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NAME OF PROJECT

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING CONSISTING OF STILT + FIVE UPPER FLOORS AT PERUMBAKKAM, CHENNAI

CLIENT

M/s ISHA HOMES (INDIA) PVT LTD.,
OLD.NO.05, NEW NO.13, I[st] AVENUE,
BESANT NAGAR,
CHENNAI 600 090.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2543

GEO MARINE CONSULTANTS PVT LTD. Chennai-41

DATE	REVISON	DESCRIPTION		AUTHORISED SIGNATORY
17/04/2023	FIRST SUBMISSION	SUBMISSION OF GEOTECHNICAL REPORT	SIGN	
			DATE	17/04/2023
			DESIGNATION	MANAGING DIRECTOR
			NAME	DR. C.V.PRASAD



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GEOMARINE

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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 PROJECT INFORMATION MATRIX:

NATURE OF PROJECT	: **RESIDENTIAL BUILDING**
STRUCTURE	: **STILT + FIVE UPPER FLOORS**
PROJECT OWNER	: **M/s ISHA HOMES (INDIA) PVT LTD**
PROJECT LOCATION	: **PERUMBAKKAM, CHENNAI**
JOB CODE	: **GT-2543**

1.1 SCOPE OF WORK:

1.1.1 FIELD WORK:

- Conducting four soil investigation bore holes of 150 mm diameter in Soil & Overburden.
- In case of rock formation NX Diameter with Core barrel shall be adopted to progress the drilling up the termination depth.
- Conducting Standard Penetration Test (SPT) within the borehole at:
  - Every 1.0m depth interval up to 6.0m.
  - From 6.0m to termination depth SPT is conducted at every 1.5m depth interval
  - Depth of investigation is 7.5m below the existing ground level
- Collection of disturbed soil samples at SPT location and undisturbed samples from the clayey strata with SPT-value greater than 2 to less than 15 if met within the investigation depth
- Collection of water samples if groundwater table met within the investigation depth

1.1.2 LABORATORY WORK:

- Natural Moisture Content
- Atterberg's limits
- Grain Size Analysis
- Consolidation test on undisturbed samples if applicable
- Chemical Analysis test on soil and water samples to give pH, Chlorides and Sulphates

1.2 STRUCTURE OF THE REPORT:

- Contents
- Introduction
- Investigation Methodology & Test Results
- Sub-Surface Stratification
- Foundation System
- Recommendation
- Annexure

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 PREAMBLE:

Four soil investigation boreholes were put as per the planning of the engineer in-charge and these locations are shown in Fig.2.0. The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.1 METHODOLOGY OF FIELD WORK:

2.1.1 EQUIPMENT USED AND METHOD OF DRILLING:

All the boreholes were sunk by conventional rotary drilling rigs. For borehole Methodology followed for boring conformed to IS: 1892 -2000. Boring was progressed by the cutting action of rotating bit with water circulation and stabilizing the side of the boreholes by using casing pipes/bentonite slurry up to required depth to prevent collapse of sidewall. Boring was continued by normal boring process using MS soil cutter in soil. However, Tungsten Carbide (TC) bit drilling was resorted to drill in highly weathered rock stratum where the normal boring process became slow. Diamond Core (DC) bit drilling was adopted in moderately weathered rock formations where penetration using TC bit was became slow.

2.1.2 STANDARD PENETRATION TESTS:

This is a field test to determine "Penetration Resistance of Stratum at the Test Depth". This has been conducted in the boreholes generally up to refusal depth using procedures described in IS: 2131- 2002. In this test, split spoon sampler (50.8 mm OD and 35 mm ID) has replaced driving bit. Sampler is then driven by dropping 63.5 kg hammer on top of driving collar with free fall of 75 cm. The length of sampler is 60 cm.

The tests were conducted at the depth intervals indicated in Chapter-1 (Sec.1.1.1).

2.1.3 COLLECTION OF SOIL SAMPLES:

2.1.3.1 DISTURBED SAMPLES:

The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per I.S.1498-1970.

2.1.3.2 UNDISTURBED SAMPLES:

From the soft to stiff clay layer, representative undisturbed samples were collected. These samples were used primarily to establish the compressibility parameters to estimate the settlements of shallow foundation system wherever applicable.

2.1.4 COLLECTION OF GROUND WATER SAMPLES:

One representative water sample from each borehole was collected after 24 hours of completing the borehole if water table met within the investigated depth.

NOTE ON GROUNDWATER TABLE RECORD:

- Groundwater table observation in geotechnical report is predominantly to arrive at foundation design criteria and shall not be construed as design guidelines for the design of dewatering systems
- The groundwater level indicated in the bore logs is specific to the duration of investigation and intensity of the monsoon rains during the time of investigation. Hence, the level shall be taken as guidelines only to plan the investigation for the dewatering system
- No foundation excavation or basement excavations if anticipated within the groundwater table zone shall be carried out without implementing groundwater lowering schemes

2.2 LABORATORY TESTING:

2.2.1 ON COARSE GRAINED SOIL:

On the representative samples, sieve analysis tests were conducted to arrive at grain size distribution. These tests were conducted as per I.S.2720 (part 4)-1985 and the results are presented in Tables-2.1 to 2.4. The graphical representation of grainsize distribution curve for the representative samples in each bore is presented in Fig. 2.6 to 2.9.

2.2.2 ON FINE GRAINED SOIL:

On the SPT sample index property tests were conducted to estimate consistency. These test results are presented in Tables-2.1 to 2.4. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig. 2.10 to 2.12.

2.2.3 CHEMICAL ANALYSIS TESTS:

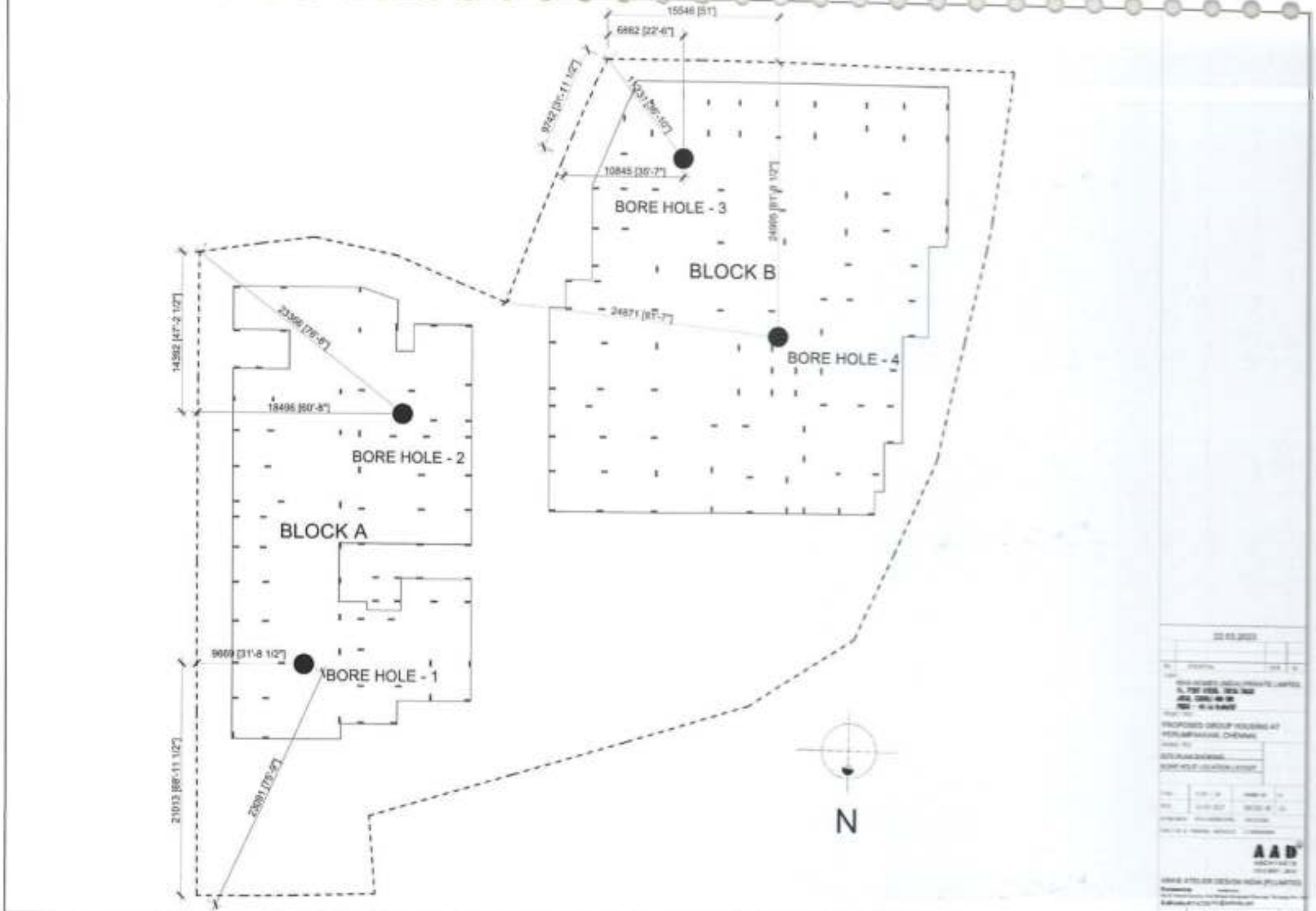
On representative soil and water samples chemical analysis tests were conducted to estimate pH, Chloride and Sulphates and these results are presented in Table - 2.5 & 2.6.

2.3 SUMMARY:

The locations of the field investigation boreholes are shown in site plan given in Fig.2.0. The average sub soil profiles encountered at each location along with their classification and engineering properties are presented in Figs.2.1 to 2.4.

Further, the cross-sectional variation of the sub surface profile through different bore holes in vertical and horizontal direction longitudinally or transversely are presented in Figs.2.5

SITE PLAN


15546 [51']
6882 [22'-6"]
9742 [31'-11 1/2"]
10845 [35'-7"]
BORE HOLE - 3
24995 [81' 1/2"]
BLOCK B
24871 [81'-7"]
BORE HOLE - 4
14392 [47'-2 1/2"]
23598 [76'-6"]
18495 [60'-8"]
BORE HOLE - 2
BLOCK A
9669 [31'-8 1/2"]
BORE HOLE - 1
21013 [68'-11 1/2"]
23091 [75'-9"]
N

SOIL PROFILES

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING			DIA OF BORE HOLE	150mm / PQI		
LOCATION	Perumbakkam, Chennai	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	29/03/2023
STRUCTURE	Stilt + 5 Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	29/03/2023
JOB CODE	GT-2543	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L (m)	Drilling progress per metre: Days	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm 0-15	SPT Details: Blows/cm 15-30	SPT Details: Blows/cm 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
0	29/03/2023	11 | 25		SC	-	-												
		To																
		11 | 35					2	8	30	38	0.50	1	SS	-0.5				**FILLED UP SOIL** Grey,Moist,Poorly Graded,Fine & Medium Sand Grains,Dense & Medium Dense,**Silty SAND (SM) With Gravels**
		14 | 00									0.95							
1		To		SC	-	-												
		14 | 06					5	13	9	22	1.25	2	SS	-1.25		L1	1.50	
		14 | 25									1.70							
		To		SC	-	-												
2		14 | 30					7	10	6	16	2.00	3	SS	-2.0				
		14 | 48									2.45							
		To		SC	-	-												
		14 | 56																Brown,Moist,Poorly Graded,Fine & Medium Grains Sands,Medium Dense & Dense,**Silty SAND (SM) With Binder & Gravels Traces**
3							5	12	19	31	3.00	-	*SS	-3.0				
		15 | 15									3.45							
		To		TCB	0	0												
		15 | 20																
4							10	12Cm Penet for 58 Blows		>100	4.00	-	WS	-4.0		L2	4.0	
		15 | 35									4.27							No Core Recovery. From Collected Wash Sample the formation is interpretted as **Residual Soil to Completely Weathered Rock- Grade W5 Rock Formation**
		To		TCB	0	0												
		15 | 50																
5							SPT Hammer Rebounded			>100	5.00	-	WS	-5.0		L3	5.0	
		16 | 05																
		To		DB	9	0												
		16 | 25																Brown Grey,Grey,Pink Grey,Medium to Coarse Grain Structure,Highly Fractured & Disintegrated,**Highly Weathered Rock- Grade W4 Rock Formation** Disintegrated Hypersthene Granitic Rock
6		16 | 40					-	-	-	-	6.00	4	CS	-6.0				
		To		DB	14	0												
		17 | 19																
							-	-	-	-	6.70	5	CS	-6.7		L4	6.7	
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Siva sankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/03/2023	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	1.20	
WS - Wash Sample	DB - Diamond Bit	DATE	31/03/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 6.7 m depth below E.G.L

