TI/01/25/SBC/08-A

Safe bearing Capacity of soil

&

Geotechnical Investigation

FOR

CONSTRUCTION OF PROPOSED PROJECT

"STAFF QUARTERS & GUEST HOUSE"

AT

CIRCLE AUDIT OFFICE, STATE BANK OF INDIA

SECTOR – 7, VIDYADHAR NAGAR, JAIPUR, RAJ.

Submitted to

STATE BANK OF INDIA

CIRCLE AUDIT OFFICE

VIDYADHAR NAGAR, JAIPUR, RAJASTHAN

Team Infrastructures

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Details

1.	**Name of Client**	**State Bank of India** **Circle Audit Office** **Sector - 7, Vidyadhar Nagar, Jaipur, Rajasthan**
2.	**Letter No. & Date**	Letter No. : Confirmation by E-mail Dated : 28.12.2024
3.	**Report No.**	TI/01/25/SBC/08-A
4.	**Name of Project**	Geo-technical Investigation Work for Proposed Staff Quarters & Guest House Building Project
5.	**Site Location**	Circle Audit Office, State Bank of India, Sector -7, Vidyadhar Nagar, Jaipur, Rajasthan
6.	**Name of Test**	Geo Technical/ Soil Investigation Test
7.	**Date of Sampling**	31-12-2024
8.	**Date of Testing**	01-01-2025 to 07-01-2025
9.	**Date of Reporting**	08-01-2025

Authorized Signatory

Designation: TM/QM

INDEX

1. INTRODUCTION

There is a proposal for Conducting Geo-technical investigation work for Construction of Proposed Staff Quarters & Guest House Building Project by **State Bank of India, Circle Audit Office, Vidyadhar Nagar, Jaipur.** The report presented herein deals with the field investigation carried out to assess the nature of soil strata and other parameters required for foundation design of proposed structure. The work of soil investigation has been awarded to **Team Infrastructures**, 184/16, Pratap Nagar, Jaipur.

- The proposed site is located **at Circle Audit Office, State Bank of India, Sector - 7, Vidyadhar Nagar, Jaipur, Rajasthan.**

The objective of the present study was to carry out soil investigation so as to arrive at the parameters required for the design of foundations. For this, field investigations at the site were conducted. The results from these investigations have been analyzed in order to provide the required parameters.

In order to achieve these objectives, the stipulated scope of work allotted to the consultants consisted of carrying out the following operations

a. Transportation of plant and personnel to the site of work and withdrawing the same on completion of work.
b. Drilling three boreholes of 150 mm diameter up to 10.0 m depth below ground level.
c. Conducting Standard Penetration Test (SPT) in bore hole at 1.5 m intervals or change of strata (As per client requirement) as per IS: 2131-1981.
d. Collecting disturbed soil samples at regular interval of 1.5 m or at every identifiable change of strata.
e. Collecting undisturbed soil samples at regular interval of 3.0 m or at every change of strata whichever occurs earlier
f. Recording of water table level in the boreholes and collection of water samples from the boreholes as directed by the engineer in-charge.
g. Carrying out the laboratory tests on the selected soil samples in order to establish their engineering characteristics.

h. Submission of Geotechnical report giving details of all the field/ laboratory tests carried out and with distinct recommendation for Safe Bearing Capacity of sub-soil strata, type and depth of foundation.

To execute the work as per given scope of work three boreholes of 150 mm diameter were drilled with the help of required drilling machines.

FIELD TESTS

150 mm dia. bore hole was advanced up to the desired depth below the ground level. Boring was associated with collection of disturbed samples (DS) and undisturbed samples (UDS) and SPT tests were conducted at 1.5 m interval (As per client requirement).

Disturbed soil samples were collected from bore holes at regular intervals to determine the soil type, grain size distribution, atterberg's limits and soil classification.

Undisturbed soil samples were collected from bore holes at 3.0 m intervals /every change in strata to determine the shear parameters, natural moisture content and bulk density.

After collection from bore holes the samples were sealed and transported to the laboratory carefully in the due time. Ground water table was observed in each bore hole as per IS 6935-1973.

STANDARD PANETRATION TEST:

The Standard Penetration Test was conducted in boreholes as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows 'N'.

Standard split spoon sampler was attached to an 'A' rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as 'N' value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective bore log.

Corrections of N Value

For overburden: - The N value for cohesion less soil is corrected with the help of fig. 1 given in IS- 2131.

Due to dilatancy: - The value obtained from overburden correction (N') shall be corrected for dilatancy if the stratum consists of fine sand and silt below water table for values of N' greater than 15, as under (N"):

$$N" = 15 + ½ (N'-15)$$

Correlation with SPT N

SPT 'N' values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

Correlation for Clay / Plastic silt		**Correlation for Sand / Non-Plastic silt**	
Consistency	**SPT 'N' Value**	**Compactness**	**SPT 'N' Value**
Very Soft	0 – 2	Very Loose	0 – 4
Soft	2 – 4	Loose	4 – 10
Medium	4 – 8	Medium	10 – 30
Stiff	8 – 15	Dense	30 – 50
Very Stiff	15 – 30	Very Dense	> 50
Hard	> 30		

LABORATORY TESTS

The soil samples collected from all the bore holes were tested in the laboratory. The following tests were conducted and analyzed for determination of certain engineering properties and its bearing capacity.

(i) Grain size analysis

(ii) Atterberg's limits

(iii) Specific gravity

(iv) Free Swell Index

(v) Shear test

(vi) Natural Moisture Content

(vii) Bulk density

The samples were identified and classified as per IS: 1498- 1970. The tests of samples were conducted as per relevant Indian Standard Codes of Practice and tests results are shown in Tables.

FOUNDATION ANALYSIS

For a satisfactory performance of the foundation, following criteria must be satisfied:

(i) The foundation must be safe against shear failure.

(ii) The foundation must not undergo excessive settlement.

The smaller of the bearing pressures obtained according to (i) and (ii) above is adopted as the allowable bearing pressure.

