<u> 15 -ാം കേരള നിയമസഭ</u>

<u>7 -ാം സമ്മേളനം</u>

<u>07-12-2022 - ൽ മറ്റപടിയ്ക്</u>

<u>നക്ഷത്ര ചിഹ്നം ഇല്ലാത്ത ചോദ്യം നം. 1086</u>

	ചോദ്യം	ഉത്തരം ശ്രീ. റോഷി അഗസ്റ്റിൻ (ജലവിഭവ വകപ്പ് മന്ത്രി)		
	ശ്രീ. കെ. പി. എ. മജീദ്			
(എ)	തിത്രരങ്ങാടി മണ്ഡലത്തിലെ മൂഴിക്കൽ തടയണ നിർമ്മാണവുമായി ബന്ധപ്പെട്ട പൂർത്തീകരിച്ച നടപടികൾ എന്തെല്ലാമാണെന്ന് വിശദമാക്കമോ;	(എ)	തിത്രരങ്ങാടി നിയോജകമണ്ഡലത്തിലെ മൃഴിക്കൽ കടവിൽ തടയണ നിർമ്മാണവ്വമായി ബന്ധപ്പെട്ട് ഇൻവെസ്റ്റിഗേഷൻ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച് ചീഫ് എഞ്ചിനീയർ ജലസേചനവും ഭരണവും സമർപ്പിച്ച റിപ്പോർട്ടിൽ സാങ്കേതികപരമായ മാറ്റങ്ങൾ വരുത്താൻ ചീഫ് എഞ്ചിനീയർ (ഐ.ഡി.ആർ.ബി) നിർദ്ദേ ശിച്ചിരുന്നു. അതനുസരിച്ചു പുഇക്കിയ പ്രൊപ്പോസൽ, ഇൻവെസ്റ്റിഗേഷൻ റിപ്പോർട്ട് സഹിതം ചീഫ് എഞ്ചിനീയർ ഐ ഡി ആർ ബി യുടെ കാര്യാലയത്തിൽ ഡിസൈൻ ലഭ്യമാക്കുന്നതിനായി സമർപ്പിച്ചിട്ടുണ്ട്.	
(ബി)	പ്രസ്തത പ്രവൃത്തിയുടെ ഇൻവെസ്റ്റിഗേഷൻ റിപ്പോർട്ട് ലഭ്യമാക്കമോ;	(ബി)	ഇൻവെസ്റ്റിഗേഷൻ റിപ്പോർട്ട് അന്ഖന്ധമായി ചേർക്കന്നു.	
(സി)	പ്രസ്തുത റിപ്പോർട്ട് പ്രകാരം ഈ പ്രവൃത്തിക്കാവിശ്യമായ തുക അനുവദിച്ചുകൊണ്ട് ഭരണാനുമതി ലഭ്യമാക്കിയിട്ടുണ്ടോ; വിശദമാക്കുമോ?	(സി)	ചീഫ് എഞ്ചിനീയർ ഐ.ഡി.ആർ.ബി യുടെ കാര്യാലയത്തിൽ നിന്നും ഡിസൈൻ ലഭ്യമാകന്ന മുറയ്ക്ക് വിശദമായ പ്രൊജക്ട് റിപ്പോർട്ട് തയ്യാറാക്കി അന്യോജ്യമായ ശീർഷകത്തിൽ ഉൾപ്പെടുത്തി ഭരണാനുമതി നൽകന്നതിനുള്ള നടപടികൾ സ്വീകരിക്കാ വുന്നതാണ്.	

<u>മൂഴിക്കൽ തടയണ</u>

സെക്ഷൻ ഓഫീസർ



GOVERNMENT OF KERALA IRRIGATION DEPARTMENT MALAPPURAM

PROJECT REPORT

ON

INVESTIGATION WORKS FOR THE CONSTRUCTION OF REGULATOR ACROSS KADALUNDI RIVER AT MOOZHIKKAL KADAVU NEAR PALATHINGAL BETWEEN TIRURANGADI MUNICIPALITY AND MOONNIYUR PANCHAYATH

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[1]REPORT

[2]CHECKLIST 1

[3]CHECKLIST 2

[4] SURVEY DETAILS AND CROSS SECTION DETAILS

[5] SOIL INVESTIGATION REPORT

It is proposed to construct a regulator across Kadalundi river at Moozhikkal Kadavu near Palathingal bride. In order to find the suitable footing/Ground condition of proposed project geotechnical investigation was conducted. Analysis done at the site through 10 numbers of bore holes was taken along the proposed alignment of new regulator. Also total station surveying of proposed project was conducted. The new proposed regulator will help Thirurangadi municipality and Moonniyur panchayath people. Proposed regulator formation level will be 4.5 meter from the ground level.

CHECKLIST FOR INVESTIGATION WORKS FOR THE CONSTRUCTION OF REGULATOR ACROSS KADALUNDI RIVER AT MOOZHIKKAL KADAVU NEAR PALATHINGAL BETWEEN TIRURANGADI MUNICIPALITY AND MOONNIYUR PANCHAYATH

CHECKLIST -1

CHECK LIST OF DETAILS REQUIRED FOR APPROVAL OF ALIGNMENT

1	S.E	S AUTHENTICATION	 ✓
2	REP	ORT	✓
	2	COPIES OF SPOT LEVELS	✓
	A	ND SHOWING NAMES OF STATIONS CONNECTED	
	А	NORTH DIRECTION	✓
3	В	NAME OF RIVER	✓
	С	DIRECTION OF FLOW	✓
	D	CONTINUOUS CHAINAGES OF APPROACH ROADS	✓
	А	L.W.L.	-2.316
	В	O.F.L.	-1.438
4	С	M.F.L.	7.960
	А	L.T.L.	-
	В	H.T.L.	-
5	FOR	MATION LEVEL OF PROPOSED REGULATOR	4.5
	А	ABOVE (M.F.L / O.F.L)	OFL
	В	NAVIGABLE	YES
	С	INS	NO
	D	N.W.W	NO
6	L.S	OF THE ROAD SHOWING FORMATION LEVEL	X
7	KE	Y MAP (SITE PLAN)	✓
8	IND	DEX MAP (DISTRICT MAP)	✓
9	STR	AIGHT REACH	 ✓
	А	BOTH SIDES	✓
10	NA	TURE OF TERRAIN	PLAIN

CHECKLIST -2

CHECKLIST OF DETAILS REQUIRED FOR DESIGN

1	S.E'S AUTHENTICATION OF ALL DRAWINGS AND DATA	✓	
2	REPORT	✓	
4	LOADING	✓	
6	VERTICAL CLEARANCE ABOVE : MFL/OFL	MFL	
7	INLAND NAVIGATION SYSTEM	-	
/	NATIONAL WATERWAY	-	
8	SALINITY	-	
9	DISTANCE FROM SEA	10km/25km	
10	EXISTING BRIDGES AND IRRIGATION STRUCTURESAT UPSTREAM OR DOWNSTREAM	✓	
	COMPLETE DESIGN DATA FILLED UP		
	a L.W.L.	-2.316	
12	b U.F.L.	-1.438	
		7.960	
		-	
13	C/S OF THE U/S LEFT BANK OF RIVER AT THE SITE	 ✓ 	
14	L.S OF THE U/S LEFT BANK OF RIVER	 ✓ 	
15	CATCHMENT AREA MAP ×		
18	BOREHOLE PARTICULARS ALONG APPD. ALIGNMENT WITH CHANGE	✓	
18	SOIL INVESTIGATING REPORT	✓	

ANNEXURE II

DESIGN DATA FOR MEDIUM AND MINOR BRIDGES

A. GENERAL

1	NAME OF THE STREAM	Kadalundi
2	LOCATION OF WORK	Palathingal
3	LATITUDE	11°2'15"N
4	LONGITUDE	75°52'41"E
5	ALTITUDE FROM MEAN SEA LEVEL	
6	DISTRICT	Malappuram
7	TALUK	Tirurangadi
8	ASSEMBLY CONSTITUENCY	Tirurangadi
9	VILLAGE	Tirurangadi/Munniyoor
10	MUNICIPALITY/PANCHAYATH	Tirurangadi/Munniyoor
11	WHAT ARRANGEMENT EXISTS FOR CROSSING THE RIVER AT PRESENT	
	A DURING MONSOON	-
	B DURING DRY SEASON	-
12	LIABILITY OF SITE TO SEISMIC DISTURBANCES	-

B. CATCHMENT AREA AND RUNOFF

13	CATCHMENT AREA	
	A IN HILLY PARTS	-
	B IN PLAINS	-
14	RAINFALL DURING THE YEAR AND MAXIMUM RECORDED INTENSITY	-
15	NATURE OF CATCHMENT	Plain
16	ANY ARTIFICIAL OR NATURAL STORAGE PRESENT IN CATCHMENT	Nil

C. NATURE OF STREAM

17	IS THE STREAM					
	а	ALLUVIA	L WITH ERODABLE BANKS	Yes		
	b	QUASI- A BANKS	ALLUVIAL WITH FIXED BED BUT ERODABLE	Yes		
	С	RIGID WI	TH INERODABLE BED AND BANKS	No		
	IS T	IS THE STREAM				
	a	PERENNL	AL	Yes		
	b	SEASONA	AL	No		
	с	NAVIGABLE		Yes		
18		TIDAL. IF	SO LEVEL OF			
	d	i	HIGH TIDE	-		
		ii	LOW TIDE	-		
	b	SURFACE	E VELOCITY AT L.W.L	-		
	c	WATER S	URFACE SLOPE AT L.W.L	-		
	d	BED SLO	PE AT L.W.L	-		
	R.L AND LOCATION OF MAXIMUM SCOUR RECORDED			-		
19	BELOW H.F.L					
20	R.L OF MAXIMUM ANTICIPATED SCOUR BELOW H.F.L -					

21	LOC	CATION AND PLAN OF BORINGS TAKEN IN THE BED OF	Marked in site plan
	THE	RIVER AND AT OTHER LOCATIONS.	
	TES		
	FOL	LOWING SOIL CHARACTERISTICS	
	a	LACEY'S SILT FACTOR	
22	b	ANGLE OF INTERNAL FRICTION (0)	
22	с	COHESION OF THE	Defen seil report
	d	ANGLE OF WALL FRICTION (S)	Keler son report
	e	SAFE BEARING CAPACITY OF SOIL AT FOUNDATION	
		LEVEL	
23	DOF	ES THE STREAM CARRY DRIFTING MATTER IN FLOODS?	-
	DET	AILS OF TRAINING WORKS, IF NEEDED	
24			
24	A	IS THE STREAM NAVIGABLE? IF SO THE CLEARANCE	No
		PROVIDED	INO

D. SUPERSTRUCTURE

E. FOUNDATION

	FOU	FOUNDATIONS RECOMMENDED			
25	a	OPEN	Refer Soil		
23	b	WELL	Report		
	с	PILES			

F. EXISTING STRUCTURES

G. MISCELLANEOUS

26	NAME OF TOWN NEAREST TO THE PROPOSED SITE PARAPPANANGADI					
27	NEA	AREST RAILWAY STATION AND ITS DISTANCE	PARAPPANANGADI			
21	FRC	OM BRIDGE SITE				
	HA	VE THE FOLLOWING PLANS BEEN ENCLOSED				
	А	KEY MAP	YES			
	В	INDEX PLAN	YES			
	С	CONTOUR SURVEY PLAN	YES			
	D	SITE PLAN	YES			
	Е	LONGITUDINAL AND CROSS-SECTIONS OF THE	YES			
28		U/S LEFT BANK OF RIVER				
	F	TRIAL BORING CHARTS	YES			
	G	DRAWING OF THE REGULATOR SHOWING				
		GENERAL ARRANGEMENT, DETAILS OF	NEG			
		FOUNDATIONS, SUB STRUCTURE AND	YES			
		SUPERSTRUCTURE				

To The Executive Engineer, Minor Irrigation Division, Malapuuram-676505

SUB: GEOTECHNICAL INVESTIGATION REPORT

Respected Sir,

We are pleased to submit to you our soil investigation report on the sub soil exploration, field, laboratory investigation and geotechnical recommendation for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram .The purpose of the exploration was to evaluate the general subsoil conditions within the proposed site. This report presents our findings, conclusions and recommendations for the selection of foundation as well as construction considerations for the proposed foundation.

M/s Geo Structura appreciates the opportunity to assist you during this phase of the project. If you have any queries concerning this report, or if you need any further assistance, please contact us. We look forward to our continued relationship.

Respectfully submitted,

Geo Structura Geotechnical Engineering

Laboratory

AJ Complex Chandanathope PO Kollam, PIN- 691014

For: Jamshad Naseeri P K Payyanil Karlathu (H) Paithiniparamba

Down Hill PO, Malappuram

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NOTATIONS

BH	Bore Hole
CR	Core Recovery
FOS	Factor of Safety
G	Specific Gravity
GL	Ground Level
ISCS	Indian Standard Classification System
LL	Liquid Limit
NGL	Natural Ground Level
PI	Plasticity Index
PL	Plastic Limit
R.L	Reduced Level
RQD	Rock Quality Designation
SL	Shrinkage Limit
SPT	Standard Penetration Test
SPT 'N'	Standard Penetration Test Number
TCR	Total Recovery Ratio
UCS	Unconfined Compressive Strength
UDS	Undisturbed Sample
γ	Unit weight

1.0 INTRODUCTION

A bridge is a structure built to span a physical obstacle, such as a body of water, valley, or road, without closing the way underneath. It is constructed for the purpose of providing passage over the obstacle, usually something that can be detrimental to cross otherwise. The soil investigation work carried out for the construction of regulator across Kalandi river at Moozhikkal Kadavu near Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram.

1.1 PURPOSE & SCOPE

Geo structura geotechnical lab, Kollam prepared this geotechnical report for the design and construction of construction of regulator across Kalandi river at Moozhikkal Kadavu near Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram. We prepared this report as outlined in agreement to Mr Jamshad Naseeri, he authorized Geo structura geotechnical lab, Kollam to conduct the scope of services outlined below.

- Service plan development
- Reconnaissance
- Sub surface exploration
- Soil laboratory testing
- Total station surveying
- Data analysis and conclusions
- Report preparation

This report was prepared for the exclusive use of concerned government authorities for the further evaluation and design of project.