FIG.2.1 Sub Soil Profile at BH-01 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING			DIA OF BORE HOLE	150mm	✓	
					NX	✓	
LOCATION	Perumbakkam, Chennai	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	30/03/2023
STRUCTURE	Stilt + 5 Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	31/03/2023
JOB CODE	GT-2543	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Rig (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm 0-15	SPT Details: Blows/cm 15-30	SPT Details: Blows/cm 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
0		11	55															
		To																
		12	05	SC	-	-	12	15	15	30	0.50	1	SS	-0.5				**FILLED UP SOIL** Grey,Moist,Poorly Graded,Fine & Medium Sand Grains,Dense & Medium Dense,**Silty SAND (SM) With Gravels**
		12	20								0.95							
1		To																
		12	25	SC	-	-	6	8	7	15	1.25	2	SS	-1.25				
		12	40								1.70					L1	1.50	
		To																
		12	46	SC	-	-	8	12	7	19	2.00	3	SS	-2.0				Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Medium Dense, **Silty SAND (SM) With Gravels Traces**
2		13	00								2.45							
		To																
		13	04	SC	-	-												
							13	15	19	34	3.00	4	SS	-3.0				
3		14	00								3.45					L2	3.0	
		To																
		14	07	SC	-	-												Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Dense,**Silty SAND (SM) With Gravel / Partially Residual Soil Texture & Clay Binder (Disintegrated Rock Formation Texture)**
							18	18	35	53	4.00	-	WS	-4.0				
4		14	25								4.45					L3	4.0	
		To																
	30/03/2023	14	35	SC	-	-	15Cm Penet for 56 Blows			>100	4.50	5	SS	-4.5				Brown,Moist,Gravels & Fine to Medium Grains Sand Size Particles Predominantly,Very Dense,**Completely Weathered Rock - Grade W5 Rock Formation** Disintegrated Hypersthene Granitic Rock
		14	50								4.65							
5		To																
		15	04	DB	0	0	-	-	-	-	5.50	-	WS	-5.5				
		15	19													L4	5.5	
		To																
6		15	47	DB	13	0												Brown Grey,Pink Shades,Medium to Coarse Grain Structure,Highly Fractured,**Highly Weathered Rock - Grade W4 Rock Formation**
							-	-	-	-	6.50	6	CS	-6.5				
		15	57													L5	6.5	
		To																
7		16	20	DB	30	0												
							-	-	-	-	7.50	7	CS	-7.5				
		16	30															
		To																
8		17	30	DB	30	0												Grey,Pink Grey,Brown Shades @ Parts, Medium to Coarse Grain Structure,Highly Fractured,**Moderately Weathered Rock - Grade W3 Rock Formation** Hypersthene Granitic Rock
							-	-	-	-	8.50	8	CS	-8.5				
		09	20															
		To																
9	31/03/2023	10	47	DB	47	0												
							-	-	-	-	10.00	9	CS	-10.0				
																L6	10.0	
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Siva sankaran	PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample	SC - Soil Cutter	DATE	31/03/2023	GROUND LEVEL (m)	0.00		
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	1.65		
WS - Wash Sample	DB - Diamond Bit	DATE	31/03/2023	CASING DEPTH (m)	0.00		

Borehole terminated at 8.5 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

SITE INVESTIGATION RECORD

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BORE HOLE No.	BH-03						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING			DIA OF BORE HOLE	150mm	✓	
					PQX	✓	
LOCATION	Perumbakkam, Chennai	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	31/03/2023
STRUCTURE	Stilt + 5 Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	31/03/2023
JOB CODE	GT-2543	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm.: 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No.	Depth	Geotechnical Description
0	31/03/2023	15	20	SC	-	-												
		To																
		15	21				4	5	5	10	0.50	1	SS	-0.5				Brown Grey,Moist,Poorly Graded,Fine & Medium Sand Grains,Loose,**Clayey Silty SAND (SC)** **(Observed to be Filled Up Soil)**
		15	33						11		0.95							
1		To		SC	-	-												
		15	34				2	2	4	6	1.25	2	SS	-1.25		L1	1.50	
		15	44								1.70							
		To		SC	-	-												
2		15	45				2	1	2	3	2.00	3	SS	-2.0				Brown Grey,Moist,Poorly Graded,Fine & Medium Sand Grains,Very Loose, **Silty SAND (SM) With Binder**
		15	59								2.45							
		To		SC	-	-												
		16	00													L2	3.0	
3							4	9	10	19	3.00	4	SS	-3.0				Grey Brown,Red Shades,Moist,Fine& Medium Sand Grains With Gravels, **Residual Soil- Grade W5 Rock Formation** Disintegrated Hypersthene Granitic Rock
		16	13								3.45							
		To		SC	-	-												
		16	16													L3	4.0	
4							9	5	11Cm Penetration for 55 Blows	>100	4.00	5	SS	-4.0				Grey Brown,Red Shades,Medium & Coarse Grain Structure,Highly Fractured & Disintegrated,**Completely to Highly Weathered Rock- Grade W5 & W4 Rock Formation** Disintegrated Hypersthene Granitic Rock
		16	35								4.41							
		To		TCB	8	0												
5		16	46				-	-	-	-	5.00	6	CS	-5.0		L4	5.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	R.Kamalakannan	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	31/03/2023	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Shamila	WATER TABLE (m)	1.00	
WS - Wash Sample	DB - Diamond Bit	DATE	03/04/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 5 m depth below E.G.L

FIG.2.3 Sub Soil Profile at BH-03 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX ✓
LOCATION	Perumbakkam, Chennai	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	01/04/2023
STRUCTURE	Stilt + 5 Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	01/04/2023
JOB CODE	GT-2543	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

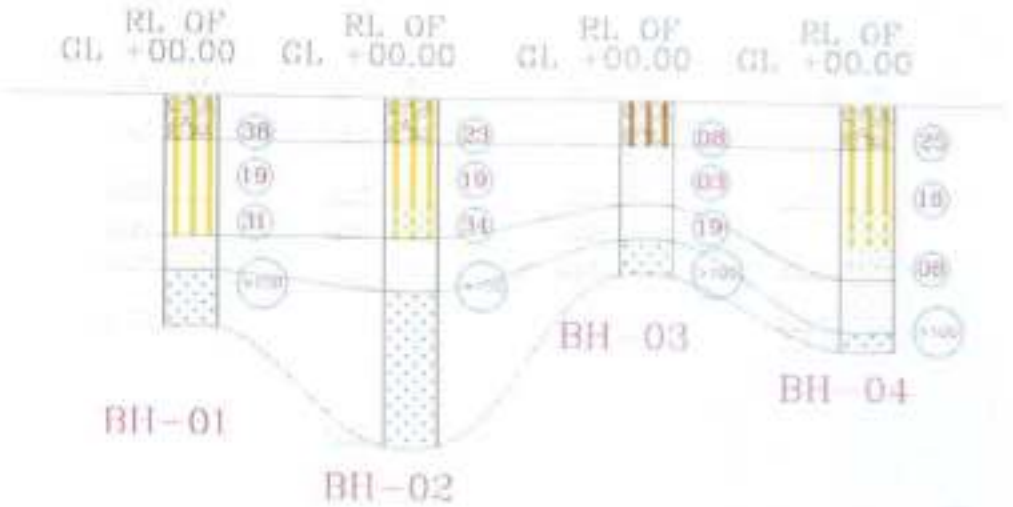
Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm 0-15	SPT Details: Blows/cm 15-30	SPT Details: Blows/cm 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: Rl. (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
0	01/04/2023	12	15	SC	-	-												
		To																
		12	16				18	19	18	37	0.50	1	SS	-0.5				**FILLED UP SOIL** Grey,Fine & Medium Sand Grains, Gravel Mix,**Silty SAND With Brick Pieces and Constructional Debris**
		12	28								0.95							
1		To		SC	-	-												
		12	29				8	6	6	12	1.25	2	SS	-1.25		L1	1.50	
		12	39								1.70							
		To		SC	-	-												
2		12	40				14	12	7	19	2.00	3	SS	-2.0				Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Sand Grains,Medium Dense,**Silty SAND (SM) With Binder**
		14	16								2.45							
		To		SC	-	-												
		14	17				9	8	8	16	3.00	4	SS	-3.0		L2	3.0	
3		14	32								3.45							
		To		SC	-	-												
		14	33															Brown,Grey Brown,Moist,Fine & Medium Grains Sands,Loose & Medium Dense,**Silty SAND (SM) With Clay Binder/ Partially Residual Soil Texture Observed (Disintegrated Rock Texture)**
4		14	48				11	5	3	8	4.00	-	*SS	-4.0				
		To		SC	-	-					4.45							
		14	53															
5		15	08				14Cm Penet for 55 Blows			>100	5.00	5	SS	-5.0		L3	5.0	
		To		TCB	0	0					5.14							
		15	13															Brown,Yellow Shades,Fine to Coarse Sand Grains With Gravel Mix,Very Dense.**Completely Weathered Rock- Grade W5 Rock Formation** Disintegrated Hypersthene Granitic Rock
6							SPT-Hammer Rebound			>100	6.00	6	WS	-6.0		L4	6.5	
		Total drilling time 53 mins		TCB /DB	18	0												
7							-	-	-	-	7.00	7	CS	-7.0		L5	7.0	Grey,Brown Shades at Fractures, Medium & Coarse Grain Structure, Highly Fractured & Weathered, **Moderately Weathered Rock- Grade W3 Rock Formation** Hypersthene Granitic Rock
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	R.Kamalakannan	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/04/2023	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	G.Sharmila	WATER TABLE (m) 1.55	*SS - Sample Failed
WS - Wash Sample	DB - Diamond Bit	DATE	03/04/202	CASING DEPTH (m) 0.00	

Borehole terminated at 7 m depth below E.G.L

FIG.2.4 Sub Soil Profile at BH-04 Location

CROSS SECTION PROFILE



LEGEND

- Filled Up Soil
- SILTY SAND (SM)
- Highly Weathered Rock - Grade W4 Rock
- Residual Soil & Completely Weathered Rock - Grade W5 Rock Formation

