

RESIDENTIAL PROJECT AT NERKUNDRAM, CHENNAI

DESIGN BRIEF REPORT

PROJECT: RESIDENTIAL DEVELOPMENT AT CHENNAI
CLIENT: RAMANIYAM REAL ESTATES (P) LTD.,
TITLE: STRUCTURAL DESIGN BASIS REPORT
STRUCTURAL: BURO ENGINEERS (I) PVT LTD
CONSULTANT

ISSUE RECORD:

DATE	PREPARED	CHECKED	APPROVED	REVISION
19-03-2025	ARVIND	JOSHI	PJ	R0



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1.0 INTRODUCTION

This Design Brief Report (DBR) is for the Proposed Residential project at Nerkundram, Chennai for Ramaniyam Real Estates (p) LTD.,

This report provides the information on Codes of Practice, Design loading, Material Strength considered for the Design and Analysis of the building. In addition, this report includes Structural system, Foundation system, Method statement of structural analysis which will be adopted for design and analysis for the building.

LEVEL	TOWER NOMENCLATURE	DESCRIPTION
1	Block - A	2 Basement + Stilt + 16 Storey + Roof + Head Room
2	Block - B (part 1 & 2)	2 Basement + Stilt + 16 Storey + Roof + Head Room
3	Block - C (part 1 & 2)	2 Basement + Stilt + 16 Storey + Roof + Head Room

Expansion Joint:

The Expansion Joint proposed between Block A, Block B and Block C, Hence those Blocks are divided into Part 1 and Part 2.

1.1 Facilities:

Basement 2: Parking, Fire Pump Room.

Basement 1: Parking, Fire Pump Room.

Stilt Floor: Parking, Electrical Room, Watchman Room, Maintenance Room, Meeting Hall.

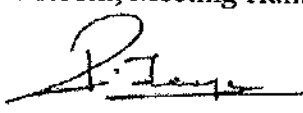
First Floor to 16th floor: Residential units.

Terrace: Open terrace, Solar Panels, OHT, and LMR.

1.2 Floor to floor height:

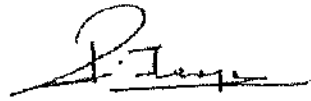
Tower A, B and C:

LEVEL	SLAB	STORY HEIGHT (m)
1	Basement 2	3.2
2	Basement 1	3.6
3	Stilt Floor	3.12
4	1 st to Terrace	3.18


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2.0 CODES OF PRACTICE

The relevant Indian Standard codes below are followed.


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2.1 CODES, STANDARDS & REFERENCES

All designs of structures shall comply with the requirements specified in the following.

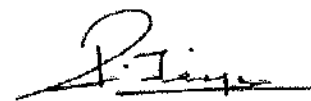
- Relevant Indian Standard Codes of Practice
- National Building Code.
- Local Building regulations.
- Other relevant international codes where required.

All applicable latest editions of codes and standards are referred and adopted in the analysis of structures and the design and detailing of structural members. All structural elements design shall be carried out primarily based on Indian Standards and Codes with latest revision, with amendments if any, as on date. In addition, other international codes and standards shall also be referred when required and relevant.

In the analysis, design and detailing of the building, the following Indian Standard codes of latest amendment will be used.

CODE	DESCRIPTION
IS 875(Part 1) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Unit weights of buildings materials and stored materials
IS 875 (Part 2) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Imposed Loads
IS 875 (Part 3) 2015	Code of practice for Design Loads (other than earthquake) for buildings and structures – Wind Loads
IS 875 (Part 5) 1987	Code of practice for Design Loads (other than earthquake) for buildings and structures – Special Loads and load combinations
IS 456 – 2000	Code of Practice for Plain and Reinforced Concrete
IS 1786 – 2008	Specification for High Strength Deformed bars and Wires for concrete reinforcement
IS 1343 – 2012	Code of Practice for Prestressed Concrete

IS 1893 – 2016	Criteria for earthquake resistant design of structures
IS 4326 – 1993	Code of practice for Earthquake Resistant Design and Construction of Buildings
IS 3370 – 2009	Code of Practice for Concrete structures for the storage of liquids
IS 1904-1995	Code of Practice for design and construction of Foundation
IS 1080 – 1997	Code of Practice for design and construction of shallow Foundation
IS 2950 - 1998	Code of Practice for design and construction of Raft Foundation
IS 800 – 2007	Code of practice for General Construction in steel
BS 8110: 1997	Plain and reinforced concrete-code of practice (British standard)
ACI 318	Plain and reinforced concrete-code of practice (American standard)
IS 13920: 2016	Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.
EN 1992-4 2013	Eurocode-2: Design of concrete structures. Part-4 Design of fastenings for use in concrete.
EN 1992-1 2004	Eurocode-2: Design of concrete structures. Part1: General rules and rules of building
SP 6(1)	Handbook on structural steel sections
SP24	Explanatory Handbook on Indian standard code of practice
SP34	Handbook on concrete reinforcement and detailing
IS 16700 - 2017	Criteria for Structural Safety of Tall Concrete Building



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c) **SELF-WEIGHT OF LIGHT WEIGHT WALLS (kN/m²)**

Infill walls (20mm for External wall & internal wall 15mm plastering on either side)

150mm thick Porothom wall : 2.5kN/m

Water Tank : Water height x 10

d) **Material Density**

Unit weight of materials are as per IS: 875 (Part-I) 1987.

Unit weight of concrete - 25 KN / Cum

Unit weight of steel - 78.5 KN / Cum.

Screed concrete - 24 KN / Cum.

Unit weight of dry soil - 18 KN / Cum.

Unit weight of saturated soil - 20 KN / Cum.

e) **WINDS LOADS**

The wind pressure shall be calculated based on the basic wind speed and other provisions laid in IS 875 Part (3) - 2015

Design Wind speed

$$V_z = V_b \times k_1 \times k_2 \times k_3 \times k_4$$

$V_b \rightarrow$ Basic Wind velocity for Chennai = 50m/s

$k_1 \rightarrow$ Risk coefficient for all general buildings = 1.00

$k_2 \rightarrow$ Terrain category 2 = 1.10

$k_3 \rightarrow$ Topography factor = 1.00

$k_4 \rightarrow$ Importance Factor for cyclonic Region = 1.00



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3.0 DESIGN OF LOADINGS

SUPERIMPOSED DEAD LOADS AND LIVE LOADS

The following are the imposed loads such as SDL and LL to be considered for the design of floor system depending on usage floor. In addition to these loads, self-weight of structural elements will be considered depending on member sizes shown in the floor plans.

a) **LIVE LOAD (kN/m^2)**

Car park	3.0
Baths and Toilets	2.0
Kitchen and Utility	2.0
Living, Dining and other room	2.0
Lobby/Corridor/Staircase/ Balconies	3.0
Meter room, Electrical room, Pump room	7.50
Terrace	3.0


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Permissible reduction in imposed load on each floor is considered for design of columns and footings as per IS 875 Part (2), Along with IS 1893: 2016.

b) **SUPER IMPOSED DEAD LOADS (kN/m^2)**

Super imposed Loads:

Living, Dining, Bedrooms and Corridors (50mm Floor Finish)	1.2 kN/m^2
Kitchen (75 mm Floor Finish)	1.8 kN/m^2
Staircase	3.6 kN/m^2
Plant / Mechanical / Electrical Rooms (100 mm Floor Finish)	2.4 kN/m^2
Toilets & Balcony (50 mm Floor Finish + 100 mm Sunk filling)	3.6 kN/m^2
Car Parking (75mm Floor Finish)	1.8 kN/m^2
Terrace (Avg 150 mm Screed)	3.6 kN/m^2

*Sunken Filling Density Considered: 15kN/Cum

Based on the above,

$$\text{Max. design wind speed (V}_z\text{)} = (V_b \times k_1 \times k_2 \times k_3 \times k_4) = 42.90 \text{ m/s}$$

K _a	Area Averaging Factor	0.8
K _d	Wind Directionality Factor	0.9
K _c	Combination Factor	0.9

f) SEISMIC LATERAL FORCE

Design of lateral force under seismic condition shall be as per IS1893 – 2016. Total lateral force (base shear) of the building shall be estimated as per clause 7.2.1 of IS1893 – 2016 which provides by

$$\text{Base shear } V_b = A_h W$$

A_h is horizontal seismic coefficient and W is seismic weight of the building, Horizontal seismic coefficient depends on location of the building (Zone factor Z), usage of the building (Importance factor, I), building lateral resisting system (Response reduction factor, R) and design acceleration coefficient (S_a / g) which is based on subsoil condition and fundamental natural period (T_a).

For the proposed development is for Residential use. Considering it, the seismic weight is summation of total dead load and 25% of live load.

- 1) The building with ductile RC structural wall system.
- 2) As per IS 1893:2016 code, Chennai lies in Zone III with Zone factor Z = 0.16
- 3) The Design Base Shear is given by $V_b = A_h \times W$, Where $A_h = Z / 2 \times I / R \times S_a / g$

I = Importance Factor = 1.2

Soil Type 2 (Medium or Stiff soils)

R (Response reduction factor) = 4.0

S_a/g = Average Response acceleration coefficient

For the building height with reference to IS: 1893-2016, since the buildings are not well connected with basement walls so for the time period calculation the heights are considered Ground to roof that is 42.95 m for Block 1 and 2.

The fundamental natural period (T_a) for building,

For X and Y direction the time period is calculated


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7.6.2 The approximate fundamental translational natural period T_s of oscillation, in second, shall be estimated by the following expressions:

- a) Bare MRF buildings (without any masonry infills):

$$T_s = \begin{cases} 0.075h^{0.75} & \text{(for RC MRF building)} \\ 0.080h^{0.75} & \text{(for RC-Steel Composite MRF building)} \\ 0.085h^{0.75} & \text{(for steel MRF building)} \end{cases}$$

- b) Buildings with RC structural walls:

$$T_s = \frac{0.075h^{0.75}}{\sqrt{A_w}}$$

where A_w is total effective area (m^2) of walls in the first storey of the building given by:

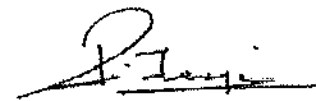
$$A_w = \sum_{i=1}^{N_w} \left[A_{wi} \left\{ 0.2 + \left(\frac{L_{wi}}{h} \right)^2 \right\} \right]$$

- c) All other buildings:

$$T_s = \frac{0.09h}{\sqrt{d}}$$

H = 42.95m (Ground to Roof)

Sl. NO	TOWER	Dimensi on in X Dir (m)	Dimen sion in Y Dir (m)	Time Period in X Dir (Sec)	Time Period in Y Dir (Sec)
1	Block- A	41.3	19.86	1.579	1.421
2	Block - B (part 1 & 2)	36.94	71.53	1.617 & 1.255	1.406 & 1.401
3	Block - C (part 1 & 2)	50.52	74.63	1.272 & 1.377	1.617 & 1.4



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4.1 LOAD COMBINATIONS

The various loads combinations used for design in accordance with IS 1893-2016 are as follows

1. $1.5 (DL + LL)$
2. $1.2 (DL + LL + SPECX + 0.3SPECY + 0.3SPECZ)$
3. $1.2 (DL + LL + SPECY + 0.3SPECX + 0.3SPECZ)$
4. $1.2 (DL + LL + SPECZ + 0.3SPECX + 0.3SPECY)$
5. $1.2 (DL + LL \pm WindX)$
6. $1.2 (DL + LL \pm WindY)$
7. $1.5 (DL + SPECX + 0.3SPECY + 0.3SPECZ)$
8. $1.5 (DL + SPECY + 0.3SPECX + 0.3SPECZ)$
9. $1.5 (DL + SPECZ + 0.3SPECX + 0.3SPECY)$
10. $1.5 (DL \pm WindX)$
11. $1.5 (DL \pm WindY)$
12. $0.9DL + 1.5(SPECX + 0.3SPECY + 0.3SPECZ)$
13. $0.9DL + 1.5(SPECY + 0.3SPECX + 0.3SPECZ)$
14. $0.9DL + 1.5(SPECZ + 0.3SPECX + 0.3SPECY)$
15. $0.9DL \pm 1.5WindX$
16. $0.9DL \pm 1.5WindY$

Where accidental / fire tender load case is applicable, the following load combination is considered

$$1.50 DL + 1.05 AL + 1.50 LL$$

The various service loads combinations of structure as per IS 456 are as follows

17. $1.0DL + 1.0 LL$
18. $1.0DL + 1.0SPECX$
19. $1.0DL + 1.0SPECY$
20. $1.0DL \pm 1.0WindX$
21. $1.0DL \pm 1.0WindY$
22. $1.0DL \pm 1.0TEMP$
23. $1.0DL + 0.8LL + 0.8SPECX$
24. $1.0DL + 0.8LL + 0.8SPECY$
25. $1.0DL + 0.8LL \pm 0.8WindX$
26. $1.0DL + 0.8LL \pm 0.8WindY$



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i) MATERIAL GRADES

CONCRETE ELEMENT	GRADE
Retaining Walls	M30
Water Tank, STP, UG Sump	M30
RCC Slab	M30
RCC Beams	M30
RCC Shear walls and Columns (up to 5 th floor)	M40
RCC Shear walls and Columns (above 5 th floor)	M35
Pile and Pile Cap	M30
Staircase	M30

on behalf of CMDR M&B Panel, the detailed structural design calculations are generally reviewed and in order.

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Planning and Designs Circle,
Chepauk, Chennai-5.

ii) REINFORCEMENT

Reinforcement bars of grade Fe550D conform to IS 1786-2008.

5.0 COVER AND FIRE RATING

Fire rating considered - 2hrs.

Exposure condition - Moderate

Cover to reinforcement considered for various elements.

Pile and Pilecap	75 mm
Columns	40 mm
Shear Wall	30 mm
Beams (simply supported)	40 mm.
Beams (continuous)	30 mm
Slabs (simply supported)	35 mm
Slabs (continuous)	25 mm

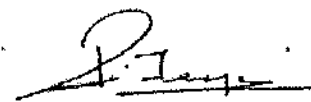
6.0 STRUCTURAL SYSTEM

SUPER STRUCTURE

The structural system for the super structure is a conventional beam and slab system resting on columns and walls. The slab thickness considered for the design are

125mm/150mm/175mm/250mm.

Structural walls are considered as the main lateral load resisting element.

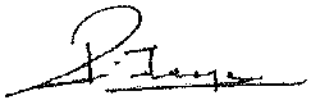


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7.0 DEFLECTION CRITERIA

7.1 Lateral Deflection (Wind)

Overall Deflection	<	Height/500
Storey Deflection	<	Storey height/500


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7.2 Lateral Deflection (Seismic)

Overall Drift	<	H / 250
Storey Drift	<	0.004 times storey height

7.3 Vertical Deflection of Beams and Slabs due to Gravity Loads

Total Deflection (DL + LL)	<	Span/250
Deflection including the effects of Temperature, Creep and Shrinkage Occurring after erection of partitions and the application of finishes	<	Span/350 or 20mm whichever is less

8.0 STRUCTURAL ANALYSIS

Computer-aided analysis using finite element method (FEM) shall be carried out for the design of structural elements. For 3D or 2D structural frame analysis the latest version of software ETABS shall be used.

Prokon, RCDC and verified in-house spreadsheets will be used for the design of reinforced concrete (RC) and steel elements in consideration of flexure, shear, and axial forces.

9.0 FOUNDATION

Proposed Foundation system is Pile Foundation and the Capacity of 900mm dia pile is 2400kN. The founding depth is to be 32.5m from the Existing ground level with reference to the soil investigation report GT- 2374 from Geo Marine Consultants (P) Ltd.

10.0 COMPUTER PROGRAMS

The following Software / spreadsheet to be used to carry out Structural analysis and design.

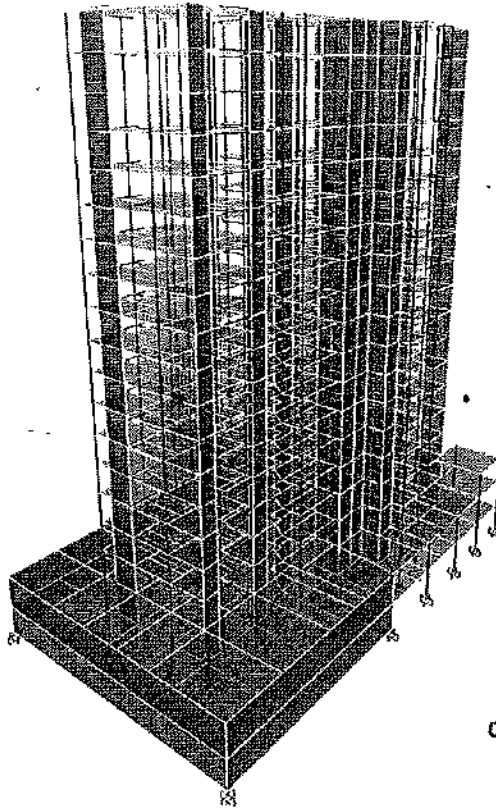
1. ETABS Ver 21.0.1 -Three-Dimensional Program, Wall design, Beam Design
2. SAFE Ver 20.0 - Combined Pile Footings.
3. In-House Spreadsheet - One way/ Two-way slab design
4. RCDC - Individual Pile Footings.

ETABS MODEL



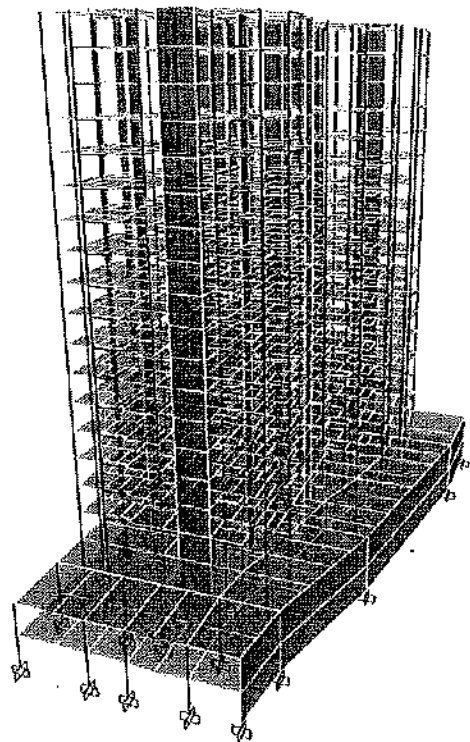
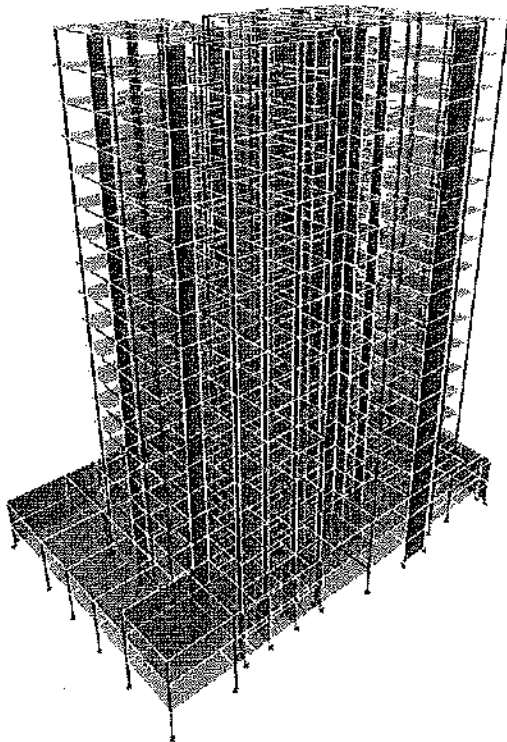
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BLOCK A

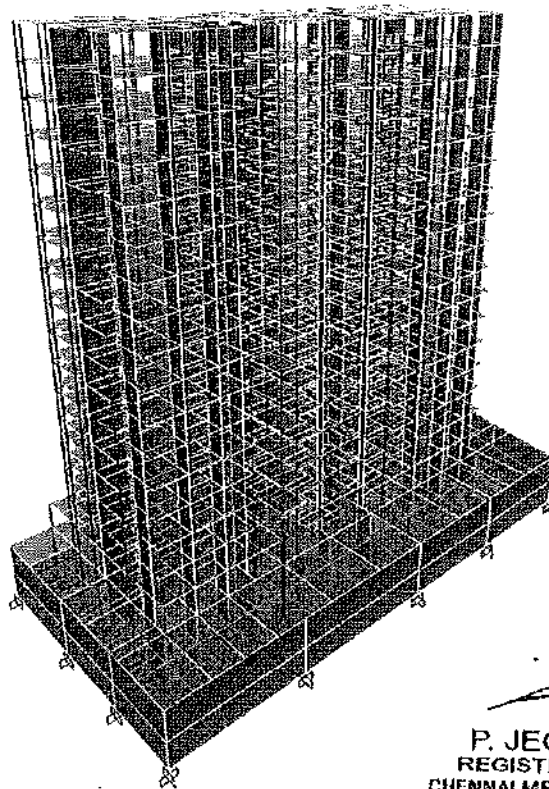
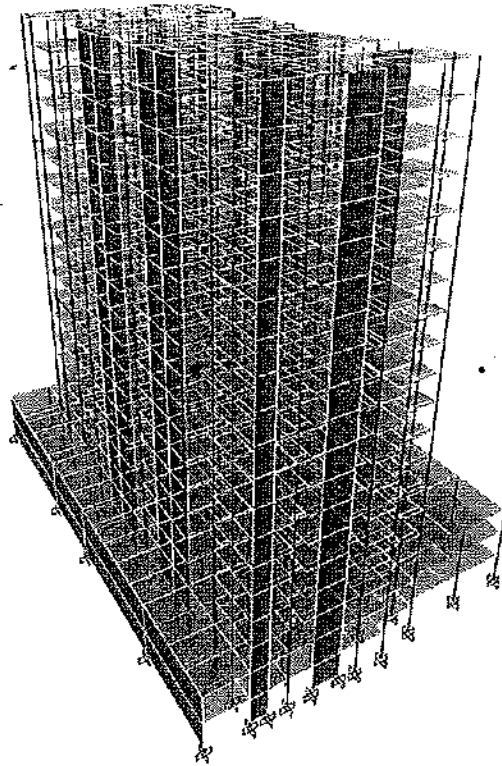


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BLOCK B (Part 1 & Part 2)



BLOCK C (Part 1 & Part 2)



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1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

Tower	Name	Height in	Master Story	Similar To	Splice Story	Color
T1	TERRACE	3.18	No	2nd floor	No	Magenta
T1	16th floor	3.18	No	2nd floor	No	Magenta
T1	15th floor	3.18	No	2nd floor	No	Magenta
T1	14th floor	3.18	No	2nd floor	No	Magenta
T1	13th floor	3.18	No	2nd floor	No	Magenta
T1	12th floor	3.18	No	2nd floor	No	Magenta
T1	11th floor	3.18	No	2nd floor	No	Magenta
T1	10th floor	3.18	No	2nd floor	No	Magenta
T1	9th floor	3.18	No	2nd floor	No	Magenta
T1	8th floor	3.18	No	2nd floor	No	Magenta
T1	7th floor	3.18	No	2nd floor	No	Magenta
T1	6th floor	3.18	No	2nd floor	No	Magenta
T1	5th floor	3.18	No	2nd floor	No	Magenta
T1	4th floor	3.18	No	2nd floor	No	Magenta
T1	3rd floor	3.18	No	2nd floor	No	Magenta
T1	2nd floor	3.18	Yes	None	No	Yellow
T1	1st floor	3.12	No	None	No	Gray8Dark
T1	STILT	3.6	No	BASEMENT 1	No	Blue
T1	BASEMENT 1	3.2	Yes	None	No	Green

2 Loads

This chapter provides loading information as applied to the model.

2.1 Load Patterns

Table 2.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	Yes	Other	0	
~SPEC WYECC	Yes	Other	0	
~SPEC WYECC	Yes	Other	0	
~SPEC WZECC	Yes	Other	0	
~SPEC-XECC	Yes	Other	0	
~SPEC-YECC	Yes	Other	0	
~SPEC-ZECC	Yes	Other	0	
Dead	No	Dead	1	
EQX	No	Seismic	0	IS 1893:2016
EQY	No	Seismic	0	IS 1893:2016
Live<3	No	Reducible Live	0	
Live>3	No	Reducible Live	0	
SDL	No	Super Dead	0	
WALL	No	Super Dead	0	
WX	No	Wind	0	User Loads
WY	No	Wind	0	User Loads


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2.2 Auto Seismic Loading

IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQX according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = X

Structural Period

Period Calculation Method = User Specified

User Period

T = 1.377sec

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3]

Z = 0.16

Response Reduction Factor, R [IS Table 9]

R = 4

Importance Factor, I [IS Table 8]

I = 1.2

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, S_a [IS 6.4.2]

$$\frac{S_a}{g} = \frac{1.36}{T}$$

$\frac{S_a}{g} = 0.987654$

Equivalent Lateral Forces

Seismic Coefficient, A_h [IS 6.4.2]

$$A_h = \frac{Z I \frac{S_a}{g}}{2R}$$

Calculated Base Shear

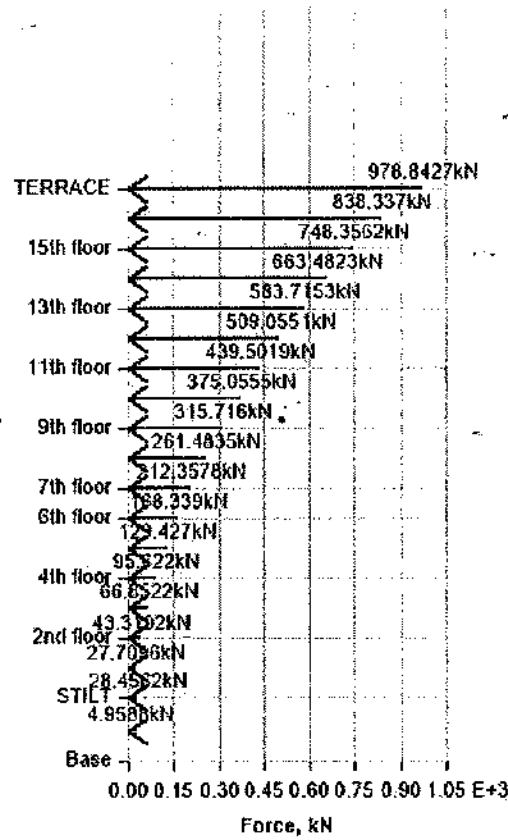
Direction	Period Used (sec)	W (kN)	V _b (kN)
X	1.377	273821.6464	6490.5872



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Applied Story Forces

Lateral Load to Stories - X



Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
TERRACE	60.8	978.8427	0
16th floor	57.62	838.337	0
15th floor	54.44	748.3562	0
14th floor	51.26	663.4823	0
13th floor	48.08	583.7153	0
12th floor	44.9	509.0551	0
11th floor	41.72	439.5019	0
10th floor	38.54	375.0555	0
9th floor	35.36	315.716	0
8th floor	32.18	261.4835	0
7th floor	29	212.3578	0
6th floor	25.82	168.339	0
5th floor	22.64	129.427	0
4th floor	19.46	95.622	0
3rd floor	16.28	66.8522	0
2nd floor	13.1	43.3192	0
1st floor	9.92	27.7086	0
STILT	6.8	28.4562	0
BASEMENT 1	3.2	4.9588	0
Base	0	0	0


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IS 1893:2016 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern EQY according to IS 1893:2016, as calculated by ETABS.

Direction and Eccentricity

Direction = Y

Structural Period

Period Calculation Method = User Specified

User Period

$T = 1.4 \text{ sec}$

Factors and Coefficients

Seismic Zone Factor, Z [IS Table 3]

$Z = 0.16$

Response Reduction Factor, R [IS Table 9]

$R = 4$

Importance Factor, I [IS Table 8]

$I = 1.2$

Site Type [IS Table 1] = II

Seismic Response

Spectral Acceleration Coefficient, $\frac{S_a}{g}$ [IS 6.4.2]

$$\frac{S_a}{g} = \frac{1.36}{T}$$

$$\frac{S_a}{g} = 0.971429$$

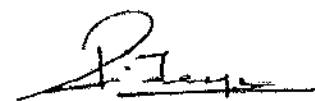
Equivalent Lateral Forces

Seismic Coefficient, A_h [IS 6.4.2]

$$A_h = \frac{Z I \frac{S_a}{g}}{2R}$$

Calculated Base Shear

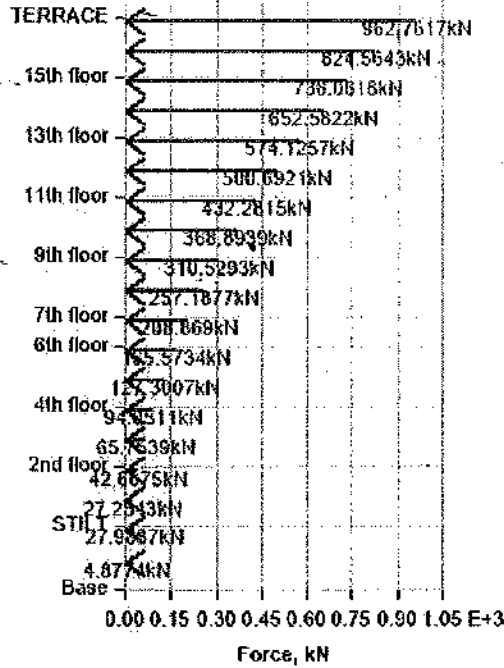
Direction	Period Used (sec)	W (kN)	V_b (kN)
Y	1.4	273821.6464	6383.9561



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Applied Story Forces

Lateral Load to Stories - Y



Story	Elevation	X-Dir	Y-Dir
	m	kN	kN
TERRACE	60.8	0	962.7617
16th floor	57.62	0	824.5643
15th floor	54.44	0	736.0618
14th floor	51.26	0	652.5822
13th floor	48.08	0	574.1257
12th floor	44.9	0	500.6921
11th floor	41.72	0	432.2815
10th floor	38.54	0	368.8939
9th floor	35.36	0	310.5293
8th floor	32.18	0	257.1877
7th floor	29	0	208.869
6th floor	25.82	0	165.5734
5th floor	22.64	0	127.3007
4th floor	19.46	0	94.0511
3rd floor	16.28	0	65.7539
2nd floor	13.1	0	42.6075
1st floor	9.92	0	27.2543
STILT	6.8	0	27.9887
BASEMENT 1	3.2	0	4.8774
Base	0	0	0


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2.3 Functions

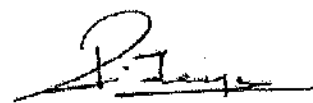
2.3.1 Response Spectrum Functions

Table 2.4 - Functions - Response Spectrum - IS1893 2016

Name	Period sec	Value	Seismic Zone	I	Soil Type	R	Damping Ratio
IS1893	0	0.024	III	1.2	II	4	0.05
IS1893	0.1	0.05					
IS1893	0.55	0.05					
IS1893	0.8	0.0408					
IS1893	1	0.03264					
IS1893	1.2	0.0272					
IS1893	1.4	0.023314					
IS1893	1.6	0.0204					
IS1893	1.8	0.018133					
IS1893	2	0.01632					
IS1893	2.5	0.013056					
IS1893	3	0.01088					
IS1893	3.5	0.009326					
IS1893	4	0.00816					
IS1893	4.5	0.00816					
IS1893	5	0.00816					
IS1893	5.5	0.00816					
IS1893	6	0.00816					
IS1893	6.5	0.00816					
IS1893	7	0.00816					
IS1893	7.5	0.00816					
IS1893	8	0.00816					
IS1893	8.5	0.00816					
IS1893	9	0.00816					
IS1893	9.5	0.00816					
IS1893	10	0.00816					

Table 2.5 - Functions - Response Spectrum - User Defined

Name	Period sec	Value	Damping Ratio
Z DIR	0	0.04	0.05
Z DIR	10	0.04	

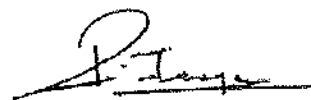


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2.4 Load Cases

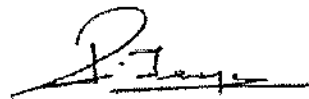
Table 2.6 - Load Case Definitions - Summary

Name	Type
Dead	Linear Static
Live	Linear Static
Modal	Modal - Ritz
SDL	Linear Static
WALL	Linear Static
EQX	Linear Static
EQY	Linear Static
WX	Linear Static
WY	Linear Static
SPEC-X	Response Spectrum
SPEC-Y	Response Spectrum
Live23	Linear Static
SPEC WX	Response Spectrum
SPEC WY	Response Spectrum
SPEC-Z	Response Spectrum
SPEC WZ	Response Spectrum



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FOUNDATION DESIGN



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Design Code : IS 456 : 2000 + IS 13920 : 2016
Pilecap No : PC53
Column No : C53 (600mm x 900mm)
Member Ref. No : C53

Concrete Grade : M30
Steel Grade : Fe550
Clear Cover : 50 mm
Top of pile-cap below ground : 3.1 m

Density of Soil = 18 kN/cum
Founding Depth = 4 m
Pile Capacity in Compression = 2400 kN
Pile Capacity in Tension = 800 kN
Pile Capacity Reduction = 0 %
Pile Overloading = 10 %
Pile Group Overloading = 10 %
Pile Capacity Increase for EQ = 25 %
Pile Capacity Increase for Wind = 25 %
Live Load Reduction = 50 %

Consider Capacity Design : No
Consider Overburden Pressure : No

No. of Piles = 2
Pile Diameter = 900 mm
Pilecap Offset = 150 mm
Pile Spacing = 2.5 x Ø
Pilecap Size = 3450 x 1200 mm
Pilecap Depth = 900 mm
Pile-cap Wt. = 93.15 kN


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For design, moments along shorter direction of pile cap has been ignored

Check for Maximum Compressive Load on One Pile:

Critical Load Combination : [10] : (Dead) +(SDL) +(WALL) +(Live) +(Live>3) +(WY)
Pcomb = 6259.16 kN
Ptotal = Pcomb + Pilecap Wt.
= 6352.31 kN
Mx = -46.94 kNm

My	=	-66.64	kNm
P	=	Ptotal/ No. of Piles	
	=	3176.16	kN
Pmx	=	20.861	kN
Pmy	=	0	kN

Maximum Compressive load on pile	=	3197.02	kN
Allowable Compressive load on pile	=	2400 x 1.25 x 1.1	
	=	3300	kN

Check for Maximum Compressive Load on Pile Group:

Critical Load Combination	:	[1] : (Dead) +(SDL) +(WALL) +(Live) +(Live>3)	
Pcomb	=	4329.99	kN
Ptotal	=	Pcomb + Pilecap Wt.	
	=	4423.14	kN
Mx	=	0.97	kNm
My	=	-105.77	kNm

Maximum Compressive load on pile group	=	4423.14	kN
Allowable Compressive load on pile group	=	2 x 2400 x 1.1	
	=	5280	kN

Check for Tensile Load on One Pile:

No Tensile load in pile group.

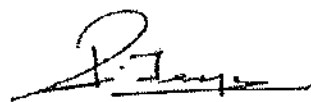
Check for Maximum Tensile Load on Pile Group:

No Tensile load in pile group.

Design for Bending:

Bottom Reinforcement Along Column-D

Critical Load Combination	:	[31] : 1.5 (Dead) +1.5 (SDL) +1.5 (WALL) +1.5 (WY)	
Pcomb	=	8695.84	kN
Ptotal	=	Pcomb + Pilecap Wt.	
	=	8835.565	kN
Mx	=	-72.76	kNm
My	=	-58.11	kNm
Ppile	=	Max Load on pile	
	=	4450.12	kN


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Deff	=	840	mm
Beff	=	1200	mm
DfCol	=	0.68	m
BMux	=	Ppile x DfCol	
	=	3003.83	kNm
PtReq	=	0.89	%
AstReq (BM)	=	7443	sqmm/m
AstPrv	=	T32 @ 105 C/C	
	=	7659.52	sqmm/m

Top Reinforcement Along Column-D

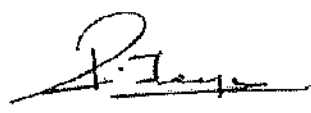
There is no Tensile Force, hence Minimum Percentage of steel will be provided.

D	=	900	mm
AstReq (BM)	=	Min Pt for Top Reinforcement x D x 1000/100	
	=	0.06 x 900 x 1000/100	
	=	540	sqmm/m
AstPrv	=	T10 @ 145 C/C	
	=	541.66	sqmm/m

Bottom Reinforcement Along Column-B

There is no Compressive Force, hence Minimum Percentage of steel will be provided.

D	=	900	mm
AstReq (BM)	=	Min Pt for Bottom Reinforcement x D x 1000/100	
	=	0.2 x 900 x 1000/100	
	=	1800	sqmm/m
AstPrv	=	T16 @ 110 C/C	
	=	1827.82	sqmm/m


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Top Reinforcement Along Column-B

There is no Tensile Force, hence Minimum Percentage of steel will be provided.

D	=	900	mm
AstReq (BM)	=	Min Pt for Top Reinforcement x D x 1000/100	
	=	0.06 x 900 x 1000/100	
	=	540	sqmm/m
AstPrv	=	T10 @ 145 C/C	
	=	541.66	sqmm/m

Design for One Way Shear:

Along Column-D (Compression Case)

Critical Load Combination	:	[31] : 1.5 (Dead) + 1.5 (SDL) + 1.5 (WALL) + 1.5 (WY)
Pcomb	=	8695.84 kN
Ptotal	=	Pcomb + Pilecap Wt.
	=	8835.56 kN
Mx	=	-72.76 kNm
My	=	-58.11 kNm
Ppile	=	Max Load on pile
	=	4450.123 kN

Location of critical section is at $d/2$ from face of column

Section Location from column center = 870 mm

Data for Piles

Pile No	Load (kN)	% covered	Shear (kN)
P1	4450.12	21.67	3485.93
P2	4385.44	21.67	3435.26

Design Shear Force (V_u) = Max. of (Shear due to P1, P2)
= 3485.93 kN

Deff = 840 mm

Beff = 1200 mm

$T_v = \frac{V_u}{(B_{eff} \times D_{eff})}$
= 3.46 N/sqmm

$T_c = 0.626$ N/sqmm

$A_v = 255$ mm

Shear enhancement factor = $2 \times D_{eff} / A_v$
= 6.59

Enhanced shear strength (T_{ce}) = 3.5 N/sqmm

$T_v < T_{ce}$, Hence Shear Reinforcement is not required


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Along Column-D (Tension Case)

All Load Combination having Compressive Force. Thus, One way Shear is not applicable for Tensile Force.

Along Column-B (Compression Case)

One way shear check do not applicable for 2 pile pile-cap design

Along Column-B (Tension Case)

One way shear check do not applicable for 2 pile pile-cap design

Design of Face Reinforcement:

$$\begin{aligned}\text{Asfr Req} &= \text{SFR \%} \times D \times \text{Beffsfr} \\ &= 0.05 \times 900 \times 500 / 100 \\ &= 225 \quad \text{sqmm} \\ \text{Asfr Prv} &= 3\text{-T10} \\ &= 236 \quad \text{sqmm}\end{aligned}$$

Check for Load Transfer from Column to PileCap

$$\begin{aligned}\text{Critical Analysis Load Combination} &= \\ \text{Critical Load Combination} &: [31] : 1.5 (\text{Dead}) + 1.5 (\text{SDL}) + 1.5 (\text{WALL}) + 1.5 (\text{WY}) \\ P &= 8695.84 \quad \text{kN} \\ A2 &= 0.54 \quad \text{sqm} \\ A1 &= 4.14 \quad \text{sqm} \\ \text{Base Area} &= 4.14 \quad \text{sqm} \\ A1 &< \text{Base Area} \\ \text{Modification Factor} &= \text{SquareRoot}(A1/A2) \leq 2 \\ \text{SquareRoot}(A1/A2) &= 2.77 \\ \text{Thus, Modification Factor} &= 2 \\ \text{Concrete Bearing Capacity} &= 0.45 \times F_{ck} \times \text{Modification Factor} \times \text{Column Area} \\ &= 14580 \quad \text{kN} \\ \text{Concrete Bearing Capacity} &> P, \text{ Hence Safe.}\end{aligned}$$


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WALL DESIGN



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ETABS Shear Wall Design

IS 456:2000 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (mm)	Centroid Y (mm)	Length (mm)	Thickness (mm)	LLRF
BASEMENT 1 TO ROOF	EHW8	57943.3	23332.4	3650	230	0.6

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

Γ_s	Γ_c	IP_{MAX}	IP_{MIN}	P_{MAX}	MinEcc Major	MinEcc Minor
1.15	1.5	0.04	0.0025	0.8	Yes	Yes

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 mm	Left Y_1 mm	Right X_2 mm	Right Y_2 mm	Length mm	Thickness mm
Top	Leg 1	56118.3	23332.4	59768.3	23332.4	3650	230
Bottom	Leg 1	56118.3	23332.4	59768.3	23332.4	3650	230

Flexural Design for P_u , M_{u2} and M_{u3}

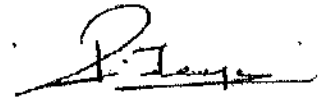
Station Location	Required Rebar Area (mm ²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kN	M_{u2} kN-m	M_{u3} kN-m	Pier A_g mm ²
Top	3966	0.0047	0.003	0.9DL+1.5SPEC WY	2676.2686	298.2542	1343.3477	839500
Bottom	3892	0.0046	0.003	0.9DL+1.5SPEC WY	2735.0137	297.5456	1310.2306	839500

Shear Design

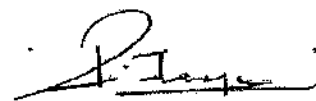
Station Location	ID	Rebar mm ² /m	Shear Combo	P_u kN	M_u kN-m	V_u kN	V_c kN	$V_c + V_s$ kN
Top	Leg 1	575	1.5DL+1.5SPEC WX	4669.4052	1982.471	-484.7602	356.0098	961.9098
Bottom	Leg 1	575	1.5DL+1.5SPEC WX	4768.3766	1896.2901	-484.7602	354.9277	960.8277

Boundary Element Check

Station Location	ID	Edge Length (mm)	Governing Combo	P_u kN	M_u kN-m	Stress Comp MPa	Stress Limit MPa
Top-Left	Leg 1	575	1.5DL+1.5SPEC WX	5405.1816	-1761.3913	9.89	7
Top-Right	Leg 1	575	1.5DL+1.5SPEC WZ	5517.6456	878.3165	8.29	7
Bottom-Left	Leg 1	575	1.5DL+1.5SPEC WZ	5620.6542	-705.5177	8.08	7
Bottom-Right	Leg 1	575	1.5DL+1.5SPEC WZ	5620.6542	810.2876	8.28	7


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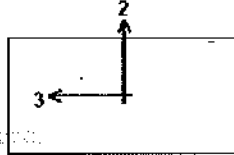
COLUMN DESIGN



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ETABS Concrete Frame Design

IS 456:2000 Column Section Design (Summary)



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Column Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
BASEMENT 1 TO ROOF	C46	1215	C 300X600 M35	1.5DL+1.5SPECX	0	3180	0.6	Ordinary Frame

Section Properties

b (mm)	h (mm)	dc (mm)	Cover (Torsion) (mm)
600	300	58	30

Material Properties

E_c (MPa)	f_{ck} (MPa)	Lt.Wt Factor (Unitless)	f_y (MPa)	f_{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γ_c	γ_s
1.5	1.15

Axial Force and Biaxial Moment Design For P_u , M_{u2} , M_{u3}

Design P_u kN	Design M_{u2} kN-m	Design M_{u3} kN-m	Minimum M_2 kN-m	Minimum M_3 kN-m	Rebar Area mm ²	Rebar % %
2092.0881	52.6369	-84.8677	52.6369	41.8418	1440	0.8

Axial Force and Biaxial Moment Factors

	K Factor Unitless	Length mm	Initial Moment kN-m	Additional Moment kN-m	Minimum Moment kN-m
Major Bend(M3)	1	2580	-33.9471	0	41.8418
Minor Bend(M2)	1	2580	10.6473	0	52.6369

Shear Design for V_{u2} , V_{u3}

	Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv} /s mm ² /m
Major, V_{u2}	50.829	108.4313	58.0792	0	665.06
Minor, V_{u3}	15.2344	114.6956	65.0396	0	332.53

Joint Shear Check/Design

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm ²	Shear Ratio Unitless
--	----------------------------	--------------------------	----------------------------	----------------------	----------------------------------	----------------------------

	Joint Shear Force kN	Shear V_{Top} kN	Shear $V_{u,Tot}$ kN	Shear V_c kN	Joint Area cm ²	Shear Ratio Unitless
Major Shear, V_{u2}	N/N	N/N	N/N	N/N	N/N	N/N
Minor Shear, V_{u3}	N/N	N/N	N/N	N/N	N/N	N/N

(1.4) Beam/Column Capacity Ratio

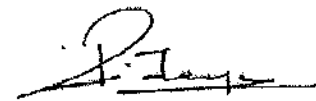
Major Ratio	Minor Ratio
N/N	N/N

Additional Moment Reduction Factor k (IS 39.7.1.1)

A_g cm ²	A_{sc} cm ²	P_{uz} kN	P_b kN	P_u kN	k Unitless
1800	14.4	3429	1107.5571	2092.0881	0.575897

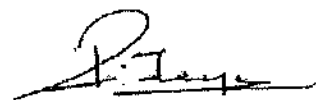
Additional Moment (IS 39.7.1)

	Consider M_a	Length Factor	Section Depth (mm)	KL/Depth Ratio	KL/Depth Limit	KL/Depth Exceeded	M_a Moment (kN-m)
Major Bending (M_1)	Yes	0.811	300	8.6	12	No	0
Minor Bending (M_2)	Yes	0.811	600	4.3	12	No	0



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BEAM DESIGN



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ETABS Concrete Frame Design

IS 456:2000 Beam Section Design (Summary)



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Beam Element Details

Level	Element	Unique Name	Section ID	Combo ID	Station Loc	Length (mm)	LLRF	Type
2nd floor	B139	1746	B 230X600	ENVELOPE	947.5	3790	1	Ordinary Frame

Section Properties

b (mm)	h (mm)	b _f (mm)	d _s (mm)	d _{ef} (mm)	d _{cb} (mm)
230	600	230	0	35	35

Material Properties

E _c (MPa)	f _{ck} (MPa)	Lt.Wt Factor (Unitless)	f _y (MPa)	f _{ys} (MPa)
29580.4	35	1	550	415

Design Code Parameters

γ _c	γ _s
1.5	1.15

Factored Forces and Moments

Factored M _{u3} kN-m	Factored T _u kN-m	Factored V _{u2} kN	Factored P _u kN
-2.4115	0.0054	3.7605	0

Design Moments, M_{u3} & M_t

Factored Moment kN-m	Factored M _t kN-m	Positive Moment kN-m	Negative Moment kN-m
-2.4115	0.0135	69.8457	-2.4251

Design Moment and Flexural Reinforcement for Moment, M_{u3} & T_u

	Design -Moment kN-m	Design +Moment kN-m	-Moment Rebar mm ²	+Moment Rebar mm ²	Minimum Rebar mm ²	Required Rebar mm ²
Top (+2 Axis)	-2.4251		201	0	9	201
Bottom (-2 Axis)		69.8457	267	267	0	201

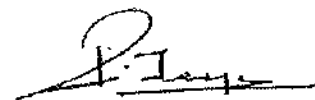
Shear Force and Reinforcement for Shear, V_{u2} & T_u

Shear V _e kN	Shear V _c kN	Shear V _s kN	Shear V _p kN	Rebar A _{sv} /s mm ² /m
----------------------------	----------------------------	----------------------------	----------------------------	--

Shear V_u kN	Shear V_c kN	Shear V_s kN	Shear V_p kN	Rebar A_{sv}/s mm ² /m
3.7605	43.4708	51.98	46.8512	254.94

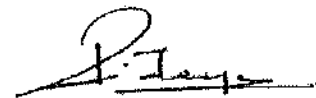
Torsion Force and Torsion Reinforcement for Torsion, T_u & V_{U2}

T_u kN-m	V_u kN	Core b_1 mm	Core d_1 mm	Rebar A_{sv1}/s mm ² /m
0.0046	3.7605	170	540	0



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SLAB DESIGN



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DESIGN OF SLAB : TS29

Panel Name : One longer edge discontinuous

Code : 6

Clear Longer span, $l_y = 3300$ mm

Clear Shorter span, $l_x = 3250$ mm

$l_y / l_x = 1.02 < 2$, Hence, Twoway slab.

Effective Longer span = 3396.00 mm

Effective Shorter span = 3346.00 mm

Assume thickness of slab = 125.00 mm

Effective depth available = 96.00 mm

Loads :

Dead Load and Imposed Load (fixed) :

Floor finish = 1.200 kN/m²

Self weight = 3.125 kN/m²

$w_{DL} = 4.325$ kN/m²

Imposed Load (Not fixed) :

Occupancy classification as per IS: 875(Part 2) - 1987 :

Live load = 2.000 kN/m²

$w_{LL} = 2.000$ kN/m²

Total load, $w = w_{DL} + w_{LL} = 6.325$ kN/m²

Span Moments:

Along Shorter span: $BM = \alpha_x w l_x^2 = 0.029 \times 6.33 \times 3.346^2 = 2.02$ kNm $M_{ux1} = 3.03$ kNm

Along Longer span: $BM = \alpha_y w l_x^2 = 0.028 \times 6.33 \times 3.346^2 = 1.98$ kNm $M_{uy1} = 2.97$ kNm

Support Moments:

Along Shorter span: $BM = \alpha_x w l_x^2 = 0.038 \times 6.33 \times 3.346^2 = 2.67$ kNm $M_{ux2} = 4.00$ kNm

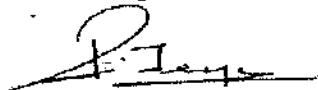
Along Longer span: $BM = \alpha_y w l_x^2 = 0.037 \times 6.33 \times 3.346^2 = 2.62$ kNm $M_{uy2} = 3.93$ kNm

Check for section :

Factored Max. BM, $M_u = 4.00$ kNm / m

For M30 grade concrete & Fe550 grade steel, $M_u, \text{lim} / bd^2 = 4.139$

Effective depth required = 31.11 mm < Effective depth available, OK


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Along the Shorter span

A_{st} reqd at midspan :

$$A_{st} = [0.5f_{ck}/f_y] \{1 - \sqrt{1 - [4.6 M_{ux1} / (f_{ck} b d^2)]}\} b d = 66.79 \text{ mm}^2 / \text{m}$$

Provide 8 mm dia bars @ 200 mm c/c $A_s = 251.33 \text{ mm}^2 / \text{m}$ OK

A_{st} reqd at support :

$$A_{st} = [0.5f_{ck}/f_y] \{1 - \sqrt{1 - [4.6 M_{ux2} / (f_{ck} b d^2)]}\} b d = 88.72 \text{ mm}^2 / \text{m}$$

Provide 8 mm dia bars @ 200 mm c/c $A_s = 251.33 \text{ mm}^2 / \text{m}$ OK

Along the Longer span

A_{st} reqd at midspan :

$$A_{st} = [0.5f_{ck}/f_y] \{1 - \sqrt{1 - [4.6 M_{uy1} / (f_{ck} b d^2)]}\} b d = 65.60 \text{ mm}^2 / \text{m}$$

Provide 8 mm dia bars @ 200 mm c/c $A_s = 251.33 \text{ mm}^2 / \text{m}$ OK

A_{st} reqd at support :

$$A_{st} = [0.5f_{ck}/f_y] \{1 - \sqrt{1 - [4.6 M_{uy2} / (f_{ck} b d^2)]}\} b d = 87.05 \text{ mm}^2 / \text{m}$$

Provide 8 mm dia bars @ 200 mm c/c $A_s = 251.33 \text{ mm}^2 / \text{m}$ OK

Min $A_{st} = 0.12\%$ Gross section area = $150 \text{ mm}^2 / \text{m}$

$$\text{Distribution steel} = 0.5 \times (0.12/100) \times 1000 \times 125 = 75.00 \text{ mm}^2 / \text{m}$$

Provide 8 mm dia bars @ 250 mm c/c $A_s = 201.06 \text{ mm}^2 / \text{m}$ OK

Max Spacing = $3d$ or 300 mm whichever is less = 288 mm or 300 mm

Check for deflection:

$$f_s = 0.58 \times f_y \times (A_{st} \text{ reqd} / A_{st} \text{ pro}) = 84.77 \text{ MPa}$$

$$MF = 1 / (0.225 + 0.00322 f_s - 0.625 \log_{10} (1/\text{pt})) \leq 2 = 2.000$$

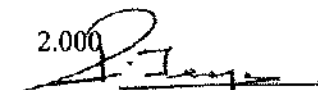
Type of Slab = Continuous

Effective Shorter span = 3346.00 mm

Basic Value = 40

Allowable $l/d = 64.00$

Actual $l/d = 34.85$ Hence OK


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PROJECT

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED RESIDENTIAL BUILDING
CONSISTING OF TWO BASEMENT FLOOR + STILT + SIXTEEN UPPER FLOORS AT
NERKUNDRAM, CHENNAI

CLIENT

M/s RAMANIYAM REAL ESTATES (P) LTD.,
RAMANIYAM CORPORATE OFFICE,
NO-1735, 2ND MAIN ROAD,
GANDHI NAGAR, ADYAR,
CHENNAI-6000 020.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2374



DATE	REVISION	DESCRIPTION		AUTHORISED SIGNATORY
10/10/2022	FIRST SUBMISSION	SUBMISSION OF GEOTECHNICAL REPORT	SIGN	
			DATE	10/10/2022
			DESIGNATION	MANAGING DIRECTOR
			NAME	DR. C.V.PRASAD

Rev

19/10/22

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ANNEXURE-I

	Estimation of safe load carrying capacity of vertical pile design
	Lateral Load Carrying Capacity of Bored Cast- Situ Piles
A1	Relationship Between Angle of Internal Friction & N-Value
A2	Relationship Between UCC & SPT -Value (N) of Saturated Clay

ANNEXURE-II

	LIQUEFACTION ANALYSIS AS PER IS 1893
	CONSOLIDATION TEST RESULTS

ANNEXURE-III

	MANUSCRIPT BORELOG – FIELD DATA
	SPLIT SPOON SAMPLES (SPT) PHOTOGRAPHS
	FIELD TEST PHOTOS

REPORT TEXT

INTRODUCTION

1.0 PROJECT INFORMATION MATRIX:

NATURE OF PROJECT	: PROPOSED RESIDENTIAL BUILDING
STRUCTURE	: 2 BASEMENT + STILT + 16 FLOORS
PROJECT OWNER	: M/s RAMANIYAM REAL ESTATES (P) LTD
PROJECT LOCATION	: NERKUNDRAM, CHENNAI
JOB CODE	: GT-2374

1.1 SCOPE OF WORK:

1.1.1 FIELD WORK:

- ❖ Conducting nine 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 12.0m, SPT is conducted at every 1.5m depth interval
 - From 12.0m to 20.0m SPT is conducted at every 2.0m depth interval
 - Beyond 20.0m SPT is conducted at every 2.5m depth interval till the termination depth.
 - Depth of investigation ranges from 30.0m to 33.0m 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

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 PREAMBLE:

Nine 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 2.9. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig. 2.13 to 2.21.

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 2.9. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig. 2.22 to 2.45.

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 - 2.10.

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 2.9.