1.2 FIELD INVESTIGATION

The field investigation consists of the following methods

- Mobilization including transportation of all necessary plant and equipment and materials of boring, field and sampling, demobilization after completing the work and personals.
- Setting up of **10 Number** of bore holes.
- Boring / drilling up to 50m or depth where hard strata available below N.G.L or refusal.
- Conducting standard penetration test (SPT) & collection of disturbed sample (DS) at the locations prefixed by the Engineer-in-charge.
- Observation of the depth of water table in the borehole.
- Study of site condition and surroundings with regards to the need of the project.
- Taking observation of surrounding structure to observe any deficiency in safety.
- Transportation of all soil samples to laboratory for analysis with proper care.

1.3 LABORATORY TESTS:

The Laboratory tests for the sample collected are given below

- Grain size analysis
- Soil moisture content
- Liquid limit ,Plastic limit
- Specific gravity ,Shear strength
- Preparation and submission of a technical report containing the details of the tests carried out, their analysis and recommendations regarding the economical and best foundation type to be adopted. Three copies of the report are to be submitted.

1.3 PROJECT LOCATION

Fig 1.1 and 1.2 displays the site location of proposed site .



Fig 1.1 Site location

1.4 PROJECT DESCRIPTION

The proposed project includes the construction of regulator across Kadalundi river at Moozhikkal Kadavu near Palathingal between Thirurangadi municipality and Moonniyur panchayath, Malappuram. In order to find the suitable footing/ground condition of proposed project geotechnical investigation was conducted. Analysis done at the site through 10 numbers of bore holes at various remote points across river. Bore holes 1 and10 was taken at each land portion of River (Total 2 Nos), 2.3,4, 5,6,7,8 and 9th bore holes was taken in the river. Also total station surveying of proposed project was conducted.

2.0 FINDINGS

2.1 RECCONAISSANCE

2.1.1 GEOLOGY

According to district survey report, Malappuram District, Kerala State, In the proposed project area contain riverine alluvium. Riverine alluvium is very deep with sandy loam to clayey loam texture. The riverine alluvium contains moderate organic matter, nitrogen, phosphorous and potash.

Malappuram district is mainly drained by the Kadalundi River, Chaliyar River and Bharathappuzha (locally known as Ponnani River). Of these rivers, only Chaliyar and Bharathappuzha are perennial and all others get dried up in summer and hence Malappuram district is drought prone. The Kadalundi River is formed by the confluence of its two main tributaries viz; the Olipuzha and the Veliyar. The Kadalundi River is 130 km long with a drainage area of 1274 sq. km. The river joins the Lakshadweep Sea at about 5 km south of the Chaliyar river mouth.

The drainage pattern of the three rivers in the district is generally dendritic. Tidal effects are experienced in places such as Vallikkunnu and Tirurangadi, which are 10km and 25km away from the coast. Analysis of the drainage characteristics of the two basins reveals that Kadalundi river is a fourth order stream, the Ponnani river is fifth order stream and the Chaliyar river is a seventh order stream .

2.1.2 SURFACE CONDITIONS

Riverine alluvium and Lateritic loam was found at the surface. Grass land, medium high trees and bushes at the banks of river.

According to site plan provided by Compass Surveyors ,Malappuram. Reduced levels shown are based on assuming bench mark elevation 7.654 m.

Following site features observed during renaissance and field Photography review

- The proposed regulator bridge has to be constructed across Kadalundi river near Moozhikkal Kadavu near Palathingal between Thirurangadi municipality and Moonniyur panchayath, Malappuram.
- Water level in the river is less and RL was -1.600m

2.2 SOIL EXPLORATION

Our field exploration included rotary drilling through 10 borings cross the river width on site. We performed field exploration on December 2019 to February 2020. The location and elevations of our explorations are approximate and were determined using total station survey. Following describes soil exploration techniques used in the project.

2.2.1 SELECTION OF BOREHOLE

10 bore-holes was selected by the Engineer in charge in order to obtain comprehensive subsoil data for this site with a provision of borings up to 50.0 m depth as required as per IS:1892 -1979. A Schematic site plan showing the location of the test points marked by the client is given in appendix A. For detailed laboratory investigation, SPT is conducted at 1.0 m intervals or at change of soil strata in different Boreholes and S.P.T soil samples were collected for laboratory analysis. Disturbed representative, soil samples from all the boreholes were collected at 1.0 m. interval for different tests.

10 no's of 100 mm diameter bore holes are drilled using heavy duty calyx drilling rigs with direct mud circulation i.e wash boring for soil other than Rocks. Standard penetration tests (SPT) are done as per IS 2131 1963, the SPT value, viz (N values) are recorded in the bore log charts are accompanying this report. The soil samples are recovered using split spoon sampler are classified and tested in the laboratory. These lab investigations are included in this report.

2.2.2 BORING

Observed drilling of 10 borings and logged the subsurface conditions at each location. Boring locations are shown on site plan. Borings were advanced mechanically by rotary power drilling equipment using tungsten carbide bit (TC) in soft strata and power operated mechanical boring in hard strata using diamond cutter, as per IS : 1892 - 1979.

Borings were backfilled with drill cuttings. Rotary drilling is the most rapid method of advancing the boreholes in any type of soil. This method uses rotation of drill bits (tungsten), with the simultaneous application of pressure to advance the borehole.

In core drilling, an annular bit, fixed to the bottom of the outer rotating tube of a core barrel, cuts a core, which is recovered within the inner-most tube of the core barrel assembly and brought to the surface for examination and testing. The core is prevented from dropping out of the core barrel

by a core catcher made of spring steel and located just above the core bit. The boring/drilling works at the proposed locations identified and marked by client's representative were performed by the hydraulic rotary drilling rig. Rotary drilling operations were performed to obtain the best possible recovery of rock cores and disturbed soil samples in the boreholes. Disturbed soil samples were obtained through a split spoon sampler during execution of Standard Penetration Tests (SPT).

The test consists of dropping of a hammer of mass 63.5 kg on to a drive head from a height of 750 mm. The number of such blows (N) necessary to achieve a penetration of the split spoon sampler by 300 mm is regarded as the penetration resistance. The blow counts for each 150 mm penetration were recorded. Small, disturbed samples of soil were obtained from the split spoon sampler after completion of the tests.

On reaching the rock, the rock core samples were obtained through double tube core barrels. The quantitative description of natural fracture state of rock masses is indicated by means of total core recovery (TCR) and rock quality designation (RQD) as determined from the borehole cores.

TCR is the percentage ratio of core recovered (whether solid, intact with full diameter, or nonintact) to the total length of core run.

RQD is a quantitative index based on core recovery procedure that incorporates only those pieces of core which are 100mm or more in length. It is the total length of solid core pieces, each greater than 100mm between natural fractures, expressed as a percentage of the total length of core run.

2.2.3 STANDARD PENETRATION TESTS

Standard penetration test plays a major role in sub soil investigation termination of safe bearing capacity of soil in non-cohesive type soil, particularly in non-cohesive granular sandy soil and where the UDS could not be collected either due to high liquidity or non-cohesive nature of soil .The SPT tests were conducted as per IS: 2131-1981 respectively.

The SPT sampler was lower inside the borehole after drilling the required level and is driven by a 63.50 kg Rammer with a free fall of 750 mm. driving 450 mm in One stages 150 mm each and the number of blows for each 150mm penetration for 2nd & 3rd 150 mm drive recorded as "N". Refusal was considered for N>100. The details of location of test and SPT value [N] are presented in bore log data annexed separately.

SL	Bore Hole No	In-situ Test/	Termination	Field Activity Dates		
NO		No of SPT	Depth (m)	From	То	
1	1(Land)	16	36.6000	21-12-2019	26-12-2019	
2	2(Under Water)	18	36.7000	28-12-2019	01-01-2020	
3	3(Under Water)	17	36.1000	04-01-2020	08-01-2020	
4	4(Under Water)	16	34.3000	10-01-2020	15-01-2020	
5	5(Under Water)	15	35.1000	17-01-2020	21-01-2020	
6	6 (Under Water)	16	36.9000	23-01-2020	27-01-2020	
7	7 (Under Water)	16	37.0000	29-01-2020	01-02-2020	
8	8 (Under Water)	16	36.0000	04-02-2020	07-02-2020	
9	9 (Under Water)	17	35.6000	11-02-2020	14-02-2020	
10	10(Land)	16	35.9000	17-02-2020	20-02-2020	

Table 2.1 Summary of Field Work executed for the Project

Table 2.2 Bore Hole Number with Surface elevation (Reduced Level)

Bore Hole No	1	2	3	4	5	6	7	8	9	10
Reduced Level (m)	2.812	-1.178	-1.501	-1.487	-1.888	-2.809	-2.117	-1.784	-0.783	3.139
Total depth (m)	36.60	36.70	36.10	34.30	35.10	36.90	37.00	36.00	35.60	35.90

2.3 SUMMARY OF EXPLORATION OF BOREHOLES

A total of 10 borings were drilled during the exploration. The locations and graphical logs of these borings are shown on respectively, in Appendix A.

All borings were performed at the original planned locations of the proposed regulator bridge. 163 sample and 10 rock core borings were drilled at each of the bore locations. contour map were drawn to the assessment of drilling program This map is presented in the report. During the drilling process in soils, attention was given to the description and consistency of the soils encountered. Soils were identified in terms of classification, colour, grain size, consistency, and moisture content. The location of the groundwater table was also noted on the logs, Because of the size of check dam and the loads to which it could be subjected, rock bearing foundations are anticipated for substructure support. As an indication of general competency of the rock cored, the Core recovery (CR) of each coring run was recorded. A complete listing of the CR values recorded for the borings is presented in Table 2.4

BH	Depth interval	Elevation interval	
No	(m)	(m)	Soll/rock type
	0.00 - 0.80	2.812 - 2.012	Fine sand
	0.80 - 3.00	2.0120.188	Silty clay (Brown)
	3.00 - 5.10	-0.1882.288	Sandy clay (Yellow, Pink, Brown)
	5.10 - 8.50	-2.2885.688	Fine sand (Black, Yellow)
	8.50 - 12.50	-5.6889.688	Clay (Black)
	12.50 - 16.80	-9.68813.988	Clayey sand (Yellow,Light grey)
1	16.80 - 21.00	-13.98818.188	Medium to fine sand (Light grey)
	21.00 - 24.80	-18.18821.988	Laterite/Sandy clay (Yellow,Brown)
	24.80 - 28.20	-21.98825.388	Clayey sand (Yellow,Light brown)
	28.20 - 28.40	-25.38825.588	Boulder
	28.40 - 33.20	-25.58830.388	Clayey sand (Yellow,Light brown)
	33.20 - 33.60	-30.38830.788	Soft rock
	33.60 - 36.60	-30.78833.788	Hard rock
	0.00 - 0.80	-1.1781.978	Fine sand (Black, Yellow)
	0.80 - 3.20	-1.9784.378	Silty clay(Brown)
	3.20 - 4.80	-4.3785.978	Sandy clay (Yellow, Pink, Brown)
	4.80 - 8.90	-5.97810.078	Clay (Black)
	8.90 - 12.00	-10.07813.178	Lateritic clayey sand (Yellow,Light grey)
2	12.00 - 15.40	-13.17816.578	Lateritic clayey sand (Yellow,Light grey)
2	15.40 - 21.80	-16.57822.978	Clayey sand(Black,Yellow)
	21.80 - 24.40	-22.97825.578	Lateritic medium to fine sand (Light grey)
	24.40 - 27.00	-25.57828.178	Lateritic sandy clay (Yellow, Brown)
	27.00 - 32.80	-28.17833.978	Lateritic clayey sand (Yellow,Light brown)
	32.80 - 33.70	-33.97834.878	Soft rock
	33.70 - 36.70	-34.87837.878	Hard rock
	0.00 - 0.90	-1.5012.401	Fine sand
	0.90 - 4.10	-2.4015.601	Lateritic clayey Sand (Brown,Grey,Yellow)
	4.10 - 8.70	-5.60110.201	Clay (Black,Grey)
	8.70 - 11.50	-10.20113.001	Lateritic clayey Sand (Yellow,Grey)
	11.50 - 12.60	-13.00114.101	Sandy clay (Brown,Grey)
3	12.60 - 15.40	-14.10116.901	Medium to fine sand with clay (Pink,Grey)
5	15.40 - 19.00	-16.90120.501	Lateritic gravelly sand (Grey, Dark brown)
	19.00 - 23.50	-20.50125.001	Lateritic Silty sand (Yellow)
	23.50 - 30.80	-25.00132.301	Lateritic clayey silty sand (Yellow,Light brown)
	30.80 - 32.30	-32.30133.801	Weathered rock/Fine sand (Grey)
	32.30 - 33.10	-33.80134.601	Soft rock
	33.10 - 36.10	-34.60137.601	Hard rock