FIG.2.5 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH 01 TO 04

GRAIN SIZE DISTRIBUTION CURVE

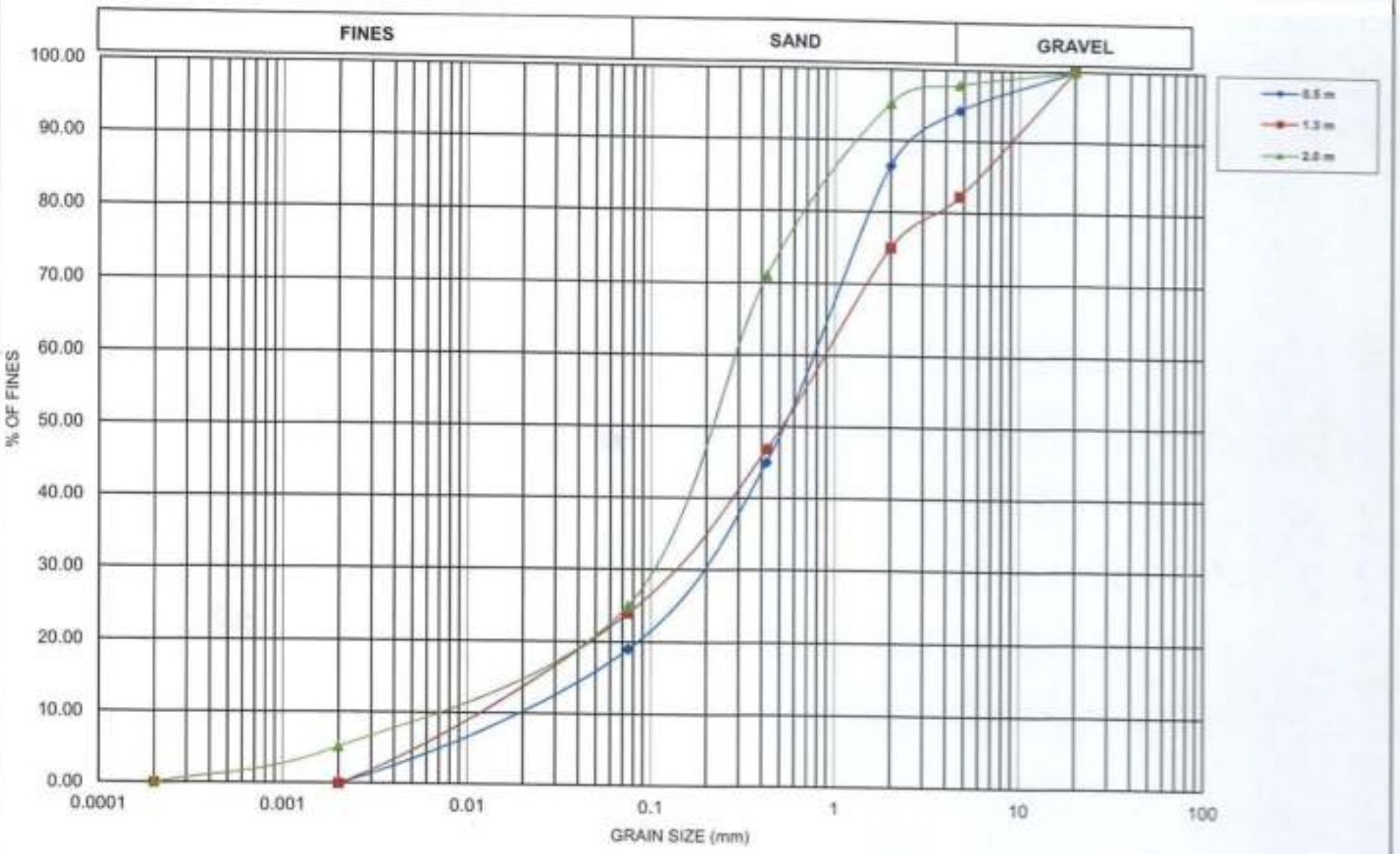


Fig. 2.6 GRAIN SIZE DISTRIBUTION CURVE - BH-01

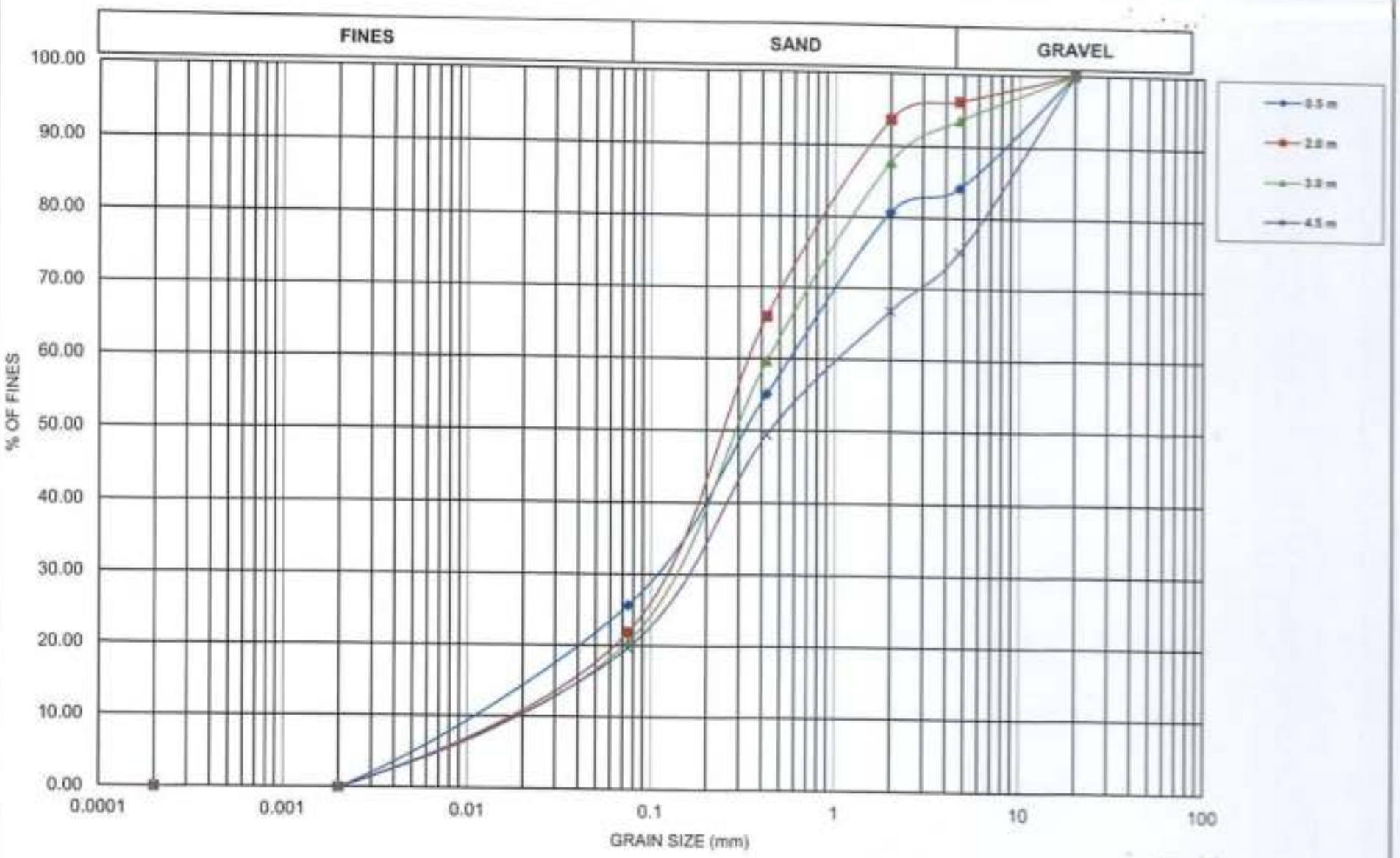


Fig. 2.7 GRAIN SIZE DISTRIBUTION CURVE - BH-02

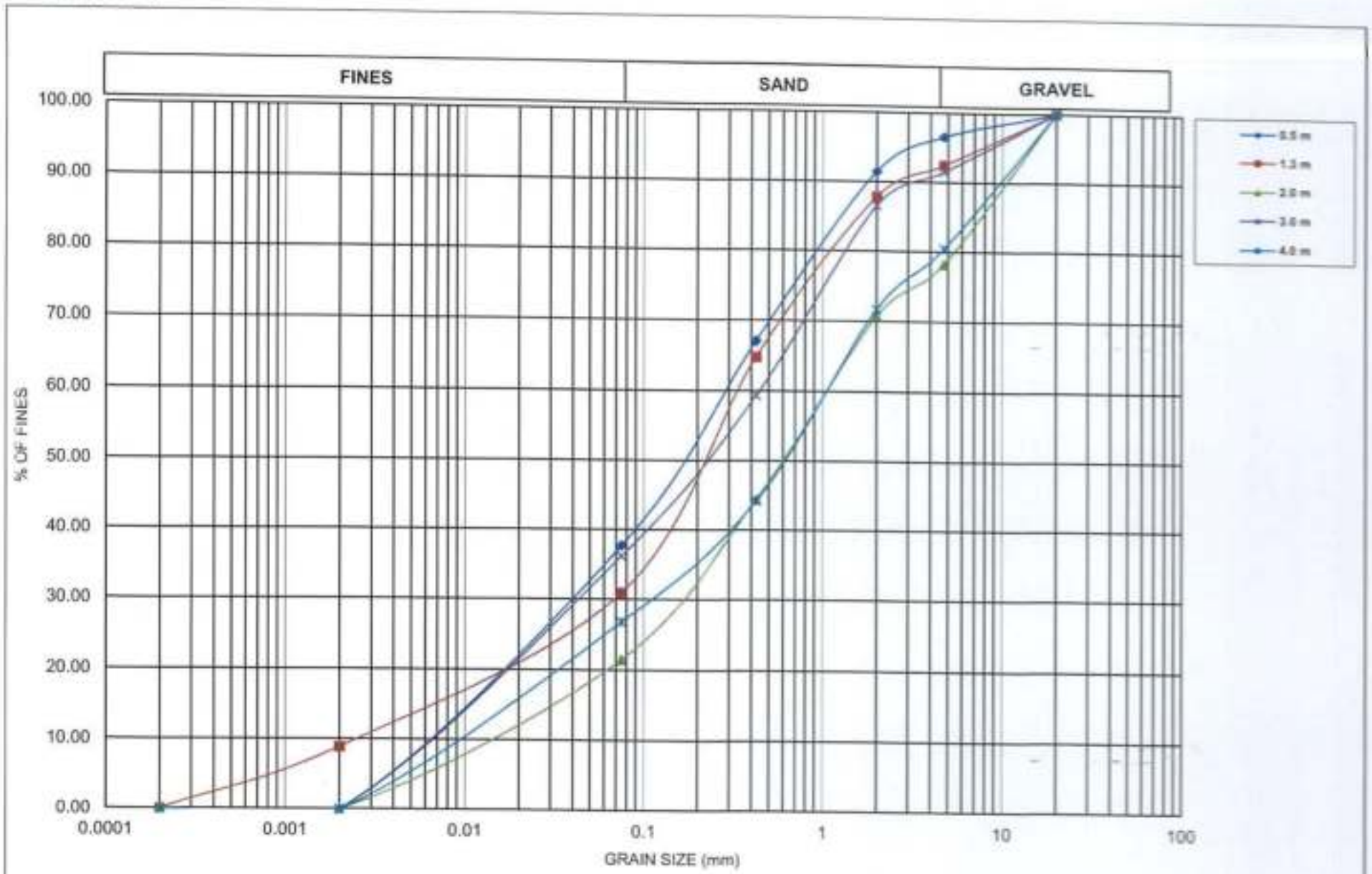


Fig. 2.8 GRAIN SIZE DISTRIBUTION CURVE - BH-03

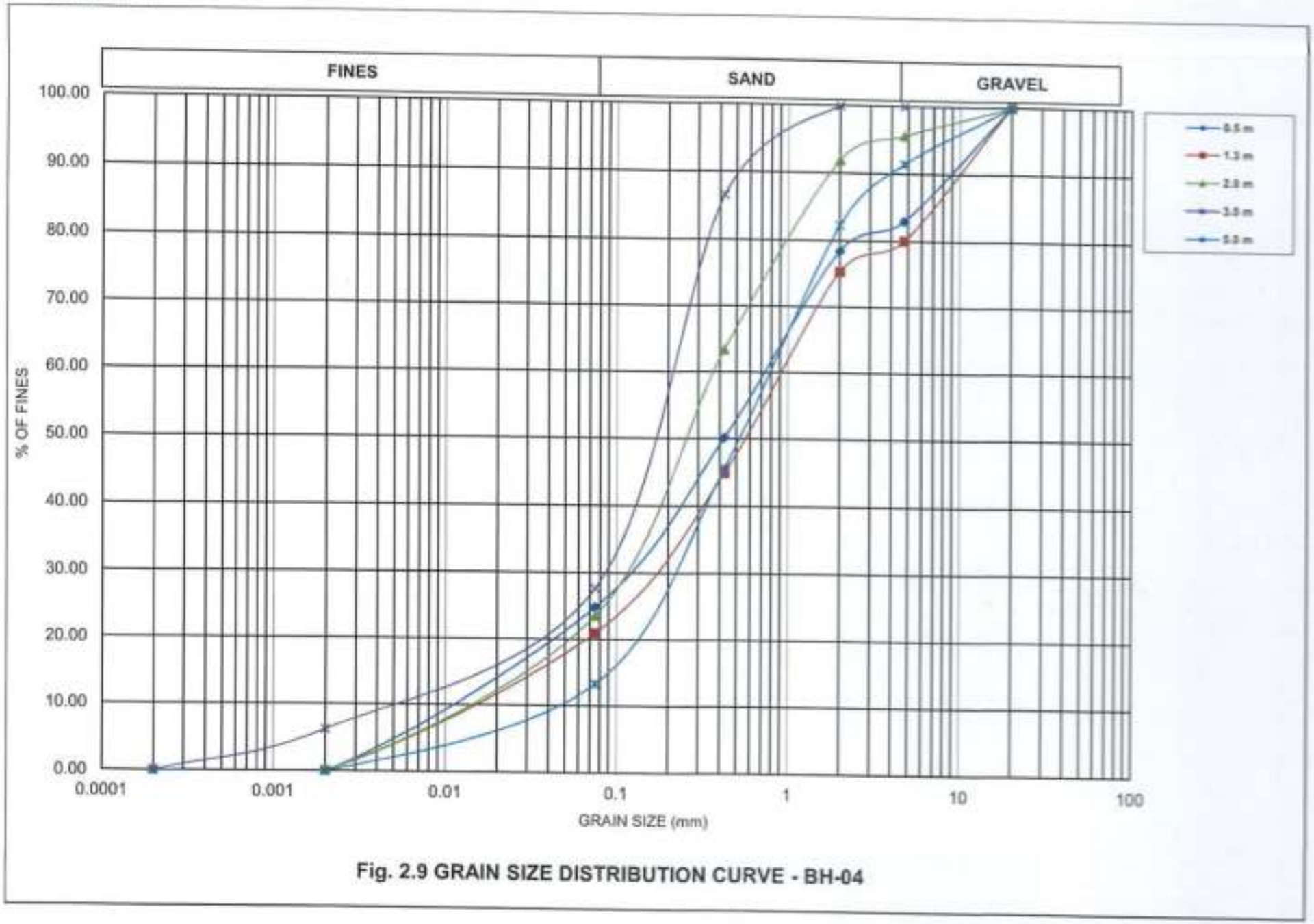


Fig. 2.9 GRAIN SIZE DISTRIBUTION CURVE - BH-04

HYDROMETER ANALYSIS CURVE

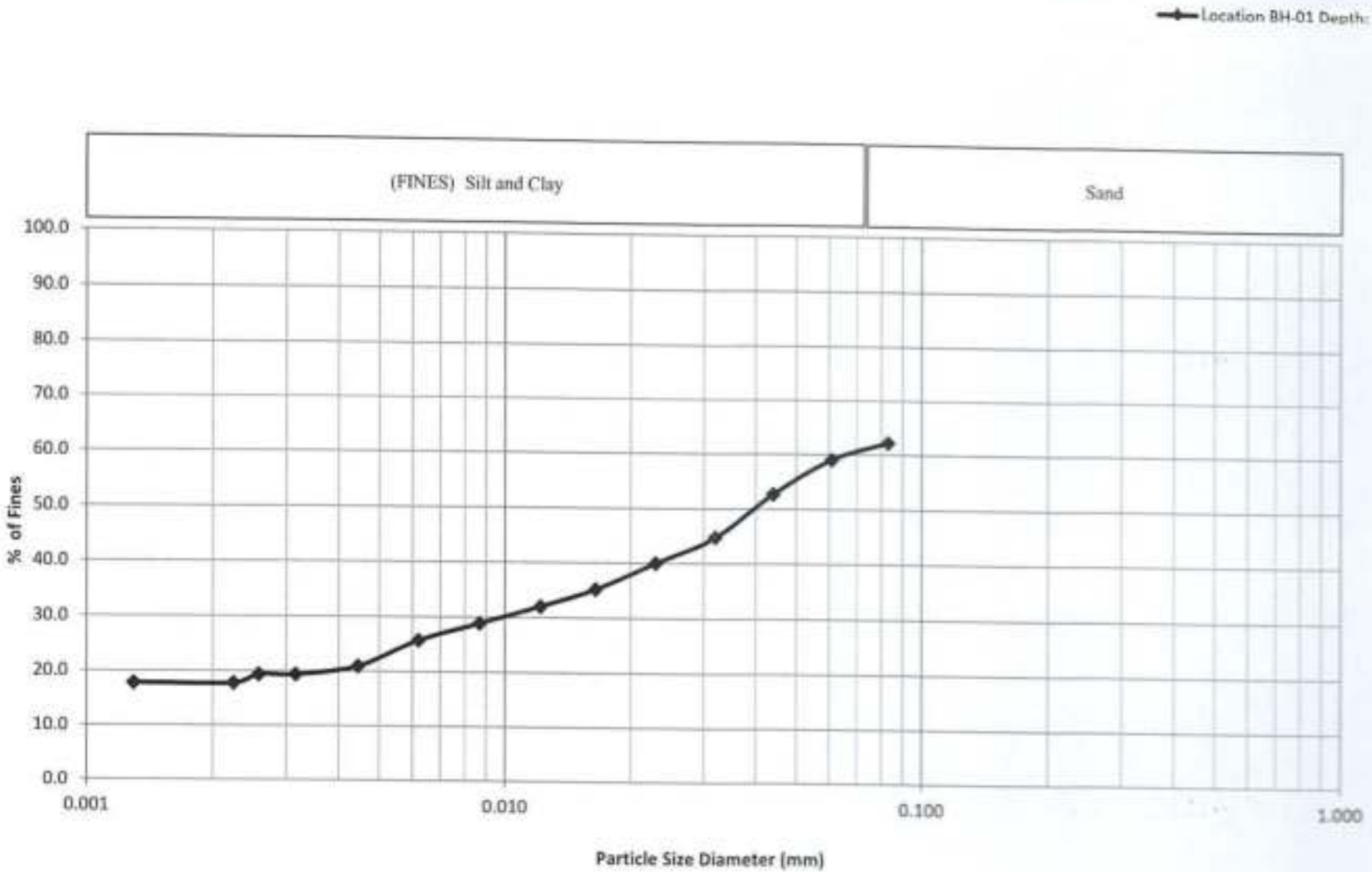


Fig 2.10 Hydrometer Analysis Master Curve

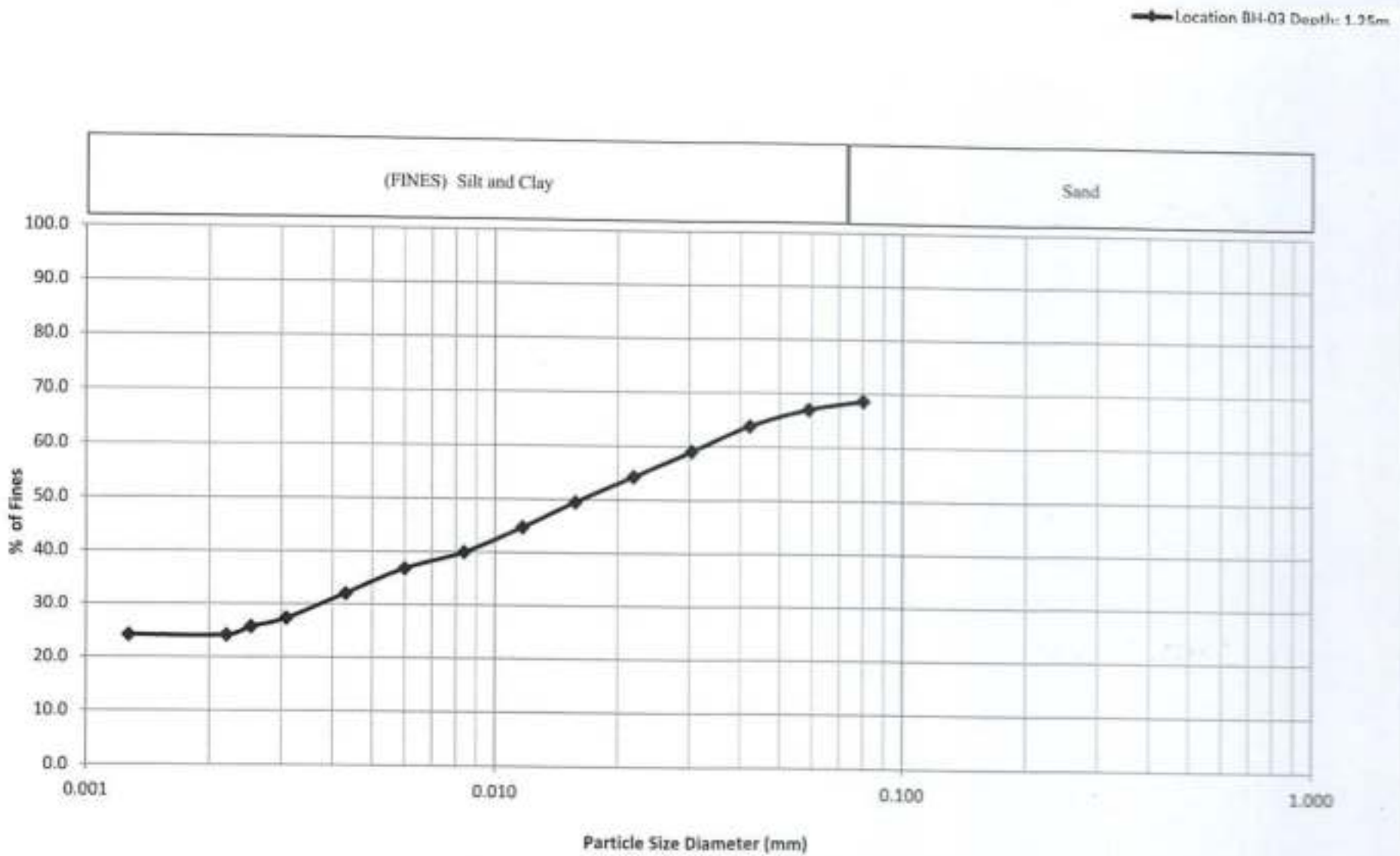


Fig 2.11 Hydrometer Analysis Master Curve

