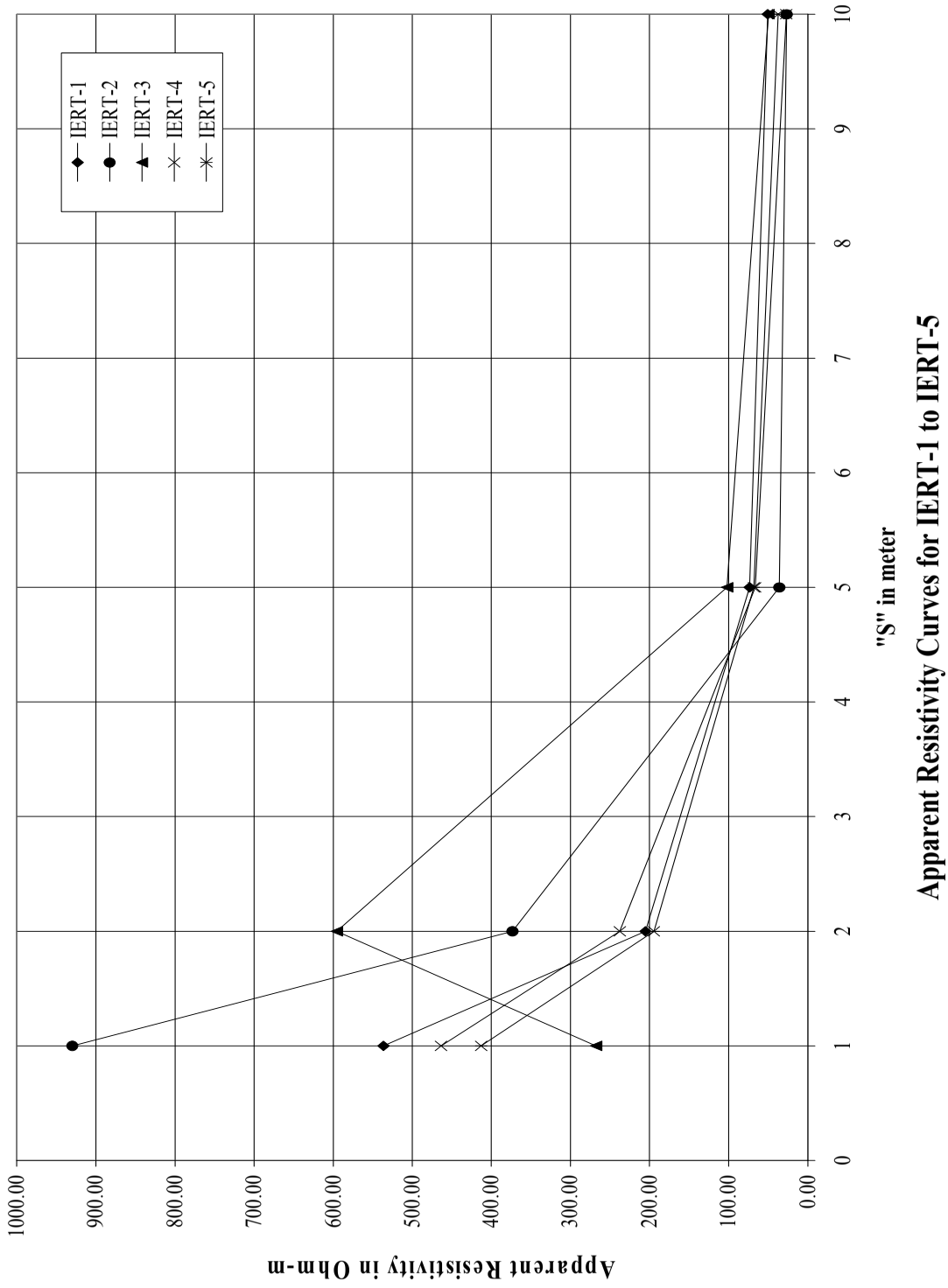
Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	1294.16	1207.68	1427.83	1281.58	1302.81
2	2	371.75	537.05	524.17	476.40	477.34
3	5	177.27	169.41	172.39	169.96	172.26
4	10	122.58	137.50	107.64	130.43	124.54

Mean Resistivity at IERT-10 is 519.24 Ohm - m.