For the foundation resting on Soil, a permissible total settlement of 50 mm for a foundation resting on sand and 75 mm for a foundation resting on clay is specified in IS: 1904-1978.

For foundation resting on Rock, a permissible total settlement of 12mm for a foundation resting on rock is specified IS: 13063-1991.

The allowable bearing pressure of subsoil strata shall be computed for shallow footing. The analysis is carried out for shear and settlement failure considerations as per IS: 6403-1981, IS: 8009 Part-I (1976) and IS: 1904-1986.

IS-8009(part-I)-1976

The safe bearing pressure can be calculated using readymade chart for any value of permissible settlement, given width of footing and corrected value.

IS-6403-1981

The following formulae have been used for calculating ultimate net bearing capacity as per IS : 6403-1981

Local Shear Failure Criterion-

$$Q_{nf} = 0.67cN_c\, s_c\, d_c\, i_c + q\,(N_q\text{-}1)\, sq\, d_q\, i_q + 0.5\, B\gamma\, N_\gamma\, s_\gamma\, d_\gamma\, i_\gamma\, w$$

General Shear Failure Criterion-

$$Q_{nf} = cN_c\, s_c\, d_c\, i_c + q\,(N_q\text{-}1)\, sq\, d_q\, i_q + 0.5\, B\gamma\, N_\gamma\, s_\gamma\, d_\gamma\, i_\gamma\, w$$

Where

N_c N_q N_γ = Bearing capacity factors

C= Unit Cohesion

B= Width of strip footing

s_c s_q s_γ = Shape factors

d_c d_q d_γ = Depth factors

i_c i_q i_γ = Inclination factors

γ = Bulk unit weight of foundation soil

Qnf = Net ultimate bearing capacity

w = Correction factor for location of water table

* Note-

Factor of safety equal to 3 has been used to calculate net safe bearing capacity, to obtain safe bearing capacity γD has been added to net safe bearing capacity.

2. SOIL INVESTIGATION & TEST REPORT

Net Safe Bearing Capacity (Minimum of Three Bore Holes)

Foundation Type	Foundation Size	Depth in Meter From E.G.L	Net Safe Bearing Capacity		Recommended Net Safe Bearing Capacity (t/m^2)
			Settlement Criteria (t/m^2)	Local Shear Criteria (t/m^2)	
Square Footing	1.5 m X 1.5 m	**1.50**	14.51	7.67	**7.50**
		3.00	23.88	13.40	**13.00**
		4.50	28.71	24.08	**24.00**
		6.00	45.10	31.40	**24.50**
	2.0 m X 2.0 m	**1.50**	13.10	8.31	**8.00**
		3.00	21.59	14.04	**14.00**
		4.50	26.04	24.95	**24.50**
		6.00	42.10	32.26	**24.50**
	2.5 m X 2.5 m	**1.50**	12.29	8.96	**8.50**
		3.00	20.31	14.69	**14.50**
		4.50	24.54	25.82	**24.50**
		6.00	39.79	33.12	**24.50**
	3.0 m X 3.0 m	**1.50**	11.48	9.61	**9.50**
		3.00	19.03	15.34	**15.00**
		4.50	23.04	26.69	**24.50**
		6.00	37.49	33.99	**24.50**
Raft Footing	6.0 m Wide	**1.50**	15.12	12.51	**12.50**
		3.00	24.47	18.24	**18.00**
		4.50	29.14	30.59	**29.00**
		6.00	46.04	37.86	**37.50**

Soil is suitable for laying foundation and recommended net safe bearing capacity as listed in table may be taken for design of foundation.

Authorized Signatory

Designation: TM/QM

3. SOIL PROPERTIES

RECORD OF BORING - BH- 1

Project - : Staff Quarters & Guest House
Bore Hole No. : 01
Depth of Borehole : 10.0 m
Dia./Size of Borehole : 150 mm

Date of Starting : 31-12-2024
Date of Completion : 31-12-2024
Location : Vidyadhar Nagar, Jaipur
Depth of GWT : Not Intersected

Description Of Strata	Bore Log	Depth from EGL (meter)	Samples Type	No. of Blows Related to Depth of Penetration			"N" Value
				I	II	III	
Poorly Graded Sand		1.50	S/UDS	2	3	3	6
Poorly Graded Sand		3.00	S/DS	3	4	6	10
Poorly Graded Sand		4.50	S/UDS	6	9	11	20
Poorly Graded Sand		6.00	S/DS	7	11	15	26
Poorly Graded Sand		7.50	S/UDS	10	14	18	32
Poorly Graded Sand		9.00	S/DS	9	17	20	37
Poorly Graded Sand		10.00	S/UDS	11	20	22	42

R-Refusal (N >100)
N Value=Penetration Resistance
UDS – Undisturbed Sample
DS – Disturbed Sample
S- Standard Penetration Test

RESULTS OF LABORATORY TEST

Soil Properties for bore hole 01

Depth from EGL (meter) 659	SOIL TEST RESULT														
	Grain Size Analysis					Atterberg's Limit			IS Classifications	Free Swell Index (%)	Specific Gravity	Shear Parameters		Natural Moisture Content (%)	03Bulk Density(g/cc)
	Silt & Clay (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)				C (Kg/ cm^2)	Φ (degrees)		
1.50	4.0	95.0	1.0	-	-	24.5	NP	-	SP	-	2.61	CL	29.0	3.8	1.67
3.00	2.0	98.0	-	-	-	23.2	NP	-	SP						
4.50	2.0	98.0	-	-	-	23.8	NP	-	SP	-	2.60	CL	32.0	3.2	1.75
6.00	3.0	97.0	-	-	-	24.2	NP	-	SP						
7.50	2.0	98.0	-	-	-	23.1	NP	-	SP	-	2.60	CL	33.0	3.5	1.76
9.00	2.0	92.0	-	-	6.0	24.0	NP	-	SP						
10.00	2.0	98.0	-	-	-	23.6	NP	-	SP	-	2.60	CL	34.0	3.0	1.78

Note: NP-Non Plastic, CL- Cohesion less

- Soil is poorly graded sand from 1.5 m to 10.0 m depths. It is primarily fine sand (92 to 98%), mix with very small percentage of silt & clay (2 to 4%).
- Soil is non-plastic and cohesion less up to 10.0 m depth.
- Soil is loose at 1.5 m depth, medium from 3.0 m to 6.0 m depth and dense from 7.5 m to 10.0 m depth.
- Rock was not encountered up to 10.0 m depth.
- Water table was not intersected up to 10.0 m depth.