Table 2.3 Summary of Boring Locations and Elevations

DILN	Depth interval	Elevation interval	Soil/rock type			
BH NO	(m)	(m)	Son/rock type			
	0.00 - 4.10	-1.4875.587	Lateritic clayey sand (Light brown, Grey)			
	4.10 - 8.80	-5.58710.287	Silty clay (Black,Grey)			
	8.80 - 14.00	-10.28715.487	Lateritic clayey sand (Brown, Yellow, Grey)			
	14.00 - 19.00	-15.48720.487	Lateritic sandy clay (Pink,Grey)			
1	19.00 - 20.60	-20.48722.087	Fine to medium sand (Red,Brown)			
-	20.60 - 24.40	-22.08725.887	Lateritic clayey sand (Grey,Brown)			
	24.40 - 24.70	-25.88726.187	Lateritic boulder			
	24.70 - 30.70	-26.18732.187	Lateritic clayey sand (Pink,Yellow)			
	30.70 - 31.30	-32.18732.787	Soft rock			
	31.30 - 34.30	-32.78735.787	Hard rock			
	0.00 - 3.80	-1.8885.688	Lateritic clayey sand (Brown,Red,Grey)			
	3.80 - 9.00	-5.68810.888	Silty clay (Grey)			
	9.00 - 14.90	-10.88816.788	Lateritic clayey sand (Brown,Red,Grey)			
	14.90 - 20.60	-16.78822.488	Lateritic clayey sand (Yellow, Brown)			
5	20.60 - 24.10	-22.48825.988	Lateritic silty clayey sandv(Grey, Brown)			
	24.10 - 31.20	-25.98833.088	Lateritic silty sand (Pink,Yellow)			
	31.20 - 31.60	-33.08833.488	Weathered rock			
	31.60 - 32.10	-33.48833.988	Soft rock			
	32.10 - 35.10	-33.98836.988	Hard rock			
	0.000 - 4.30	-2.8097.109	Lateritic clayey sand (Brown,Red,Grey)			
	4.30 - 8.60	-7.10911.409	Sandy clay (Grey)			
	8.60 - 14.00	-11.40916.809	Lateritic clayey sand (Brown,Red,Grey)			
	14.00 - 20.80	-16.80923.609	Lateritic clayey sand (Yellow, Brown)			
6	20.80 - 24.70	-23.60927.509	Lateritic silty clayey sand(Grey, Brown)			
	24.70 - 32.80	-27.50935.609	Lateritic silty sand(Pink, Yellow)			
	32.80 - 33.20	-35.60936.009	Weathered rock			
	33.20 - 33.90	-36.00936.709	Soft rock			
	33.90 - 36.90	-36.709 39.709	Hard rock			
	1.80 - 3.10	-2.1172.217	Lateritic clayey sand (Brown,Red,Grey)			
	3.10 - 9.30	-2.2178.417	Sandy clay (Grey)			
	9.30 - 12.40	-8.41711.517	Lateritic clayey sand (Brown,Red,Grey)			
	12.40 - 16.20	-11.51715.317	Lateritic clayey sand (Yellow,Brown)			
7	16.20 - 24.60	-15.31723.717	Lateritic silty clayey sand(Grey,Brown)			
	24.60 - 30.90	-23.71730.017	Lateritic silty sand(Pink,Yellow)			
	30.90 - 33.30	-30.01732.417	Weathered rock			
	33.30 - 34.00	-32.41733.117	Soft rock			
	34.00 - 37.00	-33.11736.117	Hard rock			

BH No	Depth interval	Elevation interval	Soil/rock type
	(m)	(m)	L staritis slaver and (Drown Dod Cree)
	0.00 - 4.10	-1./843.884	Lateritic clayey sand (Brown, Red, Grey)
	4.10 - 5.90	-5.8847.084	Sandy clay (Grey)
	5.90 - 8.00	-/.6849./84	Lateritic clayey sand (Brown,Red,Grey)
	8.00 - 12.60	-9.78414.384	Clay(Grey)
	12.60 - 16.70	-14.38418.484	Laterific clayey sand (Yellow,Brown)
8	16.70 - 21.60	-18.48423.384	Lateritic silty clayey sand(Grey, Brown)
Ū	21.60 - 24.90	-23.38426.684	Silty clay (White)
	24.90 - 27.40	-26.68429.184	Lateritic silty sand(Pink,Yellow)
	27.40 - 32.10	-29.18433.884	Lateritic silty clayey sand(Grey, Brown)
	32.10 - 32.80	-33.88434.584	Weathered rock
	32.80 - 33.00	-34.58434.784	Soft rock
	33.00 - 36.00	-34.78437.784	Hard rock
	0.00 - 2.80	0.7832.017	Fine sand (Grey, Yellow)
	2.80 - 5.60	-2.0174.817	Lateritic clayey sand (Brown, Yellow)
	5.60 - 9.70	-4.8178.917	Silty clay (Grey)
	9.70 - 13.20	-8.917 -12.417	Lateriic clayey sand (Yellow, Brown)
9	13.20 - 18.50	-12.41717.717	Lateritic sand (Yellow, Grey, red)
	18.50 - 25.00	-17.71724.217	Lateritic medium sand with clay (Grey, Yellow)
	25.00 - 31.80	-24.21731.017	Silty clay (White)
	31.80 - 32.60	-31.01731.817	Soft rock
	32.60 - 35.60	-31.81734.817	Hard rock
	0.00 - 0.30	3.139 - 2.839	Lateritic clay
	0.30 - 1.40	2.839 - 1.739	Fine sand (Grey, Yellow)
	1.40 - 4.00	1.7390.861	Lateritic clayey sand (Brown.Grey)
	4.00 - 5.30	-0.8612.161	Silty clay (Grey)
	5.30 - 6.60	-2.1613.461	Clayey sand (Brown.Yellow)
	6.60 - 10.20	-3.4617.061	Silty clay (Grey)
10	10.20 - 12.70	-7.0619.561	Lateritic clavey sand (Yellow, Grey, Brown)
	12.70 - 15.60	-9.56112.461	Sandy clay (White, Yellow)
	15.60 - 24.80	-12.46121.661	Medium sand(Grey)
	24.80 - 26.30	-21.66123.161	Hard laterite
	26.30 - 32.60	-23.16129.461	Silty clay (White)
	32.60 - 32.90	-29.46129.761	Soft rock
	32.90 - 35.90	-29.76132.761	Hard rock

Boring No	Top of	Bedrock (m)	Core Recovery Ratio (cm/300cm)
	Depth Interval	Elevation Interval	
1	33.60 - 36.60	-30.78833.788	118
2	33.70 - 36.70	-34.87837.878	225
3	33.10 - 36.10	-34.60137.601	162
4	31.30 - 34.30	-32.78735.787	182
5	32.10 - 35.10	-33.98836.988	194
6	33.90 - 36.90	-36.709 39.709	205
7	34.00 - 37.00	34.00 - 37.00	185
8	33.00 - 36.00	-34.78437.784	174
9	32.60 - 35.60	-31.81734.817	200
10	32.90 - 35.90	-29.76132.761	194

Table 2.3 Summary of Rock Core Data

2.5 GROUND WATER CONDITIONS

Soil investigation at site was carried out in the month of December 2019 to February 2020, during this season, ground water table was varies at each bore location (by considering the level difference) 3.00m depth from ground level at land area. Details of water level encountered in each bore location was indicated in each bore log sheets.

3.0 LABORATORY INVESTIGATIONS

3.1 GENERAL

The selected disturbed soil and rock core samples meant for testing were transported to M/s Geo Structura laboratory, Kollam. The laboratory tests were conducted as per relevant parts of Indian Standards. Tests were performed based on the laboratory testing schedule approved by Client. A summary of laboratory tests carried out is shown below and complete testing results are presented along with bore logs.

3.2 MOISTURE CONTENT

To obtain the natural moisture content of soil specimen at various depth were carried out as per IS 2720 (Part 2/Section 1) by oven drying method. The results have been presented in the summarized data sheet.

3.3 GRAIN SIZE ANALYSIS

To obtain information concerning the type of soil met at various depths and to classify each soil strata, grain size analysis were carried out as per IS: 2720 (Part-IV). The results have been presented in the summarized data sheet.

3.ATTERBURGS LIMITS

Soil consistency refers to the resistance of the soil offered against forces that tend to deform or rupture the soil aggregate. Consistency limits indicate the soil moisture content limits for various states of consistency. The consistency limits include Liquid Limit (L.L), Plastic Limit (P.L), and Shrinkage Limit (S.L). The difference between the numerical values of liquid limit and plastic limit of the soil is called the Plasticity Index (P.I). It indicates the range of moisture content over which the soil exhibits plasticity. It is determined as per the procedure laid down in IS: 2720 (Part-IV). Plasticity index was computed. Results of liquid limit and plasticity index have been reported in the summarized data sheets.

3.5 SPECIFIC GRAVITY

The specific gravity of the soil sample is the ratio of the mass of a given volume of soil sample in air to the mass of an equal volume of water at 27^oC. Specific gravity of soil sample was determined as per the provisions of IS: 2720 (Part –III). Specific gravity of soil sample obtained during the test has been reported in the summarized data sheet.

3.6 UNCONFINED COMPRESSIVE STRENGTH TEST

The undrained shear strength of clay and silty clay soil was determined by IS 2720 (Part X). The determination of unconfined compressive strength of undisturbed and remolded soil was limited to cohesive or naturally or artificially cemented soil. Soil with inclined fissures, sand and silt lenses and slickenside has a tendency to slide prematurely along these weaker planes in unconfined compression tests. The unconfined compressive strength is considered to be equal to the load at which failure occurs divided by the cross sectional area of the sample at the time of failure. In clayey soil the undrained conditions are expected to be the lower design limits (i.e. the minimum factor of safety), the undrained shear strength (i,e Cohesion) governs the behavior of clay. This undrained shear strength is approximately equal to half the unconfined compressive strength of undisturbed samples.

3.7 DIRECT SHEAR TEST

The direct shear test was performed in accordance with IS 2720 (Part XIII). Apparent cohesion or angle of internal friction was obtained by conducting this test. Shear strength attributes to friction required a normal force and the soil material exhibit friction characteristics and multiple contact areas. In dense soils the individual soil grains can interlocks when sliding occurs the individual grains lifted over one another against the normal stress, there for the force required to overcome particle interlock is proportional to the normal stress. The angle of internal friction represent the sum of sliding friction and interlocking, it is the function of density, roundness, angularity and particle size.

4.0 FOUNDATION RECOMMENDATIONS

4.1 GENERAL

The soil investigation of this project is being designed in accordance with the Indian Standard Specifications. Total 10 bore holes were investigated in this project & Hard rocks were available at reasonable depth.

Axial compression load is assumed to be carried entirely in the bedrock, by combined rock socket side friction and end bearing at the base of the rock socket. The contribution of the overburden soil to piles axial capacity is neglected the average soil properties for the calculation of pile capacities listed in table 4.1.

Pile length shall take according to the availability of hard rock for each bore holes and according to laboratory results and SPT N Value. The safe load capacity of each pile was provided in accordance with IS Specifications.

4.2 BORE HOLE DESCRIPTION

1st and 10th bore holes were taken at each sides of river and other bore holes were at river.

In BH1, very loose fine sand/riverine alluvium was found as top soil up to 0.8m depth. Soft clay loam[silty clay & sandy clay] was found below up to 5.1m depth with SPT N of 1,16 and 15 at 1.5m,3m and 4.5m depth. Fine sand was found below up o 8.5m and very soft soil was found from 8.5m to 12.5m depth. Loose to dense sandy loam [Clayey sand] was found up to 0.2m thick boulder bed at 28.2m depth. SPT N at 6m, 7.5m, 9m, 10.5m, 12m, 13.5m, 15m, 17m, 19m and 25m depth was 7, 8, 3, 3, 2, 18, 23, 35, 39, 51 and more than 50 at 23m and 25m depth respectively. Dense clayey sand was found from 28.4m to 33.2m depth with SPT N of 49 at 32m depth. Soft rock followed by hard rock[Core recovery 118cm] was available at 33.2m and 33.6m depth respectively. Bore hole terminated at 36.6m depth.

In BH2, very loose fine sand/riverine alluvium was found as top soil up to 0.8m depth from river bed. Soft clay loam[silty clay & sandy clay] was found below up to 8.9 m depth with SPT N of 3,10,8 and 8 at 1.5m,3m and 4.5m depth and 5t 6m and 7.5mdepth respectively. Lateritic clayey sand was found below, up 24.48m and hard sandy clayey soil was found from 24.4m to 27m depth. Dense sandy loam [Clayey sand] was found up soft rock bed at 32.8m. SPT N at 9m,10.5m,12m,13.5m,15m,17m,19m,21m and 23m depth was 12,14,16,22,26,39,32,38 and 41, 45 at 28m & more than 50 at 25m,31m and 32m depth and 25m depth respectively. Soft rock followed

by hard rock[Core recovery 225cm] was available at 32.8m and 33.7m depth respectively. Bore hole terminated at 36.7m depth.

In BH3, very loose fine sand/riverine alluvium was found as top soil up to 0.9m depth from river bed. Very loose lateritic clayey sand was found up to 4.1m depth and very soft clay was found between 4.1m and 8.7m. medium soft sand clay was found below up to 12.6m. loose to dense sand and sandy loam was found from 12.6m and 30.8m depth. SPT N at 1.5m, 3m, 4.5m, 6m, 7.5m, 9m, 10.5m, 12m, 13.5m, 15m, 17m, 19m, 21m, 23m, 25m and 28m depth was 5, 6, 2, 4, 4, 22, 25, 32, 27, 31, 45, 26, 27, 33, 50 and & more than 50 at 31m respectively. Weathered fine sand was found from 30.8m and 32.3m depth. Soft rock followed by hard rock[Core recovery 162cm] was available at 32.3m and 33.1m depth respectively. Bore hole terminated at 36.1m depth.

In BH4, very loose lateritic sand and sandy or silty clay was found upto 8.8m depth from river bed with SPT N of 2,3,2,3 and 3 at 1.5m, 3m, 4.5m, 6m and 7.5m depth. Lateritic sand or sandy clay was found from 8.8m to 19m depth. Very dense to dense laterite was found below, up to 30.7m depth. Soft rock was at 20.7m and hard rock available at 31.3m[Core recovery 182cm].SPT N of 28,42,50,45,48,41,46,45,50 and 50 at 9m, 10.5m, 12m, 13.5m, 15m, 17m, 19m, 21m, 23m and 25m depth respectively. Bore hole terminated at 34.3 depth.

In BH5, Lateritic clayey sand was found up to 3.8m depth from river bed with SPT N of 3 and 5 at 1.5m and 3m depth respectively. Very soft silty clay layer was found below, up to 9m depth with SPT N at 6m and 7.5m depth was 2. Loose lateritic clayey sand was found below, up to 14.9m depth with SPT N of 15,14,11 and 14 at 9m, 10.5m, 12m and 13.5m depth respectively. Dense to very dense lateritic sand and sandy loam was extended below, up to weathered rock bed at 31.2m depth. SPT N was 39,33,40,22,33,50 and 45 at 15m, 17m, 19m, 21m, 23m, 25m and 28m depth respectively. Soft rock followed by hard rock [Core recovery 194cm] was available at 31.6m and 32.1m depth. Bore hole terminated at 35.1m depth.