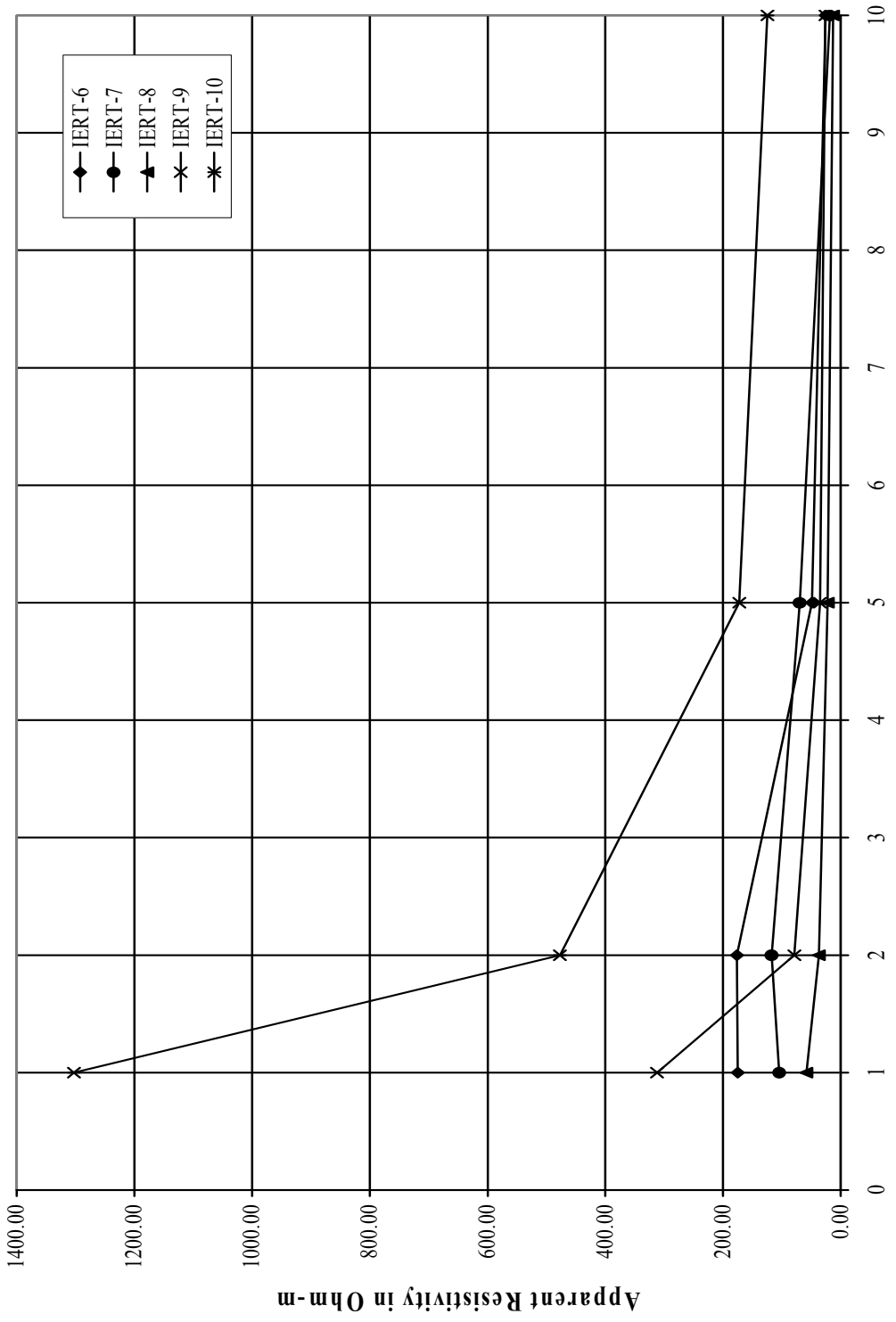
For C. E. Testing Company Private Limited,

Prepared By	Checked By	Approved By
(B. BANERJEE)	(S. NATH)	(DR. M. NAYAK)

APPARENT RESISTIVITY CURVES



Apparent Resistivity Curves for IERT-1 to IERT-5



Apparent Resistivity Curves for IERT-6 to IERT-10

REPORT ON
EARTH RESISTIVITY TEST (ERT) FOR THE PROPOSED 2 x 250 MW UNITS AT BARAUNI TPS, PH-II, BIHAR.

INTRODUCTION:

Electrical resistivity survey was carried out at proposed 2X250 MW Units, of Barauni Thermal Power Station, PH-II, District Begusarai, Bihar on 14.09.2011 to 16.09.2011 and 25.09.2011 to 27.09.2011 using resistivity meter (model DDR2, IGIS) and following Indian standard at Eleven (11) locations.

METHODOLOGY:

The survey was carried out with four electrodes arrangement commonly known as Wenner arrangement in Geophysical Resistivity Survey or Electrical Resistivity Survey using Indian standards IS 3043. In this method all four electrodes are placed in one line, the outer two electrodes are used as current electrodes (through which current inserted into the ground) whereas the inner ones are used for measuring potential differences. The distances between each of the consecutive electrodes (S) is kept constant and is progressively varied to reach the depth at which resistivity information is wanted. Suitable electrode spacing determine the conductivity of the top soil as well as the various subsurface layers occurring in the area under study. At each location (centre point), four sets of observations are taken for each electrode spacing (S). In N-S, E-W, NE-SW, and NW-SE directions nine different electrode spacing viz S = 1m, 2m, 5m and 10m have been used to know the nature of change of resistivity with depth.

Apparent resistivity is determined by the formula

$$\rho = 2\pi SR = \rho_a \text{ (in case of inhomogenous medium)}$$

Where S = distance between the two consecutive electrodes & ρ (apparent resistivity) corresponds to a point at the centre of electrode spread.

R = Observed resistance.

The mean value of the resistivity estimated was taken as the representative one.

GEOLOGY:

In this area top layer mainly covered with filled material which consist of fly ash upto a depth of about 6.00m from the ground surface. Below the top surface, sand layer is obtained.

Summarized result of the resistivity measurements at different locations in the area are given in the following tables.

It may be indicated here that in case of highly resistive formations, current penetrates much deeper into the earth than when the subsurface formations are conducting. Further, in the present investigation only apparent resistivity is measured which may be taken (as a first approximation) as the weighted average of the true resistivity of the subsurface formations in which current lines flow.

APPARENT RESISTIVITY VALUES

ERT No. 05 (N =79408.00, E = 100602.00, RL = 45.403M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	433.54	400.83	413.57	394.07	410.50
2	2	287.85	353.22	315.82	290.05	311.74
3	5	91.78	80.54	87.22	80.22	84.94
4	10	59.24	42.27	46.20	59.40	51.78

Mean Resistivity at ERT-05 is 214.74 Ohm - m.

ERT No. 06 (N =79409.00, E = 100479.00, RL = 46.417M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	422.37	373.63	432.12	398.47	406.65
2	2	328.39	291.93	286.28	290.37	299.24
3	5	138.76	148.04	182.61	155.97	156.35
4	10	53.59	66.63	42.26	49.81	53.07

Mean Resistivity at ERT-06 is 228.83 Ohm - m.