RECORD OF BORING - BH- 2

Project - : Staff Quarters & Guest House
Bore Hole No. : 02
Depth of Borehole : 10.0 m
Dia./Size of Borehole : 150 mm

Date of Starting : 31-12-2024
Date of Completion : 31-12-2024
Location : Vidyadhar Nagar, Jaipur
Depth of GWT : Not Intersected

Description Of Strata	Bore Log	Depth from EGL (meter)	Samples Type	No. of Blows Related to Depth of Penetration			"N" Value
				I	II	III	
Poorly Graded Sand		1.50	S/UDS	3	4	4	8
Poorly Graded Sand		3.00	S/DS	4	5	7	12
Poorly Graded Sand		4.50	S/UDS	4	6	7	13
Poorly Graded Sand		6.00	S/DS	6	9	12	21
Poorly Graded Sand		7.50	S/UDS	6	12	15	27
Poorly Graded Sand		9.00	S/DS	10	14	19	33
Poorly Graded Sand		10.00	S/UDS	13	18	21	39

R-Refusal (N >100)
N Value=Penetration Resistance
UDS – Undisturbed Sample
DS – Disturbed Sample
S- Standard Penetration Test

RESULTS OF LABORATORY TEST

Soil Properties for bore hole 02

Depth from EGL (meter)	SOIL TEST RESULT														
	Grain Size Analysis					Atterberg's Limit			IS Classifications	Free Swell Index (%)	Specific Gravity	Shear Parameters		Natural Moisture Content (%)	Bulk Density(g/cc)
	Silt & Clay (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)				C (Kg/ cm^2)	Φ (degrees)		
1.50	2.0	98.0	-	-	-	23.6	NP	-	SP	-	2.60	CL	30.0	3.6	1.69
3.00	2.0	98.0	-	-	-	23.8	NP	-	SP						
4.50	2.0	98.0	-	-	-	23.0	NP	-	SP	-	2.60	CL	31.0	3.9	1.72
6.00	3.0	97.0	-	-	-	24.0	NP	-	SP						
7.50	4.0	96.0	-	-	-	24.1	NP	-	SP	-	2.61	CL	32.0	3.5	1.74
9.00	4.0	92.0	-	-	4.0	24.5	NP	-	SP						
10.00	4.0	93.0	2.0	1.0	-	23.9	NP	-	SP	-	2.61	CL	34.0	4.0	1.76

Note: NP-Non Plastic, CL- Cohesion less

- Soil is poorly graded sand from 1.5 m to 10.0 m depths. It is primarily fine sand (92 to 98%), mix with very small percentage of silt & clay (2 to 4%).
- Soil is non-plastic and cohesion less up to 10.0 m depth.
- Soil is loose at 1.5 m depth, medium from 3.0 m to 7.5 m depth and dense from 9.0 m to 10.0 m depth.
- Rock was not encountered up to 10.0 m depth.
- Water table was not intersected up to 10.0 m depth.

RECORD OF BORING - BH- 3

Project - : Staff Quarters & Guest House
Bore Hole No. : 03
Depth of Borehole : 10.0 m
Dia./Size of Borehole : 150 mm
Date of Starting : 31-12-2024
Date of Completion : 31-12-2024
Location : Vidyadhar Nagar, Jaipur
Depth of GWT : Not Intersected

Description Of Strata	Bore Log	Depth from EGL (meter)	Samples Type	No. of Blows Related to Depth of Penetration			"N" Value
				I	II	III	
Poorly Graded Sand		1.50	S/UDS	3	3	4	7
Poorly Graded Sand		3.00	S/DS	3	4	7	11
Poorly Graded Sand		4.50	S/UDS	4	7	8	15
Poorly Graded Sand		6.00	S/DS	6	10	13	23
Poorly Graded Sand		7.50	S/UDS	9	13	17	30
Poorly Graded Sand		9.00	S/DS	10	15	19	34
Poorly Graded Sand		10.00	S/UDS	13	18	23	41

R-Refusal (N >100)
N Value=Penetration Resistance
UDS – Undisturbed Sample
DS – Disturbed Sample
S- Standard Penetration Test

RESULTS OF LABORATORY TEST

Soil Properties for bore hole 03

Depth from EGL (meter)	SOIL TEST RESULT														
	Grain Size Analysis					Atterberg's Limit			IS Classifications	Free Swell Index (%)	Specific Gravity	Shear Parameters		Natural Moisture Content (%)	Bulk Density(g/cc)
	Silt & Clay (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)				C (Kg/ cm^2)	Φ (degrees)		
1.50	4.0	95.0	1.0	-	-	24.4	NP	-	SP	-	2.61	CL	29.0	4.0	1.67
3.00	2.0	98.0	-	-	-	23.2	NP	-	SP						
4.50	2.0	98.0	-	-	-	23.5	NP	-	SP	-	2.60	CL	31.0	3.6	1.74
6.00	2.0	92.0	1.0	1.0	4.0	23.9	NP	-	SP						
7.50	4.0	96.0	-	-	-	24.0	NP	-	SP	-	2.61	CL	33.0	3.7	1.75
9.00	4.0	90.0	1.0	-	5.0	24.6	NP	-	SP						
10.00	4.0	93.0	2.0	1.0	-	24.1	NP	-	SP	-	2.61	CL	34.0	3.2	1.77

Note: NP-Non Plastic, CL- Cohesion less

- Soil is poorly graded sand from 1.5 m to 10.0 m depths. It is primarily fine sand (90 to 98%), mix with very small percentage of silt & clay (2 to 4%).
- Soil is non-plastic and cohesion less up to 10.0 m depth.
- Soil is loose at 1.5 m depth, medium from 3.0 m to 6.0 m depth and dense from 7.5 m to 10.0 m depth.
- Rock was not encountered up to 10.0 m depth.
- Water table was not intersected up to 10.0 m depth.