In BH6, Lateritic clayey sand was found upto 4.3m depth from river bed with SPT N of 4 at 1.5m depth. Very soft sandy clay layer was found below, up to 8.6m depth with SPT N at 4.5m,6m,7.5m and 9m depth was 6,1,1 and 9 respectively. Loose lateritic clayey sand /silty sand was found below, up to 31.8m depth with SPT N of 15,21,30,36,36,46,42 and 32 at 10.5m, 12m, 135.m, 15m, 17m ,19m 21m and 23m depth and more than 50 at 25m,27m and 29m depth respectively. Weathered rock bed was found at 32.8m depth. Soft rock followed by hard rock [Core recovery 205cm] was available at 33.2m and 33.9m depth. Bore hole terminated at 36.9m depth.

In BH7, Lateritic clayey sand was found upto 3.1m depth from river bed with SPT N of 6 at 1.5m depth. Very soft sandy clay with SPT N of 1,1,2and 8 at 4.5m, 6m, 7.5m and 9m depth respectively. Loose to dense lateritic clayey sand /silty sand was found below, up to 29.4m depth with SPT N of 16,16,21,34,39,39,36,41 and 52 at 10.5m, 12m, 13.5.m, 15m, 17m ,19m 21m, 23m and 25m depth and more than 50 at 27m and 29m depth respectively. Weathered rock bed was found at 30.9m depth. Soft rock followed by hard rock [Core recovery 185cm] was available at 33.3m and 34m depth respectively. Bore hole terminated at 37m depth.

In BH8, Lateritic clayey sand was found from upto 4.1m depth from river bed with SPT N of 7 at 3m depth. Very soft sandy clay extended up to 5.9m and up to 8m depth respectively with SPT N of 5,2,3 and 5 at 4.5m, 6m, 7.5m and 9m depth respectively. Very soft to soft clay was found below up to 12.6m with SPT N at 10.5m and 12m depth was 21 and 24 respectively. Loose to dense lateritic clayey sand /silty sand was found below, up to 32.1m depth with SPT N of 22,41,38,47,46,45,50,26 and 47 at 13.5.m, 15m, 17m ,19m 21m, 23m 25m, ,27m and 29m depth respectively. Weathered rock bed was found at 32.1m depth. Soft rock followed by hard rock [Core recovery 174cm] was available at 32.8m and 33m depth respectively. Bore hole terminated at 36m depth.

In BH9, Loose riverine alluvium found up to 2.8m depth from river bed with SPT N at 1.5m and 3m was 7 and 8 respectively. Lateritic clayey sand was found from 2.8m to 5.6m depth with SPT N of 6 at 4.5m and 3,4, and 3 at 6m, 7.5m and 9m depth respectively. Very soft silty clay was extended from 5.6m up to 9.7m depth. Loose to dense lateritic clayey sand and sand was found up to 25m depth. Medium soft silty clay (Kaolin clay) was found up to soft rock bed at 31.8m with SPT N of 32 and 33 at 28m and 31m depth respectively. Hard rock[Core recovery 200cm] available at 32.6m.Bore hole terminated at 35.6m depth.

In BH10, very loose lateritic sand /silty clay was found at alternate layers up to 10.2m from ground level with SPT N of 7,6,1,2,3 and 3 at 1.5m, 3m, 4.5m, 6m,7.5m and 9m depth. Lateritic clayey sand or sandy clay was found from 10.2 m to 15.6m depth with SPT N of 28,24,21 and 24 at 10.5m, 12m, 13.5m, 15m depth respectively. Very dense to dense medium sand was found below, up to 24.8m depth with SPT N of 49 at 17m and 50 or more than 50 at 19m, 21m and 23m depth.1.5m thick hard laterite layer was found 24.8m depth below, were, SPT hammer rebounded. Medium hard silty clay was found between 26.3m and 32.6m depth with SPT N at 28m and 31m was 32 and 29 respectively. Soft rock was at 32.6m and hard rock available at 32.9m[Core recovery 194cm].Bore hole terminated at 35.9m depth.

4.3 TYPE OF FOUNDATION

Provide pile foundation resting over hard rock (Core recovery >50%) at each pier location as the foundation of regulator bridge & should be provided by angering the pile into rock bed.

Bore hole No	1	2	3	4	5	6	7	8	9	10
Pile length (m)	>33.6m	33.7	33.5	31.5	32.5	34.5	34	33.5	33	33.0

Table 4.1 Minimum length of pile at bore locations

Load carrying capacity of individual piles in each bore locations was tabulated here.

Pile	Safe Axial	Safe lateral capacity (T)							
diameter (m)	capacity (T)	Normal Load	Seismic Load						
0.60	83	9	7						
0.70	110	14	12						
0.80	145	16	14						
1.00	227	21	17						
1.20	320	24	22						

Table 4.2 Load Carrying Capacity at Bore locations

5.0 LIMITATIONS & UNIFORMITY CONDITIONS

This report presents geotechnical recommendations for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near Palathingal between Thirurangadi municipality and Moonniyur panchayath, Malappuram If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations. The conclusions and recommendations contained in this report are solely professional opinions .We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area.

This report is based upon field and other conditions discovered at the time of report preparation.

We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of the actual subsurface conditions across the site.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative Information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

APPENDIX A I BORELOG SHEETS II LAB TEST REPORT III. LOCATION SKETCH IV TOTAL STATION SURVEY - DETAILED DRAWING

				GE	отес	CHNIC	CAL BOF	RING	LOG					
Name of Proj	ect :	: S Th	oil investigation wor irurangadi Municipa	k for the cons lity and Moon	truction niyur l	n of reg Panchay	gulator acro /ath, Malaj	oss Ka opuran	dalund n	li river	at Moozh	ikkal Kadavu near Pala	thingal between	
Client		: T	he Executive Engine	er, Minor Irrig	gation	Divisio	n,Malapuu	ram-6	76505					
Contractor		: Ja	amshad Naseeri P K				Site Loca	tion		: Pala	thingal-Pa	rapanagadi site, Malap	puram	
					BOR	ING/DI	RILLING	DAT	A					
Bore Hole No	D	:	1 (Land)	Date of Com	mmence				12-20	19	Ground v	water level	: 5.200 m	
Type of borir	ıg	: R	otary Drilling	Date of comp	Date of completion			: 26-12-2019 Reduc			Reduced	Level Surface	: 2.812 m	
Termination	depth(m)	:3	86.60 m	Diamond carl	bide bi	t drillin	g (m)	: 3.0	0 m		Tungstor (m)	n carbide bit drilling	: 0.60 m	
Notations : D	S/UDS-Di	stur	bed/Undisturbed sar	nple , SPT - S	tandaro	l penetr	ation test		DENIE		ON TEST D			
	SUBS	ы м	FACE PROFILE	er	STAN	DARD	PENEI		UN TEST L	PLOT OF SPT 'N'	_			
Elevation (M)	R.L (M)	aphic Lo	Description	Layer Thickness (M)	su vos	ſ Numb	DEPTH	Pene	etration	Value	 	VALUE	OBSERVATIONS	
		Gn			Q	SP	(m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90		
0.00	2.8120		Fine sand	0.80	-									
0.80	2.0120		Silty clay (Brown)	2.20	DS1	SPT1	1.50	2	1	1	2			
3.00	-0.1880		Sandy clay		DS2	SPT2	3.00	6	8	8	16			
5 10	-2 2880		(Yellow,Pink,Brow n)	2.10	DS3	SPT3	4.50	5	7	8	15			
5.10	-2.2000		E ! 1		DS4	SPT4	6.00	4	3	4	7			
			Fine sand (Black,Yellow)	3.40	DS5	SPT5	7.50	3	3	5	8			
8.50	-5.6880				DSC	SDT4	0.00	1	1	2	2			
			Clay (Black)	4 00	DS0 DS7	SPT0 SPT7	9.00 10.50	1	2	1	3			
			Clay (Diack)	4.00										
12.50	-9.6880				DS8	SPT8	12.00	1	1	1	2			
			Clayey sand (Yellow,Light	4.30	DS9	SPT9	13.50	8	9	9	18			
16.80	-13.9880		grey)		DS10	SPT10	15.00	8	10	13	23			
10.00	10.000				DS11	SPT11	17.00	12	16	19	35			
			Medium to fine	4 20										
			sand (Light grey)	4.20	DS12	SPT12	19.00	13	18	21	39			
21.00	-18.1880				DS13	SPT13	21.00	18	24	27	51			
			Laterite/Sandy											
			clay (Yellow,Brown)	3.80	DS14	SPT14	23.00	26	33	17	>50	•	Balance 9cm	
24.80	-21.9880				DS15	SDT15	25.00	10	28	22	>50		Balance 7cm	
			Clayey sand (Yellow,Light brown)	3.40	0315	51115	25.00	19	20	22	250		TC bit drilling from	
28.20	-25.3880				-		28.20	SPT	Rebou	inded			28.2m to 28.4m	
28.40	-25.5880		Boulder	0.20										
22.20	20.2000		Clayey sand (Yellow,Light brown)	4.80	DS16	SPT16	29.00	17 5 рт	21 D-b	28	49		TC bit drilling from 33.2m to 33.6m	
33.20	-30.3880		Coft wool:	0.40			32.00	5r I	Red00	maed			DC bit drilling from	
33.60	-30.7880		SULL FOCK	0.40			Core recovery : 20cm [33.6m to 34.6m], 98cm [34.6m -36.6m]						33.6m to 36.6m	
36.60	-33.7880		Hard rock	3.00						END (OF BORE	E HOLE AT 36.60 m		

				GE	отес	CHNIC	CAL BOF	RING	LOG	r			
Name of Proj	ect :	: S Th	oil investigation wor irurangadi Municipa	rk for the cons ality and Moon	truction niyur l	n of reg Panchay	gulator acr ath, Mala	oss Ka opurar	adalunc n	di river	at Moozhi	ikkal Kadavu near Pala	thingal between
Client		: T	he Executive Engine	eer, Minor Irri	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	umshad Naseeri P K				Site Loca	tion		: Palat	hingal-Par	rapanagadi site, Malap	puram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole N	D	:2	2 (Under water)	Date of Com	mence			: 28-	-12-20)19	River wa	ter level	: 3.000 m
Type of borir	ıg	: R	otary Drilling	Date of completion				:01-01-2020			Reduced bed)	Level Surface (River	: -1.178 m
Termination	depth(m)	h(m) : 36.70 m Diamo			bide bi	t drillin	g (m)	: 3.0	00 m		Tungston (m)	i carbide bit drilling	: 0.90 m
Notations : D	<u>S/UDS-Di</u> SUBS	Disturbed/Undisturbed sample , SPT - : BSURFACE PROFILE				d peneti	ation test STAN	DARD	PENE	TRATIO	ON TEST D	DATA	
Elevation (M)	BL M	M) II Description		Layer	SUD	umber		Pene	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
Elevation (IVI)	K.L (WI)	Graph	Description	Thickness (M)	DS/	N TQS	DEPTH (m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
	1.8220		Water	3.00	-								
0.00	-1.1780		Fine sand (Black,Yellow)	0.80									
0.80	-1.9780 -4 3780		Silty clay(Brown)	2.40	DS1	SPT1	1.50	2	1	2	3		
5.20	-4.5700		Sandy clay		D52	SP12	5.00	4	5	5	10		
4 80	-5 9780		(Yellow,Pink,Brow n)	1.60	DS3	SPT3	4.50	3	4	4	8	•	
-100	219700				DS4	SPT4	6.00	2	2	3	5	•	
			Clay (Black)	4.10	DS5	SPT5	7.50	2	2	3	5	•	
8.90	-10.0780				DS6	SPT6	9.00	3	5	7	12		
			Lateritic clayey sand (Yellow,Light grey)	3.10	DS7	SPT7	10.50	4	7	7	14	•	
12.00	-13 1780		B/		DS8	SPT8	12.00	6	7	9	16		
12.00	10.1700		Lateritic clayey sand (Yellow,Light	3.40	DS9	SPT9	13.50	7	10	12	22		
15.40	-16.5780		grey)		DS10	SPT10	15.00	9	11	15	26		
					DS11	SPT11	17.00	12	17	22	39		
			clayey sand(Black,Yellow)	6.40	DS12	SPT12	19.00	12	14	18	32		
21 80	-22.9780				DS13	SPT13	21.00	13	17	21	38	↓ · · · · · · · · · · · · · · · · · · ·	
21.00			Lateritic medium to fine sand (Light grey)	2.60	DS14	SPT14	23.00	18	24	17	41		
24.40	-25.5780		Lateritic sandy		DS15	SPT15	25.00	19	30	20	>50		Balance 5cm
			clay (Yellow,Brown)	2.60									
27.00	-28.1780				DS16	SPT16	28.00	13	15	30	45		
			Lateritic clayey sand (Yellow,Light brown)	5.80	DS17	SPT17	31.00	16	20	30	>50		Balance 8cm
					DS18	SPT18	32.00	50	_	_	>50		32.8m to 33.7m Balance 9cm
32.80	-33.9780		Soft rock	0.90			32.80	SPT	Rebou	unded			DC bit drilling from
33.70	-34.8780				-		Core rec 34.7m], 1	overy <u>64</u> cm	: 61cn [<u>3</u> 4.7r	n[33.7 <u>n -</u> 36.'	m- 7m]	L	33.7m to 36.7m
36.70	-37.8780		Hard rock	3.00						END (OF BORE	HOLE AT 36.70 m	