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.2.10 to 2.12

SITE PLAN



SOIL PROFILES

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-01				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		1 OF 4				
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NK				
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N - E -		BORE START DATE		24/05/2022				
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite						BORE END DATE		25/05/2022				
												TOTAL DRILL DAYS		2				
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
1	24/05/2022	11	00	SC	-	-												Filled Up Brown Silty Sand With Brick Pats Mix
		To	11	05														
		11	20	SC	-	-												Brown, Moist, Silty CLAY (CL-ML) & Silty CLAY (CI) Clay of Low & Medium Plasticity
		To	11	25														
2			11	40	SC	-	-											
		To	11	44														
3			12	05	SC	-	-											
		To	12	09														
4			12	25	SC	-	-											
		To	12	09														
5		12	50	SC	-	-												
	To	12	54															
6		14	00	SC	-	-											Brown, Moist, Poorly Graded, Pred. Fine Grains @ Parts & Pred. Medium Grains @ Parts, Medium Dense & Dense, Poorly Graded SAND - Silty SAND (SP-SM) & Silty SAND (SM)	
	To	14	06															
7		14	25	SC	-	-												
	To	14	29															
8		14	55	SC	-	-											Brown, Grey, Moist, Poorly Graded, Pred. Medium Grains, Fine & Medium Grains, Medium Dense, Poorly Graded SAND - Silty SAND (SP-SM)	
	To	14	59															
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	24/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vineth	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-01										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 2 OF 4										
LOCATION		Block-1	MACHINE No.	HR-01	CHAINAGE (m)	-		DIA OF BORE HOLE 150mm ☒ NX										
STRUCTURE		2 Basement + Stilt + 16 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-	BORE START DATE 24/05/2022										
JOB CODE		GT-2374	FLUSHING MEDIUM	Bentonite	CO-ORDINATES	E	-	BORE END DATE 25/05/2022										
								TOTAL DRILL DAYS 2										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
11	24/05/2022	15	20	SC	-	-	19	13	8	21	10.50	9	SS	-10.5				Brown, Grey, Moist, Poorly Graded, Pred. Medium Grains, Fine & Medium Grains, Medium Dense, Poorly Graded SAND - Silty SAND (SP-SM) & Silty SAND (SM)
12		15	23				3	4	5	9	10.95V							
13		15	47	SC	-	-												
14		15	52				2	5	6	11	12.00	10	SS	-12.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clay of High Plasticity
15		16	30	SC	-	-												
16		16	33				1	3	4	7	12.45V							
17		17	05	SC	-	-												Black, Dark Grey, Moist, Medium Stiff, Silty CLAY (CI) Clay of Medium Plasticity
18		17	09															
19		17	37	SC	-	-	3	6	4	10	16.00	12	SS	-16.0				Black, Dark Grey, Moist, Medium Stiff, Silty CLAY (CI) Clay of Medium Plasticity
20		17	42															Shells Mix @ 20.0m Sample
21		17					4	6	8	14	16.45V							
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CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	24/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-01								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 3 OF 4								
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)								
STRUCTURE		2 Basement + 5th + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS								
DIA OF BORE HOLE		150mm		NX		BORE START DATE		24/05/2022								
BORE END DATE		25/05/2022		TOTAL DRILL DAYS		2										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC/TCB/DB)	Core Details		SPT Details			Sample Details			Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45								
21	09	20	SC	-	-	5	13	8	21	22.50	15	SS	-22.5	L7	22.5	Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) Clay of Medium Plasticity
22	09	30														
23	10	20	SC	-	-	13	23	27	50	25.00	16	SS	-25.0	L8	25.0	Grey, Moist, Poorly Graded, Fine to Coarse Sand With Gravels, Medium Dense, Clayey Silty SAND (SC) With Lenses of Fissile Clay
24																
25	11	25	SC	-	-	27	45	39	64	27.50	17	SS	-27.5	L9	27.5	Grey, Brown, Moist, Hard, Fissile Silty CLAY (CH)/ Soft Shale Texture Fissile Clay of High Plasticity
26																
27	12	20	SC	-	-	15cm Penet for 57Blows	>100	30.00	30.15	18	SS	-30.0	L10	30.0	Grey, Yellow Grey, Moist, Poorly Graded, Fine & Medium Grains Sands, Very Dense, Silty SAND (SM)	
28																12
29	Grey, Fine Grains Structure, Fissile Texture, Hard, Lithified SHALE Rock of Gondwana Formation															
30																

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	25/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2022	CASING DEPTH (m)	0.00	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-01								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		4 OF 4								
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Slit + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE								
										24/05/2022								
										BORE END DATE								
										25/05/2022								
										TOTAL DRILL DAYS								
										2								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
31	25/05/2022	14 05 To 14 35	DB	-	-													Grey, Fine Grains Structure, Fissile Texture, Hard, Lithified SHALE Rock of Gondwana Formation upto 31.0m Beyond 31.0m. Grey, Moist, Sub Fissile to Fissile Texture, Hard, Fissile CLAY/ Soft SHALE of Gondwana Formation
32		15 35 To 16 10	SC	-	-													
33						33	11cm Penet for 58Blows	>100	33.00 33.26	19	SS	-33.0			L11	33.3		
34																		
35																		
36																		
37																		
38																		
39																		
40																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	25/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	16/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 33 m depth below E.G.L.
FIG.2.1 Sub Soil Profile at BH-01 Location

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-02							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		2 OF 4							
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-							
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -							
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE							
										20/05/2022							
										BORE END DATE							
										23/05/2022							
										TOTAL DRILL DAYS							
										3							
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
11	21/05/2022	11:29 To 11:34	SC	-	-	3	11	16	27	10.50	9	SS	-10.5				Grey, Moist, Poorly Graded, Fine & Medium Grains Sand, Pred. Fine Grains Sand, Medium Dense, Poorly Graded SAND - Silty SAND (SP-SM) & Silty SAND (SM)
12		11:56 To 11:59	SC	-	-	3	6	9	15	12.00	10	SS	-12.0				
13		12:25 To 12:29	SC	-	-	-	-	-	-	12.45	-	SS	-12.0				
14		12:54 To 13:00	SC	-	-	4	7	7	14	14.00	11	SS	-14.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CL) With Sand Lenses & Silty CLAY (CH) Clay of Low & High Plasticity
15		14:00 To 14:10	SC	-	-	-	-	-	-	14.45	-	SS	-14.0				
16						-	-	-	-	16.00	-	UDS	-16.0				
17						3	3	5	8	18.00	12	SS	-18.0				Black, Moist, Stiff, Silty CLAY (CI) Lean Clay of Medium Plasticity
18						-	-	-	-	18.45	-	SS	-18.0				
19						4	8	12	20	20.00	13	SS	-20.0				Black, Moist, Very Stiff, Silty CLAY (CI) Lean Clay of Medium Plasticity
20						-	-	-	-	20.45	-	SS	-20.0				

CS - Core Sample		DS - Disturbed Sample		LOGGED		K. Sivasankaran		PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample		SC - Soil Cutter		DATE		21/05/2022		GROUND LEVEL (m)		0.00	
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		A. Vinoth		WATER TABLE (m)		4.30	
WS - Wash Sample		DB - Diamond Bit		DATE		17/06/2022		CASING DEPTH (m)		0.00	

*(F) - Sample Failed

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-02							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		3 OF 4							
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-							
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -							
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE							
										20/05/2022							
										BORE END DATE							
										23/05/2022							
										TOTAL DRILL DAYS							
										3							
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
21	10	40	SC	-	-	11	17	19	36	22.50	15	SS	-22.5	L7	22.5		Black, Moist, Very Stiff, Silty CLAY (Cl) Lean Clay of Medium Plasticity
22	10	49															
23	11	27	SC	-	-	13	19	25	44	25.00	16	SS	-25.0				Grey, Green Shades, Moist, Pred. Fine Grain Sand Mix, Dense, Clayey Silty SAND (SC)
24	11	55															
25	12	35	SC	-	-	27	10cm Penet for 60Blows	>100	27.50	27.75	17	SS	-27.5	L8	27.5		Brown Yellow, Moist, Poorly Graded, Fine & Medium Grains Sand, Very Dense, Silty SAND (SM)
26	12	49															
27	14	06	SC	-	-	47	5cm Penet for 55Blows	>100	30.00	30.20	18	SS	-30.0	L9	30.0		Grey, Moist, Fine Grain Structure, Fissile Texture, Fissile Silty CLAY (CH)
28	14	28															
29																	
30																	

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	23/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	17/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-02									
								SHEET		4 OF 4									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						DIA OF BORE HOLE		150mm									
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-									
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -									
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		TOTAL DRILL DAYS									
BORE END DATE		23/05/2022		BORE START DATE		20/05/2022													
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data						
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description		
		Hr.				Min.	0-15	15-30										30-45	
31	23/05/2022	15	15	SC	-	-	21	45	18	63	33.00	19	SS	-33.0					Grey, Moist, Fine Grain Structure, Fissile Texture, Fissile Silty CLAY (CH) Partly Lithified SHALE Rock & Beyond 30.5m/31.0m Soft SHALE Gondwana Formation
32		15	45																
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40																			

CS - Core Sample		DS - Disturbed Sample		LOGGED		K. Sivasankaran		PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample		SC - Soil Cutter		DATE		23/05/2022		GROUND LEVEL (m)		0.00	
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		A. Vinoth		WATER TABLE (m)		4.30	
WS - Wash Sample		DB - Diamond Bit		DATE		17/06/2022		CASING DEPTH (m)		0.00	

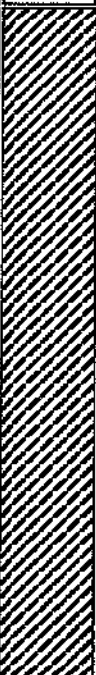
Borehole terminated at 33 m depth below E.G.L.
FIG.2.2 Sub Soil Profile at BH-02 Location

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-03			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		1 OF 4			
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NX			
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N E		BORE START DATE		19/05/2022			
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite						BORE END DATE		19/05/2022			
												TOTAL DRILL DAYS		2			
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
1	11	00	SC	-	-	7	11	13	24	1.00	1	SS	-1.0				Brown, Moist, Very Stiff to Hard, Silty CLAY (CL) & Silty CLAY (CH) Clay of Low & High Plasticity @ 1.0m Sand & Pred. Silt Mixture
	11	02															
	11	10	SC	-	-	8	13	18	31	2.00	2	SS	-2.0				
	11	12															
2	11	21	SC	-	-	9	15	18	33	3.00	3	SS	-3.0				Brown, Moist, Very Stiff to Hard, Silty CLAY (CL) & Silty CLAY (CH) Clay of Low & High Plasticity @ 1.0m Sand & Pred. Silt Mixture
	11	30															
	11	42	SC	-	-	2	11	11	22	4.00	4	SS	-4.0				
	11	50															
3	12	04	SC	-	-	16	27	23	50	5.00	5	SS	-5.0				Brown, Moist, Poorly Graded, Fine & Medium Grains Sand, Dense, Silty SAND (SM) & Poorly Graded SAND - Silty SAND (SP-SM)
	12	06															
	12	18	SC	-	-	22	20	20	40	6.00	6	SS	-6.0				
	12	20															
4	12	31	SC	-	-	10	16	16	32	7.50	7	SS	-7.5				Brown, Moist, Poorly Graded, Fine & Medium Grains Sand, Dense, Silty SAND (SM) & Poorly Graded SAND - Silty SAND (SP-SM)
	12	34															
	12	48	SC	-	-	19	18	12	30	9.00	8	SS	-9.0				
	12	50															
5	14	05	SC	-	-					9.45							
6	14	08															

CS - Core Sample	DS - Disturbed Sample	LOGGED	O.Venugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	18/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.60	

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-03								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		2 OF 4								
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE								
										18/05/2022								
										BORE END DATE								
										19/05/2022								
										TOTAL DRILL DAYS								
										2								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
11	18/05/2022	14	20	SC	-	-	3	2	2	4	10.50	9	SS	-10.5		L2	10.5	Brown, Moist, Poorly Graded, Fine & Medium Grains Sand, Dense, Silty SAND (SM) & Silty SAND (SP-SM)
12		14	24								10.95							Black, Dark Grey, Moist, Very Soft, Silty CLAY With Lenses of SAND (CI) Clay of Medium Plasticity
13		14	36	SC	-	-	3	6	10	16	12.00	10	SS	-12.0		L3	12.0	
14		14	40								12.45							
15		14	54	SC	-	-	2	6	8	14	14.00	11	SS	-14.0				Black, Dark Grey, Moist, Stiff to Very Stiff, Silty CLAY (CH) Clay of High Plasticity
16		14	00								14.45							
17		15	15	SC	-	-	2	5	5	10	16.00	12	SS	-16.0		L4	16.0	Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clay of High Plasticity
18		15	20								16.45							
19		15	38	SC	-	-	5	8	9	17	18.00	13	SS	-18.0		L5	18.0	Black, Moist, Very Stiff, Silty CLAY (CH) With Shells Mix Clay of High Plasticity
20		15	46								18.45							
							9	13	19	32	20.00	14	SS	-20.0		L6	20.0	Green, Brown Shades, Moist, Hard, Silty CLAY (CH) With Sand Mix at Times
											20.45							

CS - Core Sample	DS - Disturbed Sample	LOGGED	D.Venugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	18/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD										BORE HOLE No. BH-03						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET 3 OF 4						
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE 150mm ☒ NX						
STRUCTURE		2 Basement + Stilt + 18 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE 18/05/2022						
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		-		BORE END DATE 19/05/2022						
TOTAL DRILL DAYS		2																
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
21	18/05/2022	Total drilling time 0hr 20mins		SC	-	-	15	27	29	56	22.50	15	SS	-22.5		L7	25.0	Green, Brown Shades, Moist, Hard, Silty CLAY (CH) With Sand Mix at Times Clay of High Plasticity
22											22.95							
23		Total drilling time 0hr 28mins		SC	-	-	19	20	20	40	25.00	16	SS	-25.0		L8	27.5	Yellow, Grey & Brown Shades, Moist, Poorly Graded, Fine & Medium Grains Sand, Dense, Clayey Silty SAND (SC)
24											25.45							
25	19/05/2022	Total drilling time 0hr 20mins		SC	-	-	45	10cm Penet for 50Blows		>100	27.50	17	SS	-27.5		L9	30.0	Yellow, Grey & Brown Shades, Moist, Poorly Graded, Fine & Medium Grains Sand With Traces of Coarse Sand, Very Dense, Clayey Silty SAND (SC)
26											27.75							
27		Total drilling time 0hr 50mins		SC	-	-	40	10cm Penet for 50Blows		>100	30.00	18	SS	-30.0		L9	30.0	Brown, Moist, Fine Grains Structure, Fissile Texture, Hard, Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana
28											30.25							
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	D.Venugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-03								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		4 OF 4								
LOCATION		Block-1		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -								
										BORE START DATE								
										18/05/2022								
										BORE END DATE								
										19/05/2022								
										TOTAL DRILL DAYS								
										2								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data						
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
31	19/05/2022		SC	-	-	45	8cm Penet for 50Blows	>100	33.00 33.23 ↓	19	SS	-33.0						Brown, Moist, Fine Grains Structure, Fissile Texture, Hard, Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana Formation Lithified Shale Rock @ Locations
32		14 05 14 50																
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	D.Venugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonra]	WATER TABLE (m)	4.30	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 33 m depth below E.G.L
FIG.2.3 Sub Soil Profile at BH-03 Location

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-04									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		1 OF 4									
LOCATION		Block-2		MACHINE No.		HR-01		CHAINAGE (m)		-									
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -									
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -									
										BORE START DATE									
										12/05/2022									
										BORE END DATE									
										14/05/2022									
										TOTAL DRILL DAYS									
										3									
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data						
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description		
		Hr.				Min.	0-15	15-30										30-45	
1	12/05/2022	10	50	SC	-	-													
		To	54																
2		11	08	SC	-	-	4	8	11	19	1.00	1	SS	-1.0					
		To	12								1.45	2	SS	-2.0					
3		11	25	SC	-	-	4	6	8	14	2.00	2	SS	-2.0					
		To	28								2.45	3	SS	-3.0					
4		11	51	SC	-	-	8	8	9	17	3.00	3	SS	-3.0					
		To	53								3.45	4	SS	-4.0					
5		12	15	SC	-	-	4	5	5	10	4.00	4	SS	-4.0		L1	4.0		
		To	17								4.45	5	SS	-5.0		L2	5.0		
6		16	00	SC	-	-	8	16	18	34	5.00	5	SS	-5.0					
		To	02								5.45	6	SS	-6.0					
7		16	15	SC	-	-	16	18	20	38	6.00	6	SS	-6.0					
		To	17								6.45	7	SS	-7.5					
8		16	32	SC	-	-	12	14	16	30	7.50	7	SS	-7.5					
		To	34								7.95	8	SS	-9.0					
9		16	51	SC	-	-	3	4	5	9	9.00	8	SS	-9.0		L3	9.0		
		To	55								9.45								
10		16	55	SC	-	-													

CS - Core Sample		DS - Disturbed Sample		LOGGED		D.Venugopal		PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample		SC - Soil Cutter		DATE		12/05/2022		GROUND LEVEL (m)		0.00	
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		S.Tysonraj		WATER TABLE (m)		4.00	
WS - Wash Sample		DB - Diamond Bit		DATE		22/06/2022		CASING DEPTH (m)		0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-04								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		2 OF 4								
LOCATION		Block-2		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE								
										12/05/2022								
										BORE END DATE								
										14/05/2022								
										TOTAL DRILL DAYS								
										3								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
11	12/05/2022	17:10 To 17:14	SC	-	-	3	4	5	9	10.50	9	SS	-10.5					
12						3	5	6	11	12.00	10	SS	-12.0					
13		08:55 To 09:00	SC	-	-													
14						2	5	5	10	14.00	11	SS	-14.0					
15		09:25 To 09:30	SC	-	-													
16	13/05/2022	10:00 To 10:06	SC	-	-	2	4	5	9	16.00	12	SS	-16.0					
17																		
18						2	5	8	13	18.00	13	SS	-18.0					
19		10:45 To 10:51	SC	-	-													
20						9	13	21	34	20.00	14	SS	-20.0		L4	20.0		
										20.45								
Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) & Silty CLAY (CI) Clay of Medium & High Plasticity @ 18.0m Shells Mixture																		
Green, Moist, Hard, Silty CLAY (CH) With Sand Mix Clay of High Plasticity																		
CS - Core Sample		DS - Disturbed Sample		LOGGED		D.Venugopal		PROJECT SITE DETAILS				REMARKS						
SS - Split Spoon Sample		SC - Soil Cutter		DATE		13/05/2022		GROUND LEVEL (m)				0.00						
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		S.Tysonraj		WATER TABLE (m)				4.00						
WS - Wash Sample		DB - Diamond Bit		DATE		22/06/2022		CASING DEPTH (m)				0.00						

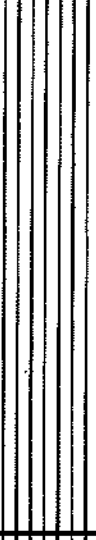
		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-04				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		3 OF 4				
LOCATION		Block-2		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NX				
STRUCTURE		2 Basement + Silt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		12/05/2022				
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -		BORE END DATE		14/05/2022				
												TOTAL DRILL DAYS		3				
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
		Hr.	Min.				0-15	15-30	30-45									
21	13/05/2022	11	35	SC	-	-	18	20	35	55	22.50	15	SS	-22.5	L5	22.5	Green, Moist, Hard, Silty CLAY (CH) With Sand Mix Clay of High Plasticity	
22		To	11															50
23																		
24		Total drilling time 0hr 15mins		SC	-	-												Grey, Yellow Shades at Times, Hard, Silty CLAY (CH) & Silty CLAY (CI) With Sand Mix Clay of Medium & High Plasticity
25							26	35	35	70	25.00	16	SS	-25.0				
26	15	15	To	15	35													
27	14/05/2022			SC	-	-												Grey, Moist, Fine Grain Sand Mix, Hard, Sandy Silty CLAY (CL) Compressed in Nature/Cemented Sandy Clay of Low Plasticity
28		08	55	To	09	55												
29								33	41	7cm Penet for 50Blows	>100	27.50	17	SS	-27.5	L6	27.5	
30							50	12Cm Penet for 50Blows		>100	30.00	18	SS	-30.0	L7	30.0	Brown, Moist, Fine Grains Structure, Fissile Texture, Hard, Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana	

CS - Core Sample	DS - Disturbed Sample	LOGGED	D.Vanugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	14/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonra]	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-04								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		4 OF 4								
LOCATION		Block-2		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE								
										12/05/2022								
										BORE END DATE								
										14/05/2022								
										TOTAL DRILL DAYS								
										3								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
31	14/05/2022	10	48	SC	-	-	60	7Cm Penet for 50Blows	>100	33.00 33.23 ↓	19	SS	-33.0		L8	33.3	Brown,Moist,Fine Grains Structure, Fissile Texture,Hard,Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana Formation Lithified Shale Rock @ Locations	
32		12	20															
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	D.Venugopal	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	14/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 33 m depth below E.G.L
FIG.2.4 Sub Soil Profile at BH-04 Location

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-05																			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		1 OF 4																			
LOCATION		Block-2		MACHINE No.		Hydraulic Auto Trip Hammer		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm																			
STRUCTURE		2 Basement + Silt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		02/05/2022																			
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -		BORE END DATE		05/05/2022																			
TOTAL DRILL DAYS														4																			
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data																				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description																
		Hr.				Min.	D-15	15-30										30-45															
1	02/05/2022	14	11	SC	-	-	3	4	5	9	1.00	1	SS	-1.0		L1	3.0	Brown,Moist,Medium Stiff & Stiff,Silty CLAY (Cl) Clay of Medium Plasticity															
		To																															
		14	18																														
2			14																42														
		To																															
		14	49																														
3		15	17																														
		To																															
		15	23																														
4		15	44																														
		To																															
		15	50																														
5		16	12																														
		To																															
		16	17																														
6		16	37																														
		To																															
		16	41																														
7		17	18																														
		To																															
		17	23																														
8	03/05/2022	09	06	SC	-	-	5	7	8	15	7.50	7	SS	-7.5		L4	9.0	Brown,Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, Silty SAND (SM) & Poorly Graded SAND - Silty SAND (SP-SM)															
		To																															
		09	11																														
9		09	34																														
		To																															
		09	40																														
10		09	40																														

CS - Core Sample		DS - Disturbed Sample		LOGGED		Karthik Prabhu		PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample		SC - Soil Cutter		DATE		03/05/2022		GROUND LEVEL (m)		0.00	
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		S.Tysonraj		WATER TABLE (m)		4.00	
WS - Wash Sample		DB - Diamond Bit		DATE		22/05/2022		CASING DEPTH (m)		0.00	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-05							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		2 OF 4							
LOCATION		Block-2		MACHINE No.		Hydraulic Auto Trip Hammer		CHAINAGE (m)		-							
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -							
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE							
										02/05/2022							
										BORE END DATE							
										05/05/2022							
										TOTAL DRILL DAYS							
										4							
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
11	03/05/2012	10 17 To 10 25	SC	-	-	5	4	3	7	10.50	9	SS	-10.5				Gray,Moist,Poorly Graded,Fine & Medium Grains Sand,Loose,Silty SAND (SM) & Silty SAND (SP-SM)
12						1	0	0	0	12.00	10	SS	-12.0		L5	12.0	
13		11 12 To 11 18	SC	-	-					12.45							Black,Dark Grey,Moist,Very Soft,Silty CLAY (CH) Clays of High Plasticity
14						1	1	1	2	14.00	11	SS	-14.0		L6	14.0	
15		12 06 To 12 13	SC	-	-					14.45							
16						1	1	1	2	16.00	12	SS	-16.0				
17		12 40 To 12 52	SC	-	-					16.45							Black,Dark Grey,Moist,Very Soft,Silty CLAY (CI) & Silty CLAY (CH) Clay of Medium & High Plasticity
18						2	2	2	4	18.00	13	SS	-18.0				
19		14 20 To 14 31	SC	-	-					18.45							
20						2	5	6	11	20.00	14	SS	-20.0		L7	20.0	
										20.45							Grey Green,Moist,Stiff,Silty CLAY (CH) Clay of High Plasticity

CS - Core Sample	DS - Disturbed Sample	LOGGED	Karthik Prabhu	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/05/2012	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraaj	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD										BORE HOLE No. BH-05						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET 3 OF 4						
LOCATION		Block-2		MACHINE No.		Hydraulic Auto Trip Hammer		CHAINAGE (m)		-		DIA OF BORE HOLE 150mm ☒ NX						
STRUCTURE		2 Basement + Silt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE 02/05/2022						
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -		BORE END DATE 05/05/2022						
												TOTAL DRILL DAYS 4						
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
21	03/05/2022	15	40	SC	-	-												Grey Green, Moist, Stiff, Silty CLAY (CH) & Silty CLAY (CI) Clay of Medium & High Plasticity
22		To	51															
23		16	36															
24	04/05/2022	16	48	SC	-	-												Brown Grey, Moist, Fine Grain Sand Mix, Hard, Sandy Silty CLAY (CL) / Compressed in Nature / Cemented Sandy Clay of Low Plasticity
25		To																
26		09	23															
27	04/05/2022	10	04	SC	-	-												Brown, Grey Brown, Moist, Fine Grain Structure, Fissile & Sub Fissile Texture, Fissile Silty CLAY (CH) / Soft SHALE Gondwana Formation
28		To																
29		11	09															
30	04/05/2022	11	53	SC	-	-												Brown, Grey Brown, Moist, Fine Grain Structure, Fissile & Sub Fissile Texture, Fissile Silty CLAY (CH) / Soft SHALE Gondwana Formation
		To																
		11	53															

CS - Core Sample	DS - Disturbed Sample	LOGGED	Karthik Prabhu	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S. Tysonraj	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-05				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		4 OF 4				
LOCATION		Block-2		MACHINE No.		Hydraulic Auto Trip Hammer		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NX				
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		02/05/2022				
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		E -		BORE END DATE		05/05/2022				
TOTAL DRILL DAYS		4																
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
31	04/05/2022																	
32		14 To 27	SC	-	-	16	22	30	52	32.50	19	SS	-32.5					Brown, Grey Brown, Moist, Fine Grain Structure, Fissile & Sub Fissile Texture, Fissile Silty CLAY (CH) Soft SHALE Gondwana Formation
33		15 To 24								32.95								
34	05/05/2022																	
35		09 To 11	SC	-	-	20	25	27	52	35.00	20	SS	-35.0					
36		11 To 37								35.45								
37																		
38																		
39																		
40																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Karthik Prabhu	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	05/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 35 m depth below E.G.L
FIG.2.5 Sub Soil Profile at BH-05 Location

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-08														
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		1 OF 3														
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-														
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -														
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE														
										03/06/2022														
										BORE END DATE														
										07/06/2022														
										TOTAL DRILL DAYS														
										3														
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data											
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description							
		Hr.				Min.	0-15	15-30										30-45						
1	03/06/2022	12	15	SC	-	-	4	6	10	16	1.00	1	SS	-1.0										
		To	12																			16		
2			12	33	SC	-	-	5	6	9	15	1.45	2	SS	-2.0									
		To	12	34																				
3			12	50	SC	-	-	-	-	-	-	2.00	2	SS	-2.0									
		To	12	51																				
4			14	18	SC	-	-	7	4	10	14	2.45	3	UDS	-3.0									
		To	14	19																				
5			14	40	SC	-	-	11	15	26	41	4.00	4	SS	-4.0									
		To	14	41																				
6		15	00	SC	-	-	11	12	16	28	4.45	5	SS	-5.0										
	To	15	02																					
7		15	30	SC	-	-	12	14	17	31	5.45	6	SS	-6.0										
	To	15	31																					
8		15	50	SC	-	-	6	10	8	18	6.45	7	SS	-7.5										
	To	15	52																					
9		16	21	SC	-	-					7.95	8	SS	-9.0										
	To	16	26																					
10											9.45													

CS - Core Sample	DS - Disturbed Sample	LOGGED	Harihara	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/06/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Nandhini J	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	27/06/2022	CASING DEPTH (m)	0.00	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-08			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		2 OF 3			
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NX			
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRELLING METHOD		Rotary		CO-ORDINATES		N - E -		BORE START DATE		03/06/2022			
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite						BORE END DATE		07/06/2022			
												TOTAL DRILL DAYS		3			
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
11	04/06/2022	10 05 To 10 06	SC	-	-	5	6	8	14	10.50 10.85V	9	SS	-10.5		L4	10.5	Black, Dark Grey, Moist, Very Stiff, Silty CLAY (Cl) Lean Clay of Medium Plasticity
12						4	4	6	10	12.00 12.45V	10	SS	-12.0				
13		10 48 To 10 49	SC	-	-												
14						3	4	4	8	14.00 14.45V	11	SS	-14.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clays of High Plasticity
15		11 18 To 11 19	SC	-	-												
16						-	-	-	-	16.00	12	UDS	-16.0				
17		11 59 To 12 00	SC	-	-												
18						8	10	13	23	18.00 18.45V	13	SS	-18.0		L5	18.0	
19		12 39 To 12 40	SC	-	-												Brown Grey, Moist, Very Stiff, Silty CLAY (CH) With Fine Sand Lenses Clays of High Plasticity
20						13	14	14	28	20.00 20.45V	14	SS	-20.0				

CS - Core Sample	DS - Disturbed Sample	LOGGED	Hartharan	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/08/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Nandhini J	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	27/06/2022	CASING DEPTH (m)	0.00	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. BH-08						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET 3 OF 3						
LOCATION		Block-3		MACHINE No.		MR-01		CHAINAGE (m)		-		DIA OF BORE HOLE 150mm ☒ NX						
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE 03/06/2022						
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -		BORE END DATE 07/06/2022						
TOTAL DRILL DAYS		3																
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
21	04/06/2022	14	40	SC	-	-	6	10	16	26	22.50	15	SS	-22.5				Brown Grey, Moist, Very Stiff, Silty CLAY (CH) With Fine Sand Lenses Clays of High Plasticity
22		14	42															
23		15	40															
24	07/06/2022	15	41	SC	-	-	28	15cm Penet for 61Blows	>100	25.00	16	SS	-25.0		L6	25.0	Brown Grey, Moist, Hard, Fine Grain Sand Mix, Sandy Silty CLAY (CL)/ Compressed in Nature/Cemented Sandy Clay of Low Plasticity	
25		16	32															
26		16	34															
27		10	15	SC	-	-	17	15cm Penet for 62Blows	>100	27.50	17	SS	-27.5		L7	27.5	Brown Grey, Moist, Poorly Graded, Fine & Medium Grains Sand, Very Dense, Clayey Silty SAND/ Silty SAND (SM) With Binder	
28		11	15															
29		11	15															
30							35	10cm Pent for 50Blows	>100	30.00	18	SS	-30.0		L8	30.0	Brown, Moist, Fine Grains Structure, Fissile Texture, Hard, Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana	
															L9	30.3		

CS - Core Sample	DS - Disturbed Sample	LOGGED	HARHARAN/G.VENUGOPAL	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	07/06/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Nandhini J	WATER TABLE (m)	4.00	
WS - Wash Sample	DB - Diamond Bit	DATE	27/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 30 m depth below E.G.L
FIG.2.6 Sub Soil Profile at BH-08 Location

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-10									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 1 OF 3									
LOCATION		Block-3	MACHINE No.	HR-01	CHAINAGE (m)	-	DIA OF BORE HOLE 150mm ☒										
STRUCTURE		2 Basement + Still + 16 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE START DATE 01/06/2022										
JOB CODE		GT-2374	FLUSHING MEDIUM	Bentonite		E -	BORE END DATE 02/06/2022										
							TOTAL DRILL DAYS 2										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45									SPT 'N' Value
1	08	00	SC	-	-	4	12	13	25	1.00	1	SS	-1.0				Brown Grey, Moist, Very Stiff, Silty CLAY (CL) Clay of Low Plasticity
	To	08 09								1.45							
2	08	30	SC	-	-	3	5	7	12	2.00	2	SS	-2.0		L1	2.0	Grey, Brown Grey, Moist, Stiff, Silty CLAY (CL) Clay of Low Plasticity
	To	08 39								2.45							
3	08	54	SC	-	-	4	7	10	17	3.00	3	SS	-3.0		L2	3.0	Grey, Moist, Very Stiff, Silty CLAY (CH) Clay of High Plasticity
	To	08 59								3.45							
4	09	15	SC	-	-	12	19	23	42	4.00	4	SS	-4.0		L3	4.0	Brown, Moist, Poorly Graded, Fine & Medium Grains Sand, Medium Dense & Dense, Silty SAND (SM) & Poorly Graded SAND - Silty SAND (SP-SM)
	To	09 17								4.45							
5	09	39	SC	-	-	12	15	19	34	5.00	5	SS	-5.0				
	To	09 43								5.45							
6	10	40	SC	-	-	6	6	20	26	6.00	6	SS	-6.0				
	To	10 44								6.45							
7	11	05	SC	-	-	9	15	28	43	7.50	7	SS	-7.5				
	To	11 08								7.95							
8	11	28	SC	-	-	5	26	22	48	8.00	8	SS	-8.0		L4	9.0	
	To	11 32								8.45							
9	12	00	SC	-	-												Black, Moist, Hard, Silty CLAY (CL) With Sand Lenses Clay of Low Plasticity
	To	12 04															
10	12	04	SC	-	-												

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/06/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonra]	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-10										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 2 OF 3										
LOCATION		Block-3	MACHINE No.	HR-01	CHAINAGE (m)	-		DIA OF BORE HOLE	150mm ☒ NX ☐									
STRUCTURE		2 Basement + Stilt + 16 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-	BORE START DATE	01/06/2022									
JOB CODE		GT-2374	FLUSHING MEDIUM	Bentonite	CO-ORDINATES	E	-	BORE END DATE	02/06/2022									
								TOTAL DRILL DAYS	2									
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
11	01/06/2022	12	30	SC	-	-	4	6	7	13	10.50	9	SS	-10.5		L5	10.5	Black, Moist, Hard, Silty CLAY (CL) with Sand Lenses Clay of Low Plasticity
		To																
		12	37															
12				SC	-	-	5	5	5	10	12.00	10	SS	-12.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
13		14	00	SC	-	-	-	-	-	-	14.00	11	UDS	-14.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
		To																
		14	09															
14				SC	-	-	-	-	-	-	-	-	-	-				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
15		14	35	SC	-	-	-	-	-	-	-	-	-	-				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
		To																
		14	42															
16				SC	-	-	4	5	4	9	16.00	12	SS	-16.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
17		15	25	SC	-	-	-	-	-	-	-	-	-	-				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
		To																
		15	30															
18				SC	-	-	2	3	4	7	18.00	13	SS	-18.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
19	02/06/2022	10	00	SC	-	-	-	-	-	-	-	-	-	-				Black, Dark Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CH) & Silty CLAY (CL) Clays of Low, Medium & High Plasticity
		To																
		10	20															
20				SC	-	-	10	14	17	31	20.00	14	SS	-20.0				Green Red, Moist, Hard, Silty CLAY (CH) Clays of High Plasticity
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.Sivasankaran		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SC - Soil Cutter		DATE		02/06/2022		GROUND LEVEL (m)		0.00								
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		S.Tysonraj		WATER TABLE (m)		3.80								
WS - Wash Sample		DB - Diamond Bit		DATE		22/06/2022		CASING DEPTH (m)		0.00								

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-10		
SHEET	3	OF	3
DIA OF BORE HOLE	150mm	☒	
	NX		
BORE START DATE	01/06/2022		
BORE END DATE	02/06/2022		
TOTAL DRILL DAYS	2		

PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING				
LOCATION	Block-3	MACHINE No.	HR-01	CHAINAGE (m)	-
STRUCTURE	2 Basement + Stilt + 16 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -
JOB CODE	GT-2374	FLUSHING MEDIUM	Bentonite		E -

Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
		Hr.	Min.				0-15	15-30	30-45									
21	11	00	SC	-	-	10	20	22	42	22.50	15	SS	-22.5		L8	22.5	Green Red,Moist,Hard,Silty CLAY (CH) Clays of High Plasticity	
22	To 11	20																
23	12	00	SC	-	-	50	10cm Penet for 50Blows	>100	25.00	25.25	16	SS	-25.0		L9	25.0	Pale Green,Moist,Hard,Silty CLAY (CI) Lean Clay of Medium Plasticity	
24	To 12	10																
25	02/06/2022		SC	-	-	10cm Penet for 50Blows	>100	27.50	27.60	17	SS	-27.5					Green,Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Dense, Silty SAND (SM) With Binder	
26	Total drilling time 0hr 16mins																	
27			SC	-	-	10cm Penet for 50Blows	>100	30.00	30.25	18	SS	-30.0		L10	30.0	Brown,Moist,Fine Grains Structure, Fissile Texture,Hard,Fissile SILTY CLAY (CH)/Soft SHALE of Gondwana		
28	Total drilling time 0hr 25mins																	
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	02/06/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonra	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	22/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 30 m depth below E.G.L

FIG.2.7 Sub Soil Profile at BH-10 Location

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-11										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 1 OF 4										
LOCATION		Block-3	MACHINE No.	HR-01	CHAINAGE (m)	-	DIA OF BORE HOLE 150mm NX											
STRUCTURE		2 Basement + Stilt + 16 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE START DATE 30/05/2022											
JOB CODE		GT-2374	FLUSHING MEDIUM	Bentonite	CO-ORDINATES	E -	BORE END DATE 31/05/2022											
							TOTAL DRILL DAYS 2											
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
1	08	50	SC	-	-													
	To	09	00															
2	09	17	SC	-	-	9	11	16	27	1.00	1	SS	-1.0					
	To	09	23							1.45								
3	09	40	SC	-	-	7	13	17	30	2.00	2	SS	-2.0					
	To	09	42							2.45								
4	10	00	SC	-	-	10	18	23	41	3.00	3	SS	-3.0					
	To	10	03							3.45								
5	10	15	SC	-	-	11	17	20	37	4.00	4	SS	-4.0					
	To	10	17							4.45								
6	10	35	SC	-	-	19	44	33	77	5.00	5	SS	-5.0		L1	5.0		
	To	10	37							5.45								
7	10	55	SC	-	-	17	20	20	40	6.00	6	SS	-6.0		L2	6.0		
	To	10	57							6.45								
8	11	14	SC	-	-	12	14	15	29	7.50	7	SS	-7.5					
	To	11	17							7.95								
9						3	5	21	26	9.00	8	SS	-9.0		L3	9.0		
										9.45								
10	11	32	SC	-	-													
	To	11	35															
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.Sivasankaran		PROJECT SITE DETAILS				REMARKS						
SS - Split Spoon Sample		SC - Soil Cutter		DATE		30/05/2022		GROUND LEVEL (m)				0.00						
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		S.Tysonraj		WATER TABLE (m)				3.80						
WS - Wash Sample		DB - Diamond Bit		DATE		23/08/2022		CASING DEPTH (m)				0.00						

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-11			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING										SHEET		2 OF 4			
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm			
STRUCTURE		2 Basement + 8/11 + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		30/05/2022			
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -		BORE END DATE		31/05/2022			
TOTAL DRILL DAYS												2					
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Rt. (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
11	30/05/2022	11:55 To 12:00	SC	-	-	2	3	3	6	10.50	9	SS	-10.5		L4	10.5	Black, Dark Grey, Very Stiff, Silty CLAY (CH) With Sand Lenses Clay of Medium Plasticity
12		12:23 To 12:27	SC	-	-	4	4	6	10	12.00	10	SS	-12.0		L5	12.0	Black, Dark Grey, Moist, Medium Stiff, Silty CLAY (CH) Clays of High Plasticity
13		12:49 To 12:54	SC	-	-	2	4	6	10	14.00	11	SS	-14.0				Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clay of High Plasticity With Shells Mix @ 12.0m
14		13:25 To 13:35	SC	-	-	3	5	6	11	16.00	12	SS	-16.0				
15		14:25 To 14:39	SC	-	-	3	6	7	13	18.00	13	SS	-18.0				
16						5	7	13	20	20.00	14	SS	-20.0		L6	20.0	Green Black, Moist, Very Stiff, Silty CLAY (CH) Clays of High Plasticity

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	30/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	3.00	
WS - Wash Sample	DB - Diamond Bit	DATE	23/06/2022	CASING DEPTH (m)	0.00	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-11							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		3 OF 4							
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-							
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -							
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite				E -							
										BORE START DATE							
										30/05/2022							
										BORE END DATE							
										31/05/2022							
										TOTAL DRILL DAYS							
										2							
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
21	09	05	SC	-	-	9	19	22	41	22.50	15	SS	-22.5		L7	22.5	Green Black, Moist, Very Stiff, Silty CLAY (CH) Clays of High Plasticity
22	09	25															
23	10	15	SC	-	-	13	21	27	48	25.00	16	SS	-25.0				Grey Green, Grey, Moist, Hard, Silty CLAY (CH) Clays of High Plasticity & Partly Fissile Texture Observed Clay of High Plasticity
24	10	40															
26	11	20	SC	-	-	23	15cm Penet for 58Blows	>100	27.50	17	SS	-27.5		L8	27.5		Brown, Moist, Poorly Graded, Fine to Coarse Sand With Traces of Gravels, Very Dense, Silty SAND (SM) With Binder
27	11	29															
28	12	17	SC	-	-	39	15cm Penet for 58Blows	>100	30.00	18	SS	-30.0		L9	30.0		Grey, Moist, Fine Grain Structure, Sub Fissile & Fissile Texture, Hard, Fissile CLAY (CH) Soft SHALE of Gondwana
29	12	37															
30																	

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	31/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S. Tysonraj	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	23/08/2022	CASING DEPTH (m)	0.00	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-11						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		4 OF 4						
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-						
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -						
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE						
										30/05/2022						
										BORE END DATE						
										31/05/2022						
										TOTAL DRILL DAYS						
										2						
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45								
31	31/05/2022	14 00	SC	-	-	10cm Penet for 58Blows	>100	33.00 33.10↓	19	SS	-33.0	L10	33.1			Grey, Brown Shades at Times, Moist, Fine Grain Structure, Sub Fissile & Fissile Texture, Hard, Fissile CLAY (CH) / Soft SHALE of Gondwana Formation
32		14 35														
33																
34																
35																
36																
37																
38																
39																
40																

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	31/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S. Tysonra	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	23/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 33 m depth below E.G.L.
FIG.2.8 Sub Soil Profile at BH-11 Location

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-12								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		1 OF 4								
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Suit + 18 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N - E -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		BORE START DATE		26/05/2022								
								BORE END DATE		28/05/2022								
								TOTAL DRILL DAYS		3								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
1	26/05/2022	11	05	SC	-	-	9	12	15	27	1.00	1	SS	-1.0	L1	2.0	Brown, Moist, Very Stiff, Silty CLAY (CI) Lean Clay of Medium Plasticity	
2	11	12	SC	-	-	-	-	-	-	1.45	2	UDS	-2.0					
3	12	05	SC	-	-	3	7	8	15	3.00	3	SS	-3.0	L2	5.0	Brown, Brown Grey, Moist, Stiff, Silty CLAY (CI) & Silty CLAY (CL) Lean Clay of Medium Plasticity		
4	12	15	SC	-	-	3	3	5	8	3.45	4	SS	-4.0					
5	12	35	SC	-	-	13	18	26	44	4.00	5	SS	-5.0	L3	9.0	Brown, Moist, Poorly Graded, Fine & Medium Grains Sands, Medium Dense & Dense, Silty SAND (SM)		
6	12	40	SC	-	-	9	18	23	41	4.45	6	SS	-6.0					
7	14	00	SC	-	-	7	15	15	30	5.00	7	SS	-7.5	L3	9.0	Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clay of High Plasticity		
8	14	18	SC	-	-	3	5	9	14	5.45	8	SS	-8.0					
9	14	40	SC	-	-					6.00								
10	14	44	SC	-	-					6.45								
	15	05	SC	-	-					7.50								
	15	09	SC	-	-					7.95								
										9.00								
										9.45								

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	26/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m)	3.60	
WS - Wash Sample	DB - Diamond Bit	DATE	23/06/2022	CASING DEPTH (m)	0.00	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-12								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		2 OF 4								
LOCATION		Block-3		MACHINE No.		HR - 02		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N - E -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		BORE START DATE		26/05/2022								
								BORE END DATE		28/05/2022								
								TOTAL DRILL DAYS		3								
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
11	15	32	SC	-	-	8	8	7	15	10.50	9	SS	-10.5		L4	10.5	Black, Dark Grey, Moist, Stiff, Silty CLAY (CH) Clay of High Plasticity	
	15	37																
12			SC	-	-	-	-	-	-	12.00	10	UDS	-12.0		L5	12.0	Grey, Moist, Poorly Graded, Fine to Coarse Grains Sand Fraction With Gravels, Medium Dense, Silty SAND (SM) With Clay Binder	
13	16	08																
	16	14	SC	-	-	3	5	6	11	14.00	11	SS	-14.0					
14																		
15	16	43	SC	-	-	5	5	5	10	16.00	12	SS	-16.0					
	16	49																
16	17	15	SC	-	-	3	5	6	11	18.00	13	SS	-18.0					
17	17	19																
18			SC	-	-	8	7	15	22	20.00	14	SS	-20.0		L6	20.0	Black, Dark Grey, Moist, Very Stiff, Silty CLAY (CH) Clays of High Plasticity	
19	17	46																
	17	55								20.45								
20																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	26/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S. Tysonraj	WATER TABLE (m)	3.60	
WS - Wash Sample	DB - Diamond Bit	DATE	23/06/2022	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-12																							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET 3 OF 4																							
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)																							
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES																							
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS																							
DIA OF BORE HOLE		150mm		NX		BORE START DATE		26/05/2022																							
BORE END DATE		28/05/2022																													
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data																		
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description														
		Hr.				Min.	0-15	15-30										30-45													
21	27/05/2022	06	35	SC	-	-	21	16	20	36	22.50	15	SS	-22.5	L7	22.5	Black, Dark Grey, Moist, Very Stiff, Silty CLAY (CH) Clays of High Plasticity														
22		To	06															49													
23																															
24		07	30															SC	-	-	13	17	28	45	25.00	16	SS	-25.0	L8	25.0	Grey, Pale Grey, Moist, Hard, Silty CLAY (CH) Clays of High Plasticity
25		To	07																												
26	08	12	SC	-	-	29	52	57	109	27.50	17	SS	-27.5	L9	27.5	Grey Brown, Moist, Poorly Graded, Fine & Medium Grains Sand, Dense, Clayey Silty SAND (SC)															
27	To	08															22														
28	09	20	SC	-	-	27	12cm Penet for 57Blows	>100	30.00	30.27	18	SS	-30.0	L10	30.0	Grey, Moist, Fine Grain Structure, Sub Fissile & Fissile Texture, Hard, Fissile CLAY (CH) / Soft SHALE of Gondwana															
29																	To	09	55												
30																															

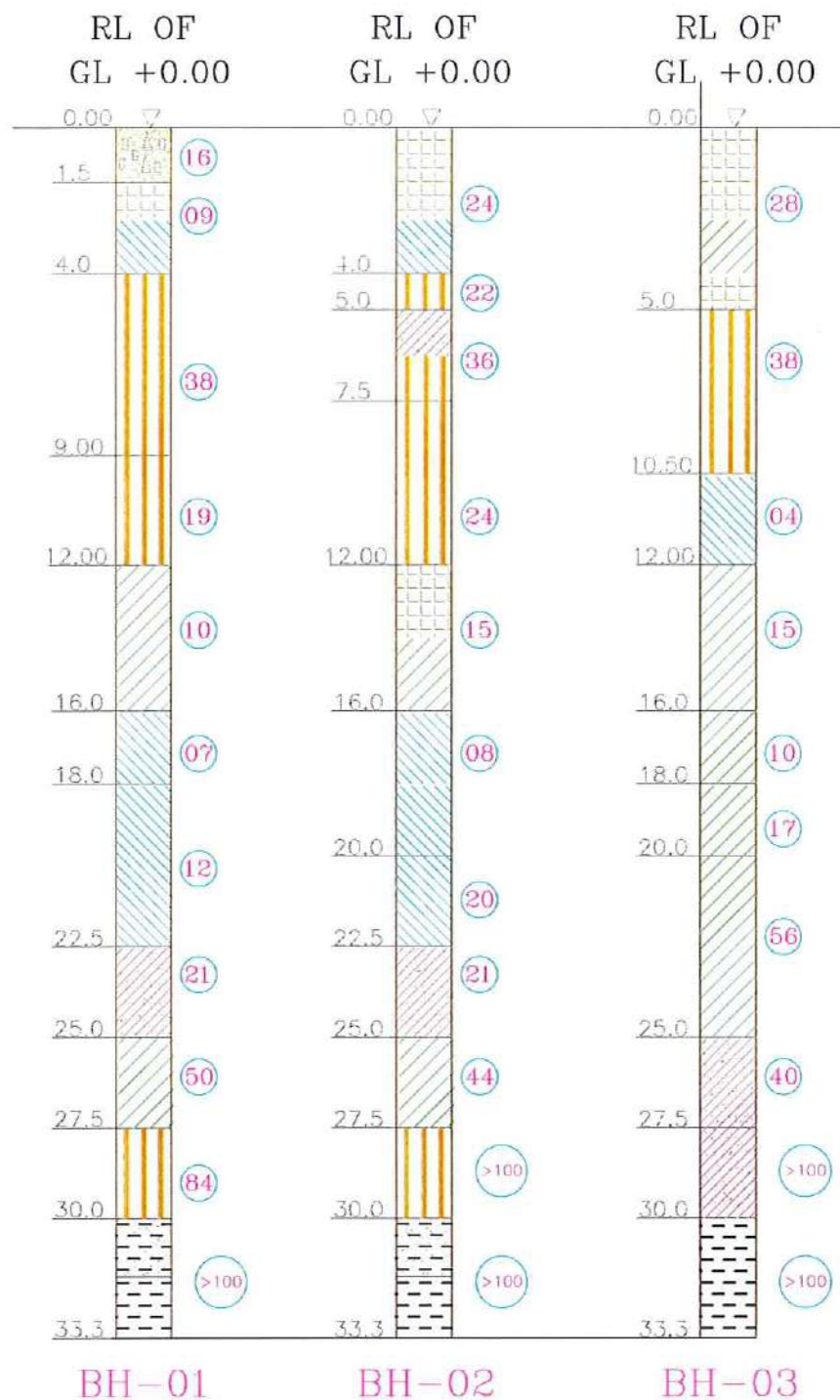
CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	27/05/2022	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraaj	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	23/05/2022	CASING DEPTH (m)	0.00	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-12								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING						SHEET		4 OF 4								
LOCATION		Block-3		MACHINE No.		HR-01		CHAINAGE (m)		-								
STRUCTURE		2 Basement + Stilt + 16 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -								
JOB CODE		GT-2374		FLUSHING MEDIUM		Bentonite		E -		-								
DIA OF BORE HOLE		150mm		BORE START DATE		26/05/2022		BORE END DATE		28/05/2022								
TOTAL DRILL DAYS		3																
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
31	28/05/2022	Total drilling time 1hr 10mins	SC	-	-	15cm Penet for 57Blows	>100	33.00 33.15	19	SS	-33.0	L11	33.0	Grey,Moist,Fine Grian Structure,Sub Fissile & Fissile Texture,Hard,Fissile CLAY (CH)/ Soft SHALE of Gondwana Formation Lithified SHALE Rock at Times (Between 31.0m & 33.0m)				
32																		33

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.Sivasankaran	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	28/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonra]	WATER TABLE (m)	3.80	
WS - Wash Sample	DB - Diamond Bit	DATE	23/06/2022	CASING DEPTH (m)	0.00	

Borehole terminated at 33 m depth below E.G.L
FIG.2.9 Sub Soil Profile at BH-12 Location

CROSS SECTION PROFILE



LEGEND

	SILTY SAND (SM)		CLAYEY SILTY SAND (SC)
	SILTY CLAY (CI)		Lithified SHALE Rock of Gondwana Formation
	SILTY CLAY (CH)		Fissile CLAY/ Soft SHALE of Gondwana Formation
	SANDY SILTY CLAY (CL)		

FIG.No.2.10 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH-01,02&03

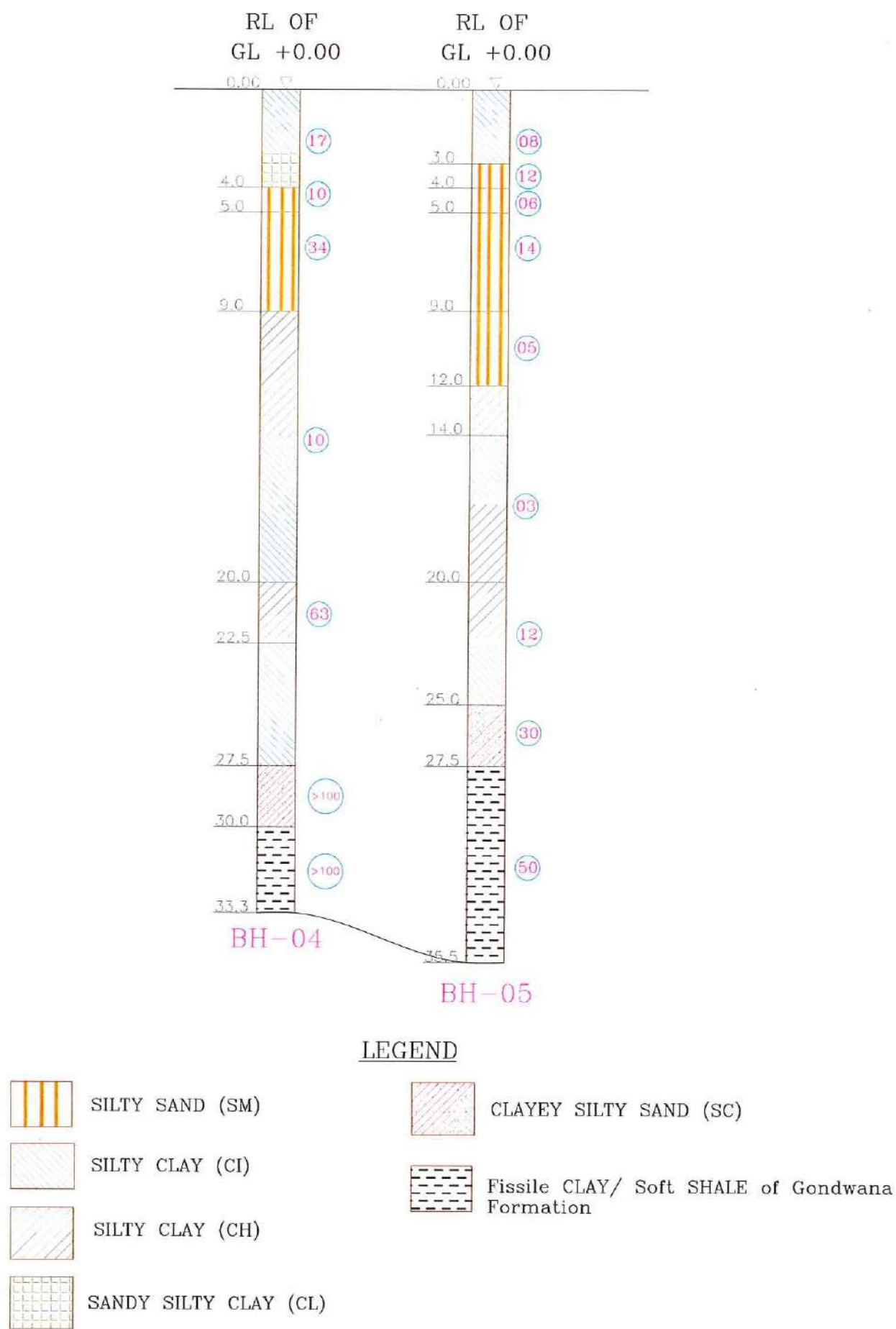
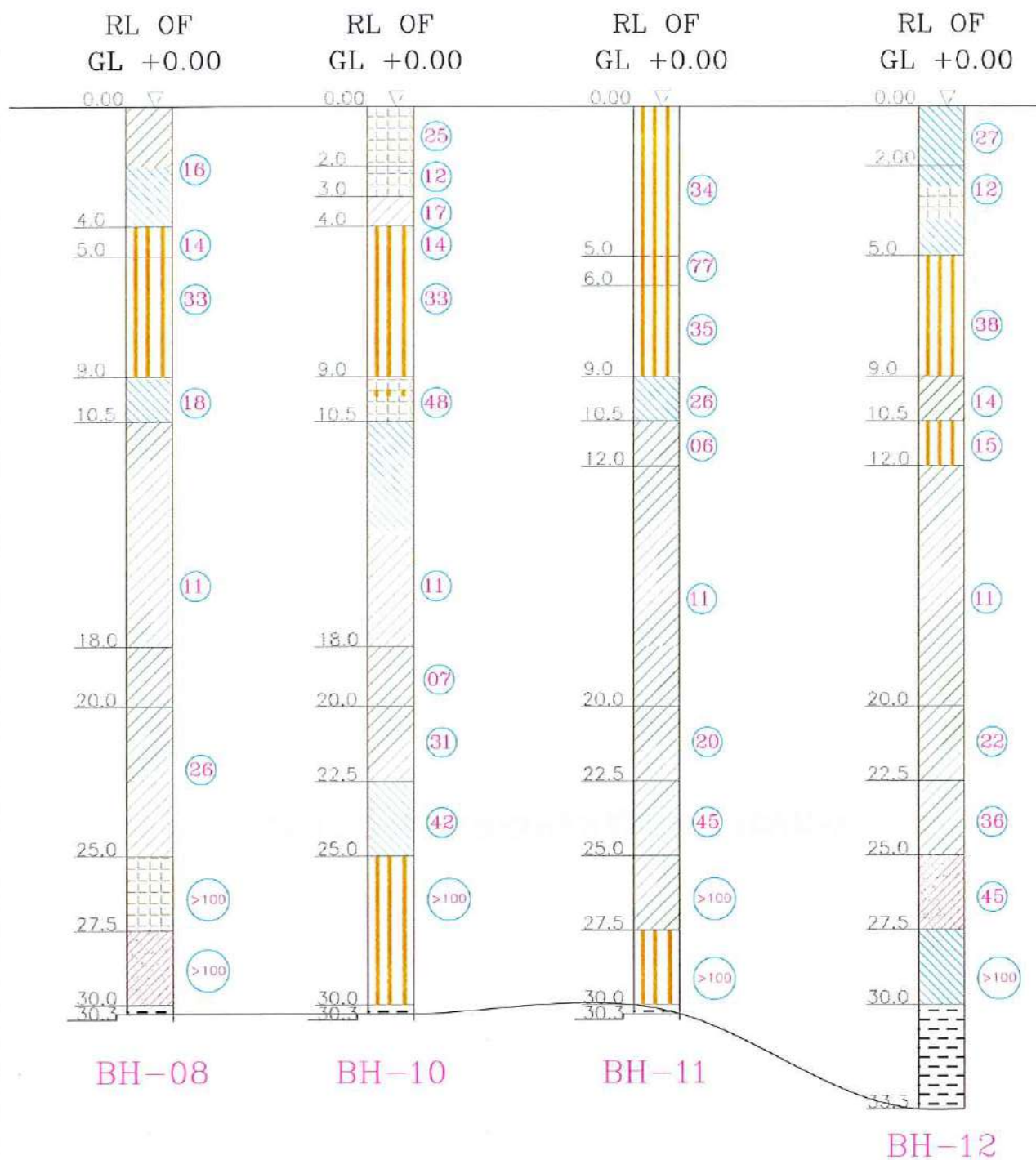


