



# KERALA ENGINEERING RESEARCH INSTITUTE

കേരള എഞ്ചിനീയറിംഗ് റിസർച്ച് ഇൻസ്റ്റിറ്റ്യൂട്ട്

An Institution of Irrigation Department Under Ministry of Water Resources, Govt of Kerala



## ANNUAL REPORT 2022-23

# Annual Report

2022 - 23

***Kerala Engineering Research  
Institute, Peechi***

Publication No. 85

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## **PREFACE**

The Kerala Engineering Research Institute, established in 1960, is one of the pioneering institutes of its kind in our country. The first Prime Minister of India, Sri. Jawaharlal Nehru laid the foundation stone of the Institute and it was inaugurated by the then Governor of Kerala, Sri. Ramakrishna Rao, with a mandate for seeking solutions to Engineering problems which would arise at different stages of planning and execution of development projects in the field of Irrigation, Navigation, Roads and Bridges and Buildings as well. This is the only Research Institute functioning under Kerala State Irrigation department. This Institute is publishing its Annual Report every year.

This report has been prepared to provide a brief record of the activities of the Institute during this Financial Year 2022-23. Details of the organizational set up, personnel, activities of each divisions and the abstract of Financial Statement are included.

This institute is a member of Higher Education Council and involving the formulation of policy decisions. Being a member, the Institute also supporting all technical guidance to coastal studies and protection works. This institute is also listed as a registered Institute for research studies of Calicut University. The institute facilitates training to Engineers and overseers from Irrigation department in Civil Engineering field.

During the year 2022-23, an amount of Rs.29,64,791/- has been collected as revenue. Out of the total outlay of Rs.100 lakhs for the financial year 2022-23, an amount of Rs.65.28002 lakhs has been utilized.(Q bill Amount (Pending @ treasury 22-23) Rs.31.60004 lakhs).

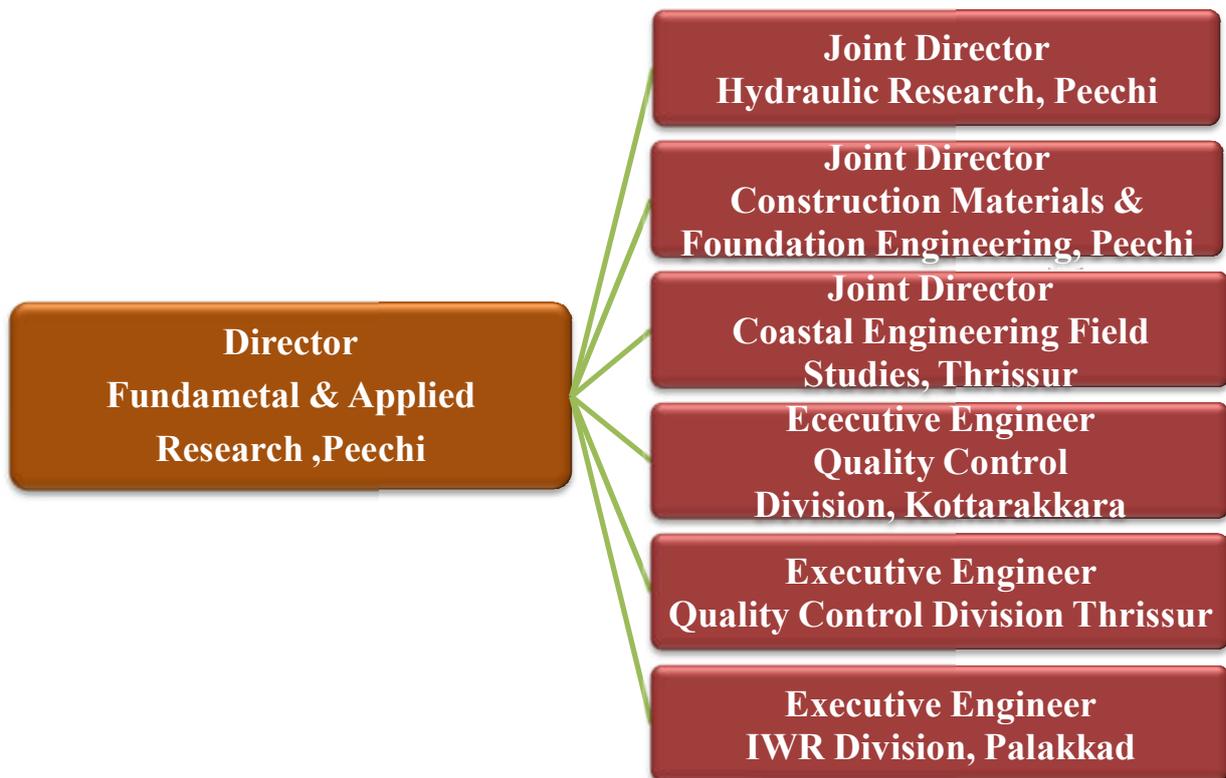
Peechi

Director

## 1. ORGANISATIONAL SET UP

The Kerala Engineering Research Institute is under the Directorate of Fundamental & Applied Research, KERI, Peechi, which is headed by a Director in the rank of Superintending Engineer, with two divisions operating at Peechi, namely the Hydraulic Research and the Construction Materials & Foundation Engineering Division, and another division functioning at Thrissur, namely the Coastal Engineering Field Studies Division, each of which is headed by a Joint Director, an officer in the rank of an Executive Engineer. The Directorate Institute is part of the Water Resources Department's I.D.R.B, which reports to the Chief Engineer, Investigation & Design (IDRB), Thiruvananthapuram.

Each Division has the following organizational structure



**I. Joint Director, Hydraulic Research**

1. Hydraulics Division
2. Sedimentation Division
3. Coastal Engineering Division

**II. Joint Director, CM&FE**

1. Construction Materials Division
2. Soil Mechanics and Foundations Division
3. Instrumentation Division
4. Publications Division

**III. Joint Director, Coastal Engineering Field Studies, Thrissur**

1. Coastal Erosion studies Subdivision, Kozhikkode
2. Coastal Engineering Studies Subdivision, Ernakulam
3. Coastal Engineering Studies Subdivision, Kollam

**IV Executive Engineer, Quality Control Division, Thrissur**

1. Quality Control Sub Division, Kannur
2. Quality Control Sub Division, Kozhikkode
3. Quality Control Sub Division, Palakkad
4. Quality Control Sub Division, Thrissur
5. Quality Control Sub Division, Muvattupuzha

**V Executive Engineer, Quality Control Division, Kottarakkara**

1. Quality Control Sub Division, Kottayam
2. Quality Control Sub Division, Alappuzha
3. Quality Control Sub Division, Kottarakkara
4. Quality Control Sub Division, Thiruvananthapuram

**VI Executive Engineer, Investigationfor Water Resources Division**

1. Investigation for Water Resources Sub Division, Palakkad
2. Investigation for Water Resources Sub Division, Thrissur

The first three divisions are doing research works, laboratory testing and collection of field data related to their respective fields and present valuable results and also analyses results having significant implications in different fields of Civil Engineering and Water Resources Management. Each subdivision has a Deputy Director in the rank of an Assistant Executive Engineer as its head and one or two Assistant Directors in the rank of Assistant Engineer to assist in the research activities.

The Quality Control wing attached to this Directorate has been constituted for the purpose of quality assurance of works of Irrigation Department. The jurisdiction of this wing is all over Kerala. There are 18 sections, under 9 Sub divisions, at Thiruvananthapuram, Kollam, Kottarakkara, Pathanamthitta, Allappuzha, Idukki, Kottayam, Aluva, Moovattupuzha, Koothattukulam, Angamaly, Thrissur, Palakkad, Malappuram, Kozhikode, Kalpetta, Kannur and Kasaragod.

Investigation Division for Water Resources Division, Palakkad is a newly formed office, under the control of Chief Engineer, IDR B and the Director, F & AR, KERI, Peechi, is functioning at Palakkad. There is a sub Divisions under this office at Palakkad.. There are three section offices under this sub divisions.

## 2. PERSONNEL

The Executive officers who headed the various offices under KERI during the financial year 2022-23 are:

<b>DIRECTORATE OF FUNDAMENTAL &amp; APPLIED RESEARCH</b>	
<b>DIRECTOR</b>	Er. Suprabha. N (from 01/04/2022to 31/03/2023)
<b>ASSISTANT DIRECTOR</b>	Er. Naveen. C.L (from 01/04/2022 to 31/03/2023)
<b>JOINT DIRECTOR, CONSTRUCTION MATERIALS &amp; FOUNDATION ENGINEERING</b>	
<b>JOINT DIRECTOR</b>	: Er. Geetha E S (from 01/04/2022 AN to 31/03/2023)
<b>ASSISTANT DIRECTOR</b>	: Er. Smitha.V.R. ( from 01/04/2022 to 22/09/2022 ) Er. Jomy Joseph. ( from 23/09/2022 to 26/09/2022 ) Er. Jomy Joseph. ( from 13/10/2022 to 15/10/2022 ) Er. Roshni.S.S.( F.A.C.from 27/10/2022 to 11/11/2022 ) Er. Roshni.S.S.( F.A.C.from 21/11/2022 to 20/12/2022 ) Er. Roshni.S.S.( F.A.C.from 21/12/2022 to 20/03/2023 ) Er. Roshni.S.S.( F.A.C. from 22/03/2022 to 31/03/2023 )
<b>CONSTRUCTION MATERIALS DIVISION</b>	
<b>DEPUTY DIRECTOR</b>	Er. Sufeera O.B. (01-04-2022 to 31-03-2023)
<b>ASSISTANT DIRECTOR I</b>	: Er. Siji T.V. (From 01.04.2022 to 21.01.2023) Vaccant
<b>ASSISTANT DIRECTOR II</b>	Er. Rappai V.V. (From 01.04.2022 to 31.05.2023) Er.Lakshmi S ( From 23/12/2022 to 31/03/2023)
<b>SOIL MECHANICS AND FOUNDATIONS DIVISION</b>	

<b>DEPUTY DIRECTOR</b>	:	Rameshkumar T V(From01/04/2022 to 31/03/2023)
<b>ASSISTANT DIRECTOR I</b>	:	Er. JoyalScaria ( from 01/04/2022 to 31/03/2023)
<b>ASSISTANT DIRECTOR II</b>	:	Er. Jomy Joseph (from 01/04/2022 to 31/03/2023)
<b>INSTRUMENTATION DIVISION</b>		
<b>DEPUTY DIRECTOR</b>	:	Er. Saju Varghese (from 01/04/2022 to 31/03/2023)
<b>ASSISTANT DIRECTOR</b>	:	Er .Arun K A ( from 01/04/2022 to 31/03/2023)
<b>PUBLICATIONS DIVISION</b>	:	Post Abolished
<b>HYDRAULIC RESEARCH</b>		
<b>JOINT DIRECTOR</b>	:	Er . Shini K K ( From 01/04/2022 to 31/03/2023
<b>ASSISTANT DIRECTOR</b>	:	Er. Saji George (From 01/04/22 to 31/03/2023)
<b>HYDRAULICS DIVISION</b>		
<b>DEPUTY DIRECTOR</b>	:	Er. Suhurban BeegumV (From 01/04/2022 to 31/05/2022 ) Er . Sina P Ravindran ( From 28/01/2023 to 31/03/2023 )
<b>ASSISTANT DIRECTOR I</b>	:	Er. Nisha Antony ( From 01/04/2022 to 30/07/2022,AC ) Er. Ganaraj K ( from 01.08.2022 to 31.03.2023)
<b>ASSISTANT DIRECTOR II</b>	:	Er. Nisha Antony ( From 01/04/2022 to 31/03/2023 )
<b>COASTAL ENGINEERING DIVISION</b>		
<b>DEPUTY DIRECTOR</b>	:	Er.RajiThampan ( from 01.04.2022 onwards)
<b>ASSISTANT DIRECTOR I</b>	:	Er. Devarajan K ( from 01/04/2022 onwards )
<b>ASSISTANT DIRECTOR II</b>	:	Er.Anoop R (from 13.04.2022 onwards)
<b>SEDIMENTATION DIVISION</b>		
<b>DEPUTY DIRECTOR</b>	:	Er.Divya C J (From 01-04-2022 onwards)
<b>ASSISTANT DIRECTOR I</b>	:	Er. Roshni S S (from 01/04/2022 onwards )
<b>ASSISTANT DIRECTOR II</b>	:	Er .Jayasree K V (From 01/04/2022onwards)
<b>COASTAL ENGINEERING AND FIELD STUDIES</b>		
<b>JOINT DIRECTOR</b>	:	Er. Ajmal. E ( from 01/04/2022 to 31/03/2022) Er. Beena N ( from 25/10/2022 to 31/03/2023 )

<b>ASSISTANT DIRECTOR</b>	Er. Anusree.A (Full additional charge from 01/04/2022 to 14/06/2022)
	Er. Suneer K M. (From 15/06/2022 to 31/03/2023)
<b>COASTAL ENGINEERING SUB DIVISION , KOLLAM</b>	
<b>DEPUTY DIRECTOR</b>	Er. Rajeena M (from 01/04/2022to 12/06/2022)
	Er.Raji C T(13/06/2022to15/12/2022)
	Er.Shiji P R(15/12/2022 FN-16/12/2022 FN (FAC)
	Er. Sugesh Krishna C P (from 16/12/2022 to 31/03/2023)
<b>COASTAL ENGINEERING SECTION, TRIVANDRUM</b>	
<b>ASSISTANT DIRECTOR</b>	Er.Ajin Singh S (from 01/04/2022 to 21/11/2023)  Er. Anusree A ( From 20/02/2023 to 31/03/2023)
<b>COASTAL ENGINEERING SECTION ,KOLLAM</b>	
<b>ASSISTANT DIRECTOR</b>	Er. Rajeena M (From 01/04/2022 to 21/11/2022)  Er. Shiji P R ( From 21/11/2022 to 31/03/2023 )
<b>COASTAL ENGINEERING SECTION, THOTTAPPALLY</b>	
<b>ASSISTANT DIRECTOR</b>	Er.Sri.Jayaprakash. D. (From 01/04/2022 to 06/05/2022)  Er.Ajin Singh S (from 07/05/2022 to 05/01/2023, FAC)  Er. Fathima R ( From 05/01/2023 to 31/03/2023)
<b>COASTAL ENGINEERING SUB DIVISION, ERNAKULAM</b>	
<b>DEPUTY DIRETOR</b>	: Er. T.K. Rajesh (from 01/04/2021 to 26/10/2022 )  Er. Clament Roy . K. R ( from 27/10/2022 to 19/12/2022 ,FAC)  Er. Kamal Roy ( from 19/12/2022 to 31/03/2023 )
<b>COASTAL ENGINEERING SECTION, ERNAKULAM</b>	
<b>ASSISTANT DIRECTOR</b>	: Er. Anusree A ( from 01/04/2022 to 31/10/2022)  Er. Clament Roy . K. R ( from 01/11/2022 to 18/11/2022 ,FAC)  Er. Deepu S ( from 19/11/2022 to 31/03/2023)
<b>COASTAL ENGINEERING SECTION, CHERTHALA</b>	
<b>ASSISTANT DIRECTOR</b>	Er. Clament Roy . K. R ( from 01/04/2022 to 31/03/2023)

**COASTAL ENGINEERING SECTION, CHAVAKKAD**

**ASSISTANT DIRECTOR** : Er. Ajantha V.D ( from 01/04/2022 to 31/03/2023)

**COASTAL EROSION STUDIES , SUB DIVISION, KOZHIKODE**

**DEPUTY DIRECTOR** : Er. Abbas M T .( from 01/04/2022 to16/07/2022)  
Er. Ammad.P.C ( from 17/07/2022 to 27/07/2022,FAC)  
Er. Abbas M T .( from28/07/2022 to28/02/2023)  
Er. Jithin.P ( from 01/03/2023 to 31/03/2023,FAC)

**COASTAL EROSION STUDY SECTION, KOZHIKODE.**

**ASSISTANT DIRECTOR** : Er. Jithin.P ( from 01/04/2021 to 31/03/2022)  
Er.Bindu K I( from 11/04/2022 to 05/12/2022)  
Er. Jithin.P ( from 05/12/2022 to 31/03/2023,FAC)

**COASTAL EROSION STUDIES SECTION, THALASSERY**

**ASSISTANT DIRECTOR** : Er. Sri. Asharaf.P (01/04/2022 to 31/05/2022)  
Er. Ammad.P.C ( from 01/06/2022 to 01/12/2022,FAC)  
Er. Sri. Jithin.P ( from 02/12/2022 to 31/03/23)

**COASTAL EROSION STUDIES SECTION, PARAPPANANGADI**

**ASSISTANT DIRECTOR** : Er. Ammad.P.C ( from 01/04/2021 to 31/12/2022)  
Er. Sri. Jithin.P ( from 01/01/2023 to 31/03/23,FAC)

**QUALTY CONTROL DIVISION, THRISSUR**

**EXECUTIVE ENGINEER** : Er. Sajeev Kumar V S (from (01/04/2022 to 20/06/2022)  
Er. DeepaR.Technical Assistant (AEE)(F.A.C  
,21/06/2022 to 05/07/2022)  
Er. Sajeev Kumar V.S (from 06/07/2022 to 31/03/2023)

**ASSISTANT EXECUTIVE ENGINEERS**

**Q.C. DIVISION, THRISSUR** : Er. Deepa R ( from 01/04/2022 to 10/06/2022)  
Er. Babu.M.S(F.A.C ,From 11/06/2022 to 19/06/2023)  
Er. Deepa .R ( From 20/06/2022 to 01/08/2022)  
Er. Babu.M.S(F.A.C, From 02/08/2022 to 07/08/2022)  
Er. Deepa .R ( From 08/08/2022 to 20/08/2022)  
Er. Babu.M.S (F.A.C , From 21/08/2022 to 25/08/2022)  
Er. Deepa .R ( From 26/08/2022 to 10/02/2023)  
Er. Babu.M.S(F.A.C , From 11/02/2023 to 16/02/2023)  
Er. Deepa .R ( From 17/02/2023 to 31/03/2023)

**Q.C. SUB DIVISION, MOOVATTUPUZHA** : Er. Kamal Roy K V (From 01/04/2022 to 17/12/2022 )  
Er. Gopu N, A.C (From 18/12/2022 to 28/02/2023 )  
Er. Kamal Roy K V (From 01/03/2023 to 31/03/2023 )

**Q C SUB DIVISION , THRISSUR** : Er. Babu M S (01/04/2022 to 31/03/2023)

QC SUB DIVISION , PALAKKAD	Er. Kamal Roy K V (01/04/2022 to 16/12/2022 ) Er. Raji C T ( from 16/12/2022 to 31/03/2023)
QC SUB DIVISION , KOZHIKODE	Er. Rajeev.B ( from 01/04/2022 to 31/05/2022) Er. Nirish.P.P ( A.C ) ( from 01/06/2022 to 23/06/2022) Er. Leena V K ( from 19/12/2022 to 31/03/2023)
QC SUB DIVISION, KANNUR	: Er. SahadevanChadayan (from 01/04/2022 to 31/03/2023)
Q.C SECTION-I, MOOVATTUPUZHA	Er. Gopu N (from 01/04/22 to 29/04/2022)
Q.C SECTION-II, KOOATHATTUKKULAM	Er. Gopu N (from 01/04/22 to 31/03/2023) Er. AswathyVijayan (from 30/04/22 to 31/03/2023)
Q.C SECTION-III, ANGAMALY	Er. Rahna U.A ( from 01/04/2022 to 20/06/2022)
	Er. Sabna Thomas B L (from 21/06/2022 to 31/03/2023)
Q.C SECTION, THRISSUR	Er. Nirish P P (F.A.C from 01/04/2022 to 20/06/2022) Er. Christeena Jose (from 21/06/22 to 31/03/2023)
Q.C SECTION, ERNAKULAM	Er. Rahna V A ( from 01/04/2021 to 31/03/2023)
Q.C SECTION, PALAKKAD	Er. Padmakumar.C( FAC from 01/04/2022 to 09/05/2022) Er. Lakshmi.S (from 09/05/22 to 22/12/2022) Er. Christeena Jose (from 22/12/22 to 31/03/2023)
Q.C SECTION, MALAPPURAM	Er. Pankajakshan.A.M,(F.A.C from 01/04/2022 to 01/12/2022) Er. Haniya( from 01/12/2022 to 11/01/2023) Er. Nirish.P.P ( F.A.C ) from 11/01/2023 to 28/01/2023) Er. Haniya( from 28/01/2023 to 31/03/2023)
Q.C SECTION, KOZHIKODE	Er. Pankajakshan.A.M,(.A.C from 01/04/2022 to 15/05/2022) Er. Vishnu K ( from 16/05/2022 to 31/03/2023 )
Q.C SECTION, WAYANAD	Er. Nirish P P (from 01/04/2022to 31/03/2023)
Q.C SECTION, KANNUR	Er.JitheshVattappara ( from 01/04/2022 to 31/03/2023 )
Q.C SECTION, KASARAGOD	Er. Pankajakshan A M ( from 01/04/2022 to 31/03/2023)
<b>QUALITY CONTROL DIVISION, KOTTARAKKARA</b>	
<b>EXECUTIVE ENGINEER</b>	: Er. Jolly Susan Cheriyan (from 01/04/2022 to 31/05/2022) Er.Leenakumari P. S. (FAC from 31/05/2022 to

	27/07/2022) Er. Merin Thomas (FAC from 29/07/2022 to 02/11/2022) Er. Anjana G S (from 02/11/2022to 31/03/2023)
<b>QUALITY CONTROL SUB DIVISION, KOTTARAKKARA</b>	
<b>ASSISTANT EXECUTIVE ENGINEERS</b>	: Er.Laly.S.S (from 01/04/2022 to 31/05/2022) Er. SheejaPanicker (FAC from 31/05/2022 to 16/01/2023) Er. Ajayakumar K ( from 16/01/2023 to 31/03/2023)
<b>QUALITY CONTROL SECTION, KOTTARAKKARA</b>	
	Er. SheejaPanicker (FAC from 01/04/2022 to 28/02/2023) Er.Rajeena.M (FAC from 28/02/2023 to 29/03/2023) Er. NehaYohannan (from 29/03/2023 to 31/03/2023)
<b>QUALIYY CONTROL SUB DIVISION, THIRUVANANTHAPURAM</b>	
<b>ASSISTANT EXECUTIVE ENGINEER</b>	Er.Leenakumari P. S. (from 01/04/2022 to 31/03/2023)
<b>QUALITY CONTROL SUB DIVISION, KOTTAYAM</b>	
<b>ASSISTANT EXECUTIVE ENGINEER</b>	Er. Merin Thomas (FAC from 01/04/22 to 31/03/2023)
<b>QUALITY CONTROL SUB DIVISION, ALAPPUZHA</b>	
<b>ASSISTANT EXECUTIVE ENGINEER</b>	Er. Jessy Thomas ( from 01/04/2023 onwards)
Q.C. SECTION , PATHANAMTHITTA	Er.Deepa B (from 01/04/2022 onwards)
Q.C,SECTION , ALAPPUZHA	Er. Anjana S (from 01/04/2022 onwards)
Q.C SECTION, TVPM	Er.Ambili I (from 01/04/2022 to 31/03/2022)
Q.C SECTION, KOLLAM	Er.Bindu R (from 01/04/2022 to 21/11/2022) Er.Rajeena M (from 21/11/2022 to 31/03/2023)
Q.C SECTION, KOTTAYAM	Er. Jayadev P S ( from 01/04/2022 to 31/03/2023)
Q.C SECTION, IDUKKI	Er. Jomi G Jose (from 01/04/2022 to 31/03/2023)
<b>INVESTIGATION FOR WATER RESOURCES DIVISION, PALAKKAD</b>	
<b>EXECUTIVE ENGINEER</b>	: Er.Unnikrishnan K V (from 01/04/2022 to 28/02/2023) Er.Geetha.E.S(from 01/03/2023 to 31/03/2023)
<b>ASSISTANT EXECUTIVE ENGINEER</b>	: Er. Sajitha M(from 01/04/2022 to 22/12/2022) Er. Padmakumar C (from 23/12/2022 to 24/01/2023) Er. Suma P .B (from 25/01/2023 to 31/03/2023)

**IWR SUBDIVISION NO.1, PALAKKAD**

<b>ASSISTANT EXECUTIVE ENGINEER</b>	:	Er. Deepa S Koomullil ( From 01/04/2022 to 15/12/2022) Er. Padmakumar (from 16/12/2022 to 15/01/2023,FAC) Er. Visalam E.A (from 16/01/2023to 13/02/2023)
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**IWR SUBDIVISION NO.2, THRISSUR**

<b>ASSISTANT EXECUTIVE ENGINEER</b>	:	Er. Rajashree R ( From 01/04/2022 to 16/12/2022) Er.Sunish K.R (from 17/12/2022 to 31/12/2022) Er.SeenaBeegum S (from 30/01/2023 to 13/02/2023)
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**ASSISTANT ENGINEERS**

IWR SECTION 1/1, PALAKKAD	:	Er. Padmakumar (from 01/04/2022 to 31/03/2023)
IWR SECTION 2/1, NILAMBUR	:	Er. Padmakumar (from 01/04/2022 to 06/06/2022,FAC) Er.RiswanaPulikkuth(from 06/06/2022 to 13/02/2023,AC)
IWR SECTION 3/1, AGALI	:	Er. Padmakumar (from 01/04/2022 to 31/03/2023,FAC)
IWR SECTION 4/1, KOZHIKODE	:	Er. Padmakumar (from 01/04/2022 to 31/03/2023,FAC)
IWR SECTION 1/2, THRISSUR	:	Er. Padmakumar (from 01/04/2022 to 01/06/2022 FAC) Er.Sunish K .R (from 01/062022 to 13/02/2023)
IWR SECTION 2/2, PEECHI	:	Er. Padmakumar (from 01/04/2022 to 01/06/2022,FAC) Er.Sunish K .R (from 01/06/2022 to 13/02/2023)
IWR SECTION 3/2, MALAPPURAM	:	Er. Padmakumar (from 01/04/2022 to 06/06/2022,FAC) Er.RiswanaPulikkuth(from 06/06/2022 to 31/03/2023)
	:	Er.RiswanaPulikuth ( from 06/06/2022 to 31/03/2023)

### **3. HUMAN RESOURCES**

The human resources of KERI comprise of both technical and non-technical personnel. During its prime, majority of the engineers working in KERI were post graduates in different disciplines of Civil Engineering. The number of fundamental researches was carried out during the period, bear witness to this. KERI was well known all over India and abroad for the research works and experimental studies carried out in this institute, especially in the field of Coastal engineering. In the past three decades, no significant fundamental studies have been carried out and the labs have gradually degenerated to the status of mere testing centres.

At present, out of the fourteen posts of Assistant Engineers, One post is lying vacant. The number of supporting technical staff in the category of draftsman is Twenty One against a sanctioned strength of twenty-five. In the workers category, as it happens to be a vanishing category, just two workers are available at present. Workers are hired on contract basis or on daily wages as per requirement.

However, a sincere and commendable effort is being made by the staff to take up all the projects assigned to it. The vacancy position of KERI is attached as Appendix – I.

### **4. FUNCTIONING OF THE INSTITUTE**

The Kerala Engineering Research Institute consists of seven divisions functioning at Peechi as well as Coastal Engineering and Field studies Division at Thrissur and Quality Control wing of the Irrigation Department. Generally, the activities of each division can be categorized as falling under Routine activities, Fundamental studies and Revamping and Modernization. The routine activities and fundamental studies conducted by each division are enumerated in this chapter.

## **A. HYDRAULICS DIVISION**

## **HYDRAULICS DIVISION**

### **1. INTRODUCTION**

Hydraulics Division works under the Joint Director, Hydraulic Research. The division conducts studies on various problems in Applied Hydraulics and Irrigation Engineering and provides solutions for the same. This has been achieved by conducting model studies of the actual/proposed hydraulic structures in the laboratory. The studies consider wide range of parameters related to spillways, sluices, chutes, energy dissipating arrangement, hydraulic behavior of canal structures, river training works etc. From these studies, hydraulically sound and economically viable solutions are provided to various challenges associated with projects.

There are two model areas under this division which accommodate a number of previous extensive project models. The maintenance of this model area is done by this division for demonstration purposes. The hydraulic models in these model areas help the students to visualize about dams, and understand better about the modeling. The division also maintains a three-dimensional model of Kerala and it is a centre of attraction for the tourists in Peechi.

Hydraulics Division had the facility for calibration of the current meter and it was stopped long years ago due to damage of the testing facility. The renovation work of test facility of calibration of current meter is included in the action plan of the financial 2022-23 which will enable KERI to provide this service for the Irrigation department, especially for the hydrology wing. The division has notch calibration facility as well. The division office is also entrusted with providing internet facilities of all offices in KERI.

Apart from the hydraulic studies, the division maintains a meteorological station. It is located on the west bank of Peechi dam, near Peechi House. From the station, measurements of weather parameters such as atmospheric pressure, temperature (Min.& Max), humidity, rainfall, evaporation, wind speed, wind direction and sunshine are observed using manual meteorological observations and automatic weather station. The monthly weather data as obtained is submitted to the Joint Director, Director and Superintending Engineer Hydrology, every month.

### **2. STAFF PATTERN**

The division is headed by a Deputy Director and the technical cadre comprises of two Assistant Directors, two Research Assistants, one Second Grade Overseer and one Third

Grade Overseer. The total sanctioned strength of the office is 9. The present staff details are given below.

Deputy Director	:	Er. Divya C.J (Additional charge 23/05/2022 FN to 27/01/2023) Er.Sina.P. Raveendran (from 28/01/2023 FN onwards)
Assistant Director	:	1. Er. Nisha Antony (from 25/01/2019 AN onwards) 2 Er. Ganaraj.K (from 01/08/2022 FN onwards)
Research Assistant	:	1.Smt.Nisa.v.p (from 16/11/2021 FN to 27/09/2022 AN)
Second Grade Overseer	:	Vacant
Third Grade Overseer	:	Smt Prabini V K (from 17/02/2022 onwards)
Clerk cum Typist	:	Smt. Radha. M.V(from 11/2/2013 onwards)
Part time sweeper	:	Vacant

### **3. ACTIVITIES OF THE YEAR 2022-23**

During the year 2022-23, with sanctioned budget of Rs.40.00 lakhs, following were the major activities of the division

#### 1. Hydraulic studies

Model study of Kuttiyadi Dam Phase II

#### 2. Infrastructure

Renovation of Kerala Model and Hydraulics division office

Renovation of office Joint Director,Hydraulic Reserch and Directorsoffice

#### 3. Instrumentation

Development of canal flow calibration and automation model at KERI, Peechi

Phase1

#### 4. Routine works of the division

Routine works of Hydraulic division office for the year 2022-23

Routine Maintenance of Kerala Model and building housing Model for the year 2022-23

Routine maintenance of Meteorological stations for the year 2022-23

Routine maintenance and renovation of Model area 1 and II for the year 2022-23

Maintenance and yearly charges of FTTH internet connection of KERI Offices  
for the year 2022 – 23

### 3.1 Initial setup and Physical Model Study of Kuttiyadi Dam

Based on the recommendation of the committee on dam safety it was decided to modify the spillway of the Kuttiyadi dam. Chief Engineer, IDR B, Thiruvananthapuram (Vide Lr.No. No:675/DAMS-AD6/1987/IDRB-Part File I dated 30.04.2018) directed KERI to undertake the physical modelling of the proposed modification of spillway of Kuttiyady dam. The study involves in verifying the flow characteristics of the proposed modification of spillway and stilling basin for energy dissipation. Based on their technical advice an initial set up for conducting the physical model study of dam was developed in the hydraulics lab. The initial setup included water proofing of overhead tank, setting up of water circulation system, underground sump for storing water etc. After developing the model the hydraulic parameters of the dam spillway and energy dissipation arrangements were studied.

#### 3.1.1 Details of Kuttiyadi Dam

It is a straight gravity masonry dam constructed across Kuttiyadi river in Kozhikode district. It utilizes the tailrace discharge of the Kuttiyadi power house at its upstream. The masonry dam has a length of 171 m. The spillway is located in the masonry dam and has 4 vents of size 12.20m x 6.10m with radial shutters. The Full Reservoir Level (FRL) is +44.41m and the crest level of spillway is +38.44m. The top level of the dam is +46.85m. The details of the dam is given below in table 1.

Description	Reduced Level
Maximum water level	+44.640 m
Full reservoir level	44.410 m
Crest level of dam	38.440m
Dam height	27.75 m
Length of dam	171 m
No of spillways	4
Maximum discharge	1584 m <sup>3</sup> /s

### **3.1.2 Details of the model**

The model of the prototype spillway of the Kuttiyadi dam was constructed to a scale of 1: 60 in the Hydraulics laboratory of Hydraulics Division, KERI. Out of four bays, an undistorted model of two bays was constructed at two different downstream bed levels (having downstream bed level at +15.0 m and +16.5 m) as in prototype. Among the two bays, the centre bay is at +15.00 m and end bay is +16.50 m as in Fig. 1, following the Froude's model law, for scaling the parameters in order to achieve dynamic similarity between the model and prototype. An Ogee type of spillway model with stilling basin and energy dissipater corresponding to the prototype was constructed according to the scaled dimensions in model following the scale ratio. The spillway was also provided with shutters so as to control the flow of water from the reservoir to the downstream. The reservoir with head maintaining facility, facility for discharge measurement, pressure head measurement, flow profile plotting along the spillway flow path also exist in the model. The discharge measurement was done using a calibrated V - notch. The model set up along with elevation of the spillway is shown in Fig. 1, with the piezometer tapings (Sp1 to Sp15) provided to measure the pressure head when the flow occurs over the spillway. The design discharge adopted for the model building of spillway as supplied by IDRB is 1584 m<sup>3</sup>/s. Based on the details supplied by the Irrigation Design and Research Board (IDRB) on the modified design of the spillway, the physical model of the prototype spillway was simulated in the hydraulics laboratory of KERI considering Froude's similitude, and the performance of the model was analysed. The details pertaining to the spillway model building, model observations, analysis are discussed.



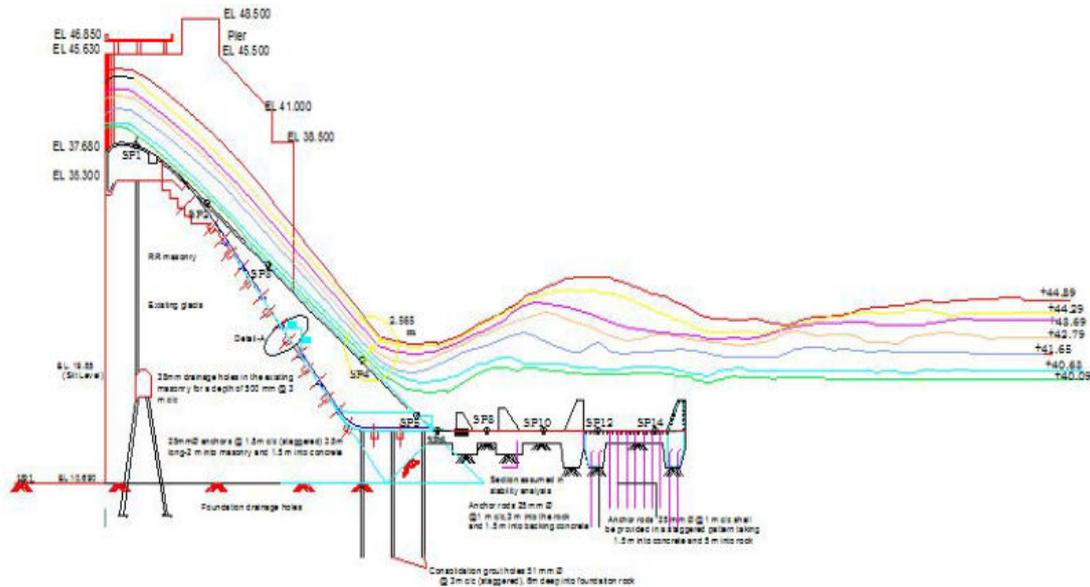
### Model details

The flow simulation through the Ogee spillway was carried out for different discharges between the minimum to the maximum corresponding to the maximum water level in the prototype. Several trials were done and flow characteristics were observed. The details of the pressure head values were recorded in the piezometer tapings. The actual discharge corresponding to different head water over the spillway crest was measured using the calibrated V notch. For the spillway having effective length 'Le' and the head over the crest 'H', the discharge co-efficient 'C' in the discharge equation for the spillway  $Q = C Le H^{3/2}$  were estimated for different discharges. Based on the theoretical and the actual discharge values corresponding to different water levels, the co-efficient of discharge of the spillway is estimated. The initial depth of flow and the sequent depth for the hydraulic jump were

measured and the velocity and Froude number at the salient points of jump were estimated. Report of Third modification is submitted.

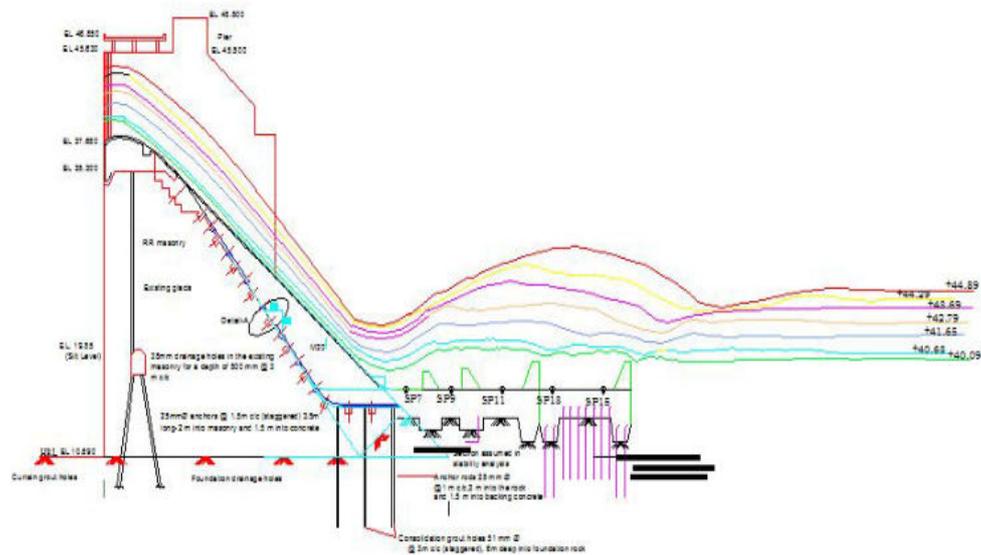
### 3.1.4 Discussion

By simulating site conditions, a physical observation of the jump in the stilling basin was done to see the flow pattern and energy dissipation.



OVER FLOW SECTION & CENTRE SPILL WAY

**Figure1: showing hydraulic jump in centre spillways**



OVER FLOW SECTION & SIDE SPILL WAY (LEFT SIDE)

**Figure 2: showing hydraulic jump in side spillways**

## **3.2 Meteorological Station, KERI, Peechi**

Weather observations are necessary to improve meteorological services in the state and enhance the predictive capability of short and long-term information for weather forecasts and climatic changes. The weather data is used for the real-time preparation of weather analysis, forecasts and severe weather warnings, for the study of climates, for local weather dependent operations, for hydrology and agricultural meteorology and for research in meteorology and climatology. The meteorological Station under K E R I, Peechi is located on the west bank of Peechi Dam, near the Peechi House at a latitude of 10° 31'30'' N, longitude 76° 21' 59'' E and height above MSL +96.03 m. The station is equipped with instruments for manual weather observations and an automatic weather station (AWS) for recording different weather parameters. The weather parameters are observed and recorded daily at 8.30 AM. The station is equipped with the instruments for measuring manually the weather parameters namely Atmospheric Pressure, Temperature, Humidity, Rainfall, Evaporation, Wind speed, Wind direction and Bright Sunshine.

### **3.2.1 Automatic Weather Station**

As part of modernization, an automatic weather station was installed in June 2014. Time series observations are vital to improve the understanding of weather dynamics and its variability. The automatic weather station (AWS) plays an important role in providing short term and long-term time series weather observations. Automatic weather station is functioning with a solar panel for uninterrupted power supply.



The Automatic Weather station collects data related to air temperature, air humidity, barometric pressure, ultrasonic wind speed, ultrasonic wind direction, global radiation and precipitation using different sensors. These data can be accessed using a software HYDRAS.

The data collected can be used to gauge current weather conditions and to make weather forecasts like temperature high/low, cloud cover and the probability of precipitation.

#### Components of Automatic Weather Station

1. Ultrasonic Wind speed and Direction sensor & Compass
2. Global Radiation Sensor
3. Temperature, Humidity, Barometric Pressure Sensors
4. Rain Gauge
5. Data Logger



**Automatic Weather Station - Instruments**

#### 3.2.2 Manual Weather Station

Manual measurements of meteorological data are done using the following instruments.

- Temperature – Max & Min Thermometers & Bimetallic Thermograph
- Relative Humidity – Psychrometer (Dry & Wet bulb) & Hair Hygrometer
- Rainfall – Standard Rain Gauge, Self Recording Rain gauge
- Evaporation – Land Pan Evaporimeter
- Wind Direction – Wind Vane
- Wind Speed – Cup Anemometer
- Bright Sunshine – Sunshine Recorder



**PSYCHROMETER**



**HAIR HYGROMETER**



**BIMETALLIC THERMOGRAPH**



**FLOAT TYPE SELF RECORDING RAIN GAUGE**



**STANDARD RAIN GAUGE**



**LANDPAN EVAPORIMETER**



**WIND VANE**



**CUP ANEMOMETER**



**SUNSHINE RECORDER**

**Weather Station- Instruments for manual recordings of weather data**



**Graph for temperature, annual rainfall, 10 days chart for rainfall, monthly chart for rainfall etc.**

### **3.3 Maintenance of 3D model of Kerala and the building housing the model**

The Relief map of Kerala (Kerala model) at K.E.R.I. is a three-dimensional model of Kerala and it is a centre of attraction of tourists in Peechi. Routine maintenance of the building had been done by this office regularly. In addition to this, artistic painting of model and building was done in this year by arranging a separate work departmentally. 3D model of Kerala has been painted with colorful paints for each district and markings for National Highway, State Highway, Railway Line and Rivers with suitable colours. Three display boards also placed on walls of the building displaying details of rivers, and dams in Kerala and National Highways passing through Kerala State. Now this building was rectified and beautified.





maintenance of model area I & II for the year 2022-23. The routine works include office maintenance, maintenance and service of instruments at meteorological station, maintenance and repair works for 3D Kerala model and maintenance and clearing of model areas etc. As part of the development of infrastructure for model study, Development of canal flow calibration and automation model at KERI, Peechi –Phase-1

Kerala Engineering Research Institute consists of various offices located in the KERI campus. High speed and stable internet connection is essential for smooth functioning of these offices and their activities as most of the processes of the Department are being switched over to the web platform. The payment of the annual charges for internet provided by BSNL and the routine maintenance and repair works of the internet facility is managed by this office.

### **3.5 Calibration of notches**

Notches are used for measurement of discharge through open channels by placing or constructing them across the stream or channel. The discharge over notch is measured by measuring the head acting over the notch. The actual discharge and theoretical discharge will be equated using a suitable coefficient of discharge and a factor for the head of flow. The process of assessing these constants is called calibration. Once the equation relating discharge and head of flow over the notch is established by calibration experiment, the discharge at any point in a channel can be estimated by fixing the notch across the channel and measuring the head of flow.



**Notch Calibration Facility**

The notch calibration tank situated at outdoor Model Area I is generally used for the calibration of notches received from various irrigation projects of Kerala. In this year we have not received any new notches for calibration.

**B. COASTAL ENGINEERING**  
**DIVISION, KERI, PEECHI**

## COASTAL ENGINEERING DIVISION, KERI, PEECHI

### 1. INTRODUCTION

Coastal Engineering Division has been started functioning from the beginning of the Kerala Engineering Research Institute itself. This division was established for the purpose of conducting research works on behavior of coastal shoreline of Kerala state. Several research on coastal protection measures, experimental study of wave run up on beaches, experiments to evolve suitable artificial blocks, study on waves and currents, mud banks, wave action on beaches, littoral drifts, artificial nourishment, model study of fishing gaps, design of fishing harbours like Mopla bay, Ponnani, Vizhinjam etc. had been conducted by this division during 1970's and 1980's. Collection of wave data and observation of beach characteristics have been carried out at several stations along the Kerala coast in the new moon day of all months for assessing the changes of Kerala Coast over years. Among these stations, observations at two stations i.e., at PadinjareVemballore and Anchangadi in Kodungallur Taluk have been carried out by this division till December 2013. Afterwards, these works have been transferred to Coastal Engineering Field Studies Division, Thrissur. Since then, this division is engaged in **Topographical investigation** for various projects under irrigation department as well as other departments **with the aid of GNSS**.

As a part of modernization of Kerala Engineering Research Institute (KERI), a Smart Station from Leica Geosystems has been procured in the financial year 2013-, and transferred to this division as per the order of the Chief Engineer (IDRB), Thiruvananthapuram. Smart station is a new revolutionary surveying system in which a high performance Total Station (TS11) and a powerful GNSS Receiver (GS14 satellite receiver) are perfectly integrated. The main components of Smart Station are Base station GNSS and Smart Antenna, RTK Rover GNSS with Pole, Antenna. CS10 Field Controller (Smart Pole) and Total station with back sight Tripod kit. Leica GS14 has been upgraded to Leica GS 18 T model in 2019-20.

Presently this division is engaged in conducting topographical investigations of various works of Kerala Irrigation Department. Topographical investigation works of other departments are being carried out as Deposit works. The quality of works is assured since the works are carried out departmentally using most modern instruments with high precision and accuracy. Works entrusted to this division are being carried out under various Head of Accounts as per the nature of works and availability of funds. These Head of accounts are 4701-80-800-99-00-34-03-(PV)-Development Of Kerala Engineering Research Institute Stage II, 4700-80-

005-99-02-00-V investigation of major irrigation schemes, 4701-80-800-88-formation of river basin organization etc.

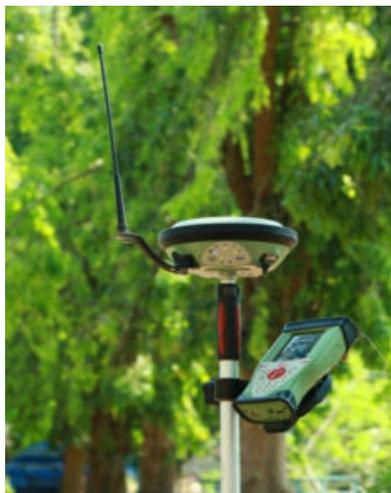
## **2. FEATURES OF GS 18T SMART STATION**

Leica GS 18T is GNSS RTK rover and is a part of the Leica Geosystems self-learning GNSS series with advanced signal tracking technologies. With more constellation and L band, GS18T will have more satellites in canopy area. GS18T is fitted with Inertial Measurement Unit (IMU) based tilt sensor, so that no magnetic field can affect the positioning. This can work close to bigger concrete structures with larger reinforcement, Electrical installations etc. Due to the tilt compensating function, it is not required to hold the survey pole in vertical position, that is there is no need to level the bubble for measuring and staking of points. In this the sensor accurately and reliably measures the pole tilt and together with RTK or Smart Link, provides an accurate tilt compensated position. There is savings up to 20 per cent over conventional surveying practices due to the fact that no time is wasted by levelling the bubble. The IMU-based tilt-compensating RTK is applicable at large tilt angles of more than 30 degrees, where a 3D positioning accuracy of 2 cm is still achievable.

Leica GS 18T is integrated with a new Cinterion cellular modem that supports LTE (4G) as well as all existing networks. In Leica GS 18T a self-learning GNSS sensor is being used, hence the best satellite signals and the best available correction data is chosen automatically thus achieving best possible position accuracy and quality. By incorporating sensor heading into 3D visualization of the surroundings, the user can easily orientate himself in the surveying environment, which improves productivity and user experience. The measurement engine in GS 18T is ME7 (measurement engine generation 7). This gives an ultimate performance in GNSS positioning.



GS14 Base



Rover Unit with  
Controller



Total Station



Leica GS18 T GNSS RTK rover with CS20 Field  
controller



GS-18 T Base/Rover

### **Instruments used for topographic surveying**

It includes latest features such as 555 channels, Multi-frequency, Multi constellation, L-band service etc. This allows tracking more satellites compared to GS14 in parallel channels. This sensor is supplied with most modern controller of Leica CS20 with specialized package software called Captivate. Captivate is the most field worthy software with more land survey features compared to CS10 controller.

### **3. WORKS UNDER THE HEAD OF ACCOUNT-4701-80-800-99-00-34-03-(PV)-DEVELOPMENT OF KERALA ENGINEERING RESEARCH INSTITUTE STAGE II**

Works under the above head consist of two types viz. Fundamental studies using smart station and Routine maintenance of offices, model area and survey equipments. These two types of

works are regarded as the action plan of Coastal Engineering Division for the financial year 2022-23.

### **3.1 Fundamental Studies using Smart Station for the year 2022-23 - Various Investigation survey works in Irrigation Department using Smart station**

All topographical investigation works related to Kerala Irrigation Department which are carried out using Smart Station are included in this category. Highlights of works taken up by this division during the year 2022-23 are as follows.

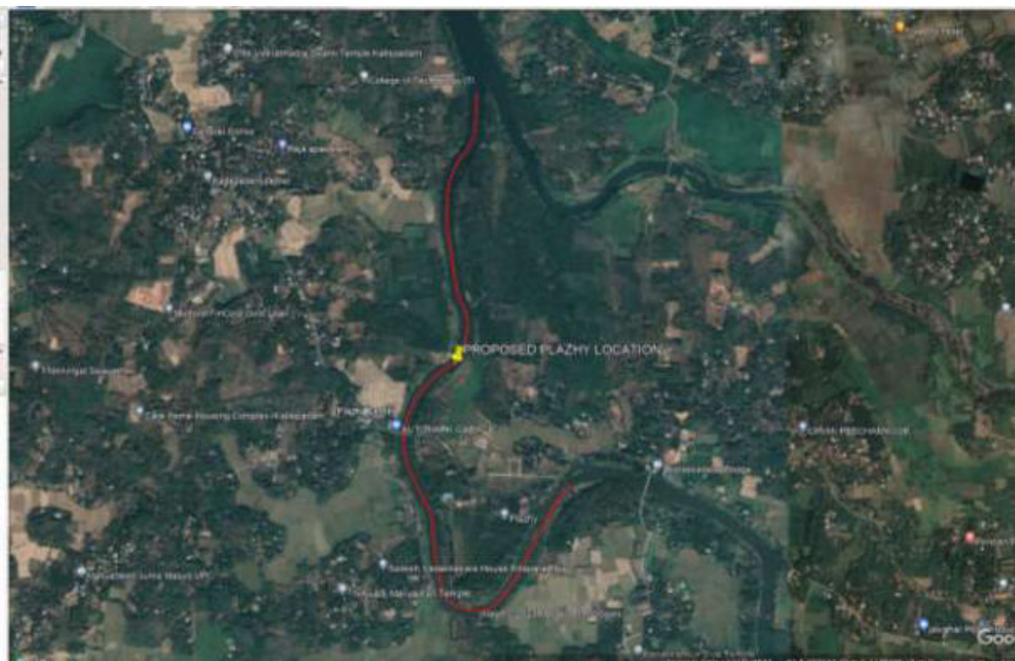
#### **3.1.1 Topographic Investigation for the Construction of Check dam across Mangalam River at Plazhy in Pazhayannur Panchayath in Thrissur District for the year 2022-23.**

Topographical investigation for the construction of check dam across Mangalam river at Plazhy in Pazhayannur Grama Panchayath in Thrissur District was taken up by this division as per the instruction of Director (F&AR), KERI based on the request received from the Executive Engineer, Additional Irrigation Division, Thrissur. The total amount of estimate comes to Rs. 1,70,000/-. The investigation survey includes taking the cross-sectional details of the river and bank at the proposed check dam location as well as at upstream and downstream of the same at particular intervals as per design requirements. For this work, cross-sections were taken at an interval of 15m for a length of 60m upstream and downstream of proposed check dam location, at 50m interval for next 500m length upstream and at 100m interval for the balance upstream and downstream reaches. A contour map at an interval of 1m was also prepared. Layout plan, contour plan, cross-sections and longitudinal sections have also been plotted.

The site is situated at Plazhi, in Pazhayannur Grama Panchayath of Thrissur district. The location for check dam was identified by project authorities. Proposed location of check dam is in Mangalam river, 1.20 Km upstream of the confluence point of Mangalam river with Gayathripuzha. The Cheerakkuzhi weir is located 4.80 Km downstream of the proposed check dam location and another check dam is located at 1.76 Km upstream of the proposed location. Following conclusions were drawn from the inferences of topographic investigation.

- Cheerakuzhi weir is situated at 4.80 Km downstream of the proposed check dam location. Hence, the overflow crest level of Cheerakuzhi weir was taken as reference bench mark. The reduced level of crest level as informed by the project authorities is +37.34 m above MSL.

- The survey work was extended upto 1.75 Km upstream due to the presence of a check dam at this location. The top level of the existing check dam is +38.80 m.
- A Temporary Bench Mark (TBM1) with a RL of +43.523 m has been marked in yellow paint on rock at 658605.87 m E and 1179360.43 m N near the proposed check dam location.
- Cross-sections of Mangalam river and bank were taken at specified intervals as per the design requirements (at 15m interval for a length of 60m in u/s and d/s, 50m interval for next 500m u/s, 100m interval for remaining u/s and d/s length.)
- One small tributary was observed in the upstream side of proposed check dam location. The tributary was surveyed until significant levels were reached and contour map has been prepared.
- River bank was also surveyed for ascertaining enough bank height for water storage.
- Layout Plan, cross-sections, longitudinal section, contour maps at 1m interval have been prepared as per design requirement.
- The longitudinal section was plotted by connecting the lowest points in each cross section.
- Roads and other permanent structures have been plotted.
- The lowest river bed level at proposed site is +35.566m



**Proposed location of check dam in Mangalam river**



**Surveying work near proposed check dam location**

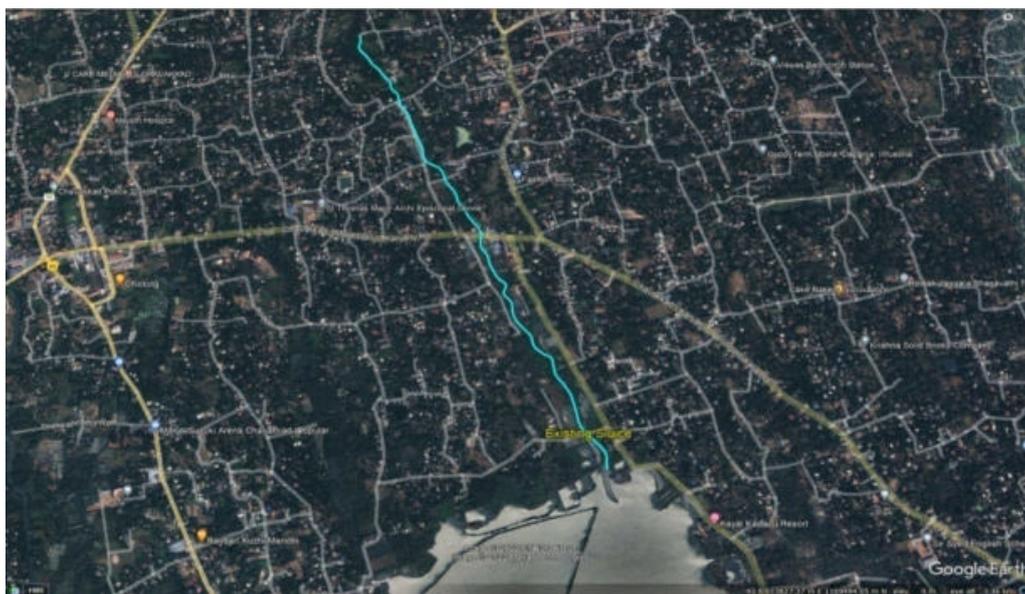
### **3.1.2 Topographical Investigation work for Reconstruction of Chakkumkandam Salt water Exclusion Sluice in Chavakkad Municipality in Thrissur District for the year 2022-23.**

Topographical investigation work for the reconstruction of Chakkumkandam salt water exclusion sluice in Chavakkad Municipality in Thrissur District was taken up by this division as per the instruction of Director (F&AR), KERI based on the request received from the Executive Engineer, Minor Irrigation Division, Thrissur. The total amount of estimate comes to Rs. 1,25,000/-. The purpose of the topographical survey is for the re-construction of existing salt water exclusion sluice. The topographical survey includes taking cross-sections of the river (or thodu) and bank at the proposed sluice location as well as upstream and

downstream of the same at particular intervals as per the design requirements. For this work, cross-sections of the river and bank were taken at an interval of 15m for a length of 60m upstream and downstream of existing sluice location, at an interval of 50m for next 500m length upstream and at an interval of 100m for the balance upstream and downstream reaches of the river and bank. Contour map with colour indication for the different ranges of river bed and bank levels is prepared. Layout plan, colour contour plan, cross-sections and longitudinal sections have been plotted.

Following conclusions are obtained from the inferences of topographic surveying.

- Reduced Level already established at Idiyanchira RCB at the location (616878.603E,1165132.324N) was considered as the reference bench mark and the respective value is 6.308m.
- TBM was established near the site on top of boundary stone at 613840.46E,1169253.00N. Elevation of this TBM was found to be +2.083m which was also cross verified with GTS Bench Mark at Kodungallur.
- Location of existing sluice is 614030.695E,1169052.545N.
- Topographical survey was conducted to determine the cross-sections of the river and bank at specified intervals as shown in the drawings.
- River bank was also surveyed for ascertaining the bank height.
- Layout plan, cross-sections, longitudinal section and colour contour plan are prepared as per the design requirements.
- The longitudinal section was plotted by connecting the lowest points in each cross-section.
- Roads and other permanent structures are plotted.



**Map showing location of existing saltwater exclusion sluice**



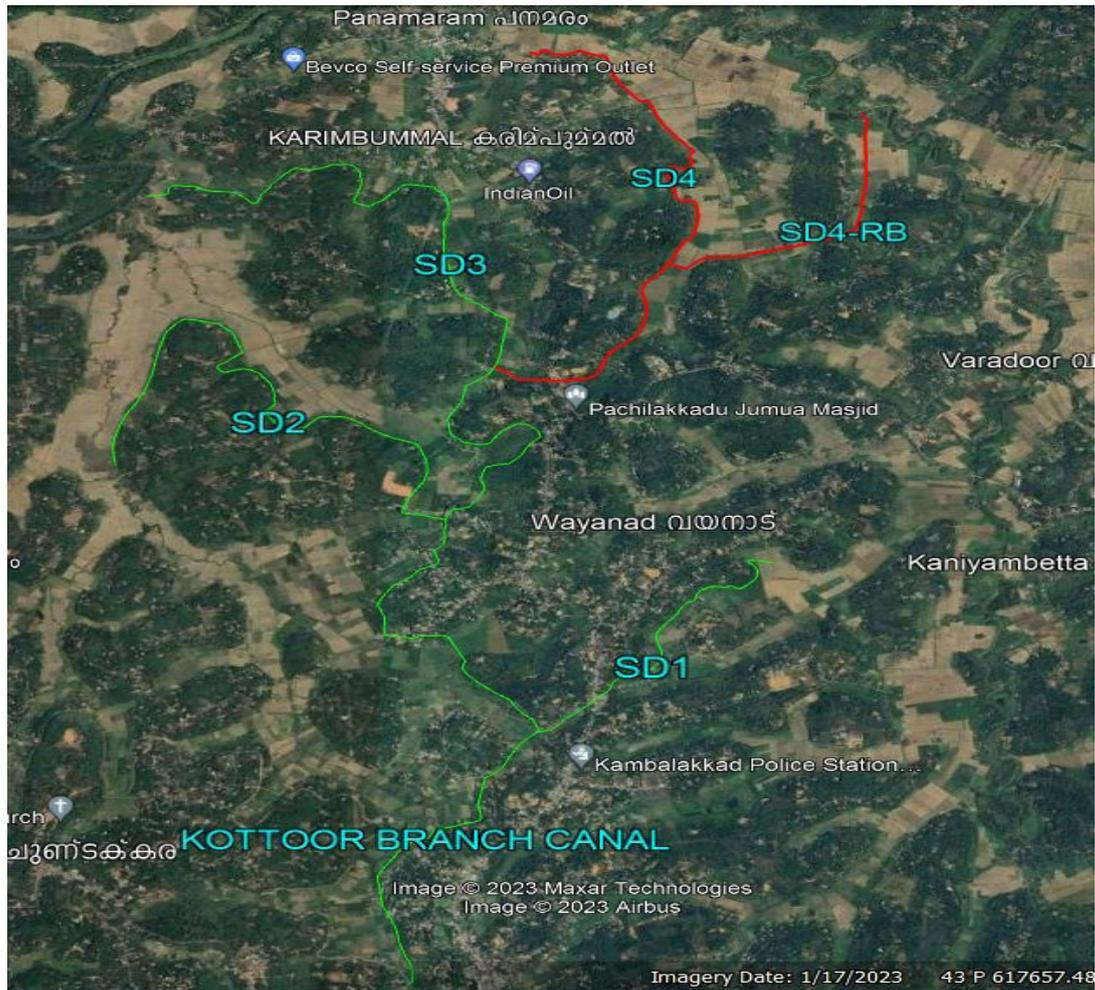
**Images of surveying the upstream of sluice**

### **3.1.3 Topographic Investigation for additional distributary of Kottoor Branch Canal of LBC- Karapuzha Irrigation Project in Wayanad District.**

Topographic Investigation for additional distributary of Kottoor Branch Canal of LBC- Karapuzha Irrigation Project in Wayanad District was taken up by this division as per the instruction of Director (F&AR), KERI based on the request received from the Executive Engineer, Karappuzha Irrigation Project Division, Kalpetta. The total amount of estimate comes to Rs. 1,50,000/-. Site was connected with MSL by transferring the level of Bench Mark at Karapuzha dam. The proposed additional distributary (SD4) has a length of 4113m which off-takes at a chainage of 1269 m of SD3 distributary of Kottoor branch canal. A sub distributary SD4-RB having a length of 2000m which originates from the chainage 1560 m of SD4 was also investigated. The SD4-RB joins natural thodu at a chainage of 1060m. Based on the inferences from topographic investigations, following conclusions are drawn.

- The temporary bench mark is fixed at the site by transferring the MSL from Karappuzha dam
- Alignment for an additional distributary SD4 and sub-distributary SD4-RB were fixed through the topographic surveying as the additional distributaries became necessary for meeting increased agricultural requirements. The necessity of these distributaries is clearly indicated in the request letter from Executive Engineer of Karappuzha Irrigation Project.
- Additional distributary SD4 and sub-distributary SD4-RB were surveyed by taking cross-sections at an interval of 30m

- Permanent features in the site such as buildings, roads, bridges and culverts were plotted
- Layout plan, cross-sections, longitudinal section and contour plan were plotted
- Longitudinal section was plotted by connecting points through the centre-line of alignment



Map showing alignment of SD4 and SD4-RB from SD3



Images taken during surveying



**Discussion with Karappuzha Irrigation Project authorities**

### **3.1.4- Topographic Investigation for connecting various locations for fixing water level sensors in Chalakudy and Karuvannur river basins in Thrissur District for the year 2022-23**

Topographic Investigation for connecting various locations with MSL for fixing water level sensors in Chalakudy and Karuvannur river basins in Thrissur District for the year 2022-23 was taken up as per the directions received from Joint Director, Hydraulic Research, KERI, Peechi based on the request received from Deputy Director, Instrumentation Division, KERI, Peechi. The total amount of estimate comes to Rs. 55,000/-. The water level sensors are planned to fix at various critical locations such as pump houses, bridges and regulator cum bridges in the Chalakkudy, Manali, Kurumali and Karuvannur rivers. The idea is to correlate the water levels measured by the sensor at various critical locations with the inundation happening at various low lying areas near these rivers. Based on developing such correlations, evacuation process shall be done well prior to the flooding conditions and thus minimizing the loss of lives and property. In order to develop such correlations, it is necessary to determine the latitude, longitude and RL of various critical locations at which sensor to be placed using topographic surveying .

The fly leveling was started from Arangaly CWC station for the Chalakkudy river basin and from Peechi dam for the Karuvannur river basin and positions of various critical locations were determined. The fly leveling was properly closed at the point from which it is started.