				GE	OTE	CHNIC	CAL BOR	RING	LOG				
Name of Pro	ject :	: S Th	oil investigation wor irurangadi Municipa	rk for the cons ality and Moon	truction niyur l	n of rea	gulator acr yath, Malaj	oss Ka opuran	idalunc n	li river	at Moozhi	ikkal Kadavu near Pala	athingal between
Client		: T	he Executive Engine	eer, Minor Irri	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	amshad Naseeri P K				Site Loca	ation		: Pala	thingal-Par	rapanagadi site, Malap	puram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole N	0	: :	3 (Under water)	Date of Com	mence			: 04-	-01-20	020	River wa	ter level	: 3.000 m
Type of borin	ıg	: R	otary Drilling	Date of comp	Date of completion				:08-01-2020 Reduc			Level Surface(River	: -1.501 m
Termination	depth(m)	:3	6.10 m	Diamond car	bide bi	t drillin	g (m)	: 3.0	0 m		Tungston (m)	a carbide bit drilling	: 0.80 m
Notations : D	OS/UDS-Di SUBS	stur SURI	bed/Undisturbed sar	nple , SPT - S	tandaro	l peneti	ation test STAN	DARD	PENE	FRATI	ON TEST D	DATA	
	DI 40	ic Log	D. 1.4	Layer	SUU	umber		Pene	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
Elevation (M)	K.L (M)	Graph	Description	Thickness (M)	DS/	SPT Ni	DEPTH (m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
	1.4990		Water	3.00									
0.00	-1.5010		Fine sand	0.90	-								
0.90	-2.4010		Lateritic clayey		DS1	SPT1	1.50	2	2	3	5		
			(Brown,Grey,Yello	3.20	DS2	SPT2	3.00	2	3	3	6		
4.10	-5.6010		w)		-								
					DS3	SPT3	4.50	1	1	1	2		
			Clay (Black,Grey)	4.60	DS4	SPT4	6.00 7 50	1	2	2	4		
8 70	10 2010				DS5	SPT5	7.50	2	2	2	-		
0.70	-10.2010				DCC	ODT	0.00	-	0	12	22		
			Lateritic clayey Sand	2.80	DS6	SP16	9.00	6	9	13	22		
			(Yellow,Grey)	2.00	D67	CDT7	10.50	8	12	13	25		
11.50	-13.0010		Sondy aloy		D57	SP17	12.00	11	14	18	32		
12.60	-14.1010		(Brown,Grey)	1.10	D38	SPT9	13.50	7	11	16	27		
			Medium to fine		237	5117							
	4 < 0.040		sand with clay (Pink.Grev)	2.80	DS10	SPT10	15.00	10	13	18	31		
15.400	-16.9010		Lateritic gravelly		DS11	SPT11	17.00	12	19	26	45		
10.00	20 5010		sand (Grey,Dark brown)	3.60									
19.00	-20.5010				DS12	SPT12	19.00	12	11	15	26		
			Lateritic Silty sand	4 50	DS13	SPT13	21.00	9	11	16	27		
			(Yellow)	4.50									
					DS14	SPT14	23.00	12	15	18	33		
23.50	-25.0010												
					DS15	SPI15	25.00	19	32	18	50		Balance 5cm
			Lateritic clayey										
			(Yellow,Light	7.30	D816	SDT16	20.00	16		20			
			brown)		DS16	SP110	28.00	16	22	29	51		
30.80	-32.3010				-								D.L. St
			Weathered	1.50	DS17	SPT17	31.00	50	-	-	>50		Balance 34cm
			(Grey)	1.50									TC bit drilling from 32.3m to 33.1m
32.30	-33.8010		Soft rock	0.80			32.30	SPT	Rebou	unded			DC bit drilling from
33.10	-34.6010				-		Core rec	overy	: 52cn	n [33.1	m to		55.1m to 56.1m
			Hard rock	3.00			34.1m], 1	10cm	[34.1r	n - 36.	1m]		
36.10	-37.6010									END (OF BORE	HOLE AT 36.10 m	

				GE	отес	CHNIC	CAL BOH	RING	LOG	r			
Name of Proj	ject :	: S Th	oil investigation wor irurangadi Municipa	k for the cons lity and Moon	truction niyur l	n of reg Panchay	gulator acr /ath, Malaj	oss Ka ppuran	idaluno n	di river	at Moozhi	ikkal Kadavu near Pala	thingal between
Client		: T	he Executive Engine	eer, Minor Irrig	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	umshad Naseeri P K				Site Loca	ation		: Pala	thingal-Par	apanagadi site, Malapı	puram
					BOR	ING/DI	RILLING	DAT	A				
Bore Hole N	0	: 4	4 (Under water)	Date of Com	mence			: 10-	-01-20	020	River wat	ter level	: 3.000 m
Type of borir	ıg	: R	otary Drilling	Date of comp	oletion			: 15-	-01-20)20	Reduced bed)	Level Surface(River	: -1.487m
Termination	depth(m)	: 3	4.3 m	Diamond carl	bide bi	t drillin	g (m)	: 3.0	0 m		Tungston (m)	carbide bit drilling	: 0.60 m
Notations : D	S/UDS-Di SUBS	stur	bed/Undisturbed sar	nple , SPT - S	tandaro	d penetr	ation test	DARD	PENE	TRATI	ON TEST D	АТА	
	5050	8			6	er	5111	Dint				PLOT OF SPT 'N'	_
Elevation (M)	R.L (M)	raphic L	Description	Layer Thickness (M)	ON ND	T Numb	DEPTH	15	30	45	SPT 'N'	VALUE	OBSERVATIONS
	1.5130	3	Watan	3.00	-	IS	(m)					0 15 30 45 60 75 90	
0.00	1 4970		water	5.00	-							• • • • • • • • • • • • • • • • • • •	
0.00	-1,4070		T = 4 = = 14 ² = = 1 = = = =		DS1	SPT1	1.50	1	1	1	2		
			sand (Light	4.100	DS2	SPT2	3.00	1	2	1	3		
			brown,Grey)										
4.10	-5.5870				DS3	SPT3	4.50	1	1	1	2		
			Silty clay	4 = 0	DS4	SP14 SPT5	6.00 7.50	1	2	1	3		
8 80	-10 2870		(Black,Grey)	4.70			7.50	1	1	2	5		
0.00	-10.2070				DS6	SPT6	9.00	8	11	17	28		
			Lateritic clayey		DS7	SPT7	10.50	14	18	24	42		
			sand (Brown.Yellow.Gre	5.20									
			y)		DS8	SPT8	12.00	19	27	23	50		Balance 6cm
14.00	-15.4870				DS9	SPT9	13.50	13	19	26	45		
					DS10	5P110	15.00	15	21	27	48		
			Lateritic sandy clay (Pink,Grey)	5.00	DS11	SPT11	17.00	14	17	24	41		
19.00	-20.4870				D612	CDT12	10.00		10	27			
			Fine to medium sand (Red,Brown)	1.60	DS12	SP112	19.00	11	19	27	46		
20.60	-22.0870		Lateritic clavey		DS13	SPT13	21.00	8	17	28	45		
			sand (3.80									
24.40	-25.8870		Grey,Brown)		DS14	SPT14	23.00	13	29	21	50		Balance 5cm
24.70	-26.1870		Lateritic boulder	0.30	DS15	SPT15	25.00	14	26	24	50		
					0015	51 115	25.00	14	20	24	50		Balance 5cm
			Lateritic clavev										
			sand (Pink, Yellow)	6.00									
								apr					TC bit drilling from
20 50	22.1050				-		30.70	SPT	Keboi	unded			DC bit drilling from
30.70	-32.1870		Soft rock	0.60	-		Core rec	overy	: 60cn	n[31.3	m-		31.3m to 34.3m
31.30	-34.7870		Hard rock	3.00			32.3m], 1	22cm	[32.3	m - 34	.3m]		
34.30	-35.7870				1					END	OF BORE	HOLE AT 34.3 m	

				GE	OTEC	CHNIC	CAL BOH	RING	LOG	r			
Name of Proj	ect :	: S Th	oil investigation wo irurangadi Municipa	rk for the cons ality and Moon	truction niyur l	n of reg Panchay	gulator acr /ath, Mala	oss Ka ppura	adaluno m	di river	at Moozh	ikkal Kadavu near Pala	athingal between
Client		: T	he Executive Engine	eer, Minor Irrig	gation	Divisio	n,Malapuu	ıram-6	676505				
Contractor		: Ja	amshad Naseeri P K				Site Loca	ation		: Palat	hingal-Pa	rapanagadi site, Malap	puram
					BOR	ING/DI	RILLING	DAT	'A				
Bore Hole No)	:	5(Under water)	Date of Com	mence			: 17-01-2020 River wa			River wa	ter level	: 3.000 m
Type of borin	g	: R	lotary Drilling	Date of comp	oletion			: 21	-01-20	020	Reduced bed)	Level Surface (River	: -1.888 m
Fermination of	depth(m)	:3	35.1 m	Diamond carbide bit drilling (m))0 m		Tungstor (m)	i carbide bit drilling	: 0.50 m
Notations : D	S/UDS-Di	stur	bed/Undisturbed sar	mple , SPT - S	tandaro	l penetr	ation test						
1	SUBS	SURI	FACE PROFILE	1			STAN	DARD	PENE	TRATI	ON TEST D	DATA	_
Elevation (M) R.L (M)		Description		Layer Thickness (M)	su vds	Number	ПЕРТН	Pen	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
		Gra			SQ	LdS	(m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
0.00	1.1120 -1.8880		Water	3.00		0.00001	1 50				2		
			Lateritic clayey sand (3.800	DSI	SPIT	1.50	1	2	1	3		
3.80	-5.6880		Brown,Red,Grey)		DS2	SPT2	3.00	2	2	3	5		
					DS3	SPT3	4.50	1	0	1	1		
			Silty clay (Grey)	5.20	DS4	SP14	6.00	1	1	1	2		
					DS5	SPT5	7.50	1	1	1	2		
9.00	-10.8880				DS6	SPT6	9.00	8	7	8	15		
			Lateritic clayey sand (5.90	DS7	SPT7	10.50	6	6	8	14		
			Brown,Red,Grey)		DS9	SPT9	12.00	3	5 5	0 9	11		
14.90	-16.7880						10.00		5	,			
					DS10	SPT10	15.00	9	19	20	39		
			Lateritic clayey		DS11	SPT11	17.00	6	14	19	33		
			sand (Yellow,Brown)	5.70	DS12	SPT12	10.00	12	15	25	40		
20.60	-22 4880				2012	51112	19.00	12	15	25	40		
20100					DS13	SPT13	21.00	5	9	13	22		
			Lateritic silty	3 50									
			Grey,Brown)	5.50	DS14	SPT14	23.00	5	14	19	33		
24.10	-25.9880				DS15	SPT15	25.00	9	22	28	50		Palanaa 6am
							20.00	-		20	20		Balance och
			Lateritic silty sand	7.10		1							
			(Pink, Yellow)	7.10	DS15	SPT15	28.00	14	19	26	45		
31.20	-33.0880				-		31.20	SPT	Rebo	unded			TOLIN LIVE C
			Weathered rock	0.40									TC bit drilling from 31.6m to 32.1m
31.60	-33.4880		Soft reek	0.50									DC bit drilling from
32.10	-33.9880		JULIUK	0.30	-	Core recovery : 60cm [32.1m to 33.1m] , 134cm [33.1m - 35.1m]					32.1m to 35.1m		
35.10	-36.9880		Hard rock	3.00						END)F BORE	HOLE AT 35.10 m	

				GE	отес	CHNIC	CAL BOF	RING	LOG				
Name of Pro	ject :	: S Th	oil investigation wo	rk for the cons ality and Moon	tructio	n of reg Panchay	gulator acr ath, Malaj	oss Ka ppurar	ıdaluno n	li river	at Moozh	ikkal Kadavu near Pala	thingal between
Client		: T	The Executive Engine	eer, Minor Irri	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	amshad Naseeri P K				Site Loca	ation		: Pala	thingal-Pa	rapanagadi site, Malapp	puram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole N	0	: (6(Under water)	Date of Com	mence			: 23	-01-20	020	River wa	ter level	: 3.000 m
Type of borin	ng	: R	Rotary Drilling	Date of comp	oletion			: 27	-01-20)20	Reduced bed)	Level Surface (River	: -2.809 m
Termination	depth(m)	:3	36.9 m	Diamond car	bide bi	t drillin	g (m)	: 3.0	0 m		Tungstor (m)	1 carbide bit drilling	: 1.10 m
Notations : D	DS/UDS-Di SUBS	istur SURI	bed/Undisturbed sat	mple , SPT - S	tandaro	d penetr	ation test STAN	DARD	PENE	FRATI	ON TEST I	ОАТА	
		50	,			er						PLOT OF SPT 'N'	_
Elevation (M)	R.L (M)	aphic Lo	Description	Layer Thickness (M)	SU UDS	T Numb	DEPTH	Pene	etration 20	Value	CDT INI	VALUE	OBSERVATIONS
	0.1910	5	XX 7.4	2.000	<u>а</u>	SP	(m)	15	30	45	SP1 N	0 15 30 45 60 75 90	
0.00	-2 8000		Water	3.000									
0.00	-2.0090		Lateritic clayey sand (4.300	DG1	ODTI	• • •					•	
4.30	-7.1090		Brown,Red,Grey)		DS1 DS2	SPT1 SPT2	3.00 4.50	1	2	2	4		
					DS2	SPT3	4.30 6.00	1	1	4 0	1		
			Sandy clay (Grey)	4.30									
8.60	11 4000				DS4	SPT4	7.50	1	0	1	1		
8.60	-11.4090				DS5	SPT5	9.00	4	3	6	9		
			T. 4. 141. 1.		DS6	SPT6	10.50	5	5	10	15		
			sand (5.40	DS7	SPT7	12.00	8	Q	12	21		
			Brown,Red,Grey)		DS8	SPT8	13.50	11	13	12	30		
14.00	-16.8090												
					DS9	SPT9	15.00	14	14	22	36		
			Lateritic clayey										
			sand (Yellow,Brown)	6.80	DS10	SPT10	17.00	6	12	24	36		
					0511	51111	19.00	9	17	29	40		
20.80	-23.6090				DS12	SPT12	21.00	11	14	28	42		
			Lateritic silty										
			Grey,Brown)	3.90	DS13	SPT13	23.00	12	11	21	32		
24.70	-27.5090				D014	CDT14		10	22	20	-		
					D314	SF114	25.00	12	22	28	>50		Balance 7cm
			Latanitia cilta		DS15	SPT15	27.00	14	24	29	52		
			sand(Pink, Yellow)	8.10									
					DS16	SPT16	29.00	>50	-	-	>50		Balance 38cm
32.80	-35.6090				-			an	n ·				
			Weathered rock	0.40			32.80	SPT	Rebou	unded			TC bit drilling from 32.8m to 33.2m
33.20	-36.0090				-								
			Soft rock	0.70									DC bit drilling from 33.9m to 36.9m
33.90	-36.7090		Hand real-	2.00	1		Core rec	overy	: 63cn	n [33.9	m to 34.9	m], 142cm [34.9m - 3	6.9m]
36.90	-39.7090		пага госк	3.00						END	OF BORE	HOLE AT 36.90 m	