FIG.No.2.11 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH-04&05



LEGEND

	SILTY SAND (SM)		CLAYEY SILTY SAND (SC)
	SILTY CLAY (CI)		Fissile CLAY/ Soft SHALE of Gondwana Formation
	SILTY CLAY (CH)		Lithified SHALE Rock of Gondwana Formation
	SANDY SILTY CLAY (CL)		

FIG.No.2.12 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH-04&05

GRAIN SIZE DISTRIBUTION CURVE

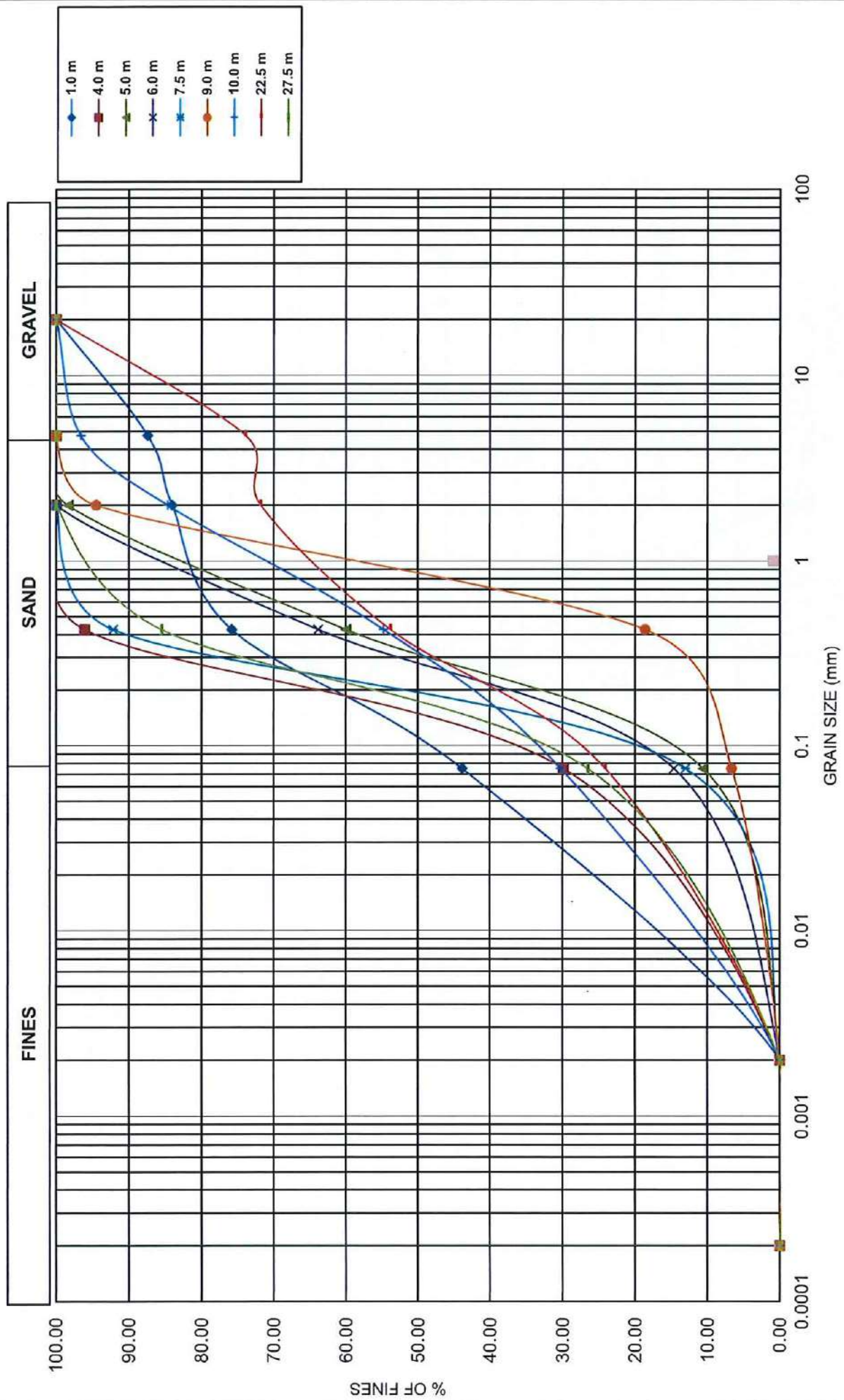


Fig. 2.13 GRAIN SIZE DISTRIBUTION CURVE - BH-01

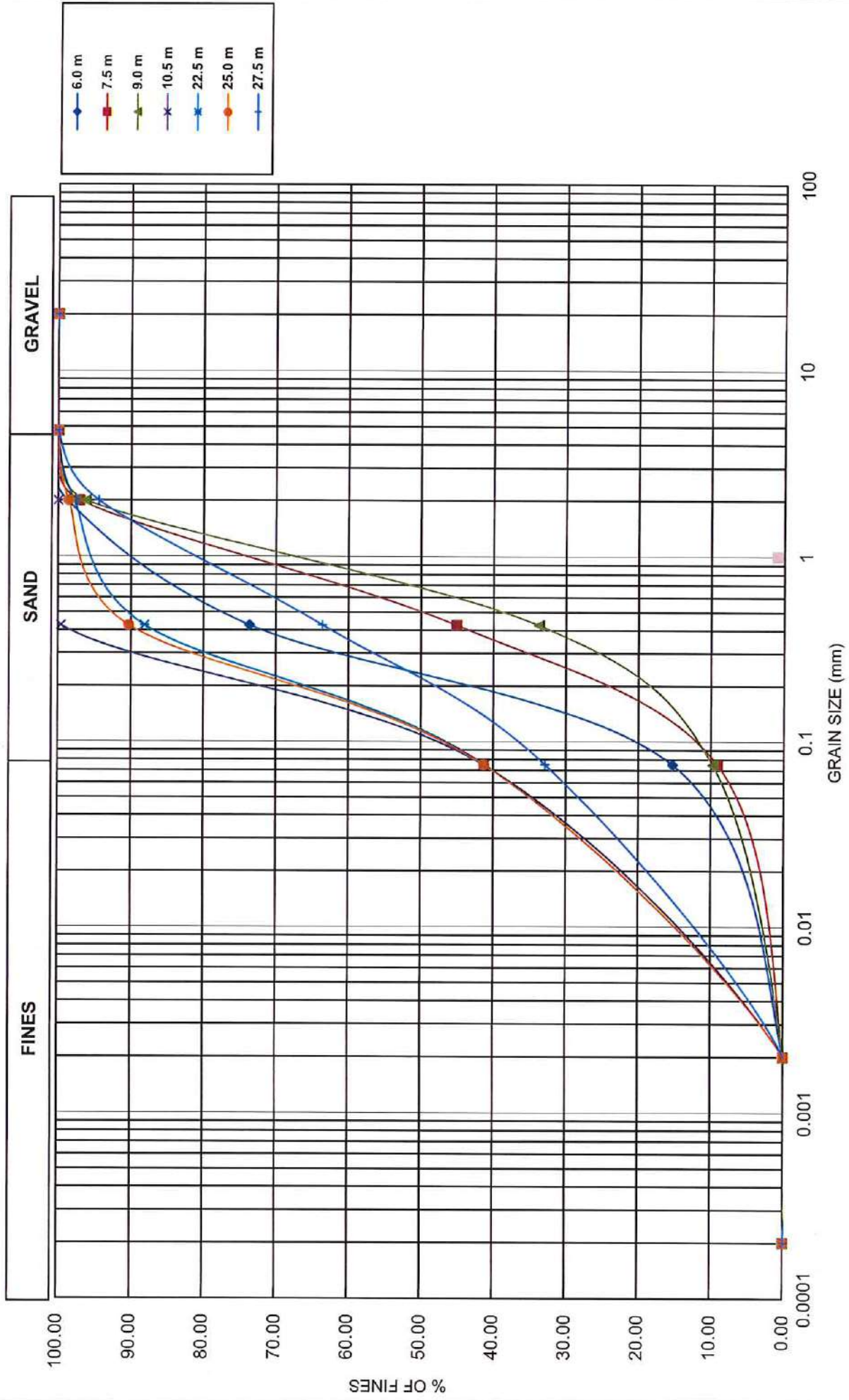


Fig. 2.14 GRAIN SIZE DISTRIBUTION CURVE - BH-02

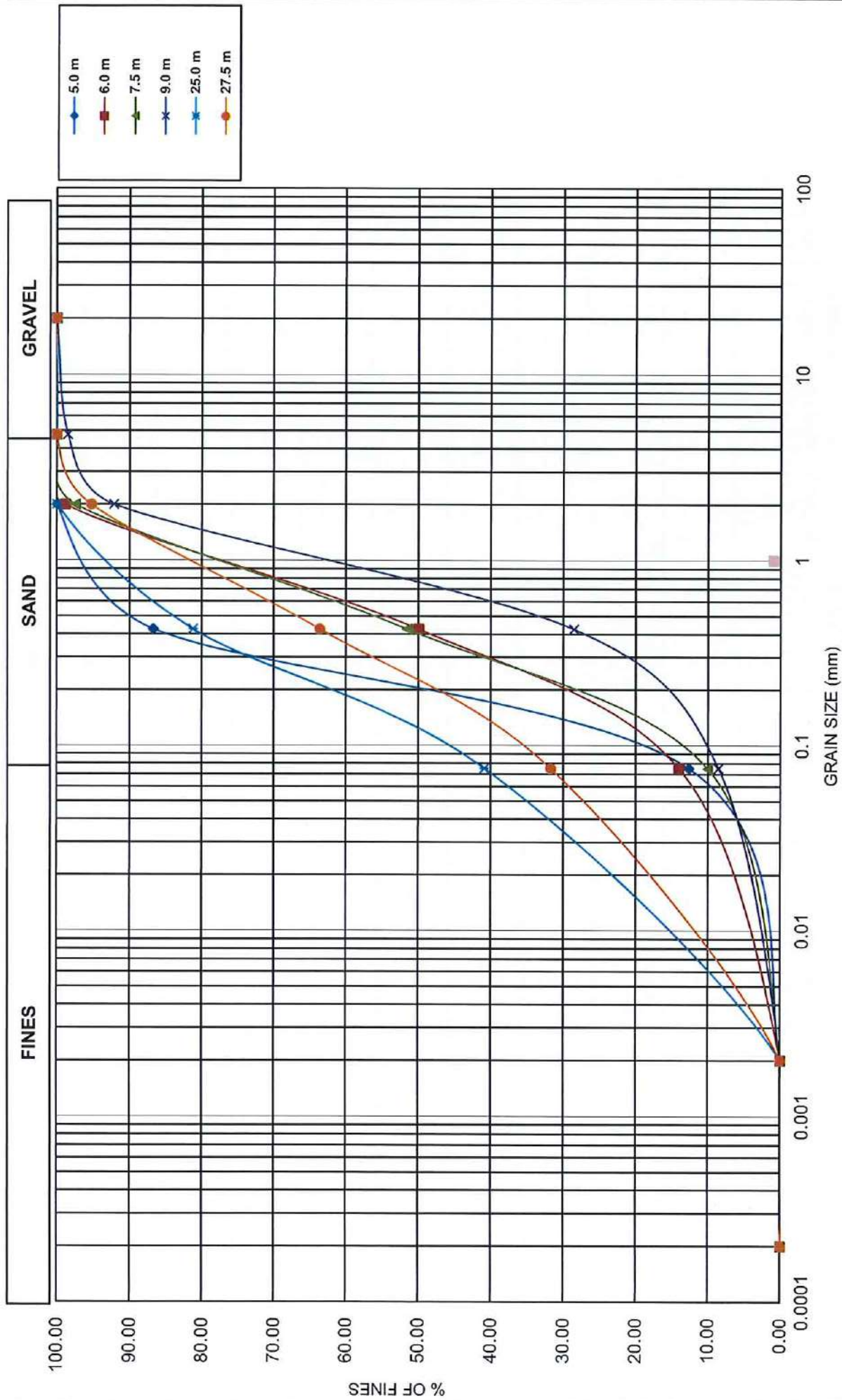


Fig. 2.15 GRAIN SIZE DISTRIBUTION CURVE - BH-03

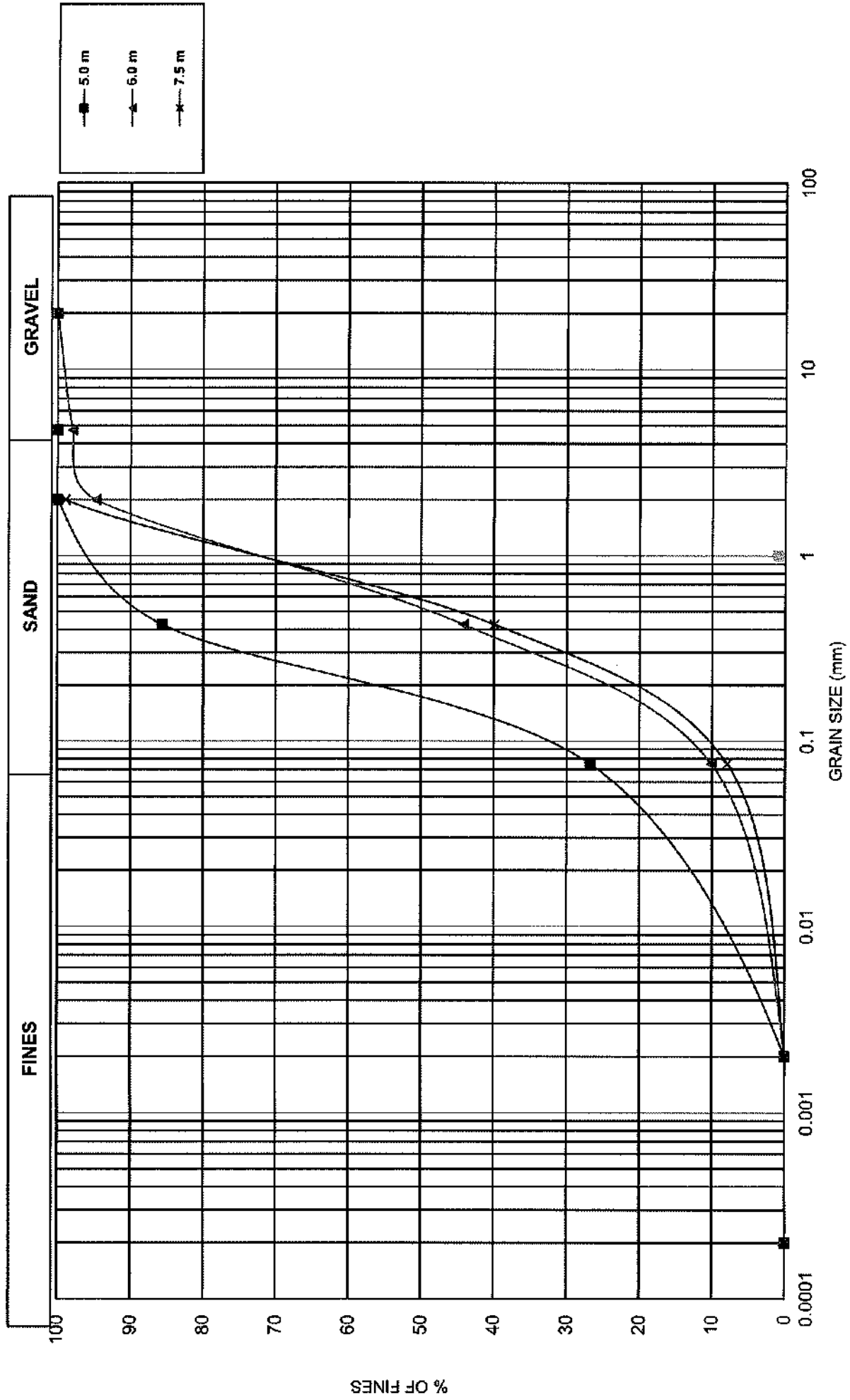


Fig. 2.16 GRAIN SIZE DISTRIBUTION CURVE - BH-04

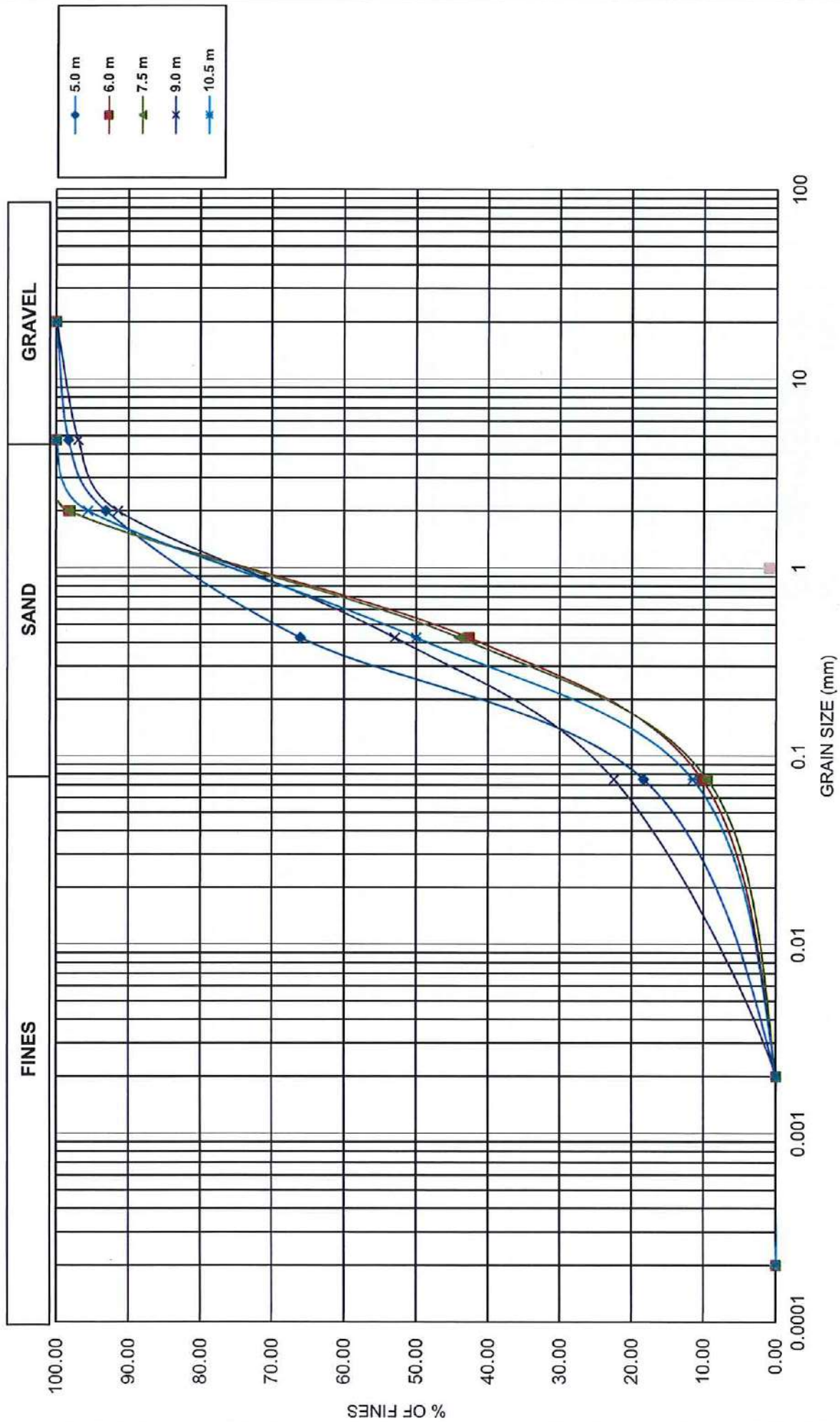


Fig. 2.17 GRAIN SIZE DISTRIBUTION CURVE - BH-05

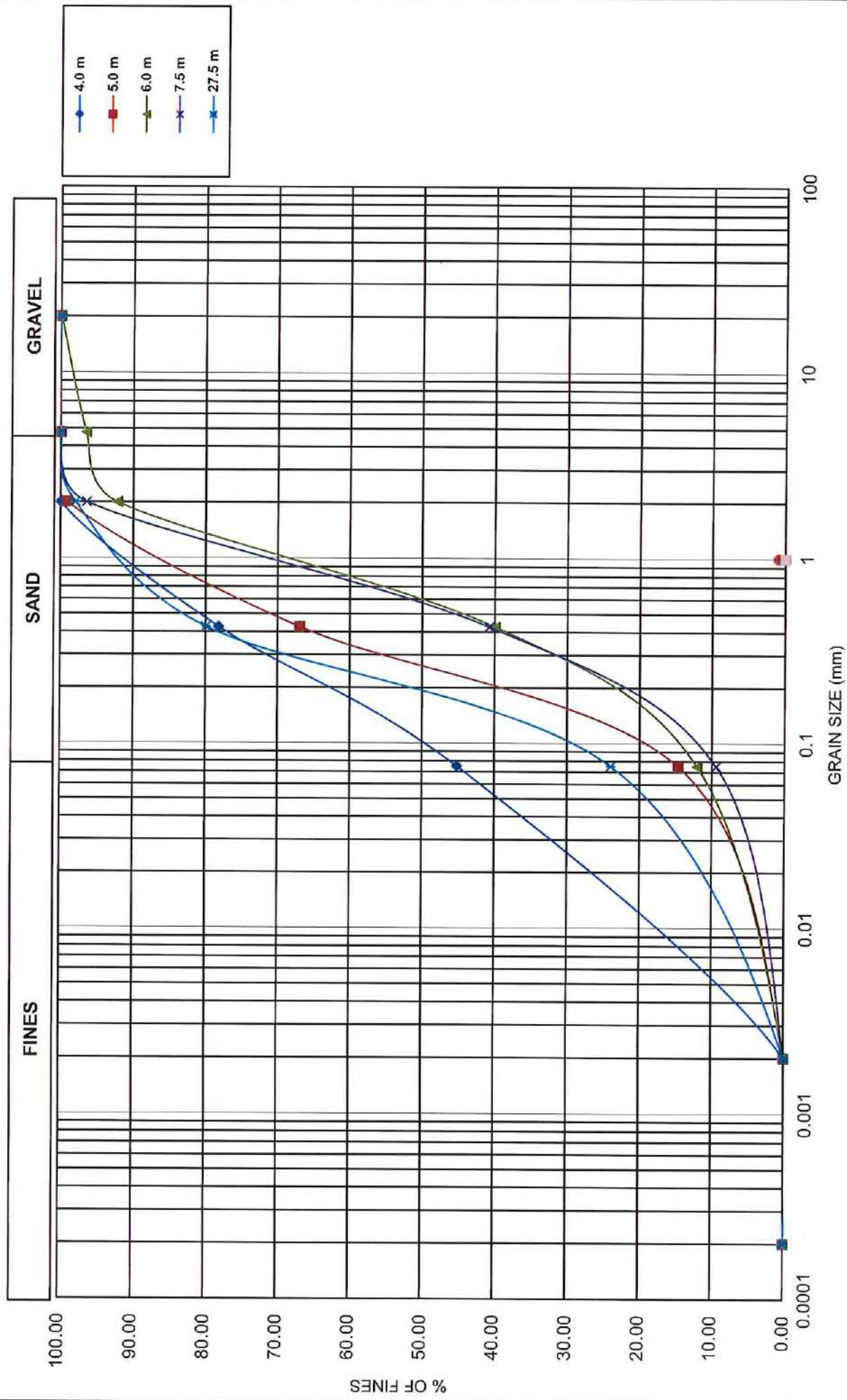


Fig. 2.18 GRAIN SIZE DISTRIBUTION CURVE - BH-08

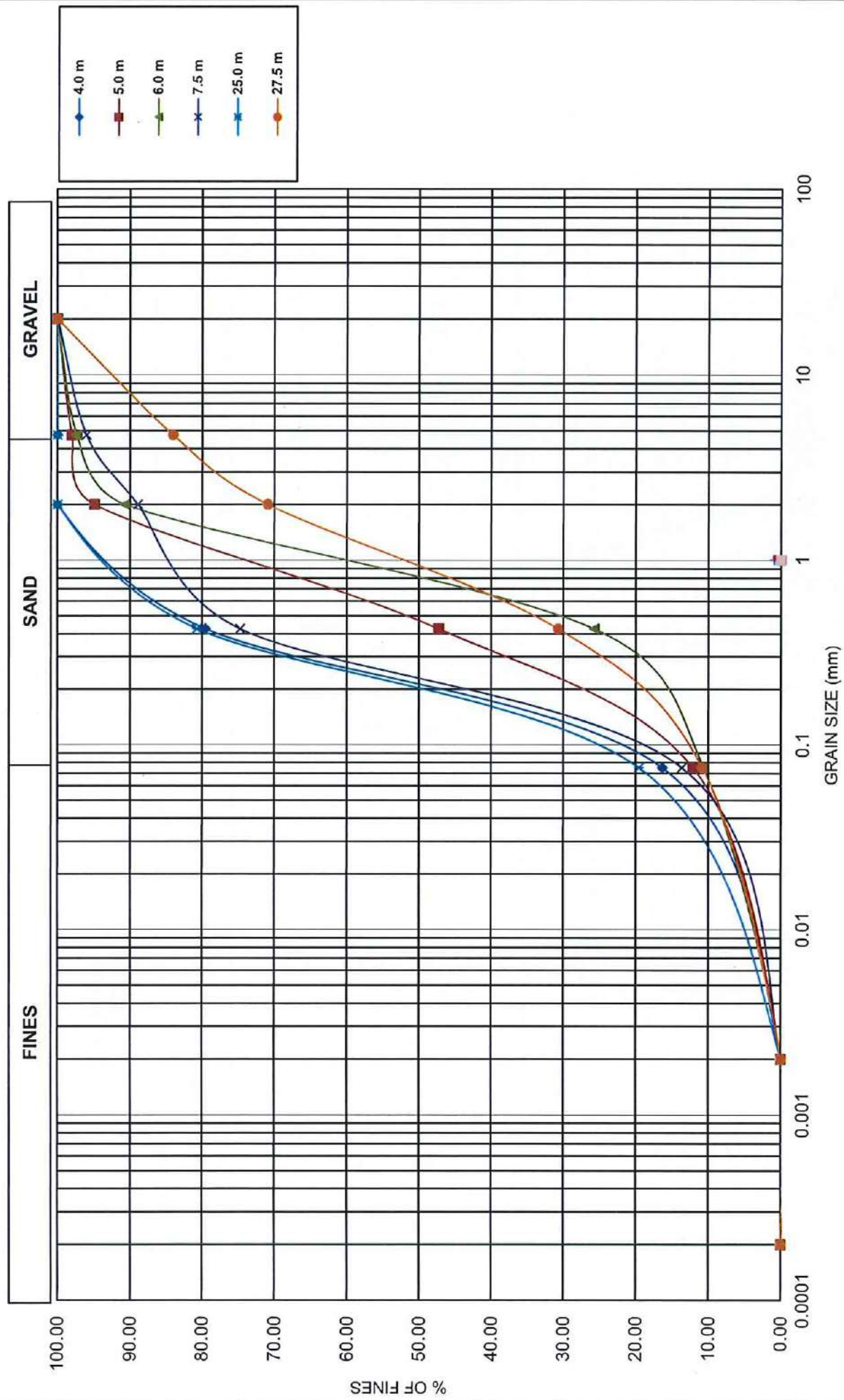


Fig. 2.19 GRAIN SIZE DISTRIBUTION CURVE - BH-10

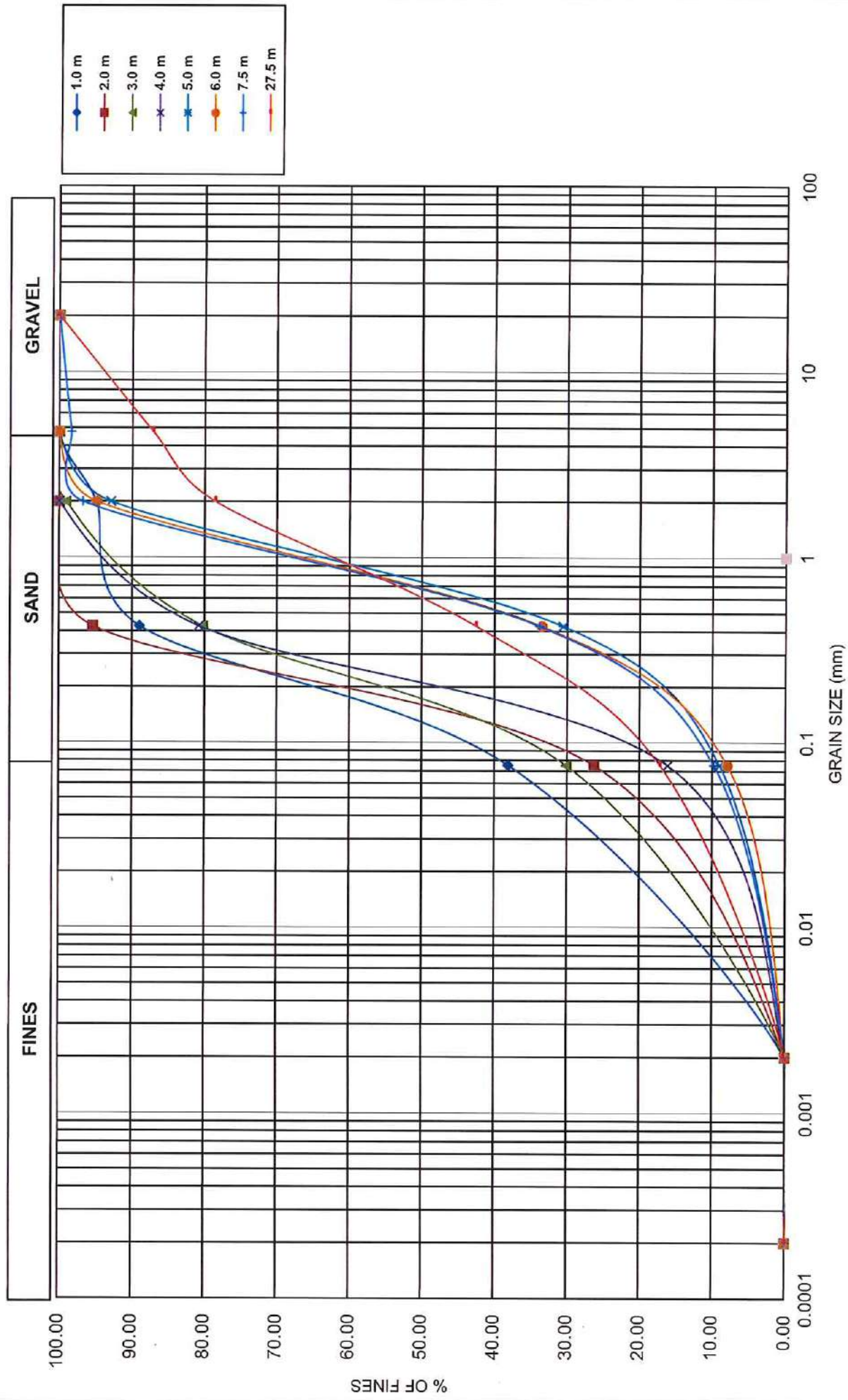


Fig. 2.20 GRAIN SIZE DISTRIBUTION CURVE - BH-11

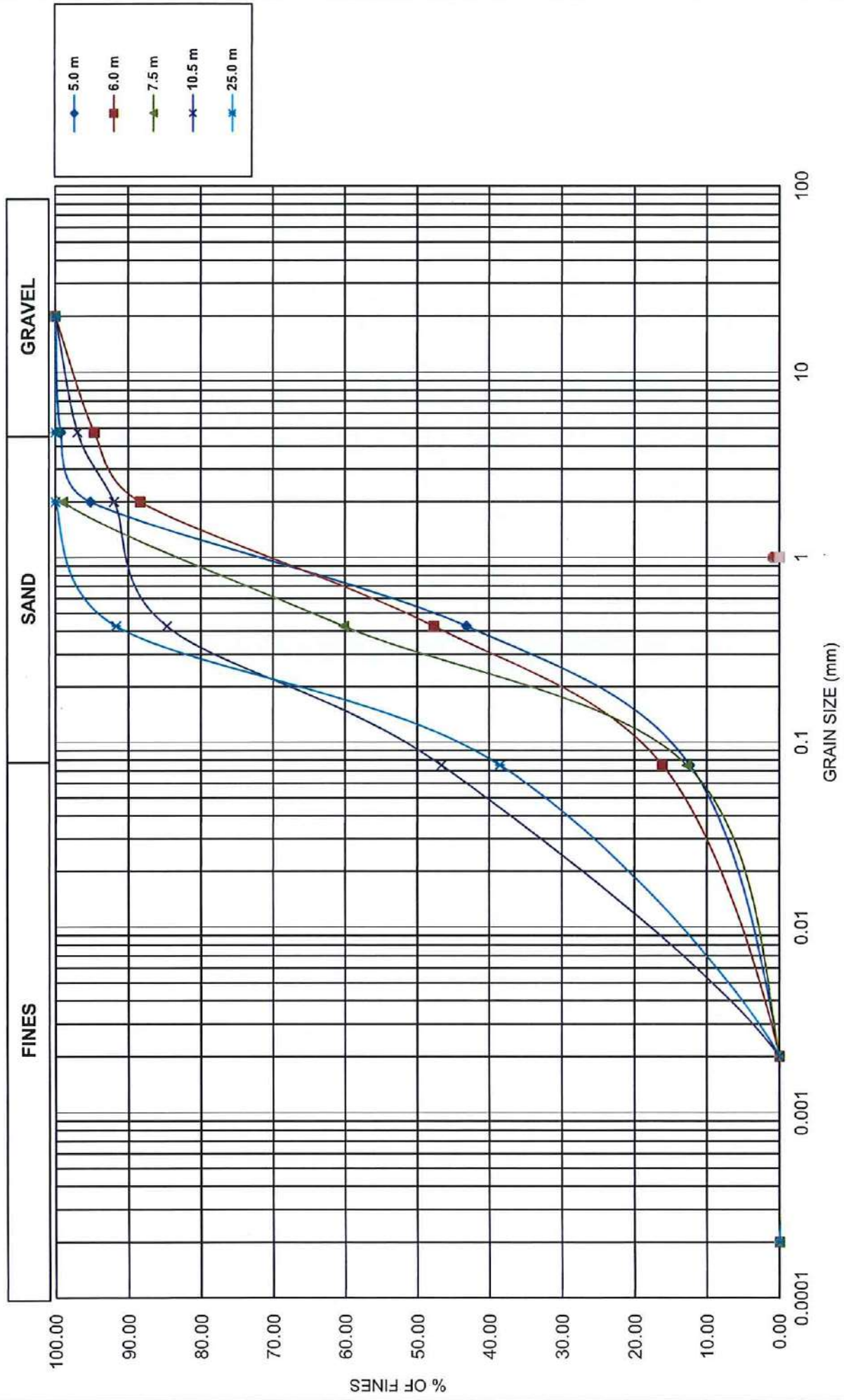


Fig. 2.21 GRAIN SIZE DISTRIBUTION CURVE - BH-12

HYDROMETER ANALYSIS CURVE

—◆— Bore Hole No: 1 Depth: 3.0m

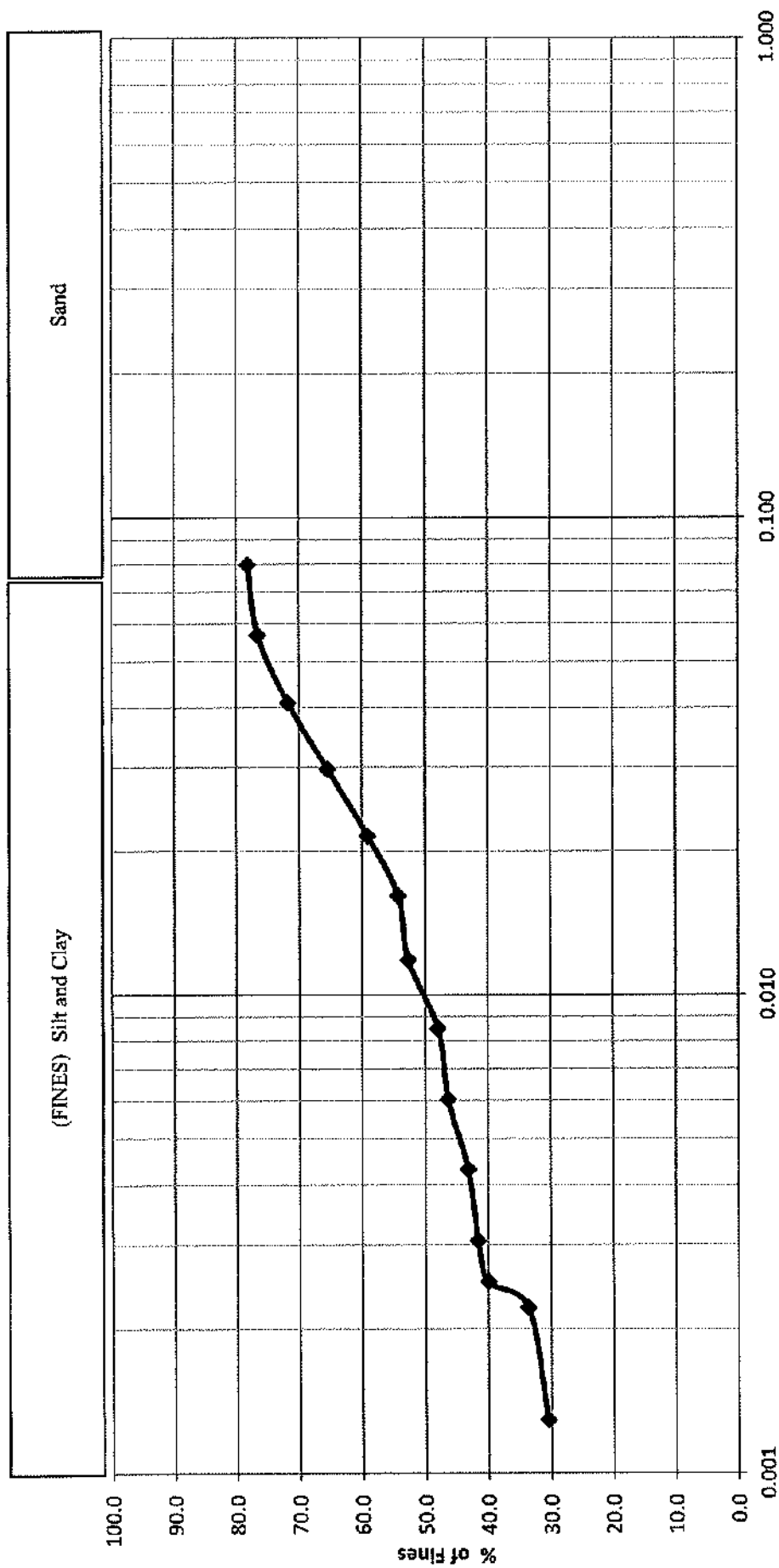


Fig 2.22 Hydrometer Analysis Master Curve

◆ Bore Hole No: 1 Depth: 12.0m

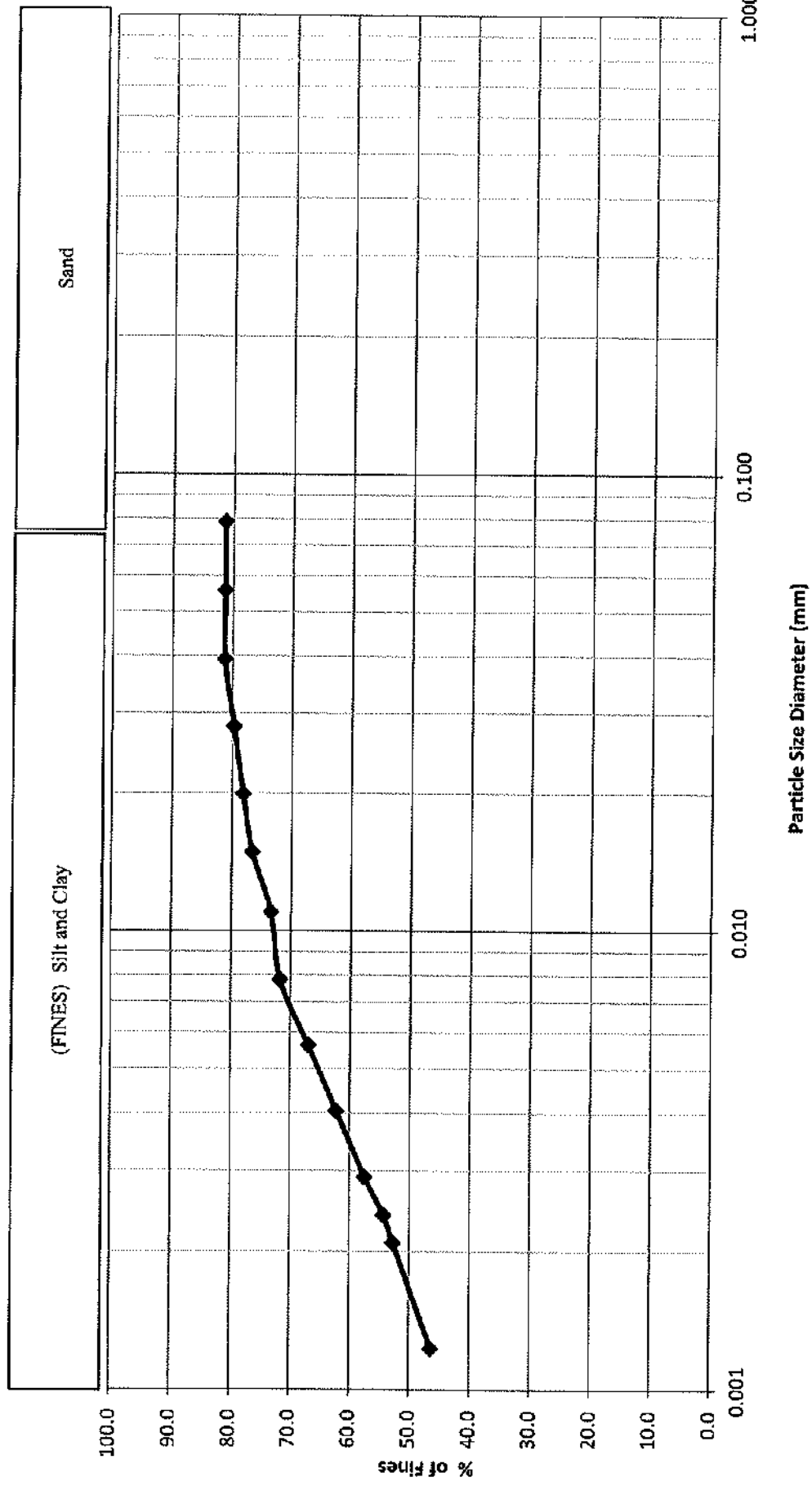
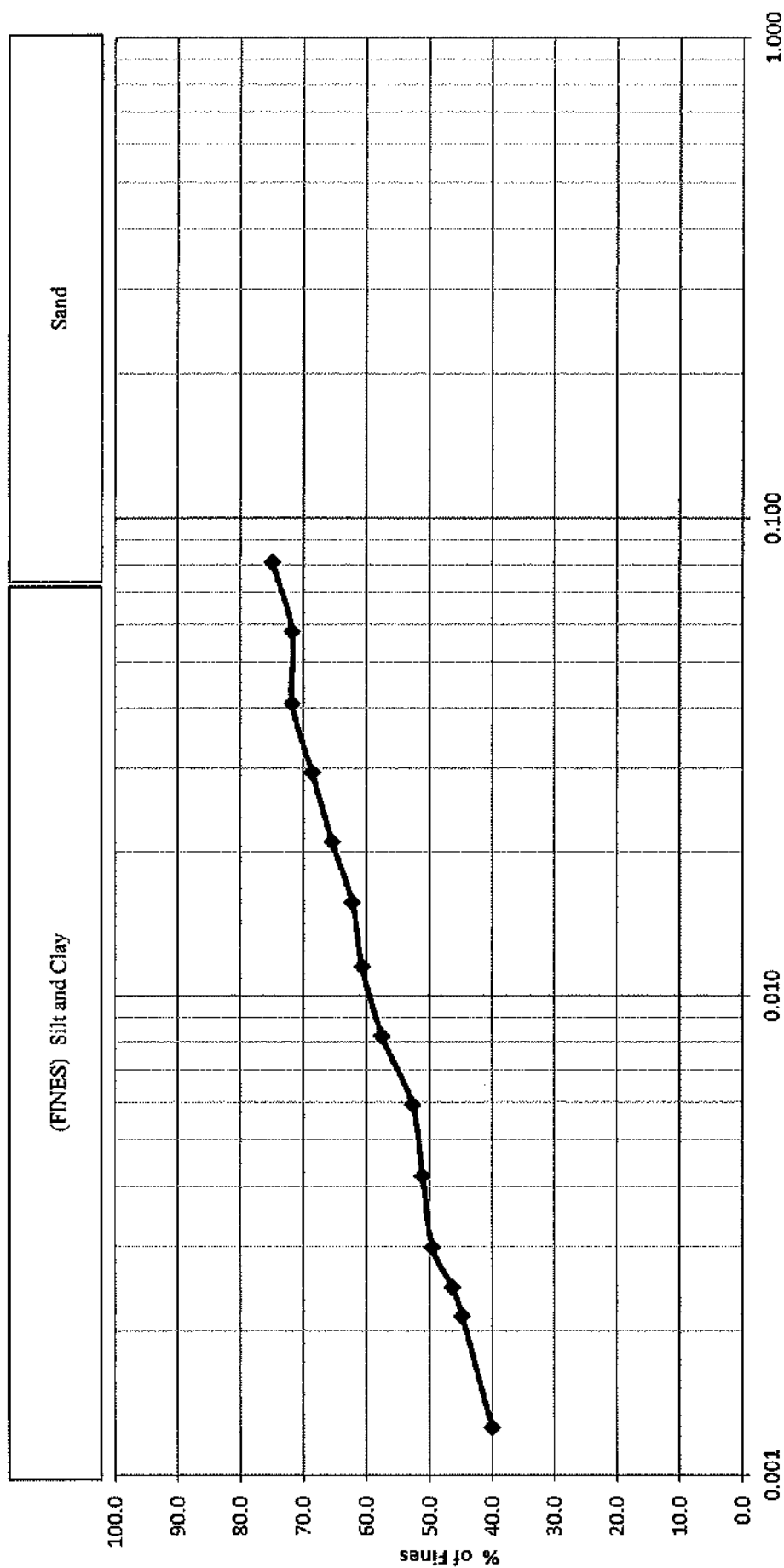


Fig 2.23 Hydrometer Analysis Master Curve

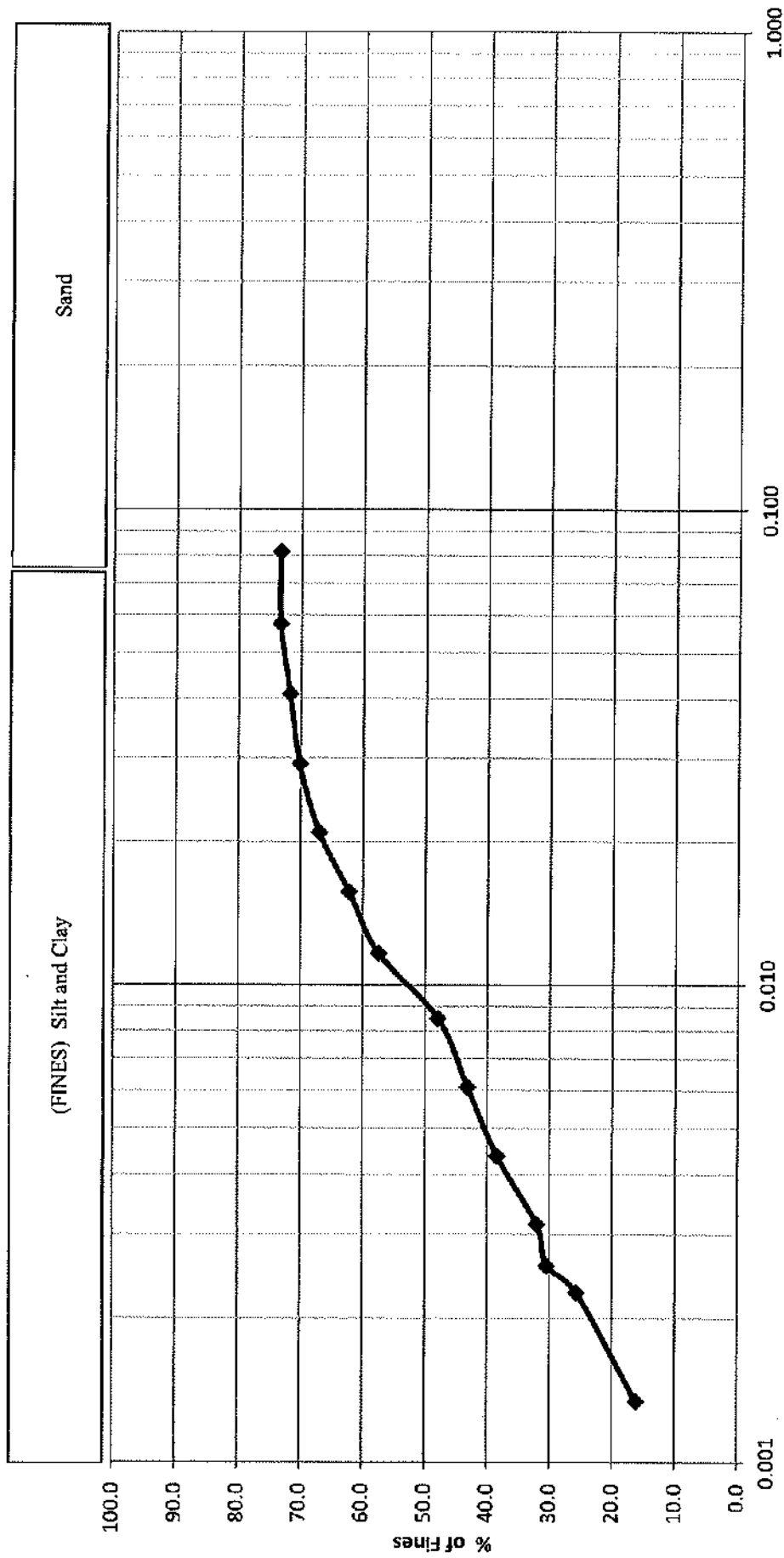
◆ Bore Hole No: 2 Depth: 18.0m



Particle Size Diameter (mm)

Fig 2.24 Hydrometer Analysis Master Curve

—●— Bore Hole No: 2 Depth: 33.0m



Particle Size Diameter (mm)