**Table 1: Details and RLs of locations selected for placing sensors in Karuvannur basin**

Sl. No.	Location	Feature	Easting	Northing	RL (m)
1.	Puthur KWA pump house	Parapet top	639518.8	1159962	12.418
		Parapet top	639519.2	1159965	12.4035
2.	PuthurPanchayath pump house	Parapet top	639523.3	1159966	12.3881
			639523.7	1159960	12.3674
			639519.6	1159961	12.392
			639525.2	1159964	12.3625
3.	Puzhambalam pump house	Well top	638946.6	1158667	11.2318
4.	Eravakkad KWA pump house	Top of marked portion on wall	636420.8	1153614	6.8827
		Top of parapet	636420.2	1153615	7.961
		Critical level for inundation	636422.5	1153616	5.0975
5.	Mupliyam bridge	Top of road	645892.7	1150091	15.198
		Top of marked portion on handrail	645892.8	1150091	16.1646
6.	Arattupuzha bridge	Top of road	634568.5	1151693	9.0865
		Top of road	634566.5	1151697	8.1729
		Level of river in 2018 flood	634532.4	1151754	7.1911
7.	Thirukkuzhy KWA pump house	Normal level of inundation during flood	634795.8	1152600	3.6618
		Level of river in 2018 flood	634789.5	1152604	5.9803
		Top of parapet	634787.8	1152605	7.6102
		Top of parapet	634791	1152605	7.6194
		Top of parapet	634794	1152603	7.6458
8.	Illikkal regulator and pump houses	Top of wing wall on downstream	631671.6	1151072	4.9507
		Top of sunshade of irrigation pump house	631763.9	1151071	6.7996
		Top of sunshade of new KWA pump house	631736.9	1151069	7.998
		Top of floor of new KWA pump house	631737	1151069	5.8369
		Marked point on floor	631740.7	1151071	5.8408

		of new KWA pump house			
9.	Ettumuna regulator	Top of marked portion on regulator platform	631910.6	1151043	8.7187
		Top of road	631919.1	1151040	4.7532
		Level of river during 2018 flood	631879.9	1151035	4.3953
		Sill level of regulator	631912.4	1151043	0.6832
10.	Koothumakkal regulator	Top of marked portion on platform of regulator	626694.9	1143083	5.6956
		Top of road	626684.4	1143094	4.0295
11.	Nandi KWA pump house	Top level of floor slab	628299.1	1149921	5.7357
		Top level of sunshade above window	628297.9	1149913	9.4305
		Level of river during 2018 flood	628299.2	1149916	5.8023
		Level of river during 2019 flood	628302.2	1149914	5.3503
12.	Karuvannur bridge	Top level of handrail	633116.6	1150308	9.4307
		Top level of road	633129.6	1150321	8.2557
13.	PadoorPulikka kadavu bridge	Top level of marked portion on handrail	616684.3	1163509	11.2348
		Top of road	616685	1163509	10.2954
14.	Chettuva bridge	Top level of marked portion on handrail	614559.7	1164499	9.4028
		Top of road	614561.6	1164498	8.3529
15.	Idiyanchira regulator	Top of road	616860.3	1165166	3.1707
		Top level of marked portion on platform	616880	1165134	6.2657
16.	Enamavu regulator	Top of downstream wing wall	621244.3	1161393	5.863
		Top of road	621302.5	1161314	6.2258
		Over RR masonry pillar of lock cum bridge	621238.9	1161391	10.4171
17.	Kottenkottvala vu regulator	Platform of regulator	628034.5	1149890	8.2914
		Top of wing wall upstream	628047.4	1149890	3.5947
		Top of road	628030.3	1149905	5.9724

**Table 2: Details and RLs of locations selected for placing sensors in Chalakkudy basin**

Sl. No.	Location	Feature	Easting	Northing	RL (m)
1.	Kannamkuzhy pump house	Top of well	671386.3	1137508	80.7315
			671385.2	1137512	81.1576
			671389.8	1137510	80.9392
2.	Munippara pump house	Top of wall along river side	653394.1	1139089	9.1251
		Top of roof slab of pump house	653393.3	1139106	13.6394
		Top of roof slab of pump house	653390	1139103	13.5928
		Top of parapet of steps			
		Top level of marked portion on wall			12.25
3.	Thavalappara pump house	Top level of basement	650239.8	1140350	9.4011
		Top level of basement	650245	1140347	9.4398
		Level over step	650233.5	1140345	5.8707
4.	Kombanpara pump house	Top level of roof slab	650554.5	1140817	11.4986
		Top level of check dam	650558.3 111	1140822. 9077	11.4522
5	Annamanada bridge	Top of road	645848.5	1132282	9.1409
		Top of road	645829.2	1132268	9.1243





**Images taken during topographic investigation**

### **3.1.5 Maintenance of office building of Coastal- Engineering Division-General Civil Work**

The nature of the work includes repair of a damaged beam and cantilever slab and items for allied maintenance activities. The damaged beam and cantilever slab need to be demolished and reconstructed. Also, the walls of toilet block need to be removed and re-constructed as they were situating above the beam which is to be demolished. Moreover, the existing partition wall between toilet blocks should be removed and new brick wall needs to be constructed. The items for the work includes demolishing of damaged beam, cantilever slab and brick walls, dismantling of existing doors, tiles over cantilever slab, partition walls and wooden frame work consisting of glass panes, RCC work for beams and cantilever slab including provisions for M20 concrete, reinforcement and shuttering, brick work for walls of toilet block, plastering and painting over brick walls, painting over doors, floor tiling over cantilever slab, support for existing slab under the toilet block, renewing glass panes in wooden frame work, re-fixing of frames, shutters, partition walls and wooden frame work with glass panes to old position. The total amount of estimate comes to Rs. 2,80,000/-.



**Toilet block after renovation**

### **3.1.6 Centralized GIS and Modelling Lab**

Centralized GIS and Modeling Lab is essential for a research institute for various research works. This laboratory is started with a vision to perform detailed analysis regarding various hydrologic problems referred to KERI. The work includes purchase of three Desktop computers (two high performance and one medium performance) and one A3 laser printer with scanner and photocopier. The total estimate amount comes to Rs 6,80,000/-. It provides useful services by fulfilling needs in the field of investigation, testing, mathematical modeling, consultancy, training, quality control and R&D activities in the field of Civil Engineering and Water Resources Engineering in particular.



**Computer systems installed in GIS and Modeling laboratory**

### **3.1.7 Physical Infrastructure Development of Coastal Engineering Division**

This work aims to strengthen the infrastructure facilities of the Coastal Engineering Division office for faster completion of investigation works. High performance computer is essential for preparation of contour plan and cross-section details in a faster manner. This work includes purchase of a high performance computer and an A3 colour printer for the office of Coastal Engineering Division, KERI, Peechi. The total estimate amount comes to Rs 2,70,000/-.



**High performance computer and Laser printer purchased for Coastal Engineering Division**

### **3.2 Routine activities of the Coastal Engineering Division office for the year 2022-23**

This work was included in the action plan for meeting the routine activities of the Coastal Engineering Division office and the renovation of toilet block. The items of this work include purchase and maintenance of computer and related accessories, purchase and maintenance of stationary items, maintenance of plumbing and electrical components and renovation of toilet block of the office of Coastal Engineering Division. These repair activities can come up at any time in a year. The renovation work includes concrete work, plastering, flooring, water proofing, painting and fixing new doors of toilet block.

### **3.3 Maintenance of the model area of the Coastal Engineering Division for the year 2022-23**

The model area where physical model studies related to Kerala Coast has been conducted in the previous years is maintained by this division. All works such as clearing the bushes, routine cleaning of model trays and Engineering museum, overall upkeep of model sheds for keeping this area spick and span were included in this work.

### **3.4 Annual Maintenance and purchase of accessories for Smart Station for the year 2022-23**

This work is for the annual maintenance of Smart station and for the purchase of accessories and any spare parts if required. As the Smart station is sophisticated electronic equipment, annual calibration and maintenance are essential so as to ensure the accuracy of the position data measured by the instrument. Provisions for these items are included in the estimate for Annual Maintenance Contract of the Total Station TS11. Batteries are one of the essential accessories for progressing the survey effectively. Any damage in batteries will delay the work. Hence as a precautionary measure, provision for purchase of additional batteries are included in this work. Provisions are included for the purchase of car battery charger, cables and any other consumables if required in emergency. A lumpsum provision is also given for the purchase and maintenance of any spare parts of the instrument, consumables and miscellaneous items for survey if required in emergency.

## **4. WORKS UNDER THE HEAD OF ACCOUNT-4701-80-800-88-FORMATION OF RIVER BASIN ORGANIZATION**

### **4.1 Sand Budgeting in Chaliyar River Basin**

Director (F&AR), KERI has submitted a proposal specifying the technical method for the assessment of quantity of sand which can be safely mined from a river as per the direction of Chief Engineer, IDRIB during the year 2017-18. The objectives of this study are (i) to ensure that the sand and gravel extraction is carried out in a sustainable way and (ii) to determine locations, period and quantity of sediments to be extracted so as to maintain the river equilibrium with the application of sediment transport principles. Chaliyar river is considered for the pilot study since it doesn't get dried up even during the drought seasons. Many other rivers in Kerala get dried up during the summer seasons. Methodology followed for sand auditing includes modelling of watershed, ascertaining the pristine conditions of river channels, sediment sampling, development of sediment transport models and analysis of the

model results. The results comprises of spatial variation of sediment deposits, time series plots of sediment deposits and variation of cross-sections of river channels.



**Sediment deposition in Chaliyar river**



**Topographic surveying of river cross-sections**



### **Field visit by officials of NIT Calicut and KERI**

Since KERI is new to the field of Sediment Transport Modelling, this portion of the proposal is decided to outsource. NIT Calicut has already been involved in sediment transport modelling works. KERI has discussed this matter with NIT Calicut and they expressed their willingness to collaborate with our institution for a pilot study, which includes capacity building of our Engineers. MoU has been signed between Director (F&AR), KERI and Director, NIT Calicut on 28<sup>th</sup> November 2019. Hydro- meteorological data, land use map, soil map pertaining to the study area etc. were collected and made available to NIT Calicut. Shape files marked with tentative locations for taking cross-sections of river along with the locations of sand mining kadavu of Chaliyar River were prepared by this division after conducting a reconnaissance survey.

Topographic survey for taking cross sections at specified intervals of Chaliyar river was conducted by this division before and after the simulation period. The GTS Bench Mark at Bench Mark at Kuttippuram was transferred to the work site for commencing the surveying work. The outputs from sediment transport model include estimates of suspended sediment concentrations, rates of sediment erosion and deposition and sediment transport pathways.

Suspended sediment sampling was started on 06-09-2021. Two stations (locations) were selected for the suspended sampling process. One station is at Edavanna and another one is at Karimpuzha. The samples are collected daily and tested in the laboratory of NIT Calicut for grain size analysis. A temporary gauging station for measuring water level and discharge was

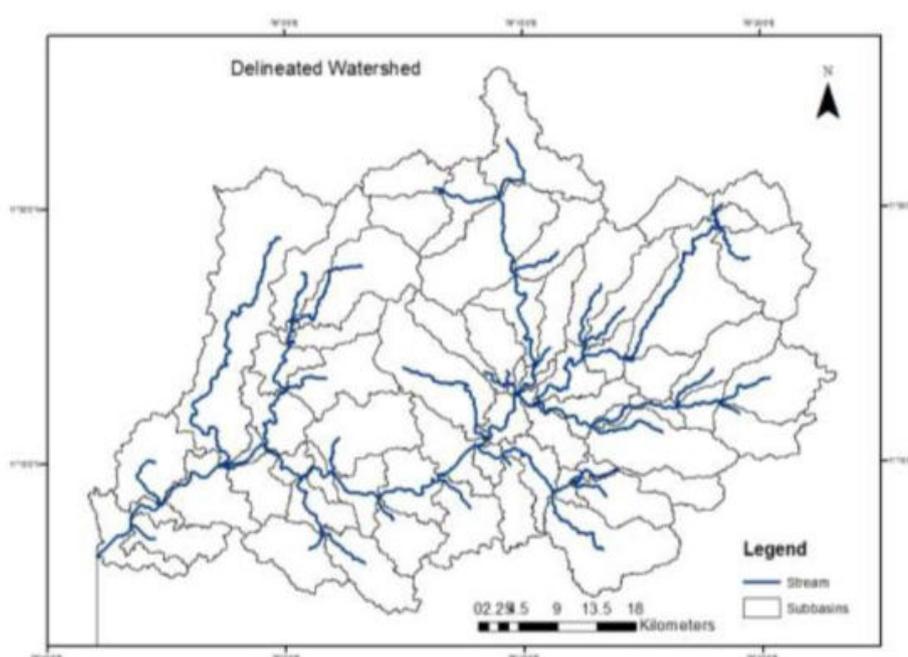
established at Edavanna. Apart from this, discharge and water level data can be collected from the monitoring station of Hydrology wing present in the Karimpuzha river. The water levels were taken on daily basis from the two stations. The water levels, discharge and sediment characteristics are used for modelling the flow and sediment transport processes in the Chaliyar river.

Physical and online capacity building programmes for the engineers of KERI were conducted by the Coastal Engineering Division with the principal investigator of this project from NIT Calicut (Prof. Santosh Thampi, Head, Department of Civil Engineering) as the resource person. Physical training was conducted from 27-12-2021 to 29-12-2021, 29-04-2022 to 30-04-2022, 23-06-2022 to 24-06-2022, 17-07-2022 and 31-08-2022 and online training sessions were conducted on 02-11-2021, 04-12-2021 and 17-02-2022 respectively.

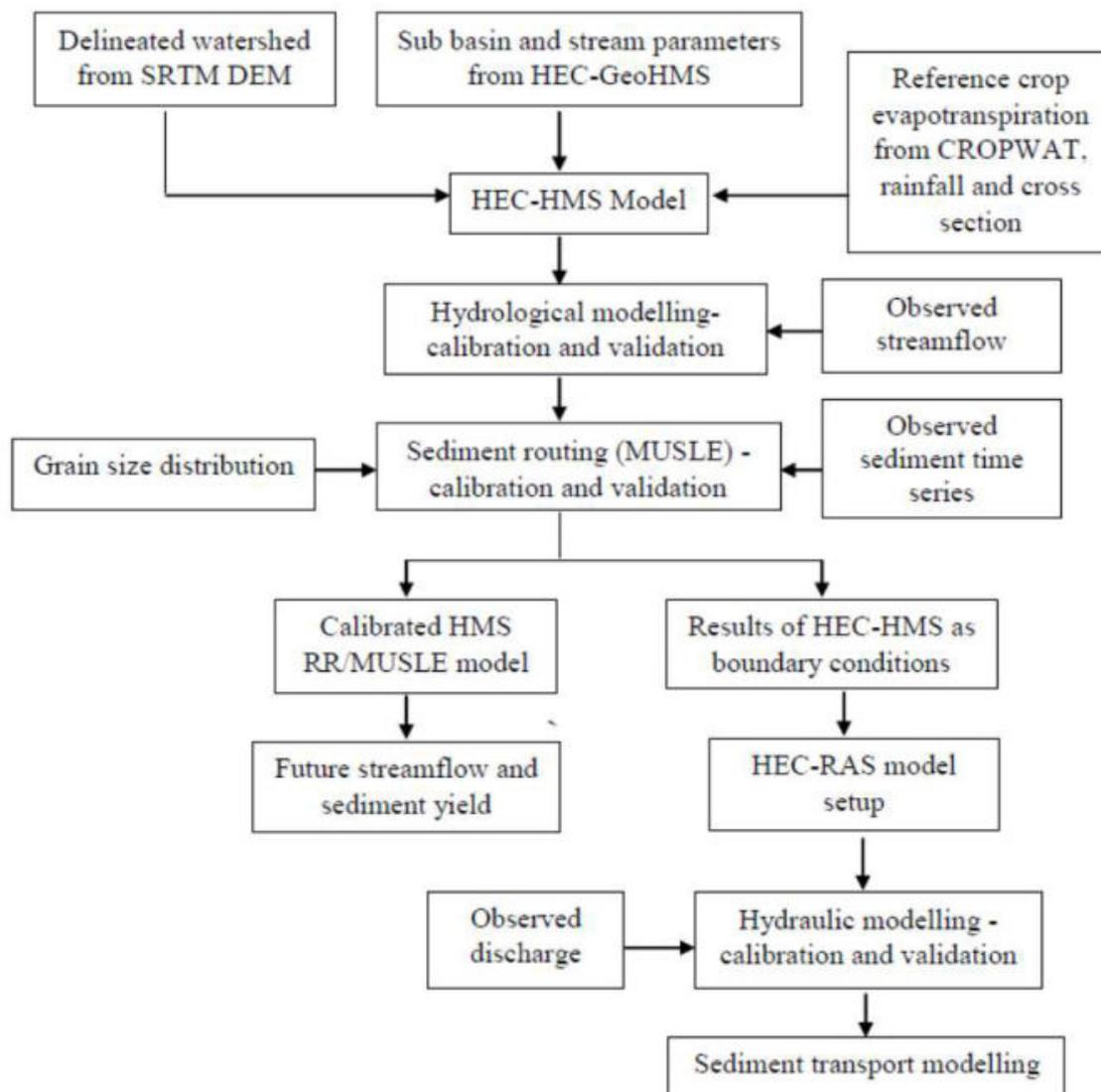
In this study, an attempt is made to develop a methodological framework to perform sand auditing and to quantify the amount of mineable sand with specific reference to the Chaliyar River in Kerala by performing hydrologic, hydraulic and sediment transport modelling. Although, the Chaliyar River has been considered in this study, the proposed methodological framework can be applied to other rivers as well. The steps involved in the modelling process and associated results are given in the following sub-sections.

#### 4.1.1 Watershed delineation

The river basin was delineated from SRTM DEM using the HEC-GeoHMS toolbar and watershed area was found to be 2953 Km<sup>2</sup>.



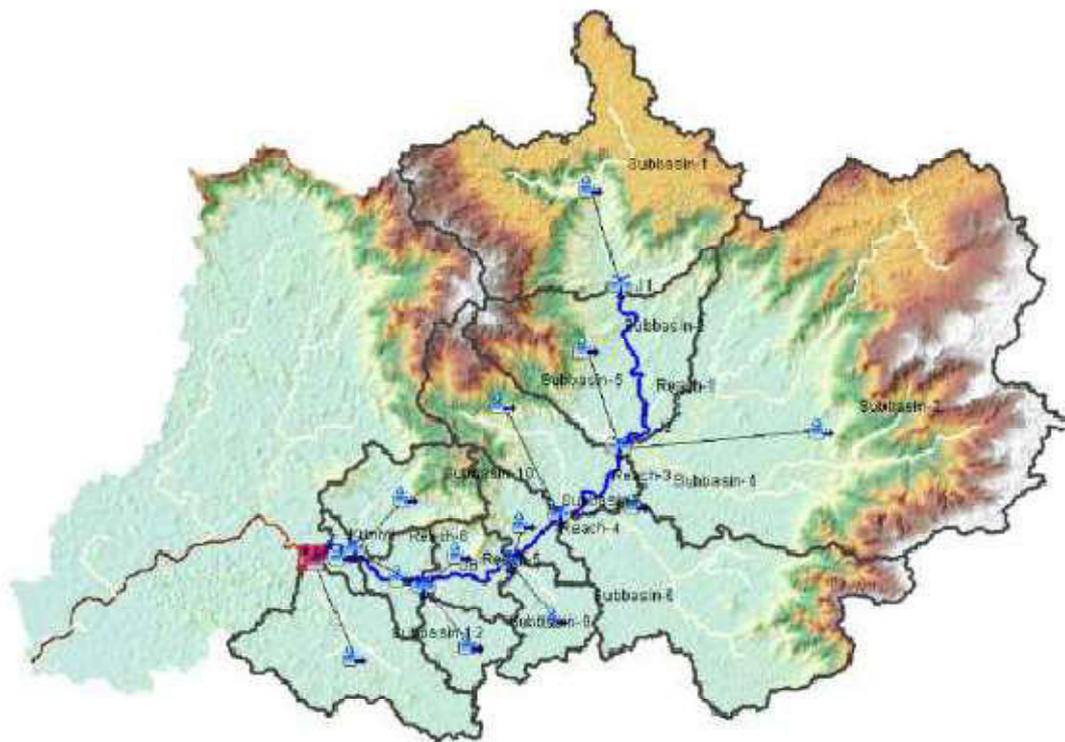
## Watershed delineated in HecGeo-HMS tool



**Flowchart outlining the methodological frame work for sediment transport modelling**

#### 4.1.2 Rainfall-runoff modelling

The first step of the sediment transport modelling process is to accurately simulate the behaviour of the catchment (flow over land or run-off) under various rainfall events. The rainfall-runoff model was developed in HecGeo-HMS platform and then imported to HEC-HMS software for further analysis. The study area was divided into 13 sub-basins and river into 6 reaches and rainfall-runoff model was developed in all sub-basins up to discharge station at Kuniyil.



### HEC-HMS model setup

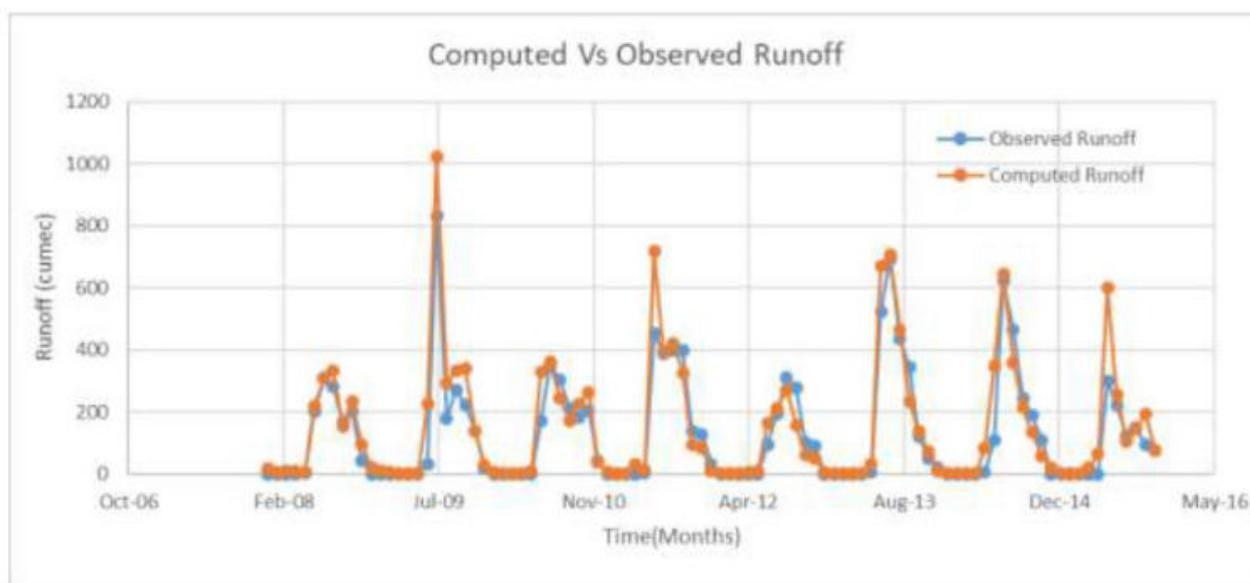
Daily rainfall data from various rain gauge stations in the basin and reference crop evapotranspiration data were given to the model. The sub-models and the respective parameters adopted in HEC-HMS platform for rainfall-runoff modelling are given in the Table given below.

#### Sub-models and parameters used for rainfall-runoff modelling

Sl. No.	Model	Method	Parameters required
1.	Loss	Deficit and constant loss	Initial deficit (mm), maximum deficit (mm), constant rate (mm/h) and % impervious
2.	Canopy	Simple	Initial storage (%), maximum storage(mm) and crop coefficient
3.	Transform	Clark unit hydrograph	Time of concentration (min) and storage coefficient (min)
4.	Baseflow	Recession	Initial discharge (m <sup>3</sup> /s), recession constant and ratio to peak
5.	Routing	Muskingum Cunge	Manning's n

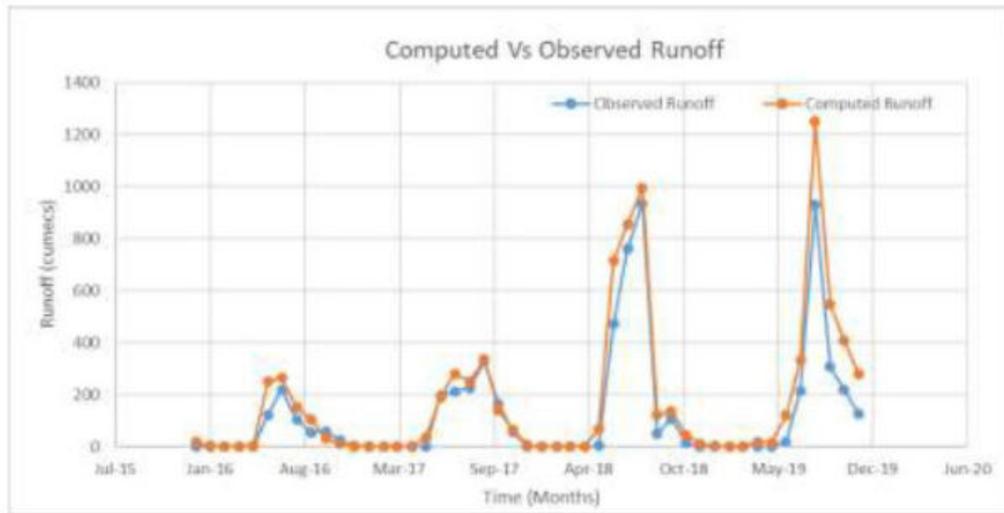
The parameters of these sub-models were fixed based during the calibration process. Using the rainfall and evapotranspiration data during the period of 2008-2015, discharge at all the 13

subbasins were determined using HEC-HMS software. The discharge values obtained at Kuniyil station from simulations were compared with the corresponding values measured from the field for the above-mentioned period. The parameters of sub-models were varied manually as well as using optimization algorithm based on Simplex method until good matching is obtained between observed and simulated flows. The matching between observed and simulated flows was assessed using the conditions such as NSE and PBIAS. After the calibration process, good matching between observed and simulated discharges at Kuniyil station was obtained and the corresponding NSE was 0.83.



#### **Comparison of observed and simulated discharge at Kuniyil station during calibration period**

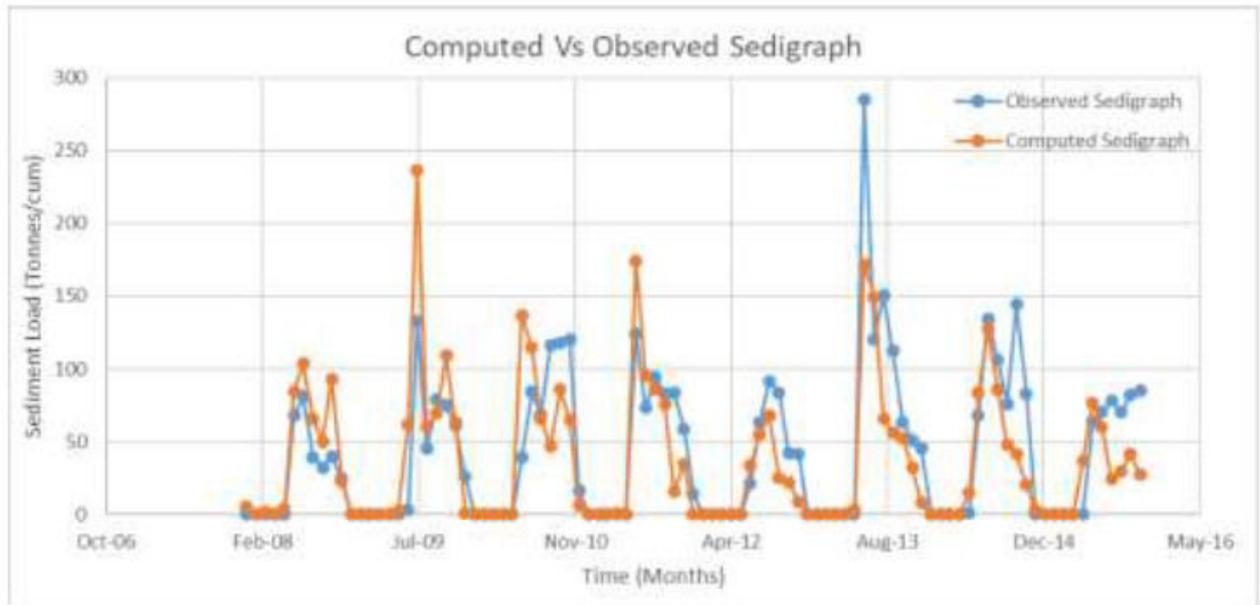
After the calibration, the performance of the model was validated by comparing the observed and simulated flows in the Kuniyil station from the year 2016 to 2019. Reasonably close agreement was obtained between the observed and simulated flows although some isolated over predictions of discharge can be seen during high flow season. The NSE obtained during the validation process is 0.85.



### Comparison of observed and simulated discharge at Kuniyil station during validation period

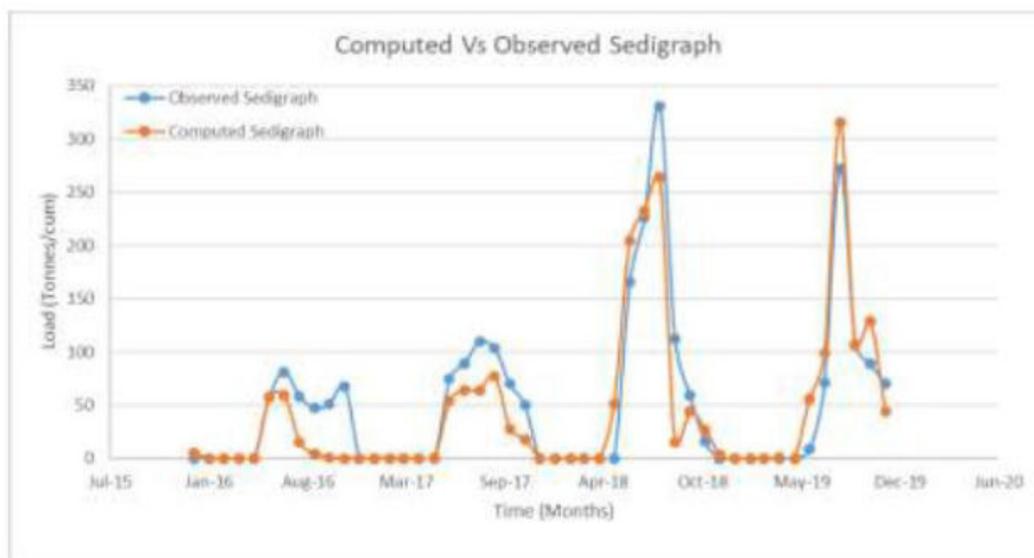
#### 4.1.3 Sediment routing

After successfully developing the rainfall-runoff model, it is necessary to accurately simulate the erosion behaviour of the catchment area during various rainfall events. This was accomplished using Modified USLE method available in HEC-HMS. The parameters required for this process such as topographic factor, cover factor, erodability factor, practice factor and enrichment ratio were determined based on catchment and soil characteristics and varied during the calibration phase until good matching between the observed and simulated sediment load (sedigraph) was obtained. The daily sediment loads were converted to monthly values during the calibration process. The observed and simulated sediment loads at Kuniyil station were compared during the calibration period by successively varying the above mentioned parameters. Finally, a reasonably good matching is obtained between observed and simulated sediment loads at Kuniyil station with a NSE of 0.45.



### Observed and simulated sediment load at Kuniyil station during calibration period

Satisfactory matching between observed and simulated sediment loads at Kuniyil station was obtained during the validation period (2016-2019). The value of NSE obtained during the validation period was 0.74.

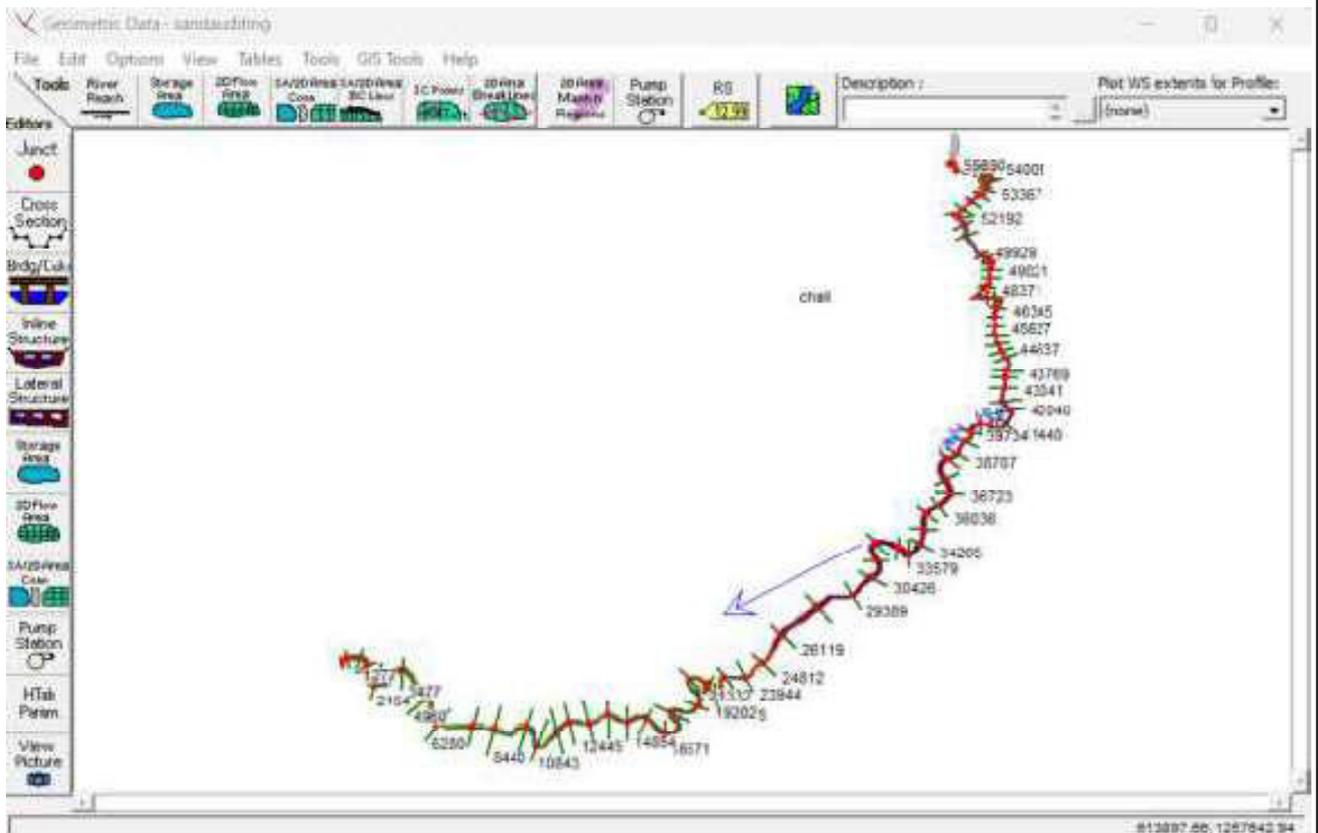


### Observed and simulated sediment load at Kuniyil station during validation period

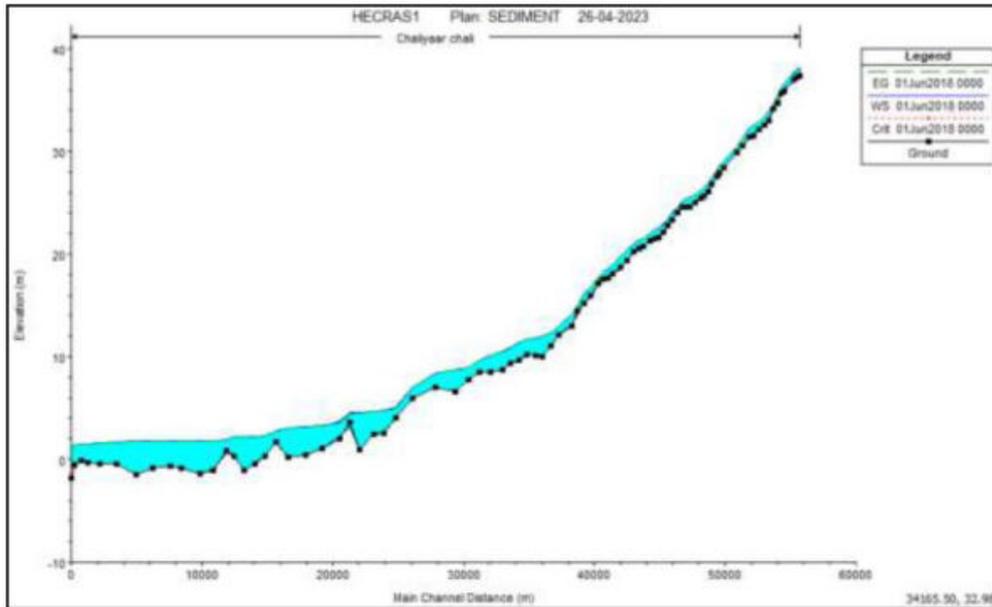
#### 4.1.4 Hydraulic modelling with HEC-RAS

Hydraulic modelling was developed for the Chaliyar river for a length of 55.65 Km, starting from upstream of Ambittanpotty bridge to Kuniyil river gauging station. The cross-sections at specified intervals were surveyed by KERI and the respective data was imported into the

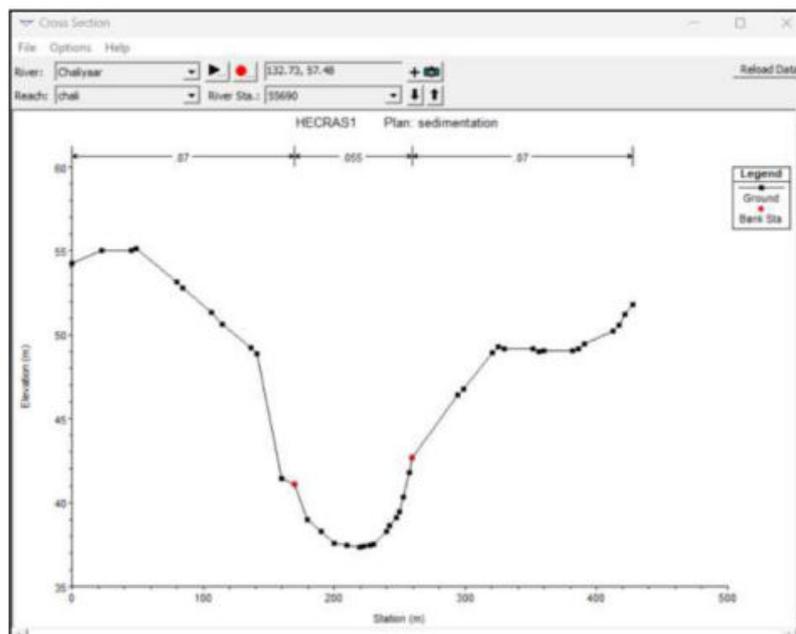
HEC-RAS software as river geometry. The bank extents of cross-sections were corrected using DEM. Unsteady flow analysis was carried out in HEC-RAS software. After defining the geometry of river channel, next step is to provide boundary conditions for the geometry thus formulated. The upstream boundary condition is the flow hydrograph at upstream of Ambittanpotty bridge and downstream boundary condition is the rating curve at Kuniyil station which was obtained from the stage-discharge curve at the respective station. The lateral inflows at the junctions where tributaries join with main river were provided as flow hydrographs at the respective locations in the main river.



HEC-RAS model setup



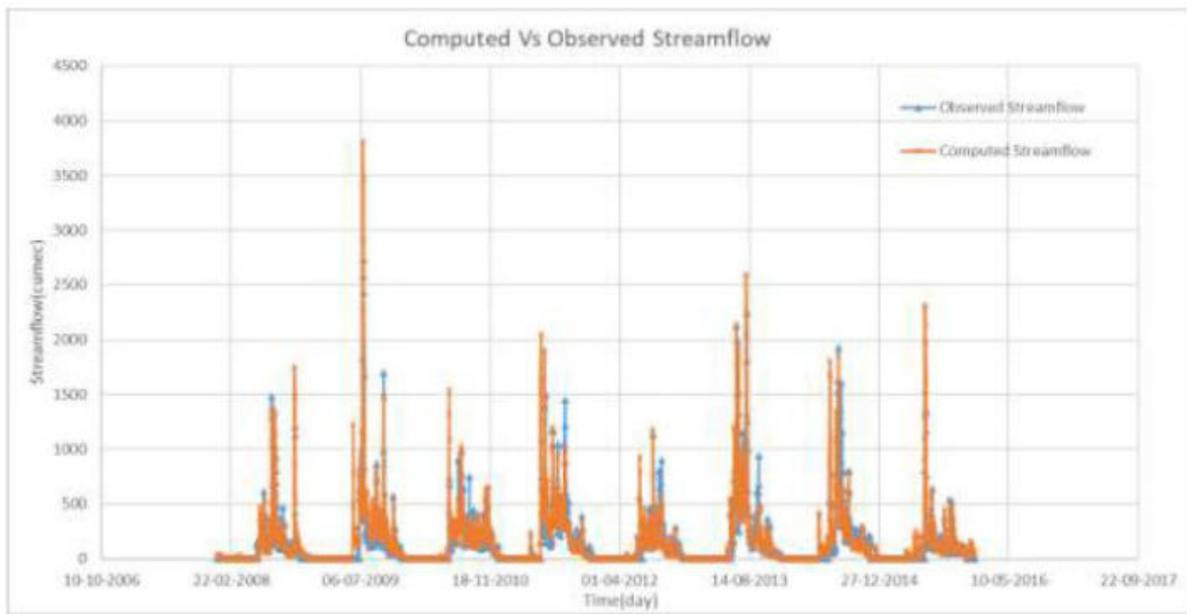
**Bed profile of Chaliyar river**



**Cross-section of river at chainage 55690m**

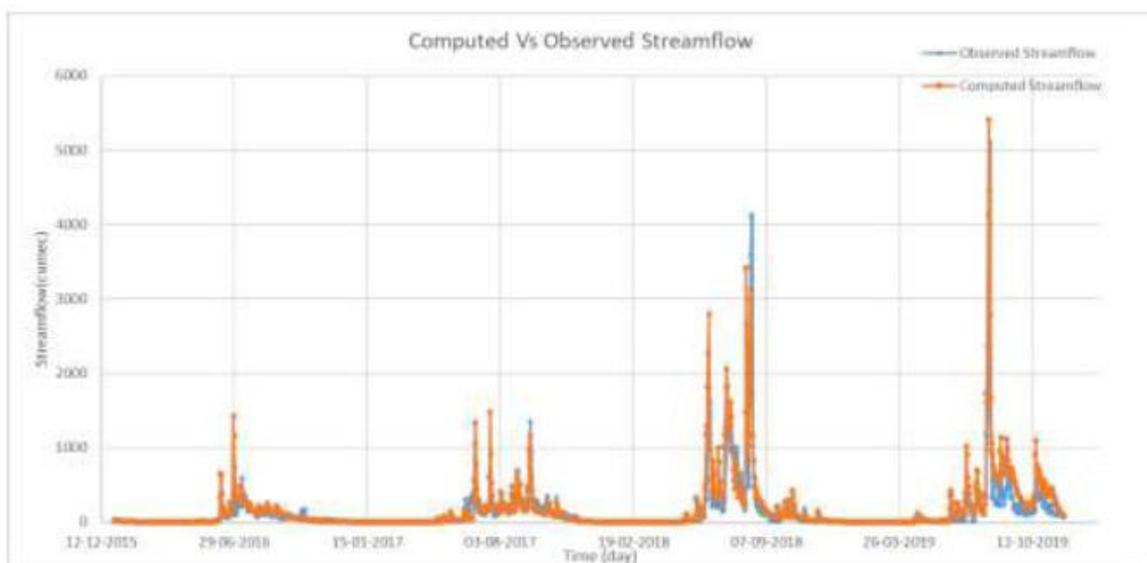
The unsteady HEC-RAS model was calibrated during the period from 2008-2015 by comparing the discharge values at the Kuniyil river gauging station. The Manning’s constant (N) was varied until good matching is obtained between the observed and simulated values of discharge at Kuniyil gauging station. The simulated stream flows at Kuniyil gauging station was compared with observed stream flows and satisfactory matching is obtained between both of these values. Slight under estimation of peak and quantity of stream flow was obtained

during the calibration period. In general, satisfactory matching was obtained between observed and simulated stream flows with a NSE of 0.52.



**Observed and simulated stream flows at Kuniyil gauging station during calibration period**

The hydraulic model is validated during the period from 2016-2019 by keeping the same value of Manning’s coefficient as that obtained from calibration process. Satisfactory matching between observed and simulated stream flows was obtained at Kuniyil gauging station with a NSE of 0.57. Slight under estimations of peak flows and discharge volumes were experienced during the validation phase also.



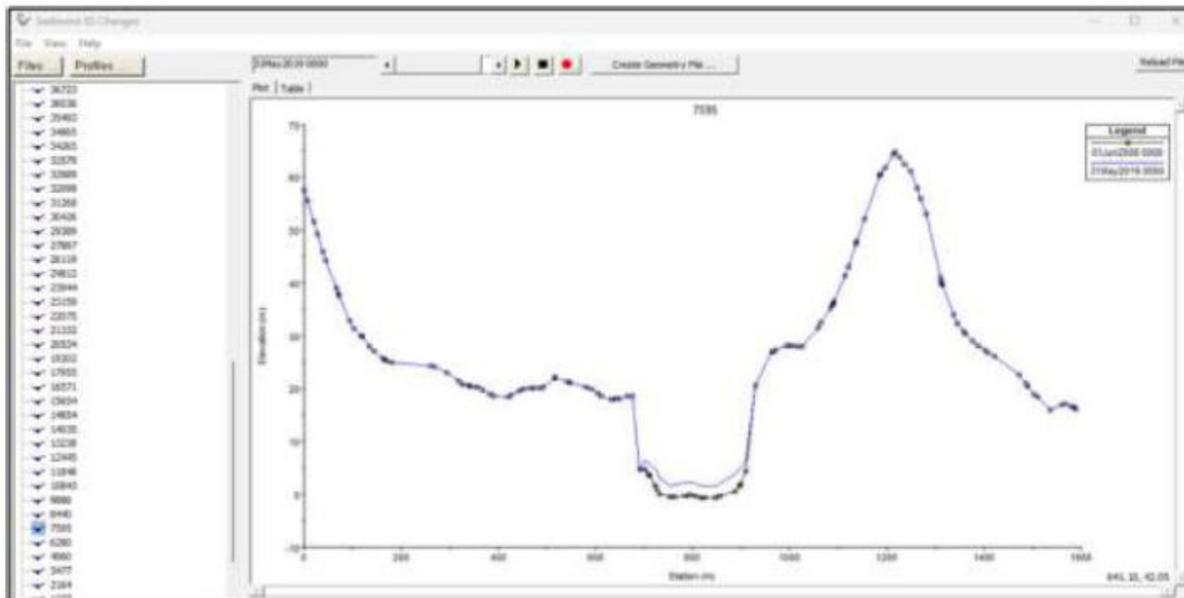
**Observed and simulated stream flows at Kuniyil gauging station during validation period**

#### 4.1.5 Sediment transport modelling

The quasi-unsteady sediment transport model was developed by providing time series of flow hydrograph obtained from HEC-HMS at upstream and lateral boundaries, stage-discharge curve at downstream boundary, sediment load time series obtained from MUSCLE model at upstream, lateral and downstream boundaries. The control volume is defined up to lateral extent of bank for a height of 1m above the thalweg of cross-section. The Wilcock-Crowe model was used to simulate the sediment transport in the catchment. Ruby's equation was used to model the fall velocity and Copeland method was used as the sorting method. Deposition outside movable bed limits was chosen as deposition method. Simulation was carried out during the period from 2018-2019. The cumulative bed change in terms of volume ( $m^3$ ), cumulative sediment inflow ( $m^3$ ), invert level change at each cross-section and cross-section change were also obtained. From these results, change in the characteristics (quantity and location) of sediment deposition with time can be studied.



**Comparison of initial (year 2018) and final (year 2019) longitudinal bed profile (green colour for the beginning of simulation period and orange colour for the end of simulation period)**

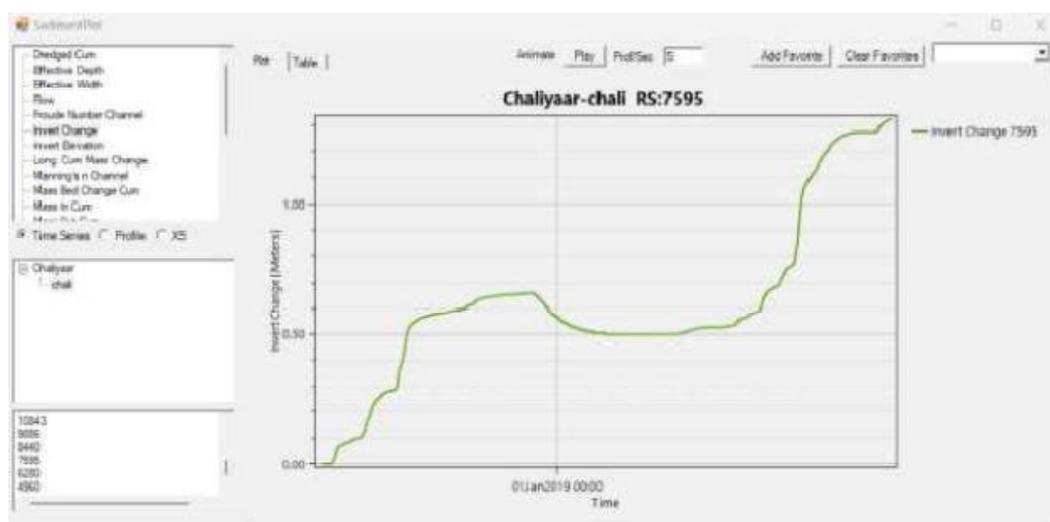


### Change in the bed level of the cross-section at chainage 7595m

In the invert (bed) level change plot, a level can be set in the form of a line below which mining will not be permitted. In this study, this line below which no extraction is permitted was set at 1m from the thalweg of the river cross-section following the Malaysia Sand Mining Guidelines (River sand Mining Management Guideline, 2009). However, any other feasible level can be set after critically examining the situation in the field. The stations at which the invert level change is greater than 1m were identified and also the date on which this threshold of 1m is reached and corresponding volume at that day were noted. This volume is then deducted from the cumulative sediment volume at the end of the simulation period, thereby yielding the volume of sand that can be safely extracted from that particular station. Excavation is not permitted within 500 m of bridges and other hydraulic structures as per as the Kerala Protection of River banks and Regulation of Removal of Sand Act (2001). Such stations were identified and marked as restricted zones in the Audit report. The mineable sand volume obtained is presented in Table below.

## Volume of available and mineable sand

Station code	Volume of sand available (tonnes)	Mineable sand volume (tonnes)
24812	353118.938	36397.626
23944	265332.344	131343.406
23159	305467.062	120548.078
22075	319663.500	141327.375
20534	272592.312	8881.312
13238	344430.000	188691.672
10843	414863.781	210314.625
9886	272553.156	65893.953
8440	555650.438	231594.750
7595	497855.562	141730.906
6280	387130.188	73787.188



## Invert level change plot

In this study, an attempt is made to develop a methodological framework to perform sand auditing and to quantify the amount of mineable sand with specific reference to the Chaliyar River in Kerala by performing hydrologic, hydraulic and sediment transport modelling. Although, the Chaliyar River has been considered in this study, the proposed methodological framework can be applied to other rivers as well.

## 5. WORKS UNDER THE HEAD OF ACCOUNT 4700-80-005-99-02-00- VINVESTIGATION OF MAJOR IRRIGATION SCHEMES

Works under this category are mainly devoted for engineering investigations for rehabilitation of existing structures under Kerala Irrigation Department. The highlights of works conducted

under this category during the year 2022-23 by the Coastal Engineering division are given below:

### **5.1 Engineering Investigations allied with the rehabilitation of existing hydraulic structures and various water resources related problems**

Kerala Engineering Research Institute (KERI) is entrusted with various works related to rehabilitation of existing hydraulic structures (for eg. investigation works allied with Attappillykkadavu RCB, Idiyanchira RCB, Kodumon aqueduct etc...) and various critical issues connected with the water resources sector of the State (Topographical investigation near Railway bridge to Vallarpadam Terminal at Vembanad lake). As a part of these investigations, it is necessary to determine the alignment or profile of structures, relative settlement of foundation of the structures, measurement of deformations or rotations of structural members and topographical features of the study area. The analysis and inference of the investigated data require expert guidance and suggestions from the faculty of other institutions and various Engineering colleges. Moreover, provision should be made for accommodating taxi charges for the site visit of officers. Therefore, an estimate of Rs. 2,00,000/- was prepared for meeting expenses of engineering investigations, honorarium for expert guidance and taxi charges for field visit of the officers. The Administrative and Technical Sanctions were accorded for this estimate and presently the work is going-on.

## **6. DEPOSIT WORKS**

The highlights of works conducted under this category during the year 2022-23 by the Coastal Engineering division are given below:

### **6.1 HK Mission - Construction of Bandhara Scheme across Kunthipuzha at Pombra, Kanjirayikkadavu in Karimpuzha Grama Panchayath in Palakkad District- Topographic Investigation.**

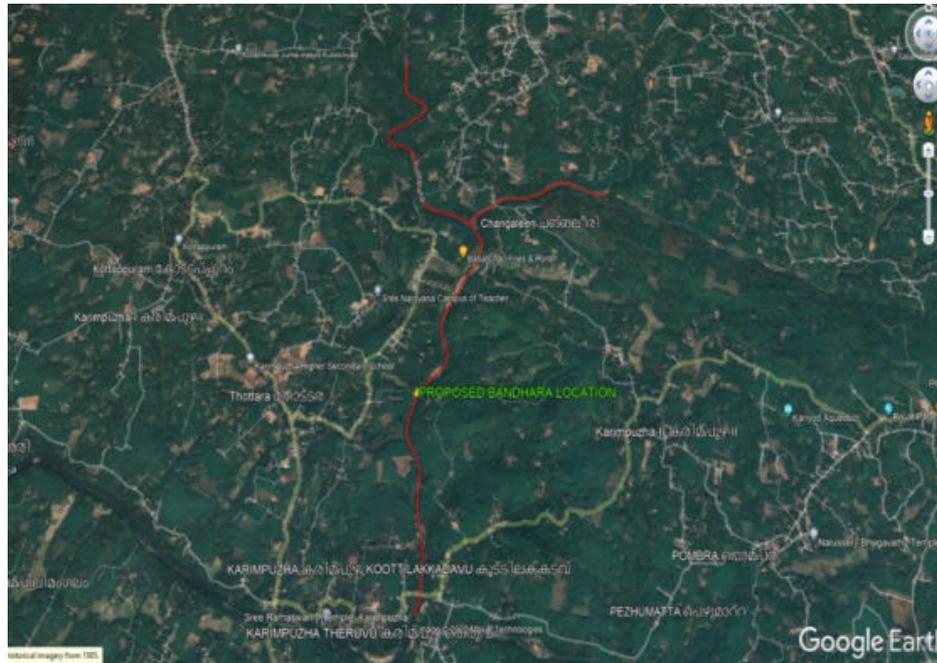
Topographic investigation for construction of Bandhara Scheme across Kunthipuzha at Pombra, Kanjirayikkadavu in Karimpuzha Grama Panchayath in Palakkad District was taken up by this division as per the instruction of Director (F&AR), KERI based on the request received from Executive Engineer, Minor Irrigation Division, Palakkad. The investigation work includes taking the cross-sectional details of the river and bank at the proposed Bandhara location as well as upstream and downstream of the same at specified intervals as per design requirements. For this work, cross-sectional details were taken at 15m interval for

a length of 60m in upstream and downstream, at 50m interval for the next 500m upstream and at 100m interval for the balance upstream and downstream reaches. A contour map at an interval of 1m was also prepared. Layout plan, contour plan, colour contour plan, cross-sections and longitudinal sections have been plotted.

The site is situated at Pombra, Kanjirayikkadavu in Karimpuzha Grama Panchayath of Palakkad district. The purpose of the investigation work is for construction of Bandhara to retain maximum quantity of water. By constructing a check dam in the proposed location, the problem of water scarcity in nearby areas can be solved. The fluctuations of water level in the river can be minimized and a steady surface and subsurface water level can be maintained. The estimate amount comes to Rs. 3,17,000/-.

Following conclusions were drawn from the inferences obtained during topographic investigation.

- GTS Bench Mark at Kuttippuram was considered as the reference bench mark. This RL was transferred to a location (629635.66m E and 1194200.957m N) near Pattambi Bridge. The RL of this location is +24.400 m with respect to MSL.
- Cross-sections of Kuthippuzha river and its banks were taken at specified intervals as per the design requirements (at 15m interval for a length of 60m in u/s and d/s, 50m interval for next 500m, 100m interval for a total of 5.765 km including d/s 1km).
- Cross-sections of Nellipuzha River and its banks (which is the major tributary of Kunthipuzha in the upstream of the proposed Bandhara location) were also measured at specified intervals (100m interval for a total of 1.515 until a significant level is reached).
- Eight small tributaries/thodu were observed in the upstream side of proposed Bandhara location. The cross-sections of these small tributaries along with their banks at specified intervals were also surveyed until significant levels were reached.
- River banks were also surveyed for ascertaining enough bank height for water storage.
- Layout plan, cross-sections, longitudinal section, contour maps at 1m interval and colour contour plan were prepared as per the design requirement.
- The longitudinal section was plotted by connecting the lowest points in each cross section.
- Roads and other permanent structures were plotted
- The river bed level varies from +43.693m to +44.608m at proposed site.
- The maximum ground level at Left bank of the proposed site is above +49.00m and that at the Right bank is above +63.00m



**Map showing proposed location of Bandhara Scheme**



**Images taken during topographic surveying**

## **6.2 JJM- Water supply scheme in Vattavada Panchayath- Construction of weir across Chilanthiyar in Idukki District-Topographic Investigation**

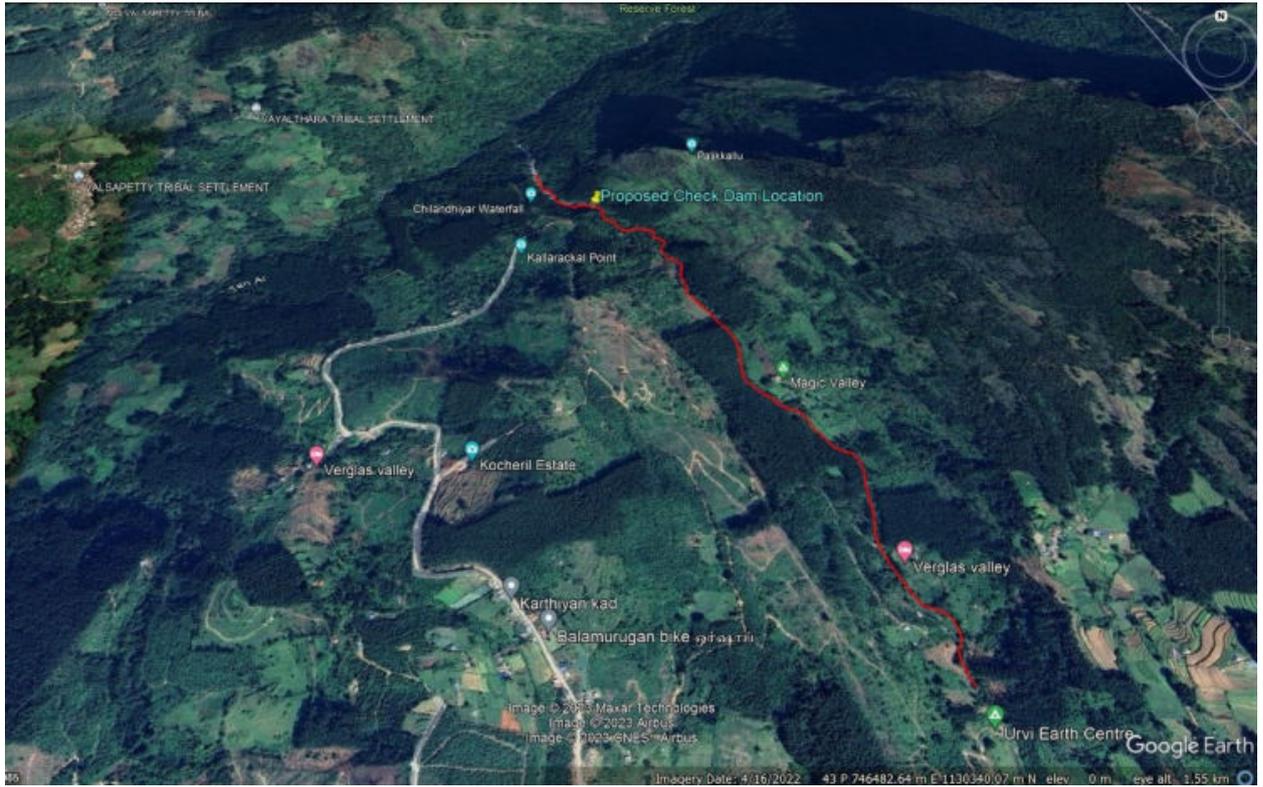
Topographic investigation for construction of weir across Chilanthiyar river at Vattavada Panchayath in Idukki District was taken up by this division as per the request received from Executive Engineer, Project Division, Kattappana. The investigation work includes taking the cross-section details of the river and bank at the proposed check dam location as well as

upstream and downstream of the same at specified intervals as per the design requirements. For this work, topographic survey was conducted at closer intervals in river and in bank near to the proposed location of check dam due to highly undulated and rocky terrain. Survey has been conducted at wider intervals for the remaining region. Contour map at an interval of 1m was also prepared. Layout plan, contour plan, cross-sections and longitudinal sections were plotted. Cross-section Number at proposed location of check dam is marked as “O”. Cross-sections towards downstream side are being marked as D1, D2, D3 etc. with positive chainages and cross-sections towards upstream side are being marked as U1, U2, U3 etc. with negative chainages.

The site is located in Chilanthiyar at Vattavada panchayath in Idukki District. The location for check dam was identified by project authorities. The proposed location is just upstream of Chilanthiyar waterfalls.

Following conclusions were drawn from the inferences of topographic surveying.

- The temporary base station for starting the surveying work was planned to connect with MSL from Cheruthoni dam. The coordinates and RL of reference benchmark of Cheruthoni dam are (715504.395 E, 1088799.720N) and +734.932m.
- The MSL was transferred first to the roof top of Kerala Water Authority Inspection Bungalow at Munnar and then to roof top of building near the work site at Vattavada. The coordinates and RL of the point established at roof top of building near work site which is considered as base station are (746854.743 E, 1127166.811 N) and +1612.558m.
- A Temporary Bench Mark (TBM) was also established at the site near an electric post with coordinates and reduced level of (745841.042E, 1131415.441N) and +1536.396m.
- Topographic surveying was conducted at closer intervals in river and bank near to the proposed location of check dam due to highly undulated and rocky terrain. Surveying was conducted at wider intervals for the remaining reaches upstream and downstream of the proposed location. River bank was also surveyed for ascertaining enough bank height for storing water.
- Cross-section number at the proposed location of check dam was marked as “O”. Cross-sections towards downstream side are marked as D1, D2, D3 etc with positive chainage values and cross-sections towards upstream side are marked as U1, U2, U3 etc with negative chainage values.
- Layout plan, cross-sections, longitudinal section and contour maps at 1m interval were prepared as per the design requirement.
- Roads and other permanent structures were plotted.



Map showing location of proposed check dam at Vattavada





**Images taken during topographic surveying**

**LIST OF PERSONNELS- 2022-23**

- |                  |  |
|------------------|--|
| 1. Raji Thampan  | Deputy Director from 01.04.2022 onwards            |
| 2. Anoop R.      | Assistant Director I from 13.04.2022 onwards       |
| 3. Devarajan K.  | Assistant Director II from 01.04.2022 onwards      |
| 4. Jaisree P. P. | Research Assistant I from 01.04.2022 to 29.09.2022 |
| 5. Jishi A. A.   | Research Assistant I from 21.12.2022 onwards       |
| 6. Biji C. J.    | Overseer Grade III from 01.04.2022 onwards         |

# **C.SEDIMENTATION DIVISION**

## **SEDIMENTATION DIVISION**

### **1.0 INTRODUCTION**

Sedimentation Division conducts studies to compute the present capacity of reservoirs and other water bodies. Such studies are conducted using modern electronic method called 'Integrated Bathymetric System'(IBS).In order to ascertain the underwater profile of the sediment layer another sophisticated instrument called 'Sub Bottom Profiler' is used. From 2004 onwards, this division has completed 60 studies using IBS which includes Kallada Reservoir, Malampuzha Reservoir, Neyyar Reservoir Mullaperiyar, Vembanad Lake and Kattampally Wetland etc. Sub Bottom profiler was used for 30 of the above studies.

#### **Relevance of the study**

- To estimate the present capacity of the reservoirs
- To manage the reservoir operations based on the present actual capacity
- Vital role in the ongoing Desiltation work of reservoirs for the capacity improvement
- To observe the influence of the heavy flood in 2018 and 2019 in the reservoir sedimentation

#### **THE SURVEY TEAM OF THE YEAR 2022-23**

<b>Director</b>	Er. Suprabha N
<b>Joint Director</b>	Er.Shini K K
<b>Deputy Director</b>	Er.Divya C J
<b>Technical Team</b>	
Er.Roshni S S	Assistant Director
Er. Jayasree K V	Assistant Director
Money K K	Research Assistant
Farisha T S	Research Assistant
Divyesh V B	Third Grade Overseer
<b>Crew</b>	
Udayan P K	Departmental Boat Driver
Jayakumar T R	Boat Driver (on HR basis)
Sudheesh K C	Departmental Jeep Driver
Anitha M M	Office Attendant

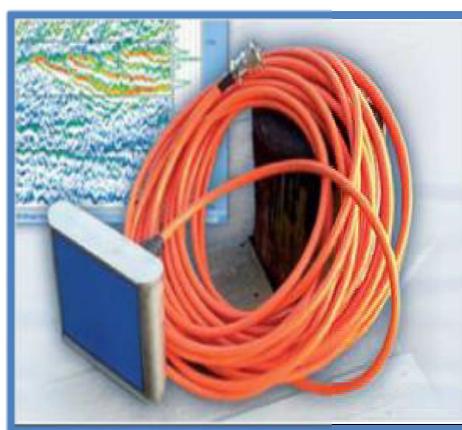
## 2.0 EQUIPMENTS OF SURVEY

### 2.1 Sub Bottom Profiler

The system SES-2000 sub-bottom profiler, which is a mobile parametric sediment sounder, was used for bathymetric and sub-bottom profiling survey. The SES- 2000 hardware component and transducers are shown in Figures below. High frequency signal (HF -100 kHz) and the secondary low frequency signal (LF -6 to 12kHz) are used. The spatial distribution of sediment in each cross section can be analyzed.



**Top- side Unit**



**Transducer**

## B. INTEGRATED BATHYMETRIC SYSTEM (IBS)

The components of IBS are

- FRP boat
- DGPS –MX-610
- Echosounder
- Survey P C
- Helms man display

### FRP BOAT

Fiber reinforced Plastic (FRP) boathaving two 60 HP petrol out board engines, dimension of 7.5m X 2.66m X 1.20m and 8persons capacity with the equipment is used for the survey.For the power supply, two solar panels of 80Watt each are mounted on the roof of the boat.



**FRP Boat**

### **DGPS SIMRAD MX-610**

DGPS SIMRAD MX- 610 is highly reliable and it receives correction from a permanent reference station, which is approved by Govt. of India, Dept. of Light house and Light ship. It can also track up to 12 satellites to achieve maximum positional accuracy. The received position is transferred to Echo Sounder and Sub Bottom Profiler data collection laptop.



**MX610 Navigation System**

### **MIDAS SURVEYOR ECHOSOUNDER**

The MIDAS Surveyor is a revolution of small boat survey work with an integral GPS receiver. It logs and displays DGPS position data in WGS 84 or Local Grid. This Echo-sounder is designed to measure under water depth up to 1200m. Accuracy of instrument is 1centimeter. The dual frequency echo-sounder is specified to distinguish between fluff top depth and the consolidated bottom. The high frequency (200 KHz) is used to detect the top of the mud/sediment. Under favorable conditions the low frequency signal (33 KHz) can penetrate into the bottom and reveal information about the bottom structure.



**MIDAS Surveyor Echo Sounder**

### **SURVEY PC**

The Qinsy survey software is installed in the laptop for data collection and processing.

All the position data collected using DGPS and the depth of water collected using echo-sounder are recorded in computer and are further processed.

### **HELMS MAN DISPLAY**

This is an extension monitor of the survey PC for guidance of boat driver.

Mobile station set up for data collection is shown below.



**Equipment Set up inside the Boat**

## SOFTWARES USING FOR THE SURVEY

### ➤ QINSY SOFTWARE

This software is used for data collection and processing in IBS survey. The Bathymetric software supports NMEA 0183 compatible devices. Local grid UTM (WGS-84) is the projection supported by this software.

### ➤ SESWIN

This software is used for the data collection in Sub Bottom Profiler.

### ➤ I.S.E. 2.9.2

This is the post processing software used for analyzing the data collected from Sub Bottom Profiler.

### ➤ Surfer software

Surfer is a graphic program used for calculating the volume based on the logged data from the IBS and Sub Bottom Profiler.