4. SAFE BEARING CAPACITY FOR 1.5 m x 1.5 m SQUARE FOOTING

Local shear criteria

Depth (m)	Width (m)	Bulk Density	γD	Cohesion T/m^2	Angle of Repose Ǿ	Ǿ	N_c	N_q	N_r	Q_{nf} (t/m^2)	Q_{ns} (t/m^2)	Q_s
BH-1												
1.50	1.5	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	23.00	7.67	10.17
3.00	1.5	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	40.19	13.40	18.41
4.50	1.5	1.75	7.64	0.00	32.00	22.72	18.03	8.72	8.37	79.48	26.49	34.13
6.00	1.5	1.75	10.26	0.00	32.00	22.72	18.03	8.72	8.37	103.78	34.59	44.85
7.50	1.5	1.76	12.90	0.00	33.00	23.51	18.97	9.39	9.25	139.70	46.57	59.47
BH-2												
1.50	1.5	1.69	2.54	0.00	30.00	21.15	16.18	7.38	6.65	26.14	8.71	11.25
3.00	1.5	1.69	5.07	0.00	30.00	21.15	16.18	7.38	6.65	45.55	15.18	20.25
4.50	1.5	1.72	7.65	0.00	31.00	21.93	17.10	8.04	7.51	72.40	24.13	31.78
6.00	1.5	1.72	10.23	0.00	31.00	21.93	17.10	8.04	7.51	94.21	31.40	41.63
7.50	1.5	1.74	12.84	0.00	32.00	22.72	18.03	8.72	8.37	127.62	42.54	55.38
BH-3												
1.50	1.5	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	23.00	7.67	10.17
3.00	1.5	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	40.19	13.40	18.41
4.50	1.5	1.74	7.62	0.00	31.00	21.93	17.10	8.04	7.51	72.24	24.08	31.70
6.00	1.5	1.74	10.23	0.00	31.00	21.93	17.10	8.04	7.51	94.30	31.43	41.66
7.50	1.5	1.75	12.86	0.00	33.00	23.51	18.97	9.39	9.25	139.20	46.40	59.25

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 1.5 m x 1.5 m SQUARE FOOTING

50 MM SETTLEMENT CRITERIA

Depth (m)	Width (m)	Bulk Density gm/cc	γD	'N'	Corrected 'N'	Q_{ns} T/m^2	Qs T/m^2
BH-1							
1.50	1.5	1.67	2.51	6	8.79	14.51	17.01
3.00	1.5	1.67	5.01	10	12.33	23.88	28.89
4.50	1.5	1.75	7.64	20	21.84	47.42	55.05
6.00	1.5	1.75	10.26	26	25.82	56.96	67.22
7.50	1.5	1.76	12.90	32	29.34	65.43	78.33
BH-2							
1.50	1.5	1.69	2.54	8	11.69	22.20	24.74
3.00	1.5	1.69	5.07	12	14.75	30.18	35.25
4.50	1.5	1.72	7.65	13	14.18	28.71	36.36
6.00	1.5	1.72	10.23	21	20.87	45.10	55.33
7.50	1.5	1.74	12.84	27	24.79	54.49	67.33
BH-3							
1.50	1.5	1.67	2.51	7	10.26	18.47	20.97
3.00	1.5	1.67	5.01	11	13.56	27.09	32.10
4.50	1.5	1.74	7.62	15	16.40	34.23	41.85
6.00	1.5	1.74	10.23	23	22.86	49.87	60.10
7.50	1.5	1.75	12.86	30	27.54	61.10	73.95

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 2.0 m x 2.0 m SQUARE FOOTING

Local shear criteria

Depth (m)	Width (m)	Bulk Density	γD	Cohesion T/m^2	Angle of Repose Ǿ	Ǿ	N_c	N_q	N_r	Q_{nf} (t/m^2)	Q_{ns} (t/m^2)	Q_s
BH-1												
1.50	2.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	24.94	8.31	10.82
3.00	2.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	42.13	14.04	19.05
4.50	2.0	1.75	7.64	0.00	32.00	22.72	18.03	8.72	8.37	82.41	27.47	35.10
6.00	2.0	1.75	10.26	0.00	32.00	22.72	18.03	8.72	8.37	106.71	35.57	45.83
7.50	2.0	1.76	12.90	0.00	33.00	23.51	18.97	9.39	9.25	142.96	47.65	60.55
BH-2												
1.50	2.0	1.69	2.54	0.00	30.00	21.15	16.18	7.38	6.65	28.39	9.46	12.00
3.00	2.0	1.69	5.07	0.00	30.00	21.15	16.18	7.38	6.65	47.79	15.93	21.00
4.50	2.0	1.72	7.65	0.00	31.00	21.93	17.10	8.04	7.51	74.99	25.00	32.65
6.00	2.0	1.72	10.23	0.00	31.00	21.93	17.10	8.04	7.51	96.79	32.26	42.49
7.50	2.0	1.74	12.84	0.00	32.00	22.72	18.03	8.72	8.37	130.53	43.51	56.35
BH-3												
1.50	2.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	24.94	8.31	10.82
3.00	2.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	42.13	14.04	19.05
4.50	2.0	1.74	7.62	0.00	31.00	21.93	17.10	8.04	7.51	74.85	24.95	32.57
6.00	2.0	1.74	10.23	0.00	31.00	21.93	17.10	8.04	7.51	96.91	32.30	42.53
7.50	2.0	1.75	12.86	0.00	33.00	23.51	18.97	9.39	9.25	142.43	47.48	60.33

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 2.0 m x 2.0 m SQUARE FOOTING