Fig 2.25 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 3 Depth: 2.0m

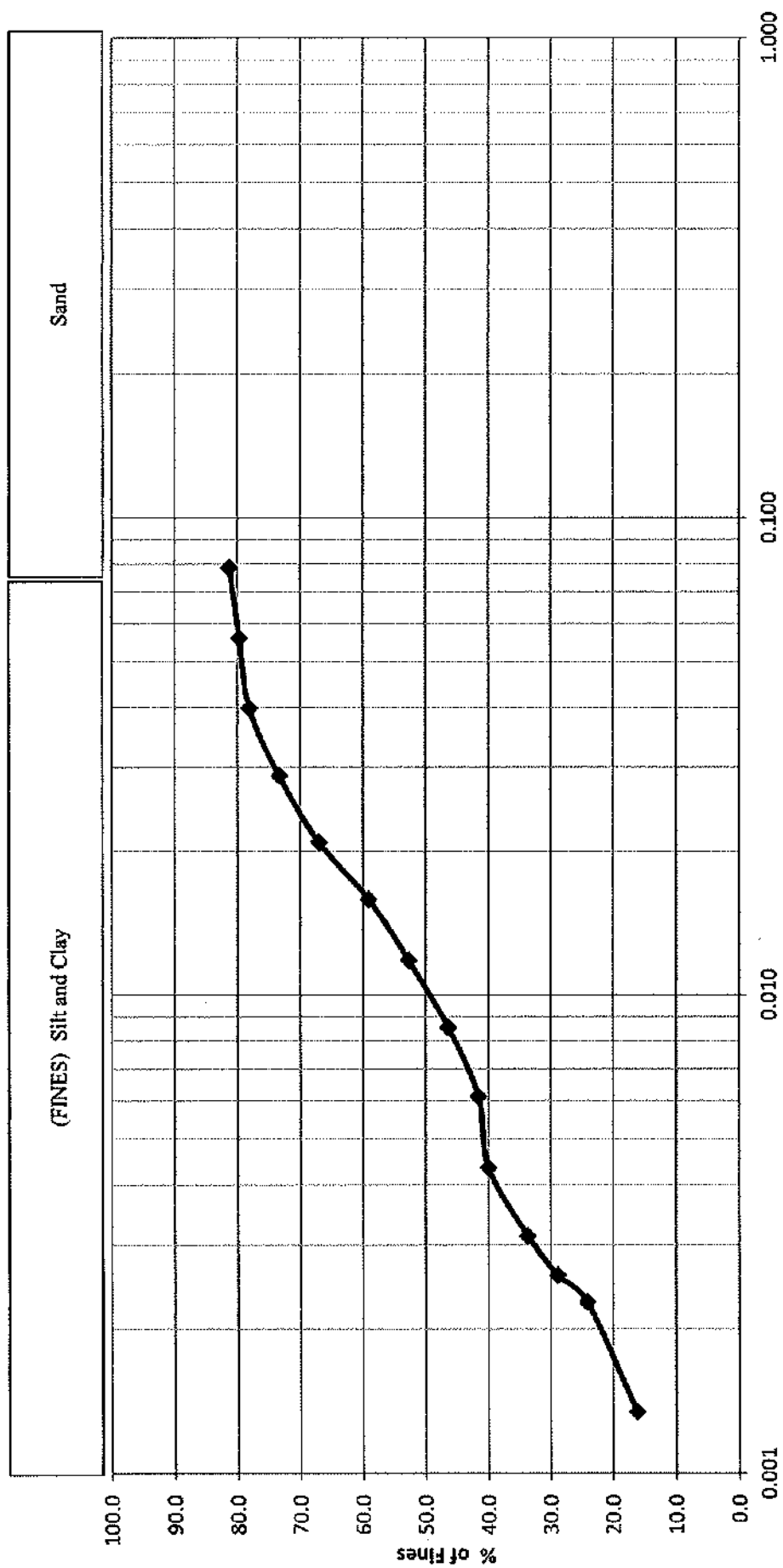


Fig 2.26 Hydrometer Analysis Master Curve

◆ Bore Hole No: 3 Depth: 12.0m

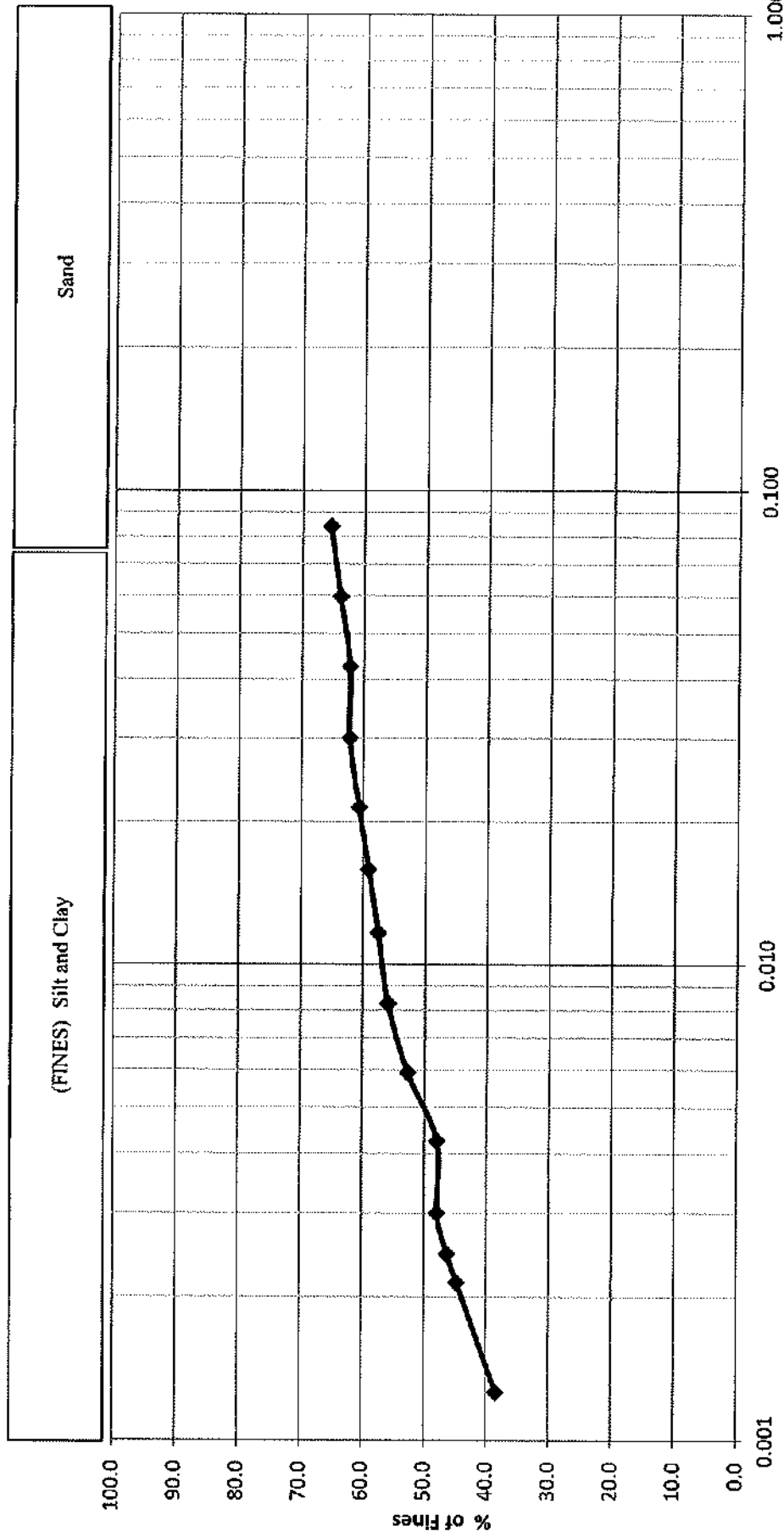


Fig 2.27 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 3 Depth: 16.0m

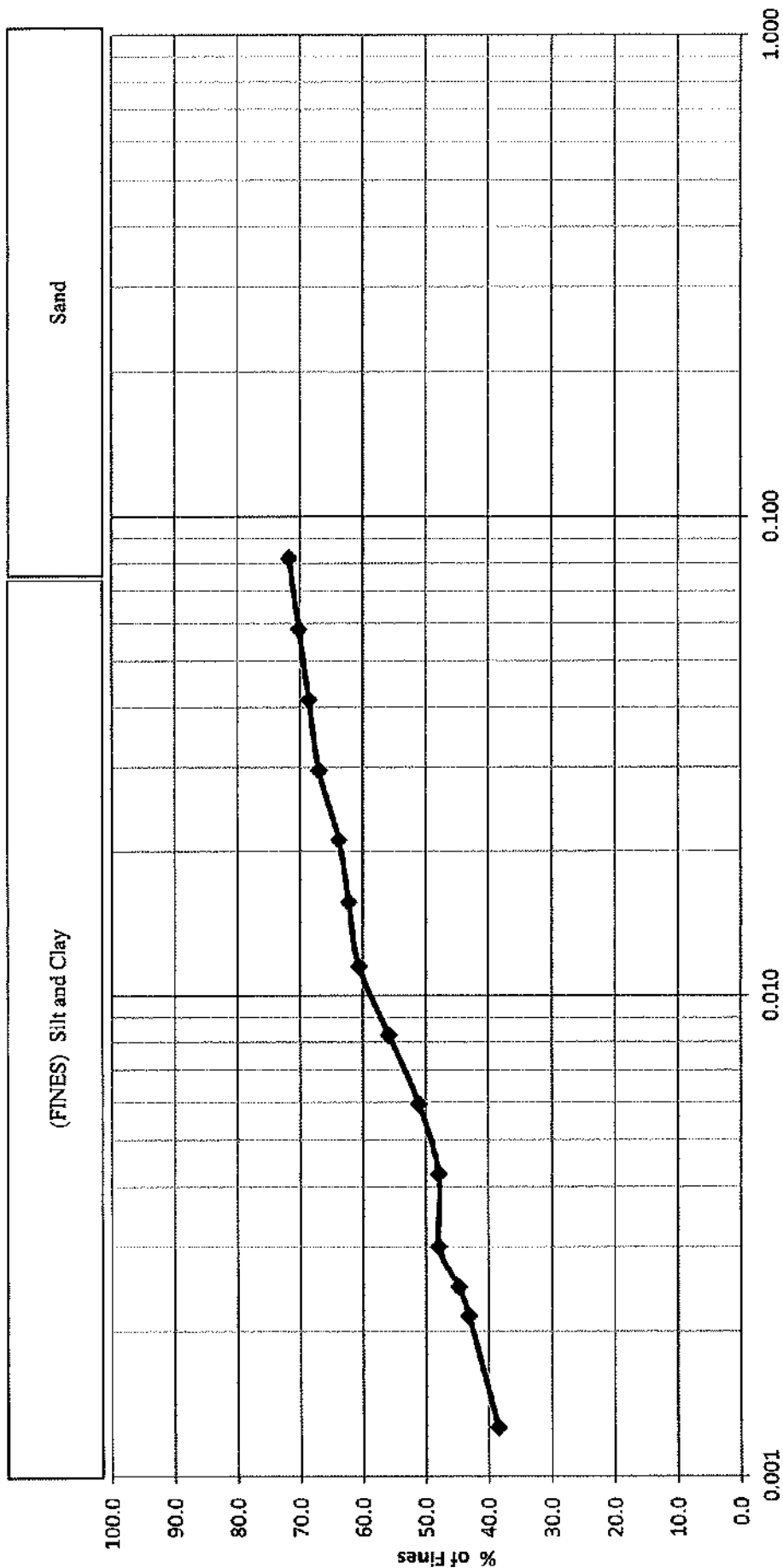


Fig 2.28 Hydrometer Analysis Master Curve

◆ Bore Hole No: 3 Depth: 30.0m

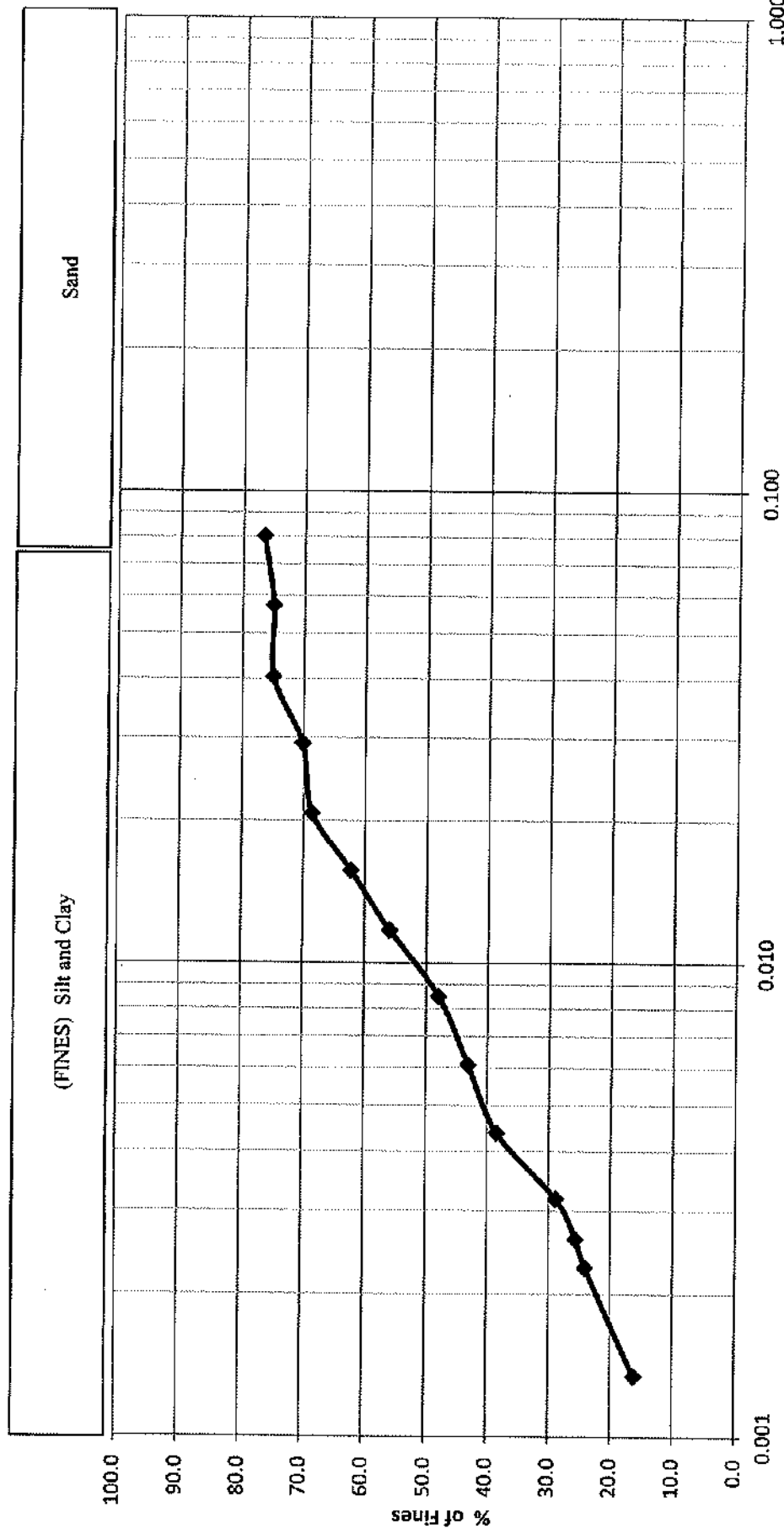
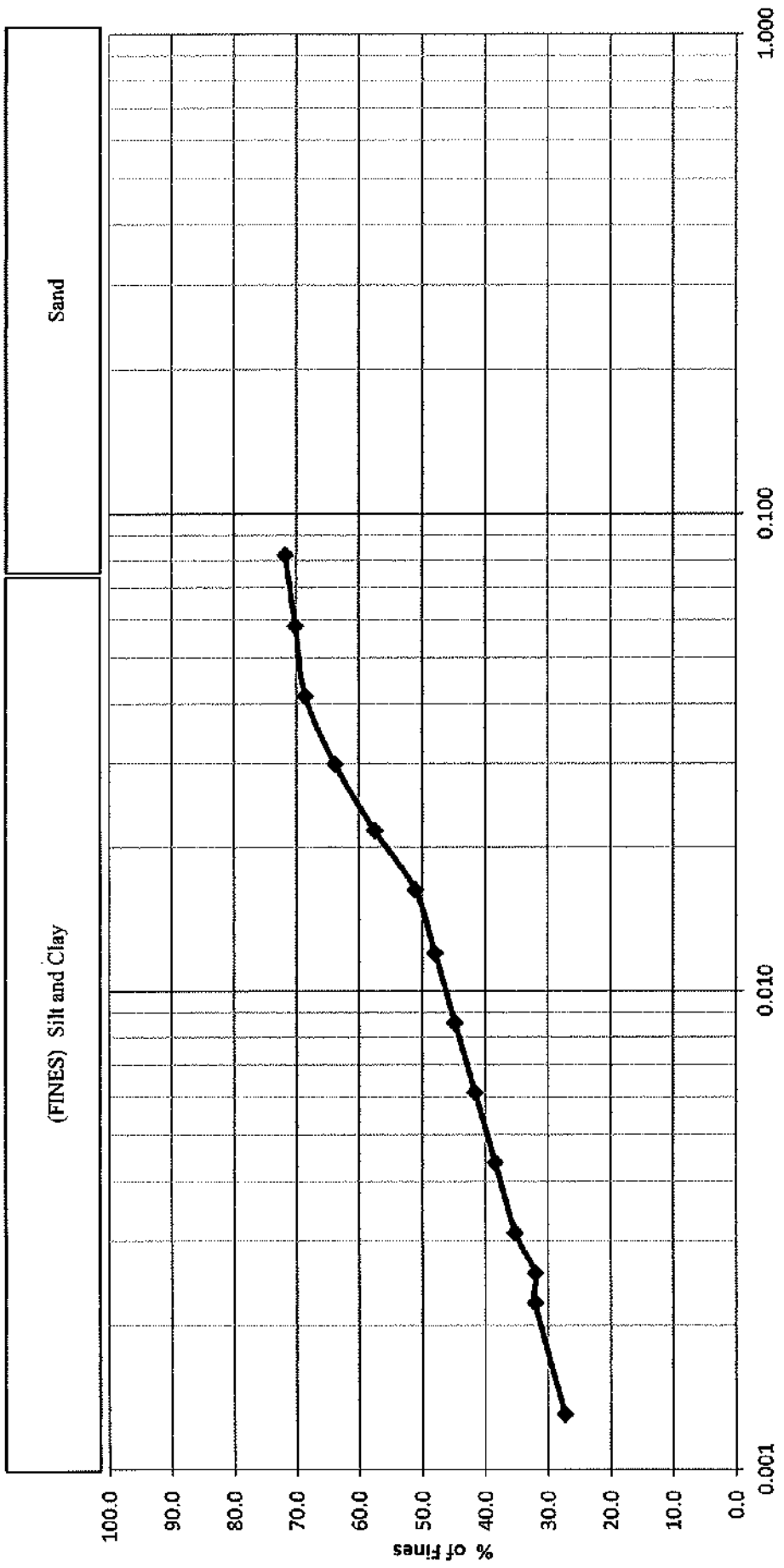


Fig 2.29 Hydrometer Analysis Master Curve

◆ Bore Hole No: 4 Depth: 2.0m



Particle Size Diameter (mm)

Fig 2.30 Hydrometer Analysis Master Curve

◆ Bore Hole No: 4 Depth: 16.0m

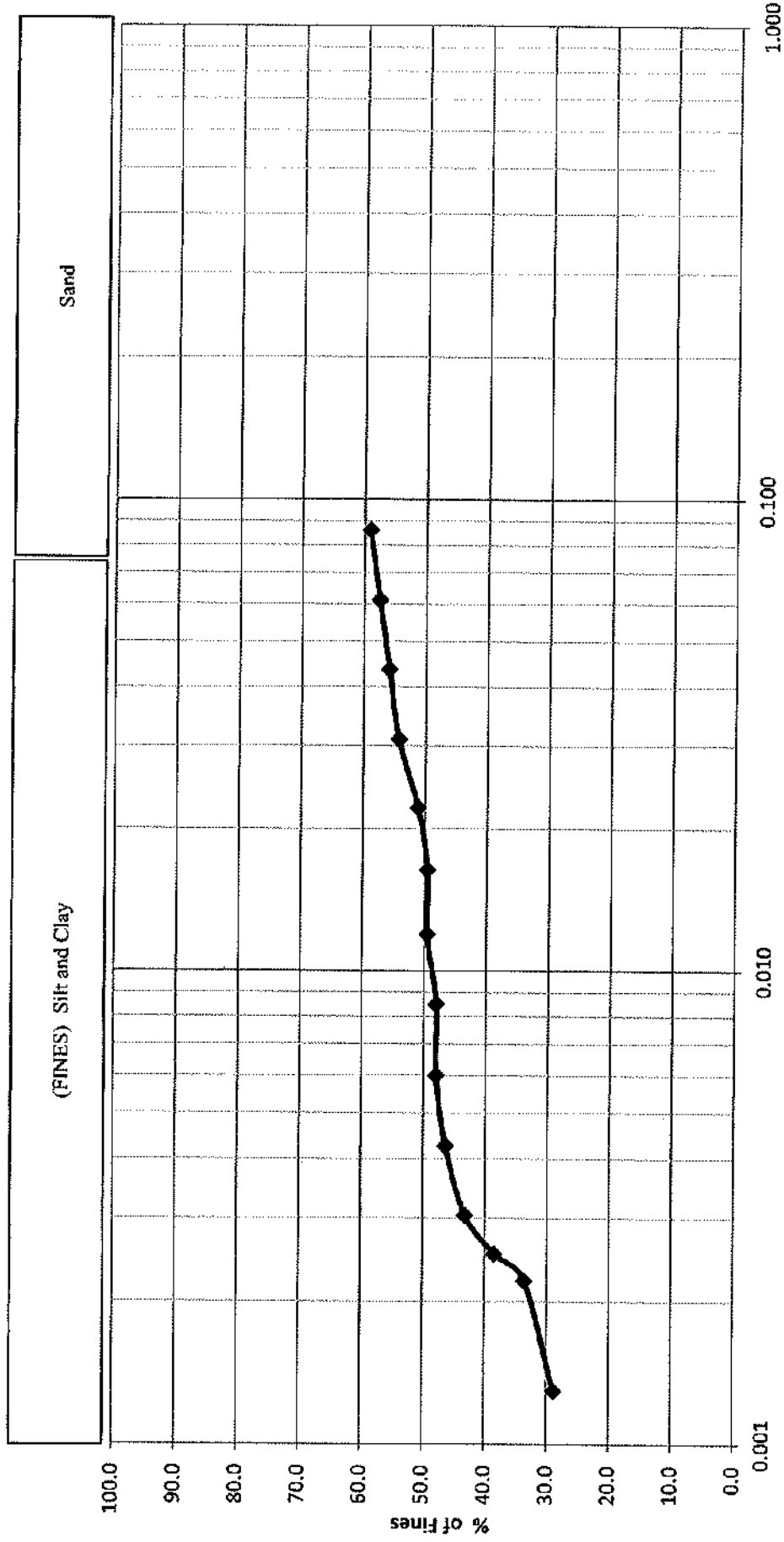


Fig 2.31 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 5 Depth: 16.0m

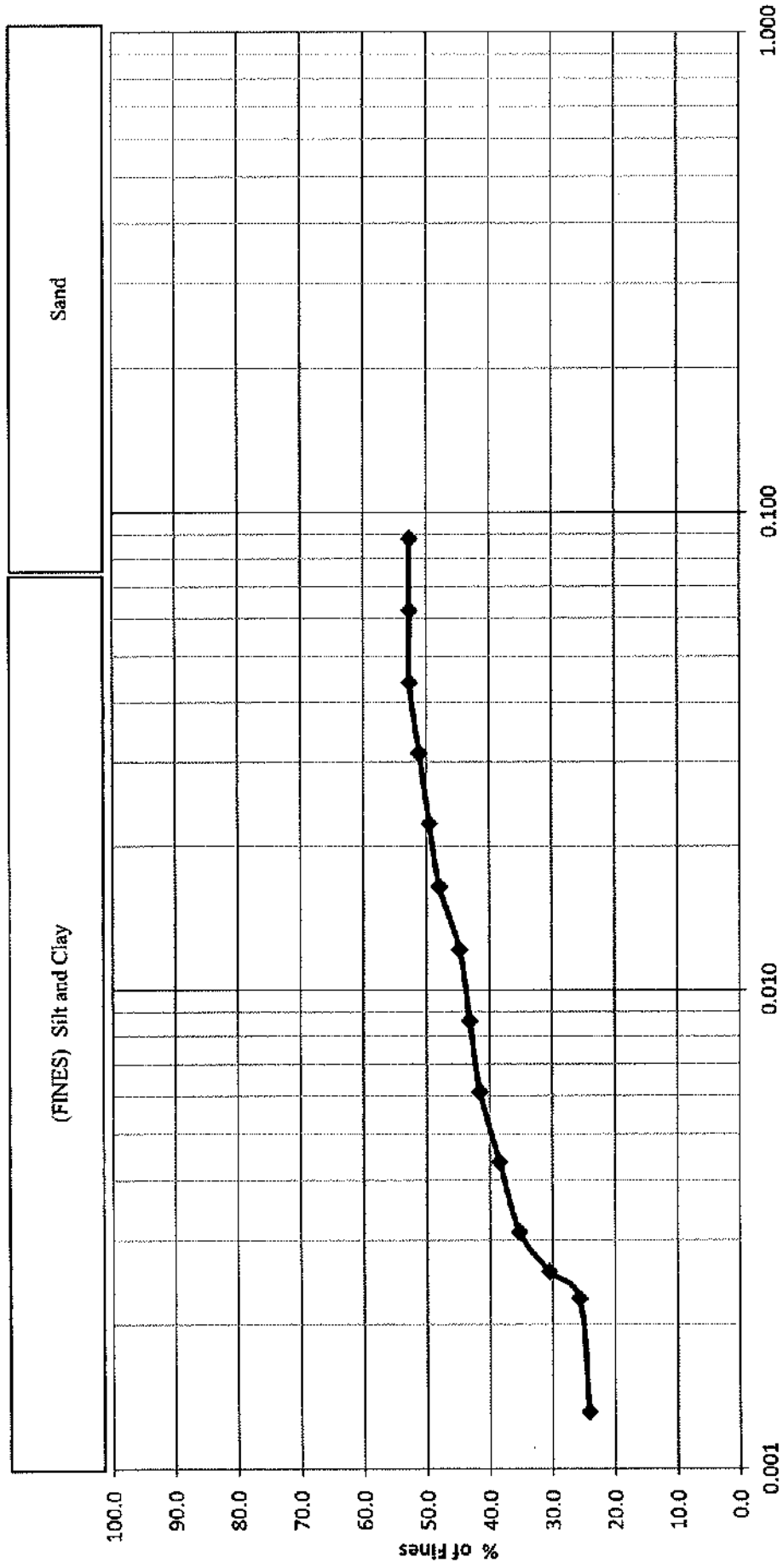


Fig 2.32 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 8 Depth: 1.0m

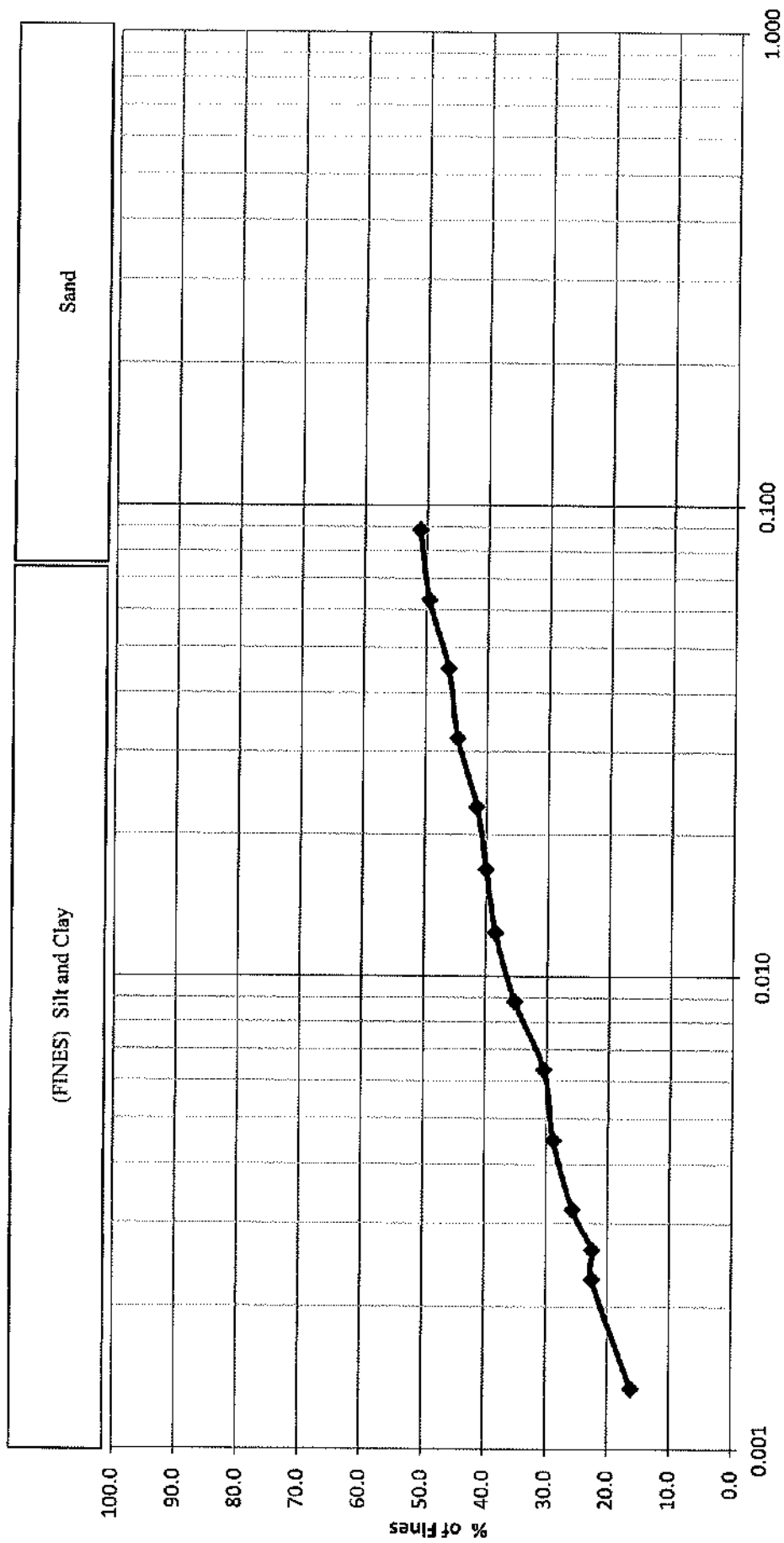


Fig 2.33 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 8 Depth: 3.0m

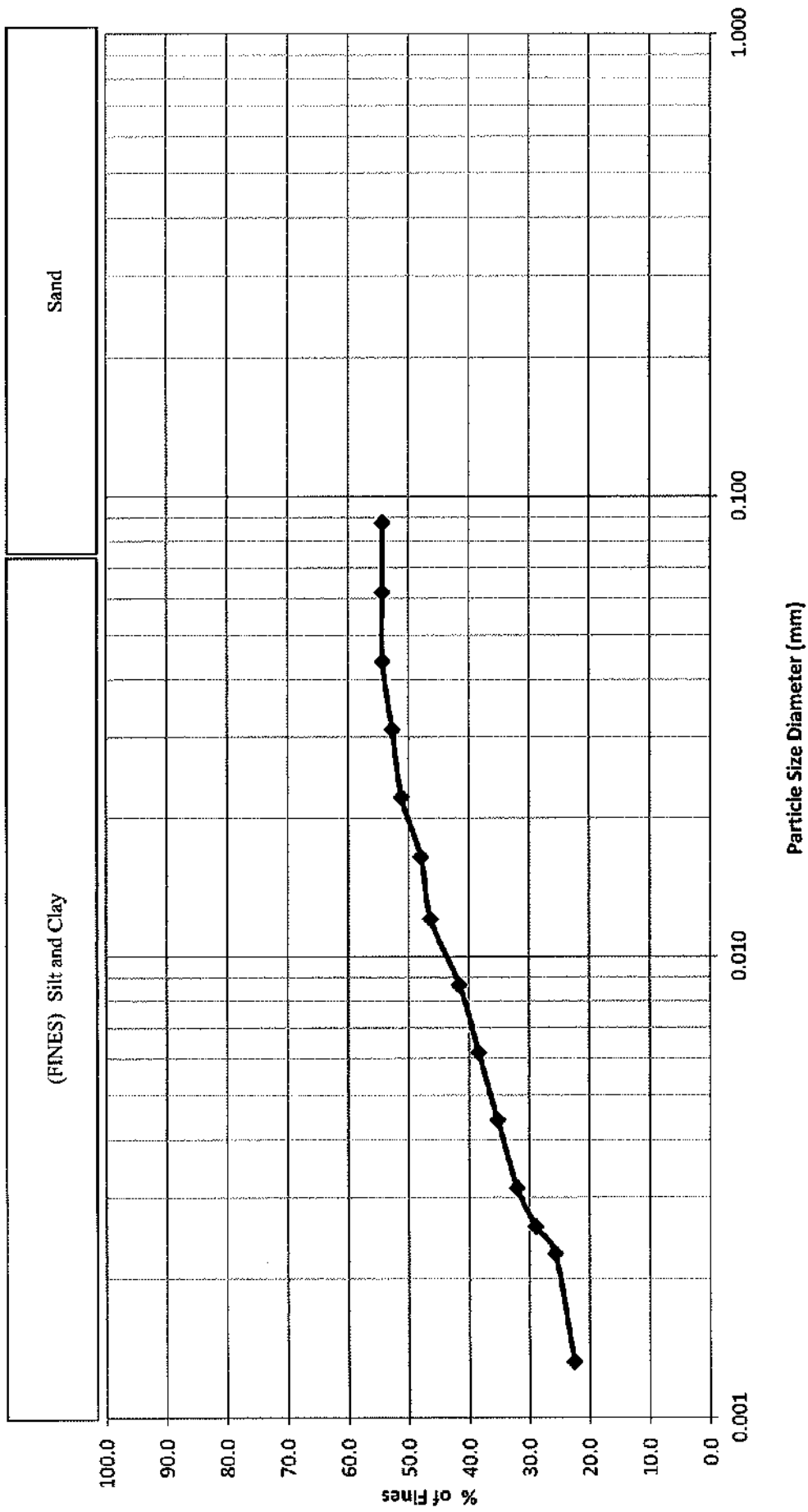


Fig 2.34 Hydrometer Analysis Master Curve

◆ Bore Hole No: 8 Depth: 9.0m

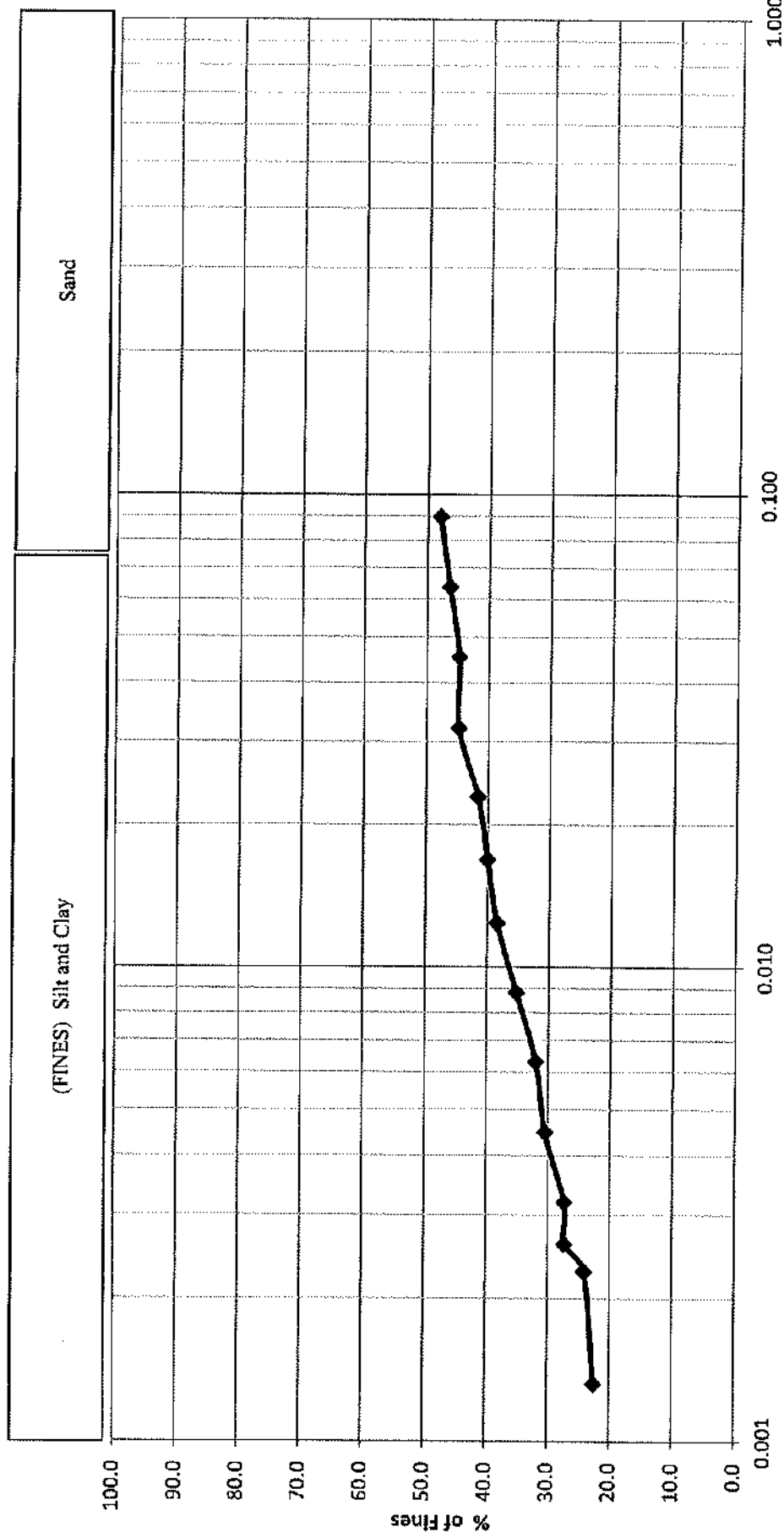


Fig 2.35 Hydrometer Analysis Master Curve

◆ Bore Hole No: 8 Depth: 16.0m

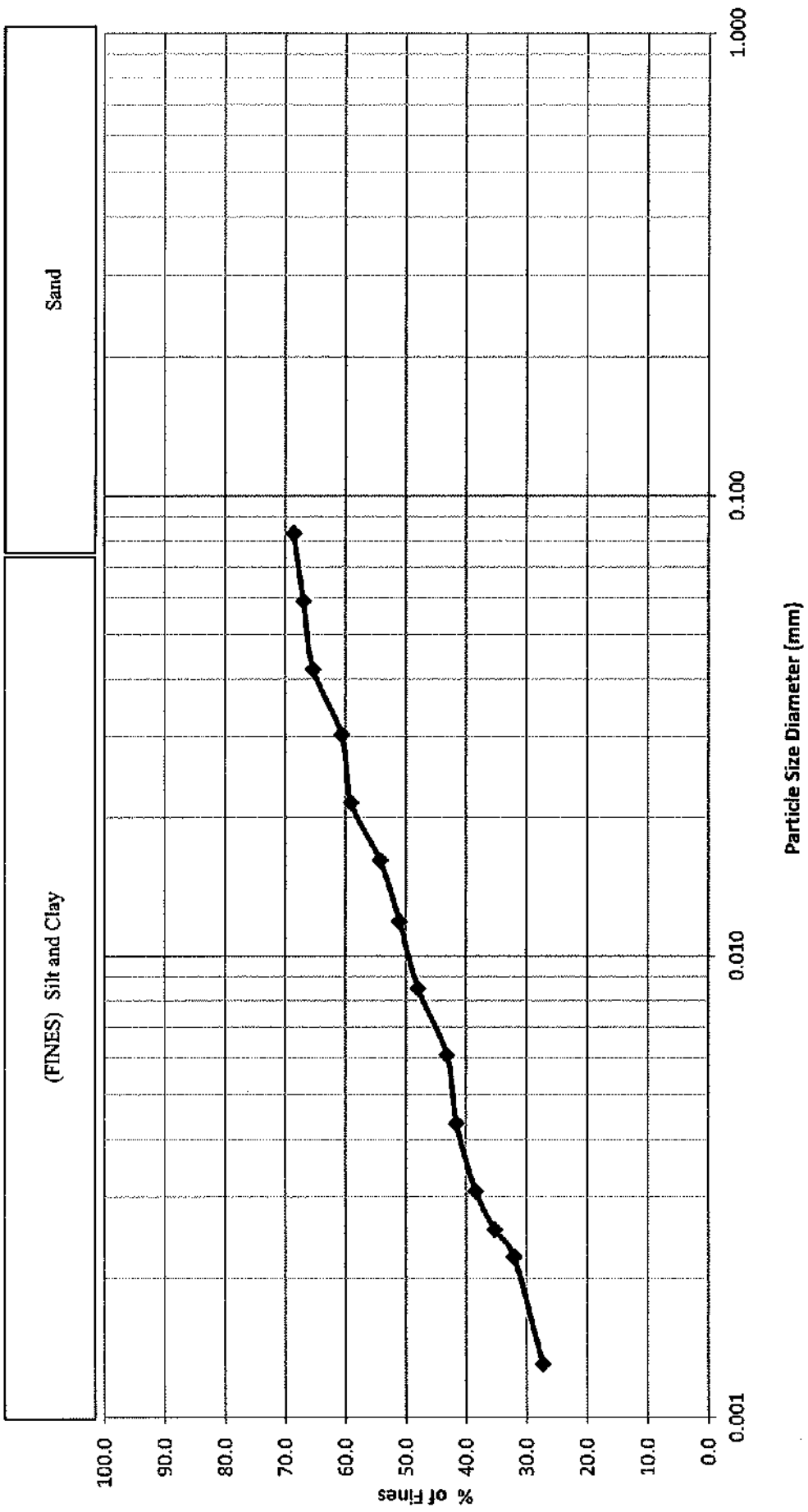
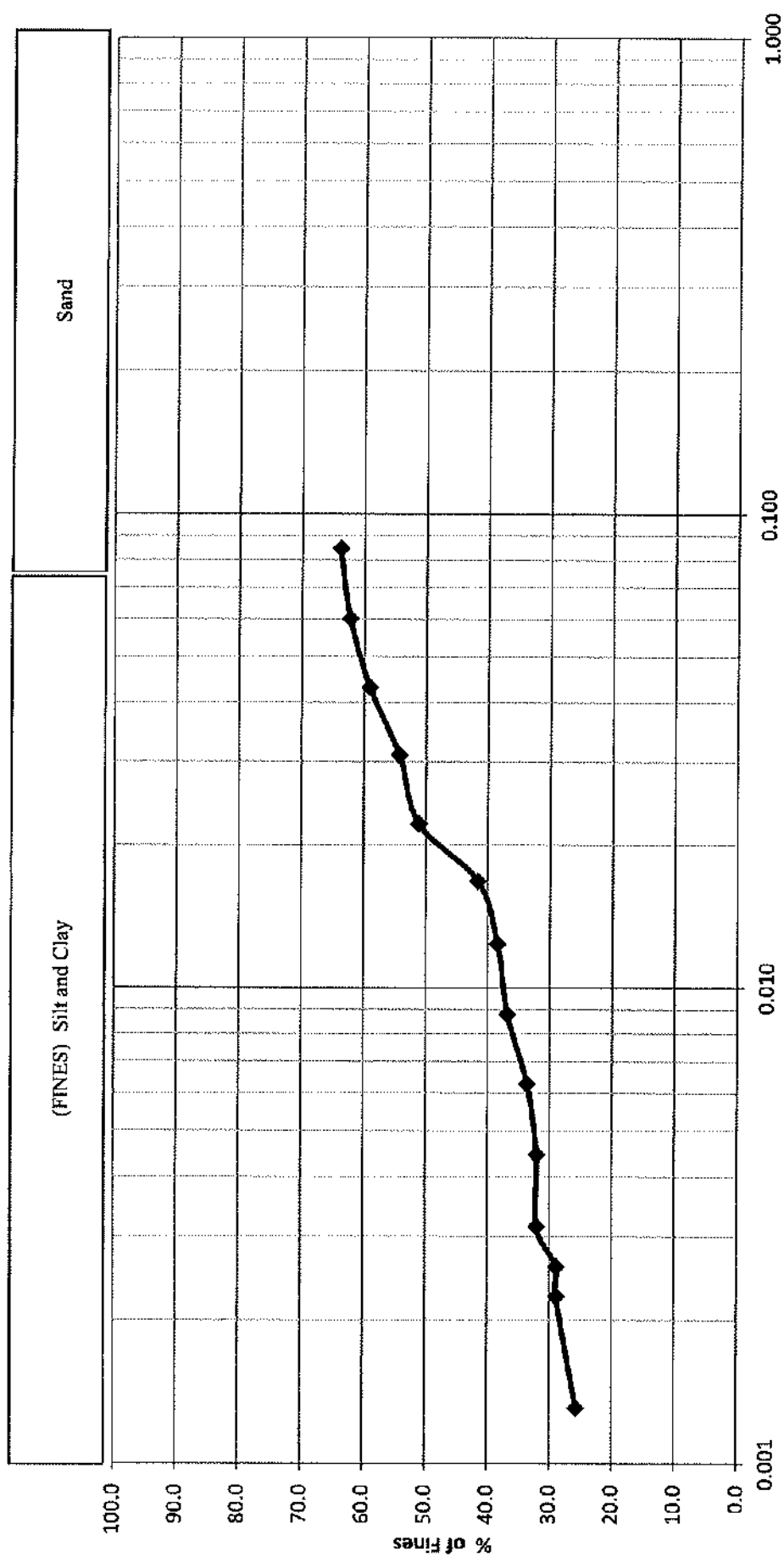


Fig 2.36 Hydrometer Analysis Master Curve

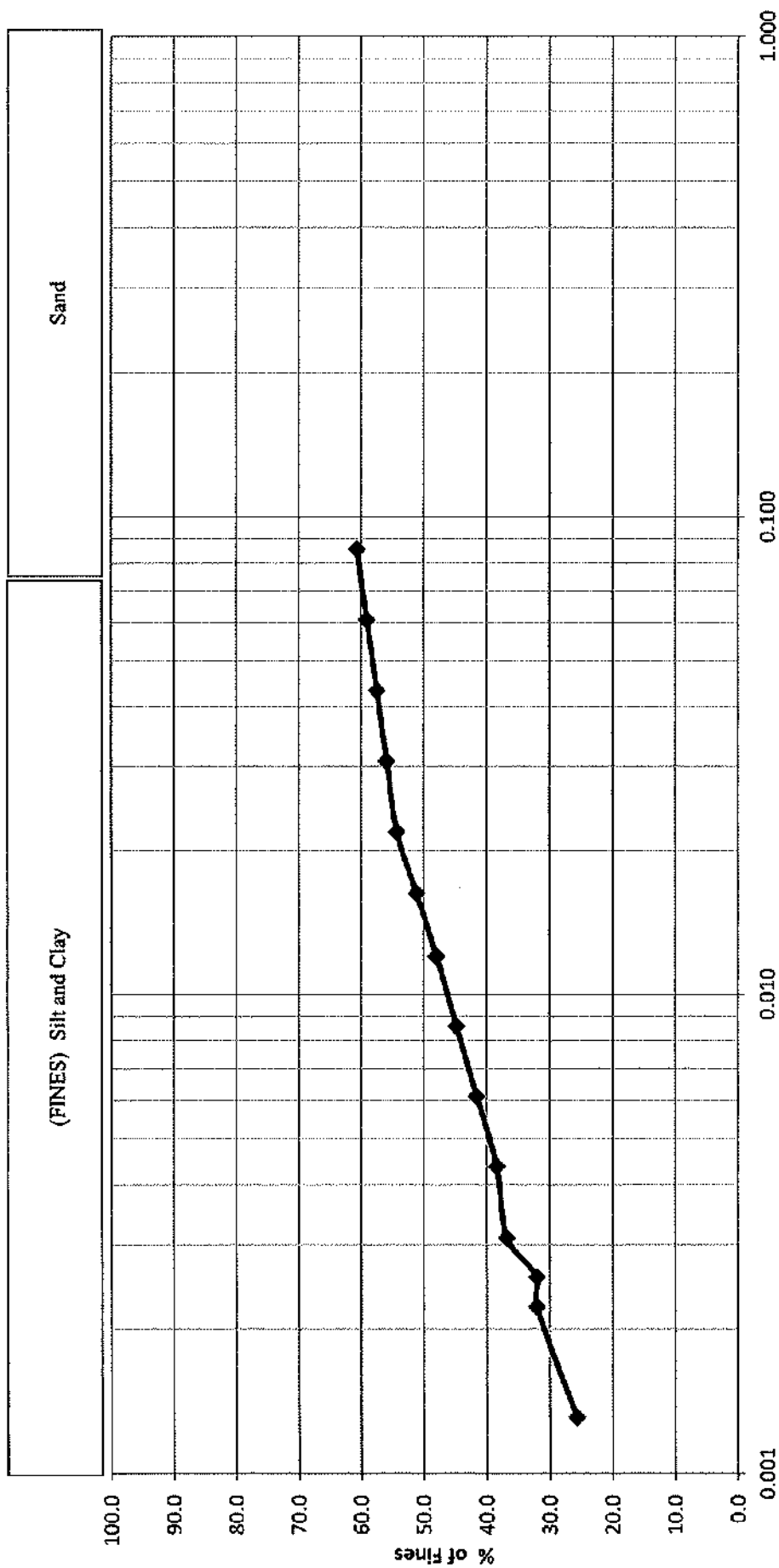
◆ Bore Hole No: 8 Depth: 22.5m



Particle Size Diameter (mm)

Fig 2.37 Hydrometer Analysis Master Curve

◆ Bore Hole No: 10 Depth: 3.0m



Particle Size Diameter (mm)

Fig 2.38 Hydrometer Analysis Master Curve

◆ Bore Hole No: 10 Depth: 14.0m

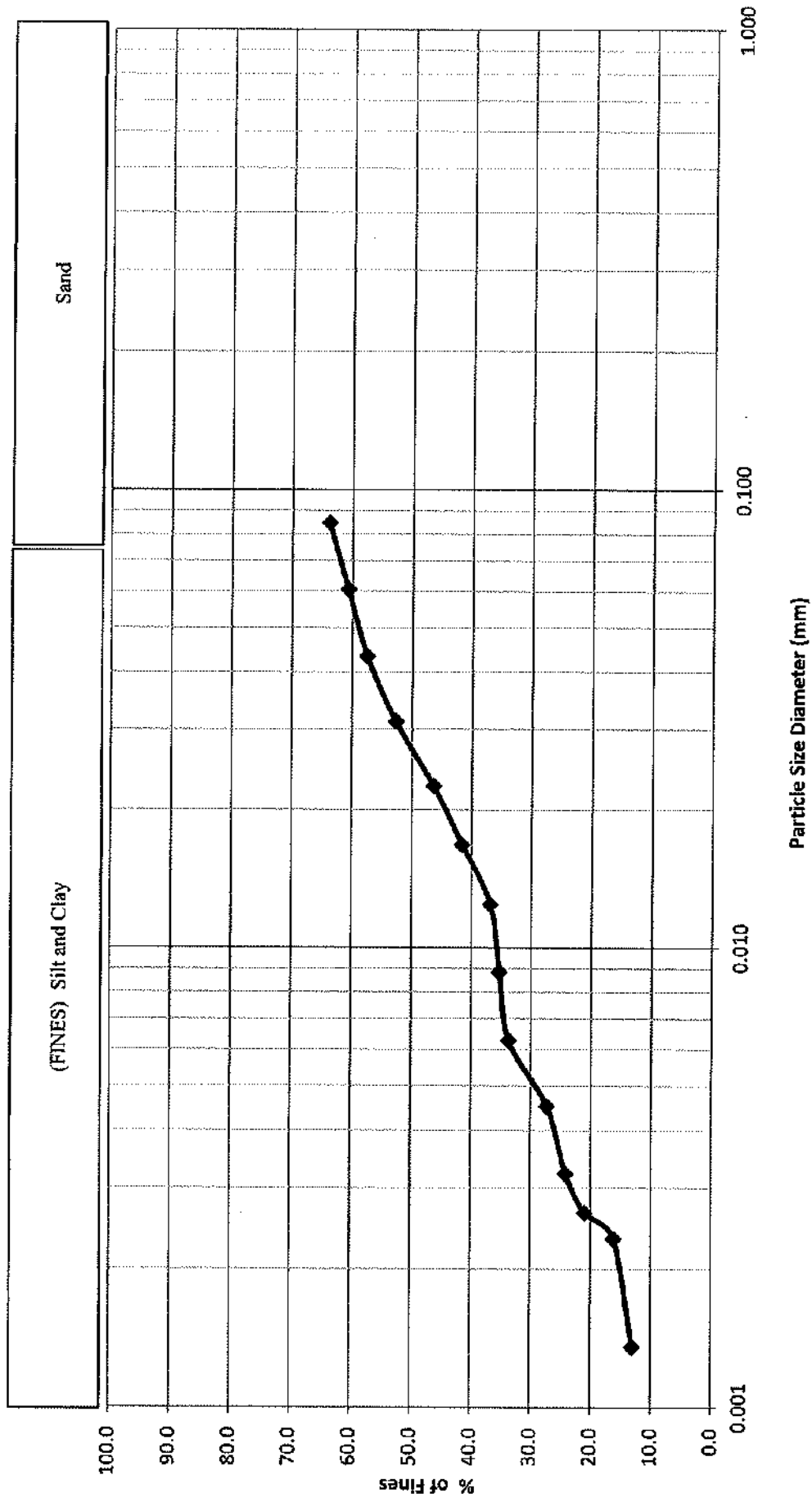
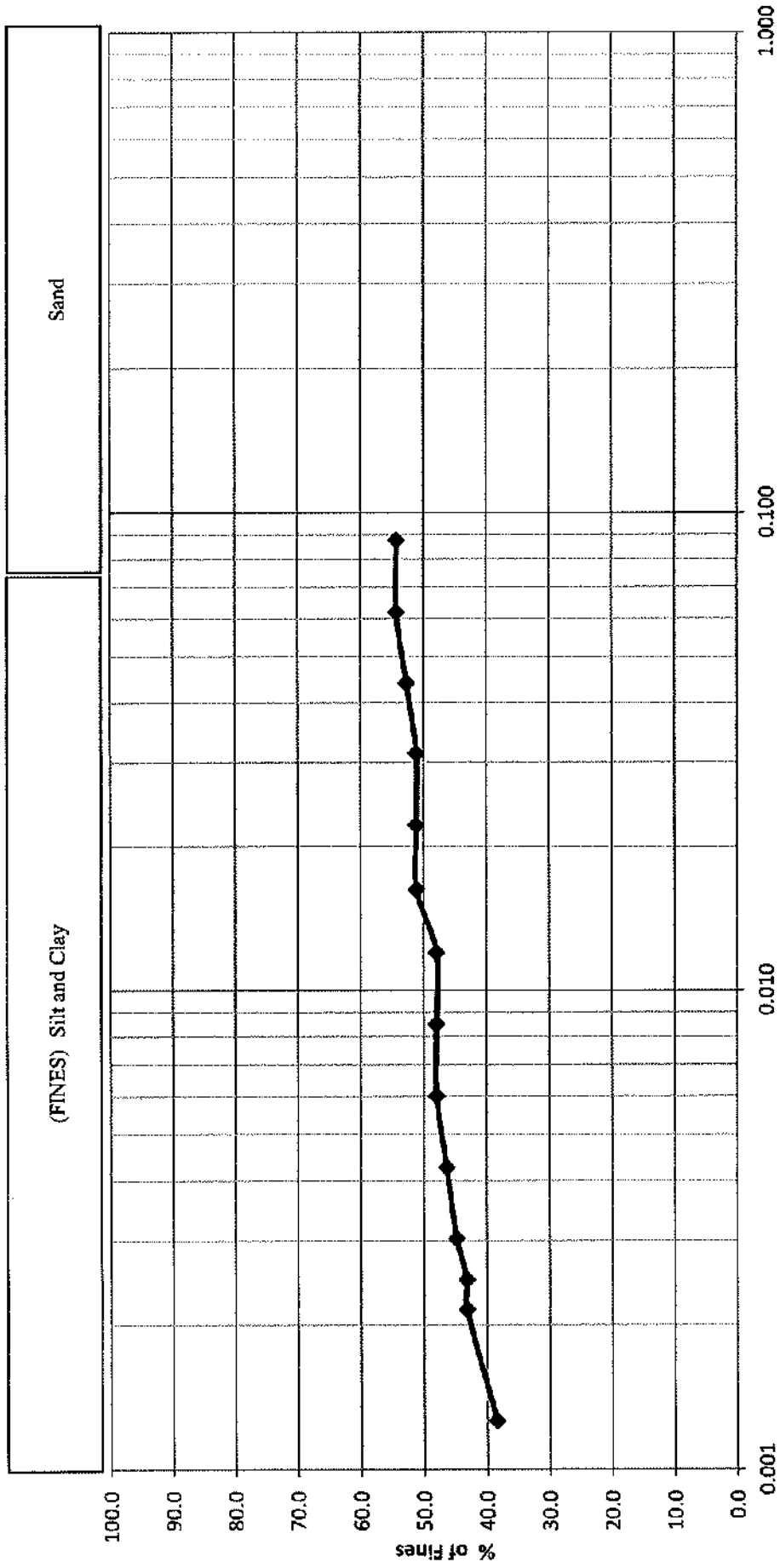


Fig 2.39 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 10 Depth: 18.0m



Particle Size Diameter (mm)