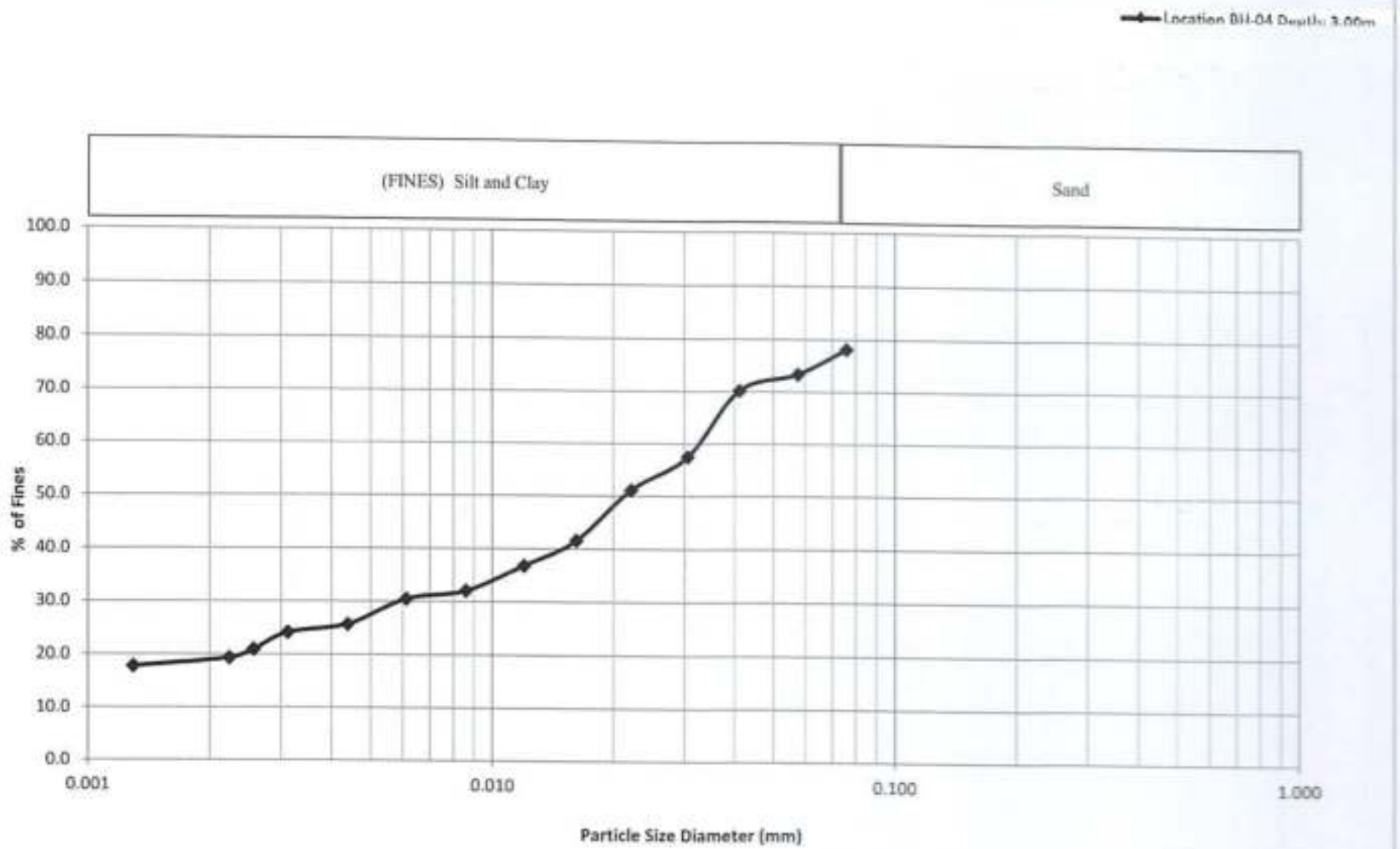


Fig 2.12 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

GEOMARINE
Phone No.: 044-24481485, 044-24480305
ULR No : TC114102300000018F

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s ISHA HOMES (INDIA) PVT LTD.,**	**Customer Reference**	: By Email
Sample Description	:	Soil Sample	**Period of Testing**	: 05/04/2023 to 12/04/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-02	**Sample Identification Number**	: GMC/0323/638
Sample Condition	:	Satisfactory	**Test Report No.**	: GT-2543
Test Method	:	As per Bureau of Indian Standards	**Report Date**	: 14/04/2023
Sample Receipt Date	:	04/04/2023	**Test Report Pages**	: One Page