ERT No. 07 (N =79348.00, E = 100538.00, RL = 45.601M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	335.41	454.61	389.98	330.06	377.52
2	2	289.11	239.14	237.57	274.34	260.04
3	5	34.37	104.98	141.91	118.02	99.82
4	10	53.43	45.41	46.36	48.86	48.52

Mean Resistivity at ERT-07 is 196.47 Ohm - m.

ERT No. 08 (N =79294.00, E = 100491.00, RL = 45.775M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	208.98	201.28	181.78	205.05	199.27
2	2	171.58	150.84	149.89	172.54	161.21
3	5	123.52	90.52	119.59	108.43	110.52
4	10	45.41	7.54	56.89	39.44	37.32

Mean Resistivity at ERT-08 is 127.08 Ohm - m.

ERT No. 09 (N =79288.00, E = 100583.00, RL = 45.000M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	354.76	332.74	346.89	338.72	343.28
2	2	257.99	328.08	295.39	301.99	295.86
3	5	167.84	190.86	178.52	167.99	176.30
4	10	90.52	93.00	91.93	90.20	91.41

Mean Resistivity at ERT-09 is 226.71 Ohm - m.

ERT No. 11 (N =79220.00, E = 100460.00, RL = 45.070M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	125.95	127.21	127.69	134.76	128.90
2	2	141.09	127.59	133.55	140.78	135.75
3	5	109.38	108.43	111.03	108.12	109.24
4	10	63.80	40.86	44.63	43.84	48.28

Mean Resistivity at ERT-11 is 105.54 Ohm - m.

ERT No. 12 (N =79219.00, E = 100512.00, RL = 45.039M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	317.17	322.68	287.77	307.11	308.68
2	2	225.00	206.15	241.65	218.72	222.88
3	5	150.86	145.52	147.41	132.32	144.03
4	10	72.44	86.27	90.20	72.44	80.34

Mean Resistivity at ERT-12 is 188.98 Ohm - m.

ERT No. 13 (N =79217.00, E = 100565.00, RL = 44.462M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	211.34	231.00	198.76	189.33	207.61
2	2	138.27	158.38	168.44	144.24	152.33
3	5	147.80	129.65	119.83	133.26	132.64
4	10	95.39	89.73	82.03	74.64	85.45

Mean Resistivity at ERT-13 is 144.51 Ohm - m.

ERT No. 14 (N =79162.00, E = 100448.00, RL = 44.235M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	132.87	127.21	127.69	130.52	129.57
2	2	120.04	121.93	137.01	128.84	126.96
3	5	84.31	86.43	82.50	85.57	84.70
4	10	36.46	42.27	38.66	40.54	39.48

Mean Resistivity at ERT-05 is 95.18 Ohm - m.

ERT No. 15 (N =79162.00, E = 100517.00, RL = 44.771M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	85.38	71.07	73.28	80.51	77.56
2	2	70.80	71.27	71.71	69.98	70.94
3	5	37.24	42.19	40.94	38.34	39.68
4	10	10.65	25.53	13.12	15.02	16.08

Mean Resistivity at ERT-15 is 51.06 Ohm - m.

ERT No. 16 (N =79163.00, E = 100575.00, RL = 44.983M)

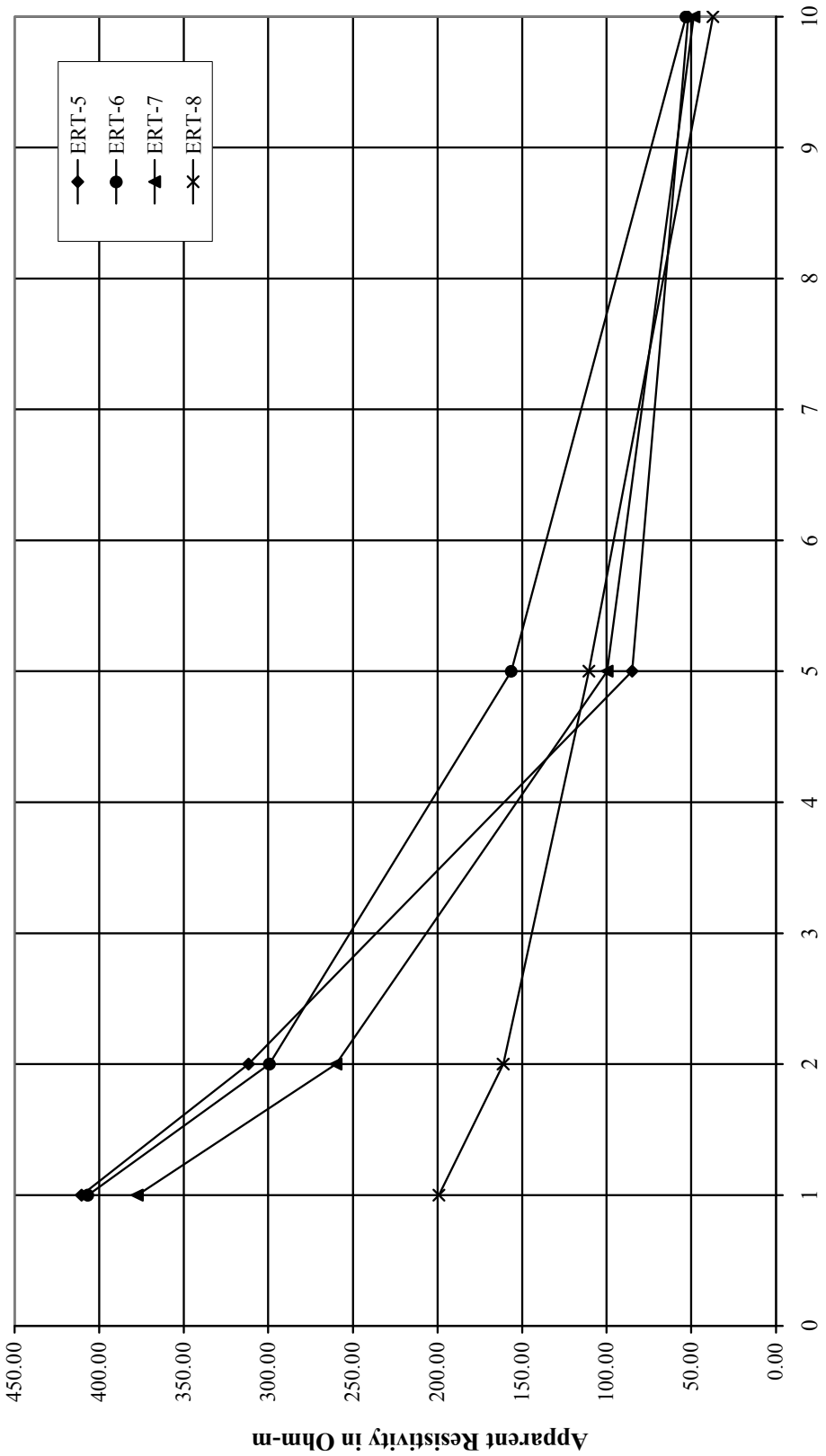
Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	318.27	324.72	305.06	321.42	317.37
2	2	174.72	187.29	164.98	176.61	175.90
3	5	95.39	83.76	90.05	89.02	89.56
4	10	53.43	46.67	45.10	48.72	48.48