Fig 2.40 Hydrometer Analysis Master Curve

◆ Bore Hole No: 11 Depth: 16.0m

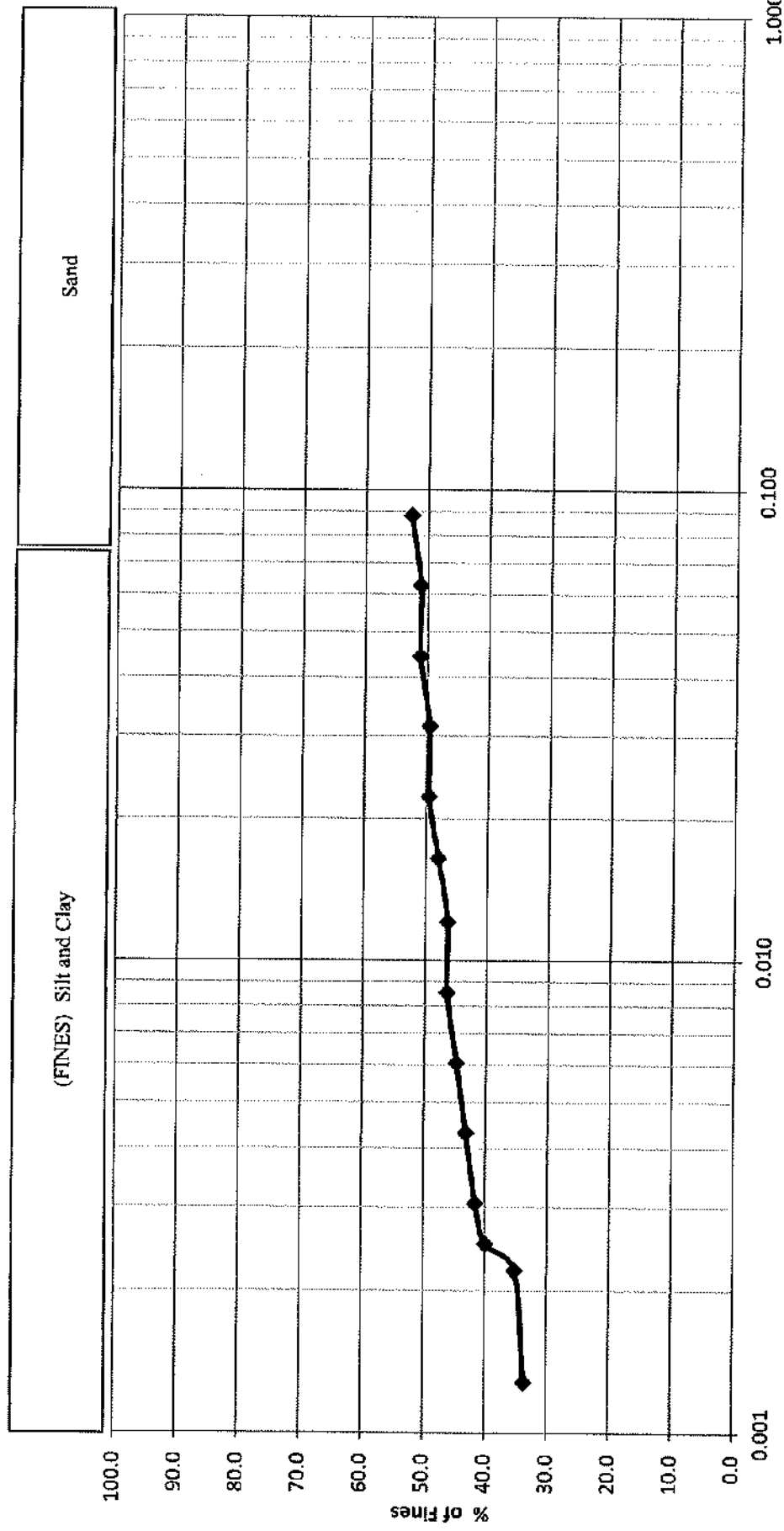


Fig 2.41 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 11 Depth: 20.0m

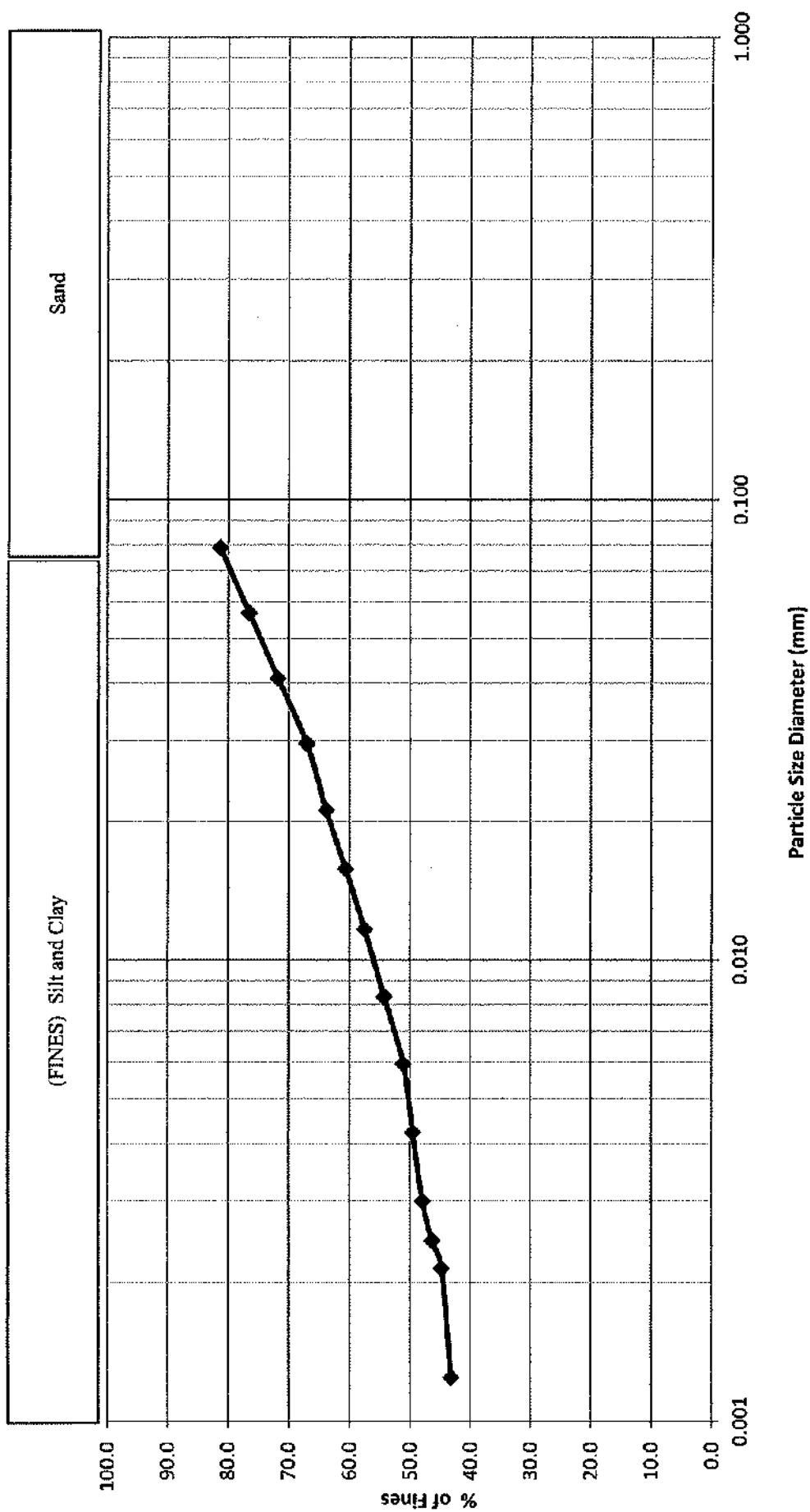
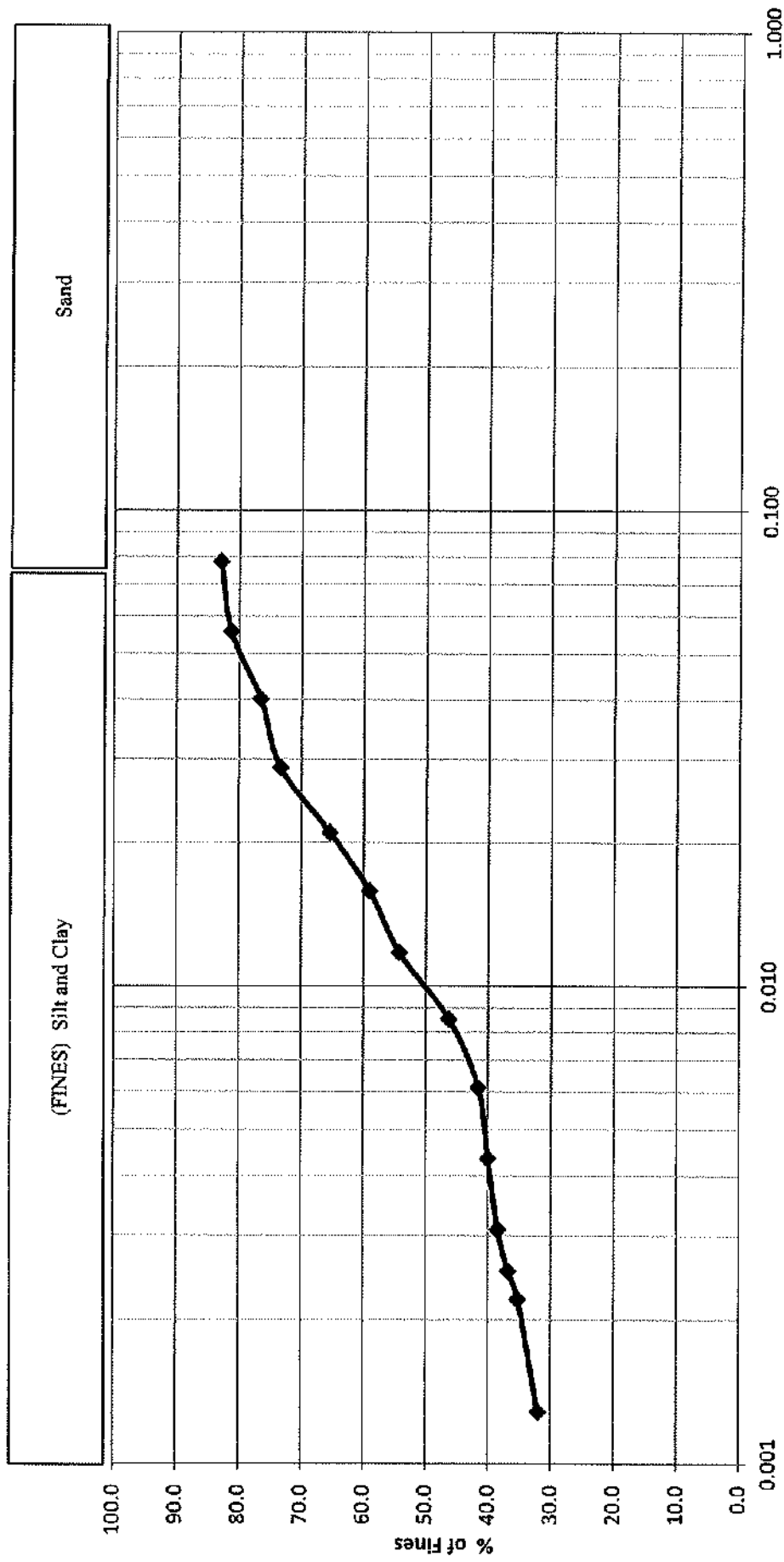


Fig 2.42 Hydrometer Analysis Master Curve

◆ Bore Hole No: 12 Depth: 2.0m



Particle Size Diameter (mm)

Fig 2.43 Hydrometer Analysis Master Curve

◆ Bore Hole No: 12 Depth: 12.0m

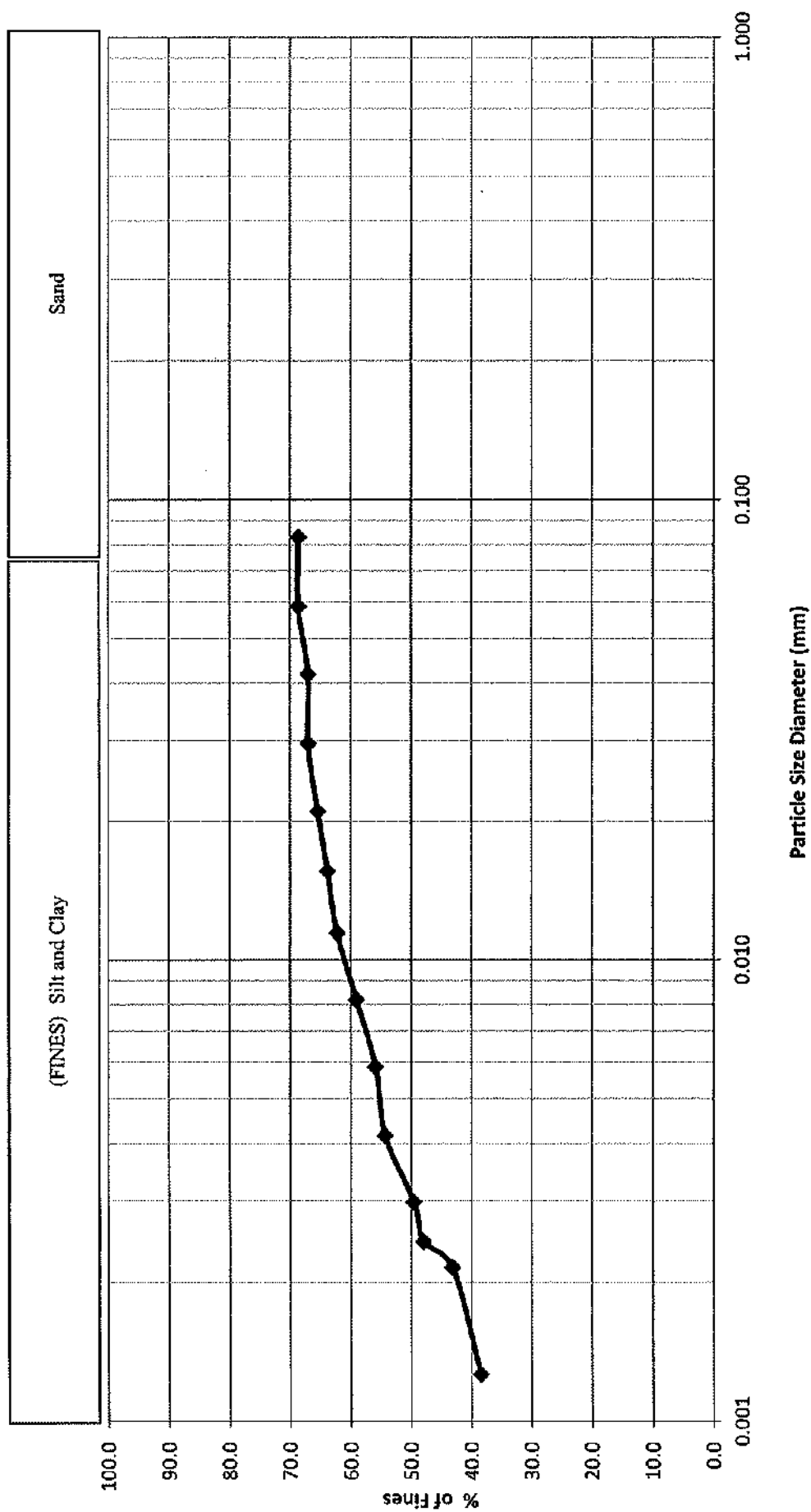
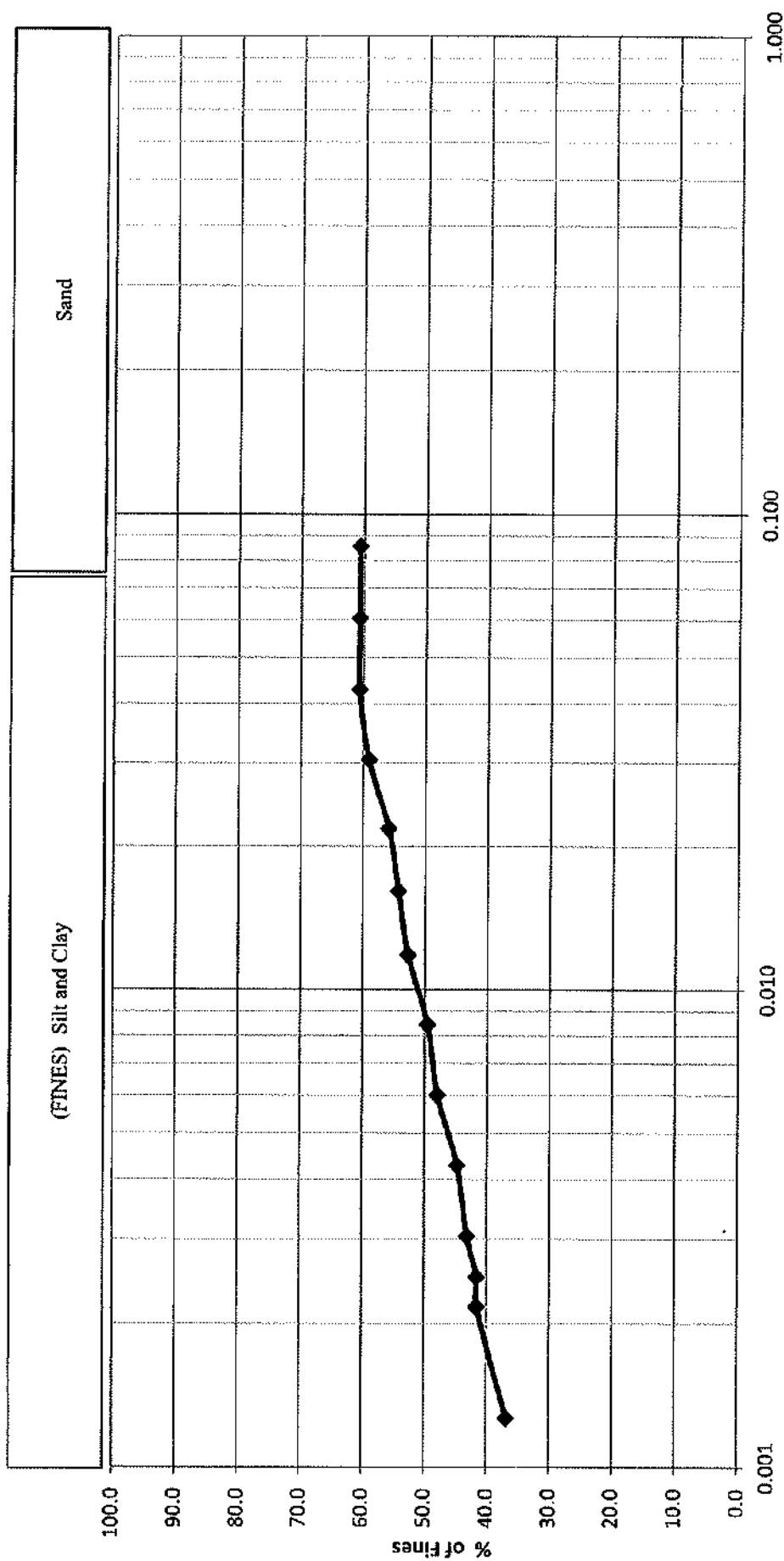


Fig 2.44 Hydrometer Analysis Master Curve

◆ Bore Hole No: 12 Depth: 16.0m



Particle Size Diameter (mm)

Fig 2.45 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

LABORATORY TEST REPORT

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

Name & Address of the Customer	: M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	: By Email
Sample Description	: Soil Sample	Period of Testing	: 06/07/2022 to 28/07/2022
Source of Sample	: Customer Supplied- Borehole No. BH-01	Sample Identification Number	: SS/GMC/052022/474/BH01
Sample Condition	: Satisfactory	Test Report No.	: GT-2374/BH-01
Test Method	: As per Bureau of Indian Standards	Report Date	: 30/07/2022
Sample Receipt Date	: 26/05/2022	Test Report Pages	: Two Pages

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)														
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (Ip= LL-PL)	Consistency Index (Ic=LL-NMCHp)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	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							D10 (mm)	D60 (mm)	Uniformity Co-Efficient Cu=D60/D10	Co-Efficient of Curvature Cc=D30^2/(D10xD60)	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	Gravel						Sand	
1.0	16	SS	-	-	-	-	-	-	CG>50%	-	-	-	12.6	3.3	8.2	31.9	43.9	-	-	-	-	-	-	M.Dense	<50%	SM	
2.0	9	SS	16.5	20.5	15.4	5.1	0.8	15.1	Stiff	Above	CL-ML	-	0.0	0.0	3.7	33.6	52.8	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
3.0	-	UDS	32.1	77.5	25.3	52.2	0.9	10.1	-	Above	CH	-	0.0	0.9	2.4	9.0	58.2	29.5	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
4.0	28	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	4.0	66.1	29.9	-	-	-	-	-	-	M.Dense	<50%	SM	
5.0	35	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.6	38.4	49.4	10.6	-	-	-	-	-	-	Dense	<50%	SP-SM	
6.0	45	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	36.1	49.2	14.7	-	-	-	-	-	-	Dense	<50%	SM	
7.5	45	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	7.8	79.1	13.1	-	-	-	-	-	-	Dense	<50%	SM	
9.0	17	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	5.5	75.8	12.0	6.7	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
10.5	21	SS	-	-	-	-	-	-	CG>50%	-	-	-	3.4	11.9	29.9	24.5	30.3	-	-	-	-	-	-	M.Dense	<50%	SM	
12.0	9	SS	32.4	53.7	27.8	25.9	0.8	13.2	Stiff	Above	CH	-	0.0	0.0	0.7	1.5	46.3	51.5	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
14.0	11	SS	29.7	55.5	25.5	30.0	0.9	12.9	Stiff	Above	CH	-	-	-	-	-	72.0	28.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
16.0	7	SS	28.9	40.7	19.5	21.2	0.6	13.0	M.Stiff	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
18.0	10	SS	24.5	37.8	21.1	16.7	0.8	13.5	Stiff	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	

Name & Address of the Customer : M/s RAMANIYAM REAL ESTATES (P) LTD
Sample Description : Soil Sample
Source of Sample : Customer Supplied- Borehole No. BH-01
Sample Condition : Satisfactory
Test Method : As per Bureau of Indian Standards
Sample Receipt Date : 26/05/2022
Customer Reference : By Email
Period of Testing : 06/07/2022 to 28/07/2022
Sample Identification Number : SS/GMC/052022/474/BH-01
Test Report No. : GT-2374/BH-01
Report Date : 30/07/2022
Test Report Pages : Two Pages

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Sample Depth (m)	SPT - "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)										IS-Notation											
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-41) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (I _p = LL-PL)	Consistency Index (I _c = LL-NMCI _p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VI) -	FREE SWELL INDEX (%) 1972, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	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 × D ₆₀)	Relative Density							
20.0	14	SS	25.4	47.1	19.8	28.3	0.8	12.6	66.7	Stiff	Above	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%	
22.5	21	SS	24.8	39.1	15.0	23.1	0.6	16.5	63.6	CG>50%	Above	-	-	-	-	-	26.1	2.1	16.0	29.7	24.2	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	SC
25.0	50	SS	26.8	66.0	31.1	34.9	1.1	12.2	81.8	Hard	Above	CH	-	-	-	-	0.0	0.3	10.2	4.1	85.4	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%
27.5	84	SS	-	-	-	-	-	-	-	CG>60%	-	-	-	-	-	-	0.0	0.0	14.5	59.0	26.6	-	-	-	-	-	-	-	-	-	-	V.Dense	<50%	SM
30.0	>100	SS											Pieces of Lified Shale Rock																					
33.0	>100	SS	17.9	66.0	25.8	40.2	1.2	-	33.3	Hard	Above	CH	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%

Pieces of Lithified Shale Rock

**** 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

A. VINOTH
(Technical Manager)

LABORATORY TEST REPORT

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

Name & Address of the Customer	: M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	: 06/07/2022 to 28/07/2022
Sample Description	: Soil Sample	Period of Testing	: SS/GMC/052022/474/BH02
Source of Sample	: Customer Supplied- Borehole No. BH-02	Sample Identification Number	: GT-2374/BH-02
Sample Condition	: Satisfactory	Test Report No.	: 30/07/2022
Test Method	: As per Bureau of Indian Standards	Report Date	: Two Pages
Sample Receipt Date	: 21/05/2022	Test Report Pages	

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)										IS-Notation					
			Moisture Content (%) AS PER IS 2720 (P-III) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-VI) - 1985, RA-2015	Plasticity Index (I _p = LL-PL)	Consistency Index (I _c = LL-NMCI _p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VII) - 1972, RA-2011	FREE SWELL INDEX AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	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 × D ₆₀)	Relative Density	Gravel
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)									
1.0	27	SS	15.7	27.5	16.8	10.7	1.1	16.0	16.7	V.Stiff	Above	CL	-	0.0	0.0	1.9	44.2	53.9	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
2.0	23	SS	19.2	39.2	21.0	18.2	1.1	13.3	20.0	V.Stiff	Above	CI	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
3.0	22	SS	19.7	41.7	21.7	19.9	1.1	12.8	38.5	V.Stiff	Above	CI	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
4.0	22	SS	Little to Non Plastic Pred. Silt Binder										0.0	0.0	0.8	59.6	39.6	-	-	-	-	-	-	M.Dense	<50%	-	-	-
5.0	37	SS	18.5	26.7	17.5	9.2	1.1	15.5	10.0	CG>50%	Above	-	-	0.0	0.0	7.0	59.9	33.1	-	-	-	-	-	-	Dense	<50%	SC	
6.0	34	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.2	25.0	58.4	15.4	-	-	-	-	-	-	Dense	<50%	SM	
7.5	23	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	2.9	52.0	36.0	9.1	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
9.0	18	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	3.8	62.5	23.9	9.8	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
10.5	27	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	0.4	58.2	41.4	-	-	-	-	-	-	M.Dense	<50%	SM	
12.0	15	SS	17.6	33.6	16.7	16.9	0.9	14.0	9.1	Stiff	Above	CL	-	0.0	1.0	9.3	8.2	81.5	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
14.0	14	SS	29.5	65.5	28.4	37.0	1.0	12.1	42.9	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
16.0			UDS Sample Failed																									
18.0	8	SS	21.3	36.5	17.4	18.1	0.8	13.9	63.6	Stiff	Above	CI	-	-	-	-	-	55.2	44.8	-	-	-	-	-	FG>50%	FG>50%	FG>50%	

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Name & Address of the Customer :

Sample Description : M/s RAMANIYAM REAL ESTATES (P) LTD

Source of Sample : Soil Sample

Sample Condition : Customer Supplied- Borehole No. BH-02

Test Method : Satisfactory

Sample Receipt Date : As per Bureau of Indian Standards

Sample Receipt Date : 21/05/2022

Customer Reference :

Period of Testing : 06/07/2022 to 28/07/2022

Sample Identification Number : SS/GMC/052022/474/BH02

Test Report No. : GT-2374/BH-02

Report Date : 30/07/2022

Test Report Pages : Two Pages

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

Sample Depth (m)	SPT - "N" Value	Type of Sample	Fine Grained (FG)										SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Coarse Grained (CG)										IS-Notation		
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (Ip= LL-PL)	Consistency Index (Ic=LL-NMCI/p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VI) -	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS:Notation														
20.0	20	SS	17.3	37.0	18.0	19.0	1.0	13.8	50.0	V.Stiff	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	
22.5	36	SS	25.8	48.7	24.2	24.5	0.8	13.5	66.7	CG>50%	Above	-	-	0.0	2.2	9.7	47.0	41.2	-	-	-	-	-	Dense	<50%	SC
25.0	44	SS	21.3	47.7	25.4	22.3	1.2	13.5	72.7	CG>50%	Above	-	-	0.0	1.4	8.3	49.0	41.4	-	-	-	-	-	Dense	<50%	SC
27.5	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	5.6	30.8	30.8	32.9	0.0	-	-	-	-	V.Dense	<50%	SM
30.0	>100	SS	25.1	55.1	26.2	29.0	1.0	-	17.6	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	
33.0	63	SS	27.3	58.1	29.8	26.3	1.1	13.3	35.7	Hard	Above	CH	-	-	-	-	-	74.3	25.7	-	-	-	-	FG>50%	FG>50%	

"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

A. VINOTH

(Technical Manager)

LABORATORY TEST REPORT

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

Name & Address of the Customer	: M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	: By Email
Sample Description	: Soil Sample	Period of Testing	: 06/07/2022 to 28/07/2022
Source of Sample	: Customer Supplied- Borehole No. BH-03	Sample Identification Number	: SS/GMC/052022/474/BH-03
Sample Condition	: Satisfactory	Test Report No.	: GT-2374/BH-03
Test Method	: As per Bureau of Indian Standards	Report Date	: 30/07/2022
Sample Receipt Date	: 21/05/2022	Test Report Pages	: Two Pages

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)										IS-Notation	
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	Liquid Limit (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (Ip = LL-PL)	Consistency Index (Ic = LL-NMCIp)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VI) -	FREE SWELL INDEX AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS-Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III) SEC-1) - 1980, RA-2010												
1.0	24	SS	14.2	18.8	4.0	1.1	16.0	15.4	V.Stiff	Above	CL-ML	-	0.0	0.0	3.5	33.4	63.1	-	-	-	-	-	FG>50%	FG>50%
2.0	31	SS	17.4	30.0	10.6	1.2	15.5	27.3	Hard	Above	CL	-	-	-	-	-	75.9	-	-	-	-	-	FG>50%	FG>50%
3.0	33	SS	17.7	56.5	30.6	1.3	12.3	6.7	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%
4.0	22	SS	14.8	29.6	14.4	1.0	15.8	12.5	V.Stiff	Above	CL	-	0.0	0.0	1.0	28.1	70.9	-	-	-	-	-	FG>50%	FG>50%
5.0	50	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	13.3	74.1	12.6	-	-	-	-	-	SM	SM
6.0	40	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.2	48.8	35.9	14.0	-	-	-	-	-	SM	SM
7.5	32	SS	-	-	-	-	-	-	CG>50%	-	-	-	0.0	2.6	45.9	41.5	10.1	-	-	-	-	-	SP-SM	SP-SM
9.0	30	SS	-	-	-	-	-	-	CG>50%	-	-	-	1.5	6.3	63.5	20.0	8.8	-	-	-	-	-	SP-SM	SP-SM
10.5	4	SS	33.5	45.3	26.9	0.4	14.8	0.0	Soft	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%
12.0	16	SS	25.7	61.4	31.2	1.1	12.3	42.9	V.Stiff	Above	CH	-	-	-	-	-	56.2	44.8	-	-	-	-	FG>50%	FG>50%
14.0	14	SS	31.1	65.5	35.0	1.0	11.7	55.5	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%
16.0	10	SS	27.2	50.1	28.5	0.9	13.3	75.0	Stiff	Above	CH	-	-	-	-	-	56.8	43.2	-	-	-	-	FG>50%	FG>50%
18.0	17	SS	24.2	55.5	30.3	1.0	12.8	65.5	V.Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Name & Address of the Customer

Sample Description

Source of Sample

Sample Condition

Test Method

Sample Receipt Date

M/s RAMANIYAM REAL ESTATES (P) LTD

Soil Sample

Customer Supplied- Borehole No. BH-04

Satisfactory

As per Bureau of Indian Standards

14/05/2022

Customer Reference

Period of Testing

Sample Identification Number

Test Report No.

Report Date

Test Report Pages

By Email

08/07/2022 to 28/07/2022

SS/GMC/052022/474/BH04

GT-2374/BH-04

30/07/2022

Two Pages

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

Sample Depth (m)	SPT- "N" Value	Fine Grained (FG)										Coarse Grained (CG)																	
		Type of Sample		AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) 1985, RA-2015	AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (Ip= LL-PL)	Consistency Index (Ic=LL-NMCIp)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	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						D10 (mm)	D30(mm)	D60 (mm)	Uniformity Co-Efficient Cu=D60/D10	Co-Efficient of Curvature Cc=D30²/(D10Xd60)	Relative Density	IS-Notation		
															Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)									
1.0	19	SS	14.6	40.3	17.2	23.1	1.1	14.5	23.1	V.Stiff	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand
2.0	14	SS	21.8	47.2	20.0	27.3	0.9	13.8	45.5	Stiff	Above	CI	-	-	-	-	67.9	32.1	-	-	-	-	-	FG>50%	FG>50%	FG>50%			
3.0	17	SS	16.5	28.8	19.0	9.7	1.3	16.0	8.3	V.Stiff	Above	CL	-	0.0	0.0	1.5	43.1	55.4	-	-	-	-	-	FG>50%	FG>50%	FG>50%			
4.0	10	SS	-	-	-	-	-	-	-	-	-	ML	-	0.0	0.0	0.7	43.1	56.2	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
5.0	34	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	14.3	58.8	26.8	-	-	-	-	-	-	Dense	<50%	SM	SM	SM
6.0	38	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	2.0	3.2	50.5	34.1	10.2	-	-	-	-	-	-	Dense	<50%	SP-SM	SP-SM	SP-SM
7.5	30	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.1	58.9	32.0	8.0	-	-	-	-	-	-	M.Dense	<50%	SP-SM	SP-SM	SP-SM
9.0	9	SS	32.5	60.1	25.6	34.5	0.8	11.9	28.6	Stiff	Above	CH	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
10.5	9	SS	37.0	74.4	28.1	46.2	0.8	10.5	30.8	Stiff	Above	CH	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
12.0	11	SS	27.3	50.7	20.6	30.0	0.8	12.5	23.1	Stiff	Above	CH	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
14.0	10	SS	29.0	53.5	25.5	28.0	0.9	12.1	71.4	Stiff	Above	CH	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
16.0	9	SS	24.4	44.0	19.4	24.5	0.8	13.3	55.5	Stiff	Above	CI	-	-	-	-	-	66.6	33.4	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
18.0	13	SS	19.1	43.8	18.7	25.1	1.0	14.0	118.7	Stiff	Above	CI	-	-	-	-	-	100.0	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Phone No.: 044-24481485, 044-24480305

Name & Address of the Customer : M/s RAMANIYAM REAL ESTATES (P) LTD
Sample Description : Soil Sample
Source of Sample : Customer Supplied- Borehole No. BH-04
Sample Condition : Satisfactory
Test Method : As per Bureau of Indian Standards
Sample Receipt Date : 14/05/2022

Customer Reference : By Email
Period of Testing : 08/07/2022 to 28/07/2022
Sample Identification Number : SS/GMC/052022/474/BH04
Test Report No. : GT-2374/BH-04
Report Date : 30/07/2022
Test Report Pages : Two Pages

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-2016	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (Ip= LL-PL)	Consistency Index (Ic=LL-NMCIp)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-I) - 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 ₃₀	Co-Efficient of Curvature C _c =D ₃₀ ² /D ₁₀ x D ₆₀	Relative Density	IS-Notation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

** 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 CONSULTANTS PVT LTD-GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Customer Reference

Customer Reference
Period of Testing

Period of Testing

Sample Identification Number

Test Report No.

Report Date

Test Report Pages

08/07/2022 to 28/07/2022

SS/GMC/052022/474/BH05

GT-2374/BH-05

30/07/2022

Two Pages

Table-2.5 Laboratory Classification of Soil Samples from BH-05

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)																			
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (I _p = LL-PL)	Consistency Index (I _c =LL-NMCI _p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-V) -	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY SEC-1) - 1980, RA-2010 AS PER IS 2720 (P-III, AS PER IS 2720 (P-IV) - 1985, RA-2015	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D ₁₅ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	Uniformity Co-Efficient C _u =D ₆₀ /D ₁₀	Co-Efficient of Curvature C _c =D ₃₀ /(D ₁₀ x D ₆₀)	Relative Density	IS-Notation						
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand					
1.0	9	SS	21.2	36.2	17.2	21.0	0.8	14.7	14.3	Stiff	Above	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%	Gravel	Sand	
2.0	6	SS	25.4	47.0	17.1	30.0	0.7	14.0	25.0	M.Stiff	Above	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%		
3.0	12	SS								CG>50%	Above	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	-	-
4.0	6	SS								CG>50%	Above	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Loose	<50%	-	-
5.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	SM	
6.0	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
7.5	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
9.0	4	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M.Dense	<50%	SP-SM	
10.5	7	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V.Loose	<50%	SM	
12.0	0	SS	48.3	63.1	22.3	30.8	0.2	13.7	13.3	Very Soft	Above	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Loose	<50%	SP-SM	
14.0	2	SS	37.8	43.0	22.2	20.8	0.2	14.2	19.5	Very Soft	Above	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%		
16.0	2	SS	41.5	45.8	23.2	22.6	0.2	14.0	45.5	Very Soft	Above	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%		
18.0	4	SS	42.7	58.2	22.0	36.2	0.4	12.1	46.2	Soft	Above	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FG>50%	FG>50%		

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Phone No.: 044-24481485, 044-24480305

Name & Address of the Customer : M/s RAMANIYAM REAL ESTATES (P) LTD
 Sample Description : Soil Sample
 Source of Sample : Customer Supplied- Borehole No. BH-05
 Sample Condition : Satisfactory
 Test Method : As per Bureau of Indian Standards
 Sample Receipt Date : 06/05/2022
 Customer Reference : By Email
 Period of Testing : 08/07/2022 to 28/07/2022
 Sample Identification Number : SS/GMC/052022/474/BH05
 Test Report No. : GT-2374/BH-05
 Report Date : 30/07/2022
 Test Report Pages : Two Pages

Table-2.5 Laboratory Classification of Soil Samples from BH-05

Sample Depth (m)			SPT. "N" Value			Type of Sample			Fine Grained (FG)										Coarse Grained (CG)									
									Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	LIQUID LIMIT (%) 1965, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1965, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (I_p = LL-PL)	Consistency Index (I_c =LL-NMCI/ I_p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-V) -	FREE SWELL INDEX (%) 1972, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS-Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Gravel (%)	Coarse (%)	Medium (%)	Fines (%)	Silt (%)	Clay (%)	D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)
20.0	11	SS	39.1	88.5	33.3	55.2	0.9	9.8	100.0	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
22.5	15	SS	26.1	49.4	20.5	28.9	0.8	13.7	50.0	Stiff	Above	CI	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
25.0	30	SS	15.9	34.3	17.5	16.6	1.1	-	23.5	V.Stiff	Above	CL	-	0.0	0.0	1.9	30.5	67.6	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
27.5	63	SS	31.1	71.0	31.2	39.8	1.0	11.2	26.7	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
30.0	52	SS	27.3	74.5	33.5	41.0	1.2	11.0	29.5	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
32.5	52	SS	28.5	74.4	32.8	41.6	1.1	11.0	39.9	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%
35.0	52	SS	27.3	69.4	31.2	36.2	1.1	11.5	25.0	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%

** 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

A. VINOTH
(Technical Manager)

LABORATORY TEST REPORT

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

Name & Address of the Customer	M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	By Email
Sample Description	Soil Sample	Period of Testing	08/07/2022 to 28/07/2022
Source of Sample	Customer Supplied- Borehole No. BH-08	Sample Identification Number	SS/GMC/052022/474/BH08
Sample Condition	Satisfactory	Test Report No.	GT-2374/BH-08
Test Method	As per Bureau of Indian Standards	Report Date	30/07/2022
Sample Receipt Date	08/06/2022	Test Report Pages	Two Pages

Table-2.6 Laboratory Classification of Soil Samples from BH-08

Sample Depth (m)	SPT. "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)															
			Moisture Content (%) AS PER IS 2720 (P-III) - 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-NMCI _p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	Position With Respect to A-Alline	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 ₄₀ (mm)	D ₆₀ (mm)	Uniformity Co-Efficient C _u =D ₆₀ /D ₁₀	Co-Efficient of Curvature C _c =D ₃₀ ² /(D ₁₀ x D ₆₀)	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)									
1.0	16	SS	22.8	52.3	25.8	26.5	1.1	12.7	25.0	V.Stiff	Above	CH	-	-	-	-	77.5	22.5	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
2.0	15	SS	28.6	46.8	23.2	23.6	0.8	13.5	46.2	Stiff	Above	CI	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
3.0	-	UDS	48.8	71.1	32.5	38.6	0.5	10.1	83.6	-	Above	CH	-	-	-	-	74.3	25.7	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
4.0	14	SS	-	-	-	-	-	-	0.0	CG>50%	Above	-	-	0.0	0.0	21.8	33.0	45.3	-	-	-	-	M.Dense	<50%	SC	Gravel	Sand	
5.0	41	SS	-	-	-	-	-	-	-	CG>50%	-	-	0.0	0.9	32.1	52.3	14.7	-	-	-	-	-	Dense	<50%	SM	Gravel	Sand	
6.0	28	SS	-	-	-	-	-	-	-	CG>50%	-	-	3.5	4.3	52.3	27.9	12.1	-	-	-	-	-	M.Dense	<50%	SM	Gravel	Sand	
7.5	31	SS	-	-	-	-	-	-	-	CG>50%	-	-	0.0	3.6	55.6	31.3	9.5	-	-	-	-	-	Dense	<50%	SP-SM	Gravel	Sand	
9.0	18	SS	21.2	40.1	22.2	17.9	1.1	15.4	0.0	V.Stiff	Above	CI	-	-	-	-	75.9	24.1	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
10.5	14	SS	34.4	60.6	30.7	29.9	0.9	11.1	16.7	Stiff	Above	CH	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
12.0	10	SS	34.5	79.8	29.5	50.4	0.9	10.3	64.3	Stiff	Above	CH	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
14.0	8	SS	32.6	71.3	30.5	40.8	0.9	10.5	75.0	Stiff	Above	CH	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
16.0	-	UDS	32.8	56.8	25.2	31.6	0.8	12.2	100.0	-	Above	CH	-	-	-	-	56.7	26.7	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
18.0	23	SS	17.7	56.5	24.2	32.3	1.2	12.5	46.2	V.Stiff	Above	CH	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	

Name & Address of the Customer : M/s RAMANIYAM REAL ESTATES (P) LTD
Sample Description : Soil Sample
Source of Sample : Customer Supplied- Borehole No. BH-08
Sample Condition : Satisfactory
Test Method : As per Bureau of Indian Standards
Sample Receipt Date : 08/06/2022

Customer Reference : By Email
Period of Testing : 08/07/2022 to 28/07/2022
Sample Identification Number : SS/GMC/052022/474/BH08
Test Report No. : GT-2374/BH-08
Report Date : 30/07/2022
Test Report Pages : Two Pages

Table-2.6 Laboratory Classification of Soil Samples from BH-08

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Coarse Grained (CG)													
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II)	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V)	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V)	Plasticity Index (I _p = LL-PL)	Consistency Index (I _c =LL-NMCI _p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VI)	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL)	Consistency	Position With Respect to A-Aline	IS-Notation															
20.0	28	SS	22.6	111.5	27.4	84.2	1.1	8.2	184.6	V.Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG<50%	FG<50%	FG<50%
22.5	26	SS	12.7	51.6	17.0	34.7	1.1	13.0	90.0	V.Stiff	Above	CH	-	-	-	-	-	71.1	28.9	-	-	-	-	-	FG<50%	FG<50%	FG<50%
25.0	>100	SS	17.9	34.5	18.1	16.4	1.0	-	63.6	Hard	Above	CL	-	0.0	0.0	2.8	34.6	62.6	-	-	-	-	-	-	FG<50%	FG<50%	FG<50%
27.5	>100	SS	Clay Binder							16.7	CG>50%	Above	-	-	0.0	2.0	18.0	56.0	24.0	-	-	-	-	V.Dense	<50%	SC	FG>50%
30.0	>100	SS	12.7	65.9	28.0	37.9	1.4	12.3	38.5	Hard	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%

** 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

A. VINOTH
(Technical Manager)

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

M/s RAMANIYAM REAL ESTATES (P) LTD
Soil Sample
Customer Supplied- Borehole No. BH-10
Satisfactory
As per Bureau of Indian Standards
08/06/2022

Customer Reference	:	By Email
Period of Testing	:	08/07/2022 to 28/07/2022
Sample Identification Number	:	SS/GMC/052022/474/BH10
Test Report No.	:	GT-2374/BH-10
Report Date	:	30/07/2022
Test Report Pages	:	Two Pages

Table-2.7 Laboratory Classification of Soil Samples from BH-10

[illegible]

Name & Address of the Customer	M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	: By Email
Sample Description	Soil Sample	Period of Testing	: 08/07/2022 to 28/07/2022
Source of Sample	Customer Supplied- Borehole No. BH-10	Sample Identification Number	: SS/GMC/052022/474/BH10
Sample Condition	Satisfactory	Test Report No.	: GT-2374/BH-10
Test Method	As per Bureau of Indian Standards	Report Date	: 30/07/2022
Sample Receipt Date	: 08/06/2022	Test Report Pages	: Two Pages

Table-2.7 Laboratory Classification of Soil Samples from BH-10

Sample Depth (m)	SPT - "N" Value	Type of Sample	Fine Grained (FG)								SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Coarse Grained (CG)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
			Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index ($I_p = LL - PL$)	Consistency Index ($IC = LL - NMCL$)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VII) -	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL) -	Consistency		Position With Respect to A-Aline	IS:Notation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
20.0	31	SS	18.5	88.7	32.2	56.5	1.2	9.7	91.7	Hard	Above	CH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**** 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

(Signature)

A. VINOTH
(Technical Manager)

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- GEOTECHNICAL LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,

KOTTIVAKKAM, CHENNAI

Name & Address of the Customer : M/s RAMANIYAM REAL ESTATES (P) LTD
 Sample Description : Soil Sample
 Source of Sample : Customer Supplied- Borehole No. BH-11
 Sample Condition : Satisfactory
 Test Method : As per Bureau of Indian Standards
 Sample Receipt Date : 01/06/2022

Customer Reference :
 Period of Testing : 08/07/2022 to 28/07/2022
 Sample Identification Number : SS/GMC/052022/474/BH11
 Test Report No. : GT-2374/BH-11
 Report Date : 30/07/2022
 Test Report Pages : Two Pages

By Email

08/07/2022 to 28/07/2022

SS/GMC/052022/474/BH11

GT-2374/BH-11

30/07/2022

Two Pages

Table-2.8 Laboratory Classification of Soil Samples from BH-11

Sample Depth (m)	SPT- "N" Value	Fine Grained (FG)										Coarse Grained (CG)																	
		Type of Sample	Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-II) -	Liquid Limit (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plastic Limit (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (I _p =LL-PL)	Consistency Index (I _c =LL-NMCH _p)	SHRINKAGE LIMIT (%) 1972, RA-2014 AS PER IS 2720 (P-V) -	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS:Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-I) - 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 ×D ₆₀)	Relative Density	IS-Notation		
			Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)																					
1.0	27	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	5.0	6.0	50.8	38.1	-	-	-	-	-	-	M.Dense	<50%	SM	Gravel	Sand
2.0	30	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	0.0	4.6	69.0	26.3	-	-	-	-	-	-	M.Dense	<50%	SM		
3.0	41	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	0.9	18.8	50.1	30.2	-	-	-	-	-	-	Dense	<50%	SM		
4.0	37	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	0.0	19.2	64.7	16.1	-	-	-	-	-	-	Dense	<50%	SM		
5.0	77	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	7.1	82.3	21.6	9.0	-	-	-	-	-	-	V.Dense	<50%	SP-SM		
6.0	40	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	0.0	5.1	61.3	25.6	8.0	-	-	-	-	-	-	Dense	<50%	SP-SM		
7.5	29	SS	-	-	-	-	-	-	CG>50%	-	-	-	-	1.6	1.6	62.9	24.0	9.8	-	-	-	-	-	-	M.Dense	<50%	SP-SM		
9.0	26	SS	17.2	37.4	17.8	19.6	1.0	14.2	23.1	V.Stiff	Above	CI	-	0.0	0.0	2.9	7.0	90.1	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
10.5	6	SS	33.7	56.4	25.9	30.5	0.7	12.7	12.5	M.Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
12.0	10	SS	30.9	58.9	24.5	34.4	0.8	11.5	23.1	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
14.0	10	SS	33.4	83.2	29.8	53.4	0.9	9.8	25.5	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
16.0	11	SS	31.1	73.5	28.8	44.7	0.9	10.2	36.9	Stiff	Above	CH	-	-	-	-	-	64.8	35.2	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%
18.0	13	SS	30.5	67.9	24.3	43.6	0.9	11.5	78.6	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	FG>50%

Name & Address of the Customer
: M/s RAMANIYAM REAL ESTATES (P) LTD
Sample Description
: Soil Sample
Source of Sample
: Customer Supplied- Borehole No. BH-11
Sample Condition
: Satisfactory
Test Method
: As per Bureau of Indian Standards
Sample Receipt Date
: 01/06/2022

Customer Reference
: By Email
Period of Testing
: 08/07/2022 to 28/07/2022
Sample Identification Number
: SS/GMC/052022/474/BH11
Test Report No.
: GT-2374/BH-11
Report Date
: 30/07/2022
Test Report Pages
: Two Pages

Table-2.8 Laboratory Classification of Soil Samples from BH-11

Sample Depth (m)			SPT - "N" Value	Type of Sample	Fine Grained (FG)										SPECIFIC GRAVITY AS PER IS 2720 (P-11, SEC-1) - 1980, RA-2010	Coarse Grained (CG)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
					Moisture Content (%) 1973, RA-2015 AS PER IS 2720 (P-11) -	LIQUID LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	PLASTIC LIMIT (%) 1985, RA-2015 AS PER IS 2720 (P-V) -	Plasticity Index (I _p = LL-PL)	Consistency Index (I _c =LL-NMCI _p)	SHRINKAGE LIMIT (%) 1972, RA-2011 AS PER IS 2720 (P-VI) -	FREE SWELL INDEX (%) 1977, RA-2011 AS PER IS 2720 (P-XL) -	Consistency	Position With Respect to A-Aline	IS:Notation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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*** 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

A. VINOTH
(Technical Manager)

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

Name & Address of the Customer	: M/s RAMANIYAM REAL ESTATES (P) LTD	Customer Reference	: By Email
Sample Description	: Soil Sample	Period of Testing	: 08/07/2022 to 28/07/2022
Source of Sample	: Customer Supplied- Borehole No. BH-12	Sample Identification Number	: SS/GMC/052022/474/BH12
Sample Condition	: Satisfactory	Test Report No.	: GT-2374/BH-12
Test Method	: As per Bureau of Indian Standards	Report Date	: 30/07/2022
Sample Receipt Date	: 31/05/2022	Test Report Pages	: Two Pages

Table-2.9 Laboratory Classification of Soil Samples from BH-12

Sample Depth (m)	SPT - "N" Value	Fine Grained (FG)										Coarse Grained (CG)																	
		Type of Sample	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 (Ip = LL-PL)	Consistency Index (Ic=LL-NMCIp)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistency	Position With Respect to A-Aline	IS-Notation	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1960, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1965, RA-2015						D10 (mm)	D30 (mm)	D60 (mm)	Uniformity Co-Efficient Gu=D60/D10	Co-Efficient of Curvature Cc=D30²/(D10x D60)	Relative Density	IS-Notation			
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Gravel		
1.0	27	SS	23.9	48.2	25.5	22.7	1.1	14.0	29.9	V.Stiff	Above	CI	-	0.0	0.0	2.0	19.4	78.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%	Gravel	Sand	
2.0	-	UDS	21.3	41.0	18.7	22.2	0.9	14.0	25.0	-	Above	CI	-	0.0	0.0	3.1	37.6	38.5	20.8	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
3.0	15	SS	19.9	33.3	15.7	17.6	0.8	16.2	7.7	Stiff	Above	CL	-	0.0	0.0	2.6	28.4	69.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
4.0	8	SS	26.5	39.8	23.0	18.8	0.8	14.7	25.0	Stiff	Above	CI	-	0.0	0.0	1.1	8.9	89.9	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
5.0	44	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.7	4.1	51.9	30.8	12.4	-	-	-	-	-	-	Dense	<50%	SM		
6.0	41	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	5.4	6.3	40.6	31.5	16.2	-	-	-	-	-	-	Dense	<50%	SM		
7.5	30	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.0	38.7	47.4	12.8	-	-	-	-	-	-	M.Dense	<50%	SM		
9.0	14	SS	26.7	54.7	24.2	30.5	0.9	13.3	0.0	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	FG>50%	FG>50%	FG>50%			
10.5	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	3.1	5.0	7.2	38.0	45.7	-	-	-	-	-	-	M.Dense	<50%	SM		
12.0	-	UDS	44.0	66.3	29.9	36.4	0.6	11.8	33.3	-	Above	CH	-	0.0	0.9	2.4	2.6	53.5	40.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
14.0	11	SS	27.2	53.9	24.2	29.7	0.9	11.8	45.5	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
16.0	10	SS	33.5	71.3	28.9	42.4	0.9	10.2	69.2	Stiff	Above	CH	-	-	-	-	-	58.4	41.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
18.0	11	SS	29.2	60.7	26.5	34.2	0.9	11.0	66.7	Stiff	Above	CH	-	-	-	-	-	100.0	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		

Table-2.10 Results of Chemical Analysis

SL No.	Bore Hole No.	Water				Soil (2:1)			
		Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)	Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)
1.0	BH-01	4.30	7.33	68.1	50.6	1.0	7.10	22.7	24.6
2.0	BH-02	4.30	7.14	36.3	337.8	2.0	7.16	181.5	31.2
3.0	BH-03	4.30	7.28	99.5	228.4	3.0	7.36	127.1	54.1
4.0	BH-04	4.00	7.01	263.2	350.3	1.0	7.25	113.4	38.7
5.0	BH-05	4.00	6.98	68.1	181.1	2.0	7.26	90.8	44.9
6.0	BH-08	4.00	7.25	139.5	211.8	2.0	7.57	158.8	38.1
7.0	BH-10	3.80	7.10	115.7	213.0	1.0	7.95	45.4	39.2
8.0	BH-11	3.80	7.21	98.7	133.5	1.0	8.37	45.4	31.0
9.0	BH-12	3.80	7.27	40.8	321.3	4.0	7.21	204.2	46.1

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:

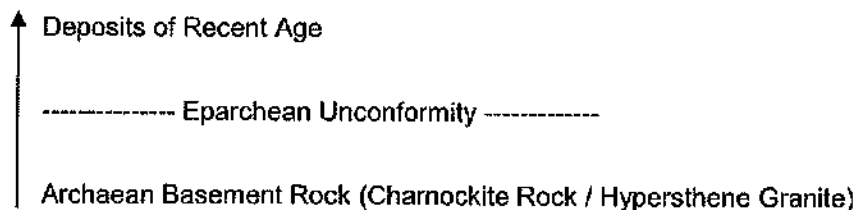
Chennai district is underlain by various geological formations from ancient Archaean to the Recent Alluvium. The geological formations of the district can be grouped into three units, namely

- 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)



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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	1.50	1.50	Filled up soil (Silty Sand)	Brown	16	Medium Dense	-	18	-	31.8
2.0	1.50	4.00	2.50	Silty Clay	Brown	9	-	Stiff	17	60	-
3.0	4.00	9.00	5.00	Silty Sand	Brown	38	Dense	-	19.5	-	38.2
4.0	9.00	12.00	3.00	Silty Sand	Brown	19	Medium Dense	-	18	-	32.7
5.0	12.00	16.00	4.00	Silty Clay	Black	10	Loose	-	15	-	30
6.0	16.00	18.00	2.00	Silty Clay	Black	7	Loose	-	14.5	-	29.4
7.0	18.00	22.50	4.50	Silty Clay	Black	12	-	Stiff	18.5	80	-
8.0	22.50	25.00	2.50	Silty Sand	Grey	21	Medium Dense	-	18.5	-	33.3
9.0	25.00	27.50	2.50	Fissile Silty Clay	Grey	50	Dense	-	20.5	-	41
10.0	27.50	30.00	2.50	Silty Sand	Grey	84	Very Dense	-	21	-	42.5
11.0	30.00	33.00	3.00	Shale	Grey	>100	-	Hard	22	400	-

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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	4.00	4.00	Silty Clay	Brown	36	-	Hard	21	240	-
2.0	4.00	5.00	1.00	Silty Sand	Brown	22	Medium Dense	-	18.5	-	33.6
3.0	5.00	7.50	2.50	Silty Sand	Brown	36	Dense	-	19.5	-	37.65
4.0	7.50	12.00	4.50	Silty Sand	Grey	23	Medium Dense	-	18.5	-	33.9
5.0	12.00	16.00	4.00	Silty Clay	Black	15	-	Stiff	20	100	-
6.0	16.00	20.00	4.00	Silty Clay	Black	8	-	Medium Stiff	16.5	53	-
7.0	20.00	22.50	2.50	Silty Clay	Black	20	-	Very Stiff	20	133	-
8.0	22.50	27.50	5.00	Clayey Silty Sand	Grey	40	Dense	-	20	-	38.75
9.0	27.50	30.00	2.50	Silty Sand	Brown Yellow	>100	Very Dense	-	21	-	42.5
10.0	30.00	33.50	3.50	Fissile Silty Clay	Grey	85	Very Dense	-	21	-	42.5

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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	5.00	5.00	Sandy Silty Clay	Brown	28	-	Very Stiff	20.5	187	-
2.0	5.00	10.50	5.50	Silty Sand	Brown	38	Dense	-	19.5	-	38.2
3.0	10.50	12.00	1.50	Silty Clay	Black	4	-	Soft	14.5	27	-
4.0	12.00	16.00	4.00	Silty Clay	Black	15	-	Stiff	20	100	-
5.0	16.00	18.00	2.00	Silty Clay	Black	10	-	Stiff	17.5	67	-
6.0	18.00	20.00	2.00	Silty Clay	Black	17	-	Very Stiff	20	113	-
7.0	20.00	25.00	5.00	Silty Clay	Green	40	-	Hard	21	267	-
8.0	25.00	27.50	2.50	Clayey Silty Sand	Yellow	>100	Very Dense	-	21	-	42.5
9.0	27.50	30.00	2.50	Clayey Silty Sand	Yellow	>100	Very Dense	-	21	-	42.5
10.0	30.00	33.30	3.30	Silty Clay	Brown	>100	-	Hard	22	400	-

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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	4.00	4.00	Silty Clay	Brown	17	-	Very Stiff	20	113	-
2.0	4.00	5.00	1.00	Silty Sand	Brown	10	Loose	-	15	-	30
3.0	5.00	9.00	4.00	Silty Sand	Brown	34	Dense	-	19.5	-	37.1
4.0	9.00	20.00	11.00	Silty Clay	Black	10	-	Stiff	17.5	67	-
5.0	20.00	22.50	2.50	Silty Clay	Green	34	-	Hard	21	227	-
6.0	22.50	27.50	5.00	Silty Clay	Grey	62.5	-	Hard	22	400	-
7.0	27.50	30.00	2.50	Clayey Silty Sand	Grey	>100	Very Dense	-	21	-	42.5
8.0	30.00	33.30	3.30	Silty Clay	Brown	>100	-	Hard	22	400	-

REFERENCE BORE HOLE				BH-05	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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	3.00	3.00	Silty Clay	Brown	8	-	Medium Stiff	16.5	53	-
2.0	3.00	4.00	1.00	Silty Sand	Brown Grey	12	Medium Dense	-	16	-	30.6
3.0	4.00	5.00	1.00	Silty Sand	Brown	6	Loose	-	14.5	-	29.2
4.0	5.00	9.00	4.00	Silty Sand	Brown	15	Medium Dense	-	17.5	-	31.5
5.0	9.00	12.00	3.00	Silty Sand	Grey	6	Loose	-	14.5	-	29.2
6.0	12.00	14.00	2.00	Silty Clay	Black	0	-	Very Soft	13	4	-
7.0	14.00	20.00	6.00	Silty Clay	Black	3	-	Soft	14	20	-
8.0	20.00	25.00	5.00	Silty Clay	Grey Green	13	-	Stiff	19	87	-
9.0	25.00	27.50	2.50	Clayey Silty Sand	Brown Grey	30	Medium Dense	-	19	-	36
10.0	27.50	35.50	8.00	Fissile Silty Clay	Brown Grey	55	Very Dense	-	20.5	-	41.75

REFERENCE BORE HOLE				BH-08	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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	4.00	4.00	Silty Clay	Brown	16	-	Very Stiff	20	107	-
2.0	4.00	5.00	1.00	Silty Sand	Brown Grey	14	Medium Dense	-	17	-	31.2
3.0	5.00	9.00	4.00	Silty Sand	Brown	33	Dense	-	19.5	-	36.825
4.0	9.00	10.50	1.50	Silty Clay	Black	18	-	Very Stiff	20	120	-
5.0	10.50	18.00	7.50	Silty Clay	Black	11	-	Stiff	18	73	-
6.0	18.00	25.00	7.00	Silty Clay	Brown Grey	27	-	Very Stiff	20.5	180	-
7.0	25.00	27.50	2.50	Sandy Silty Clay	Brown Grey	>100	-	Hard	22	400	-
8.0	27.50	30.00	2.50	Clayey Silty Sand	Brown Grey	>100	Very Dense	-	21	-	42.5
9.0	30.00	30.30	0.30	Fissile Silty Clay	Brown	>100	Very Dense	-	21	-	42.5

REFERENCE BORE HOLE				BH-10	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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	2.00	2.00	Silty Clay	Brown Grey	25	-	Very Stiff	20.5	167	-
2.0	2.00	3.00	1.00	Silty Clay	Grey	12	-	Stiff	18.5	80	-
3.0	3.00	4.00	1.00	Silty Clay	Grey	17	-	Very Stiff	20	113	-
4.0	4.00	9.00	5.00	Silty Sand	Brown	36	Dense	-	19.5	-	37.65
5.0	9.00	10.50	1.50	Silty Clay	Black	48	-	Hard	21	320	-
6.0	10.50	18.00	7.50	Silty Clay	Black	11	-	Stiff	18	73	-
7.0	18.00	20.00	2.00	Silty Clay	Black	7	-	Medium Stiff	16	47	-
8.0	20.00	22.50	2.50	Silty Clay	Green Red	31	-	Hard	21	207	-
9.0	22.50	25.00	2.50	Silty Clay	Pale Green	42	-	Hard	21	280	-
10.0	25.00	30.00	5.00	Silty Sand	Green	>100	Very Dense	-	21	-	42.5

REFERENCE BORE HOLE					BH-11	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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	5.00	5.00	Silty Sand	Brown	34	Dense	-	19.5	-	37.1
2.0	5.00	6.00	1.00	Silty Sand	Brown	77	Very Dense	-	21	-	42.5
3.0	6.00	9.00	3.00	Silty Sand	Brown	35	Dense	-	19.5	-	37.375
4.0	9.00	10.50	1.50	Silty Clay	Black	26	-	Very Stiff	20.5	173	-
5.0	10.50	12.00	1.50	Silty Clay	Black	6	-	Medium Stiff	15.5	40	-
6.0	12.00	20.00	8.00	Silty Clay	Black	11	-	Stiff	18	73	-
7.0	20.00	22.50	2.50	Silty Clay	Green Black	20	-	Very Stiff	20	133	-
8.0	22.50	27.50	5.00	Silty Clay	Grey Green	45	-	Hard	21	300	-
9.0	27.50	30.00	2.50	Silty Sand	Brown	>100	Very Dense	-	21	-	42.5
10.0	30.00	33.10	3.10	Fissile Clay	Grey	>100	Very Dense	-	21	-	42.5

REFERENCE BORE HOLE					BH-12	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/m ³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C _u) kPa	(φ) Deg.
1.0	0.00	2.00	2.00	Silty Clay	Brown	27	-	Very Stiff	20.5	180	-
2.0	2.00	5.00	3.00	Silty Clay	Brown	12	-	Stiff	18.5	80	-
3.0	5.00	9.00	4.00	Silty Sand	Brown	38	Dense	-	19.5	-	38.2
4.0	9.00	10.50	1.50	Silty Clay	Black	14	-	Stiff	19.5	93	-
5.0	10.50	12.00	1.50	Silty Sand	Grey	15	Medium Dense	-	17.5	-	31.5
6.0	12.00	20.00	8.00	Silty Clay	Black	11	-	Stiff	18	73	-
7.0	20.00	22.50	2.50	Silty Clay	Black	22	-	Very Stiff	20.5	147	-
8.0	22.50	25.00	2.50	Silty Clay	Grey	36	-	Hard	21	240	-
9.0	25.00	27.50	2.50	Clayey Silty Sand	Grey Brown	45	Dense	-	20	-	39.875
10.0	27.50	30.00	2.50	Silty Clay	Grey Brown	109	-	Hard	22	400	-
11.0	30.00	33.00	3.00	Silty Clay	Grey	>100	-	Hard	22	400	-

FOUNDATION SYSTEM

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 two basement floors and seventeen upper floors, and is meant for residential occupancy. For this kind of structure, the column loads could vary between 6000kN to 8000 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 sub soil stratification of the project site is idealised and presented below:

Layer-I extends from existing ground level, the soil stratum is silty clay and continues up to 3.5m below the existing ground level. Consistency based on "N" is Stiff to Hard With Sand Lenses

Layer-II is sandy formation and this layer extends from 3.5m to 12.0m. The relative density of this layer is Medium Dense to Dense.