Table-2.2 Laboratory Classification of Soil Samples from BH-02

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)													
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_p= LL-PL)	Consistency Index (I_c=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS-Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_u=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
													Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	30	SS	14.6	Clay Binder & Atterberg Limits are not conducted					18.2	CG>50%	-	-	-	15.8	3.5	25.6	29.4	25.7		-	-	-	-	-	M.Dense	<50%	SM
1.25	15	SS	Sample Insufficient to carry out Atterberg's Limit and Grain Size Classification. Silty Sand With Gravels & Filling Materials With Minimal Binder Based on Physical Observation.																								
2.0	19	SS	14.5	-	-	-	-	-	-	CG>50%	-	-	-	3.8	2.6	27.7	44.0	21.9		-	-	-	-	-	M.Dense	<50%	SM
3.0	34	SS	16.2	-	-	-	-	-	-	CG>50%	-	-	-	6.4	5.9	28.0	39.2	20.5		-	-	-	-	-	Dense	<50%	SM
4.0	53	WS	Sample Failed. Wash Sample Collected for Observation							CG>50%	-	-	-	7.1	21.6	63.6	7.3	0.5		-	-	-	-	-	V.Dense	-	
4.5	>100	SS	14.6	-	-	-	-	-	-	CG>50%	-	-	-	24.8	8.4	17.4	29.8	19.7		-	-	-	-	-	V.Dense	<50%	SM
5.5	-	WS	Sample Failed. Wash Sample Collected for Observation							CG>50%	-	-	-	43.3	27.4	27.2	2.2	0.0		-	-	-	-	-	V.Dense	-	

** END OF REPORT**

Terms and Conditions

(1) The test results furnished corresponds to the sample received
(2) The tested sample will not be retained for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.
(3) Any correction in this reports invalidates the reports

Authorised Signatory

A. VINOTH
(Technical Manager)

GEOMARINE
Phone No.: 044-24481485, 044-24480305
ULR No : TC114102300000018F

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s ISHA HOMES (INDIA) PVT LTD.,**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	05/04/2023 to 12/04/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-03	**Sample Identification Number**	:	GMC/0323/638
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2543
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	14/04/2023
Sample Receipt Date	:	04/04/2023	**Test Report Pages**	:	One Page

Table-2.3 Laboratory Classification of Soil Samples from BH-03

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)											Coarse Grained (CG)															
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_p= LL-PL)	Consistency Index (I_c=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VII) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_u=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	10	SS	14.2	36.0	17.2	18.8	1.2	11.8	15.4	CG>50%	Above	-	-	3.4	5.1	24.4	29.4	37.7		-	-	-	-	-	Loose	<50%	SC
1.25	6	SS	8.7	35.3	16.6	18.7	1.4	17.4	15.4	CG>50%	Above	-	-	6.9	5.3	23.0	27.7	28.2	8.9	-	-	-	-	-	Loose	<50%	SC
2.0	3	SS	15.5	Clay Binder & Atterberg Limits are not conducted					25.0	CG>50%	-	-	-	21.8	7.5	26.3	23.0	21.5		-	-	-	-	-	V.Loose	<50%	SM
3.0	19	SS	8.4						-	CG>50%	-	-	-	8.5	5.0	27.2	23.2	36.2		-	-	-	-	-	M.Dense	<50%	SM
4.0	>100	SS	16.4	-	-	-	-	-	0.0	CG>50%	-	-	-	19.6	8.7	27.5	17.4	26.8		-	-	-	-	-	V.Dense	<50%	SM

** END OF REPORT**

Terms and Conditions

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(3) Any correction in this reports invalidates the reports

Authorised Signatory

A. VINOTH
(Technical Manager)

GEOMARINE
Phone No.: 044-24481485, 044-24480305
ULR No : TC1141023000000018F

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM CHENNAI

TC-11410

Name & Address of the Customer	:	**M/s ISHA HOMES (INDIA) PVT LTD.,**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	05/04/2023 to 12/04/2023
Source of Sample	:	Customer Supplied- Borehole No. BH-04	**Sample Identification Number**	:	GMC/0323/638
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2543
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	14/04/2023
Sample Receipt Date	:	04/04/2023	**Test Report Pages**	:	One Page

Table-2.4 Laboratory Classification of Soil Samples from BH-04

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)														
			Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_p= LL-PL)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS-Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2019	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_u=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{60}xD_{10})$	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
0.5	37	SS	10.6	Clay Binder & Atterberg Limits are not conducted					8.3	CG>50%	-	-	-	17.0	4.6	28.3	25.3	24.9		-	-	-	-	-	Dense	<50%	SM
1.25	12	SS	17.3						7.7	CG>50%	-	-	-	19.9	4.7	30.5	23.9	21.0		-	-	-	-	-	M.Dense	<50%	SM
2.0	19	SS	13.4	-	-	-	-	-	-	CG>50%	-	-	-	4.4	3.8	28.5	39.8	23.6		-	-	-	-	-	M.Dense	<50%	SM
3.0	16	SS	13.4	Clay Binder & Atterberg Limits are not conducted					0.0	CG>50%	-	-	-	0.0	0.0	13.5	54.3	26.0	6.2	-	-	-	-	-	M.Dense	<50%	SM
4.0	8	*SS	Sample Failed																								
5.0	>100	SS	16.4	-	-	-	-	-	-	CG>50%	-	-	-	8.6	9.1	36.8	32.3	13.3		-	-	-	-	-	V.Dense	<50%	SM

** END OF REPORT**

Terms and Conditions

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(2) The tested sample will not be retained for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.
(3) Any correction in this reports invalidates the reports

Authorised Signatory

A. VINOTH
(Technical Manager)

CHEMICAL LABORATORY TEST RESULTS

GEOMARINE
Phone No.: 044-24480305
ULR No : TC114102300000018F

LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO 11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Table 2.5 Result of Chemical Test

Name & Address of the Customer:	**M/s ISHA HOMES (INDIA) PVT LTD.,**		
Sample Identification Number:	GMC/0323/638	**Test Method**	As per Bureau of Indian Standards
Source of Sample:	Customer Supplied	**Period of Testing:**	05/04/2023
Sample Condition:	Satisfactory	**Report Date:**	14/04/2023
Sample Description:	Water and Soil	**Test Report No.:**	GT-2543
Sample Receipt Date:	04/04/2023	**Test Report Pages:**	One Page

S No.	SAMPLE REFERENCE NO	Water				SOIL (2:1)	
		DEPTH OF SAMPLE (m)	pH AS PER IS 3025 (P-XI) - 2022	SULPHATES (mg/l) AS PER APHA 23rd Edn.2017-4500	CHLORIDES (mg/l) AS PER IS 3025(P-XXXII) - 1988, RA-2019	DEPTH OF SAMPLE (m)	pH AS PER IS 2720 (P-XXVI) - 1987, RA-2021
1.0	BH-01	1.20	8.02	49.8	442.7	2.00	7.97
2.0	BH-02	1.65	8.07	297.9	423.7	2.00	8.10
3.0	BH-03	1.00	7.93	330.8	537.9	2.00	8.26
4.0	BH-04	1.55	8.00	208.3	509.4	2.00	7.46

** END OF REPORT**

Authorised Signatory

A. VINOTH
(Technical Manager)

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be retained for more than 30 days from the date of issue of test report except in the case as required by the applicable regulations.

(3) Any correction in this reports invalidates the reports

Table-2.6 Results of Chemical Test for Soil Sample				
SL No.	Bore HoleNo.	Soil (2:1)		
		Depth of Sample (m)	SULPHATES (mg/kg)	CHLORIDES (mg/kg)
1.0	BH-01	2.00	39.0	14.3
2.0	BH-02	2.00	30.2	19.0
3.0	BH-03	2.00	34.1	9.5
4.0	BH-04	2.00	36.2	33.3

ROCK TEST RESULTS

GEOMARINE
Phone No.: 044-24480305
TC11410230000011F

LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

Table 2.7 Result of Rock Test

Name & Address of the Customer: M/s ISHA HOMES (INDIA) PVT LTD.,

Sample Description: Rock — **Sample Identification Number:** GMC/0323/638

Source of Sample: Customer Supplied — **Period of Testing:** 11/04/2023

Sample Condition: Satisfactory — **Report Date:** 14/04/2023

Test Method As per Bureau of Indian Standards — **Test Report No.:** GT-2543

Sample Receipt Date: 04/04/2023 — **Test Report Pages:** One Page

S.No	Bore Hole Number	DEPTH (m)	UNCONFINED COMPRESSIVE STRENGTH,mPa AS PER IS 9143 - 1979, RA-2021	POINT LOAD STRENGTH INDEX, mPa AS PER IS 8764 - 1998, RA-2019	WATER CONTENT, % AS PER IS 13030 - 1991, RA-2021	SLAKE DURABILITY, % AS PER IS 10050 - 1981, RA-2021	TENSILE STRENGTH, mPa AS PER IS 10082 - 1981, RA-2021
1	BH - 02	8.50 to 10.00	-	1.78	0.62	94.21	2.95
2	BH - 04	6.00 to 7.00	-	0.71	0.79	95.72	2.65

** END OF REPORT**

Authorised Signatory

A. VINOTH
(Technical Manager)

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be returned for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.

(3) Any correction in this reports invalidates the reports

CHAPTER-3

GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 PREAMBLE:

Geotechnical investigation carried out at a specific site provides location specific sub surface engineering characteristics. However in major project sites where the construction activities spread over a very large area location specific sub surface strata characteristics are studied together with the geological mapping data.

This is required to incorporate the impact of any documented macro-level geological characteristics of the region on the foundation design, irrespective of the location specific sub surface strata characteristics.

In view on the above, though it is beyond the scope of the present study to carry out macro-level geological investigation the regional geology based on the published data is presented and discussed.

3.1 CLIMATE AND RAINFALL:

The study area receives the rain under the influence of both southeast and northeast monsoons. Predominantly northeast monsoon contributes rainfall and most of the precipitation occurs in the form of cyclonic storm caused due to the depressions in Bay of Bengal. The north east monsoon occurs between October & December. The southwest monsoon rainfall is highly erratic and summer rains are negligible.

The normal annual rainfall over the study area varies from 1100 mm to 1200mm.

3.2 GEOMORPHOLOGY:

Chennai district forms part of coastal plains of northern Tamil Nadu. Major part of the district is having flat topography with very gentle slope towards east. The altitudes of land surface vary from 10 m above MSL in the west to sea level in the east.

Fluvial, marine and erosional landforms are noticed in the district. Marine transgression and regressions and neo-tectonic activity during the recent past have influenced the morphology and resulted in various present landforms.

Meandering streams with small sand bars are present along the course of Adyar River. The pediment and buried pediment in Guindy area in and around the reserved forest, is the only area where the ecological system is less disturbed, while the other areas are completely disturbed by built up area with large-scale human interference and pollution.

3.3 GEOLOGY OF CHENNAI DISTRICT:

Chennai district is underlain by various geological formations from ancient Archaean to the Recent Alluvium. The geological formations of the district can be grouped into three units, namely

i) Archaean crystalline rocks

ii) Gondwana (Consolidated Clay/Clayey Silt) and Tertiary sediments and

iii) Recent Alluvium.

The Archaean crystalline rocks of the district comprise chiefly of Charnockite, gneisses and the associated basic and ultra-basic intrusive dykes.

3.4 GEOLOGICAL ORDER OF THE STUDY AREA:

The stratigraphy of the study area can be classified as recent formation which is underlain by basement rock of meta-igneous origin (hypersthene granite/ Charnockite rock)

↑ Deposits of Recent Age

---------- Eparchean Unconformity ----------

Archaean Basement Rock (Charnockite Rock / Hypersthene Granite)

3.5 DESIGN SUB SOIL PROFILE: (WRT Foundation Engineering Application)

The sub soil characteristics obtained at the test location are further processed to arrive at the design soil parameters required for the design of sub structure using the following shear strength correlations with respect to the Standard Penetration Test Values of different layers.