Mean Resistivity at ERT-16 is 157.83 Ohm - m.

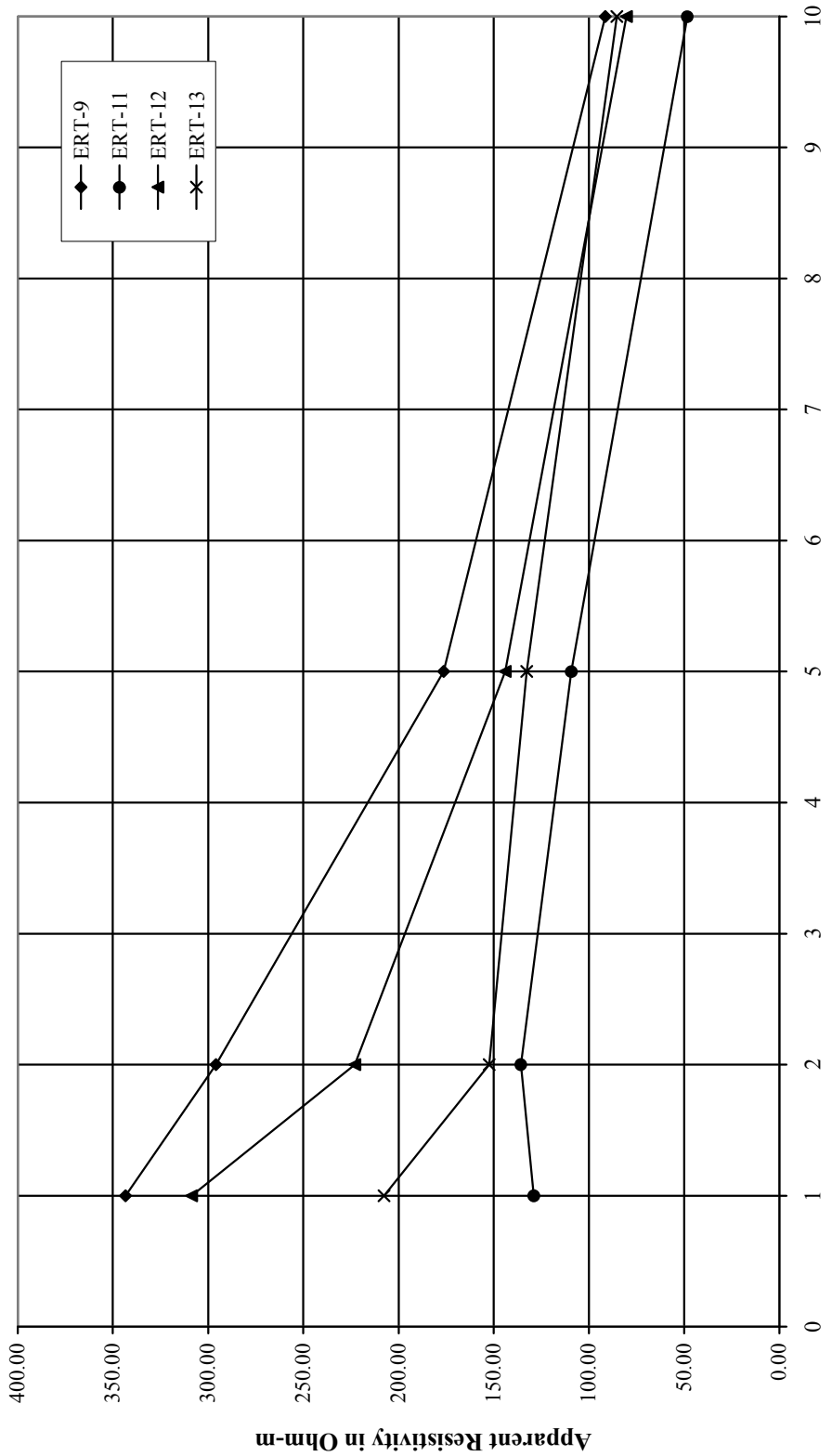
For C. E. Testing Company Private Limited,

Prepared By	Checked By	Approved By
(B. BANERJEE)	(S. NATH)	(DR. M. NAYAK)