## 3.0 DATA COLLECTION

The mobile station consists of the DGPS and its antenna, Echo sounder, Sub Bottom Profiler and the transducers etc which are mounted on the FRP boat. The transducer of Sub Bottom Profiler is permanently fixed at the center of the boat. The transducer of Echo sounder is connected to the left side of the boat and is detachable. Proper connections are made between these equipment and the laptops for the data collection. By using the **Planning and presentation** menu in **Qinsysoftware**, chart is prepared by taking UTM co-ordinate at two known points. With these co-ordinates of two points reference lines are drawn. Segment lines are drawn parallel to this reference line at a particular interval such that the entire reservoir area can be covered. The boat is sailed along the planned track with a speed of 3 to 4 knots. The data from the Echo sounder and Sub Bottom Profiler is collected simultaneously through two laptops. For IBS Survey, the laptop loaded with QINSY survey software is used. For Sub Bottom Profiler, the data is collected using laptop installed with Seswin software. There are three modules in the QINSY Software. Data Acquisition, Data Processing and Data export/import.



### Data Collection set up inside the Boat

The system **SES-2000** (Sediment Echo Sounder) Sub Bottom Profiler is a parametric (non-linear) dual frequency echo sounder. The instrument simultaneously transmits two signals of slightly different high frequencies; their interaction creates a new low frequency signal. It has a large bandwidth and a short signal length, which allows good use in very shallow water and results a high (~15 - 20 cm) vertical resolution at acceptable sub-bottom penetration up to 10 m or more. Some favorable near sub-bottom seismic and geological conditions permit to achieve a vertical resolution up to 10 cm. Parametric (non-linear) sound generation allows designing acoustical systems with small transducer dimensions and narrow sound beams at low frequencies. An Innomar SES-2000 parametric transducer has an active area of 20 x 20 cm and provides a beam width of less than four degrees (at 3dB), valid for all adjustable low frequencies between 5kHz and 15 kHz. The transmit directivity of the parametric sound beam does not show any significant side lobe characteristic, which reduces ambiguities during the interpretation of individual reflectors. Short transmit signals of single sinusoidal cycles without any ringing and high ping rates of up to 50 pings per second are further advantages. They contribute to a high spatial resolution of this acoustical system and permit to apply it in a shallow basin. Innomar's software tool ISE provides near real-time processing of the collected SES data. The operation procedure can be tuned on-line. A value of the sound velocity in water is used to convert sound travel time to the depth. The depth values are screened online.

#### 4.0 ACTIVITIES OF THE DIVISION DURING THE YEAR 2022-23

- The reports of the bathymetric studies of Kallada and Maniyar Reservoirs which were conducted during the financial year 2021-22, has been completed during this year.
- The bathymetric surveys of Sholayar reservoir (under KSEB), Chettuva Kayal, Asurankundu, Pathazhakkundu and Poomala reservoirs have been conducted during the year 2022-23.
- The following works have been carried out for Kerala Water Authority in connection with the construction of floating pump house by Jala Jeevan Mission (JJM)
- Bathymetric study of Ponmudi reservoir using IBS
- Bathymetric study of Idukki reservoir (near Cheruthoni boat landing area) using IBS
- Bathymetric study of Idukki reservoir (near Anchuruli) using IBS
- A new small boat has been purchased for conducting the sedimentation studies of small rivers, canals, ponds etc.
- A new boat shed has been constructed for the new small survey boat purchased
- Apart from that the routine upkeep of the office, survey equipment etc has been done in this financial year too.
- The common procedure preparation for the ISO certification process has been conducted.

The details of the completed reports are as follows:

#### 4.1 Sedimentation study of Kallada reservoir using Integrated Bathymetric System (IBS) & Sub Bottom profiler

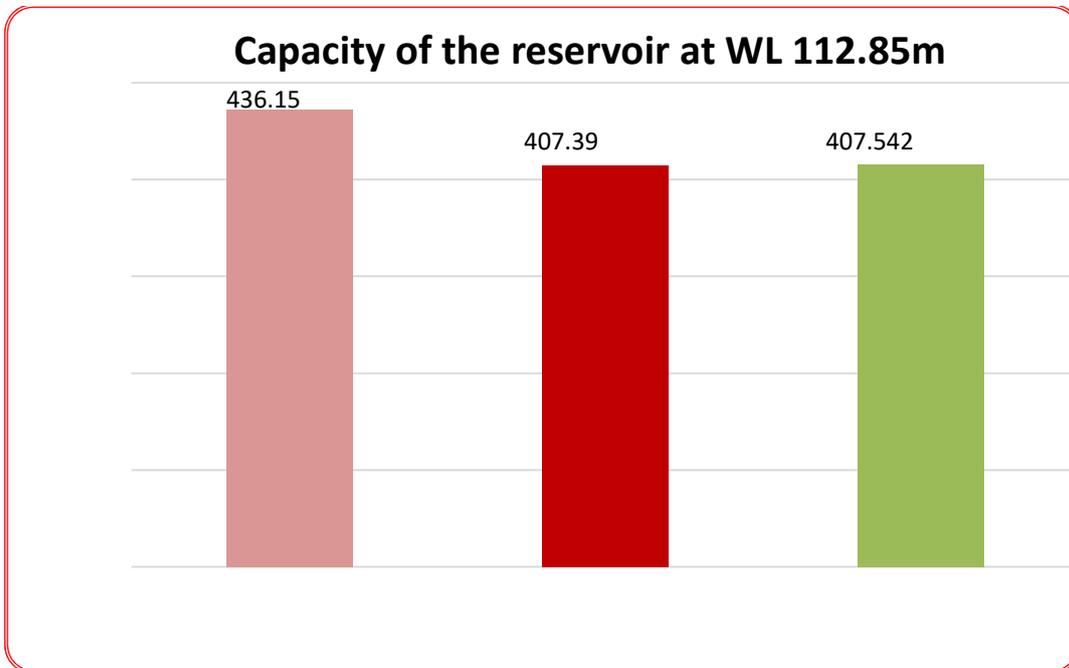
Sedimentation study of Kallada reservoir was conducted previously in 2018 before flood. The repeat study of Kallada reservoir using IBS & Sub bottom profiler has been conducted in the year 2022 to find out the changes in sedimentation due to the effect of heavy floods of 2018 and 2019.

Results and Discussion

##### ESTIMATION OF CAPACITY

The survey is carried out at the water level of 112.85 m. The original water holding capacity at this level is 436.15 Mm<sup>3</sup>. As per the current IBS study the volume of water at the same level is estimated as 407.542 Mm<sup>3</sup> and the corresponding water spread area is 23.12 Sq.km. Total capacity reduction of the reservoir at this level is 28.608 Mm<sup>3</sup> in 36 years, i.e. the reduction in capacity at the specified level is 6.56 %. In the previous survey conducted in 2018 the capacity obtained was 407.390 Mm<sup>3</sup>. Fig below shows the graphical representation

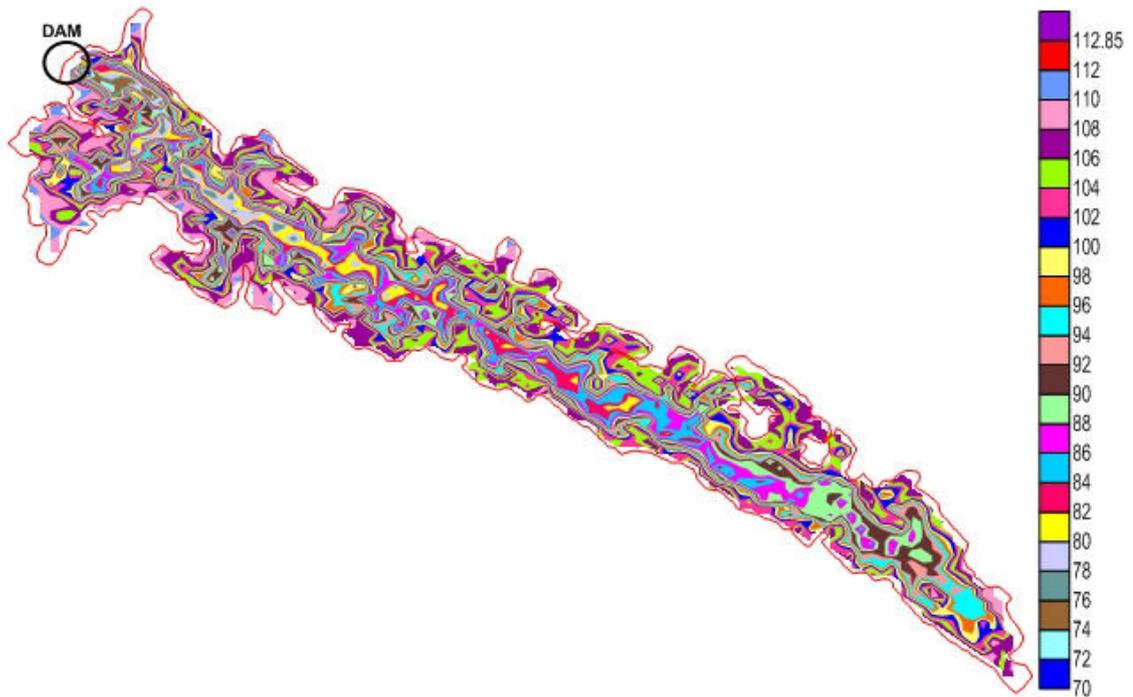
of the original capacity and the capacities in 2018 and 2022 at the same water level of 112.85m. Table below shows the comparison of reservoir capacity at WL 112.85m. At this water level the water holding capacity shows a slight increase from the previous year's value and this may be the effect of the heavy floods in 2018 and 2019.



Variations in Reservoir Capacity

Capacity reduction of the reservoir at WL 112.85m

Year of Study	Water Level (m)	Capacity Mm <sup>3</sup>	Reduction in Capacity w.r.t. Original Volume (436.15 Mm <sup>3</sup> )	
			Mm <sup>3</sup>	Percentage
2022	112.85	407.542	28.608	6.56



Contour Map based on IBS Survey

CAPACITY AT DIFFERENT WATER LEVELS

Reservoir volume at different water levels can be found out by using Surfer software from the IBS data collected through QINSY software. The present capacity at different level is compared with the original and IBS study results obtained in 2018 and is shown in Table.

Table Reservoir capacity at different water levels

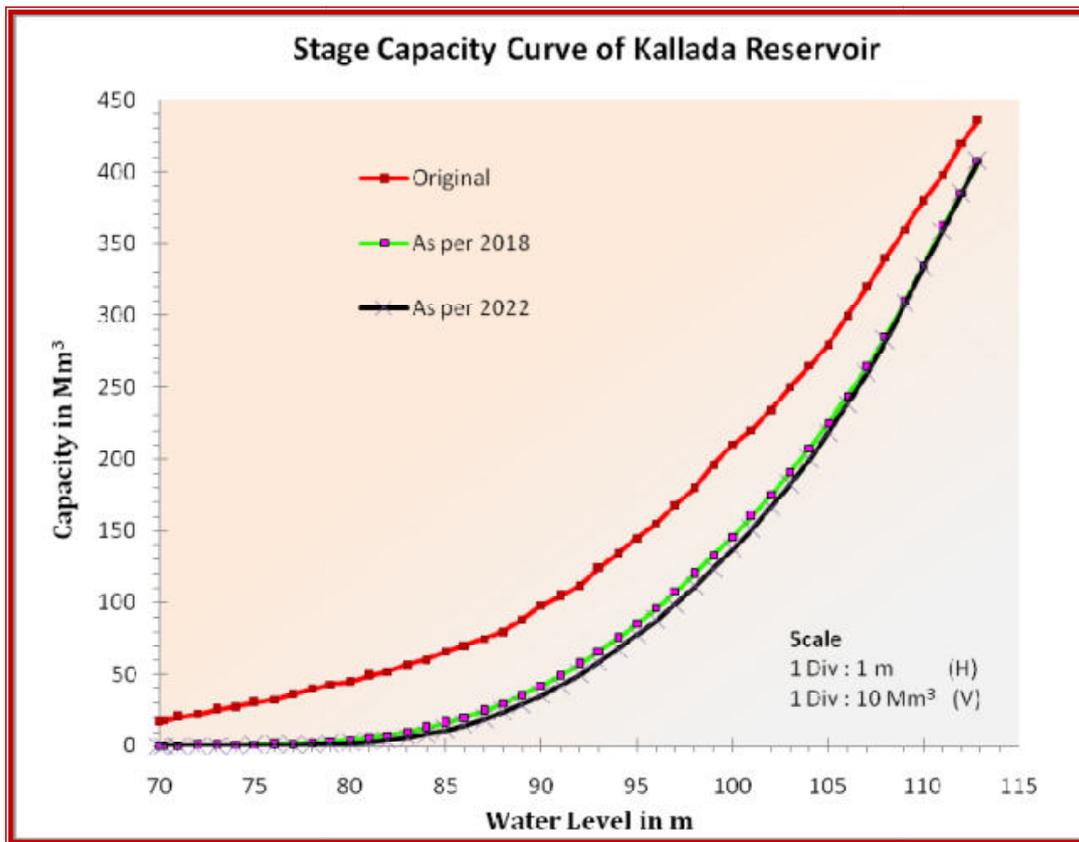
Water Level	Water Holding Capacity			Percentage Reduction in Capacity as per 2022 survey w r t original
	Original	IBS Survey 2018	IBS Survey 2022	
(m)	(M. Cub. m)	(M. Cub m)	(M. Cub m)	%
112.85	436.150	407.390	407.542	6.56
112	420.000	385.429	385.314	8.26
111	398.000	361.783	359.195	9.75

110	380.000	334.107	333.197	12.32
109	360.000	309.270	307.624	14.55
108	340.000	285.684	282.944	16.78
107	320.000	263.770	259.713	18.84
106	300.000	243.600	238.203	20.60
105	280.000	224.874	218.289	22.04
104	265.000	207.358	199.747	24.62
103	250.000	190.796	182.455	27.02
102	234.000	175.070	166.357	28.91
101	220.000	160.134	151.264	31.24
100	210.000	145.930	137.058	34.73
99	196.000	132.437	123.649	36.91
98	180.000	119.652	110.980	38.34
97	168.000	107.502	99.036	41.05
96	155.000	96.116	87.806	43.35
95	145.000	85.344	77.274	46.71
94	134.000	75.269	67.483	49.64
93	124.000	65.900	58.374	52.92
92	112.000	57.187	49.922	55.43
91	104.000	49.146	42.162	59.46
90	98.000	41.824	35.129	64.15
89	88.000	35.241	28.829	67.24
88	80.000	29.389	23.318	70.85
87	75.000	24.270	18.548	75.27
86	70.000	19.799	14.456	79.35
85	66.000	15.903	11.019	83.30
84	60.000	12.590	8.200	86.33
83	57.000	9.805	5.954	89.55

82	52.000	7.494	4.234	91.86
81	49.000	5.650	2.950	93.98
80	45.000	4.211	2.013	95.53
79	43.000	3.099	1.344	96.87
78	40.000	2.242	0.878	97.81
77	36.000	1.589	0.568	98.42
76	32.000	1.125	0.366	98.86
75	30.000	0.796	0.220	99.27
74	27.000	0.553	0.116	99.57
73	25.000	0.372	0.048	99.81
72	22.000	0.235	0.012	99.95
71	20.000	0.135	0.000	100.00
70.25*	17.750	0.086	0.000	100.00
70	17.000	0.075	0.000	100.00

\*Dead Storage Level

The original storage capacity curve is compared with the same obtained from the IBS surveys in 2018 and 2022 as is shown below.



Stage - Capacity curve

**WATER SPREAD AREA AT DIFFERENT WATER LEVELS**

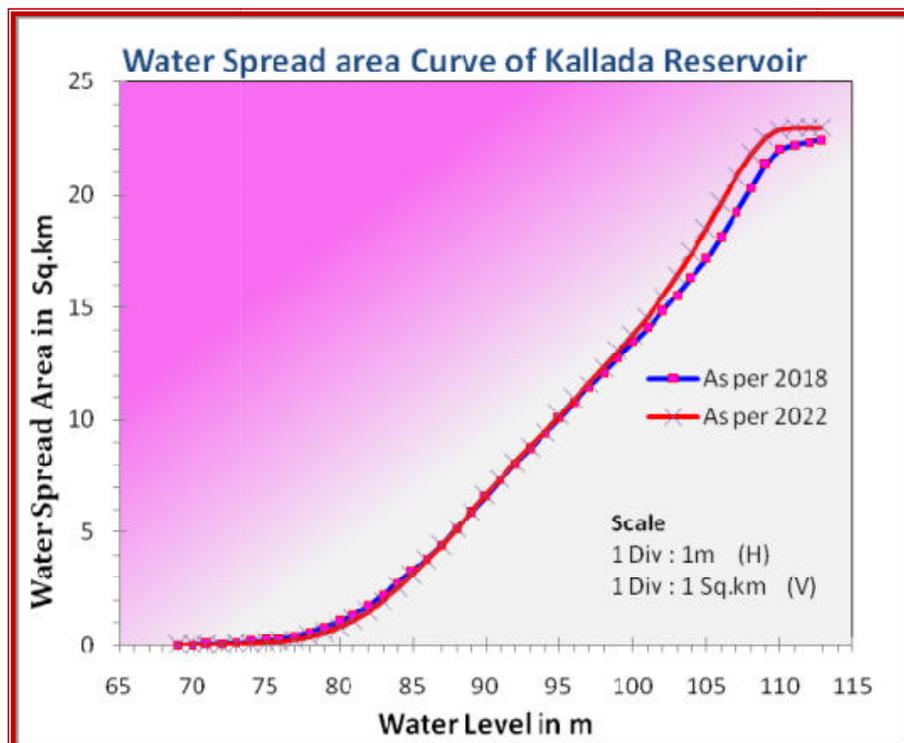
The present water spread area at different water level is compared with the area obtained in the IBS survey in 2018 and is shown in Table. Figure shows its graphical representation.

**Water spread area at different water levels**

Sl. No.	Water Level (m)	Water Spread Area	
		IBS Survey 2018 (M. Cub m)	IBS Survey 2022 (M. Cub m)
1	112.85	22.40	22.940
2	112	22.30	22.930
3	111	22.18	22.923

4	110	22.00	22.843
5	109	21.40	22.515
6	108	20.30	21.771
7	107	19.18	20.797
8	106	18.08	19.641
9	105	17.14	18.504
10	104	16.34	17.422
11	103	15.58	16.404
12	102	14.83	15.452
13	101	14.12	14.596
14	100	13.44	13.802
15	99	12.76	13.056
16	98	12.09	12.325
17	97	11.44	11.603
18	96	10.78	10.912
19	95	10.10	10.191
20	94	9.40	9.463
21	93	8.71	8.803
22	92	8.07	8.133
23	91	7.37	7.409
24	90	6.62	6.691
25	89	5.89	5.919
26	88	5.15	5.138
27	87	4.44	4.426
28	86	3.84	3.764
29	85	3.27	3.117
30	84	2.74	2.524
31	83	2.24	1.966

32	82	1.77	1.482
33	81	1.35	1.096
34	80	1.04	0.790
35	79	0.79	0.557
36	78	0.59	0.381
37	77	0.42	0.242
38	76	0.28	0.168
39	75	0.21	0.123
40	74	0.15	0.084
41	73	0.12	0.050
42	72	0.08	0.023
43	71	0.04	0.000
44	70	0.01	0.000
45	69	0.00	0.000



Water level v/s water spread area curve

## ANALYSIS OF SOIL SAMPLE

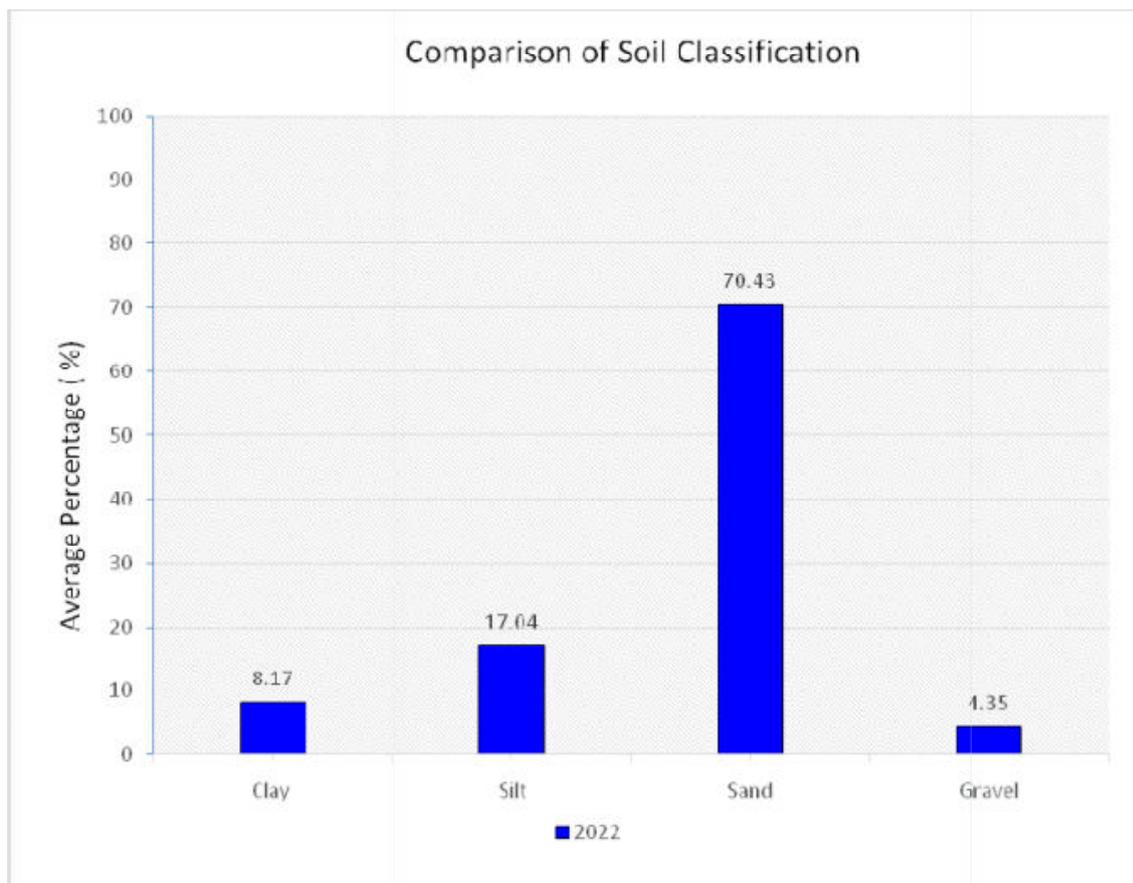
In this study 23 Nos of disturbed soil samples were analyzed. The result of soil sample analysis is shown in Table below. The graphical representation of average percentage of Clay, Silt, Sand and Gravel is shown in the form of bar chart given in the figure below.

## Soil Sample Analysis Result

Sl no.	Sample Position	Depth of Sample taken in m	Nature of sample	Soil Texture	Colour	% of Various size of Soil Particle			
						Clay	Silt	Sand	Gravel
1	N-0987451 E- 733555	7	Disturbed	Sandy soil	Slate Gray	10	4	80	6
2	N-0986560 E- 733451	12	Disturbed	Sandy soil	Light Buff	5	0	94	1
3	N-0986656 E- 735317	12	Disturbed	Sandy soil	Slate Gray	11	33	56	0
4	N-0985255 E- 735511	12.3	Disturbed	Sandy soil	Light Buff	6	2	85	7
5	N-0985821 E- 737785	12	Disturbed	Sandy soil with organic matter	Slate Gray	12	32	56	0
6	N-0985063 E- 737960	12.5	Disturbed	Sandy soil with organic matter	Slate Gray	6	10	74	10
7	N-0983747 E- 738164	9.8	Disturbed	Sandy soil	Ash Gray	2	2	96	0

8	N-0984464 E- 739521	12	Disturbed	Silty sand	Slate Gray	13	42	44	1
9	N-0983207 E- 739435	13.6	Disturbed	Sandy soil	Light Buff	2	1	95	2
10	N-0982824 E- 740769	14	Disturbed	Silty sand	Slate Gray	11	36	44	9
11	N-0982347 E- 740994	8.1	Disturbed	Sandy soil	Slate Gray	8	15	75	2
12	N-0981746 E- 741270	1.7	Disturbed	Sandy soil	Ash Gray	2	1	97	0
13	N-0986461 E- 733095	11.3	Disturbed	Gravelly sand	Ash Gray	9	11	62	18
14	N-0986446 E- 732146	10.7	Disturbed	Silty sand	Slate Gray	10	17	64	9
15	N-0988600 E- 731836	12.3	Disturbed	Sandy soil with organic content	Slate Gray	11	21	67	1
16	N-0987254 E- 729745	10.2	Disturbed	Sandy soil	Slate Gray	7	13	75	5
17	N-0987670 E- 729081	12.8	Disturbed	Sandy clay	Slate Gray	4	16	78	2
18	N-0987364 E- 730329	12	Disturbed	Silty sand	Slate Gray	14	23	61	2
19	N-0989306 E- 730448	9.4	Disturbed	Sandy soil	Slate Gray	6	12	82	0

20	N-0988778 E- 728421	7.2	Disturbed	Gravelly sand	Slate Gray	4	1	76	19
21	N-0988234 E- 727402	6.4	Disturbed	Sandy silt	Slate Gray	13	48	38	1
22	N-0989638 E- 727449	12.8	Disturbed	Silty sand	Slate Gray	12	34	52	2
23	N-0990894 E- 728495	9.3	Disturbed	Silty sand	Slate Gray	10	18	69	3



Comparison of Soil particle distribution

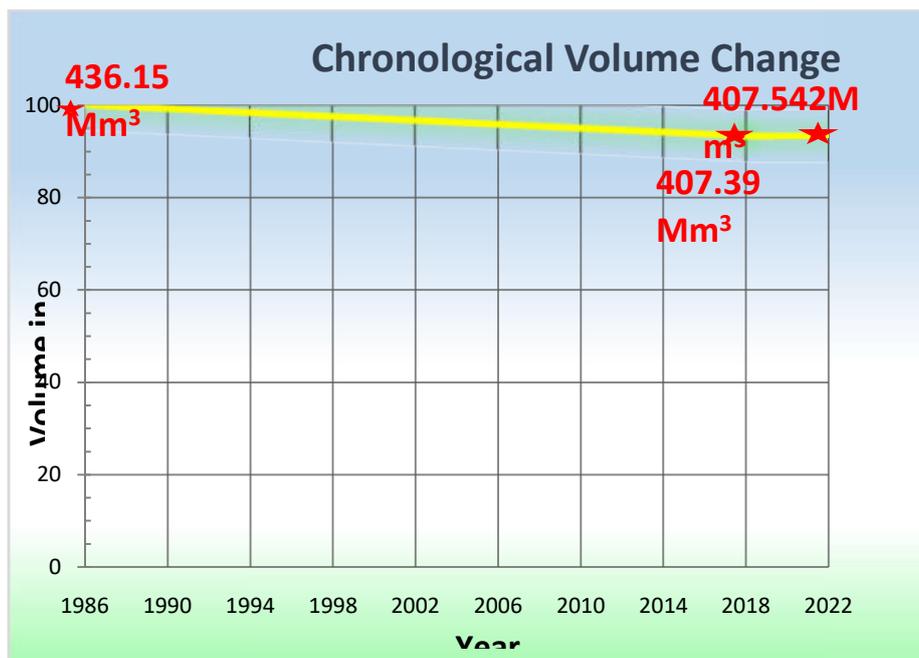
The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.

## RESULTS AND DISCUSSIONS

The full reservoir level of Kallada reservoir is 115.82 m. The present study is conducted at the water level of 112.85m. The original capacity of the reservoir corresponding to this level is 436.15 Mm<sup>3</sup>. The present study results are summarized below.

- The Reservoir capacity is 407.542Mm<sup>3</sup> at the water level of 112.85m and the capacity is reduced by 28.608 Mm<sup>3</sup> in 36 years.
- The water spread area corresponding to the level of 112.85m is 22.94 km<sup>2</sup>
- Original capacity at dead storage level (70.25m) is 17.75 Mm<sup>3</sup> and capacity at dead storage level obtained from present study is 0.0 Mm<sup>3</sup>. i.e Percentage reduction in dead storage is 100% in 36 years.
- Sediment layer profile of the reservoir area at an interval of 100m is obtained from the Sub Bottom Profiler.

The graphical representation of chronological volume change is shown in Figure below.

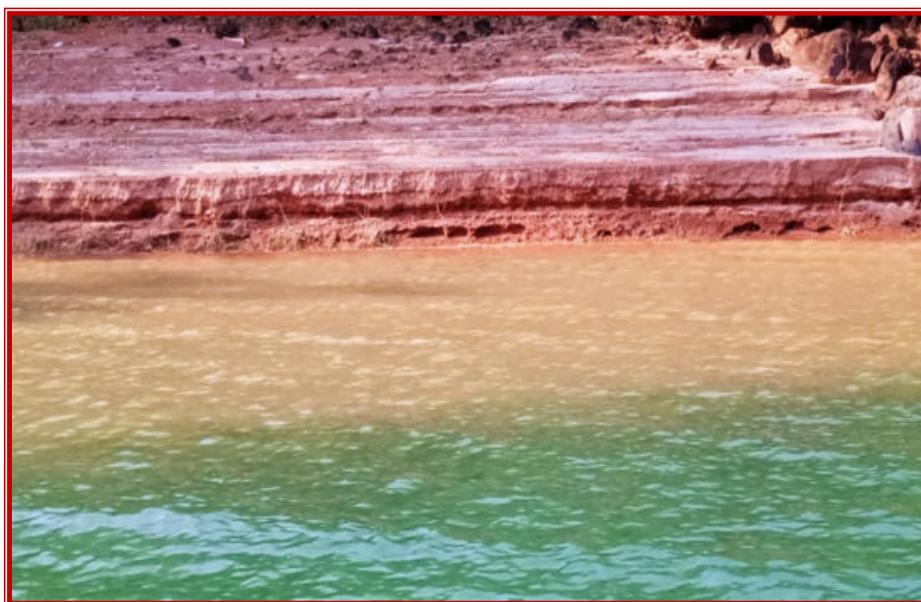


Chronological Volume Change

The reservoir capacity obtained by the previous survey conducted in 2018 (before flood) was 407.39 Mm<sup>3</sup> corresponding to the same water level of 112.85m. It is observed that the present capacity at this level is slightly increased by 0.152 Mm<sup>3</sup>. As a usual phenomenon the capacity of the reservoir should be reduced comparing with the previous survey. Hence this change in phenomenon needs to be explained. For this purpose, the sedimentation survey results were analyzed and the following observations have been made.

- ❖ At the water level of 112.85 m, the reservoir capacity shows an increase from the previous year's value and below this level the capacity decreases.
- ❖ This increase in capacity is due to the increase in water spread area from 22.40 km<sup>2</sup> (previous year's value ) to 22.94 km<sup>2</sup>.
- ❖ Up to reservoir level of 89.0m there is increase in the water spread area and there after decrease in the same.
- ❖ The capacity and water spread area is zero from the level 71.0m to 69.0m ie the dead storage area (at 70.5m) is filled completely with sediments.

The sedimentation in reservoirs is dependent on many factors such as the size of the reservoir relative to the volume of sediment flowing in, which in turn depends on river discharge, sediment load carried by the stream, topographical and physical features of the catchment area and reservoir area, duration of rainy season etc. Soil erosion occurred due to the scouring action of the high waves generated by the wind is a cumulative factor for sedimentation in Kallada reservoir. These can be illustrated in the following plates.



**Side erosion due to waves**



**Huge sand deposit at Umayar River mouth**

Scouring action of the heavy waves generated by the wind and effect of heavy flood occurred in 2018 and 2019 caused erosion in top level of reservoir. This is the reason for increase in water spread area and thus the capacity at the water level 112.85m with respect to the previous study. Water spread area shows an increase up to a level of 89.0m in the present study compared with previous study results. But the capacity shows a slight increase at the topmost level only, due to the increase in water spread area. At the bottom layers even though the water spread area shows a slight increase, the capacity decreases due to the deposition of the scoured material from the top layers. At the bottom level of 71.0m onwards the capacity loss is 100% ie; entire area below this level is filled with scoured materials from top layers and sediment load carried by the stream. From the salient features of the reservoir, it is known that the dead storage level is 70.25m. ie the reservoir area above the dead storage level also almost completely filled with sediments. The gross reduction in capacity at water level 112.85m is only 6.56%. Actual reservoir capacity of  $407.542\text{Mm}^3$  at this level is reduced by  $28.608\text{Mm}^3$  in 36 years. From this reduced capacity around 69.91% ( $20\text{Mm}^3$ ) capacity loss is caused by the deposition at bottom area below the water level of 71.0 m.

The original dead storage capacity is  $17.75\text{Mm}^3$ . This much capacity is completely filled with sediments. The live storage capacity at the level of 112.85m is reduced by  $10.858\text{Mm}^3$  of sediment deposition. That is the live storage capacity is also affected by the sediment

deposition. Hence urgent measures may be taken to restore the original capacity of the reservoir.

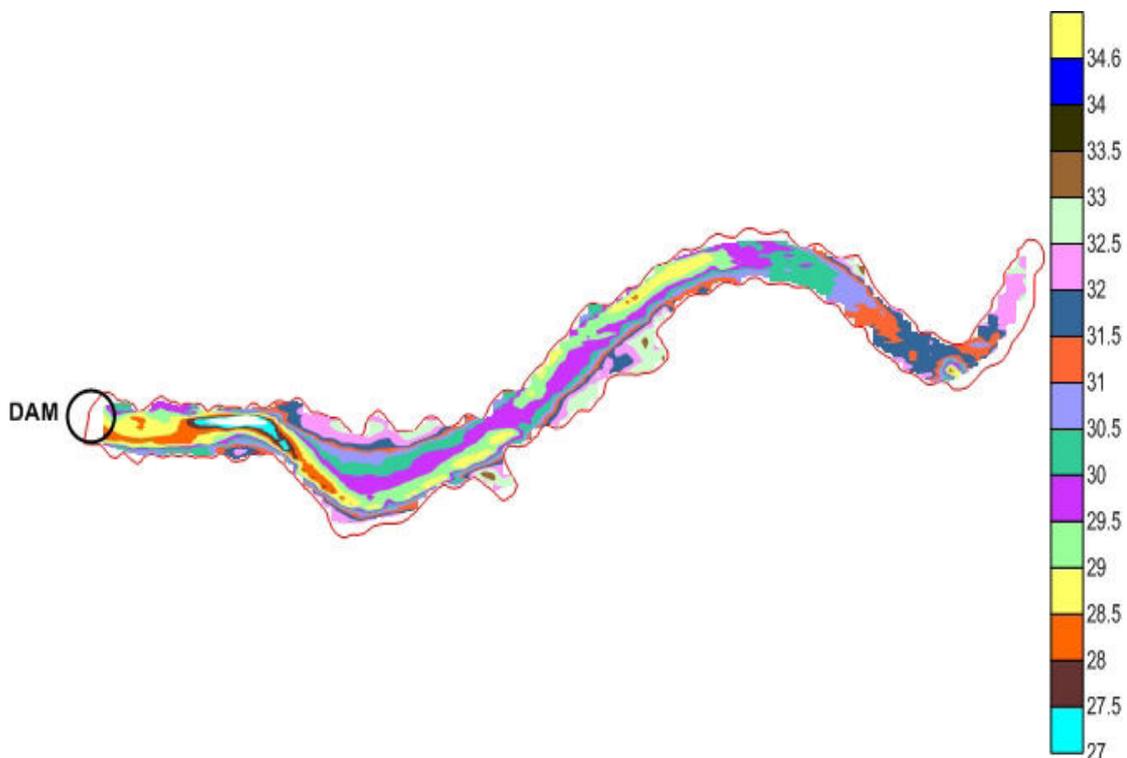
#### 4.2 Bathymetric study of Maniyar reservoir using integrated bathymetric system (IBS) & sub bottom profiler

Sedimentation study of Maniyar reservoir has not been conducted yet. The present study using IBS & Sub bottom profiler has been conducted during the year 2022-23 in order to assess the effect of the extra ordinary floods occurred in the year 2018 and 2019 as per the direction of the Chief Engineer, Projects-1.

#### Results and Discussion

##### ESTIMATION OF CAPACITY

The survey is carried out at the water level of 34.6 m. As per the current IBS study the volume at this water level is estimated as 0.982 Mm<sup>3</sup> and the corresponding water spread area is 0.201 Sq.km. Reservoir volume at different water levels can be found out from the IBS data collected through QINSY software by using Surfer software. Table shows reservoir capacity at different water levels and Figure shows contour map based on IBS survey.

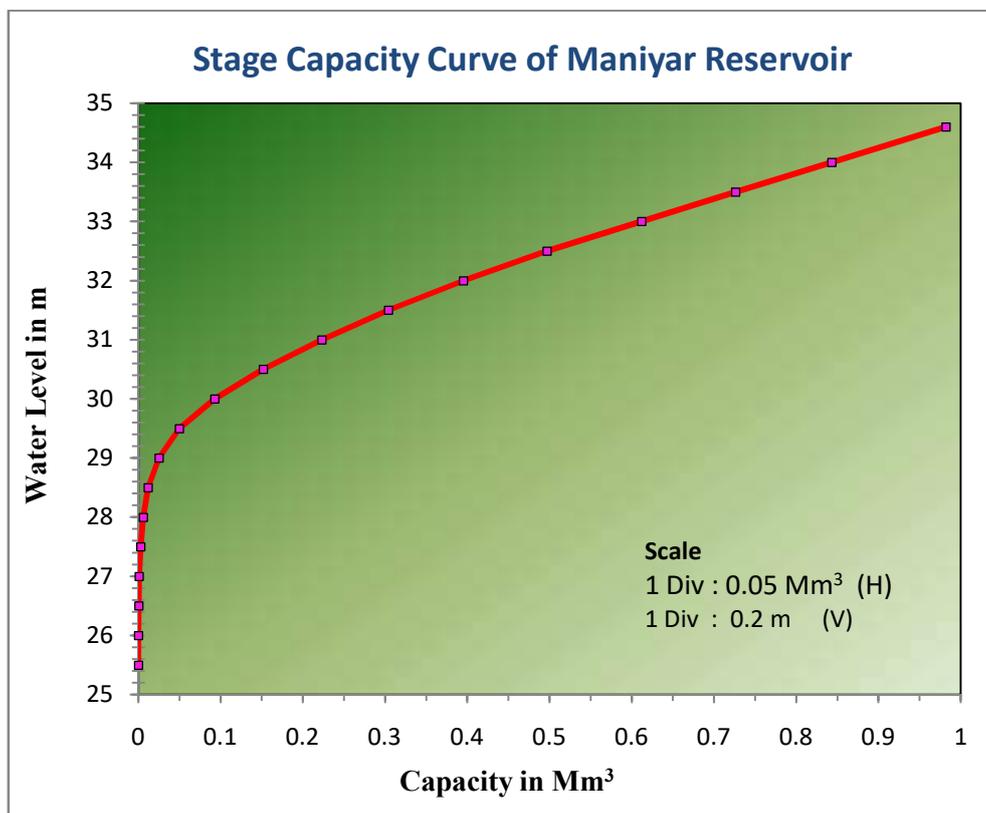


Contour Map based on IBS Survey

## Reservoir capacity at different water levels

Sl No.	Water Level (m)	Water holding capacity as per IBS Survey 2022 (Mm <sup>3</sup> )
1	34.60	0.9820
2	34.00	0.8430
3	33.50	0.7260
4	33.00	0.6120
5	32.50	0.4970
6	32.00	0.3950
7	31.50	0.3040
8	31.00	0.2230
9	30.50	0.1520
10	30.00	0.0930
11	29.50	0.0500
12	29.00	0.0250
13	28.50	0.0120
14	28.00	0.0060
15	27.50	0.0030
16	27.00	0.0010
17	26.50	0.0006
18	26.00	0.0002
19	25.50	0.00002

The stage capacity curve obtained from the 2022 IBS survey is shown in Figure below.



Stage - Capacity curve

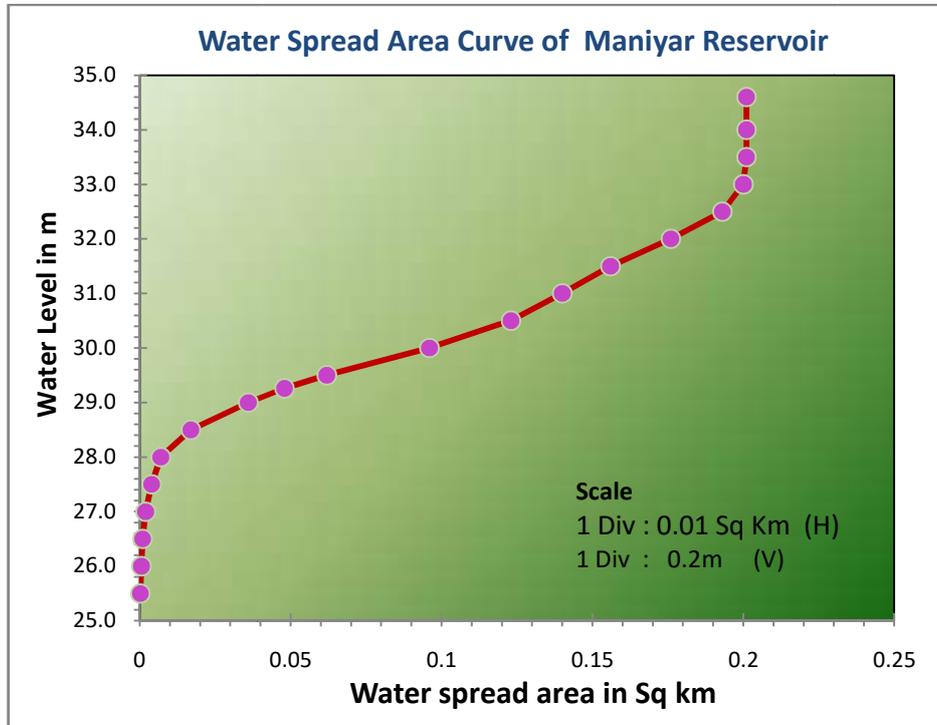
#### WATER SPREAD AREA AT DIFFERENT WATER LEVEL

The present water spread area corresponding to different water level is shown in Table. Figure shows its graphical representation.

#### Water spread area at different water levels

Sl. No.	Water Level (m)	Water Spread Area(km <sup>2</sup> )
1	34.60	0.201
2	34.00	0.201
3	33.50	0.201
4	33.00	0.200
5	32.50	0.193
6	32.00	0.176
7	31.50	0.156
8	31.00	0.140
9	30.50	0.123
10	30.00	0.096
11	29.50	0.062
12	29.00	0.036
13	28.50	0.0170

14	28.00	0.0070
15	27.50	0.0040
16	27.00	0.0020
17	26.50	0.0010
18	26.00	0.0006
19	25.50	0.0002



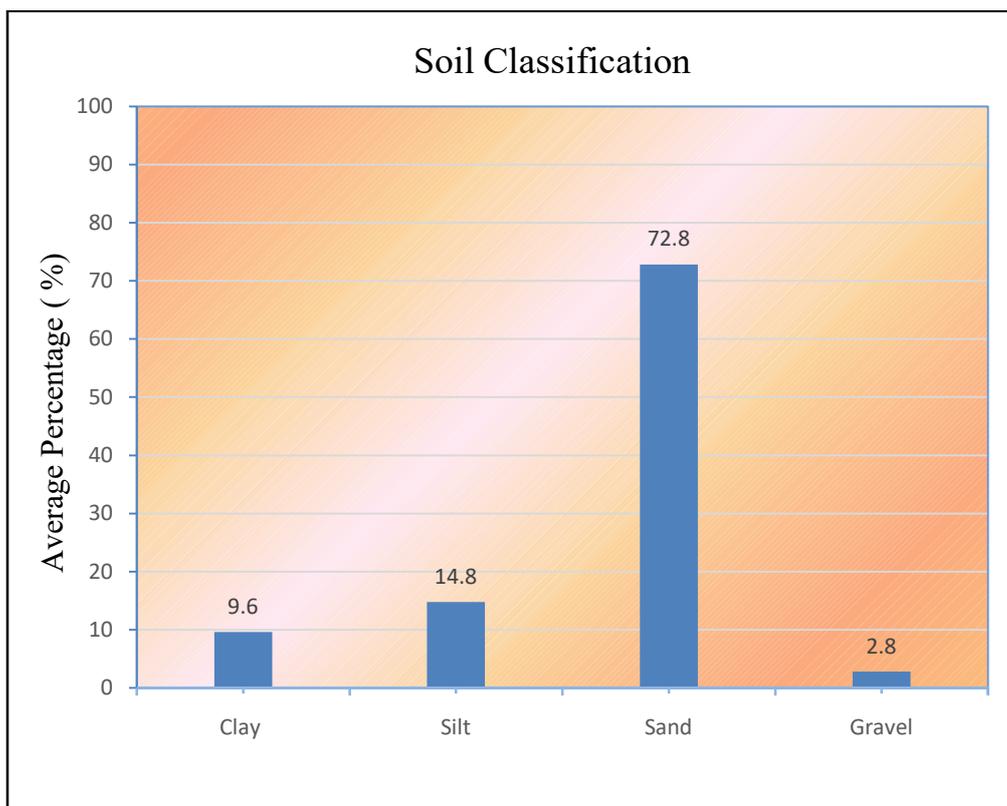
Water level v/s Water spread area curve

ANALYSIS OF SOIL SAMPLE

In this study 5 Nos of soil samples are analyzed. The average percentage of Clay, Silt, Sand and Gravel is estimated and the details are shown in the bar chart given in Figure below.

## Soil Sample Analysis Result

Sl n o.	Sample Position	Depth of Sample taken in m	Nature of sample	Soil Textu re	Colour	% of Various size of Soil Particle			
						Clay	Silt	Sand	Grave 1
1	N-1031694  E-707001	6.30	Disturbed	Sandy Silt	Ash Grey	23	52	25	0
2	N-1032151  E-707968	4.20	Disturbed	Silty Sand	Light Orange	17	18	56	9
3	N-1030940  E- 708320	2.50	Disturbed	Sandy Soil	Slate Grey	4	1	93	2
4	N-1032114  E- 708447	1.70	Disturbed	Sandy Soil	Slate Gray	2	1	96	1
5	N-1031805  E- 706521	5.90	Disturbed	Sandy Soil	Slate Gray	2	2	94	2

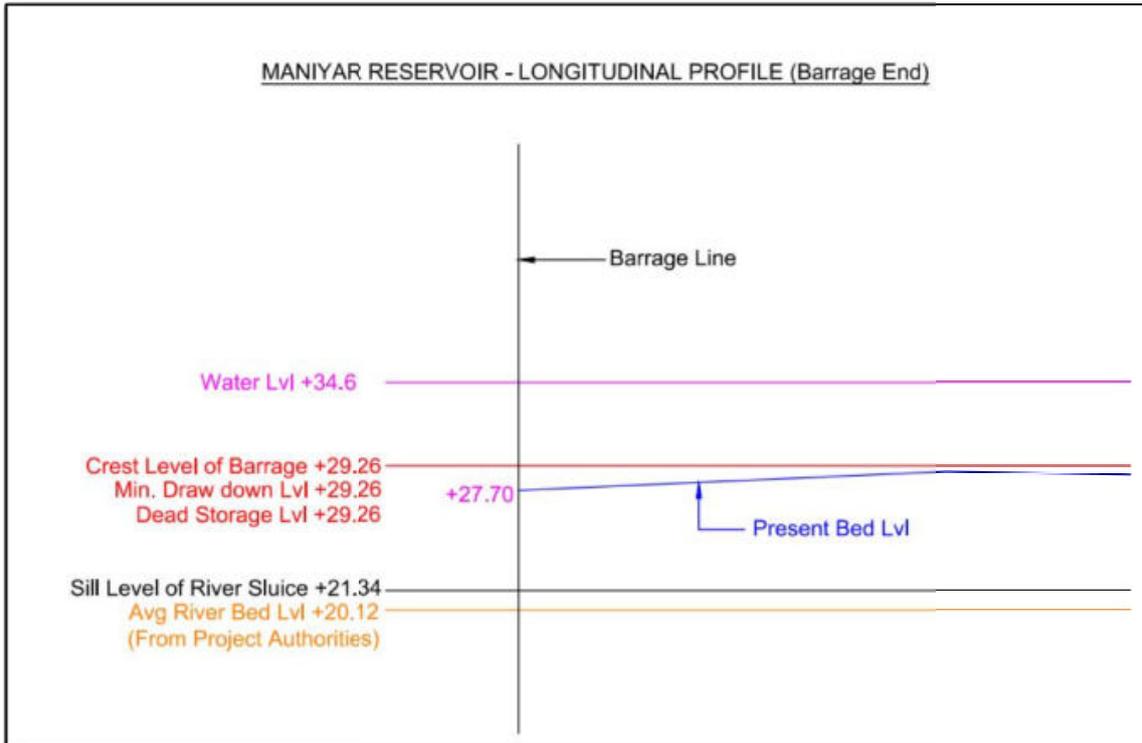


#### Soil particle distribution

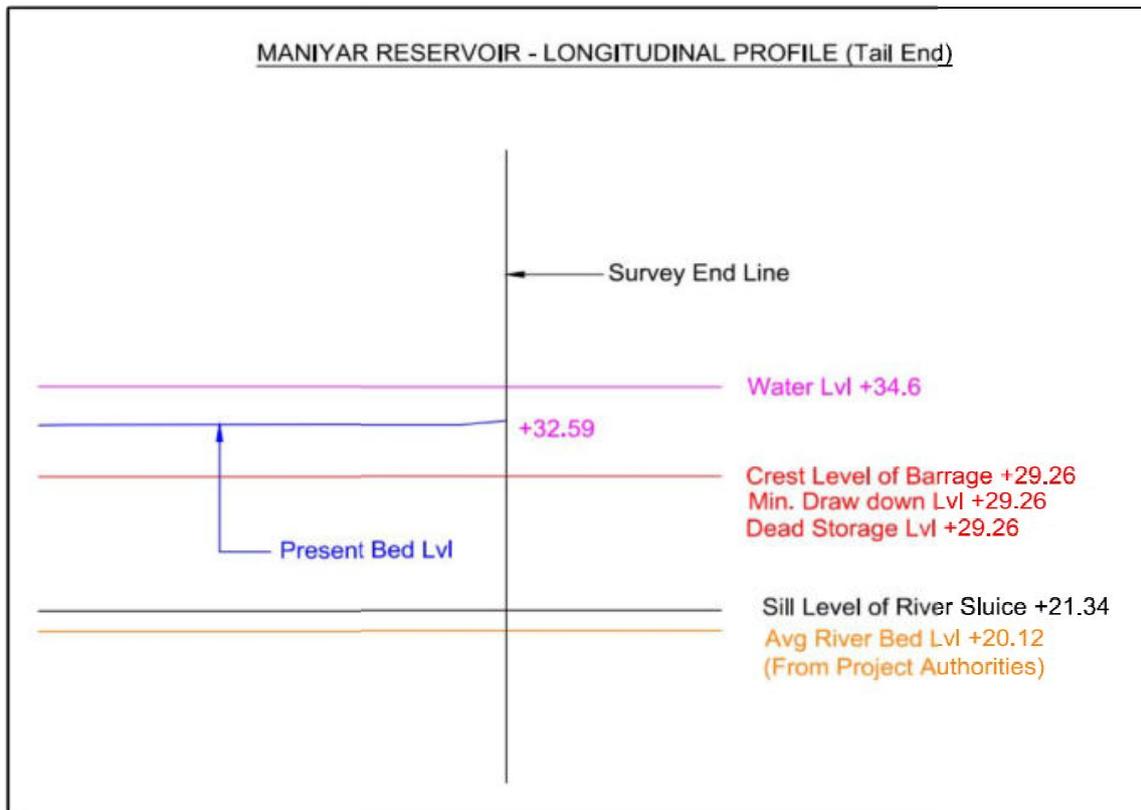
*The percentages of soil particles are only indicative and not accurate. For accurate assessment of contents in the soil, core sample analysis must be done.*

As per the salient features given by the Project Authorities, the original water holding capacity and water spread area of the reservoir at full reservoir Level of 34.62m are 8.80 Mm<sup>3</sup> and 1.08 Km<sup>2</sup> respectively. But after the construction of the barrage, many hydro-electric projects were started in the upstream side of the barrage and thus caused a reduction in original storage capacity and water spread area. As per the request from project authorities, the present IBS survey is carried out from the barrage to the Karikkayam Hydro Electric Project at the water level of 34.6 m. From the present IBS study, the water holding capacity and water spread area at this water level is estimated as 0.982 Mm<sup>3</sup> and 0.201 Sq.km respectively. The water spread area obtained from the survey matches with actual area at site. So the present capacity obtained is also reliable.

Figures shows the various levels such as crest level, river sluice level, the present bed level etc. at the face of barrage and at the end point of survey near Karikkayam Hydroelectric project respectively. The project authorities requested that the sediment should be removed up to the level below the river sluice near the barrage. Hence the quantity of sediments to be removed from the reservoir bed was calculated by keeping the proposed bed level near the barrage structure as +21.00m (Just below river sluice level) and near Karikkayam Hydroelectric Project (Survey end point) as present existing bed level (+32.59 m).



**Various levels at the face of barrage (Starting point of Survey)**



**Various levels at the end point of survey near Karikkayam Hydro - electric project**

Cross sections were drawn at every 30 m interval and quantity of sediments to be removed was calculated as shown in Table below. Contour map, longitudinal section, and cross section of reservoir are attached as Annexure. Total quantity of sediments to be removed is obtained as 0.66 Mm<sup>3</sup>.

Quantity of Sediments to be removed

Cross section No.	Chainage (m)	Cross section area of sediments to be removed (m <sup>2</sup> )	Average Cross section area (m <sup>2</sup> )	Distance between two cross sections(m)	Net Volume of sediments to be removed(m <sup>3</sup> )
0	0	399.325	400.192	30	12005.765
1	30	401.059			
2	60	395.945	398.502	30	11955.065
3	90	382.125	389.035	30	11671.057
4	120	398.328	390.227	30	11706.801
5	150	335.694	367.011	30	11010.330
6	180	262.589	299.142	30	8974.248
7	210	259.378	260.983	30	7829.503
8	240	204.786	232.082	30	6962.456

9	270	219.032	211.909	30	6357.270
10	300	301.444	260.238	30	7807.141
11	330	282.789	292.117	30	8763.496
12	360	211.726	247.258	30	7417.725
13	390	437.630	324.678	30	9740.340
14	420	570.532	504.081	30	15122.437
15	450	614.818	592.675	30	17780.251
16	480	794.440	704.629	30	21138.864
17	510	779.912	787.176	30	23615.280
18	540	988.109	884.011	30	26520.315
19	570	1007.294	997.702	30	29931.049
20	600	1028.549	1017.922	30	30537.646
21	630	980.267	1004.408	30	30132.244
22	660	872.750	926.509	30	27795.266
23	690	790.142	831.446	30	24943.387
24	720	680.344	735.243	30	22057.292
25	750	542.903	611.624	30	18348.712
26	780	469.815	506.359	30	15190.778
27	810	381.229	425.522	30	12765.655
28	840	686.631	533.930	30	16017.898
29	870	376.226	531.429	30	15942.859
30	900	252.803	314.514	30	9435.429
31	930	272.811	262.807	30	7884.211
32	960	287.556	280.184	30	8405.512
33	990	291.350	289.453	30	8683.590
34	1020	342.415	316.882	30	9506.469
35	1050	348.085	345.250	30	10357.494
36	1080	387.813	367.949	30	11038.467
37	1110	450.220	419.016	30	12570.492
38	1140	472.316	461.268	30	13838.040
39	1170	505.677	488.997	30	14669.895
40	1200	471.657	488.667	30	14660.015
41	1230	460.298	465.978	30	13979.330
42	1260	225.563	342.931	30	10287.915
43	1290	130.963	178.263	30	5347.891
44	1320	99.149	115.056	30	3451.677
45	1350	83.471	91.310	30	2739.301
46	1380	71.098	77.285	30	2318.541
47	1410	64.629	67.864	30	2035.907
48	1440	63.721	64.175	30	1925.252
49	1470	67.152	65.437	30	1963.097
50	1500	77.009	72.081	30	2162.418
51	1530	71.297	74.153	30	2224.589

52	1560	57.177	64.237	30	1927.109
53	1590	46.965	52.071	30	1562.137
54	1620	47.531	47.248	30	1417.452
55	1650	46.849	47.190	30	1415.710
56	1680	53.240	50.045	30	1501.335
57	1710	65.689	59.464	30	1783.932
58	1740	50.727	58.208	30	1746.240
59	1770	70.731	60.729	30	1821.870
60	1800	76.668	73.700	30	2210.985
61	1830	67.774	72.221	30	2166.630
62	1860	65.812	66.793	30	2003.785
63	1890	66.530	66.171	30	1985.131
64	1920	57.256	61.893	30	1856.796
65	1950	55.207	56.232	30	1686.949
66	1980	14.447	34.827	30	1044.814
67	2010	-84.138	-34.846	30	-1045.365
68	2040	14.608	-34.765	30	-1042.950
69	2070	-15.763	-0.578	30	-17.325
70	2100	-9.174	-12.469	30	-374.055
71	2130	-0.096	-4.635	30	-139.050
72	2160	14.244	7.074	30	212.220
73	2190	7.519	10.882	30	326.445
74	2220	3.140	5.330	30	159.885
75	2250	4.858	3.999	30	119.970
76	2280	-0.646	2.106	30	63.180
			Total		663920.489

## 5.0 DETAILS OF THE BATHYMETRIC SURVEYS CONDUCTED DURING THE YEAR 2022-23

The objectives of the studies were:

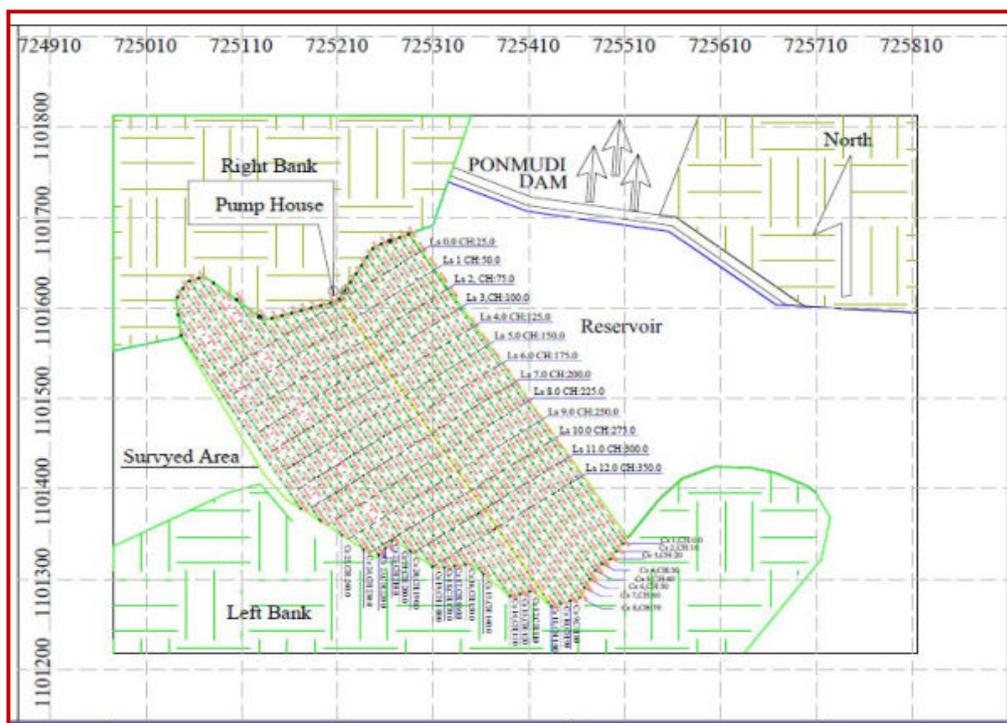
- To quantify or determine the present capacity of the reservoir using IBS
- Prepare the present Elevation – Storage curve of the reservoir to regulate the outflow of the reservoir
- Prepare the present Elevation – Area curve of the reservoir
- To find the quantity of sediment and its Distribution in the reservoir using Sub Bottom Profiler
- To observe the influence of the heavy flood in 2018 and 2019 in the reservoir sedimentation
- Study the soil particle distribution of sediment deposit in the reservoir area

## 5.1 Bathymetric study of Ponmudi reservoir using IBS in connection with the construction of a floating pump house by Jala Jeevan Mission

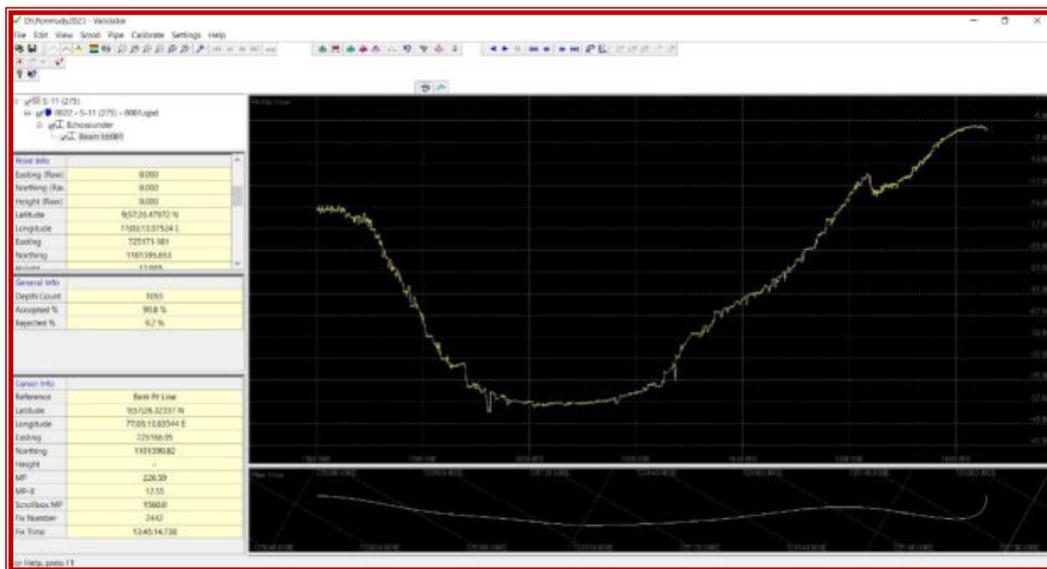
The Executive Engineer (Water Authority), Project Division, Kattappana vide Letter no.AEE II/JJM/KNTDY/UDBCL/2021 dated. 02/07/2022 had requested KERI, Peechi to conduct ground profile study of Ponmudi reservoir in Idukki district so as to fix the exact location of the proposed floating pump house. Hence the Bathymetric study of Ponmudi reservoir has been conducted as a deposit work. The estimated cost for the study is Rs.2,30,000 /-. After obtaining necessary permissions from KSEB and Forest & Wildlife officials, the survey has been conducted on 19/01/2023 and 20/01/2023.

### RESULT, DISCUSSION AND CONCLUSION

The survey has been conducted in an area of 0.115 km<sup>2</sup> surrounding the location suggested by Water Authority officials. The data collection has been done in the presence of the JJM coordinator and the contour map of the surveyed area is generated using CIVIL 3D software. The cross sections of the surveyed area along the width of the river are drawn at 10m interval and the profiles along the direction of flow are drawn at 25m interval. The cross sections, longitudinal sections, contour drawing and the plan showing the cross sections are attached as Annexure. Figure below shows the surveyed area with plotted sections.



### Surveyed area with plotted sections



**Profile 1-1 in IBS {E725067.06, N1101594.42),(E725192.68, N1101370.60}**

The present study is conducted at the water level of +706.00m. As per the information by the project authorities the lowest water level recorded in the history is 680 m at the time of Panniyar penstock tragedy during 2007. The lowest level recorded in the past 10 years history during the drought season is 690m. The following results are observed based on the bathymetric study conducted in the reservoir:

- The depth available comparing to the most vulnerable situation of 680m water level is 26m below the present water level.
- The lowest bed level in the cross section corresponding to the location suggested by the project authorities is 663.85m and the corresponding water depth is 42.15m(CS No.11 at CH.100.00 shown in the annexure, at a distance of 120m from the point located at left bank). The latitude and longitude values of the point are 9.958 and 77.055 respectively.
- Considering the previous history, a water depth of 16.15m will be available even in the worst condition of 680m water level.
- It is known from the Water Authority officials that a minimum of 3m clearance from the bed is essential for installing the floating pump house. In that context, the depth of 16.15m is sufficient for installing the floating pump house.
- More water depth than the maximum depth in the suggested cross section is observed in the downstream side cross sections.
- The maximum lowest bed level available in the surveyed portion is 656.74m and the corresponding water depth based on water level of 706m is 49.26m. This is observed in the

cross section CS no.2 (CH 10.00). The latitude and longitude values of the point are 9.959 and 77.056 respectively.

### **Conclusion**

As per the results obtained the points mentioned above are suitable for installing the floating pump house. The details of the available water depth at various other locations in the surveyed area corresponding to the water level of 706.00m are shown in the Cross section drawings (CS1 to CS 25) and Longitudinal section drawings (LCS 1 to LCS 11) which are attached as Annexure.