Layer-III is stiff to very stiff, Silty Clay formation and extends from 12.0m to 20.0m/22.0m. Further this layer at borehole location extends even up to 25.0m

Layer-IV, the geology of this layer varied from Clayey Silty Sand & Silty Clay with gravels at location. The relative density & consistency ranges from Dense to Very Dense & Hard. Layer extends from 25.0m to 30.0m below the existing ground level.

Layer-V, The geological formation beyond 30.0m is Fissile Silty Clay/ Soft Shale Formation.

The formation is predominantly **Soft Shale/ Fissile Clay** with lenses of Lithified Shale (shale rock) at depths.

4.3 FOUNDATION SYSTEM:

Taking into consideration of average depth of basement of 3.5m, the depth of excavation shall be 9.0m to 10.0m below the existing ground level including the thickness of foundation.

For the kind of proposed construction, adopt pile foundation due to very weak sub soil conditions. The length of pile is 30m from existing ground level with cut-off at 9.0m. The pile capacity do not change even if cut-off increased to 9.5m.

The piles can be installed by drilling with direct mud circulation technique (Bored Cast Insitu Piles) and Table 4.1 presents the allowable safe load carrying capacity of bored cast insitu piles in vertical, tension & lateral for different diameter and the computations are worked out as per IS 2911-Part I, Section-2.

Typical computations are presented in Annexure-I.

TABLE:- 5.1 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	BH-05	30.0	9.0	21.00	500	1000	450	27
2					550	1100	500	32
3					600	1300	550	37
4					650	1450	600	42
5					750	1800	650	53
6					800	2000	700	59
7					900	2400	800	70

4.4 FOUNDATION EXCAVATION:

Taking into consideration of high ground water table and predominantly coarse grain formation (sand formation from 3.5m) it ideal to adopt diaphragm wall as shoring system.

For lateral stability, adopt semi top-down construction technique as described below.

- ❖ Install diaphragm wall up to ground level
- ❖ Carryout mass excavation up to bottom of floor beam levels of top basement floors.
- ❖ Construct the floor system duly supported on dummy piles with pockets to grow column from lowering basement and connect the same to the diaphragm wall
- ❖ Provide pockets in floor slab with size to facilitate lowering of excavation
- ❖ Carryout excavation below top basement floor levels and progress till the pile cut-off.
- ❖ After Completion of excavation, Construct the lower basement floor and connect to the pile cut-off walls

- ❖ The factual system requires a detailed analysis by the structural consultant in association with geotechnical consultant

NOTE:

Carrying out lateral load analysis with appropriate boundary conditions and adopt the depth of diaphragm wall as a guideline, the depth shall be 20.0 m below the ground level.

4.5 DEWATERING/ GROUND WATER LOWERING DESIGN:

For ground water lowering, since diaphragm wall is recommended as shoring system for ground water lowering a combination of dewatering bore-wells installed both inside and outside the diaphragm are needed.

The internal bore-wells functions effectively for dewatering the green field zone confined within the diaphragm wall. External bore-wells helps in lateral seepage into the excavation zone.

4.5 UPLIFT DESIGN:

Though the diaphragm wall act like a cut-off wall, check the basement slab for uplift pressure equivalent to 3.0m head of water.

RECOMMENDATIONS

RECOMMENDATIONS

5.1 RECOMMENDATION FOR DEEP PILE FOUNDATION SYSTEM:

- ❖ For the kind of proposed structure and sub soil condition deep pile foundation is the suitable foundation to adopt. In the present case, 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 not only depends upon the sub soil properties, but also depends on the care and experience of installation of 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:

- ❖ The mud used shall be made out of sodium bentonite with minimum free swell index of more than 300% and liquid limit more than 100%. The silt content in bentonite shall not be more than 5%.
- ❖ The mud should be prepared using sodium bentonite with a density of range 1.03 g/cc to 1.10 g/cc. However, while flushing before concreting the density should not be more than 1.12 g/cc.

5.2 RECOMMENDATIONS FOR EXCAVATION:

- ❖ As discussed in Chapter-4.0, Section 4.4 it is recommended to adopt shoring system of diaphragm wall for excavation.

5.3 GENERAL RECOMMENDATION:

- ❖ The chlorides content in ground water & soil-water extract is less than the permissible limit of 500 mg/l as per IS 456 Table 1.0. Hence no special reinforcement is required for the construction.
- ❖ Corresponding to the sulphate content in 2:1 Water-Soil extract and ground water use Table 4.0 of IS 456 Clause 2.0 for minimum cement content and maximum water cement ratio. Hence ordinary Portland cement can be used.

- ❖ Before excavation is started a workshop shall be conducted including the Owner, Architect, Structural Engineer, Geotechnical Engineer and Execution agency to ensure the proposal given by the contractor is workable and safe.
- ❖ Before construction activities are initiated, a scientific due-diligence of the condition of the neighbouring structures shall be carried out and authenticated. This is required to ensure that no undue claims or interpretations are made by the neighbourhood that the construction activities cause damages to their structures

AUTHORISED SIGNATORY



DR. C. V. PRASAD

GEOMARINE CONSULTANTS PRIVATE LIMITED



on behalf of COMET SUB panel, the Geotechnical report is generally reviewed and in order.


Superintending Engineer, P.W.D.,
Planning and Designs Circle,
Chepauk, Chennai-5.

ANNEXURE-I

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-IN-SITU PILES

Type of Pile				Bored	Diameter of Pile				Length of Pile below G.L. (m)				30.0	As Per IS:2911-(P-I,S-2)-2010			
Reference Bore Hole				BH-01					500	mm	Surcharge Pressure		0	kPa			
Layer No.	Layer Thk. (m)			Type of Strata	Ave. SPT	(γ) kN/m ³		Shear Parameters		Effective Overburden Pressure (kPa)			Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q _s) kN		
	Top R.L.	Bot R.L.	Thickness			of Layer	Ave. upto Layer	(C _u) kPa	(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer					
1.0	0.0	9.0	9.0	Cut-Off Level													
2.0	9.0	12.0	3.0	Sand	19	18.0	18.0	-	32.7	0.0	24.0	12.0	-	1.1	q _f	2	41.3
3.0	12.0	16.0	4.0	Clay	10	17.5	17.8	67	-	24.0	54.0	39.0	0.7	-	q _f	3	307.3
4.0	16.0	18.0	2.0	Clay	7	18.0	16.8	47	-	54.0	66.0	60.0	0.9	-	q _f	4	132.9
5.0	18.0	22.5	4.5	Clay	12	18.5	17.3	80	-	66.0	104.3	85.1	0.6	-	q _f	5	311.0
6.0	22.5	25.0	2.5	Sand	21	18.5	18.5	-	33.3	104.3	125.5	114.9	-	1.2	q _f	6	345.9
7.0	25.0	27.5	2.5	Clay	50	21.0	19.8	333	-	125.5	153.0	139.3	0.3	-	q _f	7	340.0
8.0	27.5	30.0	2.5	Sand	50	20.5	20.8	-	36.0	153.0	179.3	166.1	-	1.5	q _f	8	711.0

Summation of Positive Skin Resistance (kN) Q_p = 2189.32

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

Computation of End Bearing Resistance

		SPT	φ	C _u	N _q	N _c	Eff.Ht.of Overburden	8	m
Bearing Stratum	Shale	60	-	600	-	9	Effective Overburden Pressure	62.95	kN/m ²
								End Bearing Resistance (kN) Q _p =	1060.29

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_f \cdot C_u \cdot \alpha$	Ultimate Load Carrying Capacity (Q _{ult})	Q _u = Q _f + Q _p (kN)	3249.61
Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_f \cdot q_f \cdot K \cdot \tan(\phi)$	Safe Load Carrying Capacity (Q _{safe})	Q _u / 2.5 (kN)	1299.84
End Bearing Resistance in Clay Layer is $\pi \cdot d^2 / 4 \cdot C_u \cdot N_c$	Allowable Safe Load Carrying Capacity	Q _{A-safe} (kN)	1299.84
End Bearing Resistance in Sand Layer is $\pi \cdot d^2 / 4 \cdot C_u \cdot N_q$	Allowable Safe Pull out Capacity	Q _{A-pull} = Q _f / 3 (kN)	729.77

Where
C_u = Undrained Shear Strength of Clay
φ = Angle of Shearing Resistance
N_c = Bearing Capacity Factor = 9
Q (kN) Effective Overburden Pressure at pile tip = Effective height of overburden X (γ · 10)
K = Coef. Earth Pressure at Rest
q_f = 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_f = Thickness of Layer

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-IN-SITU PILES

Type of Pile				Bored	Diameter of Pile				Length of Pile below G.L. (m)				30	As Per IS:2911-(P-I,S-2)-2010			
Reference Bore Hole				BH-03					500	mm	Surcharge Pressure		0	kPa			
Layer No.	Layer Thk. (m)			Type of Strata	Ave. SPT	(γ) kN/m ³		Shear Parameters		Effective Overburden Pressure (kPa)			Adhesion Factor (α)	Earth Pressure Coefficient (K)	Skin Friction (Q _s) kN		
	Top. R.L.	Bot. R.L.	Thickness			of Layer	Ave. upto Layer	(C _u) kPa	(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer					
1.0	0.0	9.0	9.0	Cut-Off Level													
2.0	9.0	10.5	1.5	Sand	30	19.0	19.0	-	36	0.0	13.5	6.8	-	1.3	q _f	2	15.1
3.0	10.5	12.0	1.5	Clay	4	14.5	16.8	27	-	13.5	20.3	16.9	1.0	-	q _f	3	63.6
4.0	12.0	16.0	4.0	Clay	15	20.0	17.3	100	-	20.3	60.3	40.3	0.4	-	q _f	4	270.2
5.0	16.0	18.0	2.0	Clay	10	17.5	18.8	67	-	60.3	75.3	67.8	0.7	-	q _f	5	153.7
6.0	18.0	20.0	2.0	Clay	17	20.0	18.8	113	-	75.3	95.3	85.3	0.4	-	q _f	6	138.4
7.0	20.0	25.0	5.0	Clay	44	21.0	20.5	293	-	95.3	150.3	122.8	0.3	-	q _f	7	598.3
8.0	25.0	27.5	2.5	Clayey Sand	40	20.0	20.5	-	34.0	150.3	175.3	162.8	-	1.4	q _f	8	622.1
9.0	27.5	30.0	2.5	Clayey Sand	50	20.5	20.3	-	36.0	175.3	201.5	188.4	-	1.5	q _f	9	806.2

Summation of Positive Skin Resistance (kN) Q_f = 2667.57

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

Computation of End Bearing Resistance

		SPT	φ	C _u	N _q	N _c	Eff.Ht.of Overburden	8	m
Bearing Stratum		60	-	600	-	9	Effective Overburden Pressure 67.27 kN/m ²		
									End Bearing Resistance (kN) Q _p = 1060.29

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_1 \cdot C_u \cdot \alpha$	Ultimate Load Carrying Capacity (Q _{ult})	Q _u = Q _s + Q _p (kN)	3727.86
Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_1 \cdot q_c \cdot K \cdot \tan(\phi)$	Safe Load Carrying Capacity (Q _{safe})	Q _u /2.5 (kN)	1491.14
End Bearing Resistance in Clay Layer is $\pi \cdot d^2/4 \cdot C_u \cdot N_c$	Allowable Safe Load Carrying Capacity	Q _{A-safe} (kN)	1491.14
End Bearing Resistance in Sand Layer is $\pi \cdot d^2/4 \cdot Q \cdot N_q$	Allowable Safe Pull out Capacity	Q _{A-pull} = Q _f /3 (kN)	889.19

Where
 C_u=Undrained Shear Strength of Clay
 φ=Angle of Shearing Resistance
 N_q=Bearing Capacity Factor = 9
 Q (i.e) Effective Overburden Pressure at pile tip=Effective height of overburden X (γ-10)
 K=Coef. Earth Pressure at Rest
 q_c=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
 T₁=Thickness of Layer

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)			30.0	As Per IS:2911-(P-I,S-2)-2010				
Reference Bore Hole				BH-05					500	mm	Surcharge Pressure		0	kPa			
Layer No.	Layer Thk. (m)			Type of Strata	Ave. SPT	(γ) kN/m ³		Shear Parameters		Effective Overburden Pressure (kPa)			Adhesion Factor (c)	Earth Pressure Coefficient (k)	Skin Friction (Q _f) kN		
	Top. R.L.	Bot. R.L.	Thickness			of Layer	Ave. upto Layer	(C _u) kPa	(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer					
1.0	0.0	9.0	9.0	Cut-Off Level													
2.0	9.0	12.0	3.0	Sand	9	14.5	14.5	-	29.8	0.0	13.5	6.8	-	1.0	q _f	2	18.2
3.0	12.0	18.0	6.0	Clay	2	14.0	14.3	13	-	13.5	37.5	25.5	1.0	-	q _f	3	122.5
4.0	18.0	20.0	2.0	Clay	6	15.5	14.8	40	-	37.5	48.5	43.0	1.0	-	q _f	4	125.7
5.0	20.0	25.0	5.0	Clay	20	20.0	17.8	133	-	48.5	98.5	73.5	0.4	-	q _f	5	365.6
6.0	25.0	27.5	2.5	Clay	45	21.0	20.5	300	-	98.5	126.0	112.3	0.3	-	q _f	6	306.3
7.0	27.5	30.0	2.5	Shale	60	22.0	21.5	600	-	126.0	156.0	141.0	0.3	-	q _f	7	612.6

Summation of Positive Skin Resistance (kN) Q_f = 1550.92

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

Computation of End Bearing Resistance

Bearing Stratum		SPT	φ	C _u	N _q	N _c	Eff.Ht.of Overburden	8	m
Shale		60	-	600	-	9	Effective Overburden Pressure	54.06	kN/m ²
End Bearing Resistance (kN) Q _p =									1060.29

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_f \cdot C_u \cdot u$	Ultimate Load Carrying Capacity (Q _{ult})	Q _u = Q _f - Q _f + Q _p (kN)	2611.21
Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_f \cdot q_p \cdot K \cdot \tan(\phi)$	Safe Load Carrying Capacity (Q _{safe})	Q _u /2.5 (kN)	1044.48
End Bearing Resistance in Clay Layer is $\pi \cdot d^2/4 \cdot C_u \cdot N_c$	Allowable Safe Load Carrying Capacity	Q _{A-safe} (kN)	1044.48
End Bearing Resistance in Sand Layer is $\pi \cdot d^2/4 \cdot Q \cdot N_q$	Allowable Safe Pull out Capacity	Q _{A-pull} : Q _f /3 (kN)	516.97

Note: SPT is carried out using automatic trip hammer and the efficiency is equal to 90% to 95% and the N is corrected to 60% efficiency

Where			
C _u = Undrained Shear Strength of Clay	K = Coef. Earth Pressure at Rest	d = Dia. Of Pile	
φ = Angle of Shearing Resistance	q _p = Effective Overburden Pressure at middle of Layer	α = Adhesion Factor	
N _c = Bearing Capacity Factor = 9	N _q = Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above	T _f = Thickness of Layer	
Q (i.e) Effective Overburden Pressure at pile tip = Effective height of overburden X (γ-10)			

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)			30.0	As Per IS:2911-(P-1,S-2)-2010			
Reference Bore Hole				BH-10						500	mm	Surcharge Pressure		0	kPa		
Layer No.	Layer Thk. (m)			Type of Strata	Ave. SPT	(γ) kN/m ³		Shear Parameters		Effective Overburden Pressure (kPa)			Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q _s) kN		
	Top. R.L.	Bot. R.L.	Thickness			of Layer	Ave. upto Layer	(C _u) kPa	(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer					
1.0	0.0	9.0	9.0	Cut-Off Level													
2.0	9.0	10.5	1.5	Clay	48	21.0	21.0	320	-	0.0	16.5	8.3	0.3	-	q _f	2	196.0
3.0	10.5	18.0	7.5	Clay	11	18.0	19.5	73	-	16.5	76.5	46.5	0.6	-	q _f	3	533.2
4.0	18.0	20.0	2.0	Clay	7	16.0	17.0	47	-	76.5	88.5	82.5	0.9	-	q _f	4	132.9
5.0	20.0	22.5	2.5	Clay	31	21.0	18.5	207	-	88.5	116.0	102.3	0.3	-	q _f	5	211.4
6.0	22.5	25.0	2.5	Clay	42	21.0	21.0	280	-	116.0	143.5	129.8	0.3	-	q _f	6	285.9
7.0	25.0	30.0	5.0	Sand	50	20.5	20.8	-	36.0	143.5	196.0	169.8	-	1.5	q _f	7	1453.0

Summation of Positive Skin Resistance (kN) Q_f = 2812.32

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

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c	Eff.Ht.of Overburden	8	m
Bearing Stratum	Shale	60	-	600	-	9	Effective Overburden Pressure	72.19	kN/m ²
							End Bearing Resistance (kN) $Q_p =$	1060.29	

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_1 \cdot C_u \cdot \alpha$

Ultimate Load Carrying Capacity (Q_{ult})

Q_u = Q_s + Q_p (kN) 3872.61

Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_1 \cdot q \cdot K \cdot \tan(\phi)$

Safe Load Carrying Capacity (Q_{safe})

Q_u/2.5 (kN) 1549.04

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

Allowable Safe Load Carrying Capacity

Q_{A-safe} (kN) 1549.04

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

Allowable Safe Pull out Capacity

Q_{A-pull} = Q_f/3 (kN) 937.44

Where

C_u = Undrained Shear Strength of Clay

K = Coef. Earth Pressure at Rest

d = Dia. of Pile

φ = Angle of Shearing Resistance

q = Effective Overburden Pressure at middle of Layer

α = Adhesion Factor

N_c = Bearing Capacity Factor = 9

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

T₁ = Thickness of Layer

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

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)				30.0	As Per IS:2911-(P-I,S-2)-2010			
Reference Bore Hole				BH-12					500	mm	Surcharge Pressure		0	kPa			
Layer No.	Layer Thk. (m)			Type of Strata	Ave. SPT	(γ) kN/m ³		Shear Parameters		Effective Overburden Pressure (kPa)			Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q _s) kN		
	Top. R.L.	Bot. R.L.	Thickness			of Layer	Ave. upto Layer	(C _u) kPa	(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer					
1.0	0.0	9.0	9.0	Cut-Off Level													
2.0	9.0	10.5	1.5	Clay	14	19.5	19.5	93	-	0.0	14.3	7.1	0.5	-	qf	2	103.0
3.0	10.5	12.0	1.5	Sand	15	17.5	18.5	-	31.5	14.3	25.5	19.9	-	1.1	qf	3	30.9
4.0	12.0	20.0	8.0	Clay	11	18.0	17.8	73	-	25.5	89.5	57.5	0.6	-	qf	4	568.8
5.0	20.0	22.5	2.5	Clay	22	20.5	19.3	147	-	89.5	115.8	102.6	0.3	-	qf	5	173.2
6.0	22.5	25.0	2.5	Clay	36	21.0	20.8	240	-	115.8	143.3	129.5	0.3	-	qf	6	245.0
7.0	25.0	27.5	2.5	Clayey Sand	45	20.0	20.5	-	34.0	143.3	168.3	155.8	-	1.5	qf	7	618.8
8.0	27.5	30.0	2.5	Clay	50	21.0	20.5	333	-	168.3	195.8	182.0	0.3	-	qf	8	340.0

Summation of Positive Skin Resistance (kN) Q_f = 2079.67

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

Computation of End Bearing Resistance

		SPT	φ	C _u	N _q	N _c	Eff.Ht.of Overburden	8	m
Bearing Stratum		60	-	600	-	9	Effective Overburden Pressure 71.52 kN/m ²		
		End Bearing Resistance (kN) Q _p =							1060.29

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_f \cdot C_u \cdot \alpha$	Ultimate Load Carrying Capacity (Q _{ult})	Q _u = Q _f + Q _p (kN)	3139.96
Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_f \cdot q_r \cdot K \cdot \tan(\phi)$	Safe Load Carrying Capacity (Q _{safe})	Q _u /2.5 (kN)	1255.98
End Bearing Resistance in Clay Layer is $\pi \cdot d^2/4 \cdot C_u \cdot N_c$	Allowable Safe Load Carrying Capacity	Q _{A-safe} (kN)	1255.98
End Bearing Resistance in Sand Layer is $\pi \cdot d^2/4 \cdot Q \cdot N_q$	Allowable Safe Pull out Capacity	Q _{A-pull} : Q _f /3 (kN)	693.22

Where
 C_u=Undrained Shear Strength of Clay
 φ=Angle of Shearing Resistance
 N_c=Bearing Capacity Factor = 9
 Q (i.e) Effective Overburden Pressure at pile tip=Effective height of overburden X (γ-10)
 K=Coef. Earth Pressure at Rest
 q_r=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_f=Thickness of Layer

LATERAL LOAD CARRYING CAPACITY OF BORED CAST- SITU PILES

Reference Bore Hole : BH-05

1.0 Geometrical Data

Type of Pile Head Considered	Fixed
Diameter of Pile (d)	: 0.60 m
Free standing Length of Pile (e)	: 0 m
Length of Pile below E.G.L (Le)	: 30.0 m
Cut-Off Level From E.G.L	: 9.0
Length of Pile below Cut-Off Level (Le)	: 21.0 m
Grade of Concrete (M)	: 25 MN/m ²
Young's Modulus of Concrete (E)	: 25000000 kN/m ²
Moment of Inertia (I)	: 0.006362 m ⁴

2.0 Determination of Depth of Fixity

Type of Soil Strata	: Sand
Ground Water Condition	: Submerged
Design SPT "N" Value	: 7

$$T = (EI/nh)^{1/5}$$

(n can be read as h in the above and below equation in case of Sand)

nh=	: 800 kN/m ³
In Case of Sand	: - kN/m ⁴
T=	: 2.88 m
L1/T	: 0.00
Lf/T	: 2.20
Depth of Fixity below Cut off (zf)	: 6.34 m

3.0 Determination of Lateral Load and Moment Carrying Capacity for 0.005 m Lateral Deflection:

Allowable Lateral Deflection (Y)	: 0.005 m
Lateral Load Carrying Capacity (H) = $Y \cdot 12EI / (e + z_f)^3$	: 37.44 kN
Recommended Design Lateral Load carrying Capacity	: 37 kN
Fixed End Moment, $M_F = H(e + z_f)/2$	: 119
Reduction Factor (L_1/T)	: 0.83 m
Actual Moment (Fixed End Moment/Reduction Factor), M_F	: 99 kN-m

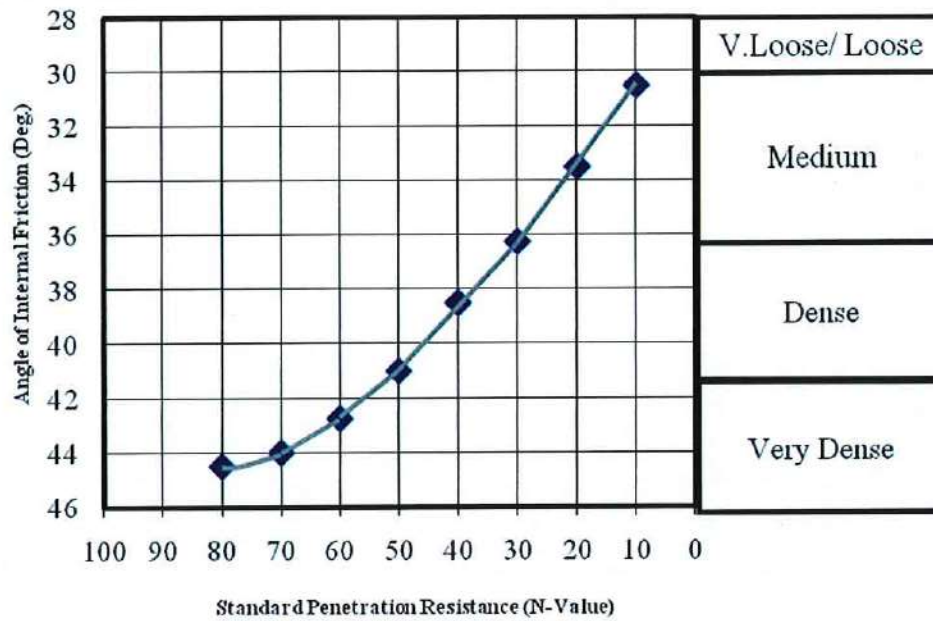


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

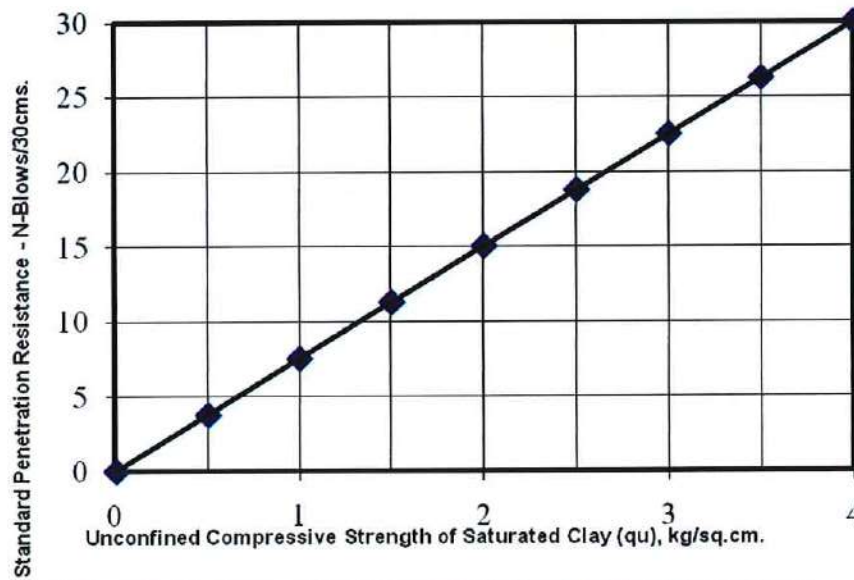


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (After Terzaghi & Peck, 1948)

ANNEXURE-II

LIQUEFACTION ANALYSIS RESULTS

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-I)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16 Location of Ground Water Table: 3.0 m C_{dr} 1 C_{ss} 1
Atmospheric Pressure: 100.00 kPa Magnitude, $M_w = 6$ C_{pw} 1 C_{rl} 1

Borehole: BH-01

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ'_v (kPa)	σ'_v (kPa)	σ_v / σ'_v	r_d	CSR (0.65' σ'_{vm} /g) (σ_v / σ'_v) γ_{r_d}	C_{u0}	N_{60} NC ₆₀	C_u	(N_1) ₆₀ NC ₆₀	α	β	(N_1) ₆₀ $\alpha + \beta$ (N_1) ₆₀	CBR ₁₅	CRR	Factor of Safety FOS=1 CRR/CSA	Possibility of Liquefaction
1.00	16	Filled up Soil	18.00	44	18	18	1.00	0.99	0.10	1.00	16	1.70	27	0.50	1.20	33.1	1.40	2.48	24.07	Non-Liquefiable
2.00	9	Silty Clay	17.00	63	35	35	1.00	0.98	0.10	1.00	9	1.69	15	0.50	1.20	18.8	0.20	0.35	3.46	Non-Liquefiable
4.00	28	Silty Sand	19.00	30	73	73	1.37	0.97	0.14	1.00	28	1.37	38	4.70	1.15	48.9	0.29	0.51	3.73	Non-Liquefiable
5.00	35	Silty Sand	19.50	11	93	63	1.47	0.96	0.15	1.00	35	1.26	44	1.07	1.02	46.2	0.26	0.45	3.09	Non-Liquefiable
6.00	45	Silty Sand	20.00	15	113	73	1.54	0.95	0.15	1.00	45	1.17	53	2.41	1.05	57.4	0.38	0.67	4.39	Non-Liquefiable
7.50	45	Silty Sand	20.00	13	143	89	1.61	0.94	0.16	1.00	45	1.06	48	1.91	1.04	51.5	0.32	0.57	3.59	Non-Liquefiable
9.00	17	Silty Sand	18.00	7	170	101	1.68	0.93	0.16	1.00	17	1.00	17	0.09	1.01	17.1	0.18	0.32	1.98	Non-Liquefiable
10.50	21	Silty Sand	18.50	30	197	114	1.73	0.89	0.16	1.00	21	0.94	20	4.73	1.16	27.5	0.35	0.62	3.88	Non-Liquefiable
12.00	9	Silty Clay	17.00	98	223	125	1.79	0.85	0.16	1.00	9	0.90	8	0.50	1.20	10.2	0.11	0.20	1.28	Non-Liquefiable
14.00	11	Silty Clay	18.00	100	259	141	1.83	0.80	0.15	1.00	11	0.84	9	0.50	1.20	11.6	0.13	0.23	1.48	Non-Liquefiable
16.00	7	Silty Clay	16.00	100	291	153	1.90	0.75	0.15	1.00	7	0.81	6	0.50	1.20	7.3	0.09	0.16	1.08	Non-Liquefiable
18.00	10	Silty Clay	17.50	100	326	169	1.93	0.69	0.14	1.00	10	0.77	8	0.50	1.20	9.7	0.11	0.20	1.41	Non-Liquefiable
20.00	14	Silty Clay	19.50	100	365	188	1.94	0.64	0.13	1.00	14	0.73	10	0.50	1.20	12.7	0.14	0.24	1.90	Non-Liquefiable
22.50	21	Clayey Sand	18.50	24	411	210	1.96	0.57	0.12	1.00	21	0.69	14	4.20	1.11	20.3	0.22	0.39	3.32	Non-Liquefiable
25.00	50	Silty Clay	21.00	85	464	238	1.95	0.51	0.10	1.00	50	0.65	32	0.50	1.20	39.4	0.10	0.18	-	Non-Liquefiable
27.50	84	Silty Sand	21.00	27	516	266	1.94	0.44	0.09	1.00	84	0.61	52	4.44	1.13	62.5	0.42	0.75	8.43	Non-Liquefiable
33.00	>100	Shale	27.00	100	637	333	1.91	0.29	0.06	1.00	100	0.55	55	0.50	1.20	66.3	0.46	0.81	13.82	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16 Location of Ground Water Table: 3.0 m C_{MT} 1 C_{CS} 1 C_{AT} 1

Atmospheric Pressure: 100.00 kPa Magnitude, M_w = 6 C_{60} 1 C_{HW} 1 C_{AL} 1

Borehole: BH-02

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ'_v (kPa)	σ_v/σ'_v	r_d	CSR $(0.65 \sigma'_{vm}/\sigma'_v) \cdot (1/r_d)$ (ton/oo. ² /m ²)	C_{60}	N_{60} NC ₆₀	C_u	$(N_1)_{L10} = C_u \cdot NC_{60}$	α	β	$(N_1)_{L10.25} = \alpha \cdot \beta \cdot (N_1)_{L10}$	CRR _{7.5}	CRR	Factor of Safety FOS=1 CRR/CSR	Possibility of Liquefaction
1.00	27	Silty Clay	20.50	54	21	21	1.00	0.99	0.10	1.00	27	1.70	46	0.50	1.20	55.6	0.36	0.64	6.18	Non-Liquefiable
2.00	23	Silty Clay	20.50	100	41	41	1.00	0.98	0.10	1.00	23	1.56	36	0.50	1.20	43.6	0.21	0.38	3.70	Non-Liquefiable
3.00	22	Silty Clay	20.50	100	62	62	1.00	0.98	0.10	1.00	22	1.28	28	0.50	1.20	34.2	-5.85	-10.35	-	Non-Liquefiable
4.00	22	Silty Sand	18.50	40	80	70	1.14	0.97	0.11	1.00	22	1.19	26	0.50	1.20	32.0	0.74	1.30	11.33	Non-Liquefiable
5.00	37	Clayey Sand	19.50	33	100	80	1.25	0.96	0.12	1.00	37	1.12	41	4.89	1.18	53.8	0.34	0.61	4.87	Non-Liquefiable
6.00	34	Silty Sand	19.50	15	119	90	1.33	0.95	0.13	1.00	34	1.06	36	2.60	1.05	40.3	0.14	0.24	1.82	Non-Liquefiable
7.50	23	Silty Sand	18.50	9	147	103	1.43	0.94	0.14	1.00	23	0.99	23	0.60	1.02	23.7	0.27	0.47	3.39	Non-Liquefiable
9.00	18	Silty Sand	18.00	10	174	115	1.51	0.93	0.15	1.00	18	0.93	17	0.81	1.02	18.0	0.19	0.34	2.31	Non-Liquefiable
10.50	27	Silty Sand	19.00	41	202	129	1.57	0.89	0.15	1.00	27	0.88	24	0.50	1.20	29.1	0.41	0.73	5.01	Non-Liquefiable
12.00	15	Silty Clay	20.00	82	232	144	1.61	0.85	0.14	1.00	15	0.83	13	0.50	1.20	15.5	0.17	0.29	2.04	Non-Liquefiable
14.00	14	Silty Clay	19.50	100	271	163	1.66	0.80	0.14	1.00	14	0.78	11	0.50	1.20	13.6	0.15	0.26	1.88	Non-Liquefiable
18.00	8	Silty Clay	16.50	100	337	190	1.77	0.68	0.13	1.00	8	0.73	6	0.50	1.20	7.5	0.09	0.16	1.27	Non-Liquefiable
20.00	20	Silty Clay	20.00	100	377	210	1.79	0.64	0.12	1.00	20	0.69	14	0.50	1.20	17.0	0.18	0.32	2.69	Non-Liquefiable
22.50	36	Clayey Sand	19.50	41	426	235	1.82	0.57	0.11	1.00	36	0.65	23	0.50	1.20	28.7	0.40	0.70	6.49	Non-Liquefiable
25.00	44	Clayey Sand	20.00	41	476	260	1.83	0.51	0.10	1.00	44	0.62	27	0.50	1.20	33.2	1.55	2.74	-	Non-Liquefiable
27.50	>100	Silty Sand	21.00	33	529	288	1.83	0.44	0.08	1.00	100	0.59	59	4.88	1.18	74.3	0.52	0.92	10.99	Non-Liquefiable
30.00	>100	Silty Clay	22.00	100	584	319	1.83	0.37	0.07	1.00	100	0.56	56	0.50	1.20	67.7	0.47	0.83	11.64	Non-Liquefiable
33.00	63	Shale	22.00	100	650	355	1.83	0.29	0.06	1.00	63	0.53	33	0.50	1.20	40.6	0.14	0.26	4.60	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-I)-2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16 Location of Ground Water Table: 3.0 m C_{dr} 1 C_{ss} 1

Atmospheric Pressure: 100.00 kPa Magnitude, $M_w = 6$ C_{dp} 1 C_{dw} 1 C_{re} 1

Borehole: BH-03

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ_v' (kPa)	σ_v/σ_v'	τ_d	CSR $(0.65 \sigma_v' i_{av}/d^*_{60})$	C_{d0}	N_{60} $N_{C_{d0}}$	C_u	$(N_1)_{dr} = C_{dr} N_{C_{d0}}$	α	β	$(N_1)_{reqd} = \alpha \beta (N_1)_{dr}$	$CRR_{s,s}$	CRR	Factor of Safety FOS=1 CRR/CSR	Possibility of Liquefaction
1.00	24	Sandy Clay	20.50	63	21	21	1.00	0.99	0.10	1.00	24	1.70	41	0.50	1.20	49.5	0.30	0.53	5.09	Non-Liquefiable
2.00	31	Sandy Clay	21.00	100	42	42	1.00	0.98	0.10	1.00	31	1.55	48	0.50	1.20	58.2	0.39	0.58	6.65	Non-Liquefiable
3.00	33	Silty Clay	21.00	100	63	63	1.00	0.98	0.10	1.00	33	1.26	42	0.50	1.20	50.6	0.31	0.55	5.39	Non-Liquefiable
4.00	22	Sandy Clay	20.50	71	83	73	1.13	0.97	0.11	1.00	22	1.17	26	0.50	1.20	31.4	0.61	1.07	9.39	Non-Liquefiable
5.00	50	Silty Sand	20.50	13	104	84	1.23	0.96	0.12	1.00	50	1.09	55	1.77	1.03	58.3	0.39	0.68	5.53	Non-Liquefiable
6.00	40	Silty Sand	20.00	14	124	94	1.31	0.95	0.13	1.00	40	1.03	41	2.21	1.04	45.2	0.24	0.43	3.27	Non-Liquefiable
7.50	32	Silty Sand	19.50	10	153	109	1.41	0.94	0.14	1.00	32	0.96	31	0.89	1.02	32.3	0.81	1.44	10.42	Non-Liquefiable
9.00	30	Silty Sand	19.00	9	181	122	1.48	0.93	0.14	1.00	30	0.90	27	0.43	1.02	28.0	0.37	0.65	4.54	Non-Liquefiable
10.50	4	Silty Clay	14.50	100	203	129	1.57	0.89	0.15	1.00	4	0.88	4	0.50	1.20	4.7	0.07	0.12	-	Non-Liquefiable
12.00	16	Silty Clay	20.00	100	233	145	1.61	0.85	0.14	1.00	16	0.83	13	0.50	1.20	16.5	0.18	0.31	2.17	Non-Liquefiable
14.00	14	Silty Clay	19.50	100	272	164	1.66	0.80	0.14	1.00	14	0.78	11	0.50	1.20	13.6	0.15	0.26	1.88	Non-Liquefiable
16.00	10	Silty Clay	17.50	100	307	179	1.71	0.75	0.13	1.00	10	0.75	7	0.50	1.20	9.5	0.11	0.19	1.44	Non-Liquefiable
18.00	17	Silty Clay	20.00	100	347	200	1.74	0.69	0.13	1.00	17	0.71	12	0.50	1.20	14.9	0.15	0.28	2.25	Non-Liquefiable
20.00	32	Silty Clay	21.00	100	389	222	1.75	0.64	0.12	1.00	32	0.67	21	0.50	1.20	26.3	0.32	0.56	4.85	Non-Liquefiable
22.50	56	Silty Clay	22.00	76	444	253	1.76	0.57	0.10	1.00	56	0.63	35	0.50	1.20	42.8	0.20	0.35	3.35	Non-Liquefiable
25.00	40	Clayey Sand	20.00	41	494	278	1.78	0.51	0.09	1.00	40	0.60	24	0.50	1.20	29.3	0.42	0.75	8.02	Non-Liquefiable
27.50	>100	Clayey Sand	21.00	32	547	306	1.79	0.44	0.08	1.00	100	0.57	57	4.82	1.17	71.6	0.50	0.88	10.82	Non-Liquefiable
30.00	>100	Silty Clay	22.00	100	602	337	1.79	0.37	0.07	1.00	100	0.55	55	0.50	1.20	65.9	0.45	0.80	11.54	Non-Liquefiable
33.00	>100	Silty Clay	22.00	100	675	381	1.77	0.29	0.05	1.00	100	0.51	51	0.50	1.20	62.0	0.42	0.74	13.72	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)-2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16

Location of Ground Water Table: 3.0 m

C_{PT} 1 C_{SS} 1

Atmospheric Pressure: 100.00 kPa

Magnitude, $MW = 6$

C_{SD} 1

C_{NW} 1 C_{RL} 1

Borehole: BH-04

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ'_v (kPa)	σ_v/σ'_v	r_d	CSR $\left[\frac{0.65 \cdot \sigma'_{vm} \cdot g}{(\sigma'_v / \sigma'_m)^{1.4}} \right]$	C_u	N_{60} NC ₉₀	C_u	$(N_1)_{60} = C_{PT} \cdot N \cdot C_{SD}$	α	β	$(N_1)_{LCS} = \alpha \cdot \beta \cdot (N_1)_{60}$	CRR _{7.5}	CRR	Factor of Safety FOS=1 CRR/CSR	Possibility of Liquefaction
1.00	19	Silty Clay	20.00	100	20	20	1.00	0.99	0.10	1.70	19	1.00	32	0.50	1.20	39.3	0.10	0.17	1.85	Non-Liquefiable
2.00	14	Silty Clay	19.50	100	40	40	1.00	0.98	0.10	1.59	14	1.00	22	0.50	1.20	27.2	0.34	0.61	5.96	Non-Liquefiable
3.00	17	Silty Clay	20.00	55	60	60	1.00	0.98	0.10	1.30	17	1.00	22	0.50	1.20	26.9	0.34	0.60	5.87	Non-Liquefiable
4.00	10	Silty Sand	15.00	56	75	65	1.15	0.97	0.12	1.24	10	1.00	12	0.50	1.20	15.4	0.16	0.29	2.50	Non-Liquefiable
5.00	34	Silty Sand	19.50	27	94	74	1.26	0.96	0.13	1.16	34	1.00	39	4.46	1.13	49.0	0.29	0.52	4.08	Non-Liquefiable
6.00	38	Silty Sand	19.50	10	114	84	1.35	0.95	0.13	1.09	38	1.00	41	0.92	1.02	43.3	0.21	0.37	2.75	Non-Liquefiable
7.50	30	Silty Sand	19.00	8	142	98	1.45	0.94	0.14	1.01	30	1.00	30	0.29	1.01	31.0	0.56	0.99	6.95	Non-Liquefiable
9.00	9	Silty Clay	17.00	100	168	109	1.54	0.93	0.15	0.96	9	1.00	9	0.50	1.20	10.9	0.12	0.21	1.43	Non-Liquefiable
10.50	9	Silty Clay	17.00	100	193	119	1.62	0.89	0.15	0.92	9	1.00	8	0.50	1.20	10.4	0.12	0.21	1.37	Non-Liquefiable
12.00	11	Silty Clay	18.00	100	220	132	1.67	0.85	0.15	0.87	11	1.00	10	0.50	1.20	12.0	0.13	0.23	1.57	Non-Liquefiable
14.00	10	Silty Clay	17.50	100	255	147	1.73	0.80	0.14	0.82	10	1.00	8	0.50	1.20	10.4	0.12	0.21	1.43	Non-Liquefiable
15.00	9	Silty Clay	17.00	100	289	161	1.79	0.75	0.14	0.79	9	1.00	7	0.50	1.20	9.0	0.10	0.18	1.33	Non-Liquefiable
18.00	13	Silty Clay	19.00	100	327	180	1.82	0.69	0.13	0.75	13	1.00	10	0.50	1.20	12.1	0.13	0.23	1.79	Non-Liquefiable
20.00	34	Silty Clay	21.00	100	369	202	1.82	0.64	0.12	0.70	34	1.00	24	0.50	1.20	29.2	0.42	0.74	6.11	Non-Liquefiable
22.50	55	Silty Clay	22.00	92	424	233	1.82	0.57	0.11	0.66	55	1.00	36	0.50	1.20	43.8	0.22	0.38	3.54	Non-Liquefiable
25.00	70	Silty Clay	22.00	77	479	263	1.82	0.51	0.10	0.62	70	1.00	43	0.50	1.20	52.3	0.33	0.58	6.05	Non-Liquefiable
27.50	>100	Clayey Sand	21.00	63	532	291	1.83	0.44	0.08	0.59	100	1.00	59	0.50	1.20	70.8	0.49	0.87	10.44	Non-Liquefiable
30.00	63	Silty Clay	22.00	100	587	322	1.82	0.37	0.07	0.56	63	1.00	35	0.50	1.20	42.7	0.20	0.35	4.89	Non-Liquefiable
33.00	63	Silty Clay	22.00	100	655	361	1.82	0.29	0.06	0.53	63	1.00	33	0.50	1.20	40.3	0.14	0.24	4.33	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-I)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{msl}/g): 0.16 Location of Ground Water Table: 3.0 m C_{HT} 1 C_{SS} 1
Atmospheric Pressure: 100.00 kPa Magnitude, M_w = 6 C_{DP} 1 C_{NW} 1 C_{RL} 1

Borehole: BH-05

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ'_o (kPa)	σ'_v (kPa)	σ'_o/σ'_v	r_d	CSR ($0.65 \sigma'_{vm}/r_d$)	C_{60}	N_{60} NC_{60}	C_k	$(N_1)_{60}$ $C_k NC_{60}$	α	β	$(N_1)_{60}$ $\alpha \beta (N_1)_{60}$	CRR _{7.5}	CRR	Factor of Safety FOS=1 CRR/CSR	Possibility of Liquefaction
1.00	9	Silty Clay	17.00	100	17	17	1.00	0.99	0.10	1.00	9	1.70	15	0.50	1.20	18.9	0.20	0.36	3.46	Non-Liquefiable
2.00	6	Silty Clay	15.50	100	33	33	1.00	0.98	0.10	1.00	6	1.70	10	0.50	1.20	12.7	0.14	0.24	2.39	Non-Liquefiable
3.00	12	Silty Sand	16.00	42	49	49	1.00	0.98	0.10	1.00	12	1.44	17	0.50	1.20	21.2	0.23	0.41	4.02	Non-Liquefiable
4.00	6	Silty Sand	14.50	43	63	53	1.18	0.97	0.12	1.00	6	1.37	8	0.50	1.20	10.4	0.12	0.21	1.73	Non-Liquefiable
5.00	15	Silty Sand	17.50	18	81	61	1.32	0.96	0.13	1.00	15	1.28	19	3.31	1.07	23.9	0.27	0.48	3.63	Non-Liquefiable
6.00	13	Silty Sand	16.50	10	97	68	1.44	0.95	0.14	1.00	13	1.22	16	0.96	1.02	17.1	0.18	0.32	2.26	Non-Liquefiable
7.50	15	Silty Sand	17.50	10	123	79	1.56	0.94	0.15	1.00	15	1.12	17	0.72	1.02	17.9	0.19	0.34	2.21	Non-Liquefiable
9.00	4	Silty Sand	13.50	23	144	85	1.70	0.93	0.16	1.00	4	1.09	4	4.00	1.10	8.8	0.10	0.18	1.10	Non-Liquefiable
10.50	7	Silty Sand	14.50	12	165	92	1.80	0.89	0.17	1.00	7	1.04	7	1.40	1.03	8.9	0.10	0.18	1.10	Non-Liquefiable
12.00	0	Silty Clay	13.00	100	185	95	1.92	0.85	0.17	1.00	0	1.02	0	0.50	1.20	0.5	0.05	0.09	-	Non-Liquefiable
14.00	2	Silty Clay	14.00	100	213	105	2.03	0.80	0.17	1.00	2	0.98	2	0.50	1.20	2.8	0.06	0.10	-	Non-Liquefiable
16.00	2	Silty Clay	14.00	100	241	113	2.13	0.75	0.17	1.00	2	0.94	2	0.50	1.20	2.8	0.06	0.10	-	Non-Liquefiable
18.00	4	Silty Clay	14.50	100	270	123	2.20	0.69	0.16	1.00	4	0.90	4	0.50	1.20	4.8	0.07	0.13	-	Non-Liquefiable
20.00	11	Silty Clay	18.00	100	306	139	2.20	0.64	0.15	1.00	11	0.85	9	0.50	1.20	11.7	0.13	0.23	1.55	Non-Liquefiable
22.50	15	Silty Clay	20.00	100	356	164	2.16	0.57	0.13	1.00	15	0.78	12	0.50	1.20	14.5	0.16	0.28	2.13	Non-Liquefiable
25.00	30	Clayey Sand	19.00	68	403	187	2.15	0.51	0.11	1.00	30	0.73	22	0.50	1.20	26.8	0.33	0.59	5.20	Non-Liquefiable
27.50	63	Silty Clay	22.00	100	458	218	2.10	0.44	0.10	1.00	63	0.68	43	0.50	1.20	51.7	0.32	0.57	5.92	Non-Liquefiable
30.00	52	Silty Clay	22.00	100	513	248	2.07	0.37	0.08	1.00	52	0.63	33	0.50	1.20	40.1	0.13	0.23	2.83	Non-Liquefiable
32.50	52	Silty Clay	22.00	100	568	279	2.04	0.31	0.06	1.00	52	0.60	31	0.50	1.20	37.9	0.02	0.03	-	Non-Liquefiable
35.00	52	Silty Clay	22.00	100	631	317	1.99	0.24	0.05	1.00	52	0.56	29	0.50	1.20	35.6	-0.38	-0.68	-	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{haz}/g): 0.16 Location of Ground Water Table: 3.0 m C_{dr} 1 C_{ss} 1
Atmospheric Pressure: 100.00 kPa Magnitude, M_w = 6 C_{eb} 1 C_{rw} 1 C_{rl} 1