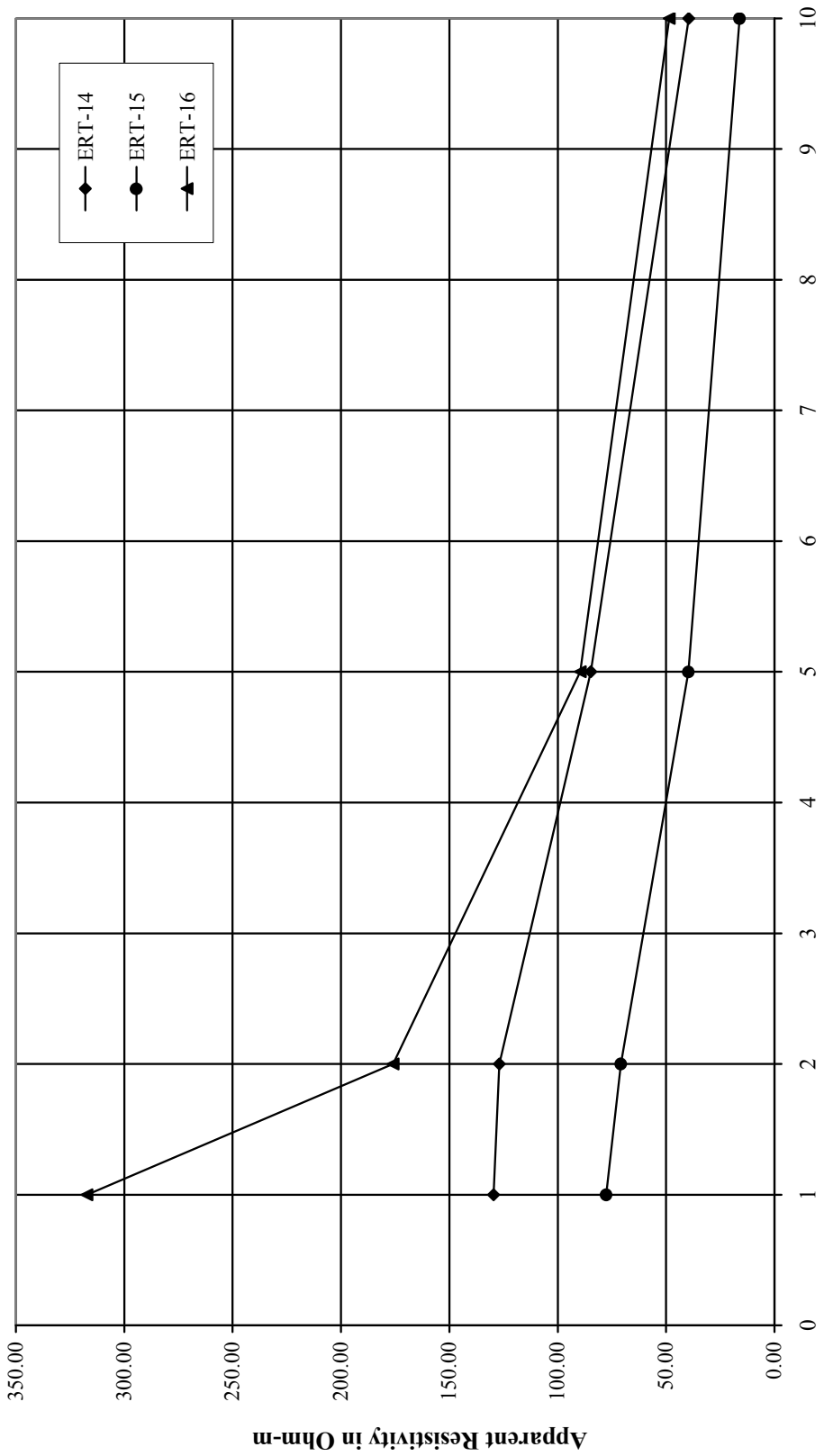
APPARENT RESISTIVITY CURVES



Apparent Resistivity Curves for ERT-5 to ERT-8



Apparent Resistivity Curves for ERT-9 to ERT-13



Apparent Resistivity Curves for ERT-14 to ERT-16

7. ELECTRICAL RESISTIVITY TESTS

REPORT ON
EARTH RESISTIVITY TEST (ERT) FOR THE PROPOSED 2 x 250 MW UNITS AT BARAUNI TPS, PH-II, BIHAR.

INTRODUCTION:

Electrical resistivity survey was carried out at proposed 2X250 MW Units, of Barauni Thermal Power Station, PH-II, District Begusarai, Bihar on 14.09.2011 to 16.09.2011 and 25.09.2011 to 27.09.2011 using resistivity meter (model DDR2, IGIS) and following Indian standard at Eleven (13) locations.

METHODOLOGY:

The survey was carried out with four electrodes arrangement commonly known as Wenner arrangement in Geophysical Resistivity Survey or Electrical Resistivity Survey using Indian standards IS 3043. In this method all four electrodes are placed in one line, the outer two electrodes are used as current electrodes (through which current inserted into the ground) whereas the inner ones are used for measuring potential differences. The distances between each of the consecutive electrodes (S) is kept constant and is progressively varied to reach the depth at which resistivity information is wanted. Suitable electrode spacing determine the conductivity of the top soil as well as the various subsurface layers occurring in the area under study. At each location (centre point), four sets of observations are taken for each electrode spacing (S). In N-S, E-W, NE-SW, and NW-SE directions nine different electrode spacing viz S = 1m, 2m, 5m and 10m have been used to know the nature of change of resistivity with depth.

Apparent resistivity is determined by the formula

$$\rho = 2\pi SR = \rho_a \text{ (in case of in homogenous medium)}$$

Where S = distance between the two consecutive electrodes & ρ (apparent resistivity) corresponds to a point at the centre of electrode spread.

R = Observed resistance.

The mean value of the resistivity estimated was taken as the representative one.

GEOLOGY:

In this area top layer mainly covered with filled material which consist of fly ash upto a depth of about 6.00m from the ground surface. Below the top surface, sand layer is obtained.

Summarized result of the resistivity measurements at different locations in the area are given in the following tables.