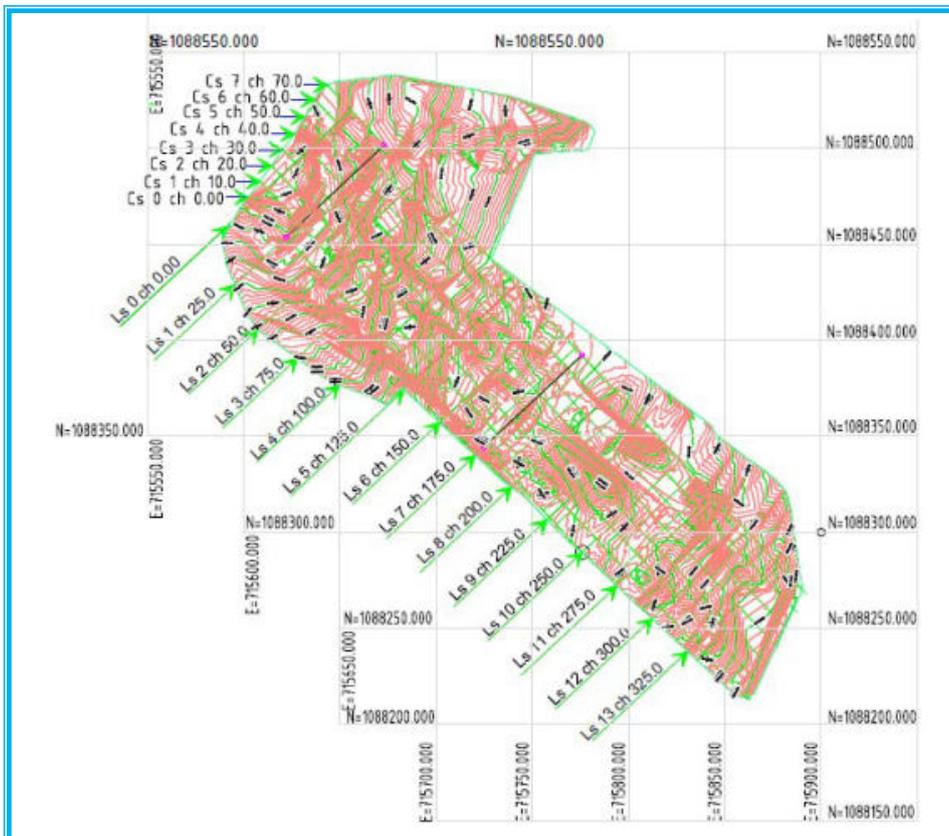
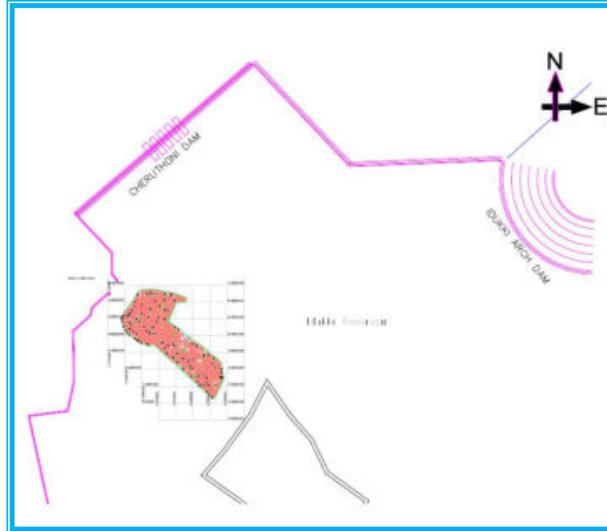
### **5.2 Bathymetric study of Idukki reservoir (near Cheruthoni boat landing area) using IBS in connection with the construction of a floating pump house by Jala Jeevan Mission**

The Executive Engineer (Water Authority), Project Division, Kattappana vide Letter no.620/DB1/2022/Pr.D-KTPA-MTPZA dated. 21/10/2022 had requested KERI, Peechi to conduct ground profile study of Idukki reservoir near Cheruthoni boat landing area in Idukki district so as to fix the exact location of the proposed floating pump house. Hence the Bathymetric study of Cheruthoni reservoir has been conducted as a deposit work. The estimated cost for the study is Rs.1,15,000/-(Rupees One Lakh Fifteen Thousand only). After obtaining necessary permissions from KSEBL(vide Lr no.RD2/DB-23/2022-23/1075 Dated.19/01/2023 of the Executive Engineer, Research and Damsafety Division No.II, Vazhathoppe, Idukki) and Forest & Wildlife officials(vide Lr no.KFDHQ-455/2023/CWW/WL4 Dated.21/01/2023 of the Principal Chief Forest Conservator(Wildlife) & Chief Wildlife warden, Kerala, the survey has been conducted on 21/01/2023 and 22/01/2023.

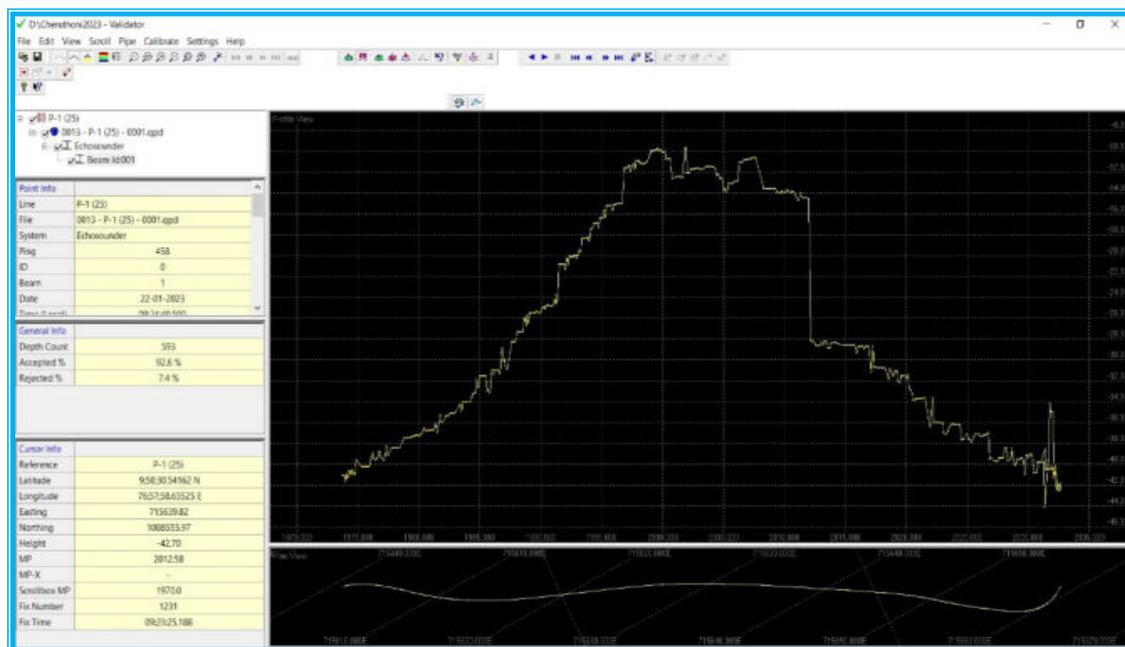
### **Result, Discussion and Conclusion**

The bathymetric survey has been conducted in Idukki reservoir for an area of 0.04km<sup>2</sup> surrounding the location suggested by Water Authority officials near Cheruthoni boat landing area. The data collection has been done in the presence of the JJM coordinator and the Forest and Wildlife officials. The details of water depth, latitude and longitude of the various points under water are taken using Echosounder and DGPS. Using this field data, the contour map of the surveyed area is generated using CIVIL 3D software. The cross sections of the surveyed area along the width of the river are drawn at 10m interval and the profiles along the direction

of flow are drawn at 25m interval. The cross sections, longitudinal sections, contour drawing and the plan showing the cross sections are plotted to know the ground profile (under water) of the area. Figure shows the surveyed area with plotted sections.



Surveyed area with plotted sections



**Profile 1-1 in IBS {(E715588.96, N1088452.97),(E715648.46, N1088534.53)}**

Even though we have requested for the water level details of the day on which survey is conducted and the lowest water level recorded in the recent history, the details are not yet obtained. The water level of the survey day obtained from KSEB dam safety organization website is +721.937m. It has been taken as the reference for plotting drawings and to find out the depth of water available at various locations. The following results are observed based on the bathymetric study conducted in the reservoir:

- The lowest bed level in the cross section corresponding to the location suggested by the project authorities is + 619.98 m and the corresponding water depth is 101.957 m (CS No.5 at CH.50.00 shown in the annexure, at a distance of 235 m from the starting point of the section). The latitude and longitude values of the point are 9.83990 and 76.96767 respectively.
- The maximum lowest bed level available in the surveyed portion is 618.77m and the corresponding water depth based on the water level of 721.937m is 103.167m.. This is observed in the cross-section CS no.1 (CH 10.00). The latitude and longitude values of the point are 9.83976 and 76.96723 respectively.
- Water depth of more than 100m is observed in all cross sections except CS0 (CH 0m) at a chainage range of 185 to 285 m.

## Conclusion

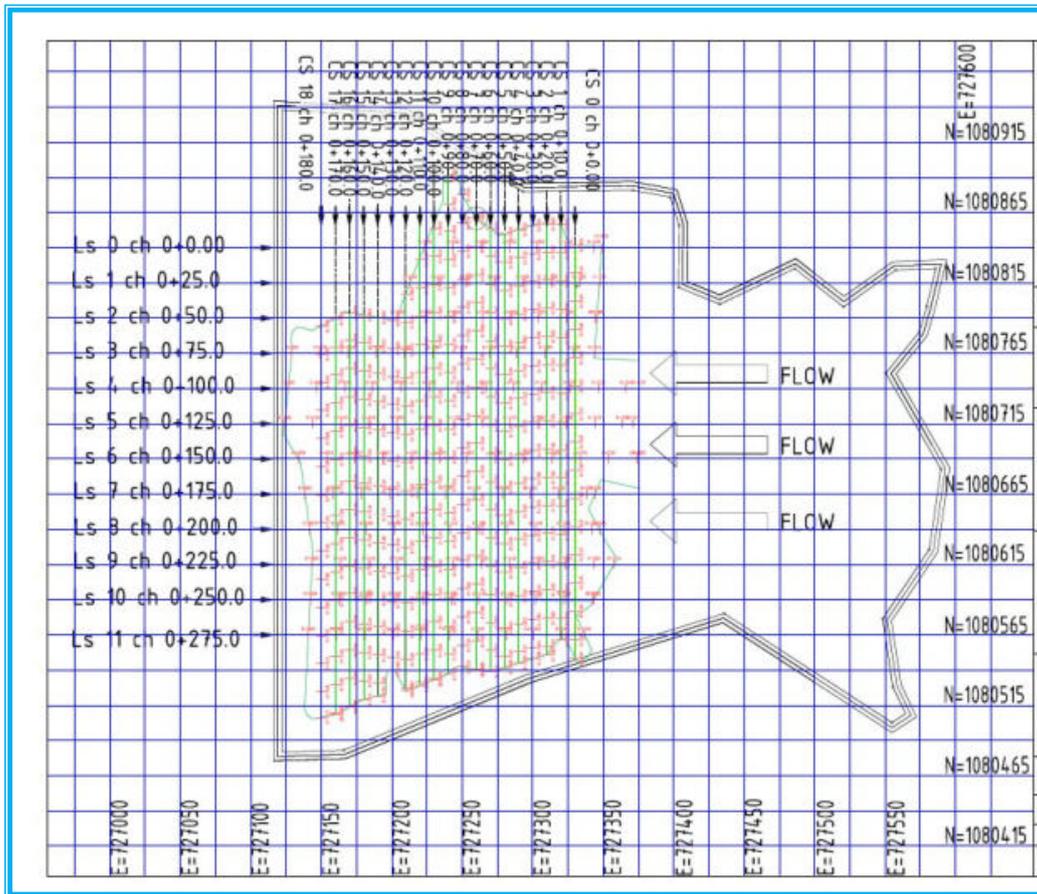
As per the results obtained the points mentioned above are suitable for installing the floating pump house. The details of the available water depth at various other locations in the surveyed area corresponding to the water level of +721.937m are shown in the Contour drawing, Cross section drawings (CS 0 to CS 7) and Longitudinal section drawings (LS 0 to LS 13).

### **5.3 Bathymetric study of Idukki reservoir (Anchuruli area) using IBS in connection with the construction of a floating pump house by Jala Jeevan Mission**

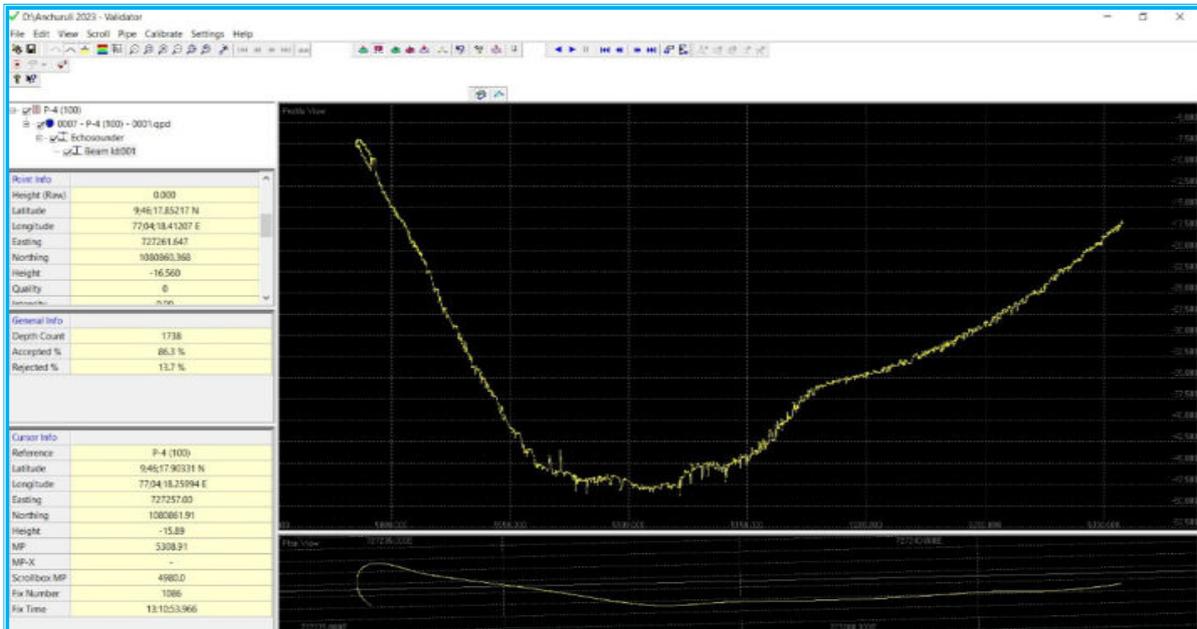
The Executive Engineer (Water Authority), Project Division, Kattappana vide Letter no.AB-JJM-571/2022/General dated. 04/07/2022 had requested KERI, Peechi to conduct ground profile study of Idukki reservoir in Idukki district near Anchuruli area so as to fix the exact location of the proposed floating pump house. Hence the Bathymetric study of Idukki reservoir has been conducted as a deposit work. The estimated cost for the study is Rs.2,50,000/-. After obtaining necessary permissions from KSEBL(vide Lr no.RD2/DB-23/2022-23/1075 Dated.19/01/2023 of the Executive Engineer, Research and Damsafety Division No.II, Vazhathoppe, Idukki) and Forest & Wildlife officials(vide Lr no.KFDHQ-455/2023/CWW/WL4 Dated.21/01/2023 of the Principal Chief Forest Conservator(Wildlife) & Chief Wildlife warden, Kerala, the survey has been conducted on 22/01/2023.

#### RESULT, DISCUSSION AND CONCLUSION

The survey has been conducted in an area of 0.065 km<sup>2</sup>suggested by Water Authority officials. The data collection has been done in the presence of JJM coordinator and Forest & Wildlife officials. The contour map of the surveyed area is generated using CIVIL 3D software. The cross sections of the surveyed area along the width of the river are drawn at 10m interval and the profiles along the direction of flow are drawn at 25m interval. The cross sections, longitudinal sections, contour drawing and the plan showing the cross sections are attached as Annexure. Figure shows the surveyed area with plotted sections.



Surveyed area with plotted sections



Profile 1-1 in IBS {E727264.06, N1080543.98),(E727261.64, N1080860.36)}

Even though we have requested for the water level details of the day on which survey is conducted and the lowest water level recorded in the recent history, the details are not yet obtained. The water level of the survey day obtained from KSEB dam safety organization website is +721.937m. It has been taken as the reference for plotting drawings and to find out the depth of water available at various locations. The following results are observed based on the bathymetric study conducted in the reservoir:

- The lowest bed level available in surveyed portion is + 666.73 m and the corresponding water depth is 55.207 m (CS No.18 at CH.180.00 shown in the annexure, at a distance of 90 m from the starting point of the section). The latitude and longitude values of the point are 9.770133199 and 77.0707545077 respectively.
- Water depth of more than 42 m is observed in all cross sections at a chainage range of 90 to 230 m.

### **Conclusion**

As per the results obtained the points mentioned above are suitable for installing the floating pump house. The details of the available water depth at various other locations in the surveyed area corresponding to the water level of +721.937m are shown in the Contour drawing, Cross section drawings (CS 0 to CS 18) and Longitudinal section drawings (LS 0 to LS 11).

### **5.4 Sedimentation Study of Poomala Reservoir Using Integrated Bathymetric System**

The Executive Engineer, Minor Irrigation Division, Thrissur requested vide Lr. No.D3-GL/2022 dated.29/12/2022 to conduct the bathymetric survey of Poomala Reservoir. The study has been conducted from 10th February 2023 to 20th February 2023 in the financial year 2022-23 using IBS in order to assess the present water holding capacity and water spread area of the reservoir.

Bathymetric study of Poomala reservoir has been carried out using Integrated Bathymetric System (IBS). The water level in the reservoir during the bathymetric survey using survey boat was +24 ft, which was very much lower than Full Reservoir Level of +30 ft. Hence, in order to assess the capacity of reservoir at FRL, topographic survey using Smart station was conducted in the reservoir area which was not covered in bathymetric survey using boat and having reduced level between present water level and FRL.

Survey has been done using small boat with IBS and the data has been collected along different profiles 50m apart. Soil samples have been collected and analysed. Data collection has been completed and data validation is ongoing. Report is under preparation.

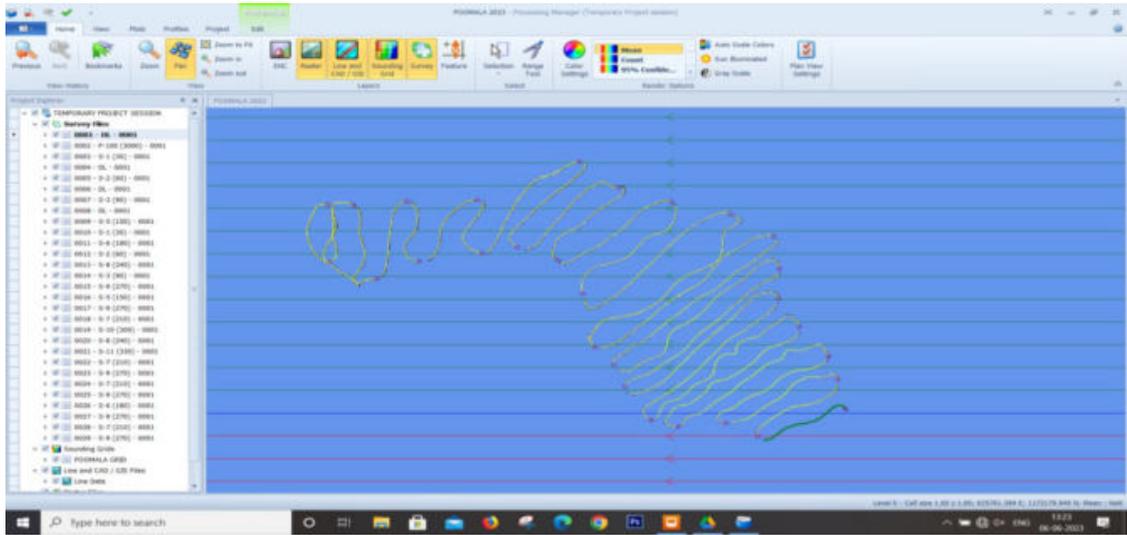


Fig Plan of Poomala reservoir showing the sections surveyed



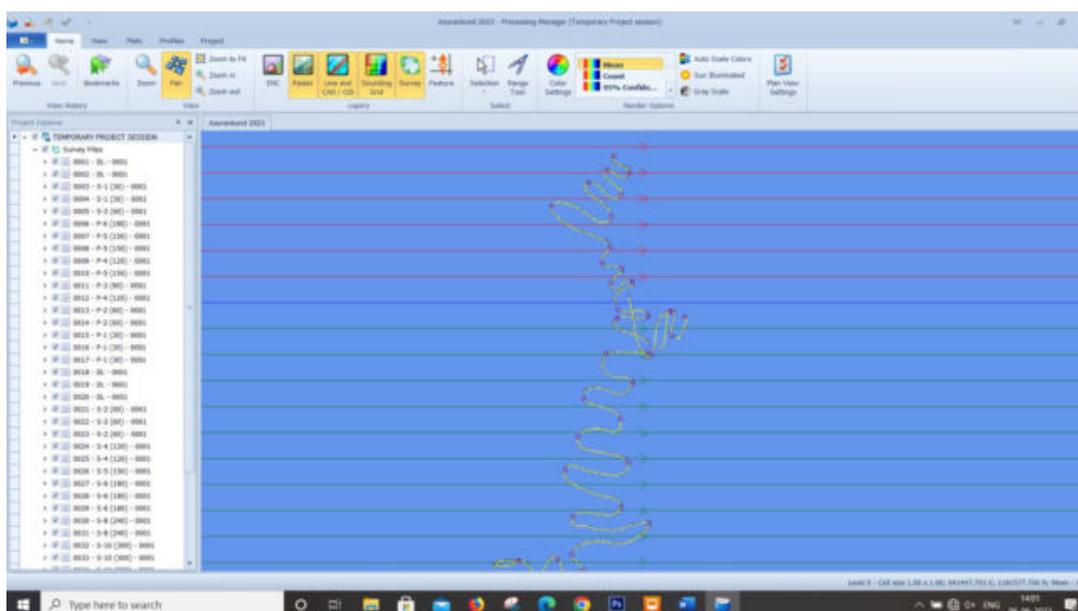
Fig Poomala\_ A Profile in IBS

## 5.5 Sedimentation Study of Asurankundu Reservoir Using Integrated Bathymetric System

The Executive Engineer, Minor Irrigation Division, Thrissur requested vide Lr. No.D3-GL/2022 dated.29/12/2022 to conduct the bathymetric survey of Poomala Reservoir. The Bathymetric survey of Asurankund Reservoir has been conducted from 15<sup>th</sup> February 2023 to 25<sup>th</sup> February 2023 in the financial year 2022-23 using IBS in order to assess the present water holding capacity and water spread area of the reservoir. The estimated cost for the study is Rs.1,10,000/-.

Bathymetric study of Asurankundu Reservoir has been carried out using Integrated bathymetric System (IBS). The water level in the reservoir during the bathymetric survey conducted using survey boat was +4.98 m, which was very much lower than Full reservoir level of +10 m. The portion of land from +4.98 m to +10m has been surveyed using Smart station to get the capacity of the reservoir at FRL. Since there is no Bench mark available at Asurankundu dam, level available at Poomala Reservoir was transferred to the Asurankundu reservoir location using Smart station and a Temporary Bench Mark (TBM) was established at the location. Level transferred to the Asurankundu reservoir area was verified by connecting with the GTS bench mark available at Cheraman Juma Masjid, Kodungallur.

Survey has been done using small boat with IBS and the data has been collected along different profiles 50m apart. Soil samples have been collected and analysed. Data collection has been completed and data validation is ongoing. Report is under preparation.



**Fig Plan of Asurankundu reservoir showing the sections surveyed**

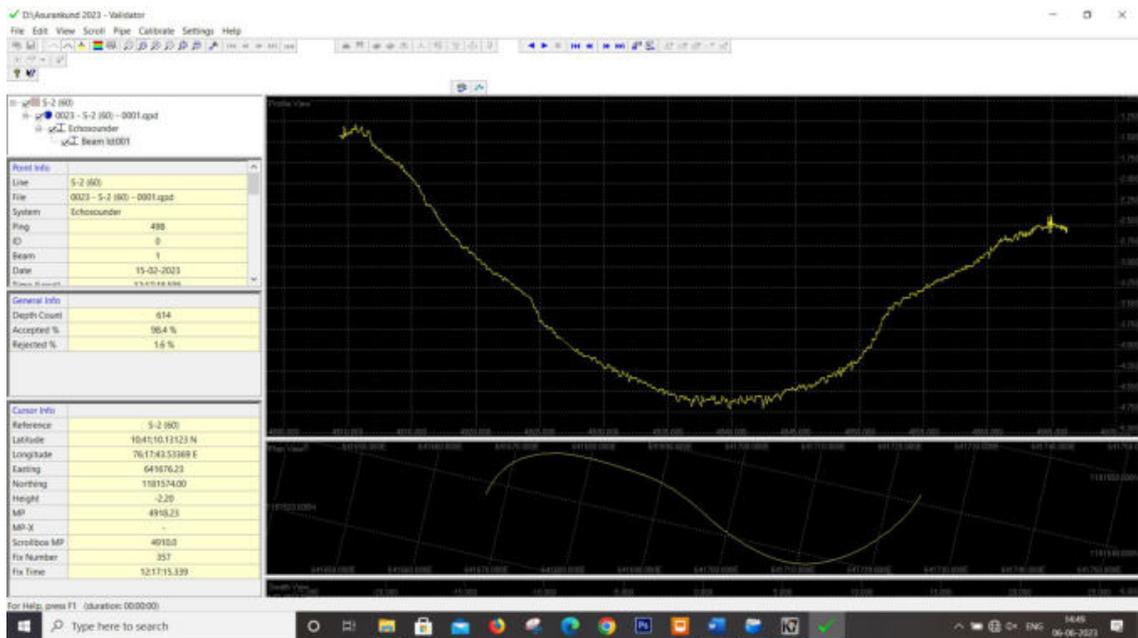


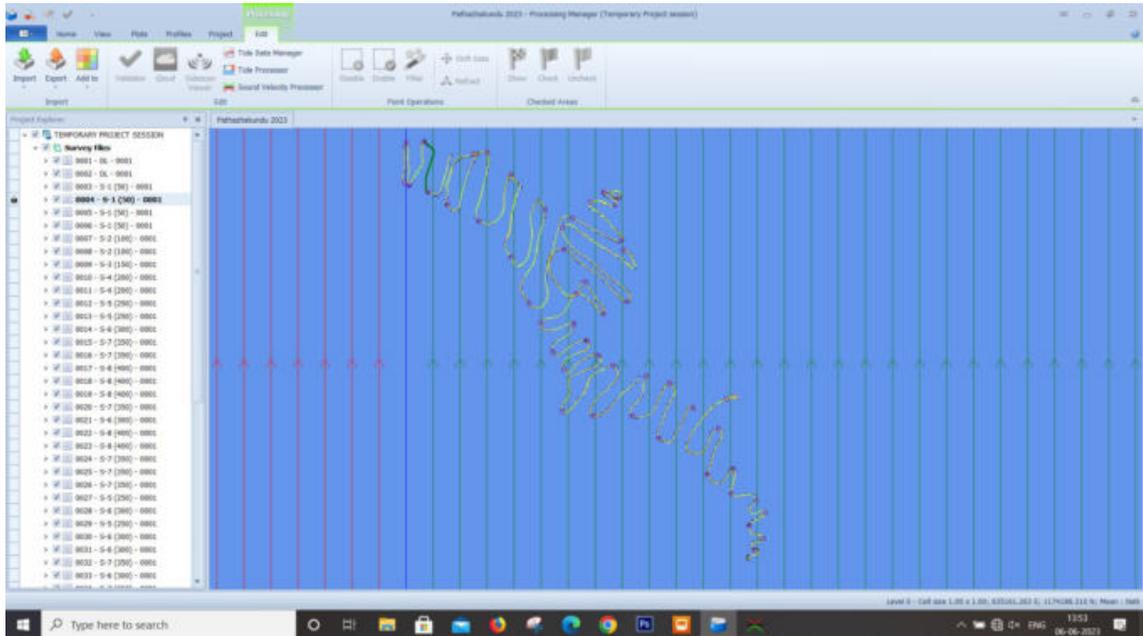
Fig Asurankundu\_AProfile in IBS

## 5.6 Sedimentation Study of Pathazhakkundu Reservoir Using Integrated Bathymetric System

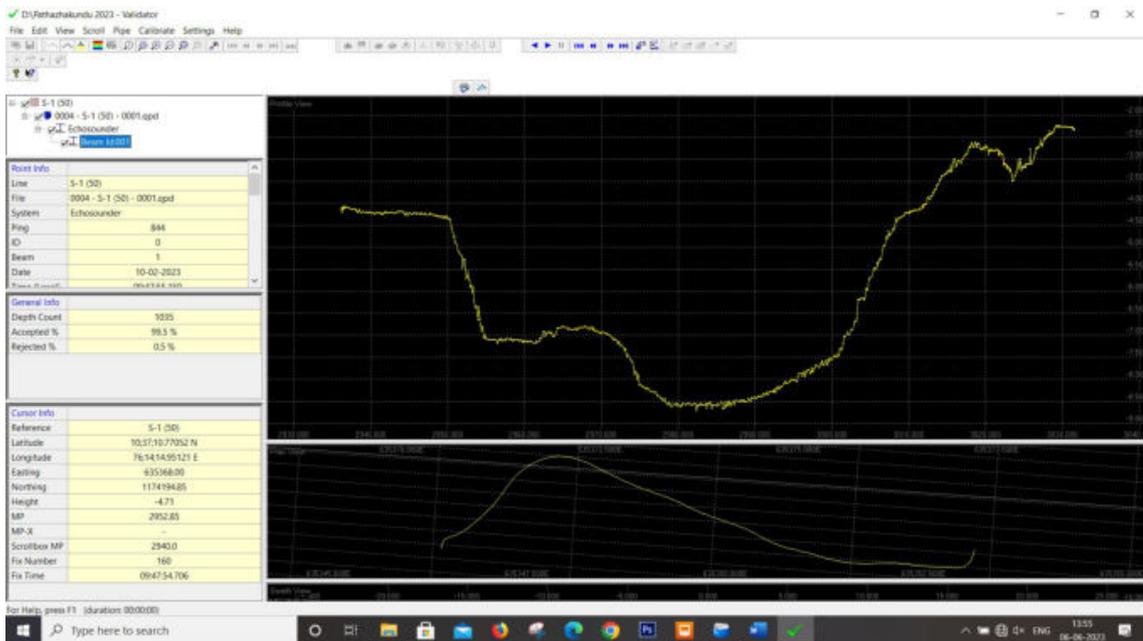
Vide Lr. No.D3-GL/2022 dated.29/12/2022, the Executive Engineer, Minor Irrigation Division, Thrissur had requested to conduct the bathymetric survey of Pathazhakkundu Reservoir. The Bathymetric survey of Pathazhakkundu Reservoir has been conducted from 08<sup>th</sup> February 2023 to 14<sup>th</sup> February 2023 in the financial year 2022-23 using IBS. The estimated cost for the study is Rs.1,35,000/-.

Bathymetric study of Pathazhakkundu Reservoir has been carried out using Integrated Bathymetric System (IBS). The water level in the reservoir during the bathymetric survey was +8.96m, which was very much lower than the full reservoir level (FRL) of +14.00m. Hence, in order to access the capacity of reservoir at FRL, topographic survey using Smart station was conducted in the reservoir area which was not covered in bathymetric survey using boat and having reduced level between present water level and Full reservoir level. Topographic survey was conducted based on the Bench Mark established near the reservoir by Coastal Engineering Division, KERI, Peechi in the year 2018.

Survey has been done using small boat with IBS and the data has been collected along different profiles 50m apart. Soil samples have been collected and analysed. Data collection has been completed and data validation is ongoing. Report is under preparation.



**Fig Plan of Pathazhakkundu reservoir showing the sections surveyed**

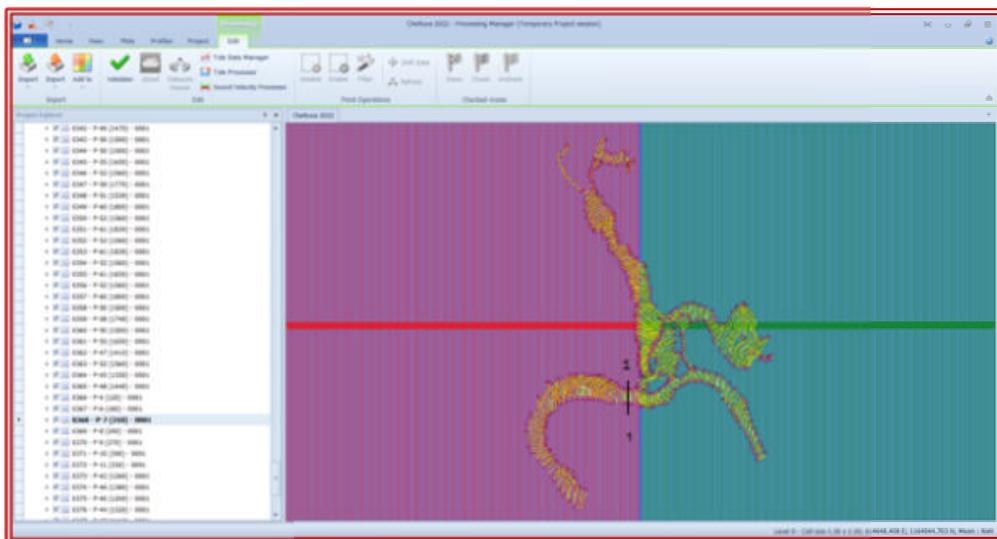


**Fig Pathazhakkundu\_AProfile in IBS**

### 5.7 Sedimentation Study of KundorkkadavuPuzha (from Chettuva bridge to Kalamana Kayal) and ChettuvuPuzha (from Pulikkakadavu Bridge to ChettuvaAzhimugam (upto Coastal Police station)) Using Integrated Bathymetric System & Sub Bottom Profiler

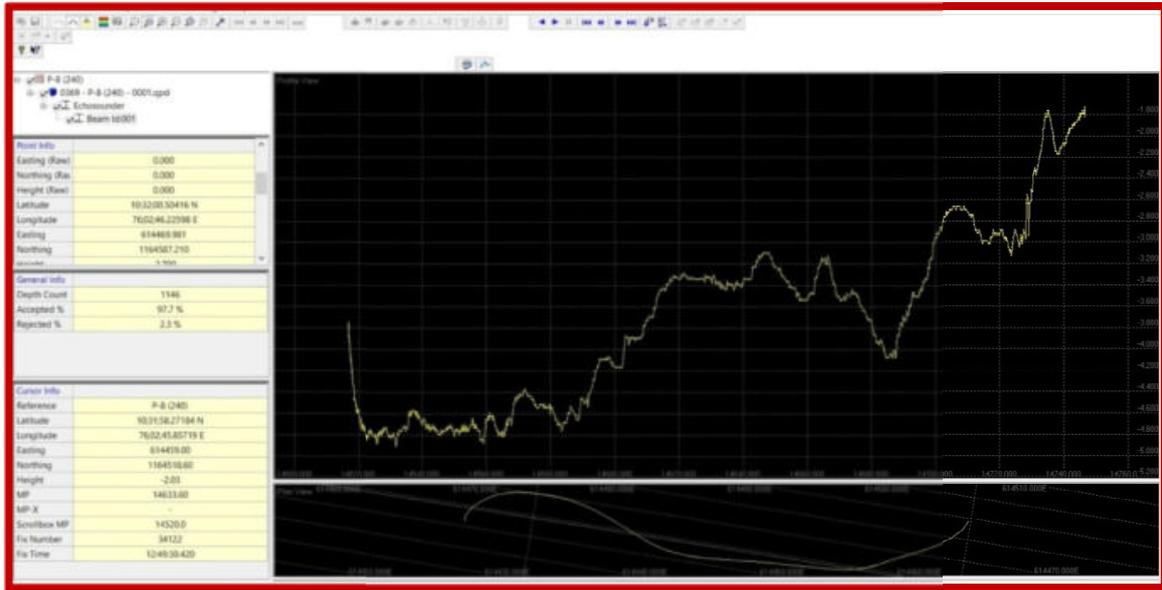
The Sedimentation study of KundorkkadavuPuzha (from Chettuva bridge to Kalamana Kayal) and ChettuvuPuzha (from Pulikkakadavu Bridge to ChettuvaAzhimugam (upto Coastal Police station)) has been conducted from 21<sup>st</sup> June 2022 to 15<sup>th</sup> July 2022 in the financial year 2022-23 using IBS and Sub Bottom Profiler. The Executive Engineer, Additional Irrigation Division, Thrissur had requested to find out the present bed level of the river and thus to assess the quantity of sediments to be removed from the area upto the proposed level suggested by them. The survey is conducted as a deposit work and the estimated cost is Rs.3,15,000/- (Rupees Three Lakhs Fifteen Thousand only).

Hydrographic survey of KundorkkadavuPuzha (from Chettuva bridge to Kalamana Kayal) and ChettuvuPuzha (from Pulikkakadavu Bridge to ChettuvaAzhimugam (upto coastal Police station)) has been carried out using Integrated bathymetric System and Sub bottom Profiler. For areas with very low water depth where hydrographic survey couldn't be done using survey boat, data collection was carried out by using Smart station equipment with the help of country boat. Since there is no water level indicator at the location for measuring river water level, reduced level w.r.t MSL available at Enamavu Regulator was transferred to the location using Smart station and a Temporary Bench Mark (TBM) was established at the location. River water level on each day w.r.t MSL was measured with reference to the TBM established at the location.

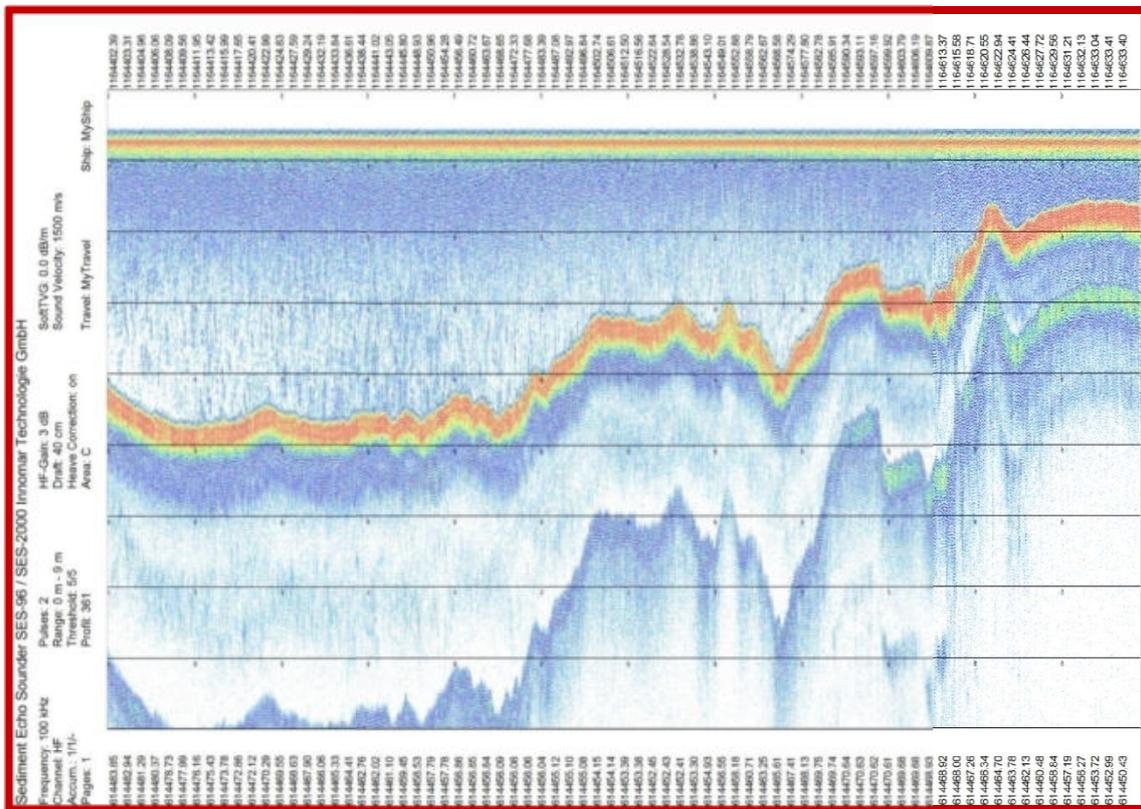


Plan of Survey area showing sections surveyed

One typical survey line 1-1 is marked in the above figure. The cross-sectional details of the above line obtained from the IBS and Sub Bottom Profiler are shown in following figures below.



**Profile 1-1 in IBS {(E614488.81, N1164401.55) (E614454.00, N1164631.28)}**



**Profile 1-1 in Sub bottom Profiler {(E614488.81, N1164401.55) (E614454.00, N1164631.28)}**

## RESULT AND DISCUSSIONS

The cutting and filling quantity in the surveyed area was calculated by comparing present bed level details obtained from the survey with the proposed bed level as suggested by the project authorities. The reference level was fixed as the present bed level at the downstream of Idiyanchira Regulator (-1.70 m w r t MSL) based on their request. For the area towards the u/s of Chettuva bridge, proposed bed level was fixed by keeping bed slope as 1 in 3000 and towards the d/s of the bridge the proposed bed slope is 1 in 5000. For calculating the cutting and filling quantity, the entire surveyed area was divided into 7 sections as follows:

Section 1: From Chettuva Bridge to ChettuvaAzhimugam (upto Coastal Police station)

Section 2: From Pulikkakadavu Bridge to Chettuva Bridge

Section 3: From Idiyanchira RCB to Raja Island

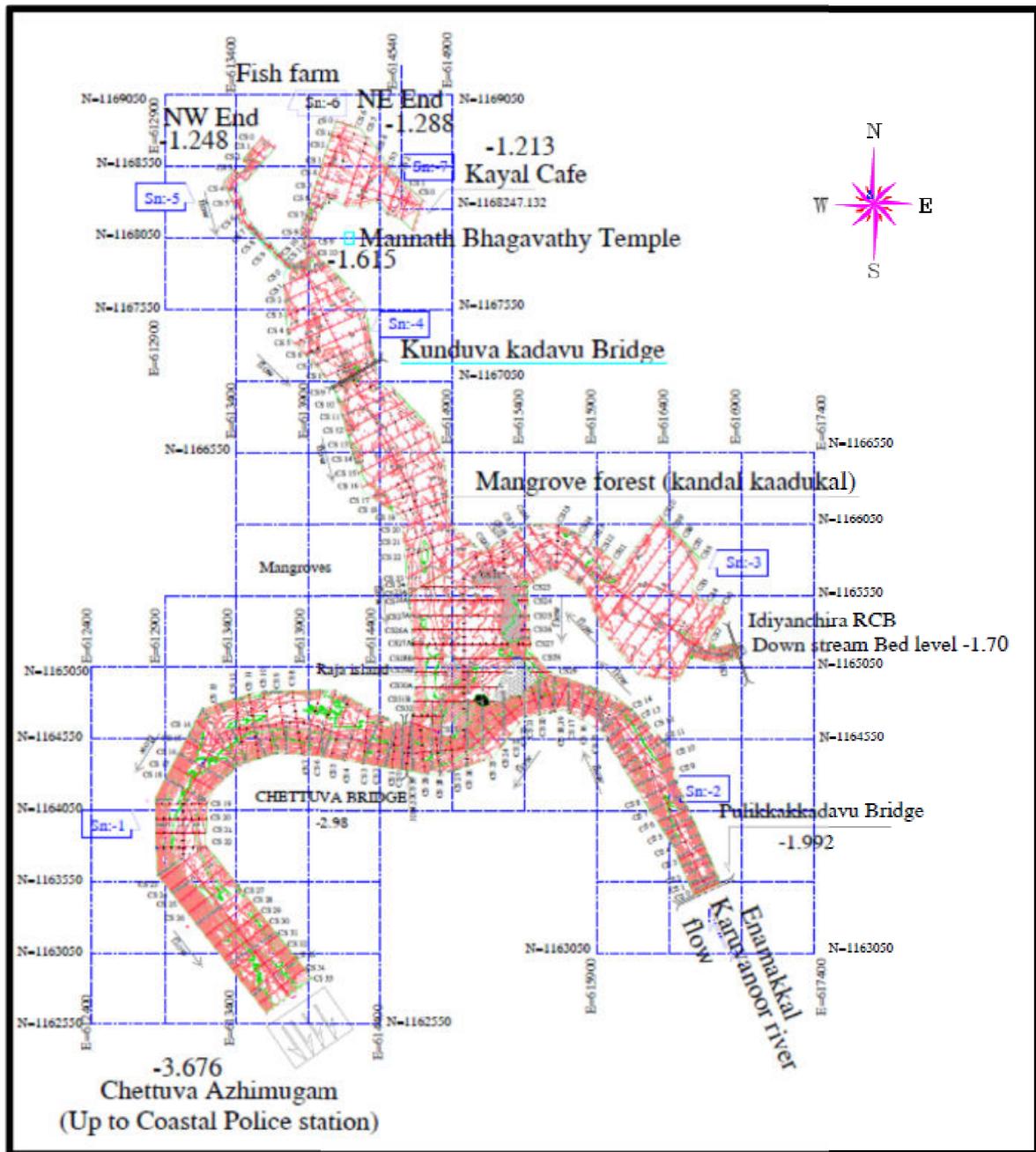
Section 4: From Near Mannath Bhagavathy Temple to Section 3 boundary

Section 5: From Fish farm North west end to area near Mannath bhagavathy temple

Section 6: From Fish farm North east end to area near Mannath bhagavathy temple

Section 7: From Kayal café to Section 6 boundary

Fig. shows the surveyed area with various sections. Quantity of cutting and filling was calculated by drawing cross sections at every 100m interval and taking the difference between the present bed level and the proposed level. Table 1 to Table 15 shows cutting and filling quantity obtained in each section. Contour map, longitudinal section and cross section drawings of the area are attached as Annexure. Total cutting and filling quantity was obtained as **6.43 Mm<sup>3</sup>** and **0.474 Mm<sup>3</sup>** respectively.

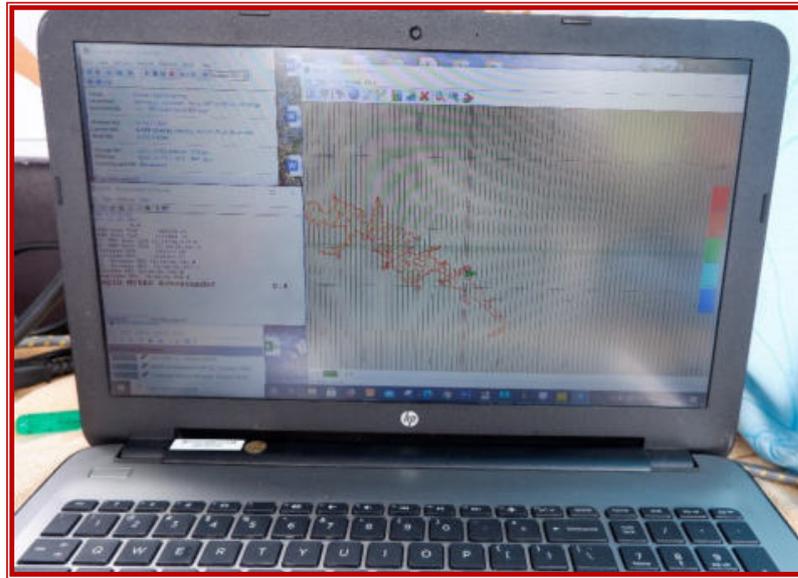


Surveyed area with different sections

### 5.8 Sedimentation Study of Sholayar Reservoir Using Integrated Bathymetric System and Sub bottom profiler

The Deputy Chief Engineer (Research & Dam Safety Organisation & DRIP), Kerala State Electricity Board Ltd. Pallom, Kottayam had directed KERI, Peechi to conduct Integrated Bathymetric Survey of Sholayar reservoir vide work order No. 10//DCE/RO/PLM/2021-22

dated 30.09.2021. Hence the Bathymetric study of Sholayar reservoir has been conducted as a deposit work. The estimated cost for the study is Rs.7,00,000/-.

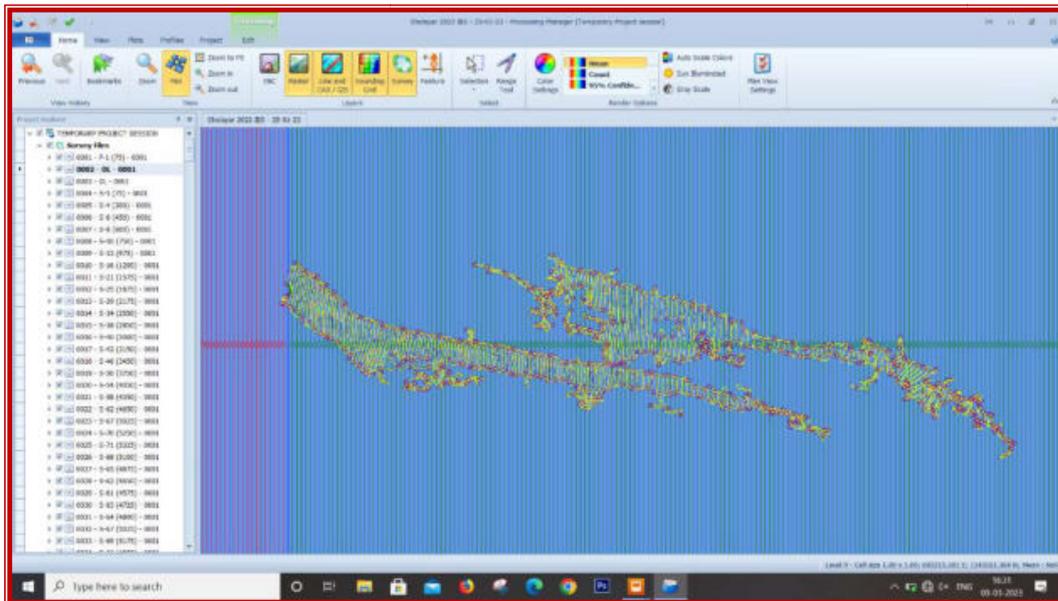


### **Data Acquisition in QINSY**

By using the QINSY software chart is prepared by taking UTM (Universal Transverse Mercator: -A special transverse Mercator grid which divides the world in to 6<sup>0</sup> zones of Longitude.) co-ordinate of two points for drawing a reference line which extend up to the boundary of the reservoir area. With these coordinates of two points reference line is drawn. Segment lines are drawn parallel to this reference line at an interval of 75 m such that the entire reservoir area can be covered.

The survey was conducted along the predetermined segment lines after setting the data logging software to record the data from the Echo Sounder at 2m intervals. The boat was sailed along the track maintaining a speed of 3 to 4 knots. The depth of water and its corresponding position is recorded simultaneously at each point. The software enables generation of depth profile and overviews using the data recorded.

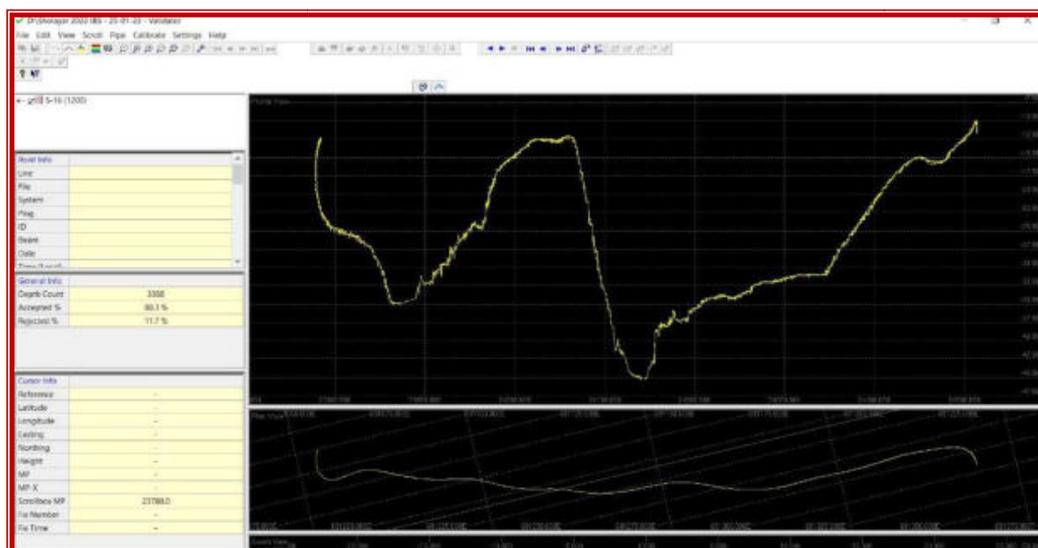
The data is then edited to eliminate spurious readings caused due to violent winds waves using the data processor in QINSY.



### Data processing

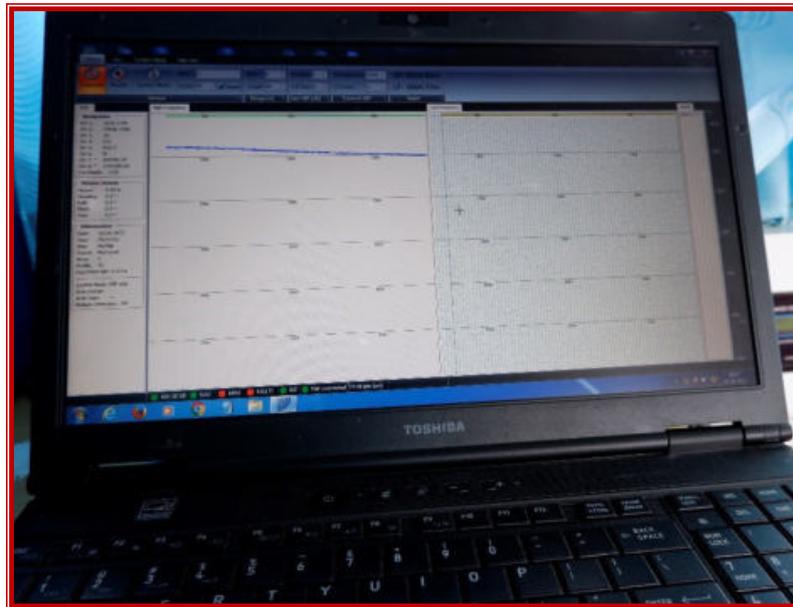
All the validated data are exported using Data Export program and it is processed in Surfer Software. This exported data converts into grid data by triangulation with linear interpolation method.

Using the grid data contour maps are drawn and volume is calculated at specified intervals.



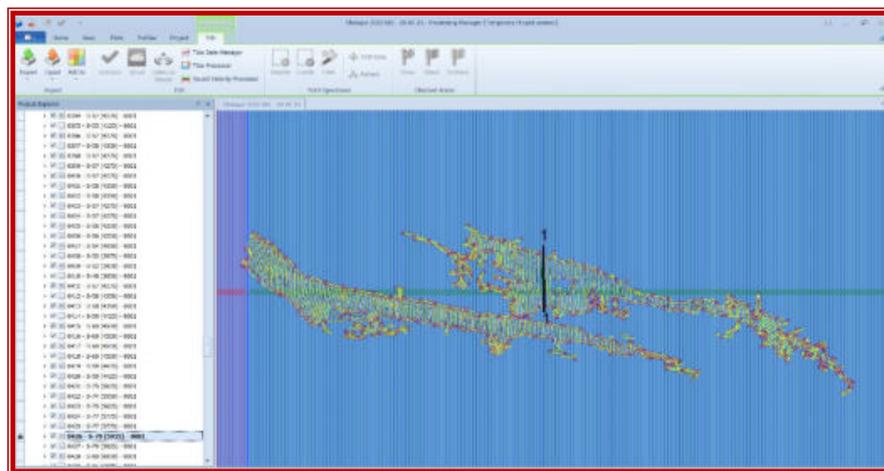
### Data Validation in QINSY

During the same time of IBS Survey, the data from the Sub Bottom Profiler, connected to the DGPS was acquired through the SESWIN software. The continuous bottom profile of the survey line obtained at the time of survey itself as shown in Figure



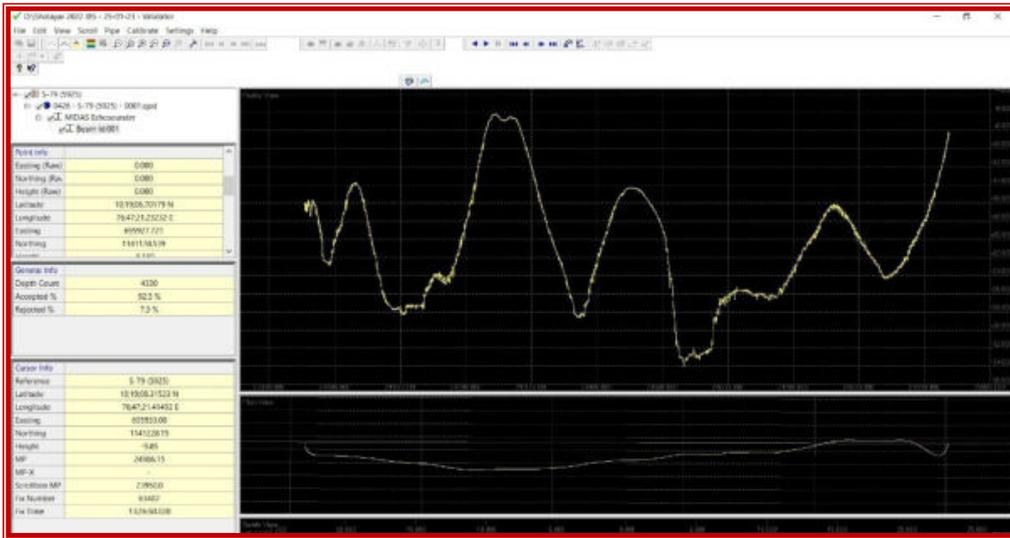
**Data Collection in Sub Bottom Profiler**

The Figure shows the plan of the survey lines covering the whole area of Sholayarreservoir.

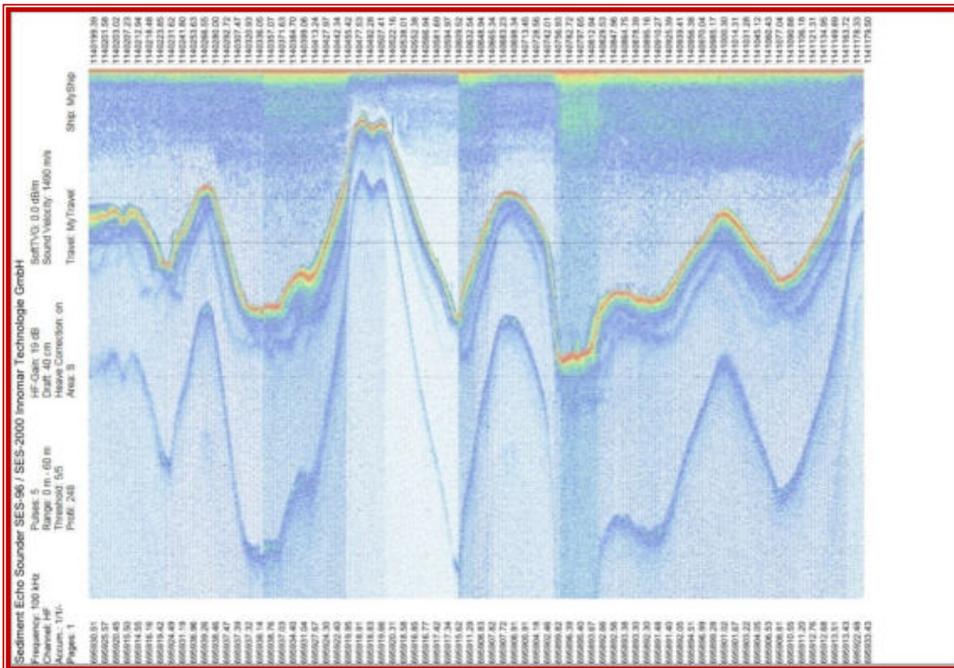


**Plan of Sholayar Reservoir showing sections surveyed**

One typical survey line 1-1 is marked in the above figure. The cross-sectional details of the above line obtained from the IBS and Sub Bottom Profiler are shown in following figures.

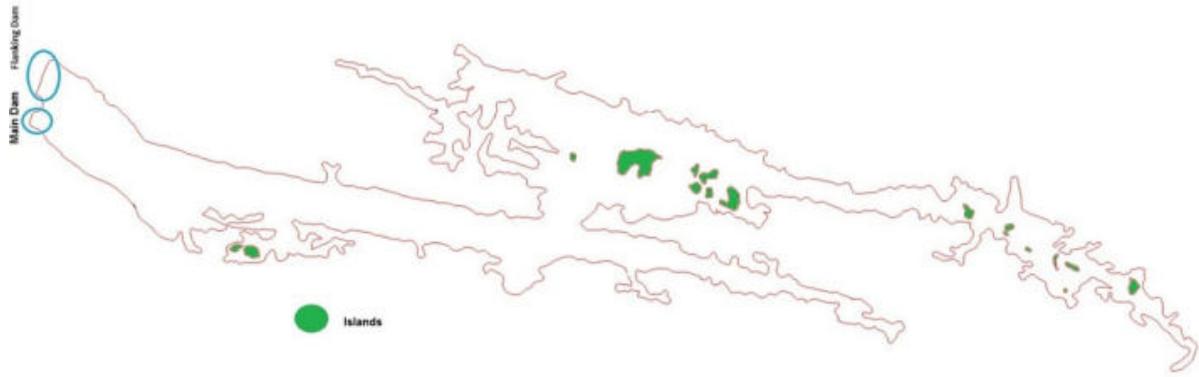


**Profile 1-1 in IBS{(E 695930.799, N 1140196.410) (E 695927.721, N 1141178.539)}**



**Profile 1-1 in SBP{(E 695930.799, N 1140196.410) (E 695927.721, N 1141178.539)}**

The reservoir area map digitized from IBS data in Surfer software is shown inFigure.



**Water spread area of Sholayar Reservoir**

**D.CONSTRUCTION**  
**MATERIALS DIVISION**

## **CONSTRUCTION MATERIALS DIVISION, KERI, PEECHI.**

### **TECHNICAL PERSONNEL**

#### **Deputy Director**

1. Er. Sufeera O.B. (01-04-2022 to 31-03-2023)

#### **Assistant Director I**

1. Er. Siji T.V. (From 01.04.2022 to 21.01.2023)

#### **Assistant Director II**

1. Er. Rappai V.V. (From 01.04.2021 to 30.04.2022)
2. Er. Lakshmi S (From 23.12.2022 to 31.03.2023)

## **1. INTRODUCTION**

Construction Material Division is one of the sub units of Kerala Engineering Research Institute (KERI) basically engaged in material testing. Testing of construction materials is an essential part for ensuring quality in construction. In addition to the testing of Irrigation departments works, other Government Departments, Central Government Departments, Public Undertakings and various Private agencies are utilizing the facilities of lab for ensuring quality construction. The CM Lab continued to contribute healthy revenue every year to the Government through various tests conducted for clients. The Lab is also functioning as a training centre of the Irrigation Department and providing training programs and refresher courses for the benefit of department engineers. The training facility extends to other department engineers also. Now the CM Lab is on the final stage of getting assessment and accreditation of Testing and Calibration Laboratories by the National Accreditation Board Testing and Calibration Laboratories (NABL) in accordance with the international standards. The accreditation from NABL will boost up the status of the Lab and likely to increase the revenue to Government.

## **2. TESTS CONDUCTED IN CM LAB**

Construction materials division of KERI deals with testing of construction materials such as cement, aggregates, steel, tiles, bricks, rock, concrete etc and design of concrete mixes. The essentials tests for getting the physical properties of above materials are carrying out at this lab. During the year 2022-23, tests were conducted for 533 samples of concrete cubes, 164 samples of steel rods, 26 samples of coarse aggregates, 27 samples of fine aggregates, 164 core samples, 30 samples of solid blocks, 30 samples of paver blocks, 5 samples of mud

blocks, 25 samples of cement, 1 sample of granite, 30 samples of clay tiles, 6 samples of vitrified tiles, 18 samples of GI pipes & 20 samples of GI wires, 12 samples of tension springs, 9 samples of sheet piles, 3 samples of WMM & GSB, 2 samples of AAC conductor and 5 samples of Stainless Steel frames in this lab. 14 no's Mix designs were carried out for various agencies.

The lab is equipped with NDT instrument for Pile Integrity Test and has done tests on 117 Piles.

Two Hundred and Seventeen test reports were generated from this division during the Financial year 2022-23 generating a revenue of **Rs. 13,59,631/-** ( Rupees Thirteen lakhs Fifty Nine Thousand Six Hundred and Thirty One only ).

## 2.1 Rock Core Testing – Soil investigation for JJM works

1. The Deputy Director, Instrumentation Division, K. E. R. I, Peechi vide letter no. DB-20/2022-23 dated 03-02-2023 & 10-02-2023 had requested to conduct necessary tests and report the Compressive Strength of Rock samples for the work:- *Soil Investigation works for JJM -Water Supply scheme to Vattavada Panchayath for Construction of Weir across Chilanthyar Waterfalls in Vattavada.* As part of soil investigations, rock core samples were collected from BH-1, BH-2, BH-3, BH-4 & BH-5 by Instrumentation Division and tested at Construction Materials Testing Lab for compressive strength.



2. The Assistant Engineer, IWR Section 3/2, Malappuram vide letter no. nil dated 10-02-2023 & 22-02-2023 had requested to conduct necessary tests and report the Compressive Strength of Rock samples for the work *Jal Jeevan Mission- Water Supply scheme to Anangadi, Thrikkadeeri, Chalavara Panchayath –Investigation works for proposed weir across Thoothapuzha in Cherupulassery Municipality.* Rock samples from BH-1, BH-1A,

BH-1B, BH-2, BH-3 & BH-4, BH-5, BH-6, BH-7, BH-7A & BH-7B are tested for compressive strength in CM Lab.



3. The Assistant Engineer, IWR Section 1/1, Palakkad vide letter no. nil dated 23-02-2023 & 08-03-2023 had requested to conduct necessary tests and report the Compressive Strength of Rock samples for the work- *JJM –Combined Water Supply scheme to Munkakkayam and Koruthodu GramaPanchayath – Site Investigation for proposed Check dam across Manimala river at Moorikkayam.* The compressive strength test of rock samples from BH-1, BH-1B, BH-2 & BH-3, BH-4, BH-4A, BH-4B, BH-5, BH-5A, BH-5B were carried out in CM Lab.



### 3. NON DESTRUCTIVE TESTS

Non-destructive testing (NDT) methods are quality assurance management techniques to provide an estimate of the relative strength and overall quality of concrete of an existing structure without damaging the structure. CM Lab is equipped with Pile Integrity Test, Ultrasonic Pulse Velocity Test and Rebound Hammer Test.

#### 3.1 Pile Integrity testing

Pile Integrity testing is a nondestructive testing conducted on piles as per IS 14893:2021. This is a method usually employed for the evaluation of the physical dimensions such as cross sectional variations, length, discontinuity etc. Impulses or vibrations are applied to the pile and converted using transducers and wave arrival times are used for computing the length and the

wave shape gives an indication of the shape of the shaft. The equipment being used by KERI is PET (USB version). Following pile integrity tests were carried out in 2022-23.

1) The Project Engineer-9, Kerala Irrigation Infrastructure Development Corporation Ltd, Thiruvananthapuram vide letter no PE9/MKM/KIIDC dated 29.03.2022 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work “KIIFB Project Construction of Regulator Cum Bridge across Thoothapuzha at Keezhmurikkadavu, Moothikkayam in Moorkkanad Panchayath”. Accordingly, the test was performed on 04.04.2022.



**8 no. of piles as per request of the Project Engineer-9, KIIDC Ltd, Thiruvananthapuram vide letter no PE9/MKM/KIIDC were tested.**

2) The Project Engineer, Kerala Land Development Corporation Ltd, Kayamkulam has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work “*VFPCK – Construction of Farmer’s Training College at Anayara*”. There are 44 nos piles were trimmed cleaned and the site was equipped for testing. Accordingly, the test was performed on 11.05.2022. 44 no. of piles as per drawing given by the Project Engineer, Kerala Land Development Corporation Ltd, Kayamkulam vide Lt. 372/PE (Kylm)/VFPCK/2019-20 dated 26.02.2022 were tested.