50 MM SETTLEMENT CRITERIA

Depth (m)	Width (m)	Bulk Density gm/cc	γD	'N'	Corrected 'N'	Q_{ns} T/m^2	Qs T/m^2
BH-1							
1.50	2.0	1.67	2.51	6	8.79	13.10	15.60
3.00	2.0	1.67	5.01	10	12.33	21.59	26.60
4.50	2.0	1.75	7.64	20	21.84	44.42	52.05
6.00	2.0	1.75	10.26	26	25.82	53.96	64.22
7.50	2.0	1.76	12.90	32	29.34	62.43	75.33
BH-2							
1.50	2.0	1.69	2.54	8	11.69	20.05	22.59
3.00	2.0	1.69	5.07	12	14.75	27.40	32.47
4.50	2.0	1.72	7.65	13	14.18	26.04	33.69
6.00	2.0	1.72	10.23	21	20.87	42.10	52.33
7.50	2.0	1.74	12.84	27	24.79	51.49	64.33
BH-3							
1.50	2.0	1.67	2.51	7	10.26	16.61	19.12
3.00	2.0	1.67	5.01	11	13.56	24.55	29.56
4.50	2.0	1.74	7.62	15	16.40	31.35	38.97
6.00	2.0	1.74	10.23	23	22.86	46.87	57.10
7.50	2.0	1.75	12.86	30	27.54	58.10	70.95

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 2.5 m x 2.5 m SQUARE FOOTING

Local shear criteria

Depth (m)	Width (m)	Bulk Density	γD	Cohesion T/m^2	Angle of Repose Ǿ	Ǿ	N_c	N_q	N_r	Q_{nf} (t/m^2)	Q_{ns} (t/m^2)	Q_s
BH-1												
1.50	2.5	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	26.88	8.96	11.46
3.00	2.5	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	44.07	14.69	19.70
4.50	2.5	1.75	7.64	0.00	32.00	22.72	18.03	8.72	8.37	85.34	28.45	36.08
6.00	2.5	1.75	10.26	0.00	32.00	22.72	18.03	8.72	8.37	109.64	36.55	46.81
7.50	2.5	1.76	12.90	0.00	33.00	23.51	18.97	9.39	9.25	146.22	48.74	61.64
BH-2												
1.50	2.5	1.69	2.54	0.00	30.00	21.15	16.18	7.38	6.65	30.64	10.21	12.75
3.00	2.5	1.69	5.07	0.00	30.00	21.15	16.18	7.38	6.65	50.04	16.68	21.75
4.50	2.5	1.72	7.65	0.00	31.00	21.93	17.10	8.04	7.51	77.57	25.86	33.51
6.00	2.5	1.72	10.23	0.00	31.00	21.93	17.10	8.04	7.51	99.37	33.12	43.35
7.50	2.5	1.74	12.84	0.00	32.00	22.72	18.03	8.72	8.37	133.44	44.48	57.32
BH-3												
1.50	2.5	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	26.88	8.96	11.46
3.00	2.5	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	44.07	14.69	19.70
4.50	2.5	1.74	7.62	0.00	31.00	21.93	17.10	8.04	7.51	77.47	25.82	33.44
6.00	2.5	1.74	10.23	0.00	31.00	21.93	17.10	8.04	7.51	99.52	33.17	43.40
7.50	2.5	1.75	12.86	0.00	33.00	23.51	18.97	9.39	9.25	145.67	48.56	61.41

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 2.5 m x 2.5 m SQUARE FOOTING

50 MM SETTLEMENT CRITERIA

Depth (m)	Width (m)	Bulk Density gm/cc	γD	'N'	Corrected 'N'	Q_{ns} T/m^2	Qs T/m^2
BH-1							
1.50	2.5	1.67	2.51	6	8.79	12.29	14.79
3.00	2.5	1.67	5.01	10	12.33	20.31	25.32
4.50	2.5	1.75	7.64	20	21.84	42.00	49.63
6.00	2.5	1.75	10.26	26	25.82	51.07	61.33
7.50	2.5	1.76	12.90	32	29.34	59.10	72.00
BH-2							
1.50	2.5	1.69	2.54	8	11.69	18.85	21.38
3.00	2.5	1.69	5.07	12	14.75	25.83	30.90
4.50	2.5	1.72	7.65	13	14.18	24.54	32.19
6.00	2.5	1.72	10.23	21	20.87	39.79	50.02
7.50	2.5	1.74	12.84	27	24.79	48.71	61.55
BH-3							
1.50	2.5	1.67	2.51	7	10.26	15.58	18.09
3.00	2.5	1.67	5.01	11	13.56	23.12	28.13
4.50	2.5	1.74	7.62	15	16.40	29.58	37.20
6.00	2.5	1.74	10.23	23	22.86	44.33	54.56
7.50	2.5	1.75	12.86	30	27.54	54.99	67.85

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 3.0 m x 3.0 m SQUARE FOOTING

Local shear criteria

Depth (m)	Width (m)	Bulk Density	γD	Cohesion T/m^2	Angle of Repose Ǿ	Ǿ	N_c	N_q	N_r	Q_{nf} (t/m^2)	Q_{ns} (t/m^2)	Q_s
BH-1												
1.50	3.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	28.82	9.61	12.11
3.00	3.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	46.01	15.34	20.35
4.50	3.0	1.75	7.64	0.00	32.00	22.72	18.03	8.72	8.37	88.27	29.42	37.06
6.00	3.0	1.75	10.26	0.00	32.00	22.72	18.03	8.72	8.37	112.57	37.52	47.78
7.50	3.0	1.76	12.90	0.00	33.00	23.51	18.97	9.39	9.25	149.47	49.82	62.72
BH-2												
1.50	3.0	1.69	2.54	0.00	30.00	21.15	16.18	7.38	6.65	32.89	10.96	13.50
3.00	3.0	1.69	5.07	0.00	30.00	21.15	16.18	7.38	6.65	52.29	17.43	22.50
4.50	3.0	1.72	7.65	0.00	31.00	21.93	17.10	8.04	7.51	80.15	26.72	34.37
6.00	3.0	1.72	10.23	0.00	31.00	21.93	17.10	8.04	7.51	101.96	33.99	44.22
7.50	3.0	1.74	12.84	0.00	32.00	22.72	18.03	8.72	8.37	136.36	45.45	58.29
BH-3												
1.50	3.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	28.82	9.61	12.11
3.00	3.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	46.01	15.34	20.35
4.50	3.0	1.74	7.62	0.00	31.00	21.93	17.10	8.04	7.51	80.08	26.69	34.31
6.00	3.0	1.74	10.23	0.00	31.00	21.93	17.10	8.04	7.51	102.14	34.05	44.28
7.50	3.0	1.75	12.86	0.00	33.00	23.51	18.97	9.39	9.25	148.91	49.64	62.49