- For Coarse Grained Material, Ref. IS: 6403 to estimate Angle of Shearing Resistance (Reproduced and shown in Fig.A1)
- For Fine Grained Material, Ref. Terzaghi & Peck, 1948, to estimate Unconfined Compressive Strength (Reproduced and shown in Fig.A2)

Based on the above, the average design soil characteristics are given below:

REFERENCE BORE HOLE					BH-01	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	1.50	1.50	Filled Up Soil	Grey	30	Medium Dense	-	19	-	36
2.0	1.50	4.00	2.50	Silty Sand	Brown	24	Medium Dense	-	18.5	-	34.2
3.0	4.00	5.00	1.00	Residual Soil to CWR	-	>100	Very Dense	-	21	-	42.5
4.0	5.00	6.70	1.70	Highly Weathered Rock	Brown Grey	CRR 9% to 14%, RQD 0%					

REFERENCE BORE HOLE					BH-02	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C$_u$) kPa	(ϕ) Deg.
1.0	0.00	1.50	1.50	Filled Up Soil	Grey	23	Medium Dense	-	18.5	-	33.9
2.0	1.50	3.00	1.50	Silty Sand	Brown	19	Medium Dense	-	18	-	32.7
3.0	3.00	4.00	1.00	Silty Sand	Brown	34	Dense	-	19.5	-	37.1
4.0	4.00	5.50	1.50	Completely Weathered Rock	Brown	77	Very Dense	-	21	-	42.5
5.0	5.50	6.50	1.00	Highly Weathered Rock	Brown Grey	CRR 0% to 13%, RQD 0%					
6.0	6.50	10.00	3.50	Moderately Weathered Rock	Grey	CRR 30% to 47%, RQD 0%					

REFERENCE BORE HOLE					BH-03	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C$_u$) kPa	(ϕ) Deg.
1.0	0.00	1.50	1.50	Filled Up Soil	Brown Grey	8	Loose	-	14.5	-	29.6
2.0	1.50	3.00	1.50	Silty Sand	Brown Grey	3	Very Loose	-	13	-	20.067
3.0	3.00	4.00	1.00	Residual Soil	Grey Brown	19	Medium Dense	-	18	-	32.7
4.0	4.00	5.00	1.00	Completely to Highly Weathered Rock	Grey Brown	CRR 8%, RQD 0%					

REFERENCE BORE HOLE					BH-04	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C$_u$) kPa	(ϕ) Deg.
1.0	0.00	1.50	1.50	Filled Up Soil	Grey	25	Medium Dense	-	18.5	-	34.5
2.0	1.50	3.00	1.50	Silty Sand	Grey	18	Medium Dense	-	18	-	32.4
3.0	3.00	5.00	2.00	Silty Sand	Brown	8	Loose	-	14.5	-	29.6
4.0	5.00	6.50	1.50	Completely Weathered Rock	Brown	>100	Very Dense	-	21	-	42.5
5.0	6.50	7.00	0.50	Moderately Weathered Rock	Grey	CRR 18%, RQD 0%					

FOUNDATION SYSTEM

CHAPTER-4

FOUNDATION SYSTEM

4.0 PREAMBLE:

In the design of foundation system, the stress-strain compatibility of the super structure, sub structure and the bearing strata should be satisfied both individually and as a combined system. In view of this, the following data are needed for the design of foundation system, defined in terms of the type of sub structure and the bearing strata characteristics.

- The super structure characteristics along with the loading pattern on the sub structure
- The sub soil characteristics that define the required substructure configuration for a safe transfer of super-structural loads to the bearing strata

Considering the above aspects of the foundation design, the suitable type of foundation system is presented below.

4.1 PROPOSED STRUCTURES:

An understanding of the proposed construction and the order of loads on the foundations is needed for choosing the appropriate foundation system. In the present case, the proposed structure is configured with stilt and five upper floors for residential occupancy. For this kind of structure, the column loads could vary between 1200 kN to 1800 kN.

The above-mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 SUB SOIL STRATIFICATION:

The geological stratification of the project site is as follows:

Layer-I	0.0m to 1.50m	Filled Up Soil (Silty Sand with Gravels/ Clayey Silty Sand with Brick Pieces/ Constructional Debris)
Layer-II	1.50m to 3.0m/4.0m	Very Loose & Medium Dense/ Dense, Silty Sand with Binder & Gravel Traces
Layer-III	3.0m/4.0m to 5.5m	Dense, Silty Sand with Gravel/ Partially Residual Soil Texture & Residual Soil to Completely Weathered Rock
Layer-IV	5.5m to 10.0m	Highly to Moderately Weathered Rock (Grade W4 & W3 Rock Formation)

Since the filling is of long duration, it is not feasible to identify the thickness of the fill based on the investigation. Hence, the thickness of the fill is based on physical appearance

4.3 FOUNDATION SYSTEM:

In the present project location, very high ground water table coupled with loose sandy strata up to 3.0m-4.0m post limitation to adopt open foundation system due to the following:

- The construction of foundation needs well point dewatering system.

- The minimum depth of foundation for footing is 2.50m and thus the excavation needs shoring and strutting.

In view of the above constraints, it is ideal to adopt short piles and adopt a cut off of 0.5m. The piles can be installed by drilling with direct mud circulation technique *(Bored Cast Insitu Piles)* and the recommended safe load carrying capacity of bored cast insitu piles in compression, pull out and lateral for diameters located at a depth of 6.0m is worked out as Per IS 2911-Part-I-Section-2 and are presented in Table 4.1.

Typical computations are presented in Annexure-I.

TABLE:- 4.1 RECOMMENDED SAFE LOAD CARRYING CAPACITIES OF BORED CAST-IN SITU PILES

Sl.No	Reference Bore hole No.	Length of Pile below E.G.L	Assumed Length of Cut-Off Below E.G.L	Length of Pile below Cut-off	Dia.of Pile in (mm)	SAFE LOAD CARRYING CAPACITY (kN)		
						Vertical Load Carrying Capacity	Pull Out Capacity	Lateral Load Carrying Capacity
1.0	BH-04	6.0	0.5	5.50	400	500	35	27
2.0					450	600	40	33
3.0					500	750	45	39

RECOMMENDATIONS

CHAPTER-5

RECOMMENDATIONS

5.1 RECOMMENDATION FOR PILE FOUNDATION SYSTEM:

- Based on the present project site, short piles (Bored Cast in situ piles) are recommended as the suitable foundation system.
- The allowable safe load carrying capacities of different diameters of piles as given in Table-4.1 can be adopted as provisional design loads, as the load carrying capacity of piles is not only depends upon the sub soil properties, but also depends on the care and experience of installation piles.
- The theoretical load carrying estimates of piles shall be confirmed by conducting pile loads tests as per the guide lines laid down in IS: 2911-Part-IV.
- The boring shall be carried out using direct mud circulation prepared out of sodium bentonite.
- After reaching the borehole termination depth, the borehole shall be cleaned using mud circulation for a minimum period of 30min or till the return mud is relatively clear of soil particles.
- After ensuring the borehole is clean, the tremie pipe shall be lowered and concreting can be done.

5.1.1 CONSTRUCTION METHOD STATEMENT OF PILE FOUNDATION:

- For the bored cast in situ piles, a guide casing of suitable length can be adopted
- The mud used shall be made out of sodium bentonite with minimum frees swell index of more than 300% and liquid limit more than 100%. The silt content in bentonite shall not more than 5%.
- The mud was prepared using sodium bentonite with a density of 1.10 to 1.15 g/cc.

5.2 GENERAL RECOMMENDATIONS:

- The present project site falls in seismic zone- III as per IS 1893-P-1.
- The chlorides content in the ground water is slightly more than the permissible limit. The chlorides content in soil-water extract is less than the permissible limit of 500 mg/l as per IS 456 Table 1.0.
- Corresponding to the sulphate content in 2:1 Water-Soil extract and ground water use Table 4.0 of IS 456 for minimum cement content and maximum water cement ratio. Hence ordinary Portland cement is ideal to adopt.

AUTHORISED SIGNATORY

GEO MARINE CONSULTANTS PVT. LTD. Chennai-41

DR. C. V. PRASAD
GEOMARINE CONSULTANTS PRIVATE LIMITED

ANNEXURE-I

GEOMARINE

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile	450	mm	Length of Pile below G.L. (m)	6.0	As Per IS:2911-(P-I,S-2)-2010
Reference Bore Hole	BH-01				Surcharge Pressure	0	kPa

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(φ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (K)	Skin Friction (Q_s) kN		
1.0	0.0	0.5	0.5	Cut-Off Level													
2.0	0.5	1.5	1.0	Filled Up	22	18.5	18.5	-	33.6	0.0	8.5	4.3	-	1.2	qf	2	0.0
3.0	1.5	4.0	2.5	Sand	24	18.5	18.5	-	34.2	8.5	29.8	19.1	-	1.2	qf	3	55.7
4.0	4.0	5.0	1.0	Residual Soil	50	20.5	19.5	-	41.0	29.8	40.3	35.0	-	1.5	qf	4	64.5
5.0	5.0	6.0	1.0	Highly Weathered Rock	60	20.5	20.5	-	41.0	40.3	50.8	45.5	-	1.5	qf	5	83.9

Summation of Positive Skin Resitance (kN) Q_f= 204.11

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	φ	C_u	N_q	N_c			
Bearing Stratum	Highly Weathered Rock	60	41.00	-	157.31	-	Eff.Ht.of Overburden	6	m
							Effective Overburden Pressure	57.75	kN/m²

End Bearing Resistance (kN) Q_p= 1444.83

Skin Resistance in Clay Layer is π*d*T*C_u*α

Skin Resistance in Sand Layer is π*d*T*σ'*K*Tan(δ)

End Bearing Resistance in Clay Layer is π*d²/4*C_u*N_c

End Bearing Resistance in Sand Layer is π*d²/4*σ'*N_q

Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f-Q_r+Q_p$ (kN)	1648.95
Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN)	659.58
Allowable Safe Load Carrying Capacity	Q_{A-safe} (kN)	659.58
Allowable Safe Pull out Capacity	Q_{Allow} Qf/3 (kN)	68.04

Where

Cu=Unconined Shear Strength of Clay

φ=Angle of Shearing Resistance

N_c=Bearing Capacity Factor = 9

K=Coef. Earth Pressure at Rest

σ'=Effective Overburden Pressure at middle of Layer

N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above

d=Dia. Of Pile

α=Adhesion Factor

T=Thickness of Layer

Q (i.e) Effective Overburden Pressure at pile tip=Effective height of overburden X (=10)

GEOMARINE

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile		Length of Pile below G.L. (m)	6.0	As Per IS:2911-(P-I,S-2)-2010	
Reference Bore Hole	BH-02		400 mm	Surcharge Pressure	0	kPa	

Layer No.	Layer Thk. (m) Top R.L.	Bot. R.L.	Thickness	Type of Strata	Avg. SPT	(γ) kN/m³ of Layer	Avg. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (K)	Skin Friction (Q_s) kN		
1.0	0.0	0.5	0.5	Cut-Off Level													
2.0	0.5	1.5	1.0	Filled Up	15	17.5	17.5	-	31.5	0.0	7.5	3.8	-	1.1	qf	2	0.0
3.0	1.5	3.0	1.5	Sand	19	18.0	17.8	-	32.7	7.5	19.5	13.5	-	1.1	qf	3	18.6
4.0	3.0	4.0	1.0	Residual Soil	34	19.5	18.8	-	37.1	19.5	29.0	24.3	-	1.4	qf	4	31.3
5.0	4.0	6.0	2.0	Completely Weathered Rock	60	20.5	20.0	-	41.0	29.0	50.0	39.5	-	1.5	qf	5	129.4

Summation of Positive Skin Resitance (kN) Q_f= 179.35

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Highly Weathered Rock	60	41.00	-	157.31	-	Eff.Ht.of Overburden	6	m
							Effective Overburden Pressure	57.75	kN/m²

End Bearing Resistance (kN) Q_p= 1141.60

Skin Resistance in Clay Layer is $\pi*d*T_i*C_u*\alpha$	Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f+Q_p$ (kN) 1320.95
Skin Resistance in Sand Layer is $\pi*d*T_i*q_i*K*Tan(\phi)$	Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN) 528.38
End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$	Allowable Safe Load Carrying Capacity	$Q_{Allowable}$ (kN) 528.38
End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$	Allowable Safe Pull out Capacity	$Q_{Allowable}$: Qf/3 (kN) 59.78

Where

Cu=Undrained Shear Strength of Clay

ϕ=Angle of Shearing Resistance

N_q=Bearing Capacity Factor = f(ϕ

K=Coef. Earth Pressure at Rest

qi=Effective Overburden Pressure at middle of Layer

N_c=Bearing Capacity Factor, Ref. Fig 1 of IS: Code Referred above

d=Dia. Of Pile

α=Adhesion Factor

Ti=Thickness of Layer

Q (i.e) Effective Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

GEOMARINE

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile			Length of Pile below G.L. (m)	6.0	As Per IS:2911-(P-4,S-2)-2010	
Reference Bore Hole	BH-03	450	mm	Surcharge Pressure	0	kPa		