3) The Assistant Engineer, PIP Section No. 6, Eraviperoor vide letter no PIP/S6/RKI/27/2019 dated 27-08-2022 has requested to conduct Pile Echo Test (PET) on the pile group pertaining

to the work ***“Pampa Irrigation Project-Right Bank Canal- Constructing Aqueduct in place of Collapsed Varayannur Aqueduct of Poovathoor East Branch canal at Ch. 1000m”***. Accordingly, the test was performed on 11.05.2022. 10 no. of piles as per drawing given by the Assistant Engineer, PIP Section No. 6, Eraviperoor were tested.



4) The Executive Engineer, Minor Irrigation Division, Ernakulam vide letter no D5-2022/737 dated 28.11.2022 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work ***“Reconstruction of box culvert at Pandarachira road near Chilavanoor in Ernakulam District-Balance work”***. Accordingly, the test was performed on 08.12.2022. 16 no. of piles as per drawing given by the Executive Engineer, Minor Irrigation Division, Ernakulam were tested.



5) The Assistant Engineer, PIP Section No. 6, Eraviperoor- 689542 vide letter no PIP/S6/RKI/27/2019 dated 30-11-2022 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work ***“Pampa Irrigation Project-Right Bank Canal- Constructing Aqueduct in place of Collapsed Varayannur Aqueduct of Poovathoor East Branch canal at Ch. 1000m”***. Accordingly, the test was performed on 09-12-2022. 15 no. of

piles as per drawing given by the Assistant Engineer, PIP Section No. 6, Eraviperoor were tested.



6) The Assistant Executive Engineer, Inland Navigation Sub Division, PMG Thiruvananthapuram, vide letter no D1-248/INSDN/TVM/2020 Vol III dated 10.01.2023 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work “*CSIND-Reconstruction of St. Andrews Bridge and approach road across TS canal Ch. 24.30km in Kadinamkulam Panchayath*”. Accordingly, the test was performed on 28.02.2023. 12 no. of piles as per drawing given by the Assistant Executive Engineer, Inland Navigation Sub Division, PMG Thiruvananthapuram were tested..



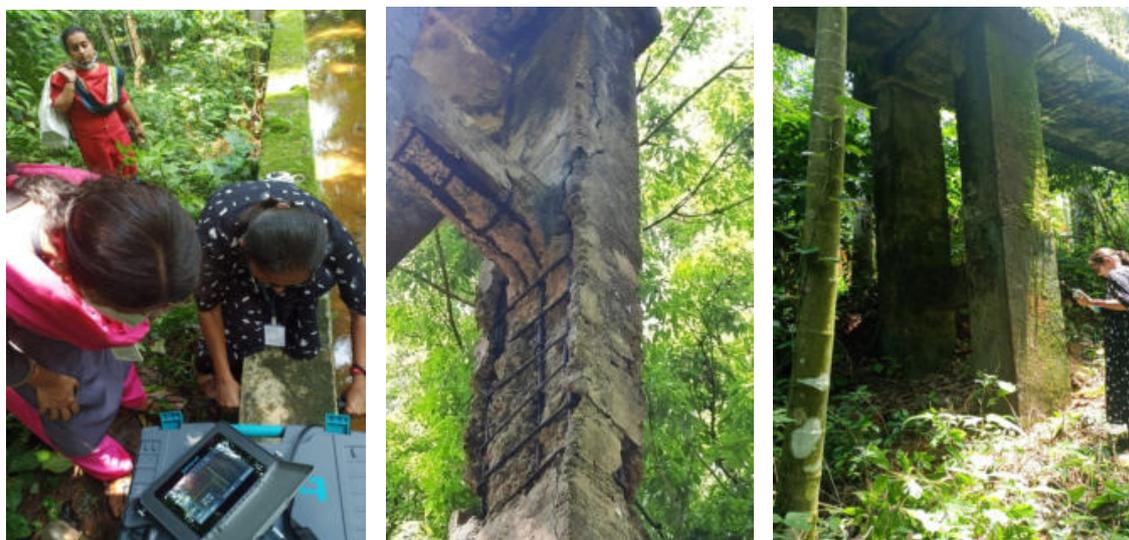
7) The Executive Engineer, Karapuzha Project Division, Kalpetta, vide letter no D4-1573/2020 dated 02.03.2023 has requested to conduct Pile Echo Test (PET) on the pile group pertaining to the work “*Karapuzha Irrigation Project-Rectification of Slided Canal embankment at Ch:1800 m of Kariambady Branch Canal at Kolempetta*”. Accordingly, the test was performed on 07.03.2023. 12 no. of piles as per drawing given by the Executive Engineer, Karapuzha Project Division, Kalpetta were tested.



### 3.2 UPV & Rebound Hammer Test

Ultrasonic Pulse Velocity Test and Rebound Hammer Tests are performed on concrete to assess the quality of concrete as per IS 516 (Part 5/Sec I): 2018 and IS 516 (Part 5/Sec 4): 2020 respectively. Proceq Pundit PL 200 with 54KHz transducers are used for UPV tests and Proceq Silver Schmidt N type hammer is used for Rebound Hammer test. Following works were carried out in 2022-23.

1) Aqueduct of Kodumon Distributory Ch. 7650m to 7850m of Kallada Irrigation project  
The Chief Engineer (Projects II), Special Enquiry Cell, Thiruvananthapuram vide Lt. no. D2-95/18/ISEC dated 30.11.2021 had instructed KERI to carry out Non Destructive Tests (NDT) of Aqueduct of Kodumon Distributory Ch. 7650m to 7850m of Kallada Irrigation project.



The tests were performed on a total of 15 pier groups and troughs. At each column, a total of 3 readings for UPV and 9 readings for rebound number were taken to arrive at average values. But the test readings are mostly affected at every tested surface due to distresses, cracks and voids present in the concrete. The available readings are taken for evaluation.

Diameter of corroded reinforcement bars is doubled whereas after removing the rust stains, the decreased diameter was also noted. The crack widths of major cracks were noted.

## 2) Poovanchira Canal Bridge in Pananchery GP

The Chief Engineer (IDRB), Thiruvananthapuram vide Lt. no. DM-AD5/2/2015/IDRB dated 29.08.2022 had instructed KERI to carry out studies to assess the condition of Poovanchira Canal Bridge in Pananchery GP constructed across right bank main canal of Peechi Irrigation Project between ch. 11/800km and 11/850km.



The tests were performed on the concrete beams and concrete deck slab of the bridge. The beams and slab are divided into three grids at downstream and upstream side. The test equipments can only be used where smooth concrete surfaces are available. The test readings are affected at every tested surface due to distresses like spalling, cracks and voids present in the concrete. The available readings are taken for evaluation. The quality of distressed parts is taken into account by visual observation.

## 3) RCC beam supporting the wall of security cabin in spill way portion of Karapuzha Dam

The Executive Engineer, Karappuzha Project Division, Kalppetta vide Lt. no. D2-605/2017(Vol III) dated 12.08.2022 had requested to carry out Ultra Sonic Pulse Velocity Test and Rebound Hammer Test to assess the quality of concrete of RCC beam supporting the wall of security cabin in the spillway portion. Accordingly the tests were carried out.



#### 4) Renovation of Erayamkudy Thura in Annammanada GP.

The Assistant Engineer, Minor Irrigation Section, Chalakkudy vide Lt. no. C-161/2019 dated 22.08.2022 had requested to carry out Ultra Sonic Pulse Velocity Test to assess the quality of concrete of second lift concrete M15 grade of retaining wall of Erayamkudy Thura.



#### 4. PROCESS OF NABL ACCREDITATION

This Division has applied for NABL accreditation for testing and calibration laboratories. Pre assessment audit was successfully completed in December 2022 and the final assessment is scheduled in May 2023. The lab has applied for NABL accreditation for two parameters - Compressive strength of hardened concrete and compressive strength of concrete paver blocks. Widening the scope of accreditation to cover all parameters/tests carried out in CM Lab is our prime goal and thereby to achieve the vision of upgrading CM Lab as a centre of excellence in testing industry.



## 5. INTERNSHIP PROGRAMMES

Several Engineering Colleges and Polytechnic Institutions have collaborated with CM Lab for internship trainings and exposure visits as part of their curriculum. Student’s interactions and training sessions were arranged in CM Lab for testing of construction materials, mix design and Non Destructive Testing. Certificates of training were issued by the Joint Director, CM&FE.

Name of College	Date of visit	No of students
Thyagarajar Polytechnic, Alagappanagar	17-09-2022	10
Malabar College of Engineering & Technology, Desamangalam	07-10-2022	13
Vidya Academy of Science and Technology, Thalakkottukara	10-11-2022	10

## 6. SNAPS OF ROUTINE LAB ACTIVITIES



Inside CM Lab



Mix Design



Testing of Steel Samples

**E.SOIL MECHANICS AND**  
**FOUNDATIONS DIVISION**

## **SOIL MECHANICS AND FOUNDATIONS DIVISION**

### **1.INTRODUCTION**

Soil, the most unpredictable of all engineering materials also happens to be the all-important material in civil engineering because all structures need to be founded on earth. In addition to being the founding medium, soil is also used as a material of construction. As in the case of other materials, properties of soil cannot be generalized since basically soil is a combination of different constituents having different properties. Therefore the study of the technical and structural aspects of soil is all important.

Major difficulties encountered in foundation work are due to the nature of soil. The investigation for any foundation engineering problem may range from a simple examination of soil to a detailed study of the soil and ground water by means of bore holes and laboratory tests on the materials encountered. The extent of the work depends on importance and foundation arrangement of structures, the complexity of the soil conditions and already available information of existing foundations on similar type of soils.

The physical characteristics of soils can be investigated by means of laboratory tests on samples taken from boreholes or trial pits. Results from lab tests can be used to derive important parameters in the design of substructure. The results of shear strength tests can be used to calculate the ultimate bearing capacity. Soil parameters so obtained by means of investigations can be utilized to design safe structures.

Soil Mechanics Laboratory under K.E.R.I. is fully equipped to determine the index as well as the engineering properties of soil samples. The soil mechanics laboratory undertakes work from Government agency and private agencies.

During investigation, the soil samples are collected and tested in the laboratory, for finding out index properties and engineering properties like Maximum Dry Density, Optimum Moisture Content, Permeability, Shear strength parameters, Consolidation and Swelling characteristics and relevant parameters are furnished to design the proposed structures. The laboratory is assisted by the Instrumentation Division which is equipped with field testing equipment for boring to collect undisturbed soil samples.

Soil samples received from various projects of Irrigation Department, PWD Roads and Buildings, Panchayati Raj institutions, Kerala State Electricity Board, KFRI, KAU and Non-Government bodies are being tested as per the codes of Bureau of Indian Standards.

The Lab contributes healthy revenue every year to the Government through various tests conducted for clients. The Lab is also functioning as a training centre of the Irrigation Department and providing training programmes and refresher courses for the benefit of department engineers. Now the Lab is on the process of getting assessment and accreditation of Testing and Calibration Laboratories by the National Accreditation Board Testing and Calibration Laboratories (NABL) in accordance with the international standards. Also research activities are being conducted at this division.

### **Tests conducted in the Lab**

Soil samples were tested from various projects of Irrigation department, other departments and private agencies. During the year 2022-23, 548 samples were tested in 51 different works for revenue of Rs.14,55,234/- (Rupees Fourteen Lakh Fifty Five Thousand Two Hundred and Thirty Four Only) and the details of works are appended.



**Fig - Snaps of soil testing**



**Fig - Snaps of soil testing**

## **2. INFRASTRUCTURE**

The important equipment's and software available in the laboratory are

- i) Hydrometer test with accessories
- ii) Atterberg's limit devices
- iii) Direct Shear apparatus
- iv) Automatic Compactor
- v) Light and Heavy compaction testing apparatus
- vi) Laboratory CBR test apparatus
- vii) Digital soil cone penetrometer
- viii) Constant head permeability test apparatus
- ix) Variable head permeability test apparatus
- x) Static Tri-axial Testing Apparatus
- xi) Unconfined Compression Test Apparatus

xii)Consolidation Apparatus

xiii)Sample extruder

xiv)Standard set of sieves

xv)Riffle Sample Divider

xvi)Plaxis 2D Software

Modernizing the lab will come true with the addition of modern Instruments. This lab is equipped with Engineering Seismograph and is used for subsurface characterization by seismic refraction method.Seismograph is also used for Seismic Tomography Survey to determine compactness in dams.



**Fig. Direct Shear Apparatus**



**Fig. Static Triaxial Testing Apparatus**



**Fig. Digital Soil Cone Penetrometer**



**Fig. Consolidation Test Apparatus**



**Fig. Unconfined Compression Test Apparatus**



**Fig. Compaction Test Apparatus**



**Fig. Apparatus used for Seismic Refraction Survey**



**Fig. Engineering seismograph**

#### 4.CONDUCTING SEISMIC TOMOGRAPHY SURVEY AT KANJIRAPUZHA DAM

The ageing and degradation of dam structures is an inevitable problem and its consequences on the safety of the structure are important. Seismic Tomography technique is generally used for detecting the deteriorated zones inside the dam (masonry and concrete) body. Seismic tomography surveys are generally conducted across vertical upstream-downstream cross sections. Seismic signals are generated with a sledge hammer, by hitting directly on the dam body. Hydrophones and geophones are arrayed in vertical on upstream side of the Dam and shot position fixed on downstream face of the Dam. Typically, tomography images are analysed to look at the velocity changes within the masonry or concrete. Areas with lower velocity correspond to weaker, less dense concrete, while those with higher velocities are considered to be sound concrete. The results also can show areas with cracking damage or other discontinuities.

Seismic tomography survey was conducted at Kanjirapuzha Dam on a study basis during February to March 2023.



Fig. Seismic Tomography study at Kanjirapuzha Dam

## 5. OTHER ACTIVITIES

### 5.1 Field work conducted

Site Visit was carried out along with other officials of KERI for the investigation work to determine obstructions to flow of Periyar River at Vaduthala, Ernakulam

### 5.2 Conference attended

Er. Joyal Scaria, Assistant Director has participated in the Indian Geotechnical Conference 2022 - "GEOLEAP - Geotechnics: Learning, Evaluation, Analysis and Practise" organised during December 15-17, 2022 at Kochi by the Indian Geotechnical Society Kochi Chapter in association with the Department of Civil Engineering, Cochin University of Science & Technology (CUSAT).

### 5.3 Internship programmes

Internship trainings were given to Diploma students from Thiagarajar Polytechnic College, Alagappanagar as part of their curriculum.



**Fig. Internship training to students of Thiagarajar Polytechnic College, Alagappanagar**

### 5.4 Trainings

This division has actively participated in various stages of training programmes (Conducting Training in Zoom Platform, Issue of Certificates etc.) given below.

**F.INSTRUMENTATION**  
**DIVISION**

## **INSTRUMENTATION DIVISION**

### **INTRODUCTION**

The Instrumentation Division plays a crucial role in conducting soil investigation works under the Construction Materials and Foundation Engineering (CM&FE) Division at KERI Peechi. The jurisdiction of the division extends to all regions within the state, with a goal to ensure the investigations are carried out comprehensively and efficiently across different areas, enabling engineers and project stakeholders to make informed decisions based on accurate and reliable data. The investigation, which includes soil exploration, is essential for evaluating the suitability of the soil for the proposed engineering work and preparing appropriate designs. By gathering reliable information about the soil and groundwater conditions at the site, engineers can make informed decisions regarding the design and construction process. The work carried out by the Instrumentation division in conducting soil investigation plays a vital role in providing essential information to engineers. This information helps in intelligent planning, design, and construction of structures, ensuring their stability and safety while optimizing construction materials and methods.

The most commonly used method for soil investigation is boring, where boreholes are excavated with a diameter of approximately 100 mm to 150 mm. In the field, a variety of devices are used for this purpose, ranging from simple hand-operated augers to drilling machines. At the Instrumentation division, presently there are augers and Rotary Calyx Drilling Machines available. The Rotary Calyx drilling machines are capable of drilling in soil, soft rock, and hard rock up to a depth of 50 m to 60 m.

The following field tests are conducted by this division;

1. Standard Penetration Test.
2. Collection of disturbed and undisturbed soil samples by hand auger and boring.
3. In situ Vane Shear test

The important equipment available in the Division are

- Equipment for hand augering.
- In situ Vane shear test apparatus
- Rotary Calyx drilling machines - 2 Nos.



Fig a. Rotary Calyx drilling machine

#### **SOIL INVESTIGATION WORKS EXECUTED DURING THE YEAR 2022-2023**

1. Soil Investigation Works for "Harithakerala mission-Investigation for the construction Bandharascheme across Kunthipuzha at pombraKanhirayikadavu in Karimbuzhagramanchayath in palakkad District."
2. Soil investigation for new buildings at IIT Palakkad campus
3. Soil investigation work regarding the formation of bund in Vaduthala, Ernakulam
4. Soil investigation of incubator building at IIT Palakkad
5. Investigation works to the construction of bridge across Naduvathythodu at Poorapuzhariver in Pariyapuram – TanurmunicipalityinMalappuram District
6. Collection and testing of Soil samples from National Waterway in Ashtamudikayal
7. Soil Investigation of check dam across Mangalamriver at Plazhy in Pazhayannur, GP

in Thrissur District.

8. Sample collection in line with the order of District Collector, Malappuram from private Agricultural land at Pothukallu village Nilambur Taluk, Malappuram as a result of 2019 flood
9. Soil Investigation of Various Works for Irrigation Department – Investigation work for New VCB cum Bridge near Marutha
10. Soil Investigation charges for the work "JJM Water supply scheme to Vattavada Panchayath for construction of weir across Chilanthyar Waterfalls in Vattavada"

### **1. Soil Investigation Works for "Harithakerala mission-Investigation for the construction Bandhara scheme across Kunthipuzha.**

The site was situated at Pombra Kanhirayikadavu in Karimpuzha Gramapanchayath in Palakkad District. The location of the boreholes were decided after the site visit conducted by officials of Instrumentation division, KERI and the officials of Minor Irrigation Division, Palakkad, and the members of the Jilapanchayath during the site visit on 24<sup>th</sup> May 2021. The boreholes were located based on the findings of the site visit. The proposed location at Pombra Kanhirayikadavu has a total width of 95m. A total of 13 boreholes were drilled for this project. Specifically, two points were explored at the left and right abutments, while five boreholes were drilled along the stream portion. Additionally, for the construction of the retaining wall, boreholes were carried out in the upstream and downstream portions, with two boreholes on each side. Two additional boreholes were proposed in the stream portion, upstream and downstream of the alignment of the proposed structure, for the design of aprons. The estimated cost for the project is 8,26,000/-, and the total expenditure incurred for the work was Rs: 4,05,998/-.



Fig.1- Investigation for Bandhara Across Kunthipuzha

## 2. Soil Investigation for New Building at IIT Palakkad

The investigation works for the construction of new buildings at IIT Palakkad Campus were carried out based on a letter received with reference number IIT PKD /EWD /2021-22, dated June 24th, 2022, from Dr. V SenthilKumar, Chairman EWD, IIT Palakkad. The soil investigation was conducted by the Instrumentation Division, KERI, as per the instructions in the aforementioned letter. The investigation included activities such as boring, collection, and testing of soil samples. For soil exploration, three boreholes were drilled between July 6 and July 11, 2022. Rotary calyx-type drilling machine was used for the boring process, with the drilling conducted until reaching the hard rock level. The estimated cost for the work is 1,90,000/-, and the total expenditure incurred for the execution of the work was Rs: 1,56,728/-



Fig.2-Soil investigation for new buildings at IIT Palakkad

## 3. Soil Investigation work regarding the formation of the bund in the Vaduthala Area.

As per the order dated 9/06/2022 of the Honourable High Court in WP (C) 24027/2021, a high level committee constituted by the G.O. (Rt) No. 520/2022/DMD dated 15-06-2022, for enquiry under chairmanship of Sri. PranabJyothiNath I.A.S, Secretary, Water Resources Department. The Chairman has entrusted KERI to conduct necessary investigations to identify the presence of bund in the river bed in presence of the High-level Committee members. 63 numbers of soil samples from various boreholes were brought to the laboratory

by Instrumentation Division for testing. The estimated amount for the work was Rs:4,00,000/- and the total expenditure incurred for the execution of work was Rs:3,29,317/-.



Fig.3-Soil investigation work regarding the formation of bund in Vaduthala, Ernakulam

#### **4. Soil Investigation of Incubator Building at IIT Palakkad.**

This project is being proposed in accordance with the letter from Dr. V Senthil Kumar, Chairman EWD, IIT Palakkad, dated June 3, 2022, requesting soil investigations related to the construction of an incubator building on the IIT campus, Palakkad. The institute intend to construct a new building for technology innovation and incubation activities in permanent campus at Palakkad. The proposed structure will have three stories and a built-up area of 6000 square metres.

As per the above-mentioned letter, The soil investigation was conducted by Instrumentation Division, KERI for the proposed work. Investigation works such as boring, collection and testing of soil samples, etc. are conducted. 3 boreholes were drilled for soil exploration. The investigation was done between July 6 and July 11, 2022. The estimated amount for the work was Rs:1,80,000/-and the total expenditure incurred for the execution of work was Rs:1,76,087 /-.



Fig.4-Soil investigation of incubator building at IIT Palakkad

**5. Investigation works to the construction of bridge across Naduvathythodu at Poorapuzha river in Pariyapuram – Tanurmunicipality in Malappuram District**

A bridge was suggested to be built in order to link the roads on the two banks of the Naduvathithodu. The present investigation works was initiated prior to the construction of the above mentioned bridge across the thodu. Director, F&AR, KERI, Peechi has received a prioritised list of investigation works from the Suprintending Engineer, Minor Irrigation Circle, Kozhikhode in accordance with Ltr No DB9-2321 /IV W/2022-23 dtd 08/11/2022. Later, Joint Director, CM& FE, KERI Peechi granted permission to conduct the investigation by including it under the action plan 2022–2023 in the title of work "soil investigation for various works of Irrigation department as per letter no. DB2/1295/2022–2023 dtd 25/11/2022. Work was undertaken in Action plan of KERI .



Fig.5-Soil Investigation for Construction of Bridge across Naduvathithodu

## **6. Collection and testing of Soil samples in National Waterway in Ashtamudikayal for usage of dredged material for NHAI Project**

As per the Letter no D3-2773/2022 dtd 14/11/2022 of Executive Engineer, Inland Navigation Division, Kollam, a request has been received for carrying out soil Investigation and testing of soil samples collected from National water way in AshtamudiKayal. Accordingly, The Director F&AR, KERI Peechi and Joint Director, CM&FE Division gave the instructions to Instrumentation division of KERI to carry out the soil investigation in the mentioned area. Subsequently a joint site inspection was conducted by KERI team with the officials of various departments such as Inland Navigation Division Kollam, Revenue Department, NHAI, IWAI on 17<sup>th</sup> November 2022. Officials from Sivalaya Construction Company Ltd, Kollam were also present. After discussion, it was decided the location where from samples to be collected and samples were collected from AshtamudyKayal for testing the soil parameters



Fig.6-Soil Investigation Work In National Water Way InAshtamudiKayal, Kollam

## **7. Soil Investigation of check dam across Mangalam river at Plazhy in Pazhayannur GP in Thrissur District.**

This investigation was done based on letter No.D6/General/ 2020, dtd 17/11/2022 received from Executive Engineer, Additional Irrigation Division, Thrissur for the proposed check dam across Mangalam River at Plazhy in Pazhayannur Grama Panchayath in Thrissur District. The total width of the stream at the proposed location (Mangalam River) is 40 m. Two points were explored at the left and right abutments. Three boreholes were to be drilled along the stream portion. Four boreholes were excavated for retaining wall upstream and

downstream portion on the left bank and right bank. Work was undertaken in Action plan of KERI.



Fig.7-Soil Investigation work for of check dam across Mangalamriver at Plazhy.

**8. Sample collection in line with the order of District Collector, Malappuram from private Agricultural land at Pothukallu village Nilambur Taluk , Malappuram as a result of 2019 flood**

The Director of KERI received a letter, numbered I/211262/2023 and dated 18/01/2023, from the District Collector of Malappuram. According to the letter, the Instrumentation Division of KERI collected five disturbed soil samples. These samples were taken to the Soil Mechanics laboratory for the purpose of determining the grain size distribution of each sample.



Fig.8 .Collection of soil samples from Agricultural land at Pothukallu village Nilambur Taluk , Malappuram

### **9. Soil Investigation work for New VCB cum Bridge near Marutha at Vazhikadavu.**

The soil investigation for the "New VCB cum Bridge near Marutha at Vazhikkadav Gramapanchayath in Malappuram District" was conducted based on letter No.D2-General/2022, dated 24/12/2022, received from the Executive Engineer, Minor Irrigation, Malappuram. The proposed location is near the Poorappuzha river, with a total width of 13m. The work was undertaken as part of the Action plan of KERI.



Fig.9-Soil Investigation work for New VCB cum Bridge near Marutha at Vazikadavu

### **10. Soil Investigation charges for the work “JJM Water supply scheme to Vattavada Panchayath for construction of weir across Chilanthiyar Waterfalls in Vattavada”**

This investigation was prepared based on letter No.AEE/JJM/Vattavada /2021-2022 dated 14/10/2022 received from Executive Engineer, Project Division Kattapana, Vellayamkudy requesting a soil investigation for the proposed check dam across Chilanthiyar Waterfalls at Vattavada Grama Panchayath in Idukki District. This report presents the geotechnical characterization of the ground based on field and lab tests at bore hole locations of the proposed construction. The total width of the stream at the proposed location is 22 m. Three borehole was drilled along the stream portion. Two boreholes were excavated for retaining wall upstream portion (on the right bank). The estimated amount for

the work was Rs:5,00,000/-and the total expenditure incurred for the execution of work was Rs:2,79,297/-.



Fig.10-Soil Investigation for JJM Water supply scheme to Vattavada Panchayath

### **Fundamental study for real time water level monitoring system with help of sensors**

To develop a system for automatically determining the water level of rivers in Thrissur District, sensor systems can be utilized to provide early flood warnings to some extent and facilitate the evacuation procedure. A real-time water level monitoring system enables automatic measurement of river water levels, alerting feature notifies the users about possible flood risks. This timely information allows for the execution of emergency plans within the available time. This initiative was started in collaboration with KERI, Peechi and Sreepathy Institute of Management and Technology (SIMAT), Vavanoor.

A trial study was conducted at Peechi Dam to assess the performance of the sensor setup for real-time water level monitoring. Continuous monitoring was carried out for two weeks at Peechi Dam to evaluate the feasibility of deploying the same setup at selected locations. Five different locations were chosen, including three along the Chalakudy River and two along the Manali River, for the installation of the sensor system.



Fig. 11 Trial study at Peechi Dam to assess the performance of the sensor setup by KERI and SIMAT

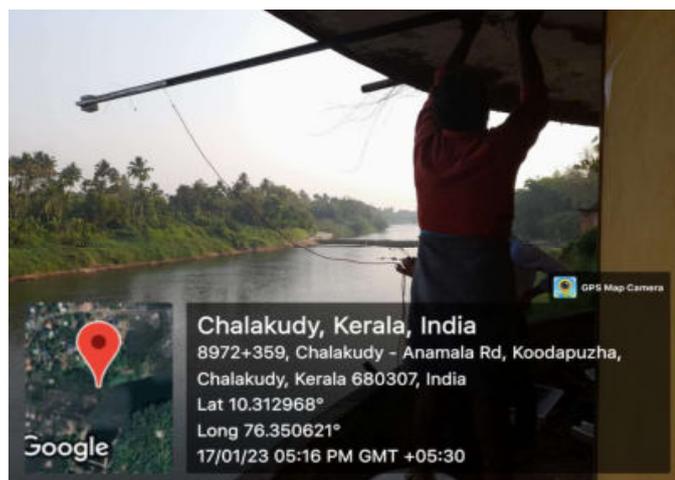


Fig.12 Deployment of sensor setup at Chalakudy river for real time water level monitoring

This project was later selected for demonstration and dissemination of selected technologies as part of UnnatiMahotsav and Expo at IIT Delhi. KERI represented as a mentor in this event. The features of the above study were presented at UnnatiMahotsav, and the idea was demonstrated at the allocated stall.



Fig. 13 Demonstration of the idea and receiving the certificate during UnnatiMahotsav and Expo at IIT Delhi

# **G.PUBLICATION WING**

## **PUBLICATION WING**

The Information Bureau of the Kerala Engineering Research Institute (KERI) is located within a technical library managed by the publication wing. This library houses approximately 10,000 books and a few current periodicals, providing essential technical knowledge to all institute staff. The department also arranges lectures and training programs for the benefit of the institute's employees. Additionally, the publication wing conducts training and refresher courses for employees of the Irrigation Department.

To ensure the library remains up to date, new publications on various topics of interest to researchers, students, and employees are regularly added. The library serves as a resource for numerous technical individuals from different government departments, as well as students from various engineering colleges and polytechnics. Officers associated with KERI can borrow books using the library software, and a card system is also maintained. Moreover, engineers from different departments and institutions are granted access to reference books.

The technical library disseminates information through technical books, e-journals, printed journals, previous study reports, and other means. The training also provides an opportunity to advance the knowledge of employees in the department. In addition to books, the library provides access to several Indian periodicals, including the Indian Geotechnical Journal, Indian Concrete Journal, Electronics for You, Indian Journal of Power & River Valley Development, Civil Engineering and Construction Review, Down to Earth. And International Journal of Civil Engineering and construction, New Building Materials & Construction World (NBM & CW), and The Bridge & Structural Engineering (B&SE)



Fig 14. Library under the publication wing of KERI

As part of ensuring smooth functioning in managing and issuing books, articles, and other materials, the library has introduced Koha software, an open-source integrated library system (ILS). Koha offers a wide range of features to automate and streamline library operations, including cataloging and circulation, among others.

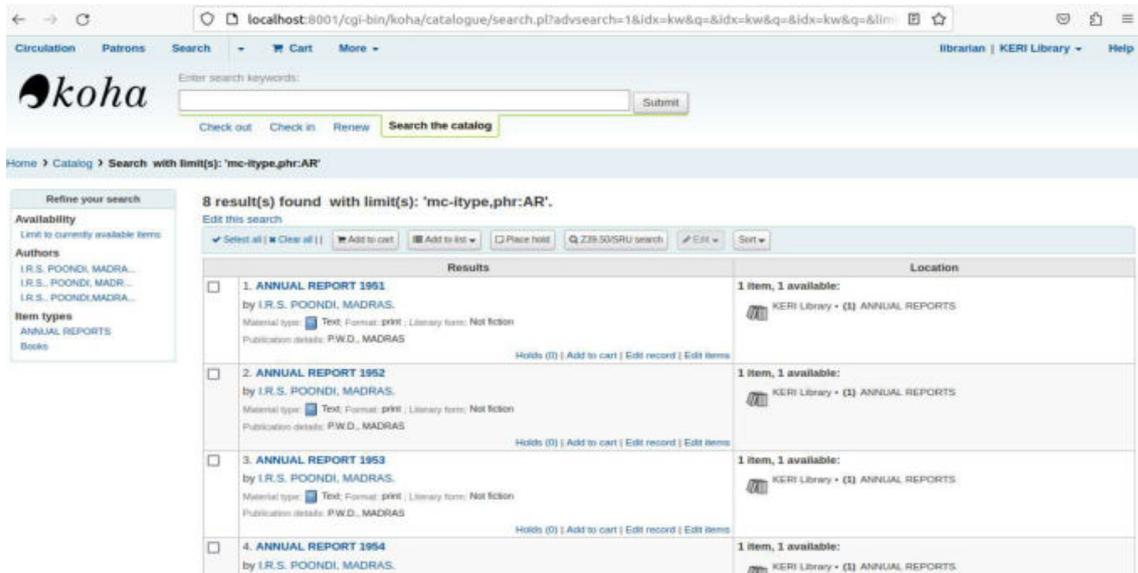
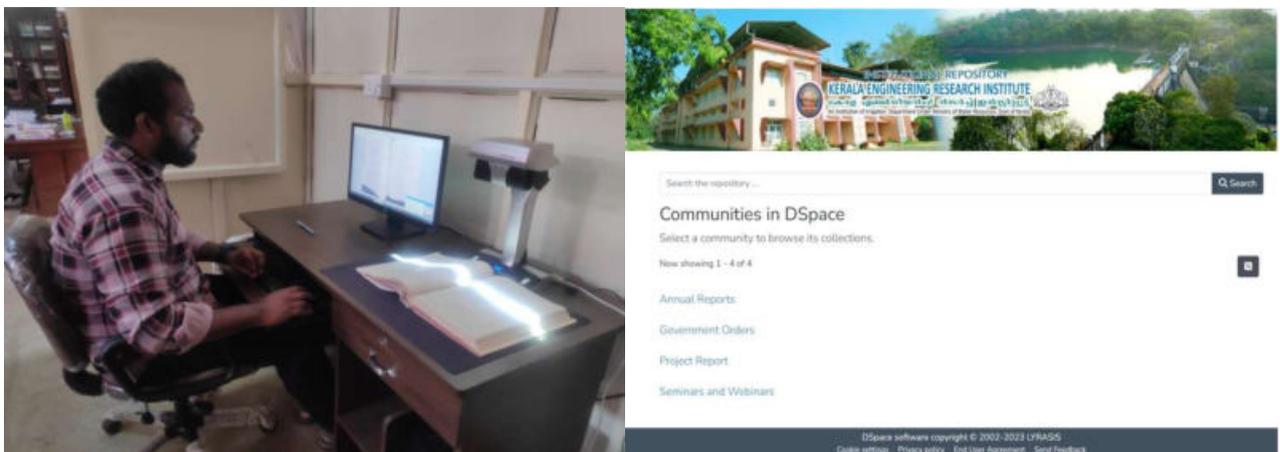


Fig 15. A screen capture view of Koha Software

In a view to make available the departmental documents/project report etc. digitally there is an initiative to digitalise the aforementioned resources in the library. By the process of digitalization of library, helps the staff in the entire department to make them accessible and available online. This involves converting physical books, documents, and other materials into digital copies, as well as adopting digital tools and technologies to manage and provide access to these resources. In order to convert the physical books to digital copies, Scanning of library books and documents were done. The scanned digital copies were then added to an open-source repository software, D space.



(a)

(b)

Fig. 16(a)Process of scanning for digitilisation programme (b) screen shot of D space.

In the financial year 2022-2023, several training programs were conducted under the purview of the publication wing to enhance the skills and technical knowledge of engineers and other staff. These training programs aimed to keep the workforce updated with the latest industry practices and advancements in their respective fields. Hands-on training in sand budgeting, soft skills training in Microsoft Word and Excel, and various other online trainings in relevant topics were conducted. The list of various trainings conducted are given below

### 1. Topic: Effective Project Management and Performance Monitoring

**Speaker : Sri. K. P. Purushothaman , Director General (Rt) , BRO on 29/06/2022**

The speaker, K. P. Purushothaman, delivered a lecture on project management and performance monitoring, in order to share his experience in Atal Tunnel, Himachal Pradesh, India. The session was conducted online.



Fig 17. Photos of online session on project management and performance monitoring by Sri. K. P. Purushothaman , Director General (Rt) , BRO

### 2. Topic: Special Concrete - From Application Perspective

**Speaker : Dr .Sunitha K Nair ,Faculty IIT Palakkad, on 12/07/2022**

The speaker, Dr. Sunitha K Nair from IIT Palakkad, delivered lectures on the application perspective of Special Concrete. The session was conducted online.



Fig 18. Photos of online session on the application perspective of Special Concrete by Dr. Sunitha K Nair , IIT Palakkad

### 3. Topic: Slope Stability with flexible Measures with Solutions

Speaker: ErAnnapoorniyer on 11/11/2022

Er Annapoorni Iyer delivered a lecture on Slope Stability with Flexible Measures and Solutions. The session was conducted online.



Fig 19. Photos of online session “Slope Stability with flexible Measures with Solutions” by Dr. Sunitha K Nair , IIT

### 4. Topic : Basics of MS word & Excel Speaker

Speaker :Sri .Jomon P Kavalakaton 22/08/2022

This training aimed to enhance the soft skills of the technical staff in using Microsoft Word and Excel. It has covered various aspects of these software applications, including document formatting, data entry, formula creation, and basic data analysis. Conducted in hands on trianing mode.



Fig 20. Photos of Basics of MS word & Excel training programme.

**5. Topic : Capacity building for the study " Sand budgeting in Chaliyar River " undertaken by KERI in collaboration with NIT Calicut**

As part of the collaborative study with NIT Calicut , KERI has conducted hands on training for HEC-HMS and HEC-RAS. These are the two commonly used software tools developed by the U.S. Army Corps of Engineers for hydrological and hydraulic modelling. Both HEC-HMS and HEC-RAS are powerful tools that assist engineers and hydrologists in analyzing and predicting the behavior of water systems, such as rivers, streams, and watersheds. Also provide insight knowledge in ArcGIS



Fig 21.hands on training for HEC-HMS and HEC-RAS

**6. Topic: GST Training Program**

**Speaker . Mr BijuKartin& Mr .Mahesh ,accounting and Financial Consultant**

**Training on 24/11/2022**

A training is given to ministerial staff in a view to get an introduction to GST, Exploring the different GST rates, exemptions applicable to various goods and services, Learning about the process of filing GST returns, GST Audit and Assessment etc. The session was conducted offline.



Fig. 22 Training on GST

**7. Topic: Subsurface Investigation, Analysis And Recommendation of Foundation**

**Speaker :Dr K.Balan on 28/12/2022**

Dr. K Balan delivered a lecture on the topics of subsurface investigation, geotechnical Analysis, foundation design and analysis, and recommendation of foundation. The lecture included an interactive session with various case studies in these areas.



Fig.23 Snapshots of seminar session by Dr. K Balan

## 8. Topic:GeoHECRAS online webinar

**Speaker: Hank Miller, Water Resource Engineer at CivilGEO Engineering Software on Tuesday, February 28, 2023**

The GeoHECRAS webinar was an interactive showcase of the advanced features of GeoHECRAS, conducted by Hank Miller, Water Resource Engineer at CivilGEO Engineering Software. With this engineers can work on an actual engineering project - flood modelling/dam failure/bridge hydraulics/culverts resizing/river channelization.

## 9. Government e Marketplace (GeM) Portal Training

Government e Marketplace (GeM) is an online portal introduced by the Government of India to facilitate procurement of goods and services by various government departments, organizations, and public sector undertakings . Training provided some important aspects of GeMlike the registration process, Product Categories available in Gem, Bidding and Tendering procedures, CatalogManagement , order Placement &tracking and so on.

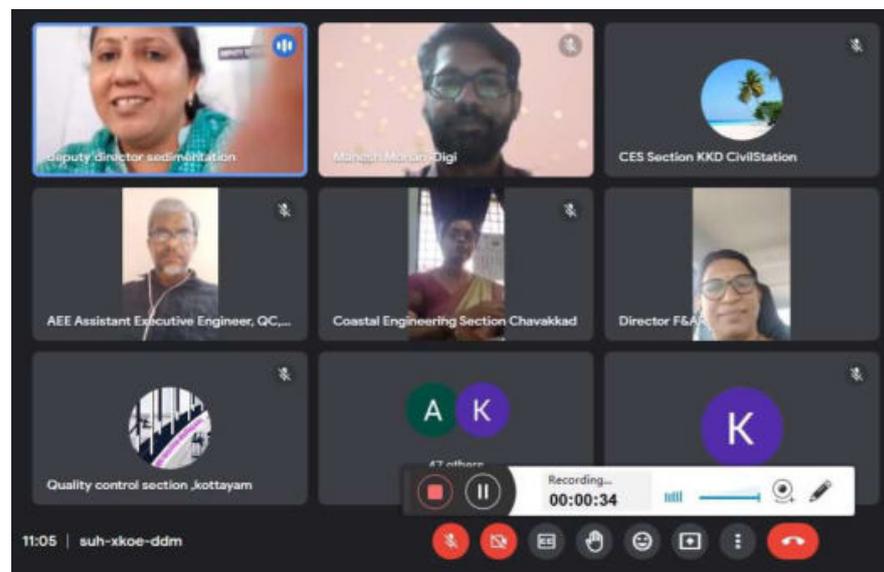


Fig. 24 Photos of Government e Marketplace (GeM) Portal Training

## 10. Interactions With WRI officials

An interactive session was held between WRI officials and KERI officials at seminar hall of publication wing. During the session with WRI officials, a case study of Mumbai city was discussed to deal with flood modelling



Fig. 25 Interactive session with WRI officials

### 11. Internships programmes offered to students from different colleges.

Internship programs are offered to students from various institutes, such as engineering colleges or polytechnic colleges, within the scope of Kerala Engineering Research Institute to provide them with practical work experience and exposure to professional environments. These internship programs aim to bridge the gap between theoretical learning and practical application within the respective scopes of each division in the institute. The Instrumentation division provides students with insight knowledge in soil investigation and its scope.



Fig. 26 Snapshots of Internships programmes offered to students from different colleges.

**H.COASTAL ENGINEERING**  
**FIELD STUDIES,THRISSUR**

## **COASTAL ENGINEERING FIELD STUDIES**

### **Contents**

1. Introduction
2. General Arrangements and Field Studies
3. Organization Setup
4. Incumbency Details
5. Programme of Study
6. Performance of the division
7. Photos of Coastal Damages
8. Details of Stones
9. List of Important Structures
10. Details of Works
11. Bottleneck Facing
12. Suggestions / Recommendations
13. Conclusion

## **I. INTRODUCTION**

The Coastal Engineering Field Studies was formed in 1973 and is engaged in the collection of data and field studies on Coastal Erosion along the Kerala Coast. The coast of Kerala extending 576 Km. in the south west coast of India, is Characterized by a narrow longitudinal barrier strip of low-lying land, sand-witched between the Arabian Sea and a continuous chain of lagoons and back waters with connection to sea at several points. This strip is formed of alluvial deposits. In considerable stretches, the space between the sea and the back waters is very narrow and even less than a few hundred meters at many places. Any break in this narrow strip would expose the back water to the fury of the waves and could endanger the entire disappearance of the barrier beaches.

The coastal zone has the maximum concentration of population and is even many times the State average at several places. Many of the foreign exchange earning industries, residential localities, a number of district headquarters, good number of ports, fishing harbours and extensively cultivated land also exist along this narrow coastal zone.

The coastline of Kerala is subjected to severe erosion in a major portion of its length during the monsoons, when the sea becomes rough due to consistent attack of waves. The coastline is sometimes subject to tidal overflow also, when adjoining low lying lands get submerged. Erosion is very severe in the coastal areas during the south west monsoon period. During the worst monsoon period, the highest waves average 2,3 metres and wave periods range from 9 to 12 sec. and they come mostly from west. Storm tides occur all along the coast during the monsoon season. During the monsoon, the high waves coupled with storm surges, cause overflow and flooding of the low lying backshore lands all along the coast, resulting in considerable loss of property, destruction of private and Government buildings, communications, dislocation of life of lakhs of population and disruption of other activities affecting economy. The influence of saline water through mouth of rivers also affects agriculture and industry.

New CP stones have been planted throughout the Kerala coast except about 25km length of north extreme end at Manjeswaram. The GPS Co-ordinates of all CP stones and seawalls have been recorded.

All aspects of the coastal erosion problems of the State, the necessity for immediate protection of vulnerable stretches, efforts made in collection of coastal data for long periods in conducting studies and in getting expert advice from all over the world and achievements made so far in tackling the erosion problem.

Many experts who visited this State, to study the behavior of the coast and also for periodical evaluation of the performance of completed sea walls, were all of the same opinion that the sea wall damage, mostly due to improper maintenance is as important as the construction of sea wall.

For proper construction and to understand the performance of the sea wall during and after construction, proper monitoring is necessary. This requires consideration of the field staff with the staff engaged in coastal erosion studies. Whenever a new sea wall is to be constructed, the research staff must be informed of the different stages of construction, starting from alignment of the sea wall forming filter, core, armour layers, etc, so that the performance of it during construction and after construction can be watched.

The field staff also must keep a date-wise record of construction details starting from alignment, excavation, putting filter, forming core, armour layer, etc, as per lines and level. The distance and levels of stones in front of sea wall also must be watched regularly with the progress of construction of sea wall. All chainages of sea wall must be made with reference to the Km/C.P stone available at site

The concerned Assistant Engineers must give all relevant details to the concerned Assistant Directors in charge of Coastal Engineering field Studies from time to time, as per the above guideline and also keep a copy of the same for reference. The offices under this office are

### **1. Coastal Engineering Sub Division Kollam**

- a) Coastal Engineering Section, Thiruvananthapuram: The jurisdiction of coastal area comprises of Kollamkode to Paravoor pozhi (CP 0000 to CP 0287)
- b) Coastal Engineering Section, Kollam: Jurisdiction of coastal area comprises of Paravoor pozhi to Kayamkulam pozhi (CP 0288 to CP 0499)
- c) Coastal Engineering Section, Thottappally: Jurisdiction of coastal area comprises of Kayamkulam pozhi to Alapuzha pier. (CP 0500 to CP 0710)

The total coastal area of Kollam Sub Division is **164.596 Km.**

### **2. Coastal Engineering Sub Division Ernakulam**

- a) Coastal Engineering Section, Cherthala: Jurisdiction of coastal area comprises of Alappuzha pier to Ponnani. (CP 810 to CP 975)
- b) Coastal Engineering Section, Ernakulam: Jurisdiction of coastal area comprises of Chellanam to Munambam. (CP 975 to CP 1187)

- c) Coastal Engineering Section Chavakkad: Jurisdiction of coastal area comprises of Azhikode to Ponnani. (CP 1188 to CP 1549)

The total coastal area of Ernakulam Sub Division is **151.6311 Km.**

### **3. Coastal Erosion Studies Sub Division Kozhikode**

- a) Coastal Erosion Studies Section, Parappanangadi: Jurisdiction of coastal area comprises of Padinjarekkara to Kadalundi (CP No. 1555 to CP 1743)
- b) Coastal Erosion Studies Section, Kozhikode: Jurisdiction of coastal area comprises of Kadalundi to Poozhithala Mahipalam. (CP 1745 to CP 2120)
- c) Coastal Erosion Studies Section, Thalassery: Jurisdiction of coastal area comprises of Mahi River to Thalapady river Manjeswaram. (CP 2140 to CP 2412 in Kannur District and CP 2507 to 2750 of old CP in Kasargode District).

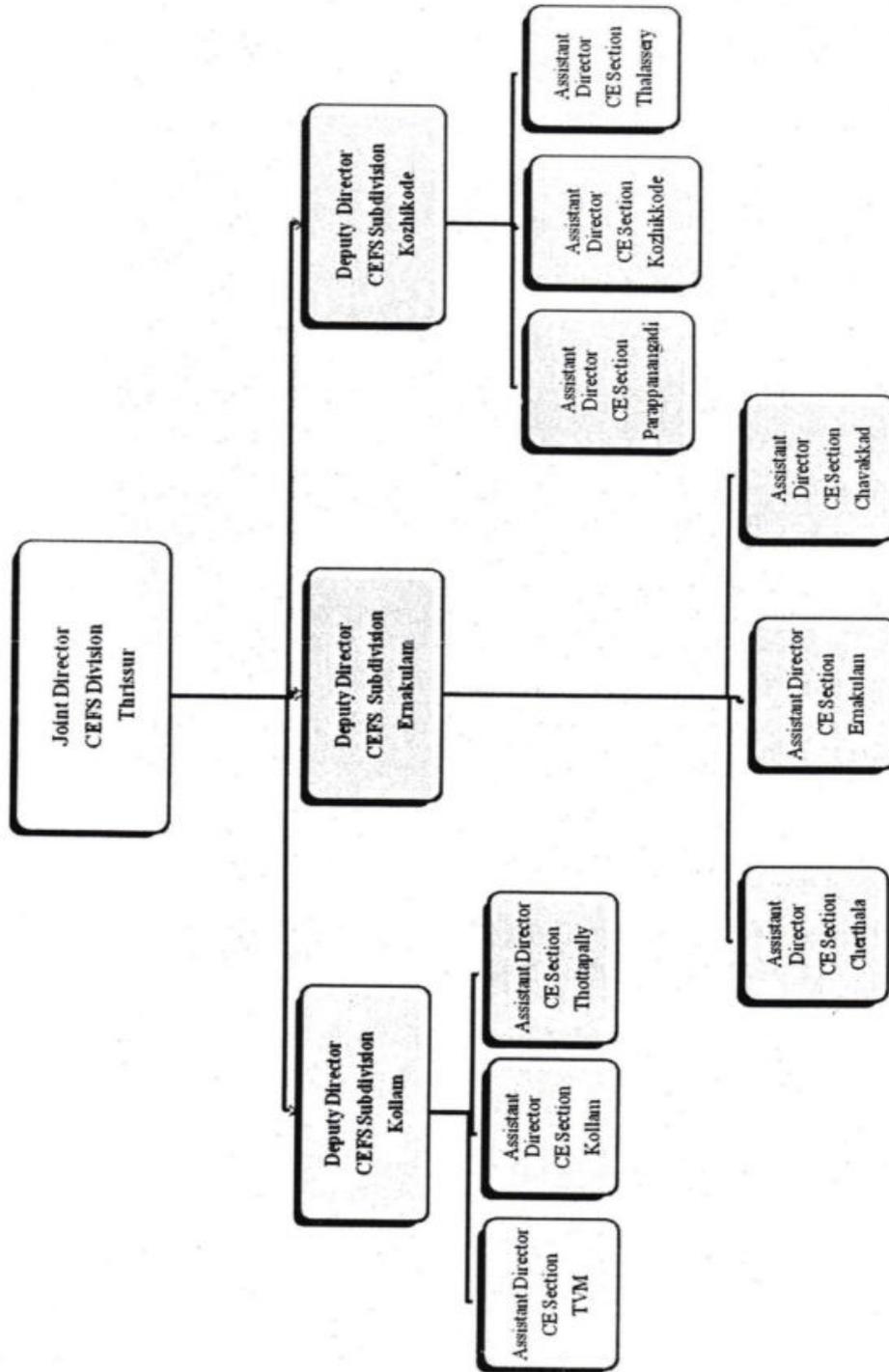
The total coastal area Kozhikode Sub Division is 260.1 Km.

## **II. GENERAL ARRANGEMENTS AND FIELD STUDIES**

For the detailed study of the characteristics and behavior of the beach, the 576 Km of the Kerala coast is divided into three regions viz. Southern region, Central region and Northern region. Each of these regions is under the control of Deputy Directors and further sub divided into the control of Assistant Directors. The three regions come under the Coastal Engineering Field Studies, headed by Joint Director who works under the guidance of Director, Fundamental and Applied Research, Kerala Engineering Research Institute, Peechi.

III. ORGANIZATION SETUP

**ORGANISATIONAL SET UP**  
Name of Sub Divisions and Sections Under Coastal Engineering Field Studies Division, Thrissur



#### IV. INCUMBENCY DETAILS

##### *COASTAL ENGG. FIELD STUDIES, THRISSUR.*

1. Joint Director : Sri. Ajmal. E (Relived on 21.10.2022)  
Sri. Abbas. M. T. (Full additional charge from 22.10.2022 to 24.10.2022)  
Smt. Beena N. (From 25.10.2022 onwards)
2. Assistant Director : Smt. Anusree A ( Full additional charge from upto 14.06.2022)  
Sri. Suneer. K M (From 15.06.2022 onwards)
3. Ist Gr.Draftsman : Smt. Bindu.K.C  
Smt. Beena.K.D  
Smt. Rajitha.K.K
- 4.Head Clerk : Smt. Amrita Sekhar ( From 20/09/2021 to 27.09.2022)  
Smt. Rinny M D (Full additional charge from 28.09.2022 to 30.09.2022)  
Sri. Ajithkumar P K (01.10.2022 onwards)
- 5 Clerk : Smt. Rinny.M.D  
: Smt. Mumthas A.A
7. Senior Grade Typist : Smt. Seema Jose
7. Driver : Sri. Denny. N.J
- 8..Office Attendant : Smt.Nigi T.K

##### *C.E.S. SUB DIVISION, KOZHIKODE*

1. Deputy Director : Sri. Abbas M T
2. Ist Gr.Draftsman : Smt. Usha K C (Upto 31.01.2023)

Smt. Nishida N P (From 01.02.2023 to 20.02.2023)

Smt. Syamala. K P (From 21.02.2023)

3. Senior Clerk : Smt. Hameeda. M. A ( up to 03.06.2022)  
: Smt. Preetha.T.K. (04.06.2022 onwards)
4. Senior Grade Typist : Smt. Prameela.K
5. Driver : Sri. Mohammed Iqbal.P
6. Office Attendant : Sri Logesh N.P.

*C.E.S.SECTION, KOZHIKODE*

1. Assistant Director : Smt. Bindu K I (up to 05.12.2022)  
Sri. Jithin.P (Full Additional Charge 06.12.2022 onwards)
2. Ist Gr.Overseer : Smt. Nishida N P
3. IInd Gr.Overseer : Smt. Rejula.K
4. Office Attendant : Smt. Seema Mol. K.C

*C.E.S. SECTION, THALASSERY*

1. Assistant Director : Sri. Ashraf P P (up to 31.05.2022)  
Sri. Ammad. P.C ( FAC from 01.06.2022 to 02.12.2022)  
Sri. Jithin.P, (03.12.2022 onwards)
2. IInd Gr.Overseer : Smt. Seena. P.P  
: Sri.Haneefa.K  
: Smt. Athira R K (11.01.2023 onwards)
3. Senior Clerk : Sri.Siju.N
4. Office Attendant : Smt.Remani.P

*C.E.S.SECTION, PARAPPANANGADI*

1. Assistant Director. : Sri. Ammad.P.C (up to 31.12.2022)  
Sri. Jithin P (FAC 01.01.2023 onwards)
2. IInd Gr.Overseer : Smt. Rehna Sulthana.K (up to 16.12.2022)  
: Smt. Shajna. P. V.  
Smt. Amanu Rahman (17.03.2023 onwards)
3. Office Attendant : Vipin.D (up to 20.10.2022)

*C.E SUB DIVISION, ERNAKULAM*

1. Deputy Director : Sri. Rajesh.T.K ( up to 26.10.2022)  
Sri. Clement Roy. K. R (FAC 27.10.2022 to 18.12.2022)  
Sri. Kamal Roy K V (19.12.2022 onwards)
2. Ist Gr. Draftsman : Smt. Letha.K.V
- 3 .Senior Clerk : Smt. Nisha.K.N
- 4 .Clerk : Smt. Suja.K.S
5. Typist : Smt. Latha K M
6. Driver : Sri.Anoop. P. G
7. Office Attendant : Smt. Alphonsa. K. X
8. Part Time Sweeper : Smt. Rugmini.N.T

*C.E. SECTION, ERNAKULAM*

1. Assistant Director : Smt. Anusree.A (up to 19.11.2022 FN)  
Sri. Deepu S (19.11.2022 onwards)
2. Ist Gr.Draftsman : Sri. Manoj Antony K
3. 2<sup>nd</sup> Gr.Draftsman : Sri. Manoj Antony K (Full Additional Charge)
- 4 . Office Attendant : Sri.Saji.T.T

*C.E.SECTION, CHERTHALA*

1. Assistant Director : Sri. Clement Roy.K.R
2. II<sup>nd</sup> Gr.Overseer : Smt. Preethimol C M  
Smt. Anjana.Prakash
3. Senior Clerk : Sri. Ajayakumar.P
4. Office Attendant : Smt. Sali.P.V (01/03/2021 to 13.03.2023)  
Sri. Sunil Kumar C G. ( 14.03.2023 onwards)

*C.E SECTION, CHAVAKKAD*

1. Assistant Director : Smt. Ajantha.V.D
2. 2<sup>nd</sup> Gr.Draftsman. : Sri. Babunath.S ( upto 19.11.2022 FN)  
Sri. Manoj Antony K (FAC 19.11.2022 onwards)  
Smt. Latha K V (FAC)
3. SENIOR CLERK : Smt. Rose Johny (upto 31.12.2022)  
Smt. Suja K S (FAC 01.01.2023 to 10.01.2023)  
Sri. Justine Paul P (11.01.2023 onwards)
4. Office Attendant : Sri. Shaji.M.K

*COASTAL ENGINEERING SUB DIVISION, KOLLAM*

- 1 .Deputy Director : Smt. Rajeeana.M (Additional in charge up to  
12.06.2022)  
Smt.Raji. C. T (From 13.06.2022 to 15.12.2022)  
Sri. Sugesh Krishna C P (16.12.2022 onwards)
- 2 .First Grade Draftsman : Sri.SibiVarghese

- 3 Senior Clerk : Sri. Anil Raj K (up to 08.02.2023)  
Smt. Priya M. D. (FAC 09.02.2023 onwards)
- 4 Clerk : Smt. Priya.M. D.
5. Typist : Nimmi. Y. P.
- 6 .Driver : Sri. Ajipushpangathan
- 7 .Office Attendant : Sri.Vickraman.P

*COASTAL ENGINEERING SECTION ,THIRUVANANTHAPURAM*

1. Assistant Director : Sri.Ajin Singh S (up to 20.02.2023 FN)  
Smt. Anusree A (20.02.2023 onwards)
2. Second Grade Draftsmen : Sri.Godlin.J.J (up to 21.03.2023)  
Sri. Salin Kumar R S (FAC 22.03.2023 onwards)  
Sri.Salin Kumar R.S
3. L. D. Clerk : Sri.Salin. S.S

*COASTAL ENGINEERING SECTION, KOLLAM*

1. Assistant Director : Smt. Rajeena M (up to 21.11.2022 FN)  
Smt. Shiji. P. R. (21.11.2022 onwards)
2. First Grade Draftsman : Smt. Smitha.R
3. Second Grade Draftsman : Smt. Anithakumari . S
4. Office Attendant : Smt. Shamina. S

*COASTAL ENGINEERING SECTION, THOTTAPPALLY*

1. Assistant Director : Sri.Jayaprakash. D. (up to 06.05.2022)  
Sri. Ajin Singh S. (FAC 07.05.2022 to 04.01.2023)  
Smt. Fathima R (05.01.2023 onwards)

2. Second Grade Overseer : Sri. Raju.T ( Retired on 31.05.2022)  
: Sri. Jaimon. T. J. (up to 30.11.2022)  
: Smt. Laly. T. R. (22.12.2022 onwards)  
: Smt. Geethamma R. (23.12.2022 A N onwards)
3. Clerk : Smt.S. Rejani
4. Office Attendant : Sri. Reji. G

## **V. PROGRAMME OF STUDY**

In coastal environment, waves, tides, currents and winds are the important parameters which need to be considered for any development. It is very much essential to understand the physics of these processes. Coastal erosion is the wearing away of land by the action of waves, current and wind. Coastal erosion is accompanied with landward recession of the sea shore and loss of land area. It is a common problem faced in almost all coastal areas. Only the magnitude and nature of erosion changes from place to place. Along the most part of Kerala coast, the erosion observed is seasonal in nature, that is, beach gets eroded during monsoon and regains its original profile during fair weather season. However, at some places erosion is of permanent nature.

### **1. Simultaneous Wave Observations**

Simultaneous wave observations are being conducted at 18 specified location along Kerala Coast on all new moon days to understand characteristics of wind, wave and tide details such as width of back shore, fore shore, slope of fore shore, composition of each materials, characteristics of littoral drifts, shore history and they are recorded on standardized format.

#### **1.1 Study of littoral drift**

Littoral transport is the movement of sediments in the near shore zone by waves and currents. This transport of suspend and bed load particles are both in parallel to the sea shore and perpendicular to sea shore. This transport of suspended materials is called littoral drift. It has been ascertained from the past studies that the dominant direction of littoral drift in Kerala coast is from north to south. However the directions, an annual quantity of net and gross quantity are important in developing shore protection arrangements. Now only the direction of drift is being studied at selected at points along the shore.

## **1.2 Study of Wind and Waves**

Winds are the natural generators of wave and their study is necessary. An understanding of the nature of the tidal phenomenon is necessary for the study of coastal behaviors. The top level of the coastal protection structures depend on the tidal level and their data must be collected.

Wave causes sand to move along the coast as well as on to or off a beach. Due to refraction, wave energy is concentrated in certain reaches of the coast where erosion became naturally severe. Hence the design of coastal protection structures primarily depend on wave characteristics and since these studies are essential.(Predominant direction of waves is from west or north west)

## **2. Study of Mud banks**

Mud banks, a phenomenon peculiar to the coast of Kerala are those in shore region where wave energy is dissipated completely as a result of the colloidal mud suspension mud bank protect the coast immediately near it, but causes erosion in the down-drift side due to diffraction of waves.

Many rivers in Kerala exhibit a continuous migrating tendency. Such migration influences the beach characteristics in the adjacent areas considerably.

## **3. Periodical measurement of shore line changes:**

Periodical surveys are taken to determine the shore line changes of the coast. The offset measurement of the shore line with respect to Control point and Alignment stones are taken every month and recorded. It provides very important data to understand the shore line fluctuation of the coast.

## **4. Collection and Study of beach samples**

Pre-monsoon (May) and post-monsoon (November), beach samples are collected from specified places for testing grain size distribution and specific gravity since the erosion and accretion of coast depends up on the nature of beach material to a certain extent. Also for natural nourishment materials can be supplemented to the beach and thereby the erosion can be reduced. Beach samples are important variables determining the beach characteristics. Study of beach materials, characteristics and sources is essential for the evolution of a long term shore protection plan.

## 5. Report on Coastal damages and Taking photographs

The details of damages at various places in the coastal beaches have been collected from time to time and photographs are taken to understand the details of erosion, coastal damages occurred during monsoon and drastic changes in the shore line.

## 6. Taking cross section profile of the beach

Cross section profiles taken using leveling instrument and leveling staff (Taken up to wading depth of waters)

## 7. Alignment fixation of sea walls:

The Joint Director inspected the sites for fixing alignment of sea wall (construction and reformation) with the concerned Irrigation officials, Deputy Director and Asst. Director of the Coastal Sub Division & Sections concerned, and approved the alignments of sea walls along Kerala Coast, considering the last 5 year shore line measurements and the alignment of the sea.

Alignment approval has been given to the following works by the Joint Director, Coastal Engineering Field studies, Thrissur during the year 2022-23

Sl.No	Name of sub Division	Alignment approved during 2020	Essentiality certificate issued during 2020
1	. CE SubDivision, Kozhikode	2	2
2	, Ernakulam CE SubDivision	Nil	Nil
3	Kollam CE SubDivision	Nil	Nil

## 8. Pilot Project- Sustainable coastal protection using mangroves at Thiruvathra Beach, Chavakkad Municipality

This pilot project is arranged together with KERI and KFRI to protect the beach by developing a vegetal cover using Mangroves and locally available trees. MoU has been signed between the Directors of KERI and KFRI on 27/01/2023. This experimental project costs Rs.4,00,000/-

**VI. PERFORMANCE OF THE DIVISION IN THE YEAR 2022-23**

Within the limitations of availability of field staff and modern instrument, this division has taken up all the possible studies in the year 2022-23. The performance can be summarized as follows.

**Types of works**

1. Topographic survey conducted for

Determining beach profiles	:	Nil
2. Periodical measurement of shoreline changes	:	4083.818 Km
3. Simultaneous observations	:	207 Set
4. Soil sample collected	;	42Set.
5. Cross section profiles	:	Nil
6. Levels connected	:	Nil
7. C.P Stones planted	:	Nil
8. Alignment stones planted	:	Nil
9. Kilometre stones planted	:	Nil
10. Bench mark stones planted	:	Nil
11. Alignment fixed by Joint Director	:	2No
12. Details of damages at various places in the		
Coastal beaches collected	:	78 Nos
13. Mud bank study	:	Nil
14. Pilot Project	:	1 No

**Sub Division-wise Coastal studies performance are as follows ;**

**1. Topographic survey conducted**

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil
Kozhikode Sub Division	:	Nil

**2. Periodical measurement of shoreline changes**

Kollam sub Division	:	1716km
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Ernakulam Sub Division	:	922.818km
Kozhikode Sub Division	:	1445km

**3. Simultaneous observations**

Kollam sub Division	:	79 Set.
Ernakulam Sub Division	:	63 Set
Kozhikode Sub Division	:	65 Nos

**4. Taking photograph**

Kollam Sub Division	:	37Nos
Ernakulam Sub Division	:	31Nos
Kozhikode Sub Division	:	10 Nos.

**5. Soil sample collected**

Kollam sub Division	:	14 Set
Ernakulam Sub Division	:	12 Set
Kozhikode Sub Division	:	16 Set

**6. Cross section profiles**

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil
Kozhikode Sub Division	:	Nil

**7. Levels connected**

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil
Kozhikode Sub Division	:	Nil

**8. C.P Stones planted**

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil
Kozhikode Sub Division	:	Nil

**9. Alignment stones planted**

Kollam sub Division	:	Nil
Ernakulam Sub Division	:	Nil

Kozhikode Sub Division : Nil

**10.Kilometer stones planted**

Kollam sub Division : Nil

Ernakulam Sub Division : Nil

Kozhikode Sub Division : Nil

**11.Bench mark stones planted**

Kollam sub Division : Nil

Ernakulam Sub Division : Nil

Kozhikode Sub Division : Nil

**12.Guard stones planted**

Kollam sub Division : Nil

Ernakulam Sub Division : Nil

Kozhikode Sub Division : Nil

**13. Details of damages** at various places in the

Coastal beaches collected

Kollam sub Division : 37 Nos.

Ernakulam Sub Division : 31 Nos.

Kozhikode Sub Division : 10 Nos.