				GE	отес	CHNIC	CAL BOR	RING	LOG				
Name of Proj	ect :	: Se Thi	oil investigation wor irurangadi Municipa	k for the cons lity and Moon	truction niyur l	n of rea	gulator acr yath, Malaj	oss Ka opurai	adalund n	li river	at Moozhi	ikkal Kadavu near Pala	thingal between
Client		: T	he Executive Engine	eer, Minor Irri	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	umshad Naseeri P K				Site Loca	ation		: Palat	hingal-Par	apanagadi site, Malapp	ouram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole No	D	:7	7 (Under water)	Date of Com	mence			: 29	-01-20	020	River wa	ter level	: 3.000 m
Type of borir	ıg	: R	otary Drilling	Date of comp	oletion			: 01	-02-20	020	Reduced bed)	Level Surface (River	: -2.117 m
Termination	depth(m)	: 3	7.0 m	Diamond car	bide bi	t drillin	g (m)	: 3.0	00 m		Tungston (m)	carbide bit drilling	:1.60 m
Notations : D	S/UDS-Di	sturl	bed/Undisturbed sar	nple , SPT - S	tandaro	i peneti	ration test						
	SUBS	URE	FACE PROFILE				STAN	DARD	PENET	FRATI	ON TEST D	DATA	_
Elevation (M)	R.L (M)	phic Log	Description	Layer Thickness (M)	Sau /	Number	DEDTH	Pen	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
	0.0020	Gra			SQ	Tq2	(m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
0.00	0.8830		Water	3.00									
0.00	-2.1170		Lateritic clayey sand (Brown Red Grey)	3.10	DS1	SPT1	3.00	1	2	4	6	•	
3.10	-2.2170		210 (11,1104,0105)		DS2	SPT2	4.50	2	1	0	1		
					DS3	SPT3	6.00	1	0	1	1		
			Sandy clay (Grey)	6.20		1							
					DS4	SPT4	7.50	1	1	1	2		
9.30	-8.4170				DS5	SPT5	9.00 10.50	1	3	5	8		
			Lateritic clayey sand (Brown,Red,Grey)	3.10	030		10.50	5	1	7	10		
12.40	-11.5170				DS7	SPT7	12.00	4	6	10	16		
			Lateritic clayey sand (Yellow,Brown)	3.80	DS8 DS9	SP18 SPT9	15.00	11	9 14	12 20	21 34		
16.20	-15.3170				DS10	SPT10	17.00	10	18	21	39		
					DS11	SPT11	19.00	13	15	24	39	••••••	
			Lateritic silty clayey sand(Grey,Brown)	8.40	DS12	SPT12	21.00	10	10	26	36	•	
					DS12	SPT12	22.00	0	10	22	41		
24.60	-23.7170				0315	51115	23.00	9	19	22	41		
					DS14	SPT14	25.00	11	24	28	52		Balance 5cm
			Lateritic silty sand(Pink,Yellow)	6.30	DS15	SPT15	27.00	16	>50	-	>50		Balance 32cm
					DS16	SPT16	29.00	>50	-	-	>50		Balance 40cm
30.90	-30.0170		Weathered rock	2.40			30.90	SPT	Rebou	inded			TC bit drilling from
33.30	-32.4170				-								DC bit drilling from
34.00	-33.1170		Soft rock	0.70			G		6			104 505 07 -	34m to 37m
35.00	26 11=6		Hard rock	3.00			Core rec	overy	: 61cn	n [34n	1 to 35m],	124cm [35m - 37m]	
37.00	-36.1170					<u> </u>				END	OF BORE	LHOLE AT 5/ m	

				GE	отес	CHNIC	CAL BOR	RING	LOG	r			
Name of Proj	ect :	: So Thi	oil investigation wor irurangadi Municipa	k for the const lity and Moon	tructio miyur 1	n of reg Panchay	gulator acr yath, Mala	oss Ka ppurar	idaluno n	di river	at Moozhi	ikkal Kadavu near Pala	thingal between
Client		: T	he Executive Engine	eer, Minor Irrig	gation	Divisio	n,Malapuu	ıram-6	76505				
Contractor		: Ja	umshad Naseeri P K				Site Loca	ation		: Palat	thingal-Par	apanagadi site, Malapı	ouram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole No	D	:8	8 (Under water)	Date of Com	mence			: 04	-02-20	020	River was	ter level	: 3.000 m
Type of borir	ıg	: R	otary Drilling	Date of comp	oletion			: 07-	-02-20)20	Reduced bed)	Level Surface (River	: -1.784m
Termination	depth(m)	: 3	6.0 m	Diamond carl	bide bi	t drillin	g (m)	: 3.0	0 m		Tungston (m)	carbide bit drilling	:0.90 m
Notations : D	S/UDS-Di	sturl	bed/Undisturbed sar	nple, SPT - S	tandaro	d peneti	ration test						
	SUBS	URE	FACE PROFILE	T		1	STAN	DARD	PENE	TRATI	ON TEST D	ATA	-
Elevation (M)	R.L (M)	phic Log	Description	Layer Thickness (M)	N UDS	Number		Pene	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
		Gral			DS	SPT	DEPTH (m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
0.00	1.2160 -1.7840		Water Lateritic clavev	3.00	-								
4.10	-5.8840		sand (Brown,Red,Grey)	4.10	DS1	SPT1	3.00	1	3	4	7	•	
			Sandy clay (Grey)	1.80	D63	CDTO	4.50	2	2	3	5	•	
5.90	-7.6840		.		DS2 DS3	SPT2 SPT3	6.00	1	1	1	2		
			Lateritic clayey sand (2.10									
8.00	-9.7840		Brown,Red,Grey)		DS4	SPT4	7.50	1	2	1	3		
					DS5	SPT5	9.00	1	2	3	5		
			Clay(Grey)	4.60	DS6	SPT6	10.50	6	9	12	21		
1. 50					DS7	SPT7	12.00	7	10	14	24	• • • • • • • • • • • • • • • • • • •	
12.60	-14.3840		Lateritic clavev		DS8	SPT8	13.50	8	9	13	22		
			sand (Yellow.Brown)	4.10			15.00	10	17	24			
16.70	-18.4840		(10100,0000)		DS9	SPT9	15.00	13	17	24	41		
			.		DS10	SPT10	17.00	11	18	20	38		
			Lateritic silty clayey sand(4.90	DS11	SPT11	19.00	11	15	32	47		
			Grey,Brown)										
21.60	-23.3840				DS12	SPT12	21.00	12	16	30	46	•	
			Silty clay (White)	3.30	DS13	SPT13	22.00	12	17	20	45		
• 4 9 9			Shity chuy (() hite)		2010	51 115	25.00	15	17	28	45		
24.90	-26.6840		T . 4 . 141 114		DS14	SPT14	25.00	10	24	26	50		Balance 5cm
			sand(Pink, Yellow)	2.50									
27.40	-29.1840				DS15	SPT15	27.00	8	11	15	26		Balance 32cm
			Lateritic silty clayey sand(Grey,Brown)	4.70	DS16	SPT16	29.00	11	22	25	47		Balance 40cm
32.10	-33.8840				-		22 10	CDT	Doha	unded			TO LA LUNC O
32.80	-34.5840		Weathered rock	0.70	-		52.10	Sr I	ACDOU	unded			32.1m to 33m
33.00	-34.7840		Soft rock	0.20									DC bit drilling from 33m to 36m
			Hard rock	3.00	1		Core rec	overy	: 59cn	n [33m	to 34m],	115cm [34m -36m]	
36.00	-37.7840			5.00						END	OF BORE	E HOLE AT 36m	

				GE	отес	CHNIC	CAL BOI	RING	LOG				
Name of Pro	ject :	: S Th	oil investigation wo irurangadi Municip	rk for the cons ality and Moor	tructio	n of reg Panchay	gulator acr yath, Mala	oss Ka ppurar	adaluno n	li river	at Moozhi	ikkal Kadavu near Pala	thingal between
Client		: T	he Executive Engin	eer, Minor Irri	gation	Divisio	n,Malapuu	ıram-6	76505				
Contractor		: Ja	amshad Naseeri P K	ĩ			Site Loca	ation		: Palat	thingal-Par	apanagadi site, Malapı	puram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole N	0	:	9 (Under water)	Date of Com	mence			: 11	-02-20	020	River wa	ter level	: 3.000 m
Type of bori	ng	: R	otary Drilling	Date of comp	oletion			: 14	-02-20)20	Reduced bed)	Level Surface (River	: -0.783m
Termination	depth(m)	: 3	5.60 m	Diamond car	bide bi	t drillin	g (m)	: 3.0	0 m		Tungston (m)	carbide bit drilling	:0.80 m
Notations : E	DS/UDS-Di	stur	bed/Undisturbed sa	mple , SPT - S	tandaro	d peneti	ration test						
	SUBS	SURI	FACE PROFILE			-	STAN	DARD	PENE	FRATI	ON TEST D	DATA	-
Elevation (M)	R.L (M)	phic Log	Description	Layer Thickness (M)	sun /s	l Number	DEPTH	Pene	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
		Gr			D	LdS	(m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
	3.7830		Water Fine sand (3.00	-								
0.00	0.7830		Grey,Yellow)	2.80	DS1	SPT1	1.50	2	3	4	7		
2.80	-2.0170		Lateritic clayey sand (Brown Yellow)	2.80	DS2	SPT2	3.00	2	3	5	8		
5.60	-4.8170				DS3	SPT3	4.50	2	3	3	0		
			Silty clay (Grey)	4.10	DS4 DS5	SPT4 SPT5	6.00 7 50	1	2	1	3		
	0.04=0				DS6	SPT6	9.00	2	1	2	3	•	
9.70	-8.9170				DS7	SPT7	10.50	7	11	16	27		
			Lateriic clayey sand (Yellow,Brown)	3.50	DS8	SPT8	12.00	10	14	18	32		
13.20	-12.4170				-	SPT9	13.50	9	8	13	21		No sample
			Lateritic sand (Yellow,Grey,red)	5.30	DS9	SPT10	15.00	15	21	28	49		
					DS10	SPT11	17.00	12	10	20	47		
18.50	-17.7170				DS11	SPT12	17.00	13	50	- 20	>50		Balance 17cm
					DS12	SDT12							Dutance Trent
			Lateritic medium sand with clay (6.50	D312	5115	21.00	22	50	-	>50		Balance 19cm
			Grey,Yellow)		DS13	SPT14	23.00	20	38	12	50		Balance 12cm
25.00	-24.2170				DS14	SPT15	25.00	9	11	16	27		
					DS15	SPT16	28.00	7	14	10	22		
			Silty clay (White)	6.80	0315	51 110	28.00	/	14	18	32		
					DS16	SPT17	31.00	11	16	17	33		TC bit drilling from
31.80	-31.0170				-		31.80	SPT	Rebou	ınded			31.8m to 32.6m
32.60	-31 8170		Soft rock	0.80									32.6m to 35.6m
32.00	-51.01/0		Hard rock	3.00			Core rec	overy	: 55cn	n [32.6	m to 33.61	m], 145 cm [33.6m -35	5.6m]
35.60	-34.8170			2100						END	OF BORE	HOLE AT 35.6 m	

				GE	отес	CHNIC	CAL BOR	RING	LOG				
Name of Proj	ject :	: So Thi	oil investigation wor rurangadi Municipa	rk for the cons ality and Moon	truction niyur l	n of reg Panchay	gulator acro ath, Mala	oss Ka opurar	idalunc n	li river	at Moozhi	kkal Kadavu near Pala	thingal between
Client		: Tl	he Executive Engine	eer, Minor Irrig	gation	Divisio	n,Malapuu	ram-6	76505				
Contractor		: Ja	mshad Naseeri P K				Site Loca	tion		: Pala	thingal-Par	apanagadi site, Malapp	ouram
					BOR	ING/D	RILLING	DAT	A				
Bore Hole No	0	:1	0 (Land)	Date of Com	mence			: 17	-02-20	020	Ground w	vater level	: 1.608 m
Type of borir	ıg	: R	otary Drilling	Date of comp	oletion			: 20	-02-20	020	Reduced	Level Surface	: 3.139m
Termination	depth(m)	: 3	5.90 m	Diamond carl	bide bi	t drillin	g (m)	: 3.0	0 m		Tungston (m)	carbide bit drilling	: 1.80 m
Notations : D	S/UDS-Di	sturł	oed/Undisturbed sar	nple , SPT - S	tandaro	l peneti	ation test						
	SUBS	SURF	FACE PROFILE			L	STAN	DARD	PENE	FRATI	ON TEST D	ATA	-
Elevation (M)	R.L (M)	phic Log	Description	Layer Thickness (M)	SQU /	Number		Pene	etration	Value		PLOT OF SPT 'N' VALUE	OBSERVATIONS
		Graf			DS	SPT	DEPTH (m)	15	30	45	SPT 'N'	0 15 30 45 60 75 90	
0.00 0.30	3.1390 2.8390		Lateritic clay Fine sand (0.30	-								
1.40	1.7390		Grey,Yellow) Lateritic clavey	1.10	DS1	SPT1	1.50	2	3	4	7		
4.00	-0.8610		sand (Brown Grev)	2.60	DS2	SPT2	3.00	2	2	4	6		
5 30	-2 1610		Silty clay (Grey)	1.30	DS3	SPT3	4.50	1	0	1	1		
6.60	-3.4610		Clayey sand	1.30			6.00	1	1	1	2		
			(Brown.Yellow)		DS4 DS5	SPT4 SPT5	7.50	1	2	1	3		
			Silty clay (Grey)	3.60	DS6	SPT6	9.00	1	2	1	3		
10.20	-7.0610		Lateritic clayey sand (2.50	DS7	SPT7	10.50	8	13	15	28		
12.70	-9.5610		Yellow,Grey,Brow		DS8 DS9	SPT8 SPT9	12.00	7	11	13	24		
			Sandy clay (White,Yellow)	2.90	DS10	SPT10	15.00	6	9	12	21		
15.60	-12.4610				D310	51110	15.00	8	11	15	24		
					DS11	SPT11	17.00	13	21	28	49		
					DS12	SPT12	19.00	20	37	13	50		Balance 10cm
			Medium sand(Grev)	9.20	DS13	SPT13	21.00	28	50	-	>50		Balance 20cm
			Sand (Or Cy)		544	000014							
					DS14	SP114	23.00	31	50	-	>50	•	Balance 18cm
24.80	-21.6610						24.80	SPT	Rebou	unded			TC bit drilling from
26.30	-23.1610		Hard laterite	1.50									24.8m to 26.3m
					DS15	SPT15	28.00	12	17	15	32		
							20.00	12	17	15	52		
			Silty clay (White)	6.30									
					DS16	SPT16	31.00	10	14	15	29		TC bit drilling from 32.6m to 32.9m
32.60	-29.4610				-		32.60	SPT	Rebou	unded			DC hit drilling from
32.90	-29.7610		Soft rock	0.30			Core	recov	ery : 6 9cm [4	5cm[3 33.9m	2.9m- -35.91		32.9m to 35.9m
35 90	-32,7610		Hard rock	3.00					[•	END	OF BORE	HOLE AT 35.9 m	