It may be indicated here that in case of highly resistive formations, current penetrates much deeper into the earth than when the subsurface formations are conducting. Further, in the present investigation only apparent resistivity is measured which may be taken (as a first approximation) as the weighted average of the true resistivity of the subsurface formations in which current lines flow.

APPARENT RESISTIVITY VALUES

ERT No. 01 (N =79798.00, E = 100705.00, RL = 45.721M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	446.28	495.34	497.06	554.78	498.37
2	2	318.33	328.39	359.50	348.19	338.60
3	5	248.30	242.01	235.72	275.79	250.46
4	10	199.89	129.49	204.13	182.92	179.11

Mean Resistivity at ERT-01 is 316.63 Ohm - m.

ERT No. 02 (N =79129.00, E = 100985.00, RL = 42.802M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	22.08	20.63	21.17	21.43	21.33
2	2	19.51	21.49	20.64	19.95	20.40
3	5	19.02	18.82	18.26	19.10	18.80
4	10	21.95	22.72	22.47	20.17	21.83

Mean Resistivity at ERT-02 is 20.59 Ohm - m.

ERT No. 03 (N =79503.00, E = 100895.00, RL = 45.601M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	200.49	187.91	193.42	211.66	198.37
2	2	143.61	116.27	127.27	139.21	131.59
3	5	68.59	58.07	60.66	63.65	62.74
4	10	30.84	30.09	30.46	30.97	30.59

Mean Resistivity at ERT-03 is 105.82 Ohm - m.

ERT No. 04 (N =79352.00, E = 100706.00, RL = 44.857M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	102.05	88.06	96.39	89.32	93.96
2	2	63.98	73.88	76.30	78.40	73.14
3	5	60.19	63.33	66.87	61.29	62.92
4	10	46.36	45.57	45.89	46.83	46.16

Mean Resistivity at ERT-04 is 69.04 Ohm - m.

ERT No. 10 (N =79244.00, E = 100698.00, RL = 44.032M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	227.07	283.83	258.20	242.63	252.93
2	2	186.04	191.37	158.38	174.40	177.55
3	5	85.88	79.28	76.06	81.40	80.66
4	10	56.57	49.81	50.44	46.83	50.91

Mean Resistivity at ERT-10 is 140.51 Ohm - m.

ERT No. 17 (N =79069.00, E = 100413.00, RL = 44.459M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	224.71	167.31	175.18	159.92	181.78
2	2	121.30	121.30	103.70	126.95	118.31
3	5	62.86	77.71	60.66	73.86	68.77
4	10	11.97	39.38	21.07	22.16	23.65

Mean Resistivity at ERT-17 is 98.13 Ohm - m.

ERT No. 18 (N =79069.00, E = 100471.00, RL = 44.265M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	121.40	103.94	113.53	132.72	117.90
2	2	102.45	97.86	99.68	109.67	102.42
3	5	33.55	55.00	48.64	38.89	44.02
4	10	4.27	3.39	9.68	12.63	7.49

Mean Resistivity at ERT-18 is 67.96 Ohm - m.

ERT No. 19 (N =79069.00, E = 100529.00, RL = 44.229M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	97.02	88.06	92.78	103.94	95.45
2	2	80.29	75.36	83.46	81.58	80.17
3	5	34.89	24.99	27.66	19.33	26.72
4	10	8.34	5.19	9.30	14.34	9.29

Mean Resistivity at ERT-19 is 52.91 Ohm - m.

ERT No. 20 (N =79069.00, E = 100586.00, RL = 43.911M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	97.65	90.58	92.46	99.38	95.02
2	2	73.85	76.14	70.67	72.84	73.38
3	5	44.39	40.31	41.80	44.79	42.82
4	10	26.40	24.54	23.41	19.17	23.38

Mean Resistivity at ERT-20 is 58.65 Ohm - m.

ERT No. 21 (N =78988.00, E = 100413.00, RL = 43.893M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	227.07	222.19	241.69	194.99	221.49
2	2	129.47	142.67	133.24	142.35	136.93
3	5	40.39	59.48	66.47	56.89	55.81
4	10	16.48	19.86	22.64	24.02	20.75

Mean Resistivity at ERT-21 is 108.74 Ohm - m.

ERT No. 22 (N =78988.00, E = 100471.00, RL = 43.871M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	200.02	209.30	201.59	166.06	194.24
2	2	99.30	120.98	135.76	106.84	115.72
3	5	51.31	51.23	41.80	40.07	46.10
4	10	11.77	50.60	47.30	33.94	35.90

Mean Resistivity at ERT-22 is 97.99 Ohm - m.

ERT No. 23 (N =78982.00, E = 100535.00, RL = 43.518M)

Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	65.42	66.04	67.14	62.43	65.26
2	2	63.48	73.31	71.77	63.98	68.14
3	5	43.76	45.33	20.43	41.25	37.69
4	10	19.81	21.09	18.48	20.35	19.93

Mean Resistivity at ERT-23 is 47.75 Ohm - m.