**14.Study of Mudbank**

Kollam sub Division : Nil

Ernakulam Sub Division : Nil

Kozhikode Sub Division : Nil

**15. Pilot Project**

Kollam sub Division : Nil

Ernakulam Sub Division : Sustainable coastal protection  
using mangroves at

Thiruvathra

Beach of Chavakkad

Municipality

Kozhikode Sub Division

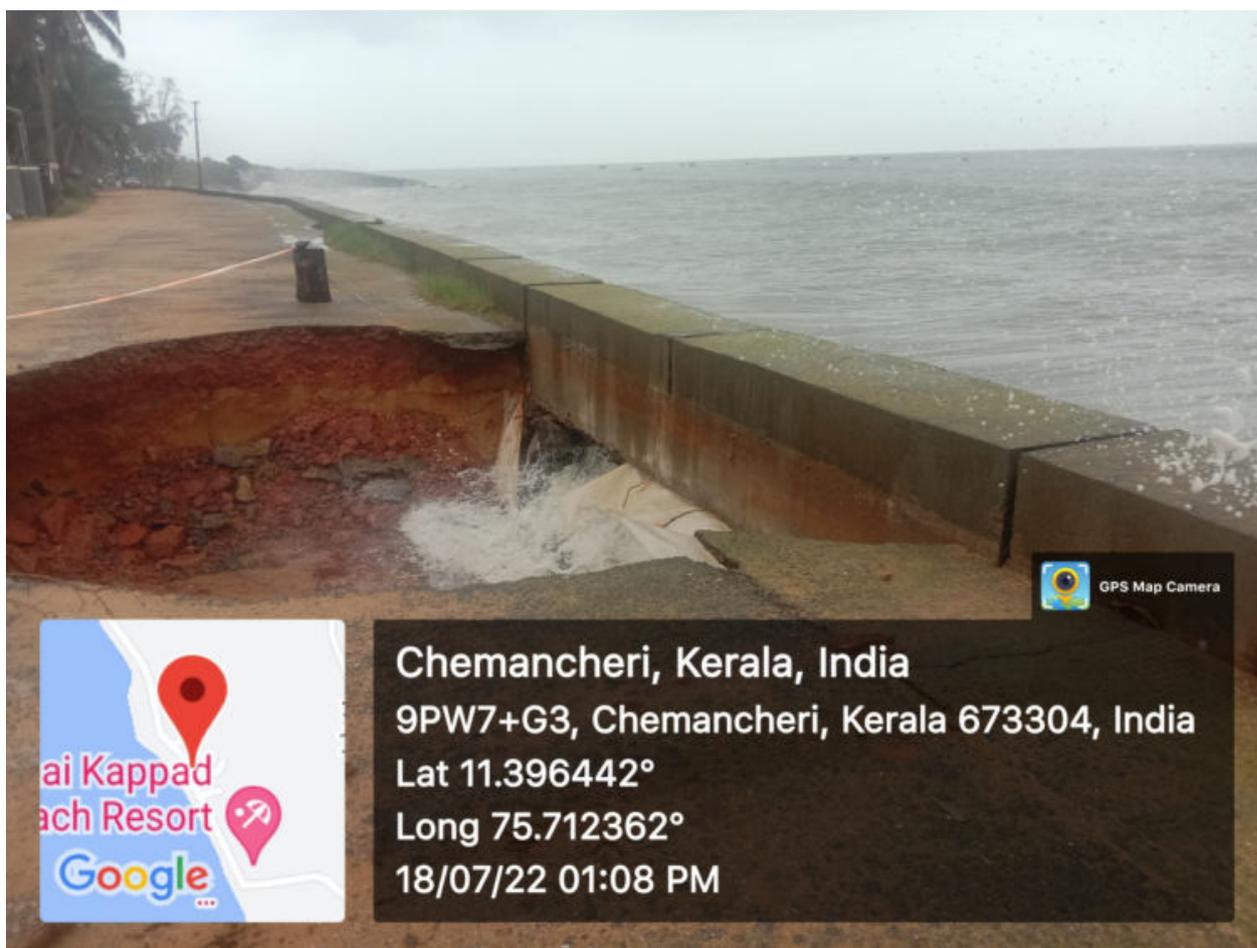
:

Nil

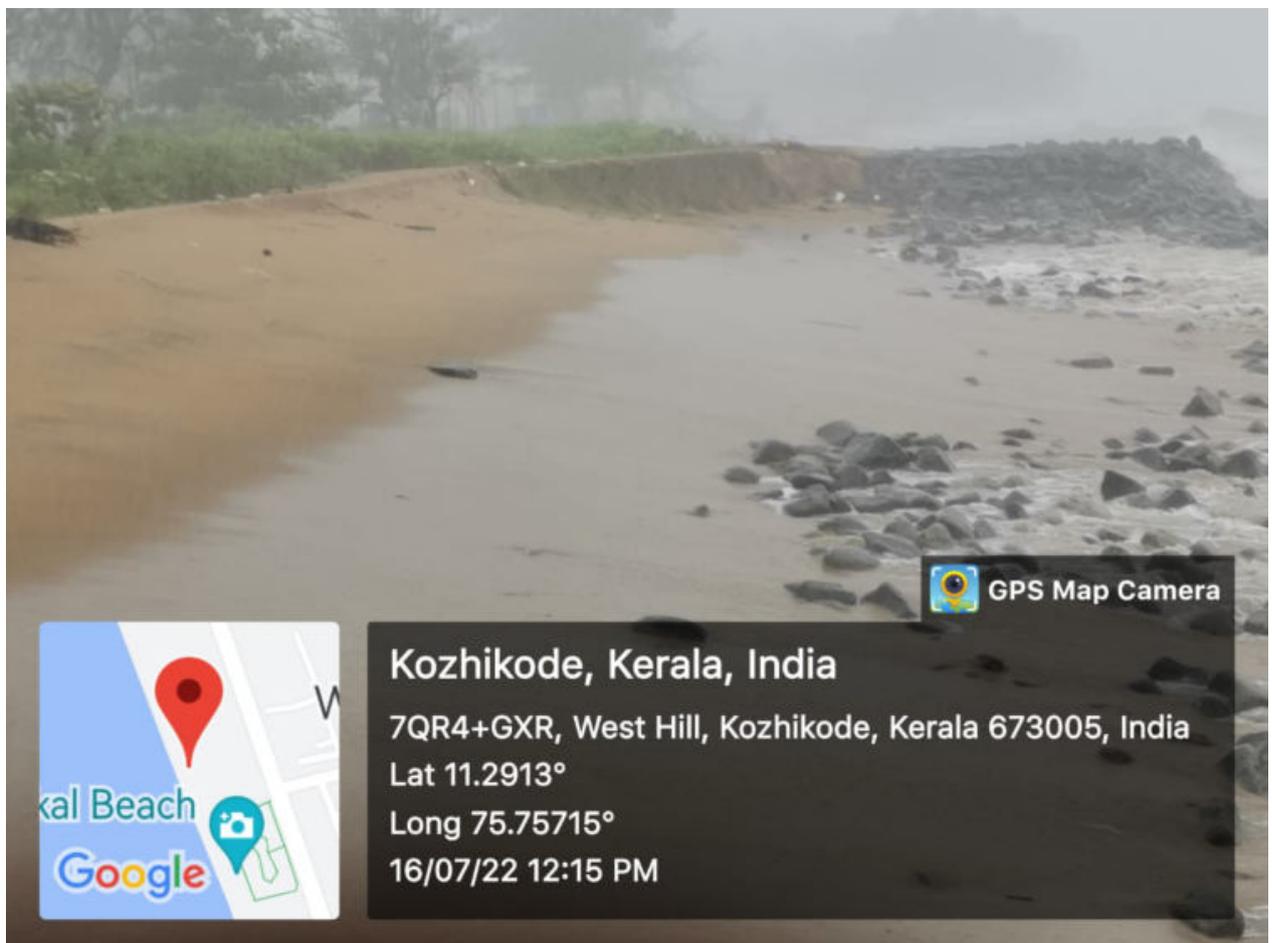
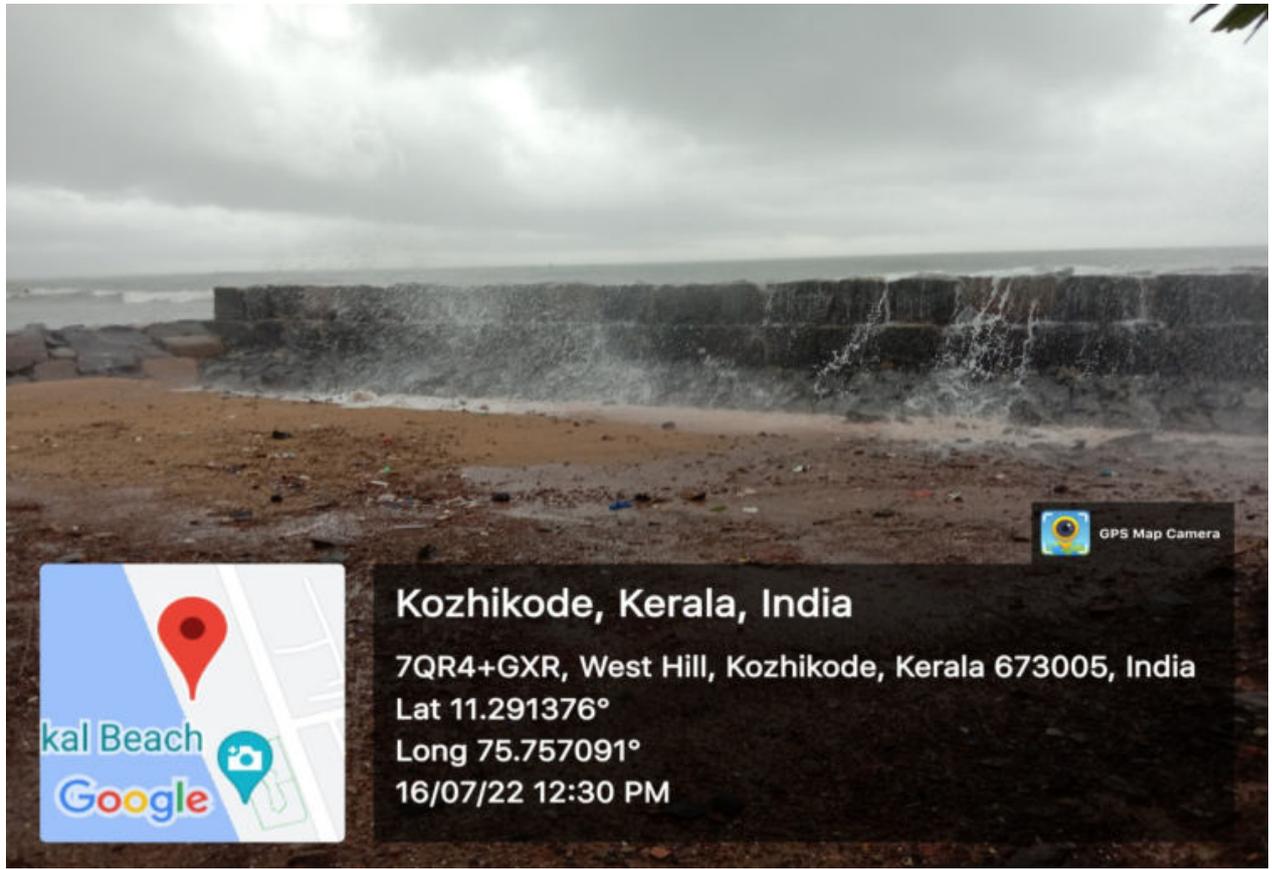
The coastal data of Periodical measurements which backs to 1990 has been digitized and the digitization of available data of sled survey.

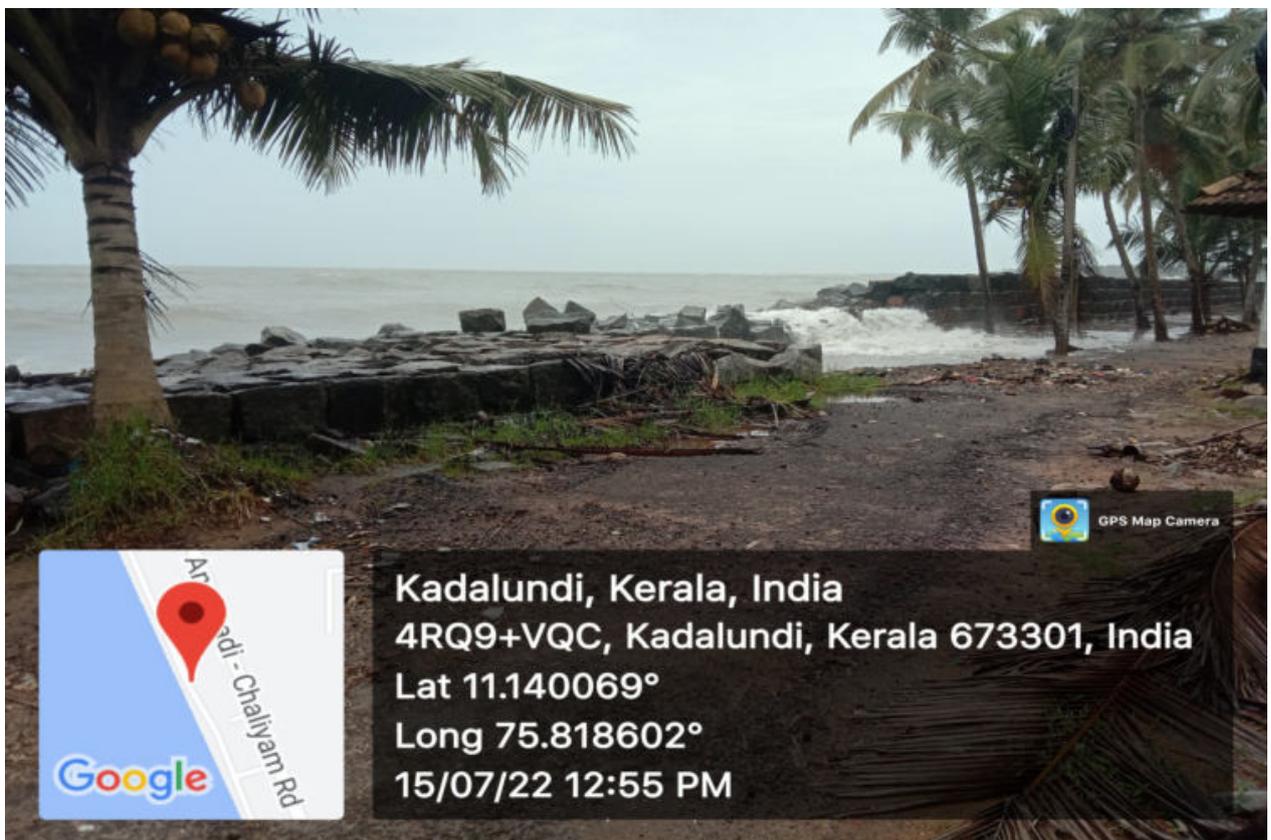
## VII PHOTOS OF COASTAL DAMAGES

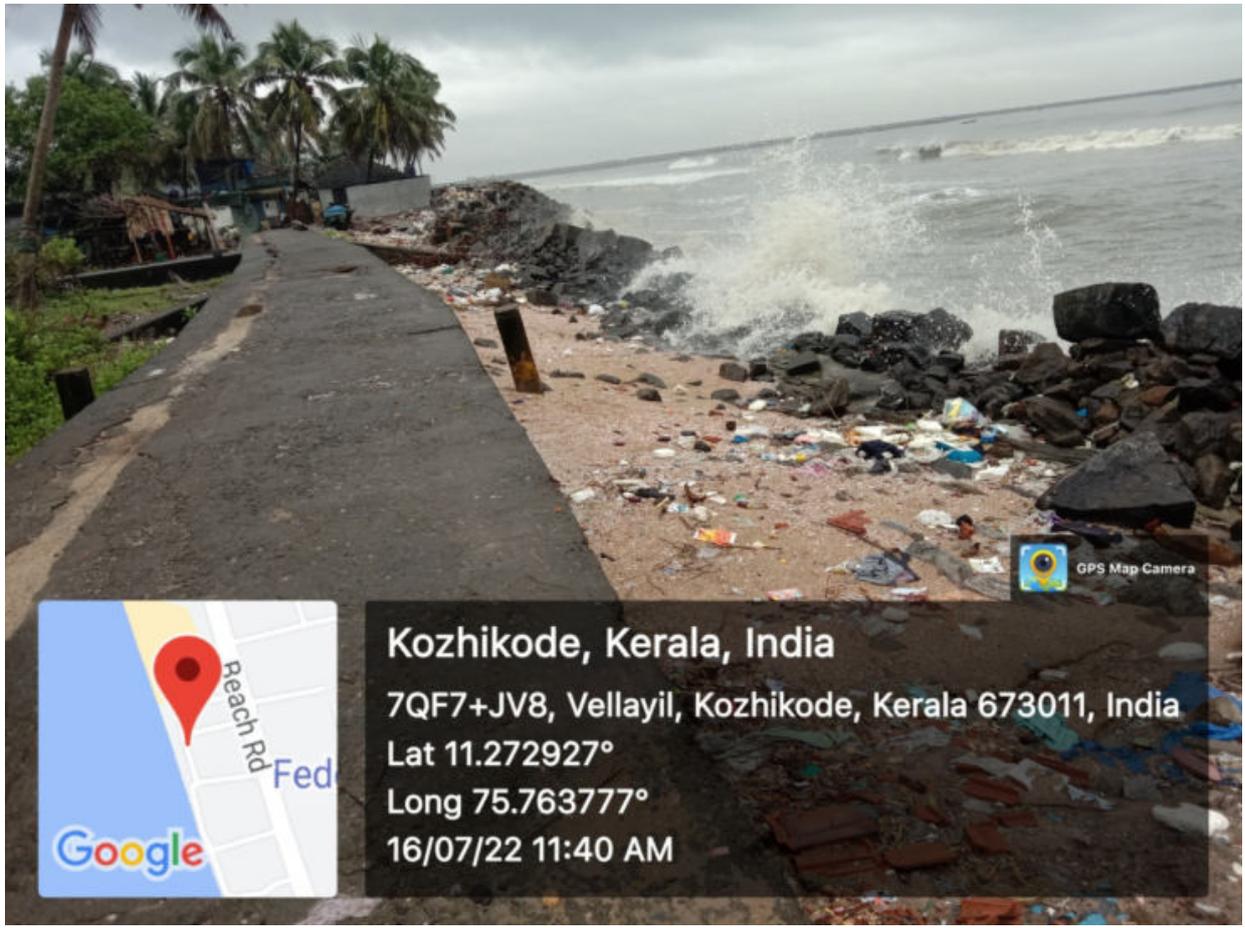
### Damages under Kozhikode sub division

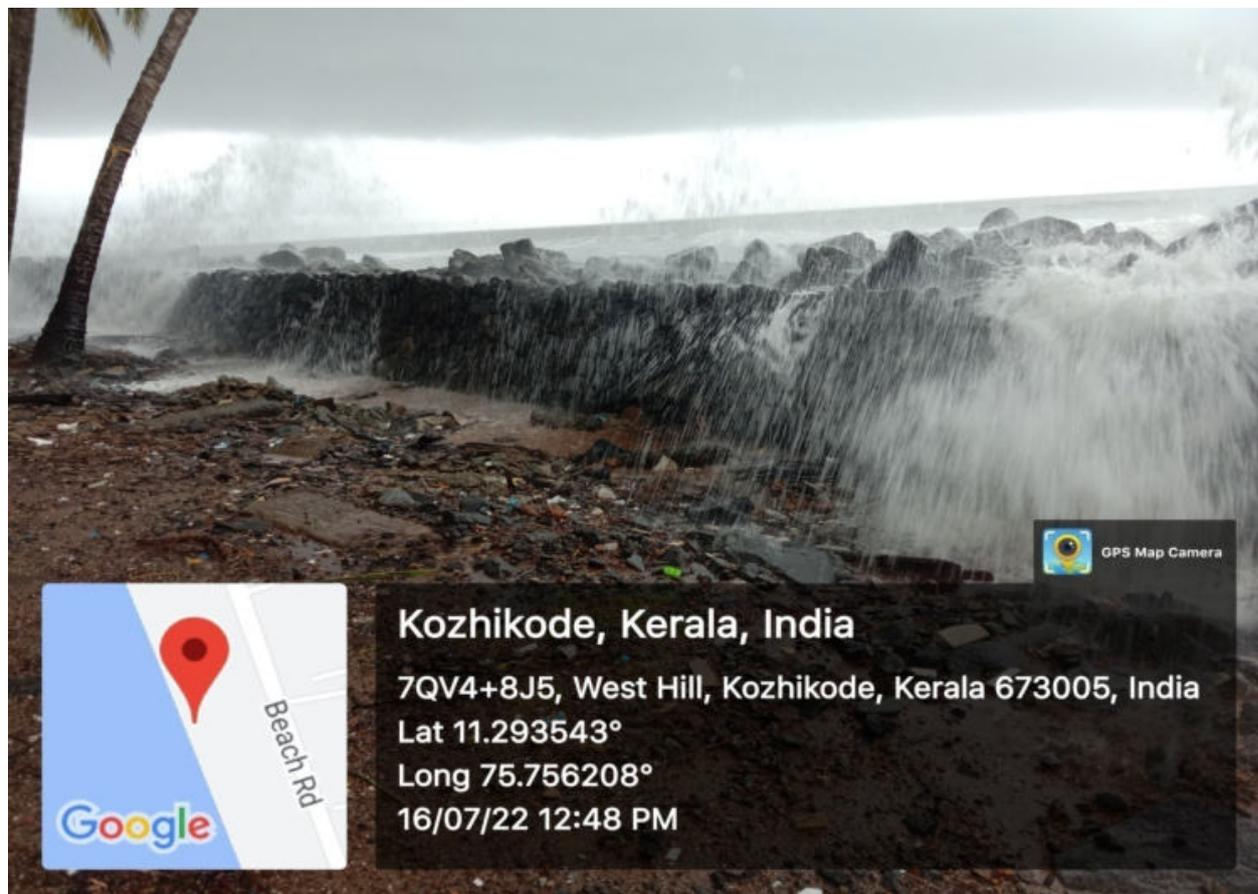












#### Damages under Ernakulam Sub Division

Coastal Damages occurred within the jurisdiction, were closely monitored and were reported every week during the monsoon. Details of coastal damages are reported once every month during off-monsoon months. During this year moderate coastal damages and heavy coastal erosion were reported from Thanky(Ottamassery) (921-929). Near Thanky in Ottamassery between CP 922 & 923, one building fully collapsed and near CP 929, one bathroom slipped and fell down and more than seven houses partially damaged. More than 13 coconut trees overturned and fell down. Due to heavy wave attack, the beach eroded for a width of about more than 9m from CP 921 to 922 and CP 928 to 929 .In Kattoor, coastal damages considerably reduced during the last year. Between CP 839 & 855 severe coastal erosion and beach loss occurred. As groynes with tetrapods have been constructed from CP 839 to 853, beach erosion has been reduced and beach formation noticed. In Chennaveli, no considerable damages were noticed during the last year. However moderate to severe coastal erosion and beach loss occurred.



Arasupuram-Arrattuvazhi Rd, Vettakkal,  
Kerala 688529, India  
Latitude 9.714117° Longitude 76.294794°  
LOCAL 10:44:55 THURSDAY 06.10.2021  
GMT 05:14:55 ALTITUDE -75 METER



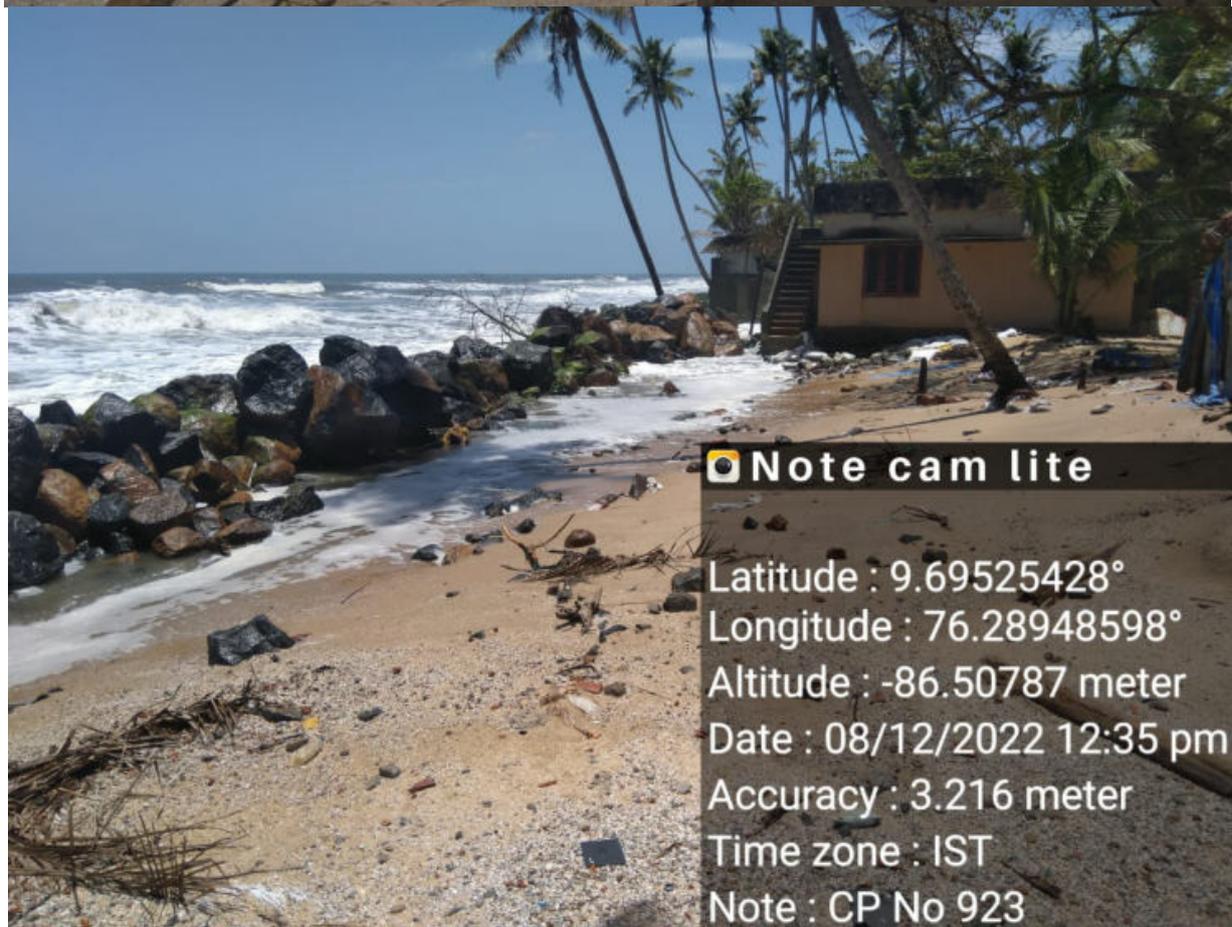
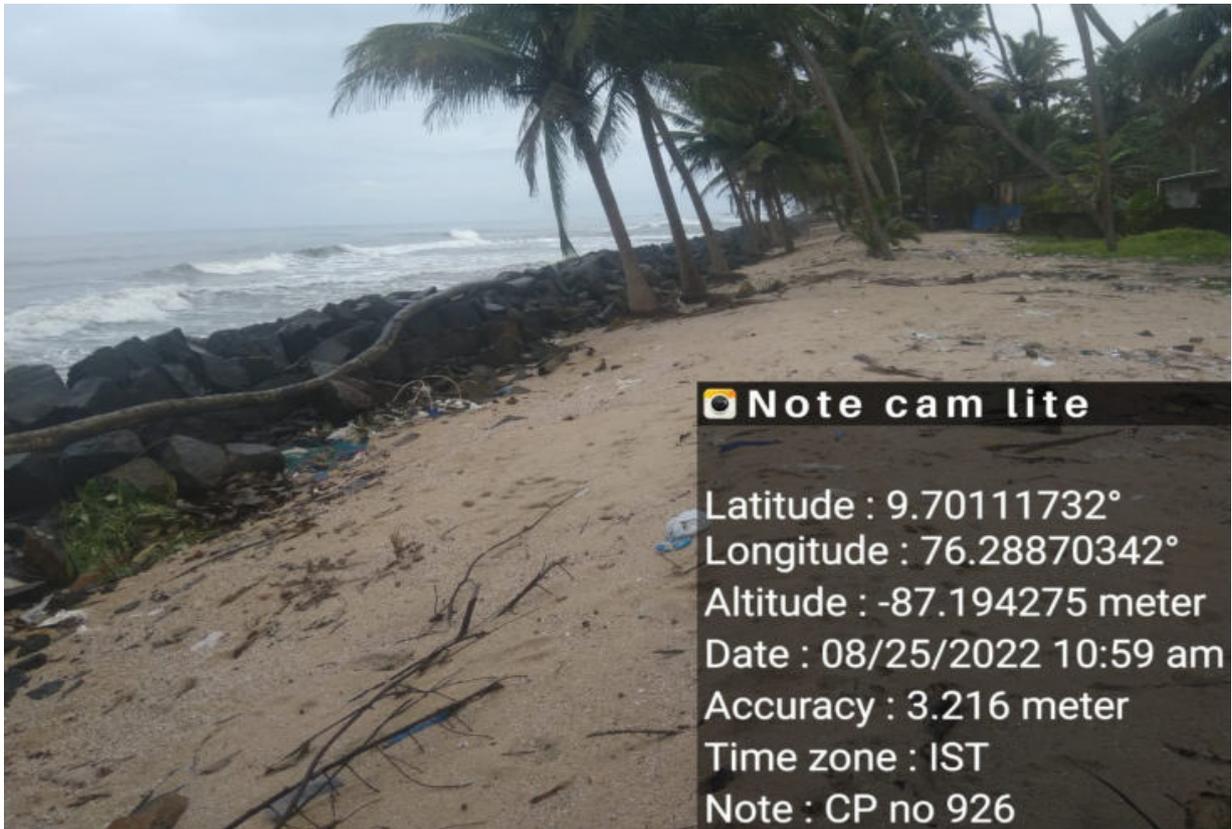
SH66, Kadakkarappally, Kerala  
688529, India  
Latitude 9.693476° Longitude 76.289766°  
LOCAL 11:49:32 THURSDAY 06.10.2021  
GMT 06:19:32 ALTITUDE -73 METER



Note cam lite  
Address : Omanapuzha,Alappuzha,Kerala,India  
Latitude : 9.5538303°  
Longitude : 76.30620862°  
Altitude : -77.678894 meter  
Date : 07/21/2022 01:56 pm  
Accuracy : 3.7900925 meter  
Time zone : IST  
Note : CP 844



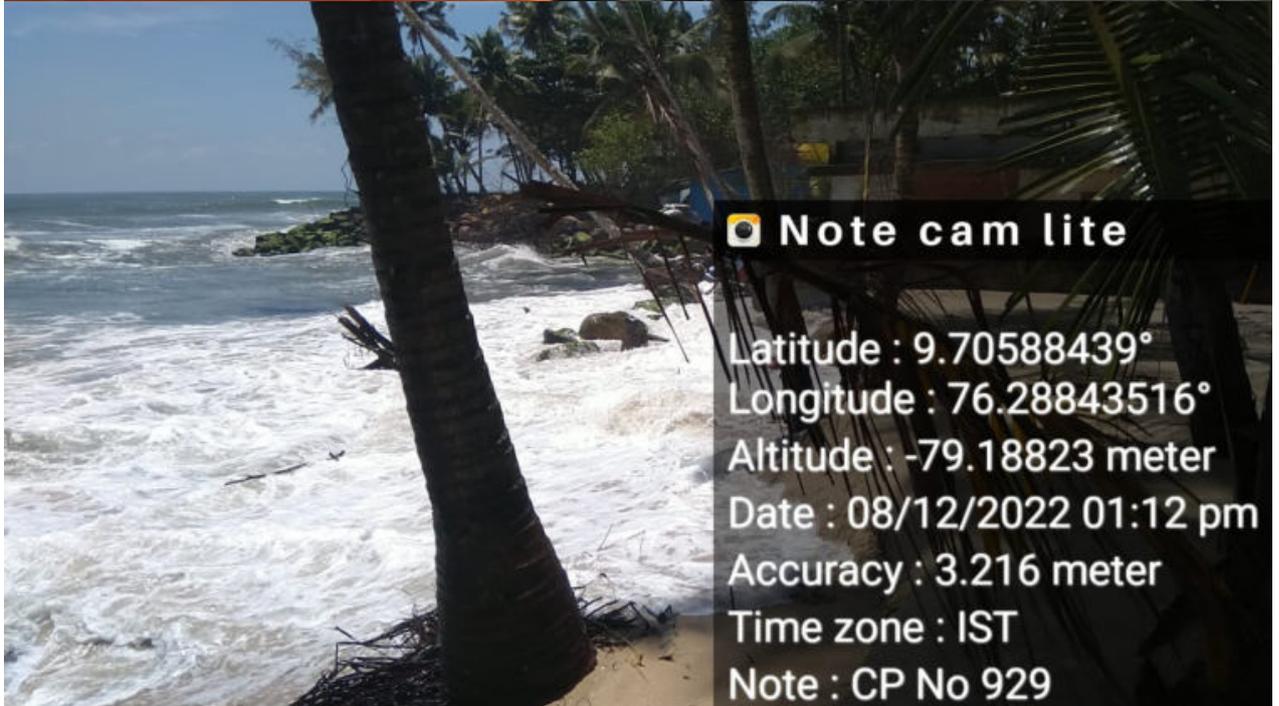
Note cam lite  
Latitude : 9.69688771°  
Longitude : 76.28923216°  
Altitude : -89.25812 meter  
Date : 08/25/2022 11:22 am  
Accuracy : 3.216 meter  
Time zone : IST  
Note : CP no 924





 **Note cam lite**

Latitude : 9.70642041°  
Longitude : 76.28815144°  
Altitude : -85.411285 meter  
Date : 08/12/2022 01:24 pm  
Accuracy : 3.216 meter  
Time zone : IST  
Note : CP No 929



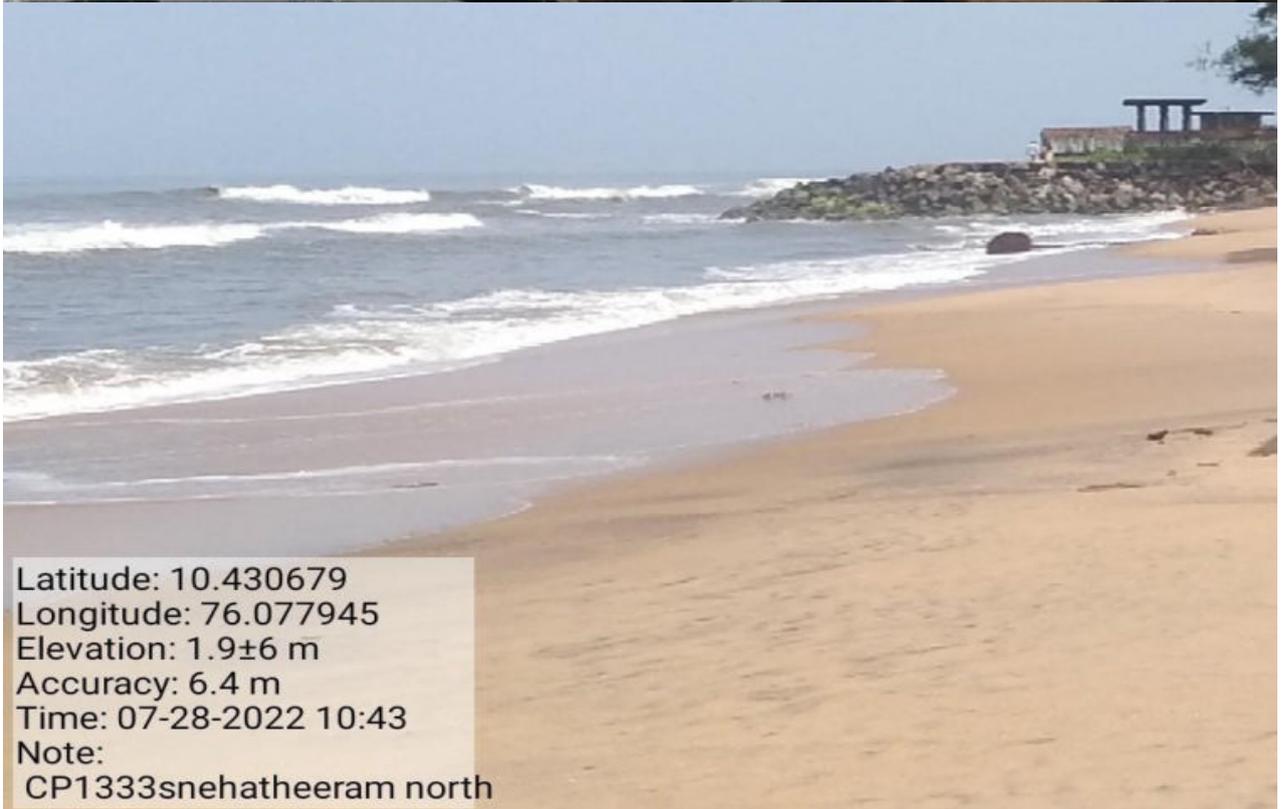
 **Note cam lite**

Latitude : 9.70588439°  
Longitude : 76.28843516°  
Altitude : -79.18823 meter  
Date : 08/12/2022 01:12 pm  
Accuracy : 3.216 meter  
Time zone : IST  
Note : CP No 929























Latitude: 10.476263  
Longitude: 76.056215  
Elevation: 1.68±20 m  
Accuracy: 8.4 m  
Time: 07-18-2022 14:47  
Note: CP 1361 Vadanappilly

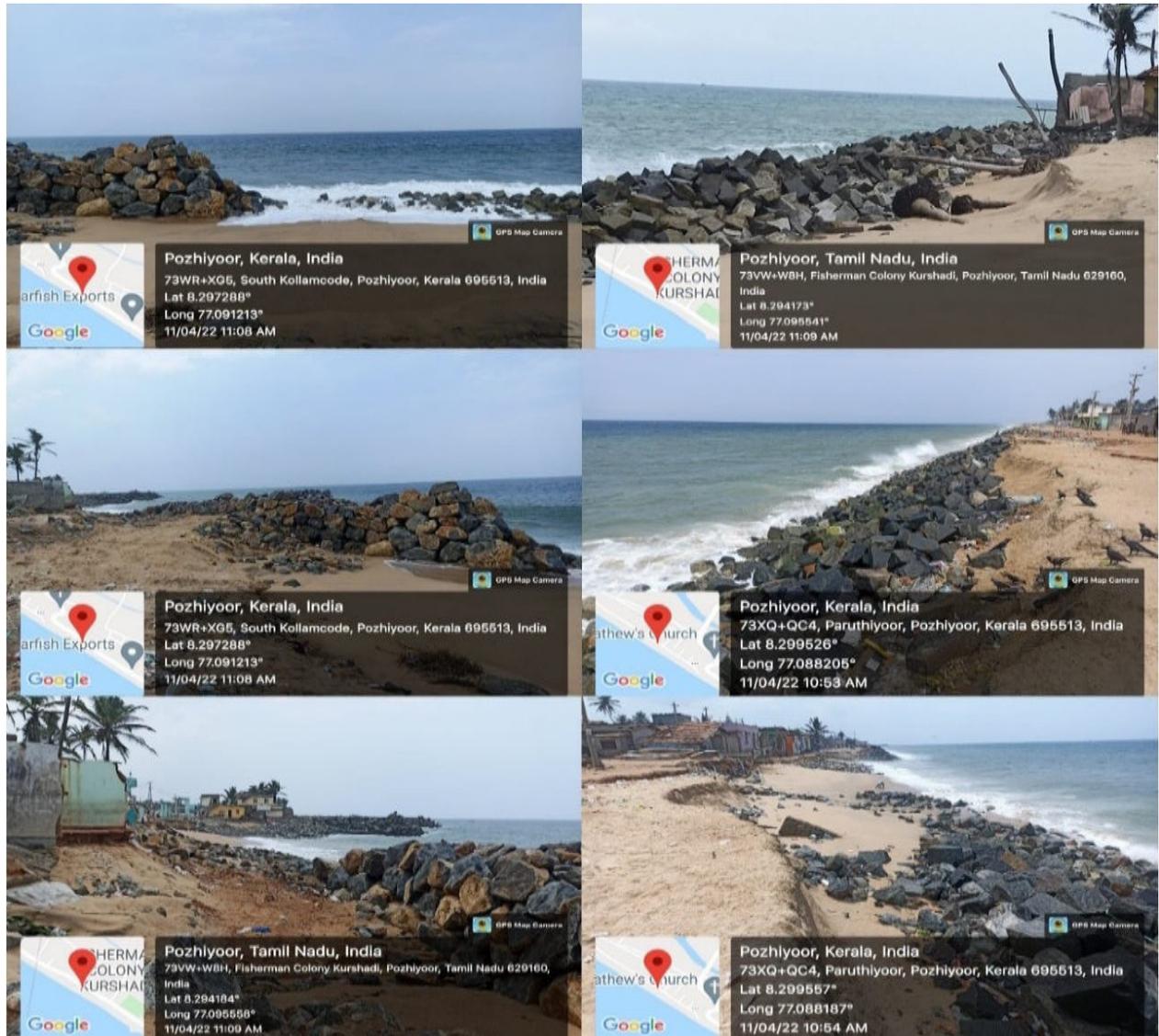
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Latitude: 10.210313  
Longitude: 76.153635  
Elevation: 8.58±7 m  
Accuracy: 9.6 m  
Time: 08-12-2022 14:55  
Note: Cp 1207

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Damages under Kollam Sub Division



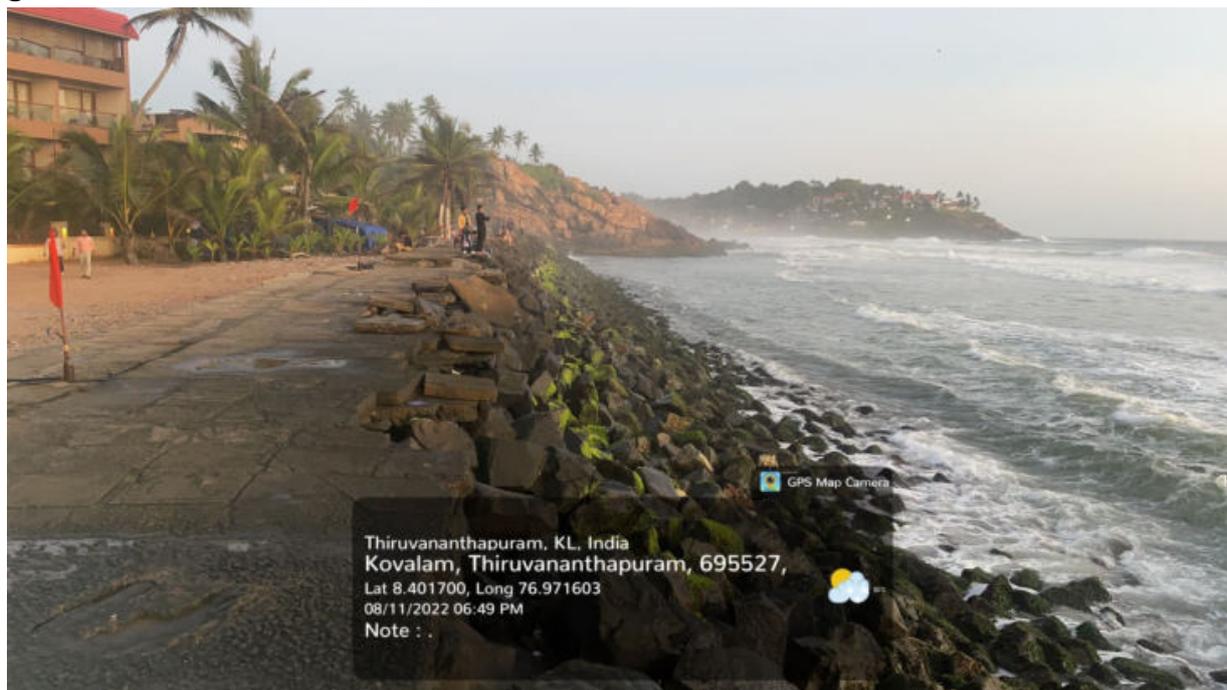
Damages at Kollamcode CP 0000-CP0008



#### Damages at Kollamkode

Kollamkode at CP NO.0000 is the starting point. The area between CP NO.0000 to CP NO. 0008 was protected by sea wall . The above area is thickly populated and is situated very near to the sea wall. Many numbers of Groynes are now under construction of Tamilnadu Government from last week of November 2019 near the South of CP.0000 at Kollamkode. The construction of Groynes are seriously affected the north side of this Groynes, that is CP.0000 to 0008. Contionous sea attack is occurred in this region due to the after effect of this Groynes construction. Many damages takes place such as about 5 nos of Houses are damaged and one net winding centre is fully damaged and collapsed during the previous year. Moreover, the existing sea wall between CP 0000 to CP 0008 is fully damaged , sinked and collapsed condition. Due to the continuous sea attack without season, this coastal region is now changed as one of the vulnerable reach. The Poovar pozhi is situated in between CP No.0010 and 0011. The Adimalathura pozhi is situated near to CP No.0044. CP No.0011 to 0044 is having good beach maintained in all the seasons. New Vizhinjam harbor & Kovalam tourist place belong to this reach. CP No. 0057 to 0070(Panathura) is protected by sea wall. The sea wall at CP 0057 to 0060(Samudra

beach) has been dilapidated and spreaded due to severe sea attack and overtopping and the remaining portion of sea wall maintained in good condition .Two numbers of groins situated between CP 0069 &0070



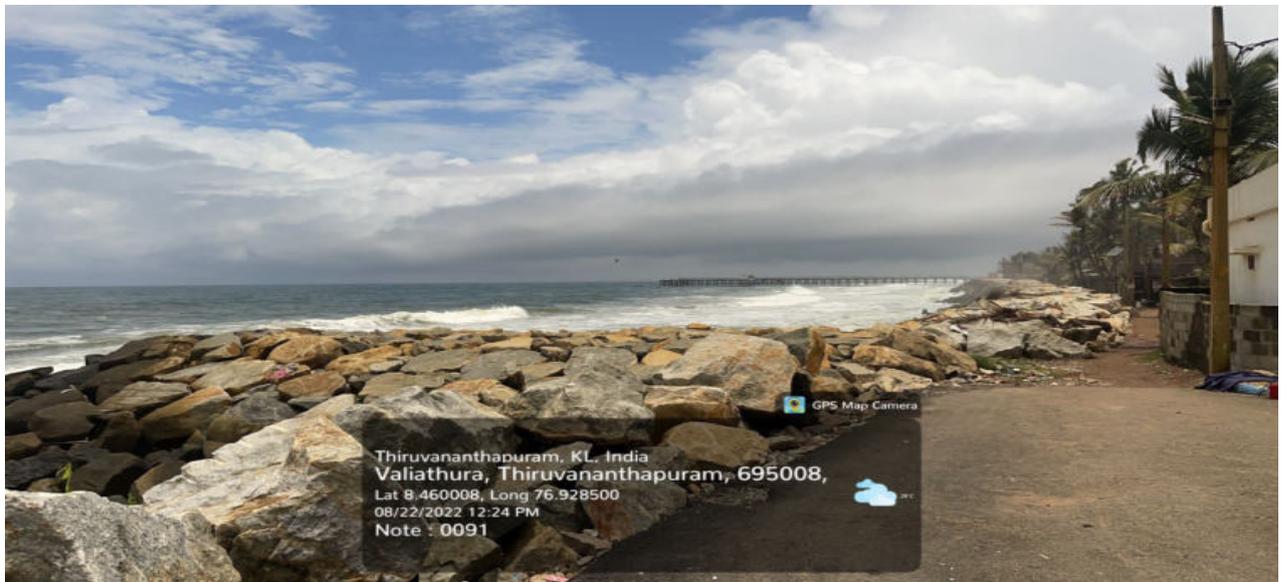
Sea attack at Kovalam

Reach 2- Panathura to Thumba (CP No.0070 to 0137)

This reach includes the vulnerable areas such as Poonthura, Beemapally, Valiathura and Sankhumugham. At Poonthura, (CP No.0080 to 0085), Beemapally(0085 to 0092),Valiathura (0092 to 0101) and Sankhumugham(0101 to 0107) ,the entire sea wall is in dilapidated condition due to severe sea wave attack. The above area is thickly populated and in monsoon seasons, the sea waves attack to nearby houses and cause damages especially in Valiyathura area. Valiyathura bridge is situated in between CP No.0094 and 0095 at Valiyathura. 15 nos of groynes has constructed at Beemapally area(Between CP 0085 and 0092). The famous Sangumugam beach was fully washed due to the sea attack during the previous years, including the approach road and the beach footpath. During this year the road has re-constructed and now the traffic maintained properly. The Diaphragm wall construction has completed between CP 0103 and 0107 for the protection of road from the sea attack. The CP No.0112 ,0114 & 0116 are simultaneous o The CP No.0128 to 0135 is protected by sea wall bservation points of this office. The Veli pozhi is situated in between CP No.0127 and 0128. The CP No.0128 to 0135 is protected by Seawall.



Damaged sea wall at poonthur



Damaged Sea wall at Valiathura

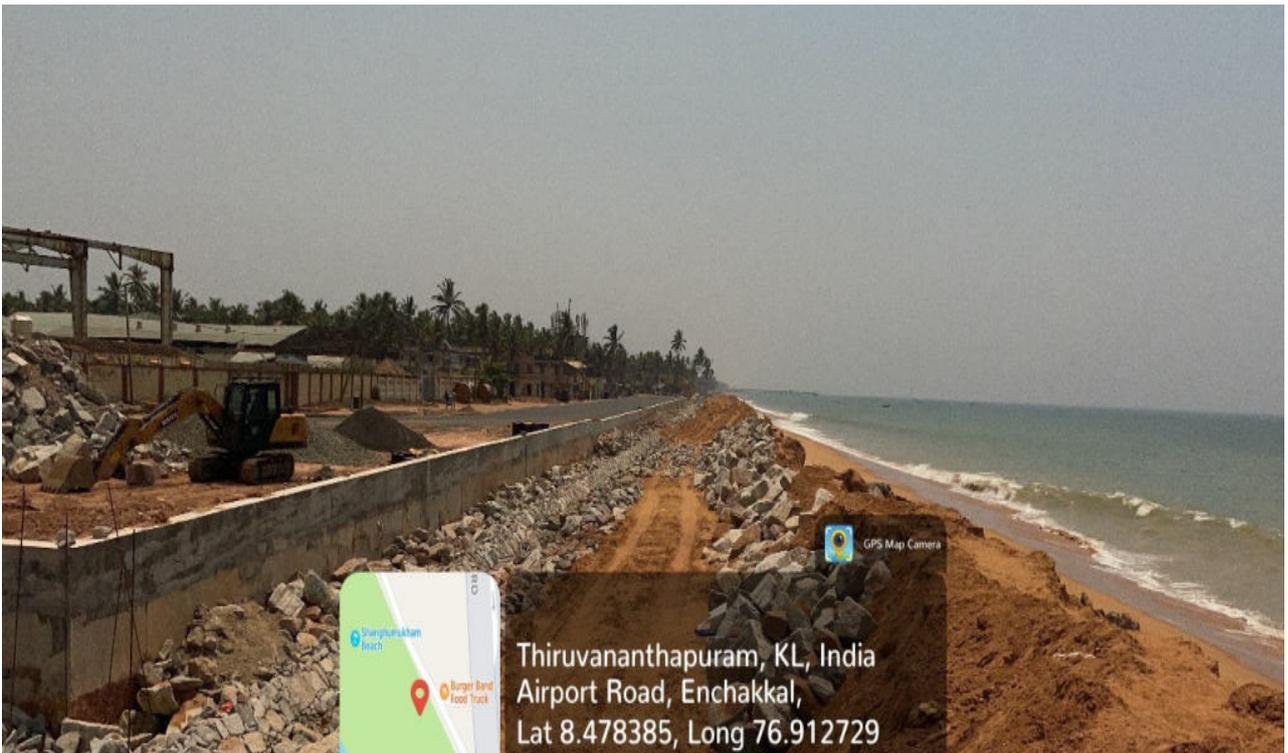


Sankhumugam Beach

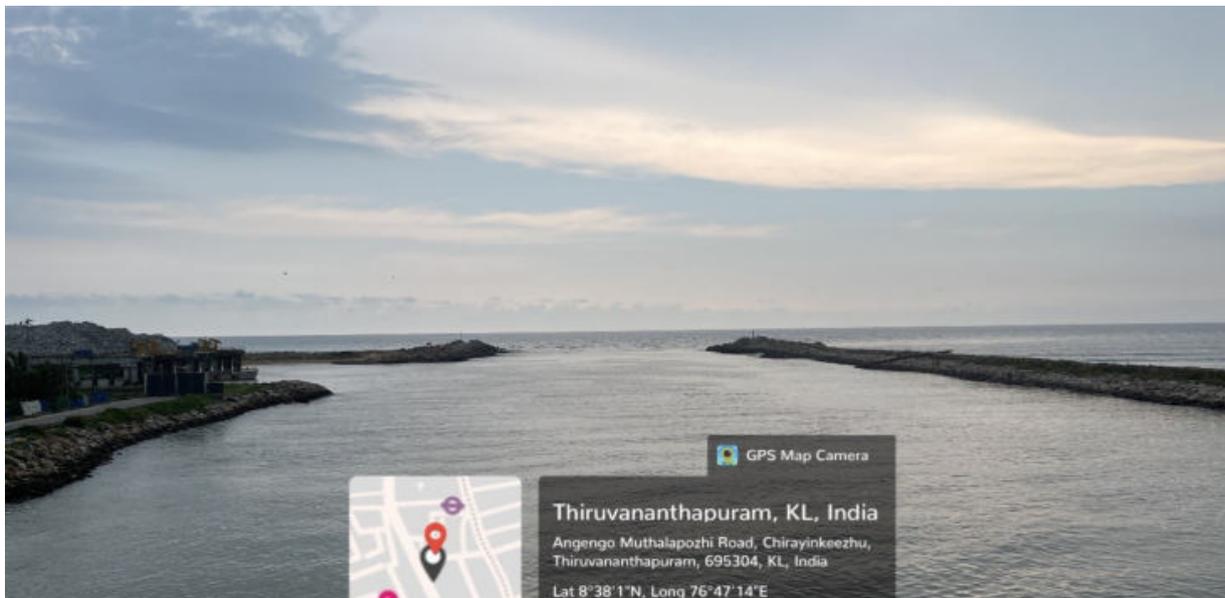


Valiathura – Sankhumugham reach beach damages

Sankgumugam road washed away 107-103



Sangumukham Beach Road -Before & After construction of RCC Diaphragm Wall  
Reach 3- Thumba to Perumathura (CP No 0137 to 0211).

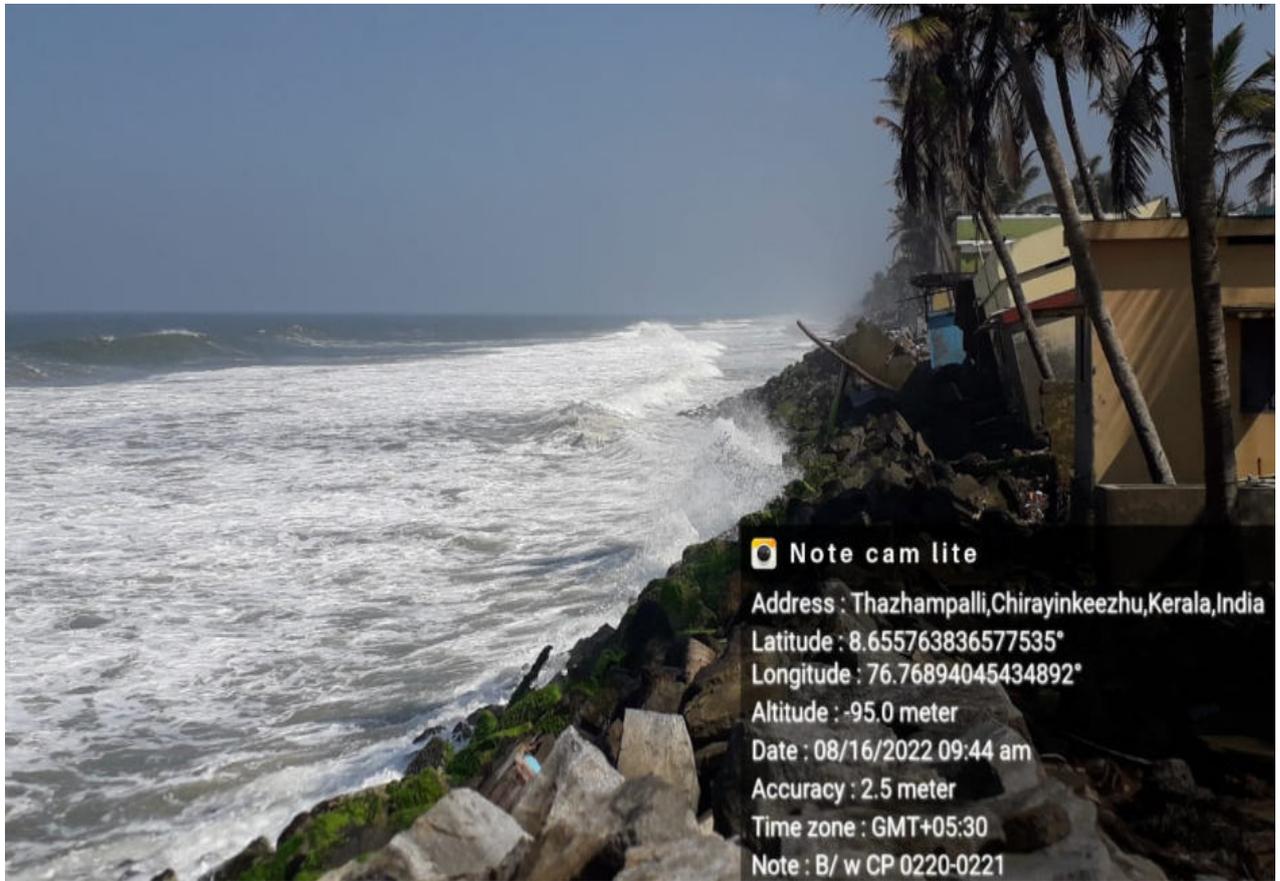


#### Perumathura Breakwater Between CP 0210-0211

Since the distance of CP between 137 to 150( about 2.6 km) are under the control of ISRO and has been declared as Restricted area, the details of coast of this area is unknown. The area under this reach is very calm and maintains good beach in all the seasons. Between CP No 0210 & 0211, the harbor engineering department has constructed the breakwater at Perumathura. Hence, very large shore was created between CP No 0195 to 0211.

#### **Reach 4- Perumathura to Paravoor pozhi (0211 to 0288)**

The harbour engineering department has constructed breakwater for fishing harbor and also constructed a groyne between CP No.0211 and 0212. Another most vulnerable areas such as Poothura and Anjuthengu are comes under this reach. The coastal area between CP 0211 to CP 223 is protected by sea wall. But the sea wall between 0211 to 0215 is partially damaged and between 0215 to 0223 is heavily damaged and treated as most vulneruble reach. This portion occures heavy sea attack and also have thick populated area . Hence special attention has to be given to this area and also to be taken the advanced coastal protection methods . The CP stones have not been planted in between CP No 0259 to 0260 (approx 8.4 km) at Varkala. The Varkala cliff, a beautiful place, is slowly disappearing due to severe sea attacks. The above places are in cliffs and some protection work is needed since some times the soil erosion has been occurred in the cliff area during the heavy rainy season and due to the heavy sea attack Hence the portion of cliff is also treated as vulnerable. The portion between CP 0262 to 0267 at Edava, the sea wall is fully damaged and in collapsed condition and this location is also treated as vulnerable.



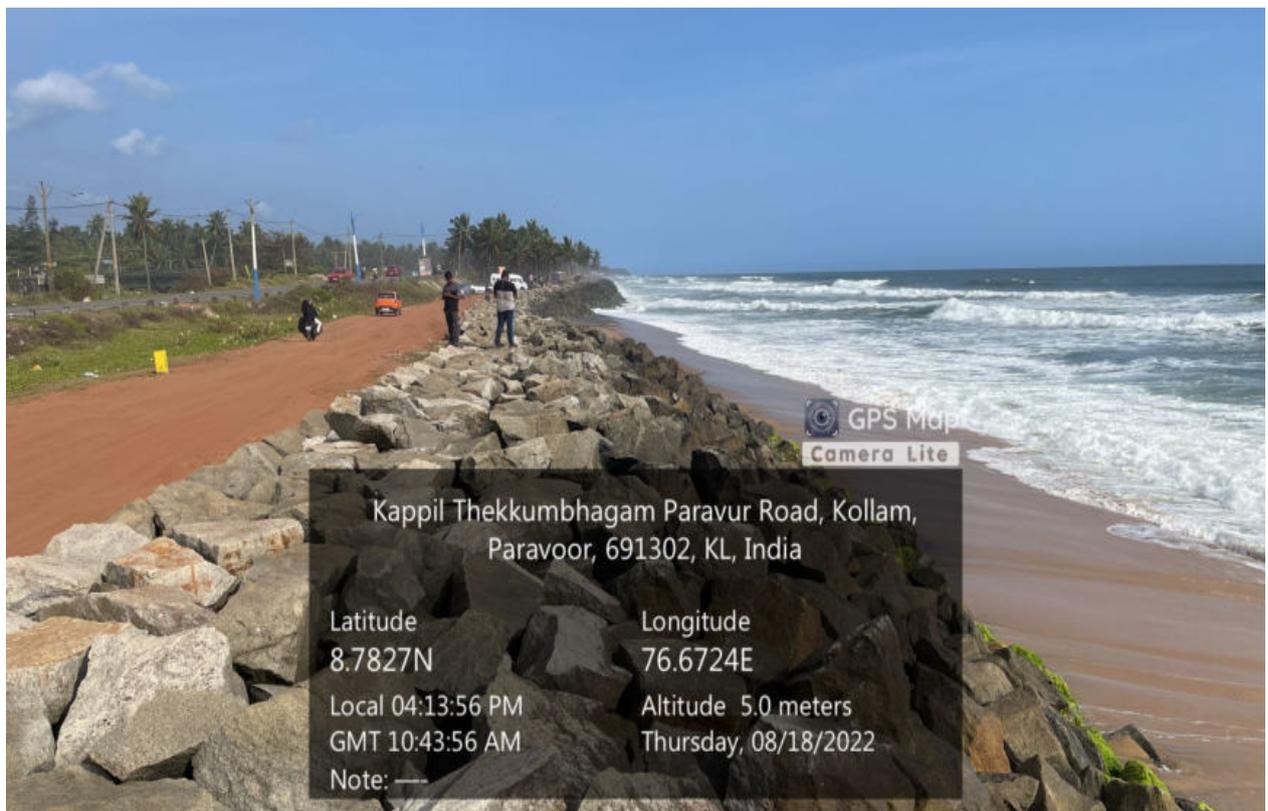
Poothura beach damages



Anchuthengu beach damages



Vettakada beach



Damaged and collapsed sea wall at Edava

### Coastal Damages from CP 288 to CP499

During the month of January 2023, seawave attack occurred along the coast of Alappad Gramapanchayth (Parayakadavu to Azheekal pozhi) and caused to heavy overtopping over seawall and water entered nearby land and houses.



CP 449 (Pandarathrth)



CP 453 (Cheriazheekal)



CP 465 (Parayakadavu)



CP 469 (Parayakadavu)during high sea wave attack



CP 475-476 (Sraikad) during sea attacks



CP 489 (Azheekal) sand entered land along with waves



CP 496 (Azheekal pozhi)



CP 449(Pandarathurth)

is at a very fast rate from 0327The Erosion at the simultaneous Observation point CP and continuing 2022May



CP 327 (2021)



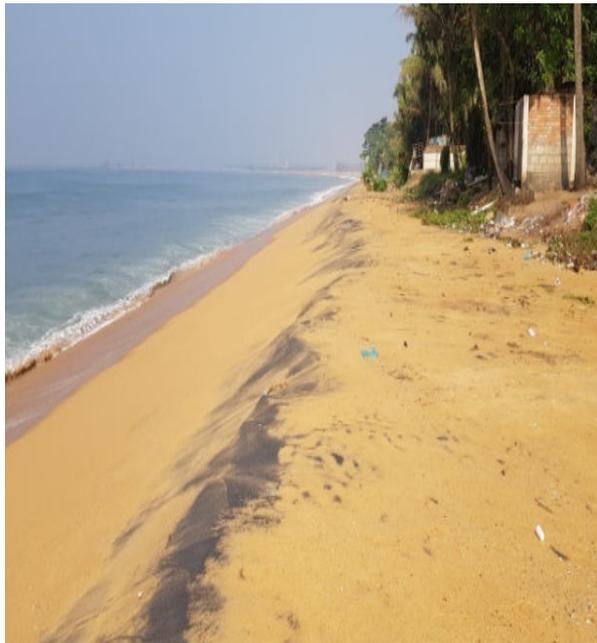
CP 327 (2021)



CP 327 towards North (2022 May)



CP 327 towards South (2022 May)



CP 327 towards North (2022 December)



CP 327 towards South (2022 December)



CP 327 towards South (2023March)



CP 327 towards North (2023March)

## VIII DETAILS OF STONES

Sl. No.	Description	Thiruvananthapuram	Kollam	Thottapally	Cherthala	Ernakulam	Chavakkad	Parappanangadi	Kozhikode	Thalassery	Total
1.	C. P. Stones	288	212	212	166	212	362	189	372	712	2725
2.	Alignment Stones	288	212	212	166	212	362	372	712	712	3248
3.	Guard Stones	48	36	36	28	36	52	32	64	100	432
4.	K. M. Stones	79	42	42	30	43	69	38	76	158	577
5.	B. M. Stones	12	9	9	7	9	13	8	16	25	108

## IX LIST OF IMPORTANT STRUCTURES

## A. Coastal Engineering Section, Thiruvananthapuram

## CHURCH

Sl. No.	CP Stone b/w	Name
1	0000 & 0001	Kollamcode Kochupalli
2	0004 & 0005	St.Mathew's Church
3	0005 & 0006	St.Marry's Magdelence Church
4	0019 & 0020	St.Berthodony Church
c	0024 & 0025	St.Andrews Church
6	0025 & 0026	Church of God
7	0029 & 0030	St. Anthonys Church kochuthura
8	0036 & 0037	
9	0078 & 0079	St.Thomas Chuch Poonthura
10	0088 & 0089	St.Asseption Chuch Cheriyaathura
11	0094 & 0095	St.Antony's Forance Church
12	0110 & 0111	St.Peter's Church
13	0115 & 0116	Vettukadu Church
14	0122 & 0123	St.Joseph Church
15	0128 & 0129	St.Thomas Church Veli
16	0152 & 0153	Pallithura Church
17	0153 & 0154	St.Thomas Aquinas Church
18	0156 & 0157	

19	0160 & 0161	St.Dominic Church
20	0163 & 0164	St.Andrews Church
21	0171& 0172	Puthenthope Church
22	0187 & 0188	St.Joseph's Church
23	0197 & 0198	St.Micheal's Church
24	0220 & 0221	St.Roche's Church
25	0226 & 0227	St.Joseph Church
26	0233 & 0234	St.Antony's Church
27	0234 & 0235	Holy Sprit Church Mampally

*TEMPLE*

Sl. No.	CP Stone b/w
1	0062 & 0063
2	0063 & 0064
3	0064 & 0065 (2 numbers)
4	0068 & 0069
5	0234 & 0235
6	0238 & 0239
7	0239 & 0240
8	0242 & 0243
9	0282 & 0283
10	0283 & 0284
11	0284 & 0285

*MAZJID*

Sl. No.	CP Stone b/w
1	0056 & 0057
2	0062 & 0063
3	0084 & 0085
4	0204 & 0205
5	0209 & 0210
6	0253 & 0254
7	0256 & 0257
8	0260 & 0261
9	0274 & 0275 (2 numbers)
10	0281 & 0282
11	0283 & 0284(2 numbers)

*KURISADI*

Sl. No.	CP Stone b/w
1	0009 & 0010
2	0018 & 0019
3	0027 & 0028
4	0036 & 0037
5	0038 & 0039
6	0042 & 0043
7	0093 & 0094

8	0123 & 0124
9	0157 & 0158
10	0163 & 0164
11	0210 & 0211
12	0213 & 0214
13	0218 & 0219
14	0228 & 0229

*FISH LANDING SHED*

<b>Sl. No.</b>	<b>CP Stone b/w</b>
1	0000 & 0001
2	0002 & 0003
3	0004 & 0005
4	0008 & 0009(2 no)
5	0018 & 0019
6	0019 & 0020
7	0020 & 0021
8	0024 & 0025
9	0025 & 0026
10	0026 & 0027
11	0027 & 0028 (2 no)
12	0028 & 0029
13	0030 & 0031 (2 no)
14	0031 & 0032 (2 no)
15	0032 & 0033 (2 no)
16	0033 & 0034 (2 no)
17	0034 & 0035 (3 no)
18	0035 & 0036 (2 no)
19	0037 & 0038
20	0039 & 0040
21	0040 & 0041 (2 no)
22	0041 & 0042 (3 no)
23	0042 & 0043
24	0043 & 0044 (4 no)
25	0183 & 0184
26	0189 & 0190 (2 no)
27	0193 & 0194
28	0194 & 0195 (2 no)
29	0223 & 0224
30	0253 & 0254
31	0256 & 0257
32	0257 & 0258

*ANGANAVADI*

<b>Sl. No.</b>	<b>CP Stone b/w</b>
1	0008 & 0009
2	0035 & 0036
3	0043 & 0044
4	0130 & 0131

5	0281 & 0282
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*Others*

Sl. No.	CP Stone b/w	Name
1	0000 & 0001	Rajiv Gandhi centre for Aqua culture
2	0002 & 0003	V.R food enterprises Pvt. Ltd
3	0011 & 0012	Mini park
4	0012 & 0013	Coastal Police station
5	0020 & 0021	Foot ball ground
6	0029 & 0030	Foot ball ground
7	0031 & 0032	Foot ball ground
8	0036 & 0037	Matsya bhavan
9	0036 & 0037	St. Xavior's library & sports club
10	0037 & 0038	Kala Sagar Arts & sports club
11	0039 & 0040	Pulluvila fish market
12	0041 & 0042	Mini park
13	0044 & 0055	Somatheeram beach, Vizhinjam port, Vizhinjam light house, Kovalam beach, Leela resort.
14	0055 & 0056	Kovalam beach
15	0056 & 0057	KTDC Resrot
16	0057 & 0059	Bait Resort
17	0057	Samudra beach
18	0062 & 0063	Coir factory
19	0094 & 0095	Valiyathura bridge
20	0103 & 0107	Sangumugam beach
21	0103 & 0107	Airport
22	0105 & 0106	Art museum
23	0106 & 0107	Sangumugam palace
24	0107 & 0108	Holy cross hospital & Pratheeksha De addiction centre
25	0118 & 0120	Titanium factory
26	0125 & 0127	Veli Touist villa
27	0131 & 0132	Primary health centre
28	0137 & 0149	ISRO (VSSC compound)
29	0152 & 0153	Pallithura higher secondary school
30	0157 & 0158	L P School
31	0161 & 0162	St. Xavior's cicket stadium
32	0162 & 0163	St. Xavior's college
33	0171 & 0172	Stella Marry's convent
34	0178 & 0179	Sea boy fisheries Pvt.Ltd.
35	0210 & 0211	Perumathura break water & bridge
36	0211 & 0212	Fishing harbor, Coastal police station, Harbour Engineering sub division.
37	0223 & 0224	Anjuthengu fort, Anjuthengu light house, community health centre, Sacret heat convent.
38	0225 & 0226	School
39	0226 & 0227	Foot ball ground
40	0227 & 0228	Anjuthengu Panchayath office

41	0228 & 0229	St. Thomas library
42	0229 & 0230	Anjuthengu service co-operative Bank
43	0233 & 0234	St. Antony's L P School
44	0238 & 0239	Kayikkara Asan Smarakam & Asan memorial L P School
45	0240 & 0241	Community health centre
46	0250 & 0251	Arivalam Tourist Park
47	0259 & 0260	Varkkala beach & cliff
48	0268 & 0270	Kappil beach
49	0273 & 0274	Mini park
50	0281 & 0282	Library
51	0287 & 0288	Mini park

Coastal Engineering Section Kollam.