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(φ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (K)	Skin Friction (Q_s) kN		
1.0	0.0	0.5	0.5	Cut-Off Level													
2.0	0.5	1.5	1.0	Filled Up	6	14.5	14.5	-	29.2	0.0	4.5	2.3	-	1.0	qf	2	0.0
3.0	1.5	3.0	1.5	Sand	3	13.0	13.8	-	20.1	4.5	9.0	6.8	-	1.0	qf	3	5.2
4.0	3.0	4.0	1.0	Residual Soil	19	18.0	15.5	-	32.7	9.0	17.0	13.0	-	1.1	qf	4	13.4
5.0	4.0	6.0	2.0	Completely Weathered Rock	60	20.5	19.3	-	41.0	17.0	38.0	27.5	-	1.5	qf	5	101.4

Summation of Positive Skin Resitance (kN) Q_f= 120.03

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	φ	C_u	N_q	N_c			
Bearing Stratum	Highly Weathered Rock	60	41.00	-	157.31	-	Eff.Ht.of Overburden	6	m
							Effective Overburden Pressure	57.75	kN/m²

End Bearing Resistance (kN) Q_p= 1444.83

Skin Resistance in Clay Layer is $\alpha*\pi*d*T*C_u*\alpha$	Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f+Q_p$ (kN) 1564.86
Skin Resistance in Sand Layer is $\pi*d*T*q_i*K*Tan\phi$	Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN) 625.94
End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$	Allowable Safe Load Carrying Capacity	$Q_{A\text{-}safe}$ (kN) 625.94
End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$	Allowable Safe Pull out Capacity	$Q_{A\text{-}pull}$ Qf/3 (kN) 40.01

Where

Cu=Undrained Shear Strength of Clay
K=Coef. Earth Pressure at Rest
d=Dia. Of Pile
φ=Angle of Shearing Resistance
q_i=Effective Overburden Pressure at middle of Layer
α=Adhesion Factor
N_q=Bearing Capacity Factor = 9
N_c=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above
T=Thickness of Layer
Q (i.e) Effective Overburden Pressure at pile tip=Effective height of overburden X (=10)

GEOMARINE

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile			Length of Pile below G.L. (m)	6.0	As Per IS:2911-(P-I,S-2)-2010
Reference Bore Hole	BH-04		500	mm	Surcharge Pressure	0	kPa

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(φ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (K)	Skin Friction (Q_s) kN		
1.0	0.0	0.5	0.5	Cut-Off Level													
2.0	0.5	1.5	1.0	Filled Up	12	16.0	16.0	-	30.6	0.0	6.0	3.0	-	1.0	qf	1	0.0
3.0	1.5	3.0	1.5	Sand	19	18.0	17.0	-	32.7	6.0	18.0	12.0	-	1.1	qf	3	20.6
4.0	3.0	5.0	2.0	Residual Soil	12	16.0	17.0	-	30.6	18.0	30.0	24.0	-	1.0	qf	4	45.9
5.0	5.0	6.0	1.0	Completely Weathered Rock	60	20.5	18.3	-	41.0	30.0	40.5	35.3	-	1.5	qf	5	72.2

Summation of Positive Skin Resitance (kN) Q_f= 138.78

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	φ	C_u	N_q	N_c			
Bearing Stratum	Completely Weathered Rock	60	41.00	-	157.31	-	Eff.Ht.of Overburden	6	m
							Effective Overburden Pressure	57.75	kN/m²

End Bearing Resistance (kN) Q_b= 1783.75

Skin Resistance in Clay Layer is $\pi*d*T_i*C_u*\alpha$

Skin Resistance in Sand Layer is $\pi*d*T_i*\sigma_0*K*Tan(\phi)$

End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$

End Bearing Resistance in Sand Layer is $\pi*d^2/4*\sigma*N_q$

Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f-Q_f+Q_b$ (kN) 1922.52
Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN) 769.01
Allowable Safe Load Carrying Capacity	Q_{A-safe} (kN) 769.01
Allowable Safe Pull out Capacity	Q_{A-pull}: Qf/3 (kN) 46.26

Where

Cu=Undrained Shear Strength of Clay

φ=Angle of Shearing Resistance

N_q=Bearing Capacity Factor = fi

K=Coef. Earth Pressure at Rest

σ=Effective Overburden Pressure at middle of Layer

N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above

d=Dia. Of Pile

α=Adhesion Factor

T_i=Thickness of Layer

(Q.1.a) Effective Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

GEOMARINE — THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No. 02 | PAGE No. 1

PROJECT NAME: Isha Homes.

LOCATION: Perumbakkam | MACHINE No. CR - 01 | CHAINAGE (m) | DIA OF BORE HOLE 150mm / 100mm

STRUCTURE | DRILLING METHOD Rotary | CO-ORDINATES N | BORE START DATE 30/3/2023

JOB CODE | FLUSHING MEDIUM Bentonite | E | BORE END DATE 31/3/2023 | TOTAL DRILLING DAYS

Depth Below G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Min.	Type and Dia of Bore Hole (TCR / DB)	Core Details: Total Core Recovery %	R.Q.D. %	SPT Details: Blows/cm 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
0		11.53													Greyish. Sandy clay with Filling materials
		12.05					12	15	15	30	.50		SS		
1		12.20													Sandy clay with filling materials.
		12.25					6	8	7	15	1.25		SS		
		12.40													Dense, Brownish, fine-medium grain clayey SAND.
2		12.46					6	12	7	19	2		SPT		
		1.00													
		1.04													Dense, Brownish, fine-medium coarse grain clayey SAND.
3				SC			17	15	19	34	3		SS		
		2.00													
		2.07													V. Dense, Brownish, fine and medium coarse grain RESIDUAL SOIL
4		2.25					18	18	25	53	4		WS		
		2.35					15cm								Brownish - Pinkish (mix) V. WEAK, medium coarse grain COMPLETELY WEATHERED ROCK
							50 (×100)				4.50		SS		
		2.50									5				
5		3.04		DB	0%	0%					5.50		WL		COMPLETELY WEATHERED ROCK
		3.15													
		3.47		DB	15%	0%					6.0		CS		WEAK - Brown, Pinkish (iron ox) medium coarse grain HIGHLY WEATHERED FRACTURED ROCK CRR = 13% RQD = 0%.
		3.57													
6		4.20		DB	30%	0%					7.5		CS		WEAK - moderate, medium - coarse grain greyish, HIGHLY WEATHERED FRACTURE ROCK CRR = 30%. RQD = 0%
		4.30													
7		5.30		DB	30%	0%					8.55				
															HIGHLY WEATHERED FRACTURED ROCK CRR = 30%. RQD = 0%.
8															
	31/3/2023	9.30		DB							9.50		CS		
9		9.47													
		10.47	am	DB	47%	0%					10		CS		CRR = 47%. RQD = 0%.
10											Bore Hole terminated at 10.00m				

CS - Core Sample | DS - Disturbed Sample | SUPERVISOR NAME: R. Sivakanthan

SS - Split Spoon Sample | SC - Soil Cutter | SIGNATURE

UDS - Undisturbed Sample | TCR - Tungsten Carbide Bit | DATE: 30/3/2023

WS - Wash Sample | DB - Diamond Bit | CLIENT IN-CHARGE

PROJECT SITE DETAILS: GROUND LEVEL (m) | WATER TABLE (m) | CASING DEPTH (m)

GEOMARINE

SITE INVESTIGATION RECORD

BORE HOLE No. 03

PAGE No. 1

PROJECT NAME: ISHA HOME'S

DIA OF BORE HOLE: 230mm / 100mm

LOCATION: PERUNDURAI | MACHINE No.: CR-01 | CHAINAGE (m): | BORE START DATE: 31/03/23

STRUCTURE: | DRILLING METHOD: Rotary | CO-ORDINATES: N | BORE END DATE: 31/03/23

JOB CODE: | FLUSHING MEDIUM: Bentonite | E | TOTAL DRILLING DAYS: 1

Depth below G.L. (m)	Drilling progress per meter: Time (Hr)	Time (Min)	Type of Drill Bit (DC / TCB / DB)	Core Details: Total Core Recovery %	R.Q.D %	SPT Details: Blows/cm 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Depth (m)	Geotechnical Description
0	31/03/23	3 30	SC			4	5	5	10	0.50	1	SS		Stiff, Greyish, sandy clay
		3 21												
1		3 33	SC			2	2	4	6	1.25	2	SS		Medium stiff, Greyish, sandy clay.
		3 34												
2		3 44	SC			2	1	2	3	2.00	3	SS		Very loose, Greyish, Silty sand with gravel.
		3 45												
3		3 59	SC			4	9	10	19	3.00	4	SS		Medium Dense, Reddish pale yellowish mix greenish, Silty clayey sand and gravel
		4 00												
4		4 13	SC			9	5	11cm / 5cm	None	4.00	5	SS		Very Dense, pale yellowish brown, clayey SAND and gravels.
		4 16												
5		4 35	TCB	8%	0%					5.00	6	CS		Weak, Grey mix Brownish, Highly weathered Rock.
		4 46												
6														
7														
8														
9														

Bore Terminated at 5.00m depth

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	R. Ranganathan	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	31/03/23	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE
THE SPIRIT OF EXCELLENCE

SITE INVESTIGATION RECORD

BORE HOLE No. 01
PAGE No. 1

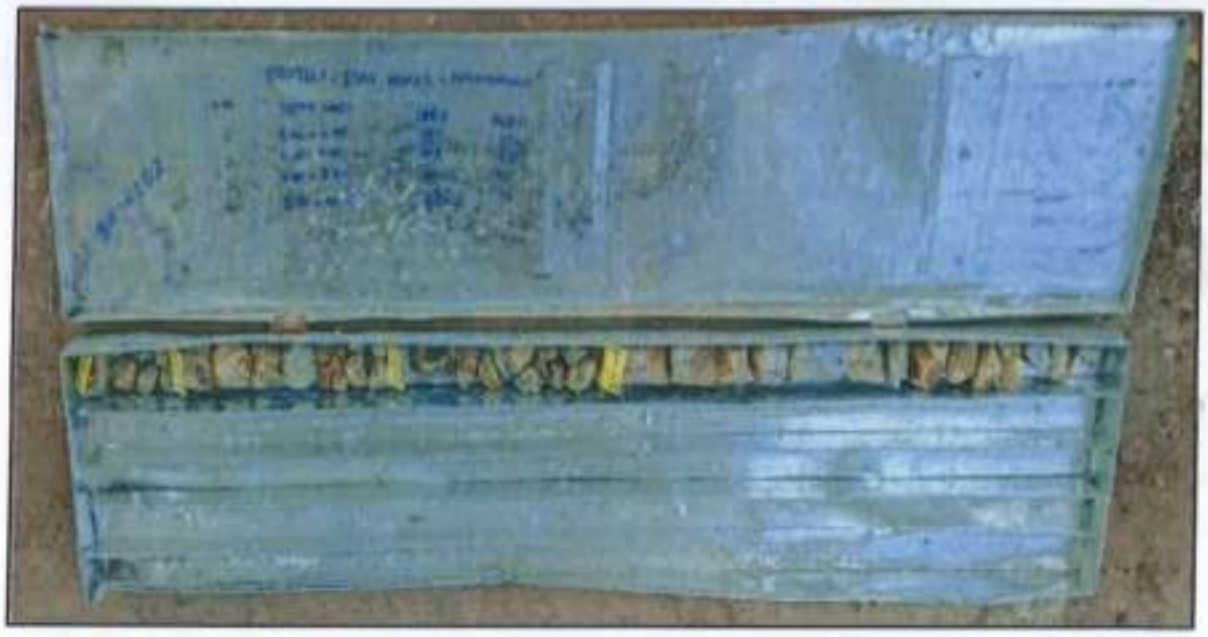
PROJECT NAME: ISHA HOMES
DIA OF BORE HOLE: 150mm / 100mm
LOCATION: ATAMIRI KIKAM | MACHINE No.: CR-01 | CHAINAGE (m): | BORE START DATE: 01/04/23
STRUCTURE: | DRILLING METHOD: Rotary | CO-ORDINATES: N | BORE END DATE: 01/04/23
JOB CODE: | FLUSHING MEDIUM: Bentonite | E | TOTAL DRILLING DAYS: 1