ERT No. 24 (N =78988.00, E = 100586.00, RL = 43.762M)

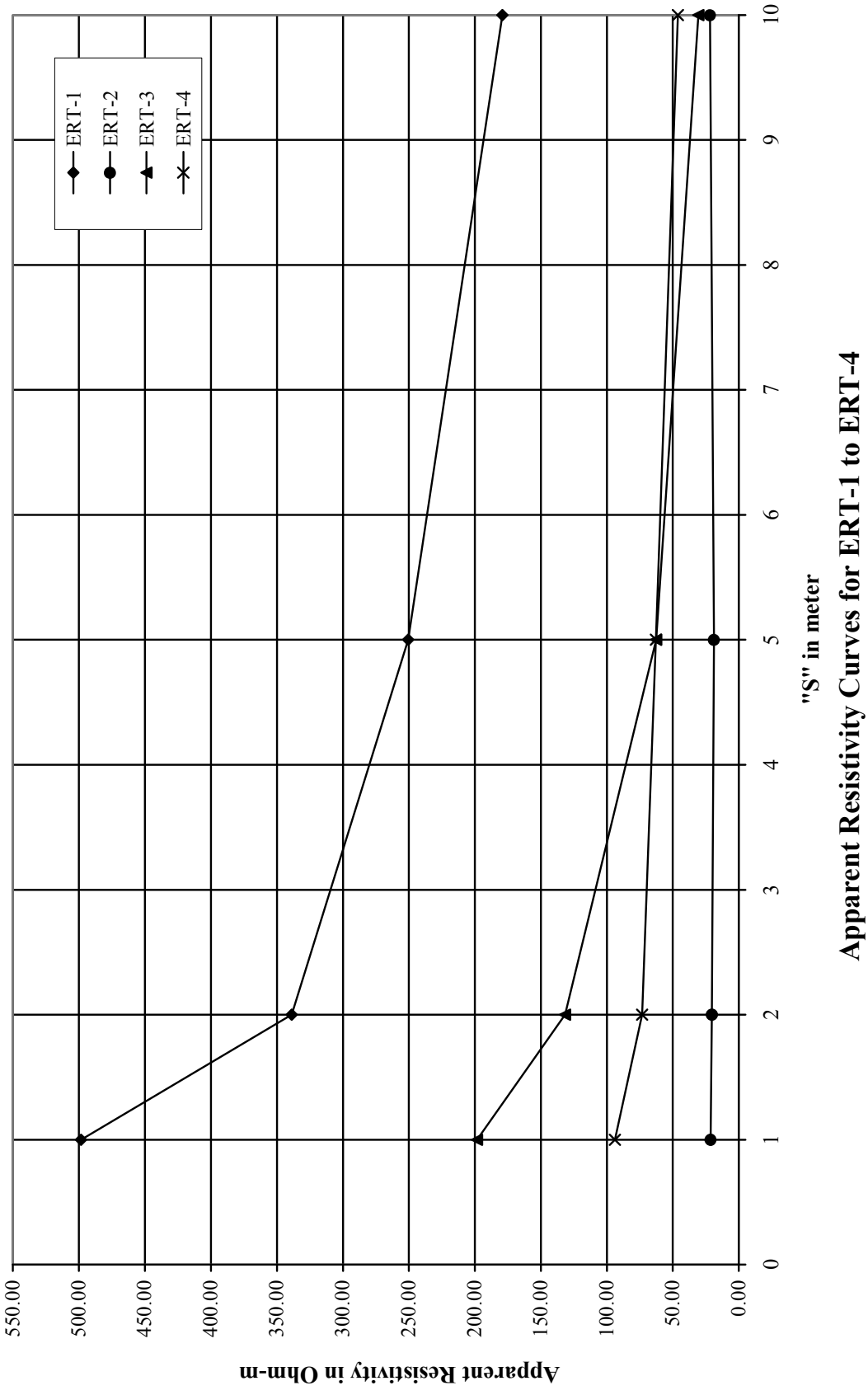
Sl No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	Mean
1	1	50.95	51.73	52.84	50.00	51.38
2	2	58.45	57.54	56.34	57.88	57.55
3	5	45.89	48.09	46.52	46.28	46.70
4	10	24.05	24.04	22.67	23.82	23.65

Mean Resistivity at ERT-24 is 44.82 Ohm - m.

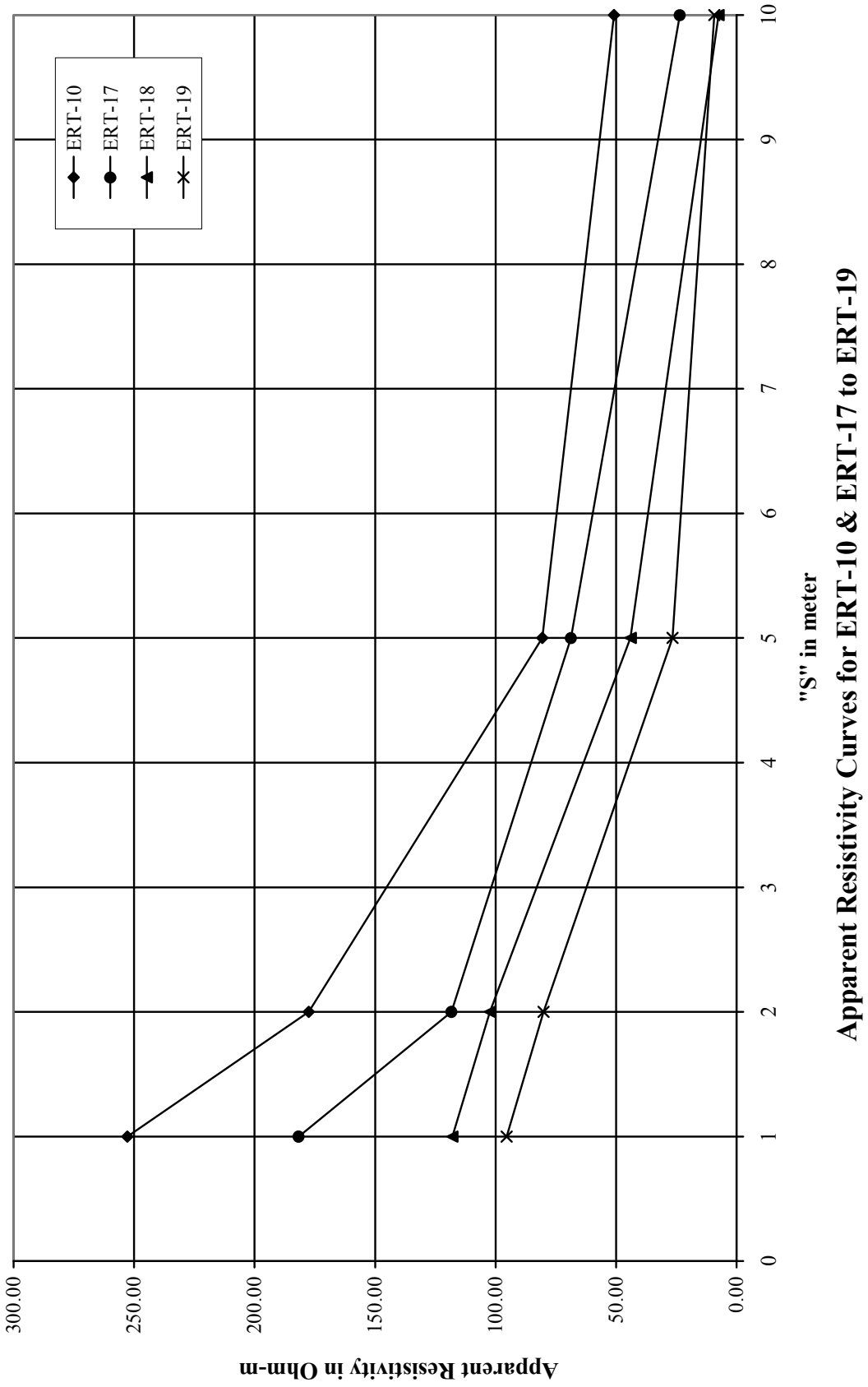
For C. E. Testing Company Private Limited,