<b>Sl. No.</b>	<b>Location</b>	<b>Structures</b>
1	CP 0292	PWD Kadavu at Mukkam
2	CP 0302	Temple at Thanni
3	CP 0303	Church at Thanni
4	CP 0315	Church near Eravipuram
5	CP 0317	Pier of Port Department at Garfill Nagar
6	CP 0331	Gandhi Park at Kochupilamoodu
7	CP 0336	Church at Pallithottam
8	CP 0336	Kollam Port
9	CP0341	Church at Vadi (Moothakkara Palli)
10	CP 0343	Fishing Harbour at Thankasseri
11	CP0347	Light House at Thankasseri
12	CP 0357	Temple at Thirumullavaram
13	CP 0359	Church at Thirumullavaram
14	CP 0376	Church at Sakthikulangara
15	CP 380	Sakthikulangara Harbour and break water
16	CP 0381	GTS Benchmark at Neendakara
17	CP 0381	Fishing Harbour Port ( Breakwater and Bridge) at Neendakara
18	CP 0393	P.B.M and M.C Health Centre at Neendakara
19	CP 0402	St. Francis Church at Karithura
20	CP 0408	Light House and IRE Company at Karithura
21	CP 0409	KMML Ltd at Kovilthottam
22	CP 0414	Church at Kovilthottam
23	CP 0415	St. Francis Church at Karithura
24	CP 0421	Temple at Kattilkadavu
25	CP 0437	Parayakadavu Church
26	CP 0439	Parayakadavu Bridge
27	CP 0446	Temple at Cheriyaazheekkal

28	CP 0452	Cheriyazheekkal Football Association Club
29	CP 0463	Govt. Homoe Dispensary at Kuzhithura
30	CP0470	Sree Amruthanandamayee Matt and Ayurveda Treatment Centre
31	CP 0477	Pachimeswaram Temple
32	CP 0482	Weigh Bridge
33	CP 0490	Govt. LP School at Srayikadu
34	CP 0497	Valiyazheekkal Bridge Road
35	CP 0499	Fishing Harbour Port (Breakwater near Kayamkulam Pozhi)

Coastal Engineering Section Thottappally

Sl. No.	Location	Structures
1	CP 710	Port building at Alappuzha
2	CP 708	W&C Hospital
3	CP 706	Village office building
4	CP 703	ESI hospital
5	CP 697	SSV LP School Vadakkal
6	CP 687	Catholic church Paravoor
7	CP 680	Catholic church Punnapra
8	CP 676	Industrial unit Khadi and Village Industries-Punnapra
9	CP 656	Auction hall of Harbour Engineering -Valanjavazhi
10	CP 651	Railway line at Kakkazham
11	CP 646	Malsyafed building at Ambalappuzha
12	CP 619	LP School at Anandeswaram
13	CP 609	Thottappally Harbour
14	CP 609	Health Centre at Thottappally
15	CP 604	Coastal Engineering Section at Thottappally
16	CP 605	Spillway at Thottappally
17	CP 578	Mosque and Church at Chelakkad
18	CP 573	Thrikkunnappuzha Temple
19	CP 563	Mosque at Pathiyankara
20	CP 557	Mangalam Water Tank
21	CP 547	Union Bank, Arattupuzha
22	CP 535	Nallanickkal Church
23	CP 500	Break water at Valiyazheekkal
24	CP 500	Azheekkal - Valiyazheekkal Bridge Valiazheekkal

List Of Important Structures Along The Coast Near Shoreline – Ernakulam Sub Division

<b>Sl. No</b>	<b>Name of important structures</b>	<b>Place</b>	<b>Between CP</b>
1	Lighthouse	Alappuzha	CP810
2	Bishop house	Alappuzha	CP811-812
3	Recreation club	Alappuzha	CP810
4	Fish landing centre	Pollethai	CP857-858
5	Chethy harbour	Chethy	CP883-884
6	Arthunkal harbour	Arthunkal	CP908-911
7	Fish landing centre	Arthunkal	CP910-911
8	Arthunkal church	Arthunkal	CP904-905
9	Church	Ottamassery	CP926
10	Church	Thankey	CP929-930
11	Lighthouse	Andhakaranazhi	CP951-952
12	Church	South Chellanam	CP975
13	Chellanam Fishing Harbour	Chellanam	979-981
14	Kannamaly St' Joseph Church	Kannamaly	1021-1022
15	Fort Kochi Beach	Fort Kochi	1067-1072
16	Vypin Light House	Vypin	1081-1082
17	Kuzhuppilly Beach	Kuzhuppilly	1146-1147
18	Cherai Beach	Cherai	1164-1165
19	Munambam Beach	Munambam	1185-1186
20	Coastal Police Station	Azhikkode	CP.1188

21	Lighthouse	Azhikkode	CP.1201 – 1202
22	Beach Park At Snehatheeram	Thalikkulam	CP.1334 – 1336
23	Groyne	Chettuva (S)	CP.1380
24	Groyne	Chettuva (N)	CP.1381
25	LightHouse at Thottappu	Blangad	CP.1406 – 1407
26	A MultiStoried Lodge Building	Blangad	CP.1419 – 1420
27	Single Storied Building Of Fisheries Department (Damaged)		CP.1499 -1500
28	A MultiStoried Building Hatchery, Fisheries	Veliancode	CP. 1510 – 1512
29	BeeviJaram	Puduponnani	CP.1514
30	LightHouse	Ponnani	CP.1548 -1549

CE Section, Thalassery: -

- 1) Thalai-Gopalpetta Fishing Harbour (CP 2162 to 2168)
- 2) Thalassery Fort and tourism projects (North of CP 2178)
- 3) Tourism development projects at Dharmadam beach (CP 2208)
- 4) Tourism development project at Muzhappilangad beach(CP 2216 to 2232)
- 5) Ayikkara Fishing Harbour (CP 2278 to CP 2281)
- 6) Kannur Fort (CP 2281)
- 7) Payyambalam Beach Park (CP 2301 to CP 2306)
- 8) Azheekal Breakwater (CP 2354)
- 9) Naval Academy, Ezhimala (North of CP 2429)
- 10) Bekal Fort (CP 2656 to CP 2661)
- 11) Kasaragode harbour (CP 2709)
- 12) Light House, Kasaragode (CP 2730)

CES Section, Kozhikode: -

- 1) Fishing Harbour, Chombal at Azhiyur (CP 2100 to 2103).
- 2) Tourism Development Project, Sandbanks, Vatakara (CP 2046).
- 3) Turtle Hatchery, Kolavipalam
- 4) Light House, Thikodi (CP 1982)
- 5) Fishing Harbour Koyilandi (CP 1936 to CP 1939).
- 6) Tourism Development Project, Kappad (CP 1905)
- 7) Fishing Harbour, Puthiyappa (CP 1861 to 1864)

- 8) Fishing harbour-Vellayil (CP 1830 to 1832)
- 9) Light House, Tourism Development Project (CP 1827)
- 10) Brake water and Port, Beypore (CP 1772 to CP 1769).
- 11) Light House and 'NIRDESH', Chaliyam, Kozhikode (CP 1768)
- 12) Bird Sanctuary, Kadalundi and Vallikkunnu (CP 1745 to CP 1743)

CES Section, Parappanangadi: -

- 1) Tourism Development Project and Brake water, Padinjarekkara (CP 1555)
- 2) Tanur harbour (CP 1659 to CP 1662)
- 3) Parappanangadi harbour (CP 1706 to CP 1708)

## **X DETAILS OF WORKS**

### **1. PLANTING OF NEW CONTROLPOINT STONES, ALIGNMENT STONES, KILOMETER STONES AND BENCH MARK STONES ALONG THE SEA COAST**

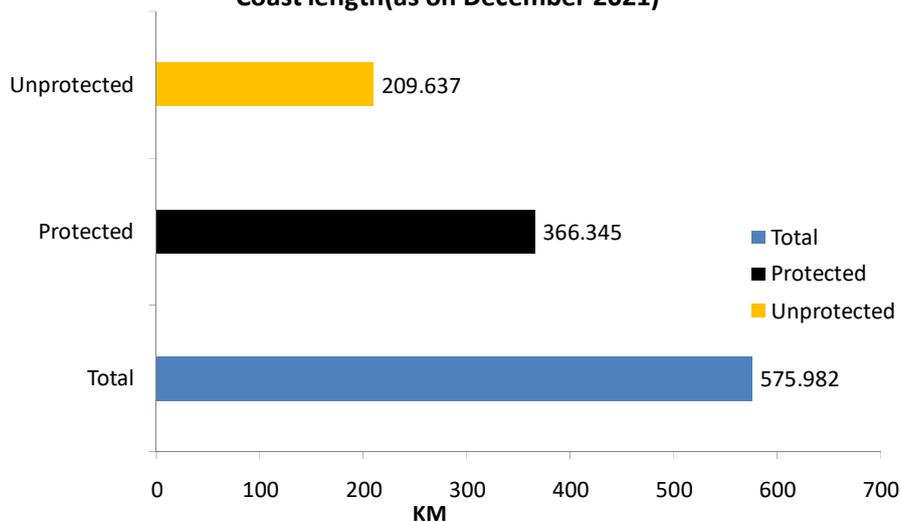
Control Point Stones and Alignment Stones are the most important reference points for all the collection of data and for carrying out the protection works. In most area, levels are also established on those stones. The regions are referred by the Control Point stones. Shore line measurements, fixing of levels, topographic survey and similar important factors are based on these stones. Similarly, K.M. Stones are established to ear mark each region. BM stones are planted along the shore as permanent level marks. The levels on Control Point Stones are further checked on the basis of the B.M. stones. Many of the Control point stones and alignment stones are seen missing and damaged due to various reasons.

### **2. INVESTIGATION WORKS**

Field studies and collection of data on coastal erosion have been conducted on all Sections under this Division.

**STATUS OF COASTLINE-KERALA**

Coast length(as on December 2021)



14

Coastal Status during the year 2022 is under preparation

Field visit with NCCR for mapping of coastal structure along Kerala Coast

Staffs under this Office accompanied NCCR team during the field visit in Kerala on the basis of MoU between NCCR & Water Resource Department on “Shoreline management Plan & coastal protection measures for Kerala coast”. The purpose of field visit was to map all coastal structures to assess their existing status along Kerala coast. Based on the field data, a report on coastal protection structure for Kerala coast will be prepared by NCCR which is essential for the preparation of shoreline management plan & design of new coastal protection strategies for Kerala coast.

Field visit with Central Water Commission (CWC) for preparation of DPR for Salinity Ingress Management Projects in Coastal Areas.

Staffs under this office accompanied with Central Water Commission team during the field visits at Chellanam, Neerkunnam & Kappad for preparation of DPR for Salinity Ingress Management Projects in Coastal Areas.

New instruments purchased

Measuring Tape, Prismatic Compass, Automatic Level and Levelling staffs, Hand held GPS, Pycnometer bottle, Hot air Oven, Laptop are purchased in this financial year.

Details of works under Kollam Sub Division

Civil Works: Nil

Details of works under Kozhikkod Sub Division

Civil Works:

Sanction for taking up a maintenance work for Re-planting CP Stones and Alignment stones in place of missing stones for an amount of Rs. 379000/- under the jurisdiction of CES Section Parappanangadi was obtained during 2021-22. This work was started on 19/11/2021 with a period of completion of six months. 100% of the work has been completed on 21.06.2022 and the final bill has been submitted.

Details of works under Ernakulam Sub Division

Civil Works: Nil

**DETAILS OF CP & ALIGNMENT STONES UNDER KOLLAM SUB DIVISION**

REGION	CONTROL POINTS			ALIGNMENT STONES			REMARKS
	EXISTING	LOST	TOTAL	EXISTING	LOST	TOTAL	
Thiruvananthapuram	221	67	288	244	44	288	
Kollam	171	41	212	175	37	212	
Thottapally	192	20	212	202	10	212	

**DETAILS OF CP & ALIGNMENT STONES UNDER KOZHIKODE SUB DIVISION**

REGION	CONTROL POINTS			ALIGNMENT STONES			REMARKS
	EXISTING	LOST	TOTAL	EXISTING	LOST	TOTAL	
Parappanangadi	167	22	189	178	11	189	
Kozhikode	337	35	372	337	35	372	
Thalassery	462	250	712	467	245	712	

**DETAILS OF CP & ALIGNMENT STONES UNDER ERNAKULAM SUB DIVISION**

REGION	CONTROL POINTS			ALIGNMENT STONES			REMARKS
	EXISTING	LOS T	TOTAL	EXISTING	LOS T	TOTAL	
Cherthala	154	12	166	157	9	166	
Ernakulam	177	35	212	197	15	212	
Chavakkad	292	71	362	309	53	362	

**XI BOTTLENECK FACING**

Coastal Engineering Field Studies is the one and only institution entrusted with the collection of coastal field data and field studies connected with the erosion of the entire sea coast of Kerala, the functions assigned to which are vital & essential. The Chairman, Coastal Protection and Development Advisory Committee (CPDAC) had advised the Chief Secretaries of all Coastal States to create a separate department for dealing with the Coastal Engineering works of the respective states vide Lr.No:4(5)/2000 CED dated 9.6.2000 to organize a coordinated program of collection, compilation, evaluation and publication of coastal data. Hence this wing is to be made permanent.

The staff strength of the wing is insufficient even for the routine performance. Vacancies of technical field staffs are not filled yet. This affects the efficiency of this wing very much. The CEFS Division is not having the posts of PA/TA., DA.

Coastal Engineering Section, Thalassery coming under the control of Deputy Director, Kozhikode Sub division extends from Mahe to Manjesweram with a length of 148 km. At present only 90 km is under study reach. No study is being conducted in the remaining 58 km (excluding Naval Academy and Bakel fort). Assistant Director of each section is collecting field data and doing survey works for an average length of about 60Km with the assistance of 2 Draftsman/Overseer.

As far as Kerala Coast is concerned, the sea is turbulent, especially during monsoon and coastal erosion is a common phenomena along the sea coast for which continuous field study in all aspects is essential. At present the wing is collecting data on shoreline measurements, simultaneous observation, preparation of coastal damage reports with photographs and

collecting soil samples only. Training programs on Coastal Engineering and allied subjects to update and train the technical personnel of the department regarding the latest development in this field is essential. No training has been conducted under this wing. The study wing now follows old conventional method of observations like visual observations, tape measurements etc. High derivative modern instruments are now available in this field.

25 Kms of stones are not planted on the Northern Side of Kerala ie, in North of Kasargode District. So no details of sea have been taken in that area. That is to be rectified immediately.

Also some stones are missing in the rest of the area, and it should be replanted immediately. Maintenance of the stones are not done till date. It is also to be done urgently.

As per the direction of Chief Engineer, I&A, TVM, the Jeep under CEFS Division has been transferred to MI Division Thrissur, the non-availability of vehicle affects the inspection of the sites.

## **XII SUGGESTIONS / RECOMMENDATIONS**

Sufficient staff has to be made available for conducting the entire study of coastal erosion. The coastal length coming under the jurisdiction of Thalassery section is 148km, and for studying the entire reach an additional section is to be formed.

The location of new International Port at Vizhinjam is between CP45 to 55 and the construction work is in progress. The construction authority has formed artificial shore and road by using materials drilled from the sea and breakwater construction is in progress. This area needs some specific studies for shoreline characteristics before and after the construction of Vizhinjam Port..Here due to terrain of land CP Stones have not been planted.

Some of the CP stones have been swallowed by the sea waves and some got destroyed by the weathering actions. As the new CP stones have not been planted for the continuous stretch, that profile could not be adopted for aligning sea walls etc. Hence CP stone planting and its timely maintenance is essential.

For getting the sufficient staff strength and for their maximum efficiency this wing is to be made permanent, considering the importance of this Division. Sufficient fund should be allocated for the training of technical staff and for procuring the modern scientific equipments for the collection of coastal data.

## **XIII CONCLUSION**

Specific studies are necessary for studying the behaviour of shore protection works like seawall, groynes and break water. The study has to be conducted for analyzing the shore

particulars before and after the construction of the groyne field. The construction of new international Vizhinjam harbor was started in between CP No. 0044 to 0055 and the construction work is in progress. This area needs some specific studies.

The main constrains is the lack of modern equipments and the shortage of fund for the study work of Coastal Engineering Department. It is also required to study the possibility of artificial nourishment and other protection works like geotube construction. The existing coastal protection works are being watched. The general behavior including its failure if any, is studied for modification.

Since the study of the coastal characteristics is the base for all constructions of anti-sea erosion structures and also for the other construction work, the data collection could not be stopped. If it is stopped the entire data collected till date will be futile. Now many numbers of CP &AS stones are missing /damaged and hence these are to be replanted and also to be reestablished the Reduced Level (RL) and their locations (Latitude & Longitude).

The studies and data collection on coastal erosion are being continued during 2022-2023 possible erosion causes are wave action, tidal action , storm surge and manmade causes. Latitude and Longitude of all Control Point Stones and Alignment Stones and Seawall are taken for Coastal Atlas Preparation. Special studies if any required shall be done as directed. Hence Coastal Engineering and Field studies take inevitable part for the developing of coastal region of Kerala.

**I.QUALITY CONTROL**  
**DIVISION,THRISSUR**

## **QUALITY CONTROL DIVISION, THRISSUR**

The quality control wing under Irrigation Department was formed in 1995 as per G.O.(MS)No. 87/1995/Irrgn dated 13.06.1995 to ensure quality of the works executed by Irrigation Department. There are two Division offices under the wing one at Thrissur with jurisdiction extending from Ernakulam to Kasargod (8 districts) and the other at Kottarakkara with jurisdiction extending from Thiruvananthapuram to Kottayam (6 districts).

### **Quality Control Division, Thrissur.**

Quality Control Division, Thrissur was formed with effect from 15-11-2000 for Checking and monitoring of the quality of works under taken by the Irrigation Department, after abolishing KIP (MCS Division) 2 at Charumoodu as per Govt. order (RE) No.891/2000/IRD Dated: 12-07-2000. Up to 04-03-2010, this division was functioning under the control of Superintending Engineer, I&P Circle, Thrissur. From 05-03-2010 onwards this division is functioning under the direct control of the Director, F& AR,KERI Peechi as per the Govt. Order No. 10 /2010 Dated: 1-2-2010.

The Quality Control Division, Thrissur comprises of a division office at Thrissur and 5 Sub Division Offices at Muvattupuzha, Thrissur, Palakkad, Kozhikode, Kannur & 11 section offices. Monitoring of works executed by the Irrigation Department in Ernakulam, Thrissur, Palakkad, Malappuram, Kozhikode, Wayanad, Kannur and Kasargod are carried out by Quality Control Division, Thrissur.

### **The main objects of the formation of 5 Subdivisions under the Quality control Division, Thrissur and its functions.**

- **Muvattupuzha** Sub Division was formed on deploying the Chimoni Dam Project in Thrissur District on 1-1-1992 as per GO(Rt) 717/91 Dt. 07-10-1991. The main object of this sub division is to check the quality of works in two divisions of MuvattupuzhaValley Irrigation Project and two divisions of Idamalayar Irrigation Project. There are three sections at Muvattupuzha, Koothattukulam, and Angamaly for this purpose. The quality of works of Muvattupuzha division of Muvattupuzha Valley Irrigation project and Pattissery Dam in Kanthalloor is checked by the Muvattupuzha Quality Control Section. The quality works under taken by the Piravam Division of Muvattupuzha Valley Project is done by the Koothattukulam Quality Control. Quality Control Section Angamaly is checking the quality of works undertaken by the Angamaly Division and Chalakudy Division of Idamalayar Irrigation Project.
- **Thrissur** Sub Division and its two sections at Thrissur and Ernakulam are envisaged to check the quality of works under taken by the various Execution divisions and subdivisions of the Irrigation department in Thrissur and Ernakulam Districts. 2nd tier quality control activities of all major and minor Irrigation works under Ernakulam and Thrissur Districts except works under Muvattupuzha, Idamalayar and Chalakkudy Irrigation projects, are

coming under this office. The works executed by 9 nos of major and minor Irrigation Divisions are coming under the jurisdiction of this office.

- **Palakkad** The quality control sub division, Palakkad was formed in the year 1995, with two sections having jurisdiction in the revenue districts of Palakkad and Malappuram. The Quality Control section Palakkad is located at Palakkad and Quality Control Section Malappuram is located at Eswaramangalam, Malappuram.
- **Kozhikode** Sub Division and its sections namely Kozhikode and Kalpetta are intended to check the quality of works under taken by the various Divisions and sub divisions of the Irrigation Department in Kozhikode and Wyanad Districts.
- **Kannur** sub division and its two sections at Kannur and Kasargod are intended to check the quality of works undertaken by the various Divisions and subdivisions of Irrigation department in Kannur and Kasargod districts.

### **Division office at Thrissur**

Apart from compiling monthly and quarterly inspection reports received from the five subdivisions, scrutinizing of test results, comparing test results with IS and other approved standards, recommending necessary suggestion if any, are the duties of Division office. Random inspections of major and important works are to be done by the Division office.

Duties of the Division office also include effective coordination and supervision of these sub divisions which have such a vast area of operation in the field of quality monitoring of works under Irrigation Department and also execution of works under head 'Modernization of Quality Control Wing'.

### **Present functional activities of the Division and Sub divisions**

Apart from inspections conducted by the Quality Control sections and Quality Control Sub Division offices, random inspection in major and important works are also being conducted by the Division Office. Shortfalls noticed are brought into the notice of the execution wing with clear direction to rectify the same. The major activities carried out under this office are implementing second tier quality control test, monitor the quality control process relating to the works under the jurisdiction of this office and bring to the notice of the field officers in case any shortfall in the quality of works carried out, approving the result of tests conducted in the QC laboratory and forwarding it with investigation report to the concerned Execution officers and submit the same to the higher office, preparation and submission of monthly progress reports etc

One of the major projects coming under this Department is Dam Rehabilitation and Improvement Project (DRIP) of major dams of Kerala. Since 2013, the wing is engaged in the Quality Control testing of DRIP works also. DRIP is implementing with financial assistance of World Bank. The second tier quality control testing of the drip work is also being done by the quality control wing.

The list of dams that are coming under the Dam Rehabilitation and Improvement Project (DRIP) are as follows.

Sl. No.	DAM	Name of District
1	Pothundy	Palakkad
2	Malankara	Muvattupuzha
3	Vazhani	Thrissur
4	Peechi	Thrissur
5	PeriyarVally Berrage	Ernakulam
6	Chulliar	Palakkad
7	Meenkara	Palakkad
8	Walayar	Palakkad
9	Pazhassi	Kannur
10	Kanhirapuzha	Palakkad
11	Chimoni	Thrissur
12	Kuttiadi	Kozhikode
13	Malampuzha	Palakkad
14	Moolathara Regulator	Palakkad (Chitturpuzha)
15	Karapuzha	Wayanad

As part of modernization of quality control wing, setting up of full-fledged laboratories with modern equipments and machineries etc. under H/A 2701-80-005-93-00-00-V (Modernization of Design wing) is in progress.

Presently we have quality control labs at Koothattukulam, Angamaly, Aluva, Thrissur, Palakkad and Kozhikode. Quality control labs to be set up at Muvattupuzha, Kalpetta, Malappuram, Kannur and Kadargod.

The details of Agreement schedule received, quality control inspection conducted, sample collected and test details during the period 2022-2023 is given below.

Name of Office	Total no of Agreement schedules received	Total Nos of actual intimation received	Total no of site inspections carried out	No of samples collected							Total no of tests conducted	Total No of tests not found satisfactory	Total no of outside tests conducted	Remarks
				Concrete	Steel	Cement	Coarse aggregate	Fine aggregate	other materials if any	Total samples collected				

Quality control Section 1 , Muvattupuzha	19	37	37	Nil	Nil	Nil	Nil	Nil	Nil	37	37	Nil	Nil	1 set core sample collected for vigilance enquiry.
Quality control Section 2 , Koothattukulam	10	36	39	39	Nil	Nil	Nil	Nil	Nil	39	39	2	Nil	3 nos surprise visit conducted
Quality control Section 3 , Angamaly	39	144	134	123	Nil	Nil	Nil	Nil	Nil	123	123	8	Nil	
Quality Control Sub Division Muvattupuzha <b>Total</b>	68	217	210	162	Nil	Nil	Nil	Nil	Nil	199	199	10	Nil	
Quality control Section , Thrissur	65	133	133	124	0	0	1	0	1	124	114	18	17	Out of 133, site inspections, 29 nos of are general inspection
Quality control Section , Ernakulam	60	148	148	155	0	0	0	5	0	160	129	17	0	Out of 148, site inspection 26 nos are general inspection
Quality Control Sub Division Thrissur <b>Total</b>	<b>125</b>	<b>281</b>	<b>281</b>	<b>279</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>5</b>	<b>1</b>	<b>284</b>	<b>243</b>	<b>35</b>	<b>17</b>	
Quality control Section , Palakkad	75	104	97	61	0	0	0	0	0	61	61	50	0	
Quality control Section , Malappuram	37	37	100	53	1	0	0	0	0	54	45	37	1	One result pending
Quality control Section , Kozhikode	70	82	124	74	Nil	Nil	Nil	2	NIL	74	53	0	0	
Quality control Section , Kalpetta	31	49	200	156	Nil	Nil	0	0	Nil	156	172	0	Nil	

Quality control Section , Kannur	88	139	185	102	Nil	Nil	Nil	Nil	Nil	102	102	1	102	
Quality control Section , Kasargode	31	64	186	75	Nil	Nil	Nil	Nil	Nil	75	75	1	75	

**Budget Allotments and expenditure**

The needs of this division is met with the provisions allotted under the head of account 2701-80-005-97 Investigation & Design & 2701-80-005-93 (Modernisation of Design Wing) under Plan and from 2701-80-004-96 for Non Plan wing.

Expenditure (For Thrissur Division)

Plan / Non Plan	Heads of A/c	2022-23
Plan	2701-80-005-93	Rs. 15.90 lakhs
Non Plan	2701-80-004-96	Rs. 748.22 lakhs

**Various Test facilities available in the QC Lab under Muvattupuzha**

**Sub Division**

SI No.	Name of Test	Remarks
1	Consistency Test of Cement	
2	Initial & Final Setting time of Cement	
3	Compressive strength test of 150mm cubes and cylinder	
4	Compressive strength of Bricks, PCC block and paving tile	
5	Non Destructive Test--Rebound hammer test	
6	Slump test for fresh concrete	

**Various test facilities available in QC Lab Thrissur**

SI No.	Name of Test	Remarks
	<b>CEMENT</b>	
1	Fineness by seiving	
2	Test for consistency	
3	Setting time (Initial & Final)	

4	Determination of compressive strength	
	<b>Testing of Aggregates</b>	
5	Sieve Analysis of fine/ Coarse aggregates	
6	Unit weight, Bulk Density and Voids	
7	Water Absorption	
8	Specific gravity	
9	Aggregate Impact value	
10	Aggregate Crushing value	
11	Bulking of sand	
	<b>Testing of Concrete and Mortar Cubes (Where material is supplied)</b>	
12	Testing of 70.6mm cubes for compressive strength test	
13	Testing of 100mm cubes for compressive strength test	
14	Testing of 150mm cubes for compressive strength test -	
	<b>Tests on Bricks and Tiles</b>	
15	Water Absorption for bricks/tiles	
16	Compressive strength of bricks of all kind	
17	Effective length and width of tiles	
18	Efflorescence test	
	<b>Tests on Steel</b>	
19	Finding the diameter and weight per meter length	
	<b>Tests on Building Stones</b>	
20	Compressive strength test of building stones of 5 cm or nearest size cubes	
21	True Specific gravity	
22	Water Absorption test (stone blocks)	
23	Compressive strength of building stones, cutting and sizing the specimen in rock cutting machine	
24	Compressive strength of building stones, 50mm cutting and sizing the specimen in rock cutting machine and grinding uneven surfaces to line and level	
25	Concrete mix design	
26	<b>NDT Test</b> --Rebound hammer test	
27	Concrete core Drilling ,Cutting and its compressive test	

SOIL TEST		
28	Specific gravity test	
29	Moisture content determination	
30	Bulk density, void ratio & porosity	
31	Atterberg limits	
32	Light Compaction test	
33	Heavy compaction	

### Quality Control Lab Ernakulam

SI No.	Name of Test	Remarks
<b>CEMENT</b>		
1	Fineness by sieving	
2	Test for consistency	
3	Setting time (Initial & Final)	
4	compressive strength test of cement	
5	Slump test	
6	Soundness	
<b>Testing of Aggregates</b>		
1	Sieve Analysis of fine/ Coarse aggregates	
2	Aggregate Impact value	
3	Aggregate Crushing value	
<b>Testing of Concrete and Mortar Cubes (Where material is supplied)</b>		
1	Compression strength test of cement and motor cubes	

Compression strength test for concrete and motor cubes and cylinder can be done only after the completion of rewiring of the lab building .

### Details of test/ Services available in QC Lab Palakkad

Test on Cement		Remarks
1	Normal consistency- Vicat apparatus	Yes
2	Initial setting time - Vicat apparatus	Yes
3	Final setting time- Vicat apparatus	Yes
4	Fineness- 90 micronsieve	Yes
6	Tensile strength of cement(standard briquette test with standard sand)	Yes
<b>Test on fine aggregate</b>		
1	Sieve analysis	Yes
2	Bulking of sand -lab method using measuring jar	Yes

Test on coarse aggregate		
1	Sieve analysis	Yes
2	Aggregate impact test	Yes
3	Aggregate crushing test	Yes
Test on Fresh concrete		
1	Slump test	Yes
Test on hardened concrete		
1	Compression test of concrete.	Yes

### Details of test/ Services available in QC Lab Kozhikode

Sl No	Name of Test/Services	Remarks
1	Compression Test / Cube test on concrete blocks	
2	Sieve Analysis of sand (using Electrical , Manual sieve shaker)	
3	Slump Test	
4	Vicat Apparatus -Initial Setting Time, Final Setting Time of cement	
5	Le-Chatlier Apparatus- for soundness of cement	
6	Liquid Limit ,Plastic Limit & Shrinkage Limit for soil	
7	Compaction Factor Test	
8	Specific Gravity Test (Pycnometer & Specific Gravity Bottle) for soil	
9	Cone Penetro Meter (Digital) Test for soil	
10	Aggregate Impact Test	
11	Crushing value - coarse aggregate	
12	Hydrometer analysis	
13	Tensile Test cement	
14	Core cutting	

### Staff strength

#### 1.Muvattupuzha Sub Division

Sl. No.	Category	Sanctioned strength	Remarks
1	Asst. Exe. Engineer	1	Vacant
2	1st Grade D'man	1	Vacant
3	2nd Grade D,man	1	
4	Head Clerk	1	
5	Senior Clerk/Junior Clerk	3	

6	Typist	2	2vacant
7	Office Attendant	3	1 vacant

**Quality Control Section No.1 Muvattupuzha**

Sl No	Staff Details	Sanctioned strength	Remarks
1	Assistant Engineer	1	
2	First Grade Overseer	1	
3	Third Grade Overseer	1	

**Quality control section III,Angamaly**

Sl. No.	Category	Sanctioned strength	Remarks
1	Asst. Engineer	1	
2	3rd Grade Overseer	1	
3	2nd Grade Overseer	1	vacant
4	Part Time Sweeper	1	

**Quality Control Section No.2 Koothattukulam**

Sl No	Staff Details	Sanctioned strength	Remarks
1	Assistant Engineer	1	
2	Second Grade Overseer	1	
3	Third Grade Overseer	1	

**Quality Control Sub Division, Thrissur**

Sl. No.	Category	Sanctioned Strength	Remarks
1	Assistant Executive Engineer	1	
2	Head Clerk	1	
3	Clerks	2	
4	Typist	1	
5	Office Attendant	2	
6	First Grade D'Man	1	
7	Second Grade D'Man	1	Vacant
8	Driver	1	
9	Part time Sweeper	1	Vacant

**Quality Control Section, Thrissur**

1	Assistant Engineer	1	
2	Second Grade D'Man	1	Vacant
3	Third Grade Overseers	2	
4	Lascar	1	
<b>Quality Control Section, Eranakulam-Aluva</b>			
1	Assistant Engineer	1	
2	Second Grade D'Man	1	
3	Third Grade Overseers	1	
4	Lascar	1	

**Quality Control Sub Division, Palakkad**

Sl.No.	Post	Sanctioned Strength	
1.	Assistant Executive Engineer	1	
2	Head clerk	1	
3	Clerks	3	1 vacant
4	Typist	1	
5	Overseer Grade I	1	
6	Overseer Grade II	1	vacant
7	Office Attendant	1	vacant
8	Driver	1	
9	Part Time Sweeper	1	
<b>Quality Control Section, Palakkad</b>			
1.	Assistant Engineer	1	Vacant – Additional charge
2.	Overseer Grade II	1	vacant
3.	Overseer Grade III	1	
4.	Lascar	1	
<b>Quality Control Section, Malappuram</b>			
1.	Assistant Engineer	1	
2.	Overseer Grade II	1	
3.	Overseer Grade III	1	
4.	Lascar	1	vacant

**Quality Control Sub division Kozhikode**

Sl.No.	Category	Sanctioned strength	
1	Assistant Executive Engineer	1	

2	I <sup>st</sup> Grade Draftsman	2	
3	Head Clerk	1	
4	LD/UD Clerk	3	
5	Typist	1	
6	Office Attendant	2	
7	Part Time Sweeper	1	

**Quality Control Section Kozhikode**

1	Assistant Engineer	1	
2	II <sup>st</sup> Grade Draftsman	1	
3	III <sup>rd</sup> Grade Draftsman	1	

**Quality Control Section Kalpetta**

1	Assistant Engineer	1	
2	II <sup>st</sup> Grade Draftsman	1	
3	III <sup>rd</sup> Grade Draftsman	1	

**Quality Control Sub Division, Kannur**

Sl. No.	Category	Sanctioned Strength	
1.	Assistant Executive Engineer	1	
2.	I <sup>st</sup> Grade Draftsman	1	
3.	Head Clerk	1	
4.	LD/UD Clerk	3	
5.	Typist	1	
6.	Office Attendant	2	
7.	Driver	1	

**Quality Control Section, Kannur**

1.	Assistant Engineer	1	
2.	III Grade Overseer	1	

**Quality Control Section, Kasargod**

1.	Assistant Engineer	1	
2.	I <sup>st</sup> Grade Overseer	1	
3.	III Grade Overseer	1	

**Thrissur Division**

Sl. No.	Category	Sanctioned strength	Remarks
1	Exe. Engineer	1	
2	Asst. Exe.Engineer/Tech. Asst.	1	
3	1st Grade D'man	1	

4	2nd Grade D,man	2	1 vacant
5	Blue Printer	1	
6	Divisional Accountant	1	
7	Junior Supdt	2	1 vacant
8	Senior Clerk/Junior Clerk	8	1 vacant
9	Typist	1	
10	Office Attendant	3	1 vacant
11	Watchman	1	
12	Part Time Sweeper	1	
	<b>Total</b>	<b>23</b>	

Additional staff requirement in the newly set up QC Labs

1. Quality control lab at Thrissur

Sl.No.	Category	Required strength
1	First Grade D'man	1
2	Third Grade Overseer	1
3	Worker Grade I/Lascar	2
4	Part Time Sweeper	1

2. Mini quality control lab at Aluva, Ernakulam

Sl.No.	Category	Required strength
1	Third Grade Overseer	1
2	Worker Grade I/Lascar	1

3. Quality control lab at Palakkad

Sl.No.	Category	Required strength
1	First Grade Dman/Lab in charge	1
2	Worker Grade I/Lascar	2

4. Quality control lab at Kozhikode

Sl.No.	Category	Required strength
1	First Grade Dman/Lab in charge	1
2	Worker Grade I/Lascar	2

Moreover the offices has a shortage of staffs. These vacancies should be filled at the earliest for the smooth functioning of the said offices.

## **Conclusion**

The testing of materials and concrete etc. as the part of routine first tier quality control process by the execution wing are now done in the outside laboratories. Such test results can be more credible, authoritative and trust worthy if these are done in Quality Control Labs under our control. After posting necessary Lab staff, additional revenue can be generated, by doing tests of private agencies, other Departments and for contractors conducting tests as per agreement.

**J.QUALITY CONTROL**  
**DIVISION, KOTTARAKKARA**

## **QUALITY CONTROL DIVISION, KOTTARAKKARA**

### **INTRODUCTION**

At Present Quality Control Division Kottarakkara have Four Sub Divisions at Thiruvananthapuram, Kottarakkara, Alappuzha and Kottayam and Seven sections which are Thiruvananthapuram, Kollam, Kottarakkara, Alappuzha, Pathanamthitta, Kottayam and Idukki under its control. This Division has jurisdiction over six districts namely, Thiruvananthapuram, Kolam, Alappuzha, Pathanamthitta, Kottayam and Idukki.

Duties of the Division office include effective coordination and supervision of these sub divisions which have such a vast area of operation in the field of quality maintenance of work under Irrigation Department. Apart from inspections conducted by the Quality Control section and Quality Control Sub Division Offices, random inspections in major and important work are also being conducted by the Division Office. Irregularities noticed are brought into the notice of the execution wing with clear direction to rectify the same

### **1. Irrigation Quality Control Sub Division, Thiruvananthapuram**

Irrigation Quality Control Sub division, Thiruvananthapuram Office is under the control of IDR Chief Engineer, and Headed by the Director, Kerala Engineering Research Institute, Peechi. Our Division office is at Kottarakkara. Entire Thiruvananthapuram District comes under the jurisdiction of this office. All Minor Irrigation, Major Irrigation, Inland Navigation works in Thiruvananthapuram and Kollam Districts are to be monitored by this office. As per the Department Quality Manual Second Tier Quality Tests are conducted by this section office on random basis. It includes site inspection, monitoring the method of construction as per norms, sample collections, testing and analysis the test result with Indian Standard Codes, and records it on test result register. Then inform the concerned execution wings to take necessary corrective measures if needed.

#### **1.1. Main Objects of Formation of Sub Division:**

The main objective of forming this sub division is to monitor and ensure the quality of works are executed under its jurisdiction as per the specification and standards. If any deviation from test result values as per manual were obtained can be informed and advised the remedial measures to the execution wing hence thereby rectification and modification of the structure can be done at an earlier stage.

#### **1.2 Present Functioning Activities and Achievements**

As per the department quality manual our office done the second tier quality tests on random basis. It includes site inspection, monitoring the work as per specifications and standards, Sample collection, Testing, Analysis the test result with relevant Indian standards and submit quality inspection report to higher offices.

Mainly Samples of M10 and above strength concrete works were taken for testing compressive strength of 28 days. During inspection brand and grade of cement used for the work and the physical appearance of other construction materials used for the work were noted and reported. After the site inspection the quality report in prescribed format will submit to higher office along with test results.

During the site inspection brand and grade of cement, physical appearance of all the materials used for the mix were noticed and tabulated in the report. Also the cross sectional details of the structure also verify with the agreed schedule and detailed estimate (T. S. recorded). Also taking photographs of site visited and kept as a record.

In connection with Modernization of Quality Control Lab in Thiruvananthapuram Technical Sanction for Rs.24.9 lakh was obtained for twelve numbers of works and of which 6 works were completed. One work is in tendering stage.

After setting up of new lab we can avoid the dependency of other agencies for testing Concrete Cube samples and other construction materials. It will also generate the source of income to our department.

The construction work of Quality control Lab at Kollam was completed and Lab opened on 16.01.2023 and Testing of concrete cube in new compression testing machine were started on 19.01.2023 this will help us to test the concrete cube collected during the site visit and it is tested in our lab test result reported to higher officers without delay. Also we are testing cube from external agencies and this generate revenue to our department.

### **1.3 Number of Inspections and Tests Conducted During this Period**

During the Financial Year 2022-2023, 167 Site Inspections were done and 154 cube samples were tested of which 142 passed and 12 failed. All test results details are reported to concerned execution division, sub division and section offices. And give instruction to take necessary corrective measures.

In Quality Control section lab Kollam, cube received by the contractor of the irrigation department which was taken by them as First tier quality control test were also tested by this Lab after remitting Treasury Chelan. Total No. of 7 cube were tested from outside and test Result and report were submitted the higher officers and also reported to the execution section and concerned contractor.

### 1.4 Pictures of test conducted on major and important works at Thiruvananthapuram



Boat jetty at the mouth of KadinakulamKayal  
(Inland Navigation Section No:2)



Cube and Cylinder samples



Setting up of Lab, Thiruvananthapuram: maintenance works-Flooring

### Quality Control Section, Kollam

#### Compression Testing Machine in new Lab at Kollam



Compression Testing Machine



Inauguration of Quality control Lab



Construction of Kallupalam – Inland Navigation Chavara



Construction of Kallupalam – Inland Navigation Chavara

## 2. Irrigation Quality Control Sub Division, Kottarakara

Quality Control Wing was formed in the Irrigation department in the year 1995. The Control wing is under the control of Chief Engineer Investigation Design & Research Board (IDRB) with headquarters at Thiruvananthapuram. Quality Control Section Office Kottarakkara is under the Quality Control Sub Division Kottarakkara. There is a Quality Control Lab attached with this section office. The jurisdiction of the section office includes area under Kallada Irrigation Project (KIP) which is distributed in Kollam, Pathanamthitta and Alappuzha districts.

### 2.1 Functional Activities

Quality Control process is the required inspection, testing and corrective measures during the construction structures. The main function of the Quality Control Section office is to monitor the works of Kallada Irrigation Project and to conduct second tier test for these works. Quality of concrete, construction materials such as cement, coarse & fine aggregates, reinforcement steel etc, and workmanship are being inspected during the quality check. Currently limited testing facilities are available in our Laboratory. This includes testing of compressive strength of concrete and sieve analysis of coarse and fine aggregates. The main works under KIP are to inspect canal lining works, construction of culvert, canal inspection roads, concreting of flume beds etc. For all the sites visited a detailed inspection report is done monthly from the section office.

Apart from KIP works, the testing of the concrete cube samples collected from the quality section offices Pathanamthitta and Kollam are also being carried out in this office. In addition to Irrigation Department works testing, testing from other Government departments and for public are also conducted here. Through the above said testing, a revenue of Rs. 1,00,563/- was generated in the financial year April 2022- March 2023.

## **2.2 Achievements for the year 2022-2023**

During the financial year 2022-23, out of the 48 Intimations received 75 inspections were conducted and 46 concrete cube samples were collected during site visits. 162 samples were collected from the Quality Control Section offices at Kollam and Pathanamthitta. The samples were tested and the results were intimated to the respective Assistant Engineers. 102 samples were obtained from Irrigation department, public and other govt. departments other than Irrigation Quality Control wing. The total revenue of Rs.1,00,563/- was generated by conducting tests for these samples collected.

In addition to this a stabilizer worth Rs.19,439/- for compression testing machine was purchased in the month September-2022 for smooth running of the lab. Also under the modernization of design wing process partition works, floor finishing for lab area and related works of Quality Control Lab, Kottarakkara was also completed for Rs.1,59,320/-

## **2.3 Aims for the year 2023-24**

To inspect all intimations that would be received from KIP offices during financial year 2023-2024. With CTM, Compression Strength of more concrete samples could be tested. Maximum revenue could also be generated by conducting compressive strength tests of samples collected from private agencies, other government departments and also from Irrigation department other than Quality Control wing. It is also planned to conduct a research study for a specific topic that enhances quality of structures. Through all these, a smooth running of the lab would be achieved.

## **3.Irrigation Quality Control Sub Division, Alappuzha**

Irrigation Quality Control Sub Division, Alappuzha was formed in 1995 with two section offices one at Alappuzha and the other at Pathanamthitta Districts. Irrigation Quality control Section Alappuzha conducts inspection of Irrigation works under Alappuzha district which includes Major, Minor, PIP and some works under Kuttanad Package. Irrigation Quality Control Section Pathanamthitta conducts inspection of irrigation works under Pathanamthitta district which includes works under Major Minor and PIP

Irrigation Quality Control Section, Alappuzha office functioned at Mini Civil Station Alappuzha which has a Mini lab in which sieve analysis of aggregates carried out Concrete cube samples are tested in Quality Control Lab in Thanneermukkom under inland Navigation and Kuttanad Package. Irrigation Quality Control Section, Pathanamthitta office situated on Pathanamthitta Civil Station compound. It has a lab in which sieve analysis of aggregate are carried out Concrete cube samples are tested in the lab of Quality Control Section, Kottarakara Water Samples are tested in Water Authority Lab in each districts.

Proposal for new lab under Irrigation Quality Control SubDivision, Alappuzha at Alappuzha is pending due to some issues related to the transfer of land from revenue department.

### **3.1 Activities**

Works carried out in the above offices in Alappuzha and Pathanamthitta district are inspected by the sections and collected samples of coarse aggregate fine aggregate, concrete and water.

Concrete cube samples (15 cm x15 cm x15cm) collected by Irrigation Quality Control Section Pathanamthitta are tested at Quality control lab at Kottarakkara and Quality Control Section Alappuzha are tested at Quality Control Lab Thanneermukkom underKuttanad Package

Results with criteria calculation sheet of the samples collected from the 43 section offices are tested and submitted to this office. They are verified in this office and submitted to Quality Control Division, Kottarakkara. Results not satisfied are intimated to the execution sub divisions and QC Division Kottarakara for necessary action.

### **3.2 Main Objectives**

Major irrigation works , Minor irrigation works and PIP works are inspected under this office LI Channel , main canal, Pump House protection work, Check Dam, Aqueduct, construction of boat jetty's ,construction of culvertand side protection of thodu are inspected included.Most of the works done by minor irrigation are side protection of thodu and construction of culvert.

Construction materials like broken stone,sand water and concrete samplesare collected from the site by the section offices. Site inspection report, test results of concrete samples, sieve analysis of course and fine aggregate and reslut of water tested at Water Authority Alappuzha and Thiruvalla labs are submitted to this office. The result are verified in this office and then submitted to Division Office. Sieve analysis is done using sieve of prescribed sizes for coarse aggregate and fine aggregate. Percentage passing of both fine aggregate and coarse aggregate

are calculated and their classification is done as whether coarse sand or medium sand or fine sand and the zone is also identified.

Colour of sand is also noted. The type of materials used including cement are also checked and direction given to use the required type of materials for the particular work. The types of machineries used are also checked and direction given to use the required type of machinery for the particular work. We ensure that vibrators are used for compaction if necessary in all work



Pipe section no.7 , Chengannur



Cube weighing machine

#### **4.Irrigation Quality Control Sub Division, Kottayam**

There are two sections under Quality Control Sub division. Kottayam section and Idukki section. The jurisdiction of the Subdivision covers Kottayam and Idukki districts. Quality monitoring of the Irrigation projects under major and minor irrigation divisions comes under this office.

##### **4.1 .Present Scenario**

###### **Kottayam subdivision**

Presently the staff pattern of the Sub division office consist of Assistant Executive Engineer, one no. of Head clerk,two no.of UD clerk, one no.of first grade draftsman,one no.of second

grade draftsman, one no. of office attendant, one no. of driver, one no. of typist, Currently one post of second grade draftsman is vacant at this office.

### **Kottayam section**

Presently the staff pattern of this office consist of Assistant Engineer, one no. of first grade overseer, two no. of third grade overseer. In addition to these staff two trainees were appointed for this year. Currently one post of third grade overseer is vacant at this office.

### **Idukki section**

Presently the staff pattern of this office consist of Assistant Engineer, one no. of first grade overseer, two no. of third grade overseer, one no. of lascar. In addition to these staff one no. of trainee was appointed for this year.

## **4.2 .Functional activities and achievements**

### **4.2.1 Getting land for Quality Control lab at Kottayam**

As per the order no: D10-5596/SE/ISC/2021 dtd 26/03/2022 of SE, Irrigation South Circle, sanction was given for using 0.086 hectare land in Sy no 194/1 at Kodimatha for the construction of Quality Control Laboratory. Actions taken from this office in this regard is listed below

- Prepared preliminary plan including the plot sketch
- The boundary demarcation survey report obtained from Thasildar Kottayam.
- Submitted detailed report to higher office regarding the green strip restriction in Kottayam master plan and limitation in planning the building at proposed site with green strip regulation.
- Submitted letter to Government for getting concession in green strip regulation.
- No further sanction is obtained in this regard.

### **4.2.2 Getting land for Quality Control lab at Idukki**

As per the order no.E4(D1)450/2021 dtd 30/3/22 of Executive Engineer, MVIP Division no.3, sanction was given for using 561m<sup>2</sup> land near ruffle club at back of MVIP cement godown for the construction of Quality Control Laboratory for Idukki. After that fund is

requested for construction of Quality Control Laboratory in action plan 2022-23. But financial sanction was not given for the same.

### **4. 3.Details of site visit**

#### **Kottayam section**

The quality monitoring of six sections under two subdivisions of Minor Irrigation Division and six sections under two subdivisions of Major Irrigation Division comes under this office. In addition to that, monitoring of works under MRVS, Hydrology etc. in Kottayam District also comes under this office. Site inspections and quality tests of these works are done through this office. Testing and report preparation is done as per the new and updated Indian standards. The main tests conducted through this office are compressive strength of concrete, sieve analysis of fine and coarse aggregates etc. In this financial year 60 sites were visited and samples were collected. Compressive strength tests of 9 works were failed during this year. Field tests such as slump test, bulking of fine aggregate, pH of water etc are tested whenever needed.

### **4. 4.Facilities made available at qc lab**

After the purchase according to action plan 2022-23, the QC labs under QC sub division Kottayam are equipped to do concrete mix design including self compacting concrete and also labs are ready to conduct the following tests on soils and construction materials.

#### **QC lab kottayam**

- a) Concrete mix design –  
Normal concrete and self compacting concrete
- b) Tests on soils
  - Grain size analysis of soils
  - Water content of soils
  - Water content-dry density relation using light compaction
  - Water content-dry density relation using heavy compaction
  - Liquid limit
  - Plastic limit
  - Specific gravity of soil
  - Field density using large sand pouring cylinder
  - Field density using large small pouring cylinder

c) Tests on cement

- Compressive strength of cement
- Consistency, setting time of cement
- Specific gravity and fineness of cement by dry sieving
- Soundness of cement by le chatlier method

d) Tests on aggregate

- Sieve analysis (fine & coarse aggregate)
- Specific gravity and water absorption
- Bulk density and voids of aggregates
- Bulking of fine aggregate (field method)
- Flakiness index/Elongation index test

e) Tests on concrete and bricks

- Compressive strength of concrete, bricks
- Slump test
- Rebound hammer test
- Water absorption of bricks
- Efflorescence of bricks

f) Tests on water

- PH test

QC lab idukki

a) Tests on soils

- Light compaction test
- Liquid limit
- Plastic limit
- Plastic size distribution
- Specific gravity of soil
- Field density test

b) Tests on cement

- Compressive strength of cement
- Consistency, setting time of cement

c) Tests on aggregate

- Elongation test

- Flakiness test
  - Bulk density of coarse aggregate
  - Sieve analysis
- d) Tests on concrete
- Compressive strength of concrete
  - Slump test

#### **4.5.Revenue Generated**

Details of revenue generated through testing in this financial year is tabulated as follows.

QC kottayam sectionlab

<b>Sl no</b>	<b>Month</b>	<b>Revenue</b>
1	2022 April	7554.00
2	2022 May	3852.00
3	2022 June	4815.00
4	2022 July	6643.00
5	2022 August	2889.00
6	2022 September	8517.00
7	2022 October	3852.00
8	2022 November	7704.00
9	2022 December	7704.00
10	2023 January	4815.00
11	2023 February	8367.00
12	2023 March	10593.00
	<b>TOTAL</b>	<b>77305.00</b>

<u>QC IDUKKI SECTION LAB</u>		
Sl.No.	Month	Revenue
1	April	1626
2	May	1136
3	June	813
4	July	1949
5	August	
6	September	
7	November	
8	December	
9	January	1926
10	February	2439
11	March	3252
	TOTAL	<b>13141.00</b>

#### **4.6. Trainings conducted**

In this financial year online training on PRICE 3 was conducted under KERI. All Technical staff in this office attended the training. Also Assistant Engineer, Kottayam has attended an offline training on PRICE 3 at Major Irrigation Division Office .

Also training on Government e Marketplace (GeM) was conducted on 27/01/2023 by KERI.

In addition to that staff in this office attended technical sessions on Slope stability measures with flexible solutions, Special concrete- from application perspective, Effective Project Management and Performance monitoring etc. conducted by KERI.

During this year internal technical sessions were conducted under Quality control Sub Division Kottayam in topics such as Concrete mix design, Soil behavior and types of foundations etc . All staff in this office attended the training program .

#### **4.7. Review meetings conducted**

Regular meetings were conducted under QC Subdivision for discussing the quality issues of various works on 30/03/22, 26/07/22 and 28/03/23. It is decided in the review meeting to bring to the notice of Execution Engineers about some commonly observed quality issues.

#### **4.8. Future plans**

1. Conducting frequent surprise visits for major works under the jurisdiction
2. Construction of new building for quality control laboratory at Kottayam and Idukki
3. Upliftment of testing facilities in the lab
4. Increasing revenue generation using available testing facilities.
5. Conducting internal training programmes.

#### 4.9 Photos of site inspections



Improving Irrigation Facilities to Oottupurapadasekharam in vakathanampanchayath



Improvements to seven boat jetties  
In vaikom consistency



Box culvert across kummadathodu at  
thannimattom in mulakulam panchayath



Drinking water project in ward no.1 of pallikkathodu panchayath



## 2. PERSONNEL

The Executive officers who headed the various offices under Quality Control Division, Kottarakara during the financial year 2022-2023

<b>QUALITY CONTROL DIVISION, KOTTARAKKARA</b>	
<b>EXECUTIVE ENGINEER</b>	: Er. Jolly Susan Cherian (01.04.2022 to 31/05/2022)
	: Er. Leenakumari P. S. (Full Addl. Charge from 31/05/2022 to 27/07/2022)
	: Er. Merin Thomas (Full Addl. Charge from 29/07/2022 to 02/11/2022 )
	: Er. Anjana. G.S (02/11/2022 to 31/03/2023)
<b>ASSISTANT EXECUTIVE ENGINEERS</b>	
QUALITY CONTROL SUB DIVISION, THIRUVANANTHAPURAM	: Er. Leenakumari P. S. (from 01/04/2022 to 31/03/2023)

QUALIYY CONTROL SUB DIVISION, KOTTATAKARA	:	Er. Laly.S.S (from 01/04/2022to 31/05/2022)
	:	Er. SheejaPanicker (Full Addl.Charge from 31/05/2022 to 16/01/2023)
	:	Er. Ajaya Kumar ( From 16/01/2023 to 31/03/2023)
QUALITY CONTROL SUB DIVISION, ALAPPUZHA	:	Er. Jessy Thomas ( from 01/04/2022 to 31/03/2023 )
QUALITY CONTROL SUB DIVISION, KOTTAYM	:	Er. Merin Thomas (from 01/04/2022to 31/03/2023 )
<b>ASSISTANT ENGINEERS</b>		
Q.C SECTION, THIRUVANANTHAPURAM	:	Er..Ambili.I (from 01/04/2022 to 31/03/2023)
Q.C SECTION, KOLLAM	:	Er..Bindhu.R ( From 01/04/2022 to /11/2022 )
	:	Er..Rajeena.M ( From 21/11/2022 to 31/03/2023 )
Q.C. SECTION , KOTTARKARA	:	Er. SheejaPanicker ( from 01/04/2022 to 28/02/2023)
	:	Er..Rajeena.M (Full Addl.Charge From 28/02/2023 to 29/03/2023 )
	:	Er..NehaYohannan ( From 29/03/2023 to 31/03/2023 )
Q.C SECTION, ALAPPUZHA	:	Er. Anjana S ( from 01/04/2022 to 31/03/2023 onwards)
Q.C SECTION, PATHANAMTHITTA	:	Er.Deepa B ( from 01/04/2022 to 31/03/2023 onwards)
Q.C SECTION, KOTTAYAM	:	Er. Jayadev.P.S (from 01/04/2022 to 31/03/2023)
Q.C SECTION, IDUKKI	:	Er. Jomy G Jose (from 01/04/2022 to 31/03/2023))

**Details of Intimation received, Quality Control Inspection conducted, sample collected and test details during the period 2022-2023**

Name of Office	Total nos of Agreement schedules received	Total Nos of actual intimation received	Total no of site inspections carried out	No of samples collected							Total no of tests conducted	Total No of tests not found satisfactory	Total no of outside tests conducted	Total Revenue earned from testing charges	Remarks
				Concrete	Steel	Cement	Coarse aggregate	Fine aggregate	other materials If any	Total samples collected					
Irrigation Quality Control Section, Thiruvananthapuram	32	40	77	60	0	0	0	0	0	60	60	5	0		
Irrigation Quality Control Section, Kollam	20	58	101	94	0	0	0	0	0	94	94	4	7	5612	Lab start on January 2022
Irrigation Quality Control Section, Kottarakara	23	48	75	310	0	0	71	73	3	457	457	69	267	100563	Total revenue earned from outside testing charge Rs.100563/-
Irrigation Quality Control Section, Alappuzha	83	83	59	59	0	0	59	59	46 (Water)	177	56	1	0		2022-23 period for 11 nos cube result not found satisfactory and reported to concerned execution sub division
Irrigation Quality Control Section, Pathanamthitta	36	36	94	94	0	0	94	94	94	282	128	10	0		
Irrigation Quality Control Section, Kottayam	8	61	60	60	1	3	55	55	0	174	174	64	68	77305	
Irrigation Quality Control Section, Idukki	49	47	47	47	0	0	47	47	0	141	141	61	14	13141	

Note: For concrete one sample means average of 3 nos of concrete cube specimen

## **K. IWR DIVISION PALAKKAD**

## **IWR DIVISION PALAKKAD**

The following are the activities carried out by IWR Division Palakkad during 2022 - 2023

### **1. PREPARATION OF PREFEASIBILITY REPORT ON SEETHAR KUNDU DIVERSION SCHEME**

#### **1.1 ABSTRACT**

The Chulliar dam is constructed across Chulliyar river, 2.4 km upstream of its confluence with Meenkara river. The waterspread area of Chulliar Reservoir is 165Ha and live Capacity is 13.70 Mm<sup>3</sup> at FRL 154.08m.

The project receives water from:

- 1) Direct rainfall from South West and North East Monsoon
- 2) The surplus water from Meenkara Reservoir (which is connected to Chulliyar reservoir by a link canal of length 4.2Km) and
- 3) Water from Palakappandy Diversion Scheme which was commissioned in 2016

Out of 35 years data available (from 1977 to 2021), the reservoir was filled to its maximum capacity only in 9 years. It is shocking to note that only 10% and 33% capacity of the reservoir was filled in the consecutive years of 2016 and 2017, even after the commissioning of Palakappandy diversion scheme. Palakappandy diversion scheme was also not successful as expected and it failed to meet the water requirement of Chulliyar reservoir. Hence, Seetharkundu diversion scheme is envisaged to utilize the water availability in the catchment of Seetharkundu river especially during the south west monsoon to augment the Chulliyar project.

#### **1.2 METHODOLOGY**

The Seetharkundu diversion scheme is proposed to convey water from Athikundu stream to Palakappandy weir through pipe lines. The proposed project has three major components namely weir, ductile iron pipe line and sedimentation tanks. The weir of height 2m, length 30m and top width 2m is proposed at Athikund to divert water from Seetharkundu catchment area. The pipe line of diameter 800mm is provided from Athikundu weir to Palakappandy canal for a distance of 3390m. The system is designed to convey a daily discharge of 0.04Mm<sup>3</sup>. The anticipated expenditure for the project is 8.9Cr.

#### **1.3 DISCUSSION**

1. From the time of commissioning of the Chulliyar dam, it was completely filled only in 9 years (from the available data).

2. The Palakappandy Diversion Scheme claimed to have an effective runoff of 22.08 Mm<sup>3</sup> from its catchment, whereas the maximum storage capacity of the Chulliyar dam is 13.7 Mm<sup>3</sup> only. But, even after the commissioning of this scheme in 2016, the dam is not completely filled till date (even in 2018).

3. Seetharkundu is an ungauged catchment, hence the rainfall data selected for Hydro meteorological studies is from rain gauge station in Manalaroo estate of nearby subcatchment in Bharathapuzha basin. This may not be a true representation of Seetharkundu catchment.

4. Though the 10 daily flow for the months June, July and August shows an yield of 12 Mm<sup>3</sup>, the 75% dependable flow for these months is only 1.4 Mm<sup>3</sup>.

5. Athikundu area has a very steep terrain, hence storage provided is very low. So the project is designed as Diversion Scheme. Hence the maximum utilization of the monsoon flow may not be feasible.

6. The daily designed discharge is 0.04 Mm<sup>3</sup>. The maximum water that could be conveyed during the months of June, July and August is only 3.68 Mm<sup>3</sup> (provided 0.04 Mm<sup>3</sup> is available daily)

7. Though the project is “need of the hour” for the farmers, BC ratio may not be justifiable (Rough estimated cost of the project is 8.9 crores)

8. The entire project falls in the forest area

The pre-feasibility report of Seetharkundu diversion scheme had been submitted on 02/02/2023 finally to Chief Engineer, IDR, TVM.

## **2. QUANTITATIVE AND QUALITATIVE ASSESSMENT OF SEDIMENT DEPOSITS IN RIVERS DRAINING INTO VEMBANAD LAKE**

Five rivers namely, Pamba, Meenachil, Manimala, Achancovil and Muvattupuzha enter the Vembanad lake before emptying into the Arabian sea. Among the five, Pamba, Meenachil and Manimala have a major role in causing flooding in Kuttanad region. 2018 flood in Pamba, four consecutive floods (2018 to 2021) in Manimala & Meenachil and 2021 land slide in Manimala have significantly reduced the carrying capacity of these rivers. Big rock pieces, boulders, debris and soil particles are deposited in the rivers. The river course has changed in some reaches. The bed level has gone up. Deltas are formed. The river has become more prone to flooding. People who live near the river and its tributaries indeed are deeply concerned about the decline in the river's water retention capacity. There is now acute shortage of water in summer. The mighty rain-fed river turns almost

completely dry in summer. Unless some serious and immediate efforts are taken, frequent floods and droughts will occur in these catchments, affecting lakhs of people who depend on these rivers.

Desilting is done to remove the fine silt and sediment that has accumulated in the river in order to restore its natural capacity, without widening or deepening of the river. Desiltation works have the potential to improve the hydraulic performance of a river and to reduce the chance of flooding.

Topographical survey by RTK method has been conducted in the critical locations, which were identified by the Executive Engineers in charge of these rivers. The quantity of the sediment deposit has been computed as follows:

Sl No.	Name of the river	Quantity in m <sup>3</sup>
1	Pamba	13,92,134
2	Meenachil	2,49,889
3	Manimala	1,67,092

Soil samples were collected from the critical locations in Pamba and Meenachil and tested the composition and gradation of the sample in the Soil laboratory of KERI, Peechi.