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 3.0 m x 3.0 m SQUARE FOOTING

50 MM SETTLEMENT CRITERIA

Depth (m)	Width (m)	Bulk Density gm/cc	γD	'N'	Corrected 'N'	Q_{ns} T/m^2	Qs T/m^2
BH-1							
1.50	3.0	1.67	2.51	6	8.79	11.48	13.99
3.00	3.0	1.67	5.01	10	12.33	19.03	24.04
4.50	3.0	1.75	7.64	20	21.84	39.57	47.21
6.00	3.0	1.75	10.26	26	25.82	48.17	58.43
7.50	3.0	1.76	12.90	32	29.34	55.78	68.68
BH-2							
1.50	3.0	1.69	2.54	8	11.69	17.65	20.18
3.00	3.0	1.69	5.07	12	14.75	24.26	29.33
4.50	3.0	1.72	7.65	13	14.18	23.04	30.69
6.00	3.0	1.72	10.23	21	20.87	37.49	47.72
7.50	3.0	1.74	12.84	27	24.79	45.94	58.78
BH-3							
1.50	3.0	1.67	2.51	7	10.26	14.55	17.06
3.00	3.0	1.67	5.01	11	13.56	21.70	26.71
4.50	3.0	1.74	7.62	15	16.40	27.81	35.43
6.00	3.0	1.74	10.23	23	22.86	41.78	52.01
7.50	3.0	1.75	12.86	30	27.54	51.89	64.74

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 6.0 m WIDE RAFT FOOTING

Local shear criteria

Depth (m)	Width (m)	Bulk Density	γD	Cohesion T/m^2	Angle of Repose Ǿ	Ǿ	N_c	N_q	N_r	Q_{nf} (t/m^2)	Q_{ns} (t/m^2)	Q_s
BH-1												
1.50	6.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	37.54	12.51	15.02
3.00	6.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	54.73	18.24	23.25
4.50	6.0	1.75	7.64	0.00	32.00	22.72	18.03	8.72	8.37	101.46	33.82	41.45
6.00	6.0	1.75	10.26	0.00	32.00	22.72	18.03	8.72	8.37	125.76	41.92	52.18
7.50	6.0	1.76	12.90	0.00	33.00	23.51	18.97	9.39	9.25	164.12	54.71	67.61
BH-2												
1.50	6.0	1.69	2.54	0.00	30.00	21.15	16.18	7.38	6.65	43.00	14.33	16.87
3.00	6.0	1.69	5.07	0.00	30.00	21.15	16.18	7.38	6.65	62.40	20.80	25.87
4.50	6.0	1.72	7.65	0.00	31.00	21.93	17.10	8.04	7.51	91.77	30.59	38.24
6.00	6.0	1.72	10.23	0.00	31.00	21.93	17.10	8.04	7.51	113.58	37.86	48.09
7.50	6.0	1.74	12.84	0.00	32.00	22.72	18.03	8.72	8.37	149.47	49.82	62.66
BH-3												
1.50	6.0	1.67	2.51	0.00	29.00	20.37	15.27	6.72	5.80	37.54	12.51	15.02
3.00	6.0	1.67	5.01	0.00	29.00	20.37	15.27	6.72	5.80	54.73	18.24	23.25
4.50	6.0	1.74	7.62	0.00	31.00	21.93	17.10	8.04	7.51	91.84	30.61	38.23
6.00	6.0	1.74	10.23	0.00	31.00	21.93	17.10	8.04	7.51	113.89	37.96	48.19
7.50	6.0	1.75	12.86	0.00	33.00	23.51	18.97	9.39	9.25	163.47	54.49	67.35

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

SAFE BEARING CAPACITY FOR 6.0 m WIDE RAFT FOOTING

75 MM SETTLEMENT CRITERIA

Depth (m)	Width (m)	Bulk Density gm/cc	γD	'N'	Corrected 'N'	Q_{ns} T/m^2	Qs T/m^2
BH-1							
1.50	6.0	1.67	2.51	6	8.79	15.12	17.62
3.00	6.0	1.67	5.01	10	12.33	24.47	29.48
4.50	6.0	1.75	7.64	20	21.84	48.53	56.16
6.00	6.0	1.75	10.26	26	25.82	58.66	68.92
7.50	6.0	1.76	12.90	32	29.34	67.38	80.28
BH-2							
1.50	6.0	1.69	2.54	8	11.69	22.85	25.39
3.00	6.0	1.69	5.07	12	14.75	30.56	35.63
4.50	6.0	1.72	7.65	13	14.18	29.14	36.79
6.00	6.0	1.72	10.23	21	20.87	46.04	56.27
7.50	6.0	1.74	12.84	27	24.79	56.09	68.93
BH-3							
1.50	6.0	1.67	2.51	7	10.26	19.24	21.75
3.00	6.0	1.67	5.01	11	13.56	27.58	32.59
4.50	6.0	1.74	7.62	15	16.40	34.72	42.34
6.00	6.0	1.74	10.23	23	22.86	51.15	61.38
7.50	6.0	1.75	12.86	30	27.54	62.92	75.77

Note: Ǿ - Angle of Repose
N_c-N_Q-N_r-Bering Capacity Factor
Q_{nf}-Net Ultimate Bearing Capacity
Q_{ns}-Net Safe Bearing Capacity
Q_s-Safe Bering Capacity

5. CONCLUSION & RECOMMENDATIONS

- Soil properties are almost similar in the three bore holes. Soil for all bore holes is poorly graded sand from 1.5 m to 10.0 m depths. It is primarily fine sand (90 to 98%), mix with very small percentage of silt & clay (2 to 4%).
- Soil is non-plastic and cohesion less up to 10.0 m depth.
- Soil is loose at 1.5 m depth, medium from 3.0 m to 6.0/7.5 m depth and dense from 7.5/9.0 m to 10.0 m depth.
- Rock was not encountered up to 10.0 m depth.
- Water table was not intersected up to 10.0 m depth.