Prepared By	Checked By	Approved By
(S. SARKAR)	(S. NATH)	(DR. M. NAYAK)

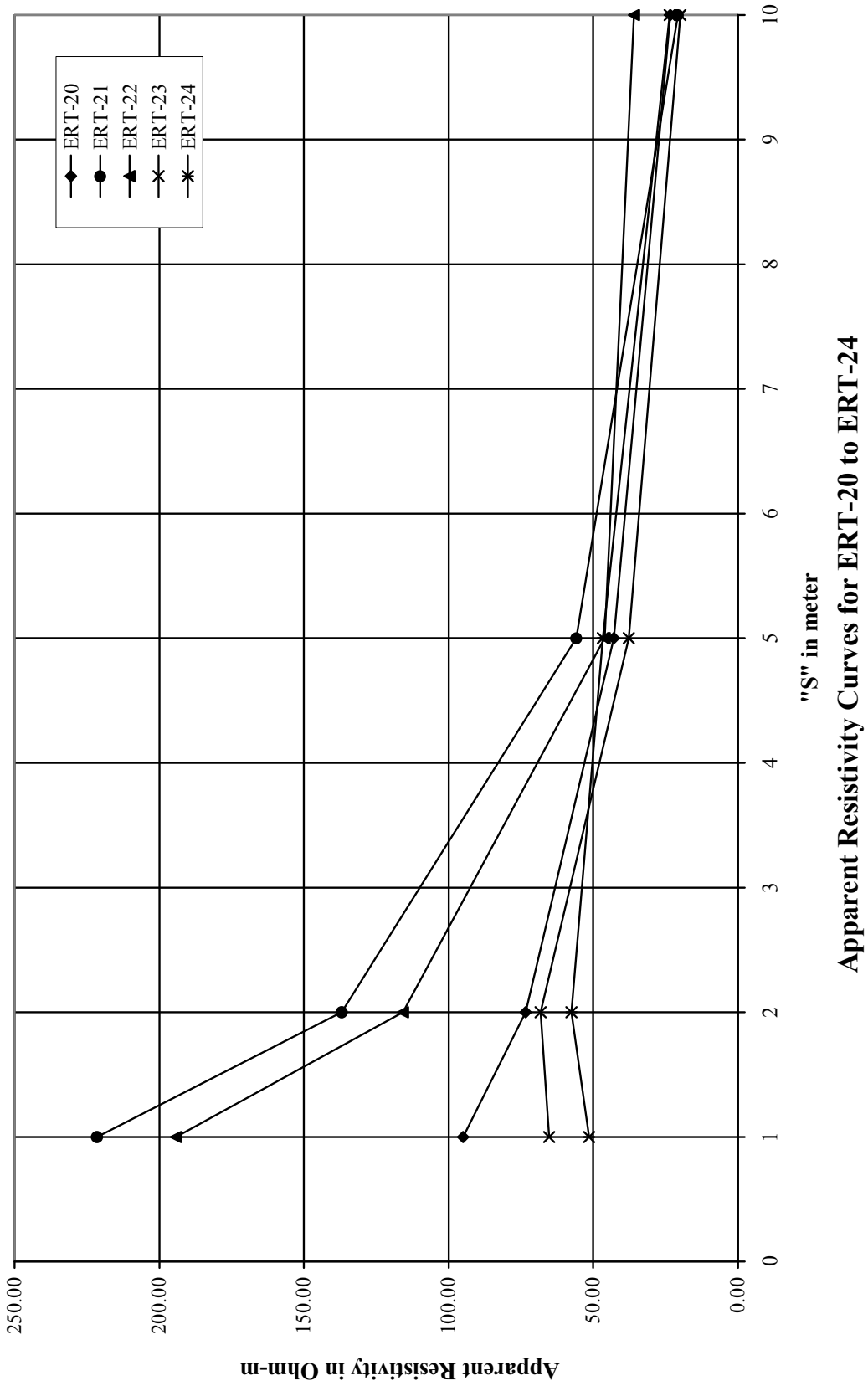
APPARENT RESISTIVITY CURVES



Apparent Resistivity Curves for ERT-1 to ERT-4



Apparent Resistivity Curves for ERT-10 & ERT-17 to ERT-19



Apparent Resistivity Curves for ERT-20 to ERT-24