### **3. PREPARATION OF ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE DESILTATION OF ERIS IN CHITTOOR TALUK**

There are three Eris associated with the Chitturpuzha project viz. Kambalathara, Venkalakkayam and Kunnampidari. The Moolathara Regulator diverts the PAP water received from Manakkadavu weir to left bank, right bank and other river systems. The storage capacity of the regulator is only 0.5488 Mm<sup>3</sup>. Water diverted to Left Bank Canal system flows through a feeder canal (referred as High Level Canal) for about 7 Km to reach the Kambalathara Eri and gets stored. Kambalathara Eri is act as a balancing reservoir for the left bank canal system, having an ayacut area of 8210 Ha. This Eri has a storage capacity of 3.00 Mm<sup>3</sup> spread in an area of 81 Ha. Water stored in this Eri is released to Venkalakkayam Eri and to the Left Bank Canal system as per demand of ayacut. Water stored in Venkalakkayam Eri is used to cater the needs of ayacut of Thembaramadakku which accounts to 3221 ha. The storage capacity of Venkalakkayam Eri is about 3.08 Mm<sup>3</sup> and having a water spread area of 62 ha.

In due course, the Eris got silted up, thus reducing the capacity of the reservoirs. Proposal for desilting of the Eris is taken up by the Siruvani Project Circle Palakkad. The most important advantage of de-silting of reservoirs / Eris is that, it enhances the water holding capacity of the water bodies and thereby contributes to augmentation of water resource and ensures water security.

It enhances the life of the reservoir / Eri and avoids the requirement of storage enhancement methods such as increasing the dam height.

As directed by the Empowered Committee meeting held on 7/10/2021, Superintending Engineer, Siruvani Project Circle, Palakkad has requested KERI to prepare the Environmental Management Plan vide letter no D6-1277/2017/Eri's dated 7/10/2021.

Scope of the EMP

- Conducting Environmental Impact Assessment Study, which includes data collection of parameters related to air, water and noise environment, soil characteristics, aquatic life, flora and fauna, etc and prediction of probable impacts on the environment and ecology due to the entire desiltation, separation and transportation operations.
- Preparation of Environment Management Plan (EMP) based on the Comprehensive EIA study which includes the recommendations of mitigation measures to minimise the adverse impacts of pollution on environment and ecology due to entire desiltation, separation and transportation operations, disposal of separated material etc.

Objectives of the EIA Study

- Assessment of the existing status of air, water, land, biological, climatic, socioeconomic, health and cultural component of environment.
- Identification of potential impacts on various environmental components due to activities envisaged during the desilting operations

#### 4. RECTIFICATION OF ATTAPPILLY REGULATOR CUM BRIDGE

Attappilly Regulator Cum Bridge is constructed across Kurumali River linking Varandarappilly and Mattathur Gramapanchayaths of Pudukkad Constituency to store water for irrigation and drinking water purposes. The work is not completed in all respect yet. Meanwhile, the left bank approach road of Attappilly Bridge has subsided on 04.06.2021 and subsequently, the bridge was closed for traffic. A further subsidence occurred in the left bank on 25.06.2021.

With a view to improve the performance / life of the Attappilly Regulator cum Bridge structure, the following examinations are performed by Kerala Engineering Research Institute

Investigation/Test	Inferences
LoadTest (25.08.2021)	The bridge satisfies all the acceptance criteria as per the clause 6.8 of IRC SP  (i) Measured deflection (1.4mm) is less than the theoretical deflection (1.439mm) (ii) Crack width formed (0.10mm) is less than 0.30mm (normal/moderate exposure) and 0.20mm (severe conditions of exposure) (iii) Min. percentage recovery of deflection (84.62%) is more than codal provision of 75%.

Review of M. Books (25.10.2021 – 24.11.2021)	Assessed the present status of the construction based on the available MBs
Reconnaissance survey/Transit walk (19.08.2021, 17.01.2022)	There is a great demand for water - for agricultural, drinking and domestic purposes in the panchayaths surrounding the Attappilly RCB. Temporary bunds can be avoided for heading up the water if the RCB is made operational.
Soil Investigation (01.10.2021 to 03.11.2021)	The rock formation exhibits a downward slope from left to right at the weir portion. Downstream portion of the RCB also shows a variation in rock level, ie. -1.73 at the left side and -2.85 at the right.
Seismic Refraction Survey (12.11.2021)	The results of seismic refraction survey at Attappilly are somewhat matching with the bore-log chart
Soil Testing (05.11.2021)	From the grain size analysis, it is observed that 14 soil samples contains more than 50% of coarser particles
Concrete and Rock core Test (25.11.2021, 15.12.2021)	Extensive voids and honeycombing are observed in the concrete core samples collected from weir. But the tested core samples have compressive strength in the range of 21N/mm <sup>2</sup> to 28N/mm <sup>2</sup> . Core samples from left abutment have compressive strength in the range 23N/mm <sup>2</sup> to 27N/mm <sup>2</sup> . The compressive strength of rock samples from BH1, BH2, BH3, BH4 are in the range of 29 to 219 N/mm <sup>2</sup> and from BH5B, BH6, BH7 are in the range of 46 to 115 N/mm <sup>2</sup> .
Topographical Investigations (07.12.2021- 14.12.2021)	
Hydrological investigations (20.10.2021- 30.11.2021)	
Underwater investigations (20.12.2021, 23.01.2022)	Present condition of the structures under water is

Based on the investigation results, it is concluded that the bridge is safe for the serviceability criterion. The design for the approach road is submitted as an immediate solution and the rectification of the regulator as the permanent solution.

## **5. SUPPLY AND DEMONSTRATION OF SMART STATION FOR IWR DIVISION PALAKKAD**

Investigation for Water Resources (IWR) Division Palakkad is one of newly formed sub unit of KERI for conducting Investigation of various projects proposed in Irrigation department and to prepare Detailed Project Reports. For the feasibility study of any project, it is very essential to conduct an efficient and expeditious survey, for which sophisticated instruments like smart station

is inevitable. Hence an estimate was prepared for the procurement of a Smart station and supply and demo was completed on 17.03.2022.

Smart station proposed here is a combination of GNSS (a base and rover with GPS, GLONAS, BeiDOu, Galileo receivers), Disto Controller and a motorized Total Station. The purpose of the equipment is to determine the position of a point on the earth accurately and then to carry out the detailed survey of the area of interest. Integrated GSM/GPRS facility with 4G supporting module would enhance the scope of survey even in forest land. Disto Controller which has an inbuilt app for measuring the distance of inaccessible points upto 100m. Stakeout app which helps in locating a point with known coordinates on the ground will be of great help.

## **6. REJUVENATION OF MEENACHIL RIVER – PRELIMINARY REPORT**

As per GO (Rt) No.430/2022/WRD dated 20/05/2020 and mail dated 02/07/2022 of the Chief Engineer, Project II and Endt No.D1/KERI/General dated 4/7/2022 of Director, F&AS, KERI, Peechi, it is directed to conduct a study and prepare a report for the Rejuvenation of Meenachil River and this work has been assigned to this office.

### **1. INTRODUCTION**

The Southwest monsoon of 2018 resulted in disastrous floods in our state. These uninterrupted rains lashed most areas of the State from 8th to 18th of August 2018 and resulted in widespread destruction in all the major sectors of the state. The floods of Southwest season can be comprehended as an evident example of global climate change impact with very heavy rainfall in a short span of time.

In a span of thirty days in 2018, 339 human lives were lost, thousands of houses damaged, over a million and half people were moved to relief camps, large stretches of major roads got washed away and many bridges got damaged. Cochin International Airport which is one of the busiest International airports of the country got flooded and suspended its operations from 15th to 29th of August 2018.

Meenachil basin is not exceptional to annual floods during monsoon season. Since 2018, flooding in Meenachil river has been a frequent and common phenomenon. The river is one of the treacherous rivers in Kerala due to flash floods and heavy undercurrents. It can change from a stream to massive size river in a short span of high intense rainfall. As a consequence, the surrounding areas of this river, from Pala town till Kottayam Municipality and the Kuttanad region (Aimanam, Thiruvarp, Kumarakom, Arpookkara, Neendoor and Vechoor panchayaths and Kottayam municipalities) are adversely affected.

On site visit, certain facts had been noted. Meenachil river has several diverges (thodu in the downstream portion, through which a major portion of river water flows into the vembanadkayal. Almost all the thodu require desiltation activity especially at merging point and kayal portion. Cross sections of the river and all the branches are to be taken for calculating the gradient of the river and bank levels for flood assessment. It is seen that due to siltation along banks in the curved portion, the width of the rivers reduced. Exact study could be done after taking the cross sections.

## **2. MEENACHIL RIVER BASIN**

River Meenachil, a 78.4 km long river in Central Kerala (Kottayam district) has its origin in Western Ghats. The river flows through the heart of important towns like Erattupetta, Pala, Kidangoor, Ettumanur, Kottayam and drains into Vembanad lake before emptying itself into the Arabian Sea. Meenachil basin is 1243 sq. km in area and is surrounded by Muvattupuzha basin in North, Periyar basin in East, Manimala basin in South and Vembanad lake in the West. Geographically, the drainage basin of R. Meenachil lies between 9°25' N to 9°55' N latitude and 76°30' E to 77°00' E longitude. As per the land use data, the area under forest cover is scarce in Meenachil river basin, i.e., only 0.54 km<sup>2</sup>, which is about 0.05% of the total river basin.

The entire Meenachil river basin is confined to Kottayam district and encompasses a total of 11 Block Panchayats, 54 gramapanchayats (22 nos. in part) and 4 municipalities

### **2.1 TOPOGRAPHY**

The elevation of the basin varies from 1200 m above MSL to 2m below MSL. The broad landforms include high and medium hills and isolated hillocks at the upper region, narrow valleys, lateritic mounds and mid-land laterite at the middle region and swamps, marshes and reclaimed lands at the lower region of the watershed. The topography of the basin can be divided into three zones (1) High land - elevation varies from 1200m to 80m above MSL - (9.38%) with plantations like rubber, tea, coffee, etc. (2) Mid land - elevation varies from 79m to 40m above MSL - (34.80%) having gently rolling terrain with fertile soil where coconut, banana, tapioca, pepper, ginger, etc. are cultivated and (3) Low land - elevation varies from 39m above MSL to 2m below MSL - (55.80%) consisting of plain area & deltaic region affected by back-waters where rice is the main crop. The topographical map and the elevation map of the basin is given in figure 2 & 3 respectively. Owing to the steep slope in the upper reach of the river, flash floods are experienced during monsoon, which is untapped. Summer flow in the river is meager.

### **2.2 DRAINAGE NETWORK**

River Meenachil is considered to have around 38 tributaries both big and small. The river is formed by the confluence of nine major tributaries like:

- |                               |                    |
|-------------------------------|--------------------|
| 1. TeekoyAr                   | 2. Poonjar         |
| 3. Chittar                    | 4. Lalamthodu      |
| 5. Munnanithodu (Valiyathodu) | 6. Kattachirathodu |
| 7 Pannagomthodu               | 8. MeenantharaAr   |
| 9 KodoorAr                    |                    |

- Konipaduthodu from Melukavupanchayath and Kadappuzha from Moonnilavu and Thalanad panchayaths join at Randattumunni forming KalathukadavuAr, to which Thrikkovilar from Marmala in Theekoypanchayath joins at Cheripad forming the first tributary Teekoy ar.
- Streams from Kurisumala, Adivaram, Kaippally, Marmala, Mudukkara, Pathampuzha, etc. in Poonjar and PoonjarThekkekkara panchayaths join to form the second tributary Poonjar. TeekoyAr and Poonjar join at Erattupetta forming the Meenachil Ar.
- Chittar stream joins at Kondoer, 4 km downstream of Erattupetta after flowing through Chettuthodu, Kalaketty, Variyanikkadu, Chemmalamattam and Thidanad
- On its course, the river reaches Pala, 18km downstream of Erattupetta, where Lalamthodu which flows through Ramapuram, Kadanad, Karoor panchayaths and Pala Municipality, joins the main stream.
- Subsequently, other tributaries like Moonnanithodu (joins at Pala near Pastoral Institute), Kattachirathodu (joins at Kattachira, d/s of Kattachiracheckdam), Pannagamthodu (joins in the d/s of Kambanikkadavubridge), Puttuchira (joins at Peroor, u/s of Poovathumood bridge), etc. join to form the River Meenachil.
- A few kilometers upstream of Kottayam town, the river bifurcates at Choottuveli, one branch viz., the Neelimangalam branch flowing northwards and draining into Vembanad lake and the other branch, viz., the Nagampadam branch flowing westward and then southwards, draining into the Vembanad lake.
- Meenantharayar&Kodoorar join to Nagampadam branch at Nagampadam (near Darsana Academy) and Nattakom (d/s of Kottayam port) respectively. The river finally joins the Vembanad lake through a series of cross-crossing channels.

## 1. OBSERVATIONS

The following conclusions are made in this study:

1. Due to steep slope in the high land, the basin is prone to land slides and flash floods.
2. Since 2018, flooding occurs atleast once in an year. Teekoy, Moonnilavu, Poonjar, Erattupetta, Pala, Kottayam and Kuttanad are flooded frequently.

3. The average rainfall for the high land, midland and lowland is calculated as 4084.60mm, 3113.90mm and 2605.40mm respectively. At Teekoy (high land), there is a phenomenal increase in rainfall over the years, at an alarming rate of 103 mm/year.
4. Upstream reach of the basin experiences droughts due to non-flow in the river
5. Number of structures across the river (bridges, checkdams, regulators etc.) is increasing (Appendix D).
6. Operation of TSW and TMB are not efficient in flood mitigation
7. Small streams in the Kuttanad region are silted up.

## **2. WAY FORWARD**

Following studies are inevitable for the flood management of Meenachil river:

1. Analysis of Discharge Vs. Drainage Capacity of the streams
2. Identification of critical sections
3. Conducting topographical survey for flood zone mapping
4. Conducting Bathymetry survey for plotting the gradient of the river
5. Study of the kayal area for increasing the discharging capacity at outlets
6. Study on the possibility of widening and deepening of streams in Kuttanad for accommodating flood water
7. Revenue survey report for fixing the extent of river
8. Study on construction of embankments as flood banks in urban areas to prevent flooding
9. Modification of existing structures in the stream for reducing the impact of flood
10. Study for increasing the efficiency of Thottappally spillway and Thanneermukkom barrage in discharging the flood water
11. Study on the possibility of a flood control dam in Meenachil river basin

## **7. JALJEEVAN MISSION – Water supply scheme to Anangadi, Thrikkadeeri, ChalavaraPanchayat – Investigation works for proposed weir across Thoothapuzha in Cherpulassery Municipality**

The existing Rural water supply scheme to Cherpulassery run by KWA is insufficient and cannot meet the increased demand of Anangadi, Thrikkadeeri, ChalavaraPanchayats and is of very poor performance. There is an infiltration gallery system and intake well at Kalikkadavu near Karalmanna is the source for the present scheme. The coverage by the existing piped water supply scheme is not covering full area and supply rate is below 40 lpcd. Hence it is proposed to construct a weir across Thoothapuzha in Cherpulassery Municipality in order to increase the capacity of existing water supply scheme. The coordinates of the proposed weir site are 10.911382, 76.304561.

## Topographical Survey

The topographical investigation survey includes taking the cross-sectional details of the river and bank at the proposed location as well as upstream and downstream of the same at particular intervals as per design requirements. For this work survey has been conducted on river and bank for cross sections at 15m interval for a length of 60m in upstream and downstream, at 50m interval for a length of 500m in upstream, 100m interval for the remaining portion of upstream and downstream length. A contour map at an interval of 1m has also been prepared. Layout Plan, Contour Plan, Colour Contour Plan, Cross sections and longitudinal sections have been plotted.

## Survey Highlights

- GTS Bench Mark at Kuttippuram was considered as the reference benchmark. This level was transferred to a location (645640.8197m E and 1205708.13m N) near MannathiKadavu Bridge. The reduced level of this location was +36.02m with respect to MSL.
- Survey has been conducted in Thoothapuzha River and bank for cross sections at particular intervals (at 15m interval for a length of 60 min u/s and d/s, 50 m interval for next 500 m, 100 m interval for a total of 5.765 km including d/s 1km).
- River bank has also been surveyed for ascertaining enough bank height for water storage.
- Layout Plan, Cross sections, longitudinal section, contour maps at 1m interval and colour contour plan have been prepared as per design requirement.
- The longitudinal section was plotted by connecting the lowest points in each cross section.
- Roads and other permanent structures have been plotted.
- The river bed level varies from 24.12 to 24.52m at proposed site.
- The maximum ground level at Left bank of the proposed site is above +32.00m and that at the Right bank is above +27.00m.

## Soil Investigation

The report was prepared based on letter No. KWA/WSP/PKD/JJM-Chalavara/2021 dated 01/06/2022 received from Executive Engineer, WS Project Division Kalmandapam, Palakkad for carrying out Soil Investigation for the proposed weir across Thoothapuzha in Cherpulassery Municipality in Palakkad District. The report presents the geotechnical characterization of the ground based on field and lab tests at bore hole locations of the proposed construction. Total width of the river at proposed location is 90 m. Seven borehole were drilled along the proposed check dam (BH 1, BH 2, BH 3, BH 4, BH 5, BH 6 & BH 7). Two boreholes were excavated for retaining wall on upstream portion (BH 1A & BH 7A) on the right bank and on the left bank. Another two

boreholes were excavated for retaining wall on downstream portion (BH 1B & BH 7B) on the right bank and on the left bank.

After completion of the field work, samples were transported to soil mechanics lab for the testing. Bore hole log and drawings, Drawings with location of bore holes, test results of soil samples provided by soil mechanics laboratory and test report on compressive strength of rock samples provided by CM Lab are included.

### **8. JALJEEVAN MISSION – Combined Water supply scheme to Mundakkayam and KoruthoduGramapanchayat – Site Investigation for Proposed Check Dam across Manimala river at Moorikkayam.**

The Combined Water Supply Scheme to Mundakkayam and KoruthoduGramapanchayaths under JJM is proposed for catering 19000 households in Mundakkayam and KoruthoduGramapanchayath. The production components of the above are providing a 9MLD Water Treatment Plant at Amaravathi in MundakkayamPanchayath and intake arrangements at Moorikkayam in Manimala River. As the lagoon at Moorikkayam is at shallow depth and lesser storage capacity as per soundings taken in 2017 for project DER, a Weir across Manimala River is required to ensure source adequacy.

Topographical and Soil investigation for the Proposed Check Dam across Manimala river at Moorikkayam at ValiyaVellanadi Estate, MundakayamGramapanchayath in Kottayam District was taken up by this division as per the letter No. PDK/DB/229/2021-22 dated 09/06/2022 received from Executive Engineer, Project Division, Kerala Water Authority, Kottayam. Detailed estimate was submitted to Assistant Executive Engineer, IWR Sub division No 1, Palakkad vide letter no IWRS/PKD/01/2022 dated 19/10/2022. Consequently vide letter no PDK/AB2-411/2021/JJM dated 22/12/2022, Executive Engineer, Project Division, Kerala Water Authority, Kottayam has informed that the estimate amount has been deposited to the Director's Account No 40907522442 on 21.12.2022. Further Technical Sanction have been accorded by the Assistant Executive Engineer, IWR Subdivision No 1, Palakkad vide TS Order No. IDPKD/2022/2/IWR/IDRB Dated 05/01/2023.

As per the above-mentioned letter, the soil investigation works such as boring, collection and testing of soil samples were conducted by IWR Division, Palakkad for the proposed work. The investigation was carried out between 10<sup>th</sup> February and 5<sup>th</sup> March of 2023. Twelve bore holes were drilled for proposed site using a rotary calyx-type drilling machine. Boring was conducted up to hard rock level and extends to a greater depth for rock core recovery.

## 2. OBJECTIVES

This study includes geo-technical and lab investigations for construction of Weir at the proposed site. Objective of this report are given below.

- To collect the factual information during the period of investigation along with laboratory tests to assess engineering as well as index properties of the soil at site.
- Conducting standard penetration tests at every required interval/ collection of UDS samples at required depth upto termination depth or till rock coring.
- Collecting core samples using core barrels when met with refusal /rock strata
- Conducting laboratory tests on core rock samples procured from the site to determine the compressive strength of the rock cores received.

## 3. DESCRIPTION OF SITE

The site is situated in ValiyaVellanadi Estate at downstream of Manimala River at Moorikkayam in Mundakayam Grama Panchayath of Kottayam district. The proposed site is located at a distance of about 10 km from Mundakayam town and was selected by the KWA authorities. The locations of bore holes is identified by combined site visit of officers of this Division and KWA.

## 4. PURPOSE AND SCOPE OF WORK

The purpose of the present investigation is to evaluate the subsurface condition at various locations of the site and to conduct the laboratory tests on disturbed and undisturbed soil samples and core rock samples collected from the site to determine geotechnical characteristics of the site. Scope of the work includes exploring subsurface conditions by advancing, sampling and logging in exploratory bore holes from the ground level.

**The scope of work for the geotechnical investigation campaign are listed as follows:**

- Mobilization of the boring rig with all necessary equipment and skilled/unskilled personals for the fieldwork.
- Boring 12 boreholes of diameter 75 mm, with drilling equipment's in all types of soil till the Standard Penetration Test showing rebound or with coring of rock samples.
- Conducting Standard Penetration Test (SPT) at every required interval until rock coring
- Collecting disturbed/undisturbed samples from different strata.
- Transferring of collected disturbed samples into airtight polythene bags with proper labeling and transporting to the laboratory.
- The undisturbed soil collected by sampler tube is detached from pipes and its ends are sealed with molten wax before transportation.

- Description of site investigation techniques
- Preparation of Borehole logs and description of soil type
- Conducting the laboratory tests on the samples collected as per relevant Indian Standards and furnishing the results.
- Preparation and submission of the report with field and laboratory results.

## **5.GEOTECHNICAL INVESTIGATION**

The Calyx rotary drilling boring plant and related accessories owned by Instrumentation division were mobilized from Kerala Engineering Research Institute, Peechi to the site on 10<sup>th</sup> February 2023. The field investigation work at this site was carried out from 13<sup>th</sup> February 2023 to 4<sup>th</sup> March 2023. Initially 11 bore holes were proposed for soil instigation: three on the stream portion along the central line (BH 2, BH 3 and BH 4), two for aprons (BH 4A and BH 4B), two for abutments (BH 1 and BH 5) and four for retaining walls on both banks at upstream and downstream (BH 1A, BH 1B, BH 5A and BH 5B). BH 1A has been discarded due to the occurrence of water loss during drilling and an additional bore hole BH 1A' was drilled on upstream of BH 1A at a distance of 3.84 m. Therefore twelve number of boreholes were drilled for this investigation.

## **9. Topographical Survey for Development of River Basin Management Plan on Downstream of Bharathapuzha River**

Bharathapuzha also known as the Nila or Ponnani River, is a river in India in the state of Kerala. With a length of 209 km, it is the second longest river that flows through Kerala after the Periyar. It originates from the Anamalai Hills in the Western Ghats, flows west through the Palakkad gap and drains into the Arabian Sea at Ponnani. River Bharathapuzha is an interstate river and major water source for three districts in Kerala, namely Malappuram, Thrissur and Palakkad. The catchment is dominated by agricultural and forest lands. The river has many tributaries in which Kannadipuzha, Kalpathipuzha, Gayathripuzha and Thuthapuzha are the major ones.

The investigation survey includes taking the cross-sectional details of the river and bank at the proposed location at downstream of Bharathapuzha at some particular intervals as per design requirements. For this work survey has been conducted in river and bank for listed cross sections specified by IIT Palakkad.

### **Survey Highlights**

- GTS Bench Mark at (CWC Kumbidi) Kuttippuram was considered as the reference bench mark. The location is 613857.28 m E and 1198713.23 m N. The reduced level of the benchmark is +11.55 m with respect to MSL.
- Survey has been conducted in the Bharathapuzha River and bank for cross sections at specified location listed by IIT Palakkad.
- The longitudinal section was plotted by connecting the lowest points in each cross section.
- Roads and other permanent structures have been plotted.

## 5. FINANCE

In the budget for the financial year 2022-23 an outlay of Rs. 100 Lakh (Rupees Hundred lakhs only) had been allotted under the Head of Account '4701-80-800-99-00-34-03 Development of KERI Stage II'. The proposal for the amount was grouped under three heads viz., Routine activities, modernization and revamping. The details of sanctioned amount and expenditure are given below. From the routine works carried out in the laboratories an amount of Rs. 29,64,791/- (Rupees twenty nine lakh sixty four thousand seven hundred and ninety one rupees only) has been collected as test charges and the amount was remitted in the treasury.

### Details of sanctioned Amount and Expenditure

Sl. No.	Divisions	A.S. Amount
<b>I</b>	<b>Joint Director, C.M. &amp;F.E., KERI, Peechi.</b>	
1	Construction Materials Division	12.80 lakhs
2	Soil Mechanics and Foundations Division	15.65 lakhs
3	Instrumentation Division	16.00 lakhs
	<b>Total amount received</b>	<b>44.45 lakhs</b>
	Expenditure	34.99267 lakhs
	Q bill Amount (Pending@ treasury 22-23)	8.99055 Lakhs
	<b>Total Expenditure</b>	<b>34.99267 lakhs</b>
<b>II</b>	<b>Joint Director, Hydraulic Research, KERI, Peechi.</b>	
1	Coastal Engineering Division	20.99 lakhs
2	Hydraulics Division	18.00 lakhs
3	Sedimentation Division	16.56 lakhs
	<b>Total amount received</b>	<b>55.55 lakhs</b>
	Expenditure	30.287 lakhs
	Q bill Amount (Pending@ treasury 22-23)	22.60949Lakhs
	<b>Total Expenditure</b>	<b>65.28002 lakhs</b>

Details of Expenditure statement for the year 2022 – 23 had been allotted under the Various **Head of Account** are given below.

Sl. No.	Head of Account	Division	A.S Amount	Expenditure
<b>I</b>	<b>Joint Director, C.M. &amp;F.E., KERI, Peechi</b>			
1	Head of Account: 4700-80-005-99-02-00-Investigation of Major Irrigation Schemes (Plan Scheme)	Instrumentation Division	13.30 Lakhs	3.29 Lakhs
2	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)	Soil Mechanics and Foundations Division	13.19 Lakhs	10.64 Lakhs
		Construction Materials Division	12.00 Lakhs	0.00 Lakhs
		Instrumentation Division	5.00 Lakhs	4.75 Lakhs
<b>Total Amount</b>			<b>30.19 Lakhs</b>	<b>15.39 Lakhs</b>
3	Head of Account: 4701-80-800-99-00-34-03 Development of KERI stage II	Instrumentation Division	16.00 Lakhs	12.986 Lakhs
		Soil Mechanics and Foundations Division	15.65 Lakhs	15.31 Lakhs
		Construction Materials Division	12.80 Lakhs	6.693 Lakhs
Q bill Amount (Expenditure)			8.99055 Lakhs	
<b>Total Amount</b>			<b>44.45 Lakhs</b>	<b>34.989 Lakhs</b>
<b>II</b>	<b>Joint Director, Hydraulic Research, KERI, Peechi.</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)	Coastal Engineering Division	3.00 Lakhs	0.1344 Lakhs
2	Head of Account:4701-80-800-88-00-00 Formation of River Basin Organization	Hydraulics Division	18.8 Lakhs	11.197 Lakhs
3	Head of Account: 4701-80-800-99-00-34-03 Development of KERI stage II	Coastal Engineering Division (Subdivision)	20.99 Lakhs	16.88 Lakhs

		Office)		
		Sedimentation Division	16.56 Lakhs	6.75 Lakhs
		Hydraulics Division (Subdivision Office)	18.00 Lakhs	6.65 Lakhs
		<b>Total Amount</b>	<b>55.55 Lakhs</b>	<b>30.28 Lakhs</b>
<b>III</b>	<b>Joint Director, CEFS</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		18.72 Lakhs	2.8422 Lakhs
2	Head of Account: 4701-80-800-88-00-00 Formation of River Basin Organization	Coastal Engineering Subdivision, Kollam	20.185 Lakhs	8.631 Lakhs
		Coastal Engineering Subdivision, Ernakulam	17.253 Lakhs	6.596 Lakhs
		Coastal Erosion Studies Subdivision, Kozhikode	23.69 Lakhs	5.042 Lakhs
		<b>Total Amount</b>	<b>61.128 Lakhs</b>	<b>20.269 Lakhs</b>
<b>IV</b>	<b>IWR Division, Palakkad</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		5.67 Lakhs	1.0191 Lakhs
2	Head of Account: 4700-80-005-99-02-00-Investigation of Major Irrigation Schemes (Plan Scheme)		15.31 Lakhs	0.00 Lakhs
<b>V</b>	<b>Quality Control Division,</b>			

	<b>Kottarakkara</b>			
<b>1</b>	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		49.54 Lakhs	12.69 Lakhs
<b>VI</b>	<b>Quality Control Division, Thrissur</b>			
<b>1</b>	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		42.88 Lakhs	5.63 Lakhs
<b>SPILL OVER 2022-23</b>				
<b>I</b>	<b>Joint Director, Hydraulic Research, KERI, Peechi.</b>			
<b>1</b>	Head of Account: 4701-80-800-88-00-00 Formation of River Basin Organization	Sedimentation Division	10.00 Lakhs	8.486 Lakhs
		Coastal Division	33.00 Lakhs	4.965 Lakhs
<b>2</b>	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)	Sedimentation Division	0.50 Lakhs	0.00 Lakhs
<b>3</b>	Head of Account: 4700-80-005-99-02-00-Investigation of Major Irrigation Schemes (Plan Scheme)	Coastal Engineering Division	2.00 Lakhs	0.9419 Lakhs
		Sedimentation Division	4.65 Lakhs	4.3835 Lakhs
		<b>Total Amount</b>	<b>50.15 Lakhs</b>	<b>18.7764 Lakhs</b>
<b>II</b>	<b>Joint Director, CM &amp; FE ,KERI, Peechi.</b>			
<b>1</b>	Head of Account: 4700-80-005-99-02-00-Investigation of Major Irrigation Schemes (Plan Scheme)	Instrumentation Division	4.82 Lakhs	2.53538 Lakhs
		Construction Materials Division	2.00 Lakhs	1.01693 Lakhs
<b>III</b>	<b>Joint Director, CEFS</b>			

1	Head of Account: 4701-80-800-88-00-00 Formation of River Basin Organization	Coastal Erosion Studies Subdivision, Kozhikode	3.79 Lakhs	1.2979 Lakhs
<b>IV</b>	<b>IWR Division, Palakkad</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		0.371 Lakhs	0.0972 Lakhs
2	Head of Account: 4700-80-005-99-02-00-Investigation of Major Irrigation Schemes (Plan Scheme)	IWR Subdvn Thrissur	14.70 Lakhs	10.832 Lakhs
		IWR Subdvn No.1 Palakkad	34.00 Lakhs	21.124 Lakhs
<b>V</b>	<b>Quality Control Division, Kottarakkara</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		23.28 Lakhs	16.783 Lakhs
<b>VI</b>	<b>Quality Control Division, Thrissur</b>			
1	Head of Account: 2701-80-005-93-00-00-PV Modernization of design wing (Plan Scheme)		15.83 Lakhs	11.191 Lakhs

## 6. SUMMARY

In the annual report for the current financial year a general introduction about the institute, organization set up, division wise functioning of the institute, implementation of modernization scheme and details regarding budget allotment and expenditure have been explained in detail.

The bottlenecks or hindrance in the development of the institute as a full fledged research organization are:

- Difficulties in adapting Price-3 in case of departmental execution work, purchase of the equipments, hiring of vehicles, tendering of works etc...
- KERI is executing works departmentally. Treasury Regulations in sanctioning work advance affecting the taking up of more investigations.
- The process of approving lowest tender system for purchasing equipments and machineries sometimes cause purchase of poor quality of equipments.
- National level suppliers are not willing to participate in Government tenders due to the procedures associated with Govt Tenders such as security Deposit from Treasury Savings Account/stamp paper from Kerala etc.
- Qualified and experienced personnel are required in every technical posts and also skilled workers like Lab assistants, Electrician etc.
- The continuous transfer and posting of staffs affecting the performance of the institution. Major Key posts remains vacant for several months.
- Lack of research activities due to lack of guidance from experts.
- Procedural challenges faced in collaborating with other leading academic institutions & industry experts for addressing solutions to various problems faced by the department.

All these require intervention from the part of the Government and it is hoped that the upgradation of the personnel of the institute will be taken up as a continuation of the modernization scheme.

**APPENDIX – I****VACANCY DETAILS OF TECHNICAL STAFF FOR THE MONTH OF MARCH 2023****Fundamental and Applied Research ,KERI,Peechi**

SL NO	NAME OF POST	SANCTIONED STRENGTH	EXISTING STRENGTH	NO POSTS VACANT	PLACE OF VACANCY IN DETAIL
1	Director	1	1	0	
2	Exe. Engineers /Joint Directors	6	5	1	IWR Dvn PKD
3	ASST. Ex.Engineer / Deputy Directors	20	19	1	QC Sub Division Muvattupuzha
4	Asst.Engineer /Asst. Director	45	40	5	1. IWR Section 3/1 Agali 2. QC Section Palakkd 3.CES Sn Kozhikode 4. CES Sn Parappanangadi 5. CM Division Peechi
5	Research Asst./ 1st Grade D man	50	43	7	1,Publication Wing,KERI,Peechi 2. DD:Coastal Eng.Division,KERI,Peechi, 3. DD:Hydraulics Division,KERI,Peechi 4, I W R,Division,P K D-2Nos QC Sub Division Muvattupuzha

6	2nd Grade D'man	46	30	16	1,Director,F& AR ,KERI,Peechi 2,JD:CM & FE,KERI,Peechi 3,DD:Sedimentation Division,KERI,Peechi, 4, DD:Coastal Eng.Division,KERI,Peechi, 5,DD:Hydraulics Division,KERI,Peechi 6, I W R,Division,P K D-1Nos 7,QC Section Palakkd 8,QC Division Thrissur 9,QC SctionNo1Muvattupuzha 10,QC,Section,Thrissur 11,CE;section,E K M 12,CE;section,Chavakkad 13,CE;section,Chavakkad 14,CE;section,T V M 15,CE;section,Kozhikod 16,,CE;section,Thalassery
7	3rd Grade Overseer	37	31	6	1,IWR,Section 1/1.P K D-2Nos 2,IWR,Section 3/1.Agaly-2 Nos 3,QC;Sn,No:1Muvattupuzha 4,QC:Subdivision,Kannur 5,QC;Sec,Kottayam
8	Tracer	1	0	1	I W R,Division,P K D
9	Tracer cum III Grade Overseer	1	1	0	
10	Scientific Assistant	2	0	2	1.DD:SM&Fdivision, KERI, peechi 2.DD:Hydraulics Division,KERI,Peechi ,
11	Blue Printer	3	1	2	1.Jd:Hydraulic Research,KERI,Peechi 2.I W R,Division,P K D
12	Information Asst.	1	0	1	1. Publication Wing,KERI,Pechi

**APPENDIX – II**

An abstract of the Weather data collected from Automatic Weather Station for the period from April 2022 to March 2023 is given below.

STATION: K.E.R.I, PEECHI

Latitude- 10° 31' 30" N Longitude- 76° 21'59" E MSL- +96.03 M.

Sl.No	Weather Elements	Range of the Weather Data
1.	Temperature	The maximum temperature was 38.1°C in March,2022 and the minimum temperature was 19°C in November 2022 and February 2023
2.	Relative Humidity	Maximum relative humidity recorded was 100% in April,July and August 2022 and minimum relative humidity was 73.% on April, August and September 2022
3.	Precipitation	Annual rainfall was 2672.18 mm and the maximum monthly rainfall was 703.50 mm in July 2022 and minimum monthly rainfall 6 mm in December 2022
4.	Wind-Direction	The main wind directions observed were from South East and South West directions.
5.	Wind Speed	Maximum daily mean wind speed was 7.78 km/hr in December, 2023 and minimum daily mean wind speed was 0.08 km/hr in April, 2022.
6.	Evaporation	Maximum Evaporation was 7.4 mm in March 2023 and minimum of 0.1 mm in July, August and September 2022.
7.	Sunshine Recorder	The maximum duration of bright sunshine was 10.00 Hours in January, 2023

**Abstract of the weather data from April, 2022 to March, 2023 station KERI Peechi**

**APPENDIX-III****List of Tests conducted during the financial year 2022-23**

<b>SL. No</b>	<b>Report No</b>	<b>Details of Client</b>	<b>Test Name</b>
1	CM 01/22-23	Assistant Engineer, Peechi Project Section, Mannamangalam	Compressive strength test on Concrete Core
2	CM 02/22-23	The Project Engineer-9, RCB Moothikayam, KIIDC, Trivandrum- M/s Paulose George Construction Company	Steel Test
3	CM 03/22-23	The Project Engineer-9, RCB Moothikayam, KIIDC, Trivandrum- M/s Paulose George Construction Company	Pile Integrity Test
4	CM 04/22-23	Planning Head, Thrissur District Labour Contract Co-operative Society Ltd	Test on fine aggregates
5	CM 05/22-23	Planning Head, Thrissur District Labour Contract Co-operative Society Ltd	Test on coarse aggregates
6	CM 06/22-23	Planning Head, Thrissur District Labour Contract Co-operative Society Ltd	Compressive strength & water absorption test on Paver Blocks
7	CM 07/22-23	Assistant Engineer, Peechi Project Section, Mannamangalam	Compressive strength test on Concrete Core
8	CM 08/22-23	Assistant Engineer, Peechi Project Section, Mannamangalam	Compressive strength test on Concrete Core
9	CM 09/22-23	Assistant Engineer, Peechi Project Section, Mannamangalam	Compressive strength test on Concrete Core
10	CM 10/22-23	Assistant Engineer, MI Section, Moolamattom, Thodupuzha	Mix Design
11	CM 11/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Core
12	CM 12/22-23	Assistant Engineer, PWD Special Building Section, MGKavu	Compressive strength test on Concrete Core
13	CM 13/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Compressive strength test on Concrete Cubes

14	CM 14/22-23	Olivia Projects. Poonkunnam, Thrissur	Compressive strength test on Concrete Cubes
15	CM 15/22-23	Nabeel Ali, Site Engineer, PMR Constructions	Compressive strength test on Concrete Core
16	CM 16/22-23	Chief Engineer, Project II, Special Enquiry Cell, Thiruvananthapuram	UPV & Rebound Hammer Test
17	CM 17/22-23	DGM(Engg), NBCC (India) Limited	Cement Test
18	CM 18/22-23	DGM(Engg), NBCC (India) Limited	Tests on Fine Aggregates
19	CM 19/22-23	DGM(Engg), NBCC (India) Limited	Tests on Granite
20	CM 20/22-23	DGM(Engg), NBCC (India) Limited	Tests on Structural Steel
21	CM 21/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Compressive strength test on Concrete Core
22	CM 22/22-23	Project Engineer, KLDC Ltd, Kayamkulam	Pile Integrity Test
23	CM 23/22-23	Registrar, KFRI, Peechi	Compressive strength test on Concrete Cubes
24	CM 24/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Core
25	CM 25/22-23	Proprietor, KMP Consultants, Civil Engineering & Professional Contractors	MIX DESIGN
26	CM 26/22-23	Assistant Engineer, PWD Building Section, Chavakad	Compressive strength test on Concrete Cubes
27	CM 27/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Cubes
28	CM 28/22-23	Nirmithi Kendra Thrissur	Compressive strength test on Concrete Core
29	CM 29/22-23	Assistant Engineer, Irrigation Sub Division, Ponnani	Mix Design
30	CM 30/22-23	Assistant Engineer, Irrigation Sub Division, Ponnani	Mix Design
31	CM 31/22-23	Assistant Engineer, Irrigation Sub Division, Ponnani	Mix Design

32	CM 32/22-23	Assistant Engineer, Irrigation Sub Division, Ponnani	Steel Test
33	CM 33/22-23	Registrar-KSCSTE ,KFRI,Peechi	Compressive strength test on Concrete Cubes
34	CM 34/22-23	Project Engineer-18,KIIDC.Thrissur	Test on Coarse and Fine aggregate
35	CM 35/22-23	Project Engineer-18,KIIDC.Thrissur	Test on Cement
36	CM 36/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Compressive strength test on Concrete Core
37	CM 37/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Compressive strength test on Concrete Core
38	CM 38/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Compressive strength test on Concrete Core
39	CM 39/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Core
40	CM 40/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Cement Test
41	CM 41/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Cement Test
42	CM 42/22-23	Deputy Director, Instrumentation Division, KERI,Peechi	Compressive strength test on Rock Core
43	CM 43/22-23	Registrar-KSCSTE ,KFRI, Peechi	Compressive strength test on Concrete Cubes
44	CM 44/22-23	Deputy Director,Instrumentation Division,KERI,Peechi	Compressive strength test on Rock Core
45	CM 45/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Cubes
46	CM 46/22-23	Deputy Director,Instrumentation Division,KERI,Peechi	Compressive strength test on Rock Core
47	CM 47/22-23	Senior Section Engineer, Southern Railway, Thrissur	Mix Design

48	CM 48/22-23	Assistant Engineer i/c, Transmission Construction Section, 400kv substation, KSEBL, Madakathara	Tension test of AAAC Conductor
49	CM 49/22-23	Assistant Engineer I, PPZ, CPWD, Palakkad	Tests on Heat Resistant Tiles
50	CM 50/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Cubes
51	CM 51/22-23	Supervisor-QC, RDC Concrete India Pvt. Ltd, Mundoor, Thrissur	Compressive strength test on Concrete Cubes
52	CM 52/22-23	Range Forest Officer, Thundathil Range, Bhoothathankett P.O, Kothamangalam	Dimension of GI Pipes & Tension spring Strength
53	CM 53/22-23	Senior Section Engineer, Southern Railway, Thrissur	Mix Design
54	CM 54/22-23	Senior Section Engineer, Southern Railway, Thrissur	Mix Design
55	CM 55/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Compressive strength test on Concrete Cubes
56	CM 56/22-23	Aneesh T.S, TTK Centre, Talikulam	Compressive strength test on Concrete Cubes
57	CM 57/22-23	Range Forest Officer, Kalady Range, Neeleshwaram P.O, Kalady	Dimension of GI Pipes & Tension spring Strength
58	CM 58/22-23	Assistant Engineer, Irrigation Section Malapuram	Cement Test
59	CM 59/22-23	Assistant Engineer, PWD Building Section, Irinjalakuda	Compressive strength test on Concrete Solid Blocks
60	CM 60/22-23	Assistant Engineer, PWD Building Section, Irinjalakuda	Test on Steel bars
61	CM 61/22-23	Assistant Engineer, Irrigation Section No.2, Ponnani	Mix Design
62	CM 62/22-23	Assistant Engineer, Irrigation Section No.2, Ponnani	Mix Design
63	CM 63/22-23	Assistant Engineer, Irrigation Section No.2, Ponnani	Mix Design

64	CM 64/22-23	Assistant Engineer, PWD Buildings Section, Irinjalakuda	Compressive strength test on Concrete Cubes
65	CM 65/22-23	Assistant Engineer, PWD Buildings Section, Irinjalakuda	Compressive strength test on Concrete Cubes
66	CM 66/22-23	Aneesh T.S, TKK Centre, Talikulam	Compressive strength test on Concrete Cubes
67	CM 67/22-23	Assistant Engineer, PWD Buildings Section, Irinjalakuda	Compressive strength test on Concrete Cubes
68	CM 68/22-23	Builtech gateway Ventures LLP, Chittur Road, Palakkad	Tests on Aggregates
69	CM 69/22-23	Assistant Engineer, Irrigation Section Malapuram	Test on Coarse and Fine aggregate
70	CM 70/22-23	Assistant Engineer, Irrigation Section Malapuram	Test on Coarse and Fine aggregate
71	CM 71/22-23	Range forest officer, Kalady range , Neeleeswaram P.O, Kalady.	Dimensions of Gauge wire and GI pipe and Tension Spring
72	CM 72/22-23	Assistant Engineer, PWD Buildings Section, Irinjalakuda	Compressive strength test on Paver Blocks
73	CM 73/22-23	Assistant Engineer, Minor Irrigation, Chalaky	Ultrasonic Pulse Velocity Test
74	CM 74/22-23	Assistant Engineer, PWD Buildings Section, Chalaky	Compressive strength test on Paver Blocks
75	CM 75/22-23	Range forest officer, Edamalaiyar range , Vadattupara	Dimensions of Gauge wire and GI pipe and Tension Spring
76	CM 76/22-23	Executive Engineer ,Karapuzha Division, Kalpetta	UPV & Rebound Hammer Test
77	CM 77/22-23	Assistant Engineer, PWD Buildings Section, Irinjalakuda	Cube test
78	CM 78/22-23	Assistant Engineer, Minor irrigation Section, Thrissur	Steel test
79	CM 79/22-23	Senior Section Engineer, Southern Railway, Thrissur	Steel test
80	CM 80/22-23	Assistant Engineer, IIP Section 1/2,	Concrete core Test -6th

		Angamaly	Barrel
81	CM 81/22-23	Assistant Engineer, IIP Section 1/2, Angamaly	Concrete core Test -5th Barrel
82	CM 82/22-23	Aneesh T.S, TKK Centre, Talikulam	Compressive strength test on Concrete cubes
83	CM 83/22-23	Range forest officer, Edamalaiyar range Vadattupara	Dimensions of Gauge wire and GI pipe and Tension Spring
84	CM 84/22-23	Range Forest Officer, Karulayi Range & Assistant Wild Life Warden, Karimpuzha	Dimensions of Gauge wire and GI pipe and Tension Spring
85	CM 85/22-23	Assistant Engineer, PIP Section No.6 Eraviperoor	Pile Echo Test
86	CM 86/22-23	Range forest officer, Edamalaiyar range Vadattupara	Dimensions of Gauge wire and GI pipe and Tension Spring
87	CM 87/22-23	Public Health Section,Assistant Engineer Kerala Water Authority.Peechi	Compressive strength test on Concrete cubes
88	CM 88/22-23	Assistant Engineer, PWD Buildings Section, No.2,Ayyanthole	Steel test
89	CM 89/22-23	Public Health Section, Assistant Engineer Kerala Water Authority. Peechi	Compressive strength test on Concrete cubes
90	CM 90/22-23	Chief Engineer, IDRIB, Thiruvananthapuram	UPV test
91	CM 91/22-23	Range Forest Officer, Pariyaram Forest Range, Chaiappankuzhi Forest Station	Dimensions of Gauge wire and GI pipe and Tension Spring
92	CM 92/22-23	Range Forest Officer, Pariyaram Forest Range, Konnakuzhi Forest Station	Dimensions of Gauge wire and GI pipe and Tension Spring
93	CM 93/22-23	Range Forest Officer, Vellikulangara Forest range, Inchakundu	Dimensions of Gauge wire and GI pipe and Tension Spring
94	CM 94/22-23	Range Forest Officer, Kodanadu Forest Range Mekkapala Forest Station	Dimensions of Gauge wire and GI pipe and Tension Spring

95	CM 95/22-23	Range Forest Officer, Vellikulangara Forest range-Pothenchira	Dimensions of Gauge wire and GI pipe and Tension Spring
96	CM 96/22-23	Range Forest Officer, Vellikulangara Forest Range-Kannatupadam	Dimensions of Gauge wire and GI pipe and Tension Spring
97	CM 97/22-23	Range Forest Officer, Palapilly Forest Range-Parakadavu Colony	Dimensions of Gauge wire and GI pipe and Tension Spring
98	CM 98/22-23	Range Forest Officer, Vellikulangara Forest Range-Nayattukundu area	Dimensions of Gauge wire and GI pipe and Tension Spring
99	CM 99/22-23	Range Forest Officer, Kalady Forest range-Pandupara	Dimensions of Gauge wire and GI pipe and Tension Spring
100	CM 100/22-23	Range Forest Officer, Palappilly Forest Range-Cheenikkunnu Colony	Dimensions of Gauge wire and GI pipe and Tension Spring
101	CM 101/22-23	Range Forest Officer, Athirappilly Forest range	Dimensions of Gauge wire and GI pipe and Tension Spring
102	CM 102/22-23	Malabar Gold Pvt Ltd, MHQ Interiors, Malabar Group headquarters, Perigolam, Calicut	Abrasion test on floor tiles
103	CM 103/22-23	Office of the Sr.Section Engineer/Works, Southern Railway	Compressive strength test on Concrete cubes
104	CM 104/22-23	Office of the Sr.Section Engineer/Works, Southern Railway	Compressive strength test on Concrete cubes
105	CM 105/22-23	Range Forest Officer, Palapilly Forest Range-Elikkodu Colony	Dimensions/ Unit weight of Gauge wire and GI pipe and Tension Spring
106	CM 106/22-23	Assistant Engineer Headworks Section, Peechi	Compressive strength test on Concrete cubes
107	CM 107/22-23	Office of the Assistant Engineer, Irrigation Quality control Section, Thrissur	Compressive strength test on Concrete cubes
108	CM 108/22-23	Office of the Assistant Engineer, Irrigation Quality control Section, Thrissur	Compressive strength test on Concrete cubes

109	CM 109/22-23	Office of the Assistant Engineer, Irrigation Quality control Section, Thrissur	Compressive strength test on Concrete cubes
110	CM 110/22-23	Office of the Senior Section Engineer/Works, Southern Railway, Thrissur	Compressive strength test on Concrete cubes
111	CM 111/22-23	Office of the Senior Section Engineer/Works, Southern Railway, Thrissur	Compressive strength test on Concrete cubes
112	CM 112/22-23	Range Forest Officer, Thundathil range Boothathankett P.O Kothamangalam-686681	Dimensions/ Unit weight of Gauge wire and GI pipe and Tension Spring
113	CM 113/22-23	M/s Paulose George Construction Company Pvt. Ltd., Puthencruz Road, Karimugal P.O, Kochi-	Steel test
114	CM 114/22-23	Project Engineer-47, RCB, Bharathapuzha, Kankakkadavu, KIIDC Tvm.	Steel test
115	CM 115/22-23	Deputy Director, Instrumentation Division, KERI, Peechi	Compressive strength test on Rock Core
116	CM 116/22-23	Assistant Engineer Headworks Section, Peechi	Solid block test
117	CM 117/22-23	Assistant Executive Engineer, Minor Irrigation Subdivision, Ernakulam, Kakkanad	Pile Integrity Test
118	CM 118/22-23	Assistant Engineer, PIP Section No.6 Eraviperoor	Pile Integrity Test
119	CM 119/22-23	Office of the Assistant Engineer PWD Special buildings Section MG Kavu, Thrissur	Cube test
120	CM 120/22-23	Assistant Engineer, LSGD Section Mathilakam GP	Steel test
121	CM 121/22-23	Assistant Engineer, LSGD Section Mathilakam GP	Cube test
122	CM 122/22-23	M/s Shapoonji Pallonji & Company Pvt.Ltd	Tile test
123	CM 123/22-23	Deputy Director, Instrumentation Division, KERI, Peechi	Rock core test

124	CM 124/22-23	Prathmesh &KK, Aurangabad,Maharastra	Test on Aggregates
125	CM 125/22-23	M.D Vincent, Project Engineer, St.Marys UP School,Lourdes Church	Mix Design
126	CM 126/22-23	Project engineer, Sports Kerala Foundation	Cube test
127	CM 127/22-23	Office of the Assistant Engineer PWD buildings Section ,Irinjalakuda Thrissur	Cube test
128	CM 128/22-23	HLL Life Care Limited, Regional incharge	Cube test
129	CM 129/22-23	Deputy Director,Instrumentation Division,KERI,Peechi	Rock core test
131	CM 131/22-23	Olivia Projects, Poonkunnam,Thrissur	Solid block test
132	CM 132/22-23	Office of the Assistant Engineer Minor Irrigation Section Cherpu	Compressive strength test on Paver Blocks
133	CM 133/22-23	Range forest officer,Edamalayar range Vadattupara	Dimensions of Gauge wire
134	CM 134/22-23	Range forest officer, Edamalayar range Vadattupara	Dimensions of Gauge wire
135	CM 135/22-23	Sreejith Suresh, PhD student, Mechanical	Tension test of steel frames
136	CM 136/22-23	Office of the Assistant Engineer Chamravattom project section1/1,Easwaramangalam, Ponnani	Mix Design
137	CM 137/22-23		
138	CM 138/22-23		
139	CM 139/22-23		
140	CM 140/22-23	Olivia Projects, Poonkunnam,Thrissur	Cube test
141	CM 141/22-23	KM Naseer ,Govt. contractor, Mannuthy,Thrissur	WMM& GSB Materials

142	CM 142/22-23		
143	CM 143/22-23	HLL Life care Limited, Regional incharge	Cube test
144	CM 144/22-23	Office of the SSE/W/TCR. Railway, Thrissur	Cube test
145	CM 145/22-23	Assistant Engineer, Public Health Section, Kerala Water Authority, Peechi	Cube test
146	CM 146/22-23	Assistant Engineer, KSEBL, TC Subdivision, Madakkathara, Thrissur-680651	UPV test
147	CM 147/22-23	Deputy Director, Instrumentation division, KERI, Peechi	Rock core test
148	CM 148/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
149	CM 149/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
150	CM 150/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
151	CM 151/22-23	Olivia Projects, Poonkunnam, Thrissur	Solid block test
152	CM 152/22-23	M/s Paulose George Construction Company Pvt. Ltd., Karimugal P.O, Kochi-682303	Steel test
153	CM 153/22-23	Assistant Engineer, Chamravattom Project Section 1/1, Eswaramangalam	Sheet pile
154	CM 154/22-23	M/s Shapoonji Pallonji & Company Pvt.Ltd	Tile test
155	CM 155/22-23	M/s Shapoonji Pallonji & Company Pvt.Ltd	Tile test
156	CM 156/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
157	CM 157/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
158	CM 158/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test

159	CM 159/22-23	Project Engineer, St. Marys UP School, Lourdes Church, Thrissur	Cube test
160	CM 160/22-23	Deputy Director, Instrumentation Division, KERI, Peechi	Rock core test
161	CM 161/22-23	Assiatnt Engineer, Chamravattom Project Section 1/1, Eswaramangalam, Ponnani	Sheet pile
162	CM 162/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
163	CM 163/22-23	IWR SECTION 3/2, Office of the Assistant Engineer, Malappuram	Rock core test
164	CM 164/22-23	Deputy Director, Instrumentation division, KERI, Peechi	Rock core test
165	CM 165/22-23	Deputy Director, Instrumentation division, KERI, Peechi	Rock core test
166	CM 166/22-23	Office of the Assistant engineer mala, Minor Irrigation Section	Cube test
167	CM 167/22-23	Office of the Assistant Engineer, Quality control ,Easwaramangalam, Malapuram-679573	Sheet pile
168	CM 168/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
169	CM 169/22-23	Prathmesh &KK, Aurangabad, Maharashtra	Test on Coarse and Fine aggregate
170	CM 170/22-23	Prathmesh &KK, Aurangabad, Maharashtra	Test on Coarse and Fine aggregate
171	CM 171/22-23	Prathmesh &KK, Aurangabad, Maharashtra	Test on Coarse and Fine aggregate
172	CM 172/22-23	Assiatnt Engineer, Chamravattom Project Section 1/1, Eswaramangalam, Ponnani	Test on aggregate
173	CM 173/22-23		Test on Cement
174	CM 174/22-23		Mix Design
175	CM 175/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test

176	CM 176/22-23	Assistant Engineer,Head works ,Peechi Thrissur	Paver blocks
177	CM 177/22-23	Assistant Engineer,IWR Section 3/2 Malapuram	Rock core test
178	CM 178/22-23	Assistant Engineer,IWR Section 1/1 Palakkad	Rock core test
179	CM 179/22-23	Assistant Engineer,Kodukara,Contr.Anas	Cube test
180	CM 180/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
181	CM 181/22-23	Olivia Projects, Poonkunnam, Thrissur	Mud blocks
182	CM 182/22-23	Assistant Engineer, Chamravattom Project Section 1/1, Eswaramangalam	Cube test
183	CM 183/22-23	Deputy Director, Sedimentation division, KERI,Peechi	Cube test
184	CM 184/22-23	Assistant Executive Engineer,Inland Navigation,Thiruvanthapuram	Pile Integrity Test
185	CM 185/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
186	CM 186/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
187	CM 187/22-23	Assistant Engineer, Chamravattom Project Section 1/1, Eswaramangalam	Cement test
188	CM 188/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
189	CM 189/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
190	CM 190/22-23	Assistant Engineer, Irrigation section, Ponnani	Steel test
191	CM 191/22-23	Assistant Engineer, LSGD Sub division, Puzhakkal Block Panchayath Thrissur	Cube test
192	CM 192/22-23	Assistant Engineer, LSGD Sub division, Puzhakkal Block Panchayath Thrissur	Cube test

193	CM 193/22-23	Executive Engineer ,Karapuzha Division, Kalpetta	Pile Integrity Test
194	CM 194/22-23	Assistant Engineer, IWR Section 1/1, Palakkad	Rock core test
195	CM 195/22-23	Olivia Projects, Poonkunnam, Thrissur	Solid block test
196	CM 196/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
197	CM 197/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
198	CM 198/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
199	CM 199/22-23	Assistant Engineer,PWD ,KRFB -PMV Division Ernakulam	Steel test
200	CM 200/22-23	Team Leader, Central Zone, WAPCOSE Ltd. (M/s Fins Engineers & Contractors Pvt. Ltd.)	Cement Test
201	CM201/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
202	CM 202/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
203	CM 203/22-23	Assistant Engineer,LSGD Mathilakam	Cube test
204	CM204/22-23	Assistant Engineer,LSGD Mathilakam	Cube test
205	CM 205/22-23	KMP Consultants, Civil Engineers and Professional Contractors, Press club Road, Thrissur	Mix design
206	CM 206/22-23	P.M.Mohanan, Contractor, Paulomlatti House, Edappalam, Pattikkad PO ,Thrissur	Cube test
207	CM 207/22-23	Assistant Engineer, LSGD Mathilakam	Cube test
208	CM 208/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
209	CM 209/22-	Assistant Engineer, Chamravattom Project	Cement test

	23	Section 1/1, Eswaramangalam	
210	CM 210/22-23	Olivia Projects, Poonkunnam, Thrissur	Solid block test
211	CM 211/22-23	Olivia Projects, Poonkunnam, Thrissur	Solid block test
212	CM 212/22-23	Assistant Engineer, PWD Building Section, Thrissur.	Steel test
213	CM 213/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
214	CM 214/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
215	CM 215/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
216	CM 216/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test
217	CM 217/22-23	Olivia Projects, Poonkunnam, Thrissur	Cube test

**APPENDIX-IV**

**LABORATORY INVESTIGATION**

Soil samples analysis for undisturbed and disturbed samples were tested for the following works:-

- C.7.01 Soil analysis for project from Vidhya Academy of Science and Technology, Thrissur
- C.7.02 CEFS-Data collection of Design parameters for urgent protection work at Erosion Hotspots along Kerala Coast-Alappad.
- C.7.03 KAU - ARS Chalakkudy - Soil samples for testing dynamic properties of the soil.
- C.7.04 KAU-Vellanikkara - Geotechnical characterisation of lateritic soil profiles in midland and highland plateaus of Kerala- Testing of Soil Samples
- C.7.05 KAU - ARS Chalakkudy (Wayanad)- Soil samples for testing dynamic properties of the soil.
- C.7.06 Disaster Management - Desiltation of Chaliyar river- Testing of Soil samples
- C.7.07 Disaster Management - Desiltation of Kadalundi river- Testing of Soil samples
- C.7.08 Desiltation of Manali River in the tributary of Karuvannur River- Desiltation point Puthur Chira in Puthur Panchayath - Testing of Soil Samples.
- C.7.09 CIP Cheruthuruthy - Desiltation of Karuvannur River- Testing of Soil Samples.
- C.7.10 CIP Cheerakuzhy - Desiltation of Karuvannur River- Testing of Soil Samples.
- C.7.11 Desiltation of Kurumali River - Desiltation point Vasupuram Chira and Thottumugham Chira in Varandarappilly Panchayath - Testing of Soil Samples.
- C.7.12 Rejuvenation of Rivers - Soil Samples Testing (Chaliyar).
- C.7.13 Desiltation in Manali River- Testing of Soil Samples.
- C.7.14 Desiltation in Puzhakkal/Thanikkudam River- Testing of Soil Samples.
- C.7.15 Desiltation in Karuvannur River - Testing of Soil Samples.
- C.7.16 Desiltation in Chittur Puzha - Testing of Soil Samples.
- C.7.17 Desilting of Kecheri River - D/S of Pathramangalam Bridge in Velur Grama Panchayath - Soil Testing.
- C.7.18 Desiltation of Karuvannoor River - Soil Testing.
- C.7.19 KAU - ARS Chalakkudy - Soil samples (Malappuram landslide locations) for testing dynamic properties of the soil.
- C.7.20 Restoration of Meenachil river at U/S of Pattarmadom Bridge in Ettumanoor Municipality in Kottayam District-Quality analysis of soil sample
- C.7.21 Soil Investigation work for “Haritha Kerala Mission – investigation for the construction of Bandhara scheme across Kunthipuzha at Pombra Kanhirayikadavu in Karimpuzha gramapanchayath in Palakkad District”.
- C.7.22 Rejuvenation of Rivers - Testing of soil samples from Chaliyar river(Punnappuzha, Karimpuzha & Kanhirapuzha)

- C.7.23 De-siltation of Chaliyar River - Kunippala yard
- C.7.24 Soil Investigation for various works of Irrigation Department - Soil Investigations Near Railway Bridge to Vallarpadam Container Terminal at Vaduthala.
- C.7.25 Desiltation of Karuvannur River- Testing of Soil Samples - Cheerakuzhy.
- C.7.26 Eriyad Gramapanchayath - Deposited soil at Blangachal Arappathodu - Testing of Soil samples
- C.7.27 Soil Investigation Works at IIT Palakkad – For Incubator Building at IIT Palakkad
- C.7.28 Testing for Geotechnical parameters of Soil Samples - KFRI, Peechi
- C.7.29 Soil Investigation Works at IIT Palakkad – For new buildings at IIT Palakkad
- C.7.30 Testing for Geotechnical parameters of Soil Samples - KFRI, Peechi
- C.7.31 Testing of soil samples collected by Hydrographic Suvey wing, Kollam for Kollam - Kollamkode Soil Erosion Survey
- C.7.32 Testing of Soil samples - DRIP-Phase II- Karapuzha Irrigation Project Rehabilitation and optimization of Dam and appurtenances.
- C.7.33 Testing of Soil samples - Hydrographic Survey of Sholayar HEP (KSEB) using Integrated Bathymetric System and Sub bottom Profiler.
- C.7.34 Disaster Management - Desiltation of Kadalundi river- Testing of Soil samples
- C.7.35 MANSOON PREPAREDNESS - Desiltation of BlangachalArappathode for a length of 300m in Manappattuchal in Eriyad Panchayath in Edavilangupanchayath in Kodungallur Taluk.
- C.7.36 Testing of soil samples in National Waterway in Ashtamudi Kayal and for usage of dredged material for NHAI Project
- C.7.37 Soil investigation works for Peechi Scheme-Aqueduct-A permanent solution for breached portion of left bank main canal bund between ch.19/600 Km and 20/650 Km (RKI).
- C.7.38 Soil investigation work for Irrigation Department - Samples collected from Plazhi Site.
- C.7.39 Soil investigation for Irrigation Department - Samples collected from Naduvathithodu Site.
- C.7.40 Soil investigation for Irrigation Department - Samples collected from Marutha-Vazhikkadavu Site.
- C.7.41 Soil investigation - Samples collected from Santhigram Machikai Thuruth at Pothukallu Panchayath site.
- C.7.42 JALJEEVAN MISSION – Water supply scheme to Ananganadi, Thrikkadeeri, Chalavara Panchayat - Investigation for proposed weir across Thoothapuzha in Cherpulassery Municipality
- C.7.43 Testing of soil samples - Pambar Basin – Detailed soil investigation work for aqueduct at ch 35 m of canal system of Pattissery Dam – IRR/PIIFL/6817/2022 - Investigation work 1

- C.7.44 JJM – Combined Water Supply Scheme to Mundakkayam and Koruthodu Grama Panchayath – Site Investigation for Proposed Check Dam across Manimala river at Moorikkayam – Testing of soil samples.
- C.7.45 Testing of Soil samples - Sedimentation Study of Poomala Reservoir using Integrated Bathymetric System (IBS).
- C.7.46 Testing of Soil samples - Sedimentation Study of Asurankundu Reservoir using Integrated Bathymetric System (IBS).
- C.7.47 Testing of Soil samples - Sedimentation Study of Pathazhakundu Reservoir using Integrated Bathymetric System (IBS).
- C.7.48 Testing of soil samples - Construction of Moolathara Right Bank Canal in Eruthenpathy Panchayath, Palakkad District
- C.7.49 Soil analysis for project from Vidhya Academy of Science and Technology, Thrissur
- C.7.50 Testing of soil samples - Rejuvenation of Kachithodu Dam in Madakkathara Grama Panchayath.
- C.7.51 Testing of Soil samples - CSIND - Development of National Highway-66 - Permission for dredging in National Water way in Vembanad Kayal and for usage of dredged material for NHAI-Project-25 Nos.

**APPENDIX-V****DATES AND PLACES OF OBSERVATIONS**

In order to have more detailed idea of the behavior of factors affecting the shore line changes, three consecutive points are taken for reference. At a particular study reach five readings are taken in all three points at definite timing. Nearly 20 to 25 Km apart straight reaches without much external disturbances are selected for taking these simultaneous observations. The places of observations with timing and CP Nos. are listed below. The dates in the year 2022-23 are as follows:

<b>Sl.No</b>	<b>Month</b>	<b>Date of observation</b>
1.	April	01.04.2022 & 30.04.2022
2.	May	30.05.2022
3.	June	28.06.2022
4.	July	28.07.2022
5.	August	27.08.2022
6.	September	25.09.2022
7.	October	25.10.2022
8.	November	23.11.2022
9.	December	23.12.2022
10.	January	21.01.2023
11.	February	20.02.2023
12.	March	21.03.2023

**APPENDIX-VI****DETAILS OF SIMULTANEOUS OBSERVATIONS**

Sl No	Name of Station	Time and CP Nos				
		9.00 AM	10.00 AM	11.00 AM	11.45 AM	12.30 AM
1	Vettukkad	0112	0114	0116	0114	0112
2	Anjuthengu Changed new location to Mariyanad from October 2022 onwards	0223	0228	0233	0228	0223
3	Eravipuram	0317	0322	0327	0322	0317
4	Thottappally	0597	0600	0602	0600	0597
5	Alapuzha	0704	0707	0710	0707	0704
6	Thanki	0926	0930	0935	0930	0926
7	Kannamali up to june	1025	1037	1047	1037	1025
8	Kuzhuppilly	1140	1147	1149	1147	1140
9	Perinjanam	1269	1274	1279	1274	1269
10	Nattika	1323	1330	1333	1330	1323
11	Blangad	1418	1421	1428	1421	1418
12	Vakkad	1595	1599	1605	1599	1595
13	Calicut	1830	1826	NCP	1826	1830
14	Melody	2013	2009	2004	2009	2013
15	Thalassey(Old CP)	Back of Bishop's house	1067	1075	1067	Back of Bishop's house
16	Kanhangad	2608	2603	2598	2603	2608
17	Kasargod(Old CP)	531	541	550	541	531
18	Kannuvatheertha (Old CP)	103	111	121	111	103