- Soil is suitable for laying foundation and recommended net safe bearing capacity as listed in the table may be taken for design of foundation.

****

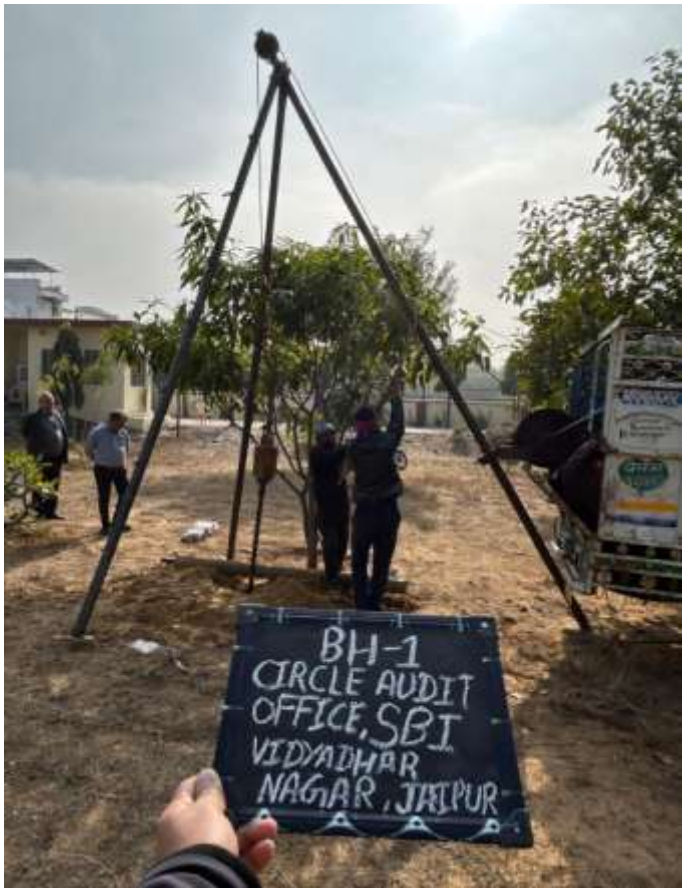
Authorized Signatory
Designation: TM/QM

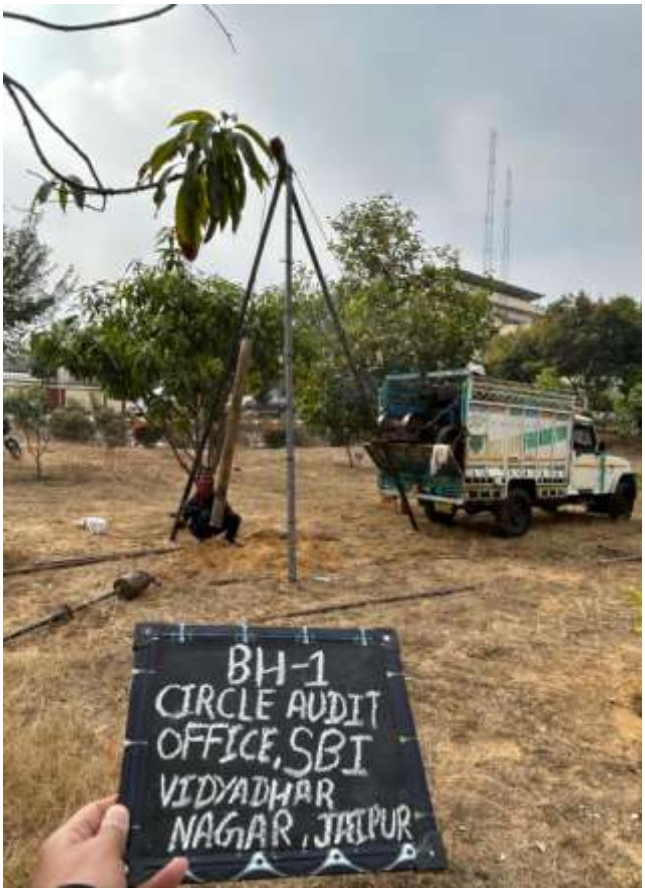
Note:
- Results related only to the sample (s) under test in as received condition and applicable parameter (s).
- This test report shall not reproduced wholly or in part and cannot be used as evidence in the court of law without written approval of M/S TEAM Infrastructures Jaipur
- Balance samples, if any shall be discarded after Fifteen Days from the date of issue of report.