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 21-12-2019-26-12-2019
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 27-12-2019-29-12-2019
BORE HOLE NO	0:1	DEPTH OF BORE HOLE	: 36.60 m

TEST RESULTS

					ə.	ty	_	(Grain S	Size Di	stribut	ion (%)	Consi	stancy] (%)	Limits		Sh Parar	ear neters	
mber	be			ue	oistur)	ravei	ation	Gra	avel		Sand			uit	it		ndex		(əə.	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mo content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I ₁	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	1.5	Silty clay (Brown)	2	17	2.40	CL	0	0	0	0	40	60	46.0	25.0		21.0	1.0	-	
SPT 2	DS2	3.0	Lateritic sandy clay (Yellow,Pink,Brown)	16	11	2.60	SC-CL	0	0	0	9	37	54	42.0	23.0		19.0	20.0	22.0	
SPT 3	DS3	4.5	-do-	15	13															
SPT 4	DS4	6.0	Lateritic fine sand (Black, Yellow)	7	15	2.54	SP	0	0	0	15	76	9						19.0	
SPT 5	DS5	7.5	-do-	8	16															
SPT 6	DS6	9.0	Clay (Black)	3	44	2.70	СН	0	0	0	0	1	99	61.0	15.0		46.0	0.2		
SPT 7	DS7	10.5	-do-	3	51		"													
SPT 8	DS8	12.0	-do-	2	51		"													
SPT 9	DS9	13.5	Lateritic clayey sand (Yellow,Light grey)	18	31	2.63	SC-CL	0	0	0	6	57	37	41.0	20.0		21.0	16.0		
SPT 10	DS10	15.0	-do-	23	30															
SPT 11	DS11	17.0	Lateritic medium to fine sand (Light grey)	35	20	2.65	SP	0	0	1	24	63	12						29.0	
SPT 12	DS12	19.0	-do-	39	18															
SPT 13	DS13	21.0	Lateritic sandy clay (Yellow,Brown)	51	21	2.66	CL	0	0	1	22	14	63					44.0		
SPT 14	DS14	23.0	Lateritic gravelly sand (Pink,Brown)	>50	18	2.60	SP	0	22	7	22	34	15					47.0	32.0	
SPT 15	DS15	25.0	Lateritic clayey sand (Yellow,Light brown)	>50	30	2.61	SC-CL	0	7	4	25	33	31							
SPT 16	DS16	29.0	-do-	49	31													42.0	31.0	

Lab in Charge : Aparna A G, B Tech NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

Test Methods Direct Shear test compression test

Friction Angle-Cohesion- Unconfined



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 28-12-2019 -01-01-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 02-01-2020 -04-01-2020
BORE HOLE NO	0:2	DEPTH OF BORE HOLE	: 36.70 m

TEST RESULTS

•.				Grain Size Distribution (%) Consistancy (%)								Limits		Sh Paran	ear neters					
mbei	be			ıe	oistuı)	ravei	atior	Gr	avel		Sand			iit	it		ndex		(əə.	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mc content (%)	Specific G1	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity In	Cohesion (kN/m2)	Friction Angle(Degr	Remarks
SPT 1	DS1	1.5	Silty clay(Brown)	3	24	2.60	CL	0	0	0	0	9	91					2.7		
SPT 2	DS2	3.0	-do-	10	26															
SPT 3	DS3	4.5	Lateritic sandy clay (Yellow,Pink,Brown)	8	41	2.56	CL	0	0	0	14	27	59					11.6		
SPT 4	DS4	6.0	Clay (Black)	5	55	2.70	CH	0	0	0	0	16	84							
SPT 5	DS5	7.5	-do-	5	29	2.77												6.7		
SPT 6	DS6	9.0	Lateritic clayey sand(Black,Yellow)	12	31	2.60	SC	0	0	0	9	47	44					16.4		
SPT 7	DS7	10.5	-do-	14	33														21.3	
SPT 8	DS8	12.0	-do-	16	29	2.60		0	0	0	24	57	19					20.0		
SPT 9	DS9	13.5	Lateritic clayey sand (Yellow,Light grey)	22	24	2.40	SC	0	0	0	0	77	23						18.6	
SPT 10	DS10	15.0	-do-	26	22	2.50												21.3		
SPT 11	DS11	17.0	Lateritic clayey sand(Black,Yellow)	39	24	2.60	SC	0	0	0	7	64	29						28.9	
SPT 12	DS12	19.0	-do-	32	19	2.64												22.9		
SPT 13	DS13	21.0	-do-	38	22			0	0	0	7	59	34							
SPT 14	DS14	23.0	Lateritic medium to fine sand (Light grey)	41	29	2.60	SP	0	0	0	17	71	12						30.0	
SPT 15	DS15	25.0	Lateritic sandy clay (Yellow,Brown)	50	35	2.56	CL	0	0	0	17	26	57					46.8		
SPT 16	DS16	28.0	Lateritic clayey sand (Yellow,Light brown)	45	33	2.64	SC	0	0	0	4	55	41					46.0	30.3	
SPT 17	DS17	31.0	-do-	>50	31	2.63														
Lab in	Charg	ge :	Aparna A G, B Tech	Ch	necked b	y:	Neethu F	R,M Te	ech,Geo	otechni	cal Eng	gg,AM	IE			GSL/O	GTE/L	.R/06/20	020/45	
NOTE: 3 Moisture All the te	Samples we content and sts are cond	ere supplie d Shear te ducted bas	d by client ts conducted on remoulded specimens ed on relevent IS Codes		Test Met Friction A Unconfin	t hods Angle- Dir ied compre	ect Shear	test				Cohe	sion-							

All the tests are conducted based on relevent IS Codes

UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 04-01-2020 -08-01-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 10-01-2020 -14-01-2020
BORE HOLE NO):3	DEPTH OF BORE HOLE	: 36.10 m

TEST RESULTS

					ə.	ty			Grain S	Size Di	stribut	ion (%)	Consi	stancy] (%)	Limits		Sh Parar	ear neters	
nber	e			Ie	istur)	avei	ation	Gr	avel		Sand			it	E.		dex		(ee	
Sample Nui	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valu	Natural Mo content (%)	Specific Gr	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity Ir	Cohesion (kN/m2)	Friction Angle(Degr	Remarks
SPT 1	DS1	1.5	Lateritic clayey Sand (Brown,Grey,Yellow)	5	12	2.60	SC-CL	0	0	0	0	55	45					4.6	-	
SPT 2	DS2	3.0	-do-	6	18	2.70	"	0	0	0	4	49	47					6.0		
SPT 3	DS3	4.5	Clay (Black,Grey)	2	45	2.63	СН	0	0	0	0	6	94	63.0	17.0		46.0	1.5		
SPT 4	DS4	6.0	-do-	4	47															
SPT 5	DS5	7.5	-do-	4	51	2.61														
SPT 6	DS6	9.0	Lateritic clayey Sand (Yellow,Grey)	22	22	2.60	SC-CL	0	0	1	5	50	44					21.6	16.7	
SPT 7	DS7	10.5	-do-	25	20															
SPT 8	DS8	12.0	Lateritic sandy clay (Brown,Grey)	32	28	2.64	CL	0	0	0	0	44	56					32.5	-	
SPT 9	DS9	13.5	Lateritic medium to fine sand with clay (Pink,Grey)	27	26	2.54	SP	0	0	0	24	55	21					21.0	26.1	
SPT 10	DS10	15.0	-do-	31	21	2.63		0	0	0	40	33	27					29.6	27.6	
SPT 11	DS11	17.0	Lateritic gravelly sand (Grey, Dark brown)	45	15	2.60	SP	0	19	21	27	20	13						30.1	
SPT 12	DS12	19.0	Lateritic silty sand (Yellow)	26	33	2.54	SM	0	0	0	0	61	39							
SPT 13	DS13	21.0	-do-	27	30														16.0	
SPT 14	DS14	23.0	-do-	33	30															
SPT 15	DS15	25.0	Lateritic clayey silty sand (Yellow,Light brown)	50	27	2.60	SM	0	0	0	0	54	46						28.6	
SPT 16	DS16	28.0	-do-	51	30														31.0	
SPT 17	DS17	31.0	Fine sand (Grey)	>50	11	2.60	SP	0	0	0	10	85	5						31.2	

Lab in Charge : Aparna A G, B Tech

NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

Test Methods Direct Shear test compression test Friction Angle-

GSL/GTE/LR/06/2020/45

Cohesion- Unconfined



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 10-01-2020 -15-01-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 17-01-2020 -19-01-2020
BORE HOLE NO):4	DEPTH OF BORE HOLE	: 34.3 m

TEST RESULTS

r					re	ity	u	(Grain S	Size Di	stributi	ion (%)	Consi	stancy (%)	Limits		Sho Paran	ear neters	
mbe	ь			ne	oistu)	rave	atio	Gra	avel		Sand			uit	iit		ndex		ree)	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mo content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	1.5	Lateritic clayey sand (Light brown,Grey)	2	26	2.63	SC-CL	0	0	0	2	57	41					1.7	-	
SPT 2	DS2	3.0	-do-	3	22			0	0	0	1	64	35					2.0	10.3	
SPT 3	DS3	4.5	Silty clay (Black,Grey)	2	61	2.64	CH	0	0	0	0	11	89					1.0		
SPT 4	DS4	6.0	-do-	3																
SPT 5	DS5	7.5	-do-	3	65	2.66														
SPT 6	DS6	9.0	Lateritic clayey sand (Brown, Grey)	28	29	2.60	SC-CL	0	0	0	0	62	38					28.6	27.4	
SPT 7	DS7	10.5	-do-	42	41		"	0	0	0	11	64	25					37.8	30.1	
SPT 8	DS8	12.0	-do-	>50	31	2.66	"													
SPT 9	DS9	13.5	Lateritic clayey sand (Grey, Yellow, Brown)	45	26	2.51	SC-CL	0	0	0	24	55	21					40.7	29.6	
SPT 10	DS10	15.0	Lateritic sandy clay (Pink,Grey)	48	36	2.64	CL	0	0	0	1	44	55					37.8		
SPT 11	DS11	17.0	-do-	41	33															
SPT 12	DS12	19.0	Lateritic fine to medium sand (Red,Brown)	46	12	2.59	SP	0	0	0	51	34	15					0.0	31.0	
SPT 13	DS13	21.0	Lateritic clayey sand (Grey,Brown)	45	27	2.53	SC-CL	0	0	0	19	44	37					27.8	28.6	
SPT 14	DS14	23.0	-do-	>50	26															
SPT 15	DS15	25.0	Lateritic clayey sand (Pink, Yellow)	>50	22	2.58	SC-CL	0	0	0	10	51	39					26.0	30.1	

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

Lab in Charge: Aparna A G, B Tech NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample

Test Methods Direct Shear test compression test Friction Angle-Cohesion- Unconfined



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 17-01-2020 -21-01-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 23-01-2020 -26-01-2020
BORE HOLE NO	0:5	DEPTH OF BORE HOLE	: 35.1 m

TEST RESULTS

					re	ity	u	(Grain S	Size Di	stribut	ion (%)	Consi	stancy] (%)	Limits		Sh Parar	ear neters	
mbe	be			ue	oistu)	rave	atio	Gr	avel		Sand			nit	uit		ndex		ree)	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mo content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	1.5	Lateritic clayey sand (Brown,Red,Grey)	3	33	2.60	SC	0	1	1	25	51	22					2.3		
SPT 2	DS2	3.0	-do-	5	26															
SPT 3	DS3	4.5	Silty clay (Grey)	1	41	2.58	CH	0	0	0	0	14	86					0.4		
SPT 4	DS4	6.0	-do-	2	44															
SPT 5	DS5	7.5	-do-	2	52	2.60												1.6		
SPT 6	DS6	9.0	Lateritic clayey sand (Brown,Red,Grey)	15	37	2.61	SC	0	0	0	4	79	17					15.2	26.4	
SPT 7	DS7	10.5	-do-	14	31														26.0	
SPT 8	DS8	12.0	-do-	11	22	2.62		0	0	0	0	70	30					10.6		
SPT 9	DS9	13.5	Lateritic clayey sand (Yellow,Brown)	14	29	2.40	SC	0	0	0	0	67	33					14.7		
SPT 10	DS10	15.0	-do-	39	14	2.64													28.5	
SPT 11	DS11	17.0	-do-	33	16													29.8		
SPT 12	DS12	19.0	-do-	40	17	2.60		0	0	0	0	65	35							
SPT 13	DS13	21.0	Lateritic silty clayey sand(Grey, Brown)	22	26	2.62	SC	0	0	0	0	64	36					20.7		
SPT 14	DS14	23.0	-do-	33	24														25.6	
SPT 15	DS15	25.0	Lateritic silty sand(Pink, Yellow)	>50	11	2.60	SM	0	0	0	7	71	22							
SPT 16	DS16	28.0	-do-	45	16	2.50	"												30.1	

Lab in Charge : Aparna A G, B Tech NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens

All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

Test Methods Direct Shear test compression test Friction Angle-Cohesion- Unconfined