Depth below G.L. (m)	Drilling progress per metre: Date	Time: Hr	Min	Type of Drilling Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	R.Q.D %	SPT Details: Blows/cm 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
1	01/04/23	12 15		SC			18	19	18	37	0.50	1	SS		Dense, Greenish Grey, clay mix SAND with concrete Pieces
		12 16													
		13 28		SC			8	6	6	12	1.25	2	SS		Medium Dense, Greyish, Silty clayey SAND with concrete Piece
2		12 39		SC			14	12	7	19	2.00	3	SS		Medium Dense, Blackish brown Silty SAND
		12 40													
3		2 16		SC			9	8	8	16	3.00	4	SS		Medium Dense, Reddish pale yellowish brown, clay mix Silty SAND and Gravels.
		2 17													
4		2 32		SC			11	5	3	8	4.00	5	Nil		Sample Nil
		2 33													
5		2 48		SC			14cm / 55/40		4.5	N>100	5.00	6	SS		Very Dense, Pale yellowish brown, Residual Soil.
		2 53													
6	WH	88		TCB	0%	0%		4.8		N>100	6.00	7	WS		Brownish, completely weathered Rock
	WH	13													
	WH	17		TCB											
7	WH	41		DB	18%	0%					7.00	8	CS		Weak, Greyish brown, Highly weathered Rock.
	WH	59													
	WH	18													
8															
9															
10															

Bore Terminated at 7.00m depth

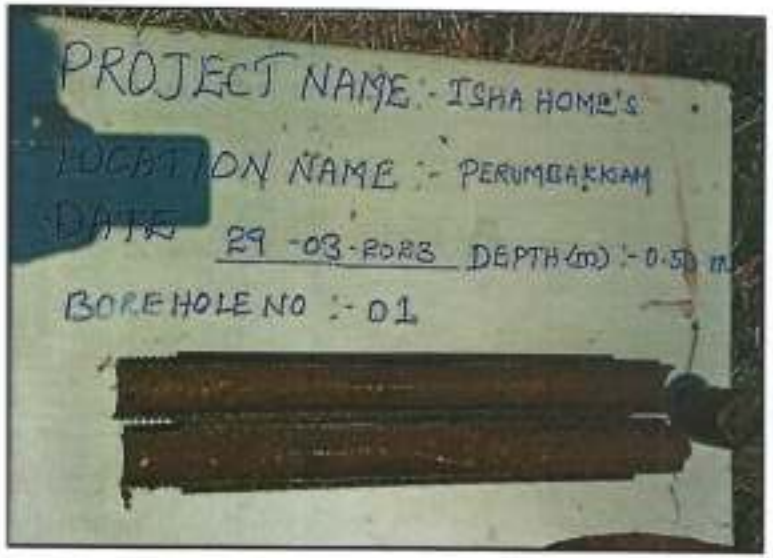
CS - Core Sample | DS - Disturbed Sample | SUPERVISOR NAME: R. Kamalakannan
SS - Split Spoon Sample | SC - Soil Cutter | SIGNATURE: R.K
UDS - Undisturbed Sample | TCB - Tungsten Carbide Bit | DATE: 01/04/23
WS - Wash Sample | DB - Diamond Bit | CLIENT IN-CHARGE:

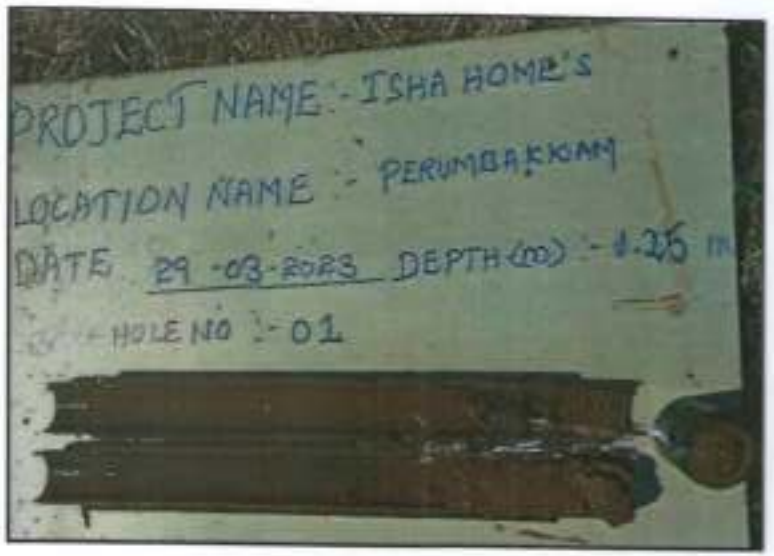
PROJECT SITE DETAILS
GROUND LEVEL (m):
WATER TABLE (m):
CASING DEPTH (m):

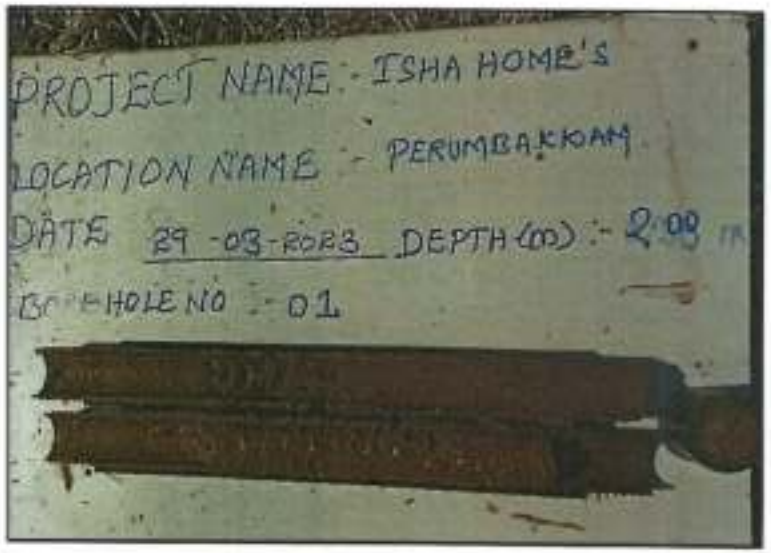




GEOMARINE


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 29-03-2023 DEPTH (m) :- 0.50 m
BOREHOLE NO :- 01


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 29-03-2023 DEPTH (m) :- 1.25 m
HOLE NO :- 01


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 29-03-2023 DEPTH (m) :- 2.00 m
HOLE NO :- 01


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 30-03-2023 DEPTH (m) :- 0.50m
BOREHOLE NO :- 02

GEOMARINE


PROJECT NAME :- ISHA HOME'S
ON NAME :- PERUMBAKKAM
30 -03-2023 DEPTH (m) :-
BOREHOLE NO :- 02


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 03-2023 DEPTH (m) :-
:- 02


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 30 -03-2023 DEPTH (m) :-
BOREHOLE NO :- 02


PROJECT NAME :- ISHA HOME'S
LOCATION NAME :- PERUMBAKKAM
DATE 30 -03-2023 DEPTH (m) :-
BOREHOLE NO :- 02

GEO MARINE
THE SPIRIT OF ENGINEERING

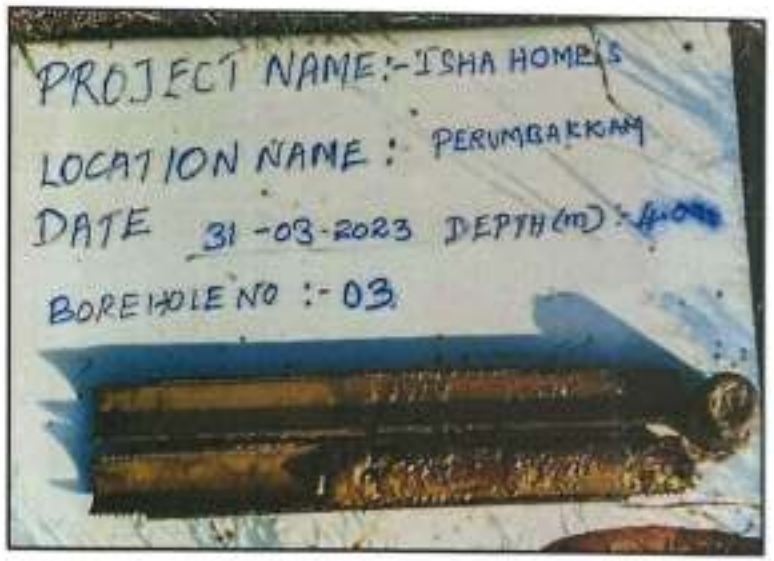


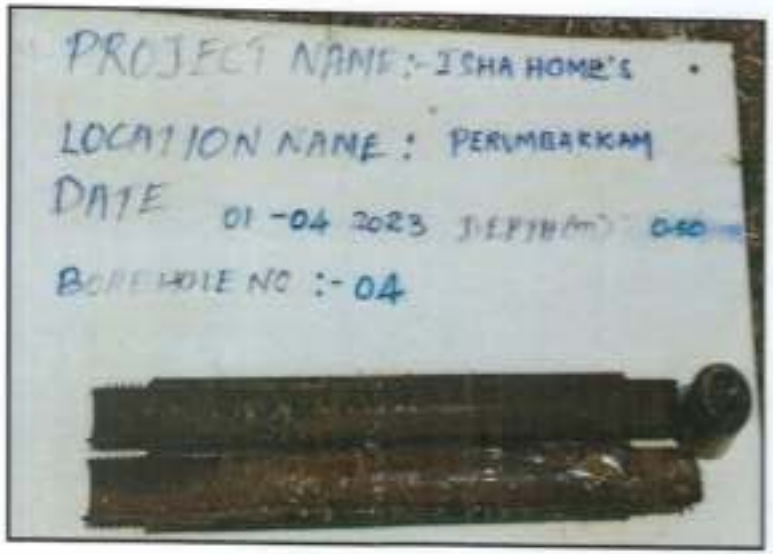




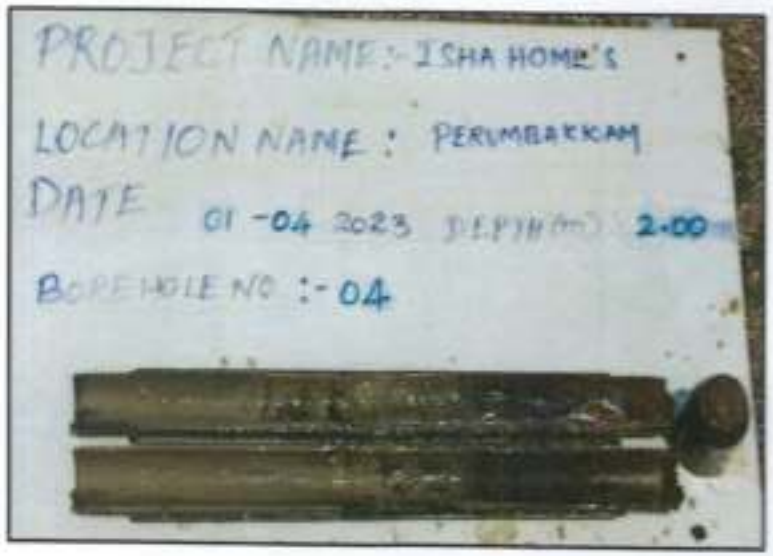


GEO MARINE

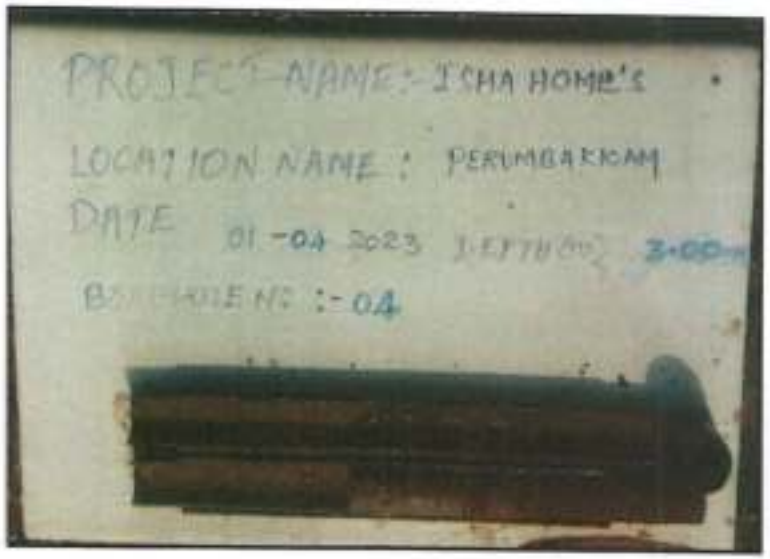

PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 31-03-2023 DEPTH(m) :-
BOREHOLE NO :- 03


PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 01-04 2023 DEPTH(m) 0.50
BOREHOLE NO :- 04


PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 01-04 2023 DEPTH(m) 1.25
BOREHOLE NO :- 04


PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 01-04 2023 DEPTH(m) 2.00
BOREHOLE NO :- 04

GEOMARINE


PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 01 -04 2023
BOREHOLE NO :- 04


PROJECT NAME:- ISHA HOME'S
LOCATION NAME : PERUMBAKKAM
DATE 01 -04 2023 DEPTH(m) 5.00
BOREHOLE NO :- 04







our services doesn't just end there

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Compliance & Special Services

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Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

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Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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