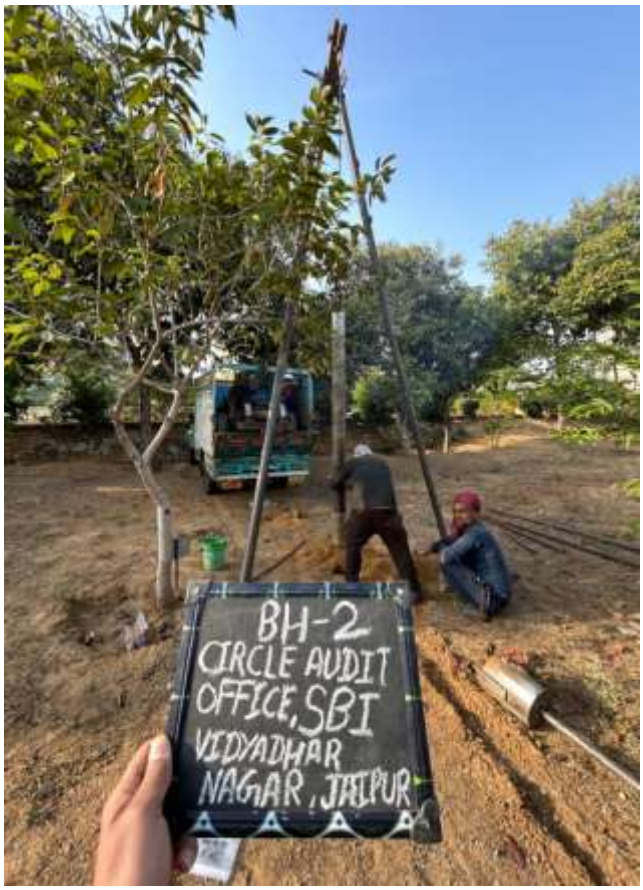
6. REFERENCES CODES & STANDARDS

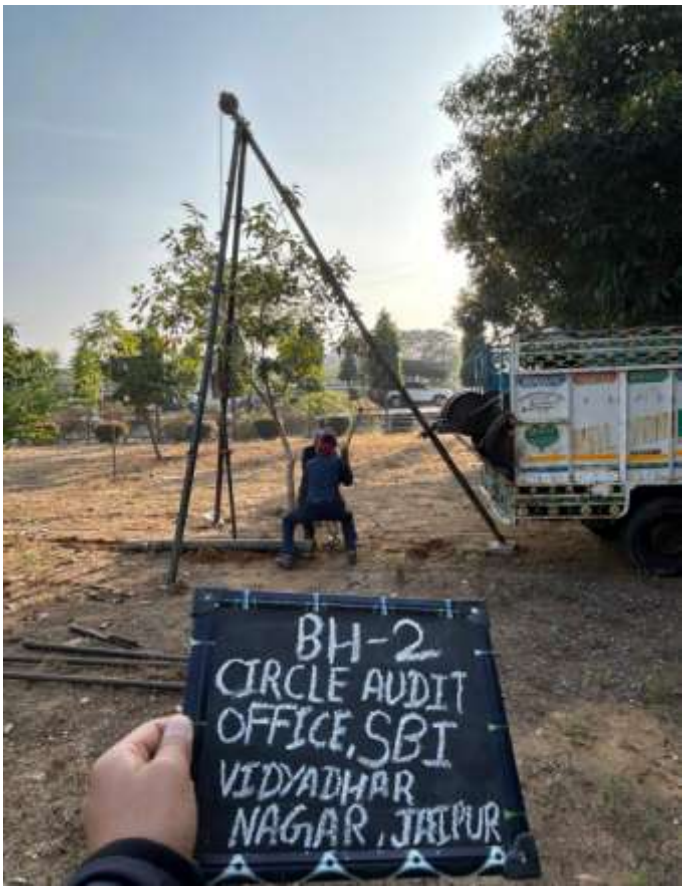
1	IS: 1498-1970	Classification & Identification of soil for general engineering purpose
2	IS: 1892-1979	Code of practice for subsurface investigation for foundation
3	IS: 1904-1978	Code of practice for design and construction of foundation on soil- General Requirement
4	IS: 2131-1981	Method of standard penetration test for soil
5	IS: 2720	Methods of determination of Engineering Properties of soil
6	IS: 6403-1981	Code of practice for determination of bearing capacity of shallow foundations capacity of shallow foundations
7	IS: 6935-1973	Method for determination of water level in a borehole
8	IS: 8009 Part I 1976	Code of practice for calculation of settlement of foundations

7. SITE PHOTOGRAPHS

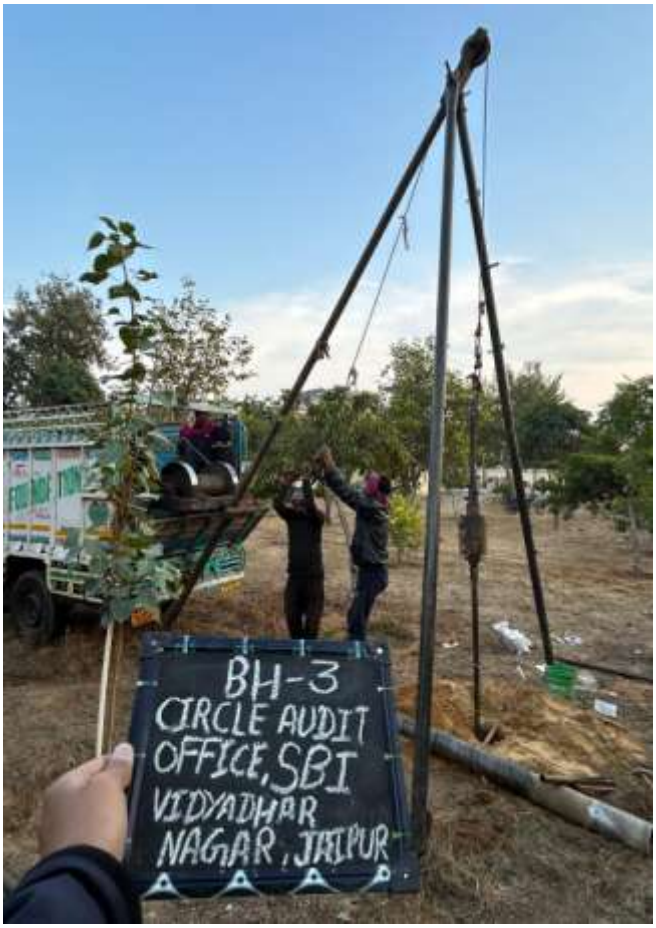









BH-3
CIRCLE AUDIT
OFFICE, SBI
VIDYADHAR
NAGAR, JAIPUR


BH-3
CIRCLE AUDIT
OFFICE, SBI
VIDYADHAR
NAGAR, JAIPUR

8. BORE HOLE LOCATION PLAN