Borehole: BH-08

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ'_v (kPa)	σ_v/σ'_v	τ_d	CSR $(\frac{0.65 \cdot \tau_{dmax}}{100 \cdot \sigma'_v})$	C_{dr}	N_{sp} NC_{dr}	C_u	$(N_{1,60})_{CS}$ $C_u \cdot NC_{dr}$	α	β	$(N_{1,60})_{CS}$ $\alpha \cdot \beta \cdot (N_{1,60})_{CS}$	$CRR_{2.5}$	CRR	Factor of Safety $FOF=1$ CRR/CSR	Possibility of Liquefaction
1.00	16	Silty Clay	20.00	100	20	20	1.00	0.99	0.10	1.00	16	1.70	27	0.50	1.20	33.1	1.40	2.48	24.07	Non-Liquefiable
2.00	15	Silty Clay	20.00	100	40	40	1.00	0.98	0.10	1.00	15	1.58	24	0.50	1.20	29.0	0.41	0.72	7.06	Non-Liquefiable
4.00	14	Silty Clay	19.50	45	79	59	1.33	0.97	0.13	1.00	14	1.30	18	0.50	1.20	22.3	0.25	0.44	3.25	Non-Liquefiable
5.00	41	Silty Sand	20.00	15	99	70	1.42	0.96	0.14	1.00	41	1.20	49	2.42	1.05	53.9	0.34	0.61	4.27	Non-Liquefiable
6.00	28	Silty Sand	19.00	13	118	79	1.50	0.95	0.15	1.00	28	1.13	32	2.02	1.04	34.8	-1.00	-1.76	-11.87	Liquefiable
7.50	31	Silty Sand	19.50	9	147	93	1.58	0.94	0.15	1.00	31	1.04	32	0.69	1.02	33.4	1.91	3.37	21.79	Non-Liquefiable
9.00	18	Silty Clay	20.00	100	177	109	1.63	0.93	0.16	1.00	18	0.96	17	0.50	1.20	21.2	0.23	0.41	2.59	Non-Liquefiable
10.50	14	Silty Clay	19.50	100	207	123	1.68	0.89	0.16	1.00	14	0.90	13	0.50	1.20	15.6	0.17	0.29	1.89	Non-Liquefiable
12.00	10	Silty Clay	17.50	100	233	135	1.73	0.85	0.15	1.00	10	0.86	9	0.50	1.20	10.8	0.12	0.21	1.39	Non-Liquefiable
14.00	8	Silty Clay	16.50	100	266	148	1.80	0.80	0.15	1.00	8	0.82	7	0.50	1.20	8.4	0.10	0.18	1.18	Non-Liquefiable
18.00	23	Silty Clay	20.50	100	348	191	1.82	0.69	0.13	1.00	23	0.72	17	0.50	1.20	20.5	0.22	0.39	2.98	Non-Liquefiable
20.00	28	Silty Clay	20.50	100	389	212	1.83	0.64	0.12	1.00	28	0.69	19	0.50	1.20	23.6	0.27	0.47	3.86	Non-Liquefiable
22.50	26	Silty Clay	20.50	100	440	239	1.84	0.57	0.11	1.00	26	0.65	17	0.50	1.20	20.7	0.22	0.40	3.61	Non-Liquefiable
25.00	>100	Sandy Clay	22.00	63	495	269	1.84	0.51	0.10	1.00	100	0.61	61	0.50	1.20	73.6	0.52	0.91	9.42	Non-Liquefiable
27.50	>100	Clayey Sand	21.00	24	548	297	1.84	0.44	0.08	1.00	100	0.58	58	4.18	1.11	68.4	0.47	0.84	9.94	Non-Liquefiable
30.00	>100	Silty Clay	22.00	100	503	328	1.84	0.37	0.07	1.00	100	0.55	55	0.50	1.20	66.8	0.46	0.81	11.40	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-I)-2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{haz}/g): 0.16 Location of Ground Water Table: 3.0 m C_{dr} 1 C_{ss} 1
Atmospheric Pressure: 100.00 kPa Magnitude, $M_w = 6$ C_{ep} 1 C_{nw} 1 C_{rl} 1

Borehole: BH-10

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_o (kPa)	σ_o' (kPa)	σ_o'/σ_o	r_d	CSR ($0.65 \sigma_o' r_d / r_{cs}$)	C_{ep}	N_{60} $N_{C_{ep}}$	C_k	$(N_1)_{eq} = C_k N_{C_{ep}}$	α	β	$(N_1)_{eq} = \alpha \cdot \beta (N_1)_{eq}$	$CRR_{7.5}$	CRR	Factor of Safety FOS=1 CRR/CSR	Possibility of Liquefaction
1.00	25	Silty Clay	20.50	92	21	21	1.00	0.99	0.10	1.00	25	1.70	43	0.50	1.20	51.5	0.32	0.57	5.48	Non-Liquefiable
2.00	12	Silty Clay	18.50	100	39	39	1.00	0.98	0.10	1.00	12	1.60	19	0.50	1.20	23.6	0.27	0.47	4.60	Non-Liquefiable
3.00	17	Silty Clay	20.00	100	59	59	1.00	0.98	0.10	1.00	17	1.30	22	0.50	1.20	27.1	0.34	0.60	5.92	Non-Liquefiable
4.00	42	Silty Sand	20.00	16	79	69	1.14	0.97	0.12	1.00	42	1.20	50	2.86	1.06	56.2	0.37	0.65	5.63	Non-Liquefiable
5.00	34	Silty Sand	19.50	12	99	79	1.25	0.96	0.12	1.00	34	1.13	38	1.60	1.03	41.1	0.16	0.28	2.76	Non-Liquefiable
6.00	26	Silty Sand	19.00	11	118	88	1.33	0.95	0.13	1.00	26	1.07	28	1.11	1.03	29.5	0.44	0.77	5.83	Non-Liquefiable
7.50	43	Silty Sand	20.00	14	148	103	1.43	0.94	0.14	1.00	43	0.98	42	2.10	1.04	46.1	0.25	0.45	3.22	Non-Liquefiable
9.00	48	Silty Clay	21.00	100	179	120	1.49	0.93	0.14	1.00	48	0.91	44	0.50	1.20	53.1	0.34	0.59	4.12	Non-Liquefiable
10.50	13	Silty Clay	19.00	100	208	134	1.55	0.89	0.14	1.00	13	0.86	11	0.50	1.20	14.0	0.15	0.27	1.84	Non-Liquefiable
12.00	10	Silty Clay	17.50	86	234	145	1.61	0.85	0.14	1.00	10	0.83	8	0.50	1.20	10.4	0.12	0.21	1.45	Non-Liquefiable
16.00	9	Silty Clay	17.00	100	302	174	1.73	0.75	0.13	1.00	9	0.76	7	0.50	1.20	8.7	0.10	0.18	1.34	Non-Liquefiable
18.00	7	Silty Clay	16.00	100	334	187	1.79	0.69	0.13	1.00	7	0.73	5	0.50	1.20	6.6	0.08	0.15	1.16	Non-Liquefiable
20.00	31	Silty Clay	21.00	100	376	209	1.80	0.64	0.12	1.00	31	0.69	21	0.50	1.20	26.2	0.32	0.56	4.71	Non-Liquefiable
22.50	42	Silty Clay	21.00	100	428	237	1.81	0.57	0.11	1.00	42	0.65	27	0.50	1.20	33.2	1.56	2.76	25.62	Non-Liquefiable
25.00	>100	Silty Sand	21.00	20	481	265	1.81	0.51	0.10	1.00	100	0.61	61	3.54	1.08	69.7	0.48	0.86	8.95	Non-Liquefiable
27.50	>100	Silty Sand	21.00	11	533	293	1.82	0.44	0.08	1.00	100	0.58	58	1.17	1.03	61.1	0.41	0.73	8.73	Non-Liquefiable
30.00	>100	Silty Clay	22.00	100	588	323	1.82	0.37	0.07	1.00	100	0.56	56	0.50	1.20	67.2	0.46	0.82	11.61	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16

Location of Ground Water Table:

3.0 m

C_{dr} 1 C_{ss} 1

Atmospheric Pressure: 100.00 kPa

Magnitude, $M_w =$ 6

C_{d0} 1

C_{HW} 1 C_{RL} 1

Borehole: BH-11

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ'_v (kPa)	α_v/σ'_v	r_d	CSR $(0.65 \cdot \sigma'_v \cdot \alpha_v / g)$ (ton/ton)	C_{dr}	N_{60} NC ₆₀	C_N	$(N_1)_{60} = C_N \cdot NC_{60}$	α	β	$(N_1)_{60} \cdot \alpha \cdot \beta$	$CRR_{7.5}$	CRR	Factor of Safety $FOS = 1 - CRR/CSR$	Possibility of Liquefaction
1.00	27	Silty Sand	19.00	38	19	19	1.00	0.99	0.10	1.00	27	1.70	46	0.50	1.20	55.6	0.36	0.64	6.18	Non-Liquefiable
2.00	30	Silty Sand	19.00	26	38	38	1.00	0.98	0.10	1.00	30	1.62	49	4.42	1.13	59.2	0.39	0.70	6.80	Non-Liquefiable
3.00	41	Silty Sand	20.00	30	58	58	1.00	0.98	0.10	1.00	41	1.31	54	4.72	1.16	66.9	0.46	0.82	8.02	Non-Liquefiable
4.00	37	Silty Sand	19.50	16	78	68	1.14	0.97	0.12	1.00	37	1.22	45	2.80	1.05	50.2	0.31	0.54	4.69	Non-Liquefiable
5.00	77	Silty Sand	21.00	9	99	79	1.25	0.96	0.12	1.00	77	1.13	87	0.56	1.02	88.7	0.63	1.12	8.98	Non-Liquefiable
6.00	40	Silty Sand	20.00	8	119	89	1.33	0.95	0.13	1.00	40	1.06	42	0.29	1.01	43.2	0.21	0.37	2.77	Non-Liquefiable
7.50	29	Silty Sand	19.00	10	147	103	1.43	0.94	0.14	1.00	29	0.99	29	0.80	1.02	30.0	0.47	0.83	5.90	Non-Liquefiable
9.00	26	Silty Clay	20.50	90	178	119	1.50	0.93	0.14	1.00	26	0.92	24	0.50	1.20	29.1	0.42	0.74	5.08	Non-Liquefiable
10.50	6	Silty Clay	15.50	100	201	127	1.58	0.89	0.15	1.00	6	0.89	5	0.50	1.20	6.9	0.09	0.15	1.05	Non-Liquefiable
12.00	10	Silty Clay	17.50	100	227	139	1.64	0.85	0.15	1.00	10	0.85	8	0.50	1.20	10.7	0.12	0.21	1.45	Non-Liquefiable
14.00	10	Silty Clay	17.50	100	262	154	1.70	0.80	0.14	1.00	10	0.80	8	0.50	1.20	10.2	0.11	0.20	1.43	Non-Liquefiable
16.00	11	Silty Clay	18.00	100	298	171	1.75	0.75	0.14	1.00	11	0.77	8	0.50	1.20	10.6	0.12	0.21	1.55	Non-Liquefiable
18.00	13	Silty Clay	19.00	100	336	189	1.78	0.69	0.13	1.00	13	0.73	9	0.50	1.20	11.8	0.13	0.23	1.79	Non-Liquefiable
20.00	20	Silty Clay	20.00	100	376	209	1.80	0.64	0.12	1.00	20	0.69	14	0.50	1.20	17.1	0.18	0.32	2.69	Non-Liquefiable
22.50	41	Silty Clay	21.00	100	429	237	1.81	0.57	0.11	1.00	41	0.65	27	0.50	1.20	32.4	0.87	1.54	14.33	Non-Liquefiable
25.00	48	Silty Clay	21.00	100	481	265	1.81	0.51	0.10	1.00	48	0.61	29	0.50	1.20	35.9	-0.28	-0.49	-	Non-Liquefiable
27.50	>100	Silty Sand	21.00	17	534	293	1.82	0.44	0.08	1.00	100	0.58	58	3.06	1.06	65.0	0.44	0.79	9.45	Non-Liquefiable
30.00	>100	Fissile Clay	21.00	100	586	321	1.82	0.37	0.07	1.00	100	0.56	56	0.50	1.20	67.4	0.46	0.82	11.62	Non-Liquefiable
33.00	>100	Fissile Clay	21.00	100	649	355	1.83	0.29	0.06	1.00	100	0.53	53	0.50	1.20	64.2	0.44	0.77	13.90	Non-Liquefiable

ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-I)-2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16

Location of Ground Water Table: 3.0 m

C_{WT} 1 C_{SS} 1

Atmospheric Pressure: 100.00 kPa

Magnitude, $M_w = 6$

C_{SD} 1

C_{GW} 1 C_{RI} 1

Borehole: BH-12

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m ³)	Fines Content FC	σ_v (kPa)	σ_v' (kPa)	σ_v/σ_v'	r_d	CSR $(0.65 \cdot \sigma_v' / s_u) \cdot r_d$	C_{FD}	N_{60} NC_{60}	C_u	$(N_1)_{60}$ $C_u \cdot NC_{60}$	α	β	$(N_1)_{60} \alpha \cdot \beta \cdot (N_1)_{60}$	$CRR_{7.5}$	CRR	Factor of Safety $FOS=1$ CRR/CSR	Possibility of Liquefaction
1.00	27	Silty Clay	20.50	79	21	21	1.00	0.99	0.10	1.00	27	1.70	45	0.50	1.20	55.6	0.36	0.64	6.18	Non-Liquefiable
3.00	15	Silty Clay	20.00	69	61	61	1.00	0.98	0.10	1.00	15	1.29	19	0.50	1.20	23.6	0.27	0.47	4.66	Non-Liquefiable
4.00	8	Silty Clay	16.50	90	77	67	1.15	0.97	0.12	1.00	8	1.22	10	0.50	1.20	12.2	0.13	0.24	2.04	Non-Liquefiable
5.00	44	Silty Sand	20.00	12	97	77	1.25	0.96	0.13	1.00	44	1.14	50	1.70	1.03	53.4	0.34	0.60	4.79	Non-Liquefiable
6.00	41	Silty Sand	20.00	16	117	88	1.34	0.95	0.13	1.00	41	1.07	44	2.83	1.06	49.1	0.29	0.52	3.90	Non-Liquefiable
7.50	30	Silty Sand	19.00	17	146	101	1.44	0.94	0.14	1.00	30	0.99	30	3.01	1.06	34.6	-1.41	-2.50	-	Non-Liquefiable
9.00	14	Silty Clay	19.50	100	175	116	1.51	0.93	0.15	1.00	14	0.93	13	0.50	1.20	16.1	0.17	0.30	2.08	Non-Liquefiable
10.50	15	Silty Sand	17.50	47	201	127	1.58	0.89	0.15	1.00	15	0.89	13	0.50	1.20	16.4	0.17	0.31	2.11	Non-Liquefiable
14.00	11	Silty Clay	18.00	100	264	156	1.69	0.80	0.14	1.00	11	0.80	9	0.50	1.20	11.1	0.12	0.22	1.54	Non-Liquefiable
16.00	10	Silty Clay	17.50	100	299	171	1.74	0.75	0.14	1.00	10	0.76	8	0.50	1.20	9.7	0.11	0.19	1.44	Non-Liquefiable
18.00	11	Silty Clay	18.00	100	335	188	1.78	0.69	0.13	1.00	11	0.73	8	0.50	1.20	10.1	0.11	0.20	1.57	Non-Liquefiable
20.00	22	Silty Clay	20.50	78	376	209	1.80	0.64	0.12	1.00	22	0.69	15	0.50	1.20	18.8	0.20	0.35	2.97	Non-Liquefiable
22.50	36	Silty Clay	21.00	63	429	237	1.81	0.57	0.11	1.00	36	0.65	23	0.50	1.20	28.5	0.39	0.69	6.42	Non-Liquefiable
25.00	45	Clayey Sand	20.00	39	479	263	1.82	0.51	0.10	1.00	45	0.62	28	0.50	1.20	33.8	5.74	10.16	105.93	Non-Liquefiable
27.50	109	Silt Clay	21.00	100	531	291	1.83	0.44	0.08	1.00	100	0.59	59	0.50	1.20	70.9	0.49	0.87	10.44	Non-Liquefiable
30.00	>100	Fissile Clay	21.00	100	584	319	1.83	0.37	0.07	1.00	100	0.56	56	0.50	1.20	67.7	0.47	0.83	11.64	Non-Liquefiable
33.00	>100	Fissile Clay	21.00	100	647	352	1.84	0.29	0.06	1.00	100	0.53	53	0.50	1.20	64.4	0.44	0.78	13.91	Non-Liquefiable

ANNEXURE-III

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No. 01	
PROJECT NAME		RAMANIYAM						PAGE No. 1	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE	
STRUCTURE		DRILLING METHOD		CO-ORDINATES		BORE END DATE		150mm	
JOB CODE		FLUSHING MEDIUM		Bentonite		TOTAL DRILLING DAYS		100mm	
11:00		11:08 AM		2 8 8 16		1		M. dense, Brownish, fm-gra / SANDY SILT with Bricks.	
11:20		11:25		3 4 5 9		2		Stiff, moist, Brownish, compact SILTY CLAY	
11:40		11:46		27		3		UNDISTURBED SAMPLES.	
12:05		12:09		8 13 15 26		4		M. dense, fine grains, compact SANDY SILT	
12:25		12:36		15 20 15 25		5		Dense, Brownish, fm-med, un-weathered SAND,	
12:50		12:56		22 25 20 45		6		SAND	
2:00		2:06		12 20 25 45		7.5		Dense, grey, fm-grains. SILTY SAND.	
2:25		2:29		12 8 9 17		9		M. dense, Brownish, medium coarse grain SAND.	
2:55		2:59		19 13 8 21		10.50		M. dense, grey fm-grains. SILTY SAND.	
CS - Core Sample		DS - Disturbed Sample		SUPERVISOR NAME		K. Sivasankaran		PROJECT SITE DETAILS	
SS - Split Spoon Sample		SC - Soil Cutter		SIGNATURE		A. Gnanapavan		GROUND LEVEL (m)	
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		DATE		24/05/2022		WATER TABLE (m)	
WS - Wash Sample		DB - Diamond Bit		CLIENT IN-CHARGE				CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		1					
								PAGE No.		2					
PROJECT NAME		RAMANIYAM						DIA OF BORE HOLE		150mm					
LOCATION		Nerukundram	MACHINE No.		H201	CHAINAGE (m)			BORE START DATE		24/05/2022				
STRUCTURE			DRILLING METHOD		Rotary	CO-ORDINATES		N	BORE END DATE		25/05/2022				
JOB CODE			FLUSHING MEDIUM		Bentonite			E	TOTAL DRILLING DAYS						
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1		3.20	3.23												stiff, moist, Blackish compact - clay
2							3	4	5	9		12			
3		3.47	[CS]												stiff, moist, Blackish, compact - clay
4		3.52					2	5	6	11		14			
5		4.39													m. stiff, moist, Blackish, com clay
6		4.33					1	3	4	7		16			
7		5.05	[CS]												stiff, moist, Blackish, compact - clay
8		5.09					3	6	4	10		18			
9		5.37													stiff, moist, Blackish compact - clay with muscovite
10		5.42					4	6	8	14		20			

Split core samples for laboratory tests

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

SUPERVISOR NAME		K. Suresh Kumar	
SIGNATURE		SUPERVISOR NAME	K. Suresh Kumar
DATE	24/05/2022	SIGNATURE	
CLIENT IN-CHARGE		DATE	24/05/2022

CORE SAMPLES	
CS - Core Sample	DS - Disturbed Sample
SS - Split Spoon Sample	SC - Soil Cutter
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit
WS - Wash Sample	DB - Diamond Bit

SITE INVESTIGATION RECORD

BORE HOLE No.	02
PAGE No.	1
DIA OF BORE HOLE	150mm 100mm
BORE START DATE	20/05/2022
BORE END DATE	23/05/2022
TOTAL DRILLING DAYS	3

PROJECT NAME	RAMANIYAM.			
LOCATION	Norukundram	MACHINE No.	HR-01	CHAINAGE (m)
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES
JOB CODE		FLUSHING MEDIUM	Bentonite	

Depth below E.C.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details				Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	20/05/2022	2.00 PM			7	12	15	27	1					Dense, v. fine grain Brownish, SANDY CLT
2		2.12			8	11	12	23	2					v. stiff, Brownish, compact CLAY
3		2.37			6	11	11	22	3					v. stiff, Brownish, compact CLAY
4		2.41			9	12	10	22	4					m. dense, fine grain. SILTY SAND.
5		3.00			4	10	27	37	5					urey-Brownish, clay with SILTY SAND.
6		3.09			6	9	25	34	6					m. dense, Brownish, fine grain SILTY SAND
7		3.30			8	11	12	23	7.50					m. dense, ureyish, fine-medium coarse grain SILTY SAND.
8		3.38			6	8	10	16	9					m. dense, ureyish, medium coarse SILTY SAND
9		3.55			3	11	16	27						m. dense, v. fine grain. ureyish-urey (mix). SILTY SAND
10	21/05/2022	3.59												
		4.17												
		4.22												
		4.50												
		4.56												
		5.20												
		5.24 PM												
		11.05 PM												
		11.10												

split spoon samples

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. Siva Sankaran	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. Siva Sankaran	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	21/05/2022	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		

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

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 02			
PROJECT NAME		RAMANIAM										PAGE No. 2			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS					
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E					
JOB CODE		FLUSHING MEDIUM		Bentonite											
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1		11	29												
2		11	34												V. stiff, moist, Blackish. compact. CLAY
3		11	50												
4		11	50												stiff, moist, Blackish, compact CLAY
5		12	25 PM												
6		12	29 PM												Sample the Slipped.
7		12	56												UDS failed
8		1	00												stiff, moist, Blackish, compact CLAY
9		2	00												
10		2	10 PM												X. Stiff, moist, Blackish compact. CLAY - SHALE
Core Sample		DS - Disturbed Sample		SUPERVISOR NAME		K. Sankaranarayanan		PROJECT SITE DETAILS							
SS - Split Spoon Sample		SC - Split Cutter		SIGNATURE		K. Sankaranarayanan		GROUND LEVEL (m)							
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		DATE		21/08/2022		WATER TABLE (m)							
WS - Wash Sample		DB - Diamond Bit		CLIENT IN-CHARGE				CASING DEPTH (m)							

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 02	
PROJECT NAME		RAMANIYAM										PAGE No. 3	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE		BORE END DATE			
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E			
JOB CODE		FLUSHING MEDIUM		Bentonite		TOTAL DRILLING DAYS		3					
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
						0-15	15-30	30-45					
1	23/05/2022	10:40											
2		10:49	[SC]			11	17	19	36	22.5			V. stiff - Hard, moist, greyish greenish (mix) compact SANDY SILTY CLAY
3		11:27											
4		11:35				13	19	25	44	25			V. stiff - Hard, greyish, compact SANDY SILTY CLAY
5		12:35											
6		12:49	[SC]										
7													
8		2:06				27	60	(200)	10m	27.5			X. Dense, Brownish-yellowish (mix) medium coarse v grain SAND with Pebbles. <u>urumi</u>
9		2:28											
0						47	55	(700)	50m	30			X. HARD, greyish, compact v. thinly bedded SHALE

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. S. Sankaran	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	[Signature]	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	23/05/2022	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

[illegible]

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 03		
PROJECT NAME		Ramaniyam site at Nerukundram										PAGE No. 01		
LOCATION		MACHINE No. HR-01		CHAINAGE (m)		BORE START DATE 18/05/2022		DIA OF BORE HOLE 150mm ✓		100mm				
STRUCTURE		DRILLING METHOD Rotary		CO-ORDINATES N		BORE END DATE 19/05/2022		TOTAL DRILLING DAYS						
JOB CODE		FLUSHING MEDIUM Bentonite		E										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time		Total Core Recovery %	R.C.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	11:00 TO 11:02					7	11	13	24	1.00	1	SS	1.00	TOPSOIL Brownish silty sandyclay
2	11:10 TO 11:12					8	13	18	31	2.00	2	SS	2.00	Brownish Medium Dense silty sandy silty clay
3	11:21 TO 11:30					9	15	18	33	3.00	3	SS	3.00	Brownish Sandy Hard clay
4	11:42 TO 11:50					2	11	11	22	4.00	4	SS	4.00	Brownish Hard clay
5	12:01 TO 12:06					16	27	23	50	5.00	5	SS	5.00	Brownish stiff clay with sand patches
6	12:18 TO 12:20					22	20	20	40	6.00	6	SS	6.00	Brownish dense to very dense Fine to Medium sand
7	12:31 TO 12:34					10	16	16	32	7.50	7	SS	7.50	Brownish Dense to very Dense Fine to Medium Coarse Sand
8	12:48 TO 12:50					19	18	12	30	9.00	8	SS	9.00	DO
9	2:05 TO 2:08					3	2	2	4	10.00	9	SS	10.00	Brownish Dense fine to medium coarse sand
10														Blackish soft clay with sand patches

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	D. VENUGOPAL	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	19/05/22	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 03			
PROJECT NAME		Ramanigam site at Nerukundram										PAGE No. 02			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS					
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E					
JOB CODE		FLUSHING MEDIUM		Bentonite		E									
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1	18/05/2022	2.20	2.24												
2		2.36	2.40				3	6	10	16	12.00	10	SS	12.00	Blackish very stiff clay
3		2.54	3.00												
4		3.15	3.20				2	6	8	14	14.00	11	SS	14.00	Blackish stiff clay
5		3.38	3.46												
6							2	5	5	10	16.00	12	SS	16.00	Blackish sandy stiff clay,
7															
8							5	8	9	17	18.00	13	SS	18.00	Blackish very stiff clay with shells.
9															
10							9	13	19	32	20.00	14	SS	20.00	Dark Greenish Dense sandy clay

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	[Signature]	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	19/05/22	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No. 03			
PROJECT NAME		Ramaniyam site at Nerkeendram						PAGE No. 03			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE			
STRUCTURE		DRILLING METHOD		Rotary		BORE END DATE		150mm ✓			
JOB CODE		FLUSHING MEDIUM		Bentonite		TOTAL DRILLING DAYS		100mm			
Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)		Core Details		SPT Details		Sample Details			
Time		Total Core Recovery %		R.Q.D %		Blows/cm.		SPT 'N' Value			
Date		Hr. Min		0-15		15-30		30-45			
Depth below E.G.L. (m)		Depth (m)		No.		Type		Geotechnical Description			
18/05/2022		A-05 4-19				15 27 29 56		22.50 15 SS 22.50		Light Greenish Dense to Very Dense Sandy clay.	
19/05/2022		A-24 A-30				19 20 20 40		25.00 16 SS 25.00		Greenish to yellowish Dense to Very Dense Clayey Sand	
19/05/2022		9-30 10-00 10-10 10-45				AS 100% SOIL N > 100		27.50 17 SS 27.50		DO	
19/05/2022		10-50 11-00 11-05 11-15				40 100% SOIL N > 100		30.00		Brownish Very Hard Compacted clay (shale)	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 03			
PROJECT NAME		Ramaniyam site at Nerkundram										PAGE No. 04			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS					
STRUCTURE		DRILLING METHOD		CO-ORDINATES		BORE END DATE		BORE END DATE		TOTAL DRILLING DAYS					
JOB CODE		FLUSHING MEDIUM		Bentonite		E		E		TOTAL DRILLING DAYS					
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data			
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description	
						0-15	15-30	30-45							
1	19/05/2022	2-05 70 2-50													
2															
3															
4															
5															
6															
7															
8															
9															
10															
CS - Core Sample		DS - Disturbed Sample		SUPERVISOR NAME		D. VENUGOPAL		PROJECT SITE DETAILS							
SS - Split Spoon Sample		SC - Soil Cutter		SIGNATURE		A. V. V.		GROUND LEVEL (m)							
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		DATE		19/05/22		WATER TABLE (m)							
WS - Wash Sample		DB - Diamond Bit		CLIENT IN-CHARGE				CASING DEPTH (m)							

45 Bcm N > 100 33.00 M SS 33.00 Brownish Very Hard
 50blu
 Borehole terminated at 33.00 depth in below GL.

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 04			
PROJECT NAME Ramaniyam site at NerKundram												PAGE No. 01			
LOCATION		MACHINE No. HR-01		CHAINAGE (m)		BORE START DATE 12/05/2022		DIA OF BORE HOLE 150mm L		BORE END DATE 14/05/2022		TOTAL DRILLING DAYS			
STRUCTURE		DRILLING METHOD Rotary		CO-ORDINATES N		BORE END DATE		DIA OF BORE HOLE 100mm		TOTAL DRILLING DAYS					
JOB CODE		FLUSHING MEDIUM Bentonite		CO-ORDINATES E		TOTAL DRILLING DAYS									
Depth below G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1	12/05/2022	10:50 TO 10:54				4	8	11	19	1.00	1	SS	1.00	Top Soil. Brownish sandy clay	
2		11:08 TO 11:12				4	6	8	14	2.00	2	SS	2.00	Brownish M. Dense silty Sandy clay	
3		11:25 TO 11:28				8	8	9	17	3.00	3	SS	3.00	Brownish stiff clay with sand patches	
4		11:51 TO 11:53				4	5	5	10	4.00	4	SS	4.00	Brownish M. Dense clayey silty fine sand	
5		12:15 TO 12:17				4	5	5	10	4.00	4	SS	4.00	Brownish loose silty fine sand	
6		4:00 TO 4:02				8	16	18	34	5.00	5	SS	5.00	Brownish Dense silty fine sand with clay binder	
7		4:15 TO 4:17				16	18	20	38	6.00	6	SS	6.00	Light Greenish to Brownish Dense fine to M. coarse Sand	
8		4:32 TO 4:34				12	14	16	30	7.50	7	SS	7.50	— DO —	
9		4:51 TO 4:55				3	4	5	9	9.00	8	SS	9.00	Blackish stiff clay	
10						3	4	5	9	10.50	9	SS	10.50	— DO —	

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE S. M. M.	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE 14/05/2022	WATER TABLE (m)	4.00m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE	CASING DEPTH (m)	

m

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 04		
PROJECT NAME		Ramaniam site at NerKundram										PAGE No. 02		
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS				
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E				
JOB CODE		FLUSHING MEDIUM		Bentonite										
Depth below E.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	12/05/22	5.10												
2		5.14				3	5	6	11	12.00	10	SS	12.00	Blackish shift clay with sand patches
3		8.55												
4		9.00												
5		9.25				2	5	5	10	14.00	11	SS	14.00	Blackish shift clay
6		9.30												
7	13/05/2022	10.00				2	4	5	9	16.00	12	SS	16.00	Blackish sandy shift clay
8		10.06												
9		10.45				2	5	8	13	18.00	13	SS	18.00	Blackish shift clay with shell.
10		10.51				9	13	21	34	20.00	14	SS	20.00	Light Greenish Hard Compacted clay.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	Dr. Venugopal	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	14/05/22	WATER TABLE (m)	4.00m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 0A	
PROJECT NAME		Ramaniyam site at Nerukundram										PAGE No. 03	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE		150mm			
STRUCTURE		DRILLING METHOD		Rotary		BORE END DATE		100mm		✓			
JOB CODE		FLUSHING MEDIUM		Bentonite		TOTAL DRILLING DAYS							
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
						0-15	15-30	30-45					
1	11-35	10											
2	11-50												
3	12-50	10				18	20	35	55	22-50	15	SS	22-50
	1-00												Greyish Hard compacted clay with gravel pieces
4	2-30	10											
	2-35												
5						26	35	35	70	25-00	16	SS	25-00
													Greyish & yellowish. Dense & v. Dense clayey Sand.
6	3-15	10											
	3-35												
7													
8						33	41	70	N>100	27-50	17	SS	27-50
													Greyish Dense & very Dense clayey Sand.
9	8-55	10											
	9-55												
10						50	124	50	N>100	30-00	18	SS	30-00
													Brownish to yellowish v. Hard compacted clay

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	D. VENUGOPAL	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	14/05/2022	WATER TABLE (m)	4.00m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING						SITE INVESTIGATION RECORD								BORE HOLE No.		0A			
PROJECT NAME Ramanyam site at Nerbandram								MACHINE No.				CHAINAGE (m)				PAGE No.		04	
						LOCATION				DRILLING METHOD		Rotary		CO-ORDINATES		N		DIA OF BORE HOLE	
STRUCTURE				FLUSHING MEDIUM		Bentonite				E		BORE START DATE		12/05/2022		BORE END DATE		14/05/2022	
JOB CODE												TOTAL DRILLING DAYS							
Depth below G.L. (m)		Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)		Core Details		SPT Details			Sample Details			Layer Data					
		Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description				
			Hr.	Min			0-15	15-30	30-45										
1	14/05/2022	10:48	70																
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
0																			
CS - Core Sample		DS - Disturbed Sample		SUPERVISOR NAME		D. VENUGOPAL		PROJECT SITE DETAILS											
SS - Spilt Spoon Sample		SC - Soil Cutter		SIGNATURE		[Signature]		GROUND LEVEL (m)											
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		DATE		14/05/2022		WATER TABLE (m)											
WS - Wash Sample		DB - Diamond Bit		CLIENT IN-CHARGE				CASING DEPTH (m)											

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 05	
PROJECT NAME		Romaniyam - Perumthottam										PAGE No. 1	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS			
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E			
JOB CODE		FLUSHING MEDIUM		Bentonite									
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
						0-15	15-30	30-45					
1	14	11	SC	-	-	3	4	5	9	1.00	1	SS	Brown, stiff sandy silty clay
2	14	18	SC	-	-	2	3	3	6	2.00	2	SS	Brown, m. stiff silty clay.
3	14	42	SC	-	-	2	6	6	12	3.00	3	SS	Brown gassy, m. dense silty sand.
4	15	17	SC	-	-	2	1	5	6	4.00	4	SS	Brown clayey silty sand.
5	15	49	SC	-	-	5	7	8	15	5.00	5	SS	Brown, m. dense sand.
6	15	50	SC	-	-	5	6	7	13	6.00	6	SS	-DO-
7	16	12	SC	-	-	5	7	8	15	7.50	7	SS	Gray, m. dense sand.
8	16	17	SC	-	-	2	2	2	4	9.00	8	SS	Gray, v. loose sand.
9	16	37	SC	-	-								
10	16	41	SC	-	-								
11	17	18	SC	-	-								
12	17	23	SC	-	-								
13	09	05	SC	-	-								
14	09	11	SC	-	-								
15	09	34	SC	-	-								
16	09	40	SC	-	-								

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

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. <u>D5</u>			
PROJECT NAME		Pananiyam - Perkundram.										PAGE No. <u>2</u>			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS					
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E					
JOB CODE		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		N		E					
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1							5	4	3	7	10.5	9	SS		grey loose sand.
2							1	0	0	0	12	10	SS		Black, clay with fine sand mix.
3															
4							1	1	1	2	14	11	SS		Black, v. soft clay
5															
6							1	1	1	2	16	12	SS		- DO -
7															
8							2	2	2	4	18	13	SS		Black soft clay.
9															
0							2	5	6	11	20	14	SS		Grey green, lat red stiff silty clay.

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

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 05	
PROJECT NAME		Ramanujan - Per Kundraan										PAGE No. 3	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE 02/05/22		DIA OF BORE HOLE 150mm ✓		BORE END DATE 05/05/22			
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES N		TOTAL DRILLING DAYS 4		E			
JOB CODE		FLUSHING MEDIUM		Bentonite									
Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)		Core Details		SPT Details		Sample Details		Layer Data			
Date		Time		Total Core Recovery %		Blows/cm.		SPT 'N' Value		Geotechnical Description			
Hr.		Min.		R.Q.D %		0-15 15-30 30-45		Depth No. Type		Depth (m)			
03/05/2022		15 40		SC - -		4 6 9 15		22.5 15 SS		gray brown, stiff sandy silty clay.			
03/05/2022		15 51		SC - -									
03/05/2022		16 36		SC - -		8 14 16 30		25 16 SS		Brown gray dense cemented sand.			
03/05/2022		16 48		SC - -									
04/05/2022		09 23		SC - -		25 30 33 63		27.5 17 SS		Hard, shale Brown shale.			
04/05/2022		10 04		SC - -									
04/05/2022		11 00		SC - -		16 22 30 52		30 14 SS		Brown shale shale (Hard)			
04/05/2022		11 53		SC - -									

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 05			
PROJECT NAME		Panamiam - Norkudraan										PAGE No. 4			
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE 02/05/22		DIA OF BORE HOLE 150mm ✓		BORE END DATE 05/05/22					
STRUCTURE		DRILLING METHOD Rotary		CO-ORDINATES N		BORE END DATE 05/05/22		DIA OF BORE HOLE 100mm		TOTAL DRILLING DAYS 4					
JOB CODE		FLUSHING MEDIUM Bentonite		CO-ORDINATES E		TOTAL DRILLING DAYS 4									
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1	04/05/2022	02	27	SC	-	-									
2		03	34				16	22	30	52	32.5	19	SS		Hard, Brown shale.
3	05/05/2022	9	11	SC	-	-									
4		11	37				20	25	27	52	35	20	SS.		Hard, Brown shale.
5															
6															
7															
8															
9															
0															

Bore hole Terminated at 35' below E.G.L.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	Kaustubh Prabhu.	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	P. K. K.	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	05/05/2022	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

DATE		TIME		LOCATION		WELL		DEPTH		CORRECTION		REMARKS	
DAY	MONTH	YEAR	HOUR	MIN	SEC	STATION	WELL	DEPTH	CORRECTION	REMARKS	WELL	DEPTH	REMARKS
10	05	80	100	5	6	8	19	0.15	1	SS			stiff, gray clay
10	05	80	99.7	4	4	6	10	12	10	SS			stiff, dark gray clay
10	05	80	100	3	4	4	8	14	11	SS			stiff, dark gray, compact clay
10	05	80						16	12	SS			undisturbed sample
11	05	80	100	8	10	13	23	18	13	SS			very stiff, brownish gray clay
12	05	80		13	14	14	28	20	14	SS			very stiff, brownish gray clay with silts

SS - Sand Sample	DS - Disturbed Sample	SUPERVISOR NAME	ROUND TRIP
SS - Split Sample	SC - Split Core	SIGNATURE	DATE
UDS - Undisturbed Sample	TCS - Tungsten Carbide Bit	DATE	CLIENT IN CHARGE
WS - With Sample	DB - Diamond Bit	CLIENT IN CHARGE	EXAMINER (S)

[illegible]

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No. 10						
PROJECT NAME		R A M A N I Y A M						PAGE No. 1						
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE						
STRUCTURE		DRILLING METHOD		CO-ORDINATES		BORE END DATE		150mm						
JOB CODE		FLUSHING MEDIUM		Bentonite		TOTAL DRILLING DAYS		100mm						
11/06/2022		Rotary		N										
				E										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	8.00	8.09				4	12	13	25	1				V. stiff, moist, grey-blackish (mix) compact. <u>SILTY CLAY</u>
2	8.30	8.39				3	5	7	12	2				stiff, moist, grey-blackish (mix) compact. <u>SILTY CLAY</u>
3	8.54	8.59				4	7	10	17	3				<u>SILTY CLAY</u>
4	9.15	9.12				12	19	23	42	4				Dense, Brownish, firm-medium grain <u>SILTY SAND</u>
5	9.38	9.43				12	15	19	34	5				Dense, grey firm-medium grain <u>SILTY SAND</u>
6	10.40	10.40				6	6	20	26	6				<u>SILTY SAND</u>
7	11.05	11.08				9	15	28	43	7.5				Dense, grey-firm grain. <u>SILTY SAND</u>
8	11.28													
9	11.32					5	21	22	48	9				V. firm grain greyish-blackish <u>CLAYEY SILT</u>
10	12.00	12.04				4	6	7	12	10.50				stiff, moist, blackish, loamy <u>SILTY CLAY with clayey sand</u>

split spoon samplers

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. Sivasankaran	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. Sivasankaran	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	11/06/2022	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 10		
PROJECT NAME		R A M A N I Y A M										PAGE No. 2		
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE		150mm				
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		BORE END DATE				
JOB CODE		FLUSHING MEDIUM		Bentonite		E		TOTAL DRILLING DAYS		11/06/2022				
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1		12.30												
2		12.37				5	5	5	10	12				m. stiff, moist, compact SILTY CLAY
3		2.09												
4		2.09								14				UNDISTURBED SAMPLES
5		2.35												
6		2.42				4	5	4	9	16				stiff - moist, Blackish compact: SILTY CLAY
7		3.25												
8		3.30				2	3	4	7	18				m. stiff, moist, Blackish compact SILTY CLAY
9														
0														

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. V. S. Sankaranarayanan		PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. V. S. Sankaranarayanan		GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	11/06/2022		WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE			CASING DEPTH (m)	

GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 10		
PROJECT NAME		Ramaniyam Site at Nerukemdam										PAGE No. 03		
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS				
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E				
JOB CODE		FLUSHING MEDIUM		Bentonite										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	10:00	10:20	SC			10	14	17	31	20.00			20.00	Dark Greenish Red Hard compacted clay
2	11:00	11:20	SC			10	20	22	42	22.50			22.50	Light Greenish Dense to very dense Sandyclay.
3	12:00	12:10												
4														
5	12:50	1:56	SC			50	100	N > 100	50	25.00			25.00	Dark Greenish Dense to V-Dense silty fine Sand
6	2:10	2:30												
7	3:05	3:10	SC			10cm	50	N > 100	50	27.50			27.50	Brownish dense to very dense coarse sand with gravel.
8	3:25	3:45												
9														
0			SC			7.5	10cm	N > 100	50	30.00			30.00	Brownish very hard shale (compacted clay).

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	D. VENUGOPAL	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	R. Vell	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	2/06/22	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No.		11				
								PAGE No.		7				
PROJECT NAME		RAMANIYAM						DIA OF BORE HOLE		150mm 100mm				
LOCATION		Nandambam		MACHINE No.	HR-0		CHAINAGE (m)		BORE START DATE		30/05/2022			
STRUCTURE				DRILLING METHOD	Rotary		CO-ORDINATES	N	BORE END DATE		31/05/2022			
JOB CODE				FLUSHING MEDIUM	Bentonite		E		TOTAL DRILLING DAYS					
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45					
1	8.50 AM	9.00	9.17				9	11	16	27	-1			m-dense, Brownish, x-fine grained SANDY SILT
2		9.23					7	13	17	30	-2			dense, Brownish, fine grains SILTY SAND
3		9.40	9.42				10	12	23	41	-3			dense, Brownish, fine grain SILTY SAND
4		10.00	10.03				11	17	20	37	-4			SILTY SAND
5		10.15	10.17				19	44	33	97	-5			v-dense, Brownish, fine-med coarse grain SAND
6		10.35	10.37				17	20	20	40	-6			dense, Brownish, medium coarse grain SAND
7		10.55	10.57				12	14	15	29	-7.5			greyish, fine-medium grain SAND (m-dense))
8		11.14	11.17				3	5	21	26	-9			greyish-blackish (mix) SILTY CLAY WITH SILTY SAND
9		11.32												
10		11.35					2	3	3	6	-10.25			Blackish, moist, compact silty SILTY CLAY

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 11		
PROJECT NAME		RAMANIYAM										PAGE No. 2		
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		BORE END DATE		TOTAL DRILLING DAYS				
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E				
JOB CODE		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		N		E				
Depth below G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Dtc	Time		Total Core Recovery %	R.O.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
						0-15	15-30	30-45						
1	11.55	12.00												
2						4	4	6	10	12				moist - stiff, moist, compact SILTY CLAY
3	12.23													
4	12.27					2	4	6	10	14				stiff, moist, blackish, compact SILTY CLAY
5	12.49													
6	12.50					3	5	6	11	16				stiff, moist, Blackish compact SILTY CLAY
7	1.25													
8	1.35					3	6	7	13	18				SILTY CLAY
9	2.25													
10	2.39					5	7	13	20	20				stiff - blackish - greenish mix compact CLAY

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. G. V. S. M. Chavan	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	G. G. M. G.	GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	30/05/2022	WATER TABLE (m)	3.80
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

SITE INVESTIGATION RECORD

BORE HOLE No.	11
PAGE No.	3
DIA OF BORE HOLE	150mm 100mm
BORE START DATE	30/05/2022
BORE END DATE	31/05/2022
TOTAL DRILLING DAYS	

PROJECT NAME	RAMANIYAM			
LOCATION	Norukundram	MACHINE No.		CHAINAGE (m)
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES
JOB CODE		FLUSHING MEDIUM	Bentonite	

Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1	30/05/2022	9.05	AM												
2		9.25													
3		10.15		SC			9	19	22	41	22.5				HARD, greyish-greenish compact CLAY
4		10.40													
5		11.20					13	21	27	48	25				HARD, greyish, compact & thinly bedded CLAY on
6		12.20													
7				SC											
8							HAMMERED 23 58 (>100) 1540			27.5					V. dense, Brownish, med iu coarser grain. SAND
9		12.17													
10		12.37					HAMMERED 39 58 (>100) 150m			30.00					X-HARD, greyish, & thinly bedded SHALE

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. Siva Sankaran	PROJECT SITE DETAILS
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. Siva Sankaran	GROUND LEVEL (m)
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	31/05/2022	WATER TABLE (m)
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BONE HOLE No. 11			
PROJECT NAME		RAMANIYAM										PAGE No. 4			
LOCATION		MACHINE No.		CHAINAGE (m)		BONE START DATE		BONE END DATE		TOTAL DRILLING DAYS					
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		E					
JOB CODE		FLUSHING MEDIUM		Bentonite											
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min.				0-15	15-30	30-45						
1		2.00													
2		2.35													
3				SC			58	100m	(>100)			33.00	8SS		v. HARD, greyish, v. thin bedded SHALE
4															
5															
6															
7															
8															
9															
0															Bore hole terminated at 23m depth

SITE INVESTIGATION RECORD

BORE HOLE No.	12
PAGE No.	1
DIA OF BORE HOLE	150mm 100mm
BORE START DATE	26/05/2021
BORE END DATE	28/05/2021
TOTAL DRILLING DAYS	

PROJECT NAME: **RAMANIYAM**

LOCATION	Nonduram	MACHINE No.	HAB1	CHAINAGE (m)	
STRUCTURE		DRILLING METHOD	Rotary	CO-ORDINATES	N E
JOB CODE		FLUSHING MEDIUM	Bentonite		

Depth below E.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
		11.05	Am												
1		11.20					9	12	15	27	1		SSS		V. stiff, moist, Brownish, Compact. CLAY
2		11.35													
		11.45								22	2				UNDISTURBED SAMPLES
		12.05	Pm												
		12.15													
3							3	7	8	15	3				V. stiff, moist, Brownish Compact. CLAY
4		12.35													
		12.40					3	3	5	8	4				M. stiff - Brownish - grey CLAY, Compact.
		12.56													
5		12.50					13	18	26	44	5				Dense, Brownish, medium- grain. SAND
		2.00													
6		2.03					9	18	23	41	6				Dense, Brownish, fine-medium grain SAND
		2.18													
		2.20													
7							7	15	15	30	7.5				Dense, Brownish, fine-medium grain. SAND.
		2.40													
		2.46													
9							3	5	9	14	9				stiff, moist, Blackish Compact CLAY
		3.05													
0		3.09													
							8	8	7	15	10.5				In. dense moist, grey-black V. fine grain silty SAND

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. SIVASUBRAMANIAM	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	26/05/2021	WATER TABLE (m)	9.80
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD						BORE HOLE No. 12							
PROJECT NAME		RAMANIYAM						PAGE No. 2							
LOCATION		Narikundram		MACHINE No. H265		CHAINAGE (m)		DIA OF BORE HOLE 150mm 100mm							
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		BORE START DATE 26/05/2022							
JOB CODE		FLUSHING MEDIUM		Bentonite				BORE END DATE 28/05/2022							
								TOTAL DRILLING DAYS							
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data		
	Date	Time			Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Depth (m)	Geotechnical Description
		Hr.	Min				0-15	15-30	30-45						
1	26/05/2022	3.32	337												
2									23	12					UNDISTURBED SAMPLES
3		4.08	414												m. soft, moist, Blackish Compact. clay
4								3	5	6	11		14		
5		4.43	449												m. soft, moist, Blackish Compact. clay
6								5	5	5	10		16		
7		5.15	519												m. soft, moist, Blackish Compact. clay
8								3	5	6	11		18		
9		5.46	555												m. soft, moist, Blackish Compact. clay
10								8	7	15	22		20		m. soft, moist, Blackish Compact. clay

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. G. Sankaran	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. G. Sankaran	GROUND LEVEL (m)	
US - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	26/05/2022	WATER TABLE (m)	3.80
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

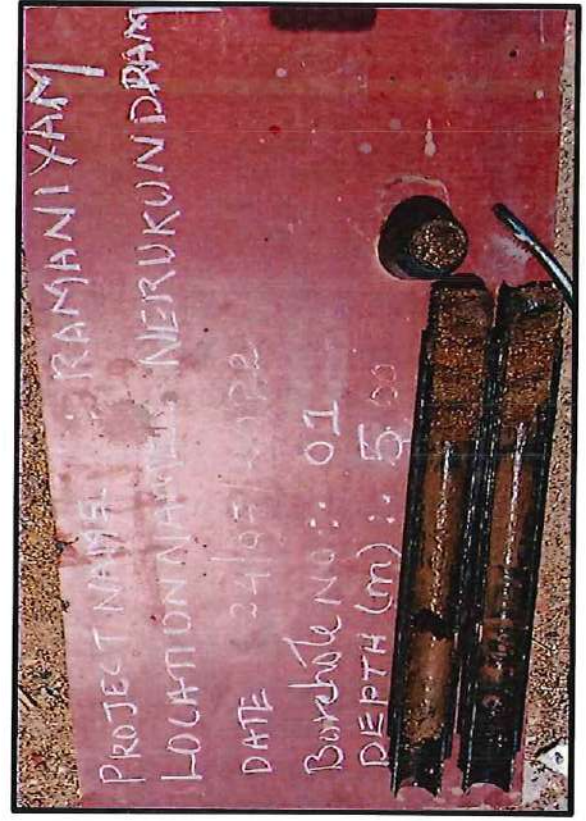
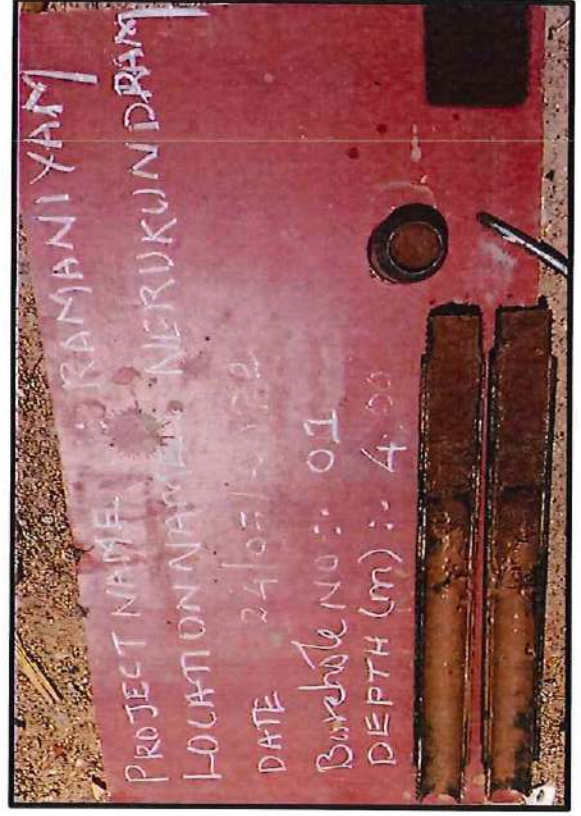
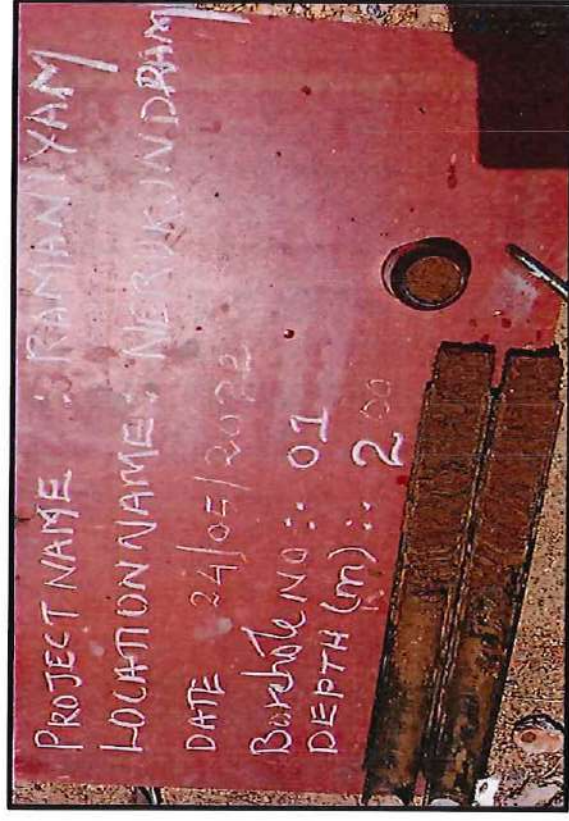
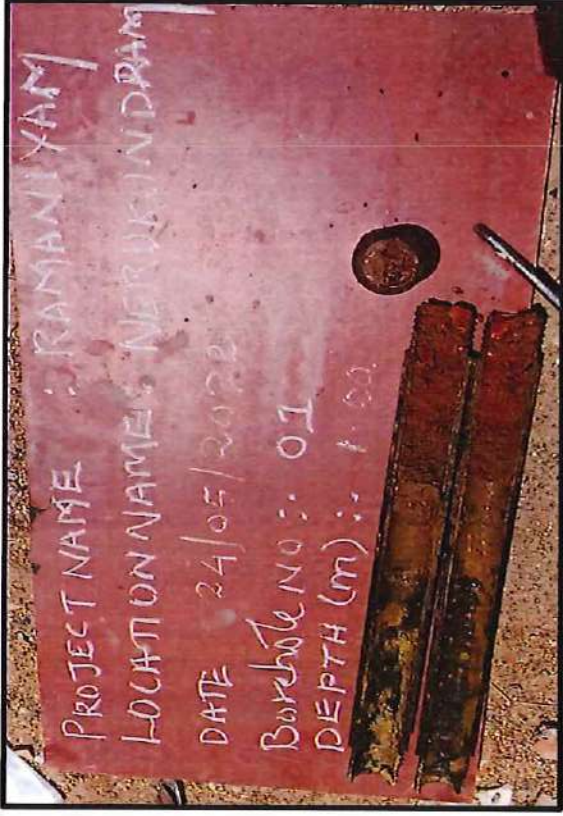
GEO MARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 12	
PROJECT NAME		RAMANIYAM										PAGE No. 3	
LOCATION		MACHINE No.		H201		CHAINAGE (m)				DIA OF BORE HOLE			
STRUCTURE		DRILLING METHOD		Rotary		CO-ORDINATES		N		BORE START DATE			
JOB CODE		FLUSHING MEDIUM		Bentonite				E		BORE END DATE			
										TOTAL DRILLING DAYS			
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.O.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
						0-15	15-30	30-45					
1	27/05/2022	6.35											
2		6.49				9	16	20	36	22.5			V. stiff - HARD, greyish Ash colour & thin bedded SHALE
3													
4		7.30											
5		7.42				13	17	28	45	25			V. HARD, greyish - Brown (mix) compact & V. thin bedded SANDY CLAY
6													
7		8.12											
8		8.22				29	52	57	109	27.5			V. HARD, greyish - Brownish (mix) compact & V. thin bedded SANDY SILTY CLAY
9		9.20											
10		9.55				27	57	(> 100)		30.00			V. HARD, greyish, compact & V. thin bedded SHALE
11													
12													

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. S. S. Sankaran	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	K. S. S. Sankaran	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	27/05/2022	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		
			PROJECT SITE DETAILS	
			GROUND LEVEL (m)	
			WATER TABLE (m)	3.80
			CASING DEPTH (m)	

GEOMARINE THE SPIRIT OF ENGINEERING		SITE INVESTIGATION RECORD										BORE HOLE No. 12	
PROJECT NAME		RAMAKIYAM										PAGE No. 4	
LOCATION		MACHINE No.		CHAINAGE (m)		BORE START DATE		DIA OF BORE HOLE		BORE END DATE			
STRUCTURE		DRILLING METHOD		CO-ORDINATES		BORE END DATE		DIA OF BORE HOLE		TOTAL DRILLING DAYS			
JOB CODE		FLUSHING MEDIUM		Bentonite		E		DIA OF BORE HOLE		TOTAL DRILLING DAYS			
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data	
	Date	Time		Total Core Recovery %	R.Q.D. %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	Geotechnical Description
						0-15	15-30	30-45					
1	28/05/2022	3.45											
2	28/05/2022	4.15											
3	28/05/2022	4.35											
4	28/05/2022	5.15											
5													
6													
7													
8													
9													
10													
CS - Core Sample		DS - Disturbed Sample		SUPERVISOR NAME		K. Srinivasan		PROJECT SITE DETAILS					
SS - Split Spoon Sample		SC - Soil Cutter		SIGNATURE		R. G. M.		GROUND LEVEL (m)					
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		DATE		28/05/2022		WATER TABLE (m)					
WS - Wash Sample		DB - Diamond Bit		CLIENT IN-CHARGE				CASING DEPTH (m)					

X. HARD, greyish, v. thin bedded compact. SHALE

Bore hole terminated at 33.00m



PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Borehole NO :- 01
DEPTH (m) :- 6.00

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Borehole NO :- 01
DEPTH (m) :- 7.50

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Borehole NO :- 01
DEPTH (m) :- 9.00

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Borehole NO :- 01
DEPTH (m) :- 10.50

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Barcode NO :- 01
DEPTH (m) : 12.00

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Barcode NO :- 01
DEPTH (m) : 14

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Barcode NO :- 01
DEPTH (m) : 16

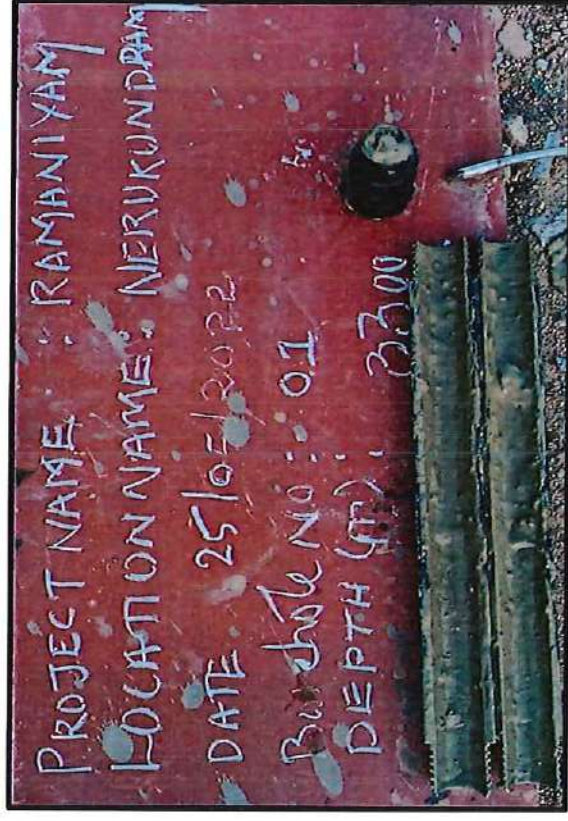
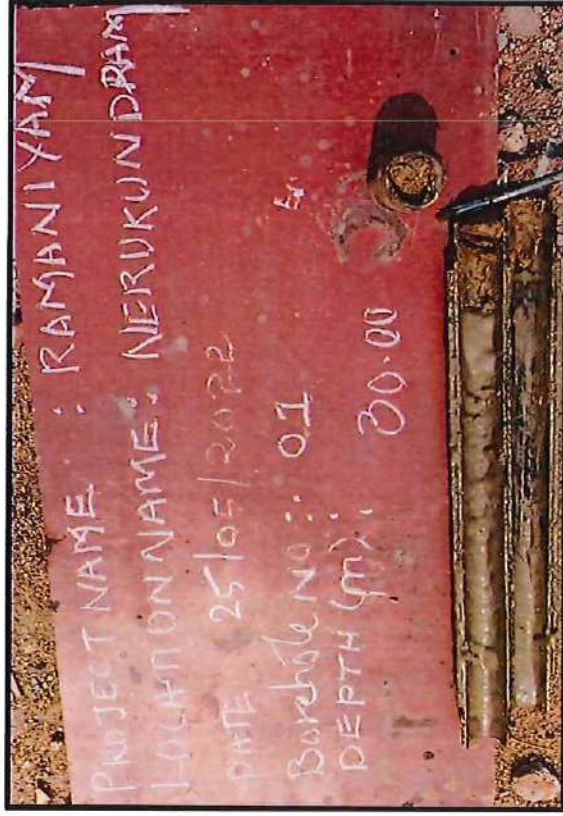
PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Barcode NO :- 01
DEPTH (m) : 18

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 24/05/2022
Borehole No :- 01
DEPTH (m) : 20

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 25/05/2022
Borehole No :- 01
DEPTH (m) : 22.50

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 25/05/2022
Borehole No :- 01
DEPTH (m) : 25.00

PROJECT NAME : RAMANIYAM
LOCATION NAME : NERUKUNDRAM
DATE 25/05/2022
Borehole No :- 01
DEPTH (m) : 27.50





PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 02
DATE : 20-05-2022
DEPTH [m/s] : 7.50 M.