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 23-01-2020-27-01-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 29-01-2020-30-01-2020
BORE HOLE N	0:6	DEPTH OF BORE HOLE	: 36.9 m

TEST RESULTS

L					re	ty	-	(Grain S	Size Di	stributi	ion (%)	Consi	stancy (%)	Limits		Sh Parar	ear neters	
mbei	be			ne	oistu)	ravei	atior	Gra	avel		Sand			uit	üt		ndex		ree)	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Me content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	3.0	-do-	4	25	2.61	SC	0	0	0	1	77	22					2.6	17.6	
SPT 2	DS2	4.5	Sandy clay (Grey)	6	41	2.66	СН	0	0	0	0	41	59					5.5		
SPT 3	DS3	6.0	-do-	1														0.9		
SPT 4	DS4	7.5	-do-	1	42	2.61												0.4		
SPT 5	DS5	9.0	Lateritic clayey sand (Brown,Red,Grey)	9	38	2.65	SC	0	0	0	0	71	29					9.6	20.7	
SPT 6	DS6	10.5	-do-	15				0	0	0	6	70	24					14.6		
SPT 7	DS7	12.0	-do-	21	36	2.40												22.0	25.5	
SPT 8	DS8	13.5	-do-	30	44															
SPT 9	DS9	15.0	Lateritic clayey sand (Yellow,Brown)	36	26	2.65	SC	0	0	0	26	52	22					26.6	28.4	
SPT 10	DS10	17.0	-do-	36	40		"	0	0	0	1	24	75							
SPT 11	DS11	19.0	-do-	46	26													37.6		
SPT 12	DS12	21.0	Lateritic silty clayey sand(Grey,Brown)	42	31	2.61	SC	0	0	0	0	77	23					41.2	30.2	
SPT 13	DS13	23.0	-do-	32																
SPT 14	DS14	25.0	Lateritic silty sand(Pink, Yellow)	>50	21	2.64	SM	0	0	0	2	71	27						31.2	
SPT 15	DS15	27.0	-do-	52	17			0	0	1	6	77	16							
SPT 16	DS16	29.0	-do-	>50	18	2.65													29.8	

Lab in Charge : Aparna A G, B Tech

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample Test Methods Friction Angle- Direct Shear test Cohesion- Unconfined compression test



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 29-01-2020-01-02-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 03-02-2020-05-02-2020
BORE HOLE NO	0:7	DEPTH OF BORE HOLE	: 37.0 m

TEST RESULTS

L					re	ity	I	(Grain S	Size Di	stribut	ion (%)	Consi	stancy (%)	Limits		Sho Paran	ear neters	
mbei	pe			ue	oistu)	ravei	atior	Gr	avel		Sand			nit	uit		ndex		ree)	_
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Me content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I	Cohesion (kN/m2)	Friction Angle(Deg)	Remarks
SPT 1	DS1	3.0	Lateritic clayey sand (Brown,Red,Grey)	6	27	2.60	SC	0	0	0	44	15	41					1.2	17.1	
SPT 2	DS2	4.5	Sandy clay (Grey)	1	33	2.69	CH	0	0	0	10	44	46					0.5		
SPT 3	DS3	6.0	-do-	1				0	0	0	0	45	55							
SPT 4	DS4	7.5	-do-	2	34	2.65												1.8		
SPT 5	DS5	9.0	-do-	8			"	0	0	0	0	41	59							
SPT 6	DS6	10.5	Lateritic clayey sand (Brown,Red,Grey)	16	29	2.60	SC	0	0	0	17	51	32					16.0	26.4	
SPT 7	DS7	12.0	-do-	16	27		"													
SPT 8	DS8	13.5	Lateritic clayey sand (Yellow,Brown)	21	33	2.62	SC	0	0	0	0	58	42					20.8	26.9	
SPT 9	DS9	15.0	-do-	34	40		"													
SPT 10	DS10	17.0	Lateritic silty clayey sand(Grey,Brown)	39	37	2.63	SC	0	0	0	0	62	38					36.4	30.1	
SPT 11	DS11	19.0	-do-	39			"												28.7	
SPT 12	DS12	21.0	-do-	36	30	2.65	"	0	0	0	0	64	36					29.6		
SPT 13	DS13	23.0	-do-	41			"												28.9	
SPT 14	DS14	25.0	Lateritic silty sand(Pink, Yellow)	>50	20	2.61	SM	0	0	0	1	71	28							
SPT 15	DS15	27.0	-do-	>50	21														27.8	
SPT 16	DS16	29.0	-do-	>50	19	2.65	"	0	0	1	1	65	33							

Lab in Charge : Aparna A G, B Tech

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

Direct Shear test

compression test

GSL/GTE/LR/06/2020/45

NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Friction Angle-Cohesion- Unconfined



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 04-02-2020-07-02-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 08-02-2020-11-02-2020
BORE HOLE NO	D:8	DEPTH OF BORE HOLE	: 36.0 m

TEST RESULTS

-					re	ity	ſ	(Grain S	Size Di	stributi	ion (%)	Consi	stancy] (%)	Limits		Sh Parar	ear neters	
mbei	be			ne	oistu)	ravei	atio	Gr	avel		Sand			uit	it		ndex		ree)	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mo content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	3.0	Lateritic clayey sand (Brown,Red,Grey)	7	34	2.56	SC	0	0	0	41	27	32					10.2	21.8	
SPT 2	DS2	4.5	Sandy clay (Grey)	5	59	2.61	CH	0	0	0	20	44	36					4.4		
SPT 3	DS3	6.0	Lateritic clayey sand (Brown,Red,Grey)	2	27	2.63	SC	0	0	0	1	65	34					1.7	14.6	
SPT 4	DS4	7.5	-do-	3	26															
SPT 5	DS5	9.0	Clay(Grey)	5	71	2.67	CH	0	0	0	0	7	93					4.9		
SPT 6	DS6	10.5	-do-	21																
SPT 7	DS7	12.0	-do-	24	65	2.67												26.7		
SPT 8	DS8	13.5	Lateritic clayey sand (Yellow,Brown)	22	29	2.68	SC	0	0	0	5	71	24					19.0	24.5	
SPT 9	DS9	15.0	-do-	41	33			0	0	0	9	65	26							
SPT 10	DS10	17.0	Lateritic silty clayey sand(Grey,Brown)	38	27	2.67	SC	0	0	0	11	61	28					30.7	28.6	
SPT 11	DS11	19.0	-do-	47				0	0	0	12	57	31							
SPT 12	DS12	21.0	-do-	46	26	2.65														
SPT 13	DS13	23.0	Silty clay (White)	45	51	2.61	CH	0	0	0	7	17	76					40.7		
SPT 14	DS14	25.0	Lateritic silty sand(Pink, Yellow)	50	20	2.67	SM	0	0	0	1	77	22					41.0	29.6	
SPT 15	DS15	27.0		26																
SPT 16	DS16	29.0	Lateritic silty clayey sand(Grey, Brown)	47	24	2.60	SC	0	0	0	5	64	31					27.0		

Lab in Charge : Aparna A G, B Tech

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Test Methods Friction Angle- Direct Shear test Cohesion- Unconfined compression test



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 11-02-2020-14-02-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 16-02-2020-19-02-2020
BORE HOLE NO	0:9	DEPTH OF BORE HOLE	: 35.60 m

TEST RESULTS

•					re	ty	-	(Grain S	Size Di	stribut	ion (%)	Consi	stancy (%)	Limits		Sh Paran	ear neters	
mbeı	ы			ıe	oistuı)	ravei	atior	Gra	avel		Sand			it	it		ndex		(əə.	
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mc content (%)	Specific G1	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity In	Cohesion (kN/m2)	Friction Angle(Degr	Remarks
SPT 1	DS1	1.5	Fine sand (Grey, Yellow)	22	16	2.63	SP	0	0	0	0	91	9						24.4	
SPT 2	DS2	3.0	Clayey sand (Brown, Yellow)	8	28	2.66	SC	0	0	0	3	70	27					8.6		
SPT 3	DS3	4.5	-do-	6	31															
SPT 4	DS4	6.0	Silty clay (Grey)	3	33	2.70	СН	0	0	0	0	14	86					2.7		
SPT 5	DS5	7.5	-do-	4	39															
SPT 6	DS6	9.0	-do-	3	41			0	0	0	0	64	36					2.8		
SPT 7	DS7	10.5	Lateritic clayey sand (Yellow, Brown)	27	26	2.65	SC	0	0	0	6	57	37					26.4	28.7	
SPT 8	DS8	12.0	-do-	32	24															
SPT 9	DS9	15.0	Lateritic sand (Yellow, Grey, red)	49	9	2.61	SP	0	0	0	22	70	8						32.2	
SPT 10	DS10	17.0	-do-	47	4															
SPT 11	DS11	19.0	Medium sand with clay (Grey, Yellow)	>50	10	2.64	SP	0	0	0	11	81	8						31.0	
SPT 12	DS12	21.0	-do-	>50	17															
SPT 13	DS13	23.0	-do-	50	11	2.62													31.5	
SPT 14	DS14	25.0	Silty clay (White)	27	30	2.64	СН	0	0	0	0	16	84					20.1		
SPT 15	DS15	28.0	-do-	32	37		"	0	0	0	0	19	81							
SPT 16	DS16	31.0	-do-	33	45	2.54												34.5		

Lab in Charge : Aparna A G, B Tech NOTE: Samples were supplied by client Moisture content and Shear tests conducted on remoulded specimens All the tests are conducted based on relevent IS Codes

UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE

GSL/GTE/LR/06/2020/45

Test Methods Friction Angle- Direct Shear test Unconfined compression test

Cohesion-



Office: AJ Complex, KP I 119 S2 Chandanathope PO, Kollam, Kerala, Pin-691014

E Mail : geostructuralab@gmail.com Contact No : +91 90 377 55 113 ,+91 88 917 888 46

PROJECT	: Soil investigation work for the construction of regulator across Kadalundi river at Moozhikkal Kadavu near	DATE OF BORING	: 17-02-2020-20-02-2020
	Palathingal between Thirurangadi Municipality and Moonniyur Panchayath, Malappuram		
CLIENT	: The Executive Engineer, Minor Irrigation Division, Malapuuram-676505	TYPE OF BORING	: Rotary Drilling
LOCATION	: Palathingal-Parapanagadi site, Malappuram	DATE OF TESTING	: 21-02-2020-24-02-2020
BORE HOLE NO	0:10	DEPTH OF BORE HOLE	: 35.90 m

TEST RESULTS

1					re	ity	-	Grain Size Distribution (%)	Consistancy Limits (%)				Shear Parameters		
mbei	be			ue	oistu)	ravei	atior	Gra	vel Sand				uit	iit		ndex		(ee)		
Sample Nu	Sample Tyl (DS/UDS)	Depth (m)	Soil Description	SPT N Valı	Natural Mc content (%	Specific G	IS Classific	Coarse	Fine	Coarse	Medium	Fine	Silt & Clay	Liquid Lim	Plastic Lim	Shrinkage Limit	Plasticity I ₁	Cohesion (kN/m2)	Friction Angle(Deg1	Remarks
SPT 1	DS1	1.5	Fine sand (Grey, Yellow)	7	10	2.58	SP	0	0	0	0	94	6						21.2	
SPT 2	DS2	3.0	Clayey sand (Brown.Grey)	6	22	2.60	SC	0	0	0	2	75	23						26.0	
SPT 3	DS3	4.5	Silty clay (Grey)	1	41	2.61	CH	0	0	0	0	17	83					0.5		
SPT 4	DS4	6.0	Clayey sand (Brown.Yellow)	2	33	2.66	SC	0	0	0	0	74	26						18.6	
SPT 5	DS5	7.5	Silty clay (Grey)	3	46	2.70	CH	0	0	0	1	19	80					2.7		
SPT 6	DS6	9.0	-do-	3	47													3.3		
SPT 7	DS7	10.5	Clayey sand (Yellow,Grey,Brown)	28	26	2.62	SC	0	0	0	4	75	21						27.0	
SPT 8	DS8	12.0	-do-	24	28															
SPT 9	DS9	13.5	Sandy clay (White, Yellow)	21	54	2.65	CL	0	0	0	0	11	89					22.1	27.7	
SPT 10	DS10	15.0	Sandy clay (Yellow)	24	52	2.66	CL	0	0	0	0	27	73					24.1	27.9	
SPT 11	DS11	17.0	Medium sand(Grey)	49	29	2.58	SP	0	0	0	27	44	29						30.2	
SPT 12	DS12	19.0	-do-	50	10	2.60														
SPT 13	DS13	21.0	-do-	95	9	2.65		0	0	0	28	51	21						31.3	
SPT 14	DS14	23.0	-do-	95	11															
SPT 15	DS15	24.8	-do-	95	7	2.65		0	0	0	77	11	12						31.0	
SPT 16	DS16	28.0	-do-	32	10															
SPT 17	DS17	31.0	Silty clay (White)	29	41	2.66	СН	0	0	0	0	74	26					28.9		
Lab in Charge : Aparna A G, B Tech Checked by : Neethu R,M Tech,Geotechnical Engg,AMIE GSL/GTE/LR/06/2020/45 NOTE: Samples were supplied by client GSL/GTE/LR/06/2020/45																				

Moisture content and Shear tests conducted on remoulded specimens

All the tests are conducted based on relevent IS Codes

UDS/DS - Disturbed Soil Sample and Undisturbed Soil Sample

Friction Angle-Cohesion- Unconfined





CLIENT :- Drawing Of parappanangadi River Site.

Distric: Ma	lappuram	Village :						
Taluk :								
PAPER SIZE = A1	SCALE=1:18	800						
River Bou	Indary Line							
River bot	tom							
Existing F	Road							
Compound Wall								
crosssction line								
Electric Post								
TBM								
Bore hole	9							
Existing	Building							
Bridge								
River								
crossscti	on line level	1.254						
water flo	w direction							
No No All C Leve Eleva Co-ce Co-ce Each Each Each	ote:- Dimensions are in I shown are based ation 7.654 m. ordinate shown an ordinate E=1000,N Grid Interval shown Major Contour Li Minor Contour Li	meters. I on Assuming Bench Mark re based on Assuming I=1000 wing on 3 m ne is Showing on 0.2 m ne is Showing on 0.4 m						