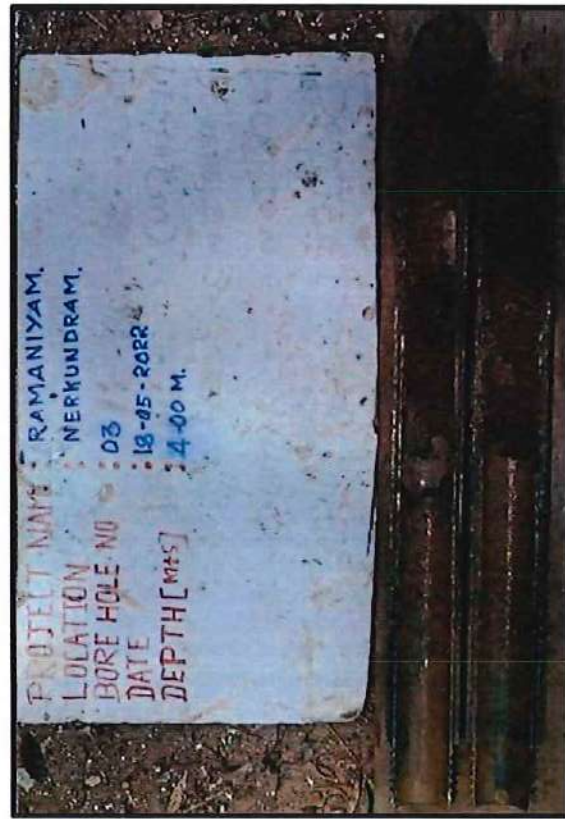
PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 02
DATE : 21-05-2022
DEPTH [m/s] : 10.50

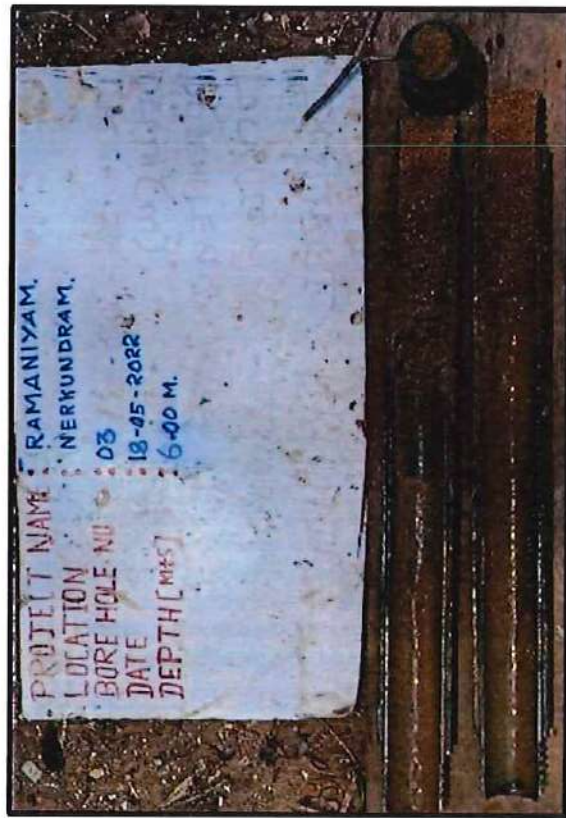
PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 02
DATE : 21-05-2022
DEPTH [m/s] : 12.00

PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 02
DATE : 21-05-2022
DEPTH [m/s] : 14.00









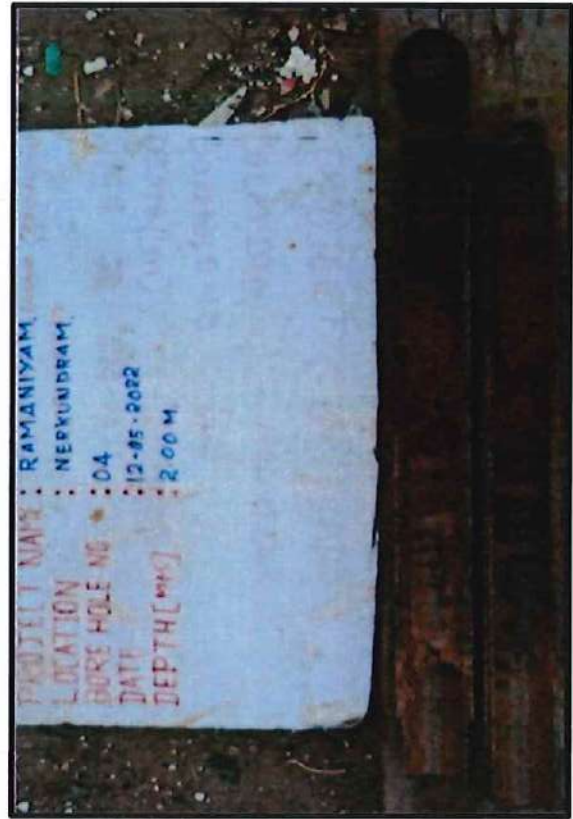
PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 03
DATE : 18-05-2022
DEPTH [mfs] : 12.00 M.

PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 03
DATE : 18-05-2022
DEPTH [mfs] : 14.00 M.

PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 03
DATE : 18-05-2022
DEPTH [mfs] : 16.00 M.

PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 03
DATE : 18-05-2022
DEPTH [mfs] : 18.00 M.





PROJECT NAME : RAMANIYAM,
LOCATION : NERKUNDRAM,
BORE HOLE NO : 04
DATE : 12-05-2022
DEPTH [MMS] : 3.00 M.

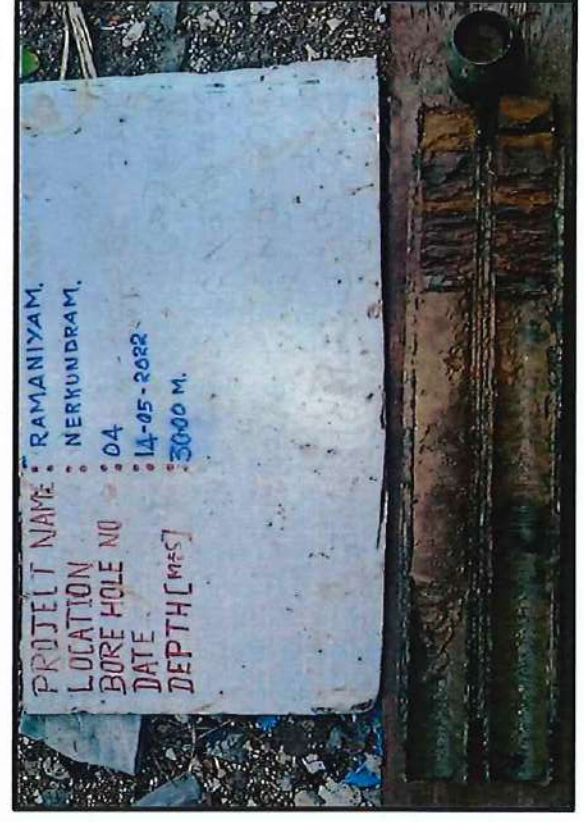
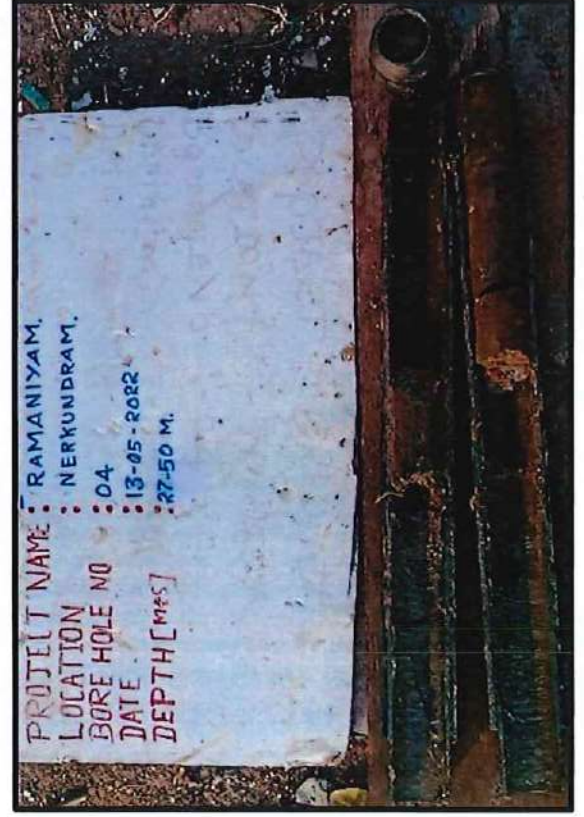
PROJECT NAME : RAMANIYAM,
LOCATION : NERKUNDRAM,
BORE HOLE NO : 04
DATE : 12-05-2022
DEPTH [MMS] : 4.00 M.

PROJECT NAME : RAMANIYAM,
LOCATION : NERKUNDRAM,
BORE HOLE NO : 04
DATE : 12-05-2022
DEPTH [MMS] : 5.00 M.

PROJECT NAME : RAMANIYAM,
LOCATION : NERKUNDRAM,
BORE HOLE NO : 04
DATE : 12-05-2022
DEPTH [MMS] : 6.00 M.







PROJECT NAME : RAMANIYAM.
LOCATION : NERKUNDRAM.
BORE HOLE NO : 04
DATE : 14-05-2022
DEPTH [m] : 33.00 M.

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 1.00 m.
C.R.R - -
R.Q.D - -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 2.00 m.
C.R.R - -
R.Q.D - -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 3.00 m.
C.R.R - -
R.Q.D - -

Project name- Rainanigam
Location - Nervkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 4.00 m.
CRR - -
RQD - -

Project name- Rainanigam
Location - Nervkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 6.00 m.
CRR - -
RQD - -

Project name- Rainanigam
Location - Nervkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 5.00 m.
CRR - -
RQD - -

Project name- Rainanigam
Location - Nervkundram.
Bore hole no - 05
Date - 02/05/2022
Depth - 7.50 m.
CRR - -
RQD - -

Project name-	Ramaniyam
Location	- Nerukundram.
Bore hole no	- 05
Date	- 02/05/2022
Depth	- 9.00 m.
- C.R.R.	-
- R.Q.D.	-

Project name-	Ramaniyam
Location	- Nerukundram.
Bore hole no	- 05
Date	- 03/05/2022
Depth	- 10.50 m.
- C.R.R.	-
- R.Q.D.	-

Project name-	Ramaniyam
Location	- Nerukundram.
Bore hole no	- 05
Date	- 03/05/2022
Depth	- 12.00 m.
- C.R.R.	-
- R.Q.D.	-

Project name-	Ramaniyam
Location	- Nerukundram.
Bore hole no	- 05
Date	- 03/05/2022
Depth	- 14.00 m.
- C.R.R.	-
- R.Q.D.	-

Project name- Ramaniyam
Location - Nervkundram.
Bore hole no - 05
Date - 03/05/2022
Depth - 16.00m.
- C.R.R. -
- R.Q.D. -

Project name- Ramaniyam
Location - Nervkundram.
Bore hole no - 05
Date - 03/05/2022
Depth - 18.00m.
- C.R.R. -
- R.Q.D. -

Project name- Ramaniyam
Location - Nervkundram.
Bore hole no - 05
Date - 03/05/2022
Depth - 20.00m.
- C.R.R. -
- R.Q.D. -

Project name- Ramaniyam
Location - Nervkundram.
Bore hole no - 05
Date - 03/05/2022
Depth - 22.50m.
- C.R.R. -
- R.Q.D. -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 03/05/2022
Depth - 25.00m.
CRR -
RQD -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 04/05/2022
Depth - 27.50m.
CRR -
RQD -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 04/05/2022
Depth - 30.00m.
CRR -
RQD -

Project name- Ramaniyam
Location - Nerkundram.
Bore hole no - 05
Date - 04/05/2022
Depth - 32.50m.
CRR -
RQD -

Project name- Ramaniyam
Location - Nerukundram.
Bore hole no - 05
Date - 05/05/2022
Depth - 35.00 m.
CRR -
RQD -

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE: 03/06/2022
DEPTH-(m)- 1 mt
CRR %
RQD %

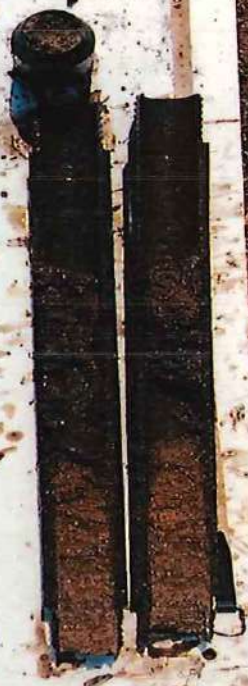
PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE: 03/06/2022
DEPTH-(m)- 2 mt
CRR %
RQD %

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE: 03/06/2022
DEPTH-(m)- 3 mt (ups)
CRR %
RQD %

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 03/06/2022
DEPTH =(m) 4 mt
CRR %
RSD %



PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 03/06/2022
DEPTH =(m) 5 mt
CRR %
RSD %



PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 03/06/2022
DEPTH =(m) 6 mt
CRR %
RSD %



PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 03/06/2022
DEPTH =(m) 7.5 mt
CRR %
RSD %



PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	03/06/2022
DEPTH = (m)	9 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	03/06/2022
DEPTH = (m)	10.5 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	12 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	14 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	16 mt (VPS)
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	18 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	20 mt
CRR %	
RQD %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDRAM
BORE HOLE NO	08
DATE	04/06/2022
DEPTH = (m)	22.5 mt
CRR %	
RQD %	

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 04/06/2022
DEPTH =(m). 25 mt
CRR%
RSD%

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 04/06/2022
DEPTH =(m). 27.5 mt
CRR%
RSD%

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 08
DATE 07/06/2022
DEPTH =(m). 30.00 mts
CRR%
RSD%

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 10
DATE 01/06/2022
DEPTH =(m). 1.00
CRR%
RSD%

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 10
DATE : 01/06/2022 /
DEPTH-(m) 2.00
CRR %
RQD %

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 10
DATE : 01/06/2022 /
DEPTH-(m) 3.00
CRR %
RQD %

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 10
DATE : 01/06/2022 /
DEPTH-(m) 4.00
CRR %
RQD %

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 10
DATE : 01/06/2022 /
DEPTH-(m) 5.00
CRR %
RQD %

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDURAM
BORE HOLE NO	10.
DATE	01/06/2022
DEPTH-(m)	6.00
CRP %	
RSP %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDURAM
BORE HOLE NO	10.
DATE	01/06/2022
DEPTH-(m)	7.50
CRP %	
RSP %	

PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDURAM
BORE HOLE NO	10.
DATE	01/06/2022
DEPTH-(m)	9.00
CRP %	
RSP %	

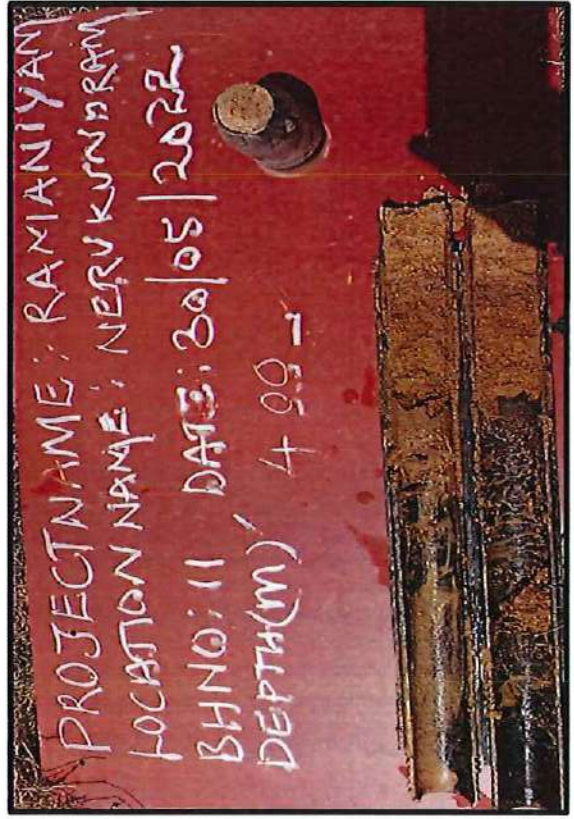
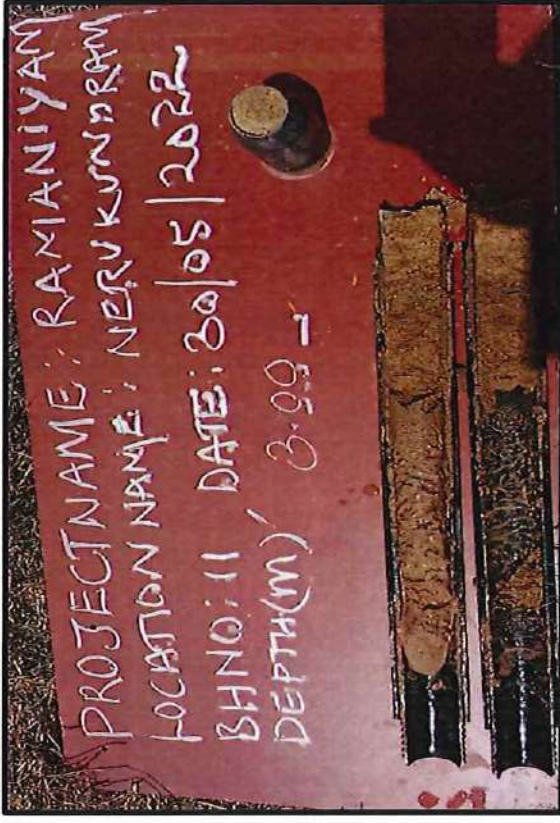
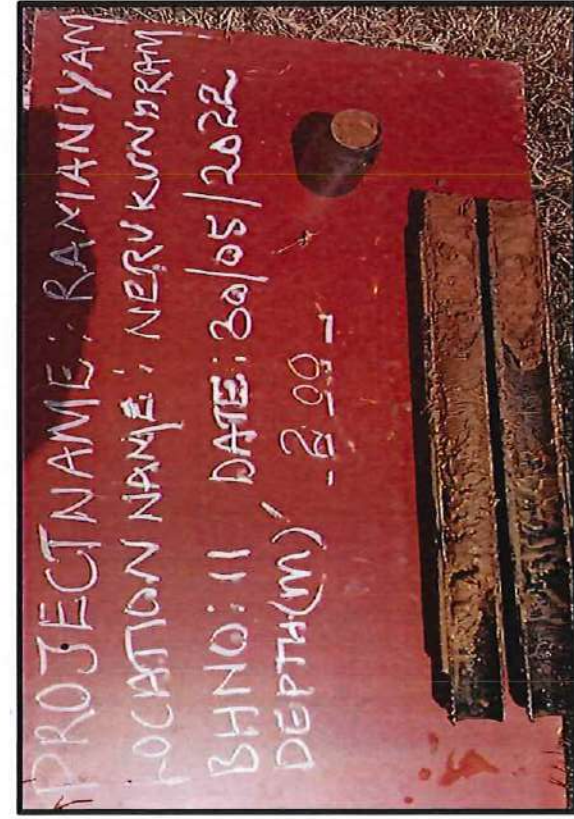
PROJECT NAME	RAMANIYAM
LOCATION NAME	NERUKUNDURAM
BORE HOLE NO	10.
DATE	01/06/2022
DEPTH-(m)	10.50
CRP %	
RSP %	

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BORE HOLE NO: 10
DATE: 01/06/2022
DEPTH-(m) 12.00
CRR: %
RSD: %

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BORE HOLE NO: 10
DATE: 01/06/2022
DEPTH-(m) 16
CRR: %
RSD: %

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BORE HOLE NO: 10
DATE: 01/06/2022
DEPTH-(m) 18
CRR: %
RSD: %

PROJECT NAME: RAMANIYA
LOCATION NAME: NERUKUNDRAM
BHNO: 11 DATE: 30/05/2022
DEPTH(m) 1.00
CRR: %
RSD: %





PROJECTNAME: RAMANIYAN
LOCATION NAME: NERUKUNDRAM
BHNO: 11 DATE: 30/05/2022
DEPTH(m) 12.00 m

PROJECTNAME: RAMANIYAN
LOCATION NAME: NERUKUNDRAM
BHNO: 11 DATE: 30/05/2022
DEPTH(m) 14.00 m

PROJECTNAME: RAMANIYAN
LOCATION NAME: NERUKUNDRAM
BHNO: 11 DATE: 30/05/2022
DEPTH(m) 16.00 m

PROJECTNAME: RAMANIYAN
LOCATION NAME: NERUKUNDRAM
BHNO: 11 DATE: 30/05/2022
DEPTH(m) 20.00 m

PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 11
DATE: 31/05/2022
DEPTH-(m) 27.50
CRR%
RQP%



PROJECT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 11
DATE: 31/05/2022
DEPTH-(m) 30.00
CRR%
RQP%

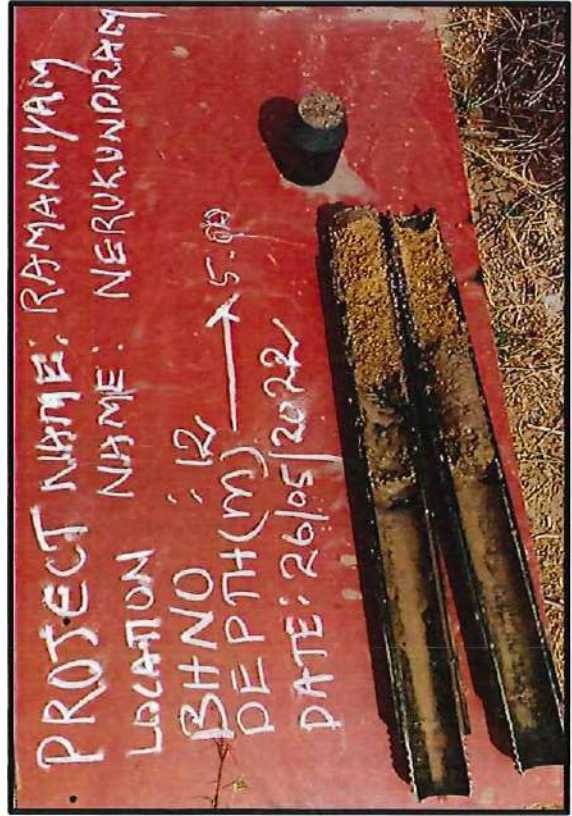
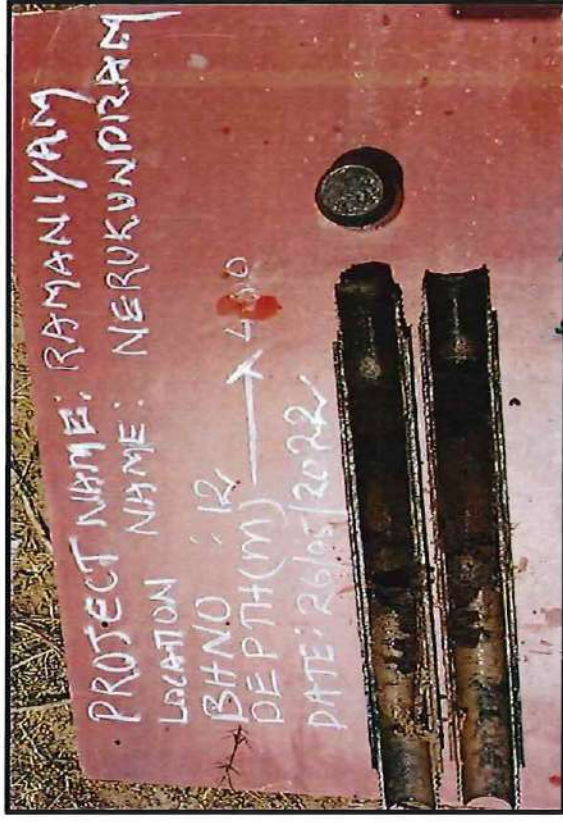
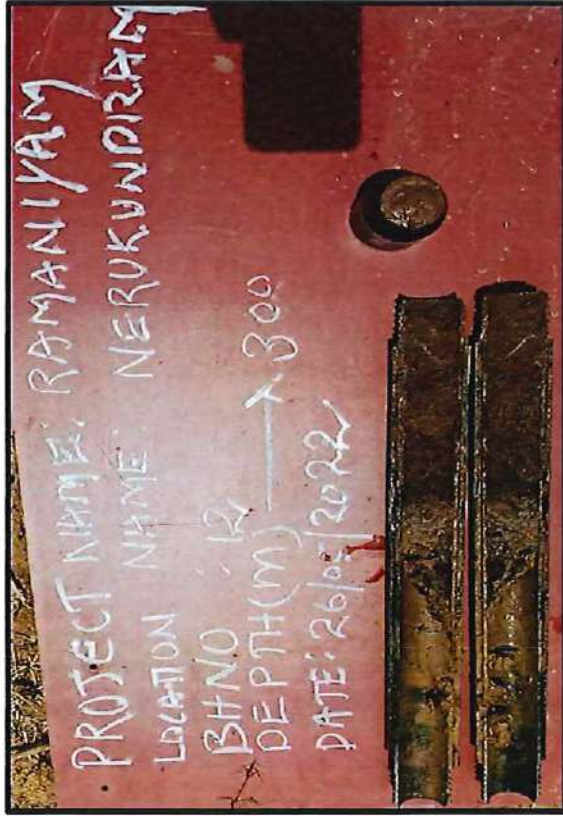


CT NAME RAMANIYAM
LOCATION NAME NERUKUNDRAM
BORE HOLE NO 11
DATE: 31/05/2022
DEPTH-(m) 33.00
CRR%
RQP%



PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BHNO: 11
DEPTH(m): 31.00
DATE: 26/05/2022
CRR%
RQP%





PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDIRAM
BHNO : 12
DEPTH(M) → 7.50
DATE: 26/05/2022

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDIRAM
BHNO : 12
DEPTH(M) → 9.00
DATE: 26/05/2022

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDIRAM
BHNO : 12
DEPTH(M) → 10.50
DATE: 26/05/2022

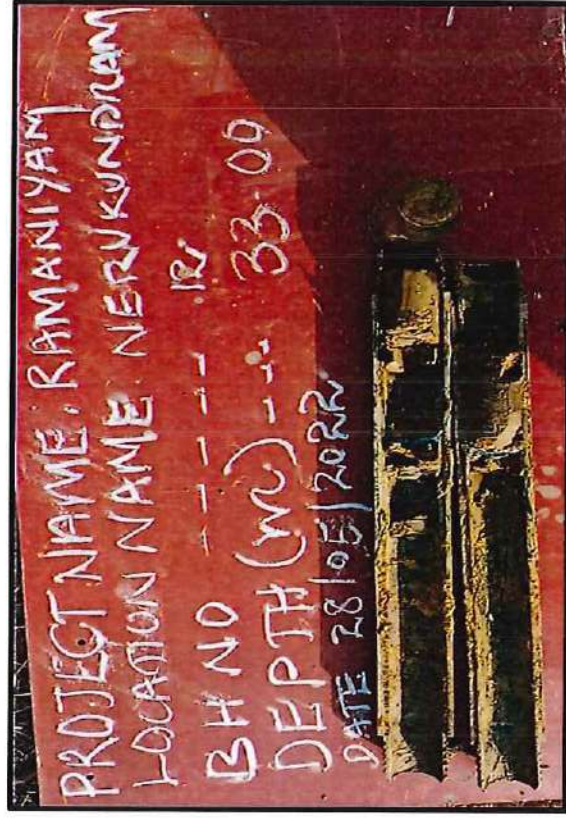
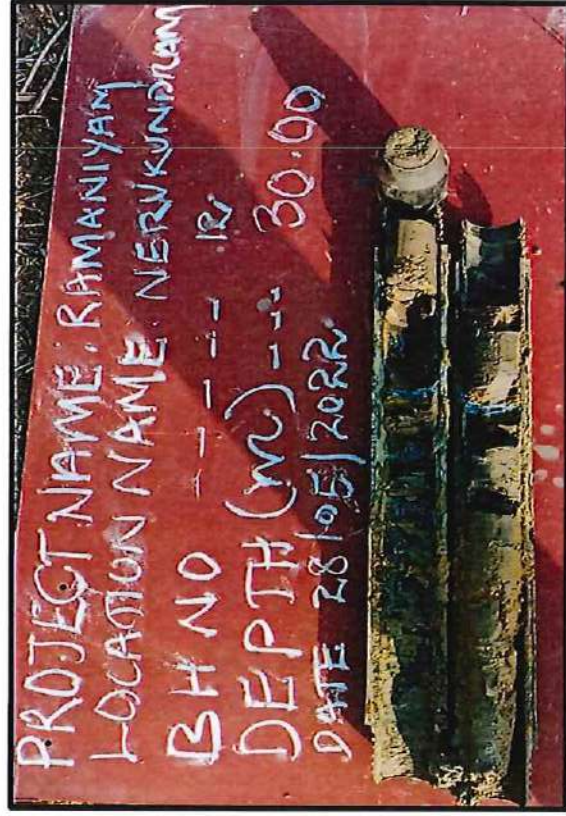
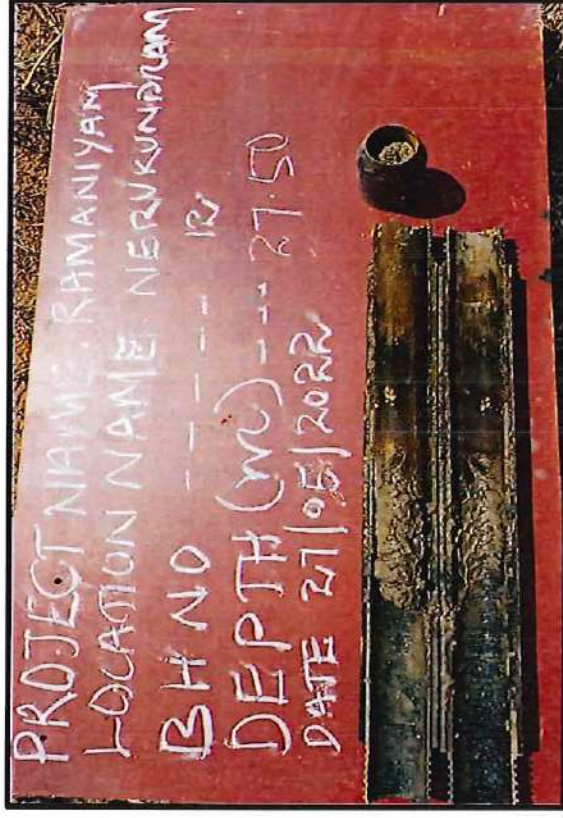
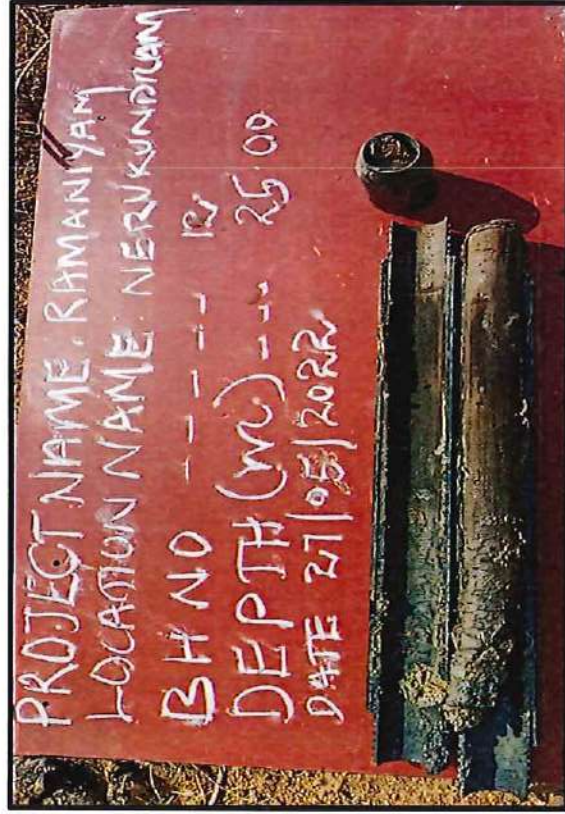
PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDIRAM
BHNO : 12
DEPTH(M) → 10.00
DATE: 26/05/2022

PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BH NO: 12
DEPTH (m) → 16.00
DATE: 24/05/2022

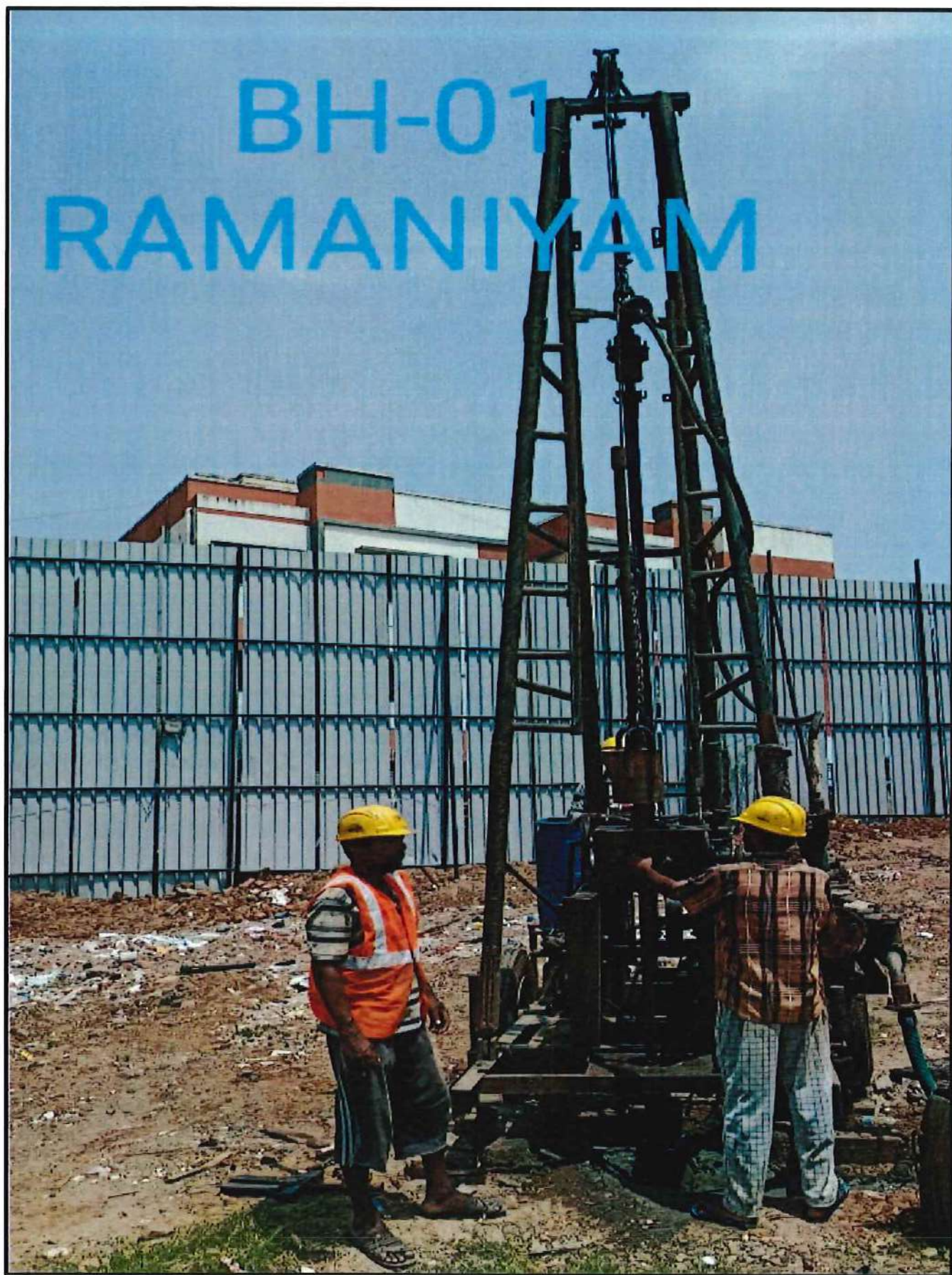
PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BH NO: 12
DEPTH (m) → 16.00
DATE: 24/05/2022

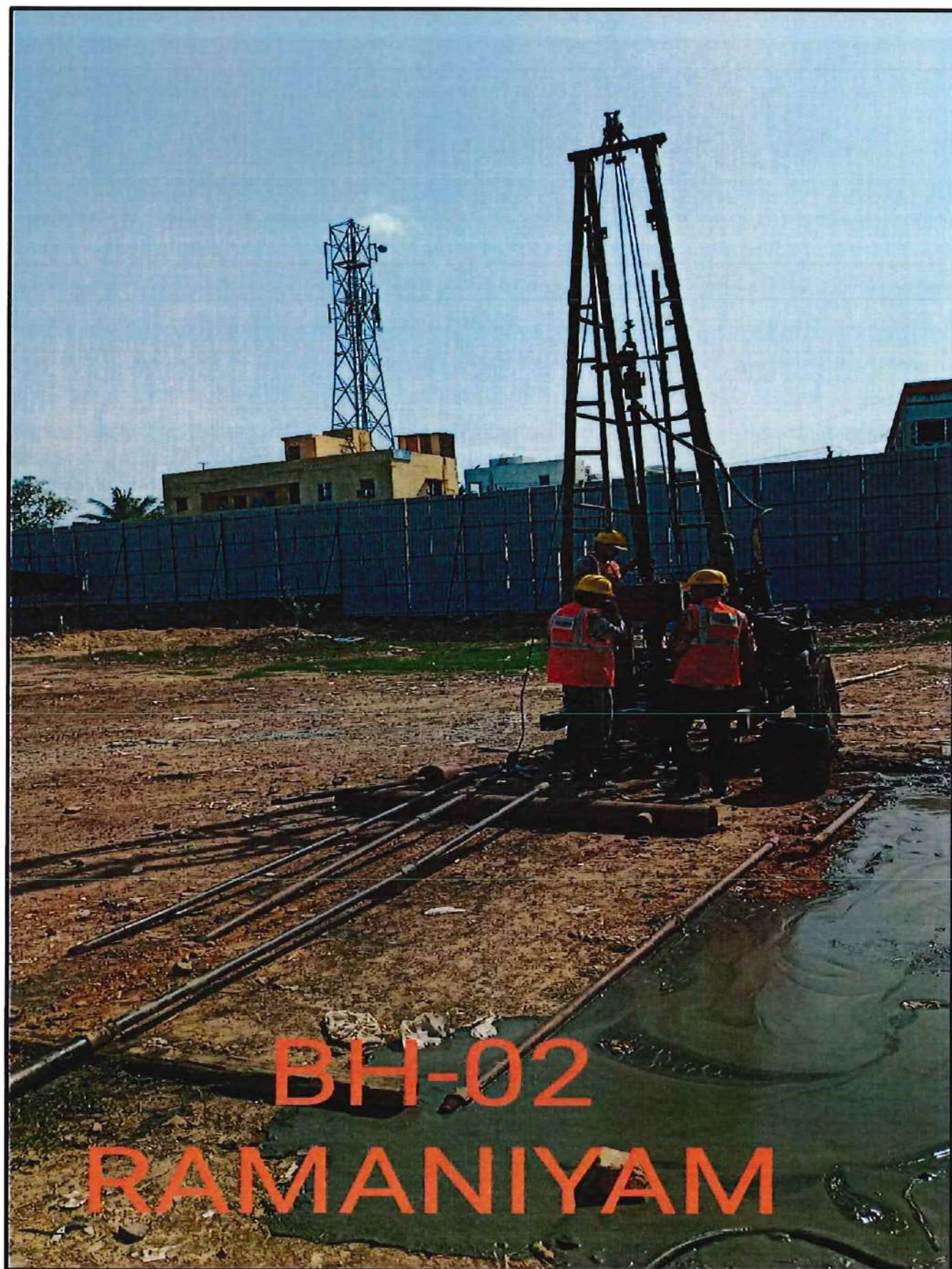
PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BH NO: 12
DEPTH (m) → 20.00
DATE: 26/05/2022

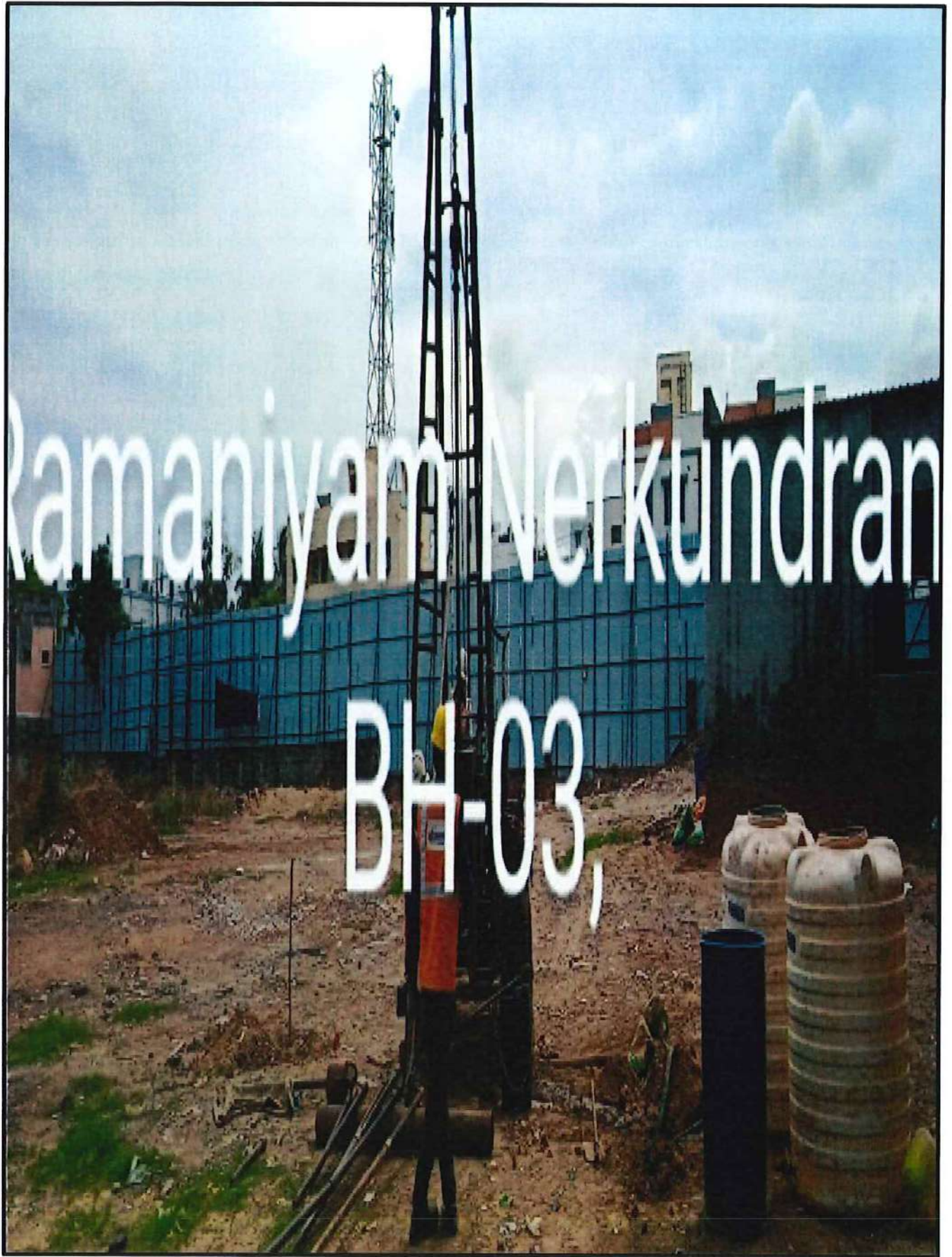
PROJECT NAME: RAMANIYAM
LOCATION NAME: NERUKUNDRAM
BH NO: 12
DEPTH (m) → 22.50
DATE: 27/05/2022

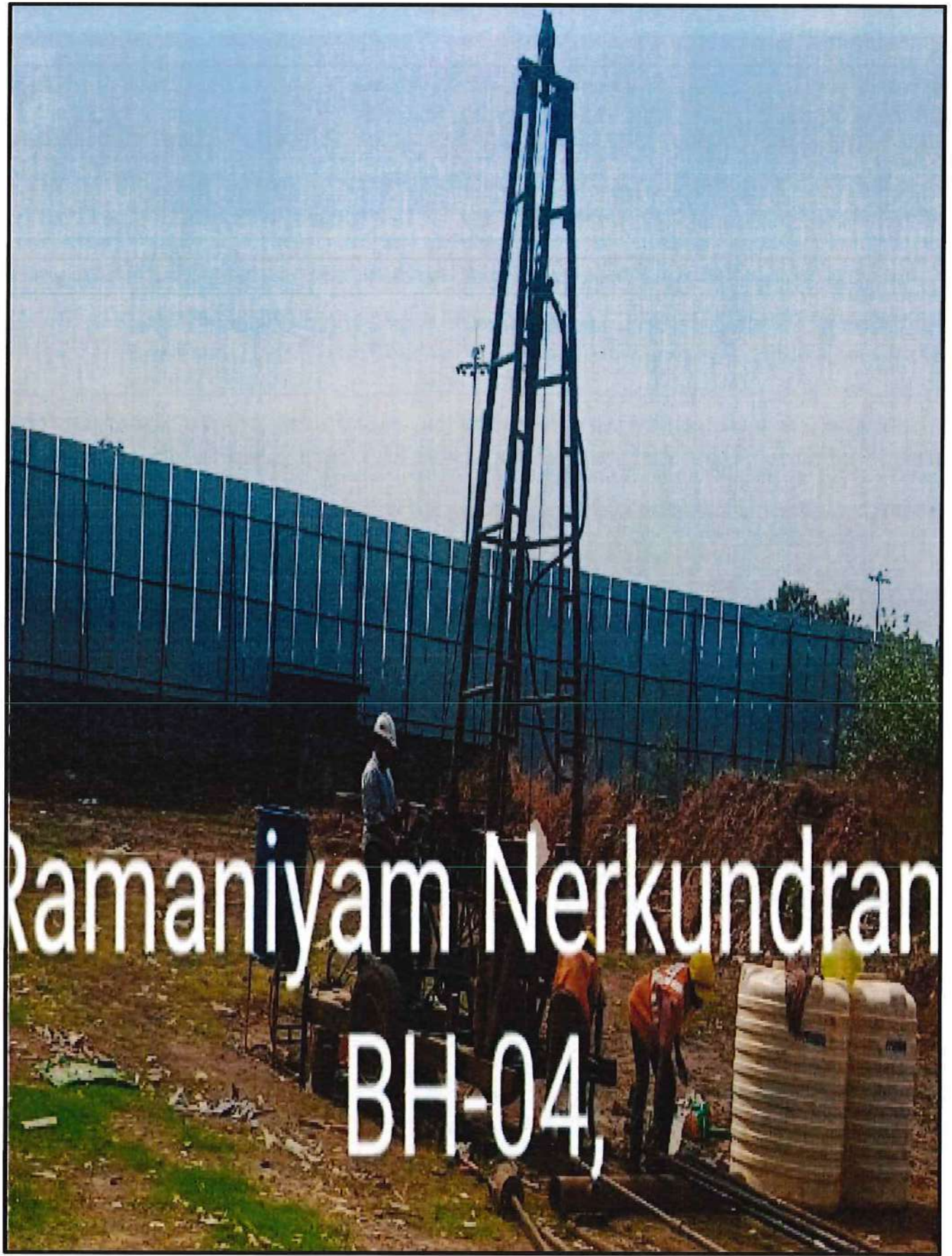


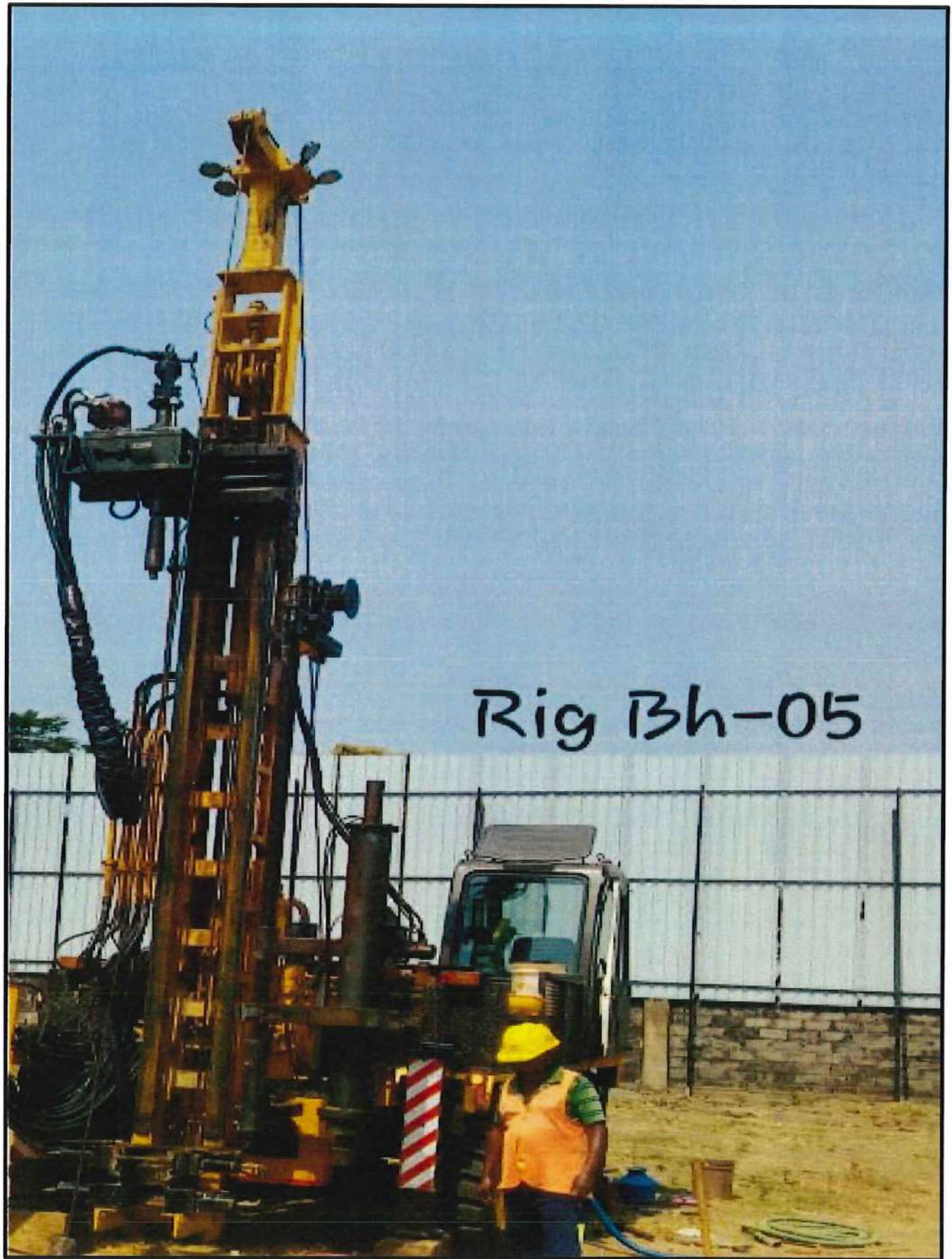
BH-01 RAMANIYAM















BH-12

